United States Patent

Fuzzell

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[45] **May 2, 1972**

[54] BUCKET POSITIONING DEVICE UTILIZING A BIASED PROXIMITY SWITCH

[72] Inventor: **Joe E. Fuzzell,** Peoria, Ill.

[73] Assignee: **Caterpillar Tractor Co.,** Peoria, Ill.

[22] Filed: **June 9, 1971**

[21] Appl. No.: **151,591**

Related U.S. Application Data

[62] Division of Ser. No. 812,829, Apr. 2, 1969, abandoned.

[52] **U.S. Cl.**.....**214/764,** 214/776, 335/207

[51] **Int. Cl.**.....**E02f 5/14,** E02f 3/70, E02f 3/28

[58] **Field of Search**.....335/205-207; 214/764, 776

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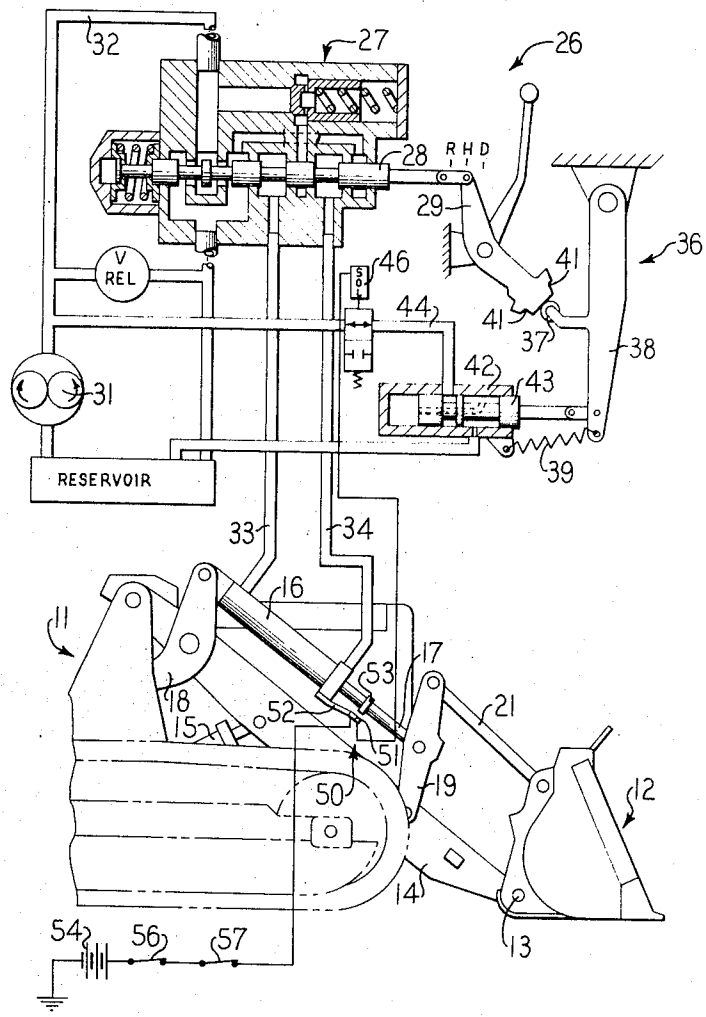
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Primary Examiner—Bernard A. Gilheany
Assistant Examiner—R. N. Envall, Jr.

[57] **ABSTRACT**

In a loader having a bucket pivotably supported upon a lift frame, tilt jacks interconnected between the lift arms and bucket by tilt linkage and a detented control valve by which the tilt jack is operated. A biased proximity switch and actuating magnet are positioned respectively upon the cylinder and rod of the tilt jack for disengaging the control value from a detented position as the bucket approaches its load position.

5 Claims, 18 Drawing Figures



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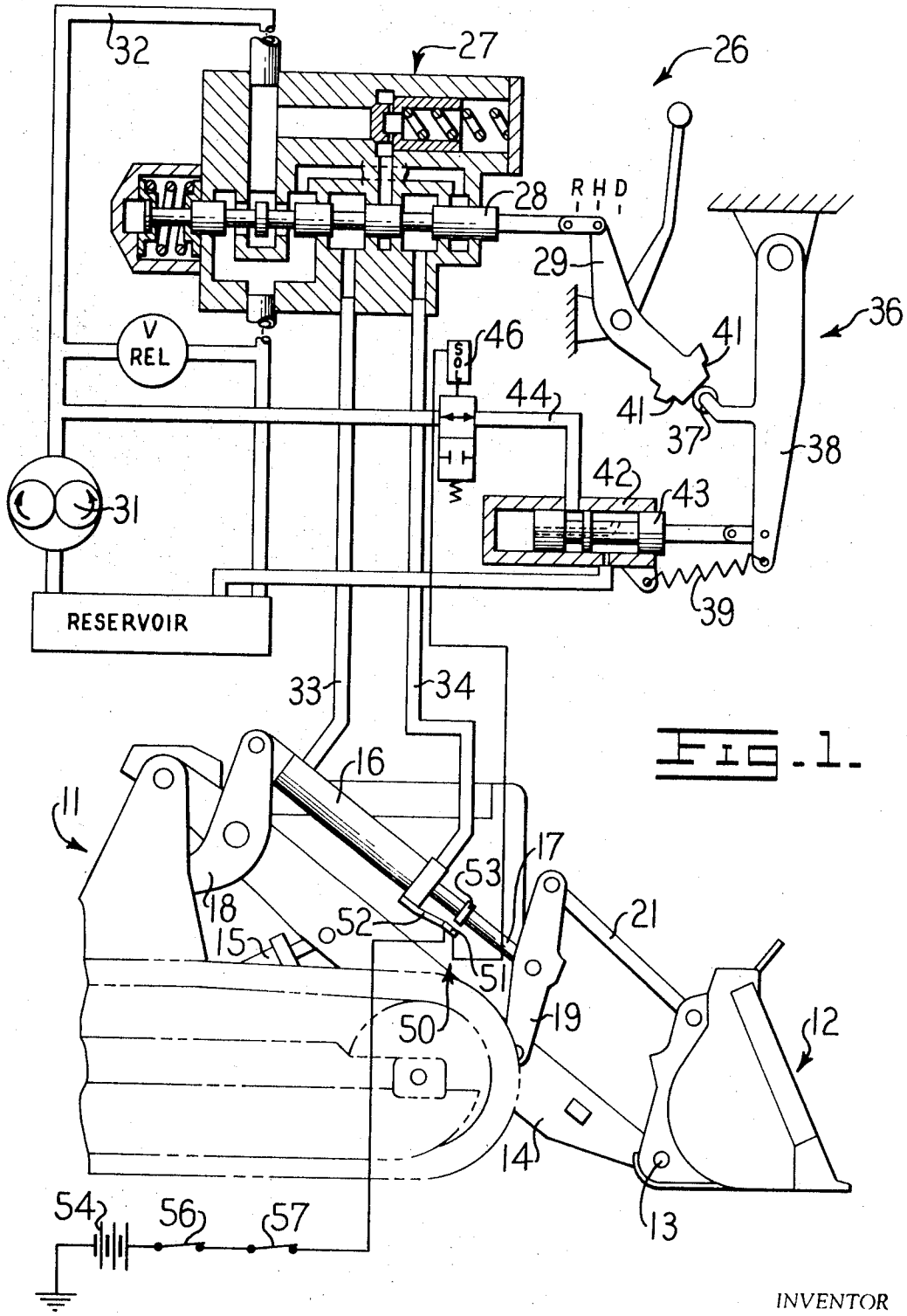


Fig. 1.

INVENTOR
JOE E. FUZZELL

BY
Fryer, Ehrenwald, Fisk, Phillips & Lempio
ATTORNEYS

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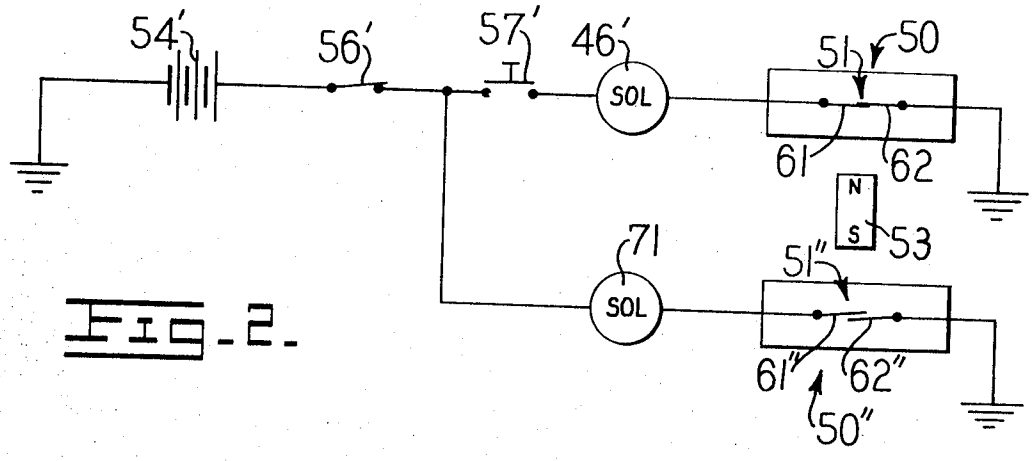


Fig. 2.

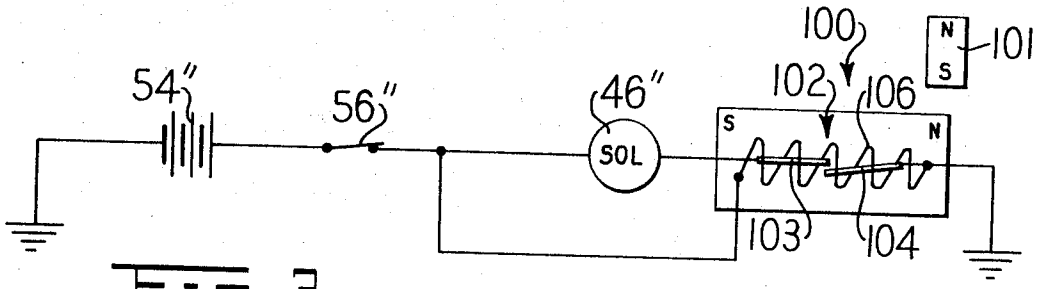


Fig. 3.

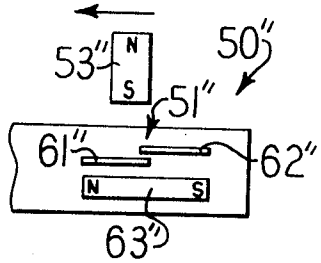


Fig. 9.

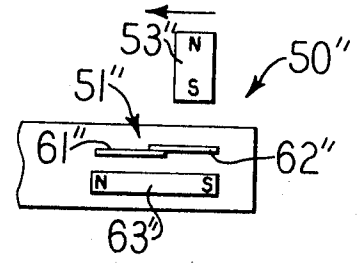


Fig. 8.

INVENTOR
JOE E. FUZZELL

BY
Fryer, Tjensvold, Feix, Phillips & Lempio
ATTORNEYS

Patented May 2, 1972

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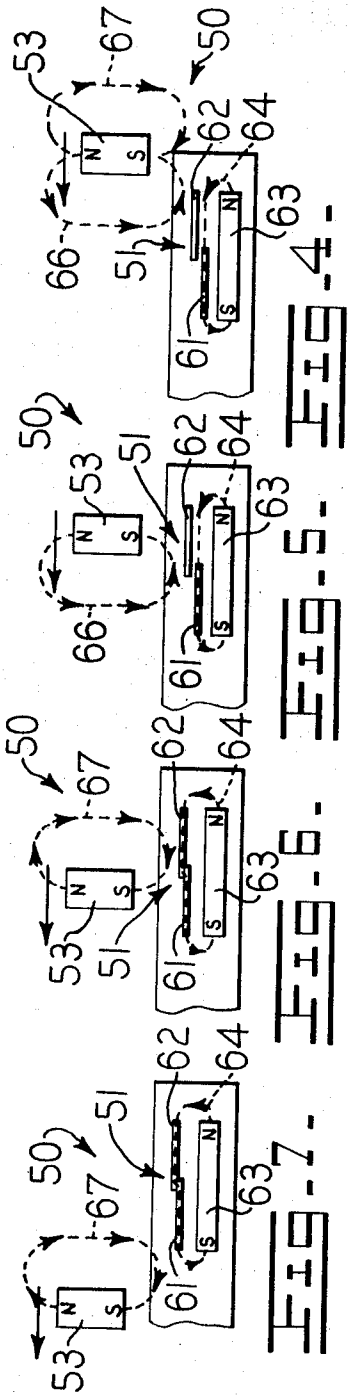


Fig-4-

Fig-5-

Fig-6-

Fig-7-

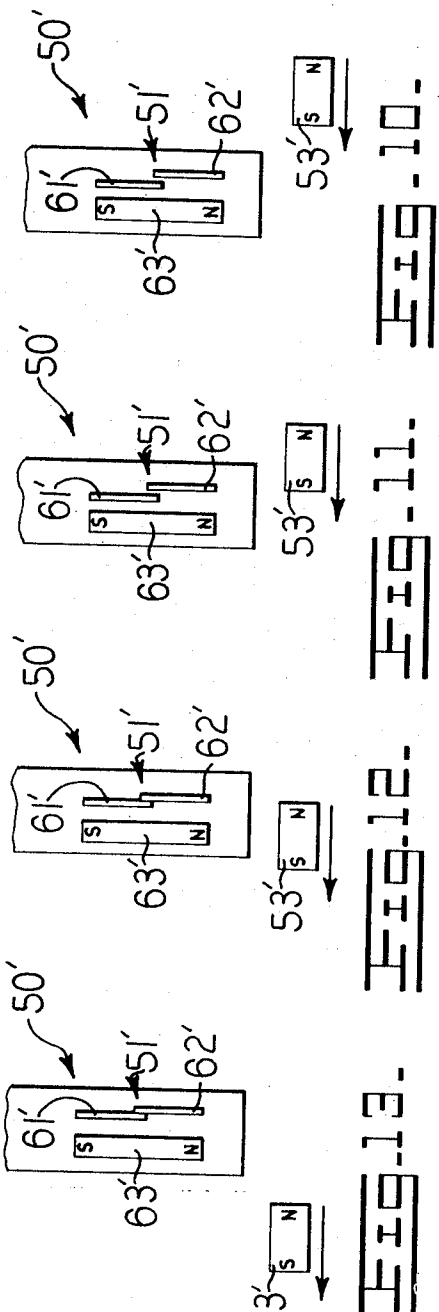


Fig-10-

Fig-11-

Fig-12-

Fig-13-

INVENTOR
JOE E. FUZZELL

BY
Fryer, Tjensvold, Feix, Phillips & Lempio
ATTORNEYS

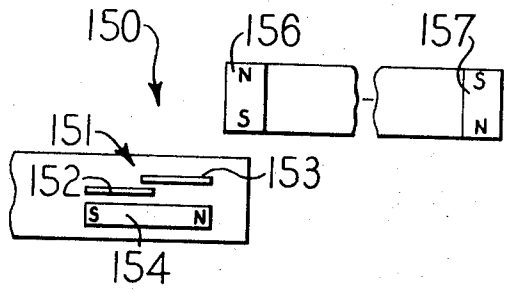


Fig. 14.

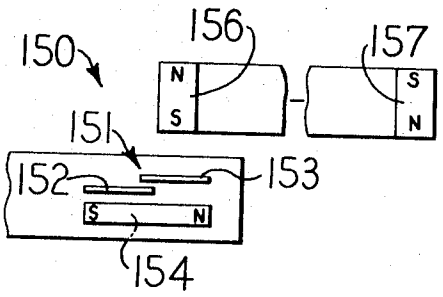


Fig. 15.

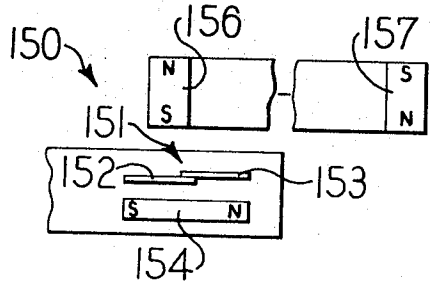


Fig. 16.

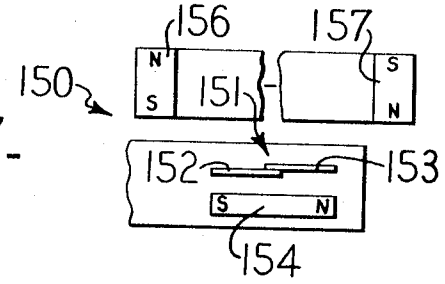


Fig. 17.

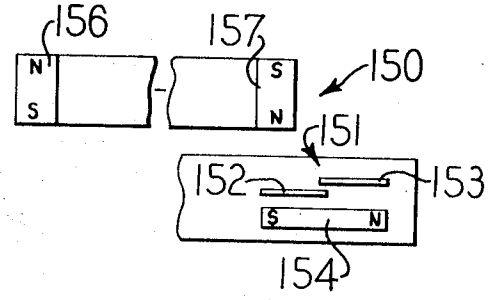


Fig. 18.

INVENTOR
JOE E. FUZZELL

BY
Fryer, Tjensvold, Feit, Phillips & Lempio
ATTORNEYS

BUCKET POSITIONING DEVICE UTILIZING A BIASED PROXIMITY SWITCH

This application is a division of application Ser. No. 812,829; now abandoned.

The present invention relates to a proximity switch and more particularly to a magnetically responsive switch including biasing means which permit the switch to be maintained in more than one operating position. The present switch assembly is described below having reference to the control circuit for a loader bucket wherein the present invention is particularly adaptable. However, it will be apparent that the loader bucket control circuit represents only an exemplary environment for the switch and that the switch assembly of the present invention is readily adaptable to many other applications.

Proximity switches of the type being responsive to a control magnet are well known in the prior art. Such a switch assembly may typically include a reed switch, for example, which is normally open. The switch is closed by placing a control magnet in close proximity to the switch so that magnetic flux from the control magnet passes through the reeds and urges them into contact with each other. The switch, however, is closed only while the control magnet remains in close proximity to the switch. As soon as the control magnet is moved away from the switch, the switch tends to return to its normally opened position.

A proximity switch of this type is described within the control circuit for a loader bucket in U.S. application, Ser. No. 770,670, now U.S. Pat. No. 3,519,155 filed by Charles R. Jefferson, et al. on Oct. 25, 1968 and assigned to the assignee of the present invention. Consideration of the present switch assembly used within such a control circuit illustrates numerous advantages of the present switch assembly in comparison with the prior art. For example, the switch and control magnet may be mounted on relatively reciprocating parts of the bucket linkage with the switch to be actuated by the magnet when the bucket is in a selected position. In certain situations, examples of which are described in greater detail below, it is desirable that the switch be maintained in its actuated condition over a range of bucket positions. With the prior art proximity switches of the type described above, it is necessary to provide a substantially elongated magnet so that a portion of the magnet remains in close proximity with the switch throughout the selected range of bucket position. The elongated magnet tends to complicate construction of the control circuit. The characteristics of these switches further tend to limit the number of applications wherein such proximity switches may be employed.

To overcome problems of the type set forth above, it is accordingly an object of the present invention to provide a biased proximity switch permitting greater versatility in its manner of use.

It is also a particular object of the present invention to provide a proximity switch which may be maintained in more than one operating position even when a control magnet is not in close proximity thereto.

It is a still further object of the invention to provide a proximity switch of a type which may be placed in one operating position by passing a control magnet in close proximity to the switch in one direction and which may be placed in a second position by passing the control magnet in close proximity to the switch in an opposite direction of travel.

It is also an object to provide a proximity switch of the type referred to above wherein sequential operation of the switch may be accomplished through the use of a plurality of control magnets.

It is another object of the invention to provide a proximity switch suitable for use in a control circuit for regulating operation of a loader bucket.

Additional objects and advantages of the present invention are made apparent in the following description having reference to the accompanying drawings.

In the drawings:

FIG. 1 illustrates the forward portion of a bucket loader and a partially schematic representation of a control circuit for the loader bucket as an exemplary environment for the present invention;

FIGS. 2 and 3 schematically illustrate different embodiments of control circuits within which the proximity switch of the present invention may be employed;

FIGS. 4–7 illustrate an embodiment of the present proximity switch and provide a sequential representation of the manner in which the switch is actuated by movement of a control magnet therepast;

FIGS. 8 and 9 illustrate a variation of the proximity switch assembly of FIGS. 4–7;

FIGS. 10–13 illustrate another variation of the switch assembly and similarly provide a sequential representation of the switch operation; and

FIGS. 14–18 illustrate yet another variation of the switch assembly wherein a plurality of control magnets are employed to accomplish selected sequential operation of the switch with the combination of figures sequentially illustrating operation of the switch by the control magnet.

An exemplary environment for the present invention is illustrated in FIG. 1. Having reference to FIG. 1, a bucket loader vehicle 11 has an ejector bucket 12 pivotably supported at 13 upon a pair of lift arms, one of which is indicated at 14. A tilt motor or hydraulic jack having a cylinder 16 and extendible rod 17 is interconnected between each of the lift arms 14 and the bucket 12 by means of tilt linkage which includes a pair of levers 18, 19 and a link 21 connecting the forward lever 19 with the bucket 12. Raising and lowering of the bucket is accomplished by lift jacks, one of which is indicated at 15, interconnected between the vehicle and lift arm 14.

A control circuit or system for operating the bucket and particularly for operating the tilt jacks 16 is illustrated by the schematic portion of the drawing as indicated at 26. A tilt control valve 27 includes a spool 28 which is positioned by a lever 29 to selectively communicate hydraulic fluid under pressure from a pump 31 and inlet conduit 32 into the head and rod ends of the cylinder 16 through respective conduits 33 and 34.

The bucket 12 may be racked back or pivoted in a counterclockwise direction as viewed in FIG. 1 by shifting the lever 29 and spool 28 to the position indicated at R. With the spool in this position, fluid from the conduit 32 is directed to the rod end of the cylinder 16 through the conduit 34 so that the rod 17 tends to be retracted within the cylinder 16. With the lever 29 and spool 28 shifted to a position indicated at D, fluid is directed through the conduit 33 to the head end of the cylinder 16 so that the rod 17 is extended and the bucket is moved in clockwise fashion as viewed in FIG. 1. The lever 29 and spool 28 may also be moved into a centered position indicated at H wherein both ends of the cylinder 16 are isolated from the fluid circuit so that the tilt jack 16 is prevented from moving the bucket.

Within such a control circuit, it is desirable that the operator be able to position the lever 29 for selected pivotal movement of the bucket and then direct his attention to operation of the vehicle while tilting movement of the bucket is automatically terminated during selected portions of a loading cycle. To commence a typical loading cycle, the bucket is placed in a position as illustrated in FIG. 1. The vehicle is then driven forwardly to load material into the bucket. As is common in such operations, the bucket is then alternately raised by the lift jack 15 and racked back by the tilt jack 16 in order to accomplish more complete loading of the bucket. This operation is commonly referred to as "fishtailing" of the bucket. When complete loading of the bucket is assured, it is then completely racked back to a carry position (not shown) and raised by the lift jacks 15 to a position suitable for dumping. With the bucket then positioned over a transport vehicle, for example, the bucket is pivoted forwardly or in clockwise fashion beyond the position shown in FIG. 1 to unload material from the bucket.

When the above cycle is completed, the operator may be fully occupied with steering the vehicle and returning it to a loading site to commence a new loading cycle. Accordingly, it is desirable that he is able to position the lever **29** and have the bucket automatically return to its loading position illustrated in FIG. **1**. At this point, it is noted that it would be similarly desirable to provide automatic controls for the lift jack **15** in order to permit fully automatic return of the bucket to its loading position. A similar control circuit could be employed for the lift jacks as for the tilt jacks. Accordingly, the control circuit for the lift jacks is not shown for the purpose of simplifying the specification of the present application.

To permit automatic operation of the tilt controls, a detent mechanism **36** is associated with the lever **29**. The detent mechanism includes a roller **37** mounted upon a pivotable lever **38**. The lever is urged leftwardly, as seen in the drawing, by a spring **39** for engaging the roller **37** with detent notches **41** defined in the lever **29**. When the lever **29** is moved to either of the positions indicated at R and D, the roller **37** is accordingly engaged with one of the notches **41**. To release the detent roller from the lever **29**, a slave cylinder **42** has its spool **43** linked to the lever **38**. Introduction of fluid under pressure from a conduit **44** into the slave cylinder urges the spool **43** rightwardly to pivot the lever **38** and release the roller **37** from one of the notches **41**. Communication of fluid through the conduit **44** is regulated by a solenoid operated, spring loaded valve **46**. Normally, the valve **46** is positioned by its spring to prevent the communication of fluid to the slave cylinder **42**. In this condition, the detent roller **37** is free to engage the lever **29** under the influence of spring **39**. However, upon actuation of the solenoid valve, it directs fluid through the conduit **44** to the slave cylinder **42** so that the lever **38** is pivoted rightwardly to prevent detent engagement of the roller **37** with the lever **29**.

The present invention particularly relates to a proximity switch which may be adapted for use in the bucket support linkage to selectively actuate the solenoid valve **46**. The proximity switch assembly indicated at **50**, described in greater detail, includes a magnetically responsive switch **51** supported by a bracket **52** extending forwardly from the cylinder **16** and a control magnet **53** which is secured to the extendible rod **17**. The switch **51** is electrically connected in series with the solenoid **46** and a DC electrical source indicated at **54**. The series connection with the source **54** also includes a normally open pressure switch **56** and a master switch **57** which controls the complete electrical circuit for the loader vehicle **11**. The switch **56** remains closed during operation of the vehicle **11** but automatically functions to break the circuit with the solenoid **46** in the event the machine **11** is shut down while the switch **51** is in a closed position.

Referring again to the proximity switch assembly **50**, the switch **51** is normally open at least when the control magnet **53** is positioned substantially to the right of the switch **51** as seen in FIG. **1**. With the switch **51** in its normally open position, the solenoid valve **46** is positioned by its spring so that the detent roller **37** is permitted to engage the lever **29**. As the rod **17** is retracted and the magnet **53** is moved into the position shown in FIG. **1**, the switch **51** is caused to close and actuate the solenoid valve **46**. The switch **51** remains in this closed position as the magnet **53** moves leftwardly past the switch **51**. When the rod **17** is again extended and the magnet **53** approaches the switch **51** in a rightward direction as viewed in FIG. **1**, the switch **51** is again caused to open. As the magnet **53** then moves rightwardly past the switch **51**, the switch remains in its open position, thus, permitting the detent mechanism **36** to effectively engage the lever **29**.

Utility of the switch assembly **50** is particularly apparent upon considering the loading cycle described above. Upon dumping the bucket, it tends to be in a position pivoted forwardly or clockwise from its position shown in FIG. **1**, with the rod **17** being extended and the magnet **53** moving rightwardly away from the switch **51**. At this point, the lever **29** is moved into its rack back position indicated at R with the lever being engaged by the detent mechanism **36** to hold it in that position. As the bucket is pivoted toward the position indicated in FIG. **1**, the magnet **53** also approaches the switch **51** and causes it to close, thus actuating the solenoid **46** and releasing the detent mechanism **36** from the lever **29**. The bucket is thus automatically positioned to commence a new loading cycle. Further, as the operator intermittenly operates the tilt control lever **29** into its rack back position during the "fishtailing" operation described above, the magnet is moving leftwardly away from the switch so that the switch remains in its closed position. Thus, the operator need not manually overpower the detent mechanism **36** each time he operates the tilt control lever **29** during this portion of the loading cycle.

One embodiment of the proximity switch assembly **50** is illustrated in FIGS. **4–7**. Referring to those figures, the magnetically responsive switch **51** may be a reed type switch having a pair of generally parallel reeds **61** and **62** which tend into an open position as illustrated in FIG. **4**. Biasing means such as the magnet indicated at **63** is associated with the switch **51**. The biasing means are effective to maintain the switch **51** in a second or closed position once the switch is moved into that position in a manner described below. As shown in the figure, the biasing magnet **63** is generally parallel with the reeds **61** and **62**. The poles of the biasing magnet **63**, indicated by the letters N and S, are arranged so that its external flux flow which affects the reeds **61** and **62** is indicated by the broken arrows **64**. The magnetic or flux circuit from the biasing magnet **63** magnetizes the reeds **61** and **62** and causes the reeds to have an attraction for each other. However, the magnetic flux of the biasing magnet alone is insufficient to close the switch **51**.

The control magnet **53** also has magnetic poles indicated by the letters N and S. The control magnet **53** is arranged so that its polar axis is generally perpendicular to the reeds **61**, **62** as well as to the polar axis of the biasing magnet **63**. Magnetic flux flow from the control magnet **53** is also generally indicated by the broken series of arrows **66** and **67**. It is particularly noted that the flux flow **66** to the left of the control magnet **53** tends to oppose flux flow from the biasing magnet **63** while flux flow **67** to the right of the control magnet **53** travels in a manner tending to reinforce flux flow from the biasing magnet **63**.

The effects on the switch **51** from leftward movement, for example, of the control magnet **53** past the switch is sequentially represented by FIGS. **4–7**. While the control magnet remains at the right of the switch **51**, as illustrated in both FIGS. **4** and **5**, the switch **51** is generally affected only by the flux field established to the left of the control magnet **53**. As noted above, this portion of the control magnet flux field opposes that of the biasing magnet **63** so that there is generally no effect upon the switch **51** and it remains in its open position. However, as the control magnet **53** commences to move leftwardly of the switch **51**, as seen, for example, in FIG. **6**, the switch **51** is affected by the flux field established to the right of the control magnet **53** as seen in that figure. As noted above, this portion of the control magnet flux field tends to reinforce the flux field of the biasing magnet **63** resulting in increased magnetization of the reeds **61** and **62**. The strengths of the magnets **53** and **63** are selected so that their combined or reinforcing flux fields magnetize the reeds **61** and **62** and cause sufficient attraction between the two reeds so that they contact each other and the switch **51** is then closed.

As the control magnet **53** continues its leftward travel and passes out of proximity with the switch **51**, it no longer has any substantial effect upon the reeds **61**, **62**. In this condition, the flux field of the biasing magnet is sufficiently strong so that the reeds **61**, **62** tend to be held in their closed or abutting position. The ability of the biasing magnet to maintain the reeds in a closed position while being unable by itself to close the reeds, may be explained by the increased permeance between the reeds when they are contacting or abutting each other. In this condition, the magnetic flux passing through the reeds from the biasing magnet **63** causes a sufficient attraction

between the reeds so that they tend to be held together in a closed position.

Effectiveness of the control magnet **53** to again open the switch **51** as it moves rightwardly past the switch **51** in close proximity thereto may be understood from considering the converse operating sequence represented by FIGS. **4–7**. For example, as the control magnet moves rightwardly through the position indicated in FIG. **7** and into the position indicated at FIG. **6**, only the reinforcing portions of the control magnet flux field effect the switch **51**. Accordingly, the switch **51** tends to remain in its closed position. However, as the control magnet **53** moves further to the right, for example, to the position indicated in FIG. **5**, portions of the control magnet flux field **66** tend to act upon the switch **51** in opposition to the flux field **64** of the biasing magnet **63**. For this position of the control magnet, the flux fields tend to balance or cancel each other so that the attraction between the reeds **61** and **62** is reduced and they again return to their open position as indicated in FIGS. **5** and **4**. As the control magnet continues its rightward motion past the position indicated in FIG. **4**, it again has no effect upon the switch **51** so that the switch **51** remains in its open position.

A variation **50'** of the switch assembly **50** is illustrated in FIGS. **10–13**. Portions of the proximity switch assembly **50'** which correspond to portions of the proximity switch assembly **50** are indicated by similar primed numerals. It will be noted that for both the proximity switch assemblies **50** and **50'**, the polar axis of the control magnet **53** and **53'** is arranged in perpendicular relation to the reeds **61, 62** or **61', 62'** as well as to the polar axis of the biasing magnet **63** and **63'**. However, in the switch assembly **50**, the biasing magnet **63** and the reeds **61, 62** are arranged parallel to the path along which the control magnet **53** moves. In switch assembly **50'**, they are arranged in perpendicular relation to the same path of travel. Since the control magnets **53** and **53'** are both arranged with their polar axis in perpendicular relation to the switch **51** or **51'** and the biasing magnets **63** or **63'**, the switch reeds **61', 62'** tend to be magnetized by movement of the control magnet **53'** therepast in the same manner as described above for the switch assembly **50**. Thus, operation of the switch assembly **50'** as sequentially represented by FIGS. **10–13** is similar to the manner of operation described above with respect to FIGS. **4–7**.

Another variation of the proximity switch assembly is indicated at **50''** in FIGS. **8** and **9**. Similar components of the switch assembly **50''** are also indicated by similar double primed numerals. It will be apparent that the components of the switch assembly illustrated in FIGS. **8** and **9** are arranged in generally similar relation as for the switch assembly illustrated in FIGS. **4–7**. However, it is noted that the polarity of the biasing magnet **63''** has been reversed in the switch assembly **50''**. Thus, for the sequence of operation described with respect to FIGS. **4–7**, the switch **51''** operates in a manner exactly opposite from that of the switch **51**. A comparison of these two sets of figures indicates that by merely reversing the polarity of the biasing magnet **63**, the switch **51** may be caused to function as either a normally closed or a normally open switch within the same operating environment. In this regard, a normally open switch refers to one which when closed, completes a circuit so that a desired function is performed. On the other hand, a normally closed switch is one which performs a desired function upon being opened.

To further illustrate the manner in which these variations of the switch assembly may be employed, for example, in the control circuit for the loader bucket of FIG. **1**, reference is now made to FIGS. **2** and **3**. The circuit illustrated in FIG. **2** may be employed to operate a loader bucket control circuit similar to that of FIG. **1**. For example, the circuit in FIG. **2** includes a DC source **54'**, switches **56'** and **57'**, and solenoid **46'** similar to those illustrated in FIG. **1**. However, the circuit of FIG. **2** is further adapted for controlling a bucket of a conventional type having an ejector which is to be actuated for assistance in unloading of the bucket (seen at **12** in FIG. **1**). The ejector (not shown) operating circuit is closed by actuation of a second solenoid valve **71**. Thus, in the circuit shown in FIG. **2**, the solenoid **46'** is connected in series with the normally open proximity switch assembly **50**. The ejector solenoid **71** is connected in electrical series with a normally closed switch indicated at **50''**. Both the switch assemblies **50** and **50''** are responsive to a single control magnet **53**. From the above description, it is apparent that with the control magnet **53** being positioned to the right of the two switch assemblies, the switch assembly **50** is open and the switch assembly **50''** is closed. As the control magnet **53** moves slightly to the left of the two switch assemblies, the switch **50** is then closed and the switch **50''** is opened. Accordingly, the switch assembly **50** has a similar operating sequence as that described above with respect to FIGS. **4–7** while switch assembly **50''** has the converse or opposite operating sequence as referred to with respect to FIGS. **8** and **9**.

In a typical operating sequence for bucket loaders employing this combined circuit, the switch **51** is closed and the switch **51''** is open when the bucket is in the position illustrated in FIG. **1**. The switch assembly **50** operates in the same manner as described above with respect to FIG. **1**. However, the switch assembly **50''** is closed only as the bucket approaches a forwardly pivoted position suitable for dumping. Thus, the ejector cannot be operated while the bucket is racked back or pivoted counterclockwise from the position shown in FIG. **1**. In this manner, the ejector may be prevented from dumping material over the back of the bucket **12** and onto the vehicle **11** while the bucket is in its carry position.

The circuit illustrated in FIG. **3** includes a proximity switch assembly **100** employed with components similar to those in FIGS. **1** and **2**. The switch assembly **100** includes a control magnet **101** similar to the control magnet **53** of FIG. **4** and a switch **102** including reeds **103** and **104** generally similar to the reeds **61** and **62** of switch **51**. However, different biasing means are shown in association with the switch **102**. In this embodiment, the biasing means comprises an electrically conductive coil **106** which encompasses the reeds **103, 104** of the switch **102**. Current flow through the coil is selected to induce a magnetic field having north and south poles, as indicated by the letters N and S respectively, equivalent to those for the biasing magnet **63** illustrated, for example, in FIGS. **4–7**. Thus, the switch assembly **100** operates in a generally similar manner as the switch **50** described with respect to FIGS. **4–7**.

Still another variation of the switch assembly is indicated at **150** in FIGS. **14–18**. The switch assembly **150** includes a switch **151** made up of reeds **152, 153** similarly as the switch **51** of FIG. **4**. A biasing magnet **154** is associated with the switch **151** also in a similar manner as for the biasing magnet **63** of FIG. **4**, for example. However, in this switch assembly, a plurality of control magnets are employed, for example, those indicated at **156** and **157**. The two control magnets **156** and **157** may be mounted on a single member such as the extendible rod **17** illustrated in FIG. **1**. The arrangements and relative spacing shown for the control magnets are selected to permit sequential operation of the switch **151** as the two control magnets move past the switch in a single direction. The control magnets **156** and **157** are both arranged with their polar axis in perpendicular relation to the reeds **152, 153** and the polar axis of the biasing magnet **154**. However, it is noted that the magnetic poles or polarity of the two control magnets are reversed with respect to each other. Thus, whereas the control magnet **156** operates in generally an identical manner as the control magnet **53** of FIG. **4**, the reversed control magnet **157** will have exactly the opposite effect upon the switch **151**. For example, FIGS. **14–18** sequentially represent operation of the switch **151** by the two control magnets **156** and **157**. As the two control magnets move leftwardly past the open switch **151**, the control magnet **156** first causes the switch **151** to close when the magnet **156** is in a similar position as the control magnet **53** illustrated in FIG. **6**. However, as the two control magnets continue to move leftwardly in unison and the magnet **157** approaches a similar actuating position, its mag-

netic flux field is in opposition to that of the biasing magnet **154**. Thus, the control magnet **157** again causes the switch **151** to open. It is immediately apparent that relative spacing between the two control magnets **156** and **157** may be selected to cause the switch **151** to close and again open within a selected distance of travel for the control magnet combination while both of the control magnets are moving in a single direction. Movement of the two control magnets **156** and **157** in an opposite direction also has a respectively converse effect upon the switch **151** in the same manner as described above for the other switch embodiments.

What is claimed is:

1. A tilt control system for a bucket loader including a vehicle, at least one lift arm pivotally connected to the vehicle and an implement pivotally supported on the lift arm, motor means being interconnected between the vehicle and lift arm for raising and lowering the implement, the tilt control system comprising,

a hydraulic tilt jack interconnected between the implement and the vehicle for rotating the implement about its pivotal connection with the lift arm,

a valve in communication with the tilt jack and having operating positions for rotating the implement in different directions, the valve including a detent mechanism tending to maintain the valve in at least one of its operating positions,

electrically responsive means coupled with the detent mechanism and operable to disengage the detent mechanism, and

a proximity switch assembly associated with the tilt jack and operatively coupled with the electrically responsive means, the switch assembly including a reed switch having a pair of magnetizable reeds and arranged on one portion of the tilt jack, magnetic biasing means being arranged on the one tilt jack portion adjacent the reed switch and having a polar axis parallel to the reeds, the switch assembly also including magnetic control means arranged on another portion of the jack which is movable relative to the one jack portion during extension and retraction of the jack, the magnetic control means having a polar axis perpendicular to the polar axis of the biasing means, the arrangement of the reed switch and control means on the two tilt jack portions being selected so that the control means is in actuating register with the reed switch when the implement is rotated to a selected position whereby the reed switch is opened when the control means passes thereby in one direction and closed when the control means passes thereby in the opposite direction to permit engagement of the detent mechanism with the control valve and to maintain the detent mechanism in a disengaged condition when the implement is rotated in opposite directions from its selected position by the tilt jack.

2. The tilt control system of claim **1** wherein the implement is a loader bucket arranged for loading in its selected position, the bucket being rotatable in one direction from its selected position to a carry position and in the opposite direction to an unloading position.

3. The tilt control system of claim **1** wherein the biasing means and control means are magnets.

4. The tilt control system of claim **1** wherein the implement is an ejector bucket and further comprising electrically responsive means for operating the ejector, the switch assembly including a second similar reed switch and parallel biasing means effectively coupled with the electrically responsive means for operating the ejector and arranged on the one portion of the tilt jack so that it is also opened and closed by the operating means.

5. The tilt control system of claim **4** wherein the biasing means for both reed switches are magnets and the control means is a single magnet.

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