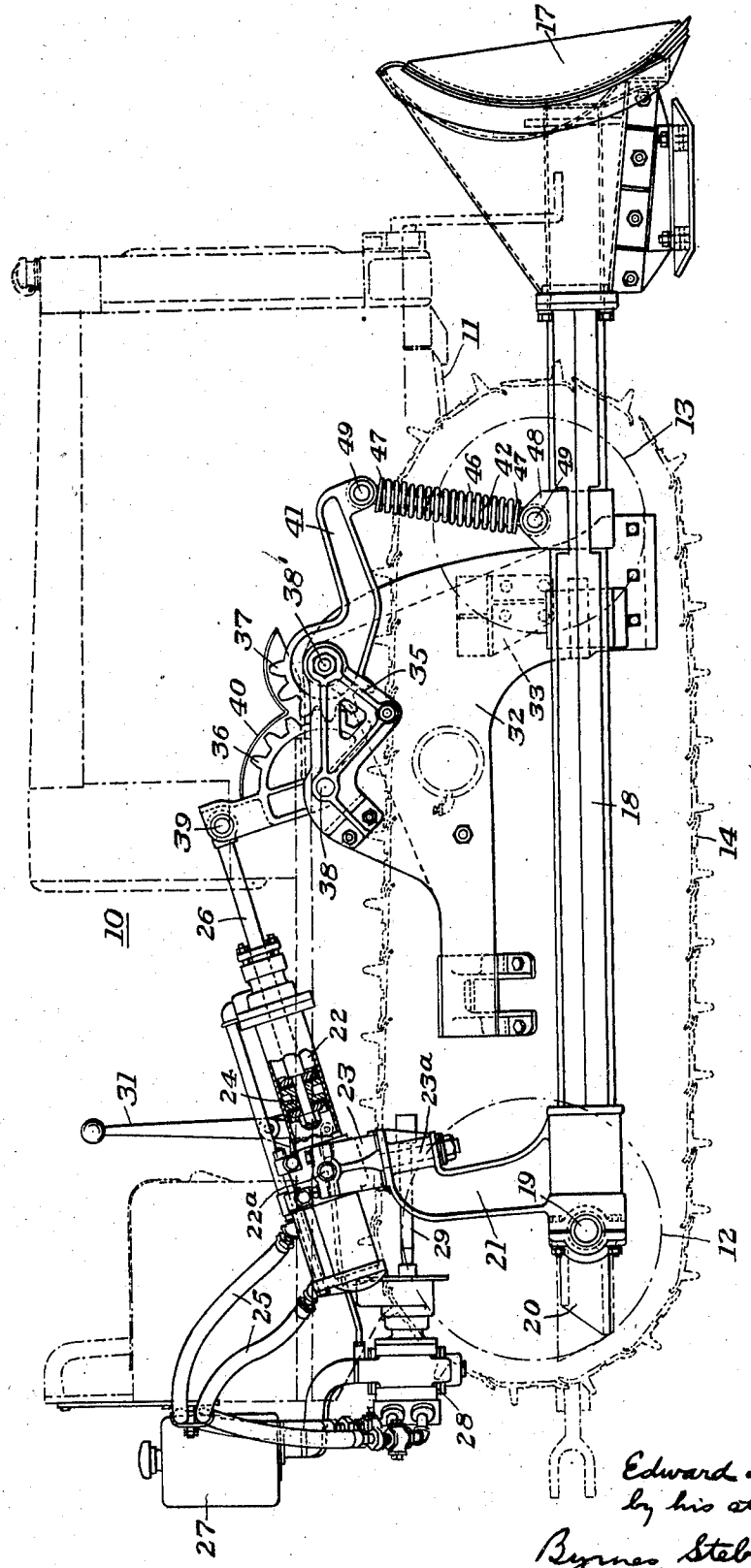
Sept. 28, 1937. E. L. HARRINGTON 2,094,153

EARTH MOVING APPARATUS

Filed June 25, 1935 2 Sheets-Sheet 1

Fig. 1.



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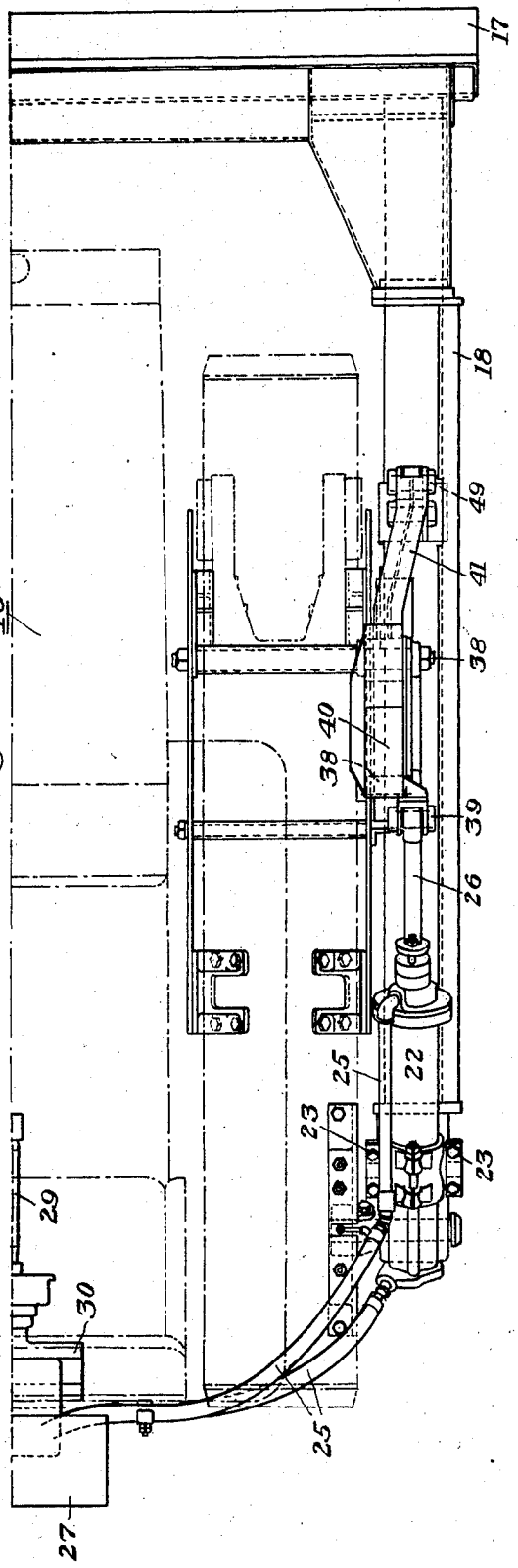


Fig. 2.

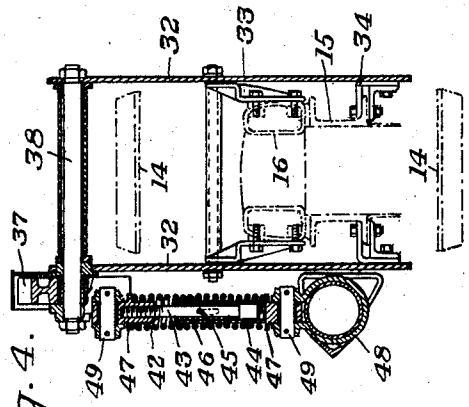


Fig. 4.

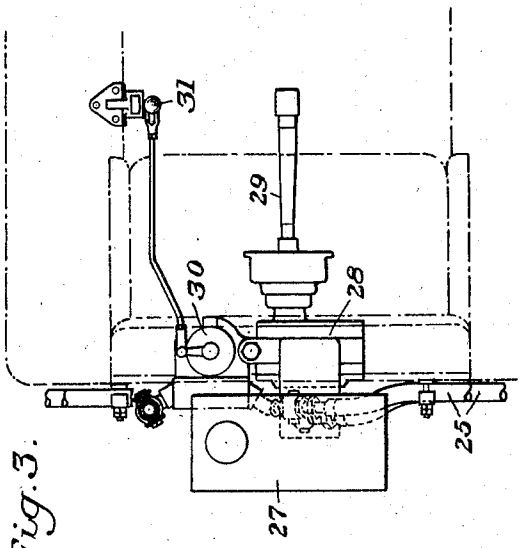


Fig. 3.

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UNITED STATES PATENT OFFICE

2,094,153

EARTH MOVING APPARATUS

Edward L. Harrington, Pittsburgh, Pa., assignor to Blaw-Knox Company, Pittsburgh, Pa., a corporation of New Jersey

Application June 25, 1935, Serial No. 28,281

10 Claims. (Cl. 37—144)

My invention relates to an earth-moving apparatus and, specifically, to that form of apparatus generally known as a bulldozer, and including an earth-engaging blade mounted adjacent the front of a power vehicle and adapted to be raised or lowered. Devices of this kind are used generally in excavating and heavy grading work of various kinds.

Bulldozers as heretofore constructed have usually included a pair of thrust arms pivoted to a tractor for carrying the earth-engaging blade, and hydraulic gear for effecting tilting movement of the arms to cause raising or lowering of the blade. The mounting of a bulldozer blade and side thrust arms on a power vehicle, such as a tractor, displaces the center of gravity of the latter toward the forward end and this displacement has been further increased by the prevailing practice of mounting the hydraulic gear very close to the front of the apparatus. While such mounting has an increased mechanical advantage over a mounting further to the rear, when the gear is connected directly to the arms, this is more than offset by the resulting displacement of the center of gravity of the combined apparatus toward the forward end.

A more important disadvantage of the previous construction of bulldozers, however, is that only a relatively small "lift" of the blade is possible unless especially bulky hydraulic gear is employed.

In accordance with my invention, I provide a bulldozer for tractor mounting which is capable of an exceedingly high "lift", and is so constructed as to maintain the center of gravity of the combined apparatus as far toward the rear as possible and low enough to give the apparatus a high degree of stability in operation. Specifically, I mount the hydraulic gear on the thrust arms adjacent the axis about which they tilt, and connect the hydraulic gear to the forward end of the arms by a relatively simple and effective linkage, to obtain the mechanical advantage of exerting the lifting force at a considerable distance from the tilting axis. The invention also comprises means permitting upward, movement of the bulldozer blade by the forces exerted thereon in the normal operation of the device, without imparting any undue strain to the adjusting apparatus.

For a complete understanding of the invention, reference is made to the accompanying drawings illustrating the present preferred embodiment, although it will be understood that other forms of the invention may be resorted to within the scope of my broader claims. In the drawings:

Figure 1 is a side elevation of the invention mounted on a tractor of substantially standard design, the latter being shown in dot-and-dash lines;

Figure 2 is a partial plan view;

Figure 3 is another partial plan view showing a different portion of the apparatus; and

Figure 4 is a sectional view taken along the line IV—IV of Figure 1.

Referring in detail to the drawings, a tractor 10 on which the bulldozer of my invention is mounted, may be of known construction, including a chassis 11 mounted on driving and idler sprockets 12 and 13 around which are trained crawler belts 14. Between the sprockets 12 and 13, the crawler belts 14 travel on guide frames, including side channels 15 and a top casting 16.

The bulldozer proper includes an earth-engaging blade 17 carried at the front end of the tractor on side thrust arms 18. The arms 18 are tiltably mounted on hinge pins 19 extending outwardly from brackets 20 secured in any convenient manner to the crawler belt guide frames. Upstanding brackets 21 are mounted on each of the arms 18 adjacent the hinge pins 19. The description hereafter will refer to the blade-adjusting mechanism on only one side of the device. It will be understood that this structure is duplicated on the opposite side. A fluid pressure cylinder 22 is tiltably mounted by trunnions 22a in a fork 23 which is swiveled on a pin 23a mounted on the upper end of the bracket 21. A piston 24 is reciprocable in the cylinder 22 under the influence of fluid under pressure admitted to opposite ends thereof through connections 25, and has a piston rod 26 reciprocating therewith. The cylinder 22, piston 24 and rod 26 constitute a hydraulic thruster. The connections 25 are part of a hydraulic system including a reservoir 27, a pump 28 driven by a power takeoff 29 from the tractor engine, and a control valve 30 operable by a hand lever 31. The cylinders are connected in parallel to the valve so as to operate simultaneously with equal force.

The universal mounting of the cylinders permits slight disalignment of the parts of the linkage operated thereby, to be described shortly, thus allowing for slight weaving of the tractor when traversing rough ground.

By suitable operation of the lever 31, fluid under pressure can be admitted to either end of the cylinder 22 and any fluid on the other side

of the piston 24 discharged through the opposite end of the cylinder.

A novel feature of the invention which is quite advantageous is the fact that the reaction on the cylinder of the thrust exerted on the piston by the fluid pressure tends to lift the side arms 18, because of the mounting of the cylinders on the brackets 21 carried on the arms. This assists the pistons to perform their function, viz., to control the elevation of the blade 17. The means by which they effect this operation will now be described.

Bearing plates 32 are disposed on opposite sides of the crawler belt 14, being secured to brackets 34 attached to the side channels 15. A bearing bracket 35 is attached to the top of the outer bearing plate 32 and a pair of meshing gear segments 36 and 37 are rotatable on shafts 38 and 38'. The shaft 38 extends through the bearing plates 32 and the bracket 35. Shaft 38' extends through the bracket 35 and the outer plate 32 only. The segment 36 has an extension pivotally connected at 39 to the piston rod 26. This connection is such as to allow for the slight play necessary between the piston rod and the extension of the segment on reciprocation of the former and rotation of the latter. The segments 36 and 37 are partially enclosed in a sheet metal housing 40.

The segment 37 has an extension 41. A telescoping linkage 42 is pivotally connected to the extension 41 and the arm 18. The linkage 42 comprises a rod 43 reciprocable in a sleeve 44. The rod and sleeve are normally forced apart as far as permitted by a pin and slot connection 45, by means of a compression spring 46. The spring 46 bears against terminals 47 into which the rod 43 and the sleeve 44 are respectively threaded. The terminals 47 are pivoted to the extension 41 and a clevis 48 on the arm 18 by pins 49.

From the foregoing description of the invention, it will be clear that when it is desired to raise the blade 17, the lever 31 should be operated so as to cause fluid under pressure to be admitted to the rear end of the cylinders 22. This causes the pistons 24 and the piston rods 26 to be thrust forward in clockwise rotation to the segments 36. The meshing segments 37 are thus rotated counterclockwise and the arms 18 tilted in the same direction. Lowering movement of the blade, conversely, may be effected by admitting fluid under pressure to the forward ends of the cylinder 22.

The springs 42 normally exert a downward thrust on the arms 18 to hold the latter in the position to which they are adjusted by operation of the hydraulic gear. If the blade 17 should strike an obstacle exerting an upward force thereon, however, the rod 43 and sleeve 44 telescope against the force of the spring 42 and permit the blade 17 to yield upwardly, without subjecting the remaining parts of the blade-adjusting mechanism to any excessive stress.

It will be apparent that the invention possesses many advantages over devices of the same general character which have been employed heretofore. In the first place, the center of gravity of the entire apparatus is moved forward little, if any, by the mounting of the bulldozer proper thereon, because the hydraulic gear is positioned toward the rear. A simple linkage connects the hydraulic gear to the thrust arms adjacent the blade. This linkage is simple and may easily be designed to have sufficient strength and rigidity to stand the shocks to which apparatus of this kind is subject in use. The yielding connection between the thrust arms and their adjusting mechanism relieves the latter of a great many shocks to which it would otherwise be subject. The linkage between the hydraulic gear and the thrust arms is such that almost any desired "lift" of the blade can be obtained. Since the hydraulic cylinders are positioned directly over and in line with the thrust arms, all the forces involved in adjusting the position of the arms operate in a single plane, avoiding any twisting or torsional forces. At the same time, the swiveled mounting of the cylinders and a slight lost motion in the linkage connections permits them to accommodate themselves to any weaving of the tractor chassis.

Although I have illustrated and described herein but one preferred form of the invention, it will be obvious that changes in the construction disclosed may be made without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. A bulldozer comprising a tractive vehicle having a frame, thrust arms mounted on the frame for pivotal movement about an axis adjacent the rear of the frame, said thrust arms extending forwardly of the vehicle, an earth-engaging blade attached to said arms, and means for raising and lowering said arms including a fluid-pressure cylinder and piston mounted on at least one of said arms adjacent said axis, and meshing gear segments mounted on said frame and pivotally connected to said piston and said one of said arms, respectively.

2. A bulldozer adapted to be mounted on a vehicle comprising an earth-engaging blade, arms supporting the blade, bearings on the vehicle for tiltably supporting said arms, a bracket extending upwardly a substantial distance from one of said arms, a fluid-pressure cylinder and piston carried on the bracket with its longitudinal axis substantially offset from said bearings, and a linkage including a fixed fulcrum connected to the piston and to one of said arms, whereby the reaction on the cylinder aids the piston to tilt the arms.

3. The apparatus defined by claim 2 characterized by said linkage including meshing gear segments rotatably mounted on the vehicle.

4. A bulldozer adapted for vehicle mounting comprising a blade, arms supporting the blade, bearings on the vehicle for tiltably supporting said arms, a fluid-pressure cylinder and piston for tilting said arms, said cylinder being mounted on one of said arms with its longitudinal axis substantially offset from the tilting axis of said arms whereby the reaction on the cylinder aids the piston to tilt said arms, a linkage connecting the piston to one of said arms and a fixed bearing for the linkage.

5. A bulldozer adapted to be mounted on a vehicle comprising an earth-engaging blade, arms supporting the blade, bearings on the vehicle for tiltably supporting said arms, a bracket on one of said arms, a fluid-pressure cylinder and piston swiveled on the bracket adjacent said bearings but spaced vertically thereof, and a linkage connected to the piston and one of said arms, parts of said linkage bearing on said frame, whereby the reaction of said piston and cylinder aids in lifting said arms and blades.

6. A bulldozer comprising a tractive vehicle having a frame, thrust arms mounted on the frame for pivotal movement about an axis adjacent the rear of the frame, said thrust arms extending forwardly of the vehicle, an earth-

engaging blade attached to said arms, and means for raising and lowering said arms including meshing gear segments mounted on said frame and a fluid-pressure thruster mounted on at least one of said arms with its longitudinal axis at a substantial distance from said first-mentioned axis whereby the reaction of the thruster tends to aid in operating said arms, said thruster being pivoted to one of said segments and said one of said arms to the other.

7. A bulldozer adapted to be mounted on a vehicle comprising an earth-engaging blade, arms supporting the blade and adapted to be pivoted to the vehicle, means for tilting the arms including a fluid-pressure thruster mounted on one of said arms with its longitudinal axis substantially offset from the pivotal axis of the arms, whereby the reaction of the thruster aids in tilting the arms, and means to which the thruster is pivoted for tilting the arms on extension or contraction of the thruster.

8. A bulldozer comprising a blade, side arms tiltably carried on a vehicle for supporting said blade, a piston and cylinder thruster mounted on one of said arms with its axis offset from the axis about which said arms tilt, and a crank system having fixed bearings pivoted to said one of said arms and said thruster, whereby the force exerted by the thruster and the reaction resulting therefrom both apply torque to said one of said arms.

9. A bulldozer adapted to be mounted on a vehicle comprising an earth-engaging blade, arms supporting the blade, bearings on the vehicle for tiltably supporting said arms, a fluid pressure cylinder and piston, means projecting upwardly a substantial distance from one of said arms for supporting said cylinder and piston substantially over one of said bearings with their longitudinal axis substantially offset from the axis of said bearings, and a linkage connecting the piston to one of said arms, said linkage and said cylinder both tending to raise the arms on advance of the piston, whereby the reaction of the fluid on the cylinder is effective through a substantial moment arm to aid the piston in tilting said arms.

10. A bulldozer adapted to be mounted on a vehicle comprising an earth-engaging blade, arms supporting the blade, bearings on the vehicle for tiltably supporting said arms, means for causing tilting of the arms comprising a linkage pivoted to the arms and including meshing toothed members journaled on the vehicle, and a hydraulic jack connected to said linkage and one of said arms with its axis offset from said bearings.

EDWARD L. HARRINGTON.