United States Patent

Billings

[15] **3,669,287**

[45] **June 13, 1972**

[54] PRESSURE PLATE AND LINKAGE CONNECTION BETWEEN A DIPPER STICK AND AN IMPLEMENT

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[21] Appl. No.: **55,910**

[52] **U.S. Cl.** .....**214/147 G,** 214/137
[51] **Int. Cl.** **B66c 3/00**
[58] **Field of Search** .....214/137, 147, 147 G, 145, 127, 214/129, 141, 138

[56] **References Cited**

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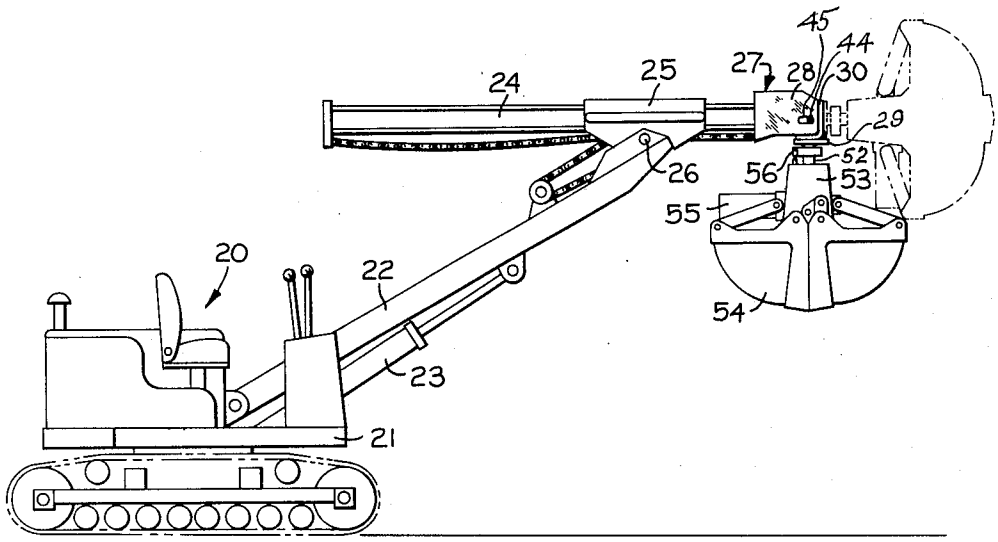
[57] **ABSTRACT**

The lower end of the dipper stick of a crane has spaced plates with L-shaped engaging edges forming a female pressure member which coacts with a male pressure plate in the upper end of an implement such as a clamshell bucket. A short flexible connector is connected at its lower end to the male pressure plate and has its upper end within the space between the two plates of the female pressure member, there being means within the cavity at the lower end of the dipper stick for releasably taking up slack in the flexible connector to provide a desired amount of snugness or looseness in the connection between the bucket and the dipper stick, with, however, the male and female pressure members always being engaged in a manner which will prevent rotating movement or undesired swinging of the implement relative to the dipper stick. A guide roller in the female pressure member coacts with one of the connector links to allow the bucket to be snugged up in most positions.

11 Claims, 6 Drawing Figures



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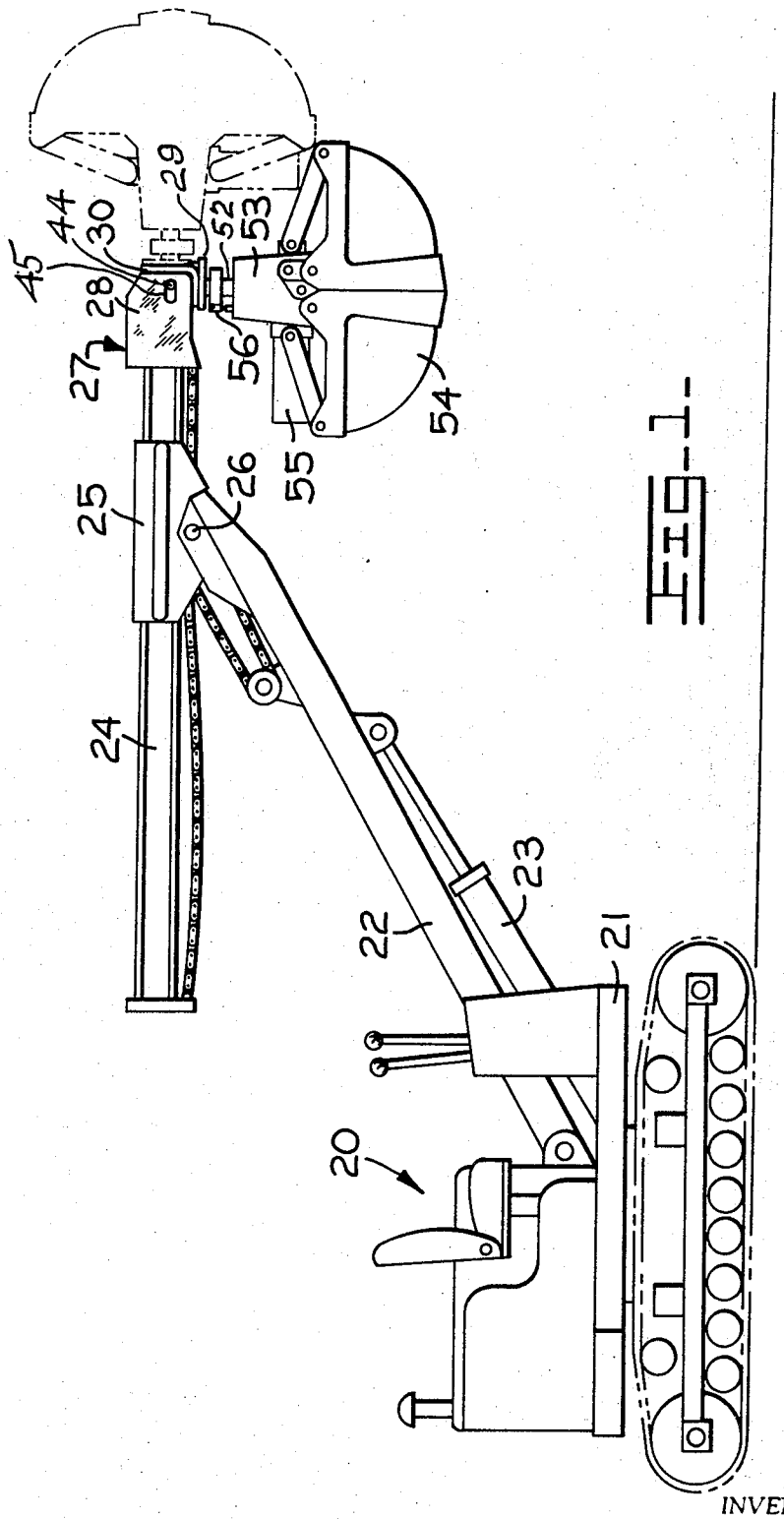

FIG. 1

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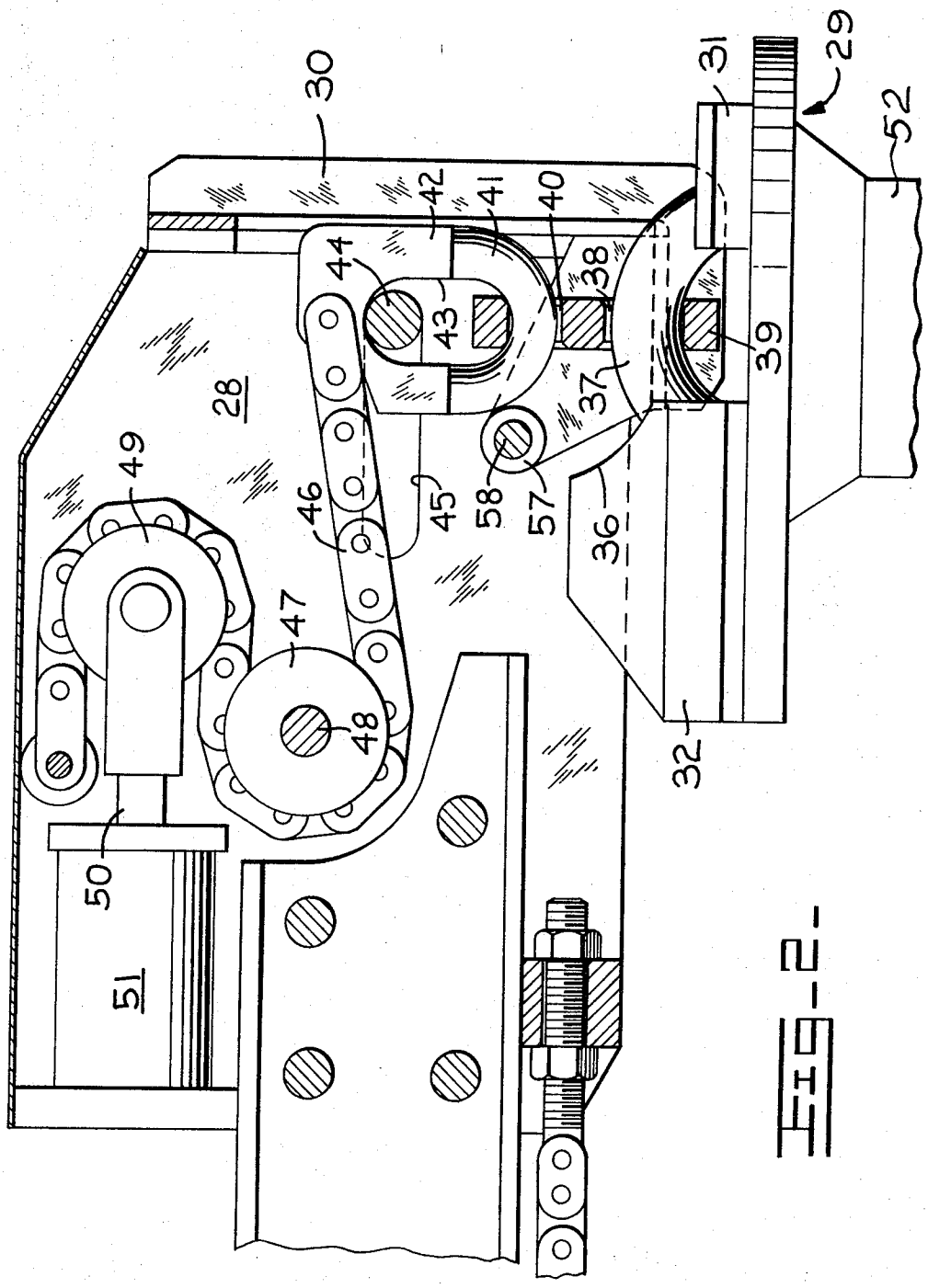

FIG-2-

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Fig-3-

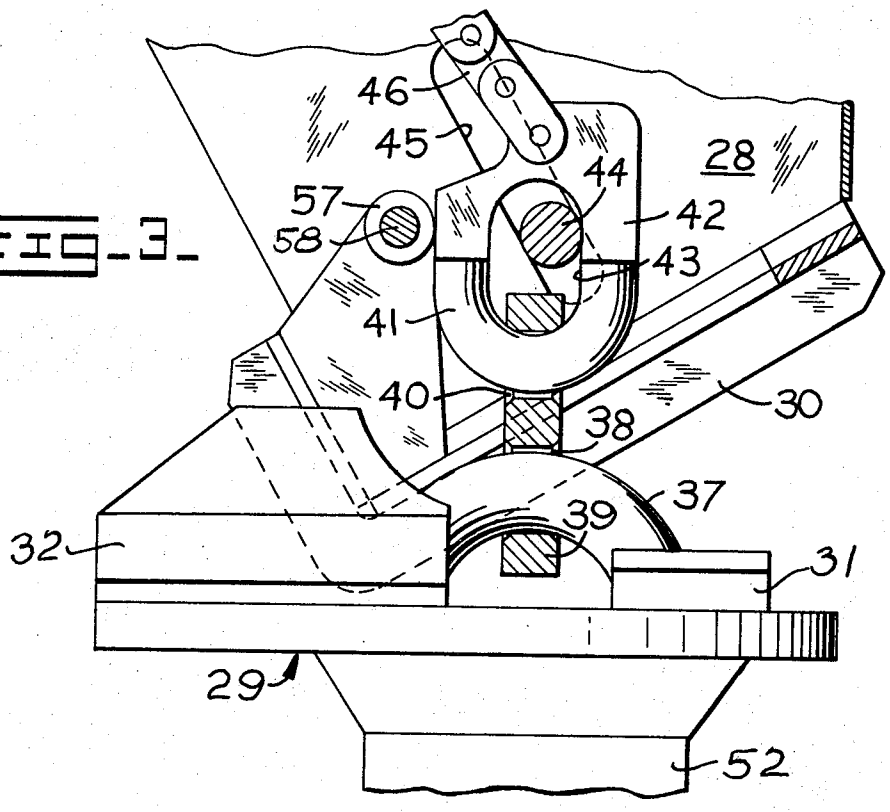
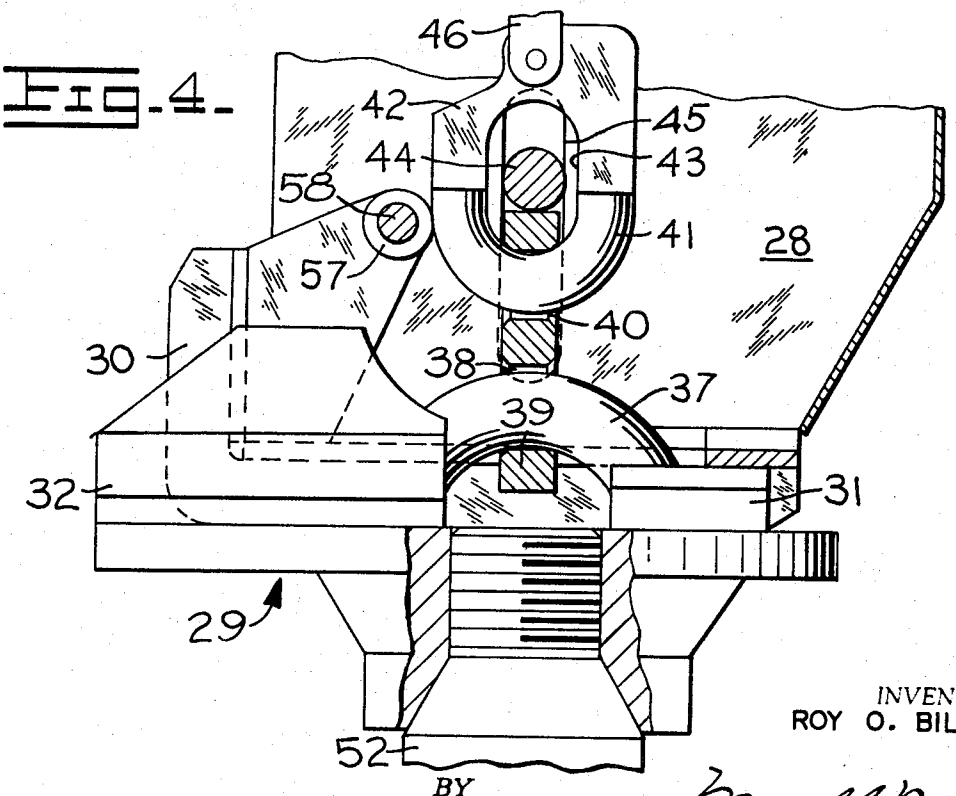


Fig-4-



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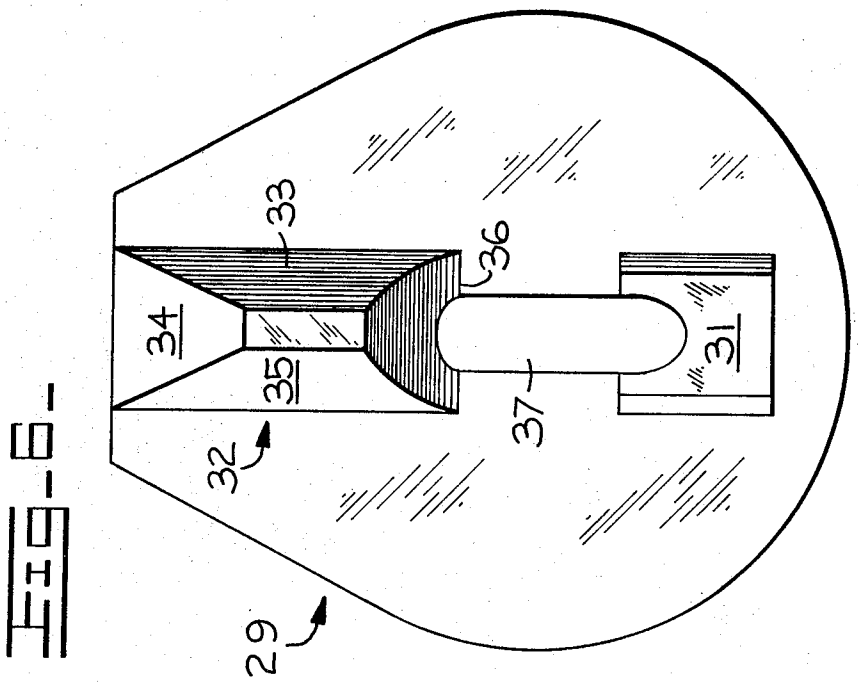

FIG-6-

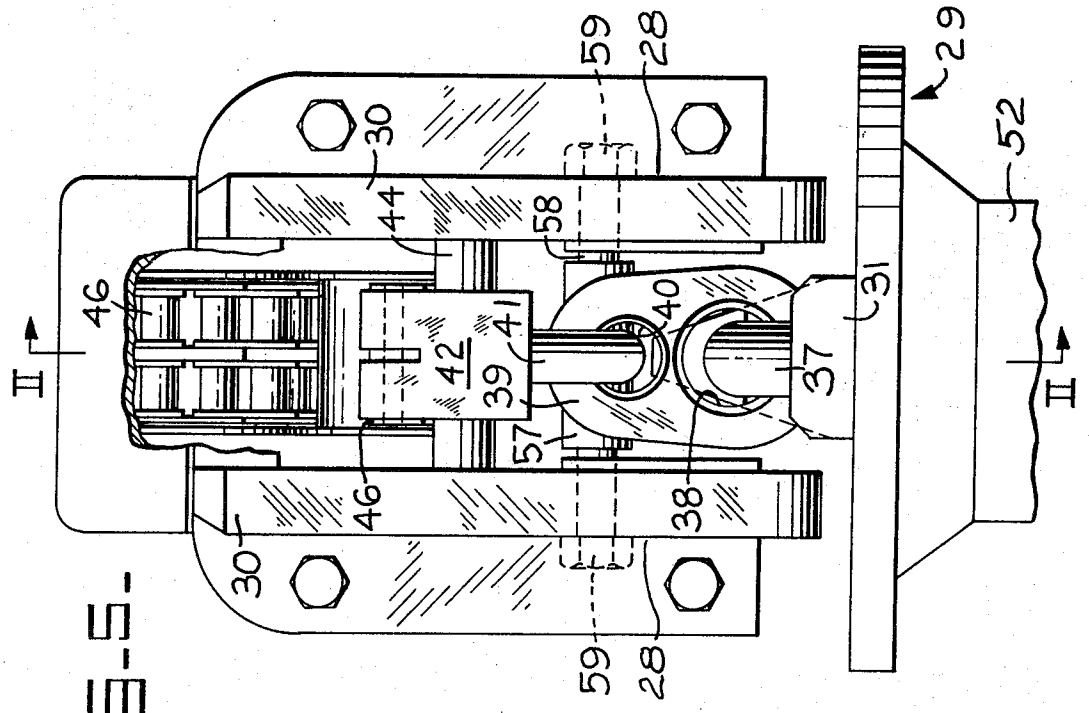

FIG-5-

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PRESSURE PLATE AND LINKAGE CONNECTION BETWEEN A DIPPER STICK AND AN IMPLEMENT

BACKGROUND OF THE INVENTION

1. Field of the Invention

The improved device is particularly useful in cranes of the type having a boom with a pivoted dipper stick wherein there is a clamshell bucket supported by the dipper stick, which device combines the desirable features of both a clamshell bucket and a back hoe.

2. Description of the Prior Art

Heretofore most clamshell buckets have been of the "free fall" type. That is, the buckets are so supported, usually by cables, that they are allowed to fall onto the work, and the bowls being closed by pulling upwardly on cables. Thus the bucket relies on its own weight to dig into the ground. Where the ground is very hard it is difficult to dig with this type of bucket because it tends to skim over the surface. An improvement was disclosed in my prior U.S. Pat. Nos. 3,143,228 and 3,143,229 where there is a crane having a dipper stick from which an hydraulically operated clamshell bucket is adjustably suspended, there being cooperable male and female pressure plates with controlled means for causing either a tight or loose connection between the pressure plates. In my prior patents, however, there was no means for preventing undesired rotating movement of the bucket or swinging movement thereof when it was in a loosely-supported condition. Thus it was at times difficult to cause the bucket to properly reenter the trench being dug, or to properly align it with the side of an existing footing or obstacle.

SUMMARY OF THE INVENTION

The present invention provides, in a crane type of device having a boom with a dipper stick adjustably connected thereto, means for flexibly suspending an implement such as a clamshell bucket from the dipper stick in a manner which permits either a tight or loose connection, while permitting the implement to assume various angles with respect to the dipper stick and while providing a novel male-female pressure plate connection which maintains sufficient engagement between the two members in all positions of adjustment that undesired rotating or swinging action is prevented, this being accomplished while maintaining a full range of adjustable movements, and while permitting both a tight and loose engagement with the dipper stick.

A general object of the invention is to provide, in a device of the class described, novel means for maintaining an engagement between the male and female pressure members regardless of the angle between the implement and dipper stick, and regardless of the condition of tightness or looseness of the bucket.

A further object of the invention is to provide, in a construction of the class described, a flexible connection between the male and female pressure members which includes a link, together with means in the cavity of the female pressure member for guiding said link during takeup and loosening movement, whereby the link is kept in a properly located condition under control of the operator and is prevented from causing any jamming up in operation.

A further object of the invention is to provide an improved pressure plate and linkage connection which allows the bucket to be contained while reentering the trench, or to be aligned with the side of an existing footing or obstacle while being loose enough to provide a 120° range of adjustment with respect to the dipper stick, and while being loose enough so that it can rest on its side while digging in such position, this being often required under walks or footings.

A further object of the invention is to provide an improved pressure plate and linkage connection as above described in which the interengaging portions of the male and female members are always lined up and in at least partial engagement regardless of the position of adjustment of the parts, whereby both digging and dumping may be done without altering the relative position of the interengaging parts.

With the above and other objects in view, the invention consists of improved pressure plate and linkage connection between a dipper stick and an implement, and all of its parts and combinations, as set forth in the claims, and all equivalents thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings, in which the same reference numerals designate the same parts in all of the views:

FIG. 1 is a side elevational view of a crane equipped with a dipper stick, showing the improved pressure plate and linkage connection between the dipper stick and a clamshell bucket, the broken lines indicating how the bucket may be snugged up endwise with respect to the dipper stick;

FIG. 2 is a fragmentary sectional view taken approximately on the line 2—2 of FIG. 5, and showing the male pressure member partially snugged up in a 90° position with respect to the dipper stick;

FIG. 3 is a fragmentary sectional view of the same parts shown in FIG. 2, however, showing the male pressure plate interengaged with a corner of the female member so as to be in a different angular relationship;

FIG. 4 is a view showing similar parts to FIGS. 2 and 3 with, however, the male pressure plate being snugged up endwise against the end of the dipper stick in a position at right angles to the position of FIG. 2;

FIG. 5 is a view looking at the right-hand end of the mechanism of FIG. 2; and

FIG. 6 is a top plan view of the male pressure member.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring more particularly to the drawings, the numeral 20 designates the tractor portion of a crane which has a turntable 21 supporting a pivoted boom 22, the angle of which may be controlled by an hydraulic actuator 23, as is well-known in the art. A dipper stick 24 is adjustably slideable in a saddle 25 pivoted as at 26 on the boom. At the outer end of the dipper stick is a head 27, the lower end of which forms a female pressure member, said head having spaced side plates 28 defining a chamber therebetween for receiving portions of a male pressure member 29, as shown in FIGS. 2, 3 and 4. The female pressure member includes an L-shaped wearing bar 30 at the lower portion of each plate 28, and said bars are adapted to coact in various relationships with the male pressure member as shown in FIGS. 2, 3 and 4 to exert pressure on the male member during digging.

The male pressure member 29 is best shown in the top view (FIG. 6). It includes a pear-shaped plate having a front upstanding block 31 and having a larger, rectangular, upstanding block or male element 32 which is always more or less engaged between the spaced side plates 28 of the female pressure member. The top of the block 32 has converging tapered faces 33, 34, 35 and 36, and the face 36 is preferably concaved, as is best shown in FIG. 2. A curved arched rod 37 connects the top of the block 31 with an end of the block 32, as shown in FIGS. 2 and 6. The arched rod extends loosely through an enlarged lower opening 38 in an oval link 39, as is best shown in FIG. 5. The link 39 has an upper opening 40 (see FIG. 2) through which a half link 41 projecting from the bottom of a control member 42 extends. The control member 42 has a slotted opening 43 therein, as shown in FIGS. 2, 3 and 4, which is an extension of the opening of the half link 41. A pin 44 extends through the slot 43 and has its ends guided in slots 45 in the spaced plates 28 of the female pressure member. A roller chain 46, preferably double as illustrated in FIG. 5 to keep the sprocket sizes at a minimum, is connected to the top of the control member 42. It extends around an idler sprocket 47 (see FIG. 2) which is rotatably mounted on a shaft 48 extending between the spaced side plates 28 of the female pressure member. The roller chain is also trained around sprocket wheels 49 rotatably carried on the end of a ram 50 which is telescopically associated with a double-acting hydraulic cylinder 51.

Supported rigidly from the lower portion of the male pressure plate **29** in the manner shown in FIG. **4** is a swivel shaft **52** which suitably supports the head **53** of an implement **54** as shown in FIG. **1**. In the illustrated embodiment of the invention the implement is a clamshell bucket which is hydraulically operated in opening and closing movement by an hydraulic cylinder **55** in a manner more fully described in application Ser. No. 839,372, filed July 8, 1969, now U.S. Pat. No. 3,557,621. Desirably, there is an hydraulic actuator **56** for controlling rotating movement of the clamshell bucket around the axis of the swivel shaft **52**, as fully disclosed in co-pending application Ser. No. 879,686, filed Nov. 25, 1969.

OPERATION

In use of the improved crane, the clamshell bucket may be completely loosened by fully retracting the hydraulic ram **50**. In this position, by changing the angle of the dipper stick **24** the dipper stick end may be aligned in any one of a number of selected positions with respect to the bucket. Thereafter, by extending the ram **50**, the bucket may be snugged up in any of the various adjusted positions. The broken lines of FIG. **1** show the bucket snugged up in a position against the extreme end of the dipper stick. The full line position of FIG. **1**, as well as of FIG. **2**, shows the bucket at right angles to the dipper stick. With the bucket in loose condition, by tilting the dipper stick upwardly from the position of FIG. **1**, it can be swung to an acute angle with respect to the dipper stick. Thus there are possible adjusted positions within a range from the last described position to the broken line position of FIG. **1** covering approximately a 120° range.

With the construction of my prior U.S. Pat. No. 3,143,228, when the bucket was in loose condition there was no engagement between the pressure member at the top of the bucket head and the pressure member on the lower end of the dipper stick. As a result, while changing the angle of the bucket, it could swing freely, interfering with the reentry of the bucket to a trench or with a desired alignment with the side of an existing footing or obstacle. With the present invention, even when the bucket is in its loosest condition with respect to the dipper stick, the upper portion of the block **32** of the male pressure member **29** is always between and overlapped by the spaced side plates **28** of the female pressure member so that undesired rotation or swinging movement is prevented without interfering with the movement of the bucket from one adjusted position to another.

During take-up of the bucket, upon extension of the ram **50**, the pin **44** extending through the control link can shift in the slots **45** of the spaced plates **28** of the female pressure member, thus giving a desired flexibility to the arrangement. The pin also serves to limit the amount of slack.

An important feature of the present invention is the guide roller **57** which is rotatable on a bolt **58**, the latter extending entirely through the plates **28** (FIG. **5**) and having nuts **59** on the ends thereof. The roller **57** acts as a guide for the control member **42** during changes in adjustment and keeps the latter in proper position preventing jamming of any of the parts. The engagement of the roller **57** with the control member **42** is shown in FIGS. **2**, **3** and **4** during various adjusting movements. This roller takes certain stresses during take-up. In addition, the bolt **58** holds the plates **28** from spreading during digging or when subjected to the various strains.

During most digging operations the corners of the wearing bars **30** engage the top of the male pressure plate **29** as shown in FIG. **3**. In FIG. **3** the male pressure plate is nearly snugged up against said corners for digging against foundations, or at any angle required. In FIG. **4** the male pressure plate is completely snugged up against the end of the dipper stick and in the broken line position of FIG. **1**. This is useful to allow for straight out digging, such as under porches, buildings, sidewalks, or the like. In FIG. **2** the male pressure plate is partly snugged up in a right-angular position corresponding to the full line position of FIG. **1**. It is to be noted that in all of these positions the upper portion of the block **32** is engaged more or less between the side plates **28** of the female pressure member to always contain the bucket against undesired swinging or rotating. It is also apparent that in any one of the various positions of the bucket with respect to the dipper stick, it is possible to have either a tight or loose engagement. Thus complete flexibility of operation is provided and there is complete control of the bucket whether it is in a high dumping position, in a side digging position, or in any of the other various possible positions. It is also apparent that the special connection and linkage arrangement can keep the male and female pressure members engaged while the bucket is still loose enough to lie on its side for digging. This is frequently necessary when digging under sidewalks or footings.

An important feature of the invention is that the sides **28** of the female pressure member are widely spaced so that there is a widely spaced engagement with the male pressure plate **29** as shown in FIG. **5**. This eliminates possible tipping of the clamshell bucket when down pressure is applied through the dipper stick, the male pressure plate being rigid on the deck of the clamshell bucket or other attachment.

It is to be understood that I do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

What I claim is:

1. In a crane having an elongated, rigid, movably supported, implement-supporting arm provided with an outer end having an end chamber, said crane also having an implement head equipped with a male pressure plate, there being flexible coupling means between said pressure plate and chamber for adjustably supporting said implement, and there being means in said chamber for controlling slack in said flexible coupling means whereby said male pressure plate of the implement may be drawn toward and away from the outer end of said arm, the improvement comprising laterally spaced, outwardly projecting side plates at the outer end of said supporting arm forming a female pressure member and between which said chamber is located, said side plates being so disposed relative to one another that the chamber therebetween has communicating openings at the end of the supporting arm and at one side thereof, said flexible coupling means being mounted for movement from one of said opening portions to another, the male pressure plate of the implement head having a projecting male element located between and of such size and shape that it is overlapped by said spaced side plates of the female pressure member regardless of the condition of slack in said flexible coupling means and in all positions of adjustment between the arm and implement to thereby maintain control of the implement and prevent swinging movement, and said spaced side plates having portions located for engagement with the male pressure plate of the implement to impart working forces thereto when the slack in the coupling means has been taken up.

2. A crane as claimed in claim **1** in which said chamber between the spaced side plates of the female pressure member with the communicating opening portions at the end of the supporting arm and at one side thereof, provides a range of movement of the implement with respect to the arm of at least 90°.

3. A crane as claimed in claim **2** wherein, when the flexible coupling means is in slack condition, the implement has a range of movement of approximately 120°.

4. A crane as claimed in claim **1** in which each side plate of the female pressure member has an L-shaped pressure edge extending along its end and part of its side edge, said pressure edges having corners positioned for working engagement with the male pressure plate when the implement is at an oblique angle with respect to the supporting arm.

5. A crane as claimed in claim **4** in which there is an L-shaped wearing bar along each pressure edge.

6. A crane as claimed in claim **2** in which the coupling means is so supported that the male element of the male pressure plate may be snugged up into the side opening portion of

the female pressure member to support the implement at right angles to the supporting arm, or may be snugged up into the end opening to support the implement substantially in axial alignment with the supporting arm, or may be snugged up in selected angular positions therebetween.

7. A crane as claimed in claim 1 in which the movably-supported, implement-supporting arm is a dipper stick which is pivotally and extensibly carried by a boom of the crane, and in which the implement is a clamshell bucket.

8. In a crane having an elongated, rigid, movably-supported, implement-supporting arm provided with an outer end having an end chamber, said crane also having an implement head equipped with a male pressure plate, there being flexible coupling means between said pressure plate and chamber for adjustably supporting said implement, and there being means in said chamber for controlling slack in said flexible coupling means whereby said male pressure plate of the implement may be drawn toward and away from the outer end of said arm, the improvement comprising laterally spaced, outwardly projecting side plates at the outer end of said supporting arm forming a female pressure member and between which said chamber is located, the male pressure plate of the implement head having a projecting male element located between and of such size and shape that it is overlapped by said spaced side plates of the female pressure member regardless of the condition of slack in said flexible coupling means and in all positions of adjustment between the arm and implement to thereby maintain control of the implement and prevent swinging movement, and said spaced side plates having portions located for engagement with the male pressure plate of the implement to impart working forces thereto when the slack in the coupling means has been taken up, said flexible coupling means including a control element between the side plates of the female pressure member, and there being a transverse roller between said side plates positioned to be engaged by one side of the control element for guiding said element during take-up and loosening of the flexible coupling means.

9. A crane as claimed in claim 8 in which the flexible coupling means has a chain portion within the supporting arm connected to the inner end of the control element and in which there is a link movably connected between the outer end of the control element and the male pressure plate, and in which the control element had a slotted opening, there being slotted openings in the spaced side plates of the female pressure member, and in which there is a pin having its ends movably positioned in the slots of the spaced side plates and extending through the slot of the control element.

10. In a crane having an elongated, rigid, movably-supported, implement-supporting arm provided with an outer end having an end chamber, said crane also having an implement head equipped with a male pressure plate, there being flexible coupling means between said pressure plate and chamber for adjustably supporting said implement, and there being means in said chamber for controlling slack in said flexible coupling means whereby said male pressure plate of the implement may be drawn toward and away from the outer end of said arm, the improvement comprising laterally spaced, outwardly projecting side plates at the outer end of said supporting arm forming a female pressure member and between which said chamber is located, the male pressure plate of the implement head having a projecting male element located between and of such size and shape that it is overlapped by said spaced side plates of the female pressure member regardless of the condition of slack in said flexible coupling means and in all positions of adjustment between the arm and implement to thereby maintain control of the implement and prevent swinging movement, and said spaced side plates having portions located for engagement with the male pressure plate of the implement to impart working forces thereto when the slack in the coupling means has been taken up, there being an upwardly arched rod on the male pressure plate to which the flexible coupling means is connected.

11. In a crane having an elongated, rigid, movably supported, implement-supporting arm provided with an outer end having an end chamber, said crane also having an implement head equipped with a male pressure plate, there being flexible coupling means between said pressure plate and chamber for adjustably supporting said implement, and there being means in said chamber for controlling slack in said flexible coupling means whereby said male pressure plate of the implement may be drawn toward and away from the outer end of said arm, the improvement comprising laterally spaced, outwardly projecting side plates at the outer end of said supporting arm forming a female pressure member and between which said chamber is located, the male pressure plate of the implement head having a projecting male element located between and of such size and shape that it is overlapped by said spaced side plates of the female pressure member regardless of the condition of slack in said flexible coupling means and in all positions of adjustment between the arm and implement to thereby maintain control of the implement and prevent swinging movement, and said spaced side plates having portions located for engagement with the male pressure plate of the implement to impart working forces thereto when the slack in the coupling means has been taken up, there being a control element forming part of the flexible coupling means and having a slotted opening, and there being slotted openings in the spaced side plates of the female pressure member, and there being a pin having its ends movably positioned in the slots of the spaced side plates and extending through the slot of the control element.

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