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MOTOR CONTROLLER.

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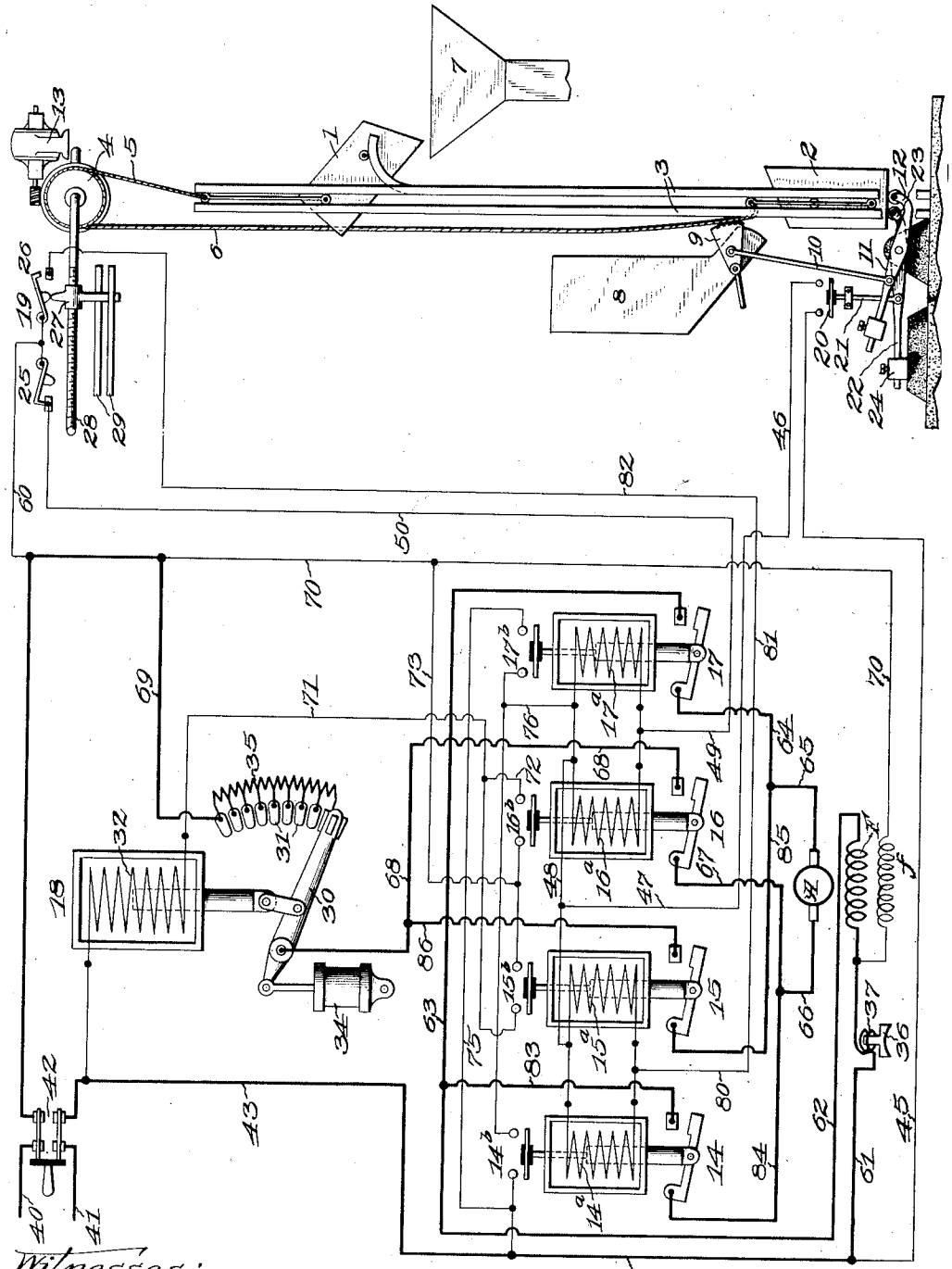
982,362.

Patented Jan. 24, 1911.



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MOTOR-CONTROLLER.

982,362. Specification of Letters Patent. Patented Jan. 24, 1911.

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To all whom it may concern:

Be it known that I, CLARK T. HENDERSON, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Motor-Controllers, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to improvement in electric motor controllers.

My invention is particularly applicable to the control of motor operated skip hoists, but it should be understood that certain features thereof are applicable to various other kinds of motor operated devices.

One object of my invention is to provide a controller for a motor operating one or more skip cars by means of which each car will be automatically moved to dumping position and then stopped and returned to initial or filling position, the same cycle of operation being repeated indefinitely without requiring any attention from attendants.

A further object of my invention is to provide a controller which will automatically start each skip car when the same has received a load of a predetermined weight but not until the load attains the desired weight, whereby the controller acts as a weighing device and enables the use of an automatic delivery hopper for filling the cars.

Various other objects and advantages in my invention will be hereinafter clearly and fully set forth.

For the purpose of more fully disclosing the nature and characteristic features of my invention, I shall describe the apparatus, diagrammatically illustrated in accompanying drawing, which embodies my invention in one form. It should be understood, however, that my invention is not limited to the specific form shown in the drawing, but is susceptible of various modifications.

For the purpose of illustration, I have schematically shown two skip cars 1 and 2, arranged to travel along guide ways 3. The cars 1 and 2 are connected to a suitable hoisting drum 4, by means of cables 5 and 6, respectively, the cables being wound on the drum 4 in opposite directions, whereby, as the drum is revolved, the cars will move in opposite directions. The guide ways and the connections between the cars and the supporting cables are of the ordinary type, whereby, when the cars have been moved a predetermined distance, they will be caused to empty their contents into a suitable receiving hopper 7. The cars are arranged to be filled from a delivery hopper 8. As illustrated, the chute of the delivery hopper is provided with a pivoted door 9, connected by a rod 10 to an operating lever 11. The operating lever 11 is weighted to bias the door 9 to closed position, and is provided with an extension 12, arranged to be depressed by the skip cars, to automatically open door 9 when said cars reach the proper position, to receive a fresh load. The drum 4 is arranged to be operated in either direction by electric motor 13. Of course, so far as my invention is concerned, the particular structure of the apparatus just described is immaterial.

I shall now describe the controller for the motor 13, whereby I am enabled to secure entire automatic operation of the skip cars. The controller includes suitable circuit closing switches 14, 15, 16 and 17, adapted to cause the motor to operate in either direction, an accelerating device 18, a limit switch 19 and a control switch 20. The switches 14, 15, 16 and 17 are provided with operating windings 14^a, 15^a, 16^a and 17^a respectively, and with auxiliary contacts 14^b, 15^b, 16^b and 17^b respectively. As will be hereinafter set forth, the switches 14 and 15 are adapted to start the motor in one direction, while the switches 16 and 17 are adapted to start the motor in the opposite direction. The operating windings of these switches are adapted to be controlled by the switch 20, to start the motor, and by the limit switch 19, to stop the motor. It is my desire to have the switch 20 operated to close the circuit through the operating windings of the starting switches, as soon as the car receiving a fresh load has been filled to the desired degree. Of course, this may be accomplished in various ways and by different means. For the purpose of illustration, I have shown the switch 20 as being connected by rod 21 to a lever 22, having an extension 23, arranged in a path of the skip cars. On the opposite end of the lever 22 is an adjustable weight 24 tending to move the lever 22 to open the switch 20. Of course, when the weight of the skip car overbalances the weight 24, then the lever will be rocked to close the switch 20. It will thus be seen,

that by varying the positions of the weight 24 on the lever 22, the car may be made to start after receiving any desired load. In other words, the position of the weight 24 on the lever 22 determines the weight of the charge received by the cars, and, therefore, acts as a weighing device.

The limit switch 19 for deënergizing the starting switches to stop the motor, may be of any preferred type. As illustrated, the device 19 merely comprises two switches 25 and 26, tending to stand in closed position and arranged to be actuated by a traveling nut 27, mounted on a screw-threaded shaft 28, said nut being provided with guides 29, to prevent rotation thereof. As illustrated, the shaft 28 is connected to the winding drum 4, but, of course, the same might be connected to the motor, or some other part of the operated mechanism.

The accelerating device 18, as illustrated, merely comprises a pivoted switch arm 30, movable over a series of contacts 31 and arranged to be operated by a solenoid 32, a dash pot 34, being provided to retard the operation of said switch arm. Of course, in practice, any preferred accelerating device or devices may be employed. The switch arm 30 is arranged to control a variable resistance 35, connected in the armature circuit of the motor 13, said motor being diagrammatically illustrated as provided with an armature A, a series field winding F, and a shunt field winding *f*. While I have illustrated a compound wound motor, it should be understood that any preferred type of motor either A. C., or D. C. may be employed. For bringing the motor to a quick stop after its circuit has been opened, I have provided a mechanical brake 36, having a winding 37 for rendering the same ineffective, while the motor circuit is closed.

I shall now describe the operation of the apparatus shown, at the same time setting forth the circuit connections therefor, assuming the current is supplied to the windings of the various switches from supply lines 40 and 41 through a double pole switch 42. With the skip cars in the position illustrated, the motor circuit will be opened, and the skip car 2 will receive a charge from the delivery hopper 8, said car being in a position to hold the door of the hopper open. In this position, car 2 also rests upon the extension 23 of the lever 22, and when the charge received by said car, overbalances the weight 24, it rocks said lever 22, thereby, closing the switch 20. Closure of the switch 20 completes a circuit from main line 41 by conductors 43, 44 and 45, through said switch 20 by conductors 46, 47 and 48, through the operating windings of switches 16 and 17 in parallel, by conductors 49 and 50, through the switch 25 of the limit switch by conductor 60 to main line 40. Thereupon, switches 16 and 17 respond to close the motor circuit, which may be traced from main line 41 by conductors 43, 44 and 61, through the brake coil 37, series field windings F, conductors 62 and 63, through the switch 17, by conductors 64 and 65, through the motor armature A by conductors 66 and 67, through the switch 16 by conductor 68, through the switch arm 30 of the accelerating device, thence through the resistance 35 by conductor 69 to main line 40. The circuit of the shunt field winding *f* of the motor extends from conductor 61 through said winding by conductor 70 to main line 40, and hence is permanently connected across the supply lines. Closure of the switches 16 and 17, thus, start the motor in a direction to raise the skip car 2, and to lower the skip car 1. The motor, however, is started at a slow speed, but upon closure of the switch 16, the auxiliary switch 16^b thereof completes a circuit from main line 41, through the operating winding of the accelerating device by conductors 71 and 72, through said auxiliary switch by conductors 73 and 70 to main line 40, thereby, energizing the accelerating device. The arm 30 is thereupon, moved over the contacts 31, thereby, gradually removing the resistance 35 and accelerating the motor. As the skip car 2 moves upwardly, it releases the lever 12, which thereupon, closes the door of the supply delivery hopper. Also, the car 2 releases the lever 22, which under the influence of the weight 24 opens the switch 20. The opening of the switch 20 would result in deënergizing switches 16 and 17, thereby, stopping the motor, but for the fact that the switch 17 upon closing, establishes a maintaining circuit for the switches 16 and 17, independent of the switch 20. This maintaining circuit is established by auxiliary contact 17^b of the switch 17, and extends from conductor 43 by conductor 75, through said contact 17^b by conductor 76, through the windings of the switches 16 and 17 in parallel, and thence through the limit switch 19 to main line 40, as already traced. It will thus, be seen that the switch 20 is rendered ineffective to deënergize the switches 16 and 17, when released by skip car 2. The skip car 2 continues to ascend and the skip car 1 continues to descend until the traveling nut 27 of the limit switch engages and opens the switch 25, which occurs when the skip car 2 reaches the position to discharge into the hopper 7. This, of course, results in deënergizing the switches 16 and 17, thereby, opening the motor circuit, and also, opening the circuit through the brake coil 37. The brake 36 is thereupon applied to quickly bring the motor to a stop. The position of the skip cars has now been reversed, the car 2 being in a position to discharge its load into the receiving hopper,

and the car 1 being in a position to receive a fresh load.

When the car 1 has been loaded to the proper degree, it operates the lever 22, thereby, again closing the switch 20. The closure of the switch 20, this time, results in completing the circuits of the switches 14 and 15. The circuit of these switches may be traced from main line 40 to the switch 20, as already described, thence, by conductors 46, 47 and 48, through the operating windings of said switches, in parallel by conductors 80, 81 and 82, through the switch 26 of the limit switch, which has been closed, and thence by conductor 60 to main line 40. The switches 14 and 15, thus respond, closing the motor circuit from main line 40, through the series field windings, as already traced, thence to conductor 63 by conductor 83, through the switch 14 by conductors 84 and 66, through the motor armature A by conductors 65 and 85, through the switch 15, thence by conductor 86 to conductor 68 and through the resistance 35 to main line 40, as already traced. It will be noted, however, that upon closure of the switches 14 and 15, current flows through motor armature in an opposite direction to that previously described, while the polarity of the field windings remains the same, consequently, the motor will now operate in an opposite direction to that previously described, thereby, causing the car 1 to be raised, and car 2 to be lowered. Upon closure of the switch 15, the auxiliary contact 15^b thereof, completes a circuit through the operating winding of the accelerating device in the same manner as the auxiliary contact 16^b of the switch 16, while closure of the switch 14 causes its auxiliary contact 14^b to complete a maintaining circuit, in parallel with the control switch 20, in the same manner as the auxiliary contact 17^b of the switch 17. Hence, the motor, when started by the switches 14 and 15 will continue to operate until the traveling nut of the limit switch engages and opens the switch 26. This, of course, deënergizes the switches 14 and 15, thereby, stopping the motor, at which time, the skip cars will again be in the same positions illustrated.

Of course, various provisions might be made for permitting the skip cars to settle under the weight imposed thereon during the filling process without interference from, or affecting, the hoisting mechanism. In practice, however, I prefer to so adjust the controller that the motor will be maintained in operation for a predetermined time after the down car has come to rest, thereby continuing to pay out the hoisting rope of the down car until enough slack is obtained to leave the car free to settle under the weight of its load. In the drawing the down car is illustrated as provided with a slack hoisting rope for this purpose.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a motor controller in combination, means for starting and stopping the motor and automatically operated means for causing said first mentioned means to start the motor when the load to be operated thereby, attains a predetermined weight, and for stopping the motor when the load has been moved a predetermined distance.

2. In a motor controller in combination, means for starting and stopping the motor, said means upon successive operations being adapted to alternately start the motor in opposite directions and automatically operated means controlling said first mentioned means to cause the same to start the motor when the load to be operated thereby attains a predetermined weight, and to stop the motor when the load has been moved a predetermined distance.

3. In a motor controller in combination, electroresponsive means for starting and stopping the motor and automatically operated means controlling said electroresponsive means to cause the same to start the motor when the load to be operated attains a predetermined weight, and to stop the motor when the load has been moved a predetermined distance.

4. In a motor controller in combination, electroresponsive means for starting and stopping the motor, said electroresponsive means being adapted to cause the motor to operate in either direction, and automatically operated means controlling said electroresponsive means to cause the same to start the motor when the load to be operated thereby attains a predetermined weight and to stop the motor when the load has been moved a predetermined distance, said last mentioned means being adapted to cause said first mentioned means to alternately start the motor in opposite directions.

5. In a motor controller in combination, means for starting and stopping the motor, and means controlled by the weight of the device to be operated and by the movement thereof for controlling said first mentioned means to cause the motor to move the device, stop the same in a predetermined position and then return it to initial position automatically.

6. In a motor controller in combination, electroresponsive means for starting and stopping the motor, and means controlled by the weight of the device to be operated, and by the movement of the device, for controlling said first mentioned means to cause the motor to move the device, stop the same in a predetermined position and then return it to initial position automatically.

7. In a motor controller in combination, electroresponsive means for starting and

stopping the motor, and means controlled by the device or devices to be operated and by the movement thereof, for controlling said first mentioned means to cause the motor to move the device or devices a predetermined distance, then stop and automatically return the same to initial position.

8. In a motor controller in combination, electroresponsive means for starting the motor in either direction and for stopping the same, and means controlled by the weight of the device or devices and by the movement thereof for controlling said first mentioned means to cause the motor to move the device or devices in one direction when the load carried thereby is of predetermined weight, and then move the same in an opposite direction when the load carried thereby has been reduced.

9. In combination, two or more conveying receptacles movable in opposite directions between predetermined points and adapted to be simultaneously operated by an electric motor, means for starting and stopping the motor, means for causing said first mentioned means to start the motor each time one of said receptacles is given a load of predetermined weight, and for stopping the motor when any one of the loaded receptacles has reached the predetermined position.

10. In combination, two or more conveying receptacles movable in opposite directions between predetermined points and adapted to be simultaneously operated by an electric motor, means for starting and stopping the motor, means for causing said first mentioned means to start the motor each time one of said receptacles is given a load of predetermined weight, and for stopping the motor when any one of the loaded receptacles has reached a predetermined position, and means for automatically loading each receptacle when in a predetermined position.

11. In combination, two or more conveying receptacles movable simultaneously between predetermined points and adapted to be operated by an electric motor, means for starting and stopping the driving motor, said means upon successive operations thereof being adapted to start the motor alternately in opposite directions, and means controlling said first mentioned means to start the motor whenever one of said receptacles is given a load of predetermined weight, and for stopping the motor when the loaded receptacle has reached a predetermined position.

12. In combination, two or more conveying receptacles movable simultaneously between predetermined points and adapted to be operated by an electric motor, means for starting and stopping the driving motor, said means upon successive operation thereof being adapted to start the motor alternately in opposite directions, and means controlling said first mentioned means to start the motor whenever one of said receptacles is given a load of a predetermined weight, and for stopping the motor when the loaded receptacle has reached a predetermined position, and means for automatically loading each receptacle when the same is in the predetermined position.

13. In combination, two or more conveying receptacles movable simultaneously between predetermined points, electroresponsive means for starting and stopping the driving motor, and means automatically controlled by the weight of the load carried by said receptacles, and by the movement of said receptacles for controlling said first mentioned means to cause the motor to move each loaded receptacle to unloading position and simultaneously move another receptacle to loading position.

14. In combination, two or more conveying receptacles movable simultaneously between predetermined points and adapted to be operated by an electric motor, electroresponsive means for starting the motor in either direction and means controlling said first mentioned means to cause the same to start the motor when either of the receptacles is given a load of predetermined weight to move the loaded receptacle toward unloading position and to move an unloaded receptacle toward loading position, and means controlled by the movement of the receptacles for controlling said first mentioned means to stop the motor when the receptacles reach predetermined positions.

15. In combination, two or more conveying receptacles movable simultaneously between predetermined points and adapted to be operated by an electric motor, electroresponsive means for starting the motor in either direction and means controlling said first mentioned means to cause the same to start the motor when either of the receptacles is given a load of predetermined weight, to move the loaded receptacle toward unloading position and to move an unloaded receptacle toward loading position, and means controlled by the movement of the receptacles for controlling said first mentioned means to stop the motor when the receptacles reach predetermined positions, and means for automatically loading each receptacle when in a predetermined position.

16. In a motor controller, in combination, electroresponsive means for starting the motor, means responsive to a predetermined weight for energizing said electroresponsive means to start the motor and a limit switch adapted to deënergize, said electroresponsive means to stop the motor when the same has made a predetermined number of revolutions.

17. In a motor controller, in combination, electroresponsive means for starting the

motor in either direction, a switch responsive to a predetermined weight for energizing said electroresponsive means to start the motor, and a limit switch adapted to de-energize said means to stop the motor.

18. In a motor controller, in combination, electroresponsive means for starting the motor in either direction, a switch responsive to a predetermined weight for energizing said electroresponsive means to start the motor, and a limit switch adapted to de-energize said means to stop the motor, said limit switch being adapted to control said electroresponsive means to cause the motor to be alternately started in opposite directions upon successive operations of said first mentioned switch.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses.

CLARK T. HENDERSON.

Witnesses:

FRANK H. HUBBARD,

GEORGE HAYNES.