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H. J. WHITE

3,218,740

BULLDOZER MODIFIED BLADE-BUCKET UNIT

Filed June 3, 1963

Fig. 1.

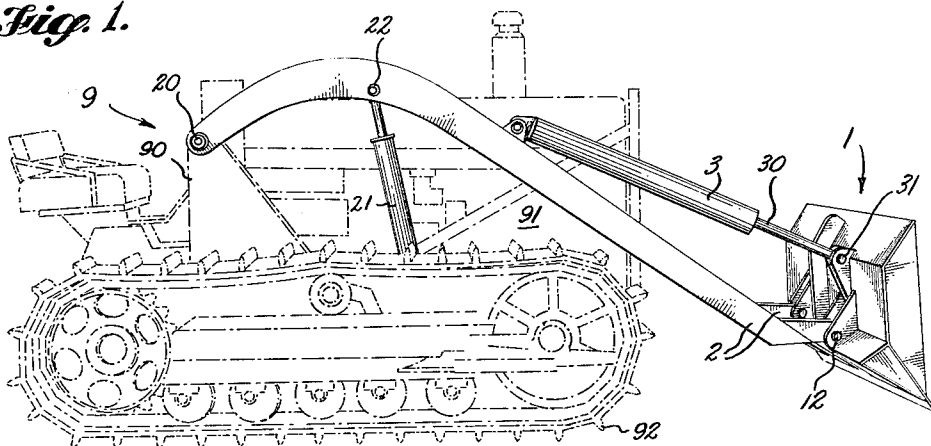


Fig. 2.

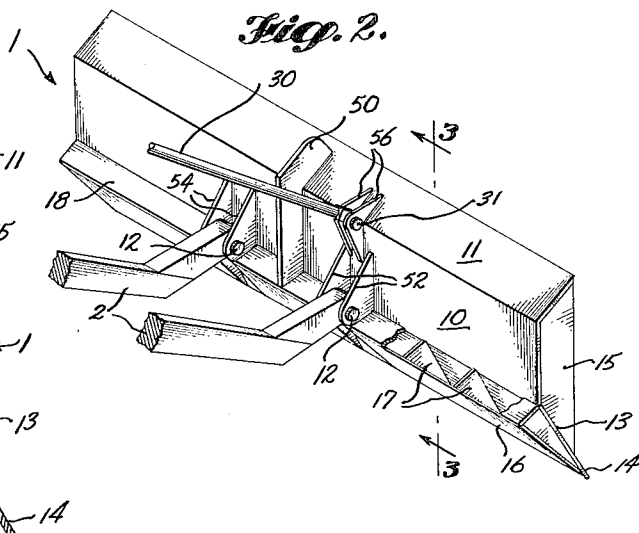


Fig. 3.

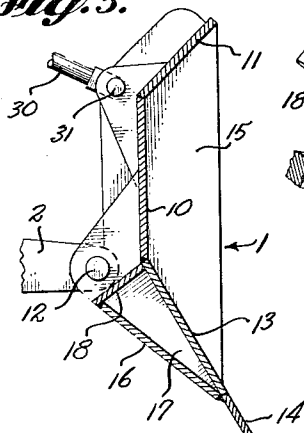


Fig. 4.

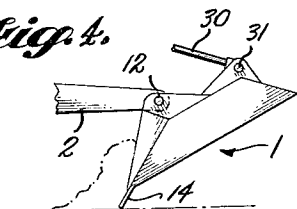
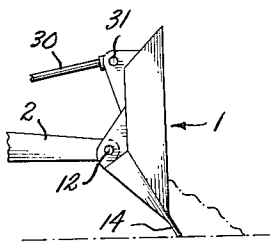
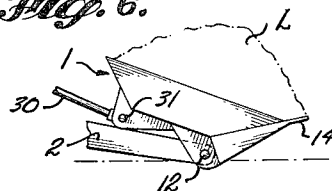


Fig. 5.

Fig. 6.



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BULLDOZER MODIFIED BLADE-BUCKET UNIT

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9 Claims. (Cl. 37—117.5)

This invention concerns earth-moving equipment, of the general nature of a bulldozer blade and its support, but usable also as a scoop in excavating, and as a bucket in gathering, transporting, lifting and dumping its load. It is designed primarily for mounting upon a tractor vehicle, such as usually travels on endless tracks, forwardly and backwardly.

A distinctive feature of the present invention is its ability to bulldoze during backward as well as forward movement, inasmuch as the surfaces which cooperate with the earth-contacting blade (which blade is usually replaceable when worn) are disposed at an angle to define a concavity, such as will cause the dirt rising ahead of the blade to fall forwardly (of the direction of travel, whether ahead or to the rear).

A further object of the invention is to form the earth-engaging element as a scoop and bucket, as well as providing it at one edge with a blade to bite into the earth, and to mount it in such way that it can tilt from a forwardly and upwardly tilted position for bulldozing during backward movement, through a rearwardly and upwardly tilted position for forward bulldozing, to generally level carrying positions "floating" on the ground or held at various elevations above the ground.

An important object is to stiffen the blade-carrying edge of the bucket against torsional and other stresses to which it is subjected during bulldozing, as by forming it as a box beam, yet without greatly adding to its weight, and at the same time to provide the bucket with a shoe which will support the loaded bucket (and sometimes help support the tractor also) from the earth's surface during forward or backward movement. This shoe is so formed that it will not greatly disturb the earth, and may indeed be used to smooth its surface, and by location of the tilting pivot axis of the bucket behind the shoe the supporting arms are protected by the shoe against wear from contact with the earth during advance of the bucket while supported on the ground.

By reason of the ability of the equipment of this invention to bulldoze effectively during backward travel of the tractor, the tendency of conventional bulldozers to climb on top of the ground during forward bulldozing, and so to lift the blade from the earth, is overcome, and this equipment operates very satisfactorily in the backward sense.

The formation of the blade-carrying edge as a stiff beam is effected in a manner to provide a wedge such as can be forced beneath roots and the like, and by reaction from the ground this wedge will loosen and raise such roots.

In its presently preferred form as herein disclosed the improved bulldozer implement comprises a forwardly concave blade proper, along the back lower side portion of which is formed an elongated stiffener box beam downwardly tapered in its cross-sectional shape and forming, cooperatively with the projecting edge of the blade, a concave blade face also on the back side. Mounted to pivot on a horizontal axis through a range including blade-level carrying position, and backwardly and forwardly tilted bulldozing positions, the composite blade assembly is carried by a support arm or arms which are protected against abrasion and wear in the blade's carrying position. In that position added flotation for the tractor is achieved by sledding of the blade unit on the earth's surface and thereby adding carrying capacity on soft ground. Level-

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ing during the carry is likewise achievable in this same manner by the scraping action of the protuberant edge of the stiffener beam. Sides provided at the ends of the blade proper permit it to serve efficiently as a scoop or bucket for carrying earth.

With these and other features, objects and advantages in mind, and others as will appear more fully hereinafter, this invention comprises the novel earth-moving equipment illustrated in the accompanying drawing, as hereinafter described by reference to the drawings.

FIGURE 1 is a general perspective view of the equipment, in position for forward bulldozing or rearward leveling, the tractor vehicle whereon it is mounted being shown in phantom.

FIGURE 2 is an isometric view of the blade assembly only, in the same position, and partly broken away.

FIGURE 3 is a cross-sectional view, at the line 3—3 of FIGURE 2.

FIGURES 4, 5 and 6 are end elevations of the blade-bucket, in backward-bulldozing, forward-bulldozing, and carrying positions, respectively.

The tractor vehicle 9 may be of any suitable type, that shown including frame elements 90, an engine 91, and two endless tracks 92 whereby it is supported, and upon which it travels forwardly or backwardly. At a suitable point 20 on a frame element 90 two forwardly directed arms 2 are pivotally mounted, so that their forward ends, ahead of the tractor, can swing upwardly and downwardly. Such swinging movement is afforded by suitable means, such as the hydraulic jacks 21, joined to the arms at 22 and reacting from a frame element.

Pivotally mounted at 12 upon the swinging end of the arms 2, ahead of the tractor 9, is the earth-contacting element, which may be termed a blade-bucket, 1. This is so formed that it will receive and carry a load of loose earth, such as is illustrated at L in FIGURE 6. To do this it is formed with a bottom 10, a top plate 11 obtusely angled relative to one edge of the bottom, and an opposite bottom plate 13, oppositely obtusely angled relative to the opposite edge of bottom 10. Plates 10, 11 and 13 form the blade proper. An extension edge 14 at the bottom of plate 13 serves as a wear-resistant ground-engaging bit. This bit is renewable or replaceable when worn, and can be joined to the body of the blade-bucket in any suitable manner (usually by welding). While the blade proper has been shown and described as formed of angularly related, generally planar plates, it will be apparent that it might be formed in a continuous curve from edge to edge. The ends of the blade-bucket will normally be closed by end plates 15.

A blade-bucket formed as just described would have some degree of rigidity, but since the blade 13, 14 must function as a bulldozer blade, it is highly desirable that it be stiffened, particularly against torsion and bending, yet it must be light in weight. In order to stiffen it, and to form it with a concavity for directing dirt ahead during backward bulldozing, as the concavity formed by the obtusely angled plates 13 and 10 does during forward bulldozing, the reverse side of the blade proper is provided with a beam. This beam comprises an exterior plate 16 extending at an acute angle from the inner plate 13, at the vicinity of the root of the blade bit 14, and is braced from the plate 13, preferably by transverse triangular gussets 17, welded in place at intervals along the length of the plates. The plate 16 defines an obtuse angle, or concavity, relative to the back side of blade 14.

The beam just referred to preferably is closed at its top, by the cover plate 18. This cover plate stiffens plate 16, and vice-versa, and it prevents dirt entering the hollow space behind plate 16, which would increase the bucket's weight. Also, it forms with plate 16 and inner plate 13

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a box beam as well as a rigid elongated corner and functions as a skid or float protecting the parts of the blade-bucket with the latter lowered to the ground in its earth-carrying position, and at the same time functions for scraping or leveling the ground with the blade-bucket in the carry position (FIGURE 6).

The pivot axis 12 where the arms 2 join the bucket is located behind this cover plate 18. When the ground is soft the bucket, loaded as in FIGURE 6, or unloaded, can be skated or floated over the ground, riding upon the plate 16, and the upwardly offset location of the pivot axis 12 as described protects the arms 2 from wear, whether the motion be ahead or in the reverse. Also, this area of the bucket can be used for leveling or smoothing of the ground, during forward or rearward advance.

Tilting of the bucket about its pivot support at 12 is accomplished by suitable means, such as the hydraulic jack 3 and its piston rod 30, reacting between an arm or the arms 2 and the bucket 1, to which it is pivotally connected at 31, at a point above the pivot 12 on the blade 14. The arrangement permits tilting of the bucket from the back-bulldozing position of FIGURE 4, wherein the bucket is tilted upwardly and forwardly, through the forward-bulldozing position of FIGURE 5, wherein the bucket is tilted upwardly and rearwardly, to the carrying position of FIGURE 6, wherein the bucket is more or less level.

It is not necessary, of course, that the blade-bucket always slide on the ground in the carrying position. The arms 2 can be raised to lift the bucket off the ground, and the vehicle can move forwardly or rearwardly with the load thus elevated. The load can be elevated to and dumped within a dump truck in that respect the device operating as a conventional loader.

It will be seen that when the bucket is in its forward bulldozing position, FIGURE 5, the blade 14, plate 13, and plate 10 define a concavity whereby dirt riding up on plate 13 is curled forwardly, as is done with a conventional bulldozer blade. But, in addition, when the bucket is in the back-bulldozing position of FIGURE 4, there is still such a concavity in the relationship of plate 16 to blade 14. The back-bulldozing capability of the equipment of this invention is therefore high, and is assisted by the normal tendency of the backing tracks 92 of the vehicle to climb over obstructions on the ground surface, which tendency reacts at the blade to urge the blade downwardly into the earth. By the same token the resistance of the blade against the ground tends to stabilize the tractor to prevent "climbing" during backward bulldozing.

Rib plate 50 located intermediate the blade's ends stiffens the blade-bucket, as do the sets of lug plates 52, 54 and 56 by which the support arms 2 and the hydraulic jack piston rod 30 are pivotally coupled to the assembly.

In use the tractor moves the bucket 1 forwardly, as in FIGURE 5, or rearwardly, as in FIGURE 4, and if the tilt of the bucket is properly regulated, it will doze off the surface of the ground while moving in either such sense. Alternatively, the blade 14 or the shoe formed by the plate 16 and associated elements may be used to level and smooth the surface. During retraction movements during cutting and grading by bulldozing in either the forward or backward direction the blade bit can dress or finish the surface in the usual manner. Whenever a load of earth must be lifted this can be accomplished by moving forwardly, tilting the bucket meanwhile about its tilting axis 12. The load of dirt can be elevated and dumped into a truck body, for hauling away, or if it is merely to be dumped at a nearby spot the tractor may carry it there, and dump it. The equipment serves efficiently as a bulldozer while moving either forwardly or rearwardly, and in addition can serve as a loader or transporter. Of considerable added importance is its utility in excavating. For example, it has been found that the entire job of excavating a basement for a building, in-

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cluding making the wall cuts with precision, grading and leveling the floor, and removing the earth can be done with great efficiency using the novel device.

These and other aspects of the invention will be evident from the foregoing description of the presently preferred embodiment.

I claim as my invention:

1. Earth-moving equipment for mounting upon a tractor vehicle, comprising support arms extending longitudinally and arranged for pivotal support at one end upon the vehicle, extensible and retractable means for interconnecting the vehicle and said arms to swing the latter upwardly and downwardly about their pivotal support, a bucket having a bottom and a lower generally planar side obtusely angled relative to the bottom, and terminating at its outer edge in a blade, an exterior plate acutely angled relative to said lower side, along a line spaced from but adjacent the blade, means bracing said exterior plate from said lower side, means pivotally mounting said bucket upon the swinging end of said arms to tilt about an axis parallel to the blade, and intermediate said lower side and said bottom, and means connected between said arms and the opposite side of the bucket to control the tilt of the bucket, from a back-bulldozing position wherein the lower side and the blade are inclined upwardly and forwardly, through a forward-bulldozing position wherein the lower side and blade are inclined upwardly, and rearwardly to a carrying position wherein the bottom is generally level.

2. A bulldozer blade implement comprising a main blade unit of laterally elongated shallow configuration disposable horizontally with its width dimension upright when in use as a bulldozer blade, said blade unit having a face which is directed forwardly in such position and which is concave vertically along its length, said blade unit including an elongated ground-engaging lower portion, an elongated plate-like member joined in acute-angled relation at its own longitudinal edge to said blade unit along a location on the latter spaced from but adjacent the lower extremity of said lower portion, and forming with the blade unit a rearwardly directed face which is concave vertically along its length, and which generally diverges upwardly in relation to said forwardly directed face to form a wedge therebetween, elongated means bridging between the plate-like member and the back side of the main blade unit to close the wedge and stiffen said plate-like member, pivot means on the implement by which to connect the same to a supporting vehicle and permit tilting through a range between level carrying position with the main blade unit's forward face directed upwardly and rearward bulldozing position with said rearwardly directed face tilted upwardly and back from the direction of movement during rearward bulldozing, and means connected with the implement for so tilting the same.

3. The implement defined in claim 2, wherein the elongated means comprises a bridging plate extending transversely between the blade unit and the plate-like member along the latter's upper edge, and wherein the pivot means on the implement comprises elements mounted on the back side of the blade unit above the bridging plate and forwardly of the upper edge of the plate-like member.

4. Earth-moving equipment for mounting upon a tractor vehicle capable of movement forwardly and backwardly, comprising a laterally elongated shallow blade bucket having upper and lower horizontal portions, pivotal means supporting the blade-bucket for tilting about a transverse horizontal axis located intermediate the extremities of the upper and lower horizontal portions, the lower horizontal portion having a ground-contacting edge, means to dispose said blade-bucket in use in a variety of dispositions, including generally upright positions inclined upwardly and forwardly from its horizontal ground-contacting edge for backward bulldozing, or upwardly and rearwardly for forward bulldozing, and a generally

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horizontal disposition, with said ground-contacting edge directed forwardly, for carrying earth, said lower horizontal portion having a ground-contacting edge being formed of an inner plate and an exterior plate joined at an acute angle, one of said plates being extended beyond such joint to constitute a blade bit, the open end of the triangular beam thus defined being closed by a cover plate, said cover plate and said exterior plate providing a surface which floats over the ground when the blade-bucket is in its generally horizontal disposition, during rearward as well as forward movement, means incorporated in said beam for reinforcing the same at lateral intervals, and means to raise or lower the pivotal support and consequently the blade-bucket.

5. Earth-moving equipment as in claim 4, wherein the exterior plate extends beyond the joint with the inner plate, to define the blade bit.

6. Earth-moving equipment as in claim 4, wherein the pivotal support is located behind the cover plate, and is protected thereby as the blade-bucket floats over the ground surface.

7. Earth-moving equipment as in claim 4, wherein said means incorporated in said beam for reinforcing the same at lateral intervals includes gussets directed forwardly and rearwardly at intervals laterally of and intermediate the inner plate and the exterior plate.

8. Earth-moving equipment for mounting upon a tractor vehicle capable of movement forwardly and backwardly, comprising a blade-bucket formed of a bottom plate and a top plate and an inner plate, said top plate and said inner plate being joined to the opposite horizontal edges of the bottom plate and extending upwardly and downwardly therefrom at opposite obtuse angles, an exterior plate joined to the inner plate above the latter's lower edge, and extending thence beneath the inner plate at an acute angle to define a reinforcing beam and a projecting blade bit, a cover plate closing the open side of said beam approximately at the joint between the bottom plate and the inner plate, supporting arms extending forwardly to the blade-bucket, and pivotally connected thereto behind said joint and forwardly of the rear edge of the cover plate, means for tilting the blade-bucket about its pivotal connection to the arms, and means for raising or lowering the arms and the blade-bucket supported thereon.

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9. Earth-moving equipment for mounting upon a tractor vehicle capable of movement forwardly and backwardly, comprising a laterally elongated shallow blade-bucket having upper and lower horizontal portions, pivotal means supporting the blade-bucket for tilting about a transverse horizontal axis located intermediate the extremities of its upper and lower horizontal portions, the lower of said portions having a ground-contacting edge, means to dispose said blade-bucket in use in a variety of dispositions including generally upright positions inclined upwardly and forwardly from its horizontally ground-contacting edge for backward bulldozing, or upwardly and rearwardly for forward bulldozing, and a generally horizontal disposition with said ground-contacting edge directed forwardly for carrying earth, said lower horizontal portion with a ground-contacting edge being formed of an inner plate and an exterior plate joined at an acute angle, the open end of the angular beam thus defined being closed by a cover plate, said cover plate and said exterior plate providing a surface which floats over the ground when the blade-bucket is in its generally horizontal disposition, during rearward as well as forward movement, and means incorporated in said beam for strengthening the same.

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