Feb. 21, 1950

R. G. LE TOURNEAU

2,498,044

ROAD GRADER

Filed April 13, 1946

6 Sheets-Sheet 1

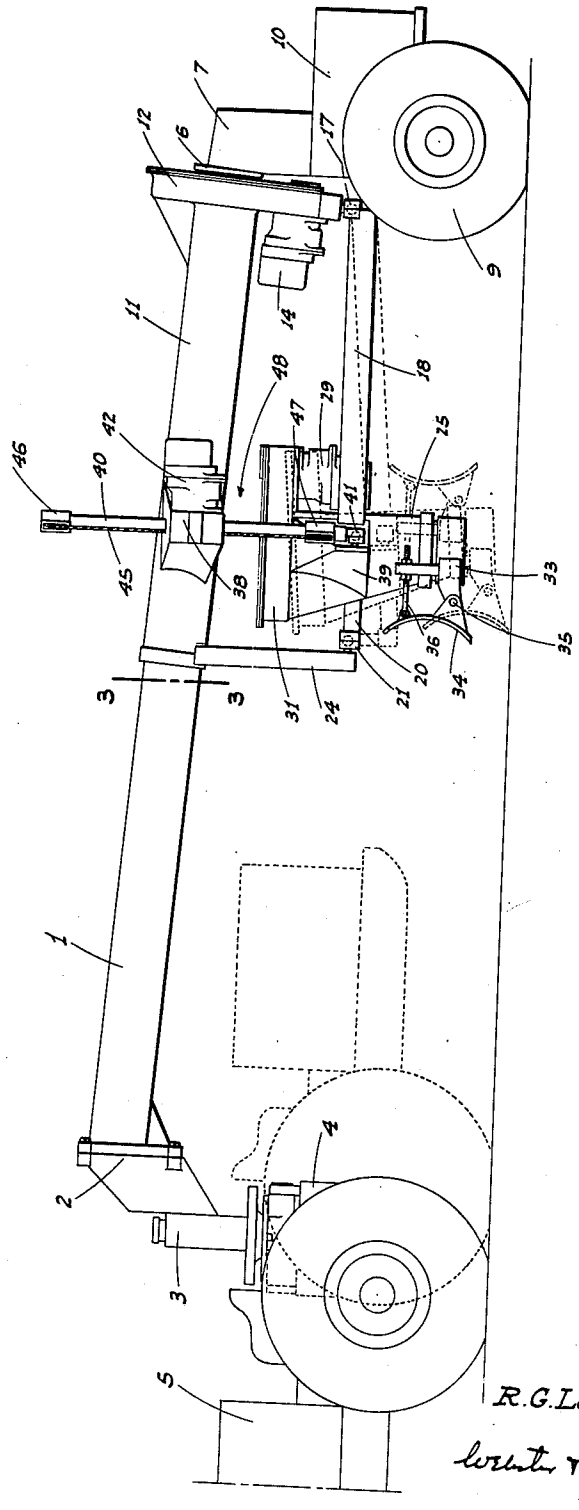


Fig. 1

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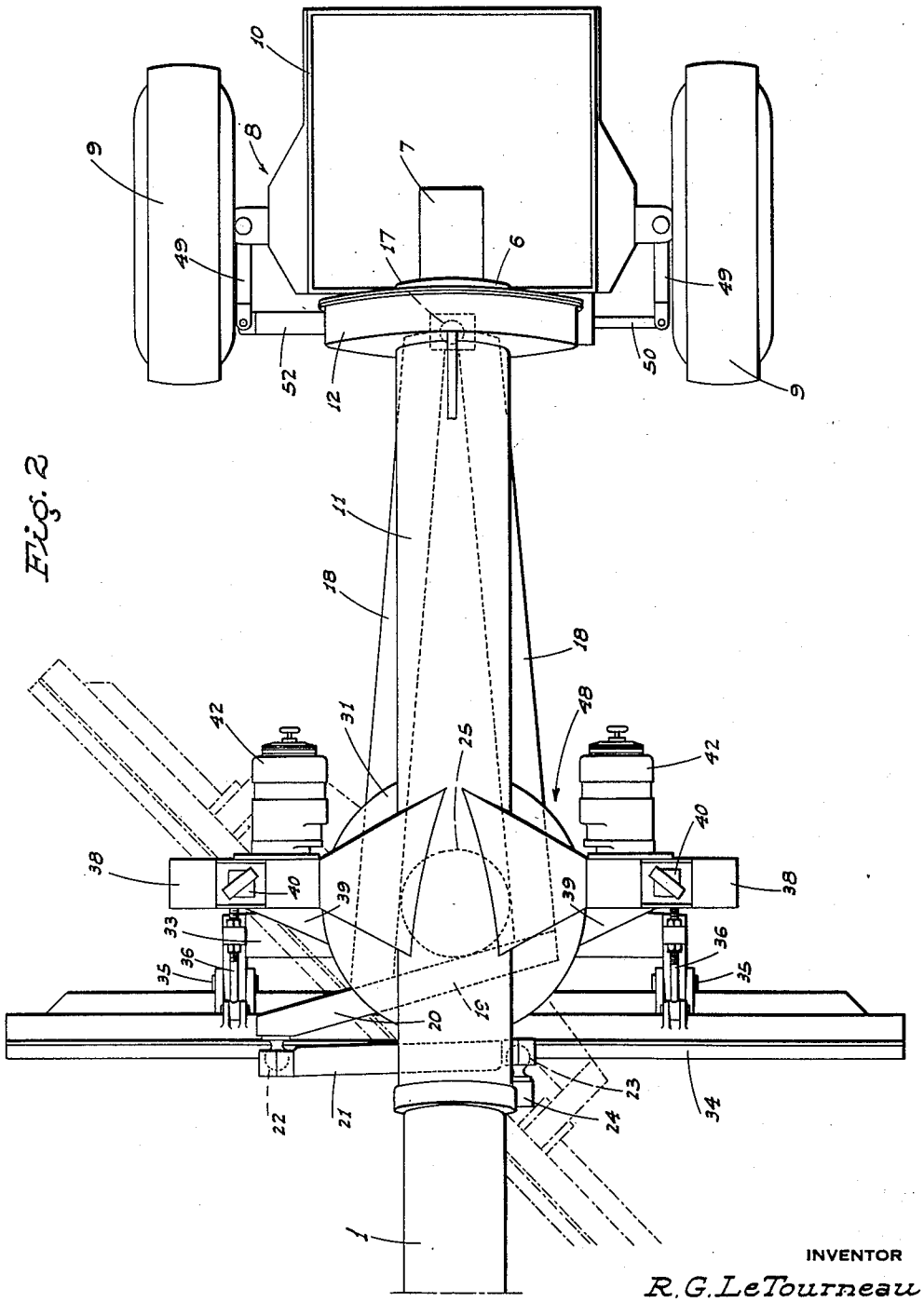


Fig. 2

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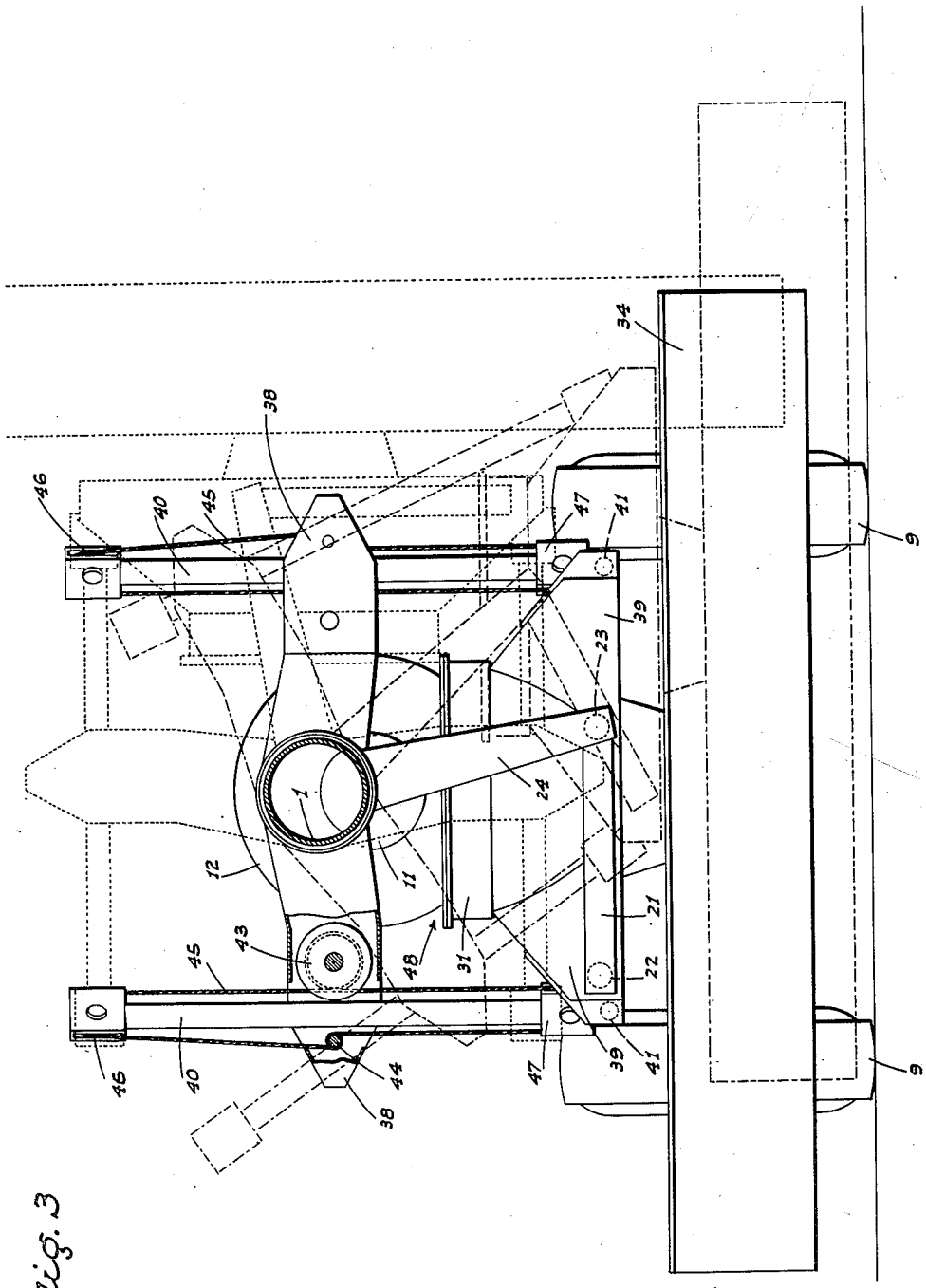


Fig. 3

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ROAD GRADER

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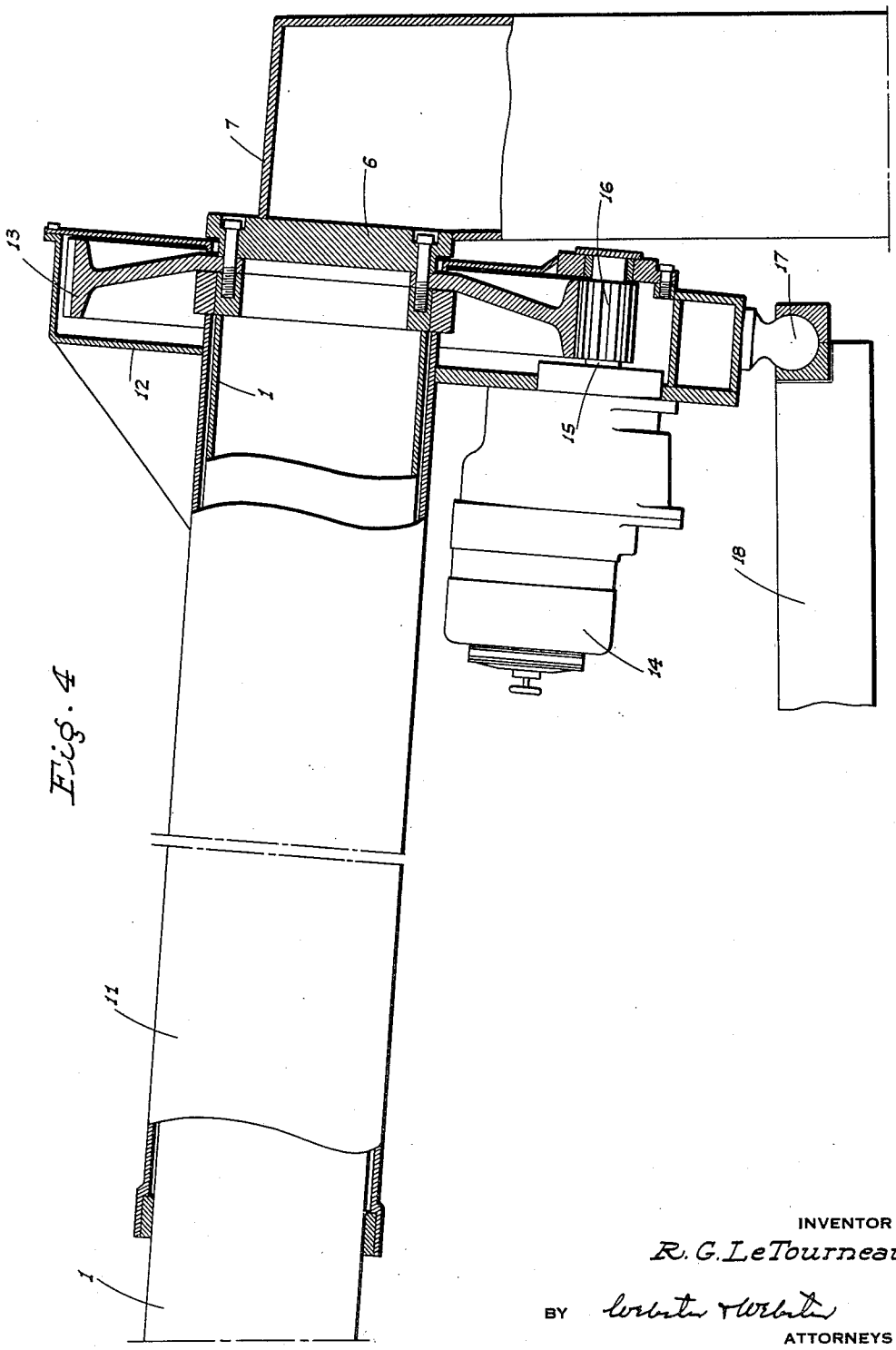


Fig. 4

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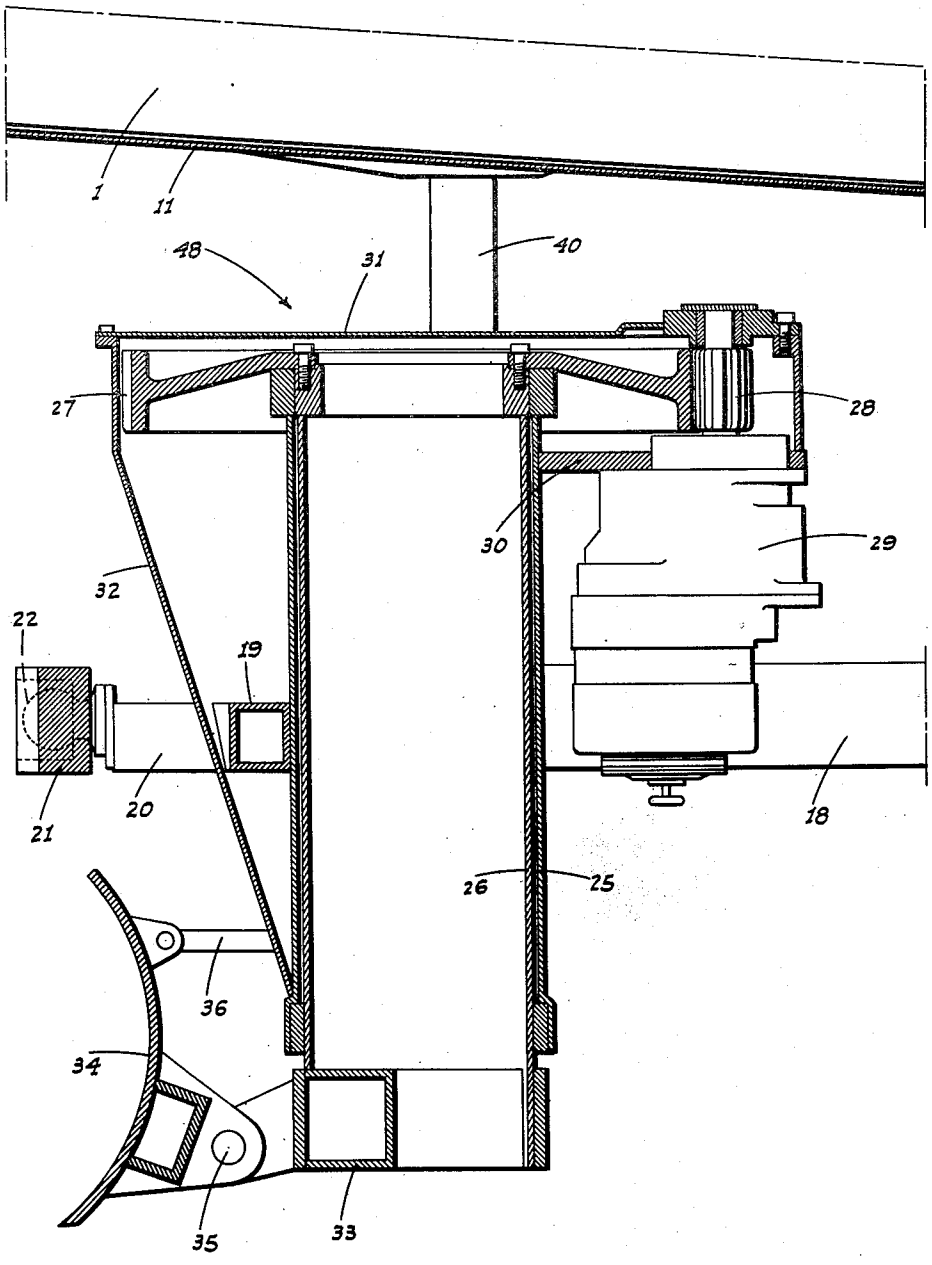
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Fig. 5



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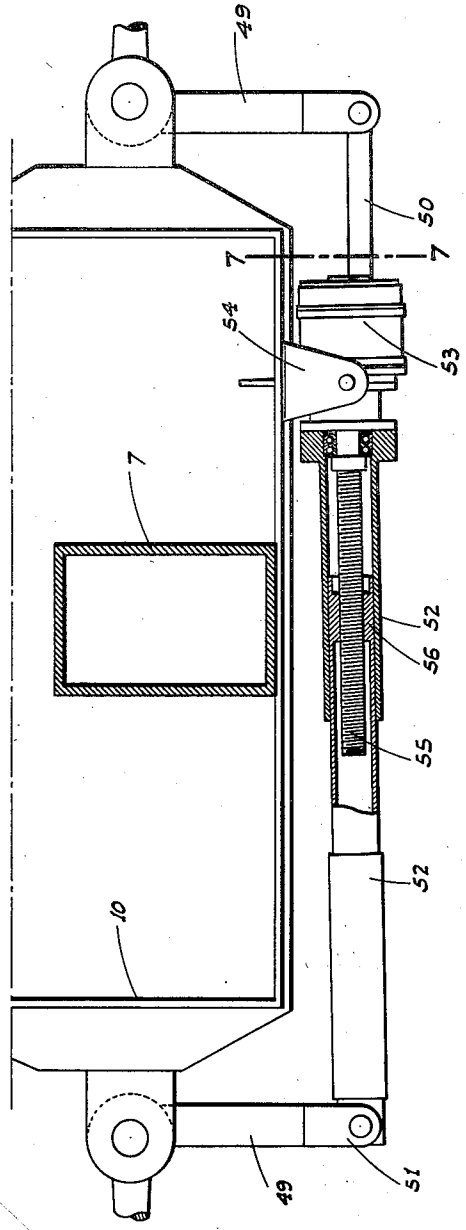


Fig. 6

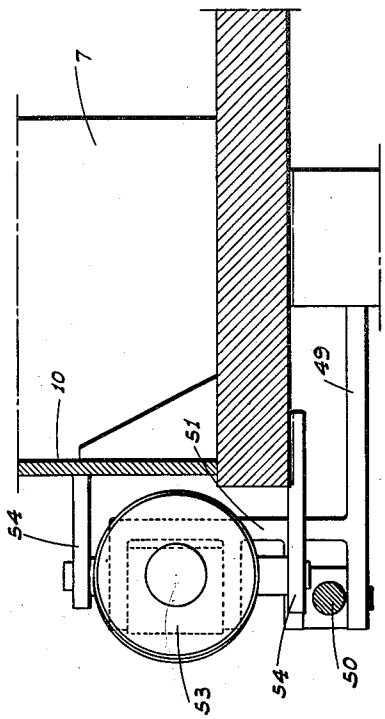


Fig. 7

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UNITED STATES PATENT OFFICE

2,498,044

ROAD GRADER

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Application April 13, 1946, Serial No. 661,957

5 Claims. (Cl. 37—156)

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This invention relates in general to an implement of the type known as a motor grader, and which includes—generally—a self-propelled, wheel-supported vehicle having a grader blade suspended therefrom intermediate its ends and for universal adjustment.

One object of the invention is to provide a motor grader which includes a novel universal mounting assembly for the grader blade; the several moving parts of said mounting being operated through the medium of electric motor units.

Another object of the invention is to provide a universal mounting assembly, for the grader blade, which includes a sleeve rotatably supported by an elongated tubular body which the motor grader includes, and a reversible electric motor unit arranged to rotate said sleeve in one direction or the other; the grader blade being suspended from the sleeve for vertical adjustment; for canting in a vertical transverse plane; for lateral shifting movement; and for rotation in a horizontal plane. Separate electric motor units are operative to effect such movements of the grader blade, selectively; all whereby universal adjustment of said blade is readily accomplished.

A further object of the invention is to provide a universal mounting assembly, as in the preceding paragraph, in which certain of said separate electric motor units work through a novel, cable-actuated thrust bar arrangement to adjust the grader blade vertically; to cant the grader blade in a vertical transverse plane; and—in combination with rotative adjustment of the sleeve—to also accomplish said lateral shifting of the blade.

An additional object is to provide a motor grader having a tractor incorporated therein in unitary but steerable relation; said tractor being arranged so that it may face away from the blade, or toward the blade as working conditions and convenience of the operator may require.

It is also an object to provide a motor grader wherein the rear wheels are steerable and controlled by a novel electric steering mechanism.

A further object of the invention is to provide a practical motor grader, and one which will be exceedingly effective for the purpose for which it is designed.

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These objects are accomplished by means of such structure and relative arrangement of parts as will fully appear by a perusal of the following specification and claims.

In the drawings:

Fig. 1 is a side elevation of the improved motor grader.

Fig. 2 is a top plan view of the same.

Fig. 3 is a cross section of the implement taken directly ahead of the universal mounting assembly.

Fig. 4 is an enlarged fragmentary elevation, mainly in section, of the rotatable sleeve, and drive means therefor, as included in the universal mounting assembly.

Fig. 5 is an enlarged fragmentary sectional elevation showing the portion of the universal mounting assembly adjacent to, and which supports, the grader blade.

Fig. 6 is a fragmentary plan view, partly in section, of the steering mechanism for the rear wheels.

Fig. 7 is an enlarged cross section on line 7—7 of Fig. 6.

Referring now more particularly to the characters of reference on the drawings, the motor grader comprises an elongated, heavy-duty tubular body 1 disposed some distance above ground. At its forward end the body 1 is connected, by a rigid coupling 2, with a power steering unit 3 which upstands from the deck 4 at the rear of a two-wheel tractor 5. The forward end portion of the tubular body 1 is disposed above ground a distance greater than the height of the tractor, and said tractor being turnable by the power steering unit 3 through a full circle, either to right or left. As a consequence, the tractor may, in operation, face forwardly as shown in full lines, or may be disposed beneath the forward portion of the body 1 and face rearwardly as shown in dotted lines, in Fig. 1, as working conditions and the convenience of the operator may dictate.

At the rear end of the implement the body 1 includes an end plate 6 fixed in connection with an upstanding post 7, which post is supported, at its lower end, by a rear wheel truck, indicated generally at 8. The rear wheel truck 8 includes steerably mounted rear wheels 9; the steering

mechanism for said wheels hereinafter being described in detail. The rear wheel truck 8 supports a box 10 for the reception of weighty material.

Substantially the rear half portion of the body 1 is surrounded by a heavy-duty, turnably mounted sleeve 11; said sleeve comprising a portion of the universal mounting assembly for the grader blade, and which grader blade is suspended from said sleeve, as will hereinafter appear. At its rear end the sleeve 11 is fitted with a substantially circular housing 12 which surrounds a relatively large-diameter gear 13 nonrotatably fixed in connection with the rear end of the tubular body 1.

Below the sleeve 11 the housing 12 supports, on the front thereof, a reversible electric motor unit 14 having a drive shaft 15 which projects into the housing 12. Within said housing the shaft 15 is fitted with a pinion 16 in mesh with the gear 13. By reason of this arrangement operation of the motor unit 14, in one direction or the other, will cause corresponding rotation of the housing 12—with the motor thereon—and the sleeve 11, about the body 1.

At the bottom the gear housing 12 is fitted with a ball and socket unit 17, and a pair of push beams 18 extend forwardly from said ball and socket unit in diverging relation to a termination adjacent but short of the forward end of the sleeve 11, and below the latter. At their forward ends the push beams 18 are connected together by a transverse beam 19 which includes a laterally projecting end portion 20. A transverse link 21 is connected at one end by a ball and socket unit 22 to the outer end of the laterally projecting portion 20 of beam 19, and connected at the other end by a ball and socket unit 23, with the lower end of a rigid bracket 24 which depends from the forward end of the sleeve 11; the ball and socket units 22 and 23 being disposed on opposite sides of the longitudinal axis of the body 1, as shown in Fig. 2.

The frame structure formed by the forward portions of the push beams 18 and the transverse beam 19 fixedly supports a normally upstanding tubular bearing housing 25 of substantial length, and which projects some distance below said frame structure. A tubular spindle 26 is turnably supported, in axially immovable relation, in the bearing housing 25 and extends to a termination below the lower end of the latter. At its upper end the tubular spindle 26 is fixed with a relatively large-diameter gear 27 adapted to be reversibly driven by a pinion 28 in mesh therewith at the rear. The pinion 28 is driven by a reversible electric motor unit 29 mounted in depending position from a bracket plate 30 secured on the bearing housing 25. The gear 27 is disposed within a protective case 31 which includes, below the top thereof, a shield 32 of generally inverted conical shape, which extends about the assembly of the bearing housing 25 and tubular spindle 26 at the front and sides of the latter.

At its lower end the tubular spindle 26 fixedly supports a heavy-duty cross beam 33 intermediate the ends of the latter and ahead of which a transverse grader blade 34 is disposed. The grader blade 34 is pivotally connected to the cross beam 33 by transversely spaced pivots 35, for tilting adjustment lengthwise of the direction of travel. Such tilting is accomplished by adjustable thrust units 36 corresponding to, and disposed above, the pivots 35; said thrust units being connected between the grader blade 34

and short upstanding posts 37 on the end portions of the cross beam 33.

Adjacent but short of the forward end of the sleeve 11, the latter is formed with hollow, laterally projecting arms 38, and below the same matching arms 39 project laterally outwardly from the rigid shield and frame structure which supports the assembly of bearing housing 25 and tubular spindle 26. Upstanding thrust bars 40 project in slidable laterally swingable relation through the hollow arms 38 and pivotally connect, at the lower end, as at 41, with the outer ends of the laterally projecting arms 39.

Each of the laterally projecting hollow arms 38 supports, on the rear thereof, a reversible electric winch unit 42 which includes a cable drum 43 disposed within said hollow arm 38. Each thrust bar 40 is disposed between the adjacent cable drum 43 and a cross pin 44. A cable 45 is reeved about the cable drum 43 and thence the runs thereof extend in opposite directions about a top sheave 46 and a bottom sheave 47 on the adjacent thrust bar, said runs then extending toward each other and being dead-ended on the corresponding cross pin 44.

The universal mounting assembly as described above, and which is shown generally at 48 in Fig. 1, functions as follows:

To adjust the grader blade in a horizontal plane, the reversible electric motor unit 29 is actuated to run in one direction or the other, causing turning of the gear 27 and spindle 26. In this manner the grader blade can be set to work at an angle, in a horizontal plane, relative to the direction of travel, as shown in broken lines in Fig. 2, and can be adjusted to face forwardly as shown in full lines, or to face rearwardly as shown in broken lines, in Fig. 1.

The vertical position of the grader blade 34 is regulated by operation of the thrust bars 40, either upwardly or downwardly, by means of the reversible electric winch units 42, and in addition canting of the grader blade in a vertical transverse plane can be effected by differential movement of the thrust bars 40, which is possible for the reason that the reversible electric winch units 42 are separately and independently operable.

When it is desired to shift the grader blade laterally of the implement, whereby said blade will work in a path offset relative to the longitudinal axis of the implement, the sleeve 11 is rotated in one direction or the other by operation of the reversible electric motor unit 14 working through the pinion 16 and gear 13. In cooperation with such turning movement of the sleeve 7, and to compensate for corresponding turning of the grader blade about the tubular body 1, the thrust bars 40 are differentially actuated to reestablish the grader blade in a proper working position, but in such an offset path. This position of the blade is shown in broken lines in Fig. 3, and in said figure there is also shown, in broken lines, the position then occupied by the parts of the universal mounting assembly.

Vertical adjustment of the grader blade, together with canting of said blade in a transverse vertical plane, and said lateral shifting thereof, as above described, can be accomplished by reason of the fact that the frame structure comprised of push beams 18 and transverse beam 9, as well as the transverse link 21, are universally connected in the manner described. Such frame structure can be tilted laterally, and can be raised or lowered at its forward end.

It is also possible, by rotation of the sleeve 11, to turn the grader blade to an upstanding position alongside the tubular body 1 for the purpose of working on the sides of banks or the like, and such a position of the blade and the corresponding position of the parts of the universal mounting assembly are shown in dotted lines in Fig. 3.

The rear wheels 9 are controlled by novel electric steering mechanism comprising the following:

Each wheel is supported on a spindle assembly which includes a knuckle arm 49; the knuckle arms being pivotally connected by a tie rod 50. One of the knuckle arms 49 includes a double yoke 51; the adjacent end of the tie rod 50 being coupled in pivotal relation to one portion of the yoke, while a telescopic steering arm 52 disposed above and in substantial parallelism to said tie rod is connected to another portion of said yoke. The telescopic steering arm 52 is connected, at the end opposite the yoke 51, with a reversible electric motor 53 pivotally mounted on a bracket 54 on the rear wheel truck 8. The reversible electric motor unit 53 drives a screw 55 disposed within the telescopic steering arm 52; said screw running through a nut 56 fixed in the portion of said steering arm which is coupled to the yoke 51. It will thus be seen that with rotation of the electric motor unit 53 in one direction or the other, the telescopic steering arm 52 will be expanded or contracted, resulting in lateral shifting of the tie rod 50 and steering of the rear wheels 9.

As the two-wheel tractor 5 and the rear wheels 9 of the implement are steerable, the implement is highly maneuverable, as it travels either forwardly or rearwardly. For example, when the implement is traveling forwardly the operator may accomplish the entire steering of the implement by the tractor, and yet when the tractor is facing rearwardly, as shown in dotted lines in Fig. 1, and the implement traveling rearwardly, the latter may be steered entirely by the wheels 9. Under certain conditions the operator may find it desirable to steer by both the two-wheel tractor 5 and rear wheels 9.

The several reversible electric motor units, and reversible electric winch units, as embodied in the implement, are incorporated in a control circuit by means of which such units may be separately, selectively and reversibly actuated by the operator from his station on the tractor. In order to avoid complexity of disclosure the leads or wires comprising said circuit are not shown in the drawings. Each of said reversible electric motor units, and reversible electric winch units, includes a reduction gear box, and a normally set brake; such brake automatically releasing when the unit is actuated, and automatically resetting to prevent overrunning when the unit is deenergized.

From the foregoing description it will be readily seen that there has been produced such a device as substantially fulfills the objects of the invention as set forth herein.

While this specification sets forth in detail the present and preferred construction of the device, still in practice such deviations from such detail may be resorted to as do not form a departure from the spirit of the invention, as defined by the appended claims.

Having thus described the invention, the following is claimed as new and useful and upon which Letters Patent are desirable:

1. A motor grader comprising an elongated, wheel-supported body disposed above and driven for movement along the ground, a grader blade, a sleeve surrounding and rotatably mounted on the body, means adjustably suspending the grader blade from th. sleeve, a gear fixed on the body at one end of the sleeve, a housing on the sleeve surrounding the gear, a reversible electric motor unit mounted on the housing, and a pinion driven by the motor unit in mesh with the gear.

2. A motor grader comprising an elongated, wheel-supported body disposed above and driven for movement along the ground, a sleeve rotatably surrounding the body, driving mechanism between the body and sleeve at one end of the latter operative to rotate the same, said mechanism including a reversible electric motor unit, a vertically adjustable frame structure normally disposed under the body and intermediate the ends thereof, a grader blade mounted in connection with said frame structure for rotation in a horizontal plane, a reversible electric motor unit arranged to cause such rotation of the grader blade, and means suspending the frame structure from the sleeve for such vertical adjustment; the driving mechanism between the body and sleeve including a relatively large-diameter gear, there being a housing on the sleeve surrounding the gear, and said frame structure including a longitudinally extending push beam assembly universally connected at the adjacent end with said gear housing.

3. A motor grader as in claim 2 including a bracket depending from the sleeve at the end opposite the driving mechanism; the adjacent end of the frame structure including a laterally projecting portion, and a transverse, universally connected link coupled between said bracket and the outer end of said laterally projecting portion of the frame structure.

4. A motor grader comprising an elongated, wheel-supported body disposed above and driven for movement along the ground, a sleeve rotatably surrounding the body, a gear mounted on the body at one end of the sleeve, a housing on the sleeve surrounding the gear, a reversible electric motor unit mounted on the housing and including a pinion in mesh with the gear, a pair of push beams universally connected to the gear housing and extending lengthwise below the body in diverging relation, a cross beam connecting the ends of the push beams opposite the gear housing, said cross beam including a laterally projecting portion, a rigid bracket depending from the sleeve adjacent the cross beam but spaced transversely relative to said projecting portion thereof, a universally connected link coupled between the bracket and the outer end of said laterally projecting portion of the cross beam, the push beams and cross beam thus forming a vertically adjustable laterally tiltable frame structure, arms projecting laterally from the sleeve above said frame structure, normally upstanding thrust bars slidable through said arms, means connecting the thrust bars at their lower ends to the frame structure at transversely spaced points, a reversible electric power unit on each arm operative to raise or lower the corresponding thrust bar, a normally transverse grader blade unit mounted on the frame structure for rotation in a horizontal plane, and an electric motor unit mounted on the frame structure and arranged to rotate the grader blade.

5. A motor grader comprising an elongated wheel mounted body held above the ground, a sleeve on the body turnable about such body as

an axis, a frame supported from the sleeve and arranged to have transverse swinging movement and lateral tilting movement relative to such sleeve, a pair of laterally projecting arms on the sleeve, thrust bars movable through the arms and pivotally connected to the frame, a cable drum journaled in each arm adjacent the thrust bar therein, a cable reeved around the drum and connected at its opposite ends to the corresponding ends of the thrust bar, and a reversible electric motor mounted on each arm and connected in driving relation with the corresponding drum.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
Re. 19,987	Wells et al.	May 26, 1936
404,774	Bunnell	June 4, 1889
1,714,152	Wilson	May 21, 1929
1,814,635	Schlundt	July 14, 1931
1,841,403	Dean	Jan. 19, 1932
2,281,224	Baumgartner	Apr. 28, 1942

OTHER REFERENCES

Advertising Circular Form 4119, entitled "Adams Motor Grader No. 201." Published by J. D. Adams Co., Indianapolis, Ind. Copy in Division 4, received November 25, 1941.