June 13, 1950 F. H. NORRIS 2,511,123

BULLDOZER

Filed May 31, 1946 2 Sheets-Sheet 1

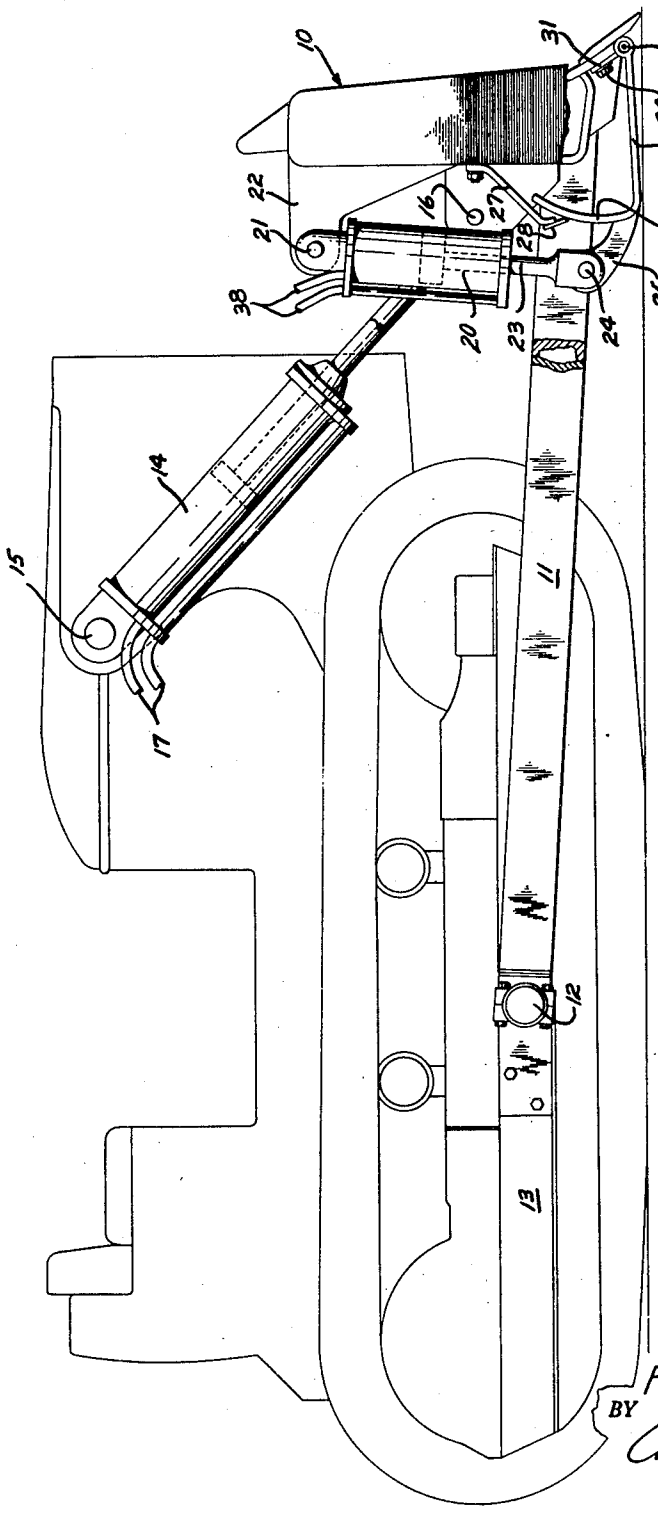



Fig. 1

INVENTOR.
FRED H. NORRIS
BY Charles M. Fryer
ATTORNEY.

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Fig. 4.

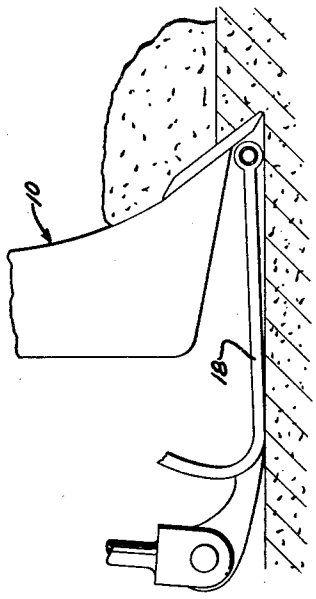



Fig. 6.

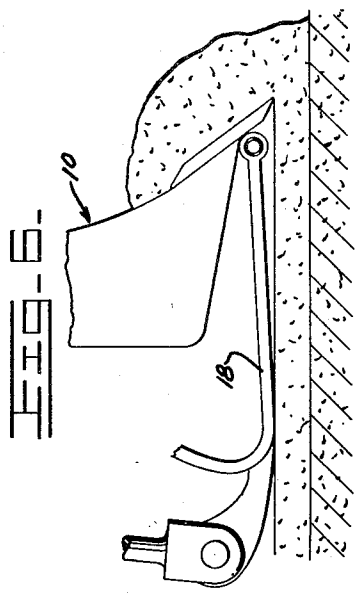



Fig. 3.

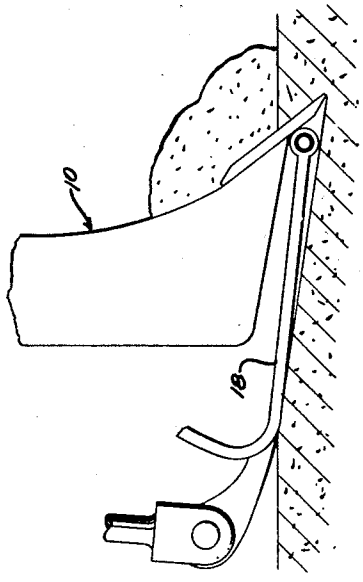



Fig. 5.

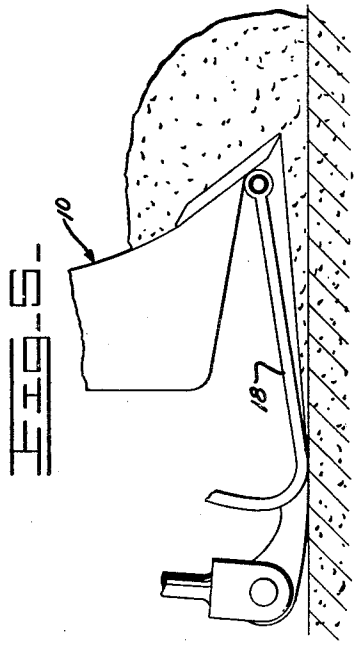
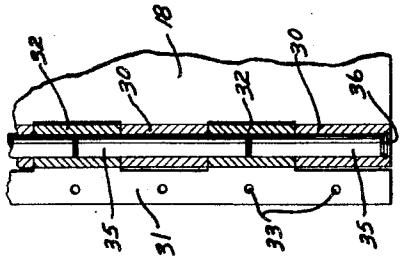



Fig. 2.




INVENTOR.
FRED H. NORRIS
BY Charles M. Fryer
ATTORNEY.

Patented June 13, 1950 2,511,123

# UNITED STATES PATENT OFFICE

2,511,123

## BULLDOZER

Fred H. Norris, Elmwood, Ill., assignor to Caterpillar Tractor Co., San Leandro, Calif., a corporation of California

Application May 31, 1946, Serial No. 673,703

1 Claim. (Cl. 37—144)

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This invention relates to bulldozers and particularly to means for controlling the operation of a bulldozer as it is advanced over the ground by a tractor or other power unit.

Bulldozers are usually pivotally secured to a tractor in a forward position to be pushed or advanced over the surface of the earth for the purpose of leveling or filling. The bullrozer unit is capable of being raised or lowered about its pivotal support on the tractor as by a system of cables or hydraulic mechanisms, preferably capable of being controlled from the operator's station on the tractor. When the level of the cutting edge of the bulldozer blade has been established for the purpose of making a desired cut or fill, the tractor is advanced. Often because of variations in the type of earth encountered by the cutting edge of the bulldozer or because of the fact that the tractor may be pitching or rocking as it advances over irregular terrain, there is a tendency for the blade to dig in or to lift out of the earth. As a consequence, an uneven cut is made and in any event it is difficult to make a very fine cut or fill with any degree of uniformity.

It has been common practice to fit a pair of trailing shoes to opposite ends of the bulldozer adjacent its cutting edge, which shoes tend under certain circumstances to prevent digging in of the blade. These shoes, however, are not readily adjustable and cannot be employed to insure uniform operation of the bulldozer blade at different depths.

It is an object of the present invention to provide a bulldozer having trailing shoes means controlled by the operator for varying the depth of cut or fill being made during operation. A further object of the invention is to provide a bulldozer having a shoe or ground engaging plate adjacent its cutting edge which is readily adjustable during operation of the bulldozer to determine accurately the depth of operation of its cutting edge as it floats or rides over the surface of the earth under the influence of gravity only. Still further and more specific objects and advantages of the invention are made apparent in the following specification wherein reference is made to the accompanying drawings which illustrate one form of the invention.

In the drawings:

Fig. 1 is a view in side elevation of a tractor having a bulldozer which embodies the present invention associated therewith, parts of the bulldozer being broken away to clarify the disclosure;

Fig. 2 is an enlarged fragmentary detail of a

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hinge connection between the bulldozer blade and a trailing shoe plate; and

Figs. 3, 4, 5 and 6 are diagrammatic views illustrating different positions of the trailing shoe with relation to the bulldozer blade and illustrating the nature of operation of the bulldozer blade when the shoe occupies different positions.

In Fig. 1 of the drawings a tractor is illustrated as having a conventional bulldozer generally indicated at 10 secured to it as by the usual forwardly extending arms 11 which are pivoted as at 12, one to each of the truck frames 13 of the tractor. The bulldozer 10 can be raised and lowered with relation to the ground by any means such as cable controlled mechanism, or a pair of hydraulic rams, one of which is shown at 14 as pivotally connected to the tractor at 15 and to the bulldozer at 16. Hoses 17 form communication between the ram 14 and a suitable source (not shown) of fluid under pressure which through conventional conduits and valves may be employed to adjust the position of the bulldozer relative to the ground. The rams 14 are operable in a conventional manner to raise or lower the bulldozer about its pivotal support 12 to hold it at a fixed elevation or to permit it to rest by gravity or float on the surface of the ground.

With the bulldozer engaging the ground either in a fixed or floating position as the tractor is moved forwardly there is a tendency for it to dig in or pull out of the ground rather than to make a continuous even cut and it is, therefore, necessary for the operator of the tractor to make frequent adjustments of the elevation of the bulldozer with the result that a perfectly even cut or fill is most difficult to accomplish.

The present invention provides a shoe 18 pivotally connected as at 19 just to the rear of and slightly above the cutting edge of the bulldozer blade. This shoe extends preferably throughout substantially the full width of the bulldozer and is capable of being adjusted about its pivotal support 19 by one or more and preferably two hydraulic rams, one of which is shown at 20 in Fig. 1. The rams 20 are pivotally supported as by pins 21 extending through brackets 22 which project rearwardly of the bulldozer. The extendable pistons of the rams shows at 23 are connected as by pins 24 to brackets 25 secured to and extending rearwardly from the adjustable shoe 18. The rear edge of the shoe 18 is flanged upwardly as is indicated at 26 so that the shoe will be rigid throughout its length. As this upwardly flanged portion of the shoe may effect the retention of earth, rocks, and other material which chances

to pass over the top of the bulldozer blade, it is preferably formed to an arcuate shape. The entrance of material between the flanged portion of the shoe and the bulldozer blade is prevented by a shield 27 bolted to the rear face of the bulldozer and having an edge 28 of light metal or resilient material such as leather or rubber engageable with the arcuate flange 26 as the shoe 18 is raised and lowered by the action of the rams 20. A convenient method of pivotally securing the shoe 18 to the bulldozer is illustrated in Fig. 2 of the drawings wherein the shoe is shown as having hinged lugs 30 formed at its edge. A complementary hinge part 31 is provided with hinge lugs 32 spaced for reception between the lugs 30 of the shoe 18. The hinge part 31 is provided with holes 33 by means of which it may be secured by bolts of capscrews 34 (Fig. 1) to the back of the bulldozer blade. A single pintle pin or rod extending through all of the hinge lugs 30 and 32 will serve to form a suitable pivotal connection but for convenience in assembly it is preferable that a plurality of short pins such as indicated at 35 be employed for this purpose. The pins 35 may be retained against accidental removal as by snap rings, one of which is indicated at 36 in Fig. 2, and which fit in suitable grooves formed in the bore of the end-most hinge lugs 30.

The hydraulic rams 20 which serve to raise and lower the shoe 18 with respect to the cutting edge of the bulldozer blade are provided with conventional conduits 38 by means of which they may be connected through a suitable control valve (not shown) with a source of fluid under pressure, and preferably the same source that is employed for operation of the ram 14. The valve for controlling the rams 20 is, of course, disposed at the tractor operator's station so that the elevation of the shoe 18 is under control of the operator at all times.

Figs. 3 to 6 inclusive of the drawings illustrate the manner in which the shoe 18 may be controlled to effect an even cut or a uniform fill without attention to the position of the bulldozer with relation to the tractor or, in other words, while the bulldozer is floating by gravity rather than under control of the hydraulic rams 14. In order to make a uniform cut, the operator first permits the bulldozer to rest on the surface of the ground under the influence of its own weight and with the shoe 18 slightly raised or adjusted to the position shown in Fig. 3 so that upon forward movement of the tractor, the tendency of the bulldozer blade is to cut into the ground at a slight angle. As soon as this cut has attained the desired depth, the operator adjusts the shoe 18 through the medium of the hydraulic rams 20 to bring it to the substantially level position shown in Fig. 4 where, by contact with the surface of the earth behind the cutting edge it supports the cutting edge against further downward movement and insures its travel in a plane determined by the depth of its own cut. To effect a fill or spreading of loose earth at a uniform depth, the bulldozer is advanced into the material to be spread with the shoe 18 in a depressed position such as illustrated in Fig. 5 so that the tendency of the cutting edge of its blade is to progress upwardly. When the desired level is obtained, the operator adjusts the shoe 18 upwardly to the position shown in Fig. 6 where it rides on top of the fill or surface of the recently spread earth and guides the bulldozer blade in a manner which causes it to continue in a plane established by the top surface of the fill. Thus, in either of the cases illustrated in Figs. 4 and 6, the bulldozer which is floating and therefore imposing a minimum of strain on the tractor and requiring no attention by the operator will operate continuously to produce a smooth regular surface which is not affected by irregularities in the surface of the earth over which the tractor is operating and which is not affected by forward pitching of the tractor which may result from various causes.



The shoe 18 is, as hereinbefore described, preferably extended throughout the entire width of the bulldozer and when so constructed serves to smooth or pack the earth as it trails behind the cutting edge of the blade particularly where a fill is being made. A shoe of lesser width would, however, function to control the cutting edge of the blade or if desired, a series of narrow shoes spaced from each other could be employed.

The use of the present invention enables a tractor-bulldozer combination to operate at exceptionally high speeds when a light cut or fill is being made. High speed operation, even in making a light cut, has heretofore been impractical because of the danger of the bulldozer blade digging in and suddenly requiring more power than is available in high gear with the result that the tractor would stall.

I claim:

A bulldozer comprising a blade disposed in a generally vertical plane, a shoe pivoted to said blade and disposed in a generally horizontal plane in trailing relationship to the lower edge of the blade, means for adjusting the shoe relative to the blade, and a guard plate carried by the blade and extending rearwardly over the shoe to prevent the deposit of earth on the shoe as the bulldozer moves forwardly.

FRED H. NORRIS.


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