Oct. 1, 1940. H. L. NICHOLS, JR 2,216,572

BULLDOZER BLADE AND FRAME

Filed Oct. 5, 1939 2 Sheets-Sheet 1

Fig. 1.

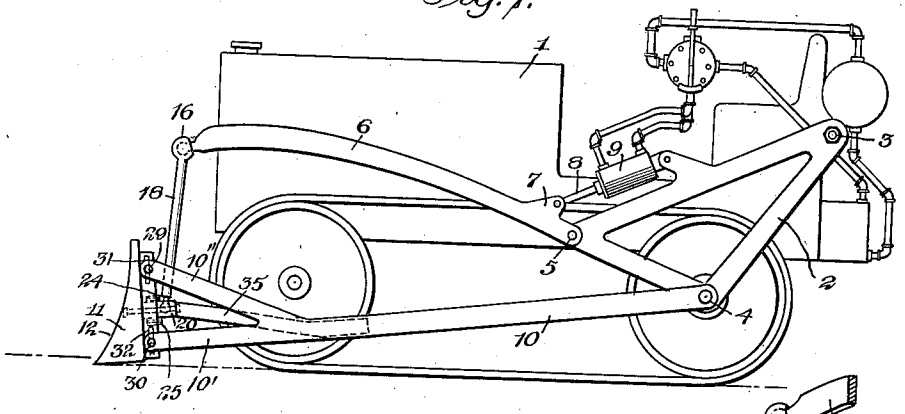


Fig. 3a

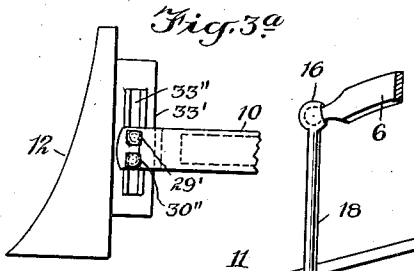


Fig. 2.

Fig. 2b.

Fig. 2a.

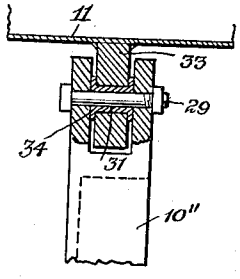
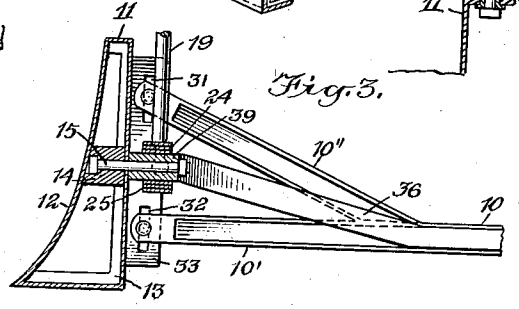


Fig. 3.



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Fig. 4.

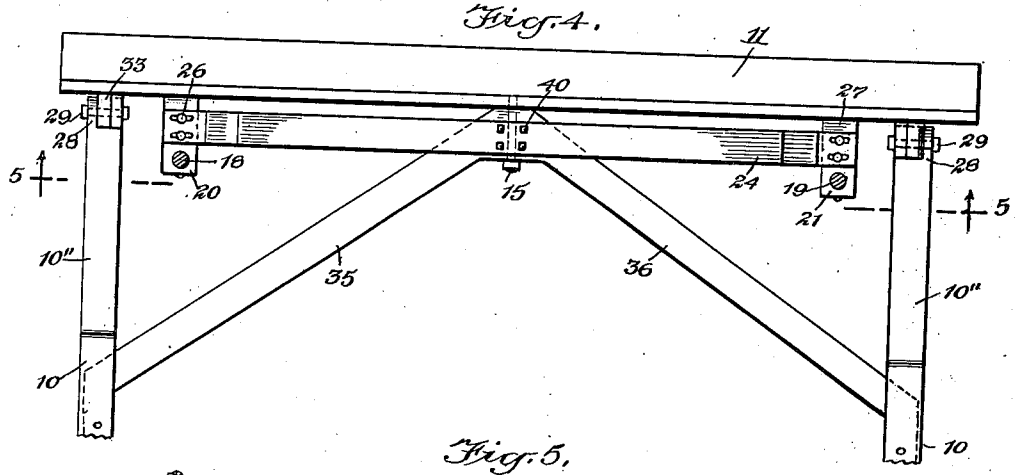


Fig. 5.

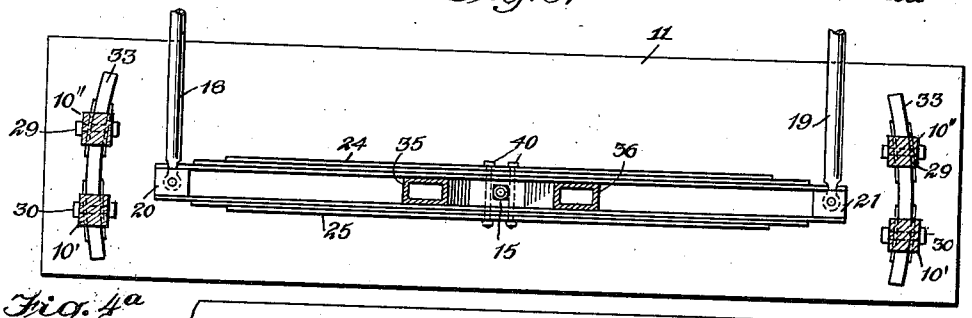


Fig. 4a

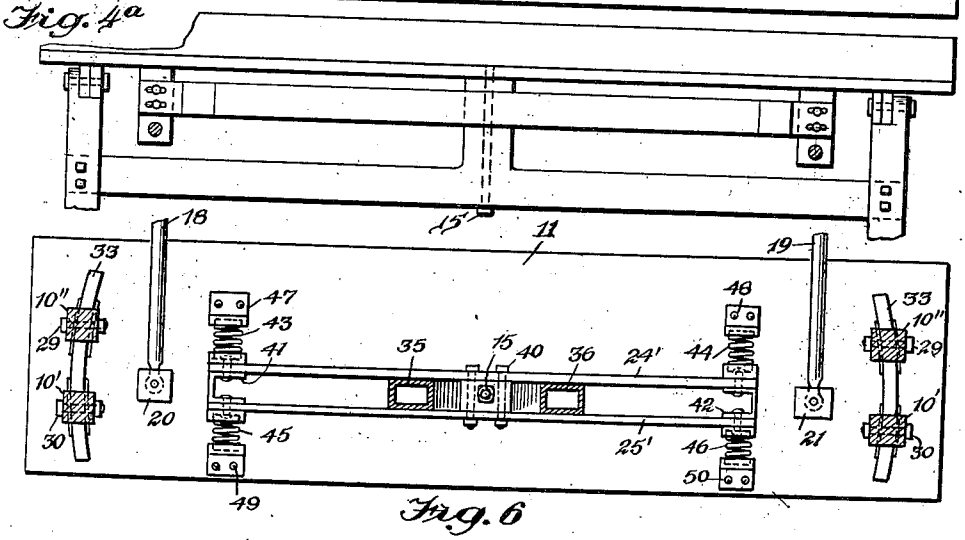


Fig. 6

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BULLDOZER BLADE AND FRAME

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Application October 5, 1939, Serial No. 298,013

7 Claims. (Cl. 37—144)

This invention relates to an improved bulldozer blade and frame, an object being to provide a construction which will readily permit the blade to be raised and lowered in a straight line or tilted and raised and lowered.

Another object of the invention is to provide an improved blade carrying frame for bulldozers wherein a proper bracing structure is provided for the blade while permitting raising, lowering and tilting means to function.

A further object of the invention is to provide a bulldozer frame and blade which is an improvement over my co-pending application Serial No. 285,117.

An additional and more specific object of the invention is to provide a special bulldozer frame in which the twisting strain of tilting the blade is taken up by a plurality of springs positioned to permit a ready raising and lowering and tilting of the blade during the normal functioning of the machine.

In the accompanying drawings—

Fig. 1 is a side view of a tractor and bulldozer structure connected therewith, the same disclosing a blade and frame embodying the invention;

Fig. 2 is a perspective view of the inner surface of the blade with part of the frame shown in connection therewith;

Fig. 2*a* is a detail fragmentary sectional view through Fig. 2 approximately on the line 2*a*—2*a*;

Fig. 2*b* is a view similar to Fig. 2*a* but showing a slightly modified construction;

Fig. 3 is a sectional view through Fig. 2 approximately on the line 3—3;

Fig. 3*a* is a view similar to Fig. 3 but showing a modified form of push bar and brace web;

Fig. 4 is a top plan view of the construction shown in Fig. 2;

Fig. 5 is a sectional view through Fig. 4 approximately on the line 5—5;

Fig. 6 is a view similar to Fig. 5 but showing a slightly modified construction.

Referring to the accompanying drawings by numerals, 1 indicates a tractor of any desired kind, as for instance an ordinary caterpillar tractor, which is used with the bulldozer mechanism. This tractor may be used in connection with conventional bulldozer structures or with a special structure embodying the invention.

In Fig. 1 a bulldozer frame 2 and one end of a blade 11 are illustrated. This frame includes a triangular structure secured at 3 to part of the tractor 1, and at 4 to the rear axle of the tractor or other support in line therewith. At this point the frame 2 may be rotatably mounted on the rear axle or may be secured rigidly to the frame of the rear axle or to any other support. At point 5 the frame is unsupported but is pivotally connected with a vertically swinging arm 6. This arm is provided with an extension 7 to which a piston rod 8 associated with a cylinder 9 is pivotally secured. The cylinder 9 and associated parts present an engine structure for reciprocating the rod 8 and thereby swinging arm 6 upwardly and downwardly. A push-and-pull rod 10 is pivotally mounted at point 4 and extends forwardly so as to be connected with blade 11 to pull or push the same. It will be understood that on each side of the tractor 1 there are provided a frame 2, members 6 and 10 and associated parts, as shown in Fig. 1.

The blade 11 is constructed as shown particularly in Figs. 2 and 3 and from these figures it will be observed that there are provided a contact surface member 12 and a bracing structure 13. Arranged between these structures there is provided a block 14. The members just described may be provided with cross braces and rigidly secured together by welding or otherwise to form a single unit. A bolt 15 extends through block 14 and the structure 13 so as to act as a pivotal and clamping member for certain parts hereinafter fully described.

When the blade 11 is in the air and is tilted, it is tilted around the axis of the bolt 15. The arms 6 and 6′, as shown in Fig. 2, extend from points at the rear of the tractor 1 to points in front thereof and are connected through ball-and-socket joints 16 and 17 to lift rods 18 and 19. The lift rods extend downwardly into blocks 20 and 21 which are preferably welded rigidly to the rear surface 13 of the blade 11. If desired, balls could be provided on the lower ends of the rods 18 and 19 and these balls could be loosely mounted in the outer ends of the blocks 20 and 21. Preferably pins 22 and 23 extend through part of the respective blocks and the respective balls just mentioned. The connection of the pins with the balls is a loose one so that there will be a limited universal movement of the balls in respect to the blocks 20 and 21. When the arms 6 and 6′ are swung upwardly evenly there will be an even pull on the rods 18 and 19 and the blade 11 and associated parts including the bars 10 will be swung upwardly. However, if one of the arms 6 or 6′ is swung upwardly and the other held stationary, the blade 11 will be tilted and the bolt 15 will be moved upwardly for half the distance of the movement of the lifted end of the blade. This tilting action is resisted by the respective springs

24 and 25. The springs are connected to the blocks 20 and 21 in any desired way, as for instance by rivets or bolts extending through suitable apertures or slots 26 and 27. The bars 10 and associated parts are of identical construction on both sides of the device and, therefore, a description of one will apply to both. It will, therefore, be seen that the use of the springs produces a steady action on the blade particularly when the blade is in a level position.

As illustrated in Fig. 2, the bar 10 may be made of tubing, hollow rectangular or U-shaped metal and provided with a straight forward extension 10' and an inclined extension 10''. Each of these extensions is provided with a bifurcated end 28 which accommodates the respective bolts 29 and 30 extending through slots 31 and 32 in a bracing web or bar 33 which is welded or otherwise rigidly secured to the blade 11.

In Fig. 2b a slightly modified construction is shown to that shown in Fig. 2a, namely, an arrangement whereby there are two webs 33 and a push bar 10 extending between these webs. This arrangement of having two webs may be used with the forked structure 10' and 10'' shown in Fig. 3 and the single structure shown in Fig. 3a.

Liners 34 are provided in the slots 31 and 32 and the respective bolts 29 and 30 extend through these liners, as shown particularly in Fig. 2a. This provides not only a desired wearing structure but slightly spaces the bifurcated parts of the respective ends 28 from the bar 33 and thereby reduces friction. When the blade 11 is narrow vertically the extensions 10' and 10'' may be merged into a single extension. This arrangement is disclosed in Fig. 3a from which it will be seen that there is provided a bracing web 33' having a single slot 33'' which accommodates bolts 29' and 30' arranged in a push bar 10 which may straddle the web 33', as shown in Fig. 2, or may extend between two webs, as shown in Fig. 2b.

Associated with the respective pull-and-push bars 10 are angle bracing bars 35 and 36 which may be formed from tubing or any other suitable material, that shown being metal and hollow rectangular metal bars. These bars have been illustrated at a certain angle but it will be evident that this angle may be varied widely without departing from the spirit of the invention. Where found desirable, a straight cross bar as shown in Fig. 4a could be substituted and positioned to extend from one push bar to the other and a connecting bar extend from the block 39 rearwardly to the cross bar. Each of the angle bars 35 and 36 is provided with an extension 37 fitting into the respective bars 10 and held therein either by welding or by rivets, bolts, or pins 38 which may be arranged tightly in place or may be removably mounted. The converging faces of bars 35 and 36 are welded or otherwise rigidly secured to a block 39 of metal through which the bolt 15 extends. The springs 24 and 25 are bolted, riveted, or otherwise secured at 40 to the block 39, so that all the parts adjacent the block 39 are rigidly connected together and present an almost integral structure supporting the pivotal bolt 15. When the left end of blade 11, as shown in Fig. 2, is raised and the right end of the blade is substantially stationary, the springs 24 and 25 absorb the twist permitting the pivotal bolt 15 to function, the pins 29 and 30 moving in the slots 31 and 32 and the structure including block 39, arms 35, 36, and 10 being of rigid or semi-rigid structure remaining relatively horizontal, being raised, however, as a unit approximately half the distance of the movement of the high end of the blade 11. If the pull on rod 18 continues until the pins 29 and 30 reach the top of slots 31 and 32, then the bars 10 and associated parts will be raised through web 33 and pivotal bolt 15, being considered a unit with the blade 11 for the duration of this pull. As the frame structure is relatively rigid there will ordinarily be no further tilt, but a vertical movement of the blade while retaining its tilt. If the upward pull on the rods 18 and 19 is the same, then all parts will swing upwardly at an even rate. When the blade 11 is horizontal and resting loosely on the ground, the parts are set normally to be as shown in Fig. 3 with the bolts 29 and 30 substantially midway of the length of the respective slots. This will allow either end of the blade to be raised without raising the respective bars 10 and associated parts though it will cause a certain tension on the respective springs 24 and 25. In all positions of the blade 11 the bars 10 with their extensions 10' and 10'' afford a brace for taking a forward or rearward strain and transmitting the same to the rear part of the tractor 1. If the blade is depressed on one side or both sides a reverse action takes place.

In Fig. 6 a slightly modified form of the invention is shown wherein the springs 24 and 25 are eliminated and bars 24' and 25' substituted. These bars are stiff, rigid bars and at their ends are connected together by U-shaped brackets 41 and 42 which are riveted or otherwise rigidly secured thereto. Springs 43 and 44 press downwardly on bar 24', while springs 45 and 46 press upwardly on bar 25'. These springs are held in place by the respective brackets 47, 48, 49, and 50 riveted or otherwise rigidly secured to blade 11. In view of this structure it will be readily understood that when the rod 18, for instance, is raised and rod 19 is held stationary, spring 43 will be brought under tension and also spring 46. These springs resist the twisting action when the left hand end of the blade 11 is raised. When the right-hand end, as shown in Fig. 6, is raised and the left-hand end held stationary, the other springs will function. In case the tilting or twisting action exceeds the capacity of the springs, then the respective bars 35 and 36 and associated parts will begin to take up the strain of the twist. From this figure, as well as from Fig. 5, it will be seen that the bracing webs 33 are struck on an arc, the center of which is the center of the bolt 15. If desired, the rod 18 could be raised somewhat and the rod 19 lowered somewhat. This would cause the blade 11 to rotate around pin 15 compressing the springs 43 and 46 and would cause the bracing webs 33 to slide in respect to the bolts 29 and 30. Therefore, it will be seen in this form, as well as in the preferred form, the blade 11 may be raised and lowered vertically or tilted with one end on the ground and then raised and lowered or even tilted during the raising operation. During all these raising and tilting operations there will be a constant supporting and bracing action by the bars 10 and associated parts whereby the blade 11 may fully function.

It will be understood that the respective cylinders 9 and associated parts which transmit power to the frame are the same as shown in my co-pending application above referred to, but the bulldozer frame may be used with other forms of tractors and other forms of raising and lowering means without departing from the spirit of the invention. When the blade 11 is in any position,

if the tractor 1 moves forward and the blade encounters resistance the thrust will be taken up at the sides by the bars 10 and the respective bolts or pins 28 and 30 and at the center by the bracing angle members or frames 35 and 36. If the tractor reverses, the drag or pull of the blade will be taken care of at the same places.

By the use of the springs 24 and 25 or the spring structure shown in Fig. 6 and the associated parts, the frame under normal working conditions does not have to take care of the usual twisting strains of the tilted blade. Only in extreme and unusual cases is there a twisting strain taken up by the frame though the frame continually takes the forward thrust or the rearward pull.

I claim:

1. A blade and frame for a bulldozer including a blade member, a pair of spaced bracing webs rigidly secured to said blade on the rear face thereof, a push bar slidingly connected with each of said bracing webs, a pair of spaced lift rods swingably connected with said blade, and a swinging lift arm swingably connected to each of said rods.

2. In a bulldozer, a blade and frame including a blade member having a curved contact face and a substantially straight rear face, a pivotal bolt extending centrally and rearwardly from said rear face, a pair of arc-shaped bracing webs rigidly secured to said rear face adjacent the ends thereof, a push bar for each of said bracing webs, each of said push bars having a forked end, means for slidingly connecting the forked ends to said bracing webs, bracing bars connecting the push bars pivotally to said blade through said bolt, a lift rod swingably connected with said blade near each end thereof, and a swinging lift arm swingably connected with each of said rods for manipulating the rods.

3. In a bulldozer, a blade and frame including a blade member, a push bar connected with said blade member adjacent each end thereof, each of said push bars being vertically slidably connected with the blade member, a pivotal bolt extending from said blade member rearwardly, a pair of bracing bars connected with said push bars, said bracing bars being pivotally mounted on said bolt to permit said blade to swing in a vertical plane, in respect to the bars, a pair of leaf springs connected to the juncture of said bracing bars, means for connecting the ends of said springs to said blade member near the ends of the blade member, a lift rod swingably connected with said blade member near the ends of said springs, and a pair of lift arms connected by a universal joint with said lift rods whereby said blade may be raised and lowered in a vertical line and also tilted, the strain of the tilting action being transmitted by said springs to said push bars.

4. In a bulldozer, a blade and frame including a blade member, a pair of arc-shaped bracing webs rigidly secured to said blade member on the rear face thereof, each of said bracing webs having an arc-shaped slot, a push bar for each of said bracing webs, each of said push bars having an apertured end, a connecting pin extending through said apertured end and the respective slots in said bracing webs for slidably connecting said push bars to the bracing webs, a central pivotal pin carried by said blade and extending rearwardly, a bracing structure connected with said push bars mounted on said pivotal pin, a lift rod swingably connected with said blade near each end thereof, a lift arm connected with each of said rods, said lift arms being connected to the respective rods by universal joints, and spring means acting on said blade and on said bracing structure for steadying the blade against shocks and causing the blade to seek a level position when not acted upon by the tilting mechanism but allowing the blade to rotate somewhat relative to said bracing structure and push arms, when one of said lift rods is moved vertically without a movement of the other rod, said spring means transmitting the strain to the push bars as they slide in respect to said bracing webs.

5. In a bulldozer, a blade and frame including a blade member, a bolt extending rearwardly from said blade member, a pair of elongated bracing webs extending rearwardly from the blade member, each of said bracing webs having a pair of slots therein, a push bar associated with each of said bracing webs, each of said push bars having a forked end straddling a bracing web, a bolt extending through each member of said forked ends and through said slots for slidingly connecting the push bars with the blade member, a pair of blocks rigidly secured to said blade member near the respective ends thereof, a lift rod swingably connected to each of said blocks, and a swinging lift arm swingably connected with each of said lift rods whereby said blade may be raised and lowered vertically and also either end may be tilted upwardly or downwardly without bringing said push rods under strain.

6. In a bulldozer, a blade and frame including a blade member, an elongated bracing web rigidly secured to said blade member near each end, each bracing web having a slot therein substantially parallel with the rear of the blade member, a push bar for each of said bracing webs, each of said push bars having a bifurcated end adapted to straddle the respective bracing webs, a bolt extending through said bifurcated ends and through said slots for slidably connecting the push bars to the blade member, a pull rod adjacent each end of said blade member universally connected therewith, and a lift arm universally connected with each of said pull rods.

7. In a bulldozer, a blade and frame including a blade member, a bolt extending rearwardly from the center of the blade member, a pair of bracing members pivotally mounted on said bolt, a bar secured to said bracing members adjacent said bolt at the top and bottom of the bracing members, a pair of springs acting against said blade and against said bars to normally hold them in a central position, a pair of push bars slidably connected with said blade member, said bars being rigidly secured to said bracing members so that said springs will steady and transmit strain to said push bars when said blade is tilted, a pair of pull rods connected with said blade and a swinging lift arm for each of said pull rods for raising and lowering said pull rods, said arms being adapted to function simultaneously and at different times for raising and lowering the blade and also for tilting the blade.

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