April 9, 1963 W. B. JOHNSON 3,084,815

LIFT GATE CONTROL SYSTEM

Filed Sept. 14, 1960 3 Sheets-Sheet 1

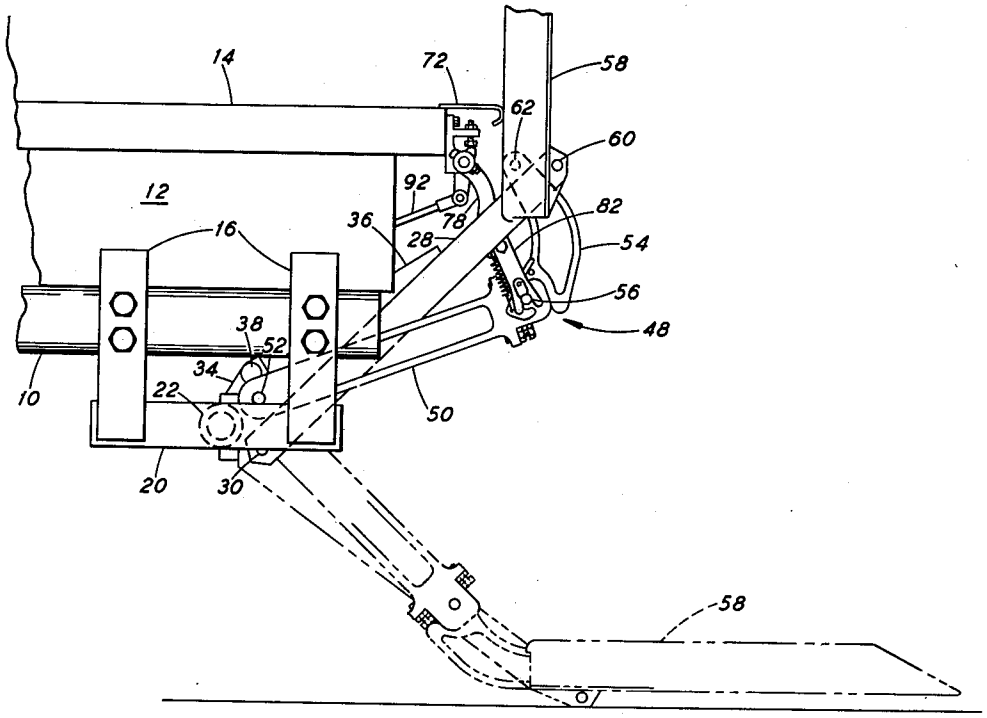


FIG. 1

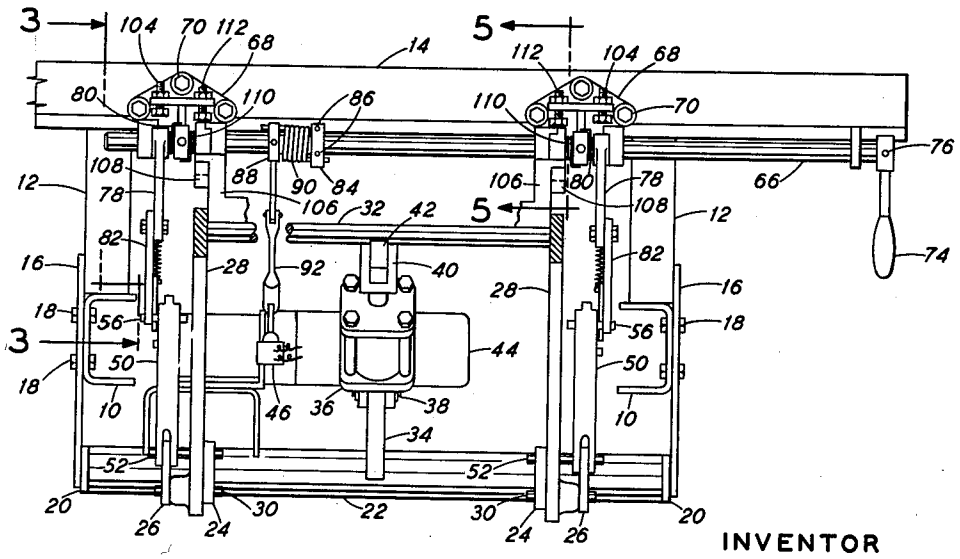


FIG. 2

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April 9, 1963 W. B. JOHNSON 3,084,815

LIFT GATE CONTROL SYSTEM

Filed Sept. 14, 1960 3 Sheets-Sheet 2

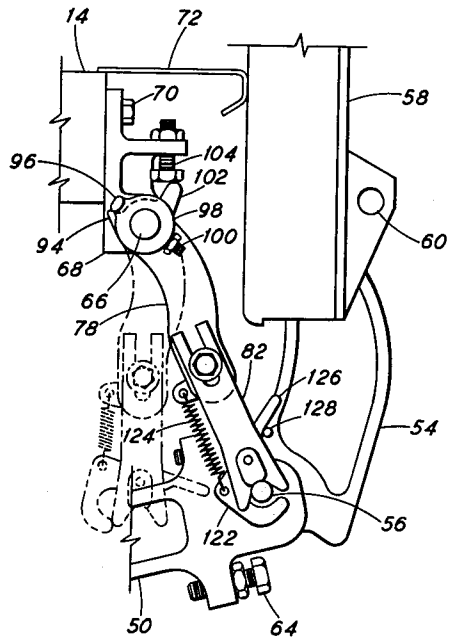


FIG. 3

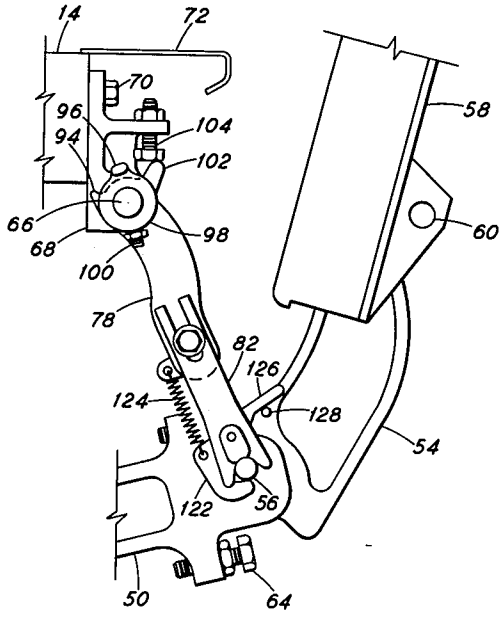


FIG. 4

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April 9, 1963 W. B. JOHNSON 3,084,815

LIFT GATE CONTROL SYSTEM

Filed Sept. 14, 1960 3 Sheets-Sheet 3

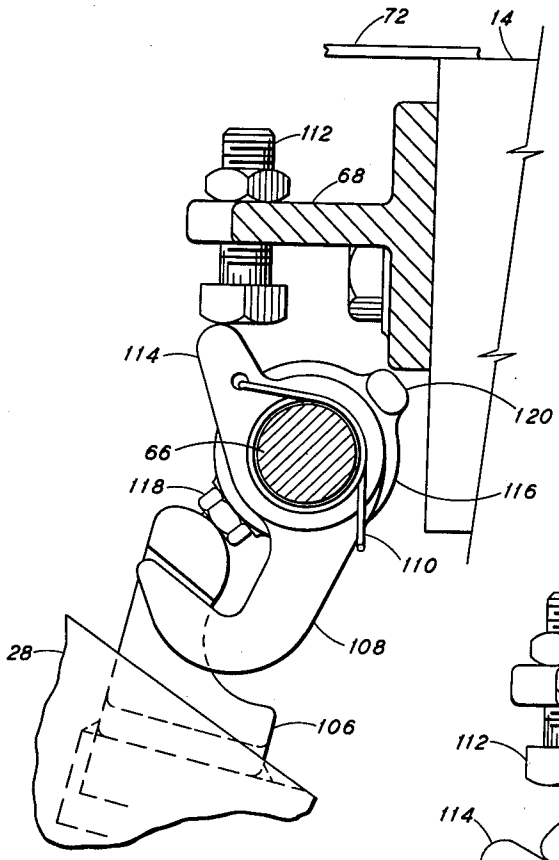


FIG. 5

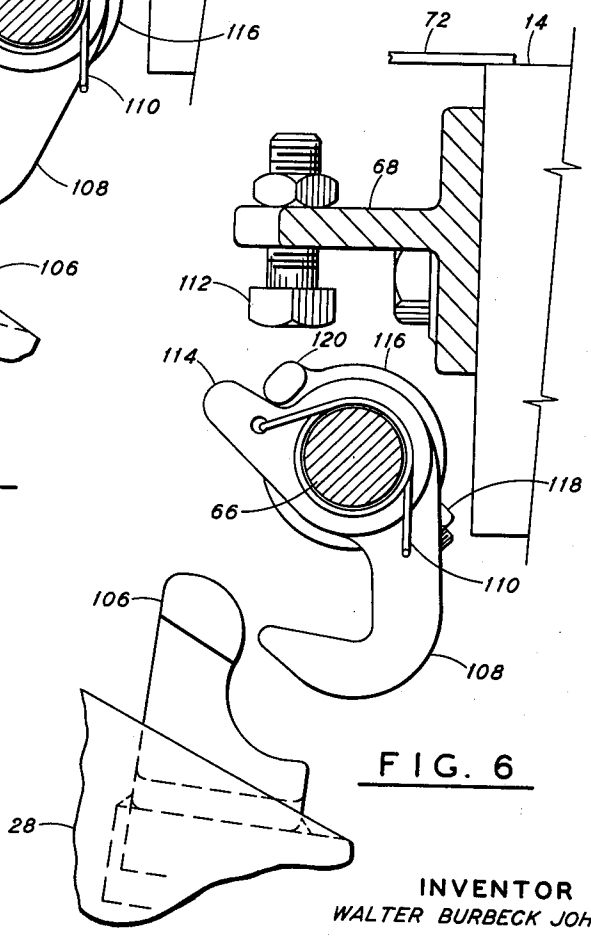


FIG. 6

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LIFT GATE CONTROL SYSTEM

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10 Claims. (Cl. 214—77)

This invention relates to load handling equipment and more specifically to lift gates for vehicles and the like. The invention is particularly useful in the type of lift gates disclosed in the copending application of McCarty and Rossoni, Serial No. 836,248, now issued as U.S. Patent No. 3,035,721, and U.S. Patent No. 2,822,938 to Ormsby.

It is a principal object of this invention to provide control means for vehicle lift gates which permit the maximum ease of operation of the lift gate by the user thereof.

It is another principal object of this invention to provide such a control system in which all functions of the lift gate can be controlled by movement of a single control element through sequential positions.

It is another principal object of this invention to provide such a control system for effecting the normal lift and lower movements of a normally horizontal load lifting platform and for alternatively effecting rotation of the load lifting platform to a non-operating position thereby reducing one of the horizontal dimensions of the vehicle.

It is another object of this invention to provide a control system for vehicle lift gates whereby sequential movement of a single control element may effect sequential lowering of the gate platform, lifting of the platform, and rotation of the platform to a generally vertical position where it may serve as the rear door of the vehicle.

It is another object of the invention to provide such a control system by which the rotation of the platform between horizontal and vertical positions can be effected efficiently while the platform is swinging between upper and lower positions with respect to the vehicle.

It is another object of the invention to provide such a control system having sequential positions of a control element for lowering, not moving, lifting and rotating the load carrying platform and having efficient means for alerting the operator's attention to the fact that he is moving the control element from the lifting position to the gate rotating position.

It is another object of the invention to provide improved means for controlling the rotation of the load carrying platform in the broken-arm type of lift gates disclosed in said application of McCarty and Rossoni and said patent to Ormsby.

It is another object of the invention to provide an improved broken-arm type of lift gate having means for effecting smooth, controlled rotation of the load carrying platform between a horizontally extended position and a retracted position.

It is another object of the invention to provide such an improved broken-arm type of lift gate having means for holding the arm-breaking strut in its arm-breaking position while the center of gravity of the platform lies between the vehicle and the axis of rotational connection of the platform to its supporting arms.

It is another object of the invention to provide such an improved broken-arm type of lift gate having means for supporting the broken arm against downward movement while the center of gravity of the platform lies between the vehicle and the axis of rotational connection of the platform to its supporting arms.

It is another object of the invention to provide such an improved broken-arm type lift gate having a single control element movable through sequential "lower," "neutral," "lift," and "gate rotate" positions and provided with means for permitting movement of the control element to the "lower" position while the arm-breaking strut is in its arm-breaking position, whereby the platform may be lowered while the arm-breaking strut controls rotation of the platform to its horizontal position.

Other objects and advantages of the invention will become apparent from the following description, read in conjunction with the attached drawings in which:

FIG. 1 is a view in side elevation of an improved broken-arm type of lift gate constructed in accordance with this invention, the platform being shown in its vertical gate-closed position and being shown in phantom outline in its horizontal, lowered position;

FIG. 2 is a view in rear elevation of the equipment of FIG. 1 with portions thereof cut away;

FIG. 3 is an enlarged view from the left side of FIG. 2 taken along the plane and in the direction indicated by the line and the arrows at 3—3 in FIG. 2;

FIG. 4 is a view similar to FIG. 3 but showing the parts rotated slightly from their positions shown in FIG. 3;

FIG. 5 is a sectional view of the equipment of FIG. 2 taken along the plane and in the direction indicated by the line and the arrows at 5—5 in FIG. 2, and

FIG. 6 is a view similar to FIG. 5 with the parts rotated to the position of the parts in FIG. 4.

Referring now in detail to the drawing and particularly to FIGS. 1 and 2, the apparatus shown therein comprises a truck chassis **10** carrying a body **12** having a load carrying bed **14**. The chassis **10** is supported by suitable wheels (not shown). A pair of plates **16** are mounted on the chassis **10** on each side thereof by means of bolts **18** and a horizontal support plate **20** is mounted on each pair of plates **16** by suitable welding or the like. A trunnion **22** is mounted between the two plates **20** preferably welded thereto and carries a pair of inner brackets **24** and a pair of outer brackets **26** thereon.

A pair of compression arms **28** are pivotally connected between the adjacent brackets **24** and **26** by means of pivot pin **30**, and the compression arms **28** are connected by a trunnion **32** at points spaced from the pivot pin **30**.

An upstanding ear **34** is welded to the trunnion **22** and carries a hydraulic cylinder **36** pivotally connected thereto by means of a pivot pin **38**. The piston rod of hydraulic cylinder **36** carries a bracket **40** on the free end thereof which is pivotally connected to an ear **42** welded to the trunnion **32**. Hydraulic cylinder **36** is actuated by the supply of hydraulic fluid through suitable hydraulic lines (not shown) to which hydraulic fluid is supplied under pressure by hydraulic pump **44** which is actuated by a switch **46**.

A pair of tension arms (indicated generally as **48** in FIG. 1) are made up of inner sections **50** which are pivotally connected to bracket **26** by means of pivot pin **52** and outer sections **54** pivotally connected to the inner sections by means of pivot pin **56**.

The compression arms **28** are pivotally connected to a load supporting platform **58** by means of pivot pin **60**, and the outer section **54** of the tension arms are pivotally connected to the platform **58** by pivot pin **62**. The axes of the pivot pins **30**, **52**, **62** and **60** generally form a parallelepiped whereby the platform **58** may be swung in a horizontal condition from the lower position illustrated in FIG. 1 to an upper position adjacent the vehicle bed **14** responsive to contraction of the hydraulic cylinder **36**. The actual alignment of the axes of the pins **30**, **52**, **62** and **60** may diverge slightly from a true parallelepiped in order to permit desirable tipping of the platform **58**, i.e., tipping of the free end of the platform **58** downwardly to the ground in the downward position etc. Adjustment screws **64** are provided on the inner section **50** of the tension arms

to permit adjustment of the alignment of the axis of pin 52 with respect to the axes of the pins 30, 52 and 60.

A control rod 66 is mounted on the vehicle at the rear of the bed 14 by means of spaced brackets 68 which are bolted to the vehicle by means of bolts 70. A bed extending lip 72 is mounted on the rear of the bed 14 covering the brackets 68. An operating handle 74 is attached to the control rod 66 at one end thereof by means of a set screw 76.

An arm-breaking strut 78 is pivotally mounted on the control rod 66 for movement between an engaged position illustrated in FIGS. 1, 3 and 4 and an unengaged position illustrated in phanton outline in FIG. 3. One of the struts 78 is mounted at each side of the control rod 66 positioned to engage one of the intermediate pivot pins 56 in the tension arm 48. A helical spring 80 interconnects each strut 78 with the adjacent bracket 68 spring biasing the strut 78 to its unengaged position. The lower section 82 of each strut 78 is bolted and then welded in place when the equipment is first assembled thereby permitting accurate positioning of the pin engaging face of the strut 78 with respect to the pivot pins 56.

A sleeve 84 is attached to the control rod 66 by means of set screws 86 and a collar 88 is pivotally mounted on the control rod 66 connected to the collar 84 by helical spring 90. A linkage 92 is provided interconnecting the sleeve 88 to the hydraulic cylinder control switch 46 for actuating the control switch 46 responsive to rotation of control rod 66. The sleeve 84 is positioned to maintain spring 90 free of stress while the control rod 66 is rotated clockwise and counter clockwise between lift, neutral and lower switching positions of switch 46; sleeve 84 applies tension to spring 90 as the control rod 66 is rotated from the lift position away from the neutral and lower positions. A shoulder 94 is provided on each strut 78 and stops, or dogs, 96, carried by sleeves 98, are attached to the control rod 66 by means of set screws 100. Each sleeve 98 is positioned so that the stop 96 will contact the shoulder 94 and rotate the strut 78 from its unengaged position to its engaged position in opposition to biasing spring 80 as the control rod 66 is rotated from its "lift" position away from the neutral and lower positions. A boss 102 is carried by the strut 78, and a stop screw 104 is adjustably mounted on the bracket 68 positioned to engage boss 102 and limit the rotation of the control rod 66.

Accordingly the control rod 66 has four operating positions rotationally spaced from each other counter clockwise as viewed in FIGS. 3 and 4 and clockwise as viewed in FIGS. 5 and 6, these positions being sequentially "lower," "neutral," "lift," and "gate rotate." The control rod 66 is illustrated in its "gate rotate" position in FIGS. 3 and 5 and is illustrated in its "lower" position in FIGS. 4 and 6.

Referring now in detail to FIGS. 5 and 6, a fixed latch element 106 is rigidly mounted on each of the compression arms 28 and a movable latch element 108 is pivotally mounted on the control rod 66 in vertical alignment with each of the fixed latch elements 106. The movable latch elements 108 are interconnected to the rod 66 by tension springs 110 which spring bias the latch elements 108 to their latched position illustrated in FIG. 5. An adustable stop screw 112 is provided in association with each movable latch element 108 positioned to contact an ear 114 on the latch element 108 and prevent rotation of the latch element 108 beyond the latched position of FIG. 5 responsive to biasing spring 110. A sleeve 116 is attached to the control rod 66 by means of set screw 118, and a stop finger 120 is carried by the sleeve 116 positioned to engage the boss 114 on movable latch element 108 and move the latch 108 to its unlatched position (as illustrated in FIG. 6) responsive to movement of the control rod 66 from its "neutral" position to its "lower" position.

As best illustrated in FIGS. 3 and 4, a holding hook 122 is pivotally mounted on the free end of each of the struts 78 and is spring biased thereon by a spring 124 to a position where the hook 122 uncovers the open end of strut 78. A finger 126 extends from each of the hooks 122 and is positioned to be contacted by a cam pin 128 as the outer section 54 of the tension arm rotates about pin 56; the cam pin 128 effects rotation of the hook 122 responsive to pivotal movement of the outer section 54 of the tension arm about pivot pin 56 to cause hook 122 to move to a hooked position (as illustrated in FIG. 3) where it encircles the pivot pin 56. The operation of the equipment illustrated above is as follows:

Assuming that initially the platform 58 is in its lower position illustrated in FIG. 1, and assuming that the control rod 66 is in its "neutral" position, the control rod 66 may be rotated (counter clockwise as illustrated in FIG. 3) until the user of the equipment feels a substantial increase in pressure on the handle 74 necessary to effect further rotation of the control rod 66. At this point, rotation of the control rod 66 has effected movement of the hydraulic cylinder control switch 46, through linkage 92, to a position to effect contraction of the piston cylinder combination 36. As such contraction continues, the piston cylinder combination 36 will force the compression arms 28 to swing upwardly which will result in upwardly swinging movement of the platform 58 until it reaches a position in alignment with the bed 14 of the vehicle. During this upward swinging movement the tension arm 48 will remain straightened out with the outer section 54 thereof in contact with adjustment screw 64, since the arm-breaking struts 78 are maintained in their unengaged position by springs 80.

As the platform 58 approaches the level of the vehicle bed 14, the fixed stop 106 (see FIGS. 5 and 6) will engage the movable stop member 108 forcing the latter to an unengaged position, and when the platform 58 reaches the level of the vehicle bed 14, the spring 110 will return the movable latch member 108 to its latched position as illustrated in FIG. 5.

The control rod 66 may then be returned to its neutral position in which it neither raises nor lowers the compression arms 28.

When it is desirable to lower the platform from the level of the vehicle bed 14 to its lower position illustrated in FIG. 1, the control rod 66 is rotated to its "lower" position (clockwise as illustrated in FIG. 3) until the control rod assumes the position illustrated in FIGS. 4 and 6. Such rotation of the control rod effects unlatching of the movable latch member 108 by action of the stop member 120 against the boss 114 on latch member 108. Such rotation also effects movement of the hydraulic cylinder control switch 46 to release fluid from the cylinder and effect gravity lowering of the compression arms 28 and platform 58. At any intermediate position between the lower position of FIG. 1 and the level of the vehicle bed 14, the platform 58 may be stopped by returning the control rod 66 to its neutral position.

When it is desirable to rotate the platform 58 from its generally horizontal position (illustrated in phantom outline in FIG. 1) to its vertical, gate closing position as illustrated in FIG. 3, the control rod 66 is first rotated to its lift position and is then further rotated against the biasing of springs 80 and 90 to its gate rotate or gate close position. During this further rotation of the control rod 66 in opposition to springs 80 and 90, the stop member 96 (see FIG. 3) contacts the shoulder 94 on each strut 78, pivoting the strut 78 counter clockwise as illustrated in FIG. 3, until the boss 102 contacts the adjusting screw 104. With the boss 102 in contact with the screw 104 the free end of each strut 78 is in position to interrupt the upward travel of one of the pivot pins 56 as the tension arms 48 swing upwardly thereby causing the outer section of each tension arm 48 to pivot about the pivot pin 56, shortening the effective length of the tension arms 48 responsive to further upward movement of the compression arms 28. As the outer sections 54 of the tension arms pivot about the pin 56, the cam pins 128 will

engage the fingers 126 on hooks 122, causing the hooks 122 to encircle the pins 56. With the pins 56 encircled by the hooks 122, the pins 56 are supported upwardly by the hooks 122 so that the struts 78 are maintained in their engaged position and the inner section 50 of the tension arms are prevented from moving downwardly when the center of gravity of the platform 58 moves to a position between the vehicle and the pivot pin 60. As the platform 58 completes its rotational movement and moves to the vertical position illustrated in FIG. 3, the latch members 106 and 108 will again operate to latch the compression arm 28 into their upward position.

When it is desirable to rotate the platform 58 back to a horizontal position and to lower it to the lower position illustrated in FIG. 1, the control rod 66 is moved to the "lower" position illustrated in FIGS. 4 and 6 where the stop 120 again unlatches the movable latch member 108 and switch 46 again effects expanding of the piston-cylinder combination 36. Such action will cause the platform 58 to rotate clockwise as illustrated in FIGS. 3 and 4 while the hooks 122 support the pivot pin 56; when such rotation carries the center of gravity of the platform 58 to the right of the pivot pin 60 (as viewed in FIGS. 3 and 4), the pivot pin 56 will again be supported by the ends of struts 78 against upward movement toward the vehicle and further rotation of the platform 58 will effect unhooking of the hooks 122. It should be noted that rotation of the control rod 66 from the "gate rotate" position to the "lower" position results in movement of the stop member 96 away from the shoulder 94 on strut 78 and does not necessitate the movement of the struts 78 away from their engaged position, thus permitting the struts 78 to control the rotation of the platform 58 both to and from the vertical position.

It will thus be seen that the structure illustrated herein provides very efficient solutions to the objects enumerated above. The structure is, of course, subject to substantial change without departing from the spirit and scope of the invention. The orientation of elements in the control system provides the maximum ease in controlling the function of the equipment, whether the control system is employed with a broken-arm structure or with other supporting arm structures known to the art; in addition, the control system, when employed with the broken-arm type of lift gate illustrated herein and the strut 78 with its hooks 122, provides substantially enhanced efficiency in the controlling step, the provision of sufficient clearance between the stop member 96 and its associated strut 78 permitting the strut 78 to remain in engaged position and control opening of the lift gate when the control rod 66 is moved to its "lower" position.

I claim:

1. In a lift gate for vehicles and the like comprising a generally horizontal platform, a compression arm and a tension arm with their ends pivotally connected to said vehicle and said platform, said tension and compression arms being normally generally parallel and of generally equal length to maintain said platform in a generally horizontal attitude for swinging movement between upper and lower positions, means for swinging said arms and platform between said upper and lower positions, said tension arm being formed of outer and inner sections pivotally connected together, with the outer section pivotally connected to said platform and said inner section pivotally connected to said vehicle, and selectively positionable means movable to an operating position restricting upward movement of said inner section of said tension arm as said arms swing upwardly, whereby said platform is rotated upwardly toward said vehicle about the axis of pivotal connection between said platform and said compression arm; the improved means for controlling the rotation of said platform which comprises means for blocking the path of downward movement of said inner section of said tension arm for a portion of the time when said selectively positionable means is in said operating position.

2. In a lift gate for vehicles and the like comprising a generally horizontal platform, a compression arm and a tension arm with their ends pivotally connected to said vehicle and said platform, said tension and compression arms being normally generally parallel and of generally equal length to maintain said platform in a generally horizontal attitude for swinging movement between upper and lower positions, means for swinging said arms and platform between said upper and lower positions, said tension arm being formed of outer and inner sections pivotally connected together, with the outer section pivotally connected to said pltform and said inner section pivotally connected to said vehicle, and selectively positionable means movable to an operating position restricting upward movement of said inner section of said tension arm as said arms swing upwardly, whereby said platform is rotated upwardly toward said vehicle about the axis of pivotal connection between said platform and said compression arm; the improved means for controlling the rotation of said platform which comprises automatically operable means for maintaining said selectively positionable means in operating position during the portion of the rotative path of said platform when the center of gravity of said platform lies between said vehicle and said axis.

3. In a lift gate for vehicles and the like comprising a generally horizontal platform, a compression arm and a tension arm with their ends pivotally connected to said vehicle and said platform, said tension and compression arms being normally generally parallel and of generally equal length to maintain said platform in a generally horizontal attitude for swinging movement between upper and lower positions, means for swinging said arms and platform between said upper and lower positions, said tension arm being formed of outer and inner sections pivotally connected together, with the outer section pivotally connected to said platform and said inner section pivotally connected to said vehicle, and selectively positionable means movable to an operating position restricting upward movement of said inner section of said tension arm as said arms swing upwardly, whereby said platform is rotated upwardly toward said vehicle about the axis of pivotal connection between said platform and said compression arm; the improved means for controlling the rotation of said platform which comprises automatically operable means for maintaining said selectively positionable means in said operating position and for blocking the path of downward movement of said inner section of said tension arm during the portion of the rotative path of said platform when the center of gravity of said platform lies between said vehicle and said axis.

4. In a lift gate for vehicles and the like comprising a compression arm pivotally connected to the vehicle for swinging movement between upper and lower positions, a tension arm having an inner section pivotally connected to the vehicle and an outer section pivotally connected to said inner section, a platform pivotally connected to the outer free ends of said arms, with said arms normally disposed generally parallel to each other when said platform is disposed in a generally horizontal, gate open position, means for swinging said arms from said lower position to said upper position, and strut means mounted to be selectively interposed between said vehicle and said inner section of said tension arm to limit upward movement of said inner section and effect rotation of said platform to a generally vertical, gate closed position; means for effecting and controlling gate opening movement by said platform comprising means for blocking the path of downward movement of said inner section of said tension arm for a portion of the time during swinging movement of said compression arm from the upper toward the lower position.

5. The improved lift gate of claim 4 in which said portion of time comprises the time while the center of

gravity of said platform lies between said vehicle and the axis of pivotal connection between said platform and said compression arm.

6. A lift gate for vehicles and the like comprising: a platform, a pair of spaced apart compression arms disposed between said platform and said vehicle and pivotally connected at their opposite ends to said vehicle and said platform, a pair of spaced apart tension arms disposed between said platform and said vehicle above said compression arms and having their opposite ends pivotally connected to said vehicle and said platform, the axes of pivotal connection of said pairs of arms to said platform and vehicle generally forming a parallepiped, whereby said platform and arms are mounted on said vehicle for swinging motion from a lower position to an upper position, with said platform in a normally generally horizontal condition, power means for swinging said arms and platform from said lower position to said upper position, said tension arms being formed of outer and inner sections pivotally connected together, with said outer sections pivotally connected to said platform and said inner sections pivotally connected to said vehicle, a strut movably connected to said vehicle for selective movement to an engaged position where it engages one of said inner sections and prevents full upward movement of said inner sections to said upper position, thereby causing said platform to rotate upwardly about its axis of pivotal connection with said compression arms as said compression arms move to said upper position, and means movable automatically to an operating position in response to upward rotative movement of said platform for blocking the path of downward movement of said inner sections for a portion of the time while said platform is rotating about its axis of pivotal connection to said compression arms.

7. The lift gate of claim 6 in which said last-mentioned means, in said operating position, interconnects said strut and one of said inner sections to prevent said strut from moving out of said engaged position.

8. The lift gate of claim 6 in which said strut is pivotally connected to said vehicle and spring biased to a position remote from said engaged position; a control rod is rotatably mounted on said vehicle and connected to said power means, said control rod having sequential "lower," "neutral" and "lift" rotationally spaced positions for actuating said power means to respectively lower, not move, and lift said platform; a dog is provided on said control rod positioned to contact said strut and move said strut to said engaged position as said rod is rotated from said "lift" position away from said "neutral" position, and sufficient clearance is provided between said dog and said strut to permit said control rod to be moved to said "lower" position while said strut is in said engaged position.

9. A lift gate for vehicles and the like comprising: a platform, a pair of spaced apart compression arms disposed between said platform and said vehicle and pivotally connected at their opposite ends to said vehicle and said platform, a pair of spaced apart tension arms disposed between said platform and said vehicle above said compression arms with their opposite ends pivotally connected to said vehicle and said platform, the axes of pivotal connection of said arms to said platform and vehicle generally forming a parallelepiped whereby said

platform and arms are mounted on said vehicle for swinging motion from a lower position to an upper position, with said platform in a normally generally horizontal condition, power means for swinging said arms and platform from said lower position to said upper position, said tension arm being formed of outer and inner sections pivotally connected together, with the said outer section pivotally connected to said platform and said inner sections pivotally connected to said vehicle, a pin carried by each of said inner sections of said tension arms, a pair of spaced apart struts, having working faces, mounted on said vehicle for selective movement to engaged positions where the working face on each one of said struts engages one of said pins and prevents full upward movement of the adjacent inner section to said upper position, to thereby cause said platform to rotate to a vertical position about its axis of pivotal connection with said compression arms as said compression arms move to said upper position, a hook pivotally mounted on each of said struts for movement between an unhooked position where the working face of each strut is uncovered and a hooked position where each hook encircles the one of said pins which each strut engages, a spring means biasing each of said hooks to said unhooked position and a cam surface carried by each of said outer sections of said tension arms positioned to engage the hook adjacent thereto and move said hook to its hooked position as said platform rotates about said axis.

10. The lift gate of claim 9 characterized further by means pivotally mounting said struts on said vehicle and the inclusion of means biasing said struts away from said engaged positions, a control rod rotatably mounted on said vehicle and having sequential "lower," "neutral," "lift" and "gate close" rotationally spaced positions, connecting means interconnecting said control rod and said power means for actuating said power means to lift, not move, and lower said compression arms when said control rod is in said "lift," "neutral"and "lower" positions respectively, a first pair of dogs mounted on said control rod positioned to contact said struts and move said struts to said engaged position as said rod is rotated from said "lift" position to said "gate close position, a first pair of latch members mounted on each of said compression arms, a second pair of latch members mounted on said vehicle in alignment with the latch members of said first pair and movable between latching and unlatching positions, spring means for biasing said second pair of latch members toward said latching position, and a second pair of dogs carried by said control rod positioned to move said second pair of latch members to said unlatching position when said control rod is moved from said "neutral" position to said "lower" position, said first pair of dogs being provided with sufficient clearance with respect to said struts to permit said control rod to be moved to said "lower" position while said struts are in said engaged position.

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