

Oct. 21, 1941.

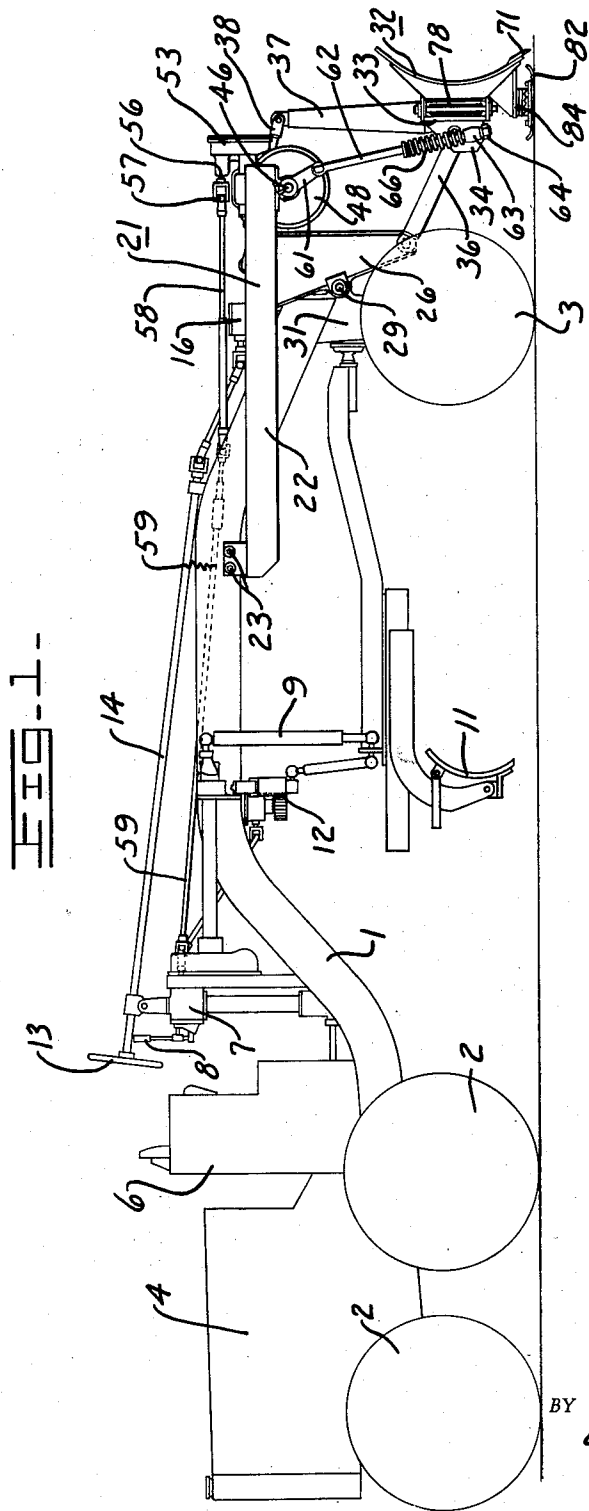
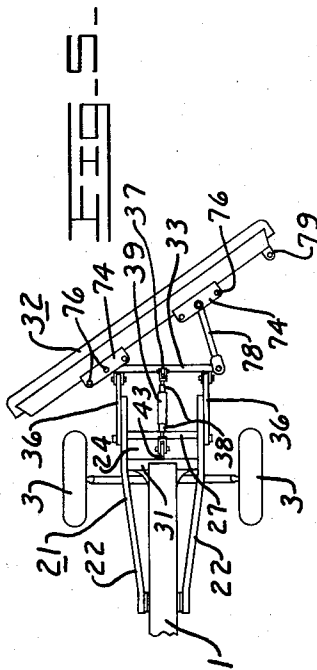
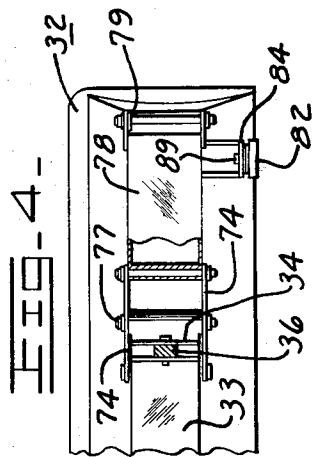
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2,259,747

BULLDOZER

Filed Nov. 13, 1939

2 Sheets-Sheet 1



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FIG. 2.

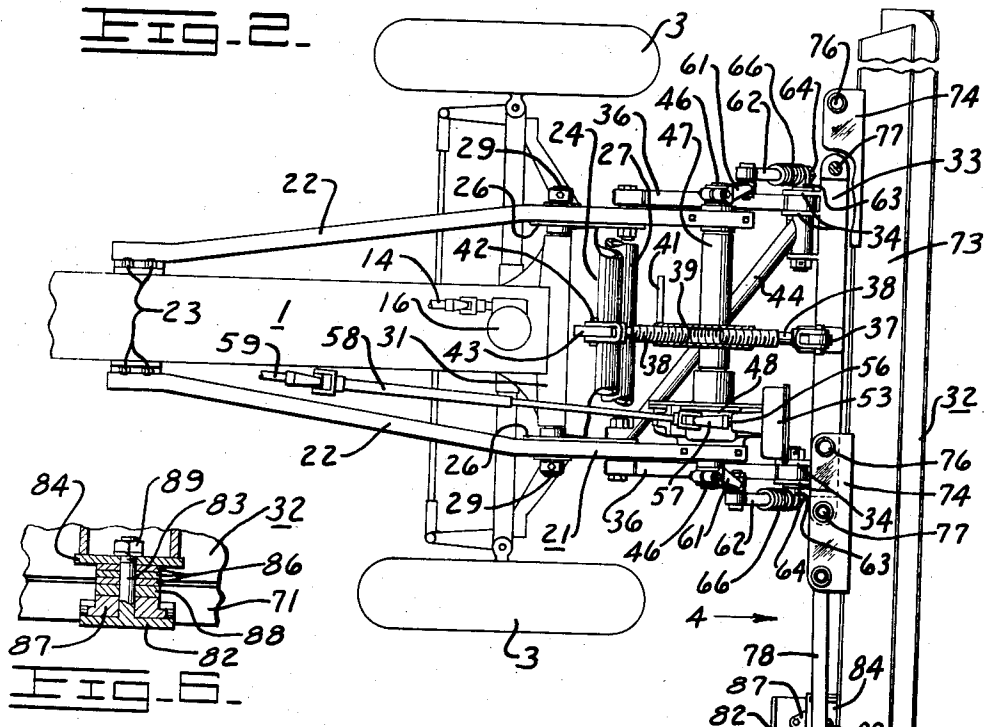
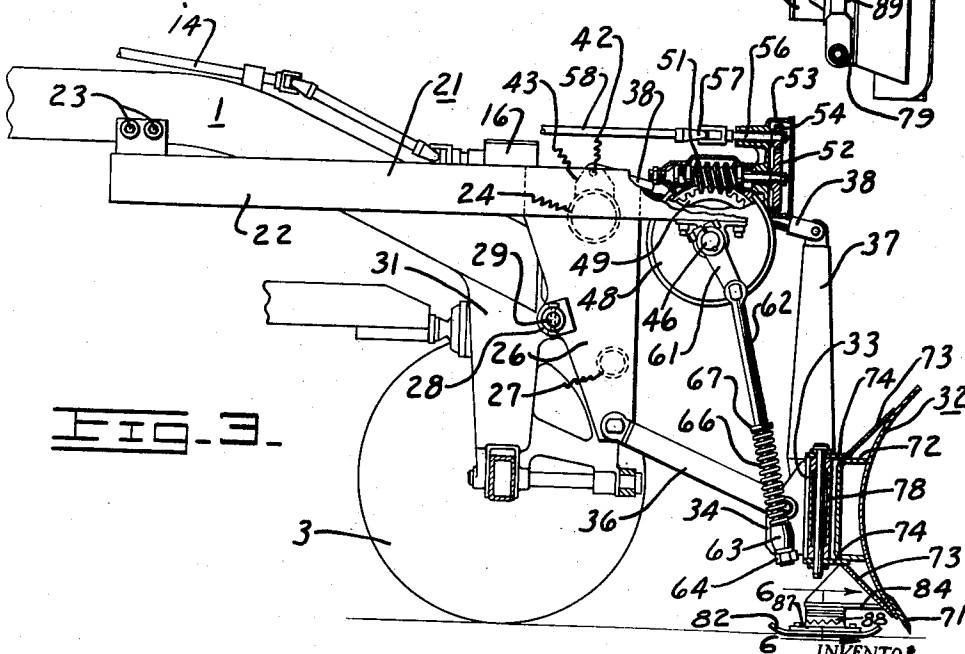


FIG. 3.



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BULLDOZER

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7 Claims. (Cl. 37—144)

My invention relates to bulldozers, and more particularly to a bulldozer attachment especially adapted for use on a self-propelled motor grader.

A type of such grader is illustrated in my prior Patent No. 2,034,141. In graders of this character, it is frequently desirable to have at the front of the machine a scraper blade which may be employed for so-called bulldozing work, namely to push material in front of the machine. Such work can not be conveniently done by the grader blade which is underneath the machine intermediate the ends thereof, because the front wheels of the machine would have to travel over the material to be bulldozed.

My invention has as its objects, among others, the provision of an improved attachment which may be conveniently mounted on the front end of a self-propelled or motor grader; which is of simple and economical construction; in which the bulldozer blade may be adjusted to various positions suitable for the work to be done; in which such blade may be lifted completely out of the way when not desired for use so as not to interfere with the normal work that the grader may be called upon to perform; and which is simple and easy to operate and control from the operator's station on the machine. Other objects of the invention will become apparent from a perusal of the following description thereof.

Referring to the drawings:

Fig. 1 is a partially schematic side elevational view of a form of self-propelled grader manufactured by my assignee, with the bulldozer attachment of my invention connected to the grader.

Fig. 2 is a plan view of the front end of the machine and the bulldozer attachment; portions of the structure being omitted and broken away to disclose more clearly the construction.

Fig. 3 is a side elevational view of the structure shown in Fig. 2; portions of the construction being shown in section and broken away to disclose more clearly the construction.

Fig. 4 is an end view looking in the direction of arrow 4 in Fig. 2.

Fig. 5 is a schematic view illustrating the bulldozer adjusted at an oblique angle with respect to the line of draft of the machine.

Fig. 6 is a section of the bulldozer shoe taken in a plane indicated by line 6—6 in Fig. 3.

Although the bulldozer attachment of my invention may be employed with any of the various types of motor or self-propelled graders on the market, I have, for the purposes of illustration, disclosed it in conjunction with the motor grader manufactured by my assignee, which is of the type disclosed in my previously referred to patent. Such grader comprises arched main frame 1 mounted on rear driving wheels 2 and on front steerable wheels 3. An engine 4 for propelling

the machine and providing power for adjusting various earth working implements on the machine, is mounted at the rear; and an operator's station 5 is positioned in front of engine 4. Power from engine 4 is transmitted to power control box 7, in the manner disclosed in my previously mentioned patent, through which by manipulation of various control handles 8, adjustments can be made to lift arms 9 for adjusting grader blade 11 and to lateral shift mechanism 12 for the grader blade. Steering of the machine is effected manually by means of steering wheel 13 connected to steering shaft 14 in turn connected to suitable steering mechanism in housing 16.

The bulldozer attachment comprises a frame 21 which supports the entire bulldozer mechanism, and which is adapted for detachable mounting as a unit on the front end of the grader. Such frame comprises side members 22 detachably secured at their rear ends to the grader main frame 1 by means of bolts 23, and which are braced near their front ends by tubular brace 24; the brace 24 being rigidly connected to side members 22 through depending plates 26 which are braced adjacent their lower ends by tubular brace 27. Adjacent their rear edges and intermediate their ends, plates 26 are provided with bosses 28 secured to cross shaft 29, supported in front bolster 31 of the grader and which normally provides a mounting for a scarifier attachment adapted to be mounted on the grader. When my bulldozer attachment is employed, the scarifier attachment, if on the machine, is removed therefrom. From the preceding, it is seen that the bulldozer attachment of my invention is rigidly supported on the front end of the grader.

Means is provided for supporting a straight bulldozer blade 32 from frame 21 including a substantially parallel lift linkage for enabling vertical raising or lowering of the blade with respect to the ground. Such vertical movement is desirable because it enables the blade to be accurately positioned on the ground, and precludes dragging of the blade upon lifting or lowering thereof when set at an oblique angle to the line of draft of the machine. The blade is adjustably connected to a supporting structure therefor in the form of cross piece 33, in a manner to be described more fully hereinafter. Adjacent each end of cross piece 33 is a pair of ears 34 in which are pivotally connected spaced struts or arms 36 in turn pivotally connected to the lower ends of plates 26. An upright post member 37 is fixedly attached to cross piece 33 at the middle thereof, and has pivotally connected to its upper end arm or strut 38 which is substantially parallel to struts 36, and is adjustable as to length by means of turn buckle 39 having handle 41 to enable turning of the turn buckle. The end of arm 38 opposite to the end pivotally connected to

post 37, is pivotally connected at 42 to bracket 43 fixedly attached to tubular brace 24.

Struts 36 are connected in back of the bulldozer blade and are, hence, well adapted to take up rearward thrust. The structure is braced against lateral thrust by cross brace 44 which at its front end is pivotally connected to cross piece 33 adjacent the front of one of struts 36, and adjacent its rear end is pivotally connected to a plate 26 adjacent the rear of the other of struts 36. Arm 38 also cooperates to take up rearward thrust but being adjustable as to length, it also performs the function of enabling adjustment of the pitch of the blade about the horizontal pivotal mounting therefor at 34.

Since the ends of struts 36 and 38 are all pivotally connected, it is apparent that they allow the bulldozer blade to be lifted out of contact with the ground, or lowered into contact with the ground; and because of the substantially parallel relationship of these members, a parallel lift linkage obtains to provide the advantages previously pointed out. Lift means mounted entirely on frame 21 so as to form a part of the entire attachment, is provided for lifting or lowering the bulldozer blade. Such lift means comprises shaft 46 journaled at the front of side members 22, and extending beyond the outer sides of such side members; the shaft projecting through sleeve 47 fixedly attached to the left side member 22. Also shaft 46 projects through gear housing 48 fixedly attached to sleeve 47 and to the right side member 22. Thus, sleeve 47 and gear housing 48 provide additional reinforcing means for side members 22.

A worm wheel 49 within gear housing 48 is fixedly attached to shaft 46 and meshes with worm 51 journaled in the top of gear housing 48. The shaft for worm 51 has secured thereto adjacent its front end, gear 52 enclosed within gear compartment 53 of gear housing 48, and which meshes with pinion 54 also enclosed within gear compartment 53. Pinion 54 is secured to shaft 56 journaled in and projecting outside of gear compartment 53. From the preceding, it is seen that rotation of shaft 56 in either one of opposite directions will effect corresponding rotation of shaft 46 in either one of opposite directions. For effecting rotation of shaft 56, I utilize the power control mechanism 7 already on the grader. For this purpose, shaft 56 is universally connected by universal coupling 57 to extensible shafting 58, which in turn is universally connected to shafting 59, the rotation of which is reversibly controllable from power control box 7 in the manner disclosed in my Patent No. 2,034,141.

Lift linkage is connected between shaft 46 and cross piece 33 comprising crankarms 61 fixedly attached to the ends of shaft 46, and pivotally connected to arms 62; such arms 62 being resiliently connected to cross piece 33 to allow the bulldozer blade to ride over obstructions and thereby preclude injury to the lifting mechanism. To provide such resilient connection, the lower ends of arms 62 are slidably connected in swivel bolts 63 pivoted in ears 34, and have nuts 64 underneath swivel bolts 63 to provide support for the bulldozer blade during lifting or lowering thereof; springs 66 about arms 62 being interposed between swivel bolts 63 and collars 67 fixedly attached to arms 62, to thrust the blade resiliently in contact with the ground.

The crankarms 61 are rotatable through 360°. Therefore, there is no danger of damaging the

lifting mechanism by lifting the blade too high because the crank arms can travel through the position which they have when the blade is lifted to its maximum height above the ground; and no special automatic control means is required to stop lifting of the blade. In this connection, lifting or lowering of the blade may be accomplished, if desired, by rotating worm 51 always in one direction. When lifted to any position, the worm 51 and worm wheel 49 drive provides a self-locking means to hold the blade in position. The entire attachment may be readily and conveniently detachably mounted on the grader; and when so mounted, it is apparent that it will not interfere with the normal operations of the grader blade 11 because when it is desired to use such grader blade for the work for which it is intended, with the attachment on the machine, the bulldozer blade 32 may be lifted completely out of the way.

Means is provided for adjustably mounting the bulldozer blade on its supporting structure 33, for both endwise and angular adjustment. Such bulldozer blade, which is arcuately shaped, has cutting edge 71 adjacent the lower edge thereof, and is braced along the rear face by channel 72 welded thereto; upper and lower reinforcing plates 73 being fixedly welded to the blade and to channel 72. Adjacent each end thereof, the bulldozer blade has secured thereto a pair of spaced horizontally extending flanges 74 which are positioned one above the other and are provided with a group of fastening stations 76 in the form of spaced holes. Such spaced groups of fastening stations 76 provide means for adjustable attachment of the bulldozer blade to cross piece 33 by means of bolts 77 adapted to be passed through selected of such fastening stations 76, and through a pair of apertures formed in cross piece 33, one adjacent each end of the cross piece. Because of the plurality of fastening stations 76 in each group thereof, it is apparent that by passing of bolts 77 through selected ones of such fastening stations, the bulldozer blade may be connected in any one of a plurality of endwise positions at a right angle to the line of draft. If desired, the spaced groups of fastening stations may be formed in cross piece 33 and a single fastening station adjacent each end of the bulldozer structure, but the described arrangement is preferred.

Under some circumstances, it may be desirable to position the bulldozer blade at an oblique angle with respect to the line of draft. The described mounting means for the bulldozer blade enables this to be accomplished by the use of an auxiliary strut 78 which when the bulldozer blade is connected so as to extend at a right angle to the line of draft performs no function, but for convenience is connected to one of fastening stations 76, and to ear 79 at the right end of the bulldozer blade, as is illustrated in Figs. 2 and 4. When it is desired to position the bulldozer blade at an oblique angle with respect to the line of draft of the machine to the position illustrated in Fig. 5, for example, the right-hand bolt 77 in Fig. 2 may be removed, the bulldozer blade pivoted about the left-hand bolt 77 in Fig. 2, strut 78 disconnected from the position shown in Fig. 2, and reconnected to the right end of cross piece 33 and to the selected one of the right-hand group of fastening stations 76. In this connection, the spaced groups of fastening stations 76 also permit adjustment of the bulldozer blade to any selected one of a plurality of

oblique positions, by selection of the fastening station 76 in one group thereof to which one end of cross piece 33 is to be connected and selection of the fastening station 76 in the other group thereof to which the strut 78 is to be connected. Fig. 5 illustrates the bulldozer blade set at an oblique angle so as to direct material to the left of the machine, but such blade may also be set at an opposite oblique angle to direct material to the right side of the machine, in the manner previously explained.

It is desirable to have the lower edge of the cutting edge 71 slightly above the grade line or ground; and for this purpose, the bulldozer blade is preferably supported at each end on shoes 82. Each shoe has an upright stud 83 which passes through a plate 84 secured to the bulldozer blade; and by adding or removing shims 86 between the shoe and plate 84, adjustment of elevation of the cutting edge with respect to the ground may be obtained. To prevent stud 83 from becoming sheared as the bulldozer blade moves along the ground, a serrated plate 87 is fixedly attached to each shoe 82 about stud 83, and engages corresponding serrations in plate 88 also about stud 83; the entire assembly of each shoe being tightly held together by a nut 89.

I, therefore, claim as my invention:

1. The combination with a self-propelled motor grader of the type including a main frame and a grader blade carrying frame supported underneath said main frame; of a bulldozer attachment mounted on the front end of said main frame including a bulldozer blade, a supporting structure for said blade, means connected to said supporting structure including a worm and worm wheel drive for raising or lowering said blade, means connected to said supporting structure for adjusting the pitch of said blade including an adjustable turn buckle, and means enabling angular adjustment of said blade on said supporting structure.

2. A bulldozer comprising a bulldozer blade structure, a supporting structure therefor, means including spaced groups of fastening stations on one of said structures for supporting said blade at a right angle to the line of draft of said bulldozer and in any selected one of a plurality of endwise positions, and means for positioning said blade at any selected one of a plurality of oblique angles with respect to said line of draft including a single auxiliary strut adapted to be connected between said structures at either end thereof to selected of said fastening stations and which forms no functional part of such connection when said blade is at a right angle to said line of draft.

3. A bulldozer unit adapted to be detachably mounted on a vehicle comprising a frame attachable on said vehicle, arms pivotally connected to said frame, a cross member pivotally connected to said arms, a bulldozer blade mounted on said cross member, an upright member secured to said cross member, a turn buckle substantially parallel to said arms and pivotally connected to said upright member and to said frame to provide for substantially vertical movement of said blade with respect to the ground, said turn buckle being adjustable to vary the pitch of said blade, and means for lifting or lowering said blade comprising a self-locking worm and worm wheel drive mounted on said frame.

4. A bulldozer unit adapted to be detachably mounted on a vehicle comprising a frame attachable on said vehicle, arms pivotally con-

nected to said frame, a bulldozer blade, means pivotally connecting said blade to said arms, an upright member connected to said blade, a turn buckle substantially parallel to said arms and pivotally connected to said upright member and to said frame to provide for substantially vertical movement of said blade with respect to the ground, said turn buckle being adjustable to vary the pitch of said blade, and means for lifting or lowering said blade comprising a self-locking worm and worm wheel drive mounted on said frame.

5. In a self-propelled vehicle having a frame, a bulldozer attachment mounted on said frame including a bulldozer blade, a supporting structure therefor, lower arms connected to said frame for pivotal movement about a horizontal axis, said supporting structure being connected to said arms for pivotal movement about a horizontal axis to provide for adjustment of the pitch of said blade, an upright member secured to said supporting structure, an upper arm pivotally connected to said upright member and to said frame, said upper arm being adjustable as to effective length to adjust the pitch of said blade in cooperation with said pivotal connection of said blade supporting structure on said lower arms, and said upper arm being substantially parallel to said lower arms to provide for substantially vertical movement of said blade with respect to the ground, means for lifting or lowering said blade together with all of said arms, and means enabling angular adjustment of said blade on said supporting structure.

6. A bulldozer unit adapted to be detachably mounted on a vehicle comprising a frame attachable on said vehicle, a bulldozer blade, lower strut means connected to said frame for pivotal movement about a horizontal axis, said blade being pivotally connected to said strut means for pivotal movement about a horizontal axis to provide for adjustment of the pitch of said blade, an upright member connected to said blade, upper strut means pivotally connected between said upright member and said frame, the length of said upper strut means in cooperation with said pivotal connection of said blade on said lower strut means determining the pitch of said blade, and means mounted on said frame including driving mechanism and a linkage connection between said driving mechanism and said blade for enabling lifting or lowering of said blade together with all of said strut means.

7. A bulldozer unit adapted to be detachably mounted on a vehicle comprising a frame attachable on said vehicle, a bulldozer blade, lower strut means connected to said frame for pivotal movement about a horizontal axis, said blade being pivotally connected to said strut means for pivotal movement about a horizontal axis to provide for adjustment of the pitch of said blade, an upright member connected to said blade, upper strut means pivotally connected between said upright member and said frame, said upper strut means being adjustable as to effective length to adjust the pitch of said blade in cooperation with said pivotal connection of said blade on said lower strut means, and said upper strut means being substantially parallel to said lower strut means to provide for substantially vertical movement of said blade with respect to the ground, and means for lifting or lowering said blade comprising a self-locking worm and worm wheel drive mounted on said frame.

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