(19) DANMARK

(10) DK/EP 2563108 T3

(12) Oversættelse af europæisk patentskrift

Patent- og Varemærkestyrelsen

(51) Int.Cl.: *A 01 C 7/20 (2006.01)*

(45) Oversættelsen bekendtgjort den: **2018-03-12**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2018-01-10**

(86) Europæisk ansøgning nr.: **11723537.4**

(86) Europæisk indleveringsdag: **2011-04-29**

(87) Den europæiske ansøgnings publiceringsdag: **2013-03-06**

(86) International ansøgning nr.: **FR2011050981**

(87) Internationalt publikationsnr.: **WO2011135272**

(30) Prioritet: **2010-04-30 FR 1053359**

(84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

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(54) Benævnelse: **Så-enhed til en såmaskine**

(56) Fremdragne publikationer:
WO-A1-01/54484
DE-A1-102008 044 520
US-B1- 6 651 570

Description

The invention relates to a seeding element for an agricultural machine and a corresponding seeder.

It relates mainly but not exclusively to seeding elements intended for so-called precision seeding.

A seeder is a machine intended for automatically planting seeds as an agricultural machine, such as a tractor, advances, the spacing between the seeds and their planting depth being predetermined and adjustable.

Seeders intended for precision seeding must provide accurate placing of the seeds in the earth, i.e. must sow them in a perfect line, with regular spacing and with constant firming and seeding depth.

Generally, such a seeder comprises a frame whereon are arranged a hopper intended for holding a stock of seeds to be sown and one or more seeding elements mounted on the frame, in a row, perpendicularly to the agricultural machine's direction of travel.

The hopper feeds a seed distribution means such as a distribution disc or a feed frame of one or more seeding elements.

In the case of a seeder with seed firming, the feed frame is associated with a press wheel, the seed is conveyed from the hopper to a feed frame aperture from where it is ejected and immediately stopped, substantially between the bottom of the furrow ploughed by the share and the press wheel.

Once the seed has been stopped, the press wheel firms the bottom of the furrow and lightly presses the seed into the earth.

The firming is effective and directly on the seed, which is stamped into the seedbed.

In addition, the apparatus is completed by a depth wheel used for regulating the seed planting depth.

Ideally, the depth wheel is situated as close as possible to the planting of the seeds.

Such a seeder is used, most often, during conventional agricultural techniques, i.e. techniques for which seeding is first preceded by soil tillage.

At present, seeding is carried out increasingly frequently with so-called simplified cultivation techniques, whereby tillage is limited.

These techniques consist, in particular, of not using any plough and of leaving varying amounts of plant residues (straw, stubble, plant cover) on the surface of the field to be sown, in order to preserve an intact soil structure to prevent erosion phenomena in particular.

Sometimes, seeders with which precision seeding can be carried out are not adapted to being applied to simplified cultivation techniques.

In this type of technique, during seeding, jamming can occur in the seed feed frame due to the plant residues such that the feed frame has difficulty in opening the furrow.

Furthermore, the nature of the soil and particularly its hardness are not controlled, which can make it difficult for the feed frame to press into the soil to a predetermined depth.

For this type of simplified cultivation technique, it is therefore essential to mount on the seeding element at least one opening disc upstream of the feed frame, this disc opening the earth upstream of the feed frame forming a share, assisting the opening of the furrow wherein the seeds will be sown and making it possible to prevent plant residues from becoming jammed against the share.

As the opening disc is not essential for conventional agricultural techniques, it may be necessary to fit it and remove it depending on the agricultural technique considered by the operator.

Furthermore, it is noted that the depth at which one or more opening discs are put in place during their being mounted on the seeding element, although assisting the formation of the furrow, is sometimes not adapted to the hardness of the soil treated and to the crops considered with the seeding element, the seeding depth of which varies depending on the crop selected.

The quality of the seeding and germination can be affected by this poor mounting of opening discs.

The addition of an opening disc to the distributing share and to the press wheel requires a compact design which prevents the risks of jamming but allows access to the various different regulating elements.

Finally, the common regulation of the bearing pressure of the disc and of the press wheel can bring about discontinuity of the bearing of this wheel on the soil, by rising of the disc when the latter encounters wide and more or less regular variations in soil hardness such as an obstacle such as a stone or substantial variations in soil hardness.

The quality and continuity of the seeding can be affected by these obstacles.

An aim of the present invention is to remedy the above-mentioned drawbacks.

Another aim of the present invention is to provide a solution for adapting one or more opening discs to the precision seeding elements while preserving their intrinsic features.

Another aim of the present invention is to provide a versatile seeding element, i.e. one which is adaptable according to the agricultural technique used and the nature of the soil or the crop considered, both with a simplified cultivation technique and with tilled earth.

It is also desirable to offer a versatile, compact seeding element with means which are simple and easy to understand.

Another aim of the invention is to provide precision seeding, seed by seed, on untilled land having plant residues.

It is also desirable to provide a seeding element promoting continuity of seed firming. A seeding apparatus comprising the features in the preamble of claim 1 is known from WO-A-0154484.

The invention provides a seeding apparatus comprising the features in claim 1.

In accordance with other features of the invention, the seeding apparatus of the invention comprises one or more of the following optional features considered on their own or in all possible combinations:

- the opening disc's impression in the soil is situated outside a seed firming section Sp defined as the thickness, on the width of the press wheel, between the lower ends of the share and of the press wheel;
- the lower portion of the share comprises at least one chamfer;
- the lower portion of the share is of a symmetrical shape relative to the seed row;
- the rear portion of the share is of a greater width than the width of the press wheel;
- the seeding apparatus further comprises means of adjusting the position of the opening disc heightwise relative to the share so as to adjust the depth of the disc in the soil and/or means of adjusting the longitudinal position of the opening disc so as to adjust the lead of said disc relative to the share;
- the means of adjusting the height and/or the longitudinal position of the opening disc relative to the share are adapted to keep the oblique orientation defined between the opening disc and the side face of the share at each movement of said opening disc so as to ensure the flush alignment of the opening disc with the front edge of the share;
- the seeding apparatus further comprises means for retracting the opening disc into an inoperative position without contact with the soil;
- the opening disc and the seeding element comprise independent soil pressure means;
- the opening disc and the seeding element comprise soil pressure means with separately adjustable intensity;
- the seeding apparatus comprises means of adjusting the height of the depth wheel relative to the press wheel to predetermined heights, these means comprising at least one shaft articulated, on the one hand, on an axis coaxial with a rotational axis of the press wheel and, on the other hand, on a rotational axis of the depth wheel so as to offset the depth wheel from its rotational axis upon adjustment of its height;
- the means of adjusting the height of the depth wheel relative to the press wheel further comprise a face-teeth or spring-loaded positioning dog coupling;
- the means of adjusting the height of the depth wheel relative to the press wheel further comprise operating means capable of causing the shaft to pivot about the axis coaxial with the rotational axis of the press wheel so as to modify the angle of inclination of the shaft relative to the direction of travel of the seeding apparatus, these operating means comprising at least one gripping element mounted at one end of the shaft and capable of pivoting to at least one position indicating a depth of the depth wheel.

The invention also relates to a seeder comprising a supporting frame on which is articulated at least one seeding apparatus as mentioned above.

Other features, aims and advantages of the present invention will appear from reading the detailed description which follows, in accordance with embodiments given by way of non-limiting examples and which is drawn up with reference to the attached drawings, in which:

- Figure 1 shows a side view of a seeding element according to a first embodiment of the present invention;
- Figure 2 shows a top view of the seeding element in Figure 1, illustrating the orientation of its opening disc relative to the plane P1, perpendicular to the soil and passing through the seed row;
- Figure 3 shows a front view of the seeding element in Figure 1, illustrating the orientation of its opening disc relative to the plane P1, perpendicular to the soil and passing through the seed row;
- Figure 4 shows a cutaway view along AA of the seeding element in Figure 1;
- Figure 5 shows an opposite side view of the seeding element in Figure 1;
- Figures 6a to 6c show a share 2 of the seeding element in Figure 1 in several views;
- Figures 7, 8 and 9 show three partial perspective views of various different elements constituting an apparatus for adjusting the position of the opening disc of the seeding element in Figure 1;
- Figures 10a to 10c show side views of a seeding element in Figure 1, the opening disc of which has various different adjustment positions;
- Figures 11a and 11b show perspective views of a seeding element in Figure 1, a depth wheel of which has various different adjustment positions;
- Figure 11c shows a perspective side view of a seeding element according to a second embodiment of the present invention, the depth wheel of which is situated at the rear;
- Figure 11d shows a perspective side view of a seeding element according to a third embodiment of the present invention, the depth wheel of which is situated at the front;
- Figure 11e shows a perspective side view of a seeding element according to a fourth embodiment of the present invention with front and rear depth wheels mounted on a bar;
- Figure 12 is a cutaway view of the mechanism for adjusting the depth wheel of the seeding element in Figure 1;
- Figures 13a and 13b each show a perspective view of a dog coupling for positioning the depth wheel mounted on a shaft of the seeding element in Figure 1.

A seeder (not shown) comprises a seed storing device placed on a frame supporting a seeding transverse bar on which are fastened several seeding elements distributed regularly along the bar and aligned, one of which is denoted by the general reference 10 in Figure 1.

Each seeding element 10 is intended for planting, in a field, seeds contained in the seed storage device.

With reference to Figures 1 and 5, each seeding element 10 comprises a longitudinal arm 3, extending in the direction of travel A of the seeder, on which are fastened at least one opening disc 5 intended in particular for opening the earth to assist the passing of a seed feed frame forming a share 2, which opens a furrow in the soil during the seeder's movement and conveys seeds by means of a channel present on its rear face which surrounds the external periphery of a press wheel 1.

The press wheel 1 itself is intended for stopping and then firming the seeds substantially between the bottom of the furrow ploughed by the share 2 and the bottom of said press wheel 1.

It should be noted that the width of the press wheel 1 can be smaller than the width of the rear face of the share 2, situated upstream and therefore the width of the furrow formed, in order to limit the forces of penetration of the press wheel 1 into the soil to a certain section of the wheel used for firming the seed.

In the embodiment illustrated in Figure 1, a depth wheel 4 intended for regulating the depth of the seeding carried out is mounted laterally to the press wheel 1.

This depth wheel 4, adjacent to the press wheel 1, is articulated on the axis of said press wheel 1.

Alternative embodiments illustrated in Figures 11c and 11d provide seeding elements 10, the depth wheel 4 of which is situated to the rear and to the front respectively of the press wheel 1 and another alternative embodiment, illustrated in Figure 11e, provides a seeding element 10, the depth wheels 4 of which are situated to the front and rear of the press wheel 1 and are mounted on a bar.

The main axle 23 of the press wheel 1 and the share 2 are themselves supported by a common, fixed support plate 11, extending parallel to the wheels and secured to the arm 3.

Regarding the shape of the share 2, this can be in the form illustrated in Figures 6a to 6c, in a non-limiting example of the present invention.

Therefore, the share 2 can be of generally prismatic shape.

As illustrated more particularly in Figure 6b, the front of the share 2 has, in the upper portion (zone B), a wide section intended for fastening of the share 2 on to the plate 11, extended towards the soil by an intermediate portion in the form of a thinned front edge 37 (zone C), which is used as a scraper for the opening disc 5, as will be seen below.

This thinned zone 37 itself extends downwards through a zone (zone D) in contact with the soil and plant residues and progressively broadens out to define the width of the impression forming the furrow.

Furthermore, advantageously, with reference to Figure 6c, the share 2 comprises, in the lower portion D, at the front of the share 2 and on the side facing the opening disc 5, a chamfer 15, the orientation angle of which faces that of the orientation angle of the opening disc 5 relative to the direction of travel A of the seeding element.

Advantageously, due to these two angles' facing each other, equilibrium of the transverse forces of penetration of the disc 5 and of the share 2 into the soil is possible.

In an alternative embodiment, the lower portion D of the share 2 is no longer in a simple chamfer but has two symmetrical chamfers, for meeting the furrow before the arrival of the seed, centred on the seed row.

It should be noted that the lower portion D of the share 2 is always adapted for obtaining a flat furrow.

Furthermore, the rear portion of the share 2 is of a width greater than the width of the press wheel 1 in order to prevent any striking of earth by the press wheel 1.

Regarding the opening disc 5 illustrated particularly in Figures 1 and 5, this is a thin disc intended for protecting the share 2, and a portion of the press wheel 1, in order to prevent the interposition of plant residues on contact with the seed.

This opening disc 5 is rotatably mounted about an axis transverse to the direction of travel A of the seeder and inclined relative to the direction perpendicular to said direction of travel A.

As illustrated in Figures 2 and 3, the share 2 having a planar side face F1 (visible in Figure 6c) facing the opening disc 5, the opening disc 5 is therefore slightly oblique relative to the side face F1, i.e. oriented in accordance with the angles α and β relative to the side face F1 of the share 2.

The angles α and β are defined in Figures 2 and 3 relative to the plane P1, perpendicular to the soil and passing through the seed row, in the seeder's direction of travel A.

Therefore, the opening disc 5 is adjacent to the share 2 and, in particular, the opening disc 5 is oriented so as to be flush with the front edge 37 of the share 2 used as a scraper for cleaning the opening disc 5 and for preventing the share 2 from becoming jammed.

In addition, the opening disc 5 is mounted adjacent to the share 2 so as to be close enough to the seed outlet zone at the rear of the share 2 in order to act as protection and a side guide for the seed before it is pressed.

An alternative embodiment can provide several opening discs 5 on both sides of the press wheel 1.

Irrespective of the number of opening discs 5, the impression of this disc 5 in the soil is situated outside the path of the press wheel 1 in order to preserve the seed firming section Sp formed by the dense earth situated substantially between the bottom of the furrow ploughed by the share 2 and the tread of the press wheel 1 and laterally defined by the width of the path Lp of the press wheel 1 illustrated in Figure 4.

Furthermore, in the example illustrated in Figure 1, the disc 5 is of a notched form.

However, any other type of shape capable of protecting the share 2 can be considered such as, for example, a corrugated or star shape.

Furthermore, advantageously, the opening disc 5 is adjustable heightwise and/or in longitudinal position relative to the share 2, so as to regulate the depth of planting in the soil, denoted by P and the lead of the disc 5 relative to said share 2 denoted by L in Figure 1.

As illustrated in Figures 7 to 9, an apparatus for adjusting the height and longitudinal position of the opening disc 5 comprises an arm 6 for holding the opening disc 5, extending vertically, having, in its upper portion, a flange 7 for fastening said arm, comprising vertical positioning means 8 and an oblong vertical adjustment slot 9.

The apparatus further comprises a plate 38 intended for acting as a bearing surface for said disc-holding arm 6, parallel to the arm 6.

This plate 38 comprises a horizontal slot 13 and predetermined means 12 of adjusting the position of the opening disc 5.

Therefore, several apertures 12 are provided and distributed on the surface of the plate 38 in the form of a grid with a predetermined pitch.

These apertures 12 each correspond to a particular position for adjustment of the disc-holding arm 6 and therefore of the disc 5 heightwise and longitudinally relative to the share 2.

They act as a visual reference for easily adjusting the height and longitudinal position of the opening disc 5 to a predetermined position.

These apertures 12 are intended for co-operating with stop means 8 provided projecting from the arm 6 to the plate 38 and capable of being indexed in these apertures.

The height and lead of the disc 5 therefore depend on the vertical positioning and horizontal positioning respectively of the means 8 of the flange 7 in the apertures 12 of the plate 38.

The height and lead of the opening disc 5 relative to the share 2 therefore depend on their vertical and/or horizontal movement relative to the direction of travel A of the seeding element 10.

A change to the height and longitudinal position of the disc-holding arm 6 is obtained through operating means 14 capable of releasing the arm 6 and moving it on the plate 38, bringing about the change of height and longitudinal position of the opening disc 5 and, therefore, its depth P in the soil and its lead L relative to the share 2.

These operating means 14 are also capable of immobilising and keeping in position, on the plate 38, the arm 6 for holding the disc 5.

These operating means 14 comprise, in a non-limiting example, tightening means of the bolt 14 – nut 16 type or any other adapted means.

The apparatus for adjusting the height and longitudinal position of the opening disc 5 is used as follows.

Keeping the disc-holding arm 6 in position and immobilising it are achieved by tightening the bolt 14 in the nut 16.

After loosening of the bolt 14, the disc-holding arm 6 is released from the plate 38, i.e. the stop means 8 are released from the apertures 12 wherein they were engaged, in order to immobilise them in a different position corresponding to a desired height and longitudinal position of the opening disc 5 in a vertical plane oriented in accordance with the angles α and β.

Therefore, it is possible to change from a first position of the opening disc 5 to a second, different, position by simple movement from low to high and/or from front to back and *vice versa* of the arm 6, in a vertical plane oriented in accordance with the angles α and β.

When the position of the opening disc 5 is decided on, the stop means 8 engage in the corresponding apertures 12 of the plate 38 which are associated with this position in order to lock in position the arm 6 and consequently, the opening disc 5.

Figures 10a and 10b illustrate the opening disc 5 in two different lead and height positions, the opening disc 5 in Figure 10b being lowered and with a greater lead relative to its position in Figure 10a.

It should be noted that, advantageously, the position of the opening disc 5 is adjustable heightwise and longitudinally while the opening disc 5 is kept parallel to itself and adjacent to the side face F1 of the share 2.

The position of the opening disc 5 and its orientation relative to the side face F1 of the share 2 is constant and independent of the position of the arm 6 holding the disc 5.

Indeed, the side face F1 of the share 2 and the plate 38 are oriented relatively in accordance with angles α and β relative to the plane P1, perpendicular to the soil and passing through the seed row, in the direction of travel A of the seeder, i.e. angles identical to those of the opening disc 5 with the side face F1 of the share 2.

Therefore, the disc-holding arm 6 and the opening disc 5 move in a trajectory parallel to a plane oriented in accordance with the angles α and β represented by the side face of the disc 5 in contact with the side face F1 of the share 2.

Due to such an adjustment, the opening disc 5 remains flush with the edge 37 of the share 2, independently of its position.

Good cleaning of the opening disc 5 is thus provided and the entry of plant residues is prevented, which ensures continuity of rotation of said disc 5.

Furthermore, the apertures 12 of the plate 38 are arranged so as to promote keeping the opening disc 5 outside the seed firming section Sp, flush with the front edge 37 of the share 2, irrespective of the adjustment heightwise and longitudinally of the opening disc 5.

Therefore, advantageously, depending on the nature of the soil, the crop considered and the type of technique practised, the ideal position of the opening disc 5 can be selected.

The ideal position is preferably such that the depth P of the opening disc 5 in the soil is slightly greater than that of the share 2 and of the press wheel 1 in the soil, a depth denoted by H in Figure 1.

Due to such an adjustment, it is also ensured that, irrespective of the seeding depth and the nature of the soil treated, driving of the opening disc 5 is ensured.

It is therefore possible to sow at a depth which is variable depending on the type of crop.

In addition, advantageously, adjustment of the depth and of the lead of the opening disc 5 is carried out in a simple, fast and precise manner.

Due to the presence of stop means 8 and corresponding apertures 12, the adjustment of the depth and lead of an opening disc 5 is also easily reproducible for all of the opening discs of the seeding elements of a single seeder.

In addition, the seeding element 10 becomes versatile for all known agricultural techniques.

Indeed, if the type of technique so demands, the ideal position of the opening disc 5 having been selected, it is possible to retract the disc-holding arm 6 horizontally, without contact with the soil in an inoperative position, as Figure 10c shows.

Indeed, the apparatus for adjusting the height and longitudinal position of the opening disc 5 relative to the share 2 further comprises means capable of causing the pivoting of and immobilising said disc-holding arm 6 in the horizontal position, in an inoperative position without contact with the soil.

Thus there is no need to remove the opening disc 5 from the seeding element 10.

An alternative embodiment provides that the opening disc 5 and the press wheel 1 have different diameters and therefore rotational speeds in proportion, whereby deposits of earth and any jamming of the press wheel 1, bearing in mind its proximity to the opening disc 5, can be prevented.

Furthermore, advantageously, the seeding element 10 is adapted for making it possible for the opening disc 5 to rise on contact with an obstacle or a substantial variation in soil hardness without affecting firming of the seeds.

For this, the opening disc 5 and seeding element 10 comprise independent soil pressure means.

In an alternative embodiment, the opening disc 5 and the seeding element 10 comprise soil pressure means with separately adjustable intensity.

In an embodiment of the present invention, the soil pressure of the opening disc 5 can be adjustable in a manner relative to the main pressure of the seeding element 10, said pressure itself being variable depending on the soil hardness, so as to allow the opening disc 5 to be retracted when encountering an obstacle such as a stone which is capable of causing the seeding element 10 to rise and thus capable of substantially disturbing the seed firming.

With reference to Figures 8 to 9, a mechanism for regulating the pressure and retraction of the opening disc 5 comprises at least one rectangular-section disc-holding flat 30, guided vertically in the upper portion in the flange 7 for fastening the disc-holding arm 6 to the plate 38.

It further comprises a compression spring 31 which is adjustable and inserted vertically between the disc-holding flat 30 and the flange 7 in the centre of said flat 30.

By means of this compression spring 31, it is possible to adjust the force necessary for the retraction of the disc on encountering an obstacle, i.e. it is capable of compressing so that the disc-holding arm 6 can be retracted vertically.

The disc-holding flat 30 is immobilised vertically relative to the arm-fastening flange 7, in the upper portion, on the one hand, by a stop pin 32 fastened transversely to said flat 30 and in the lower portion, on the other hand, by the contact pressure of the spring 31.

This spring 31 is guided and kept in the upper portion by a centring part 40 and in the lower portion by a washer 34 guided and stopped on a rectangular connecting part 35 on the disc-holding flat 30.

Adjustment of the force of the spring 31 is carried out by tightening or loosening a nut 41 on a threaded rod of the connecting part 35.

The retraction of the opening disc 5 is therefore vertical and directly dependent on the force exerted by the disc 5 on the spring 31, the pre-deformation value of which is adjusted by the user depending on the soil hardness.

The adjustment pressure before retraction depends on the compression adjustment of the spring and therefore on the length of tightening T of the nut 41 on the threaded rod of the connecting part 35, directly on the vertical axis of said spring 31.

The disc-holding flat 30 comprises means of adjusting this length of tightening T of the nut 41, i.e. means of adjusting the compression of the spring 31 to predetermined values.

Therefore, several reference marks 36 are provided and distributed on the disc-holding flat 30, parallel to the vertical axis of the spring 31.

As these reference marks 36 each correspond to a particular pressure of the spring 31 and consequently to a pressure of the disc 5 on the soil, they act as visual reference marking for easily adjusting the soil pressure from which the opening disc 5 starts being retracted.

Therefore, depending on the nature of the soil, the crop considered and the nature of the obstacles likely to disturb the firming, the ideal maximum contact pressure of the opening disc 5 can be selected.

In addition, the reaction of the spring 31 is rapid, directly opposite to and proportional to the trajectory of the disc-holding arm 6.

Due to the orientation of the disc-holding arm 6, identical to the plate 38 as defined above in accordance with the angles α and β, it is also ensured that, irrespective of the height of the raising of the opening disc 5, the contact of the opening disc with the face F1 and the edge 37 of the share 2 is maintained.

In addition, advantageously, due to the vertical direction of retraction of the opening disc 5, the longitudinal adjustment L of said opening disc 5 can be maintained, irrespective of its adjustment position.

Regarding the adjustment of the seeding element 10, it can, by way of example, be provided by means known *per se* such as a compression spring guided in a rod and adjustable by manual movement of a stop pin along this rod.

Furthermore, with reference to Figures 11a to 11e, 12, 13a and 13b, it is observed that the position of the depth wheel 4 is adjustable heightwise relative to the press wheel 1 in order to adjust the seeding depth, denoted by H in Figure 1.

In a first embodiment of the present invention, a mechanism 17 for adjusting the height of the depth wheel 4 relative to the press wheel 1 comprises an eccentric shaft 18 articulated, at one end about an axis 19 supported by a collar 20 secured to the support plate 11 and coaxial with the main rotational axis 23 of the press wheel 1 and, at the opposite end, about a parallel rotational axis 21 which supports the depth wheel 4, which is freely rotatable.

The height of the depth wheel 4 therefore depends on a rotation angle ω of the shaft 18 relative to the direction of travel A of the seeder, illustrated in Figure 1.

This variation of the angle ω is obtained due to operating means capable of causing the shaft 18 to pivot about the axis 19, bringing about a change of height for the depth wheel 4 and consequently a change in depth H in the soil.

In one embodiment, these operating means comprise at least one stowable key 22 (visible in Figure 1), inserted in the square section end of the shaft 18, coaxial with the rotational axis 21 of the depth wheel 4.

Furthermore, the shaft 18 is rotationally immobilised relative to the main axis 23 of rotation of the press wheel 1 adjustably due to an adapted toothed positioning dog coupling 24 placed between the shaft 18 and the support plate 11 or any other means which is adapted and rotatably movable about the axis 19.

This dog coupling comprises two opposing elements 24a, 24b, each provided with teeth intended for co-operating with one another on the opposing faces of the two elements.

In an alternative embodiment, the positioning dog coupling is a spring-loaded dog coupling.

By acting on the key 22 forming a gripping means capable of turning about the axis 19 or main rotational axis 23 of the press wheel 1, the pivoting of the positioning dog coupling and of the shaft 18 tooth by tooth about said axis 23 is brought about.

Adjustment of the angle of inclination ω of the shaft 18 is carried out therefore, by rotation, tooth by tooth, of the dog coupling 24 which rotationally releases the key 22 in order to move it in a vertical plane.

It is therefore possible to move from a first position of inclination of the shaft 18 to a second, different, position of inclination by simply acting on the key 22 from low to high and *vice versa* in a vertical plane.

The maintaining of the angle of inclination ω of the shaft 18 and its immobilisation are provided by the pressure of spring washers 25, on the dog coupling 24, placed between the plate 11 and a circlip 100, secured to the shaft 18.

This pressure, which is variable and progressive depending on the rotational position of the dog coupling 24, is transmitted to the dog coupling 24 via the shaft 18 which slides freely in the collar 20 coaxially with the axis 23 of the press wheel 1.

In practice, when the dog coupling 24 is inactive, the elements 24a and 24b are contiguous and the pressure applied to the springs 25 corresponds to a fitting preload adjustment value for these springs, which is necessary for the stability of the shaft 18 and associated elements on the plate 11.

When the dog coupling 24 is rotated by the key 22, the elements 24a and 24b of the dog coupling 24 progressively deviate from the value necessary for moving from one tooth to another.

Therefore, to the fitting load pressure is added a variable, progressive pressing force applied to the springs 25 by the horizontal movement of the element 24a of the dog coupling 24.

Furthermore, as illustrated in Figures 1, 11a and 11b, the support plate 11 of the press wheel 1 and share 2, parallel to the press wheel 1, comprises means 26 for adjusting the height H of the depth wheel 4 to predetermined heights.

Therefore, several apertures 27 are provided and distributed on the surface of the plate 11 in an arc.

These apertures 27 each correspond to a particular inclination for adjustment of the shaft 18 and of the dog coupling 24 and consequently of a height H of the depth wheel 4. They act as visual reference marking for easily adjusting the height of the depth wheel 4 to a predefined height.

As the progression of the inclination depends on the number of teeth of the dog coupling 24, it is possible to change the dog couplings 24 quickly with a predefined number of teeth and consequently to adapt the precision of the depth adjustment of the depth wheel 4 to the particular features of each seeding.

Due to the presence of the apertures 27, the adjustment of the depth of a depth wheel 4 is, in addition, easily reproducible for all of the seeding elements 10 of a single seeder.

Also, there is improvement in the precision and constancy of the seeding depth in so far as the depth wheel 4 is situated at the place of delivery of the seed to be sown.

In practice, the depth wheel 4 contributes to the drive of the press wheel by friction of the lips on the side face of the press wheel 1.

Furthermore, due to the rotation speed differential between the depth wheel 4 and the press wheel 1, a smooth, clean surface of the side face of the press wheel 1 can be maintained.

In a second embodiment of the present invention, the mechanism 50 for adjusting the height of the depth wheel 4 relative to the press wheel 1, i.e. the mechanism for adjusting the planting depth, comprises two sliding sections 51, 52 and a nut and bolt system 53 for locking the sliding of said sections 51, 52.

Such a mechanism is fitted in the alternative embodiments of the seeding elements 10 illustrated in Figures 11c, 11d and 11e.

This mechanism further comprises an operating and gripping means 54 such as a crank handle whereby, by rotation, the raising or lowering of the depth wheel 4 can be brought about.

In addition, in the alternative embodiment illustrated in Figure 11e, it should be noted that the variation in the seeding depth corresponds to the average height variation of the front depth wheel 4 and the rear depth wheel 4.

Patentkrav

1. Så-enhed (10), omfattende i det mindste et skær (2) opstrøms for et pressehjul (1), et furehjul (4) og i det mindste en forskær-skive grænsende op til skæret (2), hvorved skæret (2) omfatter en plan sideflade (F1) vendende mod forskær-skiven (5) samt en forkant (37), hvorved forskær-skiven (5) er monteret drejelig omkring en akse på tværs af retningen for så-enhedens (10) fremadgående bevægelse og i forhold til sidefladen (F1) er orienteret skråt således, at skiven (5) flugter med skærets forkant (37), **kendetegnet ved, at** skæret (2) omfatter en kanal, som findes på dets bagside, til at lede såkorn, og som omgiver pressehjulets (1) periferi.

2. Så-enhed (10) ifølge krav 1, **kendetegnet ved, at** forskær-skivens (5) aftryk i jorden befinder sig uden for et nedpresningsområde S_p for korn, som er defineret som afstanden i pressehjulets (1) bredde mellem skærets (2) nedre ender og pressehjulet (1).

3. Så-enhed (10) ifølge et af kravene 1 eller 2, **kendetegnet ved, at** skærets (2) nedre del omfatter mindst en skråkant (15).

4. Så-enhed (10) ifølge et af kravene 1 til 3, **kendetegnet ved, at** skærets (2) nedre del har en form, der er symmetrisk i forhold til såningsrækken.

5. Så-enhed (10) ifølge et af kravene 1 til 3, **kendetegnet ved, at** skærets (2) nedre del har en bredde, der er større end pressehjulets (1) bredde.

6. Så-enhed (10) ifølge et af kravene 1 til 5, **kendetegnet ved, at** den desuden omfatter midler til indstilling af forskær-skivens (5) højdeposition i forhold til skæret med henblik på indstilling af skivens (5) dybde i jorden og/eller midler til indstilling af forskær-skivens (5) længdeposition med henblik på at indstille skivens (5) forspring i forhold til skæret.

7. Så-enhed (10) ifølge krav 6, **kendetegnet ved, at** midlerne til indstilling af højden og/eller længdepositionen for forskær-skiven (5) i forhold til skæret er egnede til at opretholde den skrå retning, som er defineret mellem forskær-skiven (5) og skærets (2) sideflade (F1), ved hver forskydning af forskær-skiven (5) på en sådan måde, at forskær-skivens flugtning med skærets (2) forkant (37) sikres.

8. Så-enhed (10) ifølge et af kravene 1 til 7, **kendetegnet ved, at** den desuden omfatter midler til at tilbagetrække forskær-skiven (5) til en uvirksom position uden kontakt med jorden.

9. Så-enhed (10) ifølge et af kravene 1 til 8, **kendetegnet ved, at** forskær-skiven (5) og så-enheden (10) omfatter uafhængige midler til udøvelse af pres mod jorden.

10. Så-enhed (10) ifølge et af kravene 1 til 9, **kendetegnet ved, at** forskær-skiven (5) og så-enheden (10) omfatter midler til udøvelse af pres mod jorden med separat indstillelig intensitet.

11. Så-enhed (10) ifølge et af kravene 1 til 10, **kendetegnet ved, at** den desuden omfatter midler til indstilling af furehjulets (4) højde i forhold til pressehjulet (1) til forudbestemte højder, hvilke midler omfatter i det mindste en ledaksel (18), dels med en akse, der er koaksial med en rotationsakse for pressehjulet (1), og dels med en rotationsakse for furehjulet (4), således at

furehjulet (4) excentreres i forhold til sin rotationsakse under indstillingen af dets højde.

12. Så-enhed (10) ifølge krav 11, **kendetegnet ved, at** midlerne til indstilling af furehjulets (4) højde i forhold til pressehjulet (1) desuden omfatter en positioneringsklo (24) med indhak eller en fjeder.

13. Så-enhed (10) ifølge et af kravene 11 til 12, **kendetegnet ved, at** midlerne til indstilling af furehjulets (4) højde i forhold til pressehjulet (1) desuden omfatter påvirkningsmidler (22), som er egnede til at få akslen (18) til at dreje omkring den akse, der er koaksial med pressehjulets (1) rotationsakse, således at der sker ændring af akslens (18) hældningsvinkel i forhold til så-enhedens (10) fremføringsretning, hvilke påvirkningsmidler omfatter i det mindste et gribeelement (22), som er monteret på en ende af akslen (18) og er egnet til at dreje hen imod i det mindste en position, der indikerer en dybde af furehjulet (4).

14. Såmaskine, omfattende en bæreramme, på hvilken der ledforbundet er anbragt i det mindste en så-enhed ifølge et af kravene 1 til 13.

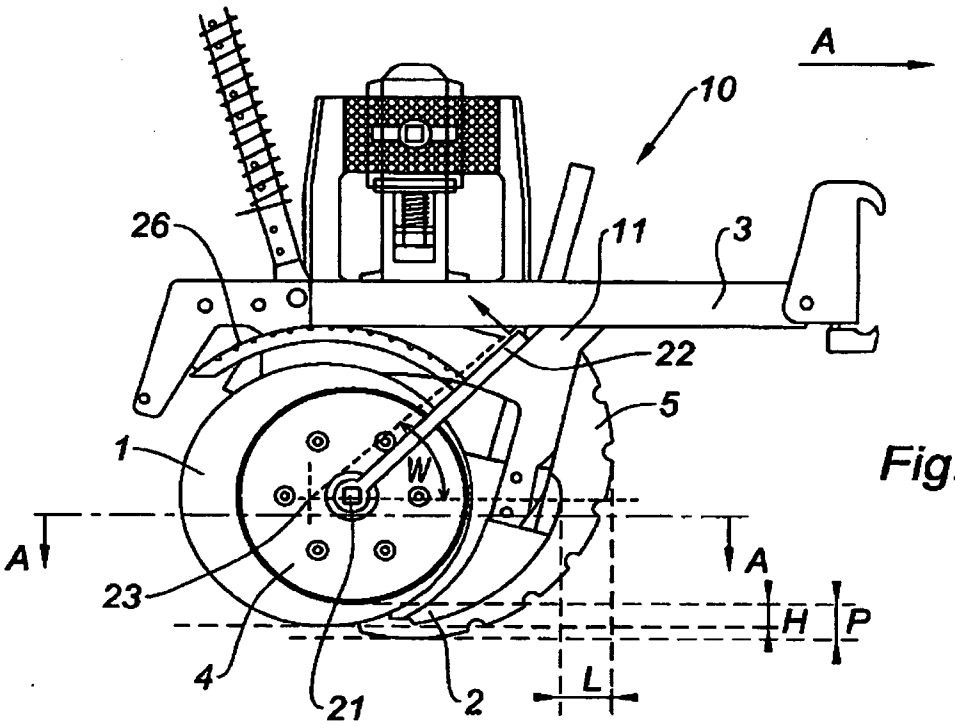


Fig. 1

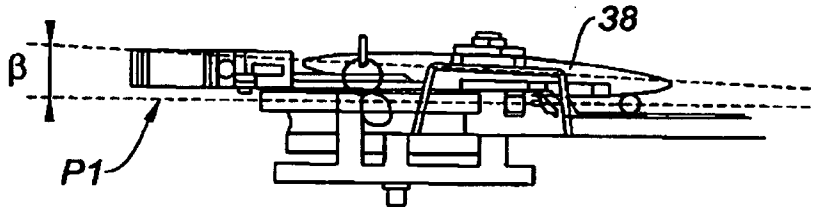


Fig. 2

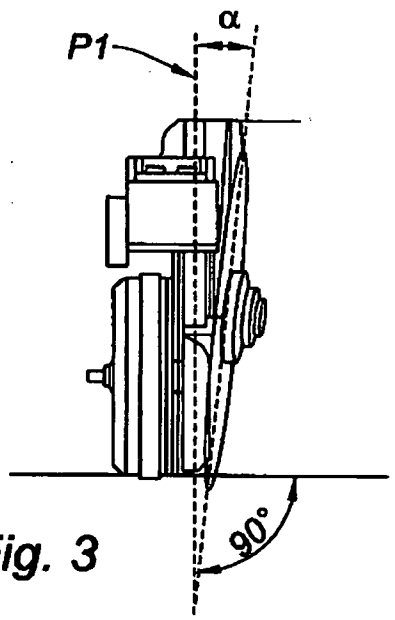


Fig. 3

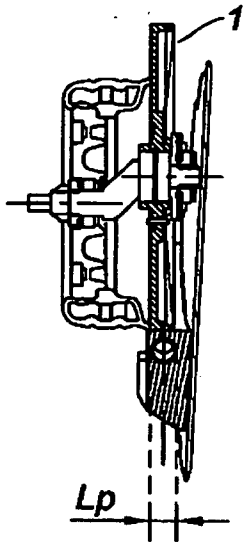


Fig. 4

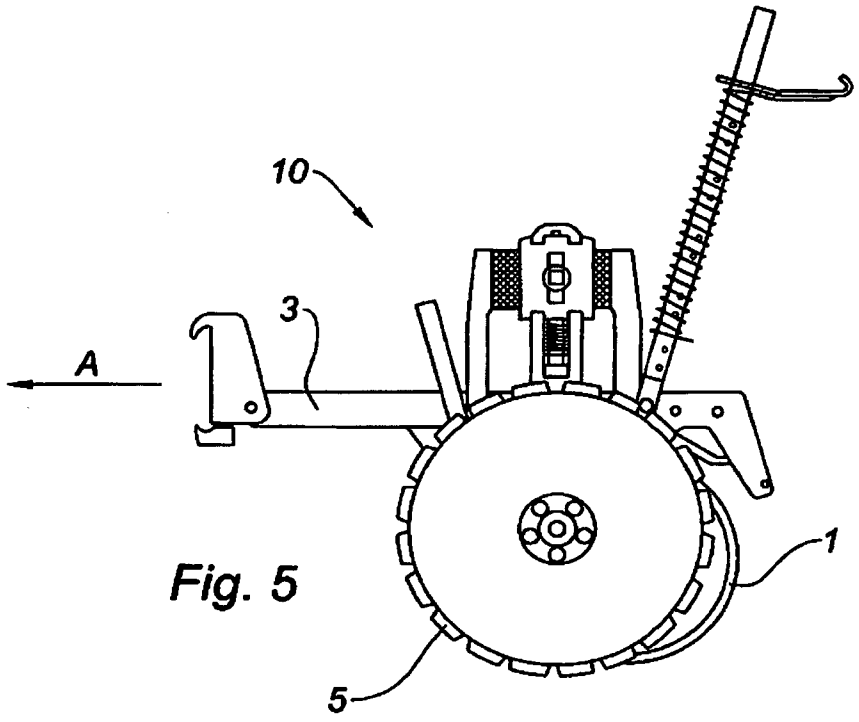


Fig. 5

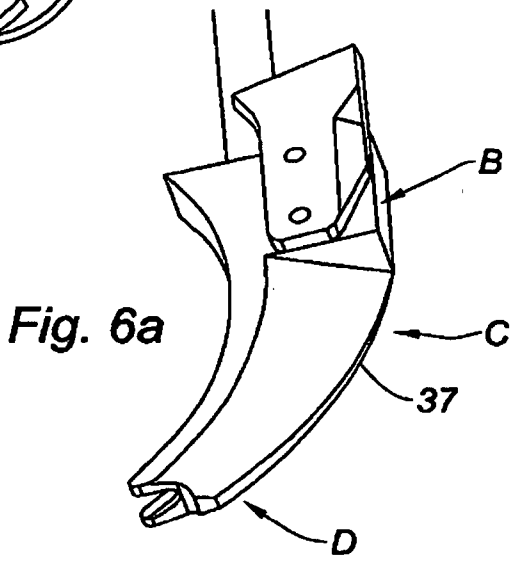


Fig. 6a

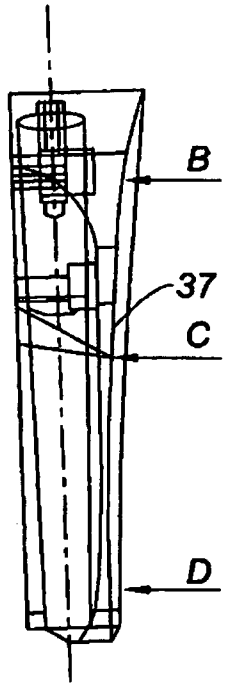


Fig. 6b

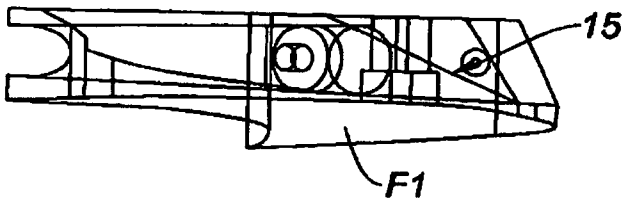


Fig. 6c

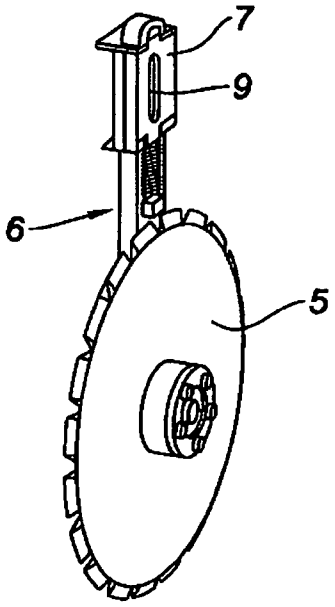


Fig. 7

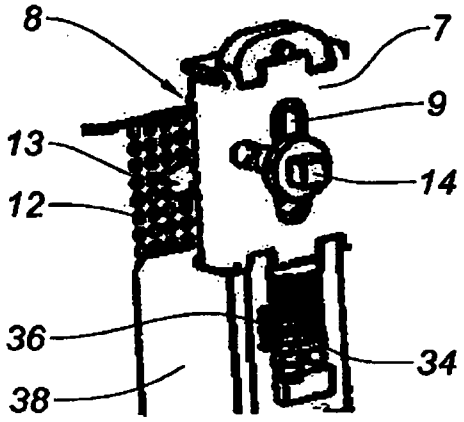


Fig. 8

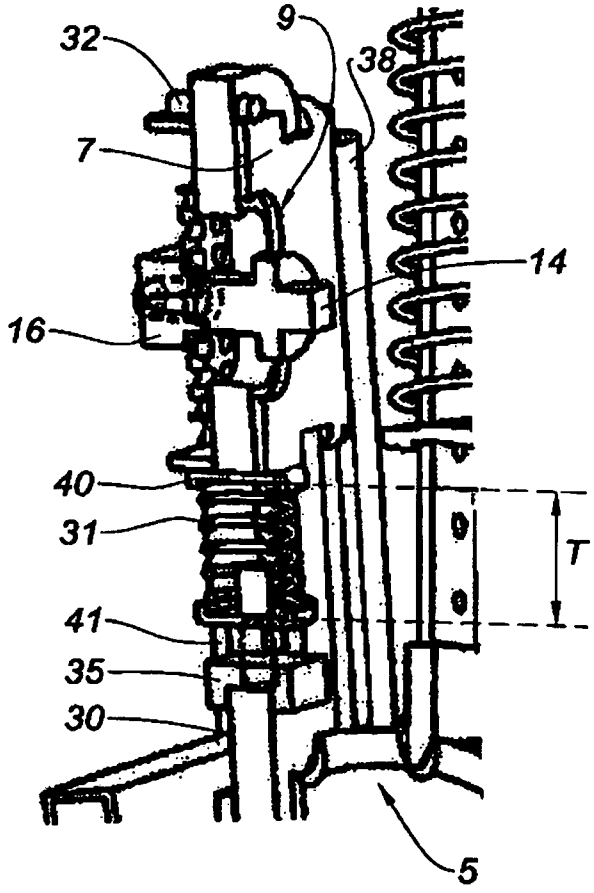


Fig. 9

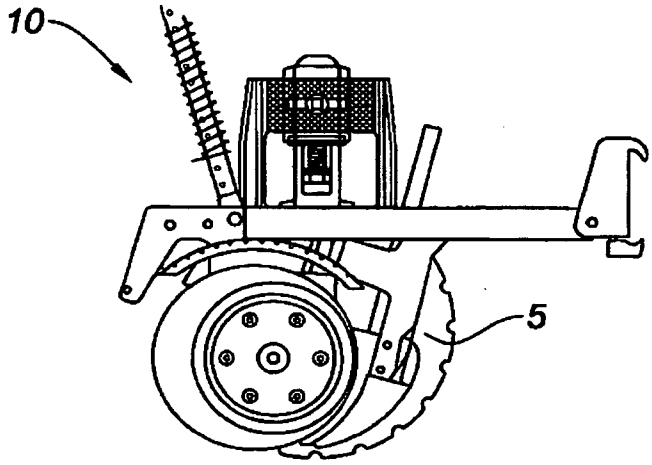


Fig. 10a

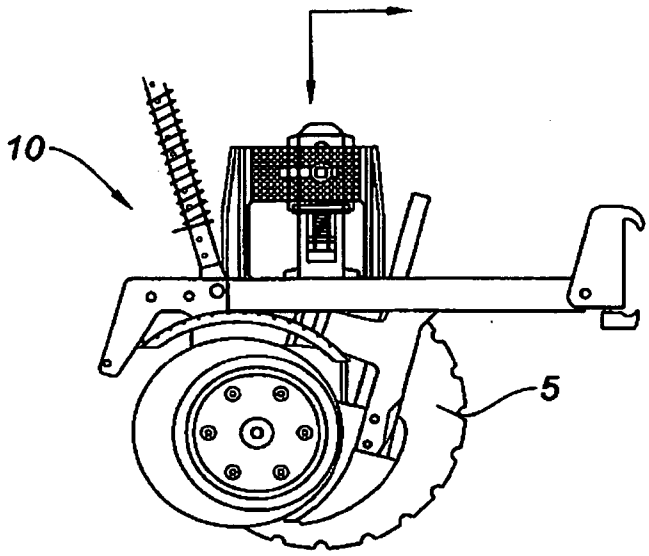


Fig. 10b

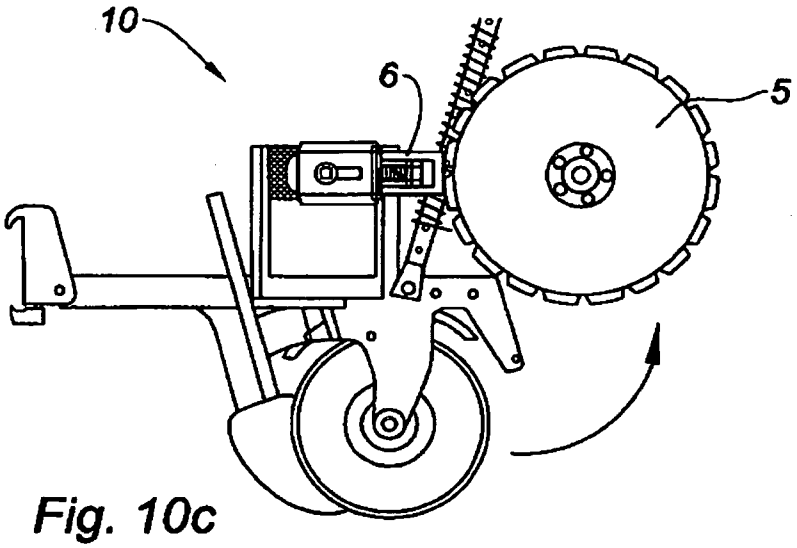


Fig. 10c

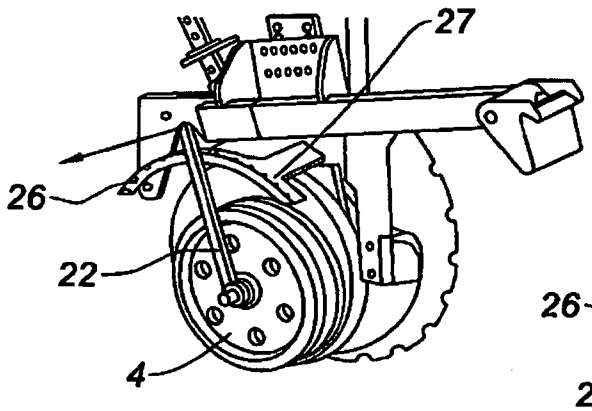


Fig. 11a

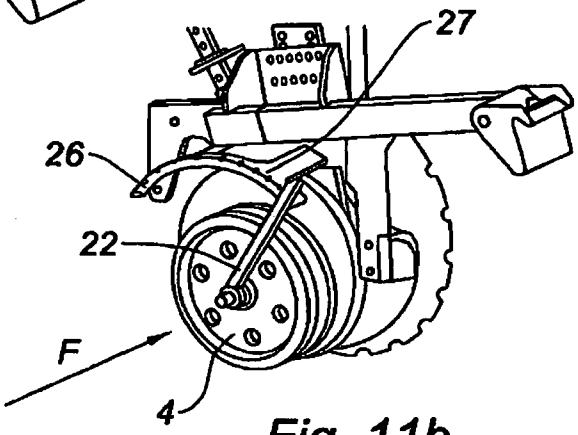


Fig. 11b

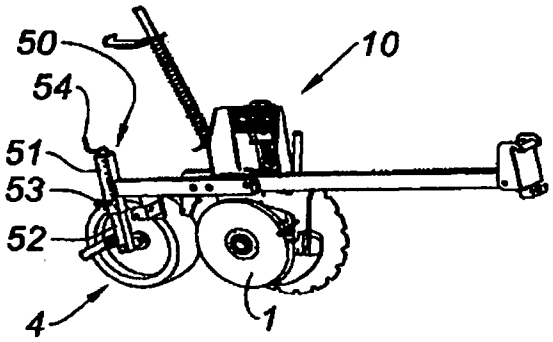


Fig. 11c

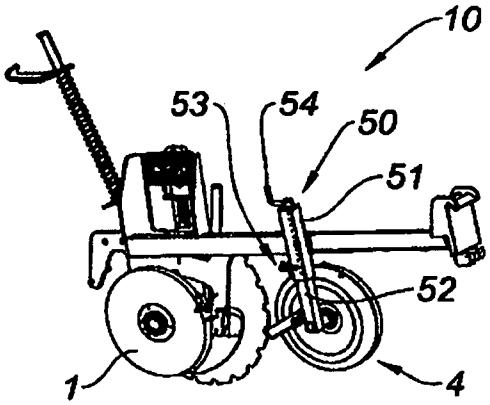


Fig. 11d

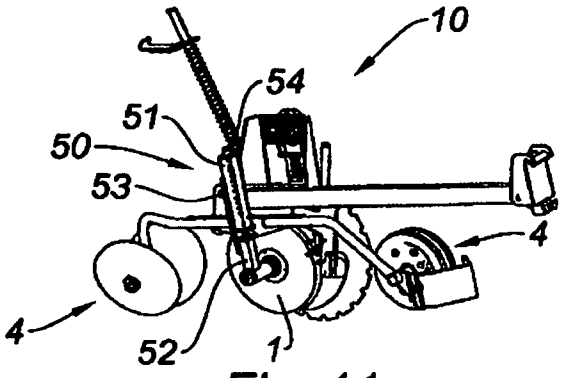


Fig. 11e

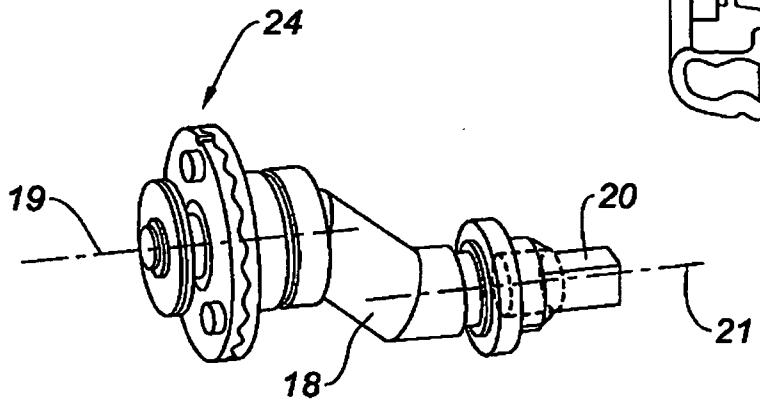


Fig. 13a

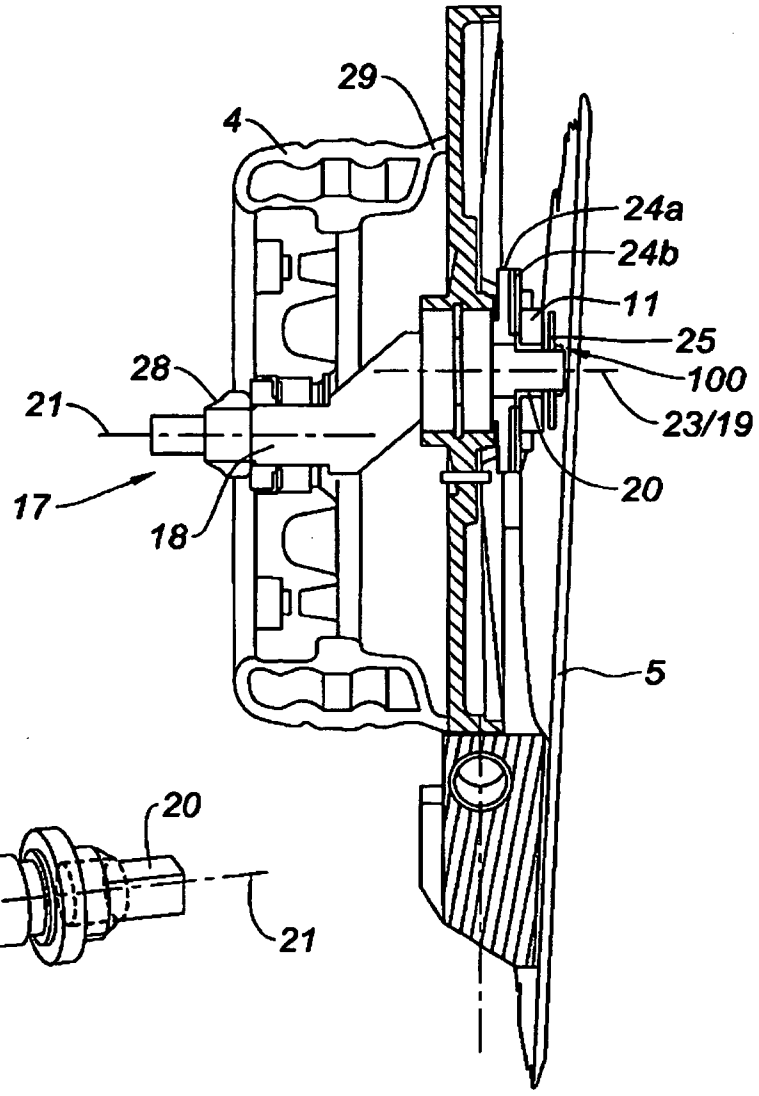


Fig. 12

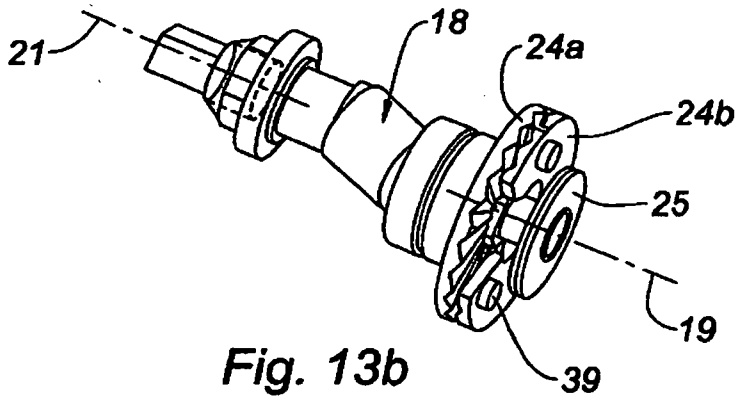


Fig. 13b