United States Patent

Billings

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[54] HYDRAULICALLY ACTUATED CLAMSHELL BUCKETS

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[52] **U.S. Cl.** **37/186,** 37/187

[51] **Int. Cl.** **B66c 3/02**

[58] **Field of Search** 37/187, 188, 185, 186, 183, 37/184

[56] **References Cited**

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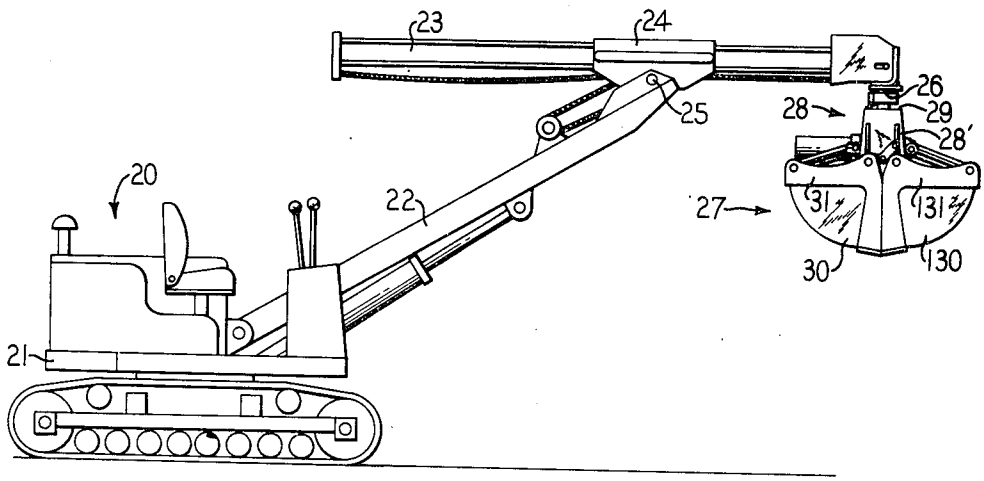
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Primary Examiner—Edgar S. Burr
Attorney—Morsell & Morsell

[57] **ABSTRACT**

A clamshell bucket has complementary bowl sections pivotally supported from a deck, there being a generally horizontally disposed hydraulic cylinder which is trunnion mounted near its head end through linkage fixed to the top of one bowl section, and there being a piston rod for said cylinder pivotally connected at its outer end through linkage fixed to the top of the other bowl section, and there also being linkage which includes an equalizer link for insuring equal movement of the bowl sections when the hydraulic cylinder is operated. A bucket cleaner is also supported from the deck and is arranged to automatically clean the bowl sections as they are moved to open position.

8 Claims, 7 Drawing Figures



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SHEET 1 OF 5

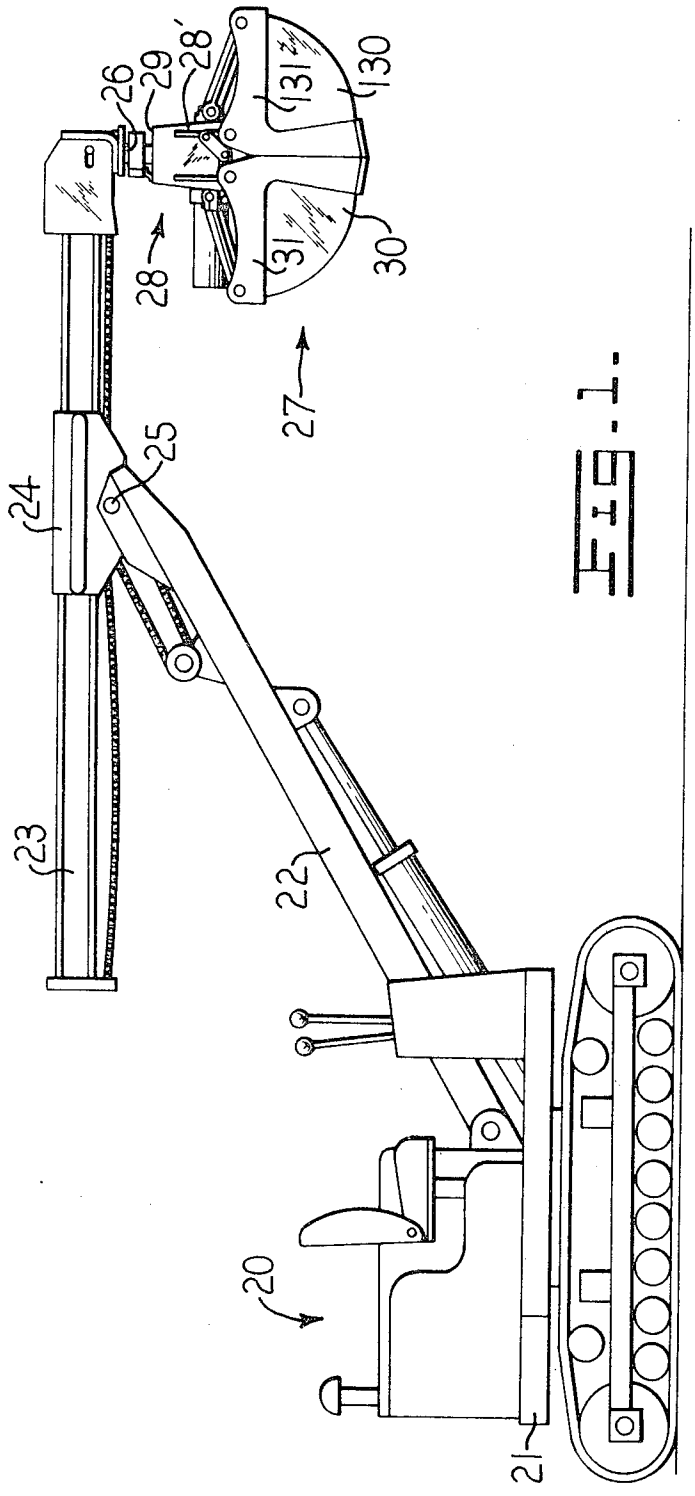


Fig. 1.

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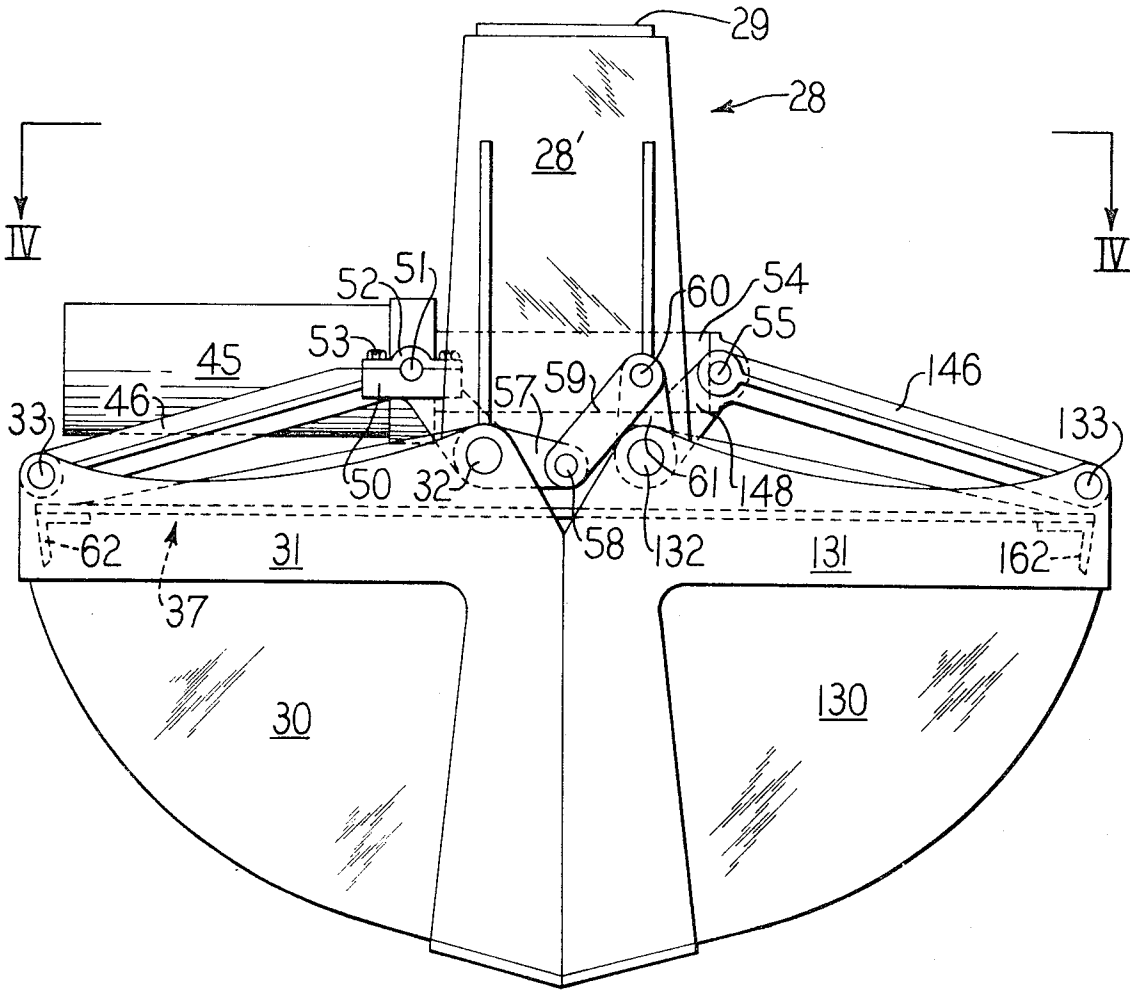


Fig. 2.

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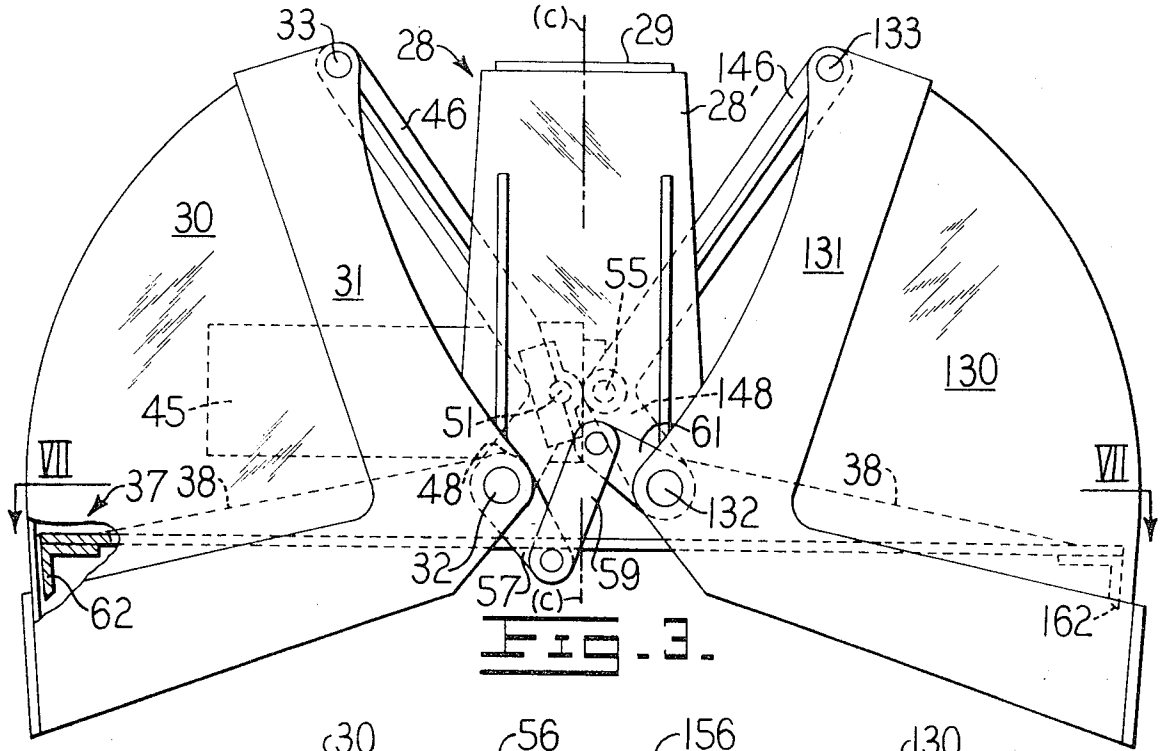


Fig. 3.

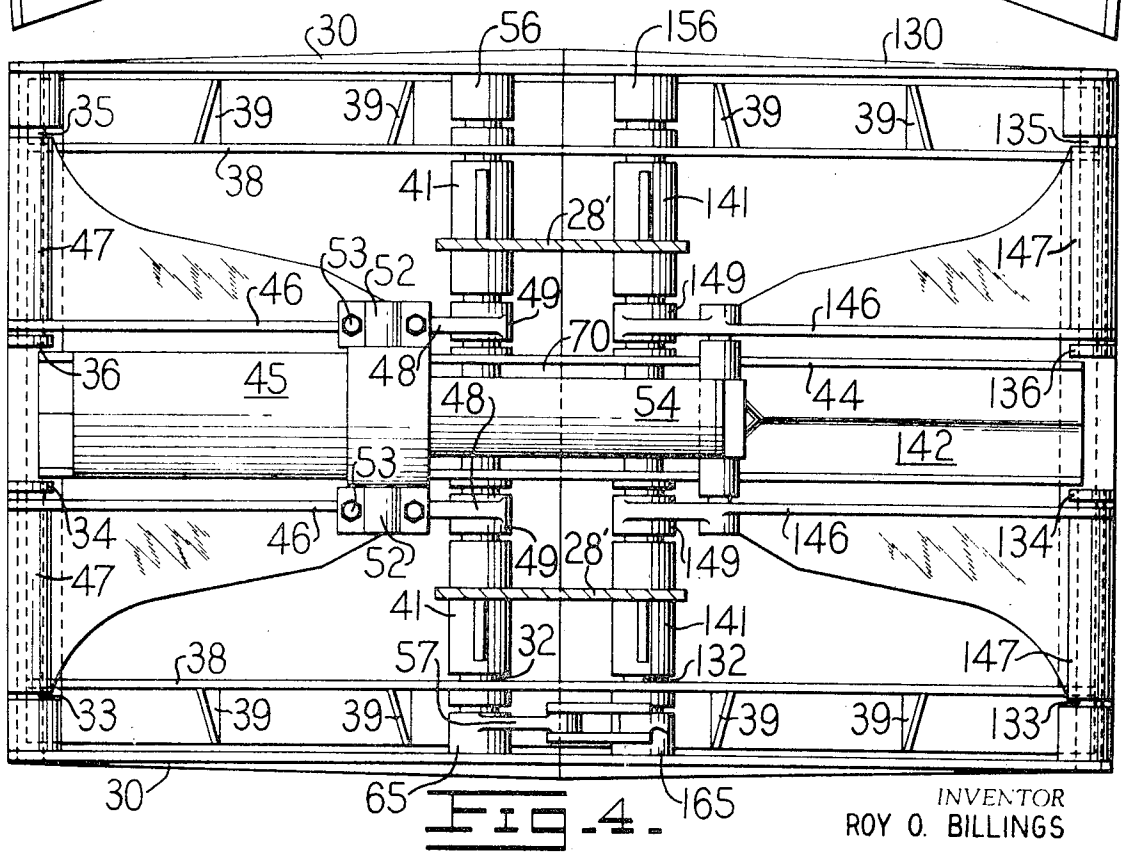


Fig. 4.

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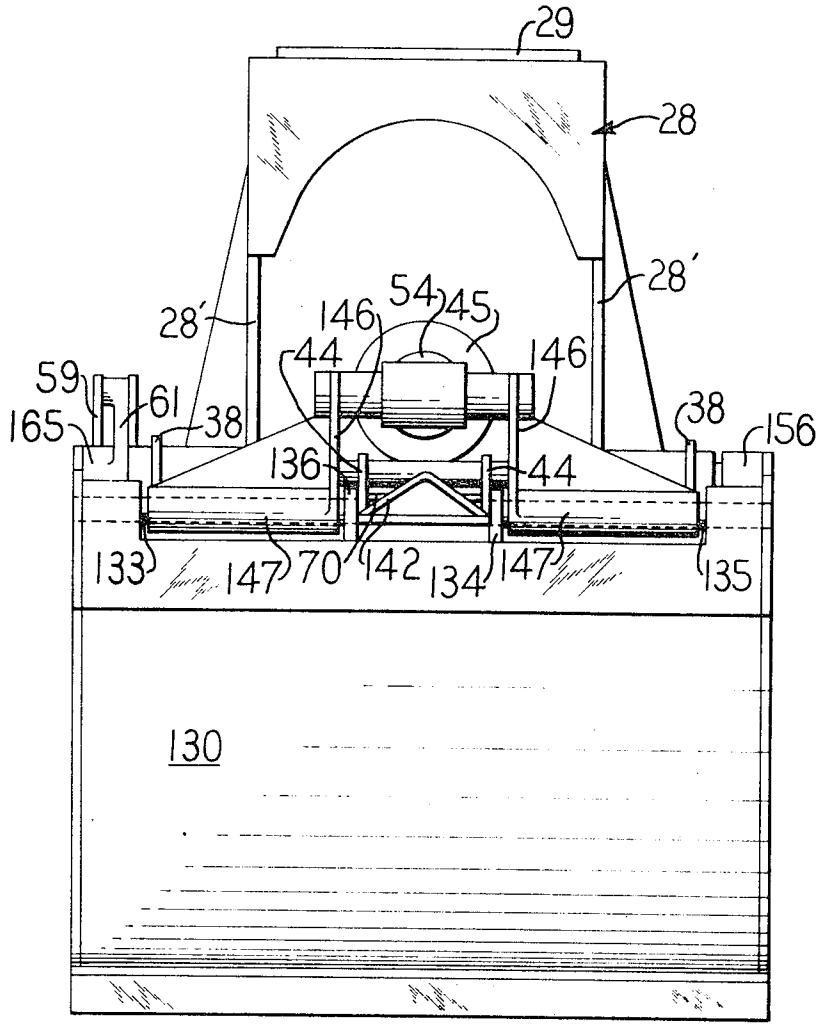


Fig. 5.

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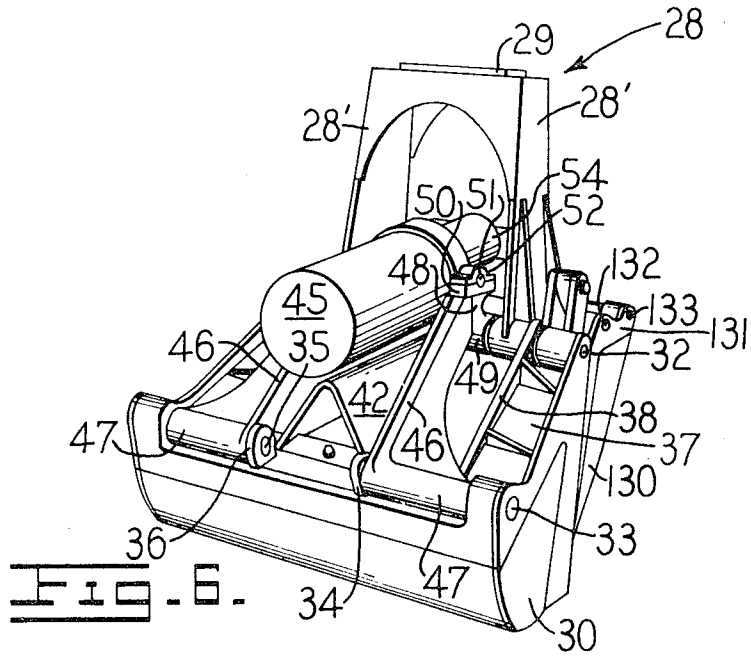


Fig. 6.

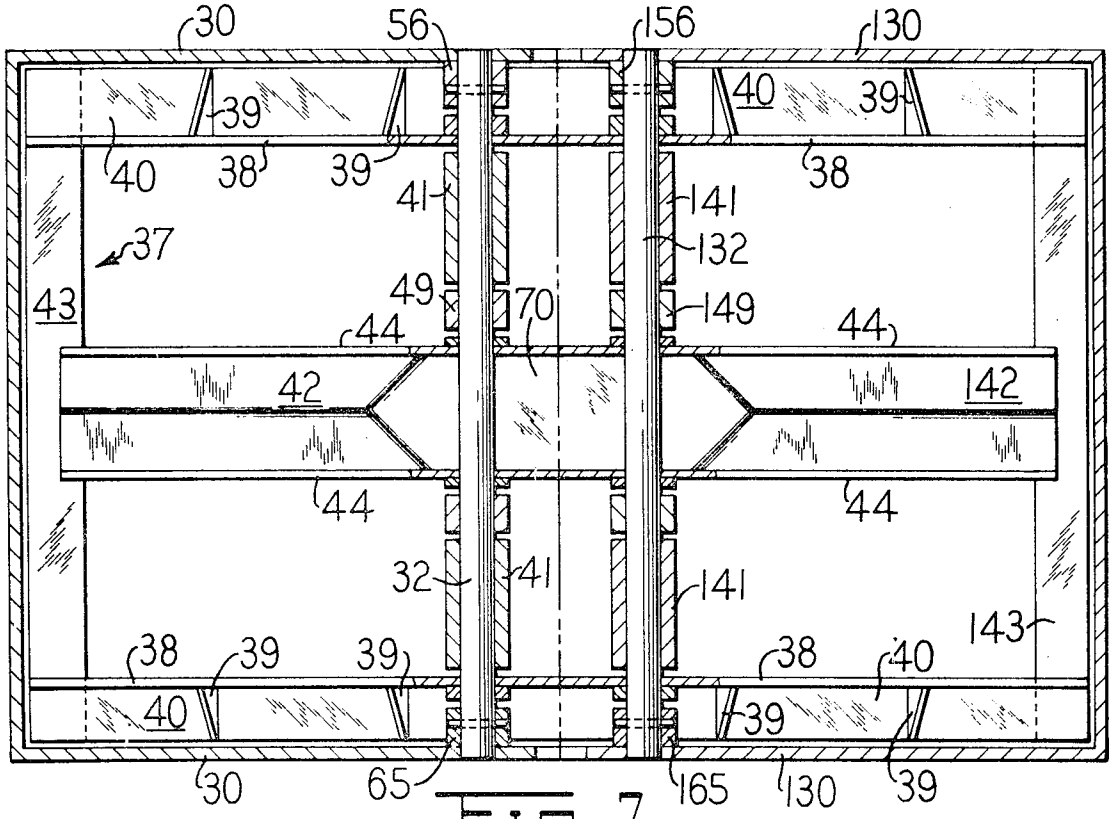


Fig. 7.

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HYDRAULICALLY ACTUATED CLAMSHELL BUCKETS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The improved clamshell bucket is adapted for use in excavating machines and is particularly useful in excavators of the type having a dipstick or the like for supporting the bucket.

2. Description of the Prior Art

Heretofore most clamshell buckets have been of the "free fall" type. That is, the buckets are so supported that they are allowed to fall onto the work and the bowls are 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. In my U.S. Pat. No. 3,143,228 a clamshell bucket is disclosed wherein there is an hydraulic cylinder for each bowl member which controls the opening and closing movement. In this prior patent one end of each hydraulic assembly is connected to a bowl member and the other end to a bucket-supporting head or deck member. With this arrangement part of the push is on the deck and the bowl closing movement loses in efficiency. Furthermore, where there are two hydraulic cylinders there is the tangling problem resulting from the necessity of having hydraulic hoses for each cylinder. Also, where there is an hydraulic cylinder for each bowl there is no assurance that the opening and closing movement of the two bowl members will be equal. Also with two cylinders there is a tendency to twist the bowls because the pressures are applied off center. The Bevan U.S. Pat. No. 2,755,946 discloses an hydraulically operated clamshell bucket wherein there is a single hydraulic cylinder assembly. However, here the cylinder is vertically disposed and it digs on the retraction of the cylinder rather than on the extension stroke, which is undesirable. Furthermore, in Bevan, with the vertical disposition of the hydraulic assembly a great deal of head room is required in operation due to the increased height of the bucket where there is a cylinder projecting vertically thereabove. Also a high bucket tends to tip when pressure is applied from above as is contemplated with the present invention.

SUMMARY OF THE INVENTION

The present invention comprises a clamshell bucket having complementary bowl sections pivotally supported from a deck having spaced depending supporting extensions. A generally horizontally disposed hydraulic cylinder is connected by trunnions near its head end through linkage which is fixed to the top of one bowl section. The piston rod for the hydraulic cylinder is pivotally connected at its outer end through linkage which is fixed to the top of the other bowl section, and there is also linkage which includes an equalizer link for insuring equal movement of the two bowl sections when the hydraulic cylinder is operated. A bucket cleaner is supported by the lower ends of the depending extensions of the deck and is arranged to automatically clean the bowl sections as they are being moved to open position.

It is a general object of the present invention to provide an improved clamshell bucket wherein both bowl sections are operated by one hydraulic cylinder, arranged generally horizontally at the top of the bucket, in a manner to provide for efficient digging action on the extension stroke of the hydraulic cylinder assembly.

A further object of the invention is to provide a clamshell bucket which is adapted to discharge its load with unusual speed.

A further object of the invention is to provide an hydraulic cylinder and ram assembly which is arranged horizontally over the clamshell bucket and which is so connected that the hydraulic cylinder moves inwardly during opening movement of the bowl sections so as not to interfere with the opening movement.

A further object of the invention is to provide an improved clamshell bucket operated by a single hydraulic cylinder having improved means for causing both bowls to open and close uniformly and in perfect timing.

A further object of the invention is to provide, in a clamshell bucket of the type described, a novel bucket cleaner supported from the depending portions of the bucket deck and so positioned as to automatically clean the bowls whenever the bowls are opened, thus aiding in the quick discharge of the load.

A further object of the invention is to provide a clamshell bucket construction wherein the hydraulic cylinder and its linkage are so arranged as to provide for a direct push on the bowls during the extension stroke, and to also provide an increased mechanical advantage when the bowls are approximately half closed, at which time extra digging power is required.

A further object of the invention is to provide a bucket which has a low outline so that it can be used in restricted locations under sidewalks or foundations or to undercut a trench, and so that pressure can be applied from above during the digging cycle without causing the bucket to tip over.

With the above and other objects in view the present invention consists of the improved hydraulically operated clamshell bucket and all of its parts and combinations, as set forth in the claims, and all equivalents thereof.

BRIEF DESCRIPTION OF THE DRAWING

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

FIG. **1** is a side elevational view of an earth working device having a dipstick which supports the improved clamshell bucket;

FIG. **2** is a side elevational view of the clamshell bucket with the bowls in closed condition;

FIG. **3** is a similar view showing the bowls in fully opened condition;

FIG. **4** is a horizontal sectional view taken approximately on the line **4—4** of FIG. **2**;

FIG. **5** is an end view of the bucket while in closed condition;

FIG. **6** is a perspective view of the closed bucket; and

FIG. **7** is a sectional view taken approximately on the line **7—7** of FIG. **3** and looking at the top of the cleaner.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring more particularly to the drawings, the numeral **20** designates the tractor portion of an earthmoving device, which device has a turntable **21** supporting a pivoted boom **22**. A dipstick **23** is adjustably slidable in a saddle **24** pivoted as at **25** on the boom. At the outer end of the dipstick is a depending shaft **26** which supports the improved clamshell bucket assembly **27**. The bucket assembly includes an inverted U-shaped supporting head **28** having a top deck **29** through which the shaft **26** extends to rotatably support the bucket assembly and having spaced, depending extensions **28'**. The shaft **26** is mounted for movement with respect to the dipstick so that the bucket may be supported in various positions with respect to the dipstick. Inasmuch as this forms no part of the present invention the particular support for the bucket assembly will not be described in detail. The deck **29** has spaced, depending extensions **29'**.

THE BOWLS

The bucket assembly includes complementary bowl sections **30** and **130** (see also FIGS. **2** and **3**). The upper portion of the bowl section **30** has a strengthened portion **31** on each side provided with sockets **56** and **65** receiving the ends of a shaft **32** near its upper inner corners. The bowl portion **31** at its outer end also receives one end of a pin **33**, the other end of said pin being supported in an upstanding bearing ear **34** (see FIG. **6**). A similar pin **35** extends inwardly from the opposite

sidewall portion 31 of the bowl 30 where its inner end is supported by a bearing ear 36.

Similarly, the bowl section 130 has strengthened portions 131 on opposite sides. Shaft 132, pins 133 and 135, and bearing ears 134 and 136, and sockets 156 and 165 correspond in function and position to the parts 32–36, inclusive, and 56 and 65 of the bowl section 30 which have heretofore been described. The bowl sections are thus pivotally supported from the head 28 at upper inner corners on the axes of the shafts 32 and 132.

THE CLEANER

The cleaning element 37 is illustrated in FIG. 7. It is generally rectangular in outline and fits within the bowl sections, as best shown by dotted lines in FIG. 2. It includes upstanding web portions 38 at the sides which are connected by braces 39 with the flat side portions 40. The shaft 32 of the bowl section 30 extends through the web sections 38, as shown in FIG. 7, and the shaft 132 of the bowl 130 also extends through the web sections 38. Bearing sleeves 41 and 141 are welded to the lower ends of the deck supports 28', as shown more clearly in FIG. 6, so that the cleaner element of FIG. 7 is supported from the deck. Intermediate the width of the cleaner element are guards 42 and 142. Each guard has its outer end supported on an end frame portion 43–143 of the cleaner element. The guards are welded between vertical webs 44 which are of decreasing height toward the ends of the bucket. Also there is a guard plate 70 between central portions of the webs and connecting the inner ends of the guards 42 and 142. The cleaner fits snugly within the sides and ends of the bowls, as shown in FIG. 7, and the bowl sections 30 and 130 are on the radius of the shafts 32 and 132 so that, when the bowls are open, they are automatically scraped by the scrapers 62–162 at the ends 43 and 143 of the cleaner, and the sides of the bowls are scraped by the sides of the cleaner.

THE HYDRAULIC OPERATING MECHANISM

In order to provide pivotal support for the hydraulic cylinder 45, the bowl section 30 has arms 46 projecting from sleeves 47, the latter being mounted on the pins 33 and 35. The inner ends of the arms have downwardly inclined extensions 48 which are welded to bearings 49 through which the shaft 32 loosely extends. At the knee portions of the arms 46–48 there is a trunnion block 50 on each side of the cylinder 45 within which trunnions 51 from the head end of the cylinder 45 are seated for oscillating movement. Caps 52 are removably bolted by cap screws 53 or the like over the trunnions 51. With this arrangement the hydraulic cylinder is mounted for easy removal for repair.

The cylinder has an extensible piston rod portion 54, the outer end of which is pivotally connected as at 55 on each side with extension arms which project upwardly from the bowl section 130. These arm portions are designated by the same numerals used for corresponding parts of the bowl section 30 except that they are preceded by the digit 1. It is to be understood that the arm portions 46–48 and 146–148 of the bowl sections are for supporting purposes and do not move relative to the bowl sections. While mounted on the pins 32 and 33–35, and 132 and 133–135, there is no pivotal action on these pins. However, this assembly provides for ready removal or replacement of parts should this be required.

One end of the shaft 32 is pinned within the socket 56 and the corresponding end of the shaft 132 is pinned within the socket 156, as shown in FIG. 7. Thus, in effect, the shaft ends are fast to the bowl. The opposite ends of the shafts 32 and 132 are likewise received in sockets 65 and 165 which are likewise pinned to the shafts. Rigidly projecting from the socket 65 is an arm 57 whose outer end is pivotally connected as at 58 to one end of an equalizer link 59. The other end of the equalizer link is pivotally connected as at 60 to the upper end of an arm 61 whose lower end is rigid on the socket portion 165 for the shaft 132.

Any suitable hydraulic cylinder and ram assembly may be employed as at 45, but it is preferred to utilize a quick-acting hydraulic cylinder of the type described in Billings U.S. Pat. No. 3,447,424 dated June 3, 1969. This cylinder is double acting and has hydraulic lines leading to a suitable source of hydraulic fluid under pressure.

OPERATION

In operation, with the bowl members in the closed position of FIG. 2, they may be opened by causing retraction movement of the piston rod 54. During such retraction movement the shafts 51 and 55 are pulled straight toward one another in a slight upward arc until they contact, as in FIG. 3, the contact being midway between the pivot shafts 32 and 132 and on the transverse centerline (c) of the bucket. During such opening movement it is to be noted that the cylinder is pulled inwardly with respect to the bottom of the bowl member 30 so as not to interfere with the opening movement of the latter. During such opening movement the ends of the cleaner, which may be equipped with scraper elements 62 and 162, follow the radius of the bowl bottoms and effectively scrape dirt from the bowl sections as the bowls move from the position of FIG. 2 to the position of FIG. 3. During such opening movement the equalizer link 59 insures that the bowl sections move uniformly with proper timing.

With the bowl open it can be lowered by the boom 22 and dipstick 23 into contact with the ground for digging. Because of the type of support on the dipstick, which forms no part of the present application, the bucket may be pressed against the ground and because of its low profile it will not tilt or tip over. Then the hydraulic circuit may be operated to cause extension of the hydraulic piston from the position of FIG. 3. This causes the bowl members to perform power digging into the dirt. Due to the particular type of linkage the greatest power is exerted when the bucket bowls are half closed. This is when the hydraulic cylinder is horizontal and the anchor arm portions 48 and 148 are more or less upright. Thus the greatest mechanical advantage is obtained when it is most needed to power the bowls into the dirt. This makes the improved clamshell bucket unusually effective at digging. With conventional clamshell buckets which are operated by cables, when the dirt is very hard the buckets tend to merely skim over the surface of the dirt. During the digging operation the equalizer link 59 provides perfect timing and insures that both bowl sections move uniformly. Thus, if one bowl section hits an obstruction, there will be no change in timing between the bowl sections as would occur if there were independently operated bowl sections. The inverted V-shaped guard 42 is below the hydraulic cylinder 45 to protect the latter from dirt or the like. This guard together with the guard 142 and the guard plate 70, the latter extending between the two guards 42 and 142, are important because they protect the piston rod 54 from dirt while it is operating, it being noted that the guard plate 70 is below the piston rod and it, together with the inner end of the inverted V-shaped guard 42, prevent dirt from contacting the portion of the piston rod which is entering the cylinder 45 at the head end of the latter.

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. A clamshell bucket comprising a supporting head, complementary bowl sections each having side cutting lips with upper ends, which lips meet along a generally upright line intermediate the length of the bucket when it is closed, said upper ends of the lips being pivotally supported from said head on spaced transverse pivot axes for opening and closing movement of the bucket, and each bowl section having an upper outer edge spaced laterally outwardly from and generally parallel to said pivot axes, only a single fluid-pressure-operated cylinder disposed over one of the bowl sections and pivotally connected at one end to one of said sections at a

location intermediate the length of the bucket and between the pivot axis of said bowl section with the head and the upper outer edge of said bowl section and closer to said pivot axis than to said outer edge, and a piston rod projecting from the pivoted end of said cylinder and pivotally connected to the other bowl section between the pivot axis of said other bowl section with the head and the upper outer edge of said other bowl section and closer to said last-mentioned pivot axis than to said outer edge, said cylinder being within one of the bowl sections when the bucket is open.

2. A clamshell bucket as claimed in claim 1 in which the end of the cylinder which is opposite its pivoted end is free and projects over and in a general direction toward the upper outer edge of the adjacent bowl section when the bucket is closed.

3. A clamshell bucket as claimed in claim 1 in which there is equalizer means interconnecting the bowl sections for insuring uniform motion during operation, which means includes: an arm projecting from one bowl section to a location intermediate the pivot axes for the two bowl sections, an arm projecting upwardly from the other bowl section, and an obliquely extending equalizer link pivotally connecting said arms.

4. A clamshell bucket as claimed in claim 3 in which the arms project from the pivot axes between the bowl sections and the head.

5. A clamshell bucket as claimed in claim 1 in which there is guard means supported from the head at the top of the bucket when the latter is closed, which guard means is intermediate the width of the bucket and below the piston rod and cylinder, said guard means extending from adjacent the upper outer edge of one bowl section when the bucket is closed to a position adjacent the upper outer edge of the other bowl section and being within the confines of the bucket when the latter is open in a position just below the cylinder to protect it and the piston rod.

6. A clamshell bucket as claimed in claim 5 in which said guard means extends axially of the piston rod, and has a portion which is inverted V-shape in cross section.

7. A clamshell bucket as claimed in claim 1 in which the pivotal supports between the bowl sections and the head include spaced parallel transverse shafts at the upper ends of the cutting lips of the bowl sections, which are nonrotatably associated with the sections, in which there is an arm rigidly connected at its inner end to and projecting from the shaft of one bowl section and having an end located intermediate the spaced parallel transverse shafts, an arm rigidly connected at its inner end and projecting from the shaft of the other bowl section, and an equalizer link pivotally connecting the outer end of said last arm with the end of said first-mentioned arm at said location between said transverse shafts.

8. A clamshell bucket comprising a supporting head, complementary bowl sections pivotally supported by said head for opening and closing movement, means consisting of a single fluid-pressure-operated cylinder having an extensible piston rod for operating said bowl sections, with said cylinder extending longitudinally of the bucket over the top thereof and intermediate its width when the bucket is closed, and cleaning means comprising an open rectangular frame having end portions positioned to scrape the bottoms of the bowl sections, and having side portions positioned to scrape the sides of the bowl sections, the bottoms of the bowl sections being described by radii of the pivots for the bowl sections, guard means intermediate the width of the cleaner frame, said guard means being supported intermediate its length by the head and having ends which are supported by end portions of the cleaner frame, said fluid pressure operated cylinder being within one of the bowl sections when the bucket is open, with the guard means positioned below the fluid-pressure-operated cylinder and its piston rod to protect the latter from dirt.

* * * * *