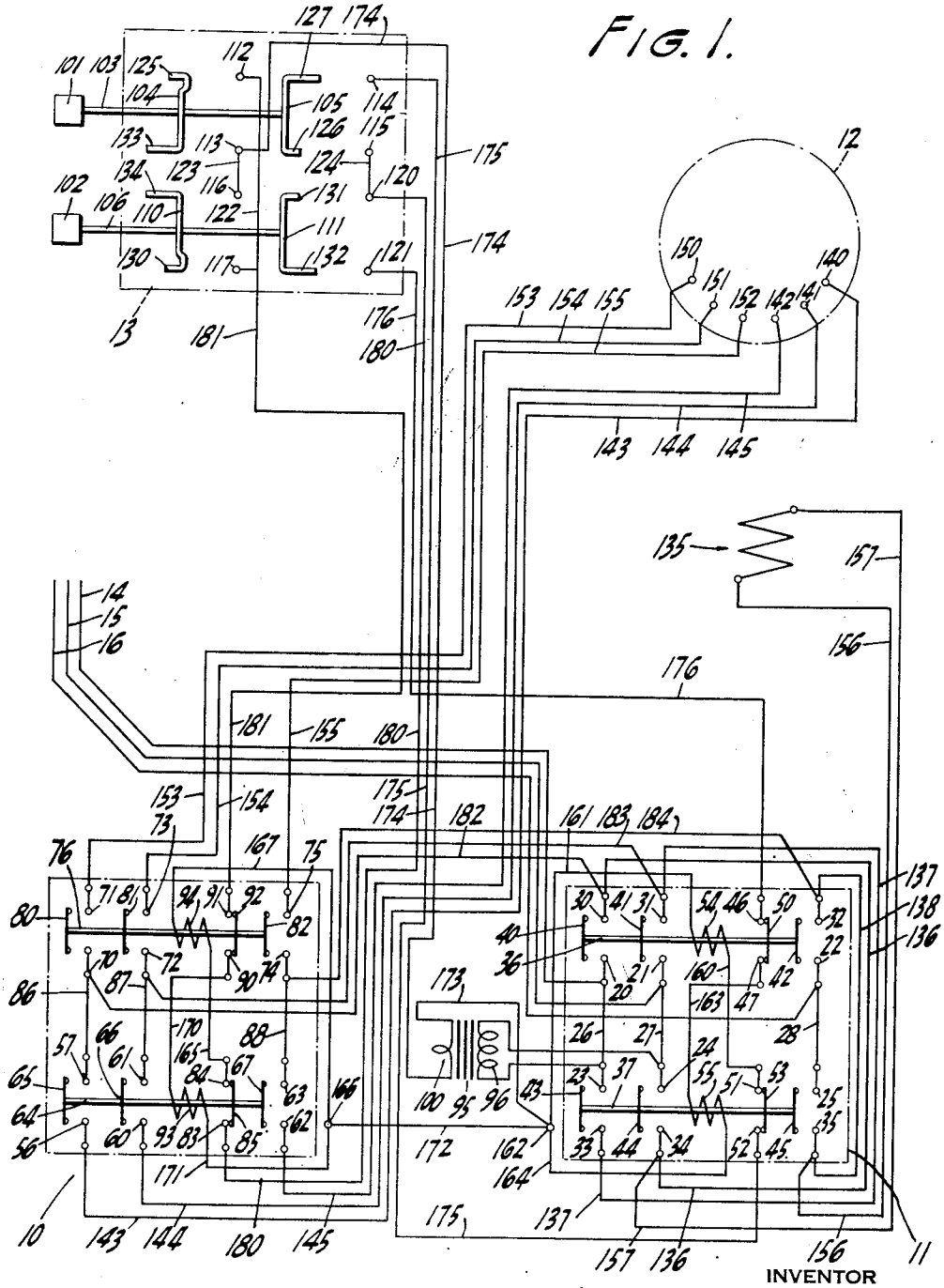
Oct. 19, 1943. C. J. MANNEY 2,332,390

CONTROL FOR ELECTRIC HOISTS

Filed May 7, 1942 2 Sheets-Sheet 1

FIG. 1.



INVENTOR
Charles J. Manney
BY
Beau, Brooks, Buckley & Beau.
ATTORNEYS

Oct. 19, 1943. C. J. MANNEY 2,332,390

CONTROL FOR ELECTRIC HOISTS

Filed May 7, 1942 2 Sheets-Sheet 2

FIG. 2.

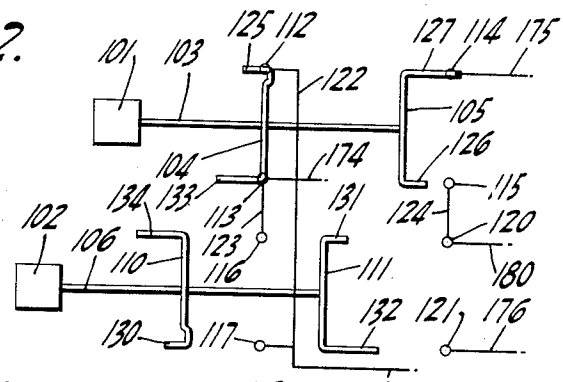


FIG. 3.

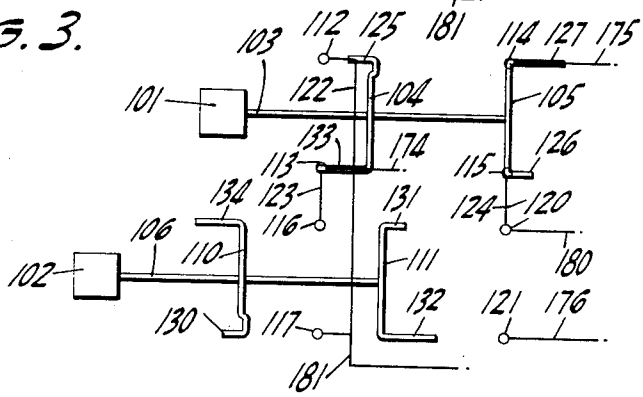


FIG. 4.

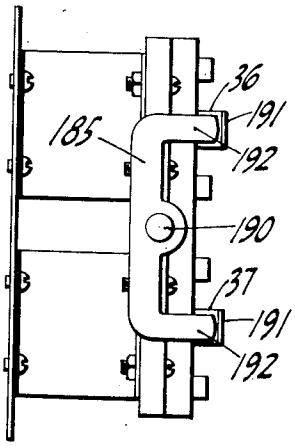
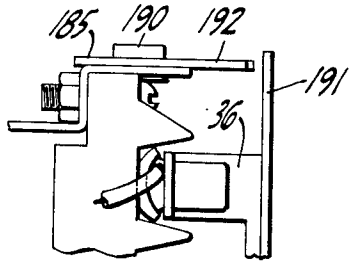


FIG. 5.



INVENTOR
Charles J. Manney
BY
Bean, Brooks, Buckley & Bean.
ATTORNEYS

Patented Oct. 19, 1943 2,332,390

UNITED STATES PATENT OFFICE

2,332,390

CONTROL FOR ELECTRIC HOISTS

Charles J. Manney, Kenmore, N. Y., assignor to Columbus McKinnon Chain Corporation, Tonawanda, N. Y., a corporation of New York

Application May 7, 1942, Serial No. 442,117

21 Claims. (Cl. 172—152)

The principal object of my invention has been to provide a control for electric hoists in which a motor, having two separate windings, is employed, and by which the motor and hoist may be operated at two different speeds in either direction.

Another object has been to provide a control unit for governing the hoisting and lowering circuits of the hoist, such circuits being so interconnected that they are electrically interlocked against simultaneous operation.

Moreover, my invention provides a two-speed control unit so designed that, for instance, the fast-speed group of contacts shall be electrically interlocked when the slow group of contacts are engaged, whereby it shall be impossible to pass current through the slow-speed and the fast-speed circuits of the motor at the same time.

Another object of my invention has been to provide control units so interconnected that the slow-speed circuit will be prepared for energization before the hoisting or lowering circuits are energized, thereby synchronizing the energization of the motor with the release of the magnetic brake of the hoist.

A further object has been to provide the hoisting and lowering contactor unit of my invention with mechanical interlocking means, whereby the closing of both hoisting and lowering circuits at the same time by impact shall be impossible.

Furthermore, it has been an object to provide a push-button unit having contacts so arranged in overlapping relation that the fast-speed circuit will be prepared and ready for energization before the slow-speed circuit is broken or vice versa, whereby the magnetic brake of the motor will not be released during the change from one speed to another.

Moreover, the contacts of my push-button unit are so arranged that they engage in a sequential manner, in order to prevent the release of the brake before the motor is energized, thus preventing the load from overhauling the motor.

The above objects and advantages have been accomplished by the invention herein shown and described.

Fig. 1 shows a diagram of a control circuit embodying my invention.

Figs. 2 and 3 show fragmentary views indicating various positions of one of the buttons of the push-button unit.

Fig. 4 is an end view of the hoisting and lowering contactor unit.

Fig. 5 is a fragmentary end elevation of this contactor unit.

For clearness of illustration, no mechanical details are shown except the mechanical interlock on the hoisting and lowering contactor. A diagrammatic representation of the various parts of the switches and push-button unit is shown for clearness of illustration, and because of the fact that various different and well-known arrangements of contact points may be employed.

Referring to Fig. 1, 10 represents in general the contactor governing the slow-speed and fast-speed circuits of the motor, and 11 represents the contactor governing the hoisting and lowering circuits of the motor. These contactors are, in the commercial structure, mounted within the casing of the hoist and connected as hereinafter described. The motor is represented at 12, and this motor is provided with two separate windings each giving a different speed of rotation. Obviously, this motor is carried by the hoist, and the windings thereof are connected to the contactors 10 and 11 and to the push-button unit 13 by suitable leads as will hereinafter be described.

The motor employed in my invention is preferably of the three-phase type and all of the circuits herein shown and described are, therefore, of a nature to conduct the three-phase current thereto which is supplied from a suitable source over leads 14, 15 and 16.

The contactor 11 is provided with a group of hoisting contact points 20—30, 21—31, and 22—32, and with a group of lowering contact points 23—33, 24—34, and 25—35. Jumpers 26, 27 and 28 connect the points 20 and 23, 21 and 24, and 25 and 22 together, respectively.

The stationary contact points of the hoisting group of the contactor 11 are provided with a movable member 36, and the stationary contact points of the lowering group of this contactor are also provided with a movable member 37. The movable member 36 of the hoisting group is provided with contact arms 40, 41 and 42 for engagement with, and closing of, opposite points 20 and 30, 21 and 31, and 22 and 32. Likewise, the movable member 37 of the lowering group of points has contact arms 43, 44 and 45 for engagement with, and closing of, opposite contacts 33 and 23, 34 and 24, and 35 and 25, respectively.

The stationary points just above described in both groups of points of the contactor 11 are normally open. The hoisting group is also provided with contact points 46 and 47, normally closed by a contact arm 50 carried by the mov-

able member 36. In like manner, the lowering group in this contactor is also provided with stationary contact points 51 and 52 which are normally closed by means of a contact arm 53 which is carried by the movable member 37. As is customary in devices of this nature, the movable members 36 and 37 may be normally held in the positions shown by means of gravity or a suitable spring (not shown), and a solenoid 54 is provided for causing the actuation of the movable member 36. A similar solenoid 55 is provided for causing the actuation of the movable member 37.

The contactor 10 is provided with a slow-speed group of oppositely-arranged stationary contact points 56—57, 60—61, and 62—63. A movable member 64 having contact arms 65, 66 and 67 serves to connect the groups of stationary points just above mentioned. In like manner, a fast-speed group of contact points 70—71, 72—73, and 74—75 is also provided on this contactor. Points 57, 61 and 63 of the slow-speed group are connected, respectively, to points 70, 72 and 74 of the fast-speed group by means of jumpers 86, 87 and 88, respectively.

A movable member 76 carrying contact arms 80, 81 and 82 serves to close the group of points 70—71, 72—73, and 74—75, respectively.

The slow-speed group of points of the contactor 10 also includes stationary points 83 and 84 which are normally closed by means of an arm 85 carried by the movable member 64. Likewise, the fast-speed group includes stationary points 90 and 91 normally closed by means of an arm 92 carried by the movable member 76. The movable members 64 and 76 of the contactor 10 may be held in the positions shown in the drawings by means of gravity or by a suitable spring (not shown), a solenoid 93 being provided for actuating the movable member 64, and a solenoid 94 being provided for actuating the movable member 76.

While the current coming from the leads 14, 15 and 16 may be used for energizing the circuits controlled by and through the push-button unit, in cases where high voltage is used it is desirable that the control circuits receive a lower voltage. In such cases a transformer 95 is employed. The primary winding 96 of the transformer receives its current from points 23 and 24 of the contactor 11 or from the jumpers 26 and 27 connecting these points to the points 20 and 21. Current from the secondary winding 100 of the transformer is connected to the push-button unit 13 and to the other parts of the control by control and directional circuits to be hereinafter described.

This push-button unit 13 comprises two push buttons 101 and 102. The button 101 is so connected, as hereinafter described, that when actuated the hoist will elevate the load. The button 102 is likewise so connected that when it is depressed it will actuate the hoist in a lowering direction. The button 101 is mounted upon a reciprocating member 103, carrying switch contact arms 104 and 105. The button 102 is carried by a reciprocating member 106, having switch contact arms 110 and 111.

Since my invention contemplates a two-speed operation of the hoist motor, each button is designed to be depressed part way only for the slow-speed operation, a further depression being given for the fast-speed operation. A number of stationary contact points are provided on the unit for engagement with the switch contact arms. The stationary points 112 and 113 are engagable by the switch contact arm 104, and stationary points 114 and 115 are also provided on the unit for engagement by the switch contact arm 105. Stationary points 116 and 117 are also provided for engagement by the switch contact arm 110 and stationary points 120 and 121 are likewise provided for engagement by the switch contact arm 111. As shown in the drawings, stationary points 112 and 117 are connected together by means of a jumper 122, points 113 and 116 are connected together by means of a jumper 123, and stationary points 115 and 120 are connected together by means of a jumper 124, for reasons to be hereinafter described.

In carrying out my invention, it is most important that certain circuits be established before others are energized. For instance, when first operating the hoist equipped with my invention, it is desirable that the slow-speed motor circuit be closed synchronously with or before the hoisting or lowering motor circuit is energized for the reason that the magnetic brake is connected in the hoisting and lowering circuits and will be energized before the motor is energized if the slow-speed motor circuit is not first energized, with the result that the magnetic brake will be released and thereby allow the load to lower without control. As shown in the drawings, it is, therefore, desirable that the stationary points 112 and 117, controlling the slow-speed motor circuit, be connected to the points 113 or 116 before these last-mentioned points are connected to the hoisting or lowering points 114 or 121. To accomplish this result the ends of the switch arms 104 and 110 which engage the points 112 and 117 are offset, as shown in the drawings, whereby they will first come in contact with these co-acting points before the opposite ends of these arms contact their co-acting points or before one end of either of the arms 105 and 111 comes in contact with its co-acting point, thus assuring that there will always be a sequential engagement of points when either of the buttons 101 or 102 are first depressed.

Furthermore, I have discovered that it is advantageous and very desirable to prepare the control circuit which controls the fast-speed operation of the hoist before the control circuit which controls the slow-speed operation is interrupted, which controls the slow-speed operation is interrupted. This is accomplished by providing a relatively long leg 125 on the switch arm 104, whereby this arm will remain in contact with the point 112 until the leg 126 of this switch arm contacts the point 115. An elongated leg 130 is provided on the switch arm 110 for prolonged contact with stationary point 117 or until such time as the leg 131 of the switch arm 111 makes contact with the stationary point 120. The switch arm 105 is provided with an elongated leg 127 which makes contact with the stationary point 114 following contact of the switch arm 104 with the point 112, and this leg is of sufficient length to maintain its contact with the point 114 throughout the remaining travel of the button.

In similar manner the switch arm 111 is provided with an elongated leg 132 which makes contact with the stationary point 121 following contact of the leg 130 of switch arm 110 with stationary point 117. This leg is of sufficient length to maintain contact with the point 121 throughout the remaining movement of the button. The switch arm 104 is provided with an elongated leg 133 which makes contact with the stationary

point 113 and maintains such contact throughout the working stroke of the button. Furthermore, the switch arm 110 has an elongated leg 134 which makes contact with stationary point 116 and maintains such contact throughout the working stroke of the button.

In the practical embodiment of my invention the contactors 10 and 11 are placed within a suitably inclosed and protected housing formed on the hoist, and the push-button unit 13 is suspended from the hoist within reach of the operator. The motor, represented at 12, is, of course, inclosed within the hoist casing and the magnetic brake 135 is, as is well-known, a standard part of the motor and serves to prevent the motor from rotating when no current is flowing therethrough.

The hoisting group of points 30, 31 and 32 of the contactor 11 are connected, respectively, to the lowering group of points 34, 33 and 35 of this contactor by means of jumpers 136, 137, and 138, respectively. The points 30, 31 and 32 of the hoisting group are likewise connected, respectively to points 70, 72 and 74 by means of leads 182, 183 and 184, respectively. Jumpers 86, 87 and 88 connect the points 70 and 57, 72 and 61, and 74 and 63, respectively, of the speed-determining contactor 10.

Points 140, 141 and 142 on the motor 12 represent the terminals of the slow-speed winding, and these terminals are connected, respectively, to the slow-speed points 56, 60 and 62 of the contactor 10 by means of leads 143, 144 and 145, respectively, and form parts of the motor circuits. Points 150, 151 and 152 on the motor represent the terminals of the fast-speed winding thereof, and these terminals are connected to the fast-speed points 71, 73 and 75 of contactor 10 by means of leads 153, 154 and 155, respectively, and form parts of the motor circuits.

The magnetic brake represented at 135 receives its current from lowering points 34 and 35 of the contactor 11, and the winding of the brake is connected to these points by leads 157 and 156, respectively.

One side of the solenoid 54 of the hoisting group is connected to the point 51 of the lowering group by means of a lead 160, and the other side of this solenoid is connected to a common terminal point 162 by means of lead 161. The solenoid 55 of the lowering group has one end connected to the point 47 of the hoisting group by means of a lead 163, and the other side of this solenoid is connected to the common terminal 162 by means of lead 164. The connections just described form parts of the directional circuits of my control. The solenoid 94 of the fast-speed group of contactor 10 has one side connected to the point 84 of the slow-speed group by means of a lead 165, and the other side of the solenoid is connected to a common terminal point 166 by means of a lead 167. The solenoid 93 of the slow-speed group has one of its sides connected to the point 90 of the fast-speed group by means of a lead 170, and the other side of this solenoid is connected to the common terminal 166 by means of a lead 171. The common terminal point 166 is connected to the common terminal point 162 by means of a lead 172. The solenoids 93 and 94 and the connections just above described form parts of the speed control circuits of my invention.

One side of the secondary winding 100 of the transformer is connected to the common terminal 162 by means of a lead 173. The other side of the secondary winding of the transformer is connected to the stationary contact point 113 of the push-button unit 13 by means of the lead 174. Current is also conducted to the point 116 by means of the jumper 123. The stationary point 114 of the push-button unit is connected to the point 52 of the lowering group of contactor 11 by means of a lead 175. The stationary point 121 of the unit is connected to the terminal point 46 of the hoisting group of the contactor 11 by means of a lead 176. Both of the leads 175 and 176 form parts of the directional circuits. The stationary points 120 and 115 of said unit are connected to the stationary point 83 of the slow-speed group of the contactor 10 by means of a lead 180 forming part of the slow-speed control circuit. The stationary points 112 and 117 (through the jumper 122) are connected to the point 91 of the fast-speed group by means of a lead 181, forming part of the fast-speed control circuit.

In the operation of a hoist equipped with my invention, when it is desired, for instance, to elevate a load carried by the hoist, the button 101 of the push-button unit 13 will be operated. Since it is desirable to operate the hoist first at a slow speed, the button 101 will be depressed only part way. In this position the contact switch arms 104 and 105 will have been moved to the positions shown in Fig. 2. Because of the offset arrangement of the upper end of the arm 104, this arm will contact with the point 112 before the lower end of the arm contacts with the point 113, and also before the leg 127 of the switch arm 105 engages contact point 114, thereby closing one of the slow-speed control circuits. This obviates the possibility of releasing the magnetic brake before current is passed to the electric motor 12. If, for instance, point 114 is connected to point 113 before point 112 is connected thereto, current will flow from contact point 114 over lead 175 of the directional circuit to the normally-closed points 52 and 51 of the lowering group and through the solenoid 54 of the hoisting group thereby actuating the movable member 36 thereof, and closing points 20—30, 21—31, and 22—32 through arms 40, 41 and 42, respectively. Since the magnetic brake 135 is energized through leads 136 and 138, and since these leads are connected to points 30 and 32, current will pass to and through the winding of the magnetic brake and thereby release the brake before the motor is energized, thus allowing any load carried by the hoist to overhaul the motor.

In accordance with my invention, however, when the button 101 of the push-button unit is operated, the switch arm 104 will contact point 112 before it contacts point 113 and before the switch arm 105 contacts point 114, thus establishing one of the slow-speed control circuits. Further movement of the arm 104 will connect point 113 with point 112 and current will be supplied by lead 174 will be conducted to point 112 and thence over jumper 122 to lead 181 of the control circuit and to the stationary point 91 of the fast-speed group. Since the arm 92 normally connects the point 91 to the co-acting point 90, current will flow in the control circuit through the arm 92 to point 90 and over lead 170 to solenoid 93, returning over lead 171 to the common point 166 and thence over lead 172 to the common point 162, and to the other side of the secondary winding 100 of the transformer over lead 173.

When solenoid 93 is energized, the movable member 64 will close stationary points 56—57, 60—61, and 62—63 through the co-acting arms 65, 66 and 67, respectively. Immediately after the slow-speed control circuit has been prepared as just above described, the leg 127 of the switch arm 105 will make contact with the point 114. Current will now flow from live point 113 over lead 175 to the stationary point 52 of the lowering group, across arm 53 to point 51 and thence over lead 160 to the solenoid 54, returning over lead 161 to the common point 162 and thence to the other side of the secondary winding 100 of the transformer, thus establishing the hoisting directional circuit. When solenoid 54 of the hoisting group is energized, the movable member 36 thereof will move arms 40, 41 and 42 into engagement with the points 20—30, 21—31, and 22—32 thereof, respectively. Since points 20, 21 and 22 are energized from a suitable source of current over leads 14, 15 and 16, current will now pass from points 30, 31 and 32 over leads 182, 183 and 184, respectively, to the stationary points 57, 61 and 63 of the slow-speed group through the jumpers 86, 87 and 88, respectively. Since the slow-speed control circuit has been initially prepared by the actuation of the movable member 64, current will flow from points 57, 61 and 63 over contact arms 65, 66 and 67, respectively, to points 56, 60 and 62, respectively, and thence over leads 143, 144 and 145, respectively, to the slow-speed winding terminals 140, 141 and 142, respectively, of the motor 12 thereby completing the slow-speed hoisting motor circuit.

If it is now desired to operate the hoist at the maximum speed in the same direction, the button 101 is pushed inwardly to the limit of its travel which will bring the points and arms to the relative position shown in Fig. 3 of the drawings. Current will be conducted over the high-speed control circuit from point 113 to point 115 over jumper 124 and lead 180 to the stationary point 83 of the slow-speed group ready to cause the solenoid 94 to be energized just as soon as the points 83—84 are permitted to close through the arm 85 by the interruption of current through the slow-speed solenoid 93. This will occur just as soon as the leg 125 of the switch arm 104 has moved out of contact with the point 112. This allows the movable member 64 of the slow-speed group to return to the position shown in the drawings in which position current will be conducted to the fast-speed solenoid 94 over lead 165 and thence to the common point 166 over lead 167. This will establish the fast-speed control circuit and will cause the movable member 76 to be actuated, thereby closing points 70—71, 72—73, and 74—75 through the medium of co-acting arms 80, 81 and 82, respectively, thus establishing the fast-speed motor circuit. Current will now flow to the terminals 150, 151, and 152 of the fast-speed winding of the motor through the leads 153, 154 and 155 thereby completing the fast-speed hoisting motor circuit for actuating the motor at full speed.

It is well-known to those skilled in the art that in present-day switches designed for two-speed motor control, there is a definite interval of time between the de-energization of one control circuit and the energization of the next control circuit. During this interval, current to the motor is interrupted, but current continues to flow to the magnetic brake, thereby holding it in its released position with the result that the load may overhaul the motor. My invention is designed to overcome this condition by so arranging the contact parts of the push-button unit 13 that the fast-speed control circuit will be prepared for energization before the slow-speed control circuit is broken, or vice versa. As shown in Fig. 3, therefore, and as hereinbefore described, the contact points and the contact arms of the slow-speed and the fast-speed group are so arranged that arm 105 will make contact with point 115 before the leg 125 of arm 104 has moved out of contact with point 112, thereby preparing the fast-speed control circuit for energization before the slow-speed control circuit is opened and thereby de-energized.

From the foregoing it will be obvious that when the solenoid 93 of the slow-speed group is energized, the normally-closed points 83 and 84 of this group will be opened. Since current can reach the fast-speed solenoid 94 only through the contacts 83 and 84, it will be seen that the fast-speed control circuit is interlocked against operation while the slow-speed control circuit is energized. When the solenoid 94 in the fast-speed control circuit is energized, movement of the member 76 thereof will draw arm 82 away from points 90 and 91 thereby opening the slow-speed control circuit. In similar manner, when the hoisting directional circuit causes the energization of solenoid 54 of the hoisting group, points 46 and 47 which are normally closed by the arm 50 will be opened, thereby preventing the passage of current through the solenoid 55 of the lowering directional circuit. In like manner, when the lowering directional circuit causes the energization of the solenoid 55 of the lowering group, points 51 and 52, normally closed by the arm 53, will be opened and thus no current can flow to the solenoid 54 in the hoisting directional circuit. Owing to this arrangement, if both buttons 101 and 102 are pushed at the same time one directional circuit will be sure to close before the other, thereby interlocking the latter directional circuit and making it impossible to cause both hoisting and lowering directional circuits to be energized at the same time.

In addition to the electrical interlock of the directional contactor 11, I provide a mechanical interlock as shown in Figs. 4 and 5. This is to obviate the possibility of both hoisting and lowering motor circuits being closed at the same time by impact in the event that the hoist is jarred against a stationary object. In order to interlock the moving elements of both groups of this contactor, I provide a pivoted interlocking arm 185 which is mounted midway of its length upon a pivot pin 190 carried by the structure of the contactor. The movable elements 36 and 37 of the hoisting and lowering groups are represented in these figures, and each of them carries a cross member 191 which contacts with the opposite upturned ends 192 of the interlocking arm. The parts are so proportioned that when one of the movable elements is depressed by means of its co-acting solenoid the other element will be prevented from being depressed by mchanical means. Should the force of impact be sufficient to overcome the strength of the acting solenoid, both movable elements will be held in inoperative position by contact with the upwardly-turned ends of the interlocking arm.

Obviously, when it is desired to lower the load, the lowering button 102 is actuated which, through the medium of the contact arms 110 and 111 and the stationary contact points 116,

117, 120 and 121 will establish the slow-speed and fast-speed control circuits and also the lowering directional and motor circuits thereby causing the motor to operate in the lowering direction at either speed.

When the button 102 is depressed, the end of the arm 110 having the leg 130 will first contact with point 117, and immediately thereafter the opposite end of this arm will contact point 116. This will cause the slow-speed control circuit to be energized and the lowering directional circuit to be also energized when the leg 132 of arm 111 contacts point 121 by current flowing over lead 176 to the lowering solenoid 55 through lead 163 and through points 46—47 and connecting arm 50 of the hoisting group, current returning to the secondary winding 100 of the transformer by means of lead 164. It will be clear that when solenoid 55 is energized, arm 53 will be moved out of its normally closed relation to points 51 and 52, whereby the hoisting solenoid 54, and, therefore, the hoisting directional circuit will be locked against energization. As in the hoisting of the load, hereinbefore described, when the button is fully depressed for fast-speed lowering movement, the leg 131 of arm 111 will contact point 120 and by means of lead 180 cause the energization of the fast-speed control circuit and solenoid 94, immediately following the de-energization of the slow-speed control circuit by the opening of the contact 116, as hereinbefore clearly set forth in connection with the hoisting movement.

While I have shown and described the contact arms 104 and 110 as having offset portions in order that contact with point 112 will be made before contact with point 113 is made, or contact with point 117 be made before contact with 116, the legs 127 and 132 of the arms 105 and 111 respectively could be shortened or the arms 104 and 110 may be straight and the points 112 and 113 and points 117 and 116 so offset as to bring about the same results. Furthermore, while I have stated that it is desirable that contact 112 be made with contact 113 and contact 117 be made with contact 116 before contact is made with point 114 or point 121, respectively, in order to prevent the energization of the magnetic brake before the motor is energized, it is obvious that the same results may be accomplished if the switch parts are so designed that contact is first made by the points 112 and 114 before contact is made with point 113 or contact is made by the points 117 and 121 before contact 116 is made. These, and other modifications of the details herein shown and described may be made without departing from the spirit of my invention or the scope of the appended claims, and I would not, therefore, wish to be limited to the exact embodiment herein shown and described.

Having thus described my invention, what I claim is:

1. A control for electric hoists, comprising a contactor having a hoisting motor circuit and an independent lowering circuit, selector means having two independently operable contact-making elements for selecting the desired circuit, and interlocking means carried by said contactor for preventing the energization of both motor circuits simultaneously.

2. A control for reversible electric hoists, comprising a contactor having a hoisting group of contacts for one motor circuit and a lowering group of contacts for another motor circuit, a directional circuit for each group of contacts including selector means having contact elements operable independently of the contact elements of the other circuit for energizing the respective directional circuits, and contact means included for each directional circuit operable upon the closing of such circuit for opening the directional circuit of the other group and thereby preventing actuation of the other motor circuit.

3. An electric hoist having a hoisting motor circuit with normally open switch means therein and a lowering motor circuit with normally open switch means therein, a directional circuit for each of the directional motor circuits, each directional circuit including an electromagnetic means operable for closing the contacts of the respective motor circuits, and normally closed contact means included in each directional circuit and adapted to be opened by the electromagnetic means of the companion directional circuit for preventing the simultaneous closing of both motor circuits.

4. An electric hoist, having a motor provided with a slow-speed circuit and a fast-speed circuit a contactor having a slow-speed group of contacts and a fast-speed group of contacts, selector means for actuating said slow-speed group and said fast-speed group in sequence, and contact means carried by each group of contacts and operable by the actuation of the selector means for opening the circuit governed by the companion group of contacts by and during the closing of the selected group of contacts.

5. An electric hoist, having a motor provided with a slow-speed circuit and a fast-speed circuit, a contactor having a slow-speed group of contacts and a fast-speed group of contacts, selector means for actuating said slow-speed group and said fast-speed group in sequence, said actuating means having contacts so arranged that the fast-speed circuit is prepared for energization before slow-speed circuit is broken.

6. An electric hoist, having a motor provided with a slow-speed circuit and a fast-speed circuit, a contactor having a slow-speed group of contacts and a fast-speed group of contacts, selector means for compelling the energization of the slow-speed circuit and the fast-speed circuit in succession, electro-magnetic means for closing each group of contacts, and switch means in circuit with each electro-magnetic means and operable upon the closing of the companion electro-magnetic means for interrupting its circuit and preventing the operation of both electro-magnetic means simultaneously.

7. An electric hoist, having a motor provided with a slow-speed winding connected in a slow-speed circuit, and a separate independent fast-speed winding connected in a fast-speed circuit, a contactor having separate groups of contact means governing the supply of current to the speed-responsive circuits, power means for supplying current to said contactor, and manually-operated switch means for causing the initial energization of the slow-speed circuit and for maintaining said energization until the fast-speed circuit is prepared for energization by and through the opening of the slow-speed circuit.

8. An electric hoist having a two-speed reversible motor with a hoisting circuit and a lowering circuit, a directional switch in each motor circuit operable for selectively closing its circuit, a slow-speed switch and a fast-speed switch adapted for being successively interposed

in the selected motor circuit, a directional circuit for each directional switch including means operable to close such direction switch, a separate control circuit for each speed-determining switch including means operable to close such speed switch, selector means operable initially to close the slow-speed switch control circuit and a directional switch control circuit to start the motor and then to close the fast-speed switch control circuit, and means in each speed switch control circuit operable upon the closing thereof for disposing the control circuit for the other speed switch against being closed simultaneously and thereby compel such successive order of interposing the two speed switches in the selected motor circuit.

9. In a control for electric hoists, the combination with a two-speed motor, two motor circuits, and two speed-determining control circuits connectable in either motor circuit, of a control circuit for each motor circuit, electromagnetic means in each control circuit, a push-button unit having a hoisting group of contact members and a lowering group of contact members, comprising a supply contact point common to both groups of members, a slow-speed contact point common to both groups, a fast-speed contact point common to both groups, a hoisting contact point, and an independent lowering contact point, said unit having movable contact arms engagable with said contact points, the contact arms being so proportioned and positioned in relation to the respective contact points that the fast-speed control circuit will be prepared for energization before the slow-speed control circuit is opened.

10. In an electric hoist wherein a motor has two directional control circuits, two speed-determining control circuits, an electro-magnetic brake energized by either of said speed-determining circuits, and means are provided for closing each of said control circuits, the combination with a manual switch having a set of contacts for each directional circuit and a set of contacts for each speed-determining circuit, the speed-determining circuits being common to each directional circuit, means for closing one speed-determining circuit and one directional circuit with the arrangement being such that the speed-determining circuit will be closed through its contacts by the time the directional circuit is closed, and means for successively closing the speed-determining circuits with the arrangement being such that the initially closed set of contacts of such circuit are not opened until after the closing of the set of contacts controlling the other circuit, whereby said brake will be applied until the motor is energized.

11. A push-button unit for electric hoists, such hoists having two motor circuits, and two speed-determining control circuits, said unit having contact members so proportioned and arranged that the contact members governing one control circuit shall overlap the contact members governing the other control circuit, whereby one control circuit shall be prepared for energization before the other speed-determining circuit is opened.

12. A push-button unit for electric hoists, such hoists having two motor circuits, and two speed-determining control circuits, said unit having contact members so relatively positioned that one of said control circuits shall be energized by the time either of the directional circuits is energized, and said contact members being so proportioned and arranged that the contact members governing one control circuit shall overlap the contact members governing the other control circuit, whereby one control circuit shall be prepared for energization before the other control circuit is opened.

13. A manual switch for interlocking contact circuits of the slow-speed and fast-speed circuits of a two-speed electric hoist, said switch comprising a fixed contact for each interlocking control circuit, and movable contact means for successively establishing electrical connection with each fixed contact and maintaining such connection with the initially engageable contact until after connection is established with the other contact, whereby to prevent the opening of one circuit before the other circuit is prepared for energization by and through the opening of the initially-energized circuit.

14. An electric hoist having a hoisting motor circuit with a group of normally open contacts therein and a lowering motor circuit with a group of normally open contacts therein, a directional circuit for each motor circuit, each directional circuit including electro-magnetic means operable for closing the contacts of the respective motor circuits, switch contact means in each directional circuit and operable upon closing the latter to open the electro-magnetic means of the companion directional circuit for preventing the simultaneous closing of both motor circuits, a slow-speed group of normally open contacts adapted to be arranged in series with either group of motor circuit contacts, a fast-speed group of normally open contacts adapted to be arranged in series with either group of motor contacts, and selector means for selectively closing either group of speed contacts.

15. In a control for electric hoists, the combination with a two-speed motor, two motor circuits, and two groups of speed-determining normally open contacts selectively connectable in either motor circuit, of a control circuit for closing each group of contacts, electro-magnetic means in each control circuit, and a push-button unit having contact members connected to a suitable source of electrical supply and to each of said control circuits, said contact members being so relatively positioned that one of said groups of speed-determining contacts should be closed by the time the selected motor circuit is energized.

16. A control for electric hoists, having a motor provided with a slow-speed motor circuit and a fast-speed motor circuit, comprising a contactor having a slow-speed group of contacts and a fast-speed group of contacts for connection respectively to said slow-speed and fast-speed motor circuits, a slow-speed control circuit and a fast-speed control circuit, a selector unit connected in said control circuits for causing said slow-speed and said fast-speed control circuits to be energized in sequence, normally closed contact means connected in said control circuits for opening each control circuit when the companion circuit is closed, and said selector unit having contact means for preparing the open control circuit for energization upon and through the opening of the closed control circuit.

17. An electric hoist having a slow-speed motor circuit and a fast-speed motor circuit, each circuit including normally open contact means movable to a circuit closing position from a normally open position, electric means for so mov-

ing each contact means to a circuit closing position, normally closed contact means in circuit with each moving means and each operable to an open position by the companion moving means when the normally open contact means of the companion motor are moved to a circuit closing position whereby to prevent the closing of both motor circuits simultaneously, and manual means in series with each normally closed contact means for cooperating therewith to close the circuit of the electric means.

18. An electric hoist having a reversible motor, an up motor circuit for the motor, a down motor circuit for the motor, normally open contact means in each circuit, a directional circuit for each contact means including electric means for closing its associated contact means, manual means for selectively closing either directional circuit, each directional circuit also including a normally closed switch in the companion directional circuit and openable by and during the operation of the electric means of the selected directional circuit whereby to prevent the manual closing of both motor circuits simultaneously, slow-speed control means, fast-speed control means, manually operable means for selectively connecting either speed control means in either motor circuit, each of said last-named manual means including means for preventing the manual operation of the companion speed control means, means for compelling the operation of the second manual means prior to the operation of the first manual means, and a brake for the hoist automatically released by the closing of either directional circuit.

19. A hoist comprising a reversible motor, slow and fast motor circuits therefor, switch means manually controlled to selectively actuate the motor for hoisting and lowering, normally open slow-speed switch means and fast-speed switch means selectively connectible in the selected motor circuit, automatic means to close the slow-speed switch means and separate automatic means to close the fast-speed switch means, and manually controlled slow and fast switch means in circuit with the automatic means for the two said speed switch means respectively, the arrangement being such that the manually controlled slow switch means will be initially closed followed by the closing of the others of the aforementioned manually controlled switch means.

20. A hoist comprising a reversible motor, slow and fast motor circuits therefor, switch means manually controlled to selectively actuate the motor for hoisting and lowering, normally open slow-speed switch means and fast-speed switch means selectively connectible in the selected motor circuit, automatic means to close the slow-speed switch means and separate automatic means to close the fast-speed switch means, manually controlled slow and fast switch means in circuit with the automatic means for the two said speed switch means respectively, the arrangement being such that the manually controlled slow switch means will be initially closed followed by the closing of the others of the aforementioned manually controlled switch means, and normally closed protective switch means in each of the speed circuits of the manually controlled slow and fast switch means, the normally closed protective switch means of each speed circuit being opened by the automatic means of the companion speed circuit when such automatic means is functioning to close its associated normally open speed switch means, whereby the speed circuits are prevented from being simultaneously closed.

21. A hoist comprising a reversible motor, slow and fast motor circuits therefor, switch means manually controlled to selectively actuate the motor for hoisting and lowering, normally open slow-speed switch means and fast-speed switch means selectively connectible in the selected motor circuit, automatic means to close the slow-speed switch means and separate automatic means to close the fast-speed switch means, manually controlled slow and fast switch means in circuit with the automatic means for the two said speed switch means respectively, the arrangement being such that the manually controlled slow switch means will be initially closed followed by the closing of the others of the aforementioned manually controlled switch means, and normally closed protective switch means in each of the speed circuits of the manually controlled slow and fast switch means, the normally closed protective switch means of each speed circuit being opened by the automatic means of the companion speed circuit when such automatic means is functioning to close its associated normally open speed switch means, whereby the speed circuits are prevented from being simultaneously closed, said manually closed slow switch means being manually open subsequent to the closing of the manually controlled fast switch means while retaining the latter closed whereby to render the associated slow speed automatic means inoperative and to restore the slow-speed switch means and its controlled protective switch means respectively to their normally open and normally closed positions, and thereby effect the actuation of the companion fast-speed automatic means.

CHARLES J. MANNEY.

CERTIFICATE OF CORRECTION.

Patent No. 2,332,390. October 19, 1943.

CHARLES J. MANNEY.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, lines 48 and 49, strike out the words and comma "which controls the slow-speed operation is interrupted,"; page 5, second column, line 6, claim 2, for "for" before "each" read --in--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 21st day of December, A. D. 1943.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)

CERTIFICATE OF CORRECTION.

Patent No. 2,332,390. October 19, 1943.

CHARLES J. MANNEY.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, lines 48 and 49, strike out the words and comma "which controls the slow-speed operation is interrupted,"; page 5, second column, line 6, claim 2, for "for" before "each" read --in--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 21st day of December, A. D. 1943.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)