Oct. 17, 1944. A. L. MEDENWALD ET AL 2,360,505

ELECTRICALLY CONTROLLED HOIST FOR MONORAILS

Filed Sept. 22, 1941 3 Sheets-Sheet 1

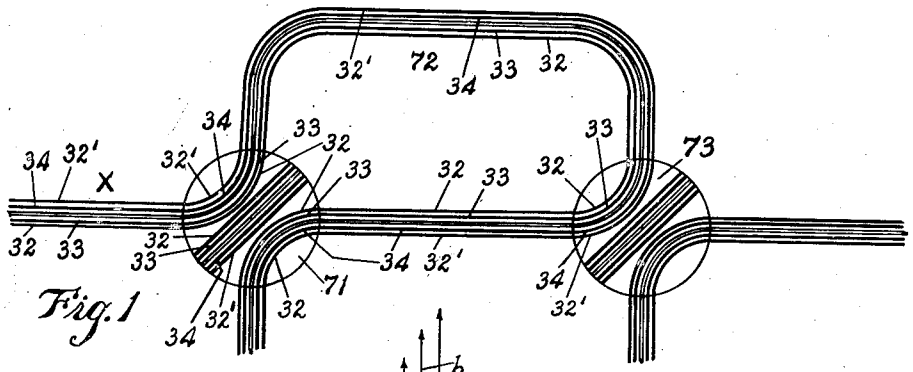


Fig. 1

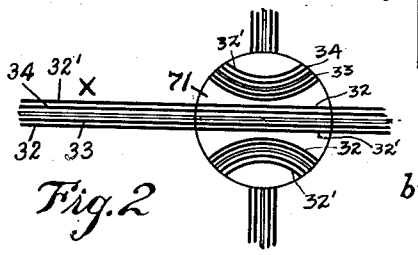


Fig. 2

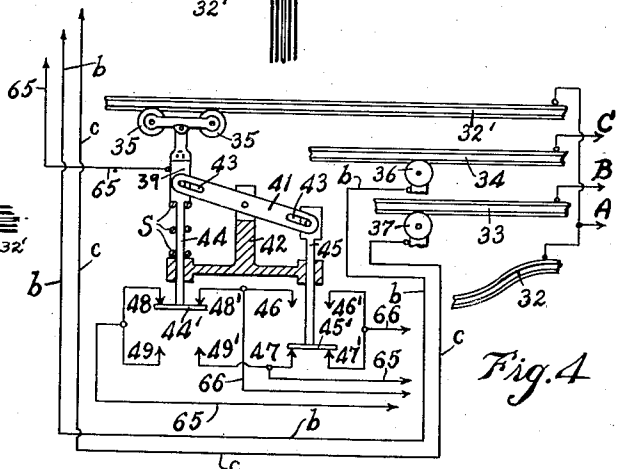


Fig. 4

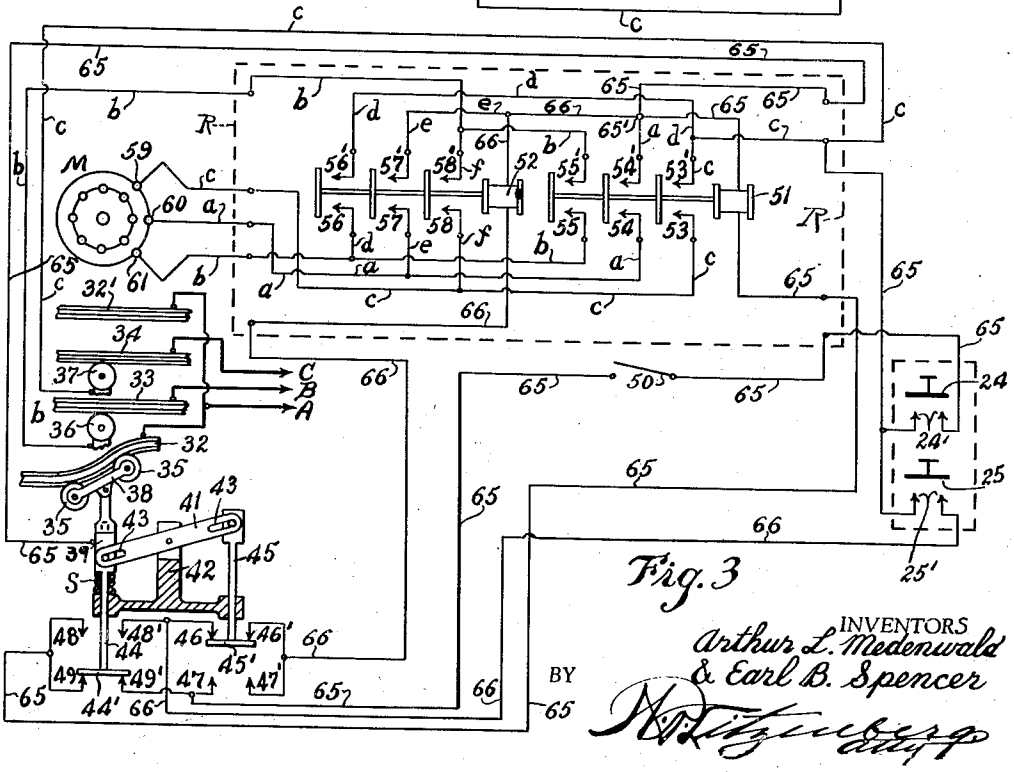


Fig. 3

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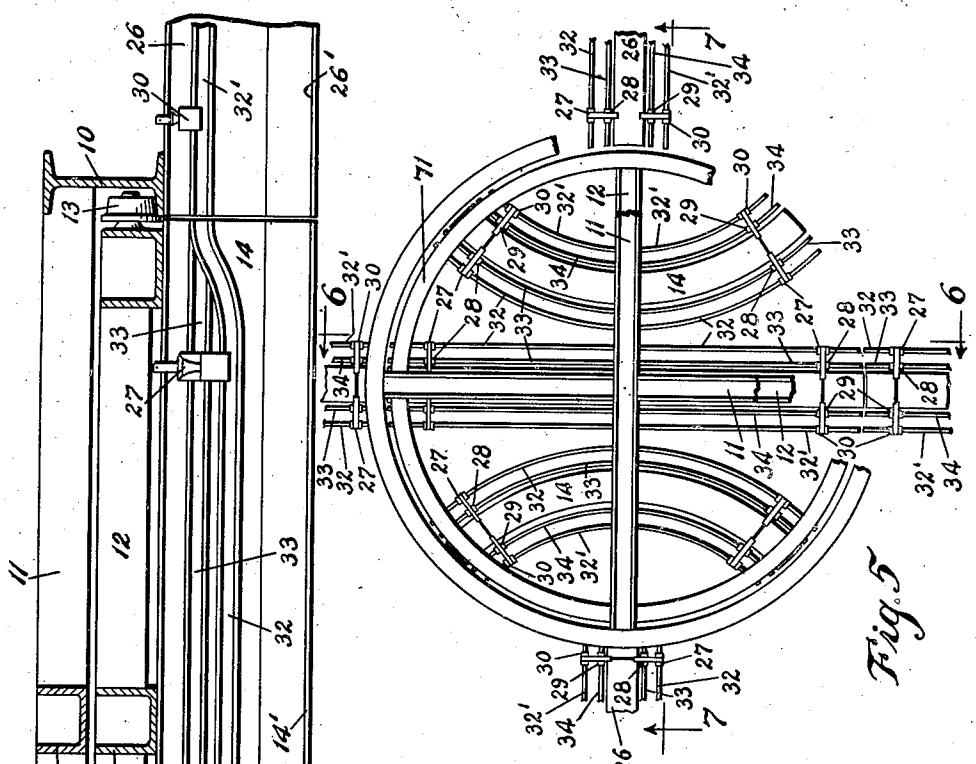


Fig. 5

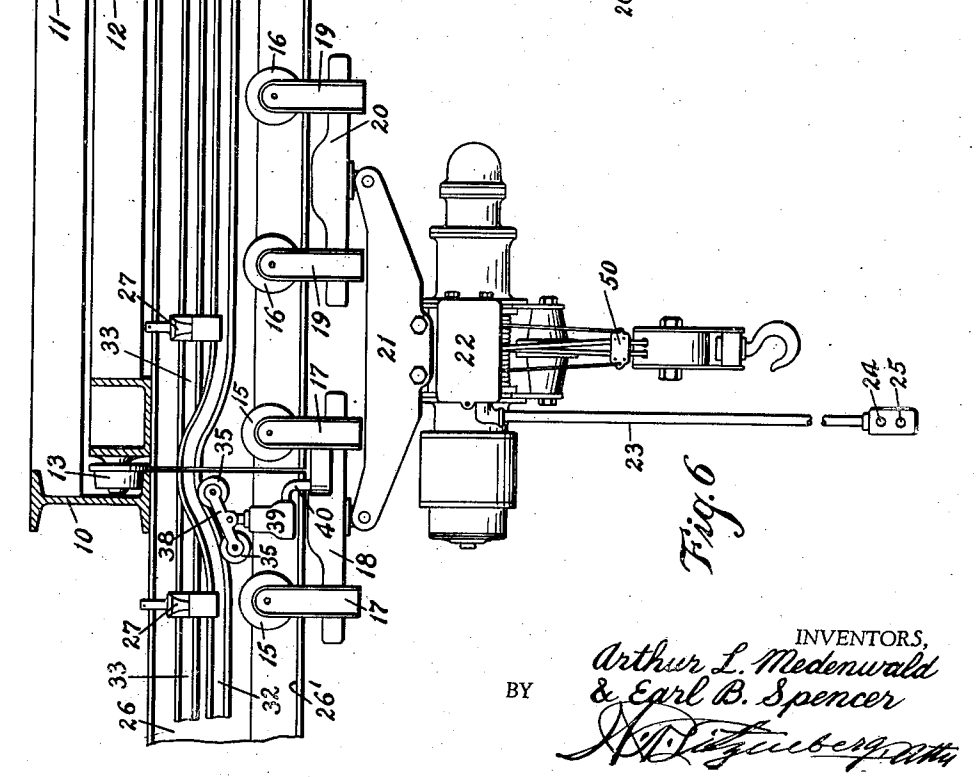


Fig. 6

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Filed Sept. 22, 1941 3 Sheets-Sheet 3

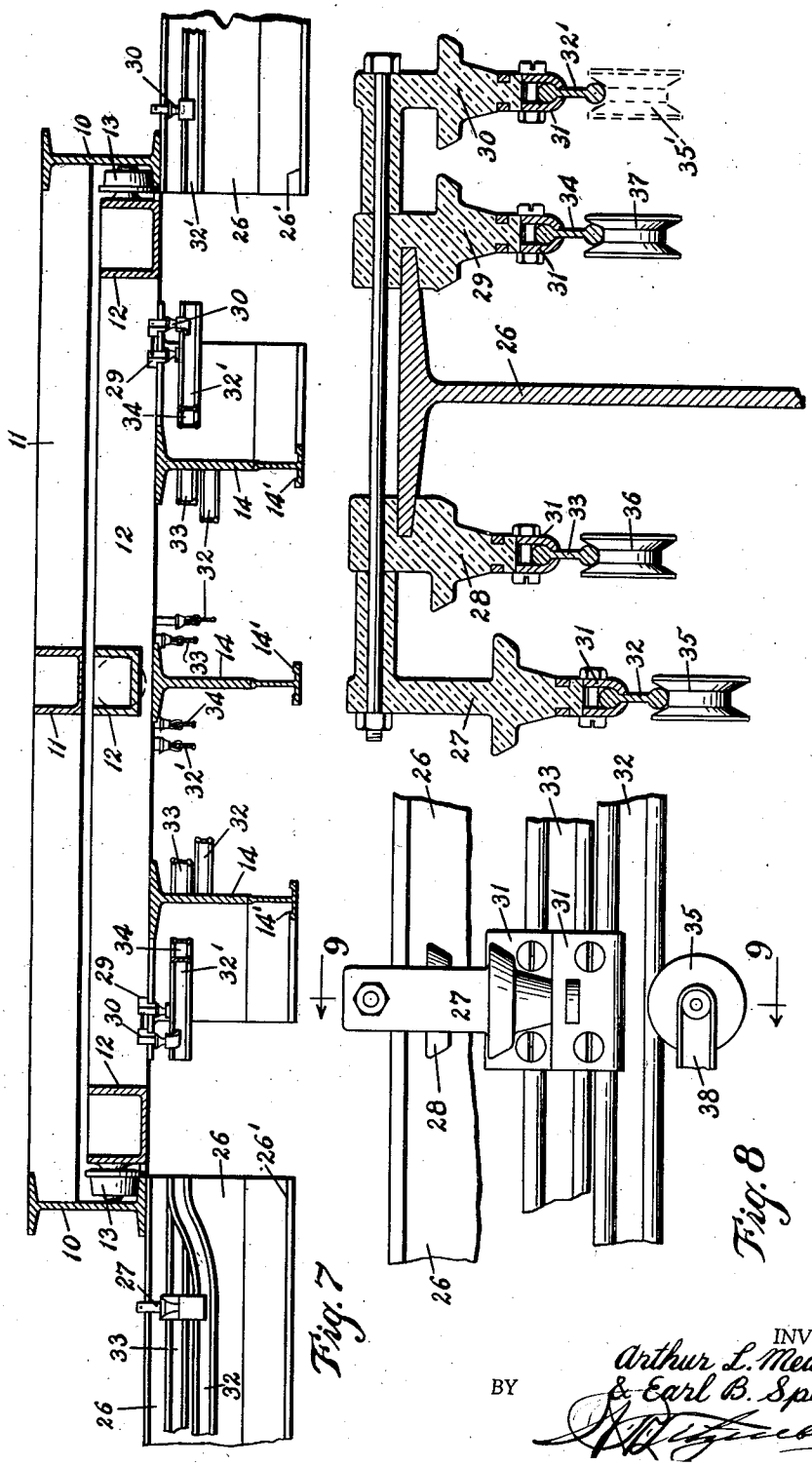


Fig. 7

Fig. 9

Fig. 8

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UNITED STATES PATENT OFFICE

2,360,505

ELECTRICALLY CONTROLLED HOIST FOR MONORAILS

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Application September 22, 1941, Serial No. 411,838

1 Claim. (Cl. 191—8)

Our invention relates to electrically controlled hoists for monorails such as are moved on overhead tracks or rails and which, in their course of travel, make a loop, or are turned around on a turntable, and returned to the track or rail on which they first approached the loop or turntable, thus reversing the position of the hoist on the track.

It is a well known fact that in a three phase alternating current system where three conductors are used, the crossing of any two conductors affects a reversal in the direction of the rotation of the motor, and it will be seen that in a group of tracks where switches or turntables are interposed, or where there is a loop in the circuit coming back into the main line, there would be a reversal of the motor, which would not only upset the marking of the "forward and reverse" or "up and down" switches, but what is still more hazardous is that it would make ineffective the usual protective devices, such as the limit switch or stop.

In order to overcome this difficulty, we have devised a system in which we interpose an auxiliary, phase reversing switch which affects the phase of the current so as to offset any reversal caused by turning the hoist around in the course of its travel, as by making a loop.

This auxiliary switch is mechanically actuated by collector or trolley wheels running on a trolley bar which is in a different position relative to the other or regular trolley bars of the system. When these trolley bars are in the regular or uniform positions or elevations, the current is undisturbed, but if the hoist is turned around and the trolley bar on the opposite side is lower, as we propose, then when the collector or trolley wheel passes under it, the forcing of said collector trolley wheel down by said lower trolley bar automatically actuates said auxiliary reversing switch, which operates to reverse the motor also. This takes place just as the traveling hoist reaches the particular point where the trolley wheels or collectors move upon the lower trolley bar and cause the actuation of the reversing switch.

In order to explain our invention, we have shown on the accompanying three sheets of drawings one practical embodiment thereof, which we will now describe:

Figure 1 is a plan view of a system of tracks to be traversed by a traveling hoist, with a plurality of turn table switches for changing the course of the traveling hoist;

Figure 2 is a fragmentary view showing a turn table adjusted for straight track travel through the turn table;

Figure 3 is a wiring diagram used in controlling the operation of the traveling hoist;

Figure 4 is a portion of the wiring diagram showing the changed position of the controlling or reversing switch;

Figure 5 is an enlarged plan view of one of the turntable switches, with parts broken out for explanatory purposes;

Figure 6 is an enlarged sectional view taken on line 6—6 of Fig. 5, showing the motor operated hoist;

Figure 7 is a similar view taken on line 7—7 of Fig. 5;

Figure 8 is an enlarged view of one of the supports for the trolley members of the system, and on which the trolley wheels of the hoist mechanism run; and

Figure 9 is a vertical sectional view taken on the line 9—9 of Fig. 8.

Referring now in detail to the drawings, overhead supporting I-beams 10 are shown as track ways or members, said I-beams or members being connected at places with channel members, 11, and shown as welded endwise against the sides of said I-beams 10.

The turntable switch members are formed of channel members 12, 12, and are provided on their outer sides with wheels, 13, 13, to run on the I-beams, in the manner indicated in Figs. 6 and 7.

Suspended from the underside of the turntable switch members 12, 12, as by welding thereto, are I-beams or supporting members 14, 14, having specially formed track-ways 14', 14' on opposite sides thereof on which run carrier wheels 15, 15, and 16, 16, as seen in Fig. 6. The wheels 15, 15, are provided with yoke members 17, 17, with a connecting member 18, supported at its opposite ends in said yoke members 17, 17. The wheels 16, 16, have the yoke members 19, 19, with a connecting member 20, supported at its opposite ends in said yoke members 19, 19. A supporting member 21, is pivotally connected at its opposite ends with said connecting members 18 and 20, as indicated in Fig. 6, said supporting member 21 carrying the motor-operated hoisting mechanism, designated as a whole 22.

From said motor operated hoist mechanism, is suspended the motor-control cable 23, provided with electric buttons or switches, as 24 and 25, Figs. 6 and 3.

Suspended under the I-beam members 10, 10, as by welding, or otherwise, Figs. 5, 6 and 7, are I-beam track members 26, 26, with the trackways 26', 26', thereon, to receive the carrier wheels 15, 15 and 16, 16, said track members 26, 26, and their trackways 26', 26', being positioned to register with the corresponding track members 14, 14, and their trackways 14', 14', on the turntable switch structures, whereby said traveling hoist, load carrying mechanism, can be run from the stationary trackways on to the trackways of the turntable switch mechanism for the purpose of changing its direction, or course of travel, as may be desired. This general mechanism is not new, but is shown and described in order to explain how our invention is applied thereto.

Supported or suspended from the upper portions of the I-beam members 14 and 26, are insulating supporting members, as 27, 28, 29 and 30, each having at its lower end a clamp, as 31, for supporting trolley bars, designated 32, 33, 34 and 32', at intervals.

It will be noted that the insulating supporting member 27 is longer than are the other members 28, 29 and 30, the purpose for which will be explained later. These supporting members are shown in enlarged form in Figs. 8 and 9. The trolley bars 32, 33, 34 and 32', it will be noted, are supported along and above the trackways to receive the trolley wheels, or collectors, designated 35, 36 and 37, on the traveling hoist or load carrying mechanism, one pair of which 35, is seen in Fig. 6, in which said trolley wheels 35, 35, are shown mounted on the opposite ends of a rocking member 38, pivotally mounted in a switch box, 39, in which can be mounted the reversing switch mechanism, designated 42, in Figs. 3 and 4, in connection with the diagrammatic figure. This is shown in smaller compass in the switch box 39, Fig. 6, to which is connected a cable or conduit for the wiring. This conduit is designated 40. The trolley wheels 35, 35, or collectors are mounted to swivel and to move up and down, as will be understood from Figs. 3, 4 and 6, so said trolley wheels can follow the trolley bars, whether low or high.

One of the important features of our invention is the mounting of one of the contact or trolley bars in a different position so that the current collectors or trolley wheels, as 35, 35, will be moved bodily relative to other wheels and in such a way as to cause the operation of an electric reversing switch. In the present showing, we have shown one of the trolley members 32 lower than the other three, as seen in Fig. 9, also in Figs. 3, 4 and 6.

In the diagrammatic view, Fig. 3, the trolley wheels 35, 35, being pivotally supported in the switch box 39, on the traveling hoist mechanism, are shown connected mechanically with a reversing switch mechanism, interposed in the circuit. This reversing switch mechanism is designated as a whole 42, and is designed to be operated by passing the trolley wheels along the differently positioned trolley bars or members.

This reversing switch mechanism may be described as follows: A lever 41 is pivotally mounted on a base 42, said lever having at its opposite ends two slots, 43, 43, with which are connected two plunger rods, 44 and 45, carrying at their lower ends contact or bridge bars 44' and 45', adapted to be moved into and out of engagement with four pairs of contact points, 46, 46'; 47, 47'; and 48, 48'; and 49, 49', for opening and closing four different circuits, hereinafter referred to. This constitutes our auxiliary reversing switch, adapted to be actuated by the passing of the trolley or collector wheels, 35, 35, under the lower trolley bar or rail 32. In Fig. 4, this auxiliary reversing switch is shown in the reversed position, having been moved to this position by a coiled spring S on the plunger rod 44, when said trolley wheels 35, 35, moved on to a high or uniform trolley rail or bar, as 32'.

In order to describe our invention and its operation, we refer particularly to Figs. 3 and 4, and also to Figs. 1 and 2. In Fig. 3, the hoist motor is designated M, and the "up" and "down" control switches are designated 24 and 25, respectively, and the auxiliary reversing switch is designated as a whole 42. The regular motor control switch, a magnetic switch, is designated R and its case is designated in broken heavy lines on Fig. 3.

Assuming that the traveling hoist 22, Fig. 6, is at the position X, on Fig. 1, with its trolley wheels 35, 35, in engagement with the lower trolley bar 32, with trolley wheel 36 in engagement with trolley bar 33, and with trolley wheel 37 in engagement with trolley bar 34, Fig. 2, and also indicated in Fig. 9. No trolley wheel is in the position indicated in light broken lines at 35', Fig. 9. Our auxiliary switch 42 is in the position seen in Fig. 3. In this position the switch bar 44' is in engagement with contact points 49 and 49', and switch bar 45' is in engagement with contact points 46 and 46'. They are in reversed positions in Fig. 4.

Assume now for explanatory purposes that the trolley bars 32 and 32' are fed with phase A, and conductor bar 33 is fed with phase B, and conductor bar 34 is fed with phase C, from the main line supply at all times, the operation may be described as follows:

If the "up" switch 24 be manually closed, a circuit, which we will designate 65, is closed, and can be traced from the right hand side of said switch 24, through the limit switch 50, thence down to contacts 49', 49, thence up to solenoid 51, of the regular magnetic motor control switch, thence up to juncture 65' and around and down to the supporting member 39, through trolley wheels 35, 35, to trolley bar or rail 32, and thence to phase A and to the main line. The energized solenoid 51, closes the magnetic switch, in the right hand portion thereof, whereby the contacts 53, 53', 54, 54' and 55, 55' are closed, connecting the hoist motor M with the main line circuit, so that phase C connects by a circuit c with terminal 59 of said motor; phase A connects by a circuit *a* and circuit 65, with terminal 60 of said motor; and phase B connects by a circuit *b* with terminal 61 of said motor. The contacts in the left hand side of said magnetic switch are all open. The motor is operated to raise the load until it strikes and opens the limit switch 50, which automatically safeguards the hoist from damage. The releasing of the switch 24 will, of course, stop the hoist also.

Now if the "down" switch 25 is closed, a circuit therefrom, designated 66, will run to contacts 46, 46', of the reversing switch, thence up to solenoid 52, in the left hand portion of the magnetic switch, closing these switches at 56, 56'; 57, 57', and 58, 58', and connecting the hoist motor M with the main line current, so that phase C connects by circuit *c*, *d* and *b* with terminal 61 of the hoist motor; phase A connects by circuits 65, 66, *e* and *a* with terminal 60 of

said motor; and phase B connects by circuits *b*, *f* and *c* with terminal **59** of said motor, under which condition the hoist will lower the load until the manual switch **25** is released. The circuit **66** continues from the solenoid **52** to the juncture with circuit **65**, at **65'**, and thence through circuit **65** around to member **39**, insulated from member **44**, and thence to the trolley wheels **35**, **35**, trolley bar **32**, and through phase A to the main line.

Assuming now that the hoist has moved from position X, Fig. 1, through switch **71**, up over the loop **72**, down through switch **73**, and back to switch **71**. Switch **71** is first manually revolved through a forty-five degree angle clockwise, to the position indicated in Fig. 2, to allow the hoist to pass straight through to the starting position X. It will be realized now that the hoist has been turned completely around, and is facing in the opposite direction from its starting position.

There has been no change in the phase relationship between conductor bars or trolleys, and trolley wheels, until the hoist reaches switch **71** on the return trip. Up to this point, collector wheels **35**, **35**, have been in engagement with the low trolley bar **32**, wheel **36** has been in engagement with trolley bar **33** and wheel **37** has been in engagement with trolley bar **34**, with no trolley wheel on high bar **32'**.

As the hoist leaves turntable switch **71**, Fig. 2, and returns to the position X, the phase relations are automatically changed and trolley wheels **35**, **35**, engage the high trolley bar **32'**, Fig. 4, trolley wheel **36** engages the high trolley bar **34**, and trolley wheel **37** engages with high trolley bar **33**. Since low trolley bar **32** and high trolley bar **32'** are both connected with phase A, Fig. 4, there is no change in this phase through wheels **35**, **35**, to the hoist, but collector wheel **36** is now fed from phase C instead of phase B and collector wheel **37** is fed from phase B instead of phase C. This phase reversal would, under ordinary conditions, cause the hoist to operate in reverse and would operate to lower when the "up" switch is closed, and to raise when the "down" switch is closed, and as the "up" limit switch **50** is not in the "down" circuit, the hoist would be subject to damage, and the operator would be confused as to which switch to press, or operate.

Referring to Fig. 4, the collector trolley wheels **35**, **35**, have moved on to a high trolley bar, as **32'**. Under the operation of the coiled spring S, on the plunger rod **44**, the pivoted lever **41** has been moved to move the switch bridge bar **45'** down to contacts **47**, **47'**, and switch bridge bar **44'** up to contacts **48**, **48'**, closing the circuits, in reverse to the showing in Fig. 3. The other circuits, of course, are open.

In this position, if the "up" switch **24** is closed, the circuit including **65**, the limit switch **50**, contacts **47**, **47'**, **66** and coil **52**, closing magnetic switches **56**, **56'**; **57**, **57'** and **58**, **58'**, and connecting the hoist motor M with the main circuit, is accomplished. Now the collector trolley wheels **35**, **35**, are connected with the high trolley bar **32'** to phase A; wheel **36** is connected with high trolley bar **34**, to phase C; and wheel **37** is connected with high trolley bar **33**, to phase B, it will be seen that phase C will flow from trolley bar **34**, through wheel **36** and through circuit wires *b*, *f* and through contacts **58'**, **58**, and wire *c* to terminal **59**, of the hoist motor M. Phase A will flow from trolley bar **32'** through wheels **35**, **35**, through circuit wires **65**, **66**, points **57'**, **57** and wires *e* and *a* to hoist motor terminal **60**. Phase B will flow from trolley bar **33**, through wheel **37**, through wires *c* and *d* and through contact points **56'**, **56**, and wire *b*, to hoist motor terminal **61**. Under this phasing, the hoist will raise the load, and the "up" limit switch **50** and the "up" switch **24** will function properly.

It should also be clear that the "down" switch **25** will function properly, and there will be no wrong or reverse action from what is intended when the "up" or the "down" switches are actuated to move the load up or down.

Thus we have interposed a reversing switch in the control circuits for a traveling hoist, with mechanical means connected with the traveling hoist mechanism for actuating said reversing switch when said traveling hoist has been reversed in its travel, whereby to automatically reverse the circuit in keeping with the reversal of the position of the traveling hoist relative to the trackways on which it moves.

We do not limit our invention to the details of the showing here made for the purposes of illustrating one embodiment of our invention, except as we may be limited by the hereto appended claim.

We claim:

In a traveling hoist system using a three phase alternating current, a reversible motor, tracks, and a control switch for starting and stopping said motor in each direction of rotation, an auxiliary control switch adapted to reverse the connections to said control switches, said auxiliary control switch having means for mechanically operating the same, said means being automatically operable by the reversal of the hoist on the track in its course of travel, and a plurality of trolley bars associated with said tracks for supplying current to said motor and for actuating said means for operating said auxiliary control switch during the movement of said hoist on said tracks, one of said trolley bars being placed at a different elevation to the other trolley bars for this purpose said trolley bars being symmetrically located transversely with respect to said tracks.

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