

April 7, 1959

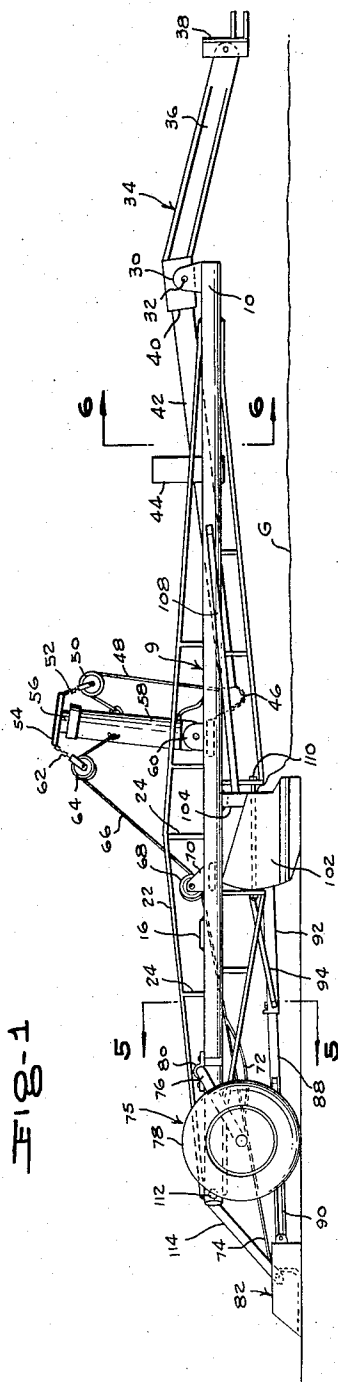
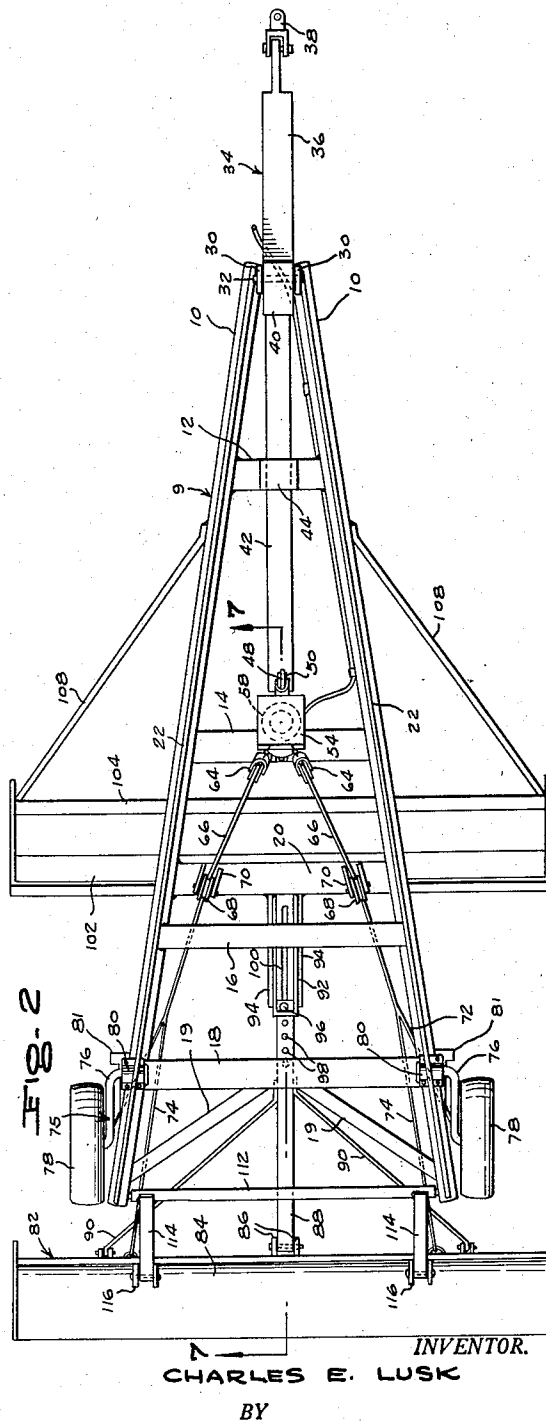
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2,880,528

LAND LEVELING APPARATUS

Filed Aug. 26, 1955

3 Sheets-Sheet 1



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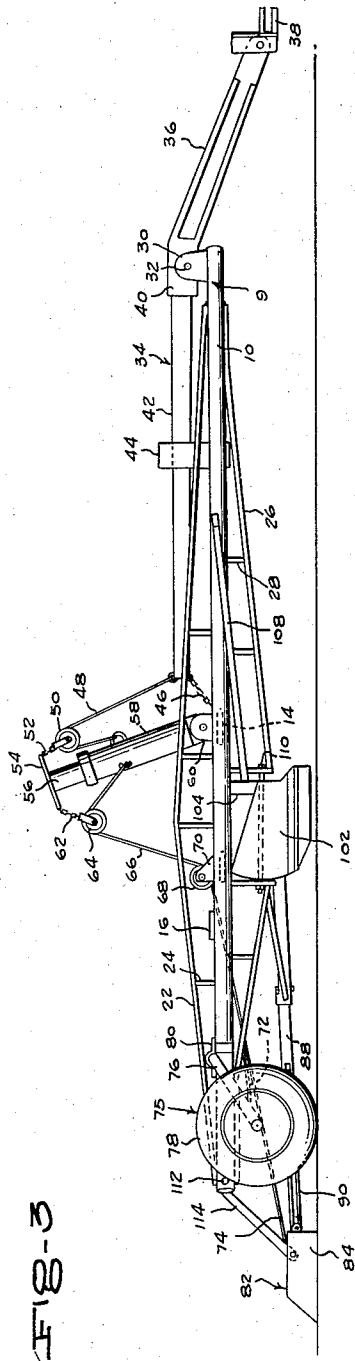
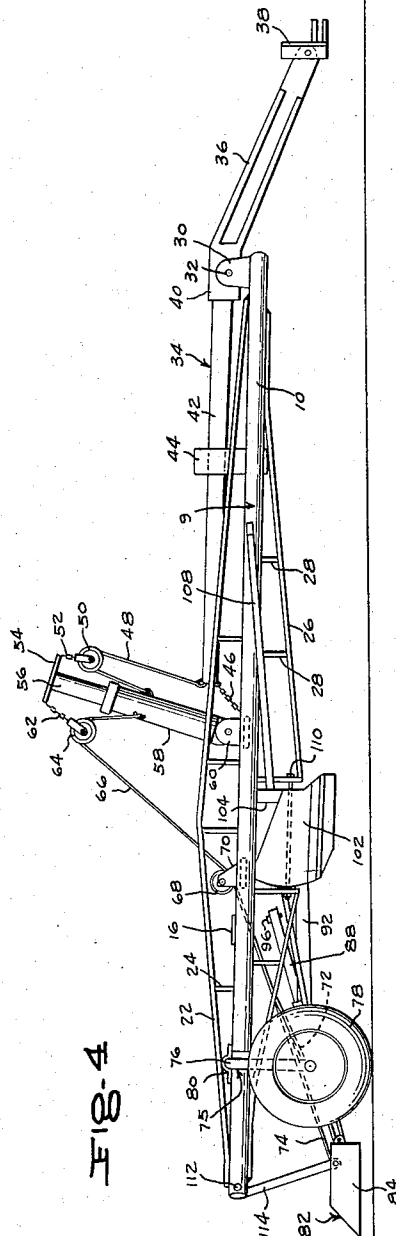
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3 Sheets-Sheet 2



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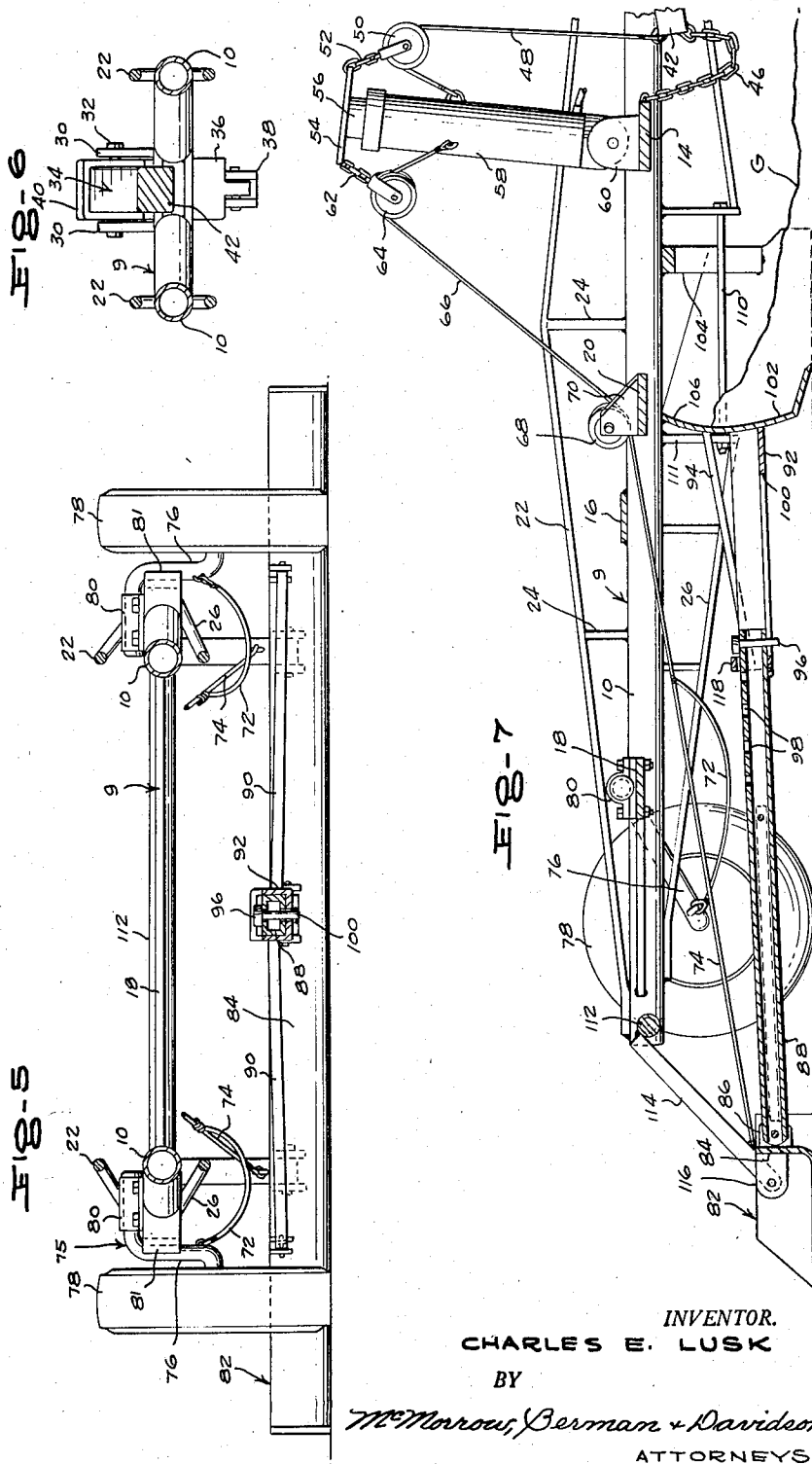
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LAND LEVELING APPARATUS

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3 Sheets-Sheet 3



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LAND LEVELING APPARATUS

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Application August 26, 1955, Serial No. 530,812

3 Claims. (Cl. 37—169)

This invention relates to land leveling apparatus, and more particularly has reference to apparatus of this nature that is characterized by a particularly strong mounting of the leveling blade, with said blade being rigidly secured to the frame so as to withstand heavy pressures exerted thereagainst due to resistance offered by the ground to passage of the leveling blade therethrough, this construction being achieved while still providing full adjustability of the leveling blade as to the ground surface and with respect to an associated, floating tail supporting shoe assembly.

A land leveller is subjected to particularly heavy stresses, and heretofore, it has been difficult to provide for full adjustability of the leveling blade in a vertical direction for depth regulation and for clearing the ground surface during transport, while at the same time mounting the leveling blade on the frame in a manner that will cause it to withstand the very heavy pressures exerted thereagainst by the ground surface during the leveling operation.

At the same time, it is important in apparatus of the character referred to, that the ground supporting shoe trailing in back of the leveling blade be supported by the associated frame in such a manner as to permit full adjustability of the leveling blade relative to the supporting shoe.

Accomplishing these several desirable results, in a single apparatus that will also be characterized by its relative simplicity, ruggedness, and its general ability to withstand heavy wear without excessive maintenance and repair expenses has been a difficult problem in the art. This is due to the fact that the provision of the necessary adjustable connections of the leveling blade to the frame, and of the supporting shoe to the frame, have usually been effected at the sacrifice of supporting the leveling blade, in each position of adjustment thereof, sufficiently strong to permit it to withstand the heavy pressures previously mentioned. Further attempts to permit the leveling blade to withstand said pressures, while still providing an adjustable connection thereof to the frame itself, have necessitated relatively complex linkages that involve a high manufacturing and maintenance cost.

The present invention aims to overcome the difficulties which have heretofore persisted, through the provision of a strong elongated frame mounted to swing bodily upon a wheeled carriage, to change the elevation of the frame above the ground surfaces, responsive to a simple and yet powerful combined lever and draw bar assembly which will effect the bodily movement of the frame responsive to extension of a hydraulic piston carried by the frame to a predetermined extent. The leveling blade, by reason of this arrangement, is capable of being welded or otherwise rigidly secured directly to the frame, while still having full adjustability in a vertical direction.

The construction encompasses, further, a linkage of the floating supporting shoe to the frame and hydraulic piston which, following extension of the piston to an extent sufficient to elevate the leveling blade, will fully

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rock the frame about the axis of rotation of the wheels of the carriage, and, in an immediately following stage of the same operation, will swing the supporting shoe to a raised position so that both the leveling blade and supporting shoe will now be supported in ground-clearing positions for transport of the apparatus to a selected location. Thus, through the medium of a single hydraulic means capable of being controlled with ease and facility by the operator of a traction vehicle behind which the apparatus is drawn, selected adjustments of the leveling blade relative to the ground surface and supporting shoe and of both the leveling blade and supporting shoe relative to the ground surface, are swiftly and easily accomplished, all without any sacrifice whatever of the ability of the leveling blade to withstand heavy pressures encountered during use of the apparatus.

Other objects will appear from the following description, the claims appended thereto, and from the annexed drawing, in which like reference characters designate like parts throughout the several views, and wherein:

Figure 1 is a side elevation view of the apparatus as it appears when in use, with the leveling blade down in ground-leveling position;

Figure 2 is a top plan view;

Figure 3 is a view similar to Figure 1 with the leveling blade raised to a slight extent and the supporting shoe still in contact with the ground, to provide for depth adjustment of the leveling blade relative to the ground surface, or for adjustment of the leveling blade fully out of contact with the ground surface while the supporting shoe remains in engagement with said surface;

Figure 4 is a view similar to Figures 1 and 3 with both the leveling blade and supporting shoe engaged for transport of the apparatus to a selected location;

Figure 5 is an enlarged transverse sectional view on line 5—5 of Figure 1;

Figure 6 is an enlarged transverse sectional view on line 6—6 of Figure 1; and

Figure 7 is an enlarged, fragmentary longitudinal sectional view on line 7—7 of Figure 2.

The frame 9 constituting the present invention is of elongated, forwardly tapering formation as shown in Figure 2, when viewed in top plan, and has the general outer configuration of an isosceles triangle. The frame includes a pair of forwardly convergent longitudinal frame members 10 of heavy tubular stock, rigidly connected at locations spaced along their lengths by a transversely extending front cross brace 12, middle cross braces 14, 16, a rear cross brace 18, and another middle cross brace 20 disposed between the braces 14, 16. These are all shown to particular advantage in Figure 2, and in the illustrated embodiment, the rear cross brace 18 has rigidly secured thereto rearwardly divergent brace members 19, welded or otherwise fixedly secured at their upper divergent, rear ends to the rear extremities of the longitudinal frame members 10.

To rigidify the frame members 10 so that they will withstand heavy pressures tending to buckle the same, there are provided upper longitudinal truss members 22 fixedly secured to the members 10 by vertical braces 24 spaced longitudinally of the truss and frame members, and lower longitudinal truss members 26, underlying the longitudinal frame members and fixedly secured thereto by vertical braces 28.

Affixed to and projecting upwardly from the front ends of the frame member 10 are laterally spaced pivot brackets 30, between which extends a pin 32 passing through a transverse opening provided in a combined draw bar and lever generally designated at 34. The draw bar-lever includes a downwardly inclined draw bar extension 36 having at its front end a clevis 38 pivotally connected to extension 36 for swinging movement

about an axis extending transversely of the frame. The draw bar extension 36 is of I beam material and at its rear end is provided with a tubular socket 40 of rectangular cross section (Figure 6), in which is fixedly engaged one end of a lever member 42 extending longitudinally and centrally of the frame and having a length approximately twice that of the extension 36, so that there is a two to one ratio in the lever-draw bar, the pin 32 extending through the socket for rockably mounting the lever-draw bar upon the frame for pivotal movement about an axis paralleling that of the clevis 38. Guiding upward swinging movement of the lever member 42 is a guide yoke 44 of inverted U-shape fixedly secured to and projecting upwardly from the front cross brace 12.

A limit chain 46 is connected between the rear end of the draw bar-lever and the middle cross brace 14 (Figure 7) and limits upward swinging movement of the member 42. Also connected to the rear end of member 42 is one end of a cable 48, trained intermediate its ends about a pulley 50 dependently supported by a chain 52 connected to a plate 54 fixed to the upper end of a ram 56 of a hydraulic cylinder 58 pivotally connected at its lower end to brackets 60 fixed to brace 14, for swinging movement about an axis paralleling the axis of pin 32. At its other end, the cable 48 is secured to the cylinder 58, and thus, when piston 56 is extended, it will exert an upward pulling force on the rear end of member 42 through the medium of the cable 48. This force will swing the draw bar-lever upwardly about the axis of its pivotal connection to the traction vehicle, not shown, and will thus be translated into an upward pull exerted through the connection 32 upon the front end of the frame 9, tending to raise the frame at the front end thereof.

Dependently supported through the medium of short chains 62 from plate 54 are laterally spaced pulleys 64, about which are trained cables 66 anchored at one end to the cylinder 58 and trained intermediate their ends under pulleys 68 mounted upon pulley brackets 70 secured fixedly to the cross brace 20. Adjacent the rear end of the frame, the respective cables 66 are forked to include cable extensions 72, 74 on each of said cables 66.

A wheeled carriage has been generally designated 75, and is provided with cranked, opposed, laterally spaced wheel hangers 76 (Figure 5) on one end of which are rotatably mounted ground wheels 78. The other ends of the hangers are rotatably engaged in bearings 80 fixedly secured to the longitudinal frame members 10 at opposite sides of the frame. Cable extensions 72 are connected to the wheel-receiving ends of the hangers 76, and thus, on extension of the piston 56 a predetermined distance, pull will be exerted in a forward direction upon said wheel-receiving ends of the hangers, as a result of which the hangers will swing between the Figure 3 and Figure 4 positions thereof, in effect causing the rear end of the frame to be swung upwardly bodily through an arcuate path about the axis of rotation of the ground wheels with the wheel hangers 76 when in the position of Figure 4 engaging the stops 81 carried by the longitudinal frame members 10.

A rear or tail assembly 82 includes a supporting shoe 84 extending transversely of the frame at the rear end of the frame, said supporting shoe as shown in Figure 7 being formed as a rearwardly opening scoop having an upstanding wall which will exert a force against loose dirt during forward movement of the apparatus, to level the mounded dirt after said dirt has been scraped loose by a leveling blade to be described in detail hereinafter.

Medially between its ends, said wall of the supporting shoe 84 has forwardly projecting, laterally spaced ears 86, between which is disposed the rear end of a connecting arm 88 of tubular formation having a rectangular cross section as shown in Figure 5. Arm 88 is pivotally connected to and between the ears 86, and the connection is braced by forwardly convergent, elongated brace

members 90 connected between the forward portions of arm 88 and the respective end portions of the leveling blade as shown in Figure 5.

At its front end, the connecting arm 88 extends into an upwardly opening channel member 92 welded at its forward end to the leveling blade and provided (Figure 2) with side braces 94. A drop pin 96 is receivable in any of a plurality of openings 98 spaced longitudinally of arm 88 (Figure 7), and at its lower end is extendable into a longitudinal guide slot 100 formed in the web of the channel member 92.

The leveling blade has been designated 102, and is formed as a forwardly opening scoop member adapted to cut into the ground G for the purpose of loosening the dirt and effecting a primary leveling action upon the ground. Dirt accumulated to excess in front of the leveling blade tends to move over the back of the leveling blade or to the sides thereof, and is leveled by the supporting shoe.

The leveling blade, as an important characteristic of the invention, is secured fixedly to the frame 9 below the same, by connecting bars 104 welded at their opposite ends to the longitudinal frame members and the scraper blade respectively. The bars 104 are formed as the depending legs of a yoke of U-shape, the bight portion of which extends transversely of the frame members. Further, the top edge of the leveling blade has a welded connection 106 directly to the longitudinal frame members as shown in Figure 7.

Fixedly secured to the ends of the leveling blade (Figure 2) and converging in a forward direction are brace members 108, welded at their convergent ends to the frame members 10.

To further strengthen the connection of the leveling blade to the frame, there are provided elongated truss bolts 110 (Figure 7) extending through openings formed in the back wall of the leveling blade, with said back wall of the leveling blade abutting against the adjacent vertical braces 111 of the lower truss assembly to further permit the leveling blade to withstand heavy pressures caused by resistance of the ground to passage of the leveling blade therethrough. The connection bolts 110 constitute parts of the lower truss assemblies, the lower truss assemblies being sectionally constituted and the sections thereof being connected by the bolts 110.

A rock shaft 112 is journaled at its opposite ends in the divergent rear ends of the frame members 10, and welded to the rock shaft are arms 114, pivotally connected at their other ends at 116 to the supporting shoe 84.

In use of the apparatus, and assuming that the equipment is in use in leveling the ground, the leveling blade and supporting shoe will be positioned as shown in Figure 1. If it is desired that the leveling blade be at a lower depth than that shown, the piston 56 can be retracted to its full extent, and this will cause the rear end of the draw bar-lever to drop down slightly below the Figure 1 position thereof, causing corresponding downward movement of the entire frame 10, release of the contacting pressure of the supporting shoe 84 with the ground surface and increase in the contacting pressure of the leveling blade 102 with the ground surface. The supporting shoe 84 by virtue of the floating mounting, namely, the connection, rock shaft 112 and rock arms 114, to the frame 10, permitting the supporting shoe in the aforementioned adjustment to swing about the rock shaft 112 so as to contact the ground surface at all times. It may be noted, in this connection, that the pin and slot connection of the arm 88 and member 92 is sufficiently loose as to permit relative pivotal movement of said arm 88 and channel member 92, during the floating of the supporting shoe over the ground surface.

When the equipment is in use, it will be seen that the piston is completely or almost completely retracted within the cylinder 58. Assuming, now, that it is desired to lift the leveling blade out of engagement with the ground

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while leaving the supporting shoe in contact with the ground surface (see Figure 3 position of the parts) the piston is extended a predetermined, first distance out of the cylinder 58. This causes the piston to exert an upward pull, through the medium of the chain 52, pulley 50, and flexible element 48, upon the rear end of the draw bar-lever, causing said lever to swing about the axis of its connection to the traction vehicle in an upward direction and the cylinder 58 to swing about its pivotal connection to the bracket 60 from the upwardly sloping direction toward the lever 34 in Figure 1, to the upwardly sloping direction away from the lever 34 as in Figure 3, thus exerting all of the weight of the whole assembly, namely, the frame 10, drawbar lever 34, and leveling blade 102 upon the tail supporting shoe assembly 82 through the chains 62, pulleys 64, cable 66, and cable extension 74. Further extension of the piston to a predetermined second position will now exert an additional force on the rear end of the draw bar-lever, still further swinging the same upwardly, as shown in Figure 4. This exerts a pulling force upon the tail supporting shoe assembly 82 sufficient to swing the rock arms 114 about the rock shaft 112 from the position outwardly of the rock shaft 112, as shown in Figure 3, to the positions of Figure 4 in which the rock arms 114 are inwardly of the rock shaft 112, and simultaneously shift the wheel carriages 75 vertically through the cable extensions 72 and 74 to positions in which the hangers 76 are vertically engaged by the stops 81. At this adjustment the weight of the entire assembly, namely, the frame 10, drawbar lever 34, leveling blade 102, and tail supporting shoe assembly 82, is carried by the wheel carriages 75. The apparatus is now ready for transport with both the supporting shoe and leveling blade fully elevated. It may be noted, in this connection, that when the apparatus is readied for transport the arm 88 and the channel member 92 move out of longitudinal alignment, the arm pivoting relative to the channel member within a yoke 118 provided at the rear end of the channel member, lifting the pin 96 fully out of the slot 100 as shown in Figure 4.

Prior to the relative pivotal movement of the arm 88 and the channel member 92, the arm 88 will have slid forwardly within the channel member, as the supporting shoe swings forwardly to its raised position.

With the apparatus in the position shown in Figure 1, and it is desired to employ same so as to work upon the ground surface, a pulling force is applied to the drawbar lever 34 by means of a traction vehicle, not shown. This pulling force results in the leveling blade 102 to excavate the earth, the excavated earth being collected within the leveling blade 102 and pushed forwardly as the apparatus travels in a forward direction under the pulling force of the traction vehicle. When the traveling apparatus reaches a low spot in the ground surface the excavated earth within the leveling blade 102 is in part discharged into the low spot, and as the apparatus continues to move in the forward direction the supporting shoe 84 smooths and compacts the freshly discharged earth into the low spot. Should the low spot be of a depth considerably below the setting of the leveling blade 102 the traveling movement of the apparatus in the forwardly direction is stopped, and the leveling blade 102 is raised to a position such that the leveling blade is above the ground surface, or the position shown in Figure 3. To effect this raising of the position of the leveling blade from the position in Figure 1 to the position shown in Figure 3, the piston 56 is extended a predetermined first distance out of the cylinder 58. This causes the piston 56 to exert an upward pull through the medium of the chain 52, pulley 50 and flexible element 48, upon the rear end of the drawbar 34, causing the lever 34 to swing about the axis of its connection to the traction vehicle in an upward direction and the cylinder 58 to swing about

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its pivotal connection to the bracket 60 from the upwardly sloping direction toward the lever 34 in Figure 1 to the upwardly sloping direction away from the lever 34 as in Figure 3, resulting in all of the weight of the whole assembly, namely, the frame 10, drawbar lever 34 and the leveling blade 102, to be exerted upon the tail supporting shoe 82 through the chain 62, pulley 64, cables 66, and cable extensions 74. With the leveling blade 102 set in the position of Figure 3, the apparatus is caused to travel in a forwardly direction by the traction vehicle exerting a pulling force to the drawbar lever 34, resulting in the leveling blade 102 discharging all or a major portion of the excavated earth contained within the leveling blade into the spot of lower depth, leaving the discharged earth at a level substantially corresponding to the setting of the edge of the leveling blade. As the apparatus continues to move in the forwardly direction the supporting shoe 84 smooths and compacts the discharged earth to the corresponding level of the previously worked ground surface.

It is believed apparent that the invention is not necessarily confined to the specific use or uses thereof described above, since it may be suited. Nor is the invention to be necessarily limited to the specific construction illustrated and described, since such construction is only intended to be illustrative of the principles, it being considered that the invention comprehends any minor change in construction that may be permitted within the scope of the appended claims.

What is claimed is:

1. A land leveler comprising a wheeled carriage including crank wheel hangers and wheels rotatably mounted on one end of the hangers, an elongated frame pivotally connected adjacent its rear end to the other ends of the hangers, a leveling blade rigid with and extending transversely of the frame forwardly of the carriage, a drawbar pivotally connected intermediate its ends to the front end of said frame, the drawbar having a front end projecting forwardly from the frame adapted for pivotal connection to a traction vehicle, a supporting shoe pivotally suspended from and extending transversely of the frame rearwardly of the carriage, the connection of the supporting shoe to the frame being adapted for limited floating motion of the supporting shoe over the ground surface with the leveling blade in engagement with said surface, longitudinally extensible means connected at one end to and projecting upwardly from the frame, said means being adjustable from a minimum length to progressively greater first, second and third lengths and having at its other end a plurality of flexible connections one extending to the rear end of the drawbar, another to the first-named ends of the hangers, the third to the supporting shoe, the connection of said means to the drawbar being taut at the minimum length of said means whereby said means when extended to its first length will exert upward pull on the drawbar to impart pivotal movement to the drawbar about the axis of its connection to the traction vehicle, thus to in turn exert an upwardly directed force on the frame at the front end thereof through the medium of the pivotal connection of the drawbar to the frame, to swing the frame upwardly about the axis of its pivotal mounting on the carriage and thereby elevate the leveling blade with the supporting shoe in floating contact with a ground surface, the connection of said means to the first-named ends of said hangers having slack therein when said means is at its minimum and first lengths, said slack being taken up on extension of the means to said second length, whereby said means when further extended to its second length will exert a pulling force on said other ends of the hangers tending to swing the same about the axis of the pivotal connection thereof to the frame, to elevate the rear end of the frame, the connection of said means to the supporting shoe being of a length such as to swing the sup-

porting shoe upwardly on extension of said means from its second to its third length, whereby said means when further extended to its third length will exert a pulling force on the supporting shoe to swing the same about the axis of its pivotal connection to the frame to an elevated position.

2. A land leveler comprising a wheeled carriage including a pair of opposed laterally spaced crank wheel hangers and wheels rotatably mounted on one end of the hangers, an elongated frame having a pivotal connection adjacent its rear end to the other ends of the hangers, a leveling blade depending from and having a rigid connection to the frame, said blade extending transversely of the frame forwardly of the carriage, a drawbar extending longitudinally of the frame pivotally connected intermediate its ends to the front end of the frame, the drawbar having a front end projecting forwardly from the frame adapted for pivotal connection to a traction vehicle, a supporting shoe pivotally suspended from and extending transversely of the frame rearwardly of the carriage, the connection of the supporting shoe to the frame being adapted for limited floating motion of the supporting shoe over the ground surface with the leveling blade in engagement with said surface, the axis of rotation of the wheels and the axis of the several pivotal connections extending transversely of the frame in parallelism with one another, a hydraulic cylinder pivotally connected at one end to and projecting upwardly from the frame, and a piston reciprocating in the cylinder, said piston being extensible from the cylinder a minimum distance and progressively greater first, second, and third distances and having a plurality of flexible connections one extending to the rear end of the drawbar, another to the first-named ends of the hangers, and the third to the supporting shoe, the connection of said piston to the drawbar being taut when the piston is extended its minimum distance from the cylinder, whereby said piston when extended its first distance out of the cylinder will exert upward pull on the drawbar to impart pivotal movement to the drawbar about the axis of its connection to the traction vehicle, thus in turn to exert an upwardly directed force on the frame at the front end thereof through the medium of said pivotal connection of the drawbar to the frame, to swing the frame upwardly about the axis of its pivotal mounting on the carriage and thereby elevate the leveling blade with the supporting shoe in floating contact with a ground surface, the connection of said piston to the first-named ends of the hangers having slack therein when the piston is extended its minimum and first distance from the cylinder, said slack being taken up on extension of the piston to its second distance from the cylinder, whereby said piston when further extended its second distance will exert a pulling force on said other ends of the hangers tending to swing the hangers about the axis of the pivotal connections thereof to the frame, to elevate the rear end of the frame, the connection of the piston to the supporting shoe being of a length such as to swing the supporting shoe upwardly on extension of the piston from its second to its third distances, whereby said piston when further extended its third distance will exert a pulling force on the supporting shoe to swing the same about the axis of its pivotal connection to the same or a position elevated above the ground surface.

3. A land leveler comprising a wheeled carriage including a pair of opposed laterally spaced crank wheel hangers and wheels rotatably mounted on one end of the hangers, an elongated frame having a pivotal connection adjacent its rear end to the other ends of the

hangers, a leveling blade depending from and having a rigid connection to the frame, said blade extending transversely of the frame forwardly of the carriage, a drawbar extending longitudinally of the frame pivotally connected intermediate its ends to the front end of the frame, the drawbar having a front end projecting forwardly from the frame adapted for pivotal connection to a traction vehicle, a supporting shoe pivotally suspended from and extending transversely of the frame rearwardly of the carriage, the connection of the supporting shoe to the frame being adapted for limited floating motion of the supporting shoe over the ground surface with the leveling blade in engagement with said surface, the axis of rotation of the wheels and the axis of the several pivotal connections extending transversely of the frame in parallelism with one another, a hydraulic cylinder pivotally connected at one end to and projecting upwardly from the frame, a piston reciprocating in the cylinder and projecting out of the upper end of the cylinder, said piston being extensible from the cylinder a minimum distance and progressively greater first, second, and third distances, pulleys dependingly supported by the pistons, a first flexible element anchored at one end to the cylinder and trained about one of said pulleys, said element being taut when the piston is extended its minimum distance, the element at its other end being connected to the drawbar, whereby to impart pivotal movement of the drawbar about the axis of its connection to the traction vehicle responsive to extension of the piston out of the cylinder its first distance, thus to in turn impart an upwardly directed force on the frame at the front end thereof through the medium of said pivotal connection of the drawbar to the frame, to swing the frame upwardly about the axis of its pivotal mounting on the carriage and thereby elevate the leveling blade with the supporting shoe in floating contact with a ground surface, and flexible connecting means trained about the remaining pulleys and anchored at one end to the cylinder, said flexible connecting means at their other ends being connected to the supporting shoe and first-named ends of the wheel hangers respectively, the connection means of the piston to the wheel hangers having slack therein when the piston is extended its minimum and first distances out of the cylinder, said slack being taken up on extension of the piston its second distance, whereby the piston on further extension out of the cylinder its second distance will exert a pulling force on the wheel hangers tending to swing the hangers about the axes of the pivotal connections thereof to the frame to elevate the rear end of the frame, the connecting means between the piston and supporting shoe being of a length such as to swing the supporting shoe upwardly on extension of the piston from its second to its third distance, whereby said piston when further extended to its third distance will exert a pulling force on the supporting shoe to swing the same about the axis of its pivotal connection to the frame to a position elevated above the ground surface.

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