Nov. 23, 1937. C. A. GUSTAFSON 2,100,005

ROAD MACHINE

Filed Feb. 5, 1934 4 Sheets-Sheet 1

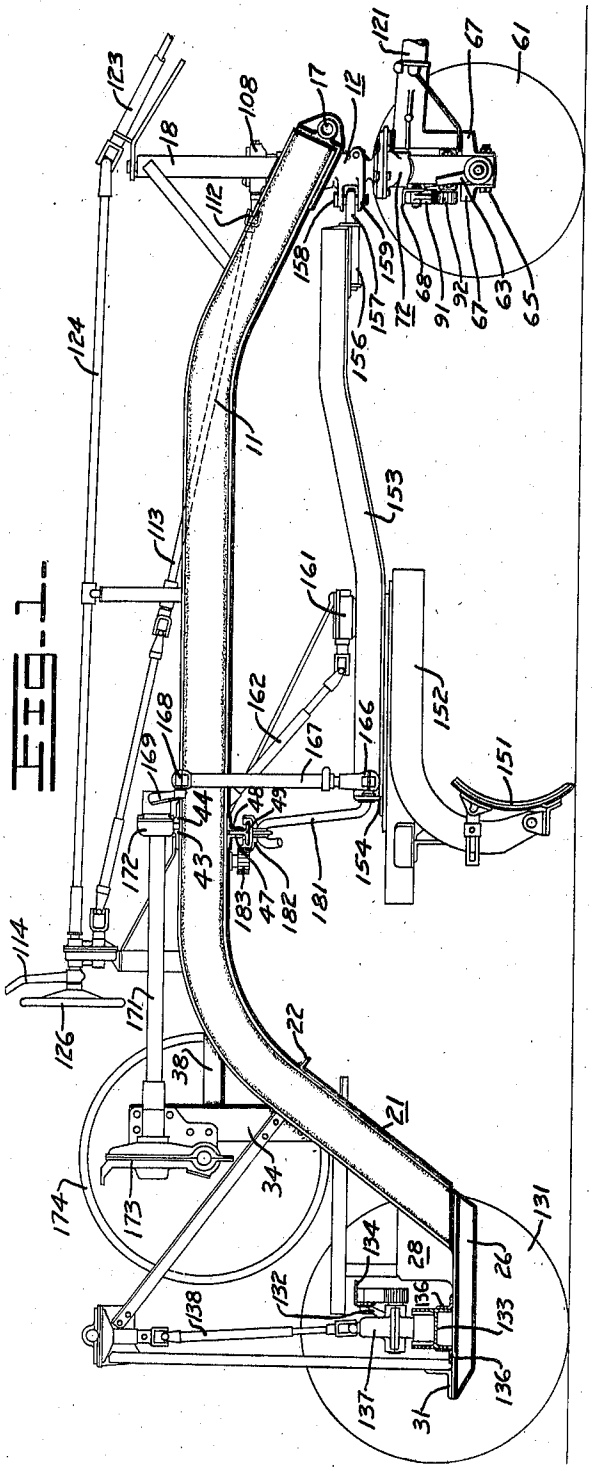


Fig. 1.

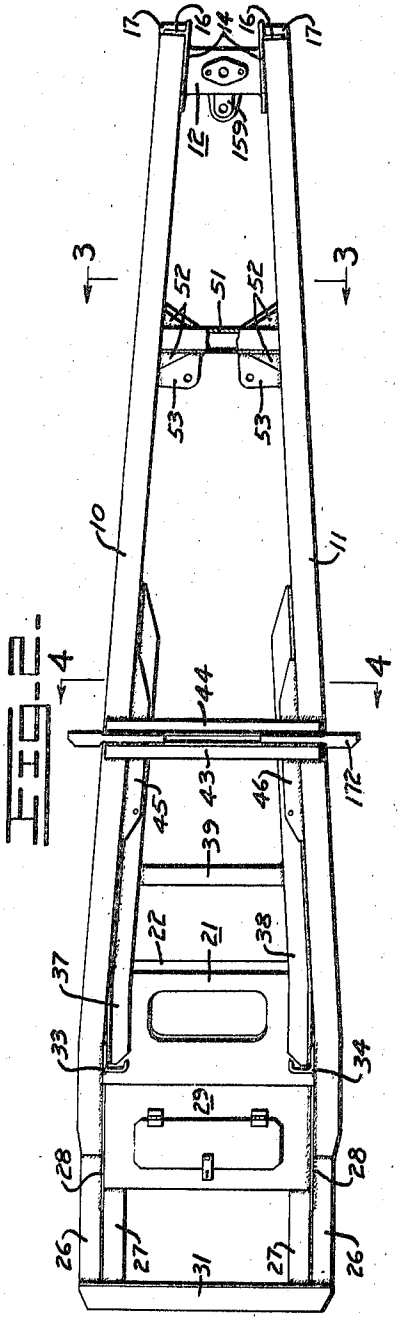


Fig. 2.

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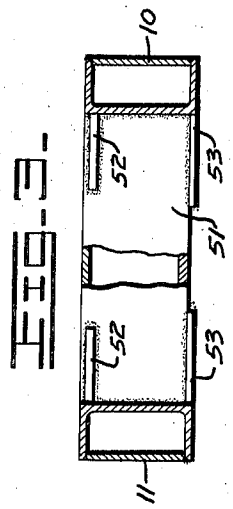


FIG-3-

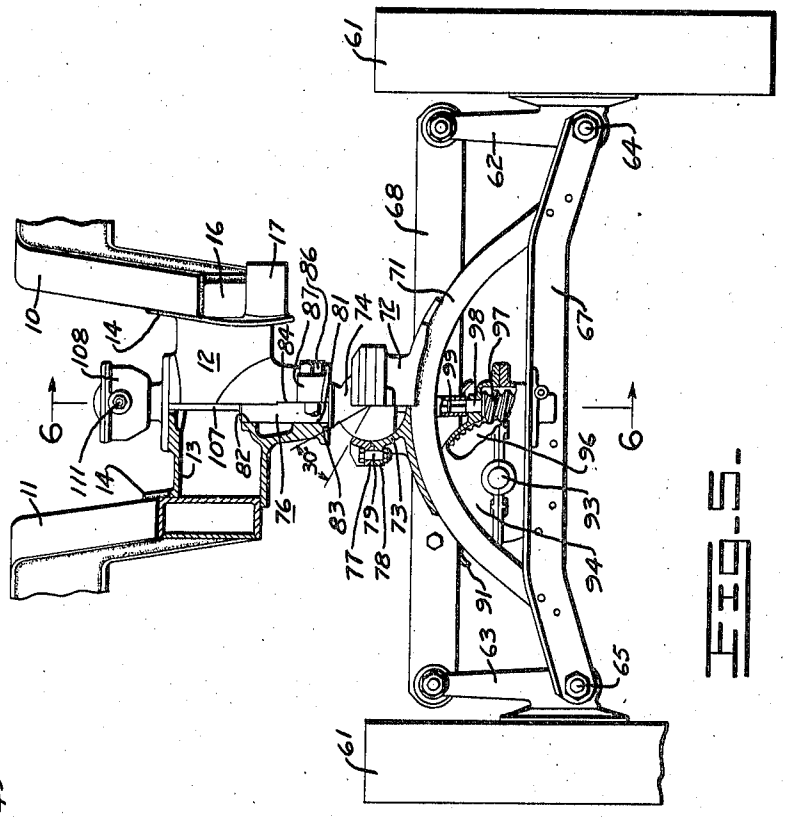


FIG-5-

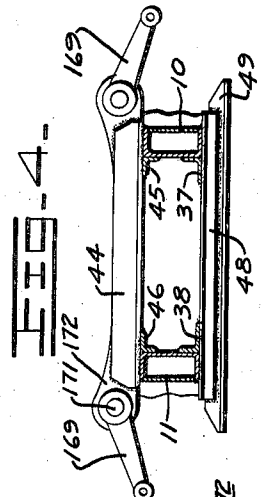


FIG-4-

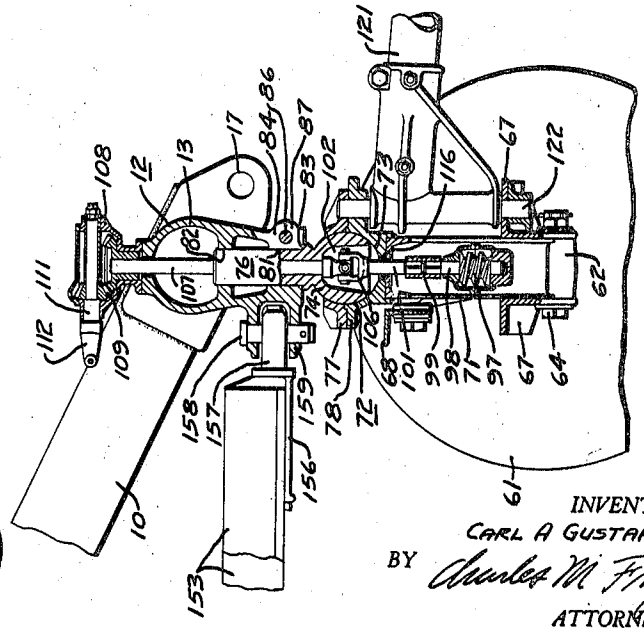


FIG-6-

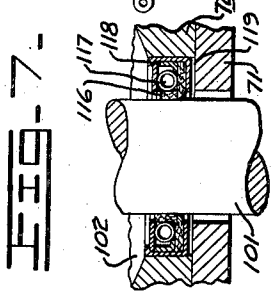


FIG-7-

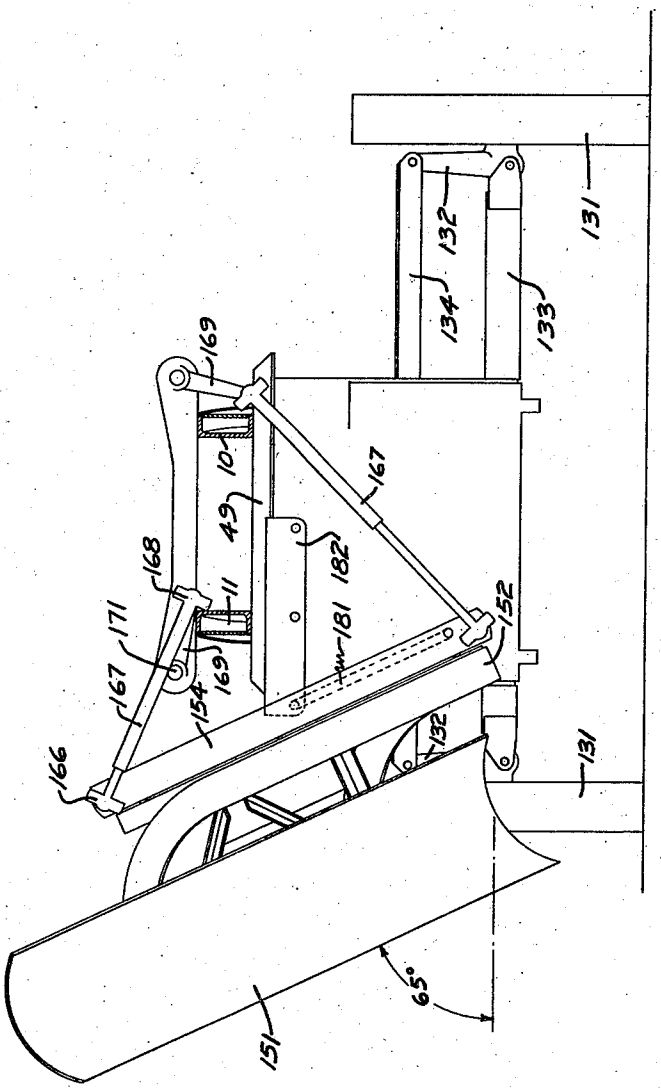
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Fig. 4.



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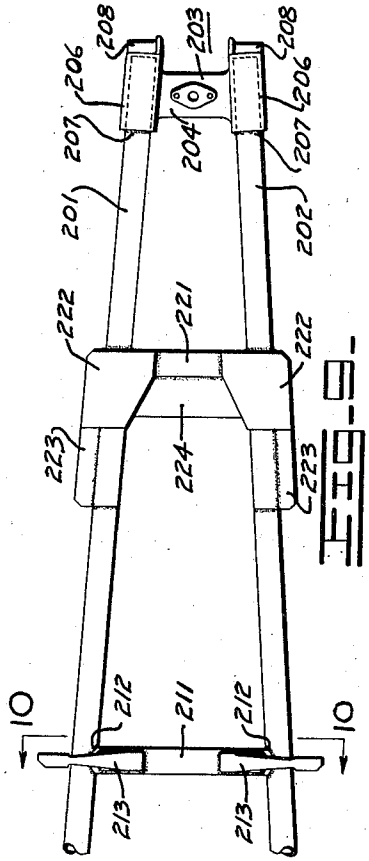


FIG. 9.

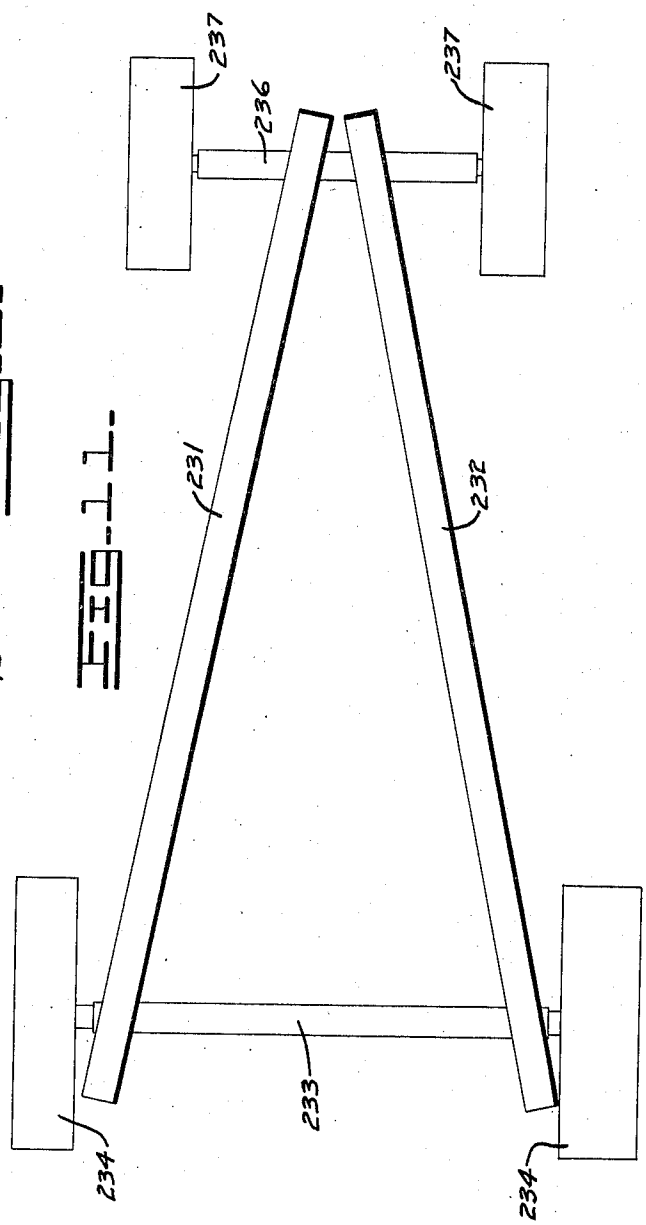


FIG. 11.

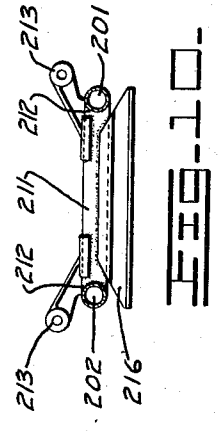


FIG. 10.

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Patented Nov. 23, 1937 2,100,005

UNITED STATES PATENT OFFICE

2,100,005

ROAD MACHINE

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Application February 5, 1934, Serial No. 709,831

1 Claim. (Cl. 280—80)

The present invention relates to road machines, and more particularly to road graders having an earth-engaging tool adapted to be positioned to make a high-angle cut.

It is an object of the invention to provide a road machine of improved construction which facilitates high-angle cutting operations.

Another object of the invention is to provide a road machine having an improved frame construction and frame suspension, which provide for a wide range of oscillation for the frame supporting means with respect to the frame while preventing any twisting of the frame.

Another object of the invention is to provide an improved road grader having a frame constructed to provide for great rigidity, while permitting positioning of the blade assembly to a relatively high-angle cutting position to either side of the frame.

Another object of the invention is to provide an improved road machine having a frame constructed to promote economy of manufacture.

Another object of the invention is to provide a road machine of improved construction providing an increased range of oscillation of the front wheel assembly with respect to the frame of the machine.

Another object of the invention is to provide a road machine having an improved front end construction, whereby a wide range of oscillation of the front wheel assembly is provided with respect to the frame, while permitting a simple drive connection from the frame of the machine to the front wheel tilting mechanism.

Other objects will appear as the description progresses.

Fig. 1 is a side elevation of a road grader constructed according to the instant invention.

Fig. 2 is a plan view of the frame.

Figs. 3 and 4 are sectional views illustrating the frame construction and taken on line 3—3 and 4—4 in Fig. 2, respectively.

Figs. 5 and 6 illustrate the front end construction.

Fig. 5 is a front elevational view with certain parts shown in section.

Fig. 6 is a sectional view taken on the line 6—6 in Fig. 5.

Fig. 7 is an enlarged fragmentary view of a portion of Fig. 6.

Fig. 8 is a schematic view illustrating the high-angle cutting position of the blade.

Figs. 9 and 10 illustrate a modified form of frame construction.

Fig. 9 is a partial plan view.

Fig. 10 is a section taken on the line 10—10 in Fig. 9.

Fig. 11 is a schematic plan view of a third form of the frame construction.

The road machine disclosed herein is a grader of the leaning wheel type having an earth-engaging tool adapted to be positioned to either side of the grader frame to make a high-angle cut. The frame is supported on the front wheel and axle assembly by means of a universal connection which provides a wide range of relative oscillation therebetween. To prevent twisting of the frame which would otherwise occur because of this type of connection, the frame is constructed of tubular members to provide rigidity. As the necessary rigidity is obtained by such construction with a narrower frame than has heretofore been possible, greater clearance for the tool assembly is provided, so that the tool can be positioned to make a high-angle cut.

The frame of the machine is substantially symmetrical with respect to the longitudinal axis, and includes tubular side members 10, 11 (Fig. 2) which extend substantially the length of the machine and have a slight convergence toward the front end. Side members 10, 11 (Fig. 3) are each formed of a channel having a plate or strip welded between the flanges thereof to provide a tubular or box construction. The side members are interconnected by various cross members to provide a rigid and well braced structure.

At the front end of the machine, bolster 12 (Figs. 2 and 5) is welded between the downwardly bent front ends of side members 10, 11. Bolster 12 is a casting comprising central transverse tubular portion 13 (Fig. 5) terminating in end flanges 14 rigidly secured by welding to the inner faces of side members 10, 11. Transverse flanges 16 (Fig. 2) extend outwardly from flanges 14 and are welded to the front ends of side members 10, 11. Transversely apertured bosses 17 are provided on bolster 12 in front of side members 10, 11, whereby auxiliary mechanism can be attached to the frame of the machine if so desired. Conventional framework 18 (Fig. 1) is secured to the front end of the frame as a support for the usual mechanism to adjust the line of draft, of which mechanism only the parts mounted on the main frame are illustrated.

At the rear end of the machine (Figs. 1 and 2), side members 10, 11 are bent downwardly and rearwardly, and brace plate 21 (Figs. 1 and 2) is welded to their bottom faces. At its upper edge, plate 21 is bent outwardly to provide bracing flange 22. Pairs of angle extensions 26, 27

(Fig. 2) are welded to the rear ends of side members 10, 11, and the connection therebetween is reenforced by vertical plates 28, between which tool box 29 (Fig. 2) is welded to provide an additional bracing cross member between side members 10, 11. The rear ends of angle extensions 26, 27 are braced by cross angle 31 welded thereto. Angle extensions 26, 27 and cross angle 31 provide a mounting for the rear wheel and axle assembly as described later.

Substantially centrally of the downwardly extending rear ends of side members 10, 11, vertical angle posts 33, 34 (Figs. 1 and 2) are welded to the inner faces of side members 10, 11, respectively, to provide a support for a portion of the blade lifting mechanism as described later. Posts 33, 34 are braced adjacent the top by longitudinal angles 37, 38 welded thereto, and extending forwardly and being welded to the inner faces of side members 10, 11. Cross member 39 braces side members 10, 11 intermediate the ends of angles 37, 38.

In the central portion of the machine above the blades (Figs. 1 and 2), the ends of spaced-apart angles 43, 44 are welded to the top faces of respective side members 10, 11, the connection therebetween being reenforced by angles 45, 46 welded thereto. In addition to reenforcing the framework, cross angles 43, 44 support a part of the blade lifting mechanism, as described hereinafter. Immediately below angles 43, 44 (Figs. 1 and 4), a pair of spaced-apart angles 47, 48 are welded to the bottom faces of side members 10, 11 and to angles 37, 38; and the central web of T-bar 49 is welded therebetween. Angles 47, 48, and T-bar 49 support the center shift mechanism, as later described.

Forwardly of cross angles 43, 44 (Fig. 2), tubular cross member 51 (Figs. 2 and 3) of box construction is welded between side members 10, 11; the connection being reenforced at the top and bottom by respective braces 52, 53 welded to side members 10, 11 and cross member 51. Cross member 51 braces the frame and also serves to mount auxiliary mechanism such as a scarifier, for example.

From the foregoing description it is seen that a rigid tubular beam frame construction is provided in which the essential parts are connected by welding. Because of the tubular construction of the side members, the over-all width of the frame, particularly at the front, can be reduced while retaining the same rigidity which would be obtained by a wider frame construction. This construction not only lends itself to economy of manufacture, but also provides for a great range of high-angle cutting positions of the blade, as pointed out in greater detail hereinafter. Further, the rigid frame construction permits the use of a universal connection between the frame and the front wheel and axle assembly as described hereinafter.

Front wheels 61 (Figs. 5 and 6) are suitably journaled on spindles integral with bell-cranks 62, 63 pivoted at 64, 65 between the ends of spaced, transversely extending angles 67 (Fig. 6) which comprise the front axle. To provide for tilting of wheels 61, the upper arms of bell-cranks 62, 63 are pivotally connected to shift bar 68, which is operated by means hereinafter described to impart equi-angular oscillation to bell-cranks 62, 63.

To provide for oscillation of the front axle in both a vertical and horizontal plane, with respect to the frame, a universal connection is provided therebetween; said connection being hollow to accommodate a drive connection for operating the wheel tilting mechanism. Arcuate channel 71 (Figs. 5 and 6) has its ends secured between axle angles 67, and at its top has casting 72 welded thereon to provide the socket of a ball and socket connection to the frame of the machine. Centrally of casting 72, semi-spherical socket portion 73 is provided which receives ball portion 74 of kingbolt 76. Ball portion 74 is held in engagement with the socket portion 73 of casting 72, by retaining collar or cap 77 secured to flange 78 of casting 72 by a plurality of bolts 79. Kingbolt 76 extends upwardly from ball portion 74 and is secured in bosses 81, 82 of bolster 12; shoulder 83 being provided thereon to engage the bottom of boss 81. Boss 81 has slot 84 to provide, with bolt 86 and apertured bosses 87 on opposite sides of slot 84, means for clamping kingbolt 76 in position. As shown in Fig. 5, the clearance between collar 77 and the bottom of boss 81 of bolster 12 permits relative oscillation through an angle of substantially 30 degrees.

To operate the tilting mechanism for the front wheels, a drive connection is provided through the kingbolt. As described above, the wheels are tilted relative to axle 67 by reciprocation of bar 68. Bar 68 is operated through arcuate rack 91 thereon (Fig. 1) by pinion 92 on shaft 93 which is suitably journaled in housing 94. Shaft 93 (Fig. 5) is operated through worm gear 96, and worm 97 (Figs. 5 and 6) integral with vertical shaft 98. The upper squared end of shaft 98 (Fig. 6) has telescopic driving engagement with connection or sleeve 99 which is similarly engaged with the lower squared end of shaft 101 which extends upwardly through apertures in channel 71 and casting 72, to space 102 within hollow ball portion 74 of kingbolt 76. Within space 102, shaft 101 has universal connection 106 with shaft 107; said universal connection 106 having its center coinciding with the center of movement of the ball and socket connection. Shaft 107 extends through kingbolt 76 and bolster 12 to housing 108 suitably mounted on the bolster. Within housing 108, shaft 107 has bevel gear connection 109 with shaft 111 extending without said housing and having universal connection 112 (Fig. 1) with telescopic shaft 113 extending rearwardly and operated through a suitable gear connection from handle 114.

Thus, the frame of the machine has a universal connection with the front wheel and axle assembly, which connection is hollow to accommodate a universal connection in the drive for the front wheel tilting mechanism.

Sealing means are provided for preventing the entry of deleterious matter within space 102; said sealing means (Fig. 7) comprising sealing ring 116 of suitable material having a portion urged into sealing engagement with shaft 101 by coiled spring 117. Sealing member 116 and spring 117 are mounted by suitable retainers 118 within aperture 119 in casting 72. Thus, deleterious matter cannot enter past shaft 101 into space 102 within ball portion 74 of kingbolt 76; and universal connection 106 is always free to operate.

The draft is transmitted to the front wheel and axle assembly from draft pole 121 (Fig. 6) pivotally connected by pin 122 to front axle angle 67 at the bottom, and to casting 72 at the top. The upper end of pin 122 extends through casting 72 and engages a suitable aperture in collar 77. Draft pole 121 is adjustable angularly with re-

spect to the front axle in the usual manner, by any suitable means which is operated through shafting 123, 124 (Fig. 1) from hand wheel 126.

The rear end of the machine is supported upon a rear wheel and axle assembly which is shiftable by conventional mechanism, transversely with respect to the frame of the machine, and which provides for tilting movement of the rear wheels with respect to the frame. Rear wheels 131 (Figs. 1 and 8) are journaled on spindles integral with bell-cranks 132 pivoted in the ends of rear axle 133, and having their upper ends pivotally connected to shift bar 134. Axle 133 includes opposite angles 136 which are engaged by suitable guide means (not shown) to control lateral movement of axle 133 with respect to angle extensions 26, 27; any suitable conventional means being provided to accomplish transverse shifting thereof. Shift bar 134 is operated similarly to shift bar 68 of the front wheel and axle assembly by gearing in housing 137, through shaft 138, which is provided with suitable operating means. For a more detailed description of the rear axle construction, reference is hereby made to my co-pending application, Serial No. 533,179, filed April 27, 1931.

The earth-engaging tool comprises a conventional blade which is mounted for vertical, transverse and angular adjustment. Blade 151 (Fig. 1) is adjustably mounted on circle 152 which is supported rotatably in a circle-carrying frame comprising forwardly converging drawbars 153 connected at their rear ends by cross bar 154. Only one of said drawbars 153 is seen in Fig. 1. Drawbars 153 (Figs. 1 and 6) converge at their front ends to connection 156 in which the rear end of eye-bolt 157 is pivotally received. The apertured end of eye-bolt 157 engages draft pin 158, which is pivoted in vertically spaced apertured ears 159 of bolster 12. Thus, a draft connection having a universal front connection, is provided from the front of the frame to the earth-engaging tool.

To accomplish angular adjustment of the blade with respect to the line of draft, circle 152 (Fig. 1) is rotated in the circle-carrying frame by conventional means including gearing in housing 161 operated by telescopic shaft 162. Shaft 162 is operated in any suitable manner by means (not shown) located at the operator's station.

To accomplish vertical adjustment of the blade and angular adjustment thereof about a longitudinal axis, similar lift mechanisms of conventional design are connected to the opposite ends of rear cross bar 154 of the circle-carrying frame, and only one of said lift mechanisms will be described in detail. The right end of cross bar 154 (Fig. 1) has universal connection 166 with telescopically adjustable lift link 167, having universal connection 168 at its upper end with lift arm 169 (Figs. 1 and 4) on the front end of lift shaft 171. Lift shaft 171 (Figs. 1, 2, and 4) is journaled in bracket 172 welded between cross angles 43, 44, and said shaft 171 extends rearwardly (Fig. 1) to housing 173 on post 34. Said shaft 171 is operated by suitable gearing in housing 173 from hand wheel 174. The lift mechanism for the left end of the blade is similarly constructed.

By operating both lift mechanisms simultaneously in the same direction, the blade can be raised or lowered, and by operating said mechanisms in opposite directions, the blade can be adjusted angularly about a longitudinal axis.

To accomplish lateral shifting of the blade, rear cross bar 154 (Figs. 1 and 8) is pivotally connected to the lower end of center shift link 181 having its upper end pivotally connected to lateral shiftable rack 182 slidable on T-bar 49. Rack 182 is operated from the operator's station through suitable means including gear 183 (Fig. 1) meshed therewith. In addition to accomplishing lateral shifting of the blade, center shift link 181 serves to maintain the blade in any laterally displaced position thereof.

For a more complete description of the adjusting mechanisms for the earth-engaging tool, reference is hereby made to my above-noted application.

By virtue of the above-described adjusting mechanisms, blade 151 can be adjusted to high-angle cutting position, as illustrated in Fig. 8. As viewed in Fig. 8, left-hand lift link 167 is adjusted to its shortest length, while right-hand lift link 167 is extended and the associated lift arms 169 are rotated to their furthest clockwise positions. Center shift link 181 is connected to the left end of rack 182 and to the right end of bar 154, being substantially parallel with said bar. As indicated in Fig. 8, blade 151 is positioned at an angle of substantially 65 degrees with respect to the horizontal.

The maximum high-angle cutting position is limited by engagement of the circle-carrying frame with the main frame. Because of the provision of tubular or box side members, the main frame can be made narrower while having the necessary rigidity against twisting action. As the main frame is narrower, the maximum high-angle cutting position of the blade is increased and the blade is provided with a greater range of high-angle cutting positions.

Figs. 9 and 10 illustrate a second form of the invention in which the frame of the machine is provided with tubular side members in the form of pipes. Pipe members 201, 202 are formed similarly to side members 10, 11, illustrated in Figs. 1–8, and are connected at their front ends by bolster 203 having transverse tubular portion 204 and longitudinal pipe portions 206 fitting over the ends of pipe members 201, 202, and welded thereto at 207. At the front of pipe portions 206, transversely apertured bosses 208 are provided for attaching auxiliary mechanism.

Intermediate their ends, pipe members 201, 202 are connected by transverse pipe member 211, having its ends welded thereto at 212. Brackets 213 are welded to the top of transverse pipe member 211 (Figs. 9 and 10) to provide a mounting for the lift arms. To provide a mounting for lateral shifting mechanism, bracket 216 (Fig. 10) is welded to the bottom side of transverse member 211, the upper portion of bracket 216 being formed as a segment of a cylinder to fit pipe member 211, and the bottom portion thereof being in the form of a T-bar to receive a laterally shiftable rack similar to rack 182 illustrated in the first modification. Between bolster 203 and transverse pipe member 211, a second transverse pipe member 221 is welded between side pipe members 201, 202, the connection therebetween being reenforced by gussets 222, longitudinally disposed angles 223, and transverse plate 224, all of which are joined by welding.

The rear ends of pipe members 201, 202 are not illustrated but are constructed and connected similarly to the rear end construction illustrated in Figs. 1–8. The frame construction described above provides for a relatively narrow yet rigid frame construction having the advantages pointed

out in describing the modification shown in Figs. 1–8.

Fig 11 illustrates a third form of the invention, and discloses a frame construction which is suitable for use with elevating graders. The frame construction is generally A-shaped, and comprises opposite side members 231, 232, having a box construction similar to side members 10, 11. At their rear ends, side members 231, 232 are secured at spaced points to rear axle 233, having wheels 234 suitably mounted thereon. Side members 231, 232 converge at their front ends, which are suitably connected and mounted on front axle 236 carrying front wheels 237 to provide a three-point suspension for the frame.

It is believed apparent that the above-described frame constructions which consist essentially of tubular members, provide rigid frame structures which can be economically manufactured and assembled.

I, therefore, claim as my invention:

In a road machine, a frame, an axle, a socket member supported by said axle, a kingbolt secured to said frame and having a hollow ball portion engaging said socket member and forming with said socket member an enclosed connection receiving space, adjustable means on said axle, and an adjusting connection for said adjustable means extending through said connection receiving space, said connection including a universal connection having its pivotal center substantially concentric with the pivotal center of movement between said ball portion and said socket member, the coincidence of said centers enabling operation of said adjustable means in any relative angular position of said frame and said axle.

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