A headstock assembly (40) for mounting a reversible plough on the rear of a propelling vehicle, said assembly comprising: a headstock (40); and, a turnover mechanism (41) mounted on the headstock (40) and operative to rotate the plough frame: in which the turnover mechanism (41) comprises: a reversible mounting member (42) rotatably mounted on the headstock (40); a piston/cylinder unit (44) having its upper end (45) mounted on the rear side (46) of the headstock (40) on an upper mounting point (47) and being pivotally connected at its lower end to the mounting member (42); and, first and second mounting points (54, 55) on the mounting member (42), spaced apart one on either side of the axis of rotation (43), and each being adapted to be coupled pivotally to the lower end of the unit (44), to provide a respective mode of operation, for use according to the type of reversible plough which is to be mounted on the headstock (40).
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HEADSTOCK ASSEMBLY FOR REVERSIBLE PLOUGH FRAME

This invention relates to a headstock assembly for a reversible plough frame and which is intended to be mounted at the rear of a tractor or other propelling vehicle.

A reversible plough usually comprises a plough frame having a plough beam with pairs of reversible plough bodies arranged along its length, and a headstock at the forward end of the plough frame which is mounted on a usual three point linkage at the rear of an agricultural tractor. The plough beam is rotatably mounted on the headstock so as to be able to rotate through about 180°, in order to reverse the plough bodies, and to adjust the plough bodies between right side ploughing and left side ploughing (and vice versa). The axis of rotation of the plough beam extends generally parallel to the ground surface, and also to the ploughing direction.

It is usual to provide a turn-over cylinder which can be actuated, in order to rotate the plough beam, and depending upon requirements, the plough beam can be caused to rotate in either one of two directions from one ploughing position to the other i.e. it has two different modes of operation. Thus, with a fully mounted plough, the plough bodies are first lifted out of the ground (by lifting of the rear lift mechanism at the rear of the tractor which lifts the plough frame via the headstock). The plough bodies can then be reversed between left side and right side ploughing positions, by rotation of the plough beam through 180°.

Depending upon requirements, in a first mode of operation the plough beam can be caused first to rotate upwardly through about 45° (to a transport position of the plough bodies if required), and then downwardly through 45° to take-up the new ploughing position. This first mode of operation is necessary when, in particular, an integrated plough / packer combination is provided, in which the packer also rotates with the plough beam.
In an alternative mode of operation, the plough beam is first caused to rotate downwardly through about 45°, and followed by upward rotation through 45° to take-up the new ploughing position. This is then followed by lowering of the plough bodies into contact with the ground.

The alternative mode of operation is not generally possible with an integrated plough / packer combination, since the packer would be driven downwardly into the ground by the initial downward rotation of the plough beam.

The applicants, Kverneland Klepp AS, have an existing design of reversible plough provided with a headstock 160 model, in which it is possible to convert the headstock to operate in either one of the two modes of operation, and by means of a relatively simple mechanical adjustment. A turnover cylinder therefore is mounted on a front side of the headstock (the side facing the rear of the tractor), and reacts between a fixed mounting point on the headstock and one end of an actuator arm which is rotatably mounted on the headstock.

The plough beam is usually carried by a reversible linkage, sometimes referred to as a "slide", which is also rotatably mounted on the headstock, and which is caused to rotate through 180° by the actuator arm when the latter is operated by the turnover cylinder.

The conversion of the headstock is achieved by adjustment of the position of the fixed mounting point of the cylinder on the headstock, with this mounting point being adjusted between upper and lower positions. When in the upper position of mounting point, the cylinder can react from this to apply initial downward rotation to the plough beam, and when in the lower position, the cylinder can react to apply initial upward rotation to the plough beam.

With this known design of headstock model 160, the turnover cylinder is mounted on the front side of the headstock (as referred to above), and this design is
relatively cheap to manufacture, and can be adjusted between the two modes of operation. However, with this known design of headstock model 160, there is a limit to the size and weight of plough which can be mounted thereon, and there are therefore larger sizes of reversible plough which cannot be handled by this headstock model. Also, the conversion of the headstock between its two modes of adjustment requires the complete uncoupling of a mounting plate on the headstock (which requires removal of four mounting bolts), followed by recoupling of the mounting plate in the new position and retightening of the bolts.

The present invention seeks to provide a new design of headstock which can handle larger designs of reversible plough frame, and which is simple to adjust when it is required to be used with a) different types of reversible plough and/or b) different types of tractor i.e. having different wheel bases.

According to the invention there is provided a headstock assembly for mounting a reversible plough on the rear of a propelling vehicle, said assembly comprising:

a headstock which is adapted to be mounted on a lifting mechanism at the rear of the propelling vehicle, said headstock being also adapted to mount a plough frame thereon for rotation through approximately 180° between right side ploughing and left side ploughing of plough bodies mounted on the plough frame; and,

a turnover mechanism mounted on the headstock and operative to rotate the plough frame about an axis which extends generally parallel to the ploughing direction and to the ground surface:

in which the turnover mechanism comprises:

a reversible mounting member rotatably mounted on the headstock, said mounting member being adapted to mount the plough frame thereon so that rotational adjustment of the can
move the plough bodies between right side ploughing and left side ploughing;

a turnover piston / cylinder unit having its upper end mounted on the rear side of the headstock on an upper mounting position and the unit being pivotally connected at its lower end to the mounting member, said unit being operative to rotate the mounting member through about 180° in order to reverse the plough bodies; and,

first and second mounting points on the mounting member, spaced apart on either side of the axis of rotation, and each being adapted to be coupled pivotally to the lower end of the piston / cylinder unit, to provide a respective mode of operation, for use according to the type of reversible plough which is to be mounted on the headstock.

The invention therefore provides a simple design of headstock assembly, which can be easily converted between two modes of operation, in order to reverse the plough bodies of different types of reversible plough.

In order to accommodate mounting of the piston / cylinder unit on the rear side of the headstock, conveniently a bearing shaft and sleeve (forming the axis of rotation) are extended, so as to create necessary space between the mounting member and the headstock in which the piston / cylinder unit can be mounted.

Preferably, the upper end of the piston / cylinder unit is releasably coupled to the upper mounting point on the headstock, and this may be provided by means of a pivot pin which is received by a mounting hole in the upper end of the headstock, and in which the mounting pin is held in position by a bolt or other fastener taken through a transverse aperture formed in the headstock and the pivot pin.

The lower end of the piston / cylinder unit (which is pivotally coupled to one or the other of the first and second mounting points), preferably comprises a pivot pin having a conical face which makes contact with a conical seating
formed in the mounting member such that, when a fastener nut is tightened on the pin, all of the slack is taken-up, and the pin can therefore transfer large forces from the piston / cylinder unit to the mounting member.

A preferred embodiment of headstock assembly according to the invention will now be described in detail, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a rear perspective view of an integrated combination of reversible plough and packer, and which may be mounted at the rear of a tractor or other propelling vehicle in fully mounted manner, by a headstock assembly according to the invention;

Figures 2a and 2b show successive stages of adjustment of a rotatable plough frame of the combination of Figure 1 from a position of right side ploughing to left side ploughing;

Figure 3, 3a and 3b show a known design of headstock assembly which can be used to couple a rotatable plough frame of a reversible plough in a fully mounted manner at the rear of a tractor;

Figure 4 is a detailed side view of an upper end of a headstock assembly according to the invention;

Figure 5 is a side view of a lower end of the headstock assembly shown in Figure 4;

Figure 6 is a plan view of the headstock assembly of Figures 4 and 5;

Figure 7 is a front view of the headstock assembly;

Figure 8 is a rear view of the rotatable mounting of a reversible mounting member on the headstock assembly, and showing two different mounting points, to provide two different modes of operation;

Figure 9 is a plan view corresponding to Figure 8;

Figure 10 is a detailed view showing the means by which a piston / cylinder unit of a turnover mechanism is
detachably coupled to one or the other of the two mounting points on the mounting member;

Figure 11 is an exploded view of parts of a further embodiment of headstock assembly according to the invention;

Figure 12 is a frontal view of the headstock shown in Figure 11, in assembled form;

Figure 13 is a detailed view of an adjustable limit stop arrangement for limiting the rotation of the plough frame between two different ploughing positions; and

Figure 14 is a front view of an alternative arrangement of slide.

Referring first to Figure 1 of the drawings, there is shown an integrated combination 10 which comprises a reversible plough 11 and a packer 12 coupled rigidly to the frame of the plough 11, so that they can be jointly rotated between a position of right side ploughing shown in Figure 1, and a position of left side ploughing, upon plough body reversal. Combination 10 is mounted on a lifting mechanism at the rear of a tractor or other propelling vehicle, in fully mounted manner, via a suitable design of headstock assembly.

As will be well known to those of ordinary skill in the art, a reversible plough has a plough frame which is rotatably mounted on a headstock assembly, to rotate about an axis which extends generally parallel to the ground surface, and in the ploughing direction. The plough frame has a plough beam with a number of pairs of reversible plough bodies arranged along its length, and rotation between a position of right side ploughing to a position of left side ploughing, for the combination 10 shown in Figure 1, is achieved first by lifting the combination 10, by operation of the lifting mechanism at the rear of the tractor, as shown in Figure 2a. The plough frame then rotates through 45°, under operation of a suitable turnover cylinder, to take-up a transport position shown in Figure 2b. To rotate from the
position of Figure 2a to that of 2b, the plough frame rotates initially in an upward direction of rotation about the axis of rotation. When the transport position is reached, as shown in Figure 2b, the completion of the plough body reversal movement is achieved by downward rotation of the plough frame about the axis of rotation, until the opposite one of the reversible pairs of plough bodies comes into contact with the ground. The packer 12 also then takes-up a suitable position on the left side of the tractor.

Figure 3, 3a and 3b show one known headstock assembly, designated generally by reference 20, which can be used in order to fully mount the reversible plough 11 on a lifting mechanism at the rear of a tractor. The headstock assembly 20 comprises headstock 21 having an upper end 22 which will be coupled with a top link of the lifting mechanism of a tractor, and spaced apart lower ends 23, each of which is connected to a respective one of the two lower links of the lifting mechanism of the tractor. A reversible linkage or "slide" 24 is rotatably mounted on the headstock 21, so as to be capable of rotating through approximately 180° between left side ploughing and right side ploughing, and a turnover cylinder 25 is mounted on the front side of the headstock 21, and is operative to reverse the plough bodies.

The cylinder 25 reacts between a fixed mounting point on the headstock 21, which is provided by means of a pivot 26 of a mounting plate 27 mounted on the front side of the headstock 21. The other end of the cylinder 25 is pivotally connected, via pivot 28, to one end of an actuator arm 29 which controls the adjustment of the slide 24.

The cylinder 25 has two different mounting positions on the headstock 21, and in the first mounting position shown in Figure 3, retraction of the cylinder 25 can effect clockwise rotation of the actuator arm 29 so that the slide 24 also rotates through 180°, in order to move the plough bodies (not shown) from the right side ploughing position to the left
side ploughing position. In this first mode of operation, the plough bodies therefore rotate initially in an upward direction about the axis of rotation until the transport position is reached, and then complete rotation of the plough frame to the alternative ploughing position by downward rotation about the axis of rotation. This first mode of adjustment will usually be necessary, to allow reversing of an integrated combination 10 of reversible plough 11 and packer 12, since it is necessary to lift the packer 12 upwardly out of contact with the ground during plough body reversal.

However, in some circumstances, and particularly in the absence of a packer 12, it may be desired to reverse the plough bodies, by rotating the plough frame through 180°, by first carrying out downward rotation of the plough bodies about the axis of rotation, and moving below the axis of rotation. The achieve this, the mounting plate 27 can be adjusted between the position shown in Figure 3, and 3a, to an alternative mounting position shown in Figure 3b, and which is achieved by uncoupling the four bolts 30 illustrated, and changing the position of the mounting plate 27, so that the pivot point 26 for the cylinder 25 moves from a position below the bolts 30, as shown in Figure 3a, to a position above the bolts 30, as shown in Figure 3b. With this adjustment of the mounting position, operation of the cylinder 25 then effects downward rotation of the slide 24 and the plough frame carried thereby.

The known headstock assembly shown in Figure 3 works generally satisfactorily, and does provide facility to adjust between the two different modes of plough body reversal. However, for larger and heavier designs of reversible ploughs, which require a greater amount of hydraulic energy to reverse the plough bodies, the headstock assembly shown in Figure 3 is not entirely suitable, and an improved design of
headstock assembly according to the invention will now be described with reference to Figures 4 to 10 of the drawings.

Referring now to Figures 4 to 10 of the drawings, a headstock assembly according to the invention will now be described in detail, and which is intended to mount a reversible plough (not shown) on the rear of a propelling vehicle in fully mounted manner. The headstock assembly comprises a headstock 40 which is adapted to be mounted on a lifting mechanism (not shown) at the rear of a tractor, and which is also adapted to mount a plough frame thereon for rotation through approximately 180° between right side ploughing and left side ploughing. The plough frame has a plough beam provided with a number of pairs of reversible plough bodies arranged along its length, and the plough frame is able to rotate through approximately 180° about an axis which extends parallel to the ploughing direction, and generally parallel to the ground surface.

A turnover mechanism 41 is mounted on the headstock 40 and is operative to rotate the plough frame in order to reverse the plough bodies. The turnover mechanism comprises a reversible mounting member in the form of a "slide" 42 to which the plough beam is coupled, and which is rotatable about axis 43 through approximately 180°, in order to reverse the plough bodies between right side ploughing and left side ploughing.

The turnover mechanism 41 also comprises a piston / cylinder unit 44 having its upper end 45 mounted on the rear side 46 of headstock 40 via an upper mounting pivot 47.

In order to mount the turnover mechanism 41 on the rear side 46 of headstock 40, it is necessary to extend the bearing shaft 43a and sleeve 43b (defining the axis of rotation 43), as shown in the side view of Figure 5, to create more space between the slide 42 and the headstock 40, which can accommodate the turnover mechanism.
The upper pivot mounting 47 comprises a pivot pin 48 taken through a mounting hole 49 in the upper end of the headstock 40, and held in position by a transversely extending bolt or fastener 50 taken through the headstock and through the pivot pin 48.

The lower end of the piston / cylinder unit 44 is pivotally connected to slide 42, and as shown in the front view of Figure 7, actuation of the unit 44 can cause the slide (and therefore the plough beam also) to rotate through 180° about axis 43, between position 1 and position 2 as shown by references 56 and 57. The pivot connection of unit 44 (described and shown in more details by references 51 and 52 with reference to Figure 10) moves along an arc, as shown in Figure 7.

The means by which the lower end of unit 44 is coupled to the slide 42 is shown in more detail in Figure 10, which shows a pivot pin 51 which is received by a cylindrical seating 52 in the slide, so that, when the pivot pin 51 is tightened by a nut 53, all slack is taken-up, and the pin 51 can transfer substantial forces from the unit 44 to the slide 42. This means that the headstock assembly of the invention can be used with larger designs of reversible plough, and can readily operate with the larger amounts of hydraulic energy necessary to reverse the plough bodies.

The embodiment of headstock assembly according to the invention also is capable of being adjusted so that it can be operated in either one of two modes of operation, during plough body reversal of different types of reversible plough, according to the selection of one of two possible mounting points provided on the slide to which the lower end of unit 44 can be pivotally connected. Two alternative mounting points are shown by references 54 and 55 in Figures 8 and 9 and which are equally spaced apart in opposite directions from axis 43. Depending upon which one of the mounting holes is used, operation of the piston / cylinder unit 44 can
effect plough body reversal, by rotation about axis 43, either clockwise or anti-clockwise about the axis 43.

When the pivot pin is located in the right hand hole 54, the pin can only rotate with the slide in an upward direction from position 1 (anti-clockwise about the axis 43), to provide one mode of plough body reversal, and which is completed when the pin reaches position 2 (see references 56 and 57 for positions 1 and 2 respectively in Figure 7). This mode of operation will be suitable for some types of reversible plough (and optionally integrated with a packer).

However, to provide an alternative mode of plough body reversal (for other types of reversible plough), it is only necessary to position the pivot pin in the left hand hole 55.

Referring now to Figure 11 of the drawings, this is an exploded view of some of the parts which can be assembled to form a further embodiment of headstock assembly according to the invention. This shows a headstock 112 which rotatably mounts a reversible linkage or slide 106, which takes the form of a reversible mounting member which is capable of carrying a plough frame, and which is rotatably mounted in headstock 112, for rotation through slightly more than 180°, between left side ploughing and right side ploughing. It is possible to adjust the limits to the rotational adjustment of the slide 106, according to ploughing requirements. This will be well known to those of ordinary skill in the art, in that usually the tractor wheel propelling the plough will run in a previously formed furrow, and the depth of this furrow will have an influence on the required angular adjustment of the plough bodies between left side ploughing and right side ploughing.

The slide 106 has a projecting stud 107 which is rotatably mounted within cylindrical bore 108 in the headstock 112, with slide 106 being presented to the headstock 112 towards the rear side thereof i.e. the side of
the headstock 112 remote from the side facing the rear of the tractor.

A cylinder bracket 109 is mounted selectively on either one of the two opposed ends of the slide 106, and has an end bracket 110 which can be connected via a vertical pin (not shown) to part of a lateral adjustment mechanism which is connected to the frame of the plough (not shown), such mechanism being adjustable in order to allow lateral adjustment of the plough frame relative to the axis of the headstock 112 and slide 106, to suit different types of plough and tractors having different wheel base. This lateral adjustment of reversible plough frames will be well known to those of ordinary skill in the art, and need not be described in detail herein.

The two mounting holes 54 and 55, described above, with reference to the previous figures, are shown on the slide 106 in Figure 11, and a mounting pin 111 can be mounted selectively in either one of the mounting holes 51 and 55, depending upon the particular type of reversible plough which is to be coupled to the headstock assembly. If mounting pin 111 is introduced into the right hand mounting hole 54, as seen in Figure 11, then plough body reversal will be initiated by anti-clockwise movement of the pin 111 about the axis of the headstock. Alternatively, if the mounting pin 111 is introduced into mounting hole 55, then plough body reversal will be caused by movement in a clockwise direction of the pin 111 about the axis.

The cylinder bracket 110 can be mounted on the right hand end of slide 106, as can be seen from Figure 11, and a set of five mounting holes is illustrated, comprising a central large hole 113, and four smaller holes arranged two above and two below the larger central hole 113. This provides a strong assembly of the cylinder bracket 110 to the slide 106.
A similar arrangement of five mounting holes is provided on the left hand end of the slide 106, although in this case the large central mounting hole is also formed by the mounting hole 55 (which forms one of the two alternative connection points of the lower end of the turnover cylinder arrangement).

Figure 12 is a view of the assembled parts, looking in the direction rearwardly of the tractor (not shown) on which the headstock assembly can be mounted. Parts corresponding with those already described are given the same reference numerals. As can be seen from the frontal face of the lower end of the headstock assembly, entrance apertures 114 are provided, one on either side of the rotational axis for the slide 106 provided by the headstock 112, and each of these can receive an adjustable limit stop (not shown), but one of which can be seen and shown by reference 115 in Figure 11, and which also can be seen from Figure 13. The adjustable stop 115 has two different modes of installation, one of which is shown in Figure 13, and it can be upwardly and downwardly adjusted by operation of an adjusting nut 116, and which thereby adjusts the end limit to rotational adjustment of the slide 106, during plough body reversal. To provide an enlarged range of adjustment, the stop 115 can be rotated through 180°, relative to its position shown in Figure 13, thereby giving a bigger range of angular adjustment possibilities for the rotational movement of the slide 106 and the reversible plough bodies. In practice, it will be usual for the plough bodies to rotate through slightly more than 180°, between left side ploughing and right side ploughing.

Figure 12 also shows in more detail one of the strengthened mounting arrangements provided at each end of the slide 106, in that there is large central mounting hole 113, and two pairs of smaller mounting holes on either side thereof, providing five separate bolt or other type fixations
to provide a strong assembly, and which is further strengthened by an internal spline 117 running lengthwise of the cylinder bracket 109. A similar arrangement is provided at the left hand end of the slide 106 also.

Finally, Figure 14 shows in more detail the construction and arrangement of the slide 106, shown in the exploded view of Figure 11. This shows the alternative mounting holes 54 and 55, arranged one on either side of the central axis of rotation 44, and equidistant therefrom, and also shows strengthened five-mounting hole assemblies at each end of the slide 106, on which the cylinder 109 can be selectively mounted.
CLAIMS

1. A headstock assembly (40) for mounting a reversible plough on the rear of a propelling vehicle, said assembly comprising:
   a headstock (40) which is adapted to be mounted on a lifting mechanism at the rear of the propelling vehicle, said headstock being also adapted to mount a plough frame thereon for rotation through approximately 180° between right side ploughing and left side ploughing of pairs of reversible plough bodies carried by a plough beam of the frame; and,
   a turnover mechanism (41) mounted on the headstock (40) and operative to rotate the plough frame:
   in which the turnover mechanism (41) comprises:
   a reversible mounting member (42) rotatably mounted on the headstock (40), said member (42) being adapted to mount the plough beam thereon so that rotational adjustment of the member can move the plough bodies between right side ploughing and left side ploughing;
   a piston / cylinder unit (44) having its upper end (45) mounted on the rear side (46) of the headstock (40) on an upper mounting point (47) and being pivotally connected at its lower end to the mounting member (42), said unit being operative to rotate the mounting member (42) through about 180° in order to reverse the plough bodies; and,
   first and second mounting points (54, 55) on the mounting member (42), spaced apart one on either side of the axis of rotation (43), and each being adapted to be coupled pivotally to the lower end of the unit (44), to provide a respective mode of operation, for use according to the type of reversible plough which is to be mounted on the headstock (40).

2. A headstock assembly according to claim 1, in which the upper end (45) of the unit (44) is pivotally connected to
an upper end of the headstock (40) via a releasable pin (48) and socket connection (49).

3. A headstock assembly according to claim 1 or 2, in which the lower end of the unit (44) is detachably coupled to the slide (42) via conical interfitting between pivot pin (51) and seating (52).

4. A headstock assembly according to any one of claims 1 to 3, in which the first and second mounting points (54, 55) are diametrically opposed to each other, with respect to the axis of rotation (43).

5. A headstock assembly according to claim 4, in which the first and second mounting points (54, 55) are spaced equal distances from the axis of rotation 43.

6. A headstock assembly according to any one of claims 1 to 5, in which a cylindrical bracket (109) is capable of being mounted selectively on either one of two opposed ends of the mounting member (106).

7. A headstock assembly according to claim 6, in which strengthened mounting of the cylinder bracket (109) on the mounting member (106) includes a symmetrical arrangement of one large central mounting hole (113) and pairs of smaller mounting holes on either side.

8. A headstock assembly according to any one of the preceding claims, and having a reversible plough mounted thereon.

9. A headstock assembly according to claim 8, in which a packer is also mounted on the frame of the plough to form an integrated combination.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A01B3/421

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

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A01B

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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Date of the actual completion of the international search: 4 April 2000
Date of mailing of the international search report: 13/04/2000

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Fax (+31-70) 340-3016

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Walvoort, B
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