United States Patent

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[54] SEMIMOUNTED TURNOVER PLOW HAVING CAM-TILTED AND INDEPENDENTLY HYDRAULICALLY STEERED REAR WHEEL

6 Claims, 3 Drawing Figs.

[52] U.S. Cl. 172/212, 172/225, 172/283, 172/285
[51] Int. Cl. A01b 3/44, A01b 69/00
[50] Field of Search 172/212, 223, 227, 282, 283, 284, 285, 288, 291, 225

[56] **References Cited**

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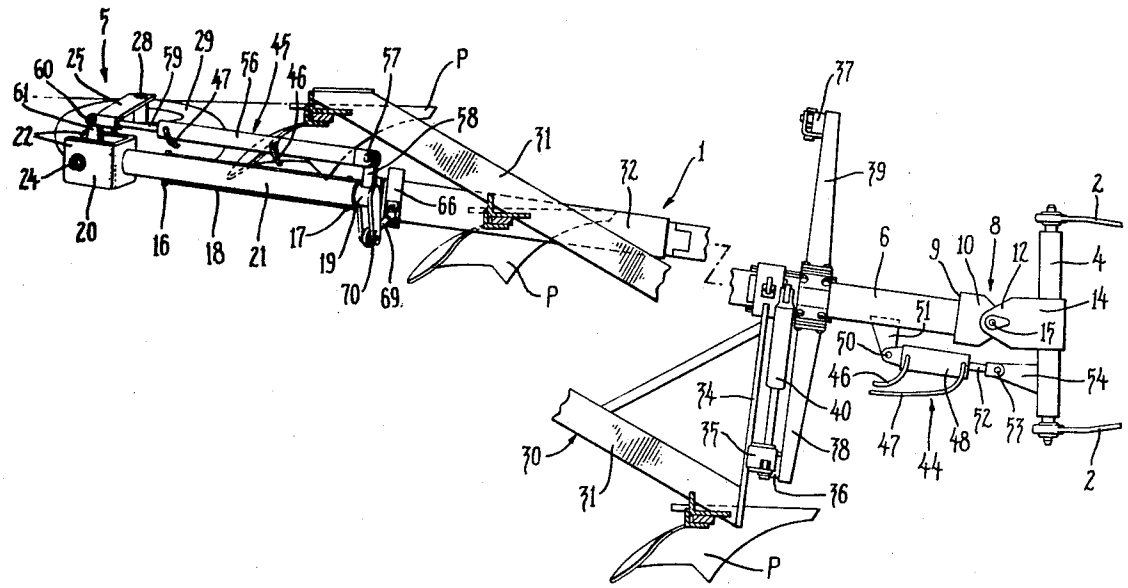
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ABSTRACT: A semimounted turnover plow having a tail wheel supported on the trailing end of the plow frame in such a manner that the wheel is automatically tilted to an inclined position to counteract side forces acting on the plow bottoms in the plowing position of the plows, and returns to a vertical position when the plows are in a transport position. The wheel is tilted about an inclined axis such that it also changes direction relative to the plow frame as it is tilted.



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SHEET 1 OF 2

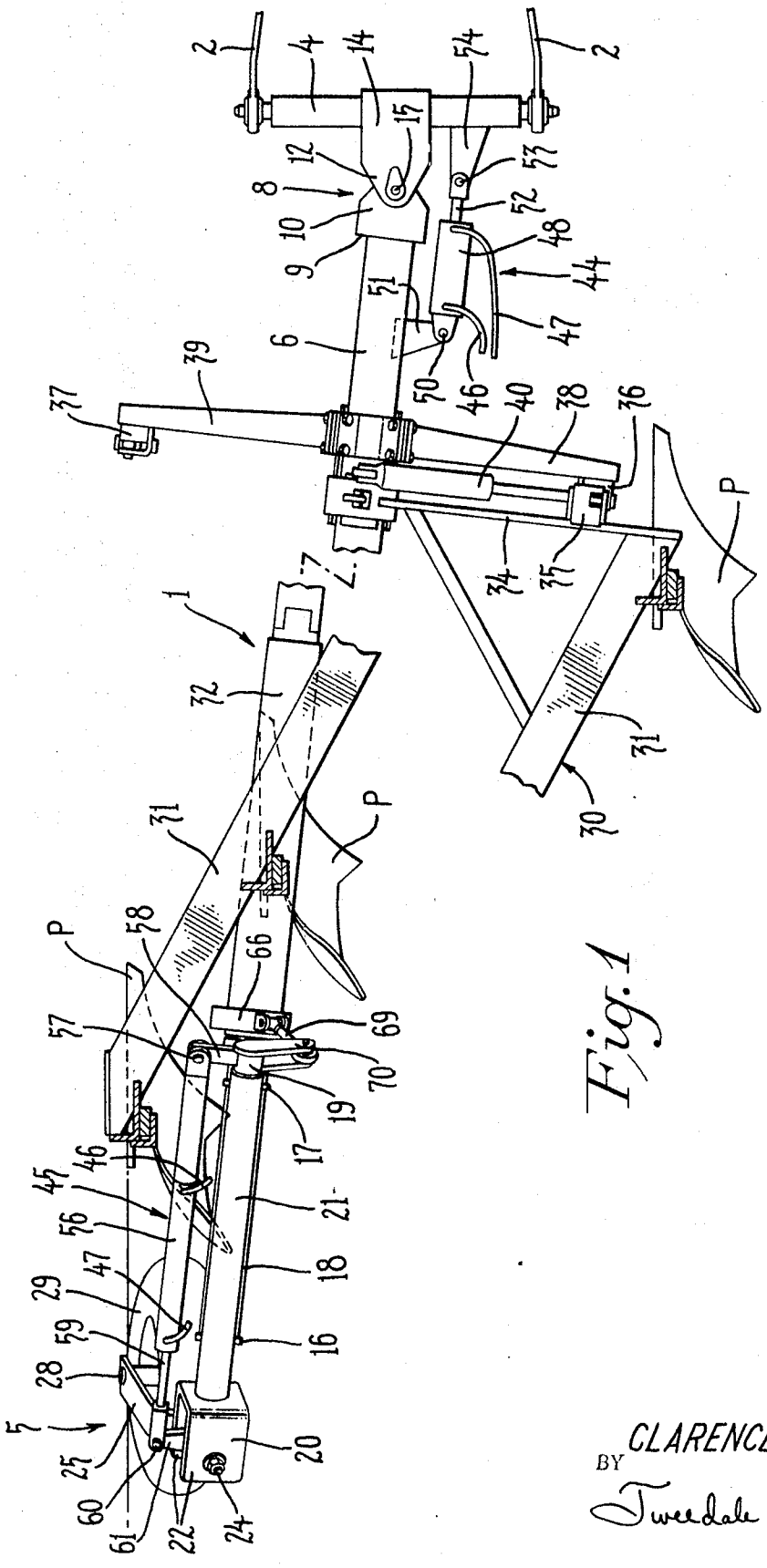


Fig. 1

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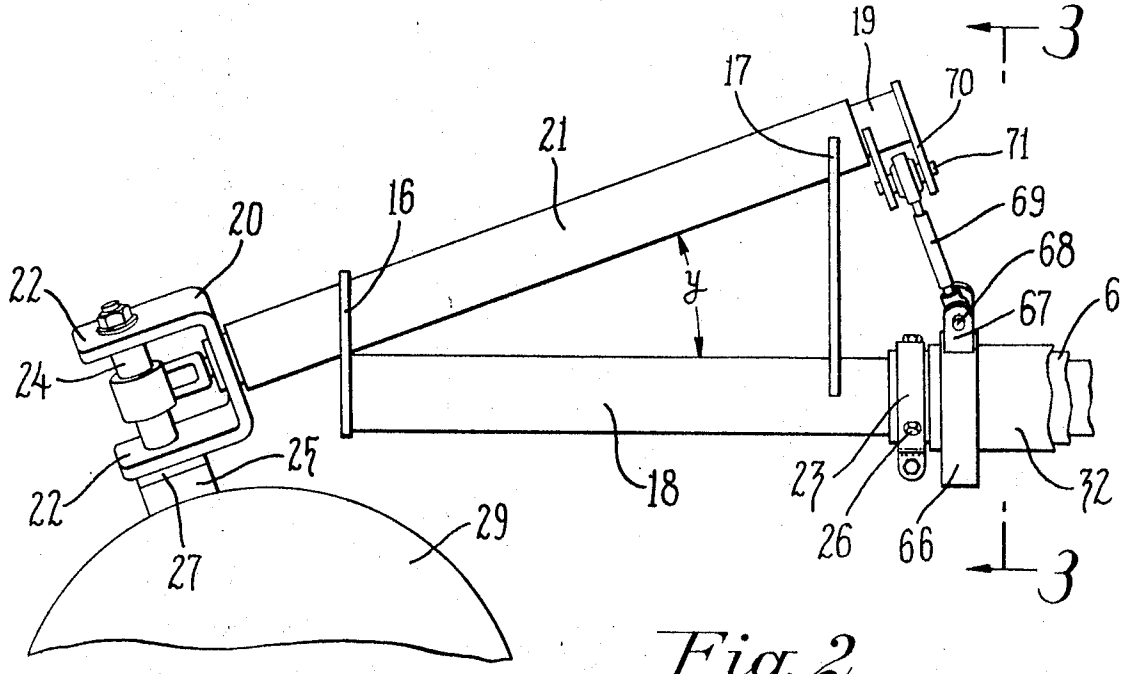


Fig. 2

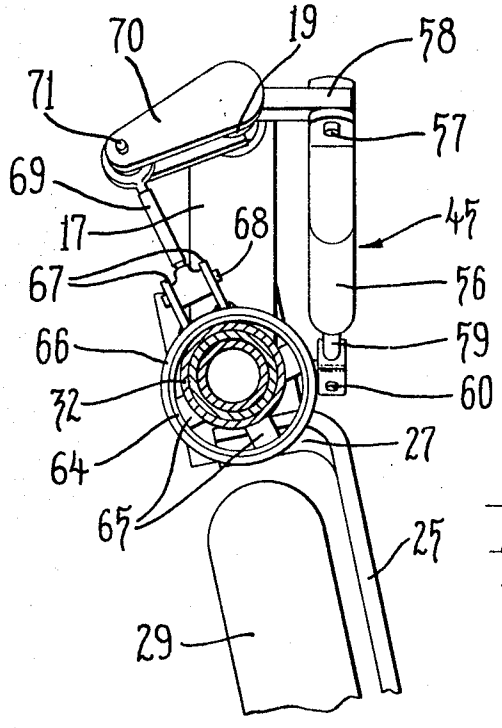


Fig. 3

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SEMIMOUNTED TURNOVER PLOW HAVING CAM-TILTED AND INDEPENDENTLY HYDRAULICALLY STEERED REAR WHEEL

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to semimounted implements, and is particularly concerned with turnover plows supported at the front on a draft vehicle and at the rear on a wheel that is steerable and can also be moved between inclined and vertical positions for plowing and transport, respectively.

2. Description of the Prior Art

In semimounted, turnover plows, the wheel supporting the trailing end of the plow frame must be mechanically linked to the hitch of a tractor or other draft vehicle to keep it upright as the plows are rotated from one position to the other. Furthermore, with multiple bottom, wide plows, the wheel must necessarily be offset from the longitudinal axis of the tractor during plowing, and accordingly must shift from one side to the other with respect to the tractor longitudinal axis when the plows are reversed from right- to left-hand and vice versa. It is also necessary that the rear wheel be maintained in alignment with the direction of movement during plowing.

My copending application, Ser. No. 524,191, now U.S. Pat. No. 3,534,509, entitled, "Semi-mounted Earthworking Implement," filed Feb. 1, 1966 discloses a semimounted plow in which an elongated frame has its trailing end supported by a wheel which has a rotary axis maintained at a fixed distance from the longitudinal axis of the frame in all positions of the plows. The wheel is interconnected to a control shaft having beveled gears engaged with the spindle of the wheel as well as with a spindle at the forward end of the frame at a connection with the draft vehicle such that the wheel has a fixed position relative to the longitudinal axis of the frame in either of the plowing positions, and is responsive to changes in direction of the draft vehicle to steer the trailing end of the frame around turns.

SUMMARY OF THE INVENTION

In accordance with the present invention, the implement includes a frame having a wheel at its trailing end and forward connecting means for connecting the forward end of the frame to a tractor hitch for side to side pivotal movement. The rear wheel is mounted for swinging or tilting movement about a tilt axis that is inclined upwardly and forwardly from the trailing end of the plow frame. The wheel is steerable about a steering axis normal to the inclined tilt axis. As the wheel swings from one side to the other about the tilt axis, the inclination is such that the trailing end of the frame is steered to an offset position relative to the tractor longitudinal axis during plowing.

The objects, advantages and features of the invention will become apparent from the following description taken in connection with the accompanying drawings in which:

FIG. 1 is a plan view of an implement embodying the invention;

FIG. 2 is an enlarged elevational view of the trailing end of the plow of FIG. 1; and

FIG. 3 is a sectional view taken along lines 3–3 of FIG. 2.

With reference to the drawings, the implement is designated collectively by reference numeral 1 and is connected at its forward end with a crossbar 4 mounted between the trailing ends of the lower draft links 2 of a conventional three-point, hydraulic tractor hitch. The rear end of implement 1 is supported on a wheel assembly 5.

Implement 1 includes an elongated draft frame member 6 on which is mounted a forward connecting assembly 8 including a C-shaped bracket 9 having vertically spaced arms 10. Arms 10 of bracket 9 are received between the ends of a pair of vertically spaced arms 12 of a frame member 14 mounted on crossbar 4. Arms 10 and 12 are pivotally connected together by a pin or spindle 15 carried by arms 12.

The wheel assembly 5 is mounted on a bracket 20 welded or otherwise nonrotatably secured to the end of an upwardly and forwardly inclined shaft 19 which is rotatably supported in a sleeve 21. Sleeve 21 is supported on a pair of plates 16 and 17 mounted on an extension member 18 having one end received within the hollow draft frame member 6 and secured against rotation by a clamp ring 23 and setscrews 26 passing through the clamp ring, draft frame member 6 and extension member or support bar 18. As shown more clearly in FIG. 2, the rotary axis of shaft 19 is inclined upwardly and forwardly at an angle y relative to the axis of draft frame member 6.

Bracket 20 is formed with vertically spaced, rearwardly projecting arms 22. Rotatably mounted between arms 22 is a spindle 24. The shaft 28 of a ground wheel 29 is mounted on an arm 25 having its upper end 27 nonrotatably secured to the lower end of spindle 24. Rotation of spindle 24 is arms 22 of bracket 20 causes wheel 29 to turn about the axis of spindle 24.

The plow bottoms P, only the right-hand plow bottoms being visible in FIG. 1, are supported on a plow frame 30 including a diagonal beam 31 which is secured intermediate its ends to a frame sleeve 32 rotatably mounted on draft frame member 6. The forward end of beam 31 is secured to one end of a transverse frame member 34 which carries a locking member 35. Oppositely projecting arms 38 and 39 carry latching member 36 and 37, respectively, which are alternately engageable by locking member 35. Locking member 35 is actuated by a hydraulic ram 40 which actuates the plow frame to rotate about the axis of draft frame member 6 between its alternate left- and right-hand plowing positions as well as transport position as is fully disclosed in the copending application, Ser. No. 524,191.

Wheel 29 is caused to turn about the axis of spindle 24 by a hydraulic steering system including an expansible and retractable power element in the form of a hydraulic ram 44. A rear hydraulic ram 45 is connected with ram 44 in a closed hydraulic circuit by hydraulic hoses 46 and 47. Ram 44 includes a cylinder 48 pivotally connected by a pin 50 to an arm 51 projecting from draft frame member 6. Reciprocable within cylinder 48 is a piston 52 pivotally connected at 53 with an arm 54 projecting from the crossmember 4. As viewed in FIG. 1, counterclockwise pivotal movement of draft frame member 6 about the axis of spindle 15 causes piston 52 to retract within cylinder 48, and clockwise movement of draft frame member 6 about the axis of spindle 15 causes piston 52 to extend from cylinder 48.

Ram 45 includes a cylinder 56 pivotally connected by a pin 57 with a lever 58 extending laterally from shaft 19. The piston 59 of ram 45 is pivotally connected by a pin 60 with an actuating arm 61 nonrotatably mounted on spindle 24. Consequently, as viewed in FIG. 1, extension of ram 45 causes counterclockwise movement of wheel 29 about the axis of spindle 24, and conversely, retraction of piston 59 within cylinder 56 causes clockwise turning movement of wheel 29 about the axis of spindle 24. Furthermore, extension of piston 59 from cylinder 56 causes hydraulic fluid to be expelled from cylinder 56 through hose 47 to thereby cause piston 52 of ram 44 to retract within the cylinder 48. The hydraulic fluid displaced from cylinder 48 flows into cylinder 56 through hose 46.

When the tractor turns toward the left, arm 54 will move relative to cylinder 48 in a direction to force piston 52 to extend from cylinder 48 to expel fluid from cylinder 48 through hose 47 to thereby cause piston 59 to retract within the cylinder 56 and turn wheel 29 in a clockwise direction about the axis of spindle 24. When the tractor turns to the right on the other hand, arm 54 moves in a direction to force piston 52 to retract within cylinder 48 and expel fluid from cylinder 48 through hose 46 which causes piston 59 to extend from cylinder 56 and turn wheel 29 in a counterclockwise direction about the axis of spindle 24. The trailing end of the plow is thus steered in accordance with changes in direction of the tractor.

As pointed out above, the soil forces on the plow when the right-hand plows are in their working position are such that the plow tends to swing toward the left, as shown in FIG. 1, about the axis of spindle 15. Wheel 29 is caused to turn in a counterclockwise direction about the axis of spindle 24 to steer the trailing end of draft frame member 6 to the position shown in FIG. 1 in response to rotation of the plow frame to the right-hand plowing position, or the position illustrated in FIG. 1. With reference to FIG. 3, an eccentric 64 is mounted on the plow frame sleeve 32 by radial spacers 65. Rotatably mounted on eccentric 64 is a collar 66 having a pair of radial lugs 67 to which a link 69 is connected by a pivot pin 68. The other end of link 69 is connected by a pivot pin 71 with a lever 70 nonrotatably secured to the upper end of shaft 19.

As viewed in FIG. 3, movement of pivot pin 68 away from draft frame member 6 causes lever 70 to rotate shaft 19 in a clockwise direction to swing wheel 29 toward the left as viewed in FIG. 3. Conversely, movement of pin 68 toward the draft frame axis results in counterclockwise turning movement of shaft 19 to swing wheel 29 toward the right as viewed in FIG. 3. As is apparent from FIG. 3, rotation of eccentric 64 180° from the position shown causes pin 68 to move upwardly to thereby swing wheel 29 clockwise, or to the left. Rotation of eccentric 64 90° from the position shown in FIG. 3 obviously causes pin 68 to move one-half the distance that it would move were the plow frame rotated through an angle of 180°.

If wheel 29 is in a vertical position relative to the ground, and is in line with the longitudinal axis of draft frame member 6 (i.e., the wheel lies in a vertical plane that passes through the longitudinal axis of draft frame member 6), swinging of wheel 29 about the axis of shaft 19 to the right side of draft frame member 6 as viewed in FIG. 1, and without turning the wheel about the axis of spindle 24, will result in the wheel 29 tending to steer the trailing end of the implement toward the right. This is due to the fact that shaft 19 is inclined upwardly and forwardly at an angle y relative to the draft frame member 6, and that the axis of spindle 24 is normal, or at a right angle to the axis of shaft 19. Conversely, if wheel 29 is swung to the left side of the draft frame member 6 about the axis of shaft 19, the wheel 29 will lie in a plane relative to the draft frame that causes the trailing end to be steered to the left.

When the plow frame 30 is rotated 90° from the position shown in FIG. 1 to place the plow bottoms in transport position such that neither the right- nor left-hand plow bottoms can engage the ground, eccentric 64 will be actuated to cause wheel 29 to move directly underneath the draft frame member and lie in a vertical plane relative to the ground. During straight line movement of the tractor the wheel 29 will lie in a vertical plane that passes through the longitudinal axis of the draft frame member 6. When the tractor turns, ram 44 responds to actuate ram 45 in a direction to cause wheel 29 to rotate about the axis of the inclined spindle 24 to steer the trailing end of the draft frame member around the turn.

Rotation of plow frame 30 from the transport position to the right-hand plowing position shown in FIG. 1 causes eccentric 64 to actuate shaft 19 to swing wheel 29 in a clockwise direction (as viewed from the rear) and move wheel 29 to the left of draft frame member 6 as shown in FIG. 1, in which position, wheel 29 is positioned to steer the trailing end of the draft frame member to the left of the tractor longitudinal axis because of the inclination of shaft 19. Conversely, when the plow frame is rotated to the left-hand plowing position, wheel 29 is swung about the axis of shaft 19 to the right of draft frame member 6 and lies at a steering angle relative to the longitudinal axis of draft frame member 6 to steer the trailing end thereof to a right-hand offset position relative to the tractor longitudinal axis.

While a specific form of the invention has been illustrated and described in the foregoing specification and drawings, it should be understood that the invention is not limited to the exact construction shown but that various alternatives in the construction and arrangement of parts, all falling within the scope and spirit of the invention, will be apparent to those skilled in the art.

I claim:

1. A semimounted, turnover plow comprising a draft frame member having forward connecting means for supporting the forward end of the draft frame member for side-to-side swinging movement on a draft vehicle, support means, a wheel assembly pivotally supported by the support means on the trailing end of the draft frame member for side-to-side swinging movement relative to the draft frame member about a tilt axis inclined upwardly and forwardly relative to the longitudinal axis of the draft frame member, means mounted on the draft frame member to pivot the wheel assembly about said tilt axis, said wheel assembly including wheel mounting means, a rotatable wheel pivotally mounted on the wheel mounting means for steerable movement about a axis, axis that is normally disposed to said tilt axis, steering means mounted on the draft frame member to pivot the rotatable wheel about said steerable axis, and a plurality of oppositely projecting left- and right-hand plow bottoms mounted on said draft frame member for rotation between left- and right-hand plowing positions to respectively place the left- and right-hand plow bottoms only in earth engaging position and a transport position to place both the left- and right-hand plow bottoms in nonearth engaging positions.

2. A semimounted turnover plow as claimed in claim 1 wherein said steering means to pivot the wheel about the steerable axis includes control means connected between the forward connecting means and the wheel and is operable to steer the wheel in accordance with changes in direction of the draft vehicle as well as to maintain the wheel in alignment with the direction of movement during straight line movement of the draft vehicle.

3. A semimounted turnover plow as claimed in claim 2 wherein said steering means comprises a front hydraulic ram extensible and retractable in response to changes in the angle between the draft vehicle and the draft frame member, and a rear hydraulic ram connected with the wheel responsive to extension and retraction of the front hydraulic ram to respectively retract and extend to steer the wheel.

4. A semimounted turnover plow as claimed in claim 3 further including a sleeve mounted on the trailing end of the draft frame member, said sleeve extending upwardly and forwardly from the trailing end of the draft frame member, a shaft rotatably mounted in said sleeve, said wheel assembly being carried by said shaft, said tilt axis being defined by the common axis of said shaft and sleeve.

5. A semimounted turnover plow as claimed in claim 4 further including a plow frame sleeve rotatably mounted on said draft member, a beam mounted between its ends on said plow frame sleeve, said plow bottoms being carried by said beam, and wherein the means to pivot the wheel assembly about said tilt axis includes means interconnecting said plow frame sleeve and said shaft to rotate said shaft for carrying said wheel assembly and to position the wheel in accordance with the position of the plow frame sleeve.

6. A semimounted turnover plow as claimed in claim 4 wherein said means interconnecting the plow frame sleeve and said shaft for carrying said wheel assembly comprises an eccentric mounted on the plow frame sleeve for rotation therewith, a collar concentrically mounted on the eccentric and secured against rotation with the eccentric, a lever mounted on the tilted shaft, and a link connecting said lever with said collar such that rotary motion of the eccentric causes rotation of the shaft.