Feb. 14, 1956 P. D. BARNES 2,734,293

EARTHWORKING MACHINE WITH AUTOMATIC LEVELING MEANS

Filed June 29, 1950 2 Sheets-Sheet 1

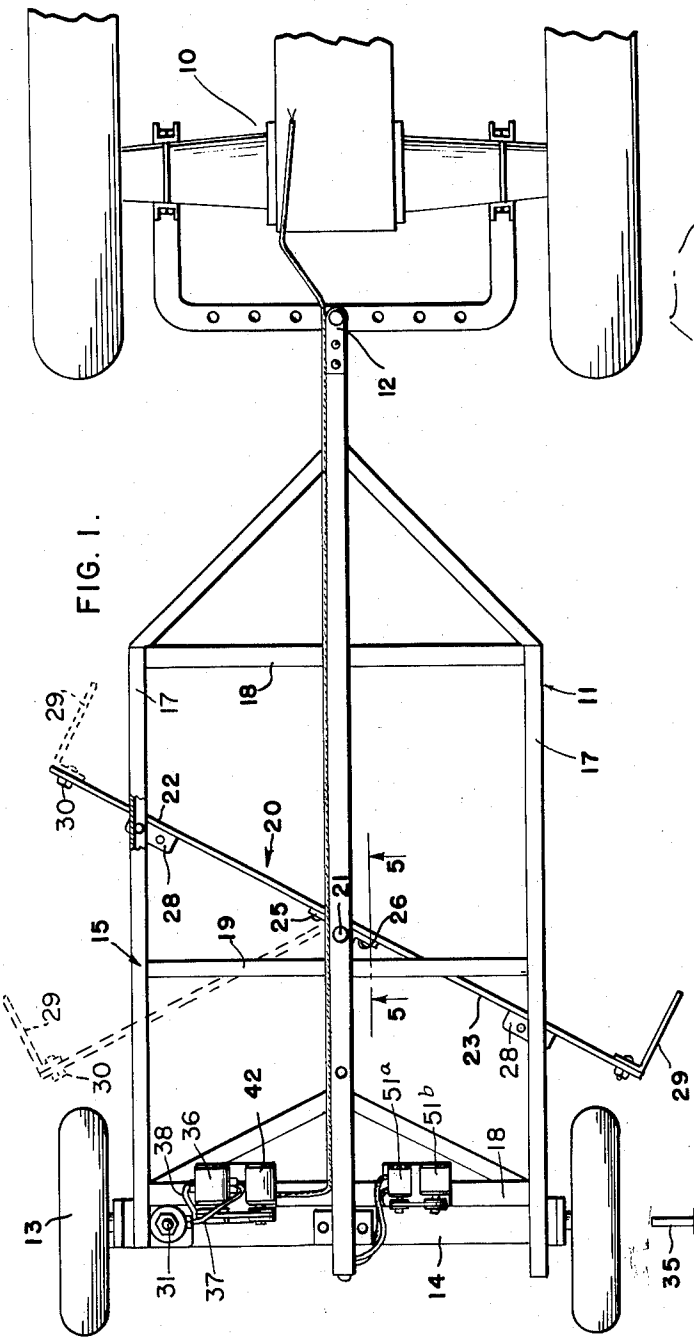


FIG. 1.

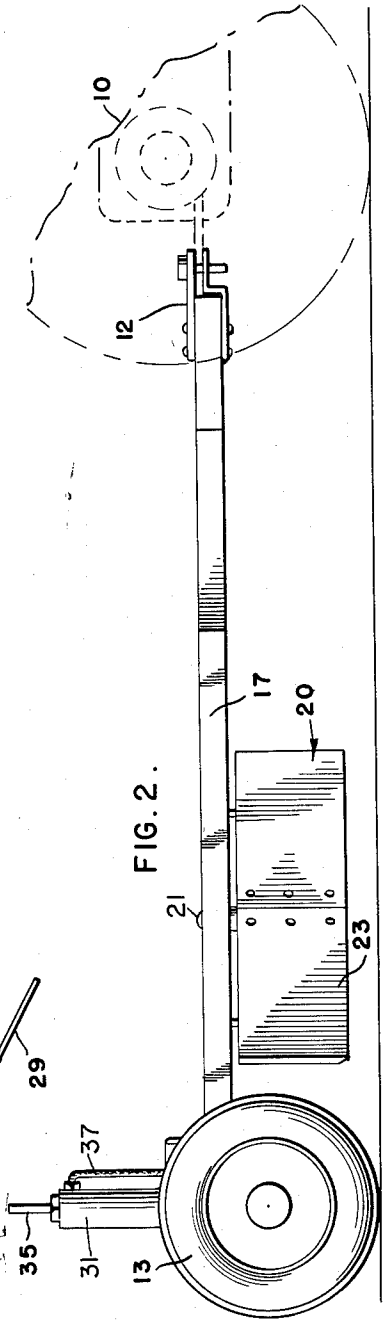


FIG. 2.

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FIG. 3.

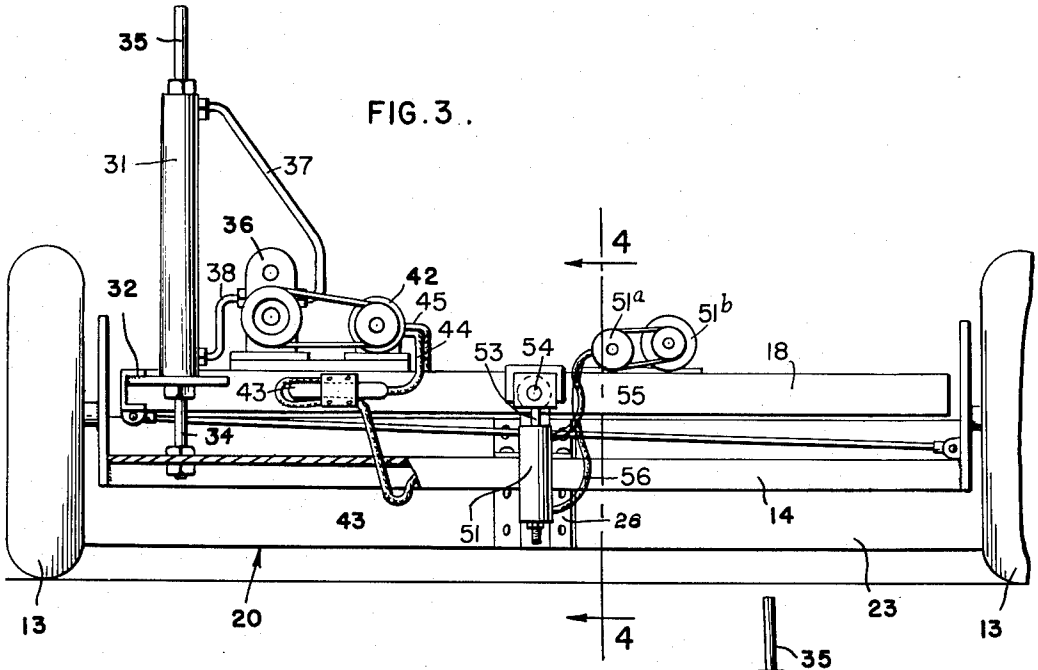


FIG. 5.

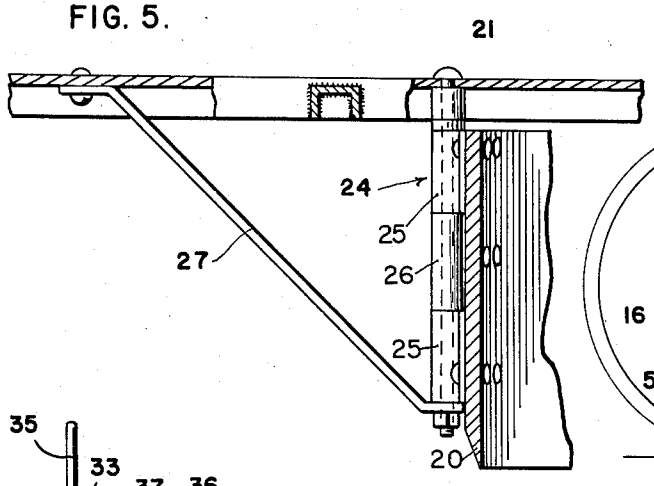
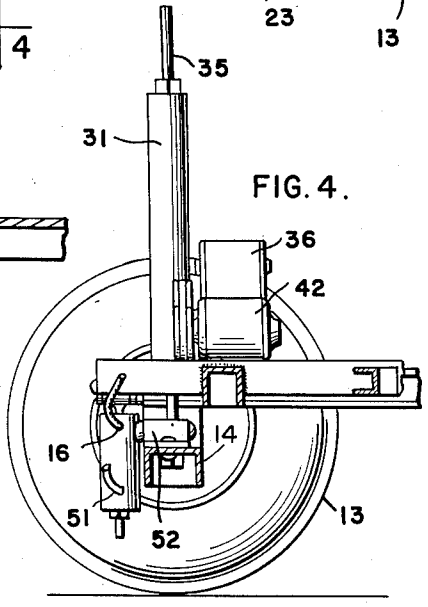


FIG. 4.



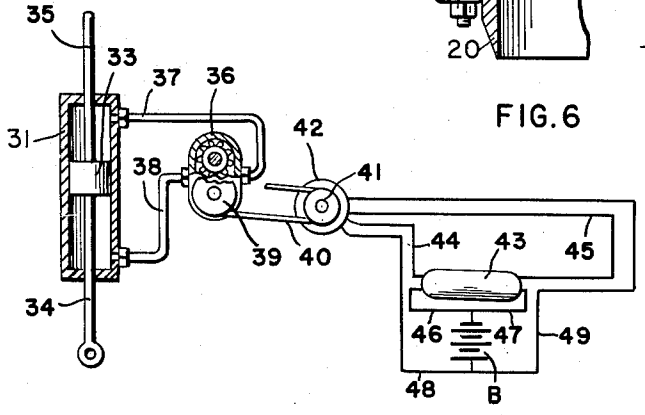


FIG. 6

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EARTHWORKING MACHINE WITH AUTOMATIC LEVELING MEANS

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Application June 29, 1950, Serial No. 170,986

4 Claims. (Cl. 37—168)

The present invention relates generally to earth working machines, and more particularly has reference to a soil working machine wherein the earth or soil between borders is maintained absolutely level. Furthermore, the machine will maintain the height of the borders level and the cycle of operations is automatically effected.

Broadly, the invention includes a frame pivotally supported by the axle of the ground wheels, the frame being coupled at its front end to a mobile vehicle, an adjustable blade pivoted to and depending downwardly therefrom intermediate its ends to the frame at a point forwardly of the ground wheels, a hydraulic unit for raising or lowering the frame to adjust the position of the blade to conform to terrain conditions, and the power means to automatically operate the hydraulic power unit.

The adjustable blade is adapted to be fixedly positioned at right angles to the direction of travel of the frame whereby the blade is employed for smoothing operations. By disposing the blade at an angle of approximately 45 degrees with respect to the direction of travel of the machine, or by disposing the blade to assume an inverted V configuration, the machine may be used for bordering purposes.

Hence, it can be seen that the equipment may be used for various purposes by simply making the necessary adjustments to the blade, which consumes relatively little time.

An object of the present invention is to provide a soil leveling machine wherein means is automatically operable to raise or lower the side of the leveling blade which may be "off" level during the movement of the machine.

Still a further object of the invention is to provide a soil leveling apparatus wherein an electrically actuated switching assembly functions to operate an electric motor which controls a hydraulic unit to raise or lower the leveling blade when the blade may be not properly leveled with respect to the terrain.

And yet a further object is to provide an earth working machine wherein the leveling blade in its entirely may be automatically raised or lowered with respect to the border in order that the borders may be kept uniform.

Still another object of my invention is to provide an earth working machine of the character described wherein the machine includes few, salient operating parts, is positive and efficient in operation, and capable of being relatively cheaply manufactured.

With the foregoing and other objects in view, the invention consists in the details of construction, and in the arrangement and combination of parts to be hereinafter more fully set forth and claimed.

In describing the invention in detail, reference will be had to the accompanying drawings forming part of this application wherein like characters denote corresponding parts in the several views, and in which:

Figure 1 is a plan view of an earth working machine made in accordance with the present invention.

Figure 2 is a view in side elevation of the machine shown in Figure 1.

Figure 3 is a rear end view of the machine shown in Figure 1 and partly in section.

Figure 4 is a view taken along the line 4—4 of Figure 3, the view looking in the direction of the arrows.

Figure 5 is a sectional view taken along the line 5—5 of Figure 1, looking in the direction of the arrows but being on a somewhat enlarged scale.

Figure 6 is a diagrammatic representation of the automatic motor control for the hydraulic raising and lowering unit.

Referring to Figure 1, I have indicated a suitable mobile vehicle such as a tractor or the like **10**, to which my novel earth working apparatus indicated generally **11** is coupled so that the apparatus **11** will follow behind the tractor **10**. The apparatus **11** comprises a single pair of ground wheels **13** carried by a suitable axle **14**, the axle **14** supporting a frame **15**, as indicated generally at **16**, as will later be more fully described. The frame **15** is capable of vertical as well as pivotal movement about the horizontal axis in order to properly treat the earth or soil being worked upon. The frame preferably comprises parallel longitudinally extending supports **17**, the ends of which are connected to transversely extending supports **18**, and an intermediate transverse support **19** is provided for strengthening or reinforcing purposes. The longitudinal members **17** and the transverse members **18** and **19** may be secured in any suitable manner, such as welding or the like.

A blade **20** is disposed intermediate the length of the frame **15** and is pivotally mounted for movement about the vertical axis relative to the frame, as shown at **21**. The blade **20** comprises a pair of complemental sections **22** and **23**, the sections being hingedly connected at their inner abutting ends by a suitable pivotal assembly indicated **24**. The pivotal assembly **24** includes complemental leaf members **25** and **26** which receive the pivot pin **21**. Consequently, it can be seen that the angular position of each of the sections **22** and **23** may be varied and, of course, means is provided to hold the sections in the angularly adjusted position. A brace or the like **27** extends from the lower end of the pivot pin **21** to the longitudinal frame members for reinforcing and strengthening purposes.

An angularly disposed bar or the like **28** is attached to the rear face of each of the sections **22** and **23** for changing the angle of the blade, and when the machine is used for smoothing purposes, the blade is disposed at right angles to the frame **15**, and an end plate **29** is connected to the outer end of the sections **22** and **23** by means of nut and bolt assemblies **30**. The end plates, of course, will prevent the soil from escaping around the ends of the blade **20**.

By disposing the blade **20** at approximately an angle of 30 degrees to the direction of travel of the frame **15** and by leaving off the end plates **29**, the blade is used for leveling and bordering the soil. In order to adjust the position of the blade **20** so that the earth or soil is kept level, it will be noted that a hydraulic cylinder **31** is attached to the frame **15** adjacent one end thereof, as shown at **32**, and a piston **33** is disposed within the cylinder, and piston rod **34** is suitably attached to the axle **14**. The piston is further provided with a dummy stem **35** to insure that the cylinder will have the same fluid displacement. A gear pump **36** communicates with the upper end of the cylinder **31** through a line **37** and with the lower end of the cylinder through a second conduit or line **38**. The pump is provided with a pulley **39** around which is trained belt **40**, the belt **40** also passing around a pulley **41** upon the armature shaft of a 6 volt reversing electric motor **42**. The pump and motor **42** can be mounted on a supporting plate or the like which in turn is attached to the frame **15**.

To control the operation of the motor **42**, an elongated mercury tube **43** is attached in a horizontal position to the rear support **18** each end of the tube having a pair of con-

tacts (not shown), the contacts being connected through lines 44, 45 to the motor and through lines 46 and 47 to a battery B and lines 48 and 49 from the battery to the motor 41. Hence, it can be seen that if the frame is not substantially horizontal, the mercury will flow to the low end of the tube to actuate the motor which, in turn, will drive the gear pump, thus moving the piston 33 downwardly to raise the low end of the frame, whereupon the blade will be leveled. This arrangement is instantaneously and automatically effected and will positively insure that the blade will be kept level.

In order to rase and lower the frame 15 relative to the axle 14 in parallelism thereto in order to remove less or more soil or earth from the borders to control the height of the borders, it will be noted that the connection 16 between the frame and the axle is a hydraulic power unit 50, cylinder 51 of which has a pivotal connection 52 with the axle at the midpoint of the axle and frame so that the frame may have limited rocking movement about the horizontal axis for the purposes hereinabove described. Piston rod 53 carries a piston head (not shown) which is slidably mounted in the cylinder 51, and the piston rod is suitably coupled to the rearmost transverse support 18 of the frame 15, as indicated at 54. In order to control the admission of fluid into the cylinder 51, a gear pump 51*a* and electric motor 51*b* similar to pump 36 and motor 42 are mounted on the rearmost support. Conduits 55 and 56 lead from the pump to the upper and lower ends of the cylinder and a suitable switching mechanism is employed for starting and stopping the operation of the motor 51*b*. Hence, if it is desired to raise the frame 15, fluid is admitted into the lower end of the cylinder to force the piston rod 53 upwardly which, of course, will raise the frame 15 and as a consequence the blade 20 to the desired height. Admission of the fluid into the upper end of the cylinder will lower the frame and the blade to remove a greater amount of earth.

It should be mentioned that when the machine is being used for floating or smoothing purposes with the end plates 29 attached to the outer end of each section 22 and 23, the electrical control for the hydraulic cylinder 31 is rendered ineffective.

It will be readily appreciated from the foregoing that the present earth working machine will assure perfect terrain contour and will dispense with the necessity of making irrigation ditches, and after the earth has been leveled and watered, the earth will not wash away, since the surface from border to border will be level. Furthermore, by adjusting the position of the blade 20 during the leveling and bordering process, it is possible to vary the width of the earth between borders.

The machine is comparatively simple in structural detail and by virtue of the automatic control, changes in contour will be simultaneously compensated for.

The invention is not to be confined to any strict conformity with the showing in the drawing, but may be changed or modified so long as such changes or modifications mark no material departure from the salient features of the invention as expressed in the appended claims.

I claim:

1. In an earth working machine of the type having a pair of ground wheels, an axle connecting the wheels, a supporting frame, a leveling blade extending transversely of and attached to the frame, a pivotal connection between the said frame and the axle whereby the frame may have limited pivotal movement about a horizontal axis relative to the axle, and means moving said frame about the pivotal connection, said means comprising a power unit at the rear of and adjacent one end of the frame operatively connected to the frame and to the axle, an electric motor carried by said frame, a drive connection between the motor and the power unit, and electric switch means on the frame controlling the motor operation so that the power unit is automatically operated during the travel of the machine to maintain the position of the frame parallel to the terrain being traversed, further power means connected to the frame and axle at the midpoint of the frame and axle to raise and lower the frame relative to the axle, and an electric motor on the frame operatively connected with said further power means to operate the same.

2. A machine as claimed in claim 1 wherein the power unit comprises a cylinder attached to the frame, a piston slidable therein, a piston rod secured to the piston and axle, conduits leading to the upper and lower ends of the cylinder, and a pump with which the conduits communicate.

3. A machine as claimed in claim 1 wherein the switch means includes a horizontally disposed mercury switch adapted to activate the motor when the axle moves from the horizontal position.

4. A mobile earth working machine to be drawn by a tractor, said machine including an axle with support wheels journaled thereon, an elongated support frame having a front portion attachable to a tractor and having a rear portion mounted on the axle for transverse tilting oscillation to allow for maintaining the same level when the axle is tilted transversely, and for vertical movement relative to the axle, a leveling blade mounted on the frame forwardly of the axle and extending generally transversely of the frame at the underside thereof for leveling the ground therebelow forwardly of the axle, power operated mechanism interposed between the frame and axle for tilting the frame relative to the axle, power transmitting means to supply power to said power operated mechanism, said power transmitting means including shiftable gravity controlled control means mounted on the frame and providing for transmission of power to said power operated mechanism to operate the same to tilt the frame relative to the axle when the support wheels pass over slopes or irregularities in the ground surface and to thereby maintain said blade in a predetermined horizontal position, and power operated mechanism including a connection between the frame and the axle approximately centrally of the ends of the axle for moving the frame vertically relative to the axle to vary the position of the lower edge of the blade relative to the soil.

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