Dec. 13, 1932. H. E. HALLENBECK 1,890,539

ELECTRICAL CONTROL MEANS FOR TROLLEY BUCKETS

Filed Oct. 9, 1930 2 Sheets-Sheet 1

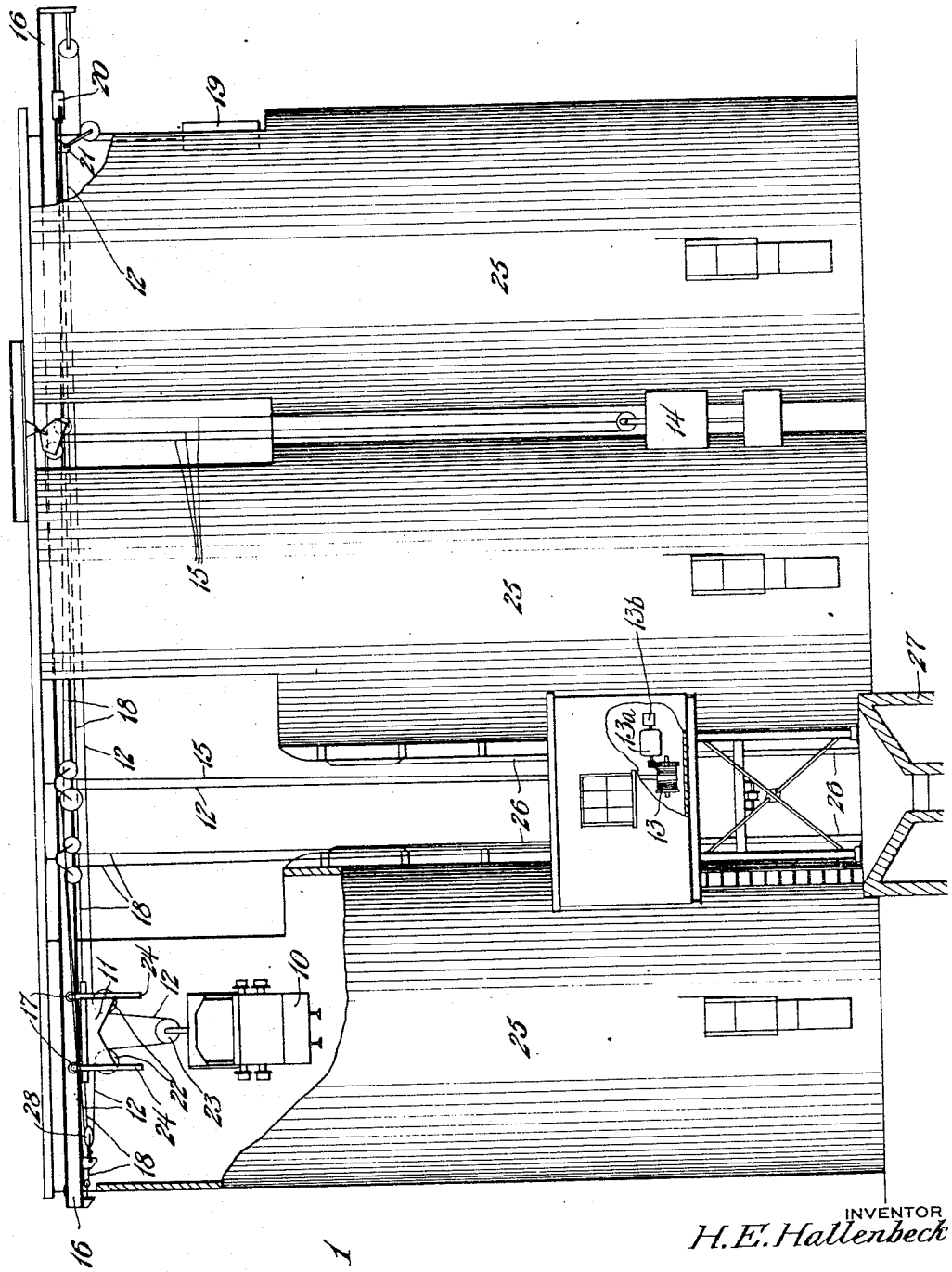


Fig. 1

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Filed Oct. 9, 1930 2 Sheets-Sheet 2

Fig. 2

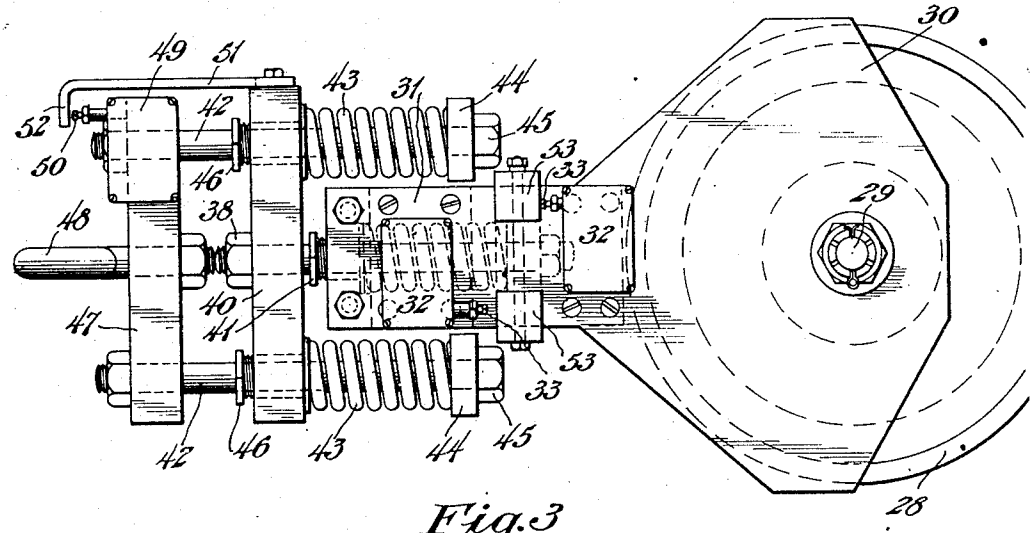


Fig. 3

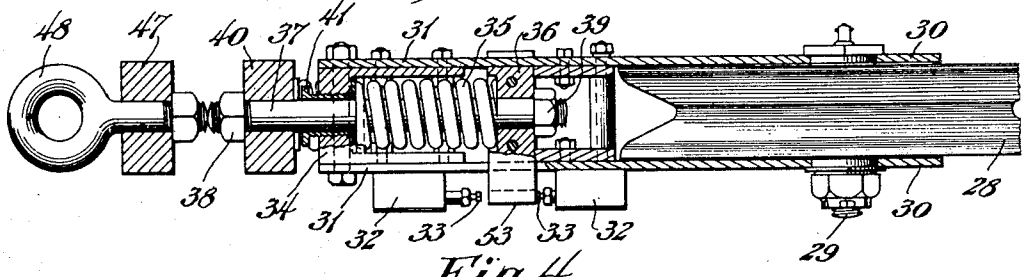


Fig. 4

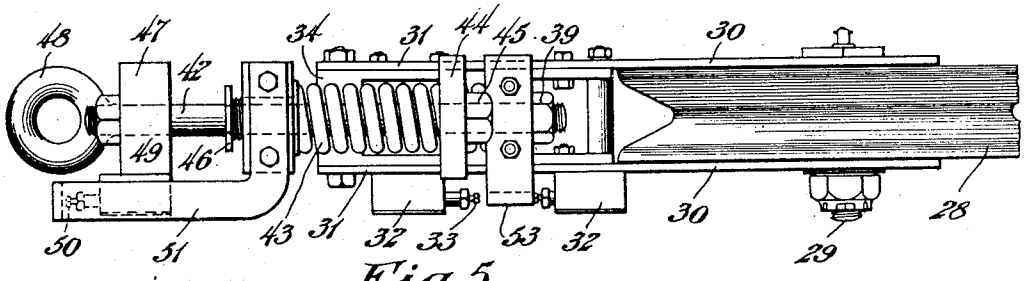
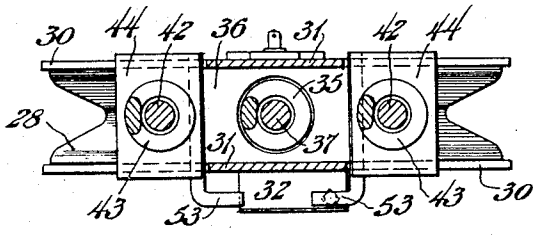


Fig. 5



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UNITED STATES PATENT OFFICE

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ELECTRICAL CONTROL MEANS FOR TROLLEY BUCKETS

Application filed October 9, 1930. Serial No. 487,628.

This invention relates to electrical control means for traversing hoists, especially, though not exclusively, for trolley buckets of the type actuated by two lines driven by separate motors. An object of the invention is to provide a hoist-line-operated control means for effecting automatically immediate return or elevation of the bucket after dumping its load, and also means associated with the first-named means for cutting off the power to the hoist motor in the event of an overload on the hoist line.

This application is in part a continuation of my application Ser. No. 420,483 filed January 13, 1930, which disclosed everything herein save the overload switch and the actuating means therefor.

Referring to the accompanying drawings showing the preferred embodiment of the invention,

Fig. 1 is an elevation, with the parts in section, of a trolley bucket installation with which the improvement is used;

Fig. 2 is a plan view, on a larger scale, of the dual control means shown with a sheave about which the hoist line is adapted to be trained;

Fig. 3 is a longitudinal section through the device of Fig. 2;

Fig. 4 is a side elevation of the device of Fig. 2; and

Fig. 5 is a cross-section of the same.

This application is a companion case to another filed October 27, 1930, Serial No. 491,534; and the improvement herein specifically claimed is also shown and broadly claimed in the aforesaid application, which is therefore the generic case. The wiring diagrams and electrical apparatus by which the device of the present invention effects automatic return of the bucket and stopping of the hoist motor in case of an overload on the hoist line are fully shown and described in the generic case and hence are omitted here. The present application is intended to cover the mechanical construction of the control device per se and also the combination of such a device with a hoist line and sheave, and other combinations as hereinafter set forth in the claims. In my pending application, Ser. No. 420,482, filed January 13, 1930, I have described and claimed a specifically different construction for returning a bucket after dumping its load, which may also be used with the wiring arrangement of the generic case.

Referring particularly to the drawings, and first to Fig. 1, there is shown a dumping bucket 10 (preferably of the construction disclosed in the Bennett Patent No. 1,741,123), a trolley 11 from which the bucket is suspended by a hoist line 12, a hoist drum 13 driven by an electric motor 13^a, equipped with the usual solenoid brake 13^b, a counterweight 14, and a counterweight line 15 connected to the drum 13 but wrapped around said drum in a direction opposite to that in which hoist line 12 is wrapped, so that the counterweight counteracts the tendency of the bucket to rotate the drum.

The trolley 11 is suspended from and travels along a monorail 16 serving as a track for rollers 17 by which the trolley is suspended. The traversing movement of the trolley, and hence of the bucket, is effected by means of an independently operated traverse line 18, the opposite ends of which are secured to the ends of the trolley 11. The traverse line 18 is led around two grooved drums, one of which is driven by an electric motor, as fully disclosed in the pending application of H. V. Harding, Serial No. 194,842 filed May 27, 1927 and assigned to the assignee of this application. Tension on the traverse rope is maintained by means of a counterweight 19 connected with a slidable carriage 20, as more fully disclosed in the H. V. Harding Patent No. 1,631,030.

One end of the hoist line 12 is secured to the hoist drum 13 and the other end is dead-ended to a fixed member, which may be on the underside of the monorail, as indicated at 21. It will therefore be clear that when the drum 13 winds up the rope 12, the bucket 10 will be elevated until it reaches the trolley and when the hoist drum pays out the line 12, the trolley bucket will be lowered. When the traverse rope 18 is moved in one direction or the other, the trolley is correspondingly moved, carrying with it the bucket. At such

times, the hoist line 12 moves around the sheaves 22 on the trolley and the sheave 23 on the bail of the bucket, or, in other words, the bucket travels along the hoist line. The bucket preferably is prevented from swinging relative to the trolley by means of a stabilizer 24, such as is described and claimed in the W. H. Towne application, Serial No. 146,890, November 8, 1926 and assigned to the assignee of this application. It will be clear that by a proper manipulation of the hoist and traverse lines, the bucket may be elevated and lowered and moved back and forth along the monorail in any manner desired.

The bucket is intended to be used for filling bins 25 which may hold building material, such as sand or gravel or various kinds of coal, the bucket dumping its load automatically through the bottom as it reaches the top of the pile. In order to fill the bucket, it is lowered along tracks or guides 26 which lead to a pit 27 beneath a railroad siding (not shown), such pit being preferably of the construction shown in the W. H. Towne Patent No. 1,720,704. The flow of material from the pit into the bucket is preferably controlled by means of a gate of the type shown in the patent of C. M. Root, No. 1,808,972, also assigned to the assignee of this application.

The apparatus so far described forms no part of the present invention, except as certain elements form new and patentable combinations with the device best shown in Figs. 2 to 5 inclusive and hereinafter described.

Referring again to Fig. 1, it is seen that at one end of the monorail the hoist line 12 passes around a sheave 28, which is held in a substantially horizontal position by the tension on the hoist line. This sheave and the associated parts are best shown in Figs. 2 to 5 inclusive, to which reference should now be made. The sheave 28 is mounted on an axle 29 secured to a pair of cheek plates 30 having parallel extensions 31. The plates 30 provide the main body of a sheave frame. Secured to one of the cheek plate extensions are two switches 32 which are of a standard construction, and hence need no description other than the statement that each is provided with a button 33 on a plunger adapted to be depressed to close the switch at certain times, as will be described. The limit switches are automatically opened as soon as pressure on the buttons 33 is released, thereby controlling the circuit of the hoist motor in the manner particularly described in the generic case.

Secured between the cheek plate extensions 31 is a U-shaped block 34 providing a housing for a coil spring 35 which is located between the extensions 31. One end of the coil spring 35 abuts against the U-shaped block 34 and the other end presses against a spring follower 36 which is slidable relative to the cheek plates and is mounted on a rod 37 passing axially through the coil spring 35. The rod 37 is threaded on its opposite ends, as is shown in Fig. 3, and has adjusting nuts 38, 39 at said ends. A cross bar 40 is also mounted on the rod 37, but outside the sheave frame, and a hollow adjusting nut 41 is provided for adjusting the tension of the spring 35. As shown in Fig. 3, the hollow nut 41 is screw-threaded in the U-shaped block 34 and has a washer engaging the spring 35 and a hexagonal head permitting turning by means of a wrench. Obviously, turning nut 41 in one direction will increase the tension of spring 35 and turning it in the other direction will diminish the tension.

Carried by the ends of the cross bar 40 are two bolts 42 on which coil springs 43 are mounted. Spring abutments or washers 44 are provided at the ends of bolts 42 and are held by bolt heads 45. The bolts 42 pass through apertures in the cross bar 40 and adjusting nuts 46 engage said apertures by their screw threads, both adjusting nuts 46 having washers for compressing or loosening the springs 43, as will be understood.

Mounted on the ends of bolts 42 is another cross bar 47, to which an eye-bolt 48 is attached. The eye-bolt 48 provides a convenient means by which the entire structure may be pivotally mounted at one end of the monorail. Mounted on the cross bar 47 is a load-responsive, safety or overload switch 49 exactly like the switches 32 and having an operating plunger 50. An arm 51 having a right-angled end 52 is secured to the cross bar 40 in such a way as to effect inward movement of the plunger 50 when the cross bars 47 and 40 move apart a certain distance. The spring follower 36 has right angle arm extensions 53 like the extension 52 for operating the plungers of limit switches 32, the arrangement being such that as the weight on the cable, acting through the sheave, pulls the cheek plate extensions to the right, as viewed in Fig. 2, the left-hand switch 32 will be closed by contact with the adjacent arm 53; and when the tension on the sheave is relieved, the cheek plate extensions 31 are moved to the left, as viewed in Fig. 2, thus causing the other switch 32 to be closed. It will be understood that the eye-bolt 48 is anchored, that is, is immovable longitudinally of the monorail, although it may swing freely, as the hoist line sags and tightens.

From the above it will be clear that the hoist line is always under considerable tension due to its weight and particularly to the weight of the bucket, whether loaded or empty. This tension on the hoist line exerts a pull on sheave 28, a pull which is transmitted through the cheek plates 31, block 34, spring 35, cross bar 40 and bolts 42 to the eye-bolt 48, which is anchored against movement. The minimum normal tension on the

hoist line exists when the bucket is empty; and the tension of spring 35 is such that it is compressed to the maximum extent permitted when this "minimum normal tension" is present. At such times the follower 36 will press one arm 53 against the left switch 32 of Figs. 2, 3 and 4 to close a circuit permitting descent of the bucket. But as soon as the "minimum normal tension" is decreased, as when the bucket has discharged its load and is partly supported on top of the pile of material in a bin, the spring 35 will expand, and the parts will assume the relative positions shown in Figs. 2, 3 and 4, the righthand switch 32 then closing a circuit to permit ascent of the bucket. This circuit and the one controlling descent of the bucket are fully shown, described and claimed in the generic case and hence are omitted here.

The above description will make the operation clear; but the invention is not limited for use with the spring 35 fully compressed when the "minimum normal tension" is present. Indeed, it has been found that better operation results from making the device more sensitive to a lessening of the load on the hoist line, and in ordinary practice, spring 35 is so adjusted that automatic return of the bucket starts when about half of the load has been discharged from the bucket. As the bucket rises, the remainder of the load is deposited and the bucket continues its ascent to the trolley. It is feasible to adjust spring 35 so that the bucket will be returned upon discharge of a small fraction of a full load. Obviously as the sensitivity of the adjustment is increased, the amount of impact of the bucket against the pile of material is decreased, and there is less tendency of the bucket to tip or tilt, effecting a smoother action when the bucket is hoisted and eliminating fouling of the hoist line (with consequent dangerous overloading of said line).

To effect shutting off of the hoisting power in case a sudden and dangerous load is imposed on the hoist line, whatever the cause may be, overload switch 49 is provided. This overload switch is never closed by ordinary tension on the hoist line, not even when the bucket is fully loaded; the two heavy springs 43 being compressed by cross bar 40 only in the presence of an excessive load on the hoist line. Then the arm 52 is moved to close switch 49, and the hoist motor 13^a is immediately stopped by the usual solenoid brake 13^b. The switch 49 is inactive at all other times.

When the invention is employed with a fully automatic trolley bucket, the bucket starts from the pit with a load, is hoisted to the monorail and stops, moves horizontally below the monorail to the pre-selected position, stops its traverse, and lowers. Then the bucket return device functions, stopping the bucket as it reaches the pile, and starting it up again; and when it reaches the monorail, hoisting is stopped, traversing begins, and continues until a point over the pit is reached; the bucket then stops traversing, and the action of switches 32 being temporarily suspended, the bucket then descends into the pit, is loaded, and starts the cycle all over again. The cycle is repeated as long as desired, without any attention whatever from the operator, other than an occasional glance to see that the apparatus is working properly.

When the invention is employed in an installation employing push-button control as disclosed in the generic case, all operations (except the automatic stopping and returning of the bucket by the return device) are effected one at a time by depressing a series of push buttons.

From the foregoing, it will be clear that the apparatus of the present invention acts as a safety device as well as a bucket-return device. For instance, suppose the bucket should be lowered into contact with the top of a bin wall, or some other obstruction, the result would be a sufficient lessening in the tension of the hoist line to cause stopping of the down motion of the bucket, and starting of the hoisting. If the obstruction is encountered again, the bucket will rise again, without damage to anything, and this may continue until the operator notices that something is wrong and either makes the necessary adjustment of the control apparatus or removes the obstruction.

As the control device is designed for use with buckets of different sizes and weights, the springs 35 and 43 are made adjustable by means of the nuts 41 and 46 respectively. When the control device is used with a heavy bucket, all such springs will be compressed by the adjusting nuts. The drawings show the springs adjusted for a relatively light bucket.

Obviously, the present invention is not restricted to the particular embodiment thereof herein shown and described. Moreover, it is not indispensable that all the features of the invention be used conjointly, since they may be employed advantageously in various combinations and sub-combinations.

What I claim is:—

1. A control device for motor-driven trolley buckets comprising, in combination, a sheave; a pair of cheek plates forming a frame in which the sheave rotates; a coil spring in the frame abutting one end thereof; a spring follower abutting the other end of said spring; a rod connected to the spring follower and passing through the coil spring; a cross bar centrally connected to the rod; a pair of bolts passing through the ends of the cross bar; springs on the bolts interposed between said cross bar and the heads of the bolts; another cross bar connected to the opposite ends of the bolts; means secured to the

second cross bar for attaching the device to a fixed support; a pair of switches on said frame so arranged as to be closed alternately as the frame reciprocates relative to the follower; an overload switch on said second-named cross bar; and means carried by the first-named cross bar to contact with said overload switch to open it when the two springs on said bolts are sufficiently compressed by movement of said second cross bar responsive to movement of the sheave and its frame.

2. A control device for motor-driven trolley buckets comprising, in combination, a sheave; a frame in which the sheave rotates; a coil spring in the frame abutting one end thereof; a spring follower abutting the other end of said spring; a rod connected to the spring follower and passing through the coil spring; a cross bar centrally connected to the rod; a pair of bolts passing through the ends of the cross bar; springs on the bolts interposed between said cross bar and the heads of the bolts; another cross bar connected to the opposite ends of the bolts; means secured to the second cross bar for attaching the device to a fixed support; an overload switch on said second named cross bar; and means carried by the first named cross bar to contact with said switch to open it when the two springs on said bolts are sufficiently compressed by movement of said second cross bar responsive to movement of the sheave and its frame.

3. A control device for motor-driven trolley buckets comprising, in combination, a sheave; a pair of cheek plates forming a frame in which the sheave rotates; a coil spring in the frame abutting one end thereof; a spring follower abutting the other end of said spring; a rod connected to the spring follower and passing through the coil spring; a cross bar centrally connected to the rod; a pair of bolts passing through the ends of the cross bar; springs on the bolts interposed between said cross bar and the heads of the bolts; another cross bar connected to the opposite ends of the bolts; means secured to the second cross bar for attaching the device to a fixed support; a pair of switches carried by said frame to control the bucket and operated upon relative movement of said follower and frame; and a third switch which opens only when the first cross bar compresses the two springs; the arrangement being such that a very heavy stress on the sheave is necessary to compress all three springs and open said third switch.

4. A unitary control device for motor-driven trolley buckets comprising, in combination, a sheave; a body on which the sheave is mounted; a switch on the body and connected in the motor circuit; means connected with the sheave to actuate said switch; and an overload switch carried by said body and so connected with said sheave as to be opened only when a heavy overload is imposed on the sheave.

5. Bucket controlling apparatus for electric motor-operated hoists comprising in combination, a frame; a grooved sheave revolvable in the frame; means for suspending the frame; a compression spring in the frame co-operating with said suspending means for carrying the load on the sheave; the frame being movable relative to said suspending means when the spring yields under heavy loads; and a pair of switches mounted on the frame; said suspending means having projecting parts for engagement with the actuating elements of the respective switches, thereby to open one circuit and to close the other circuit each time the frame moves in one direction relative to its suspending means.

6. Bucket controlling apparatus for electric motor-operated hoists comprising, in combination, a hoist rope for elevating and lowering a bucket; a motor driven drum for controlling the hoist rope; an electrical circuit for controlling the motor, said circuit comprising a pair of switches; and a sheave with a frame supporting said switches and having relatively movable parts for actuating said switches alternately, said sheave bearing a part of the load on the hoist rope, and said relatively movable parts acting to open one switch and close the other when the bucket encounters an obstruction, as and for the purpose described.

7. A bucket-controlling sheave for electric motor-operated hoists comprising, in combination, a frame; a grooved wheel revolvable in the frame; a compression spring in the frame; a block in the frame so arranged as to be movable relative to the frame; the spring bearing against said block at one end and said frame at the other end; an eye-bolt passing through the spring and frame and secured to the block, whereby the sheave may be suspended from the eye-bolt; arms projecting from the block; and switches on the frame actuated by said arms to be closed and opened alternately as the frame reciprocates relative to the block.

8. In a traversing hoist, the combination of a hoist line; motor driven means for winding up and paying out the line; a trolley; a carrier suspended from the trolley by the hoist line; an elevated horizontal track along which the trolley runs; means supported upon the track and connected to the line so as to bear a part of the tension on the line, said means having a part movable in opposite directions responsive to slackening and tensioning of the hoist line; a pair of switches mounted on the track-supported means; and mechanism so arranged that one of the switches is opened and the other closed when the aforesaid movable part moves in either direction.

9. In a traversing hoist, the combination of a hoist line; motor driven means for winding up and paying out the line; a trolley; a carrier suspended from the trolley by the hoist line; an elevated horizontal track along which the trolley runs; means supported upon the track and connected to the line so as to bear a part of the tension on the line, said means having a member movable in opposite directions responsive to slackening and tensioning of the hoist line; and reversing switch mechanism connected in the hoist motor circuit and actuated by movement of said member, to cause immediate reversal of the motor and hence of the carrier whenever the line slackens.

10. A unitary control device for motor-driven trolley buckets comprising, in combination, a hoist line; a sheave over which the hoist line may be trained; a frame for carrying said sheave; means on said frame relatively movable in one direction responsive to a certain tension on said line and relatively movable in the opposite direction when said tension is relieved; means connected to said frame for movement in one direction responsive to extremely high tension on said line; an overload switch adapted to be opened by said last named means; and a pair of switches in the motor circuit, each switch controlling movement of the motor in one direction, said switches being operated by movement of said movable means in opposite directions.

11. In a traversing hoist and trolley bucket installation, the combination of a hoist rope; a sheave about which the hoist rope passes; a frame carrying said sheave; motor-driven means to wind up and pay out the rope; a pair of switches mounted on the sheave frame in the motor circuit controlling the direction of rotation thereof and arranged to be actuated in response to different predetermined tensions of the rope; and means located on the sheave frame and rendered operable by changes in tension of the rope so as to reverse the motor by opening one of the switches and closing the other.

12. In a traversing hoist, the combination of a hoist rope; motor driven means for winding up and paying out the rope; a trolley; a carrier suspended from the trolley by the hoist rope; a sheave about which the hoist rope passes; an elevated, horizontal track along which the trolley runs; sheave supporting means to hold said sheave adjacent the track, the sheave being movable relative to its supporting means responsive to slackening and tensioning of the hoist rope; a spring connected to the sheave to resist or assist movement thereof responsive to tensioning or slackening respectively of the hoist rope; and a pair of reversing switches actuated by movements of said sheave to reverse the circuit of the motor which controls the hoist rope.

13. In combination with a hoist cable which sustains a load, a hoist drum around which the cable is wrapped, and an electric motor which drives the drum in opposite directions; switch-actuating means operatively associated with the hoist cable and rendered operable by a predetermined tension in the cable; supporting means for the switch-actuating means; a pair of switches connected in the motor circuit and each arranged to be closed by said switch-actuating means as the latter moves in opposite directions relative thereto, thereby to govern direction of rotation of the motor, when slackening of the cable occurs, and thereby to effect stopping and hoisting of the load immediately after an obstruction is encountered during lowering.

14. In combination with an electric motor-operated, trolley bucket installation, a hoisting cable carrying the bucket; a pair of separated switches for controlling the motor connected to be operated automatically in response to tension on the cable; and switch-actuating means operatively associated with the cable and with the pair of switches and movable in opposite directions relative to the switches responsive to different predetermined tensions in the cable to engage one or the other of said switches; one of the switches being electrically connected to cause the motor to lower the bucket when loaded and the other switch being connected to reverse the motor to raise the bucket when the bucket strikes an obstruction or when it reaches a pile of material.

15. Controlling apparatus for electric motor-operated buckets comprising, in combination, a hoist rope for elevating and lowering a bucket; a motor driven drum for controlling the hoist rope; an electrical circuit for controlling the motor, said circuit comprising a pair of switches; a switch-actuating reciprocatory member; means to constrain the reciprocatory member to follow a fixed path; means operatively connecting the reciprocatory member with the hoist rope so that changes of a predetermined magnitude in the load on the hoist rope effect reciprocation of said reciprocatory member; said reciprocatory member having parts located adjacent said switches to effect opening and closing of said switches as said member reciprocates, thereby to effect stopping of the lowering and automatic return of the bucket, when it reaches an obstruction or a pile of material.

In testimony, that I claim the foregoing as my own, I have hereto affixed my signature.

HAROLD E. HALLENBECK.