June 8, 1965 K. J. KOLINGER 3,187,448

BULLDOZER BLADE TILTING ARRANGEMENT

Filed July 24, 1963 2 Sheets-Sheet 1

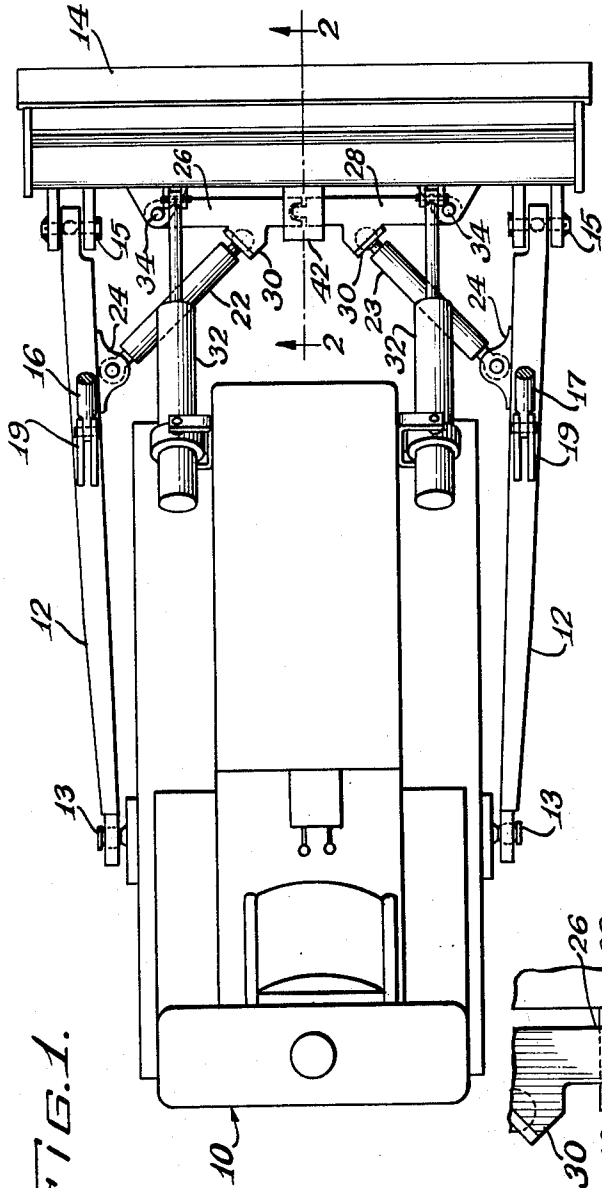


FIG. 1.

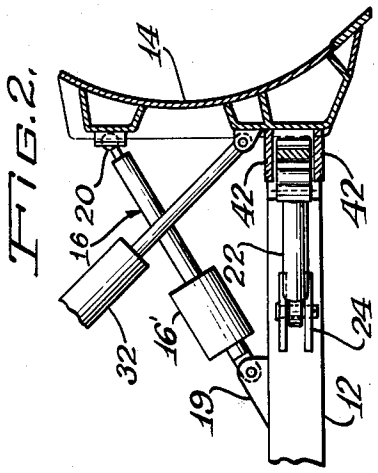


FIG. 2.

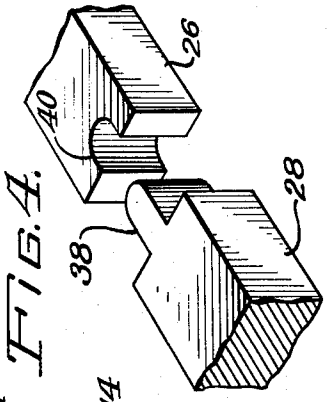


FIG. 4.

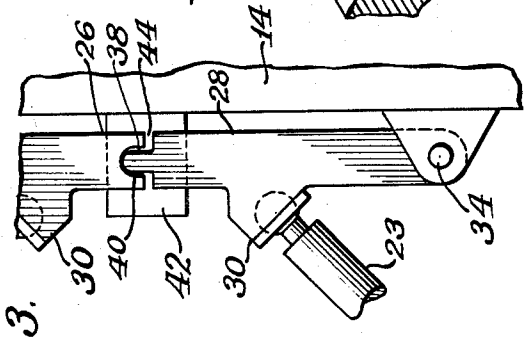


FIG. 3.

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BULLDOZER BLADE TILTING ARRANGEMENT

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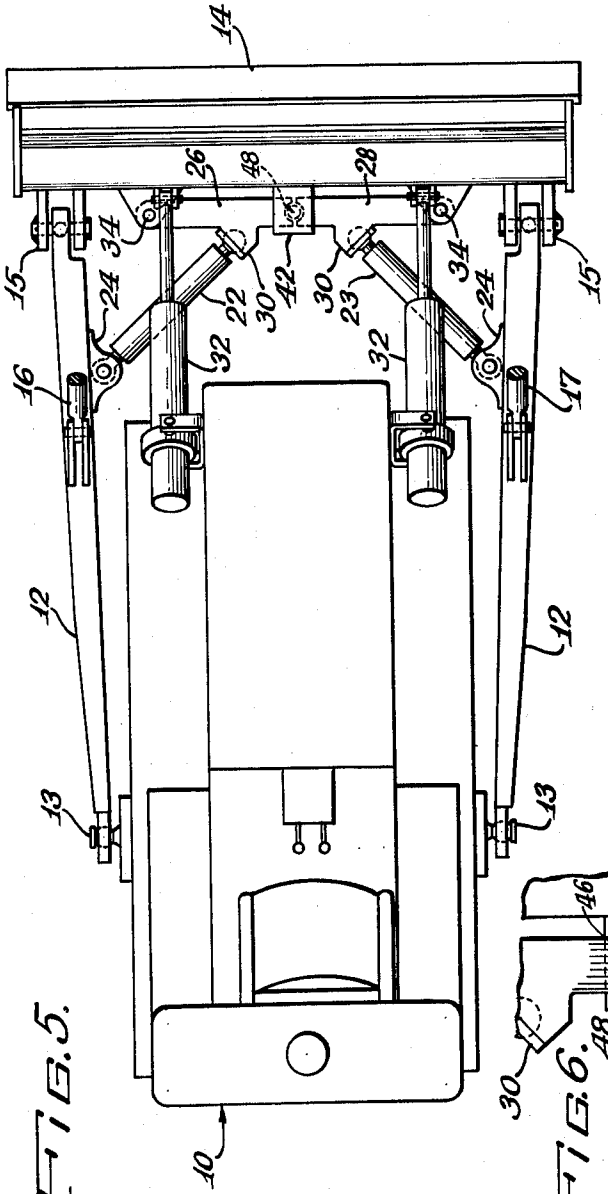


FIG. 5.

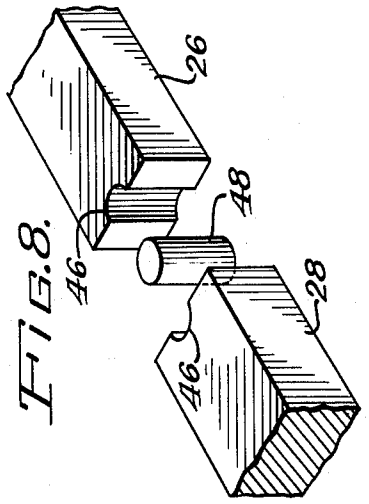


FIG. 8.

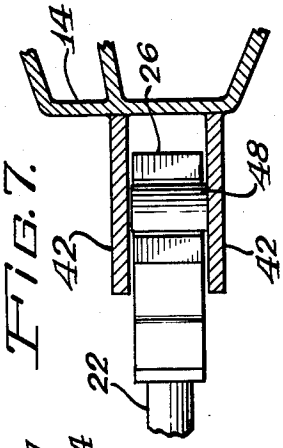


FIG. 7.

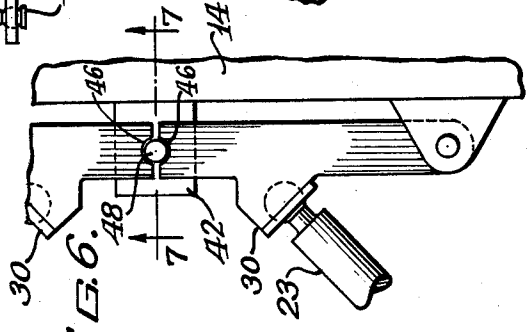


FIG. 6.

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BULLDOZER BLADE TILTING ARRANGEMENT

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Filed June 24, 1963, Ser. No. 289,849
9 Claims. (Cl. 37—144)

This invention relates generally to bulldozers and more particularly to means for bracing the blades of tiltable bulldozers to prevent fatigue damage resulting in part from stresses which are set up when a blade is adjusted to its tilt position, and in part from stresses which are imparted by the application of a side load to the blade.

When the blade of a conventional bulldozer is tilted, the diagonal braces are subjected to compressive loads, which in turn are reacted upon by the push arms and impart thereto bending stresses. When a conventional bulldozer is tilted and subjected to a side load the bending stresses in the pusharm often are of sufficient magnitude to result in fatigue failure.

It is an object of the present invention to provide a mounting for the diagonal braces of a tiltable-type bulldozer blade through which the forces above referred to are materially reduced and through which many of the stresses to which the bulldozer structures are subjected are almost completely eliminated.

It is a further object of the present invention to provide a mounting for the diagonal braces of a tiltable-type bulldozer blade which will result in distribution of side loads equally between the two pusharms.

Further and more specific objects and advantages of the invention will become apparent by reference to the following specification and the accompanying drawings wherein:

FIGURE 1 is a schematic view of a tractor with a bulldozer blade embodying the present invention;

FIGURE 2 is a sectional view taken on line 2—2 of FIGURE 1;

FIGURE 3 is a fragmentary plan view showing the attachment of the diagonal braces to the blade;

FIGURE 4 is a diagrammatic view showing the details of the tongue and groove arrangement;

FIGURE 5 is a view, similar to FIGURE 1, showing a modification of the invention;

FIGURE 6 is a fragmentary plan view, similar to FIGURE 3, showing a modified form of attachment of the diagonal braces to the blade;

FIGURE 7 is a sectional view taken on line 7—7 of FIGURE 6; and

FIGURE 8 is a diagrammatic view showing the details of the modified arrangement.

Referring now to FIGURE 1 of the drawings, a tractor, generally indicated at 10, is shown as provided with a bulldozer blade 14 carried at the forward end of a pair of push arms 12. At their rearward ends the push arms 12 are connected in a conventional manner to the track frames of the tractor as by ball and socket type joints shown as at 13. The bulldozer blade is pivotally connected to the forward ends of the push arms by ball and socket type joints or, as shown, by hinged connections 15 and held in the erect position by braces known as tilt braces and shown at 16 and 17. Either or both of the tilt braces 16 and 17 includes adjustable means which may be either mechanical or in the form of a conventional extensible hydraulic cylinder as at 16'. The tilt braces are connected by pivot pins and brackets 19 to the tops of the push arms 12 and by ball and socket joints 20 to the back of the blade adjacent its upper edge. A pair of diagonal braces 22 and 23 extend between the inner sides of the push arms to which they are pivotally connected with brackets shown at 24, and these diagonal braces are connected at their other ends to a pair of links 26 and 28

by means of ball and socket joints 30. Conventional lift jacks 32 extend between the tractor and the bulldozer blade to which they are connected for raising and lowering the blade. The lift jacks are shown for purposes of illustration only, since the present invention is also applicable to bulldozers wherein other means, such as cable controls, may be employed in place of the lift jacks 32 to raise and lower the blade 14.

To effect tilting of the blade one or the other of the tilt braces 16 or 17 is lengthened, for example by the extension of a hydraulic cylinder to which fluid would be supplied in a conventional manner. Similarly, the blade could be tilted by shortening one of the tilt braces while at the same time elongating the other. Regardless of the means employed to tilt the blade, the side of the blade nearer to the longer of the two tilt braces will be elevated while the side nearer to the short tilt brace will be lowered. When the blade of a conventional bulldozer is tilted both diagonal braces 22 and 23 are placed in compression which imposes a bending stress on each of the push arms 12. When a side load is imposed on the blade, one diagonal strut is loaded in compression while the other one is loaded in tension. When both tilt and side loads are imposed on the bulldozer, one diagonal strut will have a high magnitude of load due to the addition of forces, the other diagonal strut will have a much lower load due to the subtraction of forces. Essentially the force on one push arm will be much greater than the other, therefore the magnitude of bending stress will be much higher on one push arm than the other.

Through the present invention the loads are distributed equally between the two push arms thereby reducing the bending stress on the push arms. This is accomplished, as best shown in FIGURES 2, 3, and 4 by connecting the inner ends of the diagonal braces 22 and 23 to links 26 and 28 respectively through the ball and socket joints 30. The links 26 and 28 are pivotally pinned at 34 to the back of blade 14. Link 28 is provided with an arcuate tongue 38 which tongue engages a groove 40 in link 26. Links 26 and 28 extend substantially parallel to the back of blade 14 and are positioned between a pair of plates 42 secured to the back of blade 14. The plates 42 limit the movement of the links and especially the movement of the tongue and groove arrangement 38 and 40 in a substantially vertical plane, while permitting movement of the tongue and groove in a substantially horizontal or longitudinal plane. A clearance 44 is provided between the ends of links 26 and 28 on their mating surfaces, so that only the tongue 38 and groove 40 are in contact. This permits the tongue and groove arrangement to move forwardly or backwardly to the blade 14 as the links pivot about the pins 34.

With the construction described upon tilting of the blade by the lengthening of one of the tilt braces 16 or 17 relative to the other, both diagonal braces tend to be compressed as described above. However, due to the ability of links 26 and 28 to pivot about pins 34, the diagonal braces are relieved of the compressive load, and the application of forces which tend to bend the push arms outwardly is eliminated. When a side thrust is imparted to the blade, whether or not the blade is tilted, the tensile stress on the one brace and the compressive stress in the opposite brace are equalized due to the action of the links 26 and 28. That is, the brace under compression attempts to pivot the link to which it is connected toward the blade 14 while the brace under tension is attempting to pivot the link to which it is connected away from the blade 14. Because the links are in contact with each other through the tongue 38 and groove 40, the load of each diagonal brace is transmitted to the other, therefore keeping the system in equilibrium and thereby

distributing the side thrust loads equally between the two diagonal braces. It follows that the loads would be distributed equally between the two push arms and the stresses imposed would be of equal magnitudes.

Referring now to FIGURES 5 through 8, there is shown a modification of the present invention. A pair of push arms 12 are pivotally mounted by means of ball and socket joints 13 to tractor 10 and are connected at their other ends to the blade 14 by means of ball and socket joints or, as shown, hinge connections 15. A pair of lift jacks 32 are also connected between the tractor 10 and the blade 14. A pair of tilt braces 16 and 17, similar to the type described in connection with the embodiment shown in FIGURES 1 through 4, are connected between the top of each push arm and the upper edge of the blade 14. A pair of diagonal braces 22 and 23 are connected to the inner edges of the push arms by means of pivotal connections 24 and are respectively connected to a pair of links 26 and 28 by means of ball and socket joints 30. Links 26 and 28 are pinned to the back of blade 14 by means of pivotal pin 34. Each link is provided with a substantially semi-circular recess or groove 46. A pin 48 is disposed between the two links 26 and 28 and is engaged by recesses 46. A pair of plates 42 secured to the back of blade 14 operate in the same manner as described above to substantially limit the travel or movement of the pin 48 and recessed links 26 and 28 in a vertical plane while permitting movement in a substantially horizontal plane. The pin and recess arrangement between the two links 26 and 28 functions in the same manner as the tongue and groove arrangement shown in the embodiment of FIGURE 1 to permit the links 26 and 28 to pivot about points 34 to relieve the stresses on the push arms caused by tilting the blade. Similarly, the side thrust loads are distributed equally between the two diagonal braces in the same manner as with the tongue and groove arrangement.

I claim:

1. In a bulldozer blade mounting which comprises push arms secured to the blade, tilt braces extending upwardly between the tops of the push arms and the blade, and diagonal braces extending inwardly from the inner sides of the push arms to the blade and means to adjust the length of at least one of said tilt braces to effect tilting of the blade, means to reduce stresses set up in the mounting upon such tilting including, a pair of links pivotally pinned to said blade, one diagonal brace being connected to each of said links, engaging means on said links operatively positioning said links while permitting the same to pivot relative to each other, and plate means mounted on the back of said blade for limiting the movement of said engaging means in a substantially vertical plane while permitting movement of said engaging means in a substantially horizontal plane.

2. The invention according to claim 1 wherein said engaging means comprises a groove in the end of one of said links and an arcuate tongue on the other of said links, said tongue mating with said groove.

3. The invention according to claim 1, in which said engaging means comprises a substantially semi-cylindrical groove in the free end of each of said links, and a pin engaging each of said semi-cylindrical grooves.

4. A bulldozer blade mounting comprising a pair of push arms secured to the blade, a pair of tilt braces connected between said push arms and said blade, at least one of said tilt braces being adjustable for tilting said blade, a pair of links pivotally connected to said blade and substantially parallel thereto, a pair of diagonal braces, each diagonal brace pivotally connected at one end to one of said links and at the other end to one of said push arms, engaging means operatively positioning the free ends of said links, and plate means secured to said blade and engaging said engaging means for limiting movement thereof in a substantially vertical plane while permitting movement thereof in a substantially horizontal plane whereby when said blade is tilted said diagonal braces will move pivoting said links and relieving stresses on said push arm.

5. The bulldozer blade mounting according to claim 4 wherein said engaging means comprises an arcuate groove on one of said links and a complementary arcuate tongue on the other of said links mating with said groove.

6. The bulldozer blade mounting according to claim 4 wherein said engaging means comprises an arcuate groove on the free end of each of said links and a complementary arcuate pin engaging said grooves.

7. A bulldozer blade mounting comprising a pair of push arms secured to the blade, a pair of tilt braces connected between said push arms and said blade, at least one of said tilt braces being adjustable for tilting said blade, a pair of links pivotally connected to said blade and extending toward each other substantially parallel to said blade, a plurality of diagonal braces each brace pivotally connected at one end to one of said links and at the other end to one of said push arms, first groove means on the free end of at least one of said links, complementary engaging means at least partially retained on the free end of said other link for engagement with said groove means, and limiting means attached to said blade and engaging said free ends of said links for limiting the movement thereof in a substantially vertical plane whereby when said blade is tilted said diagonal braces will move pivoting said links and relieving stresses on said push arms.

8. A bulldozer blade mounting according to claim 7 wherein said engaging means comprises a complementary arcuate tongue secured to the free end of said other link.

9. A bulldozer blade mounting according to claim 7 wherein said engaging means comprises second groove means on the free end of said other link, and a complementary arcuate pin partially retained within said second groove means and engaging said first groove means.

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