

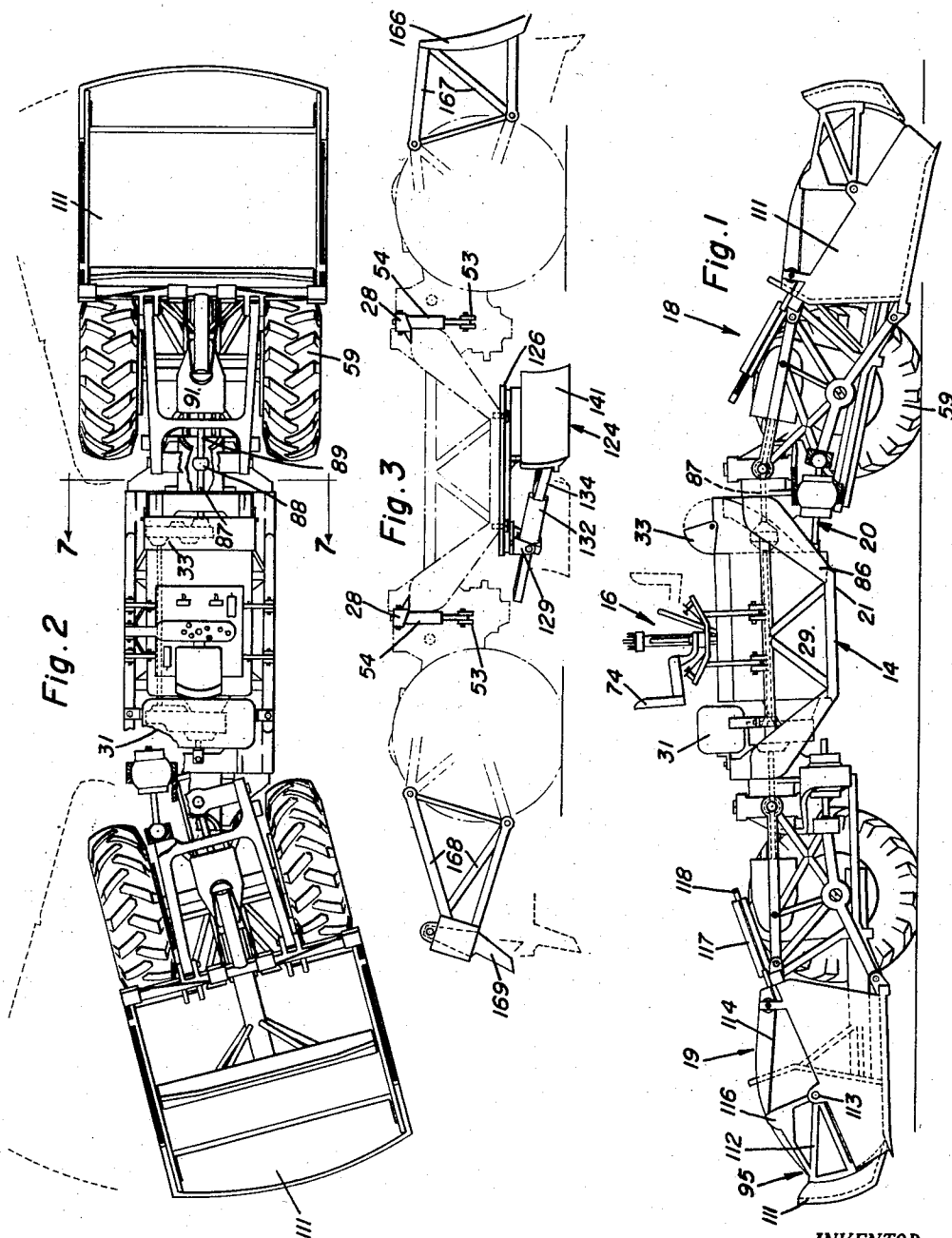
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R. L. CLIFFORD
EARTH MOVING EQUIPMENT

2,883,774

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4 Sheets-Sheet 1



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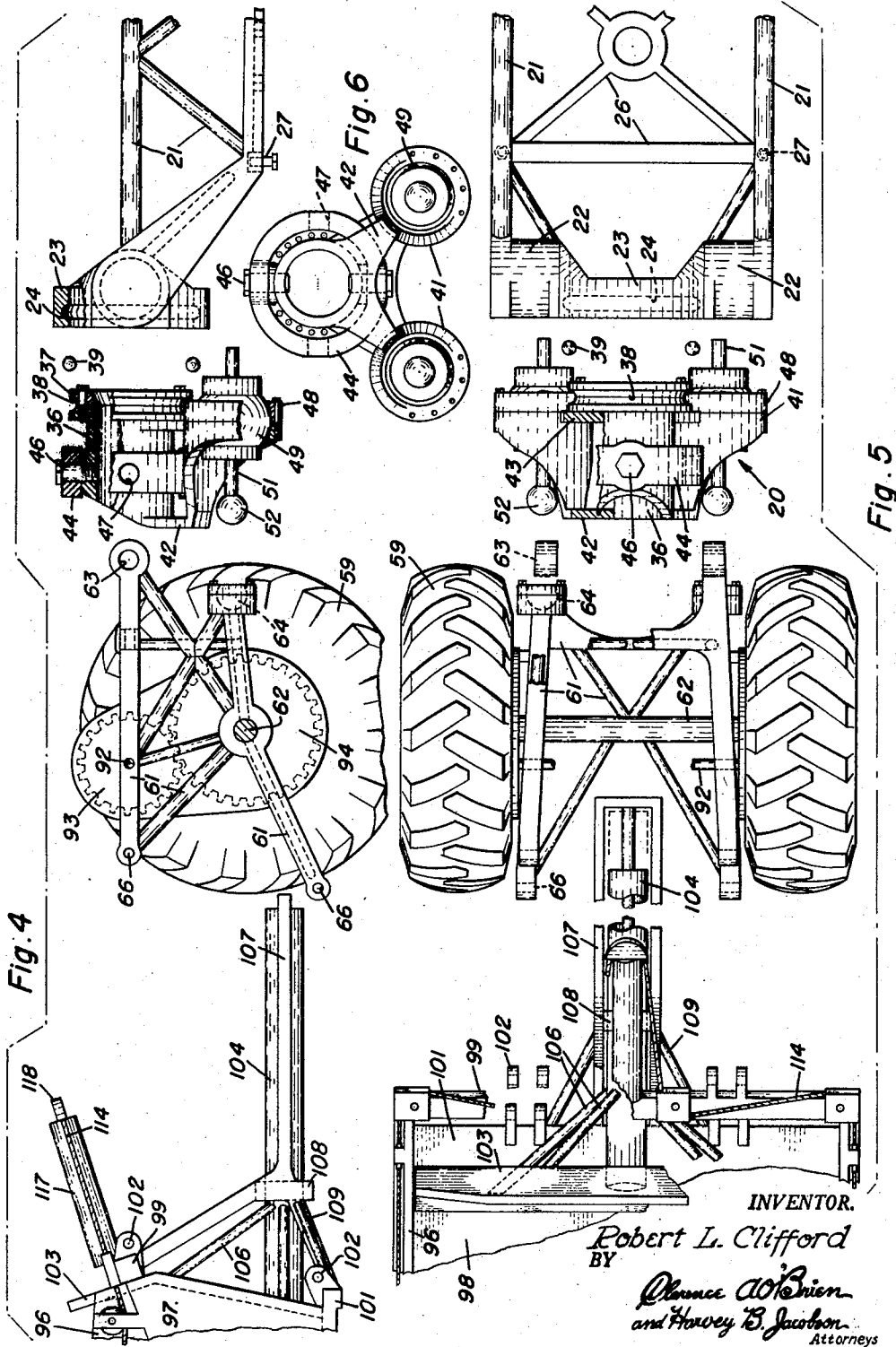
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4 Sheets-Sheet 2



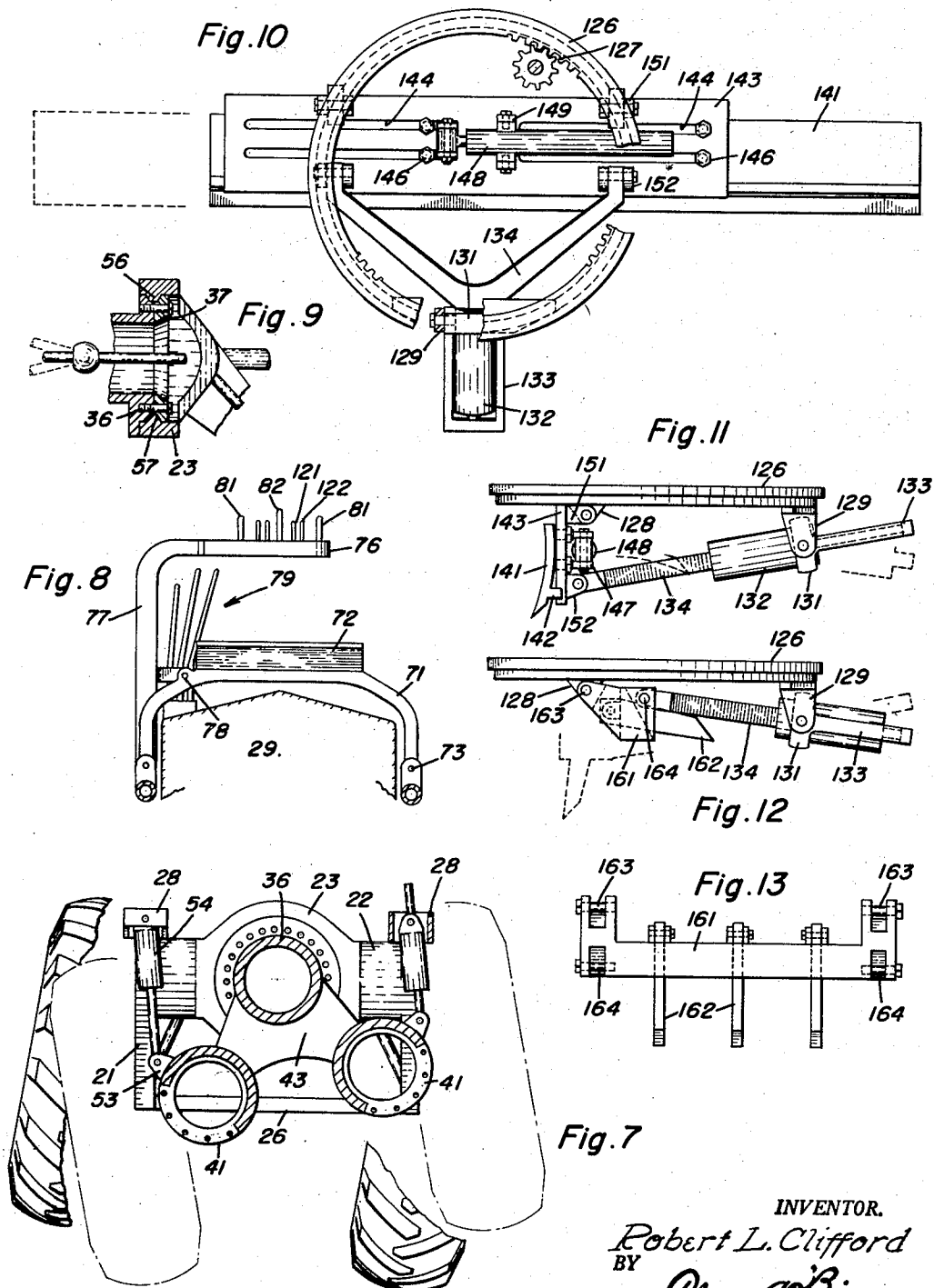
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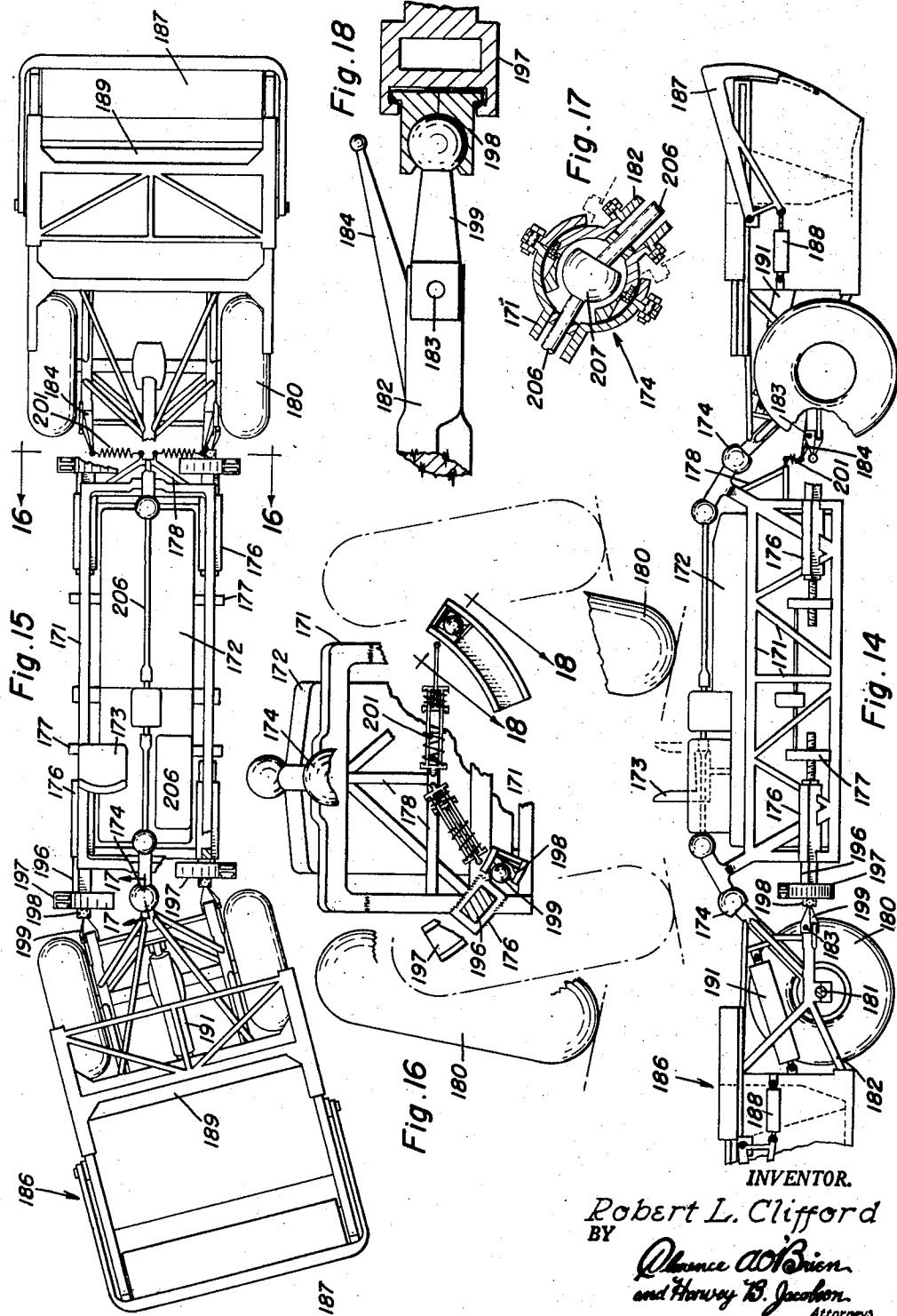
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EARTH MOVING EQUIPMENT

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Application June 20, 1955, Serial No. 516,595

16 Claims. (Cl. 37—127)

This invention relates to an improved and novel earth moving equipment or apparatus and specifically is a continuation-in-part of my co-pending application, Serial No. 73,329, filed January 28, 1949 and now abandoned.

The primary object of the present invention is to provide a self-loading, self-propelled earth handling apparatus which can travel and be steered in either direction with equal facility, speed and ease of operation wherein the weight of the machine will be carried by the driving wheels for affording maximum traction and to permit sequential loading, traveling and dumping in both a forward and a rearward direction so that loading at one end with one half the total capacity may be obtained while the machine is traveling in one direction, subsequent loading at the other end with a similar load when the direction of travel is reversed and dumping in a similar two-directional manner, thereby achieving increased efficiency due to the self-loading capacity and the loading and dumping while the machine is traveling in both directions and the reduction of travel time while empty and the elimination of turn-around time and the area required for such turn-around is eliminated.

Another object of the present invention is to provide earth moving equipment in accordance with the preceding object that is provided with a scoop at each end thereof to permit spread dumping or end dumping and may be utilized or operated as a bulldozer in both directions of travel wherein the axle of each pair of wheels is substantially equally loaded when both scoops are either loaded or empty.

A further object of the present invention is to provide a tractor with all wheels thereon being driven traction wheels which can be driven and steered in either direction with equal facility, speed and ease of operation wherein the units of the tractor are so arranged for detachably mounting and controlling various work implements or combination of implements such as scoops, grader blades, bulldozers, scarifiers, rooters and snow plows, thereby affording multiple use of the tractor, with the tractor arranged for providing certain controllable movements common to those required in the operation of the various implement thereby eliminating the requirement for duplicate mechanism in each of the implements wherein the tractor may be readily adaptable for use in conjunction with such implements or for use in other orientation such as towing or partially carrying and partially towing appropriate equipment.

Still another object of the present invention is to provide a wheeled tractor in accordance with the preceding objects having a detachable scoop with load-ejecting means and constructed with no obstructions above the scoop to facilitate shovel loading wherein the scoop may be utilized as a truck loader and wherein the overall width is of a minimum since the framing which supports the scoops is not required along the scoops in the usual manner.

A still further object of the present invention is to provide earth moving equipment in accordance with the

2

preceding objects in which a central chassis frame is provided with an articulately connected wheeled assembly at each end thereof whereby the relative angular position may be universally adjusted for positioning the basic units of the device in a desired position thereby facilitating the control and operation of the device.

Another important object of the present invention is to provide earth moving equipment having independently driven and controllable and steerable wheeled assemblies articulately connected to a central chassis whereby the operator controls the device from the central chassis and the position of the chassis may be adjusted as desired whereby a grader blade or similar type of earth working tool may be mounted on the central chassis for accurate control thereof since the position of the grader blade and the central chassis may be maintained in a constant relationship while operating and whereby the grader is operable with equal facility when traveling in either direction.

Other important objects of the present invention will reside in its ruggedness of construction, its efficiency in operation, its reduction in loading and unloading time, the increased packing of the material being dumped by the ground-engaging wheels passing over the area in two directions, its universal adjustable features, its adaptation for various purposes and uses, accurateness of control and its relatively inexpensive maintenance and operating costs.

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 elevation of one form of the earth moving and handling apparatus of the present invention with one of the scoops lowered into loading position;

Figure 2 is a plan view of the construction of Figure 1 illustrating the angular movement of the end wheeled assemblies;

Figure 3 is a phantom side elevational view illustrating attached earth working implements which may be employed in conjunction with the construction of Figure 1;

Figure 4 is an enlarged and exploded side elevational view to show details of portions of the assemblies which are combined to provide the construction of Figure 1 with certain parts being in section and broken away for clarity;

Figure 5 is a group plan view showing the construction of Figure 4 with certain details thereof shown by various elements being sectioned;

Figure 6 is an end elevational view of the connecting assembly for adjusting the angular relation of the wheeled assemblies;

Figure 7 is a transverse, vertical sectional view taken substantially upon a plane passing along section line 7—7 of Figure 2 of the connecting assembly and parts associated therewith showing two positions of the supporting wheels;

Figure 8 is an end elevational view of the operator's assembly with associated parts of the central assembly showing the control means for the device;

Figure 9 is a detailed view of a modified form of the connection between the connecting assembly and the central assembly taken in longitudinal section along a plane passing through the longitudinal center thereof;

Figure 10 is a plan view of one form of turning circle assembly with grader blade attached thereto and pivoted to an upward or retracted carrying position;

Figure 11 is a side elevational view of the turning circle assembly of Figure 10 with the grader blade being positioned in operative position;

3

Figure 12 is a view similar to Figure 11 illustrating the use of a scarifier implement shown in the inoperative position;

Figure 13 is a rear elevational view of the construction of Figure 12 showing the scarifier implement in the operative position;

Figure 14 is a side elevational view illustrating a modified form of the present invention;

Figure 15 is a plan view of the modified form of the invention;

Figure 16 is an enlarged view taken substantially upon a plane passing along section line 16—16 of Figure 15 with certain parts omitted for clarity illustrating the adjustable positioning of the wheeled assemblies;

Figure 17 is an enlarged detailed sectional view taken substantially upon a plane passing along section line 17—17 of Figure 15 illustrating structural details of the connection means; and,

Figure 18 is an enlarged longitudinal sectional view taken along section line 18—18 in Figure 16 illustrating the drive universal within the universal framing connection between the central assembly and the wheeled scraper assemblies of the modified form of the invention.

Referring now specifically to the drawings, the earth moving or handling equipment of the present invention is shown in Figures 1—13. The slightly modified form of the motorized scraper is illustrated in Figures 14—18.

The tractor unit illustrated particularly in Figures 1—9 includes a central assembly generally designated by the numeral 14 which has a control or operator's assembly 16 mounted thereon and wheeled assemblies 18 and 19 at opposite ends thereof that are interconnected to the central assembly 14 by connecting assemblies 20.

The central assembly 14 includes trussed side frames 21 which are welded at either ends to transverse tubular beams 22 that are welded to the sides of member 23 which are substantially of ring-shape and positioned in longitudinal alignment and located substantially between the side frames 21. The ring-shaped members 23 are provided with an inner annular groove 24 for connection to the connecting assembly 20. Bottom framing 26 is welded to the side frames 21 and appropriate and suitable bracing is provided for forming a rigid frame structure. Depending connectors 27 are provided on the undersurface of side frames 21 for attaching a turning circle assembly to be described hereinafter. Brackets 28 of a box-like nature are welded to both ends of the side frames 21 and contain longitudinal pivots for another connection to the connecting assembly. Mounted on the central assembly framing are an engine 29, fuel tank 31, pivotal air scoops 33 and other necessary accessories wherein the framing forms a suitable support for the engine and the accessories connected therewith.

The connecting assembly 20 includes a member 36 of substantially tubular section and including a longitudinal bore therethrough. The member 36 includes an exteriorly thickened section at the rear which is bolted at the rear surface to annular member 37. At their connecting surfaces, members 36 and 37 contain an outwardly opening annular groove 38. A plurality of spherical balls 39 are provided for engagement within and between grooves 24 and 38 to provide a pivotal connection between the central assembly 14 and the connecting assembly 20.

Two tubular members 41 are located generally below the tubular member 36 and on opposite sides thereof and an interconnecting plate 42 is welded to and between the adjacent ends of the tubular members 41 and the central tubular member 36. A reinforcing plate 43 interconnects the tubular members 41 and the central tubular member 36 adjacent the other end thereof and immediately ahead of the peripheral thickened area thereof. If desired, stiffeners (not shown) are provided for strengthening these welded connections.

Ring 44 encircles member 36 and is pivotally connected

4

thereto at upper and lower locations by centrally located vertical pivots 46. The ring 44 is provided at the sides thereof with transverse drill-holes 47 which intersect the axis of the pivots 46 substantially in the longitudinal center of the tubular member 36 thereby providing a connection to one of the wheel assemblies 18 or 19.

On either side of the connecting assembly 20, annular member 48 is bolted to the rear surface of member 41 which contain centered therein an inner spherical surface which engages ball connector 49 of actuator 51 to provide a universal connection therebetween. Forwardly on the actuator 51 is a ball connector 52 that is provided for universal connection with a wheeled assembly 18. Brackets 53 disposed at either side of the connecting assembly 20 are welded to member 41 and are connected by longitudinal pivot with actuator 54 which at the upper end thereof is connected by longitudinal pivot with bracket 28 on the central assembly 14 as shown in Figure 7.

In the modified form of the connecting means illustrated in Figure 9, ring-shaped member 23 contains an inner annular rib 56 which engages an outer annular groove 57 in the thickened end portion of tubular member 36 as formed by the annular member 37 bolted thereto thereby providing a modified pivotal connection between the connecting assembly 20 and the central assembly 14.

Each of the wheeled assemblies 18 and 19 includes a framing 61 having suitable interconnecting braces forming a rigid structure for supporting ground-engaging wheels 59 mounted on a transverse axle 62 wherein the wheels are retained in constant angular relationship to the framing 61 thereby eliminating the usual clearance for individual pivotal steering movement of the wheels 59. Connection is made to the connecting assembly 20 at each side of framing 61 and at the rear upper portion thereof the connection is made by drill holes 63 which are in transverse alignment and which are pivotally connected with drill holes 47 in ring 44 by any suitable pin. At a lower level, the connection is made by partial spherical recesses 64 within framing 61 which are transversely aligned and which are universally connected with the ball connectors 52 on the front end of actuators 51. Any suitable work implements such as a scoop, bulldozer or the like may be attached and supported by the framing 61 by utilizing the drill holes 66 at the outer end of the wheeled assemblies 18 or 19.

In operating the connecting assembly 20, the rotatable connection between members 23 and 36 provides for rotation in substantially a normal plane only between the central assembly and the connecting assembly. The vertical and transverse pivotal connections of ring 44 to member 36 and to framing 61 provide for universal but non-rotatable connection between the connecting assembly and the wheeled assembly. The operation of actuators 51 controls and limits this universal action. When both actuators at one end are retracted or extended, work implements at that end are lowered or raised for engagement in or withdrawal from the earth. This action also raises and lowers the central assembly and work implements attached thereto for primary withdrawal or engagement with earth. Actuators 51 at both ends are preferably operated together for such control of implements attached to the central assembly 14. Actuators 54 control and limit the rotation in the normal plane of the central assembly and attached work implements with respect to the connecting assembly and the associated wheeled assembly. This action is used particularly in controlling the lateral pitch of grader implement when attached to the central assembly. When desirable and when actuators 54 are of hydraulic cylinder type, the front and rear cylinder chambers above the pistons, and also below the pistons, are hydraulically interconnected on either side to provide for forcible control of the lateral pitch of the central assem-

bly and implements attached thereto with respect to both pairs of wheels, this lateral pitch being maintained with respect to an attitude substantially median to both front and rear axles 62. This arrangement is also used without powered operation of actuators 54 to maintain the intermediate attitude of the central assembly with respect to both wheeled assemblies to improve riding conditions for the operator. Actuators 54 may be replaced with springs to damp and limit this rotation.

In the operator's assembly 16, cross framing 71 is welded to platform 72 and connected by pivots 73 to framing 21 to provide for rotating to either side for access to the engine. Seat 74 is mounted on platform 72 substantially at a central location on the machine for movement about a pivot axis to allow the operator to face in either direction of travel. Control panel 76 is welded to upright support 77 which is pivotally connected to framing 21 and by bolts 78 to framing 71. Levers indicated by the numeral 79 are hand-operated brake, clutch and reversing drive levers. The clutch is disengaged when upright and is engaged when moved forward or backward. The reversing lever is moved forward for forward drive, upright for neutral gear engagement, and rearward for drive to the rear. The hand brake is arranged to be disengaged when upright and engaged when moved either forward or to the rear. Control levers 81 are pivotally arranged on the control panel for both longitudinal and transverse movement for controlling the operation of actuators 51. Right control lever 81 is moved to the right to steer front wheel assembly 18 to the right by producing retraction and extension respectively of right and left front actuators 51. Leftward movement of right lever 81 produces leftward steering by opposite actions. Forward movement of right lever 81 produces retraction of both front actuators 51, causing work implements attached to the front of wheel assembly framing to tilt downward for engagement in earth when appropriate earth-working implements are attached thereto. Rearward movement of right lever 81 raises such implements by opposite actions. The rearward and forward movements of right lever 81 also lower and raise the central assembly and work implements attached thereto. In the upright position, right control lever 81 holds the operation of front actuators 51. When the operator's seat is reversed to face in the opposite direction, control lever 81 which is then on the right, is similarly operated to produce similar results with respect to the new direction faced. The actions produced by operation of both right and left levers 81 are set forth in this example. The movement of left control lever 81 to the right produces rightward steerage of the rear wheel assembly, and when combined with the rightward movement of right lever 81, all wheel steerage to the right is produced. When an implement such as a grader is attached to the central assembly, the mechanisms of right and left levers 81 are arranged to be linked together for opposite longitudinal movement in order that primary lowering and raising of the implement may be controlled by either lever 81, which retracts or extends all actuators 51 in synchronisation thus allowing the use of one hand for this control.

Lateral pitch control lever 82 is pivotally mounted on the control panel 76 at a central location, for use principally when the grader is attached to the central assembly, and for controlling the lateral pitch of the grader. Lever 82 controls the operation of actuators 54. A switching lever (not shown) is used in conjunction with lever 82. The switching lever is moved forward for engaging lever 82 with front actuators 54, rearward for engagement with rear actuators 54 and upright to engage lever 82 with all actuators 54 by the hydraulic interconnection of front and rear actuators 54 previously described.

When facing in either direction of travel, lever 82 is moved to the right to retract right actuator 54 and extend

left actuator 54, at the front, rear or both ends depending on the position of the switching lever, with resulting forcible rotation of the power assembly and implements thereon for lateral pitch control. In the upright position, lever 82 holds the position of the respective front or rear actuators engaged or in case of the hydraulically interconnected front and rear actuators, holds the attitude in the normal plane of the central assembly with respect to an attitude substantially median to both wheel assemblies. The arrangement of actuators 54 and control lever 82 is adaptable to control lateral pitch of the grader by automatic means if desired. Foot-operated control levers, when used, are duplicated with appropriate linkage for similar operation and positioning in either direction of travel of the machine. The arrangement of the operator's seat and of control levers mostly used during traveling provides for similar operation and location of the operator with respect to such controls and the machine as a whole when facing in either direction.

Mechanisms (not shown) are provided for the transmission of controlled actuation from the operator's control levers to the various actuators and other mechanisms on the tractor and on the various work implements attached thereto. In the instance of hydraulic control, suitable conduits, pumps and control valves and the like may be provided where desired.

The specific drive means are not described and shown in detail but preferably include power transmission from the flywheel not described and shown in detail through a clutch and through power take-off and transfer means arranged to provide opposite rotation of drive shafts 87 at the opposite ends of the central assembly. Drive shafts 87 are connected with drive universals 88 which are centered at the center of universal movement between each connecting assembly 14 and the respective wheeled assemblies 18 and 19 provided by the framing connections thereof. Drive universals 88 are connected with drive shafts 89 which enter housings 91 which preferably contain fluid couplings, transmissions, reversing means and differentials for driving drive shafts 92 in either direction with a wide range of gear selection. The power drive continues from drive shafts 92 to gears 93 and gears 94 which are attached to wheels 59. Necessary universals and means of support are provided, not indicated in all cases on the drawings.

In the preferred form of the invention, two scoops 95 are provided with one at either end of the wheeled tractor thereby forming a device which may be loaded and unloaded in either direction of movement. Side plates 96 of the scoop bowl are welded to outer strengthening framings 97 which extend only part way up the sides of the bowl and are welded to bottom 98 which contains a scraping blade at the frontward edge. Framings 97 are cross-connected at the rear by beams 99 and 101 which are welded to brackets containing drill holes 102 for attaching the scoop to the drill holes 66 on the wheeled assembly 18 or 19.

A tail gate 103 is slidable within the bowl and is welded to the front of actuator 104. Diagonal braces 106 provide further rigidity between these members. Y-frames 107 which are disposed on opposite sides of the actuator 104 are welded at the upper and lower forward extremities to beams 99 and 101 and are cross-connected at the rear extremity by a member which is attached to the rear of actuator 104. Actuator 104 is slidably engaged with collar 108 which is welded at the sides to framings 107 at the interconnection of the Y-frames 107. Diagonal braces 109 are welded to the intersection of Y-frames 107 and to beam 101 to provide rigid support of collar 108 with respect to the scoop bowl. Actuator 104 operates to eject the scoop load and to retract the tail gate 103. The portion of actuator 104 which, when extended, is within and ahead of collar 108, is of high strength to maintain the upright and transverse attitude of the tail gate.

7

An apron 111 at the front of the scoop bowl is welded to side framings 112 at each side thereof which are pivoted by transverse pivots 113 to side plates 96 and framing 97. Cable 114, at one side, is attached to arm 116 of framing 112 and extends back along the outside of side plates 96, partially across the rear of the bowl along beam 99, along one side of actuator 117, through connection 118 at the rear thereof, and continues similarly to connect with arm 116 on the other side of the scoop bowl and passing through sheaves at appropriate changes in direction. Actuator 117 is rigidly connected at its forward end to beam 99. Operation of actuator 117 raises and holds and also permits lowering of the apron 111 by the force of gravity. The side framing of the apron and associated parts for its operation are so arranged as to require a minimum width outside the scoop bowl, and preferably do not extend beyond the overall width of side framing 97. This is made possible by the arrangement of apron framing 112 and associated operating means at the sides of the bowl, at a location above the side framing.

When the scoops are utilized with a tractor having an operator's assembly 16 as previously described, when facing in either direction of travel, right control 121, pivotally mounted on control panel 76, is moved to the rear to extend front actuator 117 and raise the apron. Right control 121 is moved to an upright position to prevent retraction of the actuator and hold the position of the apron and when the control 121 is moved to its forward position, the actuator is released thereby allowing the apron to lower by force of gravity. Under similar conditions, right control 122, pivotally mounted on control panel 76 is moved forward to extend actuator 104 and move the tail gate ahead and is moved upright to a holding position and to the rear to retract actuator 104 and the tail gate 103.

The device may be utilized as a grader wherein a turning circle assembly with grader, as indicated by the numeral 124, is attached to the undersurface of the central assembly 14 substantially at a central location thereof. Turning circle 126 is attached to central assembly framing 21 by connectors 27 and is turnable horizontally thereon. The inner edge of the circle is geared to a mechanism partially shown and indicated by 127, on the central assembly, for turning the turning circle assembly and implement attached thereto for operation in either direction of travel and for adjusting the horizontal angle of the implement with respect to the longitudinal axis of the tractor. Brackets 128 are welded to the underside of the circle 126, at both sides thereof and forward of the center and contain drill holes which are transversely aligned. Brackets 129 are welded to the underside of a plate which is welded to the underside of circle 126 at a rearward location. Brackets 129 are connected by a transverse pivot with collar 131 which is slidably engaged with actuator 132 and the collar 131 is welded to a yoke 133 which extends rearwardly along the sides thereof and across the rear of actuator 132. This rear member of yoke 133 is connected to the rear of actuator 132 and the front end of actuator 132 is welded to the rear of V-frame 134. The two front ends of V-framing 134 contain drill holes in transverse alignment for connection to a grader described hereinafter.

The mold board with a blade 141 being generally sharpened at the lower end thereof is provided with a transverse flange 142 on the rear surface which is engaged in a groove in framing 143 wherein the flange is slidable in this groove. Slots 144 transversely arranged in framing 143 slidably engage bolts 146 which secure the moldboard to framing 143. Brackets 147 are welded to the moldboard and extend slidably through the pair of slots 144 on the left and to the rear of framing 143 where they pivotally connect with actuator 148. To the right of this connection, actuator 148 pivotally connects with brackets 149 which are welded to the rear of framing 143.

8

The operation of actuator 148 produces slidable movement of the moldboard along framing 143 for extending the moldboard to either side. Brackets 151 welded to the upper rear framing 143 are pivotally connected with the drill holes in brackets 128 of turning circle 126. Brackets 152 are welded to the lower rear of framing 143 and are pivotally connected with the drill holes in the forward ends of the V-framing 134 of the turning circle assembly.

Operation of actuator 132 produces rotation of moldboard 141 about the transverse pivotal connection between brackets 128 and 151 for raising the blade to obtain high ground clearance when traveling and not in operation and for adjusting the vertical pitch of the moldboard with respect to the ground surface. Actuator 132 preferably contains an adjustable overload release for operation when a particularly solid object is encountered by the grader blade. Primary vertical control and lateral pitch control of the grader are accomplished by manipulation of the connecting mechanisms 20 previously discussed. Also, control levers (not shown) are provided for actuating and controlling actuators 132 and 148 thereby providing accurate control of the grader blade and moldboard 141.

If desired, a scarifier may be utilized in conjunction with the turning circle assembly previously described and is set forth in Figures 12 and 13. In providing a scarifier, a rigid framing 161 is provided with generally vertical slots which engage and support laterally spaced scarifier shanks 162. At either side and adjacent the upper end of framing 161 pivots 163 detachably connect with the drill holes in brackets 128 of the turning circle assembly. At lower locations on framing 161, pivots 164 detachably connect with the drill holes in the forward ends of the framing 134. Operation of the scarifier is similar to operation of the grader and control thereof is as previously described.

The device may be utilized as a bulldozer by providing a bulldozer blade 166 welded to framing 167 and the framing 167 is provided with drill holes in the rear thereof to connect with drill holes 66 at either end of the wheeled tractor. When the device is utilized as a bulldozer, it is controlled and actuated in the same manner as previously described.

When the device is utilized as a rooter framing 168 may be provided at each end of the device and provided with generally vertical slots which engage and laterally support spaced rooter shanks 169. At the rear, framing 168 contains transversely aligned drill holes for attaching the rooter to the drill holes 66 of the tractor. Rooter shanks 169 are reversible within framing 168 to face in either direction to travel to provide for rooting at the front or at the rear of the tractor with respect to the direction of travel depending on the material being rooted. The operation of the device with the rooter employed thereon is the same as previously described.

A modified form of earth working equipment of substantially the same character as that previously described is illustrated in Figures 14-18 and comprises a central assembly and two wheeled scoop assemblies at either end with two intermediate connecting assemblies. The assemblies are interconnected in substantially the same manner for articulately interconnecting the wheeled scoop assemblies with the central power assembly and providing means for control and operation of the device.

Framing 171 is arranged along the sides, bottom and ends of engine 172 and associated apparatus contained within the central assembly in a manner to provide efficient and high strength for this adaptation. Operator's seat 173 is reversible and swivels for facing in either direction of travel.

At either end and at an upper central location, framing 171 is rigidly connected to a universal connection 174, arranged for universal and rotatable movement, within certain limits, between the central assembly and the

wheeled scoop assemblies. At either side and end and along the lower portion thereof, framing 171 is welded to actuator guide 176 which contains a longitudinal slot of rectangular interior section. Member 177 is rigidly connected to framing 171 at the rear thereof and is arranged for connection to an actuator of the connecting assembly. At either end, framing 171 is welded to diagonal framing 178 which is arranged for connection to members of the connecting assembly.

A pair of wheels 180 are rotatable about axle 181 which supports framing 171. At an upper, central rearward location, framing 182 is rigidly connected with universal connector 174. At a lower level, at either side and rearward on framing 182, pivot 183 is provided for connection to the connecting assembly. On either side of framing 182, an arm 184 is welded thereto substantially at pivot 183 and is arranged at the rear for a connection described hereinafter. Framing 182, at the forward end, is rigidly connected with the rear rigid framing members of scoop 186 to provide support for the scoop. Apron 187 is pivotally connected to the side framing of the scoop bowl and is raised by the operation of actuators 188, pivotally connected to the apron framing and to the side framing of the scoop bowl. Lowering of the apron 187 is by gravity.

A tail gate 189 is longitudinally slidably mounted within the scoop bowl and is moved for ejection and retraction by the operation of actuator 191 which is pivotally connected to the rear of the tail gate and to framing 182. The attitude of the tail gate is maintained by a slidable interconnection along the top and at either side between the tail gate side framing and the bowl side framing.

At either side and either end of the central assembly, actuator 196 slidably and non-rotatably engages actuator guide 176. At the forward end, actuator 196 is rigidly connected with curved member 197. The curved member 197 contains flanges which interlock with flanged connector 198 to allow rotation between members 197 and 198, in a normal plane, about the longitudinal axis passing through the centers of the universal members 174 at both ends of the central assembly. Connector 198 universally and rotatably engages link 199 which, at a forward location, is pivotally connected to framing 182 by a pivot 183. Pivot 183 is in a normal plane and is aligned substantially normal to a line connecting its center with the longitudinal line passing through the centers of both universals 174. On either side, spring 201 is universally connected to diagonal framing 178 and arm 184 with these connections being shown in Figure 16.

The universal action provided between the central assembly and the wheeled scoop assembly framings, by universals 174, are controlled by operation of actuators 196. Retraction and extension of actuators 196 at one end respectively lowers and raises the scoop for engagement and withdrawal with earth, and also raises and lowers the central assembly. Opposite operation of actuators 196 provides steering. The rotatable action between the engine and wheeled scoop assemblies provided by the universals 174 is further guided and limited by the curved slidable engagement of members 197 and connector 198. This applies when the actuators are in any operating position. This rotatable movement is limited and dampened by the action of springs 201. The function of links 199 provides a universal connection and the general framing and connecting arrangement provides for the transmittal of no overturning torque to the central assembly when steering either one or both ends of the device.

The power drive includes within the central assembly, a reversing drive mechanism (not shown) and drive shafts 206 extending in both directions, which preferably rotate oppositely at either end when traveling in either direction thereby canceling the force of overturning torque. The drive shafts are disposed within the universals 174 and are connected therein by drive universals 207 and suitable means extending from the drive means to the

wheels of the wheeled scoop assemblies. Control means are provided in relation to the seat 173, but are not shown, to permit an operator to control steering, raising and lowering the scoops and the apron, extending and retracting the tail gate, and accelerating, braking and clutching when facing in either direction of travel, with equal facility and ease of operation due to swivelling of seat 173.

It will be understood that the device of the present invention may be utilized as a modified form of tractor when the scoops are either removed or not being utilized thereby permitting the tractor to pull various devices for various purposes. The particular articulate connection between the framing of the central assembly and the two outer wheeled assemblies permits the use of a tractor in areas having terrain not possible to traverse with the usual rigid frame construction employed in conventional tractors.

The device is especially useful and finds unique adaptation in earth working and earth handling devices wherein the operator positioned on the central assembly is retained in a constant relationship thereto and to working tools attached thereto when such tools are in operation, and may be retained in a desired attitude with relationship to the transverse attitudes of either wheeled assembly or to the median of both thereby permitting more accurate judgment of the earth moving or working operation thereby providing more accurate central and better work by the operator of the device such as when a particular grade line and transverse grade is being followed. The arrangement of the working tools forward of the operator provides for adequate surveillance of working operations thereby providing for improved accuracy and ease of control. The arrangement which provides for full and similar operation of working tools on the central assembly, such as the grader, when traveling in both directions eliminates the usual time and area requirement of turning at the ends of working strips or that of traveling in reverse without production.

When the device is utilized in conjunction with the scoop bowls, it will be understood that the device may be loaded in both directions and unloaded in both directions thereby eliminating the necessity of turning a relatively elongated and articulated dirt mover such as now being employed in the earth moving field of endeavor and thereby reducing unproductive travel time while empty to a minimum.

From the foregoing, the construction and operation of the device will be readily understood and further explanation is believed to be unnecessary. However, 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 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. In a mobile self-loading excavating device comprising a central power unit mounted on a chassis frame, a wheeled scraper assembly pivotally connected to each end of the chassis frame, each scraper assembly being provided with an outwardly directed earth moving scoop, the pivotal connection of each scraper assembly to the chassis frame including a universal connector assembly, a drive mechanism operatively connecting the central power unit to each wheeled scraper assembly, said drive mechanism from the power unit passing through the universal connector assembly to provide a wheel drive connection for the associated wheeled scraper assembly.

2. The structure of claim 1 wherein said wheeled scraper assembly comprises a pair of wheels mounted for rotation about common axis, wherein said earth moving scoop is mounted for limited pivotal movement about said axis and wherein raising and lowering mechanism is

connected between the chassis frame and the wheeled scraper assembly for pivoting said earth moving scoop about said axis into and out of earth engagement.

3. The structure of claim 1 wherein a steering mechanism is provided on the structure between the power unit and each wheeled scraper assembly for selectively steering each scraper assembly separately or together as a unit.

4. The structure of claim 2 wherein movement of the earth moving scoop into and out of earth engagement is actuated and controlled by extension and retraction mechanism provided on the structure connecting and causing pivotal movement between the chassis frame and each wheeled scraper assembly about the universal connector assembly.

5. The structure of claim 3 wherein the steering is actuated and controlled by extension and retraction mechanism provided on the structure connecting and causing pivotal action between the chassis frame and each wheeled scraper assembly about the universal connector assembly.

6. The structure of claim 4 wherein the extension and retraction mechanism for causing pivotal movement between the chassis frame and each wheeled scraper assembly about the universal connector assembly is the mechanism for pivoting the earth moving scoop into and out of earth engagement and which also steers the associated wheeled scraper assembly.

7. In a mobile earth moving apparatus comprising a frame, a power unit supported on said frame, a wheeled assembly articulately connected to each end of said frame, each assembly being provided with an earth working tool, and a drive mechanism operatively connecting the power unit to each wheeled assembly, said articulating connection between the wheeled assemblies and the frame permitting universal relative movement about three substantially perpendicularly arranged axes, and means interconnecting the frame and wheeled assemblies for adjusting the relative positions of said frame and wheeled assemblies about the three axes.

8. A mobile vehicle comprising a central chassis frame, a power unit mounted on said frame, wheeled assemblies articulately connected to each end of said chassis frame, and means operatively connecting said power unit to said wheeled assemblies for driving said vehicle, said articulate connection permitting universal relative movement of said wheeled assemblies and said frame about three substantially perpendicularly arranged axes, and means interconnecting the frame and wheeled assemblies for adjusting the relative positions of the frame and wheeled assemblies about the three axes.

9. A mobile vehicle comprising a central chassis frame, a power unit mounted on said frame, wheeled assemblies articulately connected to each end of said chassis frame, and means operatively connecting said power unit to said wheeled assemblies for driving said vehicle, said articulate connection permitting universal relative movement of said wheeled assemblies and said frame about three substantially perpendicularly arranged axes, and means interconnecting the frame and wheeled assemblies for adjusting the relative positions of the frame and wheeled assemblies about the three axes, said central chassis frame having operating controls thereon and an earth working tool whereby the position relationship between the earth working tool, the frame and the operator is constant when the working tool is operative.

10. A mobile vehicle comprising a central chassis frame, a power unit mounted on said chassis frame, wheeled assemblies articulately connected to each end of said chassis frame, and means operatively connecting said power unit to said wheeled assemblies for driving said vehicle, said articulate connection permitting universal rotatable relative movement of said wheeled assemblies and said chassis frame, and means for forcibly

controlling and adjusting said movements therebetween about three substantially perpendicularly arranged axes.

11. A mobile earth handling apparatus comprising two-wheeled assemblies universally and rotatably connected to the ends of a central chassis assembly, each of said assemblies being provided with an earth handling tool, power drive means provided on the structure with power transmission means to all wheels, the universal connection between the wheeled assemblies and the chassis assembly permitting individual or combined movement of each wheeled assembly with relation to the central chassis assembly about substantially vertical and transverse axes, wherein power operated means are provided within said connection for the control of said movement about said vertical and transverse axes for universally adjusting the relative positions of said chassis and said wheeled assemblies, and wherein the means for steering by said relative movement about said vertical axis is the same means that raises and lowers said work tools provided on the wheeled assemblies for engagement with and withdrawal from the earth and is also the same means for primary engagement and control of working depth of said working tool provided on said chassis assembly.

12. A mobile vehicle comprising a central chassis frame, a power unit mounted on said chassis frame, wheeled assemblies articulately connected to each end of said chassis frame, and means operatively connecting said power unit to said wheeled assemblies for driving said vehicle, said articulate connection permitting universal rotatable relative movement of said wheeled assemblies and said chassis frame, and means for forcibly controlling and adjusting said movements therebetween about three substantially perpendicularly arranged axes, said central chassis frame of the vehicle being provided with a circular member mounted on the undersurface thereof for rotation about a generally vertical axis, a grader blade mounted on said circular member in depending relation and for movement therewith about an axis extending longitudinally of the chassis frame, an operator's seat mounted on said chassis frame for movement therewith about the same longitudinal axis thereby maintaining a constant relationship between the grader blade and an operator on the operator's seat during change in the angular position of the chassis frame and blade about the longitudinal axis of the chassis frame.

13. The combination of claim 12 wherein said grader blade is pivotally suspended from said circular member for pivotal movement about a generally horizontal axis disposed perpendicularly to the longitudinal axis of rotation of the chassis frame, said operator's seat being swivelly connected to the chassis frame for rotation about a generally vertical axis thereby enabling an operator to face in either direction of movement of the vehicle.

14. A mobile vehicle comprising a central chassis frame, a power unit mounted on said chassis frame, wheeled assemblies articulately connected to each end of said chassis frame, and means operatively connecting said power unit to said wheeled assemblies for driving said vehicle, said articulate connection permitting universal rotatable relative movement of said wheeled assemblies and said chassis frame, and means for forcibly controlling and adjusting said movements therebetween about three substantially perpendicularly arranged axes, at least one of said wheeled assemblies including an earth working tool mounted thereon, said tool being in the form of a longitudinally outwardly facing scoop, a movable closure member for the outer end of the scoop for retaining a load therein, and means for opening and closing the closure member.

15. The combination of claim 14 wherein each of said articulate connections includes a ring-shaped member rigid with one end of the chassis frame and having a longitudinal axis parallel with a longitudinal axis of

13

the chassis frame, a tubular member on the wheeled assembly journaled in the ring-shaped member for rotation of the tubular member about the longitudinal axis of the ring-shaped member, an annular member encircling the tubular member in spaced relation thereto, means pivotally connecting the annular member to the tubular member for pivotal movement about an axis perpendicular to the axis of rotation of the tubular member, and means pivotally connecting the annular member with the wheeled assembly for pivotal movement of the wheeled assembly in relation to the annular member about an axis perpendicular to the axis of rotation of the tubular member and perpendicular to the axis of pivotal movement of the annular member in relation to the tubular member.

16. A mobile vehicle comprising a central chassis frame, a power unit mounted on said chassis frame, wheeled assemblies articulately connected to each end of said chassis frame, and means operatively connecting said power unit to said wheeled assemblies for driving said vehicle, said articulate connection permitting universal rotatable relative movement of said wheeled assemblies and said chassis frame, and means for forcibly controlling and adjusting said movements therebetween about three substantially perpendicularly arranged axes, said central chassis frame of the vehicle being provided with a circular member mounted on the undersurface thereof for rotation about a generally vertical axis, a grader blade mounted on said circular member in depending relation and for movement therewith about an axis extending longitudinally of the chassis frame, an operator's seat mounted on said chassis frame for movement therewith about the same longitudinal axis thereby maintaining a constant relationship between

14

the grader blade and an operator on the operator's seat during change in the angular position of the chassis frame and blade about the longitudinal axis of the chassis frame, said chassis frame including depending brackets supportingly engaging said circular member for rotation of the circular member in a plane generally paralleling the undersurface of the chassis frame, and means on said chassis frame drivingly engaged with the circular member for rotating the circular member for adjusting the angular position of the blade about the axis of rotation of the circular member, said means for forcibly controlling the movement between the chassis frame and the wheeled assemblies providing elevational adjustment of the chassis frame and blade with the elevational relationship between the chassis frame, operator's seat and grader blade remaining constant when the blade is in working position.

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