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ALTERNATING CURRENT MOTOR CONTROLLING APPARATUS.

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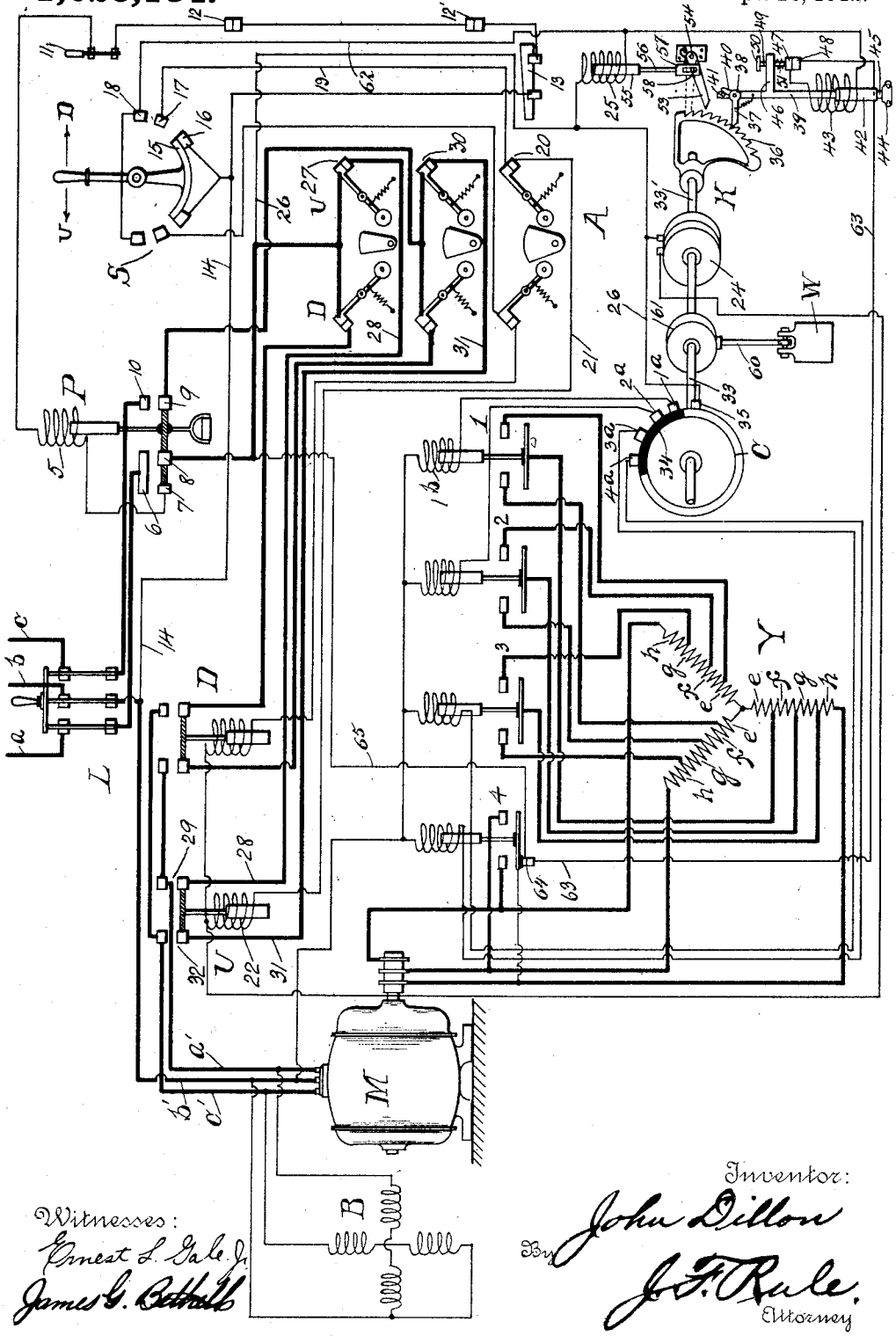

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ALTERNATING-CURRENT-MOTOR-CONTROLLING APPARATUS.

1,023,134. Specification of Letters Patent. Patented Apr. 16, 1912.

Application filed October 14, 1908. Serial No. 457,602.

To all whom it may concern:

Be it known that I, JOHN DILLON, a citizen of the United States, residing in Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a new and useful Improvement in Alternating-Current-Motor-Controlling Apparatus, of which the following is a specification.

My invention relates to controlling mechanism for electric motors, and more particularly to means for controlling the starting resistance of a motor.

One of the objects of the invention is to provide, in connection with an electric motor and mechanism for short-circuiting the starting resistance, means for operating said mechanism at a slow speed and having a definite rate of operation. In place of the dash-pots and equivalent devices that are at present employed to retard the cutting out of the starting resistance, and which are uncertain and often irregular in their operation, the present invention provides an electrically operated device which has a definite and uniform rate of operation which may be varied as desired.

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

The accompanying sheet of drawing illustrates diagrammatically an alternating current electric motor and controlling mechanism therefor forming part of an elevator system, one form of the present invention being embodied therein. The operating and controlling mechanism for the motor M comprises the reversing switches U and D, the potential switch P, a manual switch S located in the elevator car, stop motion switch mechanism A, a sectional starting resistance Y, and electromagnetic switches 1, 2, 3 and 4 controlling the starting resistance. The parts just named are not new and their construction, operation and circuit connections need only be pointed out in so far as is necessary to show their cooperation with the novel elements of the invention.

The motor M, which as here shown is an alternator of the multiphase induction type, receives current from the main line conductors *a*, *b*, *c* adapted to be connected to the motor through the line switch L, potential switch P, stop motion switches and reversing switches. The potential switch P is normally held closed by its magnet coil 5 which receives current through a circuit which may be traced from the conductor *a* through the switch contacts 6, 7, magnet coil 5, safety switch 11 in the car, upper and lower limit switches 12 and 12′, slack cable switch 13, and conductor 14 to the lead *b*. To start the motor in a direction to lift the elevator car, the lever of the car switch S is moved to the left to bring the contact strip 15 into engagement with the stationary contacts 16, 17 and 18. When the strip 15 engages contact 17, a circuit is established from the lead *b* through conductor 14, contacts 16, 15, 17, conductor 19, switch 20, conductor 21, magnet coil 22 of the reversing switch U, conductor 23, winding of a magnetic clutch 24, conductor 26, contacts 8, 6 and to the lead *a*. The magnet coil 22 therefore receives current and closes the reversing switch U and supplies current to the stator of the motor. The lead *a* is connected to the motor through the potential switch contacts 6, 8, switch 27, conductor 28, switch contacts 29 and conductor *a′*; the lead *b* is connected to the motor through conductor *b′*; and the lead *c* is connected to the motor through the switch contacts 10, 9, switch 30, conductor 31, reversing switch contacts 32, and conductor *c′*. The windings of the brake magnet B also receive current through the conductors *a′*, *b′* and *c′* and release the brake to permit the motor to start and run at slow speed, the starting resistance Y at this time being all connected in the rotor circuits.

The mechanism which controls the starting resistance Y will now be described. As here shown, it comprises a shaft 33 to which is secured a contact disk C having a segment 34 of insulating material. A series of stationary contacts 1^a, 2^a, 3^a and 4^a bear against the segment 34 when the parts are in their initial position, and a contact 35 bears at all times against the conducting portion of the disk C. A shaft 33′ in alinement with the shaft 33 is adapted to be connected therewith by a magnetic clutch 24. Secured to the shaft 33′ is a quadrant K having rack teeth 36 arranged concentrically with the shaft.

A step-by-step rotation is imparted to the segment K and connected parts by means of electromagnetically operated escapement

mechanism. This mechanism comprises a pawl 37 pivoted at 38 to a vertical rod 39. The downward movement of the pawl about its pivot is limited by a lug 40 on the pawl engaging a stop pin 41 on the rod 39. The rod 39 is carried by the core 42 of a solenoid or magnet coil 43. When the magnet is not excited, the core 42 rests on a stop 44 which may be provided with a rubber buffer 45 to deaden the noise during the operation of the magnet. The rack teeth and pawls may also be made of some material, such as fiber, that will practically be noiseless during operation. An arm 46 on the rod 39 supports a movable electric contact 47 provided with a stem 49 extending loosely through the arm 46. A head 50 on the stem limits its downward movement. A light coil spring 51 may be placed between the contact 47 and arm 46, if desired, to hold it against the stationary contact 48. These contacts are preferably made of carbon to prevent rapid depreciation owing to the frequent interruption of the current at this point.

Above the operating pawl 37 is a locking pawl 53 pivoted at 54. An electromagnet comprising the winding 25 and a core 55 is located above the pawl 53 and adapted to hold the latter in operative position as shown by dotted lines. The core 55 is connected to the pawl 53 by means of a rod 56 having a slotted head 57 engaging a pin 58 on the pawl. A centering weight W is connected by a flexible member 60 to a pulley 61 secured to the shaft 33.

Reverting to the operation of the motor, when the car switch lever is moved far enough to engage the contact 18 a circuit is established through the magnet coil 43. This circuit is from the lead *b* through conductor 14, switch contacts 16, 15, 18, conductor 62, magnet coil 43, contacts 47, 48, conductor 63, contacts 64, conductor 65, contacts 8 and 6, and to the lead *a*. The escapement mechanism is now operated as follows: The coil 43 lifts its core 42, and the pawl 37 carried thereby moves the segment K the distance of one tooth. The upper pawl 53 which at this time is prevented from falling below a horizontal position by its magnet 25, slips past one tooth as the segment K is rotated and engages below the next tooth and holds the segment against backward rotation. As the magnet core 42 is lifted the arm 46 engages the head 50 and lifts the contact 47, thereby interrupting the circuit through the magnet coil 43 and permitting the rod 39 to fall. This carries the pawl 37 below the next succeeding tooth, and again closes the circuit through the magnet, so that the parts are in position to repeat their operation.

As the disk C is rotated by the escapement mechanism, the insulating segment 34 is carried past the contact 1^a and establishes a circuit through the magnet coil 1^b of the switch 1 as follows: From the lead *a* through contacts 6, 8, conductor 26, contacts 35, C, 1^a, magnet coil 1^b and conductor *b'* to the lead *b*. The switch 1 is therefore closed and short-circuits the inner sections *e* of the resistance Y, permitting the motor to accelerate. As the disk C continues to rotate, the segment 34 is carried past the contacts 2^a, 3^a and 4^a successively, causing the successive operation of the switches 2, 3 and 4, thereby short-circuiting the sections *f*, *g* and *h* of the resistance Y and permitting a gradual acceleration of the motor to full normal speed. When the last switch 4 operates it separates the contacts 64 and interrupts the circuit for the magnet coil 43, thereby stopping the operation of the escapement mechanism.

If it is desired to reduce the speed of the motor, the car switch lever is moved toward its central position to disengage the contact 18. This interrupts the circuit to the magnet coil 25 which drops its core and permits the holding pawl 53 to drop away from the segment K. The centering weight W now rotates the shaft 33, 33' to initial position, interrupting the circuits for the switches 1, 2, 3 and 4, and reinserting the starting resistance Y, so that the speed of the motor is reduced. To stop the motor the car switch lever is brought back to central position, thereby opening the circuit to the reversing switch magnet U, which operates to cut off the supply of current to the motor and brake, which latter is applied to bring the motor quickly to rest.

The electromagnetic clutch 24 being in the circuit for the reversing switch magnets, will always be released when said circuit is opened, permitting the disk C to be returned quickly to initial position independently of the shaft 33' and holding pawl 53. The clutch may, however, be omitted if desired. When the clutch is used the magnet for the holding pawl 53 may be omitted and a simple stop provided to prevent the pawl from dropping below a horizontal position. In this case the magnet winding for the clutch preferably has the same circuit connections as shown for the coil 25. The quadrant K is also in this instance preferably replaced by a toothed wheel, so that backward rotation of the shaft 33' is unnecessary.

The escapement mechanism herein shown secures a reliable operation of the contact disk C at a uniform speed independently of dash-pots or other retarding devices such as are now in use and which are uncertain and often irregular in their operation. The self-induction in the coil 43 and the inertia of the core 42 and connected parts prevents a too rapid operation of the mechanism. The parts may be designed and proportioned to secure any desired speed. The

contacts 1^a, 2^a, 3^a and 4^a are preferably made independently adjustable, or, if desired, a separate disk may be provided for each contact.

Various changes in the details of construction and arrangement of parts other than those herein disclosed might obviously be made by those skilled in the art without departing from the spirit and scope of the invention, and I wish therefore not to be limited to the exact construction disclosed.

What I claim as new and desire to secure by Letters Patent of the United States is:—

1. The combination with an electric motor, of a sectional resistance, reversing switches, a rotatable member, means associated therewith for controlling said resistance, a second rotatable member, means for rotating said second member, an electroresponsive device for holding said second member in rotated position, a manual switch in the circuit of said electroresponsive device, and an electromagnetic clutch connecting said members and having its magnet winding in circuit with the reversing switches.

2. The combination with an electric motor, of sectional starting resistance therefor, a series of electro-magnetic relays controlling said resistance, a rotary controller controlling the circuits for the relay magnets, pawl and ratchet mechanism comprising an operating electro-magnet for operating said controller, and a switch in the circuit of said operating magnet controlled by the last relay of said series.

3. The combination with an electric motor, of a starting resistance therefor, relays controlling said resistance, a rotary controller controlling the circuits for said relays, pawl and ratchet mechanism comprising a ratchet member rotatable on a common axis with said controller, and an electromagnetic clutch connecting said controller and ratchet member.

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

JOHN DILLON.

Witnesses:
D. M. Baldwin,
N. A. Meehan.