United States Patent [19]

Blakely

[11] **3,722,724**

[45] **Mar. 27, 1973**

[54] **LOAD CARRYING DEVICE WITH IMPROVED POSITION CONTROL**

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[73] Assignee: **J. I. Case Company**

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[52] **U.S. Cl.**.....**214/776,** 214/140

[51] **Int. Cl.**.....**E02f 3/86**

[58] **Field of Search**.....214/762, 763, 764, 140, 772, 214/775, 776

[56] **References Cited**

UNITED STATES PATENTS

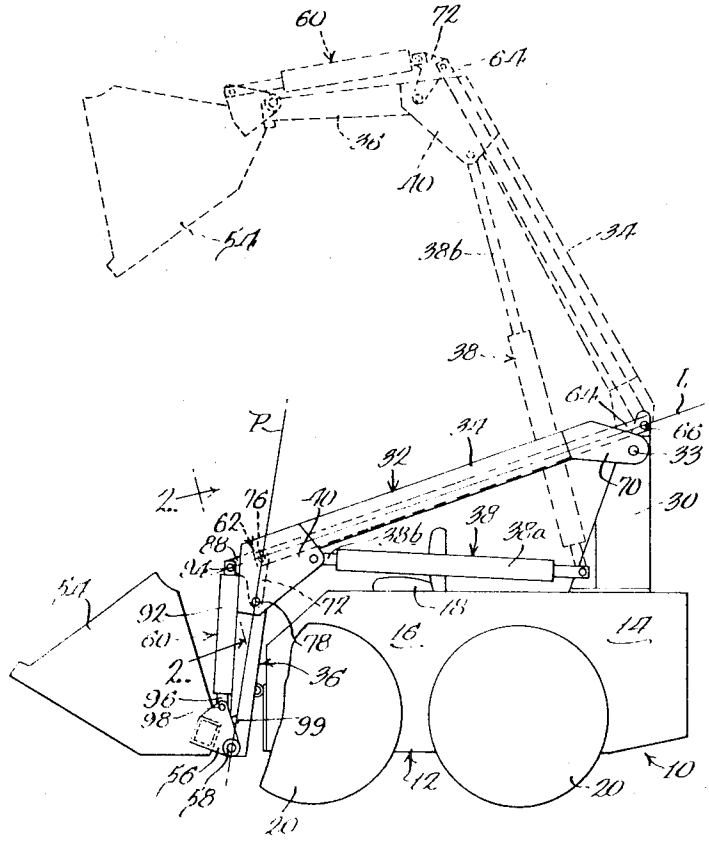
3,237,795	3/1966	Kromer	214/776
2,645,369	7/1953	Allan	214/776

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Assistant Examiner—John Mannix
Attorney—Dressler, Goldsmith, Clement and Gordon

[57] **ABSTRACT**

A material handling device having a bucket pivoted on the free ends of lift arms that extend on opposite sides of a vehicle body and are pivoted on uprights extending from the body adjacent the rear end thereof. The material handling device incorporates pivot means for tilting the bucket and automatically maintaining the bucket in a level condition as the lift arms are raised. The pivot means includes a pair of links that are supported within the hollow lift arms with a fluid motor located between one of the links and the material handling implement that is pivoted on the free end of the lift arms. The links and hollow lift arms are constructed and arranged to allow unrestricted movement of the links within the lift arms while the lift arms are pivoted between raised and lowered positions.

6 Claims, 3 Drawing Figures

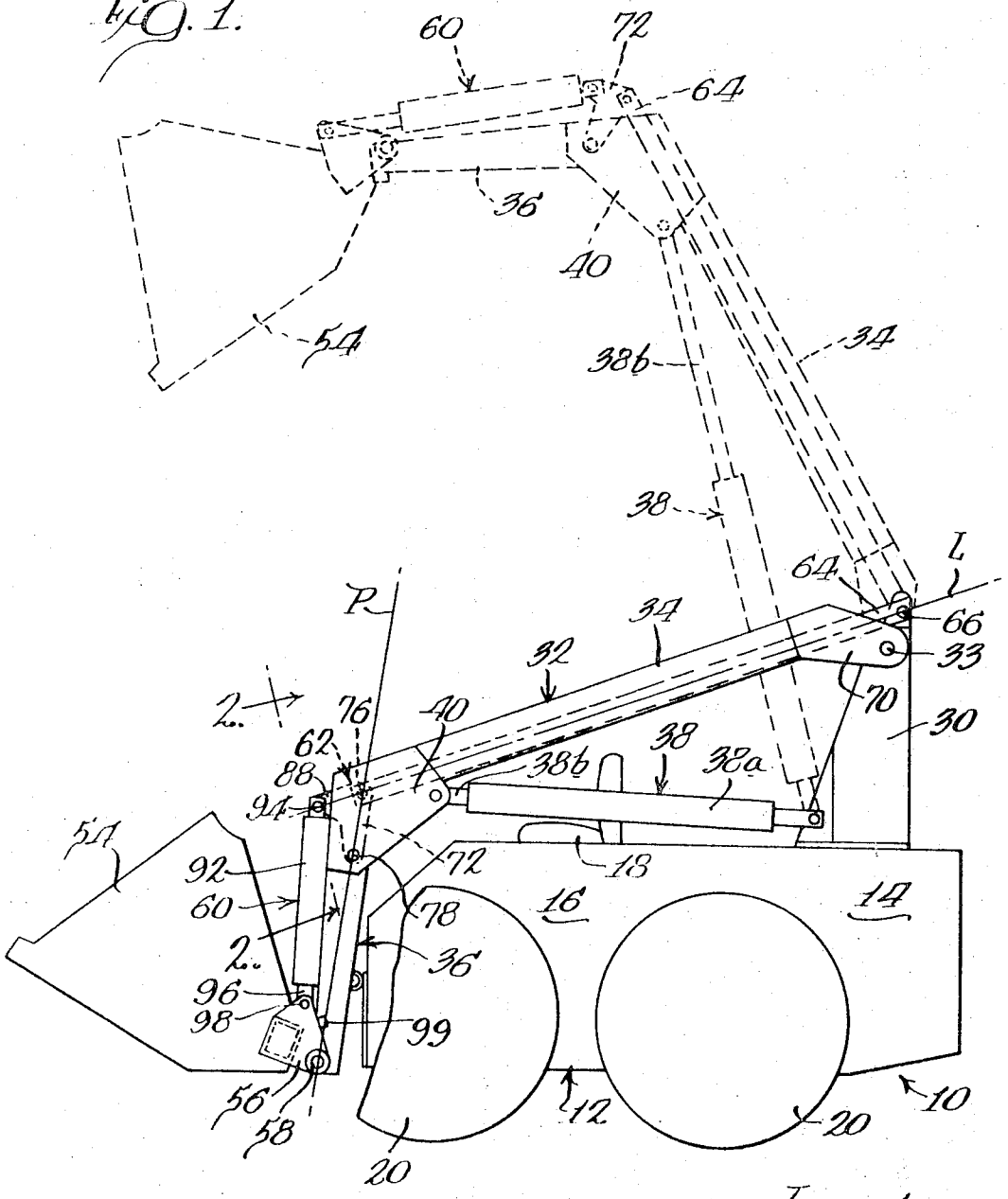


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3,722,724

SHEET 1 OF 2

Fig. 1.



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Fig. 2.

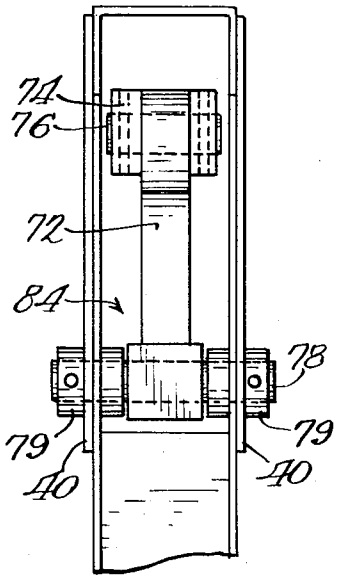
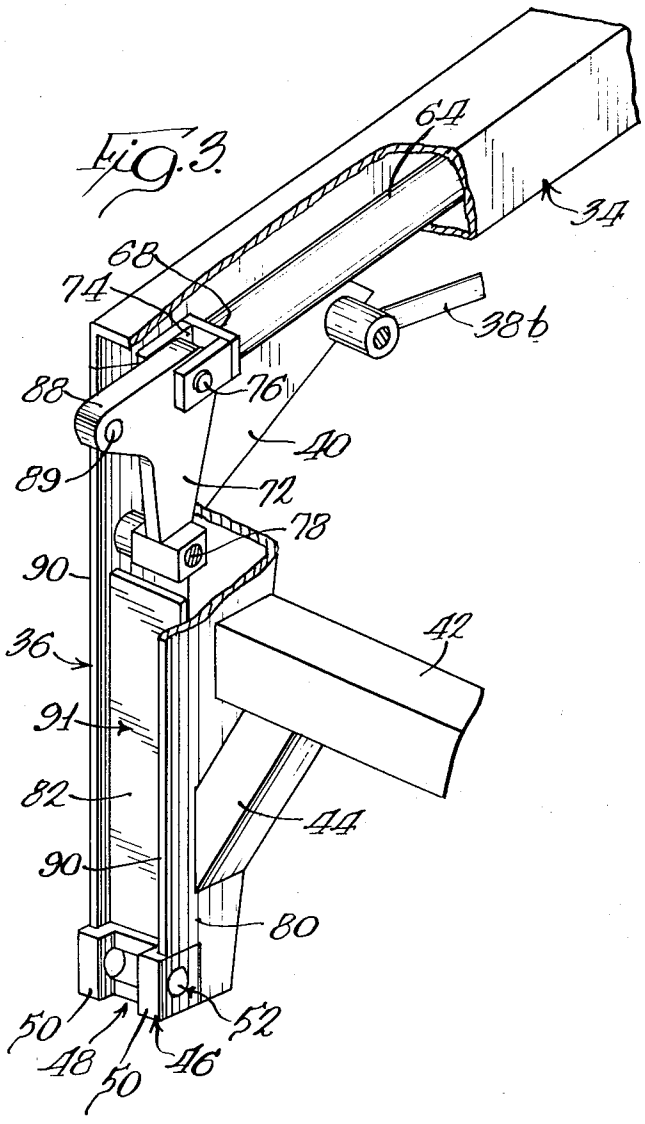


Fig. 3.



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LOAD CARRYING DEVICE WITH IMPROVED POSITION CONTROL

BACKGROUND OF THE INVENTION

The present invention relates generally to material handling devices of the type disclosed in Melroe et al. U.S. Pat. No. 3,231,117.

Material handling equipment, such as vehicle mounted "front end loaders," to which the present invention is directed, have been on the market for some time. A typical example of a compact unit of this type is disclosed in the above mentioned patent, which is incorporated herein by reference. The material handling unit disclosed in this patent includes a vehicle consisting of an elongated body having an engine compartment adjacent the rear end thereof and an operator's compartment adjacent the forward end. A pair of stanchions or uprights are fixedly secured to the body adjacent the opposite sides of the engine compartment and extend upwardly therefrom. A pair of lift arms are pivotally connected at one end about a common pivot axis on the respective uprights and extend generally forwardly along opposite sides of the body in close proximity to the operator's compartment and terminate in downwardly directed end portions. A material handling device, such as a bucket, is pivotally supported on the free ends thereof and is normally pivoted between "roll-back" and "dump" positions by hydraulically operated linkage mechanism that is controlled by the operator seated in the operator's compartment.

In the above mentioned patent, the pivotal movement of the bucket is accomplished through a fluid ram that has one end pivotally connected to the bucket at a location spaced from the pivotal connection to the free ends of the lift arms and an opposite end connected to the boom at a location laterally offset from the longitudinal axis of the downwardly directed portion.

In the raising and lowering of the lift arms and the bucket relative to the uprights, normally through a second pair of fluid rams located between the uprights and the lift arms or boom, the tilt of the bucket tends to increase and, if uncorrected, might dump material over the top edge of the bucket and down onto the tractor or vehicle and the operator. To correct this tendency, it is customary to incorporate a self-leveling linkage system that cooperates with the tilt fluid ram for pivoting the bucket so that the attitude of the bucket remains substantially constant as the lift arms are raised after the bucket has been filled with material. Examples of linkage that cooperate with the bucket fluid ram are shown in U.S. Pat. Nos. 3,237,795 and 3,447,708, issued to Kromer and Steinkamp, respectively.

While the compensating systems disclosed in the latter two patents have contributed significantly to overcoming the problem of dumping material or contents from the material handling device onto the vehicle and/or the operator, the arrangement disclosed in both of these patents is extremely hazardous to the operator and several serious accidents have resulted from the use of implements of this type. An inspection of a plan view of the disclosures of each of the above mentioned patents shows that the lift arms are raised and lowered along a predetermined path in close proximity to opposite sides of the seat where the operator is normally stationed. As the left arms are raised and lowered relative to the vehicle, the elongated or compensating link, which extends above the main body portion of the lift arm and is moved relative to the lift arm, presents an extremely hazardous safety condition should the operator accidently have some member of his body or clothing located between the compensating link and the lift arm. As was indicated above, several serious accidents have occurred as a result of the operator reaching over to perform function adjacent the lift arms and then inadvertently cause a raising or lowering of the lift arms while some body member, such as the hand, is located between the compensating link and the lift arm.

An additional disadvantage of the design disclosed in the above mentioned Kromer and Steinkamp patents is that the numerous exposed parts of the lifting as well as the tilting mechanism for the bucket results in a rather cluttered looking vehicle.

While it has been proposed to incorporate linkage into hollow lift arms (U.S. Pat. No. 2,645,369), the complicated arrangement disclosed has not found any degree of commercial success.

SUMMARY OF THE INVENTION

The present invention contemplates an improved material handling unit of the type disclosed in the above mentioned patents and which gives an extremely pleasing appearance and uncluttered look of the entire vehicle. Furthermore, the overall dimensions of the unit are considerably reduced thereby increasing the versatility of the machine.

The present invention contemplates a vehicle having an elongated body portion with an engine compartment adjacent the rear end thereof and an operator's compartment adjacent the forward end thereof with uprights extending above the body on opposite sides of the engine compartment. A pair of hollow lift arms are pivotally connected at one end to the uprights at a location spaced above the main body and have a main portion extending past the operator's compartment with angularly related or downwardly directed end portions adjacent the front end thereof. The lift arms are adapted to be raised and lowered along opposite sides of the operator's compartment by a pair of fluid rams having opposite ends connected to the respective uprights and lift arms. A material handling device, such as a bucket, is pivoted on the free ends of the downwardly directed end portions of the lift arms and is moved through a hydraulic linkage system for each of the lift arms.

According to the invention, each linkage system consists of a first link having one end pivoted on the upright at a location above and rearwardly of the pivotal connection for the lift arm. The elongated first link extends forwardly within the hollow lift arm and terminates at the juncture between the elongated main portion and the downwardly directed end portion of the lift arm. A second link is pivotally connected to the opposite end of the first link and extends downwardly within the hollow end portion with an opposite end of the link pivotally connected to the downwardly directed portion of the lift arm at a location spaced below the juncture. A projection or projecting portion of the second link extends forwardly through an opening in the downwardly directed portion and an extensible and retractable tilt ram is connected at one end to

the projection and the opposite to the material handling device. The first and second links and the lift arms are constructed and arranged to allow substantially unrestricted movement of the links within the lift arms while the lift arms are pivoted approximately 90° between raised and lowered positions on the uprights. During this movement, the elongated first link extends generally parallel to the longitudinal axis of the main body portion of the lift arm.

BRIEF DESCRIPTION OF SEVERAL VIEWS OF DRAWINGS

FIG. 1 is a side elevation view of the material handling unit having the present invention incorporated therein;

FIG. 2 is an end view of a portion of one of the lift arms; and

FIG. 3 is fragmentary perspective view of a portion of one of the lift arms with portions broken away.

DETAILED DESCRIPTION

While this invention is susceptible of embodiment in many different forms, there is shown in the drawings and will herein be described in detail one specific embodiment, with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiment illustrated.

FIG. 1 of the drawings generally discloses a vehicle **10** consisting of an elongated body **12** having an engine compartment **14** adjacent the rear end thereof and an operator's compartment **16** adjacent the forward end thereof with a seat **18** located in the operator's compartment between opposite sides of the elongated body **12**. The body **12** is supported by ground engaging means consisting of four wheels **20**, only two of which are shown in FIG. 1.

Since the remaining elements to be described, with the exception of the material handling device and some bracing structure, are duplicated on opposite sides of the main body, as is more clearly shown and described in the above mentioned Melroe et al. U.S. Pat. No. 3,231,117, only one set of elements has been shown with the understanding that the description will likewise refer to an identical set of elements located on the opposite side of the engine housings **14** and operator's compartment **16**.

A pair of transversely spaced stanchions or uprights **30** extend upwardly along opposite sides of the engine compartment **14** and terminate above the body **12** at a location spaced above the operator's seat **18**. A hollow lift arm **32** is pivotally connected at one end by a pivot pin **33** to the upper end of each of the uprights and the two pivot pins **33** for the respective lift arms are located upon a common horizontal axis. The hollow lift arms each consists of an elongated generally straight main body portion **34** and an angularly related or downwardly directed end portion **36** that extends downwardly adjacent the forward end of the body **12**. Each of the lift arms **32** is adapted to be raised and lowered on the vehicle by a fluid ram **38** including a cylinder **38*a*** pivoted on the upright **30** adjacent its lower end and a piston rod **38*b*** connected to a pair of plates **40** that interconnect the main portion **34** and end portions **36** and form a part of the juncture between the main body portion **34** and the downwardly directed end portion **36**. Extension and retraction of the fluid rams **38** will move the lift arms **32** between raised and lowered positions, respectively shown in the dotted and solid lines of FIG. 1.

The downwardly directed end portions **36**, which extend generally vertically when the lift arms are in the lowered position, are interconnected by a cross member **42** (FIG. 3) that is suitably braced by struts **44**, which cooperate with the respective downwardly directed end portions and with the cross member **42**.

A bracket **46** is secured to the lower or free end of the downwardly directed portions **36** and defines a recess **48** between a pair of lugs **50** that have horizontally aligned apertures **52**. A material handling implement **54** (FIG. 1), such as a bucket or lift fork, has rearwardly directed brackets **56** that are pivotally connected to the lugs **50** through a pivot pin **58**.

According to the present invention, the bucket **54** is pivoted on the lift arms through a hydraulic linkage that includes a tilt fluid ram **60** and a compound linkage **62** for each lift arm with the linkage being substantially completely enclosed within the hollow lift arm **32**.

Referring to FIG. 1, linkage **62** consists of a first link **64** having one end pivotally connected, through a pivot pin **66**, to the upright **30** at a location that is spaced above and rearwardly of the pivot pin **33**. The first link **64** extends forwardly within the main portion **34** of the hollow lift arm **32** and terminates at its opposite end **68** (FIG. 3) at the juncture between the main portion **34** and the downwardly directed end portion **36** of the lift arm.

For this purpose, as more clearly shown in FIG. 3, the elongated flat main portion **34** of the lift arm **32** is defined by a substantially rectangular hollow beam having a rectangular opening therein. A pair of ears **70** (FIG. 1) are fixedly secured, as by welding, to one end of the rectangular beam and extend on opposite sides of the upright **30** to pivotally support the lift arm on the pivot pin **33**. As most clearly shown in FIG. 1, the ears **70** are directed downwardly and rearwardly so that the opening in the rectangular hollow beam has its longitudinal axis located at a point spaced from the pin **33**.

The linkage **62** further includes a second link **72** that is pivotally connected to the opposite end **68** of the first link **66** through a clevice **74**, extending along opposite sides of the second link **72**, and a pin **76**. The link **72** extends downwardly from the pivot pin **76** inside the hollow downwardly directed end portion **36** of the lift arm **32** and has its opposite end pivoted about a fixed pivot axis, defined by a pin **78** that extends through bushing **79** in opposite side walls of the hollow member **36**. As more clearly illustrated in FIGS. 2 and 3, the hollow downwardly directed end portion **36** of the boom **32** consists of a substantially U-shaped or channel-shaped beam **80** having its open side directed forwardly with a plate **82** closing the open side along the major portion of the length of the channel member **80**. The plate **82** terminates at a location directly below the pivot pin **78** to define a forwardly directed opening **84** at the juncture between the main portion **34** and the downwardly directed end portion **36** and an integral projection or extension **88** on the link **72** adjacent the upper portion thereof extends through the opening **84** and has an opening **89** in the exposed portion. Also, the

plate 82 is spaced from the forward free edges 90 of the channel member and cooperates with the edges 90 to define a forwardly opening recess 91, for a purpose that will be described later.

The tilt fluid ram 60 is interposed between the projection 88 and the brackets 56 with a cylinder 92 of the fluid ram 60 connected to the projection 88 by a pin 94 extending through the aperture 90 and spaced lugs extending from the head end of the cylinder. The piston rod 96 of the fluid ram 60 is connected by a pivot pin 98 to the brackets 56 to complete the pivot means for the bucket 54. In addition, limit stops 99 are fixed to the outer surfaces of downwardly extending end portions 36 and are located in the path of movement of brackets 56 to define the maximum "roll-back" position for the bucket 54.

Thus, assuming that the operator has just filled the bucket or material handling device 54 with dirt and has pivoted the bucket to the "roll-back" position shown in FIG. 1, by completely retracting the fluid rams 60, subsequent extension of the fluid rams 38 will move the lift arms 32 from the solid line to the dotted line position shown in FIG. 1. During such movement, the bucket 54 would automatically be tilted rearwardly as the lift arms were raised, were it not for the linkage 62. However, as the lift arms are raised, the fixed link 64 extending between the pivoted link 72 and the upright 30 will cause a pivoting of the second link 72 about its pivot pin 78. By properly dimensioning and locating the links 64 and 72, as well as the main portion 34 of the lift arm 32, and properly relating the pivot pins 34 and 66 on the uprights 30, the first links 64 will remain substantially parallel to the longitudinal axes of the main portions 34 of the lift arms 32 as the lift arms are pivoted approximately 90° about the pivot pin 34. During such movement, the second link 72 will be moved about the pivot pin 78 to subsequently move the projection 88 towards the bucket 54 and maintain a substantially fixed attitude of the bucket 54 relative to a vertical axis, so long as the fluid ram 60 remains in the completely collapsed condition. After the lift arms have been moved to the raised position, the fluid ram 60 may be extended to move the bucket 54 to the dump position shown in the dotted line in FIG. 1.

The unique arrangement of locating the two links 66 and 72 within the hollow lift arm 32 considerably enhances the overall appearance of the vehicle since there is a single member which extends between the upright 30 and the bucket 54 and the fluid ram 60 is in close proximity to the lift arm.

Considering now the more specific arrangement of the present invention, with particular reference to FIG. 1, it will be noted that, in the "roll-back" position (the completely retracted position for the fluid ram 60), the ram 60 is located in close proximity to the front surface of the substantially vertical downwardly directed end portion 36 and extends substantially parallel to the longitudinal axis thereof, with a portion of the ram located in the forwardly opening recess 91. It will be appreciated that the fluid ram 60, the bracket 56, and the second link 72 cooperate to define a parallelogram linkage for pivoting the bucket and in which the link defined by the ram 60 is extended to produce the pivoting or tilting of the bucket 54. Also, viewing FIG. 1, it will be noted that the pivot pins 76, 78 and 58 are located in a substantially common plane P when the lift arms 32 are in their completely lowered position shown in FIG. 1. Likewise, in this position, the pivot pins 66, 76 and 94 are also located in a common plane, identified by the reference numeral L. Stated another way, the pivot pin 76 is aligned with the pivot pins 66 and 94 as well as the pivot pins 58 and 78.

Summarizing briefly, the present invention thus contemplates a compact attractive material handling vehicle that incorporates a self-leveling mechanism which is completely enclosed within the confines of other structure that is necessary for supporting the bucket for movement on the vehicle.

In the specific embodiment, the links and their relation to the lift arms are arranged so that there is approximately 20° of rearward tilt of the bucket as the left arms are moved from the lowered to the raised position to keep the material from spilling out of the front of the bucket. However, if other material handling apparatus were to be used with the lift arms, it may be desirable to alter the geometry of the links, lift arms and their interconnections to change the degree of self-leveling as the lift arms are raised. For example, if a lift fork is attached to the lift arm it is desirable to keep the fork absolutely level and sometimes have it tipped forward slightly when the lift arms are in the raised position.

It is also desirable to have the tilt fluid rams extensible to an extent greater than required to move the bucket to its level position when the lift arms are in the lowermost position shown by the solid line position of FIG. 1. This gives the loader the ability to dig itself out if it becomes stuck by pivoting the bucket beyond the level position when the lift arms are in the lowermost position. To prevent damage to the hydraulic system, should the lift arms be raised when the rams are fully extended which could cause the dump stops (now shown) to become engaged, relief valves are installed in the hydraulic lines (not shown) leading to the rams. This arrangement may be substantially as shown in Pilch U.S. Pat. No. 2,807,379.

I claim:

1. In a vehicle having an elongated body with an engine space at a rear end thereof and an operator's compartment forward of said engine space adjacent the front end thereof; ground engaging means on opposite sides of said body; a pair of fixed uprights adjacent opposite sides of said body and located rearwardly of said operator's compartment; a pair of hollow lift arms, said lift arms having an elongated opening and having one end, which extends downwardly relative to the longitudinal axis of said lift arms, pivotally connected to respective uprights about a common horizontal pivot axis extending through said downwardly extending end at a location spaced above said body and below the longitudinal axis of the opening, said lift arms having elongated main portions extending forwardly above the body adjacent opposite sides of said body past said operator's compartment and terminating in downwardly directed end portions adjacent the front end of said body; a material handling device pivotally connected to the free ends of said end portions; a first pair of extensible hydraulic rams, each having one end connected to one of said uprights and an opposite end connected to the associated lift arm to raise and lower said arms and device in response to extension and

retraction of said rams; and pivot means cooperating on each of said lift arms for pivoting said device, said pivot means each comprising: a first unitary rigid link having one end pivotally connected to an upright above and rearwardly of said common pivot axis, said first link extending forward within the main portion of an associated hollow lift arm and terminating at its opposite end at the juncture between said main portion and said end portion; a second link directly pivotally connected to said opposite end of said first link, said second link extending downwardly within said downwardly directed end portion and pivoted about a fixed pivot axis in said hollow lift arm below said main portion, said lift arm having a forwardly directed opening adjacent said juncture with a projection from said second link extending forwardly through said opening; and an extensible and retractable tilt ram between said projection and said device for pivoting said device on said lift arms, said lift arms and links being constructed and arranged to allow unrestricted movement of said links within said lift arms while said lift arms are pivoted substantially 90° between raised and lowered positions on said uprights.

2. A vehicle as defined in claim 1, in which each projection is located below the upper edge of the adjacent main portion of said lift arms when the lift arms are in a lowermost position.

3. A vehicle as defined in claim 1, in which said first and second links are constructed and arranged so that the pivot connections for opposite ends of said second link and pivotal connection between the device and end portion are in a substantially common plane when the lift arms are in the lowermost position.

4. A vehicle as defined in claim 3, in which the pivotal connections between the projection and the tilt ram and the pivotal connections for opposite ends of said first link are in a substantially common plane.

5. A vehicle as defined in claim 1, in which said tilt fluid ram extends generally parallel to the longitudinal axis of said end portion when the tilt fluid ram is retracted and said lift arms are in the lowermost position.

6. A vehicle as defined in claim 5, in which a portion of said tilt fluid ram is rearwardly of a forward edge of the associated end portion when the fluid ram is retracted and the lift arm is in a lowermost position.

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