Feb. 11, 1969 T. G. CAMPBELL 3,426,928

EJECTOR MECHANISM FOR LOADER BUCKETS

Filed Nov. 3, 1966 Sheet 1 of 3

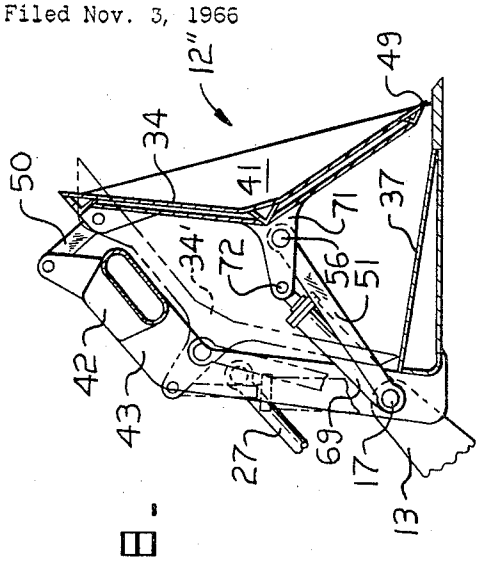

Fig. 8.

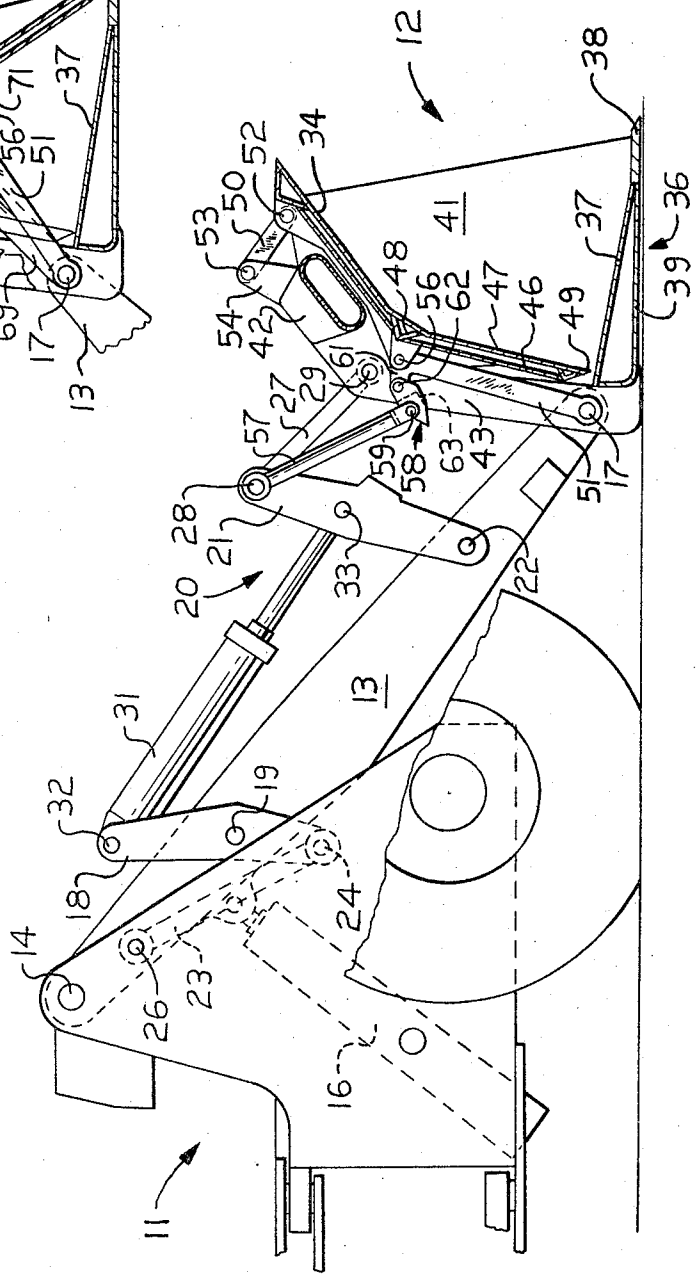

Fig. 1.

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Fig. 2.

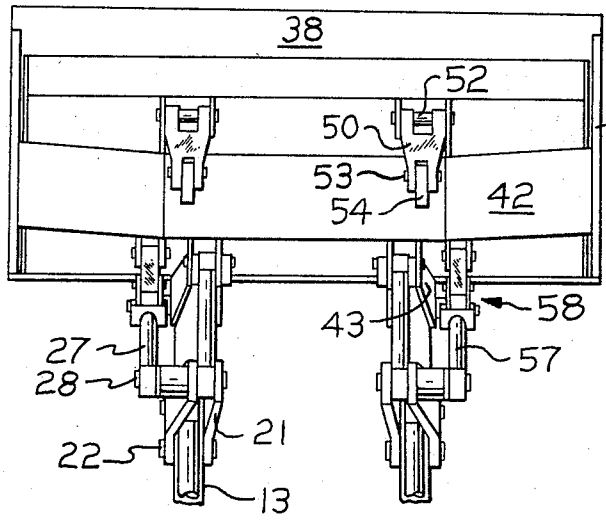
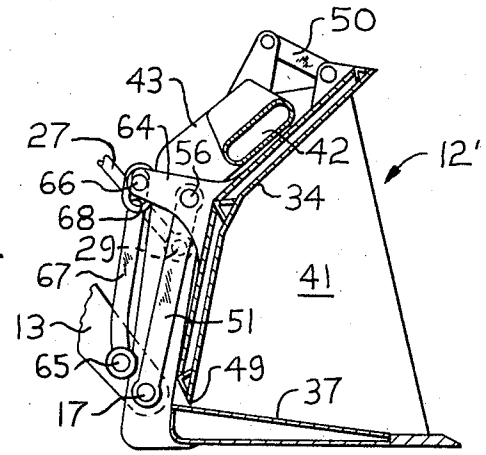


Fig. 6.



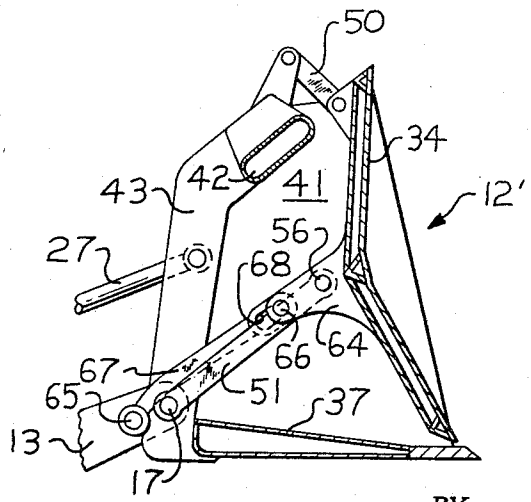


Fig. 7.

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Fig-3.

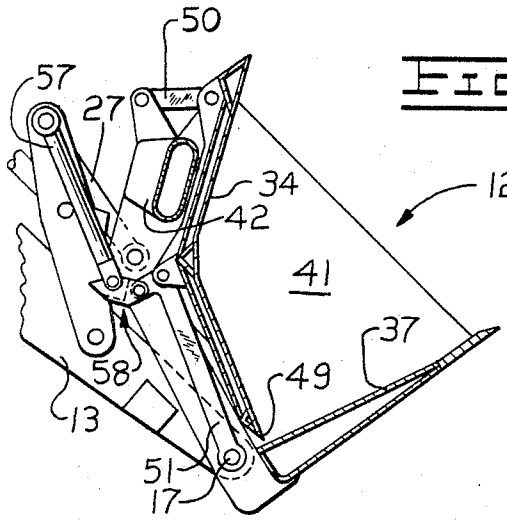


Fig-4.

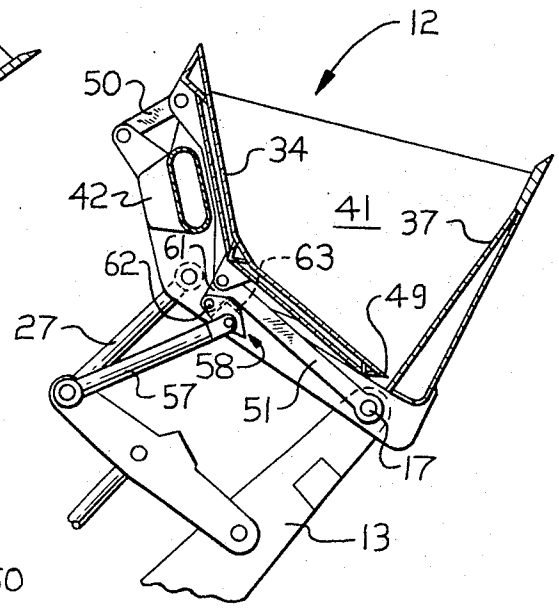
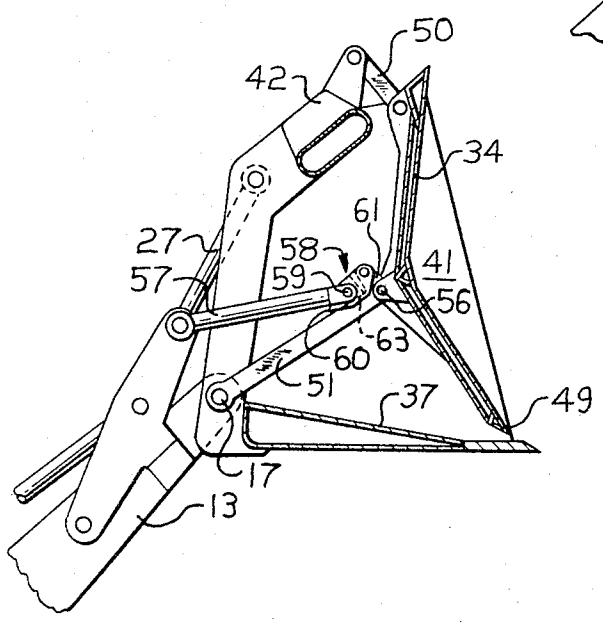


Fig-5.



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3,426,928

EJECTOR MECHANISM FOR LOADER BUCKETS

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U.S. Cl. 214—767 11 Claims
Int. Cl. E02f 3/00

This invention relates to loaders of the class having a movable bucket for receiving and lifting bulk materials and more particularly to load ejectors for forcibly discharging the contents of the bucket.

Power loaders of the type having a bucket carried on a motor driven vehicle by pivoting lift arms are used extensively for lifting bulk materials into a truck body or other elevated receptacle. In a common mode of operation, the bucket is driven into the material by forward motion of the vehicle and the bucket is then tipped back and elevated to a carrying position by operation of the lift arm. The vehicle is then operated to position the raised bucket over the truck body. Discharge of the load into the truck is accomplished in either of two ways depending upon the type of bucket which is employed.

One technique for dumping the load utilizes the bucket tip control to tilt the bucket forwardly so that the load drops through the open forward face thereof. This method of dumping has several operational disadvantages. As it is the rear portion of the bucket which is pivoted to the lift arms, the tipping movement lowers the forward edge of the bucket. This, in effect, reduces the maximum vertical reach of the loader and may make it necessary to complicate operations by tipping the bucket back in order to withdraw the loader from the truck after dumping. In addition, the lowering of the bucket increases the possibility of damage to the truck body or to the bucket itself. Further, in order to assure the complete release of all material in the bucket, it is a common practice to provide stops or snubbers against which the bucket strikes at the finish of the tipping movement. The jarring impact aids in dislodging material which tends to stick in the bucket. However, the repeated impacts accelerate wear and damage and can be discomforting to the operator of the equipment.

To avoid these problems, several forms of powered ejector have been developed in which an ejector element forms a rear wall of the bucket and is forcibly moved forward to discharge the load therefrom. A first known type of ejector is pivoted to the top of the bucket and powered means are provided to swing the member forwardly. As the lower edge of such an ejector necessarily moves in an arc, a curved floor must be provided in the bucket. This is undesirable in that it reduces the capacity of the bucket and appreciably thickens the floor construction making it more difficult to drive the bucket into material which is to be loaded.

A second known class of powered ejector dispenses with the need for a curved floor by using a double jointed suspension at the top of the ejector and allowing the bottom edge thereof to drag on the floor as it moves forwardly. In this construction, the sliding contact is subject to rapid wear and is a source of undesirable vibration. Contact between the ejector edge and the bucket floor and the need for using a curved floor are both avoided by still a third known type of powered ejector in which various systems of cam surfaces and rollers are used to provide for linear motion of the bottom edge of the ejector. These mechanisms have tended to be somewhat elaborate and require parts of massive construction because of high forces and concentrated stresses at certain points in the structure.

Accordingly a need exists for a powered ejector mechanism compatible with a flat floor but which does not contact the floor nor require complex wear prone components for avoiding such contact. The present invention provides such mechanism by attaching an ejector member to the bucket through a simple system of pivot links which constrain the lower edge of the member to move in a linear manner. While power cylinders, cables, or the like may be used to actuate the ejector, the mechanism is particularly adaptable to interconnection with the bucket tilt linkage so that the ejector is operated automatically by a relatively small tilting of the bucket at its elevated position but is not actuated when the bucket is tipped while at its lower or loading position.

Accordingly it is an object of this invention to provide a simplified powered ejector for a loader bucket in which the portion of the ejector adjacent the base of the bucket moves in a linear manner.

It is another object of the invention to provide a loader bucket ejector in which the pattern of ejector movement is fixed by linkage which suspends the ejector.

It is a further object of the invention to provide a powered loader bucket ejector which is free from complex and massive components while being suitable for use in a flat floored bucket.

It is still a further object of this invention to provide ejector mechanism for a power loader compatible with a flat floored bucket and which is adaptable for automatic operation by interconnection with the bucket tipping linkage.

The invention, together with further objects and advantages thereof, will best be understood by reference to the following specification taken in conjunction with the accompanying drawing of which:

FIGURE 1 is a side elevation view of the forward portion of a power loader embodying the invention with elements of the bucket and ejector shown in section and with the bucket in the loading position;

FIGURE 2 is a plan view of the bucket, ejector, and associated operating linkage, of FIGURE 1;

FIGURE 3 is a side elevation view of the bucket and operating linkage of the loader of FIGURES 1 and 2 with the bucket racked back while at its lower position;

FIGURE 4 is a side elevation view of the bucket, ejector and operating linkage of FIGURES 1 to 3 with the bucket in the raised load carrying position;

FIGURE 5 is a side elevation view of the bucket and operating linkage of FIGURES 1 to 4 with the bucket elevated and with the ejector actuated to discharge the contents thereof;

FIGURE 6 is a side elevation view of a second embodiment of the invention showing a loader bucket and ejector having modified operating linkage with the bucket being in the loading position;

FIGURE 7 is a side elevation view of the embodiment of FIGURE 6 with the bucket elevated and the ejector actuated; and

FIGURE 8 is a side elevation view of a third embodiment of the invention having a loader bucket and ejector in which load ejection is controlled by a fluid powered cylinder and is independent of the bucket tipping mechanism.

Referring now to the drawing and more particularly to FIGURES 1 and 2 in conjunction, there is shown a forward portion of a typical motor driven vehicle 11 of the type used in conjunction with an open faced loader bucket 12. The bucket 12 is carried at the forward end, in this instance, of vehicle 11 on a pair of pivotable parallel lift arms 13.

In a common mode of loader operation, bucket 12 is loaded by driving the tractor 11 towards the material to

be handled with the bucket 12 in the lowered position as illustrated in FIGURE 1. The bucket 12 is then racked back to the position shown in FIGURE 3 and is subsequently lifted to the elevated carrying position shown in FIGURE 4. To provide for the vertical movements involved in these operations, with reference again to FIGURES 1 and 2, the lift arms 13 are coupled to the vehicle 11 by pivots 14 and a pair of hydraulic jacks 16 or the like are coupled between the arms and the vehicle body. To provide for the racking back, or tipping, of the bucket 12 relative to the arms 13, the connection therebetween is formed by additional pivots 17 at the lower portion of the back of the bucket.

Control of the tipping of bucket 12 about pivot 17 is effected through tilt linkage 20 which includes a first pair of levers 18 coupled to arms 13 by pivots 19 situated at an intermediate position between the ends of each lever. The lower ends of a second pair of levers 21 are coupled to the lift arms 13 by pivots 22 situated between the first levers 18 and bucket 12. One of a pair of first links 23 is pivoted to the lower end 24 of each first lever 18 and is pivotably coupled to the vehicle body 11 at a position 26 spaced from the pivot connection 14 of the associated lift arm 13. A second pair of links 27 extend between pivots 28 at the upper end of each second lever 21 and pivots 29 at the back of bucket 12 above pivots 17. The tilt linkage is completed by a pair of double acting hydraulic jacks 31 each of which is connected between a pivot 32 at the top end of one of the first levers 18 and a pivot 33 on the corresponding second lever 21 at an intermediate position thereon.

Thus extension of the jacks 31 acts, through the above described tilt linkage 20, to pivot the bucket 12 forwardly about pivot 17 and retraction of the jacks racks the bucket back in a reverse direction. While providing for selective tipping of the bucket 12 by operation of the jacks 31, the linkage 20 has the further effect of automatically maintaining a fairly constant angular orientation of the bucket relative to the ground while it is raised to the load carrying position by lift arms 13. This results from the separation between the pivots 14 and 26. In the operation of loaders which lack an ejector, dumping of the bucket 12 is accomplished by operating the tilt linkage controls, such as jacks 31, to pivot the bucket forwardly on the end of lift arms 13. This technique has the several disadvantages hereinbefore discussed and accordingly the present invention utilizes an ejector 34 as a component of the bucket assembly 12.

The bottom 36 of bucket 12 is formed by a flat floor plate 37 having a cutting edge 38 disposed along the forward end thereof. To provide greater strength, a subfloor plate 39 extends from cutting edge 38 below floor plate 37 at a small angle therewith and curves upward at the rear to the back edge of the floor plate 37. End walls 41 at each side of the bucket 12 connect the bottom 36 with a cross beam 42 at the top of the bucket. To strengthen the bucket structure and to receive the previously described pivot connections 17 and 29, a pair of spaced apart angled support brackets 43 extend between bottom 36 and the cross beam 42 at the rear of the assembly.

The rear wall of the bucket assembly 12 is defined by the movable ejector member 34. To define a more enclosed load carrying region, ejector 34 has an angled configuration and for greater strength is fabricated of parallel spaced plates 46 and 47 with cross members 48 therebetween.

Ejection of a load from the bucket 12 is accomplished by forcibly moving the ejector 34 forward and it is necessary that the lower edge 49 of the ejector move in a linear manner, parallel to floor 37. In accordance with the invention, the ejector 34 is constrained to move in this manner by upper and lower links 50 and 51, respectively, which couple the ejector to the other components of the bucket. A pair of the upper links 50 extend between pivots 52 at the upper end of ejector 34 and pivots 53 at brackets 54 which project from cross beam 42. Pivots 53 are thus above pivots 52 and are situated further from the open face of the bucket. A pair of the lower links 51, which are of greater length than upper links 50 connect pivots 56 at the angled central portion of ejector 34 with the pivots 17 which couple the bucket 12 to lift arms 13.

In moving toward the front of the bucket 12, the ejector 34 pivots on the long lower links 51 about the pivot connection 17 at the lower end of the links. If unmodified, this motion would tend to cause the lower edge 49 of the ejector to describe an arc and impact against the bucket floor 37. However the short upper links 50 form a floating pivot connection which concurrently causes the ejector 34 to turn about pivots 56 in an opposite rotational sense. This motion about pivots 56 by itself would tend to move the ejector edge 49 away from floor 37 and thus may serve to cancel out the downward component of movement of the edge which tends to result from the pivoting on the lower links 51. Provided that the upper links 50 are appropriately proportioned and positioned, the actual net result is a linear movement of ejector edge 49, in parallelism with floor 37, from the position illustrated in FIGURE 1 to that shown in FIGURE 5.

The linear movement of ejector edge 49 is fixed by the supporting linkage 50 and 51 and is not determined by the particular means used to drive the ejector forward. Thus various mechanism may be used to operate the ejector, examples of which will be hereinafter described. However the ejector structure is particularly adaptable to being operated automatically by coaction with the bucket tilt linkage. By connecting the upper ends of the tilt linkage levers 21 with the upper ends of the lower ejector support links 51, through an additional pair of links 57 and 58, the ejector 34 can be operated by slight forward tipping of the bucket 12 effected through the use of the tilt linkage control jacks 31. A highly advantageous property of this system is that the limited amount of forward tipping of bucket 12 operates the ejector only when the bucket is in its elevated position. Ejector 34 is not operated by such forward tipping of the bucket 12 when it is in the lowered or loading position.

Each of the ejector actuating links 57 is coupled at one end to the pivots 28 at the top of tilt linkage levers 21 and is coupled at the other end to the relatively short link 58 by a pivot 59. The short links 58 connect to projections 61 at the upper end of ejector support links 51 by means of pivots 62. The connection between the tilt linkage 20 and the ejector 34, formed by the links 57 and 58, is articulated in this manner in order to introduce a limited amount of lost motion into the connection when the bucket 12 is at its lower position as illustrated in FIGURE 1. This avoids forced movement of the ejector 34 relative to the bucket 12 when the lowered bucket is racked back as illustrated in FIGURE 3 or tipped forward in a reverse direction.

To limit the lost motion and to provide for operation of the ejector 34 at the carry position of the bucket, a stop 63 is formed on the short link 58 in position to abut against link 51 when the bucket 12 has been elevated as shown in FIGURE 4. Once the stop 63 has seated in this manner, operation of the tilt linkage 20 to tip the bucket 12 forward also causes links 57 and 58 to drive the ejector 34 forward to the ejection position illustrated in FIGURE 5. An additional stop 60 on the link 58 abuts against link 57 to limit over travel of the link 58 at this position. Owing to the effect of the ejector supporting links 50 and 51 as hereinbefore described, the lower edge 49 of the ejector 34 travels in a linear manner during this movement in parallelism with the bucket floor 37.

Other mechanisms may be used to actuate the ejector 34 automatically by operation of the tilt linkage 20, one example being shown in FIGURES 6 and 7. In this modification of the invention, as in the previous instance,

the bucket 12' is coupled to lift arms 13 at pivots 17 situated near the lower end of the bucket support brackets 43. To control the tilt of the bucket a tilt linkage member 27 is coupled to the support brackets 43 by pivots 29 situated above the pivots 17. The operating mechanisms for the lift arms 13 and tilt linkage member 27 may be similar to that previously described.

The rear wall of bucket 12' is defined by an ejector member 34 supported by upper and lower links 50 and 51, respectively, essentially similar to those previously described so that the lower edge 49 of the ejector is constrained to move in a direction parallel to the bucket floor 37. To provide for the coupling of actuating means to the ejector 34, the brackets 64 at the rear of the central section of the ejector, to which the upper end of support links 51 are pivoted, extend further backward than in the previous instance and are transpierced by pins 66 spaced rearwardly from the pivot 56 which couple the support links 51 to the brackets. An ejector operating link 67 is connected between each such pin 66 and a pivot 65 on lift arms 13 is a small distance rearwardly from the pivots 17 which couple the bucket 12' thereto. To avoid movement of the ejector 34 when the bucket 12' is racked back while in its lower or fill position illustrated in FIGURE 6, the coupling between the ejector actuating link 67 and the pin 66 is arranged to provide for a limited amount of lost motion. One means for accomplishing this result is to provide a short longitudinal slot 68 at the upper end of the link 67 to receive the pin 66.

In operation, the bucket 12' may be loaded in the conventional manner and may be racked back about pivot 17 by retraction of the tilt linkage member 27. Provided the bucket is at its lowered position, ejector 34 remains inactive during the racking back movement inasmuch as the pin 66 can travel freely relative to operating link 67 within the slot 68 thereof. The free travel of pin 66 within slot 68 of the operating link 67 further avoids forced movement of ejector 34 as the bucket 12' is raised to its elevated position by the lift arms 13.

Referring now to FIGURE 7 in particular, a small amount of forward tipping of the bucket 12' when it is at the elevated carrying position, by means of the tilt linkage member 27, causes operating link 67 to drive ejector 34 forwardly to dump the load. As the bucket 12' tilts forwardly about pivot 27 operating link 67 exerts a generally downward pull on the pin 66 at slot 68 which forces the forward movement of ejector 34 in the bucket.

In both of the above described embodiments of the invention, the ejector is operated mechanically by an interconnection with the bucket tilt controls and this is a preferred mode of operation for many types of loader. However the ejector may also be operated by other means which are independent of the bucket tilting mechanism. Referring now to FIGURE 8, one form of independent ejector control is shown in which hydraulic jacks 69 operate the mechanism. In the embodiment of FIGURE 8, the bucket 12'' may again be similar to that previously described and includes a flat floor 37, end walls 41 extending upwardly to cross beam 42, and support brackets 43 between the floor 37 and cross beam 42 at the back of the bucket. The bucket 12'' is again carried on the end of lift arms 13 by a pivot connection 17 and is selectively tiltable thereabout through a tilt linkage member 27 pivotably coupled to the support brackets 43. As in the embodiments of the invention described above, the rear wall of the bucket 12'' is formed by an ejector supported by upper pivot links 50 and lower pivot links 51 which constrain the lower edge 49 of the ejector to a linear pattern of movement. The jacks 69 which drive the ejector 34 forwardly within bucket 12'' may be coupled between the ejector and the bucket in any of a variety of ways.

In this embodiment of the invention, each jack 69 is coupled at one end to the pivot 17 which connects the bucket 12'' with lift arm 13 and the other end of the jack is connected to a bracket 71 at the rear of the ejector at a pivot 72 situated a small distance rearwardly from the pivot 56 at the upper end of support link 51. Thus contraction of the jacks 69 pulls on bracket 71 to force a forward pivoting of ejector 34 and consequent discharging of the contents of the bucket 12''. Similarly, extension of jacks 69 exerts a reversed force on ejector 34 driving the ejector to the rear of the bucket as indicated by dashed line 34'. As the jacks 69 are coupled only to elements of the bucket and ejector assembly, the operation of ejector is independent of operation of the lift arms 13 or tilt linkage 27 and ejector may be operated with the bucket 12'' at any elevation and at any tip position.

Many other modifications are possible within the scope of the invention and it is not intended to limit the invention except as defined in the following claims.

What is claimed is:

1. Ejector mechanism for a loader bucket having a floor and a face with an opening for receiving and discharging a load comprising a movable ejector member disposed transversely in said bucket and having an edge adjacent said floor thereof, a lower link extending between said bucket and said ejector member, a first pivot connection coupling said lower link to said bucket, a second pivot connection coupling said lower link to said ejector at a point thereon spaced from said edge thereof, means for forcing said ejector member towards said face of said bucket by pivoting said ejector member and said lower link about said first pivot connection, an upper link extending between said bucket and said ejector member, a third pivot connection coupling said upper link to said bucket, and a fourth pivot connection coupling said upper link to said ejector member at a point thereon which is spaced from said edge a greater distance than the spacing of said second pivot connection therefrom whereby said ejector member is constrained to pivot relative to said lower link about said second pivot connection during said movement towards said face thereby causing said edge to move in a linear manner.

2. Ejector mechanism for a loader bucket as defined in claim 1 wherein said floor of said bucket has a flat inner surface and wherein said edge of said ejector member is linear and parallel thereto and is spaced a small distance therefrom.

3. Ejector mechanism for a loader bucket as defined in claim 1 wherein said first pivot connection is situated closer to said bucket floor than said second pivot connection and is spaced from said face of said bucket a greater distance than the spacing of said edge therefrom.

4. Ejector mechanism for a loader bucket as defined in claim 1 wherein said third pivot connection is spaced from said floor and said face of said bucket a greater distance than the spacing of said fourth pivot connection therefrom.

5. Ejector mechanism for a loader bucket as defined in claim 1 wherein said first pivot connection is situated at the end of said floor which is remote from said face of said bucket, and wherein said fourth pivot connection is situated at the top portion of said ejector member remote from said edge thereof, said third pivot connection being spaced from said floor and said face of said bucket a greater distance than the spacing of said fourth pivot connection therefrom.

6. Ejector mechanism for a loader bucket as defined in claim 1 wherein said lower link is of greater length than said upper link.

7. Ejector mechanism for a loader bucket as defined in claim 1 wherein said bucket is pivoted to the lift arms of a loader and wherein the pivot axis of said first pivot connection is coincident with the pivot axis of said bucket.

8. Ejector mechanism for a loader bucket as defined in claim 1 wherein said bucket is pivotably attached to a lift arm of a power loader of the class having a tilt linkage for pivoting said bucket relative to said arm, wherein

said means for forcing said ejector member toward said face of said bucket comprises an actuating linkage coupled to said ejector member and operative to force said member toward said face upon pivoting of said bucket by said tilt linkage.

9. Ejector mechanism for a loader bucket as defined in claim 8 wherein said tilt linkage has a selectively movable element coupled to said bucket for tilting said bucket relative to said arm and wherein said actuating linkage comprises an ejector drive link pivotably coupled to said movable element of said tilt linkage, a shorter link pivotably coupled to said ejector member, and a fifth pivot connection coupling said drive link and said short link, and stop means limiting pivoting of said short link relative to said drive link about said fifth pivot connection.

10. Ejector mechanism for a loader bucket as defined in claim 8 wherein said actuating linkage comprises an ejector operating link having a first end pivotably coupled to said loader lift arm at a point spaced from the pivot attachment of said bucket thereto and having a

second end pivotably coupled to said ejector member, said coupling between said operating link and said ejector member being of the class providing a limited amount of lost motion therebetween.

11. Ejector mechanism for a loader bucket as defined in claim 1 wherein said means for forcing said ejector member toward said face of said bucket comprises a fluid powered jack coupled between said ejector and said bucket.

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U.S. Cl. X.R.

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