Oct. 28, 1969 A. S. ROSSONI 3,474,921

LIFT TAILGATE

Filed Nov. 30, 1966 4 Sheets-Sheet 1

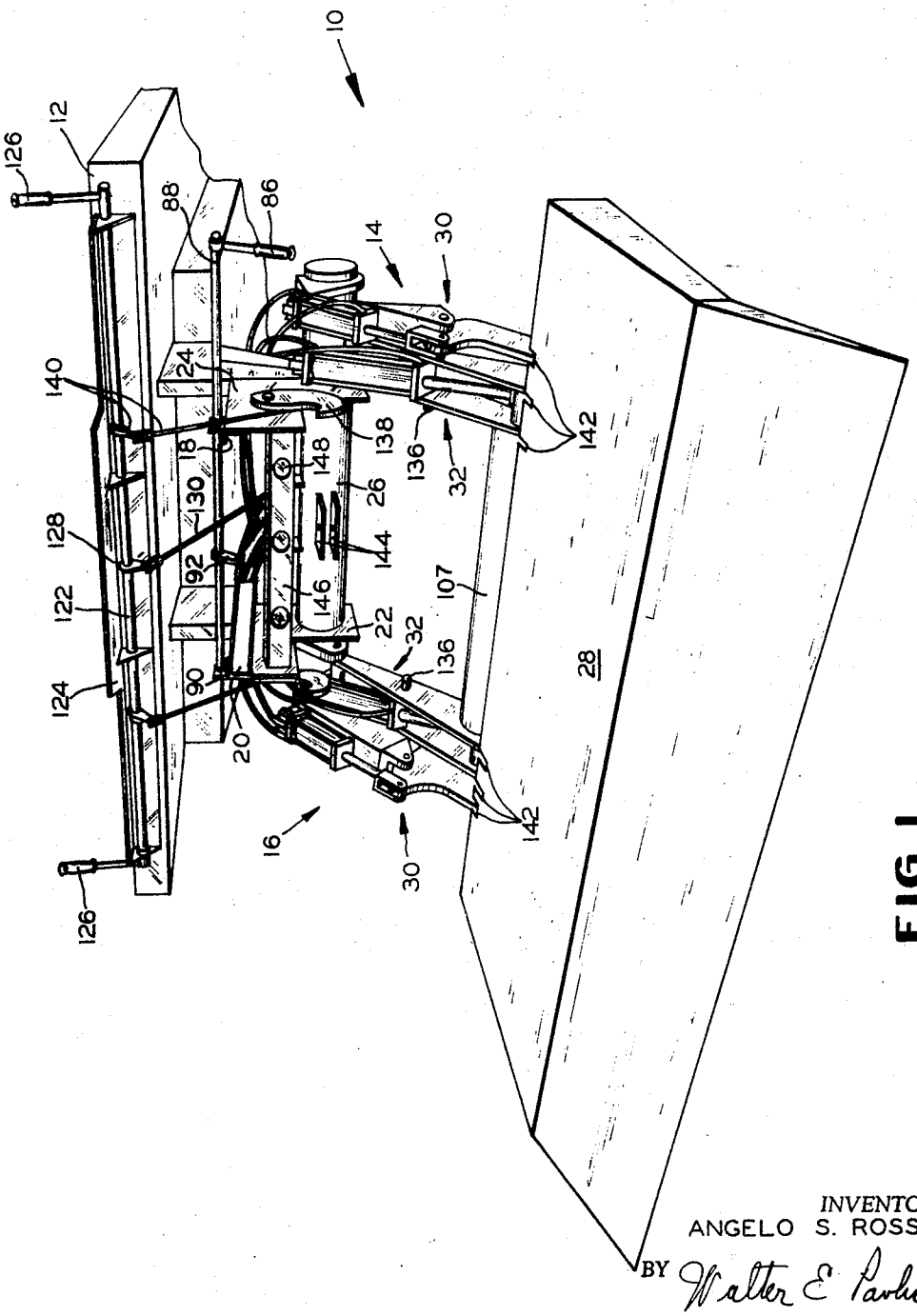


FIG. 1

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LIFT TAILGATE

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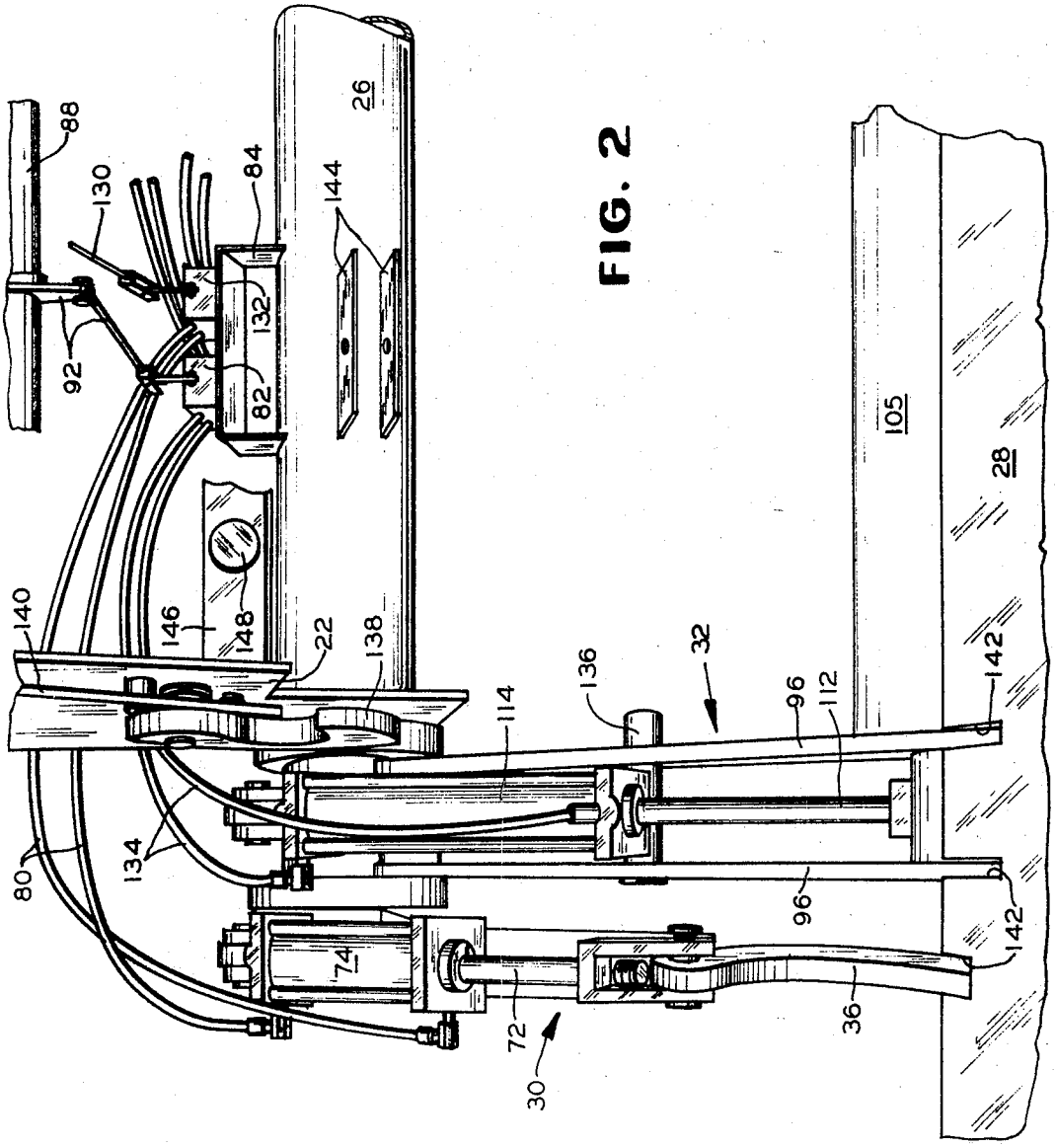


FIG. 2

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LIFT TAILGATE

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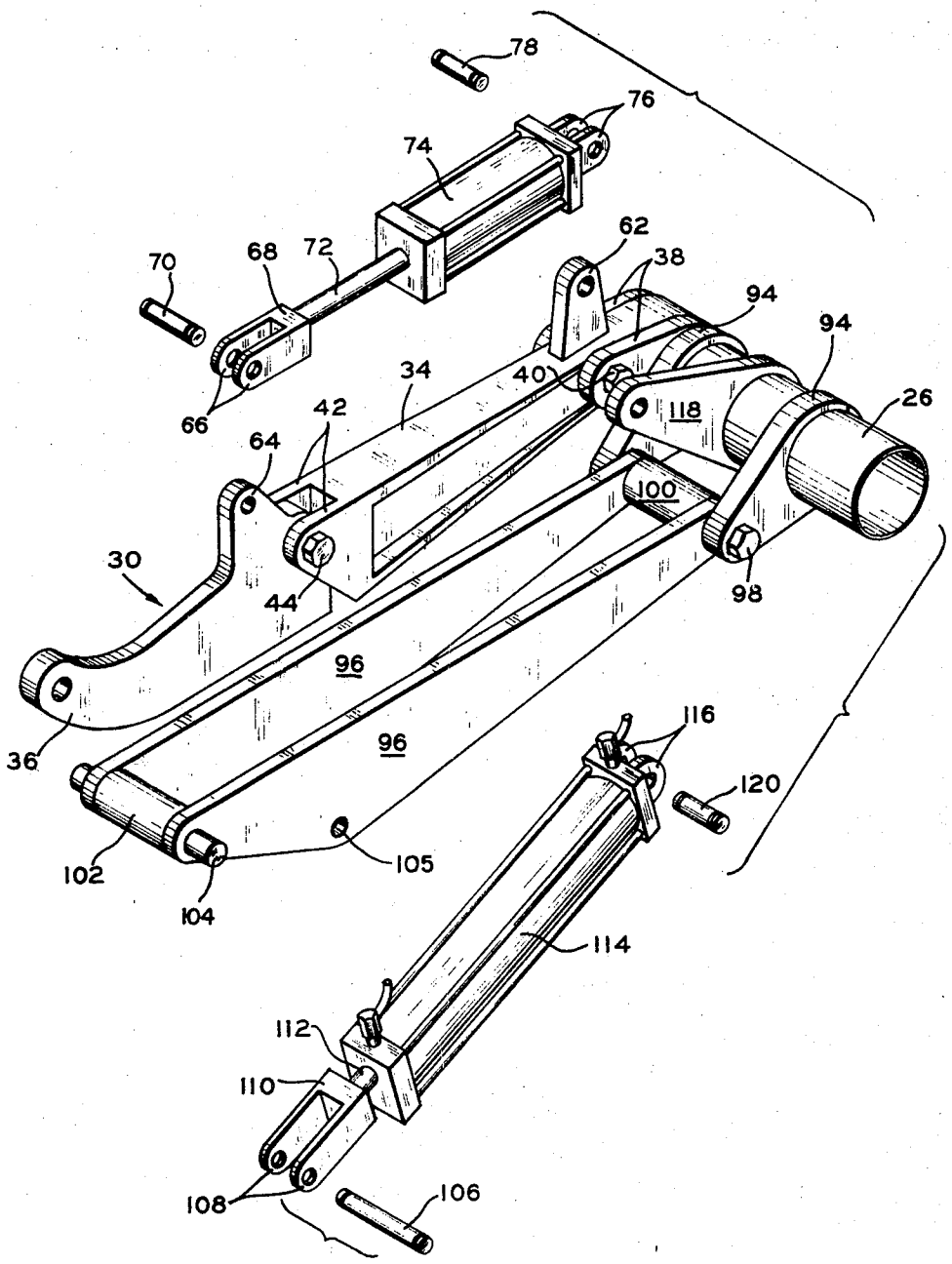


FIG. 3

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LIFT TAILGATE

Filed Nov. 30, 1966 4 Sheets-Sheet 4

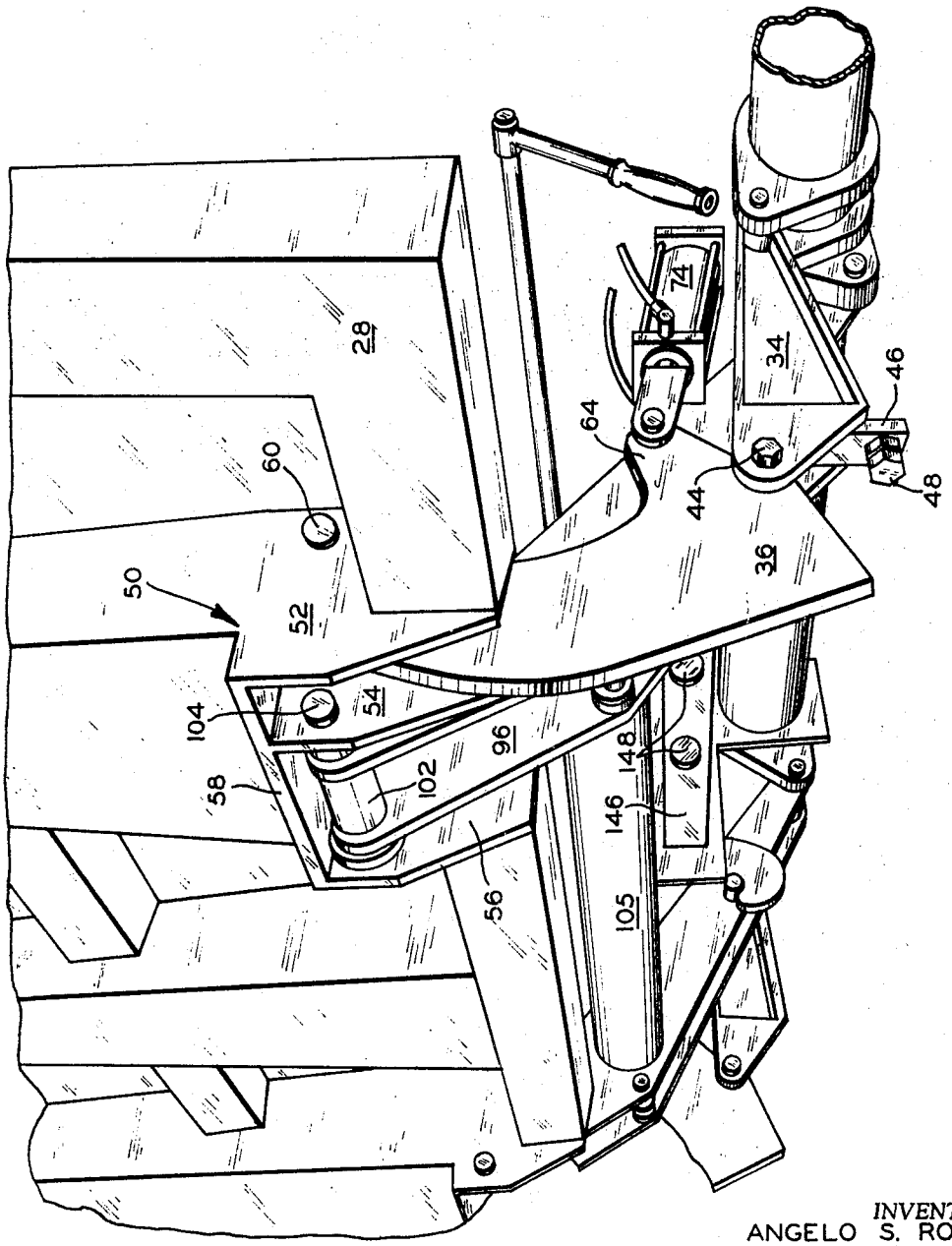


FIG. 4

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United States Patent Office 3,474,921
Patented Oct. 28, 1969

3,474,921.

LIFT TAILGATE

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Int. Cl. B60p 1/48
U.S. Cl. 214—77 11 Claims

ABSTRACT OF THE DISCLOSURE

This disclosure relates to lift tailgates for use on self loading vehicles and more particularly to the parallel linkage system for lifting and closing the gate. In this disclosure the tension arms each comprise two segments pivotally connected with a power cylinder connected to the outer tension arm segments to pivot the same and thus move the lift gate to a position closing the end of the vehicle. Each compression arm of the disclosure includes closely spaced arm segments with a lift cylinder disposed therebetween to effect movement of the lift gate from the ground engaging position to a position coplanar with the vehicle bed.

Various load elevating devices have been provided to assist in loading vehicles. Many prior art devices for this purpose include a movable, horizontal platform mounted on the vehicle, which platform is powered to carry the load from the ground or a loading dock to the level of the vehicle bed. Heavy objects are usually hand trucked onto the platform in its lowered position, lifted and then trucked onto the vehicle bed.

It is important that the platform in such a device remain relatively level during its use. Since devices of this type are subjected to repeated loading, prior known devices often sag or the parts thereof become fatigued to the extent that they must be reconstructed to be completely operative.

It is also desirable that the platform in such devices be capable of folding to a position covering the end of the vehicle bed. Not only does this provide a double use for the platform or gate, thus obviating the need for other closures for the vehicle bed, but the projection of the platform from the end of the vehicle creates an unnecessary and unsightly obstruction.

Previous attempts to provide such a gate have usually resulted in complicated and expensive structure which may not be rugged enough to withstand the hard usage required of a device of this type. For instance, most prior art structures now provide one or more cross members extending transversely between and connecting the compression arms of the two parallel linkage systems. A power cylinder is usually mounted to the vehicle and has one end connected to the cross member to effect lifting of the platform. When the compression arms are spaced relatively close together, the cross member need only be small in cross section to withstand the bending stresses imposed by the lifting cylinder; however, the overhang of the platform (that portion extending beyond and to the side of the arm connections) necessarily becomes great. Unequal loading of the platform, particularly on the overhang portion, causes twisting of the linkage mechanism resulting in early failures.

When the compression arms are spaced far apart to reduce the overhang, the bending stresses in the cross member rapidly increase. Accordingly, to be strong enough to withstand heavy loading, the cross member necessarily becomes massive in cross section. Furthermore, when the gate is moved to its closed, traveling position the cross member (when disposed anywhere but outwardly adjacent the platform where the power cylinder connected thereto then interferes) interferes with desirable outer support for the vehicle bed as well as a trailer hitch or other hardware normally used on vehicles.

To effect pivoting of the platform to a position closing the end of the vehicle bed, some prior art devices have used power cylinders in the compression arms (it being recognized that the platform is usually too heavy to be closed manually). However, the power cylinder becomes extended when the platform is in its closed position exposing the highly polished piston rods to the road grit and dirt thrown up by the vehicle wheels. This, of course, results in early leaking of the power cylinders.

It is an object of this invention to provide power cylinders for lifting and closing a lift tailgate which cylinders are substantially closed when the vehicle is traveling and thus not subjecting the piston rods to road dirt, etc.

Another object of this invention is to provide a stable, durable parallel linkage and power lifting and closing structure for a lift tailgate.

A further object of this invention is to eliminate the massive cross member so commonly used for effecting power lifting of a platform.

Still another object of this invention is to provide compression arms incorporating power cylinders for lifting the platform, the structure being such that the power cylinders are protected from damage.

A still further object of this invention is to provide tension arms incorporating power cylinders for closing the gate, the structure being such that the power cylinders are protected from damage.

It is also an object of this invention to provide a powered parallel linkage structure wherein the platform may be closed (or tilted) at any intermediate lift position.

In one preferred embodiment of this invention, a vehicle lift tailgate is provided and comprises a pair of spaced parallel acting linkages pivoted at one end to a mounting means provided on the vehicle and adapted to swing through generally vertical arcs. A horizontal platform extends between and is connected at one edge by pivots to the other end of the pair of parallel acting linkages so that the platform is swung from a grounded position spaced below the bed of the vehicle to a position coplanar with and adjacent the loading end of the vehicle bed. Each of the pair of the parallel linkages comprises a compression arm arrangement and a tension arm arrangement. The tension arm arrangement includes two segments pivotally interconnected with a power cylinder positioned to effect folding of the tension arm segments about their pivotal interconnection to move the platform to a vertical position closing the loading end of the vehicle. In another preferred embodiment the compression arm means includes a power cylinder connected to the arm to effect lifting and lowering of the platform without the need of the common linkage cross member.

Other objects and advantages of this invention will become apparent from the following detailed description when taken in connection with the accompanying drawings wherein:

FIG. 1 is a perspective view of the lift tailgate in its lowered ground engaging position;

FIG. 2 is an enlarged front elevation view of one of the two parallel acting linkage systems and its related hydraulic valve mechanism;

FIG. 3 is an exploded perspective view of the parallel linkage system shown in FIG. 2; and

FIG. 4 is an enlarged perspective view of the lift tailgate in its position closing the end of the vehicle bed.

Referring now more particularly to FIG. 1, a lift tailgate generally designated at **10** is movably secured under the rear of a vehicle bed **12** by a pair of parallel acting

linkage systems **14** and **16**. While this invention is shown connected to a particular vehicle, it is apparent that this invention may be used with a variety of vehicles and may be mounted thereto in many different ways. However, the vehicle with which this invention is used usually comprises the vehicle bed **12** which is supported on longitudinal extending frame members **18** and **20**. The longitudinal frame members are suitably interconnected with cross members (not shown) and the vehicle wheels (not shown) are suitably attached to the vehicle frame through the conventional spring mechanism in a manner well known in the art.

The longitudinal frame members **18** and **20** have downwardly extending brackets **22** and **24** suitably secured thereto as by welds and such brackets have downwardly extending legs apertured to accommodate a large cylindrical torque tube **26** which thus extends transversely of the vehicle under the rear of the bed **12** thereof and is welded to the brackets. The brackets **22** and **24** and torque tube **26** serve as a means for mounting the remainder of the lift tailgate **10** to the vehicle.

The vehicle bed **12** is open at the rear so that a platform (designated generally at **28**) when in its lowered position as shown in FIG. 1 may receive the article to be lifted. The platform is then raised to a position coplanar with and adjacent the vehicle bed. From this position the article may then be moved onto the vehicle bed **12** and the lift tailgate **10** pivoted to the position shown in FIG. 4 wherein it forms a closure for the rear of the vehicle bed.

In order to mount the platform **28** for this specialized horizontal and vertical pivotal movement, the pair of parallel linkage systems **14** and **16** are each mounted at one end to the torque tube **26** and at the other end to the platform **28**. More particularly, each parallel linkage system, as shown in FIG. 2, consists of a tension arm means **30** and a compression arm means **32**.

The tension arm means **30**, as most clearly shown in FIG. 3, includes an inner segment **34** and an outer segment **36**. The inner segment **34** is elongated and of generally boxlike configuration. A pair of spaced triangular shaped lugs **38** extend outwardly and upwardly from each end of torque tube **26** and are provided with apertures in their outer portions. The inner end of segment **34** is positioned between the spaced lugs **38** and an aperture therein is aligned with the apertures in the lugs **38** and a suitable bolt **40** extends through the apertures in the lugs **38** and the segment **34** to pivotally mount the segment to the torque tube **26**. The outer end of segment **34** is bifurcated to form ears **42**. The outer segment **36** is a slender member and is positioned between the ears **42** so that an aperture adjacent the upper portion of the segment **36** is aligned with apertures provided in the ears **42**. A bolt **44** extends through the aligned apertures in the ears **42** and the segment **36** so as to pivotally secure the segment **36** to the segment **34**.

Integral with the segment **34** and extending downwardly therefrom (see FIG. 4) is a rectangular stop member **46**. A stop bolt **48** is adjustably positioned in the stop member **46** through its threaded connection there with and is adapted to be engaged by the inner surface of segment **36** to limit counter-clockwise pivotal movement of the segment **36** about its pivotal connection at bolt **44**. The outer end of segment **36** is curved upwardly and has an aperture extending therethrough.

A pair of spaced U-shaped constructions **50** (see FIGURE 4) are provided underneath the inner edge of the platform **28** and each comprises side walls **52**, **54** and **56** all formed integral with or welded to a base wall **58** and the under surface of the platfrom. The U-shaped constructions **50** are provided to connect the parallel linkage systems to the platform and to this end, the outer end of segment **36** has its outermost aperture aligned with apertures in the outermost portions of side walls **52** and **54**. A bolt **60** extends through the aligned apertures and serves to pivotally mount the segment **36** to the platform **28**.

Integrally formed on the upper surfaces of segments **34** and **36** are a pair of upstanding lugs **62** and **64** respectively. The lug **64** is suitably apertured and is received between a pair of spaced ears **66** of a U-shaped member **68**. The ears **66** are provided with apertures which are aligned with the aperture in the lug **64** and a bolt **70** extends through the aligned apertures to provide a pivotal connection between the segment **36** and a piston rod **72** which is adjustably secured through a threaded connection to the base of the U-shaped member **68**. The piston rod **72** extends within power cylinder **74** and is secured to a piston (not shown) which is adapted for reciprocal movement within the cylinder.

The other end of the cylinder is provided with a pair of projecting ears **76** which receive the lug **62** and are secured thereto for pivotal movement by means of a bolt **78** which extends through apertures in the ears **76** and the lug **62**. Power fluid is introduced and withdrawn from opposite sides of the piston by hoses **80** which are connected to each end of the power cylinder **74**. The hoses extend to a valve housing **82** which is secured to a valve mounting bracket **84** fixedly positioned on the torque tube **26** approximately midway of the ends thereof. The valve housing **82** is also connected through appropriate hosing to a source of power fluid (not shown).

Accordingly, if it is desired to pivot the platform **28** vertically to the position shown in FIG. 4, after the platform has been moved to a position coplanar with the vehicle bed, the actuating handle or lever **86** provided on the outer end of a control bar **88** is pivoted. The control bar **88** is mounted in spaced brackets **90** secured to the gate mounting brackets **22** and **24** and pivotal movement thereof causes links **92** to operate the valve within housing **82** to effect evacuation of power fluid from the inner end of cylinder **74** to supply power fluid to the opposite side of the piston causing telescoping of the piston rod **72** within cylinder **74**. As a result, the segment **36** is forced to pivot clockwise about bolt **44** and the platform is carried with it to the vertical bed closing position. It is apparent that should it be desired to stop closure of the gate at any intermediate position between the horizontal and vertical, it is merely necessary to release the actuating lever **86** and it will return to its original position. To pivot the gate from the vertical-closed to the horizontal position, the actuating lever is merely pivoted in the opposite direction to reverse the foregoing operation.

Each of the compression arm means **32** are spaced inwardly on the torque tube **26** from the tension arm means **30** and to this end a pair of lugs **94** extend forwardly and downwardly from the torque tube **26** at points spaced slightly inwardly of the lugs **38** for the tension arm means.

A pair of elongated members **96** of similar configuration are attached to the set of lugs **94** on each side of the torque tube **26**. T accomplish this, the inwardly projecting ends of the elongated members are provided with apertures which are aligned with similar apertures in the outer ends of lugs **94**. A bolt **98** extends through the lugs **94** and the elongated members **96** as well as through a cylindrical spacer **100**, positioned between the elongated members **96**, to pivotally mount the assembly to the torque tube **26**. The outer ends of the elongated members are also provided with a cylindrical spacer **102** and the outer end of the assembly is accommodated between side walls **54** and **56** of the U-shaped mounting construction **50** underneath the inner edge of the platform **28**. A bolt **104** extends through apertures provided in the bottom portions of the side walls **54** and **56** as well as through apertures in the outer ends of elongated members **96** and the cylindrical spacer **102**. The platform structure which extends between the U-shaped mounting constructions **50** to which the parallel linkage mechanisms are pivotally secured, serves as a means to connect the outer ends of the parallel linkage

systems. While it is not essential, it has been found desirable, particularly when heavy loadings are placed on the extreme overhang positions of the platform **28**, to provide a cylindrical cross member **107** rigidly welded to the outer end of the inner elongated member **96** of each of the compression arm means **32** to further rigidly connect the same and prevent any swaying of the platform that may exist.

The compression arm assemblies also include power lifting means. More particularly, the elongated members **96** increase in depth toward the outer end thereof and are provided with apertures **105** adjacent the bottom portion. A bolt **106** extends through the apertures in the elongated members **96** and through apertures in ears **108** of a U-shaped member **110**. The U-shaped member **110** is threadedly secured to the outer end of a piston rod **112** which extends within a power cylinder **114** similar in construction but larger in size than the power cylinders **74**. The piston rod **112** is attached to a piston (not shown) adapted to reciprocate within the cylinder **114** and the inner end of the cylinder is provided with ears **116** which accommodate the outer end of an upwardly and outwardly extending lug **118** secured to the torque tube **26** between the downwardly extending lugs **94**. The ears **116** and the outer end of the lug **118** are apertured to receive a bolt **120** which extends therethrough to pivotally mount the cylinder with respect to the torque tube **26**.

Accordingly, when it is desired to raise the platform **28** from its ground engaging position as shown in FIG. 1 to vehicle bed height, a control bar **122** which is mounted for rotation in a bracket **124** secured to the rear of the vehicle bed **12** is rotated by manually moving one of the actuating levers **126** extending upwardly from each side of the control bar. Rotation of the control bar causes a link **128** secured thereto to pivot resulting in longitudinal movement of a second link **130**. The link **130** actuates a suitable valve encompassed within valve housing **132**. The valve housing **132** is positioned on the valve bracket **84** adjacent to the valve **82** which operates the power cylinder **74** of the tension arm means **30**.

Suitable hosing **134** connects both sides of the power cylinder **114** to the valve housing **132** and also connects the valve housing to a source of power fluid (not shown). The foregoing movement of the linkages **128** and **130** causes the valve within valve housing **132** to permit evacuation of power fluid from the inner ends of power cylinders **114** and supplies power fluid to the outer ends thereof through the appropriate housing **134**. Thus, the piston rods **112** become telescoped within power cylinders **114** and effect lifting of the platform **28**. The platform is therefore raised while maintaining a substantially horizontal position due to the parallel linkage systems **14** and **16**, in a manner well known in the art, until the platform **28** reaches vehicle bed height at which time inwardly extending locking members **136** on the internal surface of the inner elongated member **96** of each compression arm means engage spring biased hook-like lock members **138** secured to the mounting brackets **22** and **24**. If it is desired to pivot the platform **28** vertically to close the end of the vehicle bed **12**, once the platform **28** has reached its horizontal position at vehicle bed height and has been locked in such position, the control bar **88** is pivoted as previously described to operate the tension arm power cylinders **74**.

When it is desired to lower the platform **28** from its vehicle bed height position to the ground, again the actuating levers **126** are pivoted to effect movement of a pair of spaced linkage mechanisms **140** which first release the locking members **136** and **138** while simultaneously causing actuation of the power cylinders **114** through links **128** and **130**.

It is apparent from the foregoing description that the power cylinders **114** are positioned between the elongated members **96** of the compression arms and thus shielded from damage. The compression arms **32** may be widely spaced apart along the torque tube **26** and connected to the platform **28** to greatly reduce the side overhang of the platform with respect to the arm connections. Excessive bending stresses are not created since the power cylinders **114** are connected to the elongated arm members **96** directly and not through a transversely extending cross member (a cross member **107** has been provided for stability but is not subject to bending stresses from the power cylinders **114** during the lifting operation). The power cylinders **114** are in contracted position when the vehicle gate is in its closed traveling position so that the piston rods **112** are contained within the power cylinders **114** and thus not subject to damage which may result in early leakage of the power cylinders.

Similarly, the power cylinders **74** of the tension arm means **30** are disposed above the tension arm segments **34** and thus protected from damage thereby. When the gate is in its closed traveling position, the tension arm power cylinders **74** are also in the contracted position with the piston rods **72** accommodated within the power cylinders to further protect the same from damage resulting from stones, dirt, etc., being thrown up by the vehicle wheels. The power cylinders **74** are compactly arranged and uniquely provide a powered vertical pivoting of the platform **28** through an appropriate mechanical advantage due to the tension arm construction for effecting closing of the gate. The platform is provided with two series of slots **142** in the inner edge of the platform adjacent the U-shaped mounting constructions **50** to accommodate the tension and compression arm structures upon pivoting of the platform to the vertical vehicle bed closing position.

The tension and compression arm arrangements **30** and **32** provide a durable and compact powered parallel linkage mechanism for the vehicle gate and as a result, the central portion of the gate linkage does not contain any obstructions. Accordingly, with the construction described, the vehicle may be provided with hardware which is commonly desirable on vehicles of this type. For instance, the drawings disclose a trailer hitch in the form of two vertically spaced plates **144** rigidly secured to the torque tube **26** at the midpoint thereof. The spaced plates **144** are suitably apertured and a pin (not shown) is adapted to be dropped through the apertures and an aperture of the arm of a trailer (not shown) to be attached to the vehicle. Also, due to the novel arm arrangement, a transversely extending mounting plate **146** may be secured to the brackets **22** and serves to accommodate a series of reflectors **148**. With the construction provided it is also possible to provide additional support for the end of the vehicle bed without interfering with the parallel linkage system. Thus, without the conventional cross member disposed between the compression arm means at a location inwardly toward the torque tube and the conventional power lift cylinder or cylinders connected between the torque tube and the cross member, many advantages are attained.

While only a single embodiment of this invention has been shown and described, it is apparent that there may be changes in construction and operation without departing from the scope of this invention as defined by the appended claims.

What is claimed is:

1. A lift tailgate for vehicles, the combination comprising:

a pair of spaced parallel-acting linkages adapted to be pivotally carried adjacent one end thereof by the vehicle for swinging through generally vertical arcs;

a platform extending between and pivotally connected adjacent one edge to the other end of said pair of linkages for swinging from the grounded horizontal position below the vehicle to a position coplanar with the loading end of the vehicle and to a position closing such end;

each of said pair of linkages comprising compression arm means and tension arm means, said tension arm means including an inner and outer tension arm seg-

ment pivotally connected together intermediate the ends of said tension arm means; and

power means operatively connected to said tension arm means for effecting movement of the platform to a closed position, said power means comprising an extensible and contractable fluid power means with one end anchored relative to the vehicle and the other end pivotally secured to the outer tension arm segment for effecting folding of said tension arm segments about the pivotal connection therebetween to move said platform to the position closing the loading end of the vehicle upon contraction of said fluid power means.

2. The lift tailgate of claim 1 wherein a transversely extending mounting means pivotally secures said pair of spaced parallel-acting linkages to the vehicle and said tension arm fluid power means is disposed above said inner tension arm segment and has one end pivotally secured to said mounting means, the other end of said power means being pivotally connected to the outer tension arm segment, said tension arm power means being extensible to permit said platform to remain in a position horizontal to the ground during lifting and being contractible to cause folding of said tension arm segments about their pivot connection so that said platform closes the end of the vehicle bed.

3. The lift tailgate of claim 2 wherein the pivot connecting said tension arm segments is positioned upwardly on said segments and adjustable stop means is provided adjacent the lower portion of said segments to limit pivotal movement of the outer segment with respect to the inner segment upon extension of said fluid power means.

4. The lift tailgate of claim 2 wherein said compression arm means includes a power means for lifting said platform from said grounded horizontal position to said position coplanar with the loading end of the vehicle.

5. The lift tailgate of claim 2 wherein said compression arm means comprises a pair of compression arm segments each pivotally connected to said mounting means and to said platform and an extensible and contractible compression arm fluid power means disposed substantially between said compression arm segments and being extensible to effect movement of the platform to the grounded horizontal position and being contractible to move said platform to said position coplanar with the vehicle bed.

6. A lift tailgate for a vehicle, the combination comprising:

a pair of spaced parallel-acting linkages adapted to be pivotally carried adjacent one end thereof by the vehicle for swinging through generally vertical arcs;

a platform extending between and pivotally connected to the other end of said pair of linkages for swinging from a first substantially horizontal position below the vehicle bed to a second substantially horizontal position coplanar with the vehicle bed, the platform further being movable to a third substantially vertical position closing the loading end of the vehicle;

each of said pair of linkages including first and second arm means each pivotally connected substantially adjacent opposite ends thereof to the vehicle and to the platform, respectively, said first arm means being subjected to a tensile force and said second arm means being subjected to a compressive force as said platform is swung between said first and second positions;

said first arm means including first and second arm segments pivotally connected together intermediate the ends of said first arm means;

power means directly connected to one of the segments of said first arm means for effecting relative movement between said first and second segments to move said platform to said third position;

means locating said power means with respect to the other segment of said first arm means for allowing pivoting of said first arm means with respect to said vehicle independently of actuation of said power means; and

additional power means for moving said platform from said first to said second position.

7. A lift tailgate according to claim 6, wherein said power means causes relative movement between said first and second segments for effecting movement of said platform from said second to said third position, said second arm means remaining substantially stationary as the platform is moved from said second to said third positions.

8. A lift tailgate for a vehicle, the combination comprising:

a pair of spaced parallel-acting linkages adapted to be pivotally carried adjacent one end thereof by the vehicle for swinging through generally vertical arcs;

a platform extending between and pivotally connected to the other end of the pair of linkages for movement from a first substantially horizontal position below the vehicle bed to a second substantially horizontal position coplanar with the vehicle bed, the platform being swingable to a third position substantially closing the loading end of the vehicle;

each of said pair of linkages including a compression arm means and a tension arm means with said tension arm means having a pivot intermediate its ends;

first power means directly connected to one of said compression arm means and said tension arm means for effecting movement of said platform from said first to said second position; and

second power means independent of said first power means and directly connected to the other of said compression arm means and said tension arm means for effecting swinging of said platform to said third position.

9. A lift tailgate according to claim 8, wherein said first and second power means are connected to said compression arm means and said tension arm means, respectively.

10. A lift tailgate according to claim 8, further including control means operatively connected to said first and second power means for permitting independent control and operation of said first and second power means.

11. A lift tailgate according to claim 10, wherein said first and second power means include first and second extensible and contractible fluid power means, respectively, said first power means being connected to said compression arm means and being extensible to effect movement of the platform to the first position and contractible to move said platform from the first to the second position, said second power means being connected to said tension arm means.

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