United States Patent [19]

Stout et al.

[11] **3,720,338**

[45] **March 13, 1973**

[54] EARTH WORKING IMPLEMENT

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[22] Filed: **Oct. 26, 1970**

[21] Appl. No.: **83,877**

[52] **U.S. Cl.** **214/776**
[51] **Int. Cl.** **E02f 3/00**
[58] **Field of Search** 214/778, 140, 771, 769, 776, 214/777

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[57] **ABSTRACT**

A vehicle having one end of a boom pivoted on a support between raised and lowered positions with an implement pivoted on the free end of the boom. First and second fluid motors respectively have first elements pivoted on the implement and the support and second elements pivoted on a link which is supported on the boom intermediate the ends. In one embodiment, the fluid rams are both located on the same side of the boom and in the second embodiment, the fluid rams are located on opposite sides of the boom.

2 Claims, 6 Drawing Figures

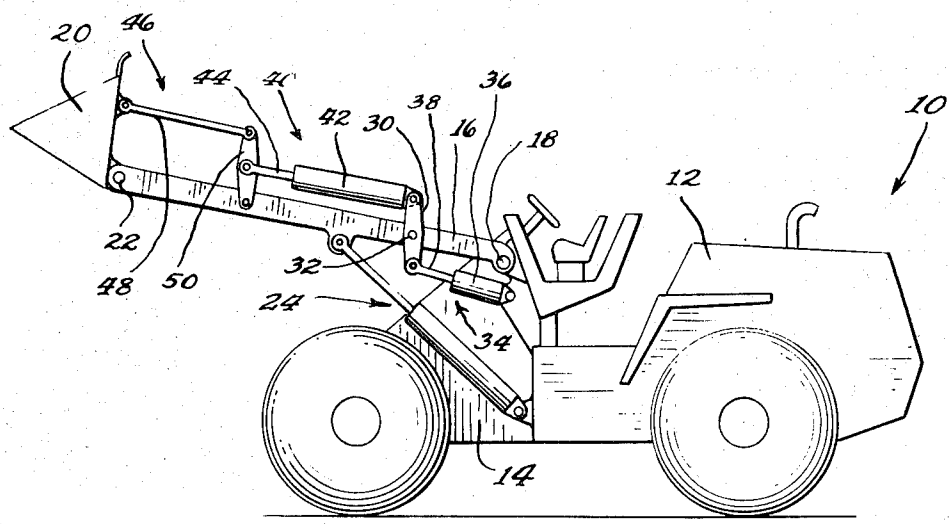


Fig. 3.

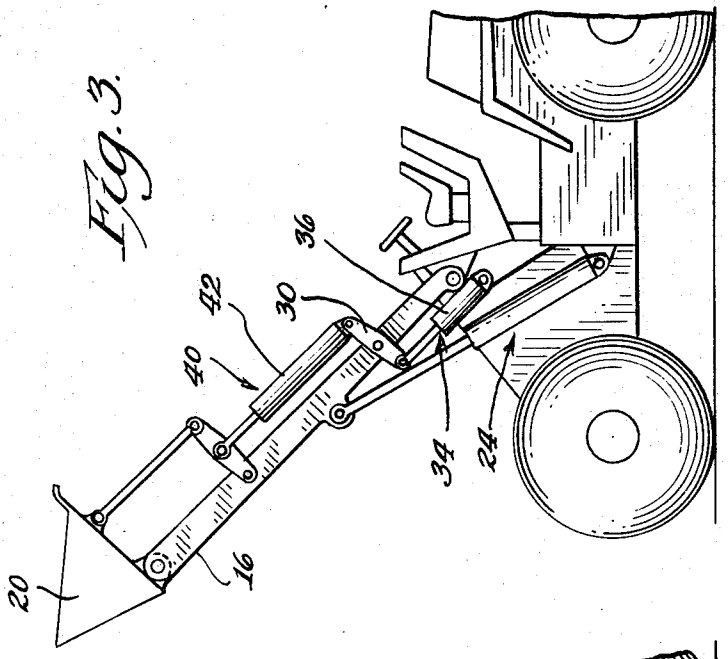


Fig. 1.

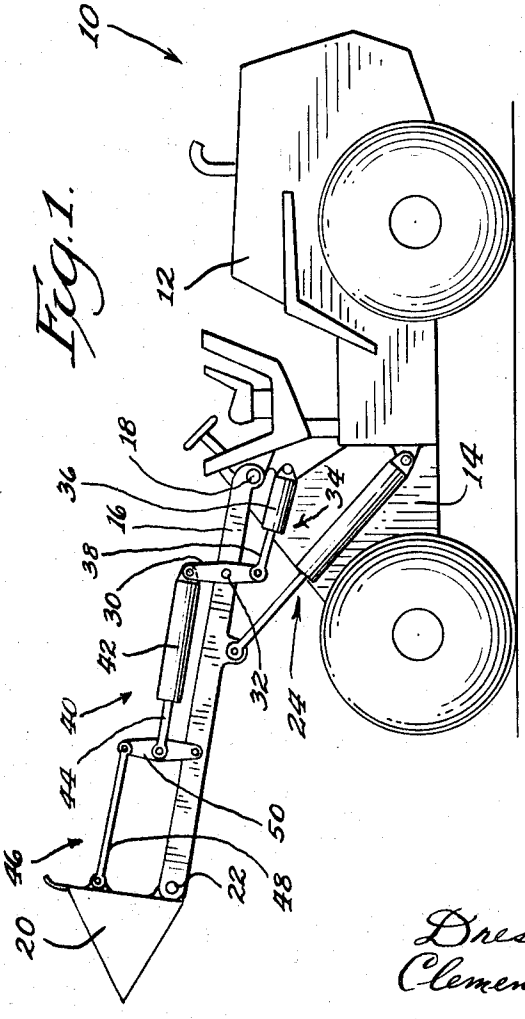
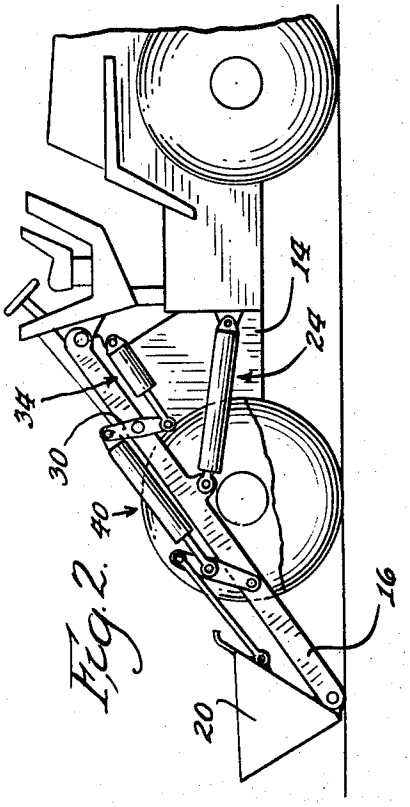


Fig. 2.



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Fig. 5.

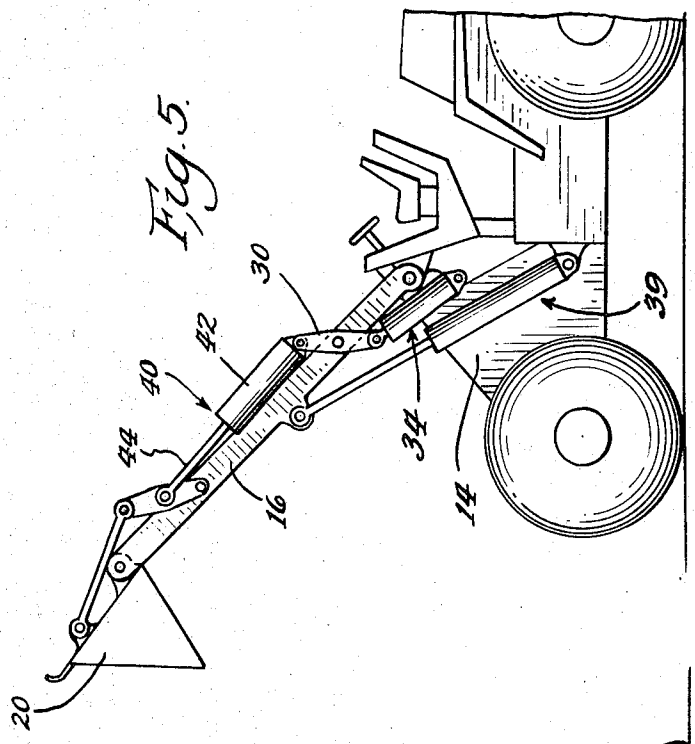


Fig. 4.

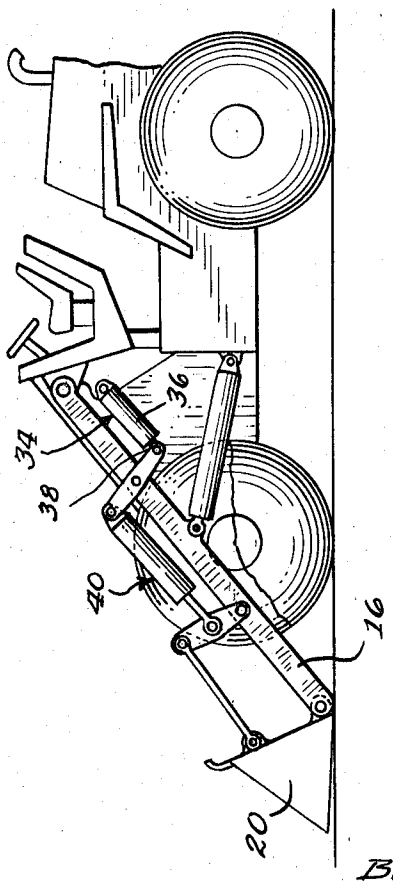
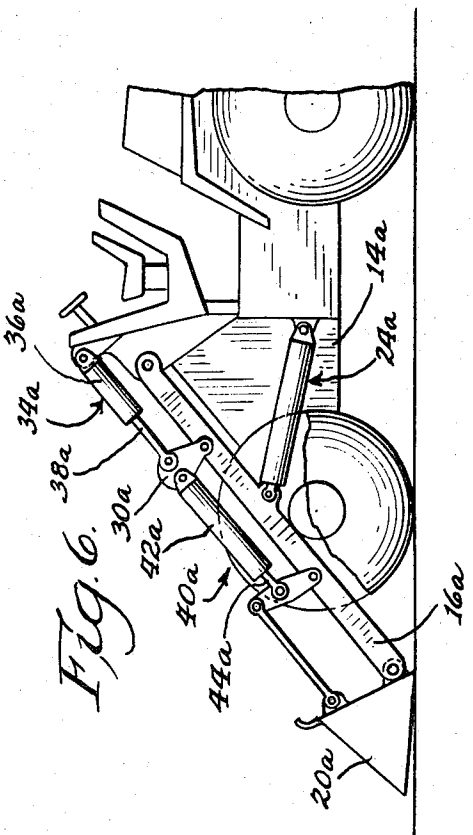


Fig. 6.



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EARTH WORKING IMPLEMENT

BACKGROUND OF THE INVENTION

The present invention relates generally to material handling devices and more particularly to an improved control mechanism for such devices.

One type of material handling device which has found extensive use is an earth working unit in which a boom is pivotally connected at one end on a support and is adapted to be raised and lowered relative thereto. An implement is then pivotally supported on the outer or free end of the boom and is moved between extreme positions by a linkage system which incorporates a fluid ram. In one such suit, the implement is a bucket and the unit is commonly referred to as a "front end loader."

In normal operation of a unit of this type, the bucket is positioned in a "dig" or working position and is forced into a pile of material by forward movement of the vehicle. The bucket is then pivoted or rolled back on the boom or lift arms for the vehicle with sufficient force to break out the mass of material within the bucket from the remainder of the pile. Subsequently, the lift arms are elevated a sufficient distance to raise the bucket above the ground and the vehicle is driven to some other location. Upon reaching the subsequent location, the bucket is pivoted to a "dumping position" where the contents are discharged, after which the operation is repeated.

In an operation such as this, it is important that the bucket be maintained at a "level position" while the loader is driven from the first location to the second to prevent the material or contents from being spilled. In addition, it is desirable that the bucket automatically be returned to the "dig" position after the implement has been dumped so that the operator may attend to maneuvering the vehicle between locations. It is also important to incorporate mechanism in the bucket control system which prevents the bucket from being pivoted beyond the "rolled back" position to insure that the contents will not be dumped upon the operator and/or the vehicle.

While various types of controls have been proposed, many of the devices presently in existence for performing the above functions are extremely complicated in nature and are expensive to incorporate into the unit.

SUMMARY OF THE INVENTION

The present invention contemplates a simple and inexpensive control mechanism for pivoting an implement between extreme positions on one end of a boom that is pivotally supported at its opposite end on a vehicle and adapted to be raised and lowered thereon. The control mechanism includes first and second extensible links which are arranged in generally end-to-end relation between the implement and the support and in which one of the extensible links is moved from one extreme position to another to pivot the implement from a dumped to a working position and the second extensible link is moved from one extreme position to another to move the implement from the working to the rolled back position. The links cooperate to produce a mechanical leveling device during raising of the boom on the vehicle and give positive protection against pivoting the implement beyond the rolled back position when the boom is in the raised position.

Stated another way, the present invention contemplates first and second fluid rams each having relatively movable elements with one element of one ram operatively connected to the implement and one element of the second ram operatively connected to a support. The second elements of the respective rams are interconnected through a link which is pivotally supported on the boom. One of the fluid rams is moved between extreme positions to move the implement from the dumped position to a working or "return-to-dig" position while the elements of the second fluid ram are moved between extreme positions to move the implement from the working position the rolled back position. In order to move the implement from the rolled back to the dump position, the elements of both fluid rams are moved to the opposite extreme position.

In one embodiment, the elements of the fluid rams are connected to opposite ends of the link and the link is pivoted intermediate its ends on the boom, so that extension of one fluid ram and retraction of the other fluid ram will move the implement in one direction.

In an alternative embodiment, one end of the link is pivoted on the boom and has the second elements of the respective rams pivotally connected adjacent an opposite end so that extension of the respective rams will pivot the implement in one direction while retraction of the respective rams will pivot the implement in the opposite direction.

The control means of the present invention allows the operator to move the implement from its dumped to a working position by actuating one of the fluid rams from one extreme position to the other extreme position while movement of the implement from the working position to the rolled back position is accomplished through actuation of the second fluid ram. Both fluid rams are utilized to pivot or move the implement from the rolled back to the dump position and the arrangement considerably increases the rate of pivotal movement from the rolled back to the dump position.

BRIEF DESCRIPTION OF SEVERAL VIEWS OF DRAWINGS

FIG. 1 discloses an earth working device having the present invention incorporated therein;

FIGS. 2–5 are similar to FIG. 1 and show the device in the various operative positions; and

FIG. 6 shows a slightly modified form of the present invention.

DETAILED DESCRIPTION

FIG. 1 of the drawings shows an earth working device **10**, such as a "front end loader," having the present invention incorporated therein. The device **10** includes a self-propelled vehicle **12** defining a pair of space supports or uprights **14** (only one being shown). Since all of the elements hereafter described, will be duplicated on opposite sides of the machine, and are substantially identical in construction, only one of the elements has been shown and will be described.

The earth working device **10** includes a boom or lift arm **16** pivotally supported at **18** on the support **14**. An implement **20**, such as a bucket, is pivoted at **22** on the opposite end of the boom **16** while the boom is adapted to be raised and lowered on the support through a fluid ram **24** interposed between the boom and the support.

The implement or bucket **20** is adapted to be pivoted on the boom by linkage means constructed in accordance with the present invention. The linkage means includes a first extensible and retractable link for moving the implement from the dumped to a working position and a second extensible and retractable link for moving the implement from the working to the rolled back position. Both links or fluid rams are simultaneously actuated to move the implement from the rolled back to the dumped position. With this arrangement, the operator can move one of the rams from one extreme position to the other extreme position to move the implement from one position to a next and movement of the second fluid ram between extreme positions will move the implement from the second to a third position. By proper selection of the fluid rams, the three positions will respectively define the dumped, working and rolled back positions for the implement.

Thus, as shown in FIG. **1** the linkage means includes a link or lever **30** pivoted intermediate its ends at **32** on the boom **16**. A first fluid ram **34** has a first element or cylinder **36** pivotally connected to the support and a second element or piston rod **38** pivotally connected to one end of the link or lever **30**. A second fluid ram **40** has one element or a cylinder **42** pivotally connected to the opposite end of the link or lever **30** while its associated second element or piston rod **44** is operatively connected to the implement **20** through a compound linkage **46**.

The compound linkage **46** includes a first link **48** and a second link **50** which have their adjacent ends interconnected and respectively have opposite ends connected to the implement and the boom. Thus, the compound linkage cooperates with a portion of the boom **22** and a portion of the implement or bucket **20** to define a parallelogram linkage.

The operation of the control system will now be described with particular reference to FIGS. **2–5**. Assuming that the implement is in the dump position shown in FIG. **5**, the next sequence of operation for the loader is to lower the boom or lift arms **22** and to move the implement **20** from the dumped position on to a working or "return-to-dig" position. This is accomplished by supplying pressure fluid, from a source (not shown), to the rod end of cylinder **42** to move the piston rod from the fully extended position shown in FIG. **5** to the fully retracted position shown in FIG. **4**.

Simultaneous to the above pivotal movement of the bucket or subsequent thereto, the pressured fluid is also supplied to the head end of the cylinder forming part of the fluid ram **34** to pivot the boom **22** on the support **14** so as to move the implement from its raised to its lowered position. By proper selection and arrangement of the various parts forming the present control system, the implement or bucket will be at the digging attitude when the boom is lowered to a digging position. This particular arrangement allows for the use of a well known commercially available detented control valve for supplying pressured fluid to opposite ends of the cylinder **42** so that the operator need only move the control valve spool to its detented position and thereafter direct his attention to other functions required to be performed at that time. When the piston rod **42** and its associated piston (not shown) are in the fully retracted position, the valve spool will automatically move to its neutral condition and the implement will be at its working or digging position.

After the implement has been filled with material, such as dirt, the next step in the operation is to pivot or roll back the bucket on the boom or lift arms with sufficient force to break out the mass of material within the bucket from the remainder of the pile of material. Subsequently, the boom **22** is raised to substantially the position shown in FIG. **3** so that the unit is ready for dumping material at a subsequent location. During such raising, it is important that the implement be maintained at a substantially level condition to prevent the contents of material from being spilled from the bucket.

According to the present invention, all of this is accomplished by utilizing the second fluid ram **34** for pivoting the implement on the boom from the working position shown in FIG. **3** to the rolled back or level position shown in FIG. **2**. To accomplish this, the fluid ram **34** is extended from its fully retracted position shown in FIG. **4** to its fully extended position shown in FIG. **2** by supplying pressure fluid to the head end of cylinder **36**. Again, the pressured fluid may be supplied from a pressure fluid source through a well known detented valve (not shown) of the above mentioned type. When the fluid ram **34** is in its fully extended position, the implement or bucket **20** will be in a substantially level condition relative to the ground. Again, by proper selection and arrangement of the various links forming part of the present control system, and their attachment to the support, the boom and the implement, the implement or bucket **20** will remain in a substantially level condition while the boom is being raised from the position shown in FIG. **2** to that shown in FIG. **3**.

Thus, the linkage system of the present invention, incorporating extensible and retractable links **34** and **40** and a pivoted link or lever **30**, will act as a mechanical self-leveling device while the implement is being raised on the support.

In addition, by arranging the parts in a manner that the fluid ram **40** is in the fully retracted position and the fluid ram **34** is in the fully extended position to define the rolled back position for the implement **20**, the linkage system also prevents the implement from being rolled back beyond the level position shown thereby preventing the possibility of inadvertently having the material dumped on the operator and/or the vehicle. Stated another way, the linkage system of the present invention is an "anti-roll back" device to prevent the implement from being rolled beyond a desired maximum position.

In order to move the implement from the position shown in FIG. **3** to the dumped position shown in FIG. **5**, the pressured fluid is simultaneously supplied to the rod end of cylinder **36** and the head end of cylinder **42** to extend the fluid ram **34** and retract the fluid ram **40**. By utilizing both fluid rams for moving the implement from the rolled back to the dumped position, the time required for such movement is considerably decreased.

It will be appreciated that the present invention provides a linkage means which includes a first extensible and retractable link which is extended and retracted to move the implement between first and second positions and a second extensible and retractable link which is

extended and retracted to move the implement between the second and a third position. This allows for the implement to be automatically moved to any one of the three positions by mere manipulation of control levers which are normally located in close proximity to the operator.

A slightly modified embodiment of the present invention is disclosed in FIG. 6 wherein like reference numerals have been applied to the various parts and the suffix *a* has been added to the respective elements. The embodiment illustrated in FIG. 6, the fluid rams **40***a* and **34***a* are arranged in substantially end-to-end relationships and one element of each of the rams, i.e., cylinder **42***a* and piston rod **38***a*, are connected to the link or lever **30***a* adjacent one end thereof while the link or lever **30***a* is pivotally connected to the boom adjacent the opposite end thereof.

The operation of the modified embodiment of the invention is substantially identical to that described in connection with FIGS. **2–5** with the exception that the actuation of the fluid ram **34***a* is reversed since both rams are located on the same side of the boom **16***a*. Thus, the fluid ram **34***a* is moved from its fully extended to its fully retracted position to move the implement or bucket from the working position to the rolled back position.

Summarizing briefly, the present invention allows for automatically moving the implement to any one of three positions by proper extension and retraction of a pair of extensible links or fluid rams and all of the elements may be of the standard form which can readily be incorporated into the equipment during design and manufacture thereof.

What is claimed is:

1. In a vehicle having one end of a boom pivoted on a support between raised and lowered positions and an implement pivoted on the free end of said boom; and means for pivoting said implement relative to said support between dumped, return-to-dig and rolled back positions, said means comprising a link pivoted intermediate opposite ends on the boom between ends thereof; a first fluid ram first and second elements respectively pivoted on said support and one end of said link; and a second fluid ram having first and second elements respectively pivoted on the opposite end of said link and said implement, said elements of said fluid rams having fully extended and fully retracted positions, said second fluid ram moving said implement from the dumped position to the return-to-dig position upon relative movement of the elements of said second fluid ram from the fully extended position to the fully retracted position while said first ram has its elements in the fully retracted position, said first ram moving said implement from the return-to-dig position to said rolled back position upon relative movement of the elements from the fully retracted position while the elements of said second fluid ram are in the fully retracted position; and means for supplying fluid to said rams to extend and retract said elements.

2. In a vehicle having one end of a boom pivoted on a support between raised and lowered positions with an implement pivoted on the free end of said boom; and means for pivoting said implement relative to said support between dumped, working and rolled back positions, said means comprising a link pivoted intermediate its end on said boom; a first fluid ram having first and second elements respectively pivotally connected to said support and one end of said link; a second fluid ram having first and second elements respectively pivotally connected to the opposite end of said link and said implement, said first and second elements of each ram each having fully extended and retracted extreme positions; and means for selectively supplying fluid to said rams, said rams and links being arranged so that (1) movement of the elements of one fluid ram from one extreme position to the other extreme position will move said implement from the dumped to the working position, (2) movement of the elements of the other fluid ram from one extreme position to the other extreme position while the elements of said one fluid ram are in the other extreme position will move said implement from the working position to the rolled back position and (3) movement of the elements of both fluid rams from the other extreme position to said one extreme position will move said implement from the rolled back position to the dumped position.

* * * * *