April 1, 1969 G. L. OMON 3,435,974

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Filed May 1, 1967 Sheet 1 of 5

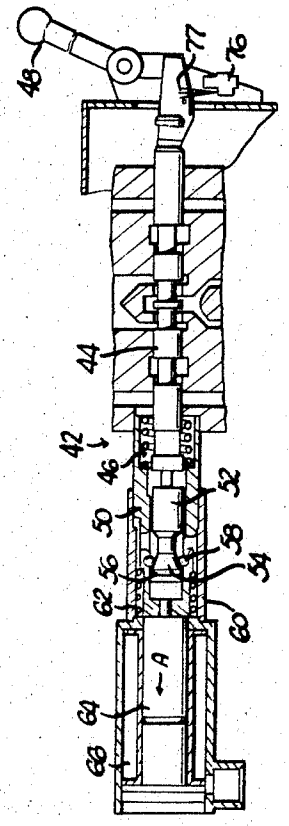


Fig. 5

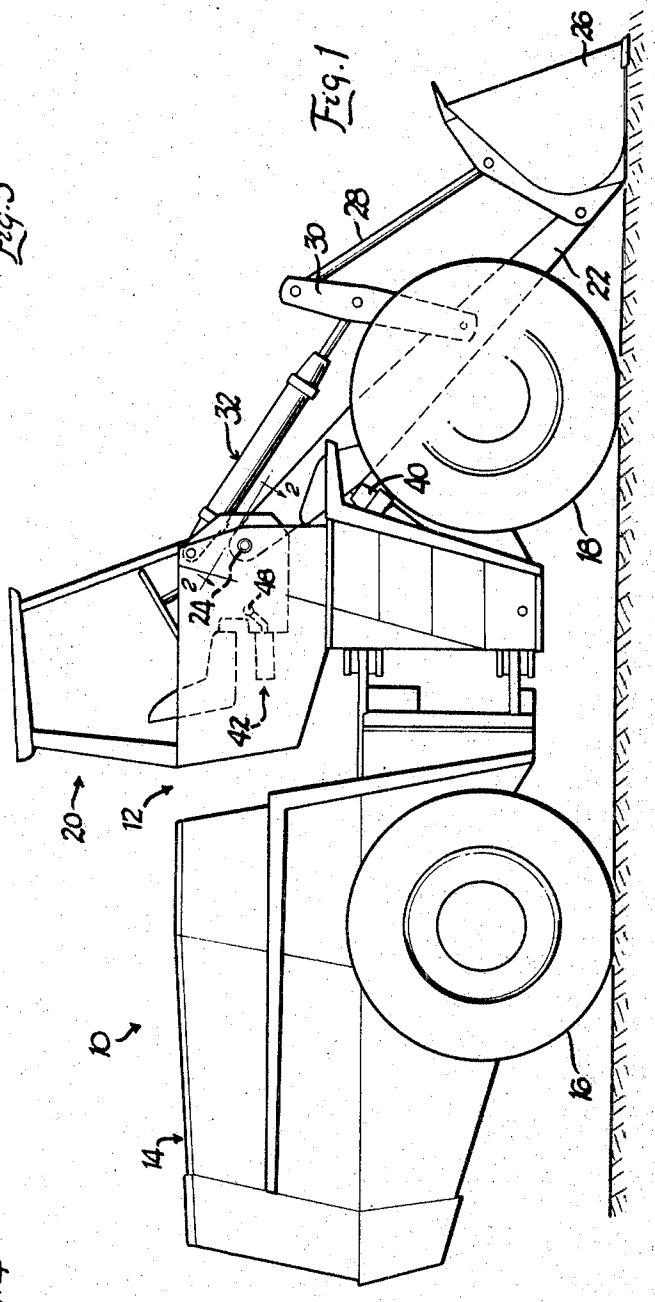


Fig. 1

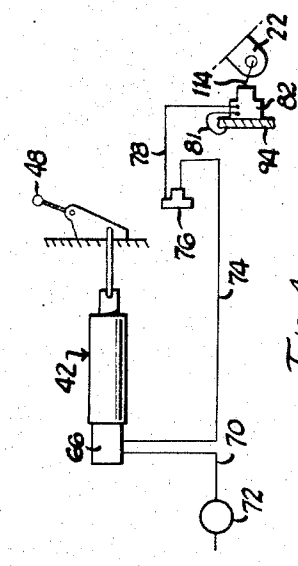


Fig. 4

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April 1, 1969 G. L. OMON 3,435,974

HEIGHT LIMITER

Filed May 1, 1967 Sheet 2 of 5

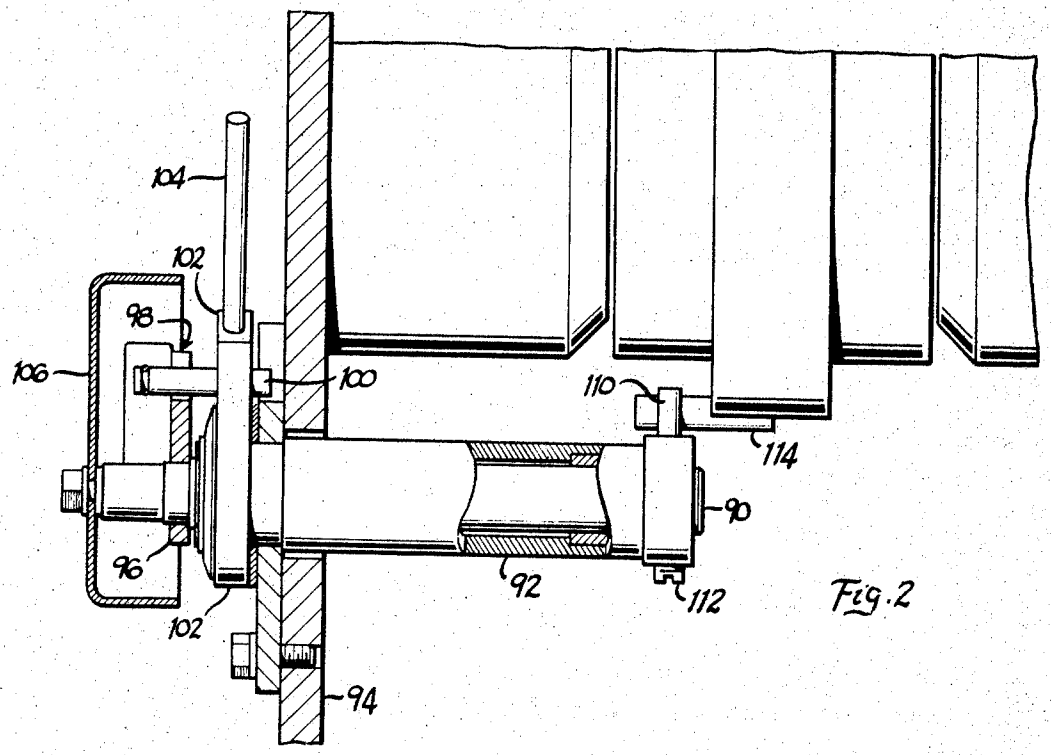


Fig. 2

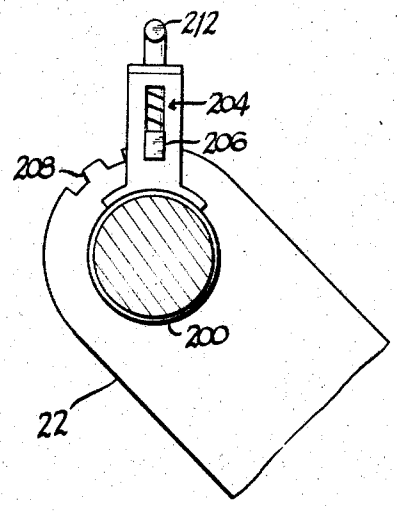


Fig. 9

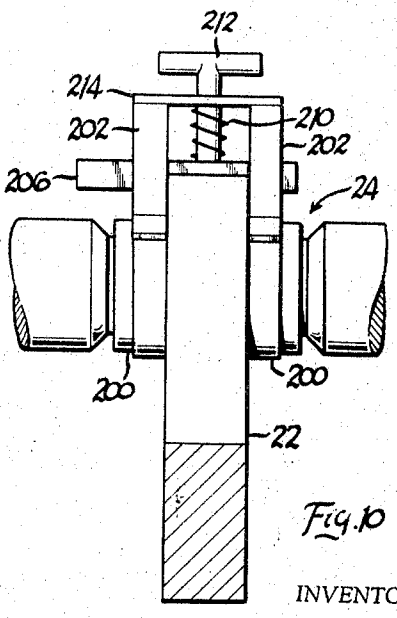


Fig. 10

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April 1, 1969 G. L. OMON 3,435,974

HEIGHT LIMITER

Filed May 1, 1967 Sheet 3 of 5

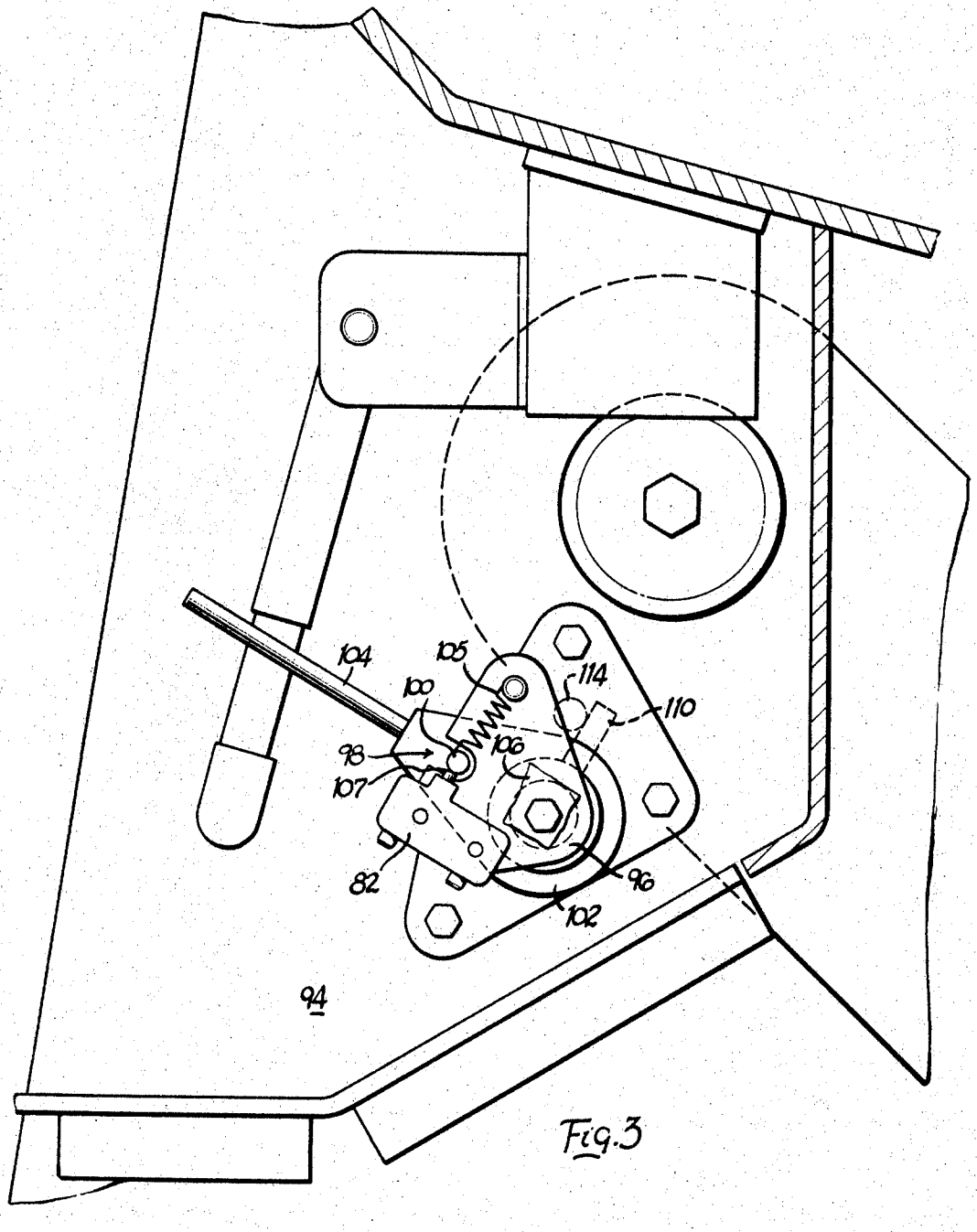


Fig. 3

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April 1, 1969 G. L. OMON 3,435,974

HEIGHT LIMITER

Filed May 1, 1967 Sheet 4 of 5

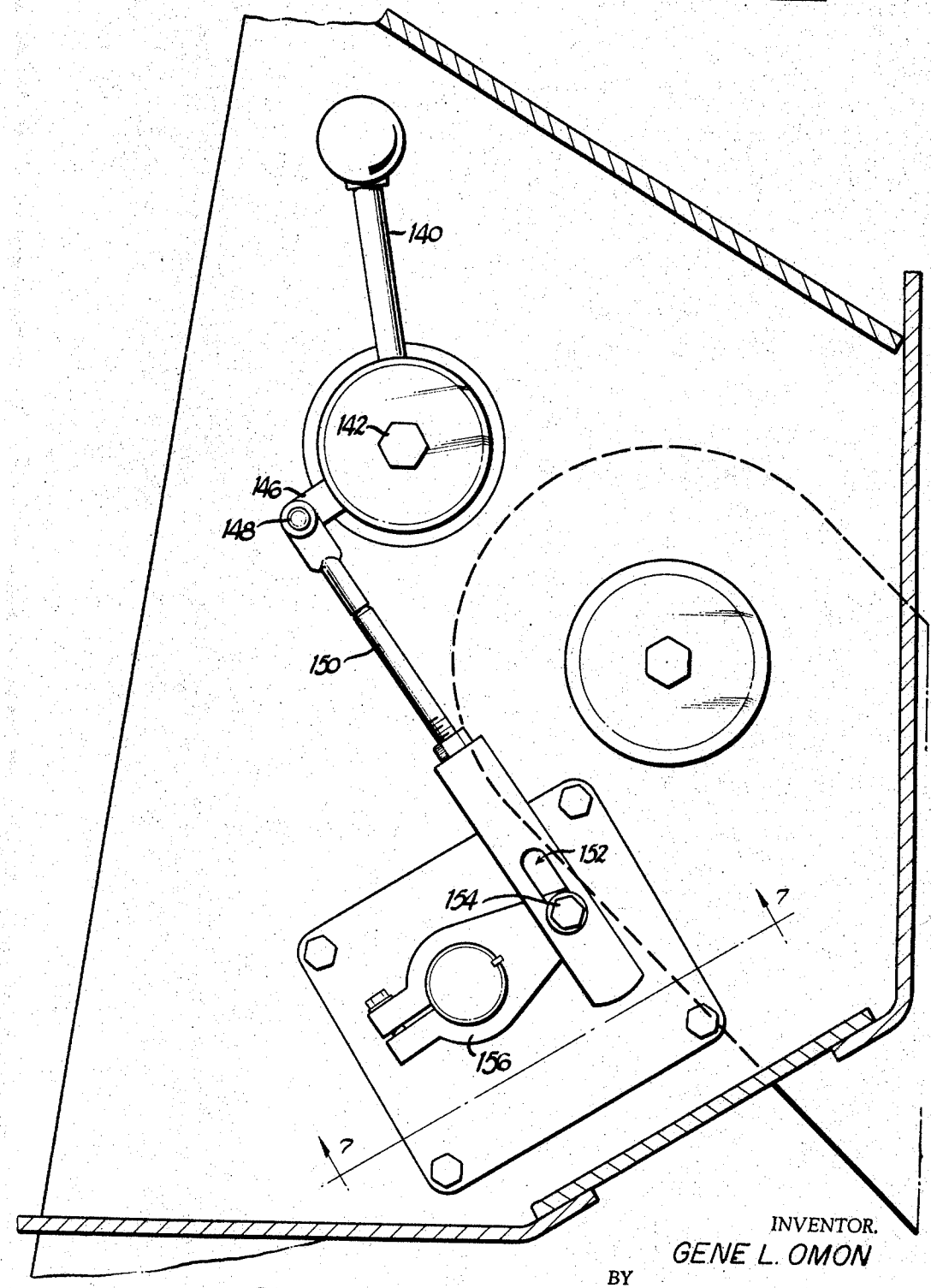


Fig. 6

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April 1, 1969 G. L. OMON 3,435,974

HEIGHT LIMITER

Filed May 1, 1967 Sheet 5 of 5

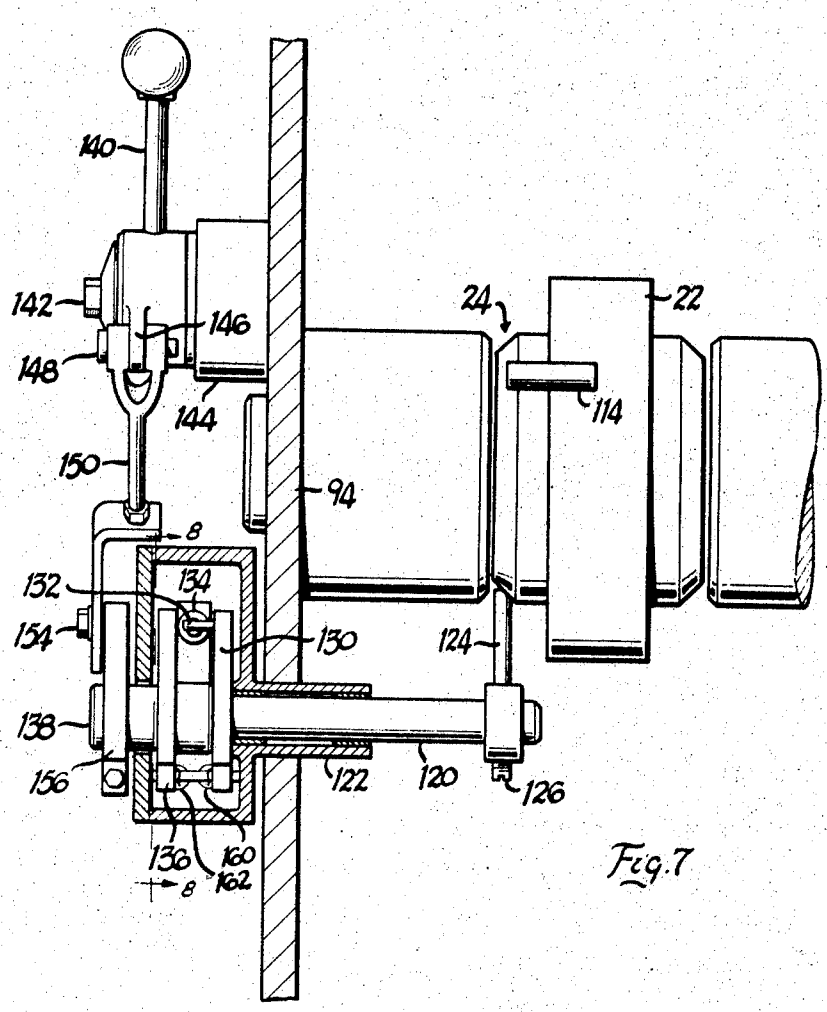


Fig. 7

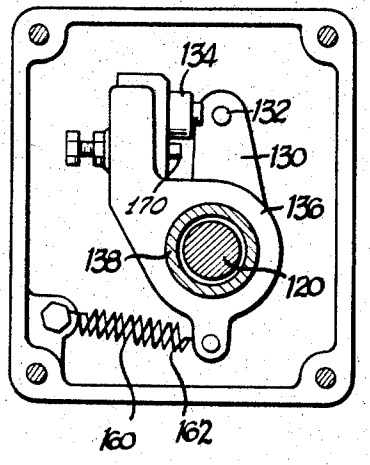


Fig. 8

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United States Patent Office 3,435,974 Patented Apr. 1, 1969

3,435,974

HEIGHT LIMITER

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Filed May 1, 1967, Ser. No. 635,147
Int. Cl. E02f 3/00
U.S. Cl. 214—762 13 Claims

ABSTRACT OF THE DISCLOSURE

A vehicle having boom means pivotally mounted on the vehicle to move an implement between raised and lowered positions through a fluid motor with valve means selectively supplying the fluid to the motor. Indexing means are provided for maintaining the valve in the operated position and the indexing means are actuated in response to predetermined pivotal movement of the boom arms on the vehicle to allow the valve to close thereby positioning the boom arms relative to the vehicle.

Background of the invention

The present invention relates generally to material handling equipment and more particularly to means for automatically neutralizing the actuating means of an implement on a vehicle when the implement has reached a predetermined position on the vehicle.

In conventional earth moving equipment, such as bucket loaders, the machine generally includes one or more lift arms pivotally carried on a vehicle, such as a tractor, with a bucket pivotally mounted on the free end of the lift arms. The lift arms are generally moved between raised and lowered positions by actuating means including a fluid motor and a valve which selectively supplies fluid to the motor.

One of the most common uses for a bucket loader is the filling of a truck or other type of vehicle. In this type of operation, the operator must continuously maneuver the loader between the pile of material and the truck and during this maneuvering the operator must simultaneously raise the boom to elevate the bucket so as to clear the top of the truck. After the contents of the bucket have been dumped, the operator must maneuver the loader to return to the pile of material and at the same time lower and position the bucket to the digging position.

While the vehicle is being maneuvered between the pile and the truck, all of the attention of the operator must be directed to steering the vehicle and controlling the direction of movement of the vehicle. Thus, the bucket must be raised to the dumping position either before or after the vehicle has been maneuvered between the pile of material and the truck.

Of course, the time required to complete this type of operation has a direct bearing on the cost and thus decreasing the cycling time for performing this operation by a matter of a second will greatly reduce the cost.

Various types of controls have been proposed for automatically limiting or positioning the boom arms in the raised position on the vehicle. However, so far as applicant is aware, all of these devices require complicated mechanisms including a mechanical or linkage connection between the movable lift arms and the fixed control valve carried by the vehicle.

Summary of the invention

Generally speaking, the present invention includes indexing means for locking the control valve in an operated position thereby directing fluid to the motor to raise the lift arms and bucket. Electrical means are provided for releasing the indexing means which includes a switch that is actuated by a member rotated in response to predetermined movement of the lift or boom arms on the vehicle.

A primary object of the present invention is to provide means for automatically limiting the height of the boom of a vehicle without a direct connection between the control elements on the vehicle and on the boom.

Another object is to provide a simplified connection between the hydraulic actuating means and the vehicle which automatically controls the positioning of the actuating means.

Other objects and features of the invention will become apparent when considered in conjunction with the following specification and the accompanying drawings.

As shown in the drawings:

FIGURE 1 is a side elevation of a vehicle mounted implement or loader embodying the present invention;

FIGURE 2 is a vertical sectional view taken generally along line 2—2 of FIGURE 1;

FIGURE 3 is a fragmentary elevational view of the details shown in FIGURE 2;

FIGURE 4 is a schematic illustration of the electrical circuitry;

FIGURE 5 is an enlarged sectional view of the control valve;

FIGURE 6 is a sectional view similar to FIGURE 3 showing a modified form of the invention;

FIGURE 7 is a sectional view taken along 7—7 of FIGURE 6;

FIGURE 8 is a vertical sectional view taken along line 8—8 of FIGURE 7;

FIGURE 9 is a fragmentary sectional view of the lift arm showing a slightly modified form of the invention shown in FIGURE 1; and

FIGURE 10 is an end view of the lift arm shown in FIGURE 9.

In the specification:

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of the parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and application and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein is for purpose of description and not of limitation.

Referring to FIGURE 1 of the drawings, there is shown a vehicle loader, which is generally indicated by the numeral **10**. The vehicle loader **10** includes forward and rearward articulated sections **12** and **14** which are supported on front and rear wheels **16** and **18**, only one of each wheels being visible in FIGURE 1. The vehicle **10** also includes an operator station generally indicated by the numeral **20**.

The vehicle **10** includes boom means which are illustratively shown as a pair of boom or lift arms **22**, only one of which is visible in FIGURE 1. It will be understood that there is another boom arm on the opposite side of the machine and each boom arm has its rear end pivotally mounted at **24** on the forward section **14** of the vehicle. The forward ends of the boom arms pivotally support a bucket **26** which is moved on the arms **22** through pivotally interconnected links **28**, **30**, and a fluid motor **32** having one end connected to the link **30** and the opposite end connected to the forward section **12** of the vehicle. Fluid is selectively admitted to opposite ends of the motor **32** from a control valve and conduit means (not shown).

The boom means or lift arms **22** are adapted to be pivoted between raised and lowered positions on the vehicle through hydraulic actuators or fluid motors **40** interconnecting the boom arms **22** and the vehicle section **12**. Fluid is selectively admitted to opposite ends

of the motor **40** through conduits (not shown) by a control valve **42** having a valve spool **44**, which is normally maintained in the neutral position by self-restoring means **46**. During normal operation, the valve spool is moved between neutral and operated positions by a control lever **48** disposed in the operator's compartment of the vehicle and pivotally interconnected with the free end of the spool **44**.

According to the invention, means are provided for controlling the fluid valve and motor which will automatically neutralize the motor, stopping the pivotal movement of the boom arms on the vehicle to define the raised position of the boom arms on the vehicle. This is accomplished by providing indexing means for locking the valve in an operated position and an electrical circuit having a switch adjacent the boom arms which is actuated in response to movement of the boom arms on the vehicle to complete the electrical circuit and allow the valve to return to the neutral position.

In the illustrated embodiment, the indexing means includes a housing **50** carried adjacent the end of the control valve **42** with a valve spool extension **52** slidably disposed in the housing **50**. The extension **52** includes an enlarged portion **54** which defines a shoulder **56**. The housing **50** also supports detent means or balls **58** slidable in openings therein and adapted to lock the valve spool in an operated position whereby fluid is being directed to the hydraulic motor **40** to raise the boom arms on the vehicle.

The detent means **58** are normally maintained in engagement with the shoulder **56** formed on the valve spool extension **52** by a detent holder **60** that is spring biased to an operated or locked position by a spring **62**. The holder **60** is adapted to be moved between the locked position and a release position by a plunger **64** fixedly secured to the detent holder **60**. The plunger is adapted to be moved between two positions by an electrically actuated solenoid **66** surrounding the plunger and which, when energized, moves the plunger from the position shown in FIGURE 5 in the direction of the arrow A to release the detent means **58** and allow the self-restoring means **46** to move the valve to the neutral position.

The electrical circuit means for the solenoid **66**, forming part of the indexing means, includes a first wire **70** operatively connected to the ignition switch **72** of the vehicle **10**. A second wire **74** has one end connected to the solenoid **66** and the opposite end connected to a first terminal of a normally open switch **76**. The second terminal of the normally open switch **76** is connected through a wire **78** to a second switch **82** which, in turn, is grounded through a wire **81** connected to the vehicle proper.

In the illustrated embodiment of FIGURES 2 and 3, the means for actuating the second switch **82** includes a member or shaft **90** rotatably supported in a tubular member **92** fixedly secured to a plate **94** forming a part of the articulated section **12** of the vehicle **10**. One end of the shaft **90** has a plate **96** fixedly secured thereto with the switch **82** mounted on the plate **96** by screws. The plate **96** has a recess or opening **98** which receives a pin **100** carried by a second plate **102** rotatably supported on the hollow shaft **92** and adapted to be moved to a plurality of positions by a control rod **104** disposed in the operator's compartment of the vehicle. The shaft **90** is biased to a first position by a tension spring **105** having opposite ends respectively carried by the plate **96** and the pin **100** so that the actuating member **107** of switch **82** is spaced from the pin or stop **100**. A suitable cover plate **106** may be provided for partially enclosing the switch **82** and various other elements of the actuating means.

The opposite end of the shaft **90** has an arm **110** removably secured thereto by a set screw **112**. A second arm or pin **114** is fixedly secured to one of the boom arms **22** and the arm **110** and pin **114** form first and second abutment means, for a purpose to be described later.

The operation of the embodiment shown in FIGURES 1 through 5 can readily be appreciated from the following description. The control lever **48** disposed in the operator's compartment of the vehicle, is rotated counterclockwise to move the valve spool **44** to an actuated position thereby placing the detent means **58** in contact with the shoulder **56** formed on the valve spool extension **52**. The action of the spring **62** will lock the detent means **58** against the shoulder **56** to maintain the valve spool in the operated position. As the valve control lever is rotated counterclockwise the actuating finger **77** of the normally open switch **76** is engaged by a pin carried by the linkage between the valve control lever and the valve spool to close the switch **76**. In this position fluid is directed from the valve to the fluid motor **40** to pivotally move the boom arms from the lowered position towards the raised position.

As the boom arms approach a predetermined raised position, the pin **114**, forming an abutment on the boom arm, engages the abutment formed by the extension or arm **110** which causes the shaft **90** to rotate clockwise as viewed in FIGURE 3. Rotation of the shaft **90** will carry the actuating member **107** of switch **82** into contact with the stop **100** as shown in FIGURE 3 thereby actuating the switch and completing the circuit to the solenoid **66**. Energizing the solenoid **66** will move the plunger **64** leftward as viewed in FIGURE 5 to overcome the action of the spring **62** allowing the self-restoring means **46** of the valve spool **44** to force the detent means **58** into the opening in the detent holder and move the valve spool to the neutral position. Of course, movement of the valve spool to the neutral position will neutralize the fluid motor **40** and stop pivotal movement of the lift arms and the bucket on the vehicle.

As clearly shown in FIGURE 3, rotation of the plate **102** carrying the pin or stop **100** may be accomplished by the operator from the operator's compartment of the vehicle by merely moving the control rod **104** in the appropriate direction. The spring **105** biasing the switch and shaft **90** to the first position will rotate the shaft **90** in the tubular member or hollow tube **92** to reposition the abutment **110** carried on the end of the shaft. Thus, moving the control rod **104** in the appropriate direction will result in changing the raised stopping position of the boom arms on the vehicle.

Of course, it will readily be appreciated that this repositioning of the boom arm on the vehicle may be accomplished by moving the pin or second abutment **114** carried by the lift arm **22** or by repositioning the first abutment or arm **110** on the shaft **90**.

A slightly modified form of the invention is disclosed in FIGURES 6 through 8, wherein like reference numerals will be used to designate identical parts of the embodiment shown in FIGURES 1 through 5. As shown in FIGURE 7, a shaft **120** is rotatably journaled in a support **122** carried by the frame part **94** forming a part of the vehicle section **12**. One end of the shaft **120** has a finger or arm **124** fixedly secured thereto by a set screw **126** with the finger **124** forming a first abutment adapted to be engaged by the pin or abutment **114** carried by the lift arm **22**.

The shaft **120** is provided with a plate **130** fixedly secured thereto to rotate therewith. The plate or member **130** has a pin **132** secured thereto which acts as a stop for actuating a switch **134**. The switch **134**, which is identical in function as that of switch **82** shown in the embodiment illustrated in FIGURES 1 through 5, is supported on an arm **136** fixedly secured to a hollow shaft **138** that is rotatably journaled on the shaft **120**.

A positioning lever **140** is rotatably journaled on a bolt **142** threadedly received in a lug **144** secured to the frame part **94** and disposed in the operator's compartment of the vehicle. A first arm **146** is carried by the control lever **140** to rotate therewith and the arm **146** is pivotally connected at **148** to an adjustable link **150**. The

opposite end of the link **150** has an elongated slot **152** which receives a bolt **154** threadedly received in an opening of a crank **156** keyed to the hollow shaft **138**.

The shaft **120** and pin or stop **132** are normally urged to a first position by a spring **160** having one end secured to the plate **130** and the opposite end secured to the support **122**. Also, as shown in FIGURE 8, hollow shaft **138**, arm **136** and crank **156** are normally urged to a first position, wherein the actuating member of the switch **134** is depressed, by a spring **162** having one end connected to the arm **136** and the opposite end connected to the support **122**. Thus, in normal operation the crank **156**, bolt **154** and switch **134** are urged in a clockwise direction, as viewed in FIGURE 6, to move the bolt **154** in the slot **152** to a position shown in FIGURE 6 and have the actuating member of the switch **134** spaced from the stop **132**. However, counterclockwise rotation of the member **130** and stop **132** depress the switch **134** and continued counterclockwise rotation of the plate **130** will carry the plate **136** against the action of the tension spring **160** to move the bolt **154** within the slot **152**. Thus, the slot **152** in the link **150** will result in a lost motion connection between the control lever **140** and the limit switch **134** to allow the switch to move relative to the lever **140** and control linkage **150**. Preferably, an adjustable stop **170** is carried by the plate **136** to engage the plate **130** during this action to eliminate damage to the switch **134**.

The operation of the modified form of the invention, shown in FIGURES 6 through 8, is similar to that disclosed and described in the embodiment shown in FIGURES 1 through 5 and the electrical circuitry is identical to that shown in FIGURE 4. Thus, a predetermined rotation of the lift arm **22** will force the abutment **114** into contact with the abutment **124** thereby rotating the shaft **120** counterclockwise forcing the stop **132** into contact with the switch **134** which will actuate the switch. Actuation of the switch **134** of course will complete the circuit to the solenoid **66** and allow the valve spool **44** to move to the neutral position.

The height or raised position of the lift arms on the vehicle in the modified form of the invention can readily be adjusted by rotation of the lever **140** in the appropriate direction. Thus, if the maximum raised position is to be increased, the lever **140** is rotated clockwise and the hollow shaft **138** carrying the switch **134** will be rotated counterclockwise against the bias of the tension spring **162** to move the switch away from the stop **132** increasing the rotational travel of the lift arms before the switch is actuated. Likewise, counterclockwise rotation of the lever **140** will cause the spring **162** to rotate the arms **156** and **136** and shaft **138** carrying switch **134** clockwise to decrease the distance between the stop **132** and the switch **134**. This will decrease the amount of pivotal movement of the lift arms before the stop **132** will actuate switch **134**.

A further modification is shown in FIGURES 9 and 10. The modification disclosed in FIGURES 9 and 10 can readily be incorporated in either of the embodiments disclosed herein above. Thus, the raised position of the lift arms on the vehicle can be varied by moving a pin or abutment, equivalent to abutment **114**, relative to the lift arm **22** to vary the height limit of the lift arms. In the illustrated embodiment, this is accomplished by providing a pair of sleeves **200** rotatably supported on the pivot point **24** for the lift arm **22**. Each sleeve **200** is provided with a block **202** having an opening **204** therein. The opening slidably receives a lug or pin **206** which is urged by a spring **210** into any one of a plurality of recesses **208** formed on the arm **22**. The spring is telescoped over the rod portion of a handle **212** with one end in constant engagement with the pin **206** and the opposite end in engagement with a removable plate **214** secured to the blocks **202**.

Thus, by pulling the handle **212**, the pin **206** may be moved against the action of the spring **210** and repositioned into any one of the plurality of recesses **208** to readily change the maximum raised position of the lift arms relative to the vehicle.

Of course, if desired, the abutments **124** or **110** could readily be moved with respect to the shafts **120** or **90**, respectively, to change the position of engagement of the abutment on the shaft and on the lift arm. Furthermore, the second switch **82** or **134** could be disposed directly in the path of the pin or abutment **114** to be engaged by the abutment upon predetermined pivotal movement of the lift arm **22**.

While several preferred embodiments of the invention have been shown and described, it will be understood that various changes and modifications may be made without departing from the spirit of the invention as defined by the following claims.

I claim:

1. In a vehicle having a boom arm pivotally mounted thereon and fluid means for raising said boom arm, said fluid means including a fluid motor and a control valve with a spool slidable between operated and self-restoring neutral positions for selectively supplying fluid to said motor, the improvement comprising means for automatically positioning said boom arm on said vehicle including a member movably supported on said vehicle, indexing means carried by said valve for maintaining said valve in operated position, electric circuit means connected to said indexing means and having a switch associated with said member, and first and second abutment means respectively secured to said member and said boom arm with said abutment means normally spaced from each other, said abutment means adapted to engage each other upon predetermined movement of said arm for actuating said switch to complete said circuit releasing the indexing means to allow said valve to return to neutral and stop said boom arm on said vehicle in a predetermined position.

2. A vehicle as defined in claim **1**, including the further improvement of a stop adjacent said member adapted to control and actuate said switch and adjustment means for changing the contact position of said switch and stop to change the predetermined stopping position of the arm on the vehicle.

3. A vehicle as defined in claim **2**, in which said adjustment means includes a rod connected to said stop to move said stop relative to said switch.

4. A vehicle as defined in claim **2**, in which said adjustment means includes a control lever movable on said vehicle, linkage means operatively connecting the lever to the switch whereby movement of said lever will move said switch relative to said stop.

5. A vehicle as defined in claim **1**, including the further improvement of adjustment means for moving second abutment between spaced points on said boom arm and means for locking said second abutment at each of said points.

6. A vehicle as defined in claim **1**, including the further improvement of means for rotating said member and first abutment on said vehicle to a plurality of adjusted positions.

7. A vehicle as defined in claim **1**, in which said circuit means includes a second switch adjacent said valve and actuating means for closing said second switch when said valve spool is moved to an operated position and opening said switch when the spool is moved to neutral position whereby said circuit is completed while said spool moves between operated and neutral positions.

8. A vehicle as defined in claim **1**, in which said member and switch are rotatably supported on said vehicle, and said last means includes a stop disposed in the path of said switch, means for producing relative movement between said switch and stop in response to movement of said boom on said vehicle to actuate said switch.

9. In a vehicle having boom means pivotally mounted thereon for movement between raised and lowered positions, hydraulic means including a fluid motor for raising and lowering said boom means and a valve movable between operated and self-restoring neutral positions for selectively directing pressured fluid to said motor, the improvement comprising means for controlling said hydraulic means including indexing means carried by said valve for locking said valve in an operated position to raise said boom means, releasing means connected to said indexing means and including circuit means, a movable member supported on said vehicle, a switch in said circuit means and movable with said member, and means responsive to pivotal movement of said boom means for moving said member thereby closing said switch and completing said circuit means to allow said valve to close and stop the movement of said boom means, said last means including a stop disposed in the path of said switch and means for moving the stop to a plurality of positions to define raised positions of said boom means on said vehicle.

10. In a vehicle having boom means pivotally mounted thereon for movement between raised and lowered positions, hydraulic means including a fluid motor for raising and lowering said boom means and a valve movable between operated and self-restoring neutral positions for selectively directing pressured fluid to said motor, the improvement comprising means for controlling said hydraulic means including indexing means carried by said valve for locking said valve in an operated position to raise said boom means, releasing means connected to said indexing means and including circuit means, a member rotatable on said vehicle, a switch in said circuit means rotatably supported by said member, means resiliently urging said member and switch to a first position, a first abutment rotatable with said member, a second abutment rotatable with said boom means and engaging said first abutment upon predetermined pivotal movement of said boom means to rotate said member and switch to a second position causing said switch to be actuated to close said circuit means to said indexing means.

11. A vehicle as defined in claim 10, further including means for moving said switch relative to said member which includes a lever, a linkage having a lost-motion connection connecting the lever to the switch whereby movement of the lever will reposition the switch to change the predetermined raised position of said boom means.

12. In a vehicle having boom means pivotally mounted thereon for movement between raised and lowered positions, hydraulic means including a fluid motor for raising and lowering said boom means and a valve movable between operated and self-restoring neutral positions for selectively directing pressured fluid to said motor, the improvement comprising means for controlling said hydraulic means including indexing means carried by said valve for locking said valve in an operated position to raise said boom means, releasing means connected to said indexing means and including circuit means, a movable member rotatably supported on said vehicle, a switch in said circuit means carried by said member, a stop fixed to said member, means urging said member and stop to a first position and abutment means on said member and said boom means to rotate said stop and member in response to predetermined pivotal movement of said boom means causing said switch to be actuated to close said switch and stop the movement of said boom means.

13. In a vehicle having boom means pivotally mounted thereon for movement between raised and lowered positions, hydraulic means including a fluid motor for raising and lowering said boom means and a valve movable between operated and self-restoring neutral positions for selectively directing pressured fluid to said motor, the improvement comprising means for controlling said hydraulic means including indexing means carried by said valve for locking said valve in an operated position to raise said boom means, releasing means connected to said indexing means and including circuit means, a movable member supported on said vehicle, a switch in said circuit means and movable with said member, and means responsive to pivotal movement of said boom means for moving said member thereby closing said switch and completing said circuit means to allow said valve to close and stop the movement of said boom means, said last means including a pin carried by said boom means and rotatable therewith, an abutment on said member and disposed in the path of said pin, means movably urging said member to a first position and movable to a second position, whereby movement of said boom means will move said pin into contact with said abutment to move said member to the second position and close said switch.

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