March 2, 1965 T. G. GRANRYD ETAL 3,171,555

TRACTOR LOADERS

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Fig. 1.

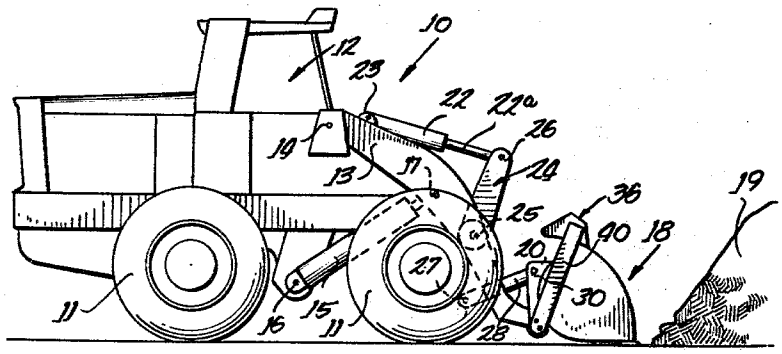


Fig. 2.

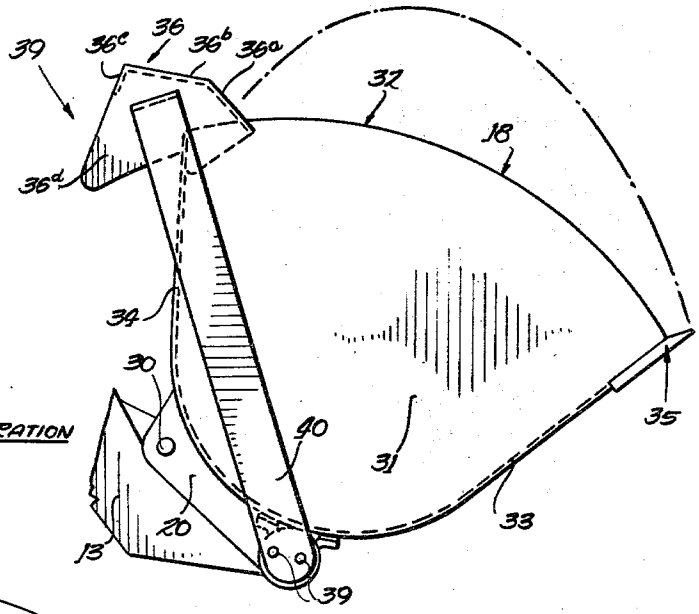
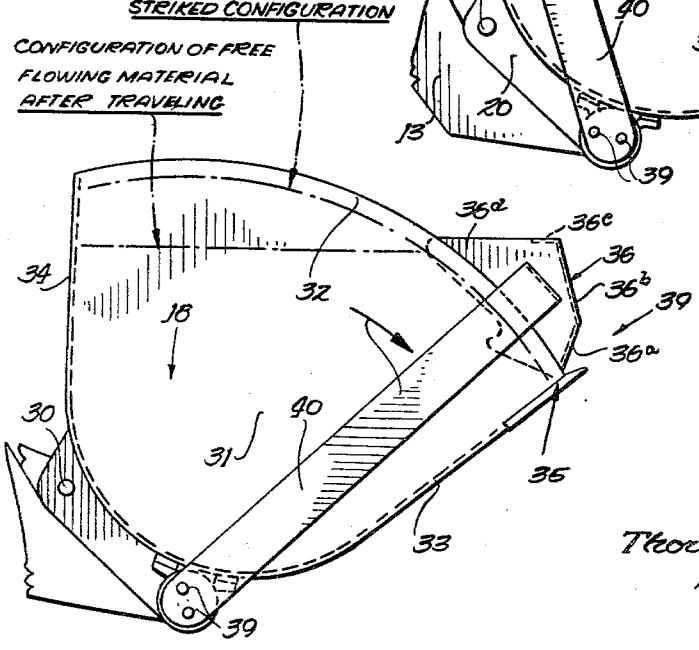


Fig. 3.



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Fig. 4

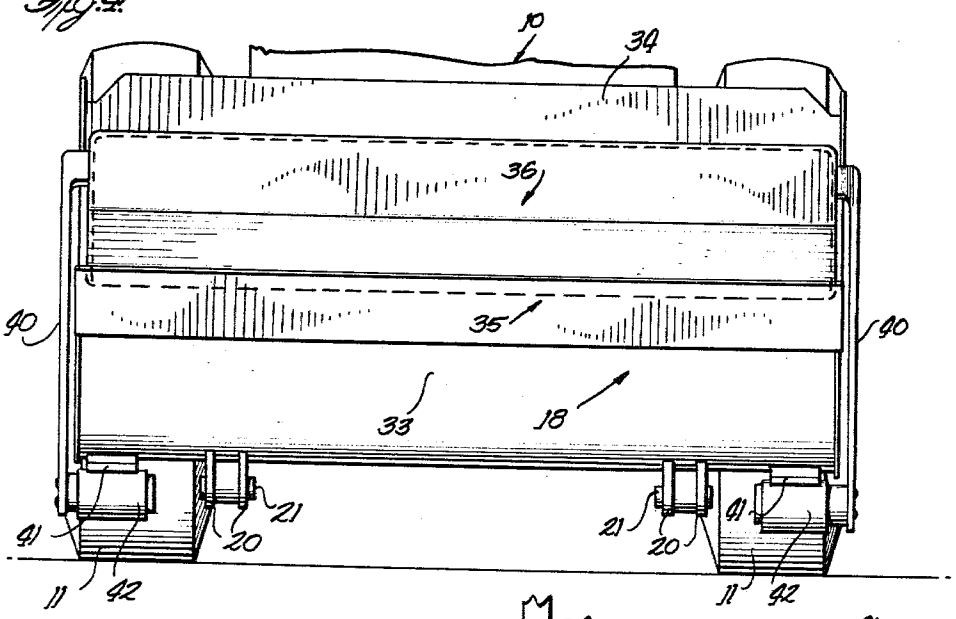


Fig. 5

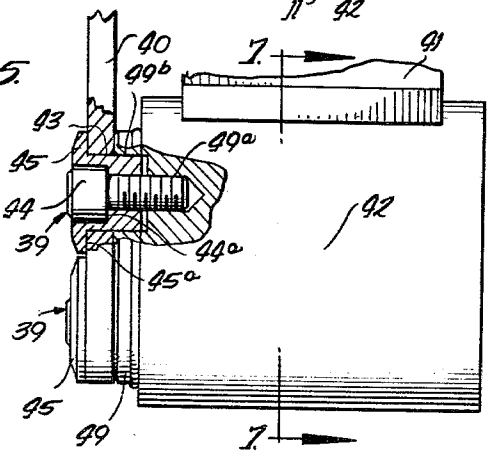


Fig. 6

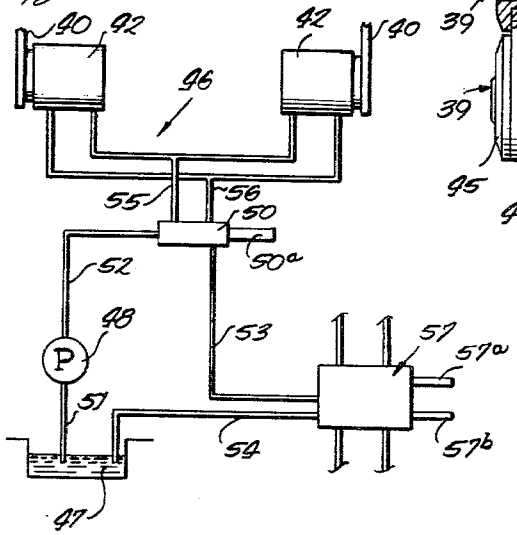
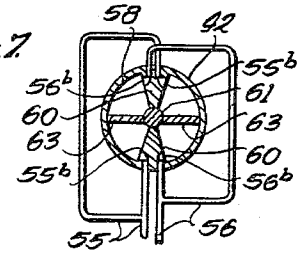


Fig. 7



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United States Patent Office 3,171,555 Patented Mar. 2, 1965

3,171,555
TRACTOR LOADERS

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Filed Sept. 13, 1962, Ser. No. 223,506
2 Claims. (Cl. 214—140)

This invention relates generally to tractor loaders, and more particularly to an improved bucket construction for a front-end type tractor loader, which bucket construction is uniquely constructed for the handling of free-flowing granulated material. Further, the improved bucket construction is a modification and a continuation in part of the improved bucket construction invention to Thorvald G. Granryd and Herbert A. Mark filed June 13, 1960 and having Serial No. 35,766, now issued Patent 3,065,870.

In the handling of free-flowing granulated material with a front-end type tractor loader such as is known in the art, a serious problem is encountered in spillage of the granulated material from the bucket. This spillage occurs in a number of ways, firstly, because of the relative ease with which the bucket may be heaped with the material from a pile, withdrawal of the tractor and bucket from the pile results in immediate spillage in the vicinity of the pile as the initial, somewhat cone-shaped, heaped load on the bucket is reduced by spillage as the bucket and machine are withdrawn from the pile. Further, in the carrying position of the bucket, the bucket is usually tipped rearwardly through an angle of approximately 40° and in this position the forward edge of the cutting edge is considerably vertically below the upper edges of the side walls and the rear or back wall of the bucket so that in the transport of the load to a remote location, additional spillage occurs until under some conditions only about one-half of the material originally dug is retained within the confines of the bucket.

It is the object of the present invention to provide a bucket arrangement for a tractor loader such as disclosed in U.S. Patent No. 2,986,292 issued May 30, 1961 to Keith W. Kampert et al., which will greatly aid in digging and carrying free-flowing granulated type of material with a minimum of spillage.

It is a feature of the present invention that a load-striker and maintainer construction is produced for a tractor loader bucket which in operation will first strike-off a heaped free-flowing load in the bucket, which load in being shaken during the traveling of the machine will level out to a substantially full bucket with substantially no spillage.

Another feature of the present invention is to provide at least a rotary actuator connected to the load striker and maintainer construction which will pivotally move the load striker construction across the open side of the bucket to first strike-off a heaped free-flowing load in the bucket and then to permit the load striker construction to retain a portion of the remaining free-flowing load during traveling with substantially no spillage.

Other objects and features of the present invention will be apparent upon a perusal of the following specification and drawings of which:

FIGURE 1 is a side elevational view of a tractor loader constructed according to the present invention;

FIGURE 2 is a view such as FIGURE 1 with a bucket operated to the break-out position;

FIGURE 3 is a view such as FIGURE 1 with a bucket operated to a load carrying position;

FIGURE 4 is a front elevational view of the structure shown in FIGURE 3;

FIGURE 5 is an enlarged elevational view partially

cross-sectional of one of the pivotal mounting connections of the strike-off member;

FIGURE 6 is a schematic diagram of the hydraulic circuit for operation of the strike-off member; and

FIGURE 7 is a cross-sectional view on a smaller scale along section line 7–7 of FIGURE 5 illustrating the internal construction of the rotary actuator.

The present embodiment is the preferred embodiment, but it is to be understood that changes can be made in the present embodiment by one skilled in the art without departing from the spirit and scope of the present invention.

For a general description of the present invention, reference is made to the drawings and the aforementioned patent. The bucket is constructed to have a pair of side walls spaced apart by a curved bottom and a rear wall. The forward marginal edge of the bottom wall is provided with a cutting edge. The bucket is pivotally mounted on a boom and a linkage arrangement is provided for pivoting the bucket relative to the boom. Means are also provided for raising and lowering the boom. In the digging position, the bucket is lowered to ground level, and the linkage means is operated to position the bottom wall of the bucket, in a substantially horizontal plane such as shown in FIGURE 1. As may be seen therein, the forward marginal edges of the side walls are curved as a portion of a circle with its original point slightly spaced from the pivotal axis of the bucket on the boom. The rear wall of the bucket is disclosed to be inclined substantially forwardly and upwardly. A somewhat U-shaped load striker and retainer or maintainer blade or element is pivotally mounted, at the ends of the legs thereof, on an axis parallel to the same axis that the bucket is pivotally mounted on the boom. The cross member of the U-shaped blade or striker element will be pivoting from the position shown in FIGURES 1 or 2 to that shown in FIGURE 3 to strike-off the heaped load along a curved plane such as shown in FIGURE 3. The cross-member which itself is somewhat U or V-shaped in cross section, has one portion which acts as the striker blade, and a striker blade with the other walls thereof further acting as load maintaining walls when the machine is operated in traveling to a remote location for dumping. During travel the free-flowing material will flow approximately from the striked configuration to the straight line configuration shown in dotted lines in FIGURE 3. The striker element is operated by a pair of rotary hydraulic motors which are secured to transversely spaced apart mounting brackets fixedly attached to the bottom wall of the bucket such that the rotary axis of the motor corresponds to the pivotal axis of the striker element and to the center of the curvature of the marginal side edges of the bucket side walls. Thus, the axis of the rotary motors is parallel to the pivotal axis of the bucket on the boom. It should now be readily apparent that depending upon the curvature of the marginal side edges of the bucket side walls, the parallel secured rotary motors could be further spaced from or even coaxial to the pivotal axis of the bucket on the boom. Through the selective operation of a hydraulic circuit connected to the rotary motors, when rotated in a counterclockwise direction, the U-shaped element is eventually positioned such as shown in FIGURES 1 or 2. When the rotary motors are completely rotated in a clockwise direction by the hydraulic circuit, the striker element assumes the position as shown in FIGURE 3. The cross-member of the striker element must have a size correlated to the dimensions of the bucket walls; so that the volume of the material in the striked configuration approximately equals the volume defined by the bucket, the striker element, and a horizontal plane through the upper surface of the cross member of the

striker element when the bucket has been tilted rearwardly to the break-out or carrying position such as shown in FIGURE 3.

For a detailed description of the present invention, continued reference is made to the drawings and the noted patent. A four-wheel, rubber tired tractor **10** having wheels **11** and an operator's compartment **12** is provided with a boom arm **13** one end of which is carried on the tractor at the pivotal connection **14** and the other end of which is disposed forwardly thereof. It is to be understood that there are a pair of duplicate boom arms **13** only one being shown in the drawings, FIGURE 1. Some means such as the rams **15** pivotally connected at one end **16** to the tractor **10** and at the other end **17** substantially intermediate the ends of the boom **13** are provided for raising and lowering the forward end of the boom **13**. The linkage arrangement is operatively carried at one end **23** on the tractor **10** the other end thereof is positioned forwardly of the tractor **10**. The linkage arrangement comprises, a double acting bucket cylinder **22** connected to the tractor end **23** and extending rod **22A** connected to a fork member **24** pivotally connected intermediate its ends to the pivotal connection **25** on the boom arms **13**. One end **26** of the fork member **24** is connected to the extending rod **22A** and the other end **27** of the fork member is pivotally connected to a forward extending link **28**.

A bucket **18** comprises a pair of spaced apart side walls **31** and a curved plate which defiines a bottom wall **33** and a rear wall **34** of the bucket **18**. The forward marginal edge of the plate bottom wall **33** is provided with a cutting edge **35**. Two pairs of flanges **20** are secured to the rear side of the bucket **18** in a spaced apart relationship transversely of each other for mounting of the bucket **18** on the forward end of the boom **13** and for connecting of the bucket **18** to the links **28**. Pins **21** are mounted through the pairs of flanges **20** and the forward end of the boom **13** to pivotally carry and connect the bucket **18** on the forward end thereof. The forward marginal edges **32** of the side walls **31** are curved, and that curvature is traced by a portion of a circle having its center at the axis of the rotary actuating motors and the pivotal connection of the strike-off member to be subsequently described which is parallel to the longitudinal pivotal axis of the pins **21**. The links **28** are pivotally connected at their forward ends through the pins **30** to the flanges **20**. Pins **30** are disposed substantially vertically above pins **21** when the bucket is in the ground level digging position such as shown in FIGURE 1. With the above described arrangement, the links **28** may be moved to pivot the bucket **18** rearwardly toward the tractor **10** about the axis of pins **21** through an angle of approximately 40° at which position the bucket cylinder **22** will prevent any further rearward tilting of the bucket **18**. The angle between the bottom wall **33** and the rear wall **34** of the bucket is approximately 40° so that when the bucket **18** is tilted from the ground level digging position such as shown in FIGURE 1 to the breakout or carrying position shown in FIGURE 2, the rear wall **34** of the bucket **18** is substantially vertically positioned, the open side of the bucket **18** is disposed upwardly, and the marginal edge of the cutting edge **35** is disposed below the upper marginal edge of the rear wall **34**. In digging a free-flowing granulated material such as shown at **19** in FIGURE 1, the bucket **18** is positioned such as shown in FIGURE 1, and the tractor **10** is then moved forwardly causing the cutting edge **35** and the side walls **31** of the bucket **18** to be forced into the material **19**. As the bucket **18** is forced into the material, the links **28** are operated to pivot the bucket **18** rearwardly toward the position shown in FIGURE 2. This scooping action of the bucket **18** as it is moved forwardly and tilted rearwardly results in a substantially heaped bucket such as shown in FIGURE 2.

The load striking and maintaining element generally

indicated by the number **39** comprises a pair of lever arms **40** and a cross member **36**. The cross member **36** includes a striker blade **36*a***, a forward retaining wall **36*b***, and an upper retaining wall **36*c***, and side retaining wall members **36*d***. The members **36*a***, **36*b***, and **36*c*** may be formed as a single plate which is somewhat U or V-shaped as shown in the drawing with the side members **36*d*** secured one at each end of the members **36*a***, **36*b***, and **36*c*** by some means such as welding.

The levers **40** are secured one at each end of the cross member side members **36*d*** by any means such as welding, and the levers **40** are spaced apart a distance slightly more than the width of the bucket **18**. The levers **40** are formed at their lower ends thereof with a pair of transverse spaced apart openings **43** one being indicated and shown in FIGURE 5. The pair of spaced apart openings **43** on the lower end of each lever **40** provide securement and attachment of each lever **40** to one end of a rotary actuating motor **42** mounted on the bottom wall **33** of the bucket **18** by means of a mounting bracket **41** securely attached thereto by suitable means such as welding. Each of the mounting brackets **41** are secured in such a manner to the bottom wall that upon assembly of the rotary actuating motors **42** thereto, the rotary motors **42** are parallel to and slightly spaced from the longitudinal pivotal axis of the pins **21** connecting the boom **13** to the bucket flanges **20**. As best shown in FIGURE 5, the lower end of each lever **40** is secured to the rotary motor **42** by a fastener assembly **39** comprising a bolt fastener **44** and washer **45**. An enlarged portion **49** of the rotary shaft at one end in the motor **42** provides the threaded opening **49*a*** and counter bored opening **49*b*** corresponding to the circular transverse opening **43** in the lever **40**. The outer diameter of the washer **45** corresponds to the diameter of the openings **43** and **49*b*** to provide a sliding fit. A shoulder **45*a*** formed on the washer **45** and a shoulder **44*a*** formed between the threaded and head portion of the bolt **44**, along with the engagement of the threaded opening **49*a*** and the threaded portion of the bolt **44**, cooperate to firmly secure the lever **40** to the enlarged shaft portion **49** at one end of the rotary shaft in the motor **42**. Although only one fastener assembly **39** is shown in cross-sectional detail in FIGURE 5 in connection to the enlarged portion **49** it is to be understood that the other fastener assembly **39** in FIGURE 5 corresponds in detail, and that the two fastener assemblies **39** for each lever **40** to each motor **42** are identical. It should be further noted that at least **2** fastener assemblies **39** are necessary, otherwise the lever **40** would pivotally move relative to the enlarged portion **49**. A hydraulic circuit as shown in FIGURE 6 is provided for operating the two rotary actuating motors **42** and comprises a reservoir **47**, a pump **48**, a control valve **50**, and a loader mechanism control valve **57** interconnected by conduits **51**, **52**, **53**, and **54**. Two other conduits **55** and **56** extending from the control valve **50** are connected at opposite ends of their branches to each of the rotary actuating motors **42**. The control valve **50** includes a valve spool **50A** whereupon selective operation by the operator directs pressure fluid from the pump **48** to one or the other motor conduits **55** or **56** or in a neutral position directs pressure fluid only to conduit **53** connected to the loader control valve **57**. It is to be understood that the loader control valve **57** provides two valve spools **57*a*** and **57*b*** for selective operation by the operator for control of the hydraulic ram **15** and bucket cylinder **22**. The pressure fluid from the control valve **57** is returned to the reservoir **47** through return conduit **54**. It is to be further understood that the preferred type of control valve construction is of the open-center type such that in the neutral position of the control valves **50** and **57** pressure fluid is freely circulated from the suction conduit **51** through conduits **52**, **53**, and **54** to the reservoir **47**.

A suitable form of construction internally of the rotary actuating motors 42 is shown by the cross sectional view in FIGURE 7. Specifically, the rotary actuating motor 42 comprises a circular housing or casing member 58 having at opposite portions radial inwardly extending converging walls 60 arcuately shaped at their ends corresponding to a surface of the rotary driving shaft 61. A pair of radial vane members 63 extend outwardly from the shaft 61 to be moved in opposite directions by the action of the pressure fluid in the four formed fluid chambers between the vane members 63 and the converging wall member 60. Further the vane members 63 secured to the shaft 61 extend to bearingly engage the inner surface of the casing member 58, while a slight clearance exists between the surface of the shaft 61 and the arcuate ends of the wall members 60. As shown in FIGURE 7, one of the motor pressure conduits 55 is connected to a pair of fluid chambers through the fluid openings 55*b* in the converging wall members 60. Similarly the other motor pressure conduit 56 is connected to the other pair of fluid chambers through a pair of fluid openings 56*b* in the fluid chambers. Thus, as pressure fluid is directed by the operator to one of the conduits 55, the vane members 63 are rotated in a clock-wise direction. Conversely, if the pressure fluid is directed to the other pressure conduit 56, vane members 63 are moved in a counterclockwise direction. Although not shown in the drawings, shaft 61 extends forwardly to connect with the enlarged portion 49 thereof at one end providing the connection of the lower end of the levers 40 through the two fastener assemblies 39.

Levers 40 carry the cross-member 36 immediately inwardly of the arcuate and horizontal planes including side walls 31. The striker portion 36*a* extends inwardly of the forward marginal edges 32 of the side walls 31 and the forward marginal edge of the cutting edge 35 an amount sufficient to strike the heaped load from the position shown in FIGURE 2 to that shown in FIGURE 3, with the surface of the material then being curved parallely to the curve of the side walls 15 and slightly inwardly thereof. The members 36*a*, 36*b*, 36*c*, and 36*d* must define a volume such that when the element 36 and the bucket 18 are positioned such as shown in FIGURE 3, a load of freely flowing material may be moved or shaken from the striked configuration indicated by the arcuate plane reference line to a substantially flat horizontal surface such as shown in FIGURE 3 by the horizontal plane reference line without the loss of any of the load resulting from the striked configuration. The relative volumetric relationships as shown in the drawings are not intended to accurately show the foregoing described volumes.

It should be noted that when the element 36 is in the position as shown in FIGURE 3, the lower marginal edge of the striker portion 36A engages the cutting edge 35 to prevent any material from following therebetween.

In the operation of the hydraulic circuit 46 of the present invention, the rotary actuating motors 42 are first rotated in a direction to move the member 36 to a counter-clockwise position such as shown in FIGURE 1, which operation thereof will bring the member 36 to a position adjacent the upper marginal edge of the rear wall 34 of the bucket 18. With the bucket 18 then positioned in a level digging position at ground level, the tractor 10 is moved forwardly to force the cutting edge 35 and side walls 31 of the bucket into the material 19. The bucket is then pivoted rearwardly by an appropriate operation of the links 28 in a load scooping action to the position shown in FIGURE 2. While the bucket 18 is still over or within material being dug, the rotary actuating motors 42 are then operated to move the member 36 in a clockwise direction to the position shown in FIGURE 3. The causes a forward movement of the member 36 with the striker portion 36*a* striking off the portion of the heaped material extending above the marginal edges of the bucket 18 with the excess material thereby being returned to the pile of material 19. With the bucket in the position shown in FIGURE 3, the tractor 10 is then moved rearwardly to withdraw the bucket 18 from the pile, and the tractor is then operated to carry the loaded bucket to a remote location for dumping. As the tractor moves, the load of free-flowing material is jostled or shaken, and the free-flowing material will level out from the striked configuration to the level configuration shown in FIGURE 3, the horizontal plane reference line, without the loss of any of the load during traveling. When the load is to be dumped, the rotary actuating motors 42 are again operated in the opposite direction to pivotally move the levers 40 in a counterclockwise direction, and the boom 13 is raised preparatory to dumping into some bin or other container. The links 28 are then operated by the bucket cylinder 22 to pivot the bucket 18 downwardly to a dumping position wherein gravity will remove the load from the bucket. The digging, carrying, and dumping cycle may then be repeated.

Although a rotary actuating motor 42 rotatable in opposite directions has been shown, it is contemplated that other types of motors may be used to rotate levers 40 about the axis of the shaft 61 and its enlarged portion 49.

Having described the invention, what is desired to be protected and claimed by Letters of Patent:

1. A tractor loader comprising a boom operatively carried on said tractor and extending forwardly thereof, a bucket comprising a pair of spaced-apart side walls interconnected by a bottom and rear wall, a cutting edge carried on the forward marginal edge of said bottom wall, means formed on the rear wall of said bucket for pivotally carrying and connecting said bucket on the forward end of the boom so that said bucket is movable from a horizontal digging position to a certain maximum load carrying position wherein the open side of the bucket is disposed substantially upwardly, a load striking and maintaining member comprising at least one lever, a cross-member connected to said lever and extending across the upper portion of said bucket, said cross-member having a length substantially equal to the distance between said side walls of said bucket, a rotary fluid actuator means secured to said rear wall parallel to said bucket pivotal connection to said boom forward end, means for pivotally connecting said lever to said rotary fluid actuator means for pivotal clockwise and counterclockwise movement of said lever to carry said cross-member over the open side of said bucket between the upper marginal edge of said rear wall and said cutting edge, the forward marginal edges of said side walls being formed to have a curvature substantially equal to that of a portion of a circle traced therethrough and having its center at the pivotal axis of said lever corresponding to the rotary axis of said actuator means, said cross-member having a shape such that the lower edge thereof strikes off the upper surface of a heaped load in said bucket immediately below the curved marginal edges of said side walls when said lever is pivoted and further having a shape which in cooperation with the walls of said bucket and said cutting edge retains substantially the remaining load of a free-flowing material within said bucket when said bucket is carried and shaken in said certain maximum load carrying position.

2. A tractor loader comprising a boom operatively carried on said tractor and extending forwardly thereof, a bucket comprising a pair of spaced-apart side walls interconnected by a bottom and rear wall, a cutting edge carried on the forward marginal edge of said bottom wall, means formed on the rear wall of said bucket for pivotally carrying and connecting said bucket on the forward end of the boom so that said bucket is movable from a horizontal digging position to a certain maximum load carrying position wherein the open side of the bucket is disposed substantially upwardly, a load strik-

ing and maintaining member comprising a pair of levers interconnected by a cross-member, said cross-member having a length substantially equal to the distance between said side walls of said bucket, a pair of rotary fluid actuator means, each of said rotary fluid actuator means secured to said rear wall parallel to said bucket pivotal connection to said boom forward end, means for pivotally connecting each of said levers to one of said rotary fluid actuator means for pivotal movement of said levers to carry said cross-member over the open side of said bucket, said actuator means being selectively operable to simultaneously and pivotally move said levers in clockwise and counter-clockwise direction, the forward marginal edges of said side walls being formed to have a curvature substantially equal to that of a portion of a circle traced therethrough and having its center at the pivotal axis of said levers corresponding to the rotary axis of said actuation means, said cross-member being

U-shaped having one portion thereof extending below the marginal edges of said side walls so that said one portion strikes off the upper surface of a heaped load in said bucket immediately below the curved marginal edges of said side walls when said levers are pivoted, the remaining portions of said U-shaped cross-member being such that when said one portion engages said cutting edge of said bucket the volume of said bucket is increased to retain substantially the remaining load of a free-flowing material within said bucket and said cross-member when said bucket is carried and shaken in said certain maximum load carrying position.

References Cited in the file of this patent

UNITED STATES PATENTS

2,994,446	Van Anwelaer et al.	Aug. 1, 1961
3,009,590	Kampert	Nov. 21, 1961
3,065,870	Granryd et al.	Nov. 27, 1962