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2,822,929

ELECTRICAL CONTROL SYSTEMS

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2 Sheets-Sheet 1

FIG. 1

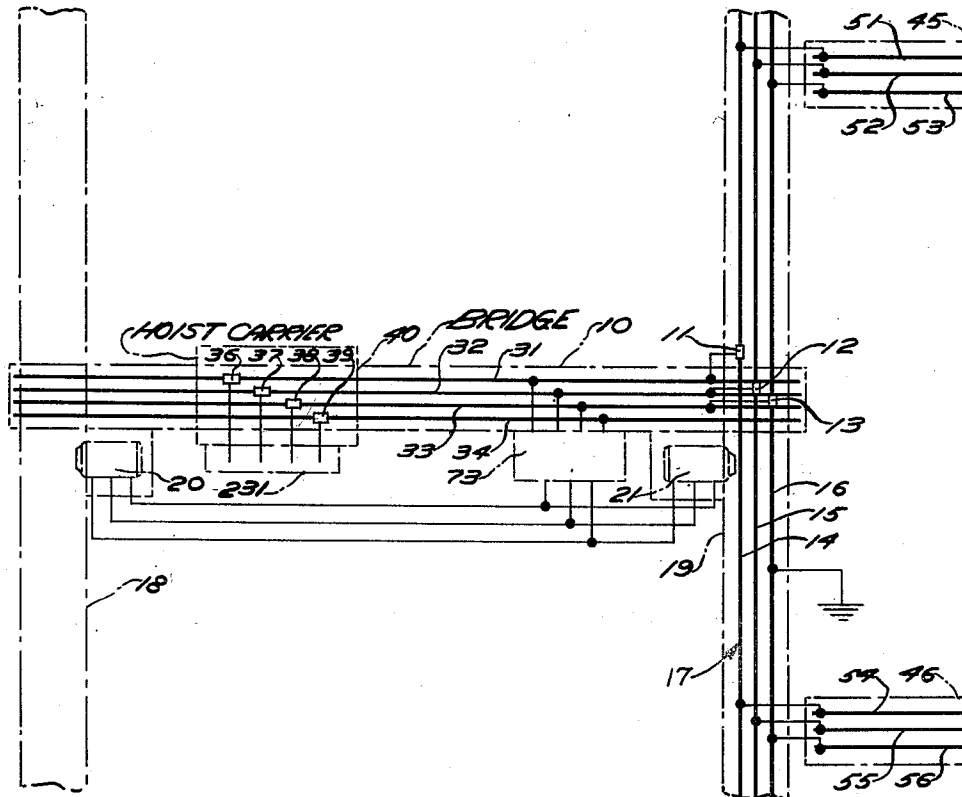
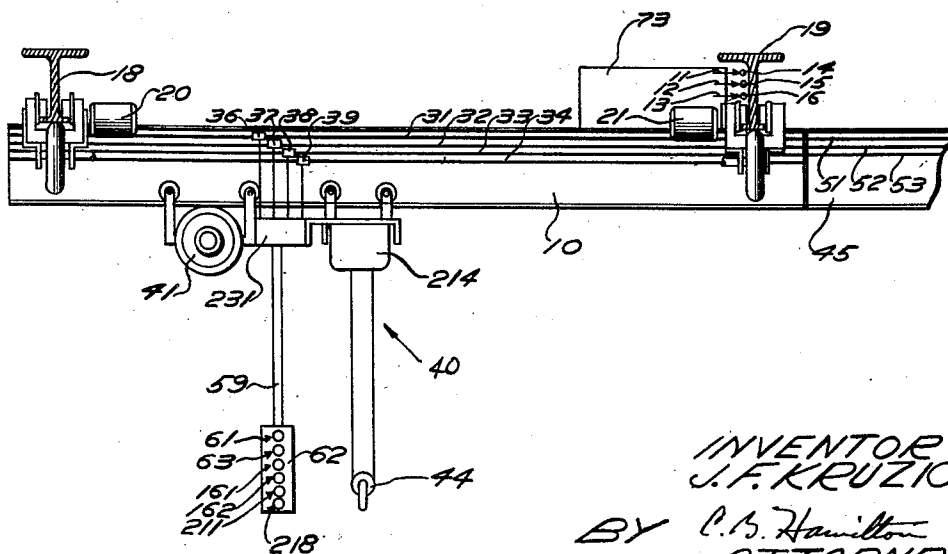


FIG. 2



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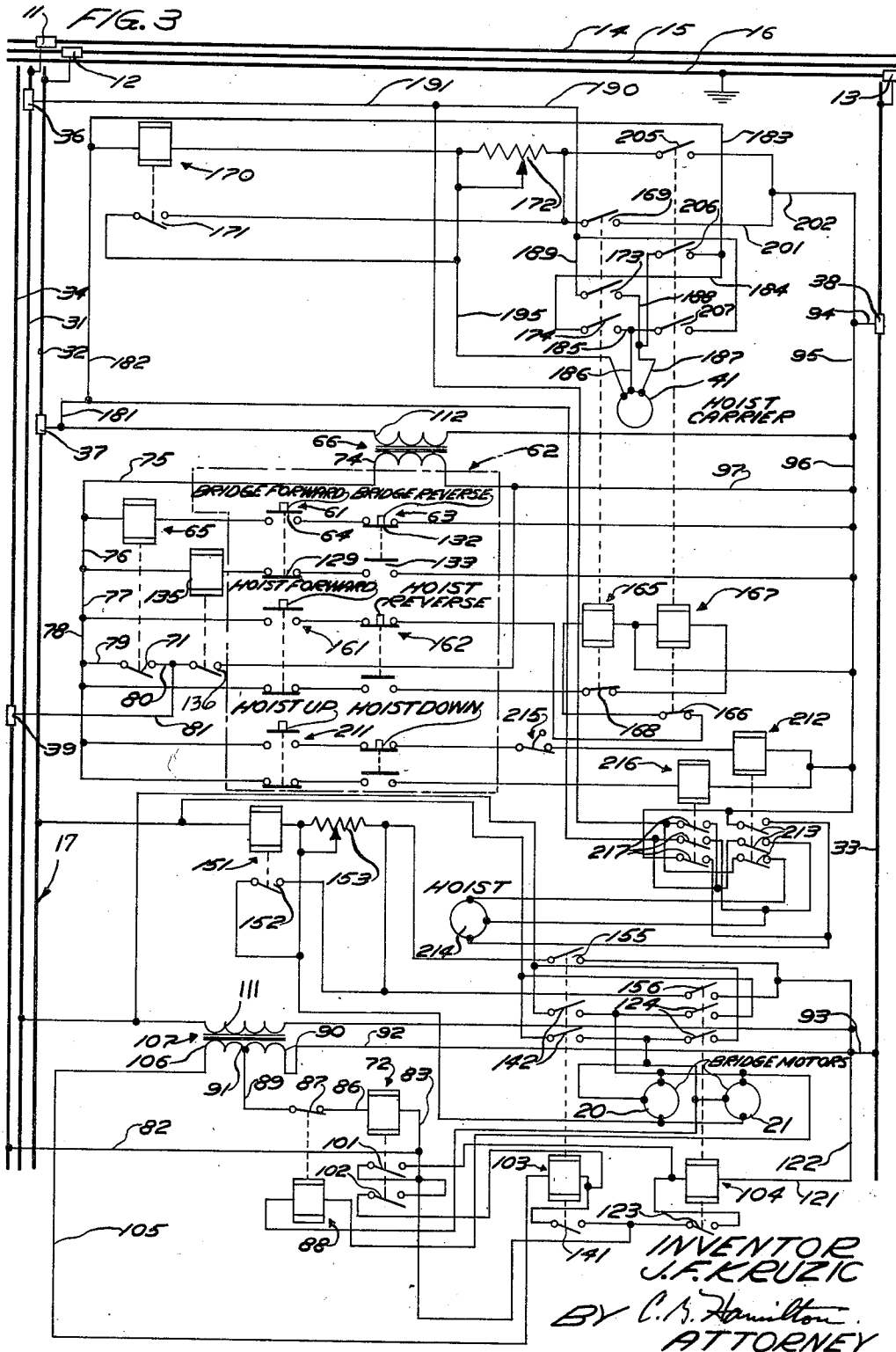
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ELECTRICAL CONTROL SYSTEMS

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5 Claims. (Cl. 212—21)

This invention relates to electrical control systems, and more particularly to control systems for bridge cranes having spur tracks.

An object of the invention is to provide bridge crane control circuits having a minimum number of conductor bars.

Another object of the invention is to provide a control circuit for preventing movement of a crane on a main track when a hoist movable along the crane has been moved off the crane.

A further object of the invention is to provide a system in which a crane-actuating brush carried by a hoist movable along the crane is moved off a conductor bar on the crane as the hoist is moved to a spur track for preventing actuation of the crane while the hoist is off the crane.

An apparatus illustrating certain features of the invention may include a crane movable by a crane drive along a main track and carrying power conductor bars connected by collector shoes travelling along power conductor bars extending along the track. A control conductor bar is carried by the crane for making connections between the drive and a control unit carried by a hoist carrier movable along the crane and deriving power from the power conductor bars. The hoist carrier has power collector shoes slidable from the power conductor bars on the crane to power conductor bars on a spur track as the hoist carrier is moved from the crane to the spur track. Another collector shoe carried by the hoist carrier is moved off the control conductor bar as the hoist carrier is so moved to prevent actuation of the crane while the carrier is off the crane.

A complete understanding of the invention may be obtained from the following detailed description of an electrical control system forming a specific embodiment thereof, when read in conjunction with the appended drawings, in which

Fig. 1 is a schematic top plan view of a crane system and a control circuit therefor forming one embodiment of the invention;

Fig. 2 is a vertical section of the crane system shown in Fig. 1, and

Fig. 3 is a diagrammatic view of the control circuit shown in Fig. 1.

Referring now in detail to the drawings, there is shown in Fig. 1 a monorail crane bridge 10 having collector shoes 11, 12 and 13 movable by the bridge along conductor bars 14, 15 and 16 of a three-phase powerline 17 paralleling tracks 18 and 19 along which the bridge is moved by electric motors 20 and 21 driving through conventional means. The bridge carries conductor bars 31, 32, 33 and 34 rigidly thereon contacted by collector shoes 36, 37, 38 and 39 carried by a hoist carrier 40 movable along the bridge by an electric motor 41 (Fig. 3) driving through conventional means. The hoist carrier carries a hoist 44. When the crane bridge is aligned with a spur monorail 45 or a spur monorail 46, the hoist carrier may

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be driven off the bridge onto the monorail 45 or 46 aligned with the bridge, at which time the shoes 36, 37 and 38 are moved off the conductor bars 31, 32 and 33 and travel along conductor bars 51, 52 and 53 or conductor bars 54, 55 and 56, respectively, connected to the conductor bars 14, 15 and 16, respectively, and the shoe 39 is moved completely out of contact with the conductor bar or contact rail 34, which is provided on the bridge 10 to control movement of the bridge along the tracks 18 and 19.

To move the bridge along the tracks 18 and 19, the hoist carrier 40 must be on the bridge 10 so that the shoe 39 is in contact with the conductor bar 34 carried by the bridge, and either a momentary bridge forward switch 61 (Fig. 3) carried by a switch box 62 supported by a cable 59 (Fig. 2) from the hoist carrier 40 or a momentary bridge reverse switch 63 is held actuated manually. If the switch 61 is closed, contacts 64 are made to energize a relay 65 from a transformer 66 carried by the hoist carrier 40 and energized through the collector shoes 37 and 38. The relay 65 closes contacts 71 to energize a relay 72, which is carried by a panel 73 (Fig. 1) carried in a fixed position by the bridge 10, through a secondary winding 74 (Fig. 3) of the transformer 66, conductors 75, 76, 77, 78 and 79, the contacts 71, conductors 80 and 81, the collector shoe 39, the conductor bar 34, conductors 82 and 83, the relay 72, a conductor 86, normally closed contacts 87 of a relay 88, a conductor 89, a half 90 of a secondary winding 91, conductors 92 and 93, the conductor bar 33, the collector shoe 38 and conductors 94, 95, 96 and 97. The relay 72 closes contacts 101 and 102 to connect one side of each relay 103 and 104 to the conductor 82 from the conductor bar 34 which is at the potential of the lefthand end of the secondary winding 74. The other side of the relay 103 is connected by a conductor 105 to a half 106 of the secondary winding 91 of a transformer 107 mounted in the panel 73. A primary winding 111 of the transformer 107 is energized in phase with a primary winding 112 of the transformer 66, and the lefthand end of the secondary windings 74 and 91 are at the same potential, the righthand ends of the secondary windings 74 and 91 are at ground potential and the potential of the conductor 89 tapped to the center point of the winding 91 is midway between ground potential and that of the lefthand ends of the windings 74 and 91. Hence, the potential of the conductor 82 is the same as that of the conductor 105 so that the relay 103 is not energized and the relay 104, the righthand side of which is connected to ground by conductors 121, 122 and 93, the conductor bar 33, the collector 13 and the grounded conductor bar 16, is energized. The relay 104 closes holding contacts 123 and contacts 124 to the bridge carrier motors 20 and 21 to drive the bridge forwardly along the tracks 18 and 19, which is upwardly, as viewed in Fig. 1. Whenever the motors 20 and 21 are energized, the relay 88 also is energized to open the contacts 87 to drop out the relay 72. However, the forward relay 104 is kept energized through the holding contacts 123 which are in parallel with the contacts 101 of the relay 72. To stop the bridge, the momentary switch 61 is released to drop out the relay 65, which opens its contacts 71 to drop out the relays 104 and 88 and stop the reversible motors 20 and 21. The switch 61 also has reverse-blocking contacts 129.

To drive the bridge 10 in reverse, downwardly as viewed in Fig. 1, the momentary reversing switch 63 (Fig. 3) is actuated to open blocking contacts 132 and close contacts 133. The contacts 133 close an energizing circuit to a relay 135, which closes its contacts 136 to connect to ground the conductor 81, the collector shoe 39, the conductor bar 34 and the conductors 82 and 83,

The potential of the winding half 90 then energizes the relay 72 to close its contacts 101 and 102 to connect the adjacent sides of the relays 103 and 104 to ground. Since the other side of the forwarding relay 104 is also at ground potential, it is not energized. However, the conductor 105 is not at ground potential and the reverse relay 103 is energized to close holding contacts 141 and reversing contacts 142. The reversing contacts 142 energize the three-phase reversible motors 20 and 21 to drive the bridge 10 (Fig. 1) in a reverse direction along the tracks 18 and 19, which is downwardly as viewed in Fig. 1. The reversing contacts 142 also actuate the relay 88 to drop out the contacts 87. To stop the reverse movement of the bridge, the momentary switch 63 is released which drops out the relay 135 to stop the motors 20 and 21 and reset the circuit. A starting delay relay 151 having contacts 152 for shunting a rheostat 153 is actuated each time either contacts 155 of the relay 103 are closed or contacts 156 of the relay 104 are closed.

Momentary switches 161 and 162 carried by the hanging switch box 62 are provided for actuating the reversible three-phase motor 41 to drive the hoist carrier 40 in either a forward direction or a reverse direction along the bridge 10 or along either of the monorails 45 and 46. To move the hoist carrier 40 in a forward direction along the bridge 10, which is toward one of the monorails or spur tracks 45 and 46, the switch 161 is actuated and held so to energize a forwarding relay 165 through blocking contacts 166 of a reversing relay 167. The relay 165 opens blocking contacts 168 and closes starting contacts 169 to energize a relay 170, which closes contacts 171 to shunt a starting rheostat 172. The relay 165 also closes forwarding contacts 173 and 174 to the hoist carrier motor 41. The motor 41 is driven in a forward direction through the conductor bar 15, the collector shoe 12, the conductor bar 32, the collector shoe 37, conductors 181, 182, 183 and 184, the contacts 174, conductors 185 and 186, the motor windings of the motor 41, conductors 187 and 188, the contacts 173, conductors 189, 190 and 191, the collector shoe 36, the conductor bar 31, the collector shoe 11 and the conductor bar 14. A third or ground wire 195 is connected to the grounded conductor bar 16 through the contacts 171 and 169, conductors 201, 202 and 94, the collector shoe 38, the conductor bar 33 and the collector shoe 13.

With the switch 161 unactuated, to reverse the hoist carrier 40, the switch 162 is actuated to energize, through the contacts 168, the reversing relay 167, which opens the blocking contacts 166 and closes contacts 205, 206 and 207 to reverse, from the forwarding connections of the motor 41, the connections of the motor 41 to the conductor bars 14 and 15 forming two wires of the three-phase powerline. The motor 41 then drives the hoist carrier along the bridge 10 to the left, as viewed in Fig. 1. Similarly, the hoist carrier 40 may be driven along either of the monorails or tracks 45 and 46, the collector shoes 36, 37 and 38 engaging the conductor bars 51, 52 and 53, respectively, or the conductor bars 54, 55 and 56, respectively. When the hoist carrier is on either of the spur tracks, the collector shoe 39 is out of engagement with the conductor bar 34 so that the bridge 10 cannot be moved in either direction. Well known means (not shown) may be provided to brake the bridge to the tracks 18 and 19 in any desired position.

The hoist 44 (Fig. 2) carried by the hoist carrier 40 may be raised by actuating a momentary switch 211 (Fig. 3) to energize through the transformer 66 a relay 212 to close contacts 213 to drive a three-phase reversible motor 214 carried by the hoist carrier 40 in a hoist-raising direction, a limit switch 215 being provided to limit upward movement of the hoist. To lower the hoist, a switch 218 is actuated to energize a relay 216 to close contacts 217. This energizes the motor 214 to lower the hoist.

The panel 73 on the bridge carries the transformer

107, the relays 72, 88, 103, 104 and 151 and the rheostat 153. A panel 231 carried by the hoist carrier 40 serves to carry the transformer 66, the relays 65, 135, 165, 167, 170, 212 and 216 and the rheostat 172. The bridge 10 also carries the motors 20 and 21, the collector shoes 11, 12 and 13, the conductor bars 31, 32, 33 and 34 and the hoist carrier 40. The hoist carrier carries also the collector shoes 36, 37, 38 and 39.

The above-described circuit provides maximum control with minimum structure, and is simple, rugged and inexpensive.

It is to be understood that the above-described arrangements are simply illustrative of the application of the principles of the invention. Numerous other arrangements may be readily devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. In a crane system including a crane, a main track, a reversible crane drive for moving the crane along the track, a hoist carrier, a reversible hoist carrier drive for moving the hoist carrier along the crane, main conductor bars extending along the main track, crane power conductor bars carried by and extending along the crane, collector shoes connecting the crane power conductor bars to the main conductor bars, the improvement comprising a control conductor bar carried by and extending along the crane, a circuit carried by the crane for actuating the crane drive and connected to the crane control conductor bar, circuit means including a control switch and collector shoes movable along one of said crane power conductor bars and along the crane control conductor bar for connecting the crane-drive-actuating circuit to the crane power conductor bars, a transformer-powered circuit on the hoist carrier and connected to the collector shoes for selectively actuating the hoist carrier drive, a forwarding relay carried by the crane, a reversing relay carried by the crane, a transformer carried by the crane having a primary winding connected to the crane power conductor bars and a center-tapped secondary winding having the ends thereof connected to one side of each winding of the forwarding and reversing relays, a control collector shoe carried by the carrier along the control conductor bar, circuit means connecting the other side of the forwarding and reversing relay windings to the center of the secondary winding and to the control conductor bar, and means for connecting opposite polarities of said transformer powered circuit selectively to the control collector shoe to selectively energize the forwarding relay and the reversing relay.

2. In a crane system including a crane, a main track, a reversible crane drive for moving the crane along the track, a hoist carrier, a reversible hoist carrier drive for moving the hoist carrier along the crane, main conductor bars extending along the main track, crane power conductor bars carried by and extending along the crane, collector shoes connecting the crane power conductor bars to the main conductor bars, the improvement comprising a control conductor bar carried by and extending along the crane, a circuit carried by the crane for actuating the crane drive and connected to the crane control conductor bar, circuit means including a control switch and collector shoes movable along one of said crane power conductor bars and along the crane control conductor bar for connecting the crane-drive-actuating circuit to the crane power conductor bars, a transformer on the hoist carrier having a primary winding connected to the collector shoes and a secondary winding having a first end and a second end, said second end of the secondary winding being connected to one of said crane power conductor bars by one of said collector shoes, means operable by said transformer for selectively actuating the hoist carrier drive, a forwarding relay carried by the crane, a reversing relay carried by the crane, a second transformer carried by the crane having a primary winding connected to the crane

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power conductor bars and a center-tapped secondary winding having the ends thereof connected to one side of each winding of the forwarding and reversing relays, one end of said center-tapped secondary winding also being connected to the same conductor bar as said second end of the first-mentioned secondary winding, a control collector shoe carried by the carrier along the control conductor bar, circuit means connecting the other side of the forwarding and reversing relay windings to the center of the secondary winding and to the control conductor bar, and means for selectively connecting the ends of the first-mentioned secondary winding to the control collector shoe to selectively energize the forwarding relay and the reversing relay.

3. In a crane system including a crane, a main track, a reversible crane drive for moving the crane along the track, a hoist carrier, a reversible hoist carrier drive for moving the hoist carrier along the crane, main conductor bars extending along the main track, crane power conductor bars carried by and extending along the crane, collector shoes connecting the crane power conductor bars to the main conductor bars, the improvement comprising a control conductor bar carried by and extending along the crane, a circuit carried by the crane for actuating the crane drive and connected to the crane control conductor bar, circuit means including a control switch and collector shoes movable along one of said crane power conductor bars and along the crane control conductor bar for connecting the crane-drive-actuating circuit to the crane power conductor bars, a transformer-powered circuit, a first transformer carried by the hoist carrier and having a primary winding connected to the collector shoes and a secondary winding having one end grounded, means powered by the secondary winding for selectively actuating the hoist carrier drive, a forwarding relay carried by the crane, a reversing relay carried by the crane, a second transformer carried by the crane having a primary winding connected to the crane power conductor bars and a center-tapped secondary winding having the ends thereof connected to one side of each winding of the forwarding and reversing relays, one end of the center-tapped winding being grounded, a control collector shoe carried by the carrier along the control conductor bar, circuit means connecting the other side of the forwarding and reversing relay windings to the center of the secondary winding and to the control conductor bar, and means for connecting opposite ends of the secondary winding of the first-mentioned transformer selectively to the control collector shoe to selectively energize the forwarding relay and the reversing relay.

4. In a crane system including a crane, a main track, a reversible crane drive for moving the crane along the track, a spur track, a hoist carrier, a reversible hoist drive for moving the hoist along the crane and off the crane and along the spur track, three main conductor bars forming a three-phase powerline extending along the main track, spur conductor bars connected to the main conductor bars, three crane power conductor bars carried by and extending along the crane, collector shoes connecting the crane conductor bars to the main conductor bars, the improvement comprising a fourth conductor bar carried by and extending along the crane, a transformer carried in a fixed position on the bridge and having a primary winding connected to the crane power conductor bars and a first secondary winding and a second secondary winding of equal output potentials, a forwarding relay carried in a

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fixed position on the crane for actuating the crane drive in one direction, a reversing relay carried in a fixed position on the crane for actuating the crane drive in the other direction, a second transformer carried by the hoist carrier, a carrier-controlling relay on the carrier, collector shoe means carried by the carrier for connecting the second transformer and the carrier controlling relays to the crane power conductor bars, collector shoe means connecting the second transformer through the control conductor bar to one side of each of the windings of the forwarding and reversing relays, means connecting the other side of the winding of the forwarding relay to one end of one secondary winding of the first transformer, means connecting the other side of the winding of the reversing relay to one end of the other secondary winding of the first transformer, means connecting the other ends of the secondary winding of the first transformer together at a predetermined point, means connecting said point to the first-mentioned sides of the forwarding relay and the reversing relay, and means for selectively connecting the ends of the secondary winding to the forwarding and reversing relays to selectively energize the forwarding and reversing relays.

5. In a crane system including a crane, a main track, a reversible crane drive for moving the crane along the track, a hoist carrier, a reversible hoist drive for moving the hoist along the crane, three main conductor bars forming a three-phase powerline extending along the main track, three crane power conductor bars carried by and extending along the crane, collector shoes connecting the crane conductor bars to the main conductor bars, the improvement comprising a fourth conductor bar carried by and extending along the crane, a transformer carried in a fixed position on the bridge and having a primary winding connected to the crane power conductor bars and a center-tapped secondary winding, a forwarding relay carried in a fixed position on the crane for actuating the crane drive in one direction, a reversing relay carried in a fixed position on the crane for actuating the crane drive in the other direction, a second transformer carried by the hoist carrier, a carrier-controlling relay on the carrier, collector shoe means carried by the carrier for connecting the second transformer and the carrier controlling relays to the crane power conductor bars, collector shoe means for selectively connecting the ends of the secondary winding of the second transformer through the control conductor bar to one side of each of the windings of the forwarding and reversing relays, means connecting the other side of the winding of the forwarding relay to one end of the secondary winding of the first transformer and to one of the crane power conductor bars, collector shoe means connecting one end of the secondary winding of the second transformer, means connecting the other side of the winding of the reversing relay to the other end of the secondary winding of the first transformer, and means connecting the center tap of the secondary winding of the first-mentioned transformer to the first-mentioned sides of the forwarding relay and the reversing relay.

References Cited in the file of this patent

UNITED STATES PATENTS

2,156,636	Miller	May 2, 1939
2,159,324	Evans	May 23, 1939
2,196,564	Nielsen	Apr. 9, 1940
2,708,715	Meyers	May 17, 1955