June 20, 1961 F. G. HOUGH ET AL 2,989,199

FRONT END LOADER

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Fig. 1

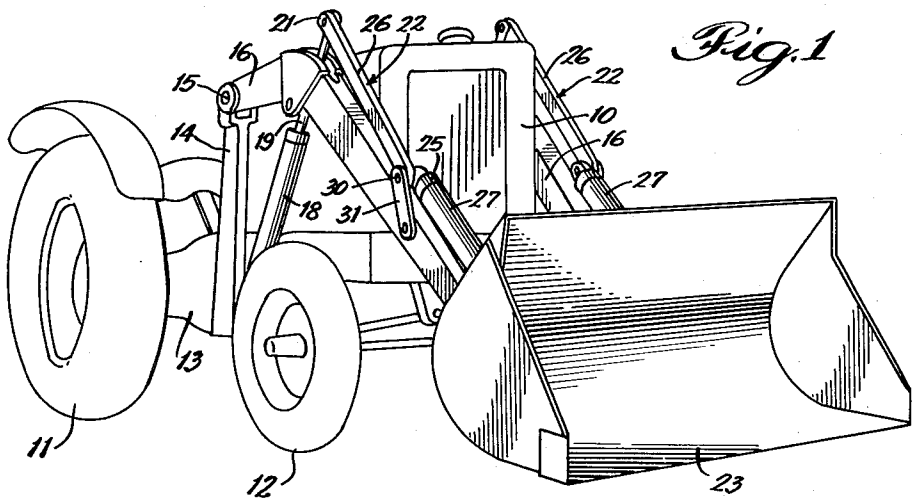
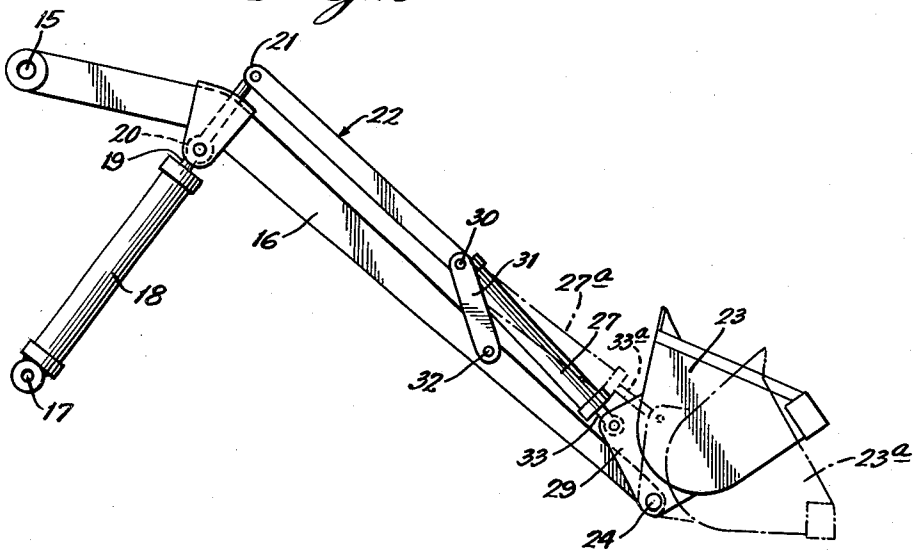


Fig. 2



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Fig. 3

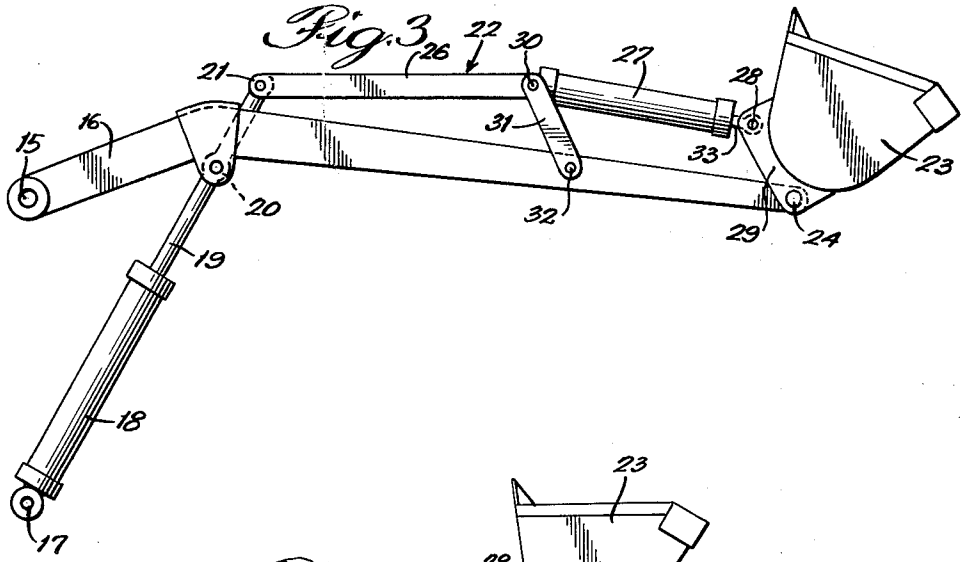
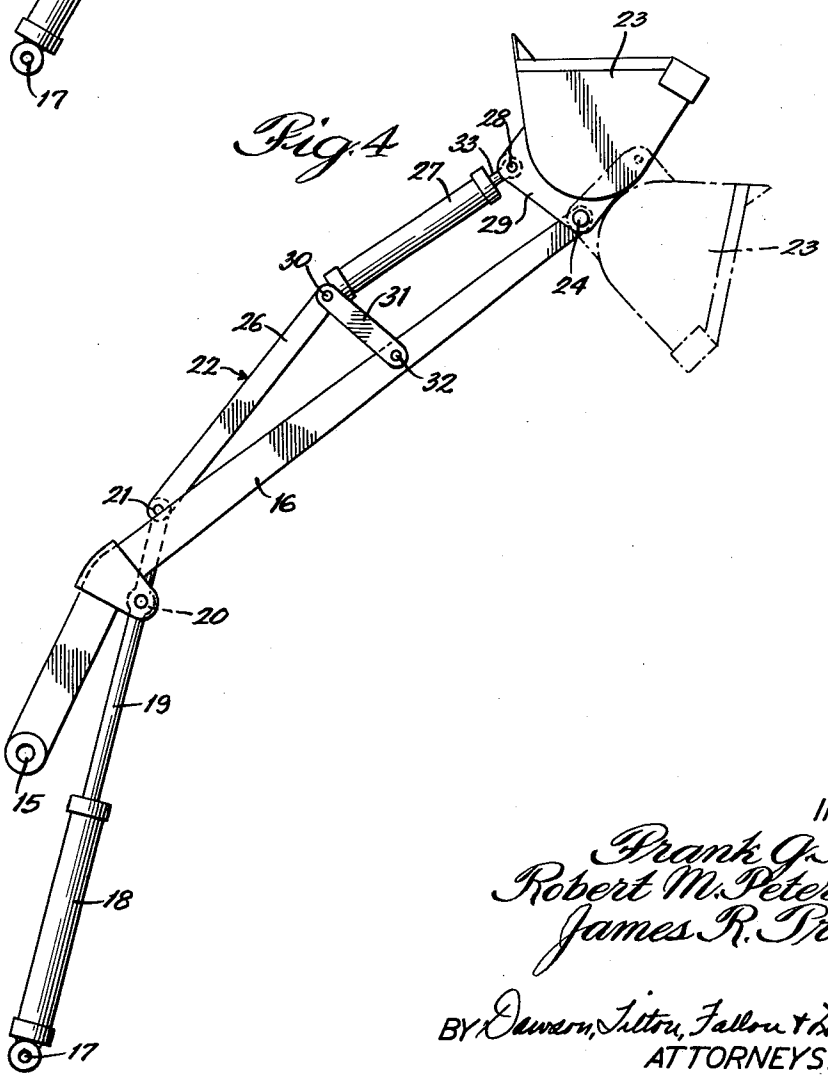


Fig. 4



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2,989,199

FRONT END LOADER

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6 Claims. (Cl. 214—140)

This invention relates to a front end loader, and, more particularly, to a loading mechanism adapted to be installed on the front end of a tractor, or like vehicle.

The structure with which this invention is concerned finds utility in back filling, for example. Where a trench or excavation has been made, it is often necessary to replace all or a part of the earth. In such an instance, a lightweight tractor can be employed with a shovel mounted at its front end for movement through a vertical arc. The shovel can engage a portion of the earth from where it is piled and thereafter deposit it where it is needed. In such an environment, an often-encountered problem is that the shovel, when raised, particularly to a dumping position, has so much of a backward tilt that a portion of the earth carried by the shovel falls therefrom and might cause damage to the tractor operator. There has been a problem to provide a simple, effective tilting mechanism for a front end loader that is operative to maintain the shovel or bucket in substantially the same position relative to the ground during the elevation of the bucket.

It is an object of this invention to provide a structure which solves the foregoing problem and which is characterized by advantageous operation, especially in connection with the environment just described. Another object is to provide a front end loader for a tractor, or the like, in which extensible linkage means extends between the bucket and the means for elevating the boom supporting the bucket. Still another object is to provide a front end loader in which the tilting mechanism connected with the bucket describes a parabolic path, while the elevating mechanism follows a circular path, whereby the bucket is positioned in substantially the same position relative to the ground during elevation. Yet another object is to provide a front end loader including a boom pivotally supporting a bucket in which the mechanism for tilting the bucket to dump the same is provided independently of any connection to the boom.

A further object is to provide a front end loading mechanism in which the bucket-tilting mechanism is coupled to boom-elevating means whereby a compact and lightweight tilting mechanism is provided, eliminating the need for the ponderous members otherwise required to resist the stresses ordinarily employed in such operations. Other objects and advantages of this invention can be seen as this specification proceeds.

The invention will be described in connection with an illustrative embodiment in the accompanying drawing, in which—

FIG. 1 is a perspective view of apparatus embodying teachings of the invention and installed on a tractor;

FIG. 2 is an elevational view of the front end loader portion of the apparatus seen in FIG. 1 and showing the bucket in its lowermost or earth-receiving position;

FIG. 3 is a view similar to FIG. 2 but with the bucket shown in a load-carrying position; and

FIG. 4 is a view similar to FIGS. 2 and 3 but with the bucket shown in its most elevated position.

Referring now to the drawing, in the illustration given, the numeral **10** designates a tractor equipped with rear wheels **11**, front wheels **12**, and a frame **13**.

Secured to the frame **13**, or, alternatively, provided as part of the frame **13**, is an upright member **14** to which

is pivotally connected as at **15** a boom **16**. The boom **16** and the pivotal connection **15** thereof can be seen in the remaining views in the drawing. The frame member **14** also provides a pivotal connection as at **17** for a power cylinder or ram **18**, as also to be seen in FIGS. 2–4.

In the illustration given, the cylinder **18** is equipped with a piston rod **19** provided with a pair of spaced-apart eyes **20** and **21** for the pivotal coupling thereto of boom **16** and a tilting linkage generally designated by the numeral **22**.

The boom **16** at the end opposite its connection with frame member **14**, pivotally carries a bucket **23** as at **24**. As can be seen from a comparison of FIGS. 2–4, the extension of piston rod **19** causes an upward movement of boom **16** and a corresponding movement of the pivot point **24** which marks the connection of bucket **23** with boom **16**.

Interconnected between eye **21** of piston rod **19** and bucket **23** is the extensible linkage **22**. In the illustration given, the extensible linkage **22** includes a rigid elongated link **26** pivotally secured at one end to the eye **21** of piston rod **19**, and at the other end to a power cylinder **27**. The power cylinder **27**, at the end thereof opposite to its pivotal connection with link **26**, is pivotally connected as at **28** to a rearwardly-extending flange **29** provided on bucket **23**.

The pivotal connection between link **26** and cylinder **27**—this pivotal connection being designated by the numeral **30**—also marks the pivotal connection of a secondary link **31** extending between pivot point **30** and the boom **16** as at **32**.

In the operation of the device just described, the piston rod **19** is retracted within cylinder **19** (under the influence usually of the tractor hydraulic system, not shown) to position the boom in the orientation seen in FIG. 2. Thereafter, the cylinder **27** is extended to pivot the bucket **23** from its solid line condition to the condition shown in dotted line, at which time it is in a position for scooping earth, or the like. Once the bucket **23** is suitably loaded, the cylinder **27** has its piston rod **33** retracted from the dotted line position designated at **33***a* in FIG. 2, and the bottom **16** is ready to be raised upwardly to the position shown in FIGS. 3 and 4. In FIG. 3, the boom is disposed generally horizontally, with the piston rod **19** of cylinder **18** being extended partway. The piston rod **33** of cylinder **27** is still retracted, and it is seen that the bucket **23** has about the same position relative to the ground in FIG. 3 as it has at FIG. 2 and when the piston rod **33** was retracted.

In some instances, it is desired to transport the load with the boom **16** in the condition seen in FIG. 3. In other instances, it may be desirable to complete the elevation of boom **16** to the position seen in FIG. 4. In FIG. 4, it is to be noted that the bucket **23** has tilted only slightly rearwardly from the positions seen in FIGS. 2 and 3, so that there is no danger of any back spillage of the load from bucket **23**. The solid line position of bucket **23** in FIG. 4 again is achieved without movement of the extensible linkage **22**, in particular, the extension of the piston rod **33** associated with cylinder **27**. The dotted line position of the bucket **23** indicates the dumping position which is achieved after the boom **16** has been completely elevated and when piston rod **33** has been extended from cylinder **27**.

From the foregoing description, it can be seen that positive control over the bucket **23** and boom **16** is achieved through the cylinders **18** and **27**, both of which can be conveniently operated from the hydraulic system of the tractor **10**. However, each cylinder is operated independently and at different times in the operational sequence so that there is no danger that concurrent opera-

tion will result in one cylinder affecting the operation of the other.

As can be seen from FIG. 1, the bucket **23** is ordinarily equipped with a pair of booms **16** and tilting mechanisms **22**. Each of these is securely tied to the frame **13** of the tractor and extends forwardly of the tractor and inboard of the front wheels **12**.

The beneficial advantages of the invention can be achieved through variations of the extensible linkage **22**, which, as illustrated, includes link **26** and cylinder **27**. For example, the link **31** may be omitted and an elongated cylinder connected between eye **21** and the pivotal connection **28** on bucket **23**. Also, the positions of the link **26** and the cylinder **27** may be exchanged. Still further, it is possible also to achieve the operational advantages of the invention where the pivotal connection of the boom **16** on piston rod **19** and the extensible linkage **26** with piston rod **19** are interchanged. The spaced-apart connections of the tilting mechanism **22** and the boom **16** on the elevating means **18** bring about a path of movement of pivot point **28** which is essentially parabolic as contrasted to the circular path followed by the pivot point **24** on flange **29**.

Excellent results in the use of the invention are achieved where the elements are positioned as seen in the accompanying drawing, i.e., the elevating cylinder **18** is oriented at an acute angle with and below the boom **16** with the acute angle decreasing as the boom is elevated upwardly.

The slight backward tilting of bucket **23**, as seen from a comparison of FIGS. 3 and 4 and with the piston rod **23** retracted, can be altered by change of the distance between the spaced-apart eyes **20** and **21** on the piston rod **19**. Increasing the spacing between pivotal connections of the boom **16** and the extensible linkage **22** on the elevating means reduces the degree of tilt at the uppermost position of the bucket **23**, while decreasing the distance between pivotal points **20** and **21** increases the degree of tilt of the bucket at the uppermost position seen in FIG. 4. Some degree of tilt is considered desirable, since it results in a slight shifting of the load prior to dumping.

With the structure illustrated and described herein, a compact and lightweight front end loader is provided with a minimum of stresses on the various parts.

In the illustration given, the provision of the link **31** results in a toggle network made up of link **26** and cylinder **27**, which provides additional flexibility in operation.

While, in the foregoing specification, we have set forth a detail description of an embodiment of the invention for the purpose of illustrating the invention, many variations in those details will be seen by those skilled in the art without departing from the spirit and scope of the invention.

We claim:

1. In a front end loader, a frame, a boom pivotally mounted on the frame for movement through a vertical arc, a bucket pivotally mounted on the end of the boom remote from the frame, a cylinder and piston rod unit, the end of said unit opposite the piston rod being pivotally connected to said frame, the piston rod of said unit being connected to said boom, a rigid extension on said piston rod, said extension also being pivotally connected to linkage means, said linkage means being extensible and pivotally connected to said bucket, whereby said piston rod, boom and linkage cooperate to maintain said bucket in substantially the same position relative to the ground during elevation of the boom.

2. The structure of claim 1 in which the said linkage means includes cylinder means.

3. The structure of claim 2 in which the said linkage means also includes a link pivotally connected to said cylinder means and said boom.

4. In a front end loader for a tractor, or the like, a pair of parallel boom members each adapted to be pivotally connected at one end thereof to said tractor and positioned for movement through vertical arcs on opposite sides of said tractor, a pair of parallel cylinder and piston rod units each adapted to be pivotally connected at one end thereof to said tractor, the piston rods of said units being aligned with said boom members and connected therewith for moving said members, said piston rods being equipped with spaced pivots, one of said pivots of each rod being connected to an associated boom, said boom members pivotally carrying bucket means at the other ends thereof, and a pair of parallel extensible linkage elements pivotally connected between said bucket means and the other pivots of said rods, whereby said piston rods, booms and linkages cooperate to maintain said bucket in substantially the same position relative to the ground during elevation of the boom.

5. In a front end loader for a tractor, or the like, frame means for rigid connection to said tractor, a pair of parallel, forwardly-extending booms pivotally secured to said frame means and spaced apart for upward movement on opposite sides of the tractor, said booms pivotally carrying a bucket at the ends thereof remote from said frame means, means for pivoting said booms through a vertical arc to elevate and lower said bucket, and means for tilting said bucket, said tilting means being pivotally connected to said bucket with the connection thereof describing a parabolic arc when the connections between said booms and said bucket describe circular arcs, said boom-pivoting means including a cylinder and piston rod unit having spaced pivot points on the piston rod thereof, one piston rod pivot being connected to a boom and the other pivot being connected to said tilting means, the cylinder portion of said unit being pivotally connected to said frame means, the said tilting means including cylinder and piston rod means.

6. In a front end loader, a pair of parallel booms equipped with connection means at one end thereof for pivotally supporting said booms on a tractor or the like, said booms being equipped with connection means at the other end thereof for pivotally supporting a bucket, a bucket secured to said booms at said other ends, a pair of fluid pressure cylinder and piston rod units equipped with connection means at the ends thereof for pivotally coupling a unit between a boom and said tractor, the piston rods of said units being connected to said booms whereby extension of said piston rods is adapted to rotate said booms through an upward vertical arc, and bucket-tilting means for each unit extending between the piston rods of said units and said bucket and pivotally connected thereto, said tilting means including a fluid pressure cylinder and piston rod unit for each rotation-producing unit, each of said tilting means being pivotally connected to its associated rotation-producing piston rod at a spaced distance from the connection thereof with its associated boom.

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