

United States Patent

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[54] LOADER LINKAGE
9 Claims, 4 Drawing Figs.

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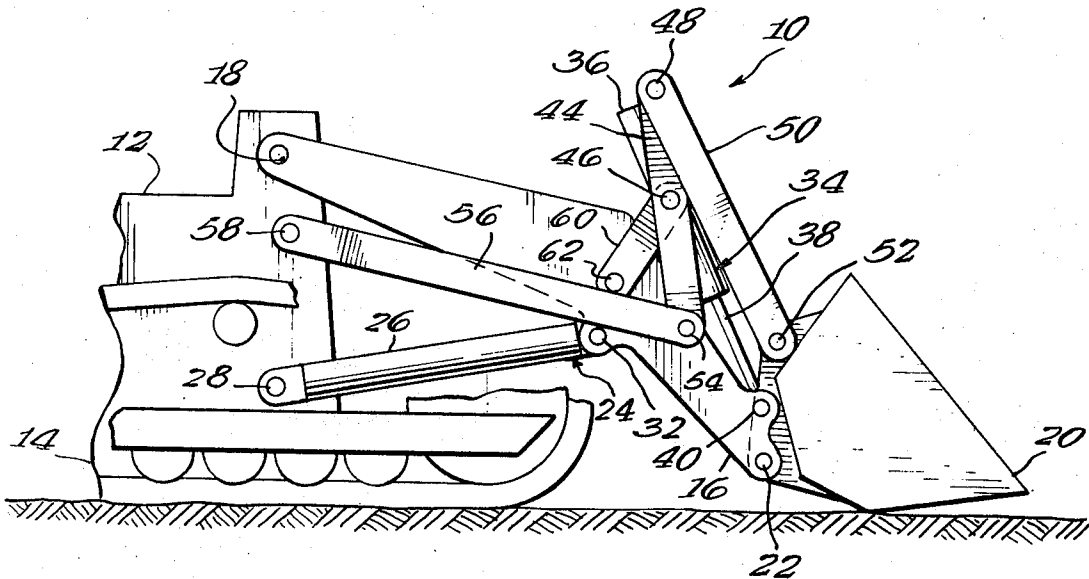
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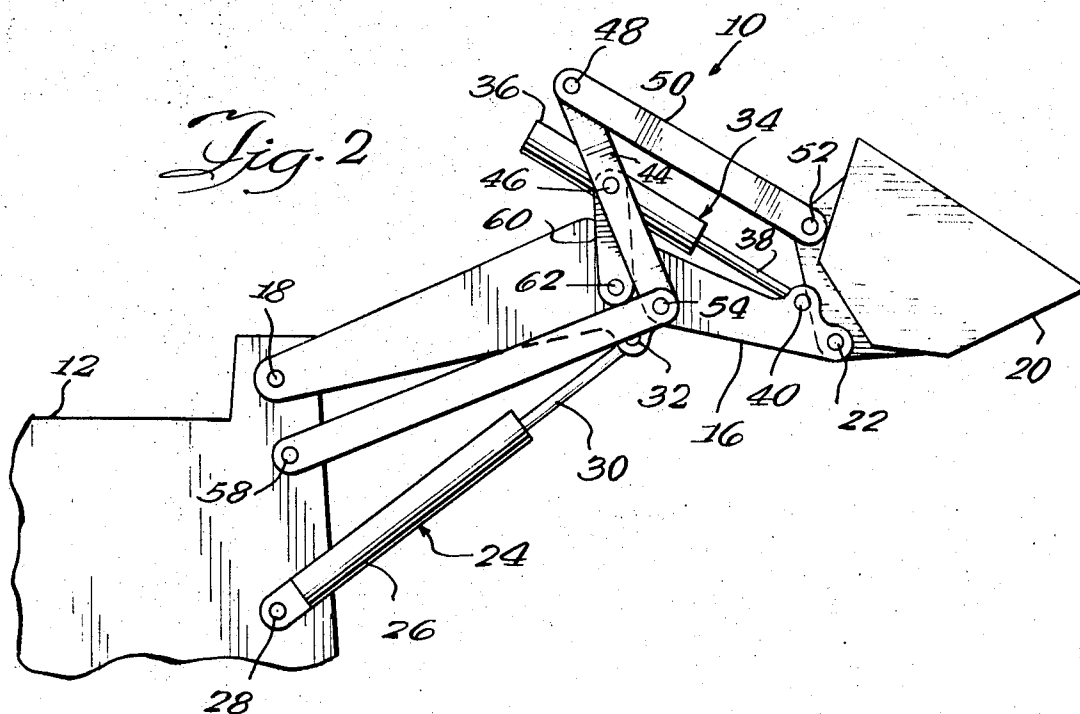
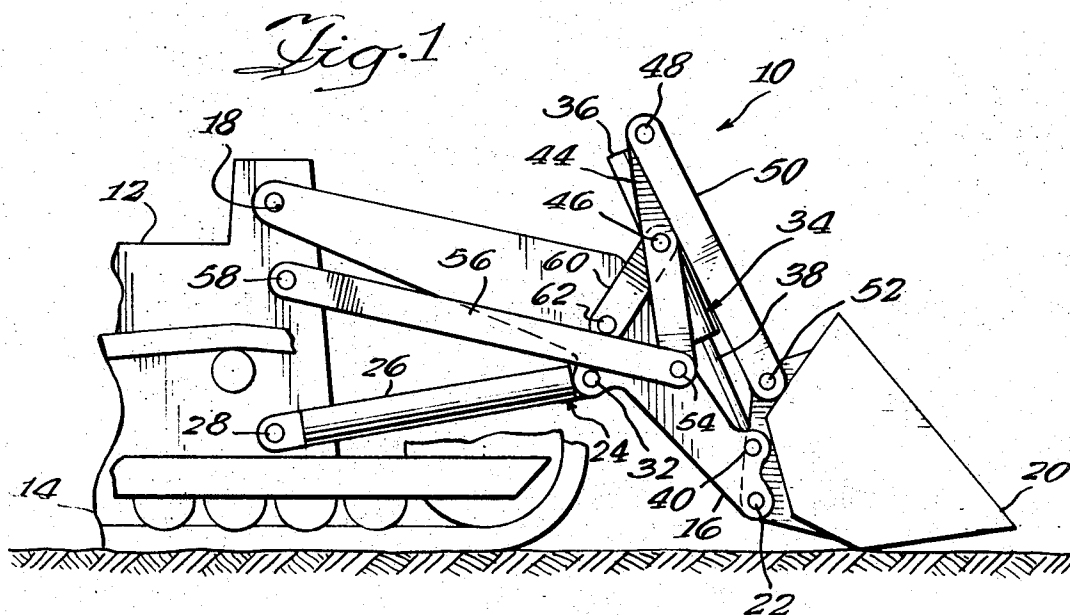
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ABSTRACT: In a material handling device of the type in which lift arms are pivotably mounted on a support and pivotally carry a bucket controlled by a hydraulic circuit including a bucket cylinder arranged to provide maximum hydraulic force for break out or rollback of the bucket and maximum speed for the dumping or forward roll of the bucket, an automatic self-leveling and antirollback linkage connected between the bucket and the support including a first member pivotally connecting the cylinder to the lift arms and a second portion including three members pivotally connected end to end and having one end pivotally connected to the bucket, the other end pivotally connected to the support and the middle member pivotally connected to the cylinder. The linkage connects the bucket to the bucket cylinder to effect pivoting of the bucket upon operation of the bucket cylinder, levels the bucket relative to the ground and prevents rollback of the bucket past its level position when the lift arms are raised.



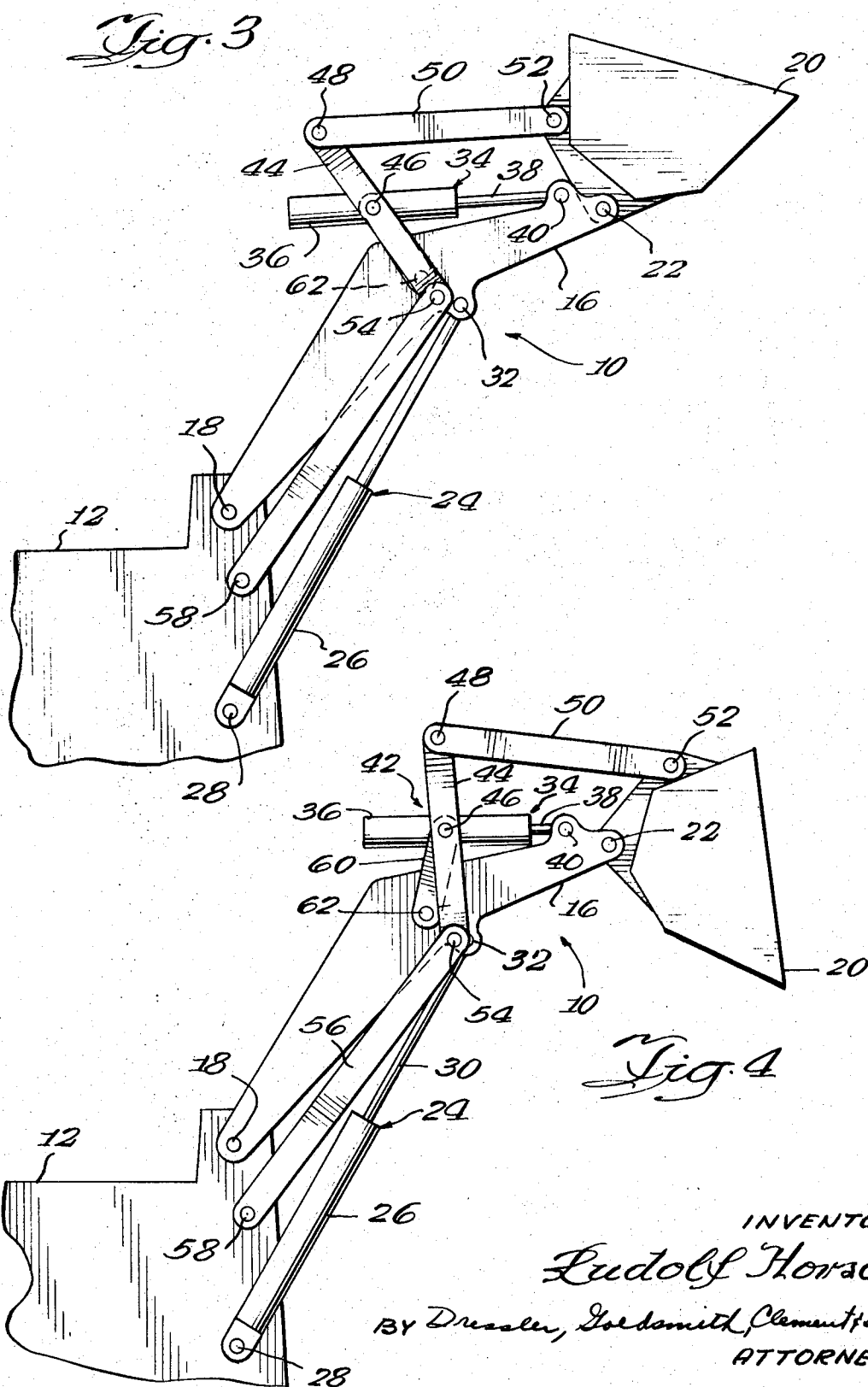


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LOADER LINKAGE

BACKGROUND OF THE INVENTION

Material handling devices such as loaders mounted on and controlled by various vehicles such as tractors are well known. Such loaders typically incorporate one or more lift arms pivotally mounted on a support on the vehicle, the lift arms pivotally carrying at their free end a bucket. Typically, at least one lift arm hydraulic motor is connected between the vehicle or support and the lift arms to raise and lower the lift arms. In addition, in the typical configuration, there is at least one bucket hydraulic motor operative to pivot the bucket relative to the lift arms.

In operation, with the lift arms lowered, the bucket is shoved into a pile of material by motion of the vehicle. The bucket is rolled back on the lift arms toward the tractor with sufficient force to break out the mass of material into which the bucket has been shoved. The lift arms are then raised and the tractor is driven to some location where the bucket is swung forwardly to a dumping position to discharge the contents therein.

As discussed in Shumaker U.S. Pat. No. 3,197,050, the breakout operation usually requires a very substantial force, and clearly a greater force than that required in the dumping operation. On the other hand, it is highly desirable to effect dumping fairly rapidly, which action does not require substantial force since the load in the bucket tends to swing the bucket in a dump direction. In the aforementioned Shumaker patent, there is disclosed an arrangement whereby the bucket cylinder is arranged to effect maximum force during break out and maximum speed of operation during dumping.

As efficient as this arrangement is, there is no provision disclosed therein for automatically maintaining the bucket parallel to the ground as the lift arms are raised and for preventing inadvertent rollback of the bucket beyond the level position with the lift arms raised. Both of these functions are important to eliminate a substantial danger to the operator of the material handling device since either inadvertent rollback or failure to level the bucket during the raising of the lift arms could result in the rearward dumping of the contents of the bucket onto the operator.

SUMMARY OF THE INVENTION

By the present invention there is provided a simple mechanical linkage associated with the bucket operating system disclosed in Shumaker U.S. Pat. No. 3,197,050 which incorporates all the advantages therein and in addition includes automatic self-leveling of the bucket during raising of the lift arm and an antirollback function to prevent inadvertent rearward dumping of the bucket when the lift arms are raised.

It can be appreciated that as the lift arms are raised, the position of the bucket relative to the ground changes because of the pivotal movement of the lift arms. It is therefore necessary to pivot the bucket forward as the lift arms are raised to maintain the bucket in a level position relative to the ground.

At the same time, in addition to automatically leveling the bucket during raising of the lift arms, it is desirable to prevent inadvertent actuation of the hydraulic circuit to rollback the bucket past its level position when the lift arms are raised. Since the position of the bucket relative to the lift arm changes as the lift arms are raised in order to keep the bucket level, any antirollback device to be effective must accommodate the varying relationship between the bucket and the lift arms and prevent rollback of the bucket past its level position at raised positions of the lift arms. However, the antirollback device should permit rollback of the bucket to maximum rollback position when the lift arms are lowered, since in this position there is no danger of the load being dumped onto the operator.

In accordance with the present invention there is provided a mechanical linkage which connects the bucket hydraulic motor to the bucket, to the lift arms and to the support to ef-

fect operation of the bucket in response to operation of the bucket hydraulic motor, to automatically level the bucket during raising of the lift arms and to prevent rollback of the bucket past its level position when the lift arms are raised.

The automatic self-leveling and antirollback mechanism of the present invention includes a two-part linkage system, one part interconnecting the bucket, the support and the bucket hydraulic motor, and the second part connecting the bucket hydraulic motor and the lift arms. This two-part linkage operates during the raising of the lift arms when the bucket hydraulic motor is idle to automatically rotate the bucket forwardly as a function of the lift arm position in order to maintain the bucket parallel to the ground. The two-part linkage is so designed to be effective when the lift arms are raised and when the bucket approaches a position relative to the ground where it would begin to tilt rearwardly.

This is effected by connecting the bucket hydraulic motor, such as the cylinder disclosed in the aforementioned Shumaker patent, to the lift arms through one part of the linkage, and connecting the bucket to the cylinder and the cylinder to the support by separate part of linkage.

More specifically, the first part of the antirollback and self-leveling linkage includes a three point lever or connecting link connected intermediate its ends to a cylinder pivot point to which is also connected a cylinder positioning link forming the second part of the linkage. The other end of the cylinder positioning link is pivotally connected to the lift arms. The remainder of the mechanical linkage includes a bucket control link pivotally connected at opposite ends to the bucket and to the upper end of the connecting link and a leveling link connected at opposite ends to the support and to the other end of the connecting link.

Because of this arrangement, the cylinder is designed to be at its maximum extended position when the bucket is rolled back completely during break out. Since self-leveling of the bucket during the raising of the arms is effected without altering the fully extended position of the bucket control cylinder, it is not possible to roll the bucket back further since the cylinder is already in its maximum position.

As the lift arms are raised, the leveling link causes the connecting link to rotate about the cylinder pivot point thereby causing the bucket to rotate forwardly through the bucket control link. When it is desired to operate the cylinder to dump the bucket, the cylinder is collapsed, rotating the connecting link and pivoting the cylinder control link thereby causing the bucket to pivot forwardly through the bucket control link.

Numerous other advantages and features of the present invention will become readily apparent from the following detailed description of the invention and of one embodiment thereof, from the claims and from the accompanying drawings in which each and every detail shown is fully and completely disclosed as a part of this specification, and in which like numerals refer to like parts.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a right side elevation of a motor mounted on the tractor, with certain parts broken away, and with the lift arms in lowered position and the bucket rolled back after breakout; FIG. 2 is a similar view showing the lift arms partially raised; FIG. 3 is a similar view showing the lift arms fully raised and the bucket retained in a level position; and

FIG. 4 is a similar view with the lift arms raised showing the bucket in a dump position.

In FIG. 1 there is shown the material handling device of the present invention in which the loader mechanism 10 is mounted on a support 12 attached to a vehicle 14, it being understood that the vehicle has numerous other parts which have no bearing on the present invention and which are therefore omitted in the interest of simplicity. Although only one side of the vehicle 14, the support 12, and loader mechanism 10 is shown in the drawings, it should be understood that various

components, which have been omitted for clarity, are normally present on both sides of the vehicle.

The loader mechanism 10 consists of a pair of lift arms 16 pivotally connected at 18 to the support 12. A bucket 20 is pivotally connected at 22 to the forward end of the lift arms 16.

Each lift arm 16 is raised and lowered about the pivot point 18 by operation of a hydraulic motor 24. Typically, such a hydraulic motor 24 includes a hydraulic cylinder 26 on end of which is pivotally connected at 28 to the support 12, and having a piston rod 30 extending out of the other end and pivotally connected at 32 to the lift arms 16. When hydraulic fluid is fed under pressure into the cylinder 26, the action of the piston rod 30 will raise or lower the lift arms 16 about the pivot 18 in a well-known manner.

The bucket 20 is rotated about pivot 22 by at least one hydraulic bucket motor 34. The bucket hydraulic motor 34 typically consists of a hydraulic cylinder 36 having a piston slidable therein and a piston rod 38 extending out one end thereof pivotally connected to the lift arms 16 at 40 adjacent to the bucket pivot 22. The bucket cylinder 36 is coupled to the bucket 20 through a mechanical linkage 42. Up to this point, description of the arrangement of the lift arms 16, the bucket 20, and lift arm hydraulic motor 24 has been substantially identical to that disclosed in the aforementioned Shumaker U.S. Pat. No. 3,197,050. However, the basic linkage 42 of the present invention is substantially different than that disclosed in the Shumaker patent, so that in addition to connecting the bucket to the bucket cylinder, the linkage also operates as an antirollback mechanism to prevent rollback of the bucket past its level position when the lift arms are raised and operates to automatically level the bucket during raising of the lift arms.

The bucket control, self-leveling and antirollback linkage 42 includes a three point lever or connecting link 44 pivotally connected intermediate its ends to the body of the bucket control cylinder at cylinder pivot point 46. The upper end of the connecting link 44 is pivotally connected at 48 to one end of a bucket control link 50, the other end of which is pivotally connected to the bucket 20 at 52. The lower end of the connecting link 44 is pivotally connected at 54 to the bucket leveling link 56, the other end of which is pivotally connected to the support 12 at 58 below the boom pivot 18 and above the boom cylinder pivot 28. An additional bucket cylinder positioning link 60 is pivotally connected to the bucket control cylinder at cylinder pivot point 46 and to the lift arms 16 at point 62, somewhat above the arcuate path followed by the pivot point 54 between the three point lever 44 and the leveling link 56.

In operation, application of hydraulic pressure to the piston end of the bucket control cylinder 36 causes the cylinder 36 to move to the left, as seen in the drawing, about cylinder positioning link 60, since the piston rod is anchored to the lift arms 16. This movement of the bucket cylinder 36 rotates the connecting link 44 about point 54, to roll the bucket 20 back through bucket link 50. Conversely, hydraulic pressure applied to the rod end of the bucket control cylinder 36 rolls the bucket 20 forward to dump the bucket.

After breaking out a load with the lift arms 16 lowered, as seen in FIG. 1, the lift arms 16 are raised in order to permit the dumping of the bucket 20. It can be appreciated that when the lift arms 16 are raised, the bucket 20, if remaining in a fixed position relative to the lift arms 16 would tend to tilt rearwardly. The result of this would be to dump the load in the bucket 20 back onto the vehicle 14 and onto the operator. Such occurrences are prevented by automatic self-leveling of the bucket 20 by operation of the leveling and antirollback linkage 42 consisting of the connecting link 44, the bucket control link 50 and the leveling link 56.

Since the bucket hydraulic motor 54 is not operated during the raising of the lift arms 16, its position relative to the lift arms 16 remains fixed under control of the positioning link 60. Thus, as the lift arms 16 are raised, the fixed length leveling link 56 causes the connecting link 44 to rotate about cylinder

pivot point 46 to roll the bucket 20 forward and maintain it at a level position.

Since the bucket control cylinder 36 forms no part of the leveling linkage 42, it can be designed so that it is fully extended when the bucket 20 is fully rolled back during breakout. Since the bucket is leveled by linkage 42 without operation of the cylinder 36, the linkage 42 also defines the maximum rollback position of the bucket 20 for any position of the cylinder 36. Since the cylinder 36 is in a maximum extended position the linkage 42 precludes additional rollback of the bucket 20 beyond its level position.

Thus by a simple two-part linkage, there is provided a mechanism which automatically levels the bucket during raising of the lift arms and which precludes accidental rollback of the bucket past its level position.

From the foregoing, it will be observed that numerous variations and modifications may be affected without departing from the true spirit and scope of the novel concept of the invention.

I claim:

1. A material handling device comprising support means, lift arm means pivotally connected to said support means; a bucket pivotally carried by said lift arm means, means for raising and lowering said lift arm means, first means for pivoting said bucket relative to said lift arm means, linkage means extending between said support means and said bucket for automatically limiting the maximum rollback of said bucket to a level position when said lift arm means are raised, said linkage means including a first portion pivotally connected to said first means and to said lift arm means and defining the position of said first means relative to said lift arm means in response to operation of said first means and a second portion having one end pivotally connected to said support means, another end pivotally connected to said bucket, and being pivotally connected intermediate its ends to said first means and defining the pivotal position of said bucket in response to the positions of said lift arm means and said first means relative to said lift arm means.

2. A material handling device as claimed in claim 1 wherein said first portion of said linkage means includes a first link, first pivot means pivotally connecting one end of said first link to said first means, and second pivot means pivotally connecting the other end of said first link to said lift arm means; and said second portion of said linkage means includes second, third and fourth links, said first pivot means pivotally connecting said second link intermediate its ends to said first means, third pivot means pivotally connecting one end of said third link to said support means, fourth pivot means pivotally connecting one end of said fourth link to said bucket, and additional pivot means pivotally connecting the other ends of said third and fourth links, respectively, to opposite ends of said second link.

3. A material handling device as claimed in claim 1 wherein said first means comprises hydraulic motor means including a hydraulic cylinder, a piston slideable in said cylinder and having a piston extending out one end thereof and pivotally connected said lift arm means, whereby relative sliding movement of said piston in said cylinder pivots said bucket relative to said lift arm means between maximum rollback and dump positions, and means pivotally connecting said cylinder to said linkage means to limit the maximum rollback of said bucket to a level position when said lift arm means are raised.

4. A material handling device as claimed in claim 3 wherein said linkage means includes a plurality of pivotally interconnected constant length links.

5. A material handling device as claimed in claim 4 wherein two of said links are pivotally connected together and to said cylinder, and wherein one of said two links is pivotally connected to said lift arm means.

6. A material handling device as claimed in claim 5 wherein the other of said two links is pivotally connected to additional links, wherein one of said additional links is pivotally connected to said support and another of said additional links is pivotally connected to said bucket.

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7. A material handling device comprising support means, lift arm means, a bucket pivotally carried by said lift arm means, first means pivotally connecting said lift arm means to said support means, first hydraulic motor means for raising and lowering said lift arm means, second means pivotally connecting said first hydraulic motor means to said lift arm means, third means pivotally connecting said first hydraulic motor means to said support means, second hydraulic motor means for pivoting said bucket relative to said lift arm means between maximum rollback and dump positions including a cylinder having a piston slidable therein and a piston rod extending out one end thereof pivotally connected to said lift arm means; said second hydraulic motor means arranged to apply maximum power during rollback of said bucket and maximum speed during dumping of said bucket, mechanical linkage means extending between said support means and said bucket for leveling said bucket when rolled back and for preventing rollback of said bucket past its level position when said lift arms are raised comprising a positioning link, a connecting link, a bucket control link, a leveling link, fourth

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means pivotally connecting one end of said positioning link and said connecting link to said cylinder, fifth means pivotally connecting the other end of said positioning link to said lift arm means, sixth means pivotally connecting one end of said leveling link to said support means, seventh means pivotally connecting one end of said bucket control link to said bucket and eighth and ninth means connecting the opposite ends of said leveling and bucket control links, respectively, to opposite ends of said connecting link.

8. A material handling device as claimed in claim 7 wherein said first means is located above said second means, said sixth means is located between said first and second means, said eighth means is disposed above said ninth means and said fourth means is disposed therebetween.

9. A material handling device as claimed in claim 7 wherein said leveling link causes said connecting link to rotate about said fourth means to pivot said bucket towards dump position in response to the raising of said lift arm means.

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