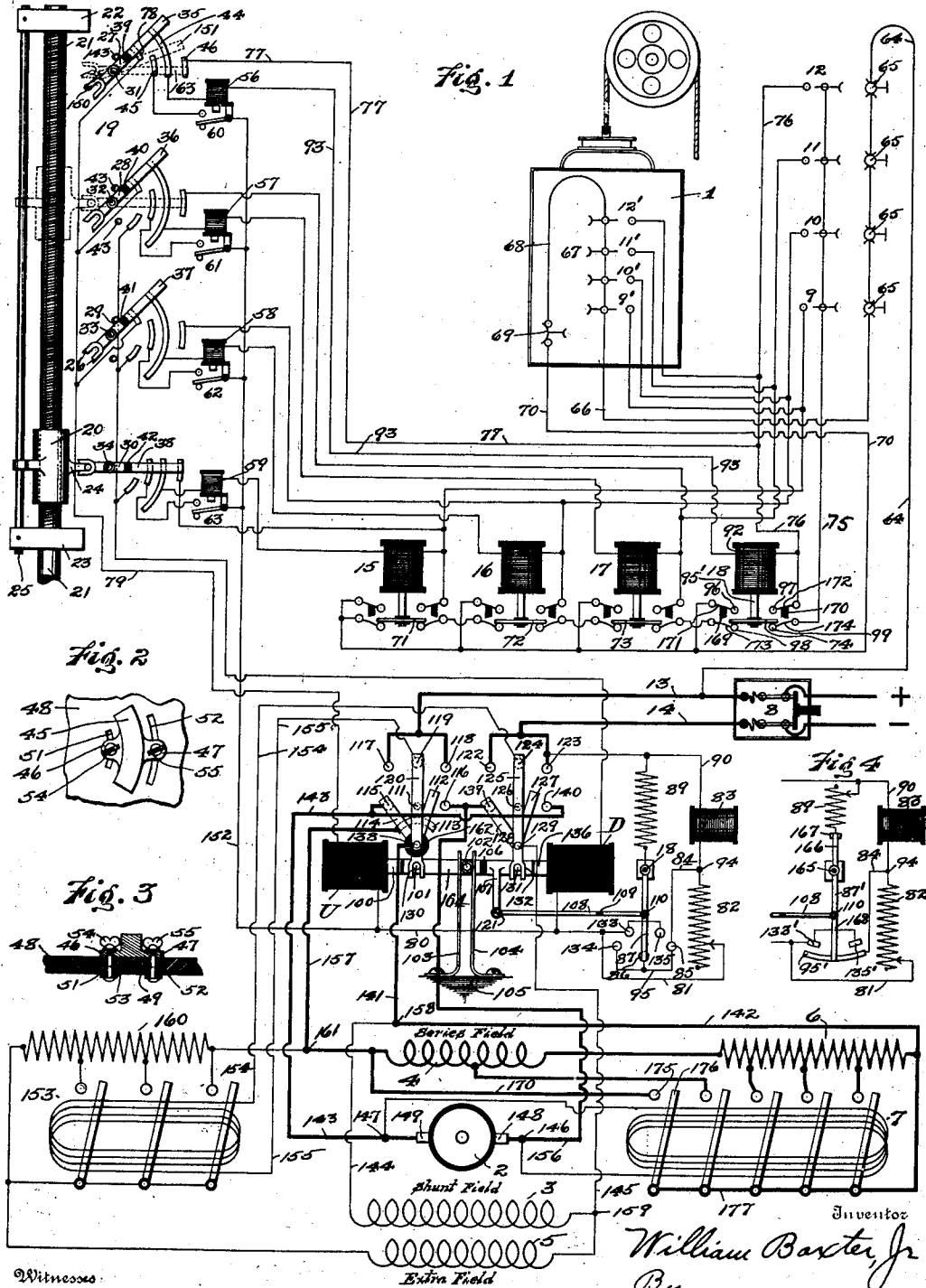


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ELEVATOR CONTROLLING APPARATUS.
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Patented Dec. 17, 1912.



Witnesses

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ELEVATOR-CONTROLLING APPARATUS.

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To all whom it may concern:

Be it known that I, WILLIAM BAXTER, JR., a citizen of the United States, residing at Jersey City, in the county of Hudson and State of New Jersey, have invented a new and useful Improvement in Elevator-Controlling Apparatus, of which the following is a specification.

My invention relates to systems of motor control, particularly such as are used for electric elevator apparatus.

The object of my invention is the provision of means for reducing to a minimum the formation of electric arcs upon the breaking of the various circuits in a motor controlling system.

A further object of the invention is to provide an improved and efficient means for slowing down the motor before stopping.

Another object is to provide efficient means for stopping the motor gradually.

Other objects of the invention will appear hereinafter, the novel combinations of elements being set forth in the claims appended to the following description.

In the accompanying drawings, Figure 1 represents diagrammatically my invention applied to a single push-button controlled electric elevator system; Figs. 2 and 3 are detail views of the floor controller; and Fig. 4 is a modification of the brake magnet circuits.

1 designates the elevator car which is connected to the hoisting mechanism in a well-known manner, the hoisting mechanism being driven by an electric motor of which 2 represents the armature, 3 the shunt field, 4 the series field and 5 the extra field. The usual starting resistances 6 and accelerating magnet 7 are connected in a suitable manner to the motor circuits so that the motor may start and gradually run up to full speed after either the up or down relay, designated U and D respectively, has been operated. By the closing of one of the hall buttons 9, 10, 11 or 12 or of the car buttons 9', 10', 11', or 12' circuits will be closed from the main lines 13 and 14 through the main line switch 8 to the floor controlling relays 15, 16, 17 or 18 and thence to the floor controller 19 which is positively connected to some moving part of the hoisting mechanism so that the car shall stop automatically at the desired floor.

The floor controller 19 comprises a revolu-

ble screw-threaded shaft 21 mounted in suitable bearings in the brackets 22 and 23. Between these brackets and on the shaft is a nut 20 which is moved along the shaft 21 with a speed proportional to the speed of the car. Through a slot in one side of the nut passes a rod 25 which is secured at its ends to the brackets 22, 23, this rod serving as a guide for the nut 20 and preventing the same from turning. On the other side of the nut 20 is a projection or striker 24 which is adapted to engage the shoulders 26 of levers 27, 28, 29 and 30 which are pivoted, respectively, at 31, 32, 33 and 34. The inner ends of these levers are shown forked to form the shoulders 26 while to the outer ends are connected the circuit closers 35, 36, 37 and 38, the circuit closers being insulated from the levers by intervening pieces of insulation 39, 40, 41 and 42, respectively. Suitable stops 43 are provided for limiting the throw of these levers and circuit closers. The circuit closers are adapted to move over a plurality of contact blocks which may be made adjustable. These contact blocks are arc-shaped and preferably made adjustable in arc with relation to the circuit closers so that the circuit closers will begin to engage the same at any time desired. One form of adjusting means is shown in Figs. 2 and 3 wherein one of the contact blocks or strips, as 45, is provided with integral projections 46, 47 through which bolts 53, 49 are passed and wing nuts 54, 55 used for clamping the arc 45 at any point within the limits of the slots 51, 52 to a suitable base 48 of insulating material.

It is seen that the station limit switches for the top and bottom floors or landings are each single while the intermediate ones are double. The distances between them are proportional to the distances between floors. Within certain limits, if the distances between floors vary the arc-shaped contacts may be moved and clamped in position so that the car will stop substantially level with the floor.

The operation of the system thus far described is as follows:—Assuming that the car is at the lowermost landing and the nut 20 in the full line position, let the push-button 12 at the top floor landing be operated to call the car to that floor. A circuit will then be established from the + main 13 to and through the wire 64, door contacts 65, 110

wire 66, car buttons 67, wire 68, safety push-button 69, wire 70, contact plates 71, 72, 73 and 74 and their lower fixed contacts, wire 75, hall push-button 12, wires 76, solenoid 92 of relay 18, wire 93, magnet 56 of one of the auxiliary relays, arc contact-strip 44, circuit closer 35, contact-strip 78, wire 79, "up" magnet U, wire 80, wire 81, adjustable resistance 82, to point 94 where the circuit divides, part going through the brake magnet 83 and wire 90 and part through wire 84, contact 85, wire 95, fixed contact 86, lever 87, and resistance 89, whence the circuit continues through the wire 91 to the — main, 14. The magnets 92 56 and U will thereupon be energized. The solenoid core 95' will be drawn up with its circuit closer 74 to form a retaining circuit for the magnet 92 through the contacts 96, 97 between the conductor 70 which is common to the hall and car push-buttons and the conductor 76 which is individual to the relay 18 and the top push-buttons. Circuit to the contacts of the relays 15, 16 and 17 is broken also, so that interference from any hall or car button is prevented until after the car is stopped and the hall door opened to open the top switch 65. The magnet 56 draws up its armature 60 but this operation has no effect until the car approaches the top floor landing. The magnet U draws its core to the left to operate the up reversing switch. The current through the brake magnet is too small to effect the release of the brake, the resistance 89 which is preferably equal to the brake magnet resistance being in parallel to the brake magnet and the resistance 82, which is substantially equal to the resistance of the magnet U, being in series with it.

It will be noticed that when the floor controlling main magnet 92 operates to lift the contact maker 74 it connects the contacts 96, 97 before it disconnects the contacts 98, 99. This is necessary in order to prevent arcing at the contacts 98, 99 and is accomplished by having the contacts 96, 97, 98 and 99 secured to the inner ends of the springs 171, 172, 173 and 174, respectively, which springs tend to move the contacts 96, 97 toward the contacts 98, 99 but are limited in their movement by the fixed intermediate blocks of insulation 169, 170. Normally the contact maker 74 rests on the contacts 98, 99, bending the springs 173, 174 as shown in full lines and the springs 171 and 172 rest on the upper sides of the insulating blocks 169, 170. It is obvious that the parts may easily be so adjusted that the contact maker 74 will connect the contacts 96, 97 a moment before it leaves the contacts 98, 99 so as not to interrupt a circuit having inductance in it.

When either the up or down magnet operates to move its core 100 or 136 to the left or right, it does so against the action of the

centering spring 103 or 104 which are fixed to the base 105. These springs normally bear against the lateral pin 102 on the rod 164 which joins the cores 100 and 136. Just to the right of the spring 104 is a downwardly extending arm 107 rigid with the rod 164 and pivoted at its lower end to the link 108. This link is pivoted at its right-hand end to an intermediate point on the lever 87 which is pivoted at a fixed point 18. This lever is adapted to act as a circuit closer to connect together either the contacts 133, 134 or 137, 85.

The lateral pins 101 and 131 are adapted to engage forks 130 and 132, respectively, which are secured to circuit closing levers 120 and 125 which are pivoted at 138 and 129. Additional circuit closing V-shaped or double armed levers having the arms 114, 112 and 128, 127 are also pivoted respectively at 138 and 129 but are independent of the levers 120 and 125. The levers 120 and 125 are longer than the arms 114, 112 and 128, 127 and are adapted to engage the isolated fixed contacts 117, 119, 118 and 122, 124, 123, respectively. Each of the long levers 120, 125 is provided with a lateral pin 111 and 126 adapted to engage the V-shaped levers to move the same in one direction or the other so that their arms shall engage the contacts 115, 116, 139 and 140.

It will be noticed that the reversing switches are insulated from each other by means of the insulating section 106 in the rod which connects the cores 100 and 136. Insulation 162 electrically separates the long lever 120 from the arms 114 and 112 but the latter are always in engagement with fixed contact strip 113. Furthermore, a section of insulation 109, insulates the switch mechanism for the brake magnet from the "down" reversing switch.

When the magnet U is energized as hereinbefore explained, the pin 101, being in engagement with the fork 130 will move the lever 120 from the contact 119 to the contact 118. At the same time the pin 111 engages the arm 112 to move the same onto the contact 116. The pin 131, by means of the fork 132, effects a movement of the lever 125 to the contact 123 and the pin 126 moves the arm 127 onto the contact 140. At this time also the lever 87 is moved to the left to connect the contacts 133, 134, whereupon the resistances 82 will be short-circuited, the circuit through the brake magnet then being through the contacts 133, 134, lever 87, wire 95, contact 85 and wire 84. Sufficient current can now pass to effect the releasing of the brake. Substantially at the same time the circuits to the motor are closed and the motor may start. The motor circuits may be traced as follows: from the main 13 to and through the contact 118, lever 120, wires 141 and 142, starting resistance 6, 130

series field 4, arc contact strip 113 and arms 114, 112 which are always in engagement therewith, contact 116, motor-armature 2, wire 143, contact 140, arm 127, lever 125, contact 123, to the main, 14. A circuit is also closed through the shunt field 3 by means of the wires 144, 145. In a well-known manner the resistances 6 and the series field 4 are cut out step-by-step by means of the accelerating magnet 7 which is connected across the motor-armature at the points 147 and 146. The motor having thus been started will continue to move the car and consequently the floor controller until the striker 24 engages the fork 150 of the lever 27 and moves the same to effect a gradual stopping of the car. At a short time before the car reaches the top floor the circuit closer 35 will engage the contact 45 besides the contacts 44 and 78; the lever 27 and circuit closer 35 will then assume the position indicated in dotted lines 151. A circuit will now be closed from contact strip 44 through circuit closer 35 and strip 45 to and through switch 60 of the auxiliary relay, thence by wire 152 to wire 80, brake magnet 83, and to the negative line. The up magnet U will therefore be short-circuited and the spring 104 will restore the reversing switches to normal position. When the reversing switches are thus restored, however, the brake magnet circuit is interrupted at the contacts 133, 134 and the self-induction discharge or "kick" will tend to produce sparking or arcing and burn up the contacts and circuit closer 87. But this discharge is taken up in the local circuit including the resistance 89 and the brake magnet 83 in series. It will be noticed that the resistance 82 is again placed in series with the brake magnet but now the up magnet U is short-circuited. The resistance 82 is primarily for the purpose of compensating for the resistance of the up magnet U so that too much current will not flow through said brake magnet when the circuit closer 35 engages the strip 45. The resistance 82 is preferably equal to that of the up magnet. It is evident that the current passing through the brake magnet at this time may be such as to only partially release the brake. This may be better accomplished by having the resistances 89 and 82 adjustable, as shown.

In Fig. 4 I have shown a modification of the brake magnet circuits in that the shunt resistance 89 is cut out when the magnet is energized to lift the brake. This is accomplished by providing a fixed pivot 165 for the lever 87' and having arc-shaped contact strips 167 and 95' for the arms 166 and 167, respectively, of the lever 87' to come in contact with. With this arrangement when the reversing switches are operated in either direction the arm 168 which is always in en-

gagement with the strip 95' will engage either the fixed contact 133' or the fixed contact 135' and the arm 166 will leave the contact 167. Preferably the arm 168 engages either of the contacts 133' or 135' before the arm 166 leaves the contact block 167 so that when the lever 87' is restored to normal position the resistance 89 will be connected in a local circuit before the resistance 82 is connected in series with the brake magnet. It is deemed an advantage to have the resistance 89 cut out during the operation of the motor so as to lessen the consumption of current but in some cases it may be desirable to shunt part of the current away from the brake magnet to prevent overheating of its coils.

It should be noted that the slow down magnet 153 is connected in circuit with the motor when the levers 120 and 125 are restored to normal position and engage the contacts 119 and 124. The motor will now act as a generator to send current through local circuits, this arrangement constituting an electro-dynamic brake, the braking effect being proportional to the load so that the car shall stop substantially level with the floor landing irrespective of the load. The first step in slowing down the motor may be the partial application of the brake. Preferably, however, the first step is the breaking of the main line circuits by the restoration of the levers 120 and 125 to normal position. The slow down magnet 153 will then be connected across the motor armature and operate in the well-understood manner to effect an automatic electro-dynamic slow down action of the motor. The accelerating magnet 7 does not have time to release its armatures and is maintained energized by the current generated by the motor, said magnet being connected across the motor brushes, so that the series field and starting resistance remain short-circuited. The circuit through the slow down magnet may be traced from brush 148, through wire 156, contact 116, arm 112, strip 113, wire 157, wire 170, contact 175, switch 176, wire 177, wires 142 and 141, lever 120, contact 119, wire 155, slow-down magnet 153, wire 154, contact 124, lever 125, arm 127, contact 140, wire 143, to the other brush 149. The shunt field 3 is connected between the points 158 and 159 in parallel with the slow-down magnet 153. An extra field 5 with sectional resistance 160 in series with it is connected in a local circuit in series with the motor-armature from brush 149 through wire 143, contact 140, arm 127, wire 145, extra field coil 5, sectional resistance 160, wire 157, strip 113, arm 112, contact 116, wire 156, to brush 148. This circuit through the extra field 5 and resistance 160 is established whenever the reversing switch has been operated, so that

the extra field and the resistance 160 are in series with the motor armature when the latter is running at normal speed. When the reversing switch magnet is deenergized and the switch levers 120 and 125 are brought back to central position a circuit is established through the slow down magnet 153, so that more or less of the resistance 160 will be short-circuited in the well-known manner by the slow-down magnet as the motor comes to rest, the amount of resistance cut out and the rate of cutting out depending upon the speed of the motor. The effect of cutting out this resistance is to strengthen the extra field 5 and increase the armature current and therefore increase the electro-dynamic braking effect.

It should be noted that the reversing switches serve a double function in that the slow-down apparatus is controlled by them as well as the starting means. This I consider a valuable feature of my invention, so also the means for preventing the formation of arcs. It will also be noticed that when a reversing switch magnet is short-circuited it is placed in a local circuit so that its discharge of self-induction may take place without any arcing as by the breaking of a circuit containing the reversing switch. This local circuit may be traced from the magnet U, for example, as the source of the electro-motive force of self-induction through the wire 152, switch 60, strip 45, circuit-closer 35, wire 79, back to the magnet.

As the car approaches more nearly to its floor or landing and has been slowed down to almost a stop the circuit closer 35 engages the strip 46 and leaves the strip 78. The circuit closer 35 then assumes the position indicated by the dotted lines 163. The removal of the circuit closer 35 from the strip 78 will produce no arcing as the magnet U has already been deenergized and its short-circuit is still closed through the contact strip 45. When the circuit closer 35 engages the strip 46, however, the floor relay magnet 92 and the auxiliary floor relay magnet 56 will be short-circuited by the wire 77, whereupon the magnets 92 and 56 will be deenergized but there can be no formation of any arcs as their self-induction current is consumed in a local circuit through the wires 93 and 77, contacts 44 and 46, and both magnets in series. The deenergization of magnet 56 will cause its armature to drop, thus interrupting the circuit to the brake magnet and effecting the full application of the brake and the absolute stopping of the car. The deenergization of the magnet 92 will cause its contact maker 74 to drop to restore the controlling circuits to normal so that by pressing one of the lower hall buttons or one of the car buttons corresponding thereto exclusive control of the car may again be obtained to call the

car to a particular floor or send the car to that floor.

Without limiting myself to the details of construction or arrangement of parts, what I claim and desire to have protected by Letters Patent of the United States is:

1. The combination with a motor, of electromagnetic reversing switch mechanism and a circuit therefor, a circuit in shunt to a magnet winding of said reversing switch, an electromagnetic relay comprising a switch in said shunt circuit and an automatic controller movable in harmony with the motor and operable to successively close the said shunt circuit and open the circuit through the reversing switch magnet.

2. The combination with a car and its motor, of motor-controlling means including reversing switch magnets, a series of main relays corresponding to the floors of a building, push-buttons and circuits connected to said relays, auxiliary relays in circuit with said main relays, means coacting with said auxiliary relays for short-circuiting said reversing switch magnets, and a short-circuit for the main and auxiliary relay magnets arranged to be closed by the aforesaid short-circuiting means.

3. The combination with a car and its motor, of motor-controlling apparatus including reversing switch magnets, a series of main relays corresponding to the floors of a building, push-buttons in circuits connected to said relays, auxiliary relays in circuit with said main relays, stop-motion limit switches for automatically and successively short-circuiting the reversing switch magnets, the main relay magnets, and said auxiliary magnets, to effect the restoration of the switches in circuit with said magnets to normal position without arcing.

4. The combination with a motor, of motor-controlling means including reversing switch magnets, means for short-circuiting said reversing switch magnets, a brake magnet connected in circuit with said reversing switch magnets, a resistance, and means for connecting said resistance in circuit with said brake-magnet to compensate for the short-circuited reversing switch magnet.

5. The combination with a motor, of electromagnetic reversing switches therefor, a brake magnet in circuit with the reversing switch magnets, means for short-circuiting said reversing switch magnets, two resistances, means for connecting one of said resistances in circuit with the brake magnet to compensate for the short-circuited reversing switch magnet and for connecting the other resistance in a local circuit with said brake magnet.

6. The combination with a motor, of reversing switch mechanism therefor, electromagnets for operating said reversing switches, a brake magnet, a resistance, and a

switch operatively connected to said electromagnets for connecting said resistance in a local circuit with said brake magnet.

5 7. The combination with a motor, of controlling means, a brake magnet, two resistances, and means co-acting with said controlling means for connecting one of said resistances in series with the brake magnet and the other in shunt thereto.

10 8. The combination with a motor, of motor-controlling means, a brake magnet, a resistance normally in series with the brake-magnet, an additional resistance in shunt to the brake-magnet, and means ac-
15 tuated upon the operation of one of the reversing switches for short-circuiting said first-named resistance.

9. The combination with a motor, of reversing switches therefor, electromagnets for operating said reversing switches, a 20 brake magnet, resistances in circuit with the brake magnet, means operated by said electromagnets for short-circuiting one of said resistances, and means effecting a centering of the last-named means and of the revers- 25 ing switches upon the deenergization of the electromagnet last operated.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM BAXTER, Jr.

Witnesses:

FRANK T. BROWN,
CHARLES M. NISSEN.