March 9, 1965 M. CONSTANTIN 3,172,218

LAND LEVELER

Filed March 20, 1963 3 Sheets-Sheet 1

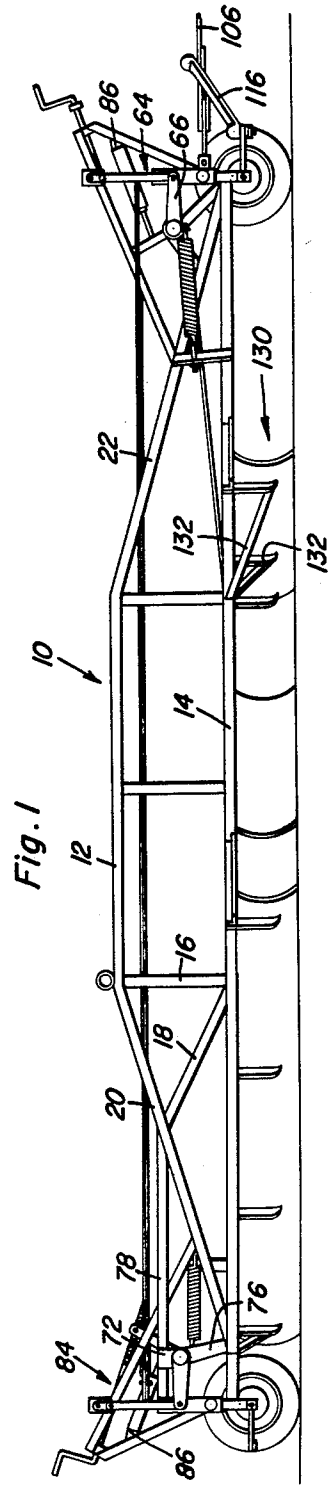


Fig. 1

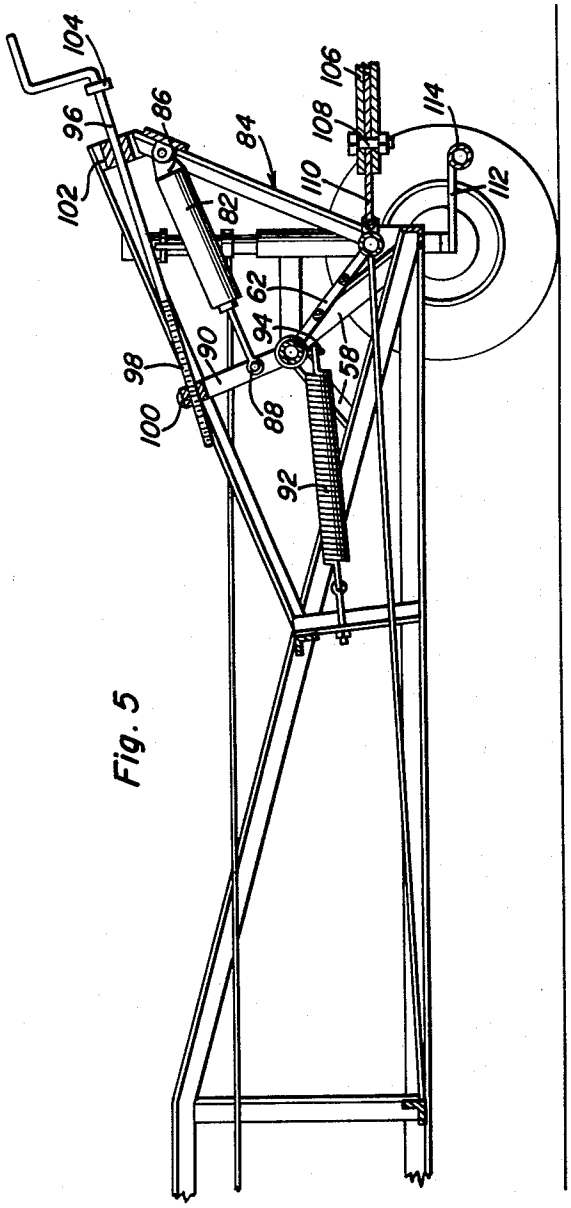


Fig. 5

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LAND LEVELER

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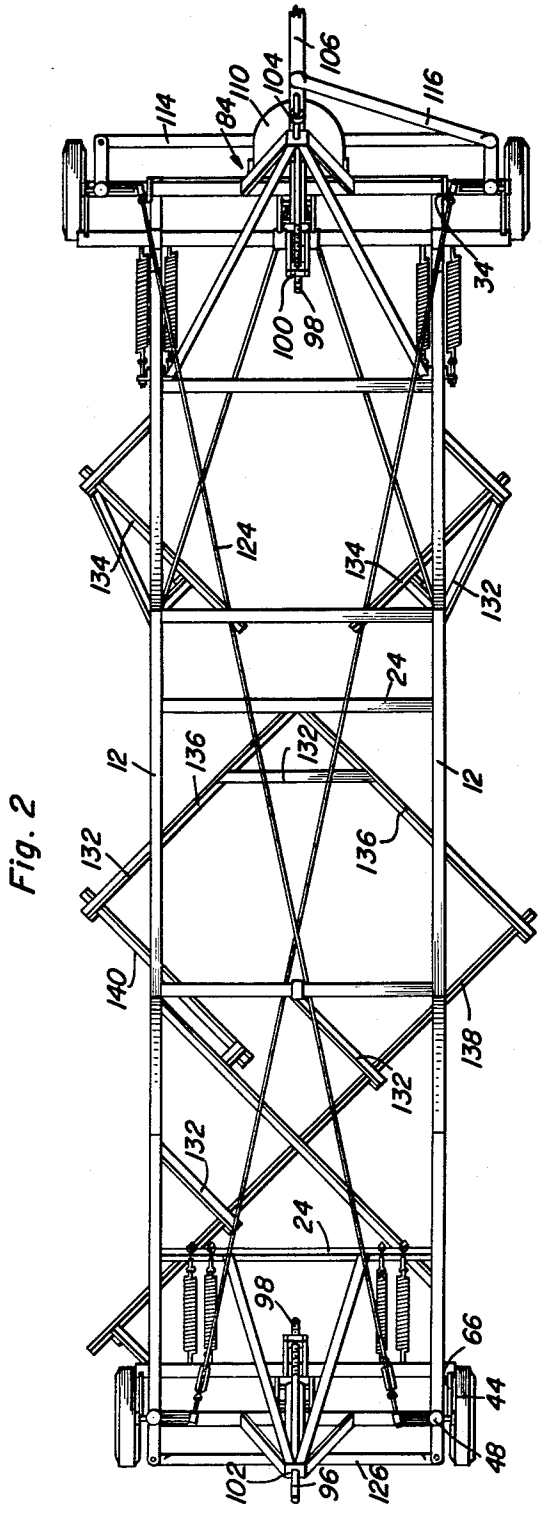


Fig. 2

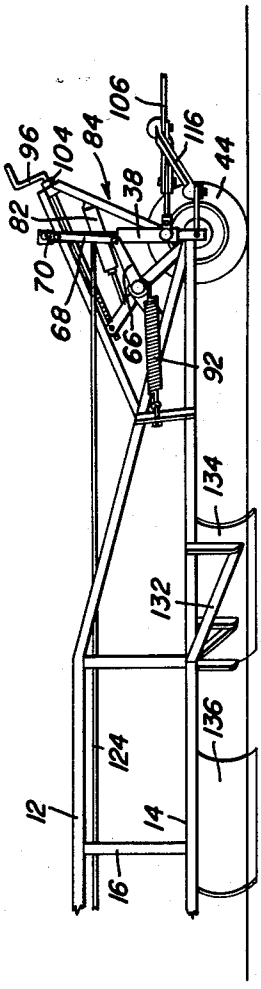


Fig. 6

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LAND LEVELER

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Fig. 3

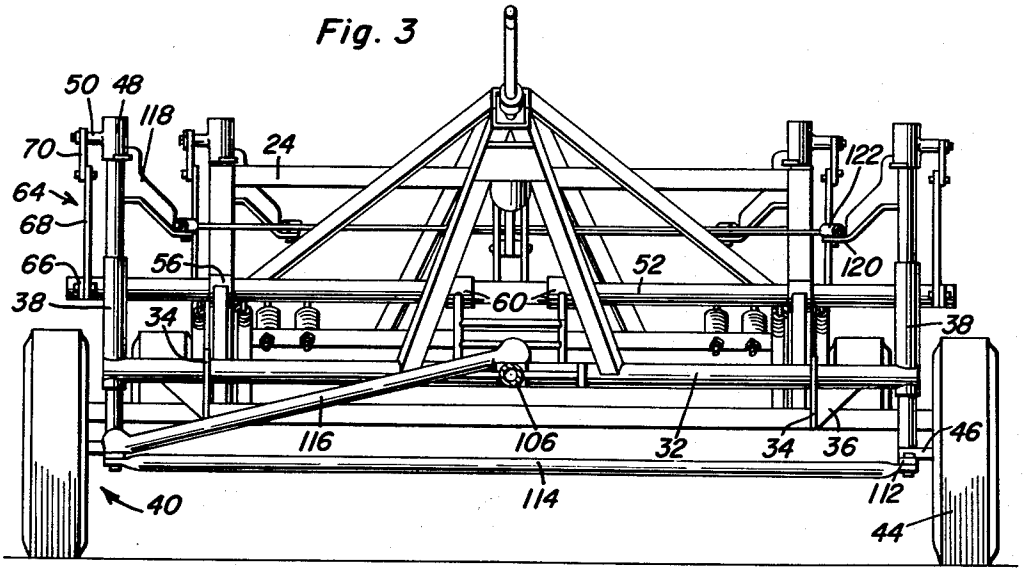
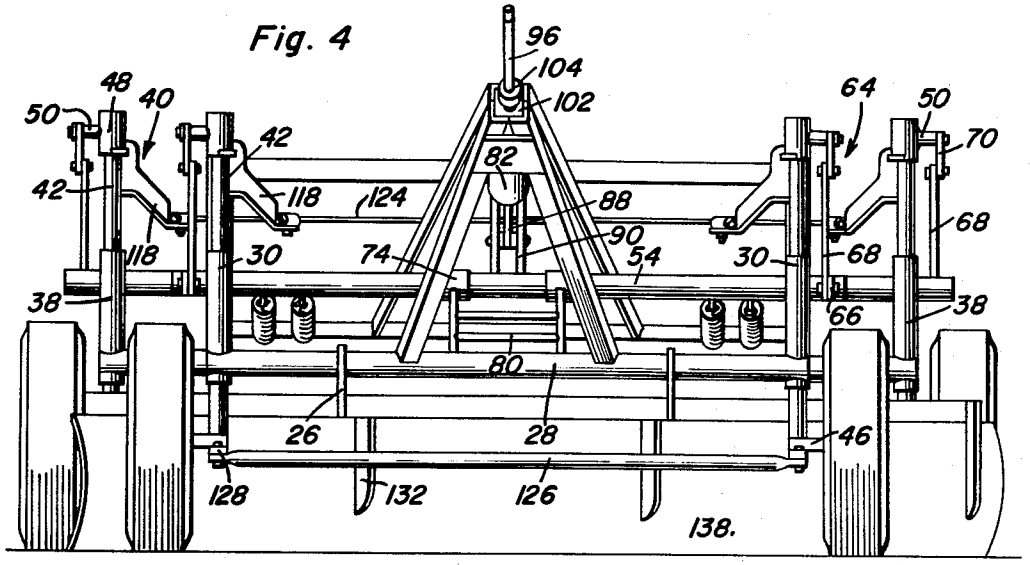


Fig. 4



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3,172,218

LAND LEVELER

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8 Claims. (Cl. 37—153)

The present invention is generally concerned with the leveling of land, and is more particularly related to a novel land leveling device incorporating a plurality of blades rigidly affixed to a frame which is in turn vertically adjustable upon four supporting and guiding wheels.

One of the primary objects of the present invention is to provide an elongated land leveler wherein all of the blades throughout the length of the leveler can be simultaneously adjusted.

It is a further significant object of the present invention to provide for the controlled steering of all four support wheels so as to greatly reduce the radius of turn without leaving an undesirable deposit of soil such as now commonly occurs with those levelers in general use.

Further, it is an intention of the present invention to set forth a novel arrangement of six scraper blades which effectively engage high spots on the earth and remove the soil therefrom, rolling this soil rearwardly throughout substantially the full length of the leveler so as to effect a complete pulverizing thereof, that portion of the soil not utilized to fill in encountered low spots being deposited solely along one side of the path of travel thus enabling its removal during a subsequent pass with the leveler.

In accomplishing the above objects, it is also an object of the present invention to provide a device which is generally simple in construction including a minimum of moving parts controlled in a manner resulting in only a minimum amount of normal maintenance so as to maintain the operability of the device.

Furthermore, it an object of the present invention to provide that the blades be rigidly and permanently affixed to the frame so as to provide a maximum amount of strength and stability to the blades, the entire frame being vertically adjustable so as to provide the desired adjustability to the blades.

In conjunction with the above objects, it is also an object of the present invention to incorporate means whereby complete control of the leveler can be effected from the means, for example a tractor, normally used to propel the leveler.

In accomplishing these objects, the present invention utilizes an elongated rigid frame having six blades rigidly affixed thereto and depending therefrom in a manner so as to roll the encountered soil rearwardly for substantially the entire length of the leveler thus effecting a thorough pulverizing of the soil. This frame has, at the four corners thereof, vertically extending spindle tubes within which are mounted, for vertical movement, spindles having rotatably mounted wheels at the lower end thereof, the frame thus being supported. Vertical movement of the frame and blades relative to the support wheels is effected by front and rear hydraulic motors controlling the rotation of front and rear transversely extending shafts rotatably mounted on the frame, these shafts being connected, through suitable linkage assemblies, to the upper ends of the spindles in a manner so as to cause a relative reciprocation between the spindles and spindle tubes responsive to the aforementioned rotation of the shafts. Steering of the leveler is effected by means of a tractor engaged tongue which is secured through a drag link to one of the wheel assemblies, this wheel assembly being interconnected with the adjoining wheel assembly by a tie rod, these two wheel assemblies, the forward wheel assemblies, being interconnected with

the rear tie rod connected wheel assemblies by crossed cables whereby a turning of the first mentioned wheel assembly in response to movement of the tongue will result in a simultaneous turning of the remainder of the wheel assemblies on substantially the same radius thus allowing for much tighter turns without any side slipping. In addition to the hydraulic motors which are to be operated simultaneously so as to miantain the substantially horizontal orientation of the frame and blades throughout the vertical movement thereof, the lever also includes front and rear manually adjustable means for varying the elevation of the leveler, these manual means acting as auxiliaries for the hydraulic motors, and also providing adjustable stops for limiting the lowering movement of the frame.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is a side elevational view of the leveler of the present invention with the near wheels removed for purposes of clarity;

FIGURE 2 is a top plan view of the leveler;

FIGURE 3 is a front elevational view of the leveler;

FIGURE 4 is a rear elevational view of the leveler;

FIGURE 5 is an enlarged cross-sectional view through the front of the leveler as illustrated in FIGURE 1; and

FIGURE 6 is a partial elevational view of the forward end of the leveler in an adjusted position relative to the position illustrated in FIGURE 1.

Referring now with more specificity to the drawings, the frame of the leveler is generally referred to by reference numeral **10**. This frame **10** consists of two elongated side truss-like frame members each including top and bottom chords **12** and **14** interconnected by suitable vertical and angular bracing members **16** and **18**, the upper chord **12** being substantially shorter than the lower chord **14** and having the ends thereof rigidly connected to the corresponding ends of the lower chord **14** by diagonally extending chords **20** and **22**, the side truss members being interconnected by suitable upper and lower transversely extending rigid bars **24**.

Mounted on the rear of the frame **10** by a pair of vertically projecting ears **26** is a transversely extending rigid rod **28** having vertically extending hollow spindle tubes **30** rigidly affixed to each end thereof.

The front of the frame **10** is similarly provided with a transversely extending rigid rod **32** supported by vertical ears **34** and braces **36**, and similarly supporting vertically extending hollow spindle tubes **38** at the outer ends thereof, these spindle tubes **38** being located laterally outward from both sides of the frame **10**.

The front and rear wheel assemblies **40** are generally similar, each consisting of a vertically extending spindle **42** received within and vertically movable relative to one of the spindle tubes **30** or **38**. Positioned laterally of the lower end of the spindle **42** of each assembly **40** is a wheel **44** rotatably mounted by a suitable stub axle **46**.

The upper end of each spindle **42** is provided with a rotatably mounted cap **48** having a laterally projecting stub **50** thereon.

The desired vertical movement of the frame **10** relative to the wheel supports or assemblies **40** is effected through transversely extending rotatably mounted shafts **52** and **54** provided on the frame adjacent the forward and rear ends thereof. The forward shaft **52** is supported within outer bearings **56** rigidly positioned by brace members **58** and inner bearings **60** positioned by a rod-like brace assembly **62**. Interengaged between the outer por-

tions of the shaft **52** and the studs **50** on the rotatable cap **48** fixed to the upper end of the spindles **42** are link assemblies **64**. Each link assembly **64** consists of a horizontally extending link **66** having the inner end thereof rigid with the shaft **52** and the outer end thereof pivotally connected to a vertically extending link **68** which in turn is pivotally secured to a second vertical link **70** having its upper end rigid with the stub **50**. It will be appreciated that such an arrangement allows for a vertical movement of the frame **10** relative to the wheel assemblies **40** upon a rotation of the shaft **52**.

The rear shaft **54** is also rotatably mounted within aligned bearings **72** and **74** rigidly positioned by vertical braces **76**, horizontal braces **78**, and a centrally located rod-like brace assembly **80**. Further, it will be noted that link assemblies **64** are also provided between the rear shaft **54** and the rear wheel assemblies **40** so as to translate rotational movement of the rear shaft **54** into vertical movement of the frame **10** relative to the wheel assemblies **40**.

It is a desire of the present invention to provide for the vertical movement of both the forward and rearward ends of the frame **10** simultaneously so as to allow for the maintaining of the substantially planar orientation thereof. Accordingly, two hydraulic motors **82** are provided, each suitably mounted within upwardly and outwardly directed frame assemblies **84**. The hydraulic motors **82**, simultaneously controlled through elongated fluid supply lines (not shown) from the drawing vehicle, preferably a tractor, have the outer ends **86** thereof pivotally mounted on the outer portion of the frame assembly **84** with the inner ends **88** pivotally mounted slightly above the corresponding shaft, either **52** or **54**, between two upwardly projecting plates **90** thus creating a moment arm for the rotation of the shafts **52** and **54** responsive to an extension or contraction of the hydraulic motors **82**.

In order to assist in the raising of the frame **10**, a plurality of spring counterbalances **92** are provided, these counterbalance springs **92** being engaged between depending lugs **94** on the respective shafts and portions of the frame **10** inwardly of the shafts, there preferably being four such spring counterbalances engaged with each shaft **52** and **54**.

In addition to the hydraulic motors **82**, the leveler of the present invention includes manual means for adjusting both the forward and rearward end of the frame **10**, this manual means consists of an elongated crank **96** having the lower threaded end **98** thereof received within an internally threaded swivel nut **100** mounted between the upper ends of the corresponding set of plates **90**, the upper outer end of the crank **96** being received through a swivel eye **102** mounted at the outer end of the frame assembly **84**, the crank **86** being freely slidable through the swivel eye **102** with a stop **104** limiting the inward movement of the crank **86**. In addition to providing for a manual raising and lowering of the frame **10** through a rotation of the shafts **52** and **54** upon a physical turning of the crank **96**, it will be appreciated that the stop **104** thereon can be poistioned so as to provide a lower limit for adjusting the frame **10** relative to the wheel assemblies by the hydraulic motors **82**. For example, FIGURES 1 and 5 illustrate the frame held in an adjusted position by the hydraulic motors **82** with the stop **104** in a predetermined position acting as a limit so as to engage the swivel eye **102**, as illustrated in FIGURE 6, thus preventing a further lowering of the frame.

Turning now to the simultaneous steering of all of the wheel assemblies **40**, it will be noted that the towing tongue **106** is rotatably mounted by a vertically extending bolt **108** on a forwardly extending plate **110** pivotally mounted on the forward rod **32** for movement about a transverse horizontal axis. Each of the forward wheel assemblies **40** includes a forwardly projecting arm **112** rigidly affixed to the bottom of the spindle **42**, the forward ends of the arm **112** being interconnected by a rigid

transversely extending tie rod **114** pivotally connected to each arm **112**. In order to transfer the horizontal movement of the tongue **106** to the wheel assemblies, a drag link **116** is extended from the tongue **106** to one of the arms **112**, a universal connection being provided at both ends of the drag link **116**. Accordingly, as the tongue **106** is moved, this movement is translated to one wheel assembly **40** by the drag link **116**, this wheel assembly controlling the movement of the other front wheel assembly by the tie rod **114**. However, it is also contemplated that the two rear wheel assemblies be simultaneously steered with the front wheel assemblies, and in order to accomplish this, laterally projecting steering arms **118** are provided rigid with the spindles **42** just below the rotatably mounted caps **48**, these steering arms **118** each having a horizontal platform portion **120** thereon upon which a cable clamp **122** is swivelly mounted, crossed cables **124** being provided between the steering arms **118** on the front wheel assemblies and the steering arms on the rear wheel assemblies, these rear wheel assemblies similarly being interconnected by a tie rod **126** engaged between rearwardly projecting lower arms **128** rigid with the spindles **42**. Such an arrangement results in a simultaneous steering of all of the wheels, the steering arms **118** of course being orientated so as to provide for a pivoting of the wheel assemblies in the proper direction for making turns. Of particular significance in regard to the means for effecting the steering of the leveler is that no interference is produced with or encountered from the raising and lowering of the frame relative to the wheel assemblies.

Turning now to the blade assembly **130**, it will be noted that each blade is rigidly affixed in depending relation to the bottom of the frame **10** with a plurality of braces **132** rigidifying and strengthening the blades. With reference to FIGURE 2, it will be noted that the two forwardmost blades **134** are arranged in rearwardly converging relationship with the rear ends thereof being spaced apart so as to allow the soil, engaged by the blades **134**, to pass therethrough for subsequent engagement by the second two blades **136** having their forward ends in engagement in line with and slightly behind the spaced rear ends of the blades **134**, the blades **136** diverging rearwardly so as to direct the soil outwardly. The soil moved by one of the blades **136** is, upon reaching the end thereof, received on a rearwardly angled elongated blade **138** extending completely across the width of the frame **10** and slightly beyond the adjoining rear wheel assembly so as to discharge the soil in a single row for engagement by a subsequent pass of the leveler.. The soil moved by the second blade **136** is received upon a rearwardly angled shorter blade **140** which terminates at a point spaced from the face of the blade **138** so as to deposit the soil also against the blade **138** for subsequent movement laterally of the frame. It is contemplated that all of these blades be angled at approximately 45° to the longitudinal axis of the frame thus providing for an efficient moving and pulverizing of the soil with a subsequent discharge of all of the soil not used to fill intermediate low spots at one side of the device.

From the foregoing, it will be appreciated that a novel land leveling device has been defined, this device including a plurality of depending blades rigidly affixed to a frame and arranged so as to completely pulverize any soil encountered thereby with the soil being deposited solely toward one side of the leveler. The frame upon which the blades are rigidly affixed is vertically adjustable on four supporting wheel assemblies in a manner so as to retain the horizontal orientation of the frame throughout any adjustment thereof without this adjustment interfering with the steering of the device, all four wheel assemblies being simultaneously pivoted thus allowing for much tighter turns and a greater degree of control than is normally provided in such devices.

The foregoing is considered as illustrative only of the

principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. A land leveling device comprising an elongated, unitary, substantially horizontal frame having a pair of longitudinally extending chords connected by cross-bars, a plurality of levelling blades secured to and depending from said frame, wheel assemblies, means mounting said frame on said wheel assemblies for vertical movement relative thereto, means for effecting a vertical movement of the frame while simultaneously maintaining its angular relationship to the ground, and means for effecting a simultaneously steering of all of said wheel assemblies at any vertically adjusted position, each of said wheel assemblies including a wheel, a vertically extending spindle, means mounting said wheel on the lower end of said spindle for rotation about a horizontal axis, and a transversely extending arm rigidly affixed to the spindle, said means mounting the frame on the wheel assemblies consisting of two vertical spindle tubes rigidly fixed on opposite sides of the forward end of the frame, and two vertical spindle tubes rigidly fixed on opposite sides of the rear end of the frame, said spindles being vertically slidable and rotatable within said spindle tubes and projecting thereabove with the transversely extending arms being located above the tubes, said means for effecting a simultaneous steering of the wheel assemblies consisting of a tongue having one end pivotally mounted to the forward end of the frame, forwardly extending steering arms rigidly secured to the forward wheel spindles adjacent the lower ends thereof, a drag link interconnecting the tongue and one of said steering arms, a tie rod connecting said steering arms and crossed cables interconnecting each transversely extending arm on the front spindles with the transversely extending arm on the opposite rear spindle, said rear spindles having rearwardly extending steering arms thereon and a tie rod extending therebetween, limit means operatively associated with the wheel assemblies for maintaining the transversely extending arms above the cross-bars in all the adjusted positions to allow for a straight line projection of each cable from front to rear with said frame being out of contact with said cables throughout the range of vertical adjustment of the frame.

2. The device of claim 1 wherein said means for effecting a vertical movement of the frame relative to the wheel assemblies consists of two transversely extending shafts, one rotatably mounted on the frame adjacent each end thereof, means interconnecting said shafts and said wheel spindles for transforming rotational movement of said shafts into vertical movement of the frame on said spindles, and means for effecting a controlled rotation of said shafts.

3. The device of claim 2 wherein said means for effecting a controlled rotation of said shafts consist of a pair of simultaneously actuatable hydraulic motors, one associated with each shaft.

4. The device of claim 3 including manually adjustable means for rotating each shaft and independently vertically adjusting the forward and rear ends of the frame.

5. The device of claim 4 wherein said manually adjustable means includes a stop thereon and adjustable therewith for providing a lower limit to the lowering of the frame by the hydraulic motors.

6. The device of claim 5, wherein there are six blades, extending substantially 45° to the longitudinal axis of the frame, a first pair of said blades being transversely aligned and angled rearwardly in converging relation from opposite sides of the frame so as to direct soil inwardly, the inner ends of said first pair of blades being spaced from each other so as to allow for the passage of the soil therethrough, a second pair of blades having their inner ends engaged directly behind the space between the inner ends of the first pair of blades, said second pair of blades diverging rearwardly from each other so as to direct the soil outwardly, and a third pair of blades converging rearwardly with their forward ends extending outwardly beyond the outer ends of said second pair of blades so as to receive the soil therefrom, one of said third pair of blades extending across the entire frame, the other of said third pair of blades having the inner rear end terminating short of the first of said third pair of blades so as to direct the soil thereto for discharge with the soil received by said first one of said third pair of blades from the corresponding one of said second pair of blades.

7. The device of claim 6 wherein said means interconnecting said shafts and wheel spindles consist of a cap rotatably fixed to the upepr end of each spindle and a link assembly, said link assembly including a first link rigid with the corresponding shaft and pivotally connected to a second link, said second link being pivotally connected to a third link which is in turn rigid with the cap.

8. The device of claim 5 wherein each shaft includes a centrally located projecting member rigid therewith, each of said hydraulic motors having one end pivotally secured to the projecting member on its associated shaft, the opposite end of each motor being pivotally secured to the frame whereby an extension or retraction of the motors will cause a rotation of the shafts and a corresponding relative vertical movement between the frame and the wheel assemblies, said means for manually rotating each shaft comprising an elongated rigid rod having one end portion threadedly engaged, through a pivotal connector, with the shaft projecting member, said rod being slidably received through a connector pivotally secured to the frame near the point of pivotal engagement of the motor, said rod generally paralleling the motor, and a handle on said rod for effecting a rotation thereof, said stop being fixed on said rod and freely abutable against the connector secured to the frame in a manner whereby an actuation of the hydraulic motor so as to raise the frame will produce a sliding of the rod through the frame connector and a movement of the stop away from abutting engagement with the frame connector, and an actuation of the motor so as to lower the frame will produce a sliding of the rod through the frame connector and a movement of the stop toward abutting engagement with the frame connector, said engagement preventing further lowering of the frame, said threaded engagement of the rod with the shaft member allowing a variation of the position of the stop relative to the frame connector so as to vary the lower limit of the frame, said threaded engagement of the rod also allowing a manual vertical adjustment of the corresponding end of the frame.

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