

April 27, 1937.

J. KUCHAR

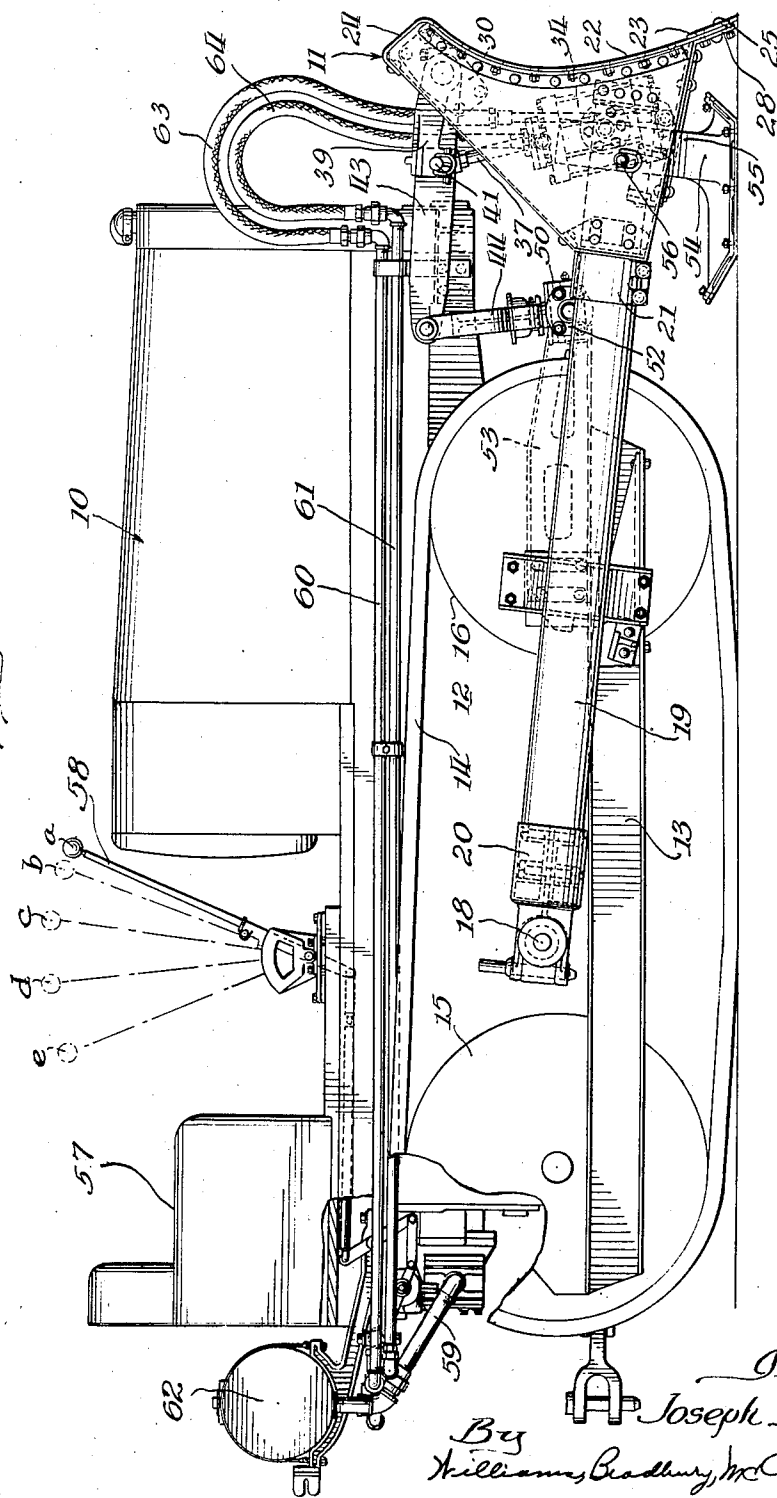
2,078,636

BULLDOZER

Filed Sept. 13, 1934

5 Sheets-Sheet 1

Fig. 1.



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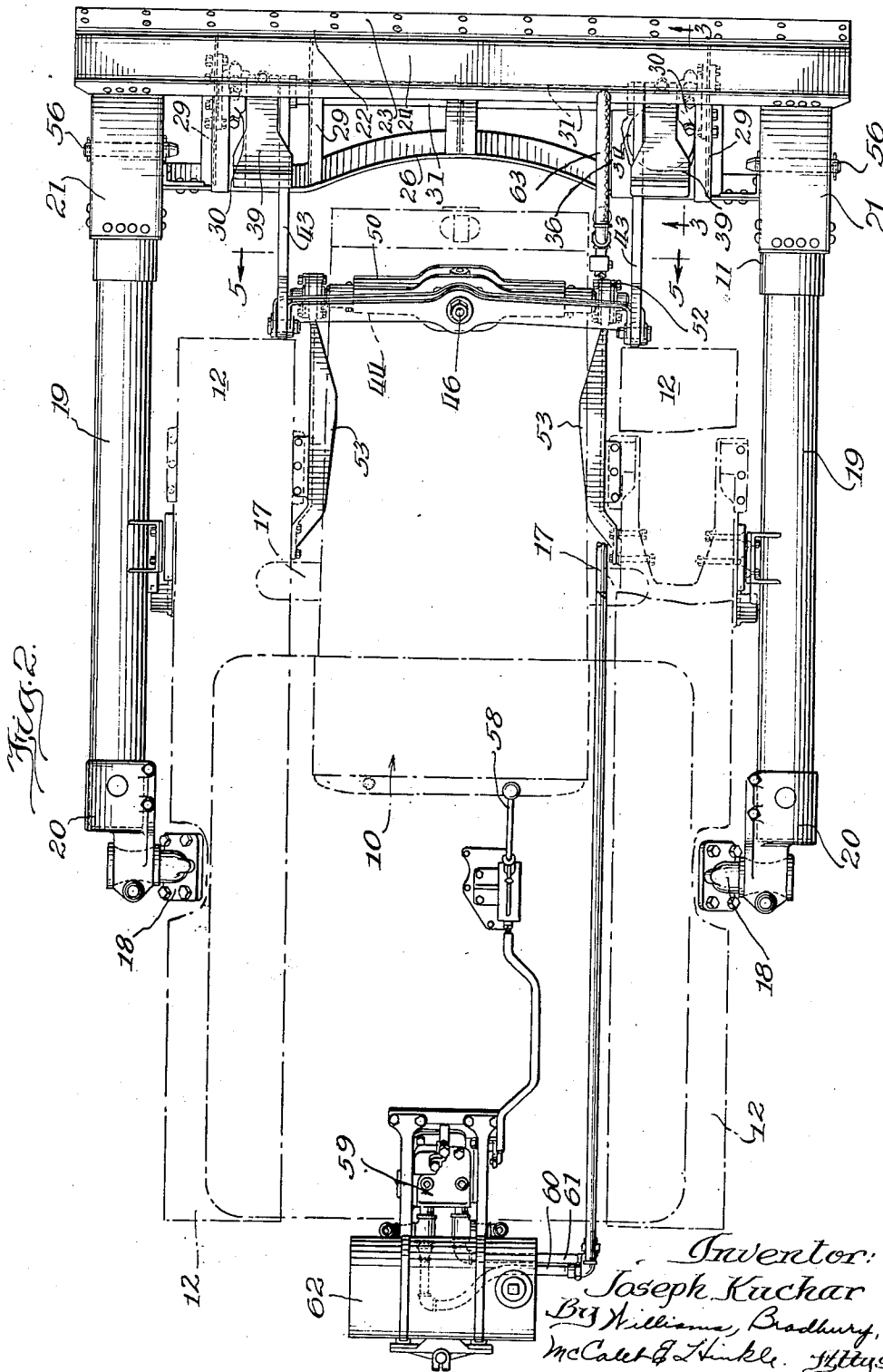
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April 27, 1937.

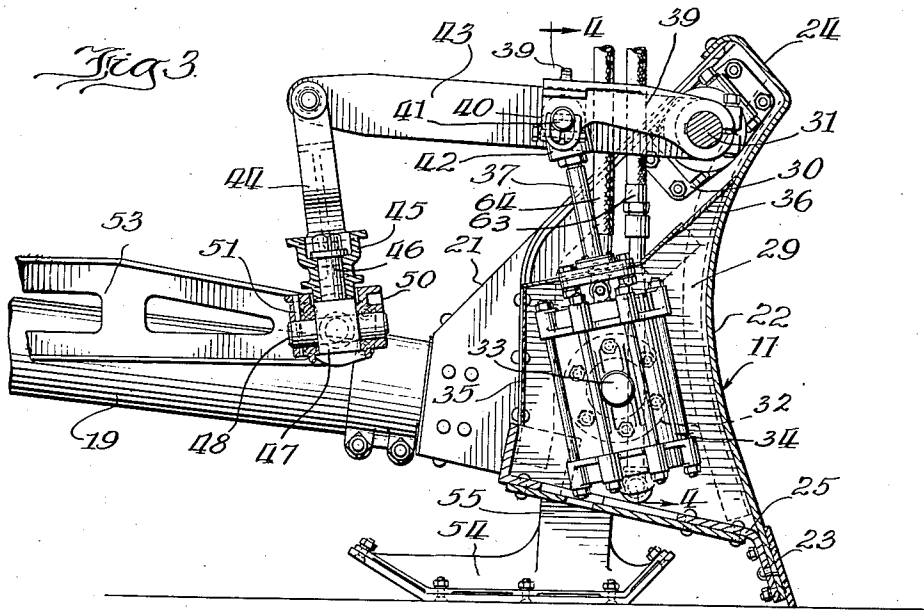
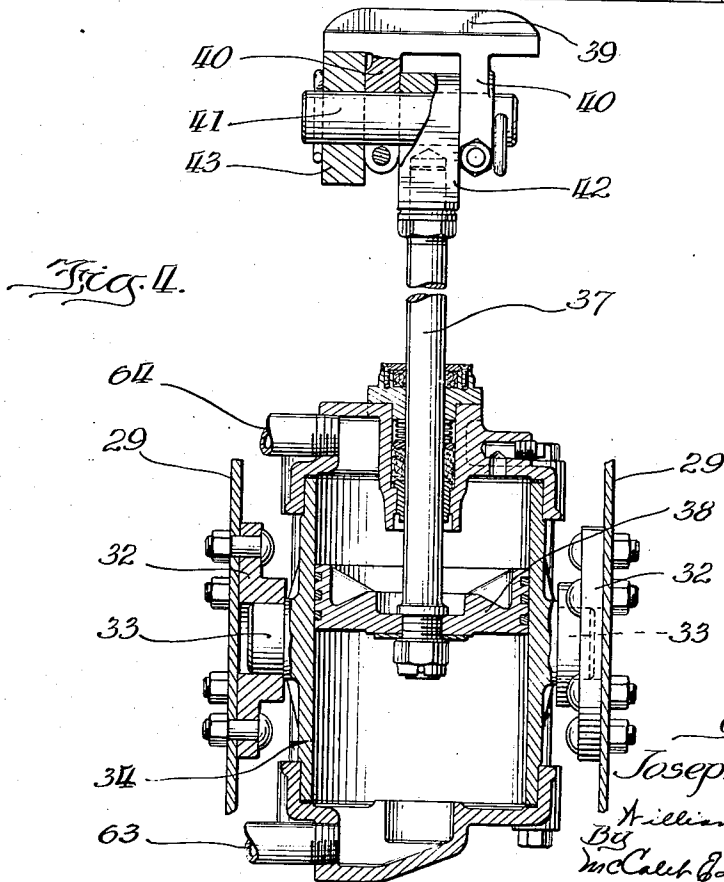
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2,078,636

BULLDOZER

Filed Sept. 13, 1934

5 Sheets-Sheet 3



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Filed Sept. 13, 1934

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Fig. 5.

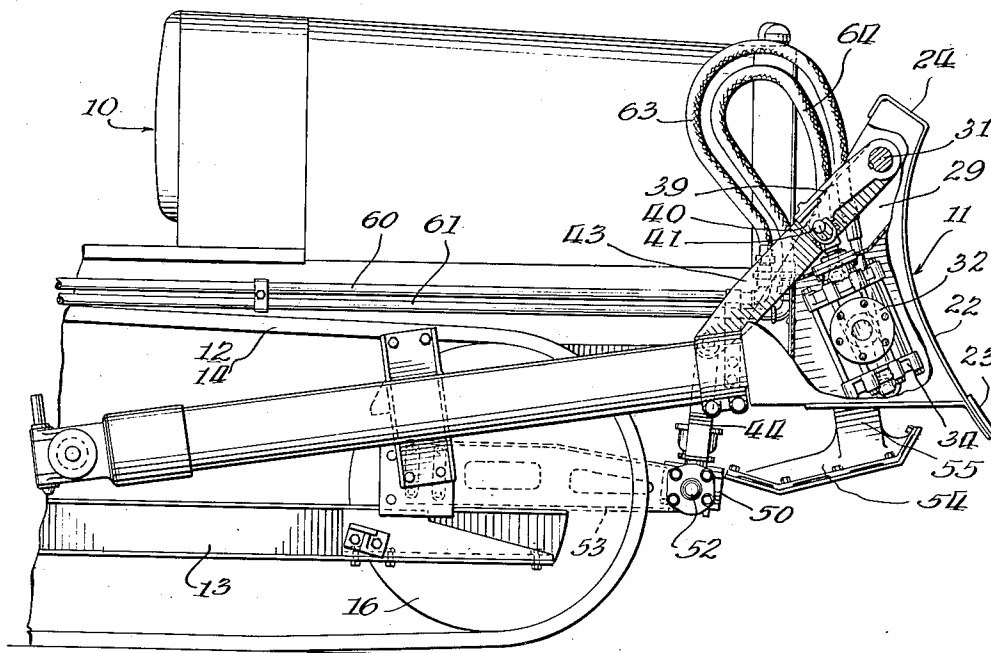
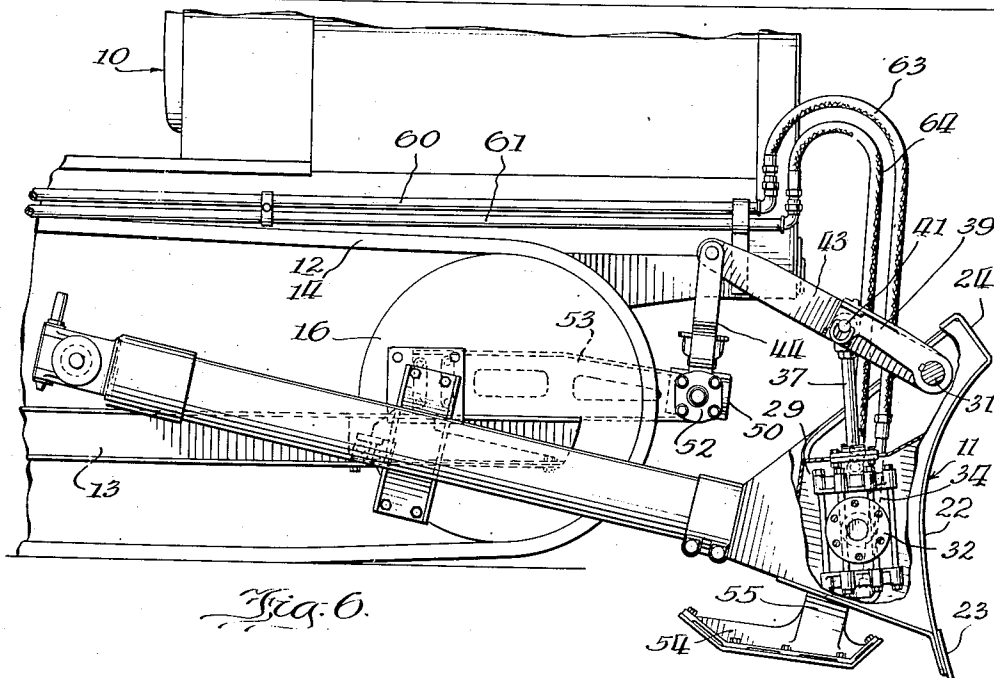


Fig. 6.

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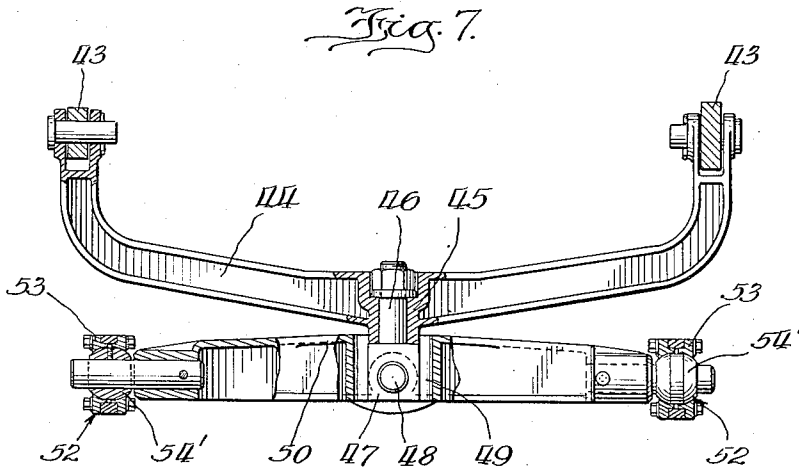
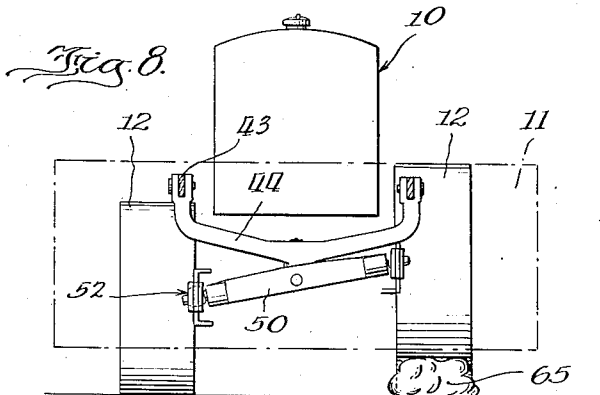
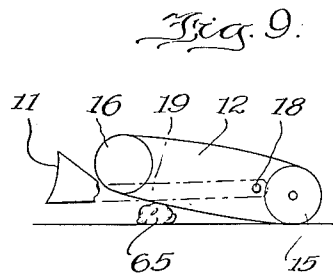
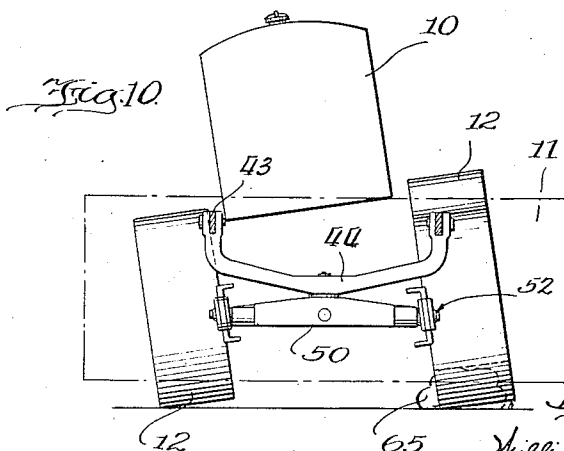
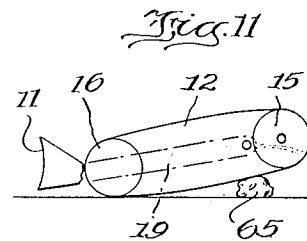
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2,078,636

BULLDOZER

Filed Sept. 13, 1934

5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE

2,078,636

BULLDOZER

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Application September 13, 1934, Serial No. 743,791

11 Claims. (Cl. 37-144)

This invention relates to bulldozers and has for its principal object to provide an improved bulldozer.

A further object of the invention is to provide a bulldozer in which the operating mechanism is more compact and more effective.

A further object of the invention is to provide an improved mounting for the bulldozer upon a tractor or the like.

A further object of the invention is to provide an improved equalizing supporting system for a bulldozer.

Other objects, advantages, and capabilities of the invention will appear from the following description of a preferred embodiment thereof illustrated in the accompanying drawings, in which

Figure 1 is a side elevation of a tractor equipped with my improved bulldozer, part of the tractor being broken away to illustrate the pump which supplies pressure fluid for the actuation of the bulldozer;

Fig. 2 is a plan view showing the bulldozer and pump in full lines and the tractor in phantom;

Fig. 3 is a sectional detail view taken on the line 3-3 of Fig. 2 showing the location and arrangement of the cylinder;

Fig. 4 is a sectional view taken through the cylinder on the line 4-4 of Fig. 3;

Fig. 5 is an elevational detail view, partly in section, showing the bulldozer at its highest point of adjustment;

Fig. 6 is a similar view showing the bulldozer at its lowest point of adjustment;

Fig. 7 is a detail view, partly in section, showing part of the equalizing structure;

Figs. 8 and 9 are diagrammatic front and side elevational views showing the relation of parts when the forward part of a wheeled structure is passing over an obstruction, and

Figs. 10 and 11 are similar views showing the relation of parts when the rearward part of a wheeled structure is passing over an obstruction.

Referring to the drawings, the reference numeral 10 designates a tractor upon which the bulldozer, designated as a whole by the reference numeral 11, is mounted. The tractor 10 is of the conventional type resting upon wheeled structures 12 on either side. The wheeled structure 12 comprises internal rigid elements such as 13, which provide a support for a belt or track 14, which belt passes over wheels 15 and 16 carried by said rigid elements 13. The whole wheeled structure 12 is pivotally connected to the body of the tractor by the axle of the wheel

15. The forward end of the tractor is supported on the wheels 12 by means of springs 17 on either side which project outwardly towards the wheels 12 and rest upon rigid elements 13 thereof.

It is convenient to remark here that when the forward end of one of the wheeled structures 12 meets an obstruction it rides up over it and is deflected upwards from the position shown in Fig. 1, rotating in counter-clockwise direction about the axle of the wheel 15, to a limited extent. It will be recognized that the deflection thus produced will have a greater influence at points on the wheeled structure remote from the axle of the wheel 15 and will have very little influence on points near this axle.

At a position near the axle of the wheel 15 is rigidly mounted on the rigid part of the wheeled structure 12 a pivot member 18 for the main arms 19 of the bulldozer. These arms 19 are preferably large tubes of great strength, which have mounted on their rear ends socket members 20 which are provided with suitable bearings for the reception of the pivots 18. The forward ends of the arms 19 are rigidly secured to housings 21, which support the main plate 22 of the bulldozer head. This main plate extends across the front of the tractor and across the arms 19 and housings 21 so as to form a rigid integral bulldozer head. At its lower edge and on its forward side the plate 22 is provided with a cutting edge 23 which is removably being held in position by means of bolts.

The main plate 22 of the bulldozer head is substantially concave as viewed from the front, and its upper edge is bent back rearwardly and downwardly to provide a strong upper rim 24. The main plate 22 is reinforced by suitable supporting elements on its rear side so as to prevent distortion during operation. On its rear side adjacent its lower edge the plate 22 is strengthened by an angle iron 25. This angle iron 25 extends across the whole width of the plate 22 and is secured thereto by means of rivets or bolts. The reinforcement for the plate 22 may suitably comprise a transverse beam 26 located in spaced relation to the plate 22 and rigidly mounted at each end upon the housings 21. The beam 26 may suitably be formed from angle iron and its center portion may suitably be bowed forward somewhat, as best seen in Fig. 2.

The main plate 22 of the bulldozer head is also reinforced by a plurality of vertical plates 29, the forward edges of which conform to the rear face of the main plate 22. The plates 29 comprise flanges by which they are secured to 55

the main plate 22, transverse beam 26 and angle iron 25. Certain of these plates 29 extend upwardly and fit snugly into the rim 24 at the upper edge of the plate 22. These latter plates 29 support bearings 30 for a rocking shaft 31 which extends transversely of the bulldozer and projects laterally on either side of the front end of the tractor. Two of the plates 29 adjacent the right-hand end of the main plate 22 are provided with bearings 32 for the trunnions 33 of a hydraulic cylinder 34. These two plates 29 are connected by a transverse rear plate 35 and transverse upper plates 36 so that the cylinder 34 is substantially enclosed. The upper plates 36 are provided with an opening which provides for free movement of the cylinder 34 and the piston rod 37 which projects upwardly, as shown in Fig. 3. The piston 38 is mounted on the lower end of the piston rod 37 and is located within the cylinder 34. The upper end of the piston rod 37 is pivotally connected to an arm 39 which is keyed upon the rocking shaft 31.

The arm 39 is preferably a casting and is of substantial width. On its under side it is provided with two downwardly extending webs 40 which are provided with openings for the reception of a pin 41. A head 42 is mounted on the upper end of the piston rod 37 and the pin 41 is adapted to pass through an opening therein. The pin 41 also extends through an opening near the forward end of a link 43 so that the link 43 is rigidly connected to the arm 39. The pin 41 is held in position by means of a cotter pin. The forward end of the link 43 is also keyed or otherwise rigidly secured to the rocking shaft 31 so as to turn therewith.

As best seen in Fig. 2, the cylinder 34 and associated arm 39 are mounted adjacent one end of the bulldozer. A similar arm 39 and link 43 are mounted on the rocking shaft 31 adjacent the other end of the bulldozer. This arm 39 and link 43 are connected together exactly the same way as the arm 39 and link 43 just described, but since it is preferred to provide only one cylinder, there is no piston rod 37 associated with the left-hand arm 39.

The links 43 extend rearwardly from the rocking shaft 31 and their rear ends are pivotally mounted in the bifurcated upper ends of a U-shaped bar 44 which extends transversely below the forward end of the tractor, its upwardly directed legs being located on either side of said forward end. At its center the U-shaped bar 44 is provided with a vertical bearing 45 whereby it is pivotally mounted upon a normally vertical pivot 46. The pivot 46 carries at its lower end a head 47 which receives a substantially horizontal pivot 48 located in the longitudinal direction of the tractor. The head 47 is located within an opening 49 in the center of a transverse beam 50 and the pivot 48 projects through openings in the beam 50, to which it is rigidly secured by suitable means, for example a pin 51, which is driven into place. The beam 50 is connected at each end by means of universal joints 52 with the forward ends of arms 53. The arms 53 extend forwardly from the wheeled structures 12, being mounted rigidly upon the internal rigid elements 13 of such wheeled structures. The universal joints 52 preferably include balls 54 which are freely slidable on the ends of the beam 50 so as to accommodate end play.

The bulldozer head is supported by feet 54 which have bearing surfaces adapted to rest on the ground. The feet 54 comprise shanks 55

which project upwardly into the housings 21. The housings 21 and the shanks 55 are provided with openings adapted to be brought into alignment and to receive pins 56 to maintain the feet 54 in desired position of adjustment with respect to the bulldozer head.

The bulldozer is controlled from the driver's seat 57 of the tractor 10 by means of the control lever 58 of the pump 59. This pump may be of any suitable type provided it is equipped with two lines 60 and 61 and a valve control whereby pressure fluid may be supplied to either of them at will and prevented from returning until it is desired to change the adjustment of the bulldozer. The pump 59 shown in the drawings may suitably be that described and claimed in my Patent No. 2,018,269, and entitled Fluid pressure mechanism. The pump control lever 58 has five positions, the lever being shown in full lines in Fig. 1 in the initial position *a*. In this position the clutch connecting the engine and pump is disconnected. When the lever 58 is moved to position *b* this clutch is engaged but the pump 59 is by-passed. When the control lever 58 is moved to position *c*, pressure fluid is delivered to the pipe 60, the pipe 61 being connected for return of fluid to the tank 62. When the lever 58 is moved to position *d*, the pump is by-passed and the pipes 60 and 61 are closed. When the lever 58 is moved to position *e* pressure fluid is supplied to the pipe 61, the pipe 60 being connected for return of fluid to the tank 62. The pipes 60 and 61 extend along the right-hand side of the tractor 10 to the front of the tractor and are connected by hoses 63 and 64 respectively to the lower and upper ends of the cylinder 34.

It will readily be understood, particularly from Figs. 5 and 6, that the supply of pressure fluid to the lower end of cylinder 34, as a result of the movement of the lever 58 to position *c*, causes a downward movement of the bulldozer head. When, however, pressure fluid is supplied to the upper end of the cylinder 34, as a result of the movement of the lever 58 to position *e*, the bulldozer head is moved upwardly. When the control lever 58 is moved to position *d*, the pump is by-passed and the pipes 60 and 61 are shut off from the pump and the tank 62. Consequently the position of the bulldozer head depends upon its mechanical mounting, the closing of the pipes 60 and 61 serving to prevent any movement of the piston 38.

Owing to the mounting of the cylinder 34 upon the head of the bulldozer and the characteristic leverage system to which its piston rod 37 is attached, I am enabled to control the position of the bulldozer head through a wide range, in fact, through a distance much greater than the length of the cylinder, as may readily be seen by a comparison of Figs. 5 and 6.

One of the outstanding advantages of the present machine is that the bulldozer head has a great tendency to remain in horizontal position, assuming work to start from a horizontal base. This characteristic greatly facilitates the attainment of a level surface since any irregularities initially present can be minimized and worked out by the simple expedient of taking another cut. To explain more fully the manner in which the equalizing and automatic leveling effects of the present bulldozer are obtained, let us consider the diagrammatic illustrations, Figs. 8, 9, 10, and 11. In Figs. 8 and 10 the wheeled structures 12 have been working on substan-

tially level ground. Let us assume that a boulder 65 falls into the path of the left-hand wheeled structure 12. The forward end of the wheeled structure 12 passes over the boulder and is elevated in the manner shown in Fig. 9, being rotated bodily to some extent in the clockwise direction (as viewed in Fig. 9), by the axle of the wheel 15. This rotation has practically no effect upon the pivot 18 for the left-hand arm 19 of the bulldozer, for the reason that the pivot 18 is very near the center of the wheel 15. As will readily be understood from Fig. 8, the left-hand arm 53 is considerably elevated by the presence of the boulder 65 under the forward part of the left-hand wheeled structure, because this arm 53 is mounted on that structure and projects forwardly therefrom. Consequently the left-hand end of the beam 50 (on the right, as viewed in Fig. 8) is substantially elevated relative to the left-hand end of the beam 50. Owing, however, to the mounting of the U-shaped bar 44 at the center of the beam 50, the only effect is to elevate the bar 44 to some extent without sloping the head of the bulldozer to any substantial extent. The head of the bulldozer is diagrammatically shown in dash-and-dot lines in Fig. 8 in order not to obscure the view of the beam 50 and the bar 44 which, of course, are behind the bulldozer head.

As the tractor continues forwardly the rear end of the left-hand wheeled structure 12 passes over the boulder 65, and while it is immediately below the wheel 15 the boulder does substantially elevate the left-hand pivot 18. This upward displacement of the pivot 18 takes place to a substantial extent only for the short distance of travel and while it undoubtedly causes some tendency to move the head of the bulldozer out of horizontal, this tendency is prevented by the feet 54 which are still riding upon the horizontal work face which has just been cut by the head of the bulldozer owing to the equalizing action just described. Owing to the length of the arms 19, the twist of the bulldozer head and mounting necessary for the preservation of a substantially horizontal cutting edge is provided without damage to the structure. It will readily be understood that by backing up and taking another cut any slight irregularities are removed from the work surface, together with obstructions such as the boulder 65. A large amount of work can very readily be performed since repeated adjustments on the part of the operator, in order to straighten the cutting blade to preserve a flat surface, such as were necessary in previously constructed bulldozers, are completely obviated.

Although the invention has been disclosed in connection with the specific details of a preferred embodiment thereof, it must be understood that such details are not intended to be limitative of the invention except in so far as set forth in the accompanying claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In combination, a tractor having track laying wheel structures pivotally mounted on the tractor adjacent their rear ends, said structures having a forwardly extending rigid framework resiliently supporting the tractor, a bulldozer pivotally mounted on the rigid frameworks of the wheeled structures adjacent their pivots, and a transverse beam pivotally supported by the

frameworks of both wheel structures at a forward position thereon, for supporting the bulldozer blade substantially horizontal.

2. In combination, a tractor having track laying wheel structures pivotally mounted on the tractor adjacent their rear ends, said structures having a forwardly extending rigid framework resiliently supporting the tractor, a bulldozer pivotally mounted near the rear of the tractor and having a blade structure, links pivotally mounted on said blade, a transverse member pivotally connected to said links, and a second transverse member pivotally connected to the first said transverse member at a central position, the last said member being supported by said frameworks at positions considerably forward of their pivoted mounting on the tractor.

3. A bulldozer comprising a blade and two rearwardly extending limbs whereby the blade may be pivotally mounted on a tractor, links pivotally mounted on the blade at their forward ends, equalizing means connected to the rear ends of said links and adapted to be connected to a tractor, and power means on the blade and operatively connected to said links whereby said links may be rotated relatively to the blade to adjust the elevation of said blade.

4. A bulldozer comprising a blade and two rearwardly extending arms, whereby the blade may be pivotally mounted on a tractor, a bar rotatably mounted on the blade and extending longitudinally thereof, rearwardly extending arms rigidly mounted on said bar an equalizer beam adapted to be carried by the tractor and having the rear ends of last said arms be pivotally connected thereto, and power means on said blade for rotating said bar to adjust the elevation of the blade.

5. A bulldozer comprising a blade, means for pivotally supporting said blade on a vehicle on a horizontal axis, arms rearwardly extending from said blade and held rigid thereon, a transverse beam to which said arms are pivotally connected, a second beam pivotally connected to the first said beam, and means for mounting the second said beam on independent wheeled structures pivotally mounted on said vehicle.

6. In combination, a tractor having relatively long track laying wheels pivotally mounted near their rear ends on an axle, means supporting the tractor on the wheels forwardly of said axle, said wheels comprising rigid frameworks, a bulldozer having a blade and rearwardly extending limbs pivotally mounted on the tractor adjacent said axle, a transverse bar mounted on said frameworks and adapted to be carried into oblique positions as the wheel frameworks swing irregularly on their pivotal mounting, a U-shaped beam pivotally mounted on the bar at its center, links pivotally connected to the ends of the U-shaped beam and to the blade, and means on the blade for holding the links rigid with respect to the blade for the purpose of maintaining the blade at a desired elevation.

7. In combination, a tractor having track laying wheel structures pivotally mounted on the tractor adjacent their rear ends, said structures having forwardly extending rigid frameworks supporting the tractor, a bulldozer pivotally supported from the tractor near the pivotal mounting of the wheel structures, and an equalizing linkage supported by the frameworks of both wheel structures at a forward position thereon, said equalizing linkage comprising a

pivotal connection in the longitudinal direction of the tractor whereby the bulldozer remains substantially horizontal irrespective of differential movements of the forward portions of said frameworks.

8. A bulldozer comprising a blade and two rearwardly extending limbs whereby the blade may be pivotally mounted on a tractor, a bar rotatably mounted on the blade and extending longitudinally thereof, arms rigidly mounted on said bar an equalizer adapted to be connected to said tractor and connected to the rear ends of said arms, and a hydraulic cylinder on said blade for rotating said bar to adjust the elevation of the blade.

9. A bulldozer comprising a blade, a foot at each end of the blade adapted to bear against the ground, long arms supporting said blade and adapted to be pivotally mounted on a tractor, and means at the front end of said bulldozer in-

cluding a pivoted equalizer beam for supporting the blade from the tractor.

10. A bulldozer comprising a blade, a foot at each end of the blade adapted to bear against the ground, long arms rigidly connected to said blade and adapted to be pivotally mounted on a tractor, means adjacent the front end of said bulldozer including linkages, and a pivoted equalizer beam for supporting the blade from the tractor, and hydraulic means mounted on the bulldozer adapted to actuate said linkages to vary the height of the blade.

11. A bulldozer comprising a blade, long arms mounted on the rear end of the tractor supporting said blade, and supporting means for each side of said blade adjacent the forward end of the tractor including a beam adapted to rock on an axis in the longitudinal direction of the tractor.

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