March 25, 1958 E. D. DUKE ET AL 2,827,717

HYDRAULICALLY OPERATED PITCH AND TILT DOZER

Filed April 15, 1955 2 Sheets-Sheet 1

Fig. 1.

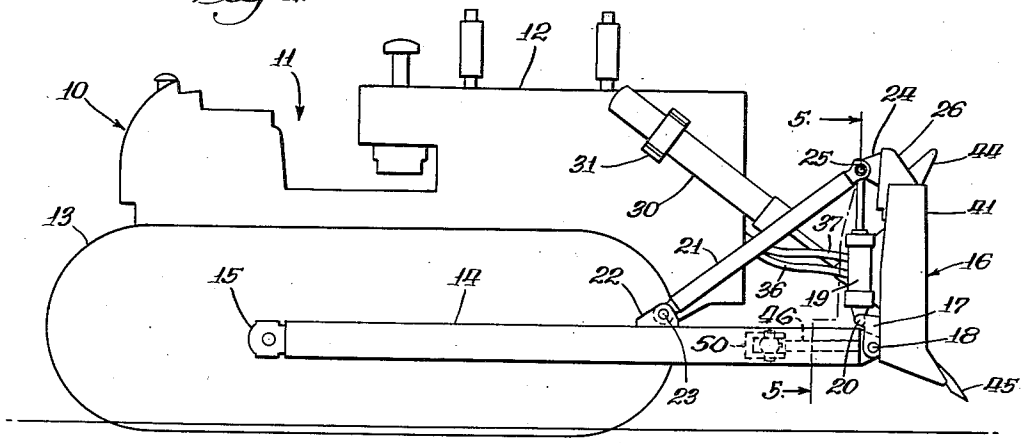


Fig. 3.

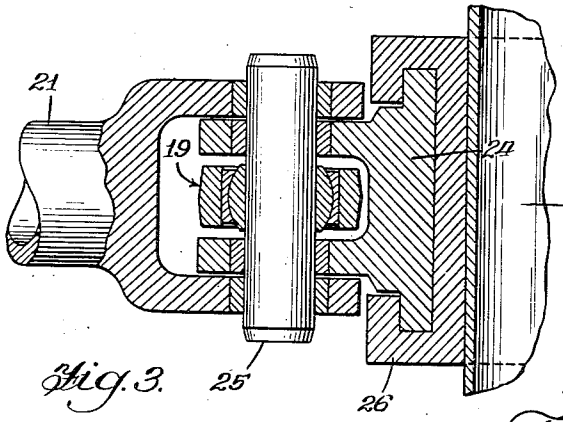


Fig. 2.

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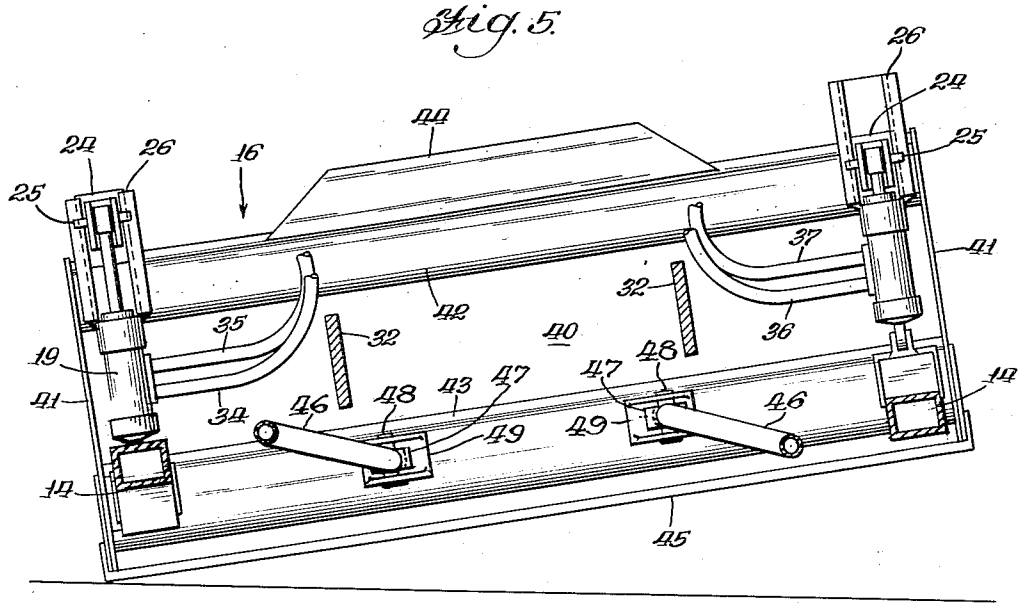
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Fig. 5.



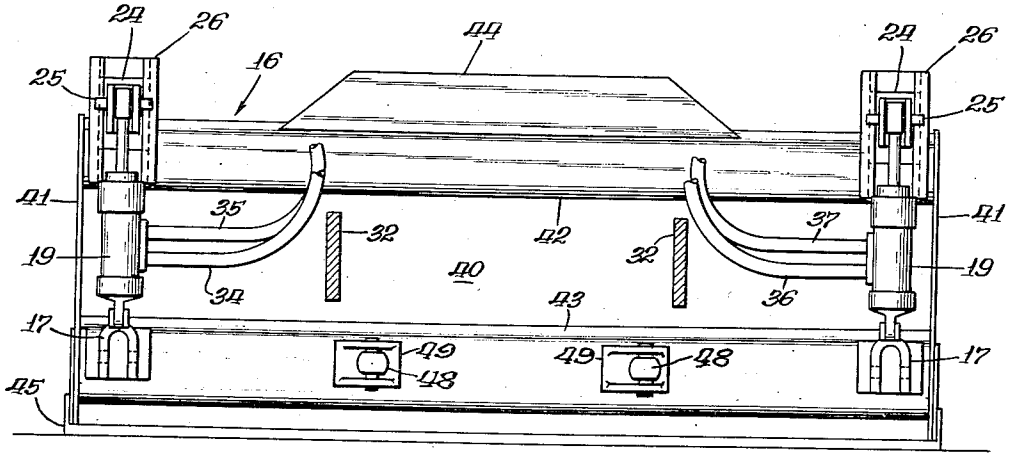


Fig. 4.

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HYDRAULICALLY OPERATED PITCH AND TILT DOZER

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Application April 15, 1955, Serial No. 501,529

7 Claims. (Cl. 37—144)

This invention relates generally to bulldozers and more specifically to a bulldozer provided with hydraulic pitch and tilt means for the blade or moldboard thereof.

Many means are known in the art by which the blade or moldboard of the bulldozer may be adjusted to various angles of pitch and tilt. However, these pitch and tilt means generally require that the angles of pitch and tilt be varied through some mechanical adjustment at the moldboard and cannot be operated or controlled from the operator's station on the bulldozer.

It is the object of the present invention to provide pitch and tilt means for a bulldozer which are simple in construction, efficient in operation, and which may be operated to pitch or tilt the blade from the operator's station on the tractor.

Other objects and features of the present invention will be apparent upon a perusal of the following specification and drawings of which:

Figure 1 is a side elevational view of a bulldozer constructed according to the present invention;

Figure 2 is an enlarged fragmentary view of the structure shown in Figure 1;

Figure 3 is a partial cross-sectional view of the structure shown in Figure 2 and taken along the line 3—3;

Figure 4 is a rear view of the blade assembly removed from the push beams, the struts, the bracing links and the hydraulic rams extending from the tractor; and

Figure 5 is a rear view of the blade assembly in one position of tilt but removed from the struts and the hydraulic rams extending from the tractor and showing the push beams in cross section.

The present embodiment is the preferred embodiment but it is to be understood that changes can be made in the present embodiment by one skilled in the art without departing from the spirit and scope of the present invention.

For a detailed description of the present invention, reference is made to the drawings. The tractor **10** is of the crawler type and comprises an operator's station **11**, an engine compartment **12**, and a crawler track mechanism **13**.

A pair of push beams **14** are provided and are each mounted at one end thereof to the track mechanism **13** through a pair of trunnions **15** positioned on each side of the tractor **10**. The trunnions **15** permit pivoting of the push beams **14** about an axis transversely of the tractor **10** and further a limited amount of pivoting of the push beams **14** about their longitudinal axes.

A blade or moldboard **16** of any type well known in the art is also provided. The blade **16** comprises a curved plate **40**, a pair of side walls or wings **41** secured to plate **40**, an upper bracing member **42** and a lower bracing member **43** secured to the rear surface of plate **40** and to side walls **41**, a plate **44** upstanding from upper bracing member **42**, and a cutting edge **45** removably secured to the lower longitudinal edge of plate **40**. The lower rear side sections of the moldboard **16** are each provided with a flange **17** mounted thereto. The flanges **17** are each

formed to have a lower U-shaped portion and an upper U-shaped portion with each of the portions being provided with a pair of openings axially aligned therethrough. The other or forward end of each push beam **14** is pivotally mounted between the lower U-shaped portion of one of the flanges **17** by means of pivotal mounting means **18**.

A pair of double acting hydraulic rams **19** are also provided. The head end of each of the hydraulic rams **19** is pivotally mounted between the upper U-shaped portion of one of the brackets **17** by means of pivotal mounting means **20**. A pair of struts **21** are also provided, and each of the struts **21** are pivotally mounted at one end thereof to a bracket **22** by means of pivotal mounting means **23**. Each bracket **22** is secured to one of the push beams **14** intermediate the ends thereof. A pair of slide members **24** are also provided and are each formed to have a pair of projecting flange portions. The projecting flange portions of each of the slide members **24** are provided with a pair of axially aligned openings therethrough as can easily be seen in Figure 3. The other end of one of the struts **21**, the rod end of one of the hydraulic rams **19**, and the projecting flange portions of one of the slide members **24** are pivotally interconnected by a pin **25**. The other ones of the struts **21**, the hydraulic rams **19** and the slide members **24** are also connected in an identical manner. It can thus be seen that if the hydraulic ram **19** on the right side of the tractor **10**, as shown in Figure 1, is contracted, the slide member **24** will be moved downwardly and forwardly of its position as shown in Figure 1. Further, if the hydraulic ram **19** is extended, the slide member **24** will be moved upwardly and rearwardly from its position as shown in Figure 1.

The upper rear side sections of the blade **16** are each provided with a channel member **26** which is secured thereto. Each of the channel members **26** are positioned directly above one of the flanges **17** with the channel of the channel member **26** positioned to lie in a vertical direction, as can readily be seen in the drawings. The slide members **24** and the channels of the channel members **26** are formed to have cooperating surfaces permitting the slide members **24** to move upwardly and downwardly within the channels of the channel members **26**, as the hydraulic rams **19** are extended and contracted. The length of stroke of the hydraulic rams **19**, and the length of the struts **21** are such that the hydraulic rams **19** lie in a substantially vertical plane, and that the moldboard **16** is in a substantially upright position, with the hydraulic rams operated to some position between completely contracted and completely extended, as is substantially shown in Figures 1 and 4.

To properly brace the moldboard **16** relative to the push beams **14**, a pair of bracing links **46** are provided. One end of each of the bracing links **46** is provided with a universal socket member **47**. The socket members **47** are each mounted about a ball and pin member **48**, and the ball and pin members **48** are mounted within a pair of brackets **49** which are secured to the lower bracing member **43** on the rear surface of the moldboard **16** in a spaced apart relationship to each other intermediate the ends of the moldboard **16**. The other or rear ends of each of the bracing links **46** are mounted to the push beams **14** intermediate the ends thereof by a similar arrangement and are designated generally with the numeral **50** in Figure 1.

To raise and lower the moldboard assembly a pair of hydraulic rams **30** are provided. Only one hydraulic ram **30** is shown in Figure 1, however the other hydraulic ram **30** is disposed on the other side of the tractor **10** in the same position. The head end of each of the hydraulic rams **30** is pivotally mounted to the tractor **10** by means of pivotal mounting means **31**. The rod end of each of the hydraulic rams **30** is pivotally mounted to the rear

face of the moldboard **16** through a bracket **32**. As the hydraulic rams **30** are contracted the blade **16** is raised from the ground as the push beams **14** are pivoted about trunnions **15** in a counterclockwise direction, as viewed in Figure 1. As the hydraulic rams **30** are extended, an opposite pivoting takes place to lower the blade **16**. If desired, any cable operated means well known in the art may be substituted for the hydraulic rams **30** to raise and lower the moldboard.

Hydraulic conduits **34** and **35** are connected into the cylinder of the hydraulic ram **19** on the left side of the tractor **10**. Hydraulic conduits **36** and **37** are connected into the cylinder of the hydraulic ram **19** on the right side of the tractor **10**. The hydraulic conduits **34, 35, 36** and **37** are connected to suitable hydraulic pump and valve means (not shown) on the tractor **10** for selective operation of the hydraulic rams **19**. Suitable hydraulic pump, valve and conduit means (not shown) are also provided for the hydraulic rams **30** for proper operation thereof.

Turning next to a detailed description of the operation of the instant invention in order that the cooperation between the various described elements may be more readily understood, reference is again made to the drawings. Discussing first a pitching of the moldboard **16**, which may be described as a pivoting of the moldboard about a horizontal axis transversely of the tractor. In a pitching of the moldboard **16** both of the hydraulic rams **19** are simultaneously operated in the same direction an identical amount. If the hydraulic rams **19** are fully extended, the slide members **24** will be moved in a circular path upwardly and rearwardly. The radii for the curves defined by the circular motion of the slide members **24** are the struts **21** pivoting about pivotal mounting means **23**. The upward component of travel of the slide members **24** will result in a sliding of the slide members **24** within the channels of the channel members **26**, and the rearward travel of the slide members **24** will result in a pivoting of the moldboard **16** rearwardly about pivotal mounting means **18** resulting in the rearward pitch of the moldboard **16**.

To pitch the moldboard **16** forwardly, the hydraulic rams **19** are contracted. As the hydraulic rams **19** are contracted, the slide members **24** will be moved in a circular path forwardly and downwardly from a position such as shown in Figure 1. The radii for the circular path of the slide members **24** again are the struts **21**. The downward component of movement of the slide members **24** will result in a sliding of the members **24** within the channels of the channel members **26** and the forward component of movement of the slide members **24** will result in a pivoting of the blade **16** in a clockwise direction as viewed in Figure 1 about pivotal mounting means **18** to pitch the blade **16** forwardly.

In tilting of the moldboard **16**, one of the hydraulic rams **19** is contracted while the other of the hydraulic rams **19** is extended. If the hydraulic ram **19** on the right side of the tractor **10** is contracted by some amount and the hydraulic ram **19** on the left side of the tractor **10** is extended by some amount, the moldboard **16** will be tilted such that the left side of the moldboard is lowered and the right side of the moldboard is raised. In order that this operation may be more readily understood, reference is made particularly to Figure 5. Assuming that the push beams **14** are removed from the trunnions **15**, and that the moldboard **16** is secured in a horizontal position, a contraction of the ram **19** on the right side of the tractor **10** will cause the slide member **24** associated therewith to be moved downwardly within the channel member **26**. Since the strut **21** associated therewith is of a fixed length greater than the distance between pivotal mounting means **23** and pivotal mounting means **18**, the downward movement of the slide member **24** will cause a downward pivoting of the rear end of the push beam **14** associated therewith about pivotal mounting means **18**. Conversely, when the hydraulic ram **19** on the left side

of the tractor **10** is extended the slide member **24** will be moved upwardly within channel member **26** and the strut **21** associated therewith will cause the push beam **14** connected thereto to be pivoted upwardly about pivotal mounting means **18**. Thus with the moldboard **16** horizontally aligned the rear end of the push beam **14** on the right side of the tractor **10** will be in some position below the height of the trunnions **15** from the ground and the rear end of the push beam **14** on the left side of the tractor **10** will be in some position above the height of the trunnions **15** from the ground. To reconnect the rear ends of the push beams **14** to the trunnions **15**, it is then necessary to raise the push beam **14** on the right side of the tractor **10** and to lower the push beam **14** on the left side of the tractor **10**. This will result in a raising of the right side of the moldboard **16** and a lowering of the left side of the moldboard **16** to cause the moldboard **16** to assume one position of tilt. It should be noted that the push beams **14** are pivoted about their longitudinal axes when the moldboard is tilted. This rotation of the push beams **14** about their longitudinal axes is provided for in the trunnions **15**. Additionally, as the moldboard is pitched or tilted, the bracing links **46** will pivot about the described universals to maintain a proper alignment with the push beams **14** and the moldboard **16**. It should further be noted that various combinations of the operations previously described may also be effected. Pitch and tilt may be combined to various degrees, or only one hydraulic ram **19** may be operated in tilting, to cite a few examples.

Having described the invention, what is considered new and desired to be protected by Letters Patent is:

1. A bulldozer attachment for a tractor comprising: a pair of forwardly extending push beams pivotally mounted to said tractor, a moldboard pivotally mounted to the forward ends of said push beams, a pair of struts, each of said struts pivotally mounted at one end thereof to one of said push beams intermediate the ends thereof, means connecting the other ends of each of said struts to said moldboard for sliding movement in a direction perpendicular to the axis of pivoting of said moldboard on said push beams, and means pivotally mounted between said moldboard and said other ends of said struts for pivoting said struts and for holding said struts in any pivoted position to positively secure said moldboard in any pivoted position.

2. A bulldozer attachment for a tractor comprising: a pair of forwardly extending push beams pivotally mounted to said tractor, a moldboard pivotally mounted to the forward ends of said push beams, a pair of struts, each of said struts pivotally mounted at one end thereof to one of said push beams intermediate the ends thereof, means connecting the other ends of each of said struts to said moldboard for sliding movement in a direction perpendicular to the axis of pivoting of said moldboard on said push beams, and a pair of double acting hydraulic rams, each of said double acting hydraulic rams pivotally mounted between said moldboard and said other ends of said struts for pivoting said struts and for holding said struts at any pivoted point.

3. A bulldozer attachment for a tractor comprising: a pair of forwardly extending push beams pivotally mounted to said tractor, a moldboard pivotally mounted to the forward ends of said push beams, a pair of struts, each of said struts pivotally mounted at one end thereof to one of said push beams intermediate the ends thereof, a pair of channel members, each of said pair of channel members mounted to said moldboard substantially vertically above one of the pivotal connections of said moldboard to one of said push beams with the channel of said channel member directed perpendicular to the axis of pivoting of said moldboard on said push beams, a pair of slide members slidably mounted within said channels of said channel members, means pivotally connecting the other ends of each of said struts and said slide members, and means pivotally mounted between said moldboard and said other

ends of said struts for pivoting said struts and for holding said struts at any pivoted point.

4. In a bulldozer attachment as defined in claim 3, said last mentioned means comprising a pair of double acting hydraulic rams.

5. A bulldozer attachment for a tractor comprising: a pair of trunnions mounted on each side of said tractor, a pair of forwardly extending push beams each mounted at one end thereof on said trunnions for pivoting movement about an axis transversely of said tractor and for a limited amount of rotative movement about the longitudinal axes of said push beams, a moldboard, means pivotally mounting the forward ends of said push beams to the lower side sections of said moldboard, a pair of struts, each of said struts pivotally mounted at one end thereof to one of said push beams intermediate the ends thereof, means connecting the other ends of each of said struts to the upper side sections of said moldboard for sliding movement in vertical planes, each of said planes including one of said struts and one of said push beams, and means pivotally mounted between said moldboard and said other ends of said struts for pivoting said struts and for holding said struts in any pivoted position.

6. In a bulldozer attachment as defined in claim 5, said last mentioned means comprising a pair of double acting hydraulic rams, each of said hydraulic rams positioned substantially in a vertical direction in one of the planes including one of said struts and one of said push beams.

7. A bulldozer attachment for a tractor comprising: a pair of trunnions mounted on each side of said tractor, a pair of forwardly extending push beams mounted on said

trunnions, a moldboard, a pair of brackets mounted on the rear surface of said moldboard substantially at the lower side sections thereof, means pivotally connecting the forward ends of said push beams to said brackets, a pair of channel members secured to the rear surface of said moldboard substantially at the upper side sections thereof, a pair of double acting hydraulic rams, means pivotally connecting the head ends of said hydraulic rams to said brackets, a pair of slide members slidably mounted within said channel members, a pair of struts, means pivotally mounting one end of each of said struts to one of said push beams intermediate the ends thereof, means pivotally interconnecting the other end of each of said struts, the rod end of each of said hydraulic rams, and each of said slide members, said pair of hydraulic rams operable to move said slide members upwardly and downwardly within said channel members and to maintain said slide members in any upward and downward position, and means mountable between said moldboard and said tractor for raising and lowering said moldboard relative to the ground.

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