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BULLDOZER WITH RESILIENT MEANS FOR PUSHING OPERATIONS

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2 Sheets-Sheet 1

FIG. 1.

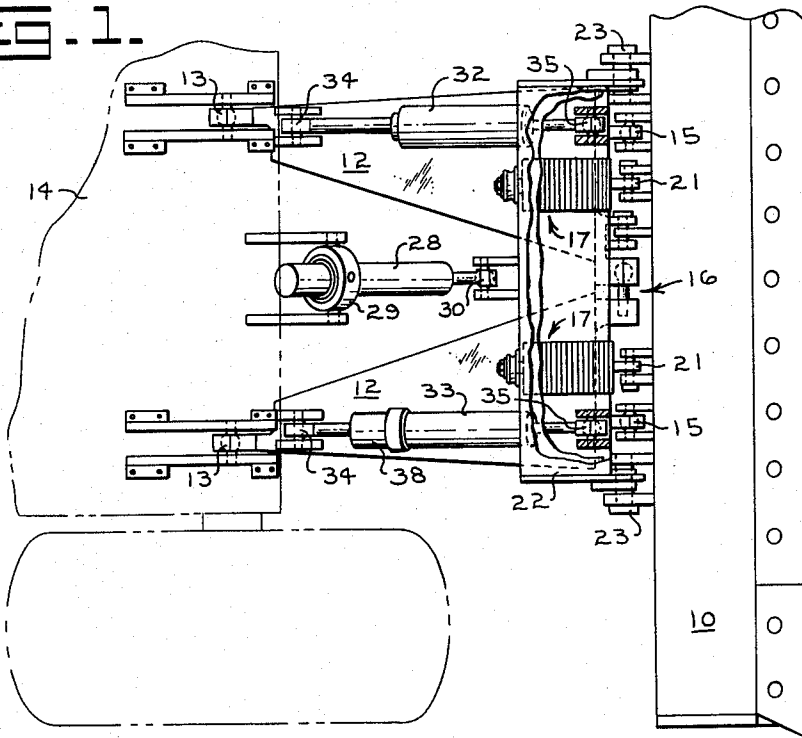
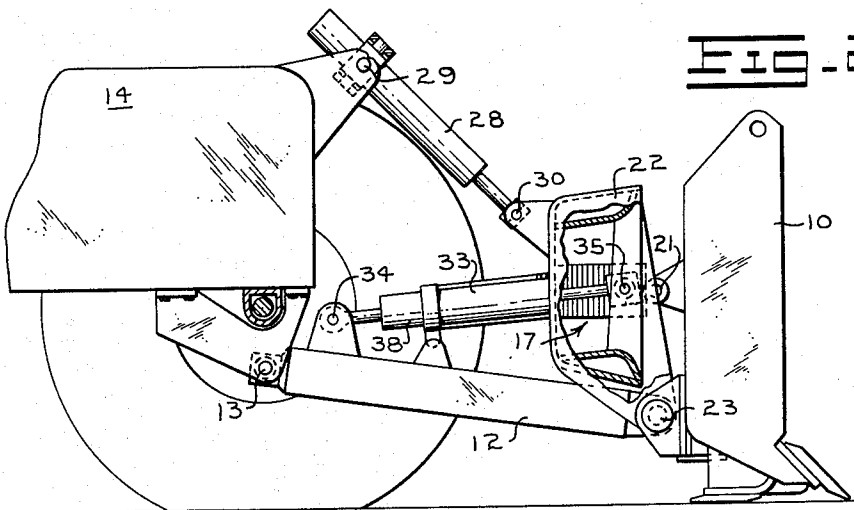


FIG. 2.



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FIG. 3.

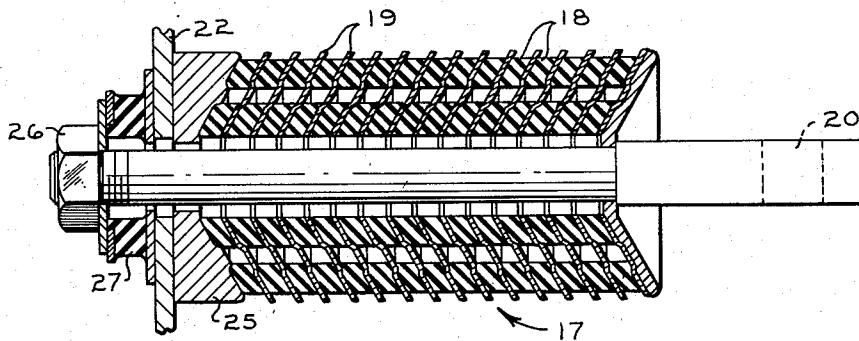
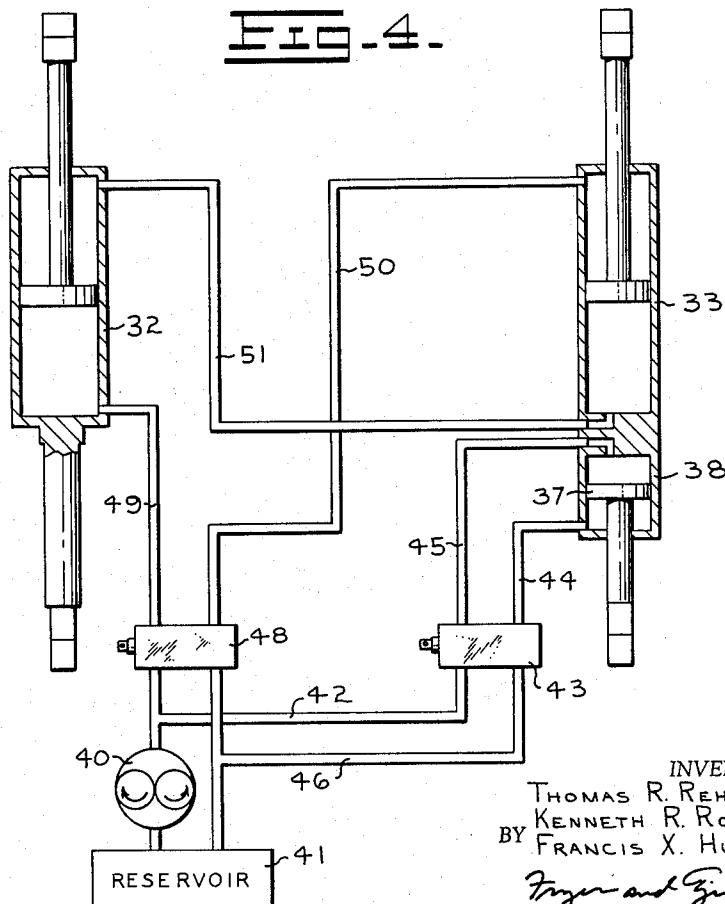


FIG. 4.



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BULLDOZER WITH RESILIENT MEANS FOR PUSHING OPERATIONS

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This invention relates to bulldozers with resilient means to cushion the shocks encountered during pushing operations and particularly with resilient cushioning means for a bulldozer constructed in a manner to enable ready adjustment of the bulldozer blade for ordinary bulldozing operations.

In moving of earth in large quantities with earthmoving scrapers, it is common practice to employ one or more tractors as pushers for assisting in the loading of the scrapers. The pushing tractors usually are equipped with a bulldozer which is employed to engage a push block on the rear framework of the scrapers. The initial contact between the blade of the bulldozer and the scraper push block is most often made when the machines are operating at speeds of five or six miles per hour and often in rough terrain so that the shock forces imposed on the tractor and scraper frames as well as on the bulldozer structure are excessively high and premature failures of various components are often experienced. It is desirable, therefore, that some means be provided to absorb these shock forces for protection of the vehicle components. This has heretofore been done by placing resilient means behind the bulldozer blade but means heretofore provided for this purpose interfere with or prevent normal adjustments of the bulldozer blade such as pitching and tilting which are required for many bulldozing operations. There are many types of earthmoving operations where pushers are employed but, because of the length of haul for the scrapers from the borrow pit to the fill, or because of the relative number of pushers and scrapers available, the pusher tractors may have free time which is often economically used for leveling, grading and clean-up operations.

It is the object of the present invention, therefore, to provide a resilient means for use in cushioning a bulldozer blade for pushing operations so constructed that the blade may be readily pitched and tilted for other ordinary bulldozing operations.

A further object of the invention is to provide a hydraulic circuit and jack means to enable the pitching and tilting function of a blade equipped as described.

Still further and more specific objects and advantages of the invention are made apparent in the following specification wherein the invention is described in detail by reference to the accompanying drawings.

In the drawings:

FIG. 1 is a fragmentary view in plan with parts broken away illustrating a bulldozer embodying the present invention shown as secured to the forward end of a tractor, a portion of which is shown in broken lines;

FIG. 2 is a view in side elevation with parts broken away of the mechanism shown in FIG. 1;

FIG. 3 is an enlarged view in cross section of one of the resilient elements shown in FIGS. 1 and 2; and

FIG. 4 is a schematic view illustrating the hydraulic circuit of the pitch and tilt means employed with the present invention.

Referring first to FIGS. 1 and 2 of the drawings, a bulldozer blade 10 of conventional construction is shown as carried at the forward ends of a pair of push arms 12 connected as by ball and socket joints 13 to the forward end of the tractor, a portion of which is shown at 14.

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forward ends of the push arms 12 are connected to the blade 10 by means of ball and socket joints 15 adjacent the outer sides of the push arms and the push arms are connected to each other adjacent their inner edges by means of a combined ball and socket and sliding connection, generally indicated at 16, disclosed and claimed in the United States patent to Lichti, No. 3,049,821. The purpose of this connection is to enable tilting of the bulldozer blade in the manner presently to be described without imposing destructive forces on the push arms.

The resilient means employed for cushioning the shocks of engagement between the bulldozer blade and the scraper to be pushed are in the form of rubber spring packs, shown at 17 in FIGS. 1 and 2, and better illustrated in FIG. 3 as a plurality of frusto-conical rubber cushion elements 18 separated by metal plates 19 and mounted on a rod which is provided at one end with an eye 20 for pivotal connections shown at 21 in FIG. 1 with the back of the bulldozer blade.

The housing for the cushion members 17 is shown at 22 in FIGS. 1 and 2 as pivotally connected to the back of the blade as by pins 23 adjacent its opposite ends. As shown in FIG. 3, an abutment member 25 behind the cushioning element engages the housing 22 and a nut 26 on the rod holds the parts in this assembled position. A rebound cushion of rubberous material shown at 27 is interposed between the nut and the rear face of the housing 22 for cushioning sharp rebound actions of the blade.

Raising and lowering of the blade is accomplished by means of a lift jack 28 shown in FIGS. 1 and 2 as pivoted between the tractor at 29 and the housing 22 at 30. A conventional hydraulic circuit and control means, not shown, is employed for operation of the lift jack.

Pitching of the blade 10 (rocking it forwardly about the axis of the ball joints 15 which connect it with the push arms 12) is accomplished by a pitch jack 32 associated with one push arm 12 and a combination pitch and tilt jack 33 associated with the other push arm. Both jacks have pin joint connections 34 with their respective push arms and ball and socket connections 35 with the inner forward wall of the housing 22. Consequently pitching of the blade is accomplished by simultaneous extension or retraction of the jacks 32 and 33.

Tilting of the blade (raising or lowering one end of the blade with respect to the other) is accomplished by extension or retraction of the jack 33 without alteration of the position of the jack 32. This is a well known operation fully described in the Lichti patent hereinabove referred to. However in the present application, a unique hydraulic circuit is employed for accomplishing tilting and pitching of the blade and this circuit is illustrated in FIG. 4.

In FIG. 4, the jack 33 is illustrated as having a secondary piston 37 in a cylinder 38 coaxial with and isolated from the main jack cylinder. Extension or retraction of jack 33 for blade tilting purposes is accomplished by supplying fluid under pressure only to the cylinder 38 while the pistons and jacks 32 and 33 are immobilized or fixed in any desired pitch adjusting position. A pump 40 directs fluid under pressure from a reservoir 41 through a line 42 and to a control valve 43. The control valve 43 selectively directs pressurized fluid to the rod end of cylinder 38 through a line 44 or to the head of the same cylinder through a line 45 and simultaneously directs return fluid from either end of the cylinder through a line 46 to the reservoir. The pump also directs fluid under pressure to a pitch control valve 48 operable to direct fluid selectively through a line 49 to the head end of jack 32 or through a line 50 to the rod end of jack 33. The rod end of jack 32 and the head end of jack 33 are connected by a line 51. Consequently fluid from one pitch jack is returned to the reservoir upon operation of the pitch jacks

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since the operation of one jack effects simultaneous operation of the other jack with its displaced fluid. In this connection, the jacks 32 and 33 have cylinders of the same length but different diameters. The diameter of jack 32 is sufficiently greater than that of jack 33 to equalize the volume contained in the rod end of jack 32 and the head end of jack 33. Consequently when fluid under pressure is directed to the head end of jack 32 as for pitching the blade forwardly, the fluid displaced from its rod end extends the piston of the jack 33 the same distance, and at precisely the same speed, as the piston of jack 32. Similarly, the pistons are retracted at the same speed when fluid under pressure is directed to the rod end of jack 33 and uniform pitching of the blade is always achieved.

With the construction described above, a bulldozer blade with cushioning means for use in pushing operations is easily and accurately adjusted through different pitch and tilt positions to afford unusual versatility to the tractor mounted bulldozer.

One of the advantages of the invention is that the arrangement of the lift jack, high on the tractor as shown in FIG. 2 and the pitch and tilt jacks, low on the push arms, provides a triangular brace opposing rearward movement of the housing 22. Thus shocks transmitted through the blade which rock it rearwardly about its **pivotal connections with the push arms are absorbed by the cushioning means between the blade and the rigidly supported housing.**

We claim:

1. In combination with a tractor and a bulldozer blade connected thereto by push arms, pivotal connections between the lower portion of the blade and the push arms, a housing behind the blade pivotally connected thereto coaxially with the push arm pivots, shock cushioning means between the back of the blade and said housing,

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and adjustable means between the housing and the push arms to vary the pitch attitude of the blade with respect to the ground.

2. The combination of claim 1 in which the adjustable means comprises hydraulic jacks.

3. The combination of claim 1 in which the adjustable means comprises a pair of blade pitch jacks between the push arms and the housing.

4. The combination of claim 3 in which a blade lift jack extends between the housing and a position on the tractor above the top of the housing.

5. The combination of claim 3 in which the rod end of one pitch jack is connected by a closed circuit to the head end of the other whereby both jacks are actuated in the same direction by fluid under pressure directed to one end of one jack.

6. The combination of claim 5 wherein the jacks are of different diameters so that the displacement from the rod end of one is equal to displacement from the head end of the other during equal piston travel.

7. The combination of claim 3 including a blade tilt jack combined with and coaxially aligned with one of the pitch jacks, and means for directing actuating fluid selectively to the tilt jack or to both of the pitch jacks.

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