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Kuncewicz

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[54] **COMBINED LEVELING AND COMPACTING EARTH WORKING MACHINE**

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Related U.S. Application Data

[63] Continuation of Ser. No. 201,922, Nov. 24, 1971, abandoned.

[52] **U.S. Cl.** **172/71,** 172/150, 404/117

[51] **Int. Cl.** **A01b 49/02**

[58] **Field of Search** 172/52, 71, 119, 170, 150; 180/20; 94/39, 50; 404/117

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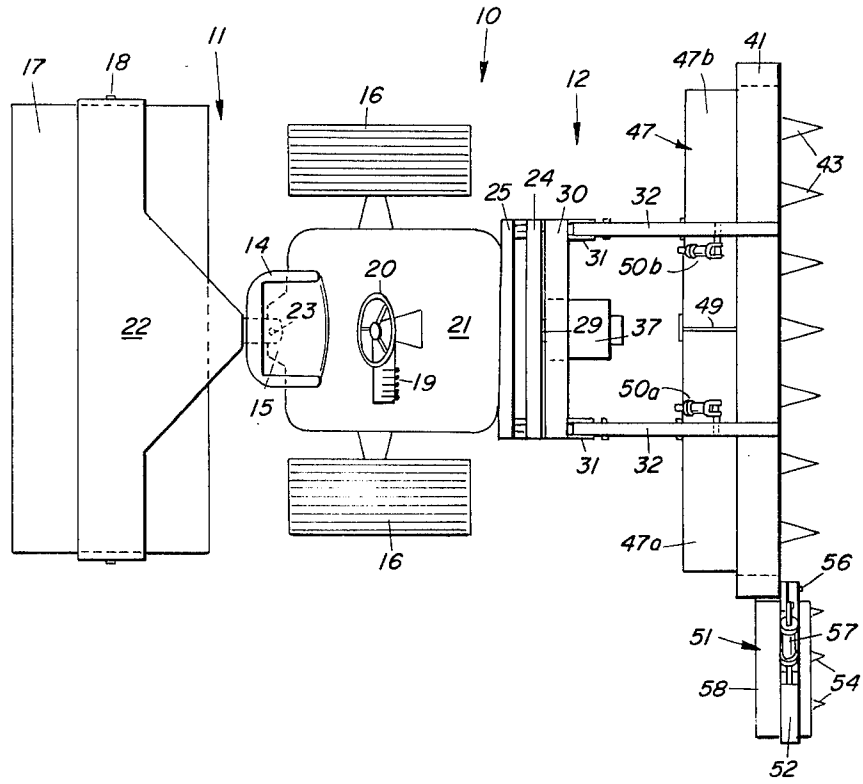
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[57] **ABSTRACT**

An earth leveling implement employs a transverse horizontal auger type excavator backed up by a vertically adjustable mold board mounted on the front of a vehicle for controlled vertical positioning and tilting; a ditcher can be attached at one side of the grader, and the vehicle can include a compactor to enable a single operator to perform the earth grading and compacting operations in a single operation.

9 Claims, 3 Drawing Figures



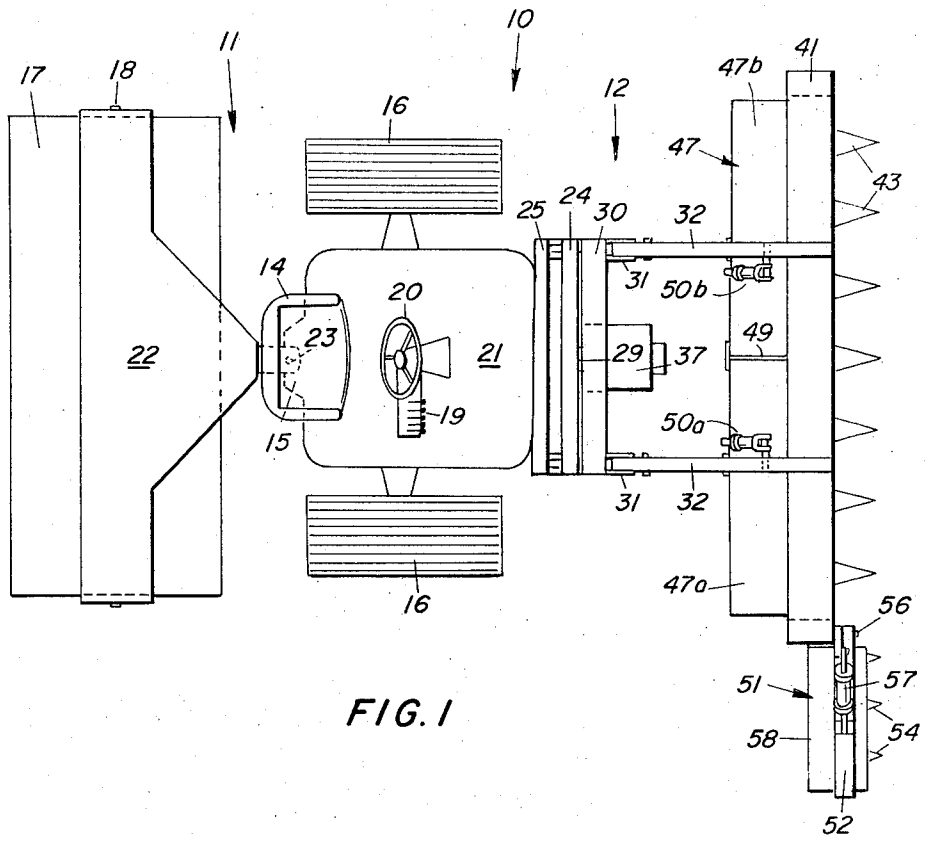

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FIG. 1

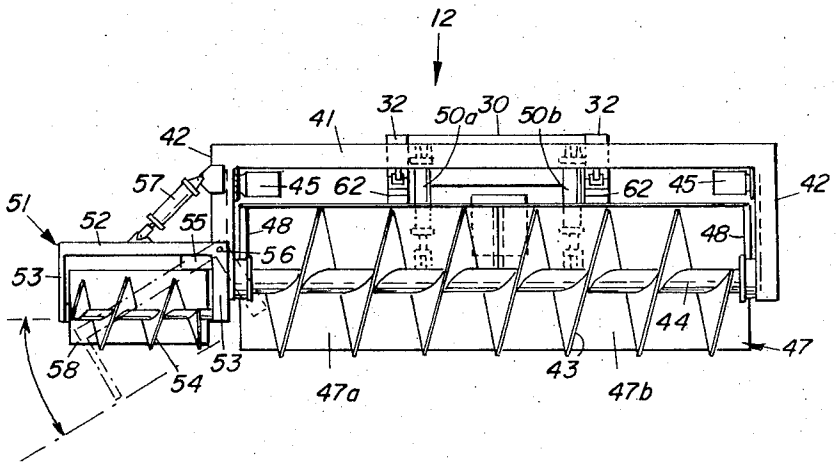

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FIG. 2

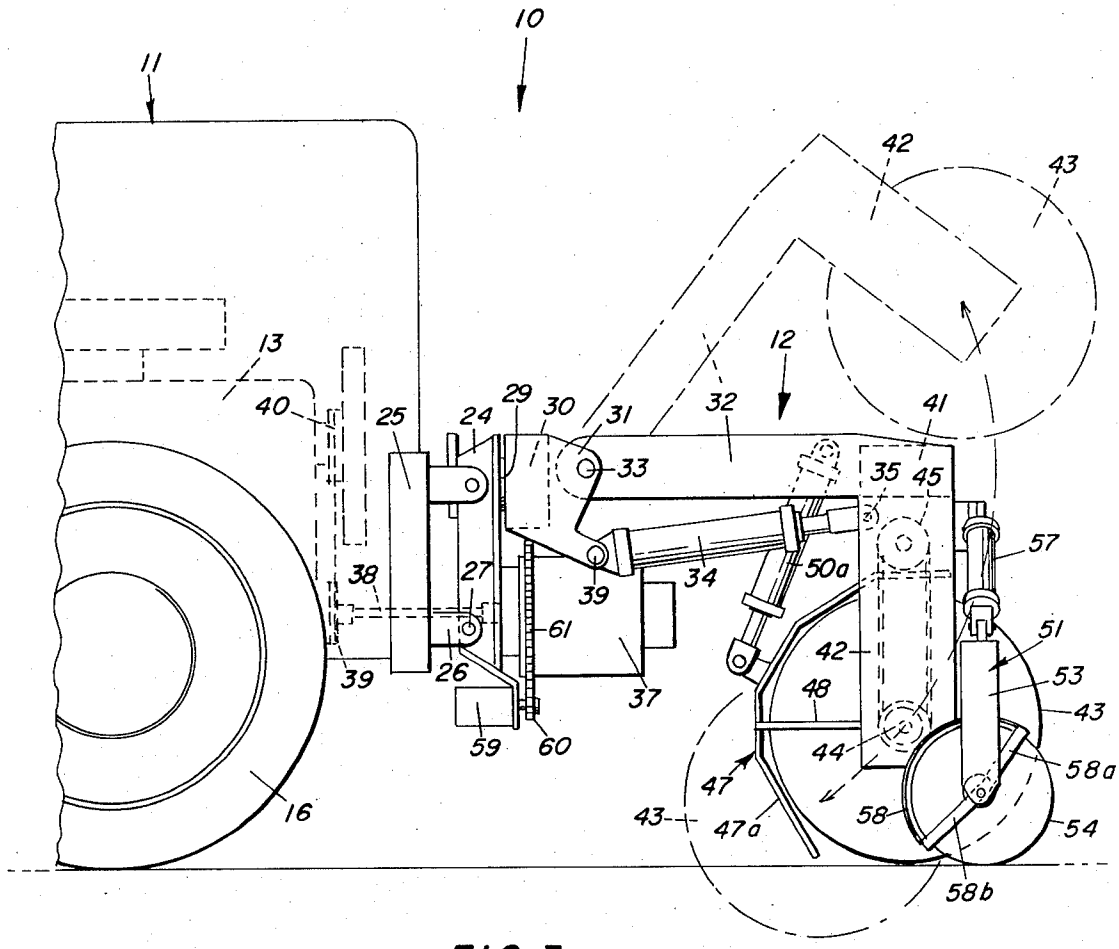

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FIG. 3

COMBINED LEVELING AND COMPACTING EARTH WORKING MACHINE

This application is a continuation of my copending application Ser. No. 201,922, filed Nov. 24, 1971, now abandoned.

This invention relates to earth working equipment, and more particularly to machinery capable of one-man operation which can excavate and level, or grade an expanse of ground either in its natural state, or after preliminary grading has been done, while practically simultaneously performing the additional operation of compacting the soil to form a solid base for later treatment.

As an example of the former, it is often desireable to create trails or roads through unimproved land to provide access to the interior portions of the land. Where there are no heavy stands of timber this may simply comprise the removal of surface vegetation, or merely filling in low spots and cutting down high spots to provide a dirt base over which ordinary road vehicles can be driven.

The present invention is also useful in the construction of level surfaces intended for extensive use by heavy vehicles such as express highways, parking lots and aircraft runways, where the soil is leveled off below grade and filled with crushed stone to provide a base for a surface layer of material such as asphalt, or concrete. In this connection, it is noted that authorities, such as the National Crushed Stone Association, indicate in their published construction guidelines that compaction of the crushed stone base for street pavements should be started immediately upon completion of the grading of the stone.

However, as far as is known to the applicant, the equipment now available requires that this can only be done in several operations, namely, by using a spreader, followed by a grader and followed by a roller.

On the other hand, the applicant's apparatus eliminates the necessity for both the spreader and the grader. The crushed stone can be deposited from the rear of a moving dump truck after which the present apparatus can be employed to distribute the stone in a level layer and then compact it with a roller (which may be static or vibratory) all in one operation and under the immediate control of a single worker.

Additionally, by virtue of combining the grading and compacting operations, it is possible for the one operator to obtain instant viewing of the compacted surface and to institute immediate corrective grading action. To date it is the common practice in preparation of earth surfaces for the roller operator to follow the grader operator at a distance in space and time. It is only after the loose, graded surface is compacted that the compacted contour of land reveals itself. It is often necessary to recall the grader to correct the compacted earth contour. With the use of the present invention an improved operating procedure and effect is made possible.

This is accomplished by the employment of a horizontal auger type rotary device having a continuous helical surface, which is mounted transversely to the front of a moving vehicle so as to be visible to the vehicle driver. This may be a truck, or tractor, whether rubber-wheeled or cleated, and in the preferred embodiment comprises a compaction roller having traction wheels in addition to the roller. In any and all events the use

of the described method for excavating and grading minimizes the power requirement of the prime mover as compared to the use of a conventional device such as a bulldozer or grader blade.

The operation of the helically surfaced element is assisted by the provision of an adjustable horizontal rearwardly positioned mold board which can be coordinated with operation of the rotary element to level off high spots, fill in low areas and deposit any excess at either side or underneath of the moving vehicle in the form of a berm.

Additionally, another helically surfaced horizontal rotary element can be mounted at one, or both sides, of the main element, and arranged for pivotal adjustment with respect to the main excavator, so as to enable a single operator to grade and compact a roadway and at the same time form a drainage ditch at one, or both, sides of the roadway.

The implement can be constructed so as to be completely self-contained for attachment to an existing machine, and is provided by hydraulically operated motors and actuator to enable the functions of the machine to be fully controlled by valves placed within reach of the vehicle operator.

In the drawings,

FIG. **1** is a plan view of a preferred form of earth working machine constructed in accordance with the present invention;

FIG. **2** is a front view of the machine showing the helicoidal excavator and ditcher means, and;

FIG. **3** is a side elevation, on an enlarged scale, of a portion of the chassis means carrying the excavator means.

Turning now to FIG. **1** it will be seen that the machine comprises an overall chassis means, indicated generally by numeral **10,** composed of a main frame means, indicated generally by numeral **11** and a grader - leveler frame means, indicated generally by numeral **12.** The main frame means supports a prime mover, numeral **13,** such as an internal combustion engine, a seat **14** for the vehicle operator mounted on an adjustable support such as a pedestal **15** which enables the operator to turn the seat about a vertical axis to maintain a clear view of the operation of the vehicle at all times.

The main frame means **11** is supported by a pair of ground engaging traction wheels **16** and a soil compacting roller means **17** mounted for rotation on the frame about a horizontal axis **18.** The roller means **17** may comprise a simple weighted roller, or may include power operated means to induce vibratory movement in the roller to increase the soil compacting effect. The roller may consist of either one compactive drum or two compactive drums either static or vibratory or in combination. Such rollers are well known in the art and need not be described in detail.

Movement of the machine as a whole may be by conventional by providing suitable power transmission devices (not shown) to connect the prime mover, or engine **13,** with either, or both of the traction wheels **16,** or the driving drum of a double drum roller, which can be controlled by the operator by means of conveniently arranged controls, such as a series of levers **19** mounted on a panel adjacent to a steering wheel **20,** which actuates a steering mechanism (not shown) to regulate the direction of movement of the chassis. Steering can be accomplished by mounting each of the wheels on individual stub axles mounted on vertical axes, and con-

nected conventional steering linkages, but in the present embodiment of the invention the main frame means **11** comprises a traction framework **21** and a roller framework **22** connected to each other by means of a heavy coupling means **23** which allows the respective frameworks **21** and **22** to turn with respect to each other about a vertical axis while restraining any relative movement about a transverse horizontal axis. The coupling means also may include power operated devices (not shown) to control the angular orientation between the two frameworks and thus steer the machine by articulation of the chassis **10.** Such devices could include electrical, or hydraulic, motors, or hydraulic cylinder - and - piston actuators or other actuators of well known construction and capable of being supplied with electrical energy, or hydraulic fluid under pressure by suitable generators, or pumps, driven by the engine **13** and controlled by the steering wheel **20.**

The excavator frame means **12** located at the end of the chassis opposite to that of compactor frame **22** includes a transverse mounting bracket **24** which enables the entire excavator means to be detachably connected to a transverse member **25** forming one end of the main frame **11,** as by means of forwarding projecting lugs **26** and bolts **27.** The bracket **24,** in turn, is connected to a sub-frame, indicated generally by numeral **28,** by means of a coupling **29** which permits rotation of the entire sub-frame about a horizontal axis extending generally in the direction of movement of the traction wheels **16.** The sub-frame includes a transverse member **30,** which is directly secured to the coupling **29,** and is provided with a fair of brackets **31** at it's outer ends to which the forwardly projecting rails **32** are connected by pivot pins **33** to allow the rails to swing about the member **30** in an arc at right angles to the axis of the coupling **29** under the control of a pair of hydraulically operated cylinder-and-piston actuators **34** which are pivotally connected at one of their ends **35** to the forward ends of the rails and also pivotally connected at their outer ends **36** to the brackets **31** at points spaced below the pivots **33.** Power for these, and other hydraulically operated devices, can be supplied by a fluid pump **37,** which is secured to the bracket member **24** in a position so that it can be driven through shaft **38** and pulley **39** by means of a belt connected with a driving pulley **40** off the engine in the usual way. For the sake of clarity, the couplings and fluid conduits leading between the pump, the valves, controlled by the control levers **19** and the various hydraulic devices are not shown in the drawings.

The pivotally mounted rails **32** support at their forward ends a transverse beam **41,** at the extremities of which there are a pair of downwardly depending arms **42** which serve as supports for a horizontally disposed helicoidally surfaced earth leveling and conveying device **43** having a concentric shaft **44** the ends of which are mounted in bearings in the respective arms **42.** In order to protect the operating parts against dirt and shock damage these arms may comprise hollow box members and the ends of the shaft **44** can extend into the interior thereof for driving connection with a pair of hydraulic motors **45** mounted at the upper ends of the arms. These motors can be supplied with motive fluid, under control of levers **19,** from the pump **37** by means of suitable conduits (not shown) and the power transmitted from the motors **45** to the shaft **44** by means of a chain and sprocket drive **46,** indicated by dotted lines in FIG. **3,** for the purpose of rotating the excavator **43** in either direction and at variable speeds. In addition, for controlling the depth and disposition of earth removed by the helicoidal excavator there is a generally semi-cylindrical mold board device, indicated generally by numeral **47** positioned behind the excavator and having suitable brackets **48** at each end to mount the device on the ends of shaft **44** for limited reciprocatory movement about the axis thereof. In the example shown, the mold board device is divided into two sections **47***a* and **47***b* along a vertical dividing line and the two adjacent edges of the sections **47***a* and **47***b* are provided with interlocking flanges at **49** to permit the two sections to be elevated or lowered independently of each other, or in unison, under control of the two cylinder and piston actuator **50***a* and **50***b*, pivotally connected between a respective section of mold board and one of the rails **32.** As with other hydraulic mechanisms, power can be supplied by pump **37** under control of levers **19,** or by another pump which may form a part of the hydraulic system of the prime mover means.

The leveler frame means **12** may also include a subsidiary edger means, indicated generally by numeral **51,** which can be used as an extension of the excavator **43** to form adjacent ditches, or to smooth off downwardly or upwardly inclined side embankments. The edger means comprises a generally C-shaped frame **52,** having depending arms **53** which rotatably support the shaft ends of a helicoidally shaped excavator **54** which is rotatably driven in either direction and at varying speeds by hydraulic motor **55,** connected directly to the excavator **54** or connected to it by a chain and sprocket drive similar to that of the main excavator **43** and also controlled by levers **19.** The C-shaped frame is secured to one of the arms **42** by a pivotal mounting **56** which enables the excavator **54** to be angularly positioned with respect to the main excavator about an axis extending generally in the direction of movement of the traction wheels **16,** as can be seen in FIG. **2.** The relative position of the C-shaped frame is controlled by the cylinder and piston actuator **57** which is pivotally attached at it's opposite ends to the C-shaped frame and one of the arms **42.** As in the case of other devices, the position of the frame is regulated by selective admission of hydraulic fluid supplied by pump **37** or by another pump under control of levers **19.** The frame **52** can also support a small, generally semi-cylindrical mold board **58,** placed behind the rotary excavator **54** and supported on the ends of the shaft thereof by means of brackets **58** to permit limited reciprocatory rotation about the axis of the shaft. The mold board may be clamped in a fixed position, or can be adjusted to various positions from the operator's position by inclusion of an actuator (not shown) similar to the actuator **50***a* and **50***b* for the main mold board device.

Finally, the entire excavator sub-frame means **28** may be tilted to a variety of positions by means of a reversible hydraulic motor **59** secured to a lower midpoint of the transverse mounting bracket **24.** The drive shaft of the motor is provided with a sprocket **60** which engages with a length of chain **61,** the ends of which are secured to the underside of the transverse member **30** at locations **62** spaced on opposite sides of the coupling **29** (See FIG. **2**).

I claim:

1. In an earth working implement, the combination including chassis means having transversely disposed helically surfaced auger means mounted at the forward end thereof for initially excavating and transversely distributing surface material, transversely disposed mold board means mounted on the chassis means behind said auger means for controlling the depth and distribution of material excavated by said auger means, a pair of ground engaging traction wheels mounted on said chassis means rearwardly of said auger means, transversely disposed ground engaging roller means mounted at rearward portion of said chassis means substantially in alignment with and substantially equal in width as said mold board means for compacting material distributed by said mold board means, prime mover means mounted on said chassis means and means connecting the prime mover means with said traction wheels and said auger means for driving said traction wheels for movement in forward and reverse directions and for rotating said auger means and means on said chassis means for steering said implement, said chassis means also including means connected with the auger means for raising and lowering and tilting said auger means and mold board means with respect to the ground, said mold board means having a transverse lower edge and including means connected between the auger means and mold board means for raising and lowering said lower edge independently of said auger means.

2. The invention defined in claim 1, wherein said chassis means is subdivided into two sections articulatedly joined together for relative movement about a vertical axis, said roller means being mounted on one of said sections, said wheels being mounted on the other of said sections.

3. The invention defined in claim 1, wherein said roller means comprises vibratory roller means.

4. The invention defined in claim 1, wherein said implement also includes auxiliary surface grading means extending transversely outwardly beyond one of the ends of said auger means and pivotally mounted on said chassis means to be positioned in angular relationship to said auger means with respect to a vertical plane.

5. The invention defined in claim 4, wherein said auxiliary surface grading means comprises an auxiliary transversely dipsosed auger means, and vertically adjustable auxiliary mold board means mounted behind said auxiliary auger means.

6. The invention defined in claim 1, wherein said auger means includes reversible hydraulic motor means for rotating said auger means and said prime mover means includes hydraulic pump means for driving said motor means.

7. The invention defined in claim 6, wherein said chassis means includes hydraulic actuator means for said raising and lowering of said auger means and mold board means.

8. The invention defined in claim 7, wherein said chassis means also includes hydraulic actuator means for said tilting of said auger means and mold board means.

9. The invention defined in claim 7, wherein said chassis means includes a station for an operator of said implement, said station including control means for a single operator to steer said implement, reversibly rotate said auger means, raise and lower and tilt said mold board means, and drive said implement in forward and reverse directions while at said station.

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