

H. W. CHENEY.
MULTIPLE VOLTAGE SYSTEM OF MOTOR CONTROL.
APPLICATION FILED OCT. 6, 1909.

960,505.

Patented June 7, 1910.

2 SHEETS—SHEET 1.

Fig. 1

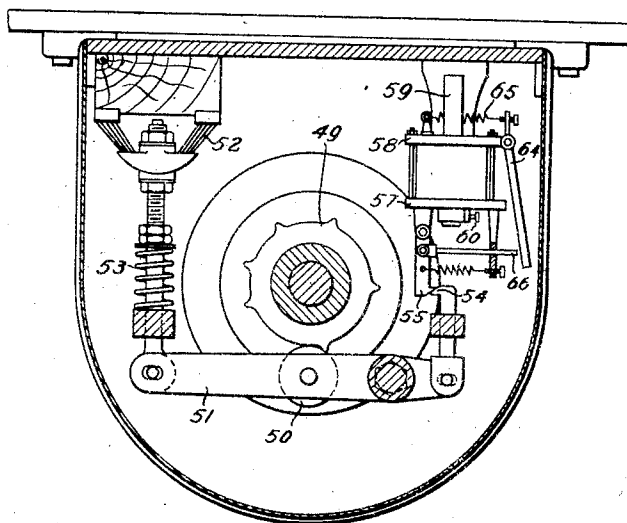
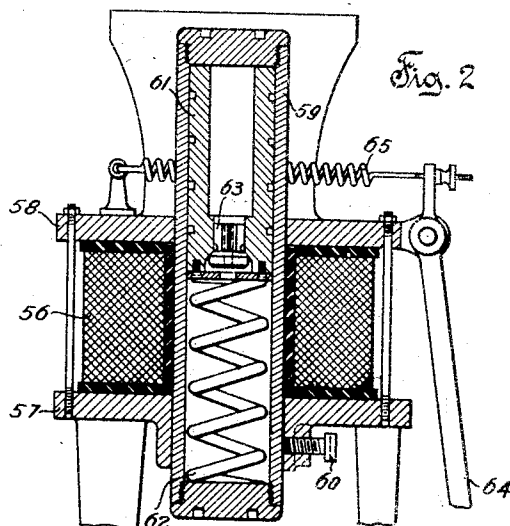


Fig. 2



Witnesses

Rob. E. Hall

Chas. L. Byron

Inventor

Herbert W. Cheney

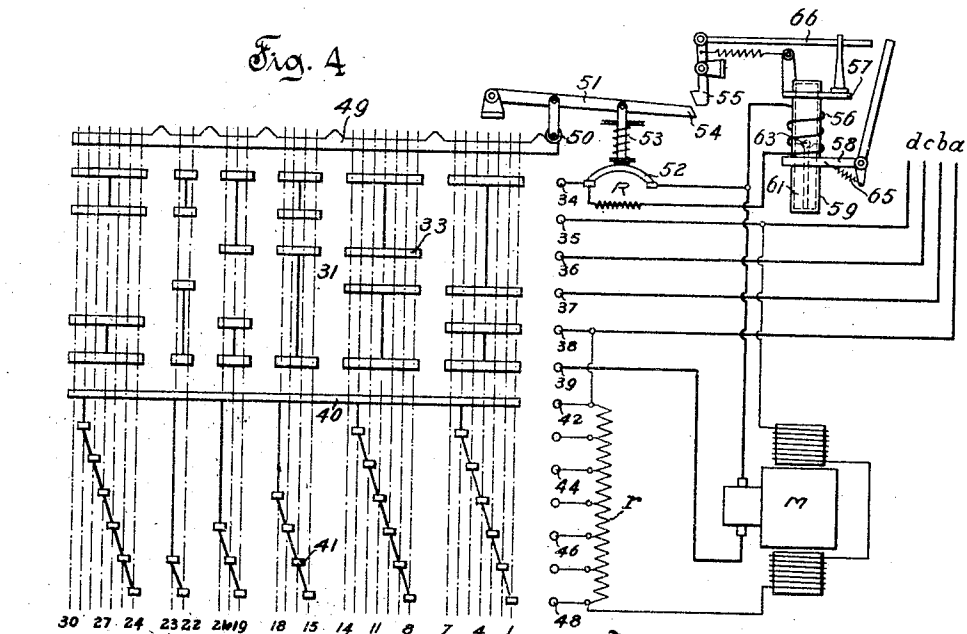
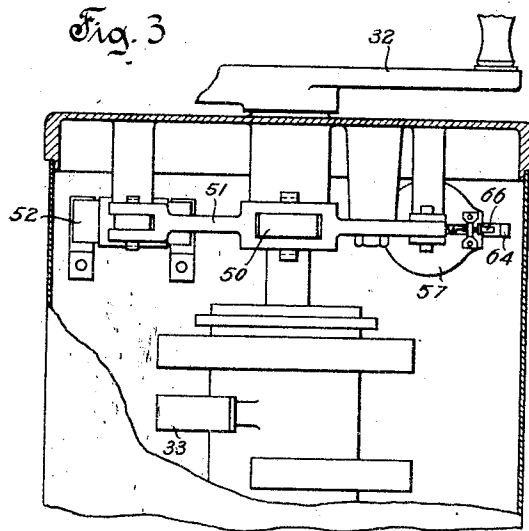
By *Chas. E. Lord*
Attorney

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2 SHEETS—SHEET 2.



Witnesses

Rob. E. Stoll

Chas. L. Byron

Inventor

Herbert W. Cheney

By Chas. E. Lord
 Attorney

UNITED STATES PATENT OFFICE.

HERBERT W. CHENEY, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO ALLIS-CHALMERS COMPANY, A CORPORATION OF NEW JERSEY.

MULTIPLE-VOLTAGE SYSTEM OF MOTOR CONTROL.

960,505.

Specification of Letters Patent. Patented June 7, 1910.

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To all whom it may concern:

Be it known that I, HERBERT W. CHENEY, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Multiple-Voltage Systems of Motor Control, of which the following is a full, clear, and exact specification.

My invention relates to multiple voltage controllers.

In the patent to Dunn No. 797,271, granted Aug. 15, 1905, there is described a multiple voltage controller in which a fixed resistance is temporarily cut into the armature circuit of a motor whenever the connections of the armature are changed from one set of mains to another. This resistance, now commonly known as a buffer resistance, serves to prevent excessive surges of current through the armature when the impressed voltage thereon is either increased or decreased. This buffer resistance, after having been inserted in circuit is cut out again after a predetermined time, which, in the Dunn patent, is controlled by an ordinary air dash-pot. While this arrangement is generally entirely sufficient, it sometimes happens that the buffer resistance is cut out too quickly or too slowly, largely on account of imperfections in the dash-pot and of its direct connection to the switching device controlling the buffer resistance. The action has been improved somewhat by substituting an ordinary oil dash-pot for the air dash-pot described by Dunn, but because of the stuffing boxes and other features of the oil dash-pot and the aforesaid direct connection there are drawbacks to its use also.

It is the object of my present invention to improve the arrangement shown in the Dunn patent, particularly as regards the means for controlling the cutting out of the buffer resistance.

In carrying out my invention there is provided means for normally preventing the cutting out of the buffer resistance after it has been cut in, and an electro-magnetically operated device for rendering the aforesaid means inoperative. The electro-magnetic device preferably operates only after a time interval after the cutting in of the buffer resistance, the time interval being obtained in the preferred form of my invention by a

dash-pot of special construction. The piston of this dash-pot is part of the magnetic circuit of the electro-magnetic device and is so arranged that there is no need of stuffing boxes, although the dash-pot may operate in oil.

The various novel features of my invention will appear from the description and drawings, and will be particularly pointed out in the claims.

Figure 1 is a section through a controller embodying my invention, showing the operating mechanism for the buffer resistance switch; Fig. 2 is an enlarged view of the electro-magnetic time element device; Fig. 3 is a partial front elevation of the controller of Fig. 1, with some parts broken away; and Fig. 4 is a diagram showing a development of the controller.

For the sake of simplicity, the controller is here illustrated with its connections approximately the same as those in the patent to Dunn, aforesaid, but it is obvious that my invention is applicable to any other form of controller in which the voltage impressed on a motor is varied and especially applicable to any form of multiple voltage controller. The controller drum 31 is operable by the usual handle 32, and has contact segments 33 arranged to cooperate with contact fingers 34 to 39 inclusive to connect the armature of a motor M to different sets of the mains *a*, *b*, *c*, and *d*. The drum also has a ring 40 and segments 41 arranged to cooperate with contact fingers 42 and 48 inclusive to vary the resistance *r* in the field circuit of the motor M.

Mounted on the shaft of the controller is a cam wheel 49, on the periphery of which rides a roller 50 carried by a lever 51. The cam wheel 49 is shown developed in Fig. 2, but in order to show more clearly the operation of the device it is there shown as if its cam projections were on its upper surface instead of on its periphery. These cam projections are so located that they engage with and move the roller 50 as the motor armature connections are being changed from one set of mains to another. The lever 51 is connected to a switch 52, which is biased to closed position by an adjustable spring 53. When the switch 52 is opened, a finger 54 carried by the lever 51 engages a latch 55 to hold the switch open. The

switch 52 when closed short-circuits a resistance R and a solenoid 56, which are in series with each other and in the armature circuit of the motor M . This solenoid 56 is located between two iron plates 57 and 58, and inside of the solenoid is a tube 59 of non-magnetic material which may be adjusted longitudinally of the solenoid. A screw 60 is provided for clamping the tube in adjusted position. Inside of the tube is an iron piston 61 which is biased toward one end of the tube by a spring 62. The tube is closed at both ends, and may be filled with oil. The piston 61 has a longitudinal opening through it, and a valve 63 closes this opening except when the piston is being moved out of the solenoid. There may be a small opening through the valve 63 if desired. The piston 61 is both a dash-pot piston and the core of the solenoid 56. An armature 64 is pivoted on the plate 58 and biased away from the plate 57 by means of an adjustable spring 65. When the solenoid is energized it moves the core 61 slowly inward against the action of the spring 62, and when the core has been moved far enough to reduce the reluctance of the magnetic circuit of the solenoid sufficiently the armature 64 is moved inward toward the plate 57 and strikes a rod 66 and moves it end-wise to release the latch 55.

When the controller is moved to change the armature connections from any set of mains to another, whether to increase or decrease the voltage impressed on the armature, the cam projections on the cam wheel 49 move the lever 51 to open the switch 52 and cut the resistance R and the solenoid 56 into the motor armature circuit. As soon as the change of armature connections has been made and the solenoid 56 energized, said solenoid begins to draw its core 61 inward, and continues to do so until because of the decreased reluctance of the magnetic circuit of the solenoid the armature 64 is moved inward to release the latch 55. When the latch 55 is released, the spring 53 closes the switch 52 quickly and cuts the resistance R and the solenoid 56 out of circuit. The deenergization of the solenoid 56 allows the springs 62 and 65 to move the core 61 and the armature 64 outward. There is a time interval between the energization of the solenoid 56 and the release of the latch 55, and this time interval may be adjusted both by moving the tube 59 longitudinally and by adjusting the spring 65.

In the controller shown the resistance R is cut into circuit when the controller passes between position 7 and 8, 14 and 15, 18 and 19, 21 and 22, and 23 and 24, and also when it passes to or from off position. Between the positions just mentioned the armature connections are changed from one set of mains to another. Between any other two

adjacent positions the controller merely varies the resistance r in the field circuit of the motor. This field resistance is arranged to be increased as the controller is moved forward between those adjacent positions when the armature connections are not varied, thus increasing the speed of the motor, but to be cut out whenever the armature connections are changed from mains of a lower voltage to mains of a higher voltage, thus insuring a strong field whenever the higher voltage is first impressed on the armature.

It is obvious that the part of the controller which controls the field resistance 80 may be varied as desired, and that the part which controls the armature connections may be adapted to any multiple voltage system and arranged, if desired, to reverse the armature connections. The structure of the electro-magnetic time element device may also be varied to a considerable extent. These modifications, as well as many others which will readily occur to one skilled in the art, may be made without departing from the spirit and scope of my invention, and are intended to be covered in the following claims.

What I claim as new is:

1. In combination, a motor, a circuit therefor, a resistance in the circuit, means for affecting changes in the potential on the leads of the armature circuit of the motor, a switch for cutting said resistance into circuit, means for holding said switch in position in which the resistance is in circuit, and an electro-magnetic device for rendering said holding means inoperative.

2. In combination, a motor, multiple voltage mains, means for connecting the motor armature across different sets of mains, a resistance, a switch for inserting said resistance in circuit with the motor armature when the latter is changed from one set of mains to another, a latch for holding said switch in position with the resistance in circuit, and electro-magnetic means for releasing said latch.

3. In combination, multiple voltage mains, a motor, means for connecting the motor armature to different sets of the mains, a resistance in the motor armature circuit, a switch normally short-circuiting said resistance, means for opening said switch as the motor armature connections are changed from one set of mains to another, a latch for holding said switch open, and electro-magnetic means rendered operative by the opening of said switch for releasing said latch.

4. In combination, multiple voltage mains, a motor, means for connecting the motor armature to different sets of said mains, a resistance in the motor armature circuit, a switch normally short-circuiting said resistance, means for opening said

switch as the motor armature connections are changed from one set of mains to another; a latch for holding said switch open; and electro-magnetic means for releasing said latch.

5. In combination, a controller arranged to connect a motor armature to different sets of multiple voltage mains, a resistance, a switch arranged to be operated to cut said resistance into the motor armature circuit when the armature connections are changed from one set of multiple voltage mains to another, a latch for holding said switch in the position in which said resistance is in circuit, and electro-magnetically operated means for releasing said latch.

6. In combination, a controller arranged to connect a motor armature to different sets of multiple voltage mains, a resistance, a switch arranged to be operated to cut said resistance into the motor armature circuit when the armature connections are changed from one set of multiple voltage mains to another, a latch for holding said switch in the position in which the said resistance is in circuit, and electro-magnetic means for releasing said latch, said electro-magnetic means being energized when said resistance is cut into the motor armature circuit.

7. In combination, a controller arranged to connect a motor armature to different sets of multiple voltage mains, a resistance for the motor armature circuit, a switch normally short-circuiting said resistance, means for opening said switch by a movement of the controller to change the motor armature connections from one set of multiple voltage mains to another, a latch for holding said switch open, and electro-magnetically operated means for releasing said latch.

8. In combination, a controller arranged to connect a motor armature to different sets of multiple voltage mains, a resistance for the motor armature circuit, a switch normally short-circuiting said resistance, means for opening said switch by a movement of the controller to change the motor armature connections from one set of multiple voltage mains to another, a latch for holding said switch open, and electro-magnetic means for releasing said latch, said electro-magnetic means being energized by the opening of said switch.

9. In combination, a controller arranged to connect a motor armature to different sets of multiple voltage mains, a resistance for the motor armature circuit, a switch which normally short-circuits said resistance, means for opening said switch by a movement of the controller to change the motor armature connections from one set of multiple voltage mains to another, and electro-magnetic means energized upon the opening of said switch for controlling the closing of said switch.

10. In combination, a controller arranged to connect a motor armature to different sets of multiple voltage mains, a resistance, a switch arranged to be operated to cut said resistance into the motor armature circuit when the armature connections are changed from one set of multiple voltage mains to another, a latch for holding said switch in the position in which the resistance is in the motor armature, and electro-magnetically operated means for rendering said latch inoperative after a time interval after the switch has been moved to cut the resistance in the motor armature circuit.

11. In combination, a controller arranged to connect a motor armature to different sets of multiple voltage mains, a resistance, a switch arranged to be operated to cut said resistance into the motor armature circuit when the armature connections are changed from one set of multiple voltage mains to another, a latch for holding said switch in the position in which the resistance is in the motor armature, and electro-magnetic means for rendering said latch inoperative after a time interval after the switch has been moved to cut the resistance in the motor armature circuit, said electro-magnetic means being energized upon the movement of the switch to cut said resistance into the motor armature circuit.

12. In combination, a controller arranged to connect a motor armature to different sets of multiple voltage mains, a resistance for the motor armature circuit, a switch normally short-circuiting said resistance, means for opening said switch by the movement of the controller to change the motor armature connections from one set of multiple voltage mains to another, a latch for holding said switch open, and electro-magnetically operated means which operates after a time interval to render said latch inoperative.

13. In combination, a controller arranged to connect a motor armature to different sets of multiple voltage mains, a resistance for the motor armature circuit, a switch normally short-circuiting said resistance, means for opening said switch by the movement of the controller to change the motor armature connections from one set of multiple voltage mains to another, a latch for holding said switch open, and electro-magnetic means which operates after a time interval to render said latch inoperative, said electro-magnetic means being rendered operative by the opening of said switch.

14. In combination, a controller arranged to connect a motor armature to different sets of multiple voltage mains, a resistance for the motor armature circuit, an electro-magnetic coil, a switch normally short-circuiting said resistance and said coil, means for opening said switch by the movement of the controller to change the motor armature connec-

tions from one set of multiple voltage mains to another, and means operated by said coil for rendering said latch inoperative.

15 In combination, a controller arranged to connect a motor armature to different sets of multiple voltage mains, a resistance for the motor armature circuit, an electro-magnetic coil, a switch normally short-circuiting said resistance and said coil, means for opening said switch by the movement of the controller to change the motor armature con-

nections from one set of multiple voltage mains to another, and means operated by said coil after a time interval after the opening of said switch for rendering said latch inoperative. 15

In testimony whereof I affix my signature, in the presence of two witnesses.

HERBERT W. CHENEY.

Witnesses:

Geo. B. SCHLEY,
CHAS. L. BYRON.