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Plough

The present invention relates to a plough, in particular a semi-mounted plough, having an elongate frame carrier, to which a plurality of plough shares are attached one next to the other, also having working width adjusting means for adjusting the working width of the plough shares, and first-body cutting width adjusting means for adjusting the first-body cutting width.

Semi-mounted ploughs typically use a chassis which on the one hand is supported on the ground via the depth wheel and on the other hand is supported at its front end via a drawbar on the tractor, which drawbar is articulated to said tractor about a perpendicular axle. Mounted on this chassis is then the said frame carrier which carries the plough shares. When the plough is formed as a reversible plough, two rows of plough shares are attached to the said frame carrier, wherein the frame carrier is mounted on the chassis so as to be pivotable about the longitudinal axis thereof, so that in order to turn the plough the frame carrier together with the rows of plough shares attached thereto can be pivoted over the chassis onto the other side. The tractive forces are introduced by the frame carrier into the drawbar via the said chassis, to which the frame carrier carrying the plough shares is attached.

Moreover, the said chassis carries the weight of the plough during turning and during transportation on roads.

In order to adjust the cutting width of the plough shares to a desired extent, the corresponding working width adjusting means can typically adjust the work angle of the said frame carrier with respect to the direction of travel, whereby the plough shares attached to the frame carrier are pivoted accordingly. In the case of semi-mounted ploughs, e.g. the work angle of the depth wheel can be adjusted for this purpose with respect to the said frame or can be moved to another steering position which forces the frame carrier into the desired orientation. In this case, the pulling line of the plough is influenced, i.e., the frame carrier together with the plough shares attached thereto moves further to the right or left in relation to the track of the tractor, thus in turn influencing the first-body cutting width. In order in this case to be able to perform a readjustment or to be able to select the first-body cutting width also for different working width adjustments in the desired manner, the first-body cutting width can be separately adjusted or varied in an advantageous manner by first-body cutting width adjusting means. For example, in the case of semi-mounted ploughs this can be achieved by virtue of the fact that the frame carrier carrying the plough shares can be bent with respect to the drawbar about a perpendicular axle. In order to adjust the said bend position and thus the first-body cutting width, e.g. hole patterns with marking pins can be used, or even - for continuous adjustment - manually operable spindle drives or even hydraulic control actuators, by means of which the first-body cutting width can be adjusted in the desired manner.

However, finding the "correct" first-body cutting width adjustment for the respectively adjusted working width adjustment is not so simple and this has so far proved quite awkward for the tractor driver to do. After adjusting the cutting width or the working width, the first-body cutting width must be readjusted in a separate working step, which possibly must be repeated many times if the tractor driver does not find the correct adjustment at the first attempt.

Therefore, the object of the present invention is to provide an improved plough of the said type which avoids the disadvantages of the Prior Art and develops the plough in an advantageous manner. In particular, a simplified first-body cutting width adaptation is to be achieved which enables the tractor driver to make individual adjustments but at the same time minimises complex readjustment work when changes are made to the working width of the plough shares.

In accordance with the invention, this object is achieved by means of a plough as claimed in claim 1. Preferred embodiments of the invention are described in the dependent claims.

In particular, it is proposed to automatically readjust the first-body cutting width adjusting means if the working width adjusting means are actuated, wherein the extent of the readjustment can be automatically specified. In accordance with the invention, a coupling device for automatically repositioning the first-body cutting width adjusting means during actuation of the working width adjusting means is provided between the working width adjusting means and the first-body cutting width adjusting means. By means of the said coupling device, the first-body cutting width adjustment can be automatically adapted to an adjustment of the working width of the plough shares.

In this case, the said coupling device can basically be formed in different ways, wherein in accordance with one advantageous embodiment of the invention the said coupling device includes an adjustment travel controller for controlling the adjustment travel of the first-body cutting width adjusting means in a specified relationship with the adjustment travel of the working width adjusting means. In particular, the said adjustment travel controller can provide a proportional adjustment of the first-body cutting width adjusting means for adjusting the working width adjusting means, wherein depending upon the plough geometry different proportionality factors can be provided. Alternatively, the said adjustment travel controller can also provide other, non-proportional or only partially proportional functional relationships between the adjustment travel of the first-body cutting width adjusting means and the adjustment travel of the working width adjusting means. However, for many applications it will be sufficient or advantageous to reposition the first-body cutting width adjustment means proportionally with respect to the working width adjusting means, in order to readjust or adapt the once selected first-body cutting width in the desired manner during adjustment of the working width of the plough shares.

In this case, the coupling device can be formed in fundamentally different ways, e.g. can include electric motor-driven actuating elements which adjust the first-body cutting width and/or the working width of the plough shares. In particular, the said coupling device can, however, operate hydraulically or can be formed so as to operate with a different pressure medium. In an advantageous development of the invention, the working width adjusting means and the first-body cutting width adjusting means can each include at least one pressure medium actuator as an actuating element, wherein in one advantageous development of the invention the coupling device comprises a pressure medium quantity controller for controlling the pressure medium quantity, which is fed to the pressure medium actuator of the first-body cutting width adjusting means, in dependence upon the pressure medium quantity fed to the pressure medium actuator of the working width adjusting means. Depending upon how much pressure medium is supplied to or drawn from the control actuator of the working width adjusting means, more or less pressure medium or a corresponding quantity of pressure medium can be fed to the at least one pressure medium actuator of the first-body cutting width adjusting means.

In particular, in an advantageous development of the invention the said pressure medium quantity controller can include a master-slave arrangement of the pressure medium actuators of the working width adjusting means and the first-body cutting width adjusting means such that the pressure medium which is displaced from a control actuator upon actuation thereof is used for actuating the control actuator of the other adjusting means. In order to reposition the first-body cutting width or to adapt it to an adjustment of the working width, in particular the control actuator of the working width adjusting means can form the master actuator, whose pressure medium outflow is coupled to the pressure medium inflow of the control actuator of the first-body cutting width adjusting means. Accordingly, every time the working width is then adjusted, the first-body cutting width is readjusted to a corresponding extent.

In this case, by adapting the displacement volumes or - in the event that pressure medium cylinders are used - the cylinder diameters, various readjustment ratios can be adjusted. If e.g. the control actuators have the same effective diameter, a readjustment is effected at a ratio of 1:1. However, in an advantageous manner the control actuator of the first-body cutting width adjusting means can have a different diameter than the control actuator of the working width adjusting means, in particular a larger diameter, so that an actuating movement of the working width adjusting means leads to a reduced extent to a readjustment of the first-body cutting width adjusting means. This can avoid overcompensations in the first-body cutting width.

However, as an alternative or in addition to the said master-slave arrangement of the control actuators, quantity-control of the pressure medium quantities, which are fed to the control actuators and cause the actuation, can also be effected in another manner, in particular by means of a quantity divider which is connected upstream of the control actuators and is connected on the inflow-side to the pressure line of the tractor or another pressure source and on the output side has at least two pressure connections which are connected to the said control actuators of the working width adjusting means and the first-body cutting width adjusting means. As a consequence, mutually tailored actuations of the working width adjusting means and the first-body cutting width adjusting means can be achieved in the desired manner, wherein depending upon the control of the quantity divider different readjustment-actuating movements can also be achieved, e.g. in different, adjustable operating modes can be achieved.

However, in one advantageous development of the invention the first-body cutting width adjusting means can be actuated not only in dependence upon an actuation of the working width adjusting means but also independently thereof in order to be able to adjust different first-body cutting widths for various operating modes, e.g. for ploughing in the furrow on the one hand and an on-land ploughing on the other hand. However, in an advantageous manner this independent actuating option for the first-body cutting width is nonetheless coupled to the said automatic readjustment capability such that an initially pre-adjusted, desired first-body cutting width e.g. for ploughing in the furrow is then automatically readjusted if the working width is varied.

In an advantageous development of the invention, the first-body cutting width adjusting means have a first actuating element which can be actuated independently of the working width adjusting means, and a second actuating element which is formed such that it can be actuated in dependence upon the adjustment of the working width adjusting means, wherein the two actuating elements are advantageously disposed connected one behind the other, in order to perform an automatic readjustment in the desired manner for various first-body cutting widths pre-adjusted by means of the first control actuator, if the working width is adjusted by the working width adjusting means.

In particular, the two actuating elements of the said first-body cutting width adjusting means can be integrated into a common pressure medium cylinder unit, in which two pistons are combined. For example, two pistons can be seated on a common piston rod and retract into separate cylinder housings which are connected to each other by means of the said common piston rod. Alternatively, two separate piston rods can also be provided which retract into a combined, common cylinder housing, in which the two pistons are accommodated, wherein in an advantageous manner the common cylinder housing can be subdivided on the inner side, in order to form separate pressure chambers for the two pistons. For example, two piston cylinder units can be placed against each other with their piston crowns back-to-back or can be integrated into a common housing part, so that the piston rods extend towards opposite sides, one of the piston rods together with the piston attached thereto forms the said first actuating element and the other piston rod together with the piston attached thereto forms the said second actuating element. As a consequence, a compact first-body cutting width adjusting device can be produced which nonetheless permits an independent pre-selection of the first-body cutting width and at the same time an automatic readjustment in dependence upon the working width adjustment.

The first-body cutting width adjusting means can act in various ways upon the frame carrier which carries the plough shares, or can adjust the frame carrier with respect to the drawbar. In an advantageous development of the invention, the frame carrier which carries the plough shares can be articulated directly to a bent drawbar which is formed in a sufficient length and which introduces the tractive forces coming from the frame carrier into the tractor and can be bent with respect to the said frame carrier about a perpendicular pivot axle and consequently can be moved to various angular positions, which leads to a corresponding adjustment of the first-body cutting width. In this case, the bending about the said perpendicular pivot axle between the drawbar and frame carrier is controlled in an advantageous manner by the said first-body cutting width adjusting means or the actuating elements thereof. Depending upon which bending angle is adjusted between the drawbar and the frame bearing and thus the frame carrier, the plough looks for its path further to the right or left behind the articulation point of the drawbar, whereby the first-body cutting width is changed accordingly. Spaced apart in each case from the said bend axis, the said actuating element can be hingedly articulated on the one hand to the drawbar, and can be hingedly articulated on the other hand to the frame carrier or a frame bearing part connected thereto, so that a corresponding pivoting movement or bending movement is achieved by the retraction and extension of the actuating element.

The working width adjusting means can likewise be formed fundamentally differently or can act upon a different point on the frame carrier, in order to change the work angle thereof with respect to the direction of travel. In particular, the said working width adjusting means can change the work angle or steering angle of a support wheel with respect to the frame carrier. When the plough is formed as a semi-mounted plough, the said support wheel can form the depth wheel, whose steering angle can be changed with respect to the frame carrier, which carries the plough shares, by virtue of the said working width adjusting means. For this purpose, the said depth wheel can be pivoted or steered with respect to the frame carrier about a pivot axis which is upright in the operating position. In this case, the control actuator of the working width adjusting means can act upon a different point in order to adjust the steering position of the depth wheel, e.g. directly between the wheel carrier of the depth wheel and the frame carrier. As an alternative or in addition, the control actuator of the working width adjusting means can also act upon a stabiliser or adjust the length thereof, by means of which the said depth wheel is stabilised in its track position with respect to the drawbar. In one development of the invention, a chassis which connects the wheel carrier fixedly to the drawbar and via which tractive forces would be introduced from the frame carrier carrying the plough shares can be dispensed with completely. In an advantageous manner, the drawbar is connected to the said depth wheel only by means of the said stabiliser which on the one hand is hingedly articulated to the drawbar and on the other hand is hingedly articulated to the depth wheel or the wheel carrier thereof. The said stabiliser serves to stabilise the track and the track angle of the depth wheel, wherein an adjustment of the stabiliser can be used for adjusting the said track angle and thus the working width.

In accordance with one advantageous embodiment of the invention, the said stabiliser can be formed in such a manner as to be variable in length, in particular it can be formed in a telescopic manner and its length can be adjusted by means of a force actuator which can be actuated by external energy, in order to be able to actively influence the adjustment of the wheel carrier position. In an advantageous manner, an additional articulation of the plough bodies can be provided, by means of which the inclination of the plough bodies can be simultaneously adjusted and therefore the working width changed via the length adjustment.

In this case, apart from the stabiliser there is advantageously no further direct connection between the said drawbar and the wheel carrier of the depth wheel. In particular, no fixed chassis is provided. The hinged articulation of the stabiliser to the drawbar on the one hand and to the depth wheel on the other hand has preferably a multiaxial articulation capability in particular in the manner of a ball-and-socket joint, so that ultimately only the distance or the inclination between the drawbar and depth wheel or the wheel carrier is controlled or stabilised by means of the stabiliser.

In an advantageous manner, the said wheel carrier is attached to the frame carrier, which carries the plough shares, in such a manner as to be pivotable about a perpendicular pivot axle. If in one development of the invention the plough is formed as a turning plough, the said wheel carrier is connected to the depth wheel, at a portion spaced apart from the frame carrier, in such a manner as to be pivotable about a horizontal pivot axis, so that when the plough is being turned the wheel carrier can be pivoted so to speak over the depth wheel and/or its axis of direction of travel.

In order to be able to introduce the tractive forces from the frame carrier directly into the drawbar even when the plough is formed without a chassis, the frame bearing of the frame carrier is indeed articulated to the drawbar in such a manner as to be pivotable about the said perpendicular pivot axle, but is attached to the drawbar in a rotationally fixed manner in relation to a transverse axis transverse to the drawbar longitudinal axis. As a consequence, the frame carrier and the plough shares attached thereto are supported in the vertical direction at two points, on the one hand namely on the depth wheel and on the other hand via the connection - which in this respect is rigid in formation - between the frame bearing and the drawbar and its support point on the tractor.

If in one development of the invention the said plough is formed as a turning plough, the said perpendicular pivot axle between the frame bearing and the drawbar is not directly rigidly attached to the drawbar but rather, in one development of the invention, is attached to a turning head which can be turned with respect to the drawbar in order to turn the plough about a turning axis approximately in parallel with the drawbar longitudinal axis and in particular approximately coaxially with respect to the drawbar longitudinal axis. If the said turning head is pivoted about the drawbar, the frame bearing articulated thereto and thus the frame carrier attached thereto are entrained and are pivoted so to speak over the drawbar onto the other side thereof.

The said perpendicular pivot axle between the frame bearing and the drawbar or the pivot head falls in this case 180° from an upright position to a position which is again upright.

In order to permit a sufficient adjustment range of the first-body cutting width when bending angles between the drawbar and the main frame bearing or frame carrier are not excessive, in one development of the invention the drawbar is formed so as to be of sufficient length. In one development of the invention, the length of the drawbar between its articulation point on the tractor and the position of the said perpendicular pivot axle of the frame bearing is at least 50% and preferably about 75% to 300% of the distance between two plough shares which are adjacent in the longitudinal direction of the frame carrier. In particular, the said drawbar length can be about 75% to 200% and in particular about 100% to 150% of the distance between two adjacent plough shares. As an alternative or in addition, the drawbar length can be dimensioned in particular such that during adjustment of the working width of the individual bodies or plough shares the working width of the first body is simultaneously adjusted to the same extent or mutually proportionate extent.

As an alternative or in addition thereto, the frame carrier to which the plough shares are attached is likewise sufficiently spaced apart from the bending axis between the drawbar and the frame bearing. For this purpose, the main frame bearing can form a frame boom and /or can include an articulation piece which protrudes transversely from the frame carrier and can be connected in an angularly fixed manner, in particular rigidly, to the frame carrier, and on its portion protruding from the frame carrier carries the said perpendicular bending or pivot axle on the drawbar or on the turning head connected thereto. In this case, the length of the said articulation piece or the vertical distance between the frame carrier and the perpendicular pivot axle is advantageously about 30% to 200%, preferably about 50% to 150% and in particular about 75% to 125% of the distance between two adjacent plough shares. In relation to the drawbar length, the length of the said articulation piece and thus the distance between the frame carrier and the perpendicular pivot axle can be about 50% to 100% and preferably about 75%.

The bending angle between the drawbar and frame boom with respect to the said perpendicular pivot axle is preferably at least 30° and preferably 45° or more in order to achieve the desired extremely large adjustment range. In order to achieve in total a favourable flow of force with a large degree of adjustability, the adjustment range of the said bending angle can be sized such that at least on the one hand an approximately parallel setting of the drawbar and frame carrier, preferably also a slightly negatively over-pressurised position at an angle of -10°, and on the other hand a positive bend at an angle of up to approximately 45° between the drawbar and the said frame carrier, as seen in plan view, can be adjusted.

The adjusting means are advantageously formed to operate continuously so that any intermediate positions between the two said bending angle adjustments can be reached and fixed. The adjusting means can be formed to be fundamentally different. For example, a mechanical pivot drive such as for instance a worm gear stage and/or a tie bar can be provided. Alternatively or in addition, a hydraulic rotary drive can be provided which can advantageously include a dual-acting hydraulic cylinder to which a control device for the continuous adjustment of the position of the hydraulic cylinder can be allocated. The said hydraulic cylinder can be attached, spaced apart from the perpendicular pivot axle, on the one hand to the frame bearing and/or frame carrier and on the other hand to the drawbar and/or the turning head attached thereto.

The invention will be explained in more detail hereinafter with reference to a preferred exemplified embodiment and associated drawings, in which:

Figure 1: shows a schematic side view of a turning plough which is mounted on a tractor,

Figure 2: shows a schematic plan view of the plough from Figure 1, formed as a semi-mounted turning plough, which shows the drawbar in a pivoted position approximately in parallel with the frame carrier which supports the plough shares so that when ploughing in the furrow the complete first-body cutting width can be used,

Figure 3: shows a schematic plan view of the semi-mounted plough similar to Figure 2, wherein a different angular adjustment between the drawbar and the frame carrier is illustrated which means that the first-body moves further out of the track,

Figure 4: shows a schematic plan view of the semi-mounted plough similar to Figures 2 and 3, wherein a further bent position of the drawbar with respect to the frame carrier is shown which means that the first-body ploughs on-land outside of the tractor track. and

Figure 5: shows a schematic illustration of the hydraulic coupling device between the control actuator of the first-body cutting width adjusting means and the control actuator of the working width adjusting means in accordance with an advantageous embodiment of the invention which provides a master-slave arrangement of the actuating elements and provides for independent actuating capability of the first-body cutting width adjusting means which goes beyond this.

The semi-mounted turning plough 1 shown in the Figures includes a beam-shaped, elongate frame carrier 2 in the form of a frame tube to which a plurality of plough shares 3 are attached spaced apart from each other. As shown in Figure 1, two rows of plough shares 3 are attached to the frame carrier 2 which means that the plough can be turned as described hereinafter.

The said frame carrier 2 is supported in its rear half on a rear portion of a depth wheel 4 on the ground. The said depth wheel 4 is connected to the frame carrier 2 by a wheel carrier 5 so that the weight of the frame carrier 2 and the plough shares 3 can be supported on the depth wheel 4. The said wheel carrier 5 is connected to the depth wheel 4 so as to be pivotable about a horizontal pivot axis 6 pointing in the direction of travel so that when turning the plough, the said wheel carrier 5 can be pivoted together with the frame carrier 2 over the depth wheel 4 from right to left or vice-versa.

The said wheel carrier 5 is attached to the frame carrier 2 by way of its opposite frame-side end. As shown in Figures 2 to 4, the wheel carrier 5 is attached to the frame carrier 2, or a wheel carrier articulation piece connected thereto, about a perpendicular pivot axle 7.

In its front half and in accordance with the illustrated embodiment in its foremost end portion between the first two plough shares, the frame carrier 2 is connected to a drawbar 9 by means of a main frame bearing in the form of a frame boom 8, which drawbar is articulated at its front end on a tractor 10 in a hinged manner about a perpendicular pivot axle 11. The said frame boom 8 includes an articulation piece 12 which can be formed e.g., as a pressing plate profile or even as a tubular or bar profile or even as a simple beam and protrudes from the frame carrier 2 in a transverse manner. The articulation piece 12 is rigidly attached to the frame carrier 2 between the first-body and the second plough share. At its protruding end, the articulation piece 12 is connected to the drawbar 9, more precisely to a turning head 13 which is connected to the drawbar 9 so as to be pivotable about the drawbar longitudinal axis, which means that the turning head 13 can be pivoted about the said drawbar 9 in order to turn the plough. For this purpose a suitable turning drive, known *per se*, is allocated to the turning head 13.

Provided between the articulation piece 12 and the drawbar 9 or the turning head 13 is a perpendicular pivot axle 14 which means that the drawbar 9 can be brought into different bent positions with respect to the frame carrier 2, as shown in Figures 2 to 4. The perpendicular pivot axle 14 is located at the rear end of the drawbar 9. However, the connection between the articulation piece 12 and the drawbar 9 is formed to be rotationally-fixed in relation to a transverse axis which is transverse with respect to the drawbar longitudinal axis so that on the one hand weight or generally vertical forces of the frame carrier 2 and of the plough shares 3 attached thereto can be absorbed by the drawbar 9. On the other hand, the articulation piece 12 and thus the frame carrier 2 are correspondingly entrained and turned when the turning head 13 is pivoted.

As shown in Figures 2 to 4, in the illustrated embodiment, the drawbar length 15 is approximately 50% to 200%, preferably approximately 75% to 150% of the inner track width of the tractor. In relation to the geometry of the plough 1 itself, the said drawbar length 15 is, in accordance with the illustrated embodiment, preferably approximately 100% to 150% of the distance between two plough shares and/or approximately 100% to 150% of the length of the articulation piece 12, i.e., its protruding length perpendicular to the longitudinal direction of the frame carrier 2.

As can be seen by comparing Figures 2 to 4, the drawbar 9 can be pivoted by at least

45° with respect to the frame carrier 2, wherein preferably at least on the one hand a position can be adjusted in which the drawbar 9 and the frame carrier 2 extend in parallel with each other, cf. Figure 2, and on the other hand a position can be adjusted in which the frame carrier 2 extends at an angle of approximately 45° with respect to the drawbar 9, cf. Figure 4.

First-body cutting width adjusting means 16 are provided for the corresponding adjustment of this pivoting or bending angle and are preferably formed to operate in a continuous manner so that any intermediate positions can be reached. In the illustrated embodiment, the said adjusting means 16 include a pressure medium cylinder unit 17 which is articulated on the one hand on the frame boom 8 and on the other hand on the drawbar 9, or the turning head 13 attached thereto, in each case spaced apart from the perpendicular pivot axle 14 so that by changing the length of the said pressure medium cylinder unit 17, the drawbar 9 is bent or pivoted.

The traction forces from the frame carrier 2 are fed directly via the said frame boom 8 into the drawbar 9 and not firstly via a chassis which is not present in this case. Only a stabiliser 18 is provided between the drawbar 9 and the depth wheel 4, being in the form of a telescopic stabiliser rod which is articulated to the drawbar 9 in a hinged manner at its front end and is attached to the wheel carrier 5 in a hinged manner at its rear end. By changing the length of the stabiliser, which can be effected by working width adjusting means 21 including an external force-actuated actuator 19 e.g., in the form of a hydraulic cylinder which is integrated into the stabiliser rod, the distance between the drawbar 9 and the wheel carrier 5 can be adjusted. In view of the articulation of the wheel carrier 5 on the frame carrier 2 and its connection to the drawbar 9, the track angle of the depth wheel 4 with respect to the plough bodies can thus be adjusted. Alternatively, the corresponding actuating movement of the wheel carrier 5 can be converted into a pivoting movement of the plough share 3 via a connecting rod 20 in order to thereby adjust the working width.

In order to automatically readjust the first-body cutting width or automatically adapt the first-body cutting width adjustment to the respectively adjusted working width, the first-body cutting width adjusting means 16 are coupled to each other to the working width adjusting means 21 *[sic]* by a coupling device 22 as shown in Figure 5. The said coupling device 22 can control the pressure medium quantities which are fed to the control actuators 17 and 19, wherein the quantities can be controlled by a master-slave arrangement of the control actuator 19 of the working width adjusting means 21 and of the control actuator 17 of the first-body cutting width adjusting means 16.

In order to be able to permit automatic readjusting, but also on the other hand independent preliminary adjustment of the first-body cutting width, the said pressure medium cylinder unit 17 advantageously includes two separate control actuators 17a and 17b which can be combined in the common pressure medium cylinder unit 17 as shown in Figure 5. In particular, two pistons 17c and 17d can be disposed in a displaceable manner in a common cylinder housing 17g, wherein the interior of the cylinder housing 17g can be divided by a partition wall 17h so that each of the pistons 17c and 17d runs into a dedicated pressure chamber. In the illustrated embodiment, the two pistons 17c and 17d have the same diameter. However, this is not absolutely necessary, e.g., different piston diameters can be provided in order to achieve different actuating paths with corresponding pressure medium quantities. In particular the piston 17c can also have a different diameter than the piston of the control actuator 19 of the working width adjusting means.

As shown in Figure 5, the control actuator 19 of the working width adjusting means 21, which is advantageously formed to operate in a bidirectional manner, can be connected on the pressure inflow-side to a pressure source P which can be provided e.g., on a tractor pulling the plough, such that the position of the control actuator 19 can be adjusted in the desired manner in order to adjust the working width of the plough in the desired manner. On the pressure outflow-side, the said control actuator 19 is coupled to the control actuator 17a of the pressure medium cylinder unit 17 such that pressure medium displaced from the control actuator 19 is supplied to the control actuator 17a. By using this master-slave arrangement, the control actuator 17a is actuated or readjusted when the control actuator 19 is actuated. Accordingly, the first-body cutting width is readjusted when the working width of the plough is adjusted.

Meanwhile, the other control actuator 17b of the pressure medium cylinder unit 17 is coupled on the pressure connection-side to a pressure wave P which can be provided for example on the tractor pulling the plough. The control actuator 17b can thus be adjusted independently of the said master-slave arrangement, which means that the first-body cutting width can also be adjusted, in particular pre-adjusted, independently of the working width. Nevertheless, automatic readjustment of the first-body cutting width is achieved by the control actuator 17a coupled to the working width adjusting means 21.

Claims

1. Plough, in particular a semi-mounted plough, having an elongate frame carrier (2), to which a plurality of plough shares (3) are attached one next to the other, also having working width adjusting means (21) for adjusting the working width of the plough shares (3), and first-body cutting width adjusting means (16) for adjusting the first-body cutting width, characterised in that a coupling device (22) for automatically repositioning the first-body cutting width adjusting means (16) during actuation of the working width adjusting means (21) is provided between the working width adjusting means (21) and the first-body cutting width adjusting means (16).

2. Plough as claimed in the preceding claim, wherein the working width adjusting means (21) and the first-body cutting width adjusting means (16) each include at least one pressure medium actuator (19; 17a, 17b), wherein the coupling device (22) comprises a pressure medium quantity controller for controlling the pressure medium quantity, which is fed to the pressure medium actuator (17a) of the first-body cutting width adjusting means (16), in dependence upon the pressure medium quantity fed to the pressure medium actuator (19) of the working width adjusting means (21).

3. Plough as claimed in the preceding claim, wherein the pressure medium quantity controller includes a master-slave arrangement of the pressure medium actuators (17, 19) of the working width adjusting means (21) and of the first-body cutting width adjusting means (16), wherein the pressure medium actuator (17a) of the first-body cutting width adjusting means (16) includes a pressure chamber which can be influenced by pressure medium which is displaced from the pressure medium actuator (19) of the working width adjusting means (21).

4. Plough as claimed in any one of the preceding claims, wherein the first-body cutting width adjusting means (16) includes a first actuating element (17b) which can be actuated independently of the working width adjusting means (21), and a second actuating element (17a) which can be actuated in dependence upon the adjustment of the working width adjusting means (21), which actuating elements are disposed connected one behind the other such that the first actuating element (17b) forms a pre-adjusting means for pre-adjusting a desired first-body cutting width and the second

actuating element (17a) forms a readjusting means for adapting the pre-adjusted first-body cutting width to the respectively adjusted working width of the plough shares (3).

5. Plough as claimed in the preceding claim, wherein the two actuating elements (17a, 17b) are combined in a common pressure medium cylinder unit (17) having two pistons.

6. Plough as claimed in any one of the preceding claims, wherein the coupling device (22) includes an adjustment travel controller for controlling the adjustment travel of the first-body cutting width adjusting means (16) in proportional relationship to the adjustment travel of the working width adjusting means (21).

7. Plough as claimed in any one of the preceding claims, wherein the frame carrier (2) can be supported on the ground via a support wheel (4) and is connected via a frame bearing (8) to a drawbar (9) which can be articulated to a tractor (10), wherein the said frame bearing (8) and thus the frame carrier (2) are connected to the said drawbar (9) so as to be pivotable about a perpendicular pivot axle (14) and by virtue of the first-body cutting width adjusting means (16) various pivot angles can be adjusted between the frame bearing (8) and the drawbar (9).

8. Plough as claimed in the preceding claim, wherein the drawbar (9) is connected to the depth wheel (4) by means of a stabiliser (18), in particular a stabiliser rod which on the one hand is hingedly articulated to the drawbar (9) and on the other hand is hingedly articulated to the depth wheel (4).

9. Plough as claimed in the preceding claim, wherein the stabiliser (18) is the only direct connection between the depth wheel (4) and the drawbar (9) and/or the semi-mounted plough is formed free of a fixed chassis connected to the depth wheel (4).

10. Plough as claimed in any one of the two preceding claims, wherein the stabiliser (18) which is installed in an articulated manner is formed such that it can be changed in terms of its length, in particular it can be telescoped, by virtue of the working width adjusting means (21).

11. Plough as claimed in any one of the preceding claims, wherein the main frame bearing (8) is attached to the drawbar (9) in such a manner as to be rotationally fixed in relation to a transverse axis transverse to the drawbar longitudinal axis.

12. Plough as claimed in any one of the preceding claims, wherein the wheel carrier (5) is mounted on the frame carrier (2) in such a manner as to be pivotable about a perpendicular pivot axle (7), wherein the pivot angle of the wheel carrier (5) can be adjusted with respect to the frame carrier (2) by virtue of the working width adjusting means (21).

13. Plough as claimed in any one of the preceding claims, wherein the wheel carrier (5) is attached to the depth wheel (4) in such a manner as to be pivotable about a horizontal pivot axis (6) pointing approximately in the direction of travel.

14. Plough as claimed in any one of the preceding claims, wherein the said perpendicular rotational axle (14) is attached between the frame bearing (8) and the drawbar (9) to a turning head (13) which can be pivoted with respect to the drawbar (9) in order to turn the plough about a turning axis approximately in parallel with the drawbar longitudinal axis, in particular coaxially with respect to the drawbar longitudinal axis.

15. Plough as claimed in the preceding claim, wherein the drawbar (9) can be pivoted with respect to the frame carrier (2) about the said perpendicular pivot axle (14) such that at least on the one hand a position can be adjusted, in which the drawbar (9) and the frame carrier (2) extend in parallel with respect to each other, and on the other hand a position can be adjusted, in which the drawbar (9) is bent by 45° with respect to the frame carrier (2).

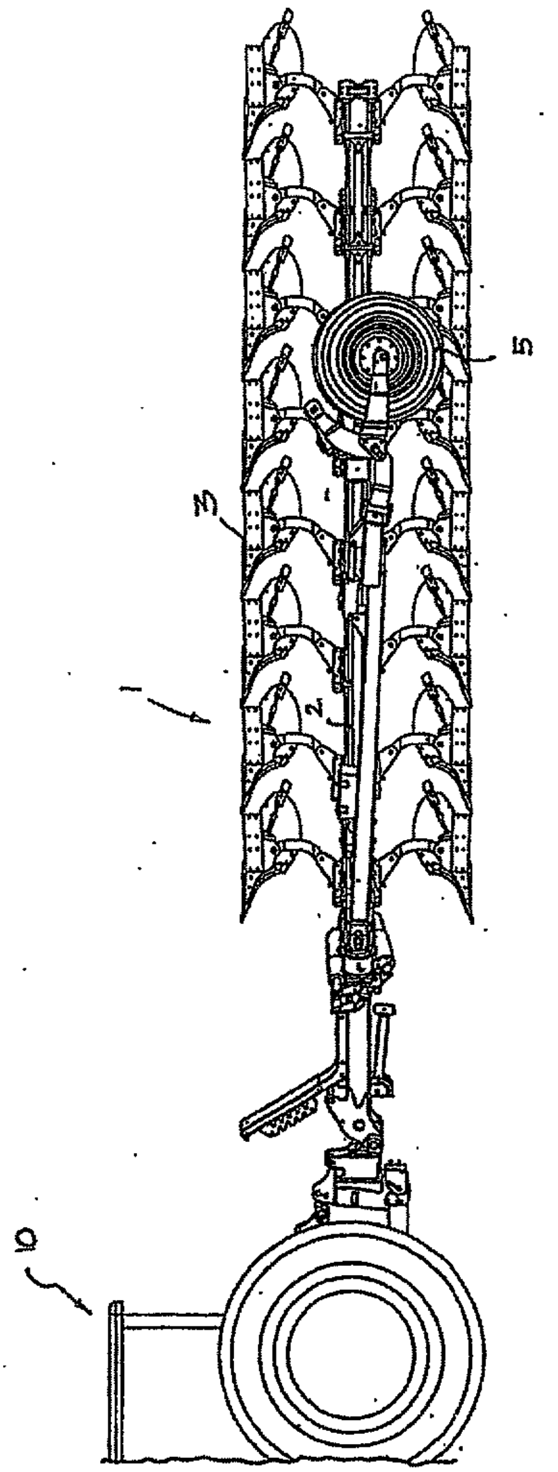

Fig. 1

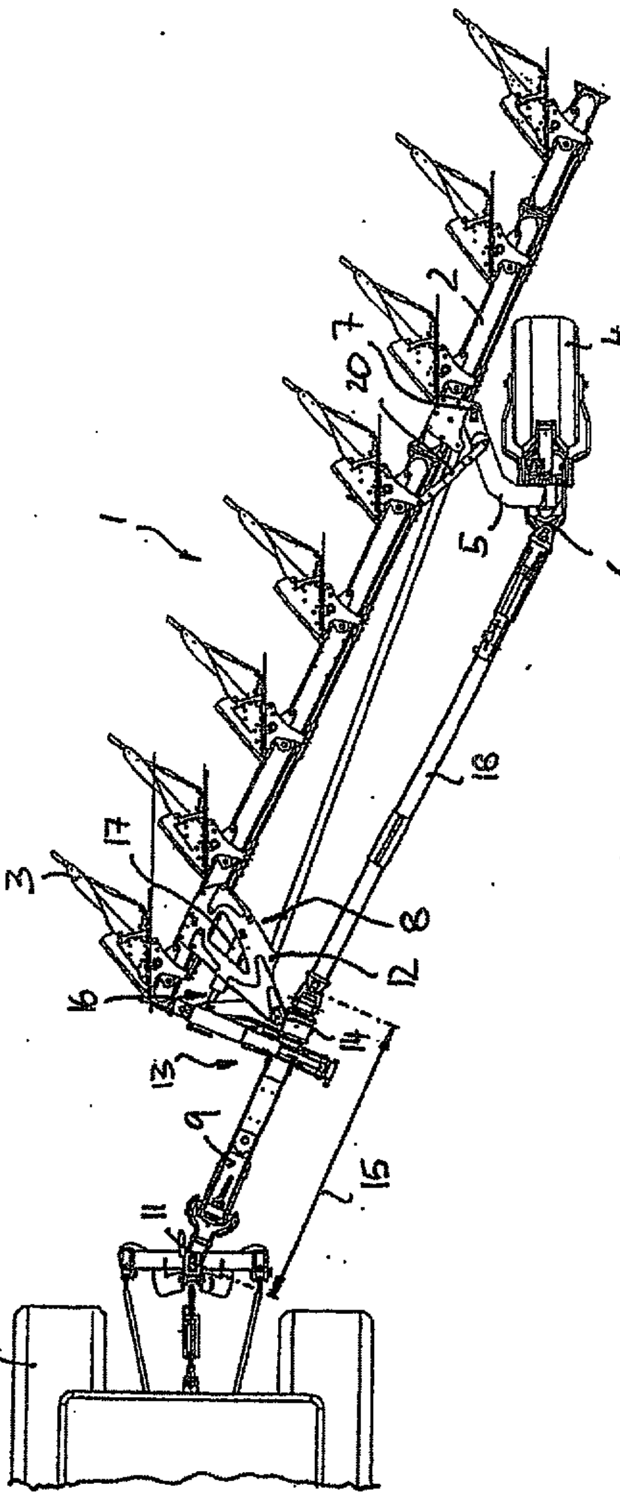

Fig. 2

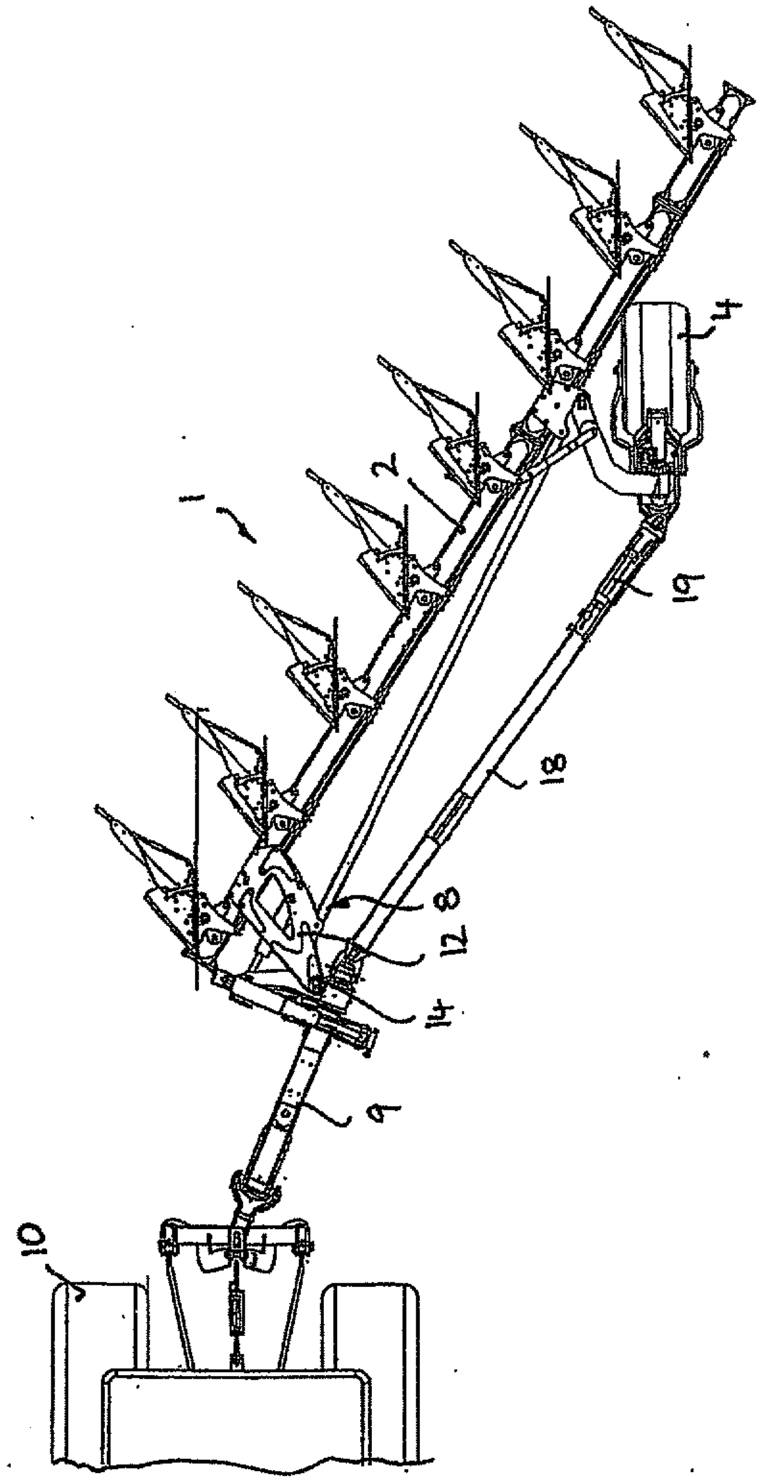

Fig. 3

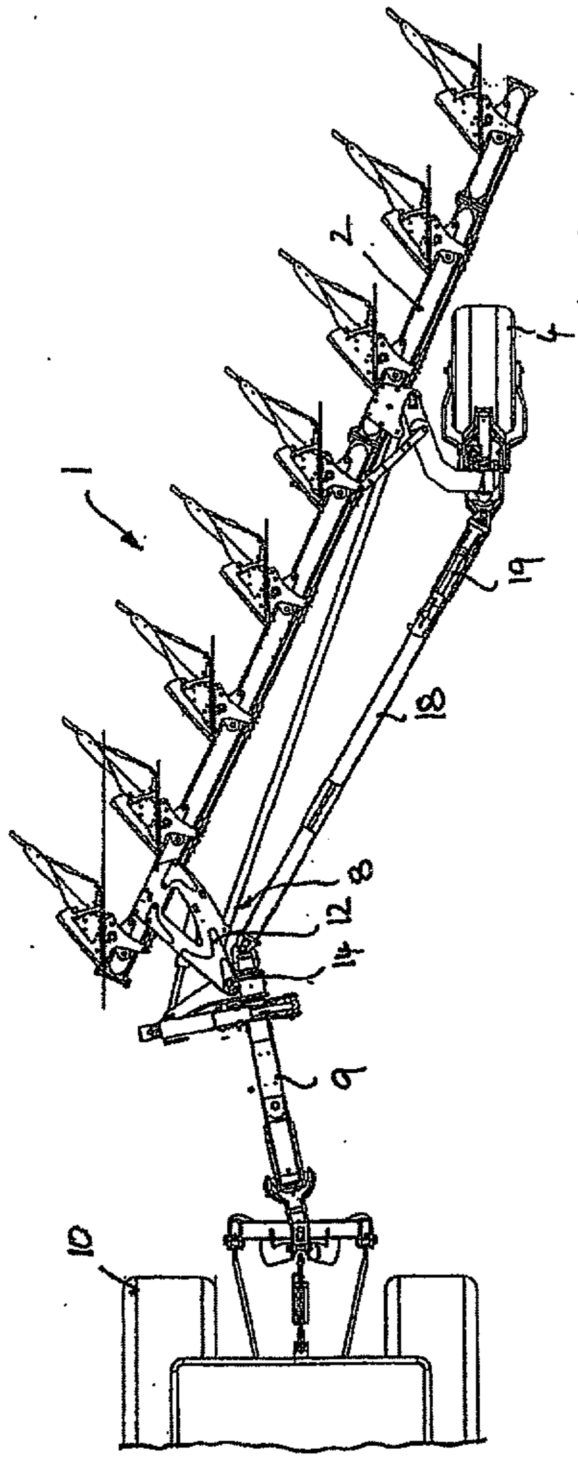

Fig. 4

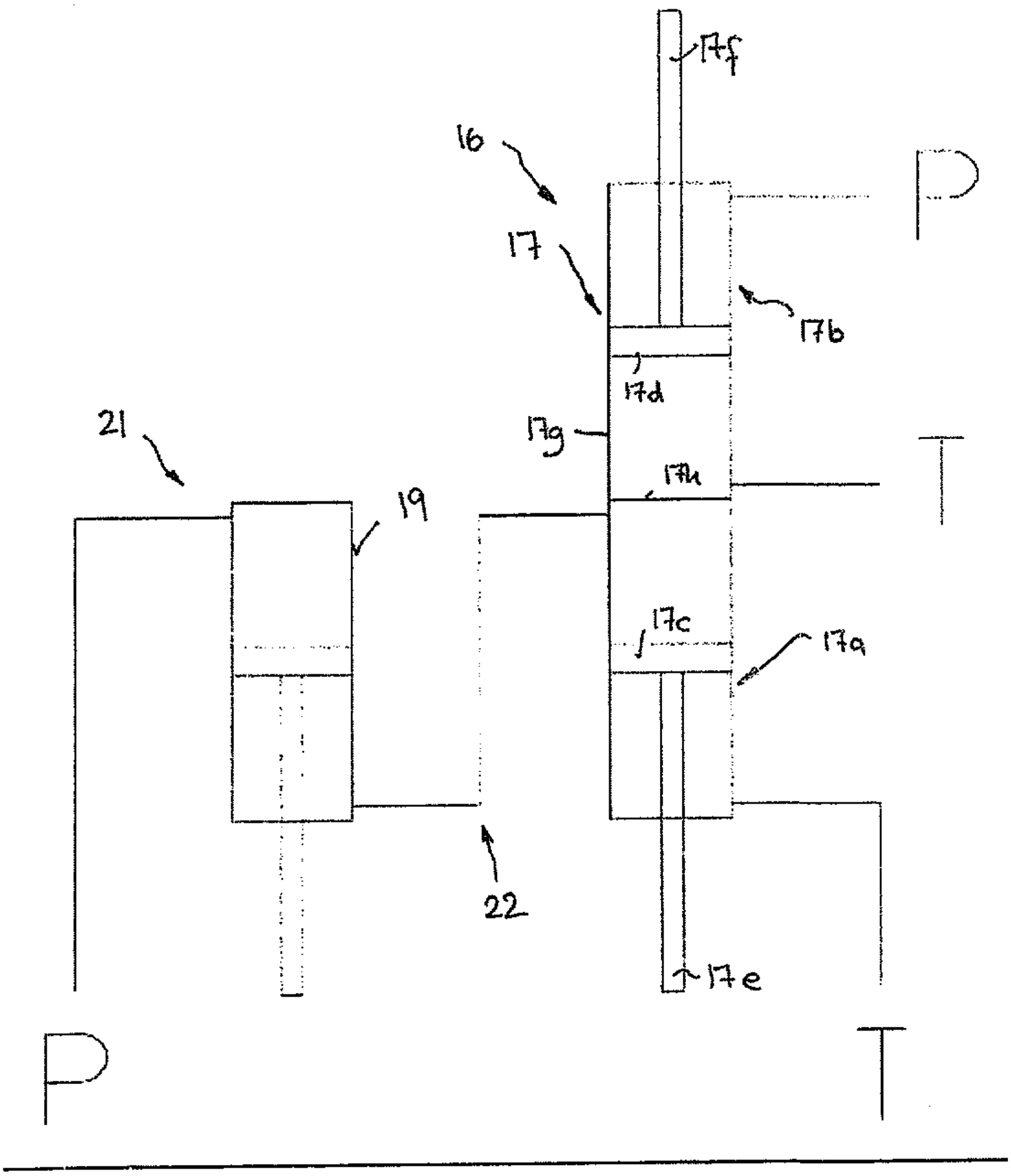

Fig. 5