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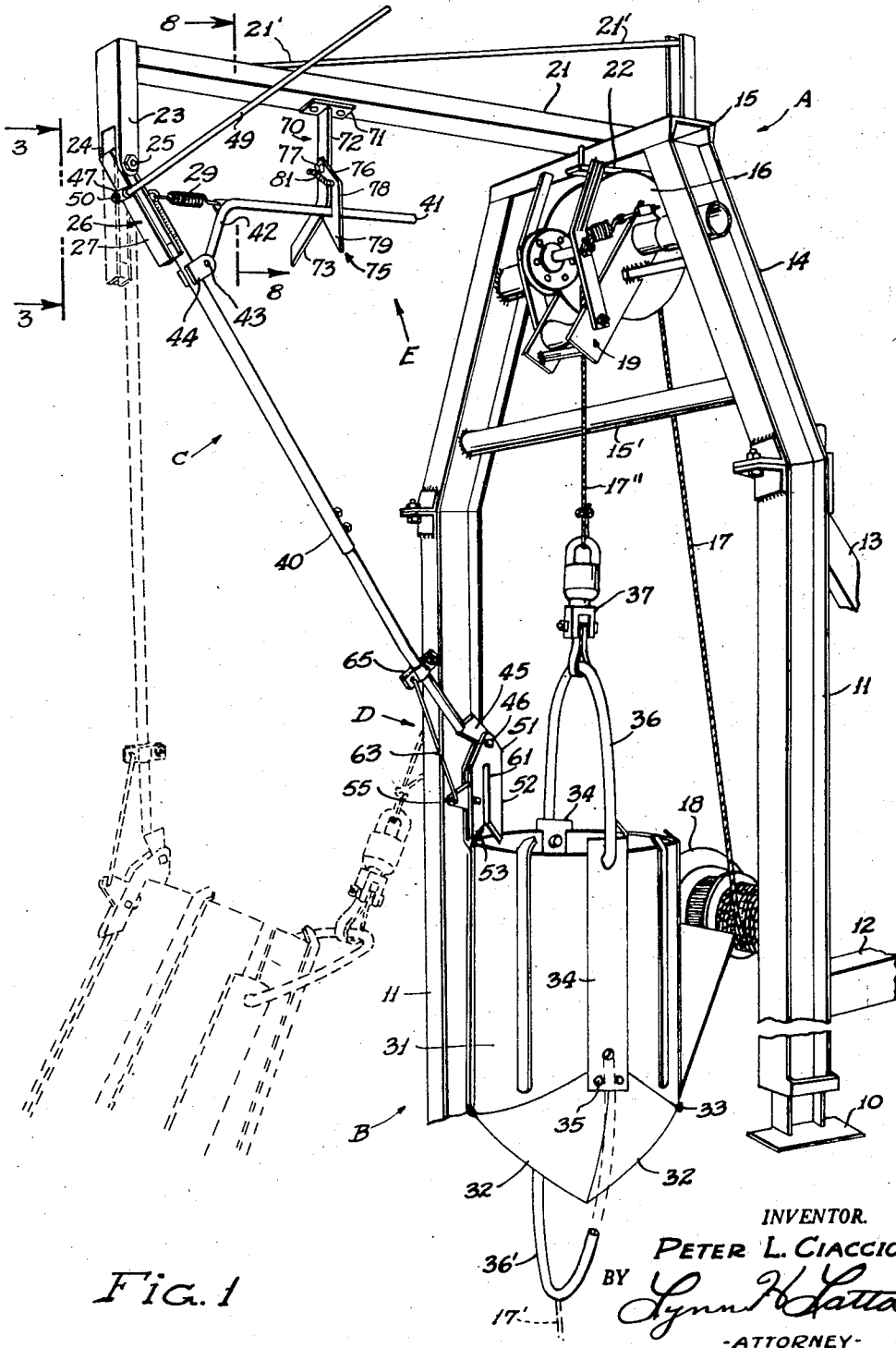
P. L. CIACCIO

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DRAG BUCKET DUMPING APPARATUS

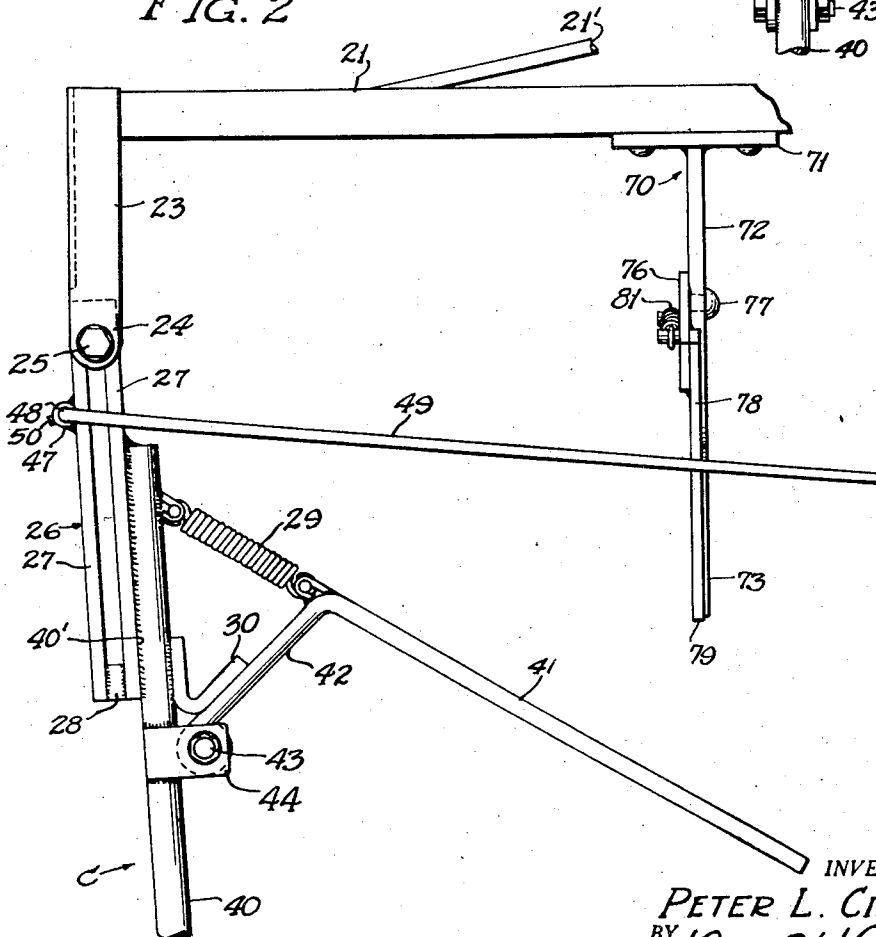
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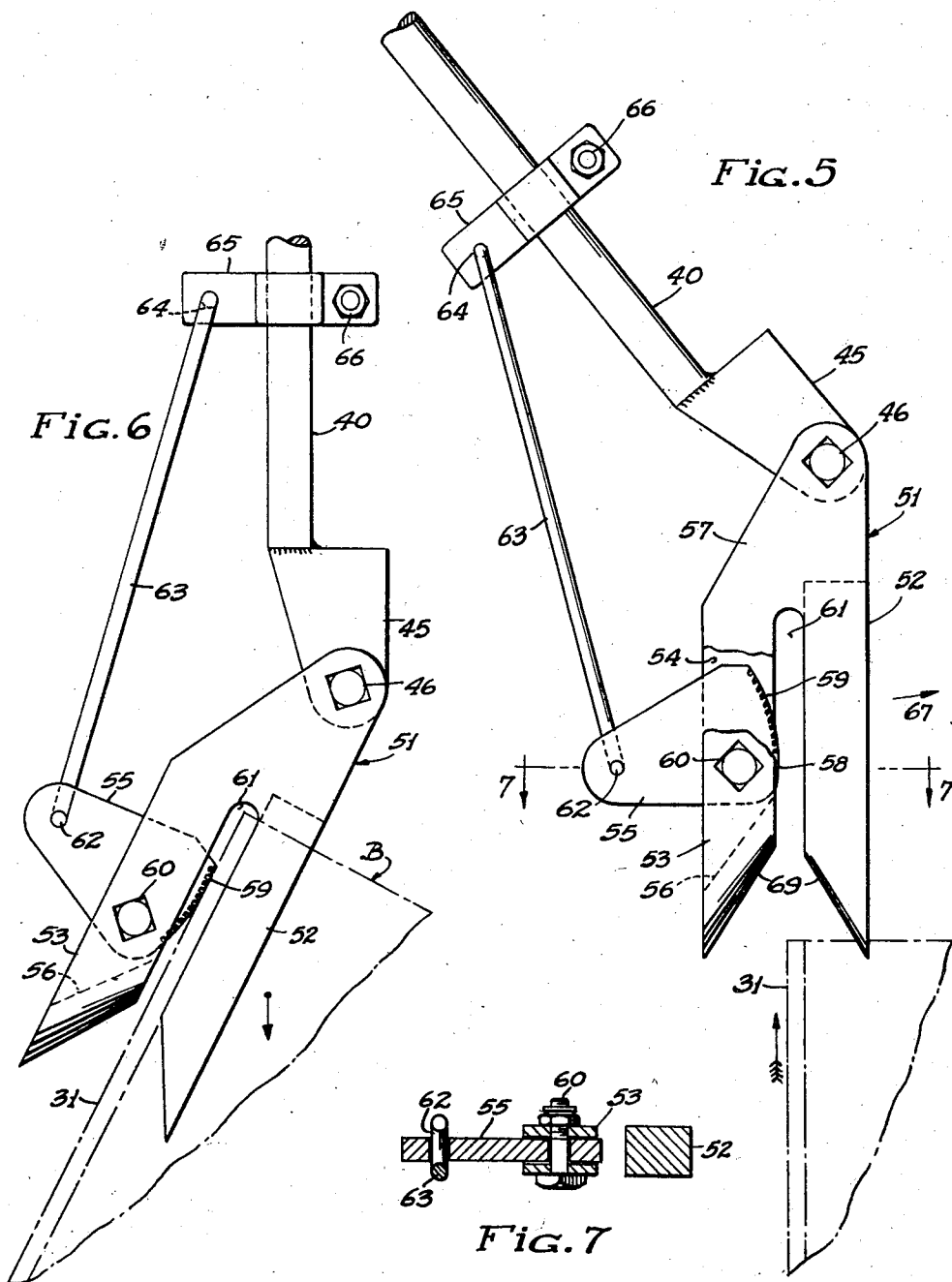
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DRAG BUCKET DUMPING APPARATUS

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4 Sheets-Sheet 3



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DRAG BUCKET DUMPING APPARATUS

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Application April 1, 1957, Serial No. 649,811

7 Claims. (Cl. 214—712)

This application is in part a continuation of my prior application S. N. 565,562, filed February 15, 1956, for Drag Bucket Dumping Apparatus.

This invention relates to sewer cleaning machines of the drag bucket type wherein portable derricks are set adjacent consecutive manholes in a sewer line to be leaned, and wherein a drag bucket is introduced into the sewer line through one of the manholes, is advanced into and then drawn back through the section of the sewer line between the manholes with a dredging action, and is then hoisted through the manhole; swung to one side and dumped. The general object of the invention is to provide in such an apparatus, a hoist having improved mechanism for effecting the lateral shifting and dumping of the bucket.

In a drag bucket apparatus now in common use, the derrick is provided with an unloading swing boom to which the loaded bucket is hitched as it is elevated from the manhole, and which is then swung horizontally about a vertical axis to convey the bucket to position from which it can be dumped. Manual effort is required for swinging the loaded boom and for dumping the bucket at the end of its swing.

A primary object of the present invention is to substantially eliminate the need for such manual effort and to attain the horizontal swinging action and dumping in a semi-automatic operation.

An important further object is to enable the execution of the entire bucket unloading operation much more rapidly than has hitherto been possible, thereby substantially increasing the daily work output of the apparatus.

Another object, a contributing factor to the attainment of the more rapid operation referred to above, is to provide a mechanism which will guide the movements of the bucket in the swinging and dumping operations, largely eliminating the necessity for hand guiding, and correspondingly speeding up such operations.

An important feature of the invention is the provision of a boom which swings in a vertical plane on a horizontal axis, starting at an elevated position above the manhole where it grasps the bucket as the latter is shifted horizontally from the manhole.

The dumping of a drag bucket is effected by spreading the clam-shell lips which, when held together, constitute the bottom of the bucket. The lips are controlled by linkage which is hooked to the drag cable and constitutes the draft connection between the cable and bucket. Thus the lips are held closed by cable tension applied through the linkage, and open by gravity (under the weight of the contents of the bucket) when the cable tension is relaxed. This is a feature of existing drag buckets, but in the apparatus embodying such buckets, it has always required the exercise of some skill and the coordinated efforts of two men to swing the bucket carrying boom laterally to the dumping position while maintaining just sufficient tension on the cable to maintain the bucket lips closed without retarding the swinging operation. One of the objects of the present invention is to eliminate the need

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for such coordinated effort and skill and to utilize the restraining pull of the cable to control the horizontal swinging operation while automatically maintaining sufficient tension to hold the bucket lips closed until the dumping position is reached.

Another object is to provide means for automatically clamping the bucket to the end of the swinging boom as an incident of hoisting the bucket above the man hole. Accessory to this object, the invention provides means for holding the boom in an elevated position above the man hole, and provides at the swinging end of the boom, a grapple which, in such elevated position of the boom, is positioned to automatically receive the edge of the bucket as it is elevated.

Further objects of the invention will become apparent in the ensuing specification and appended drawings, wherein:

Fig. 1 is a perspective view of an unloading hoist mechanism embodying the invention;

Fig. 2 is a fragmentary detail side view of the boom control mechanism;

Fig. 3 is a front elevational view of the same;

Fig. 4 is a detail sectional view of the boom suspending pivot;

Fig. 5 is a detail side view of the grapple unit in the position thereof in which it receives the upwardly moving bucket, a portion of the grapple clevis being broken away to illustrate the jaw;

Fig. 6 is a side view of the grapple unit in the dumping position;

Fig. 7 is a transverse sectional view of the grapple unit taken on the line 7—7 of Fig. 5.

Fig. 8 is a transverse sectional view of the latch unit taken on the line 8—8 of Fig. 1, and

Fig. 9 shows a modified form of the latch.

Referring now to the drawings in detail, I have shown therein, as an example of one form in which the invention may be embodied, a drag bucket hoist embodying a derrick (indicated generally by the reference character A) having suitable mobile carriage mechanism (not shown) for transporting the same to the job site and having suitable adjustable supporting legs 10 for firmly supporting the derrick on the paved surface adjacent the manhole; including a drag bucket B which, in its position shown in Fig. 1 and with the derrick properly supported as above stated, is centered directly over the manhole; including a swinging boom C for swinging the bucket B horizontally to a dumping position at one side of the manhole, such position being indicated in dotted lines in Fig. 1; a grapple unit D for grasping the bucket as it is hoisted out of the manhole and supporting the bucket at the end of the boom C as the latter swings horizontally; and boom latching mechanism E which operates, in response to certain movements of boom C to control other movements thereof, in a semi-automatic manner which will be more fully explained hereinafter. At this time it may be briefly noted that mechanism E latches the boom C in its bucket coupling position shown in full lines and subsequently releases it for downward and lateral swinging movement in response to upward movement imparted to the boom by bucket B.

A. DERRICK MECHANISM

The derrick A includes the adjustable supporting legs 10, a pair of uprights 11 which are rigidly secured to horizontal chassis members 12 of the mobile supporting carriage and may be braced thereto by diagonal braces 13; a crown arch unit 14 secured to the upper ends of uprights 11 and including a crown beam 15 and a transverse brace bar 15'; an overhead roller 16 over which there is trained a drag cable 17 coming from a windlass apparatus including a free spooling cable drum 18 and

thence extending downwardly at 17" to the drag bucket B; and a back lash pulley assembly 19, all of a conventional construction and arrangement as utilized, for example, in the power bucket machines illustrated in the catalog of Flexible Sewer-Rod Equipment Co., of Los Angeles, California.

In the present invention, there is added to the derrick A a crane arm 21 secured, as by a clamp 22, to crown beam 15, and braced by a truss 21'. Secured to its outer end is a depending bracket 23 which has a bifurcated lower end 24 (Fig. 4) in which is mounted a pivot bolt 25. An elongated clevis 26, comprising a pair of bars 27 joined in spaced relation by end blocks 28 (Figs. 2 and 4), 28', has its upper end received in the bifurcated lower end 24 of bracket 23 and is pivotally suspended upon the pivot bolt 25 which extends through the slot defined between bars 27.

It will now be apparent that arm 21, slide bracket 23 and pivot 25 provide a vertically adjustable pivotal support for the upper end of boom C at a position in front of and spaced horizontally from the plane of derrick supports 11, such that the boom C may normally assume a position inclined downwardly and horizontally toward such supports to clasp the bucket B as it is hoisted out of the manhole. When released for free swinging movement, boom C will swing by gravity under the weight of the loaded bucket, to the dumping position in which it extends vertically downwardly as indicated in the dotted lines. Thus the lateral swinging of the boom supported bucket to its dumping position is energized by the weight of the bucket and requires no manual effort.

B. THE DRAG BUCKET

The drag bucket B is of conventional construction, embodying a cylindrical tubular body 31, a pair of clam shell type lips 32 hinged at 33 to diametrically opposite sides thereof, and a pair of operator slides 34, each having a longitudinal slidable connection with bucket body 31, each having at its lower end a pair of pivotal connections 35 to adjacent lateral corners of respective lips 32, and each having at its upper end an aperture into which is pivotally hooked the respective ends of a supporting bail 36, and at its lower end an aperture into which is pivotally hooked a lower bail 36', connected to a cable section 17'. The terminal portions of the cable sections 17 and 17' may be attached to bails 36, 36' by suitable connectors 37.

The above described bucket construction is in itself conventional, but is combined with other features of the present invention to provide the semi-automatic operation which will be described more in detail hereinafter. It may be noted that in the operation of the bucket, the swinging of the bucket from above the manhole to its dumping position may be controlled by playing out the cable 17 while maintaining sufficient restraining tension therein (transmitted to lips 32 through slides 34) to maintain the lips 32 closed until the bucket reaches the dumping position, whereupon, by slackening the cable 17, the lips 32 will swing downwardly around their pivots 33, drawing slides 34 downwardly. Thus opened, the bucket will discharge its contents and the cable 17 may then be rewound on drum 18 to draw the bucket back to the position above the manhole, the renewed cable tension causing the lips 32 to again close.

C. SWINGING BOOM

Boom C comprises an arm 40 the upper end of which is welded, at 40' (Fig. 2), to one of the bars 27 of clevis 26. Boom C also includes a laterally projecting arm 41 which has a relatively short end portion 42 bent at an obtuse angle thereto and mounted at its end upon a pivot 43 mounted between a pair of ears 44 welded to the boom arm 40 just below the upper end portion thereof that is secured to clevis 26. A coil spring 29, connected under tension between the bend joining lateral arm 41 to its end

portion 42, and the upper end of boom arm 40, normally maintains the arm 41 in the position shown in Fig. 2 (with relation to arm 40) as determined by engagement of the short arm portion 42 against a stop 30 that is welded to the upper end of arm 40.

Secured to the lower end of arm 40 is a flat end fitting 45 which supports a pivot bolt 46 to which grapple D is pivoted.

Secured to clevis 26, as by welding, is a knuckle fitting 47 (Fig. 3) of sleeve form, in which is mounted the shank 48 of a latch actuator wand 49. Wand 49 is bent at an obtuse angle to its shank 48 (the latter being normal to the plane of boom members 40, 41, 42) and subtends an acute angle to said boom plane, such that wand 49 may engage near the outer end of the latch control trigger lever hereinafter described. Wand 49 projects generally toward the derrick A, and, in the raised, full line position of boom C, is inclined upwardly above the latching mechanism E as shown in Fig. 1. As the boom C swings downwardly to the bucket dumping position, wand 49 correspondingly swings downwardly to the position shown in dotted lines, wherein it engages and actuates the latch mechanism E as hereinafter explained. Shank 48 is fixedly secured in knuckle fitting 47 by means of a set screw 50 which may be loosened to adjust the angle between wand 49 and boom arm 41.

D. GRAPPLE UNIT

Grapple unit D (Figs. 5 and 6) comprises a clevis 51 which embodies opposed fingers 52 and 53, the latter comprising a pair of flat, parallel cheeks that are spaced to provide a slot 54 for receiving a pivoted gripping jaw 55. The cheeks are joined, at the lower end of finger 53, by an integral web 56 which extends at an acute angle (in the range between 30° and 45°) to the longitudinal axis of finger 53. Fingers 53 and 52 are integrally joined by a pair of bridges 57, formed as integral continuations of the cheek portions of finger 53, and similarly spaced. Bridges 57 are projected to provide a pair of spaced ears which receive the flat end fitting 45 of boom arm 40 and are pivotally connected thereto by the pivot bolt 46 extending through registering apertures in the bridge ears 57 and fitting 45.

Jaw 55 is of segment shape, having a relatively wide end 58 of arcuate contour and serrated to provide teeth 59 for gripping engagement with the outer face of bucket body 31. The lower corner of arcuate end 58 is pivoted to finger 53 by a pivot bolt 60 extending therethrough and through registering apertures in cheek portions of finger 53. From pivot 60, the arcuate array of teeth 59 extends upwardly and around the pivot axis with a continuously increasing radius, and in a path which may be approximately spiral with reference to the pivot axis. The heel portion of arcuate end face 58, radially opposite pivot 60, in the open position of the jaw shown in Fig. 5, is substantially tangent to the near side of a slot 61 that is defined between fingers 52, 53 and thus said heel portion is generally parallel to the opposite side of slot 61. The curvature of end 58 is such that, as jaw 55 is tilted clockwise (as viewed in Figs. 5 and 6) the point of tangency between arcuate end 58 and the line parallel to the opposite side of slot 61 will progressively shift upwardly. This point of tangency determines the center of pressure engagement of teeth 59 against the outer surface of the section of bucket body 31 received in slot 61, with the inner surface of the bucket body engaged against the finger 52 at the opposite side of slot 61, and may vary to accommodate any variations in thickness of bucket bodies. The teeth 59 are of saw-tooth form and are inclined upwardly to attain maximum penetration of bucket body 31 in response to the downward pull of the bucket body under the weight of its contents, whereby the grasp of the bucket by the grapple is automatically tightened by the downward pull of the bucket. A major factor in the automatic tightening of the grapple

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on the bucket, however, is the actuator linkage which will now be described.

The end of jaw 55 opposite arcuate end 58, which may be tapered as shown and which functions as a lever, is provided with an aperture in which is hooked a transverse trunnion end portion 62 of a link 63, thus providing a pivotal connection. Link 63 extends upwardly and is pivotally connected by means of a transverse trunnion end portion 64 thereof, in an opening in an ear at one end of a clamp 65 which is clamped, by means of a clamping bolt 66, upon boom arm 40 above fitting 45. Pivots 46, 60, 62 and 64 are arranged in trapezoidal array such that when grapple clevis 51 is moved on its pivot 26, as indicated by arrow 67, in the direction of alignment with boom arm 40, the consequent elongation in the distance between pivots 60 and 64 will result in the above mentioned clockwise pivotal movement of jaw 55 about its pivot 60, transmitted thereto by link 63, with the result that teeth 59 will advance into slot 61 and will grip the wall of the bucket body 31 previously loosely received by the grapple.

The above mentioned movement of grapple clevis 61 relative to boom arm 40, in the aligning direction 55, results automatically from the action of bucket B, in response to gravity, tending to maintain a depending position with its major axis vertical, as opposed to the action of clevis 51 in tilting the bucket toward the inclined position shown in dotted lines in Fig. 1, as the boom C swings from the coupling position shown in full lines toward the unloading position shown in dotted lines. It will now be apparent that, in this swinging movement of the bucket as coupled to the boom, a tilting couple will be applied to grapple clevis 51 by the bucket, tending to widen the angle between the longitudinal axes of arm 40 and clevis 51 toward an alignment position, and the force of this couple, which is resolved into clamping pressure of teeth 59 against the bucket body 31, will continuously increase to a maximum at the end of the swing. This is important for the reason that, when the bucket reaches the unloading position, the cable 17 is relaxed so as to permit the slide bars 34 to shift downwardly and the clam lips 32 to swing outwardly for discharging the contents of the bucket. During this unloading of the bucket, the full weight of the bucket is supported by grapple unit D. Conversely, as the bucket is drawn back to the coupling position, under the pull of cable 17 as it is rewound on the drum 18, the grip of jaws 55 against the bucket body 31 will gradually relax until, in the position of boom C shown in full lines of Fig. 1, the bucket, still received in clevis 51 and hanging vertically, will have tilted the clevis 51 in a counterclockwise direction as viewed in Fig. 5, so as to restore it to its original angularity with reference to the boom 40, thus actuating the jaw 55 through linkage 53 to release its grip on bucket body 31.

E. LATCHING MECHANISM

As previously noted, latching mechanism E functions to normally latch boom C in the raised, coupling position until the bucket is hoisted and coupled to grapple unit D, and thereupon operates to release the boom C for downward and lateral swinging movement, guiding the bucket to the dumping position.

To this end, latching mechanism E (Fig. 8) comprises a jaw 70 including a bracket part 71 attached to the underside of crane arm 21, and including an integral arm 72 projecting downwardly and terminating in a guide finger 73 extending diagonally downwardly and outwardly from a latching space 74 that is defined between the inner margin of arm 72 and a pivoted jaw (latching hook) which is indicated generally at 75. Hook 75 includes an elbow portion 76, hung on a pivot 77 mounted in bracket arm 72, an arm 78 integral with elbow portion 76 and projecting downwardly parallel to arm 72 when the hook 75 is in a closed position; and

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a head 79 integral with the lower end of arm 78, defining a supporting shoulder 80 as the lower extremity of latching space 74 and having an inner margin extending diagonally downwardly and outwardly in opposed relation to guide finger 73, so as to define therewith a V-shaped notch. This notch functions to receive the boom arm 41 as the latter swings upwardly in the swinging movement of boom 40 toward the derrick A, and to guide the arm 41 upwardly into the latching space 74, the hook 75 being forced laterally in this movement so as to open a gap through which the arm 41 can pass. The shock of contact of boom arm 41 against guide finger 73 and latch hook 75 in such upward swinging movement is cushioned by yielding action of spring 29. As soon as the arm 41 has cleared the supporting shoulder 80, a tension spring 81, connected between the bracket arm 72 and the elbow 76 of hook 75 and exerting a pull below the pivot 77, will return the hook 75 to the closed position shown, in which it is arrested by contact of the lateral extremity of head 79 against finger 73.

The boom C is thus latched in its normal position shown in full lines in Fig. 1, and by slightly raising bucket B to remove its weight from grapple D, it can be released from the grapple and lowered into the sewer for a new cycle of cleaning operation.

When the bucket has been filled and hoisted out of the sewer, it will return to the position shown in full lines in Fig. 1, in which its side is about to enter the grapple D.

Further upward movement of the bucket will be transferred to boom C and to boom arm 41, which will engage against elbow 76 and will force the hook 75 upwardly to the dotted line position shown in Fig. 8, in which position the hook will be held by the action of spring 81 exerting a pull above the pivot 77, the arm 78 projecting laterally beneath the latch-actuator wand 49 which has been elevated in unison with the elevating movement of boom arm 41. Upon subsequent downward swinging movement of boom arm 41, wand 49 will swing downwardly, engaging hook 75 and pushing it downwardly until spring 81 has passed dead center, whereupon the hook 75 will snap back to the closed position shown in full lines, boom arm 41 meanwhile having been unlatched and allowed to swing downwardly to its position shown in Fig. 1.

OPERATION

The operations of the various units of the mechanism have been described in connection with the description of parts of such units and their relationship, and reference is made to the foregoing description for detailed aspects of the functioning of the separate units. The present explanation therefore aims to correlate the operation of the various units into a unified whole.

In the drag bucket cleaning of an underground sewer line, duplicate portable cable operating machines (hoists) are installed at different manholes along the sewer line, the two hoists facing one another, the cable 17, 17' extending downwardly through one manhole, around suitable guide pulleys at the bottom thereof, thence horizontally through the sewer line and thence upwardly around similar guide pulleys and out through the other manhole. Bail 36, hooked to the upper end of bucket B, is opposed to bail 36' which is hooked to the lower ends of slide bars 34 and is attached to the other section 17' of the cable. This other section 17' has its remote end wound upon the drum 18 of the machine which is remote from the one shown in Fig. 1. Assuming that the bucket B as shown in Fig. 1 has just been released by grapple unit D, the remote machine will be operated to tension cable section 17' and draw the bucket downwardly into the near manhole (this action positively opening the lips 32) and the bucket is then drawn lengthwise through the sewer line so as to dredge accumulated dirt and debris therefrom.

The cable section 17 shown in Fig. 1 is played out

during this movement. At a proper point, as judged by the experience of the operator, the movement is reversed, cable section 17 being wound upon drum 18 of Fig. 1, and the other cable section 17' being relaxed and allowed to follow while the bucket is returned to the near manhole, completing the filling of the bucket, and the bucket is then hoisted through the manhole and returned to the coupling position shown in Fig. 1. This reversal of movement will have closed lips 32 at the beginning of the return movement of the bucket, and the lips will remain closed as the bucket is hoisted to the coupling position.

With the boom arm 41 latched in raised position as shown in Fig. 1, grapple unit D will be disposed in the proper position to receive the upper end portion of bucket body 31. The edge of the bucket is guided into slot 61 by the inclined lips 69 of fingers 52, 53 and rises in slot 61 until it engages the upper end thereof. The bucket is then lifted a further distance sufficient to swing boom C upwardly to the point where boom arm 41 has engaged latch hook elbow 76 and shifted the latch hook 75 upwardly to the unlatching position shown in dotted lines of Fig. 7. The operator then plays out the cable section 17 so as to allow the bucket and boom C to swing downwardly in unison, sufficient restraining pull on the cable 17 being maintained to hold the bucket against the upper end of the grapple slot 61. Actually, it is only necessary to restrain the cable sufficiently to avoid development of slack therein as the bucket and boom swing downwardly, and thus it is possible to allow a substantially free swing and to take advantage of momentum in carrying the bucket to a maximum distance horizontally from the manhole. As the swing progresses, the bucket will be forced by grapple D to tilt upwardly from its originally vertical position to substantially match the angular shifting of boom C, but the gravity resistance of the bucket to being thus tipped upwardly will cause the grapple clevis 51 to shift somewhat toward a position of alignment with arm 40 (e. g. from starting position shown in Fig. 5 to the shifted position shown in Fig. 6) thereby actuating the jaw 55 to securely grip the bucket body as the swing progresses.

At the end of the swing, with the boom C in a substantially depending position as indicated in dotted lines in Fig. 1, the cable section 17 is relaxed to the point where the weight of lips 32 under the bucket contents, assisted by the weight of the slide bars 34 and parts 36 and 37, will shift slide bars 34 downwardly and lips 32 will swing to their open positions, discharging the contents of the bucket at one side of the manhole.

As the boom C swings downwardly, actuator wand 49 will correspondingly swing downwardly until it contacts hook 75 as indicated in dotted lines in Fig. 7, and will continue its downward movement, pressing the hook 75 downwardly until the spring 81 passes dead center and becomes operative to snap the hook to its closed position. Thus the latch mechanism is reset for a subsequent latching operation.

At the end of the unloading operation, the machine is operated to wind cable section 17 on drum 18, drawing the bucket B back toward derrick A, the boom C following, until the parts return to the position in which the bucket was initially coupled to grapple D. In the final stage of this movement, boom arm 41, entering the notch between head 79 and guide finger 73, will engage and shift the hook 75 laterally until it clears the shoulder 80, whereupon the hook 75 will be spring returned to the closed position, thus latching the boom in the coupling position. In returning to this position, the bucket B, assuming a vertically depending position by the operation of gravity, shifts the grapple clevis 51, with reference to arm 40, in a clockwise direction as viewed in Figs. 4 and 5, restoring it substantially to the position shown in Fig. 5 in which jaw 55 has been actuated by link 63 to release its grip on bucket body 31.

The bucket A may now be lowered, leaving the grapple D suspended in the coupling position in which it is again engaged by the bucket when the latter is drawn from the manhole with another load therein. The bucket is now lowered into the manhole to receive the subsequent load of material, thus completing the cycle of operation.

The operation is particularly characterized by the fact that the entire cycle of operation of the apparatus can be controlled by operators operating the two sections of the cable in unison so as to alternately draw the bucket into the sewer line, then return it to the hoisted coupling position, then move it through the various stages of unloading, and then return it to the sewer without touching the bucket.

The modified latch of Fig. 9

The bracket 70 and pivoted hook 75 may be conveniently referred to as a pair of jaws between which the arm 41 is latched. Either one or both of these jaws may be provided with a supporting shoulder or shoulders corresponding to the shoulder 80 of Fig. 1. By way of example of an alternate construction that may be utilized, Fig. 9 illustrates a modified latch arrangement wherein fixed jaw 70a includes a downwardly extending arm 72a having an integral head 73a defining a supporting shoulder 80a which projects laterally from the inner margin of arm 72a toward the pivoted jaw 75a. Jaw 75a includes an elbow portion 76a, a downwardly projecting arm 78a and a guide finger 79a, arranged in laterally opposed, downwardly diverging relation to head 73a. In this arrangement, the latch is so positioned with reference to the plane of normal vertical swinging movement of arm 41, (which plane as well as the vertical free movement of arm 41 is indicated by the broken arrow 85a) that the arm 41 would just clear the extremity of shoulder 80a if the jaw 75a were absent. There is sufficient torsional flexibility in the assembly of boom C and its mounting, in the pivotal connection of arm 41 to the boom arm 40 and in the arm itself, so that the jaw 75a, under the pull of jaw closing spring 81a, will deflect the arm 41 laterally into the latching space 74a after the arm 41 has cleared the shoulder 80a in its upward movement. In such upward movement, arm 41 will first contact guide finger 79a in the full line position shown, will be deflected slightly toward guide finger 73a by camming engagement with finger 79a, until it engages finger 73a just below the extremity of shoulder 80a, and will then ride against the inclined margin of finger 73a diagonally upwardly, shifting jaw 75a away from jaw 70a until it clears the extremity of shoulder 80a, and then, being sufficiently close to spring 81a so that the closing force exerted by the spring through jaw arm 78a will be sufficient to deflect it into its latched position shown in dotted lines, the arm 41 will shift over to that position where it will be supported by the shoulder 80a.

In the further upward movement of arm 41, it will engage spring 18, which will yield upwardly, and arm 41 will then engage elbow 76a in a manner similarly to the operation of the previously described latch of Figs. 1 and 7, will shift the jaw 75a upwardly to the open position shown in dotted lines, with the spring 81a crossing over center to hold it in this position, and, thus freed from the restraining pressure of jaw 75a, arm 41 will move laterally as indicated by arrow 85b to resume a position in its plane of normal free swinging movement in line with broken arrow 85a, in which it will clear the outer extremity of shoulder 80a for unrestrained downward movement when the boom is allowed to swing away from the derrick to the dumping position. During such downward swinging movement of the boom assembly, the jaw 75a will be engaged by the wand 49 and returned to its closed position shown in full lines.

I claim:

1. Apparatus for unloading a cable-suspended drag

bucket having an openable bottom maintained closed by cable tension, comprising: a derrick having at its upper end means for suspending a length of cable for hoisting said bucket from a filling position; a crane arm secured to said upper end of the derrick and projecting horizontally; a grapple adapted to receive and to grasp an upper edge of said bucket; a boom having a free lower end carrying said grapple and a pivot suspending its upper end from said crane arm for lateral swinging movement in response to gravity acting upon said bucket, from a coupling position to an unloading position, said boom in the coupling position being inclined laterally from the vertical with said grapple elevated in position to receive said upper edge portion of the bucket as the latter is hoisted from said filling position, and in said unloading position said boom hanging freely from its said pivot and said grapple being disposed downwardly from said elevated position; a lateral arm attached to and projecting laterally from said boom; latch mechanism for supporting said boom in said coupling position, comprising a jaw attached to the underside of said crane arm and projecting downwardly and terminating in a guide finger that is downwardly and laterally inclined, a latching hook pivoted to said jaw and provided at its free end with a head having a downwardly and outwardly inclined inner margin cooperating with said guide finger to define an upwardly narrowing notch to receive said lateral arm of the boom as the latter swings toward its coupling position, said head having a latching shoulder adapted to support said lateral arm in the coupling position of the boom, spring means operating between said hook and said jaw to normally maintain said hook in a closed position in which said lateral arm may be supported on said latching shoulder, said spring means being also operable to yieldingly support said hook in an open position projecting laterally from said jaw and releasing said lateral arm for downward swinging movement of the boom; and an actuator wand attached to the boom and moving in a path above said hook, intersecting the open position thereof as the boom swings downwardly and engaging the hook to return it to its closed position.

2. Apparatus for unloading a cable-suspended drag bucket having an openable bottom maintained closed by cable tension, comprising: a derrick having at its upper end means for suspending a length of cable for hoisting said bucket from a filling position; a grapple adapted to receive and to grasp an upper edge of said bucket; a boom having a free lower end carrying said grapple and a pivot suspending its upper end from said derrick for lateral swinging movement in response to gravity acting upon said bucket, from a coupling position to an unloading position, said boom in the coupling position being inclined laterally from the vertical with said grapple elevated in position to receive said upper edge portion of the bucket as the latter is hoisted from said filling position, and in said unloading position said boom hanging freely from its said pivot and said grapple being disposed downwardly from said elevated position; a lateral arm attached to and projecting laterally from said boom; latch mechanism for supporting said boom in said coupling position, comprising a jaw secured to the derrick, projecting downwardly and terminating in a guide finger that is downwardly and laterally inclined, a latching hook pivoted to said jaw and provided at its free end with a head having an inner margin cooperating with said guide finger to define an upwardly narrowing notch to receive said lateral arm of the boom as the latter swings toward its coupling position, said head defining a latching shoulder, spring means operating between said hook and said jaw to normally maintain said hook in a closed position in which said latching shoulder faces upwardly for supporting said lateral arm and in which said head engages said jaw to provide, above said shoulder and between said jaws, a space for receiving said lateral arm with

said arm confined between said hook and jaw in supported relation, said latching hook having a portion thereof which, in the said closed position of the hook, is positioned to be engaged by said lateral arm during further upward movement thereof, whereby said hook will be swung upwardly to an open position projecting laterally from said jaw and releasing said lateral arm for downward swinging movement of the boom, said spring means being operable to yieldingly support said hook in said open position; and an actuator wand attached to the boom and moving in a path above said hook, intersecting the open position thereof as the boom swings downwardly and engaging the hook to return it to its closed position.

3. Apparatus for unloading a cable-suspended drag bucket having an openable bottom maintained closed by cable tension, comprising: a derrick having at its upper end means for suspending a length of cable for hoisting said bucket from a filling position; a grapple adapted to receive and to grasp an upper edge of said bucket; a boom having a free lower end carrying said grapple and a pivot suspending its upper end from said derrick for lateral swinging movement in response to gravity acting upon said bucket, from a coupling position to an unloading position, said boom in the coupling position being inclined laterally from the vertical with said grapple elevated in position to receive said upper edge portion of the bucket as the latter is hoisted from said filling position, and in said unloading position said boom hanging freely from its said pivot and said grapple being disposed downwardly from said elevated position; a lateral arm attached to and projecting laterally from said boom; latch mechanism for supporting said boom in said coupling position, comprising a jaw secured to said derrick and projecting downwardly, a latching hook pivoted to said jaw and provided at its free end with a head having a downwardly and outwardly inclined margin cooperating with said jaw to define an upwardly narrowing notch to receive said lateral arm of the boom as the latter swings toward its coupling position, said head defining a latching shoulder, spring means operating between said hook and said jaw to normally maintain said hook in a closed position in which said latching shoulder faces upwardly for supporting said lateral arm and in which said head engages said jaw to provide, above said shoulder and between said jaws, a space for receiving said lateral arm with said arm confined between the jaws in supported relation, said latching hook having a portion thereof which, in the said closed position of the hook, is positioned to be engaged by said lateral arm during further upward movement thereof, whereby said hook will be swung upwardly to an open position projecting laterally from said jaw and releasing said lateral arm for downward swinging movement of the boom, said spring means being operable to yieldingly support said hook in said open position; and an actuator wand attached to the boom and moving in a path above said hook, intersecting the open position thereof as the boom swings downwardly and engaging the hook to return it to its closed position.

4. Apparatus for unloading a cable-suspended drag bucket having an openable bottom maintained closed by cable tension, comprising: a derrick having at its upper end means for suspending a length of cable for hoisting said bucket from a filling position; a grapple adapted to receive and to grasp an upper edge of said bucket; a boom having a free lower end carrying said grapple and a pivot suspending its upper end from said derrick for lateral swinging movement in response to gravity acting upon said bucket, from a coupling position to an unloading position, said boom in the coupling position being inclined laterally from the vertical with said grapple elevated in position to receive said upper edge portion of the bucket as the latter is hoisted from said filling position, and in said unloading position said boom hanging freely from its said pivot and said grapple being disposed

downwardly from said elevated position; a lateral arm attached to and projecting laterally from said boom; latch mechanism for supporting said boom in said coupling position, comprising a jaw attached to said derrick and projecting downwardly, a latching hook including an elbow portion pivoted to said jaw, an arm projecting at an obtuse angle from said elbow portion, and a head on the free end of said hook arm, said head defining a latching shoulder, a coil spring operating under tension between said hook and said jaw to normally maintain said hook in a closed position in which said hook arm extends downwardly in laterally spaced relation to said jaw and said shoulder faces upwardly to provide a support for said lateral arm of the boom and cooperates with said jaw and hook arm to define a latching space in which said lateral arm may be received, and said elbow portion, in said closed position of the hook, extending diagonally upwardly to its pivot and being engageable by said lateral arm upon further upward movement thereof so as to effect upward swinging movement of said hook to an open position in which said hook projects laterally from said jaw and in which said spring is disposed above said pivot so as to yieldingly support the hook in said open position; and an actuator wand attached to the boom and moving in a path above said hook, intersecting the open position thereof as the boom swings downwardly and engaging the hook to return it to its closed position.

5. Apparatus for unloading a cable-suspended drag bucket having an openable bottom maintained closed by cable tension, comprising: a derrick having at its upper end means for suspending a length of cable for hoisting said bucket from a filling position; a grapple adapted to receive and to grasp an upper edge of said bucket; a boom having a free lower end carrying said grapple and a pivot suspending its upper end from said derrick for lateral swinging movement in response to gravity acting upon said bucket, from a coupling position to an unloading position, said boom in the coupling position being inclined laterally from the vertical with said grapple elevated in position to receive said upper edge portion of the bucket as the latter is hoisted from said filling position, and in said unloading position said boom hanging freely from its said pivot and said grapple being disposed downwardly from said elevated position; a lateral arm attached to and projecting laterally from said boom; latch mechanism for supporting said boom in said coupling position, comprising a pair of jaws including a fixed jaw attached to said derrick and projecting downwardly, and a swinging jaw pivoted to said fixed jaw for swinging movement in a vertical plane, one of said jaws being in the form of a hook having a head defining a latching shoulder, the other of said jaws having at its lower end a guide finger that has a downwardly and laterally inclined inner margin, said head likewise having a downwardly and laterally inclined inner margin, said inclined margins diverging downwardly to define an upwardly narrowing notch to receive said lateral arm of the boom as the boom swings upwardly toward its coupling position, and a coil spring operating under tension between said jaws to normally maintain them in closed positions in which said head of the one jaw engages the other jaw, in which said shoulder faces upwardly, and in which said shoulder and the jaws define above said shoulder a latching space for receiving and supporting said lateral arm in the coupling position of the boom, said lateral arm being engageable with said pivoted jaw, upon upward movement above said shoulder, to swing said pivoted jaw upwardly to an open position projecting laterally from said fixed jaw, to release the boom for downward swinging movement, said spring being arranged to move over center to a position above the pivot of said swinging jaw when the latter moves to said open position, so as to yieldingly support said swinging jaw in said open position; and an actuator wand attached to the boom and moving in a path above said swinging jaw, intersecting

the laterally projecting open position thereof as the boom swings downwardly and engaging said swinging jaw to return it to its closed position.

6. Apparatus for unloading a cable-suspended drag bucket having an openable bottom maintained closed by cable tension, comprising: a derrick having at its upper end means for suspending a length of cable for hoisting said bucket from a filling position; a grapple adapted to receive and to grasp an upper edge of said bucket; a boom having a free lower end carrying said grapple and a pivot suspending its upper end from said derrick for lateral swinging movement in response to gravity acting upon said bucket, from a coupling position to an unloading position, said boom in the coupling position being inclined laterally from the vertical with said grapple elevated in position to receive said upper edge portion of the bucket as the latter is hoisted from said filling position, and in said unloading position said boom hanging freely from its said pivot and said grapple being disposed downwardly from said elevated position; a lateral arm attached to and projecting laterally from said boom; latch mechanism for supporting said boom in said coupling position, comprising a pair of jaws including a fixed jaw attached to said derrick and projecting downwardly, and a swinging jaw pivoted to said fixed jaw for swinging movement in a vertical plane, one of said jaws being in the form of a hook having a head defining a latching shoulder; said jaws having at their lower ends, inner margins diverging downwardly to define an upwardly narrowing notch to receive said lateral arm of the boom as the boom swings upwardly toward its coupling position, and spring means operating between said jaws to normally maintain them in closed positions in which said head of the one jaw engages the other jaw, in which said shoulder faces upwardly, and in which said shoulder and the jaws define above said shoulder a latching space for receiving and supporting said lateral arm in the coupling position of the boom, said lateral arm being engageable with said pivoted jaw, upon upward movement above said shoulder, to swing said pivoted jaw upwardly to an open position projecting laterally from said fixed jaw, to release the boom for downward swinging movement, said spring means being arranged and operable upon said swinging jaw when the latter moves to said open position, so as to yieldingly support said swinging jaw in said open position; and an actuator wand attached to the boom and moving in a path above said swinging jaw, intersecting the laterally projecting open position thereof as the boom swings downwardly and engaging said swinging jaw to return it to its closed position.

7. Apparatus for unloading a cable-suspended drag bucket having an openable bottom maintained closed by cable tension, comprising: a derrick having at its upper end means for suspending a length of cable for hoisting said bucket from a filling position; a grapple adapted to receive and to grasp an upper edge of said bucket; a boom having a free lower end carrying said grapple and a pivot suspending its upper end from said derrick for lateral swinging movement in response to gravity acting upon said bucket, from a coupling position to an unloading position, said boom in the coupling position being inclined laterally from the vertical with said grapple elevated in position to receive said upper edge portion of the bucket as the latter is hoisted from said filling position, and in said unloading position said boom hanging freely from its said pivot and said grapple being disposed downwardly from said elevated position; a lateral arm attached to and projecting laterally from said boom; latch mechanism for supporting said boom in said coupling position, comprising a fixed jaw attached to said derrick and projecting downwardly and terminating in a head defining an upwardly facing latching shoulder, a swinging jaw pivoted to said fixed jaw for swinging movement in a vertical plane between a closed position in which it extends downwardly from its pivot and engages

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said head to provide a closed latching space above said shoulder, for receiving and supporting on said shoulder the lateral arm of the boom, and an open position in which it projects laterally from said fixed jaw to release the boom for downward swinging movement; said jaws having, below said latching shoulder, downwardly diverging opposed inner margins defining a notch for receiving said lateral arm and guiding it into said closed latching space as it moves upwardly, and said swinging jaw being arranged to be engaged by said lateral arm upon upward movement of the latter beyond its latching position, to move said swinging jaw to said open position; and a coil spring operating under tension between said jaws to normally maintain said swinging jaw in said closed position, said spring moving over center to a position above the

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pivot of the swinging jaw when the latter moves to said open position, for yieldingly supporting the swinging jaw in its said open position; and an actuator wand attached to the boom and moving in a path above said swinging jaw, intersecting the open position thereof as the boom swings downwardly and engaging the swinging jaw to return it to its closed position.

References Cited in the file of this patent

UNITED STATES PATENTS

1,234,717	Beindorff	July 31, 1917
2,417,121	Nelson	Mar. 11, 1947
2,502,593	Robinson et al.	Apr. 4, 1950