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R. H. HUNGER ET AL

3,038,265

METHOD AND APPARATUS FOR MOVING EARTH

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2 Sheets-Sheet 1

FIG-1

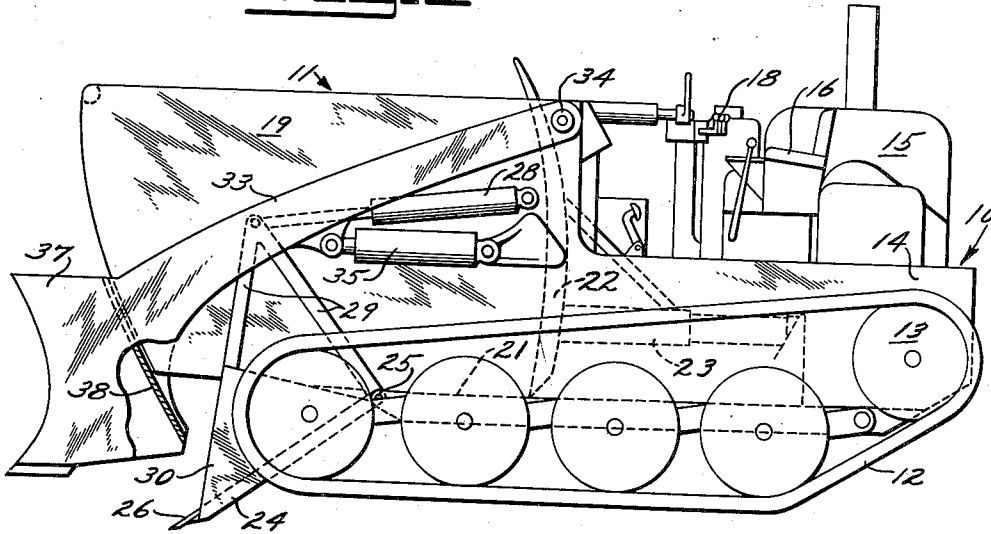
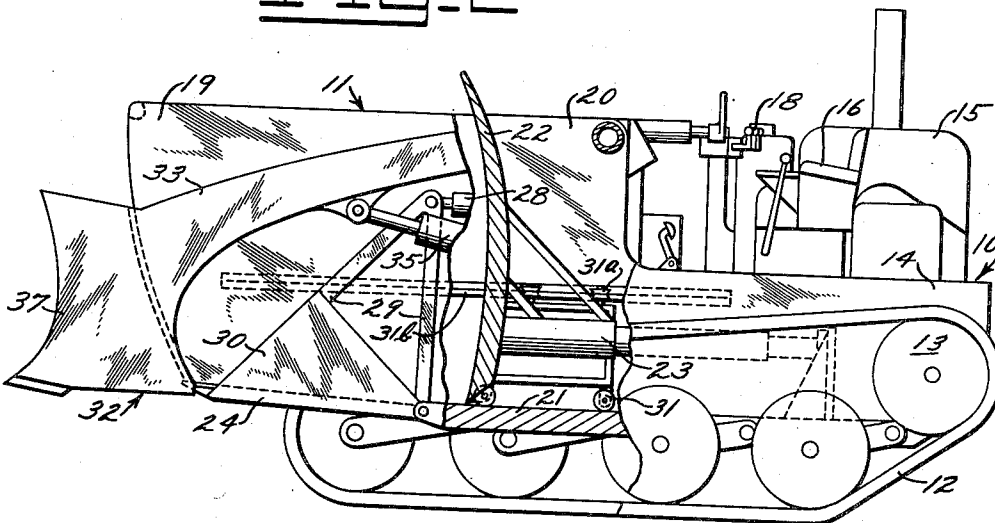


FIG-2



INVENTORS
RICHARD H. HUNGER
EUGENE E. WUICK
BY
Fryer and Johnson
ATTORNEYS

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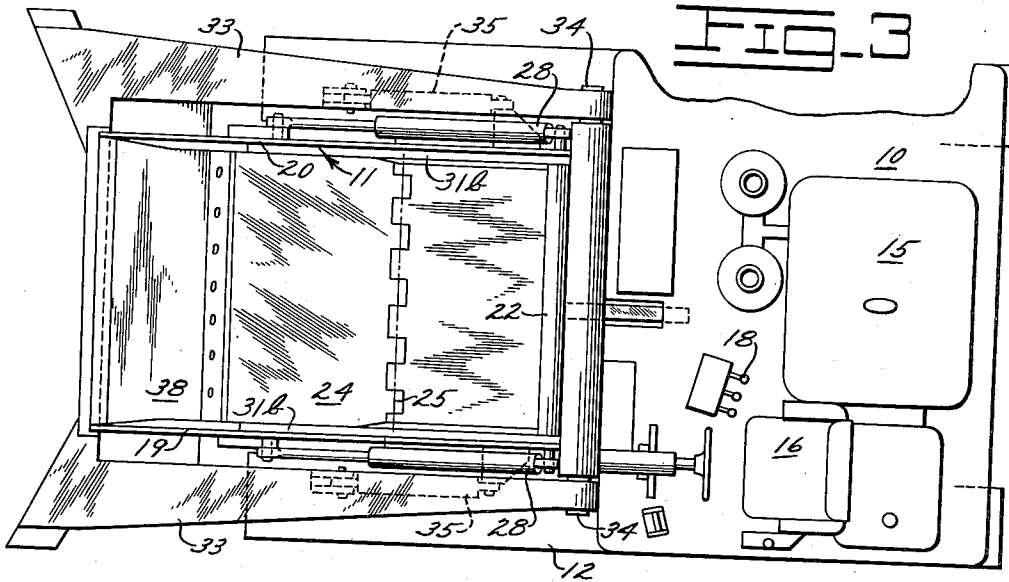
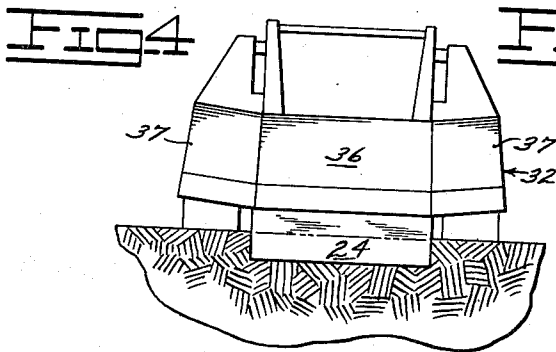
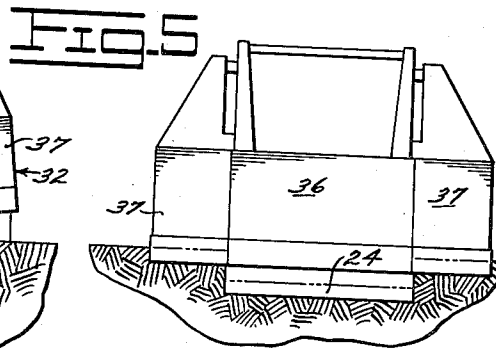
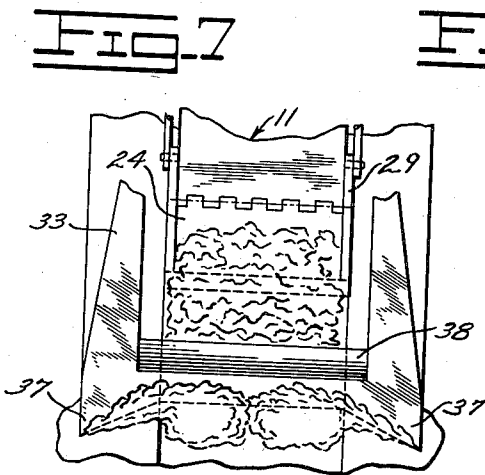
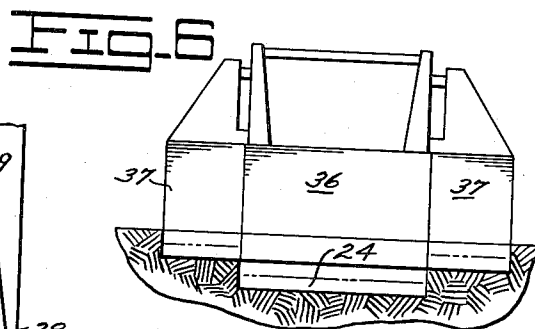
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METHOD AND APPARATUS FOR MOVING EARTH

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INVENTORS
RICHARD H. HUNGER
EUGENE E. WUICK
BY
Fryer and Johnson
ATTORNEYS

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3,038,265 METHOD AND APPARATUS FOR MOVING EARTH

Richard H. Hunger, Washington, and Eugene E. Wuigk,
Peoria, Ill., assignors to Caterpillar Tractor Co., Peoria,
Ill., a corporation of California

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This invention relates to a method and apparatus for moving earth and particularly to a light weight machine capable of performing heavy duty earthmoving operations and to the method employed for accomplishing the objects attained by such a machine.

The work per unit of time accomplished by a tractor mounted bulldozer depends in part and is limited by the overall weight of the machine. This is because traction is necessary to react the force of the motive power which pushes the load. When the machine skids or "breaks away" from the ground, the application of greater horsepower is useless unless additional weight is added to provide traction. This is also true of a scraper with an earth carrying bowl where force and traction are required not only to drive the cutting edge of the bowl through the earth, but to urge the earth into the bowl against the weight and resistance of the earth already received until the bowl is full.

Light weight and great capacity are, therefore, usually considered inconsistent in the design of earthmoving machinery though they are both economically desirable. They are also particularly desirable for military operations wherein tractors and other heavy equipment are now airborne by cargo planes and dropped into strategic areas by parachute.

It is, therefore, the object of the present invention to provide light weight heavy duty earthmoving equipment to which ballast in the form of earth loaded onto the machine under its own power provides traction for heavy duty use.

Another object of the invention is to provide a method and a structure through which a relatively light machine is made capable of loading itself with earth sufficient to adapt it for work of a much heavier machine notwithstanding its original low traction capacity.

A further object of the invention is to provide a machine of the character described capable of use as a scraper and carrier, a bulldozer, a drawbar implement and a means for picking up and moving heavy articles of various sorts.

Still further objects and advantages of the invention are made apparent in the following specification wherein reference is made to the accompanying drawings illustrating the apparatus and the method of the invention.

In the drawings:

FIG. 1 is a schematic view in side elevation of a tractor including a bulldozer and scraper embodying the present invention and with parts broken away for purposes of illustration;

FIG. 2 is a fragmentary view similar to FIG. 1 illustrating the bulldozer blade, a ramp for the scraper bowl and a scraper ejector in different positions of adjustment;

FIG. 3 is a schematic plan view of the machine illustrated in FIGS. 1 and 2;

FIGS. 4, 5 and 6 are schematic views in front elevation illustrating various positions of the parts of the machine in carrying out the method of loading which is a part of the present invention; and

FIG. 7 is a fragmentary schematic plan view of the front portion of the machine as it is illustrated in FIGS. 5 and 6.

Referring first to FIGS. 1 and 3, the machine of the present invention is illustrated as comprising a tractor, the main body portion of which is generally indicated at 10. A narrow scraper bowl, generally indicated at 11, extends forwardly from the main body of the tractor to which it is rigidly secured so that it may function in the manner of the usual frame elements of the tractor to which is connected a track-type ground engaging and driving unit, generally indicated at 12 consisting of two parts, one arranged on each side of the body of the tractor and driven by sprockets such as shown at 13 in FIG. 1 from a final drive housing 14 at the rear portion of the tractor. An engine contained in the housing 15 imparts a drive to the track through the usual transmission and final drive gearing. An operator's station is illustrated at 16 and hydraulic control levers 18 are disposed adjacent the operator's station.

The elements so far described with the exception of the bowl 11 are conventional and their construction and design may be varied within the scope of the present invention. The bowl comprises side walls as illustrated at 19 and 20, a bottom 21 and a rear wall in the form of an ejector 22 capable of being advanced through the bowl by a hydraulic cylinder shown at 23. The forward portion of the bottom of the bowl is formed as a ramp 24 hingedly connected to the bottom portion 21 as at 25 and having a hardened cutting edge 26 secured along its foremost edge. This ramp portion 24 may be raised or pivoted about its connection 25 by hydraulic cylinders 28 disposed one on each side of the bowl and pivoted thereto and having extensible piston rods engageable with a frame work 29 extending upwardly from the ramp. When the ramp is in its lowered position as is illustrated in FIG. 1, its cutting edge engages beneath the surface of the earth freeing earth which, upon forward movement of the tractor, moves up the ramp and is deposited into the bowl. Side plates 30 assist in guiding the earth on its movement upwardly over the ramp. When the ramp is in its raised position as illustrated in FIG. 2, it also serves as a bottom for the bowl so that a full load of earth may be transported by the tractor either for the purpose of moving the earth from one side to another or for the sole purpose of increasing weight and adding tractive capacity.

A partially advanced position of the ejector 22 is also illustrated in FIG. 2 and forward movement of the ejector is employed in the usual manner to eject earth from the bowl either with the ramp in its partially raised or fully raised position. The ejector 22 rolls forward on support wheels 31 and on guide rollers 31a. Rails 31b on side walls 19 and 20 provide a track for rollers 31a and thus support ejector 22 in its extreme advanced position when ramp portion 24 is lowered. A bulldozer, generally indicated at 32, is carried by the tractor on arms 33 pivoted as at 34, one to each side of the bowl 11. The bulldozer may be raised and lowered by hydraulic jacks 35 also pivoted to the sides of the bowl and having piston rods pivoted to the bulldozer arms. The hydraulic jacks 23, 28 and 35 are all subject to control by the operator's control levers 18 through hydraulic circuits all of which may be conventional and are well known in the art. The bulldozer comprises a main dozing blade 36 which is centrally disposed and of substantially the same width as the bowl 11 and wings 37 which extend outwardly and forwardly from both sides of the main blade, see also FIG. 4, forming what is sometimes referred to as a "U-type" dozer blade. Directly behind the main or central portion of the dozer blade and supported between the arms 33 is a curved plate 38 which serves as a sliding forward wall of the bowl 11. The curvature of the forward edges of the side walls of the bowl, as well as that of the plate 38, are

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struck on arcs originating at the pivot points 34 of the bulldozer arms.

In operation, the machine, as described, is employed as a scraper to pick up earth to be used as ballast and then as a bulldozer relying upon the ballast carried in the bowl 11 for traction necessary to perform the efficient bulldozing operation of a heavy machine.

The machine of the present invention is capable of picking up a load of earth equal to its own weight so that a relatively light machine of say 16,000 pounds which can be airborne and safely dropped will pick up 16,000 pounds of earth to use as ballast in bulldozing or other operations. It should be understood that this cannot be accomplished by an ordinary scraper and earth carrier but is made possible only by the structure and the method of the present invention, the method being best understood by reference to FIGS. 4 to 7, inclusive. The first step in the method is illustrated in FIG. 4 wherein the bulldozer 32 is illustrated in a raised position to clear the ground while the ramp 24 which is considerably narrower than the cutting edges of conventional scrapers is lowered beneath the surface of the ground for cutting and initial loading. The weight of the empty or unballasted machine provides sufficient traction to make this first narrow cut to a depth which may depend upon the hardness of the earth, and partial ballast is provided in this step.

In the second step which is illustrated in FIG. 5, the machine is driven over the cut formed by the first step with the ramp 24 and its cutting edge slightly lower, the original cut being shown in broken lines and with the wings 37 of the bulldozer blade also lowered to take a small cut on both sides of the original trench. Since the wings 37 are inclined forwardly, an action such as that indicated in FIG. 7 is produced where the earth cut by them passes rearwardly and inwardly to be deposited in the trench and picked up in loose form by the ramp 24. Here again the depth of cut may depend upon the hardness of the earth and if the ballast previously acquired does not provide sufficient traction, the apron may assume a higher position so as to cut little or no earth during this step. A third step is illustrated in FIG. 6 where the ramp 24 and bulldozer blade are further lowered in passing over the same trench, and by repetitive passes and adjustment of the depth of cuts depending upon the type of earth encountered, loose earth is loaded into the scraper bowl to a total weight far in excess of that possible in the operation of ordinary scrapers.

When the machine is fully loaded, the combined weight of the ballast and machine is sufficient to enable utilization of the full horsepower of the engine and bulldozing is accomplished with the same efficiency as a machine having an initial weight twice that of the present machine.

The machine of the present invention is, of course, also capable of use as a scraper for excavating and transporting earth as in road building and other operations. Furthermore because of the design of the scraper bowl with its flat bottom and forwardly disposed adjustable inclined ramp, it may be used for picking up and transporting heavy articles or it may be used as an ordinary tractor for towing other equipment.

We claim:

1. An earthmoving machine comprising a track-type tractor having an earth receiving bowl disposed between the forward portions of its tracks, a ramp with a cutting edge hinged to the bottom of the bowl at the front end thereof, and means to raise and lower the ramp to support earth in the bowl and to engage the earth for cut-

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ting and filling the bowl, and a bulldozer hinged to the sides of the bowl and having blade means disposed in front of the bowl, said ramp and blade means being disposed in spaced relationship with each other when both are in lowered position, and means on said blade means for feeding earth into the path of said ramp.

2. An earthmoving machine comprising a track-type tractor having an earth receiving bowl disposed between the forward portions of its tracks, a ramp with a cutting edge hinged to the bottom of the bowl at the front end thereof, means to raise and lower the ramp to support earth in the bowl and to engage the earth for cutting and filling the bowl, and a bulldozer hinged to the sides of the bowl and having blade means disposed in front of the bowl said ramp and blade means being disposed in spaced relationship with each other when both are in lowered position, and means on said blade means for feeding earth into the path of said ramp, and means on the bulldozer behind the blade forming a front wall for the bowl.

3. An earthmoving machine comprising a track-type tractor having an earth receiving bowl disposed between the forward portions of its tracks, a ramp with a cutting edge hinged to the bottom of the bowl at the front end thereof, means to raise and lower the ramp to support earth in the bowl and to engage the earth for cutting and filling the bowl, and a bulldozer hinged to the sides of the bowl and having blade means disposed in front of the bowl said ramp and blade means being disposed in spaced relationship with each other when both are in lowered position and wing means on said blade means for feeding earth into the path of said ramp, means on the bulldozer behind the blade forming a front wall for the bowl, and means for raising and lowering the bulldozer independently of the ramp.

4. An earthmoving machine comprising a track-type tractor having an earth receiving bowl disposed between the forward portions of its tracks, a ramp with a cutting edge hinged to the bottom of the bowl at the front end thereof, means to raise and lower the ramp to support earth in the bowl and to engage the earth for cutting and filling the bowl, and a bulldozer hinged to the sides of the bowl and having blade means disposed in front of the bowl said ramp and blade means being disposed in spaced relationship with each other when both are in lowered position, said blade means being U-shaped for feeding earth into the path of said ramp, means on the bulldozer behind the blade forming a front wall for the bowl, means for raising and lowering the bulldozer independently of the ramp, said bowl having a forwardly movable back wall, and means to move the wall forwardly to eject the contents of the bowl.

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