Aug. 21, 1945. R. O. BILLINGS 2,382,955

EXCAVATING BUCKET

Filed May 20, 1943

Fig. 1.

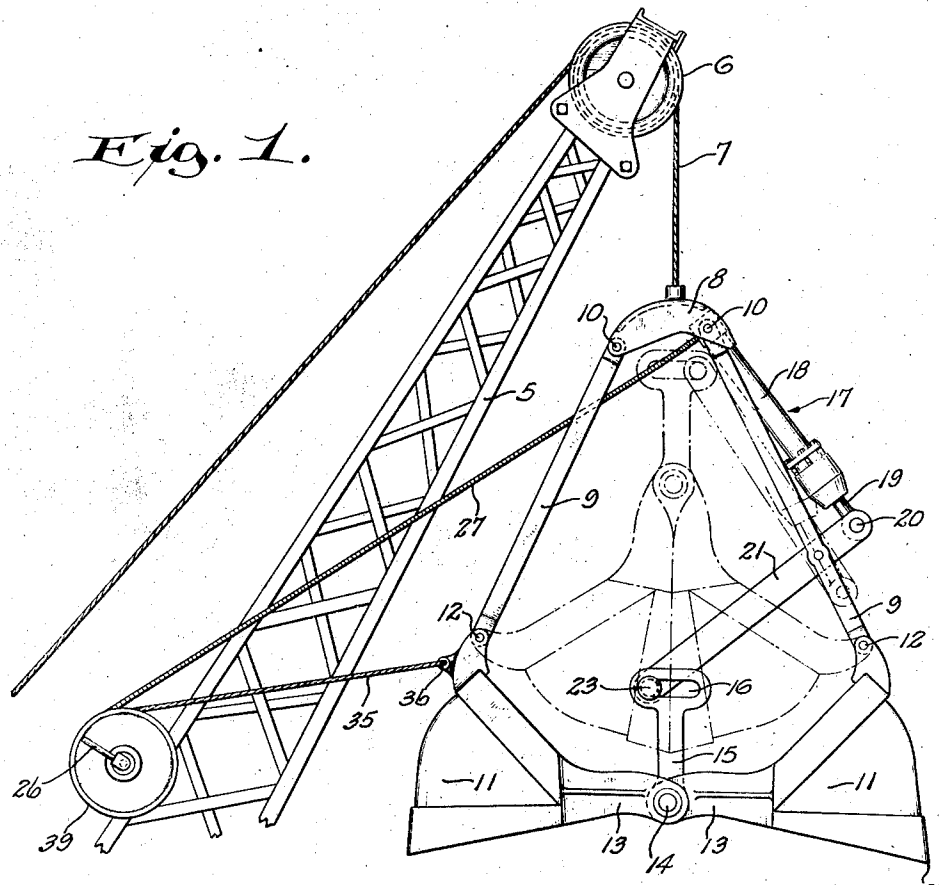


Fig. 3.

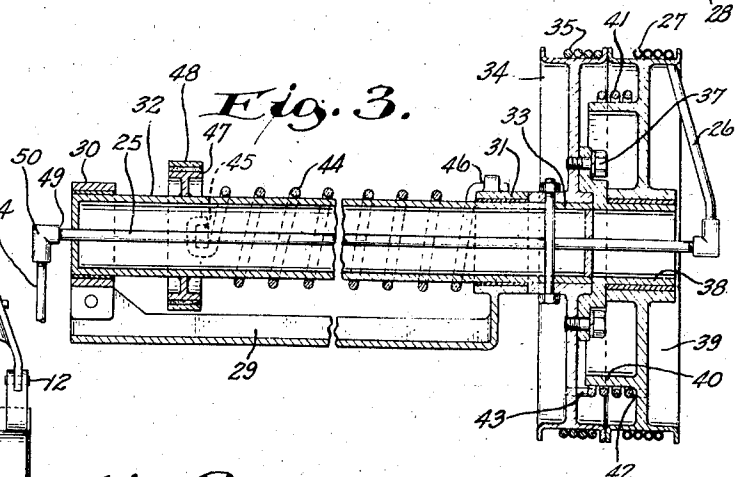
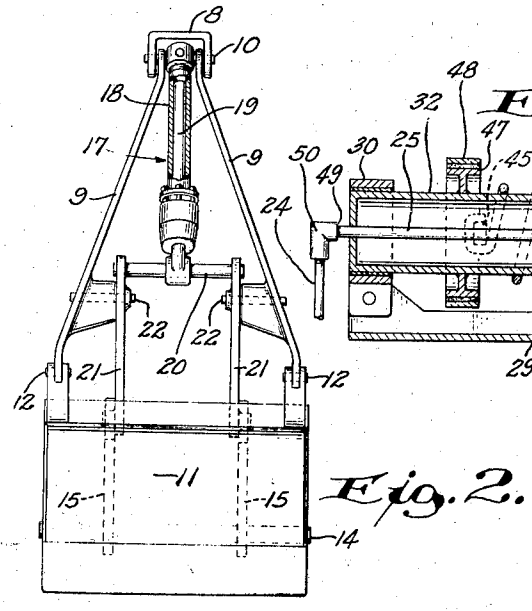


Fig. 2.



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EXCAVATING BUCKET

Roy O. Billings, Milwaukee, Wis.

Application May 20, 1943, Serial No. 487,709

8 Claims. (Cl. 37—184)

This invention relates to improvements in excavating buckets and is particularly adapted for use in connection with buckets of the clamshell type.

Clamshell buckets are commonly supported by a cable which extends over a sheave on the outer end of a boom. This cable controls the raising and lowering of the bucket. The usual type of clamshell bucket is also equipped with a second cable which controls the opening and closing of the bucket bottom. During the latter operation there is necessarily an upward pull exerted on the entire bucket which tends to raise the bucket out of proper engagement with the ground or other material to be lifted. This is obviously undesirable.

It is a general object of the present invention to obviate the abovementioned objectionable feature by providing improved means for operating the bucket bottom.

A more specific object of the invention is to provide a bucket wherein the opening and closing of the bottom is controlled by an hydraulic ram built on the bucket. The ram is preferably so arranged that the piston rod is hydraulically moved in a downward direction to cause closing of the bucket bottom.

A further object of the invention is to provide a construction in which the opening and closing of the bucket bottom is more positive than with the cable controlled methods now utilized.

A further object of the invention is to provide a clamshell bucket construction wherein the hydraulic fluid for operating the ram is conducted to the ram cylinder by means of a flexible conduit leading from the boom or other location, and wherein novel reel mechanism is utilized for paying out and taking in the flexible conduit as required.

A more specific object of the invention is to provide a construction, as above described, wherein the conduit reel may be embodied in the construction of a tagline reel so that both the flexible conduit and tagline are payed out and reeled in uniformly.

A further object of the invention is to provide in a construction, as above outlined, a two-part reel, one part accommodating the tagline, and the other accommodating the flexible conduit. The two reel parts normally rotate as a unit, but novel mechanism is included whereby one reel part may rotate somewhat relative to the other to compensate for any differences in the effective external diameters as the elongated members are wound on the reel.

A further object of the invention is to provide an improved clamshell bucket construction including an hydraulic ram wherein a novel lever arrangement is utilized for controlling the opening and closing of the bucket bottom in response to operation of the ram.

With the above and other objects in view the invention consists of the improvements in excavating buckets and all its parts and combinations as set forth in the claims and all equivalents thereof.

In the accompanying drawing illustrating one complete embodiment of the preferred form of the invention, in which the same reference numerals designate the same parts in all of the views:

Fig. 1 is a side elevational view of the bucket construction, only the upper portion of the supporting boom being illustrated. The full lines illustrate the bucket bottom in open position and the dot and dash lines indicate the position of the parts when the bucket bottom is closed;

Fig. 2 is an end view of the bucket alone in open position, part of the ram cylinder being broken away and shown in section; and

Fig. 3 is a longitudinal sectional view of the reel mechanism, part being broken away.

Referring more particularly to the drawing, the numeral 5 designates a boom having an outer end sheave 6 over which the cable 7 is guided. The boom may be part of an excavating machine, or any suitable device. The construction is particularly well adapted for use in conjunction with truck cranes of the type disclosed in my pending application, Serial No. 457,052, filed September 2, 1942, wherein there is hydraulic operating mechanism.

The bucket proper includes a supporting head piece 8 which is suspended from the lower end of the cable 7. Arms 9 are pivotally connected at their upper ends to the head piece as at 10 and at their lower ends are pivotally connected to the bucket bottom members 11 as at 12. The bucket bottom members 11 are each substantially U-shaped as is customary and have hinge portions 13 which are hingedly connected to each other by means of a hinge pin 14. Arms 15 have their lower ends pivoted on the hinge pin 14 and have their upper ends horizontally slotted as at 16.

An hydraulic ram 17 has its cylinder portion 18 pivotally connected to the head piece 8. The ram includes a piston rod 19 which has its outer end pivotally connected to a rod 20. The rod 20 connects the ends of a pair of levers 21. These

levers are pivoted to the arms 9 as at 22 and have their inner ends formed with projecting pins 23 which co-act with the slots 16 of the arms 15. The ram 17 is preferably constructed as illustrated in my pending application, Serial No. 450,974, filed July 15, 1942.

Referring now to Fig. 3, hydraulic fluid, under pressure, is forced through the pipe 24 by a gear pump or other source of hydraulic pressure on the frame of the truck or excavator. The hydraulic fluid passes through the pipe 24, through pipes 25 and 26, and through the flexible conduit 27. The flexible conduit connects with the upper end of the cylinder 18 so that fluid, under pressure, causes downward movement of the piston rod 19. The latter actuates the levers 21 and arms 15 to cause movement of the parts from the full line position of Fig. 1 to the dot and dash line position therein.

During such closing movement of the bucket bottom the pressure exerted by the piston rod 19 is in a downward direction. Where a cable is employed for closing the bottom of a clamshell bucket, as is the usual practice, there is necessarily an upward pull on the cable when the bucket bottom is being closed. This tends to undesirably lift the bucket out of proper engagement with the ground.

When it is desired to open the bucket, a suitable valve is manipulated to shut off the source of hydraulic fluid pressure on the ram 27, and to permit the return of fluid into the reservoir of the hydraulic system. The weight of the bucket bottom together with the weight of the load in the bucket will cause opening of the bucket to the full line position of Fig. 1, and return of the piston rod 19 to its full line position.

In order to prevent interference from the flexible conduit during use of the structure, it is highly desirable to keep the flexible conduit in a condition without undue slack. Accordingly a reel is preferably employed on the boom or in any other suitable location on the truck. It is a feature of the present invention to combine the reel for the flexible conduit with a tagline reel so that the tagline and flexible conduit are payed out and retrieved uniformly.

The reel, which it is preferred to utilize, includes a supporting bracket 29 which may be anchored to extend transversely of the boom. One end of the bracket 29 is formed with a bearing 30 and the other end with a bearing 31. Rotatable in said bearings is a tubular shaft 32, and one end of the shaft projects beyond the bearing 31 as at 33. Rigidly supported on the projecting end is a tagline reel part 34 on which a tagline 35 is windable. The tagline connects with the bucket as at 36. Taglines are commonly employed for preventing swinging action of the buckets and twisting of the load line cable 7.

Rigidly connected to the outer face of the reel part 34 by bolts 37 is a tubular projection 38 on which a conduit reel part 39 is rotatably mounted. The inner face of the reel part 39 has a circular flange 40 projecting therefrom for supporting a coil spring 41. This spring has one end anchored to the reel part 39 as at 42 and has its other end anchored to the reel part 34 as at 43. The spring is of such strength that the two reel parts normally rotate as a unit. However, should there be any difference in the diameter of the flexible conduit 27 with respect to the diameter of the tagline cable 35, or should one or the other of the wrappings tend to build up on the reel so that the effective external diameters of the reel parts are slightly different, then the spring 41 will permit a relative rotation of one reel part with respect to the other by way of compensation.

A coil spring 44 surrounding the tubular shaft 32 has one end anchored to the shaft as at 45 and has its other end anchored to the bearing 31 as at 46. As the reels unwind to pay out the tagline and the flexible conduit, the spring 44 is wound up. Thus, when the bucket is again raised, the spring 44 will act to automatically wind the reels in a return direction to retrieve the tagline and flexible conduit.

The reel mechanism may also be equipped with a brake drum 47 which is cooperable with a brake band 48. This arrangement is fully described in my Patent No. 2,283,784. The turning movement of the shaft 32 as the tagline is being payed out tends to automatically cause the brake band 48 to exert a drag on the shaft 32 so as to prevent slack in the tagline. When the reel is being rotated in a reverse direction, the brake band automatically unwraps to lessen the drag on the shaft 32.

The pipe 25 for conducting hydraulic fluid to and from the ram 17 extends axially through the tubular reel shaft 32. One end of the pipe 25 may have a swivel connection 49 with an L-fitting 50 connecting with the lead-in pipe 24. The pipe 25, therefore, as well as the pipe section 26 may rotate with the reel.

In use of the device, as the load line 7 is lowered to allow the bucket to contact the ground or other material, the flexible conduit 27 and tagline 35 upwind from the reel parts 39 and 34. During such unwinding the spring 44, together with the brake band 48, prevent undesired slack in either line. When the bucket engages the ground or other material, then hydraulic fluid, under pressure, is caused to flow through the pipes 24, 25, 26 and flexible conduit 27 to the cylinder 18 for the ram. This causes extension of the piston rod 19 from the full line position of Fig. 1 to the dot and dash line position therein. At the same time the levers 21 swing, as indicated, to cause forcible closing of the bucket bottom members 11. During such movement of the levers 21 the slot 16 permits transverse movement of the pins 23.

After the bucket has been loaded and closed, the load line may be raised and the boom 5 may be swung to a desired position for discharge. During the raising of the bucket, the flexible cable 27 and tagline 35 are effectively retrieved by the reel. By relieving the hydraulic pressure in the line 27 the bucket will open due to the action of gravity influenced by the weight of the bucket bottom and the weight of the load. At the same time the piston rod 19 and levers 21 will be returned to the full line position of Fig. 1.

It is obvious that the broader aspects of the invention are applicable to buckets of various types and that the mechanism for retrieving the flexible conduit 27 may be different from that illustrated. There is, however, a cooperative relationship between the tagline, flexible conduit and reels therefor which increases the efficiency of operation of the ram equipped bucket.

Various changes and modifications may be made without departing from the spirit of the invention and all of such changes are contemplated as may come within the scope of the claims.

What I claim is:

1. In a clamshell bucket having a frame portion and having a pair of hingedly connected bottom grapple members pivotally suspended from said

frame, an hydraulic ram having its cylinder pivotally connected to said frame portion, a downwardly extensible piston rod co-acting with said cylinder, lever means pivoted intermediate its length to said frame portion and having one end pivotally connected to the outer end of said piston rod, and means for connecting the other end of said lever means to said bottom grapple members to cause closing of the latter when the piston rod is extended.

2. In a clamshell bucket having a frame portion and having a pair of hingedly connected bottom grapple members pivotally suspended from said frame, an hydraulic ram having its cylinder pivotally connected to said frame portion, a downwardly extensible piston rod co-acting with said cylinder, lever means pivoted intermediate its length to said frame portion and having one end pivotally connected to the outer end of said piston rod, and arms extending upwardly from the hinged connection of the bottom grapple members, said arms having their upper ends pivotally connected to the inner end of said lever means.

3. In a clamshell bucket having a frame portion and having a pair of hingedly connected bottom grapple members pivotally suspended from said frame, an hydraulic ram having its cylinder pivotally connected to said frame portion, a downwardly extensible piston rod co-acting with said cylinder, lever means pivoted intermediate its length to said frame portion and having one end pivotally connected to the outer end of said piston rod, and arms extending upwardly from the hinged connection of the bottom grapple members, said arms having their upper ends slotted and pivotally connected in said slots to the inner end of said lever means.

4. In a crane structure, a boom, a load line suspended from said boom, a bucket having a bottom adapted to be opened and closed during use suspended from the boom by said load line, an hydraulic ram supported on the bucket for operating said bottom, a flexible conduit for conducting hydraulic fluid to the ram, a tagline connected to the bucket, a two-part reel on the crane structure for paying out tagline and flexible conduit as required by the position of the bucket, spring means connecting the two parts of the reel, said spring means being positioned to normally cause the two reel parts to rotate as a unit but permitting rotation of one reel part with respect to the other against the tension of said spring means, and means for conducting hydraulic fluid to the flexible conduit on one of said reel parts.

5. In a clamshell bucket having a frame and having a pair of hingedly connected bottom grapple members pivotally suspended from said frame, an hydraulic ram having its cylinder pivotally connected to said frame portion, an extensible piston rod co-acting with said cylinder, lever means pivoted intermediate its length to said frame portion and having one end pivotally connected to the outer end of said piston rod, and means for connecting the other end of said lever means to said bottom grapple members to cause movement of the latter when the piston rod is extended.

6. In a clamshell bucket having a frame and having a pair of hingedly connected bottom grapple members pivotally suspended from said frame, an hydraulic ram having its cylinder pivotally connected to said frame portion, an extensible piston rod co-acting with said cylinder, lever means pivoted intermediate its length to said frame portion and having one end pivotally connected to the outer end of said piston rod, and arms extending upwardly from the hinged connection of the bottom grapple members, said arms having their upper ends pivotally connected to the inner end of said lever means.

7. In a clamshell bucket having a frame and having a pair of hingedly connected bottom grapple members pivotally suspended from said frame, an hydraulic ram having its cylinder pivotally connected to said frame portion, an extensible piston rod co-acting with said cylinder, lever means pivoted intermediate its length to said frame portion and having one end pivotally connected to the outer end of said piston rod, and arms extending upwardly from the hinged connection of the bottom grapple members, said arms having their upper ends slotted and pivotally connected in said slots to the inner end of said lever means.

8. In a crane structure, a boom, a load line suspended from said boom, a bucket having a bottom adapted to be opened and closed during use suspended from the boom by said load line, an hydraulic ram supported on the bucket for operating said bottom, a flexible conduit for conducting hydraulic fluid to the ram, a tagline connected to the bucket, a two-part reel on the crane structure for paying out tagline and flexible conduit as required by the position of the bucket, means normally causing the two reel parts to rotate as a unit and constructed to permit rotation of one reel part with respect to the other when necessary to compensate for differences in the effective external diameters of the two reel parts, and means for conducting hydraulic fluid to the flexible conduit on one of said reel parts.

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