

June 28, 1927.

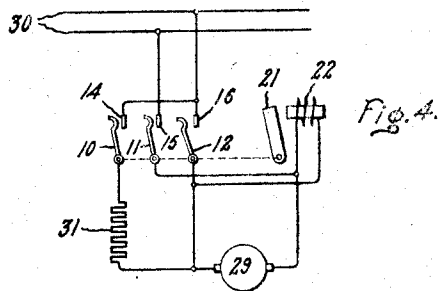
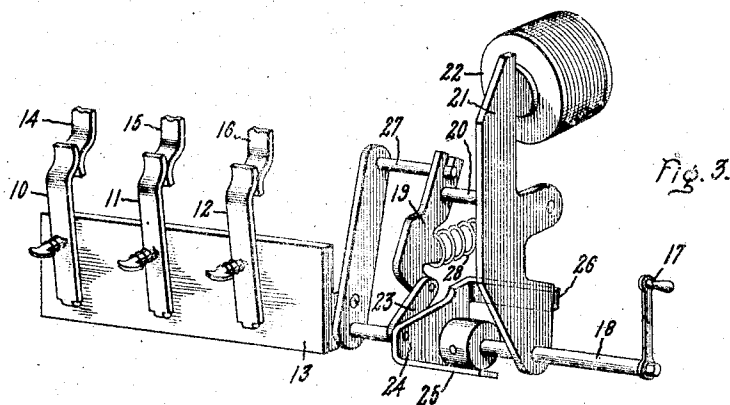
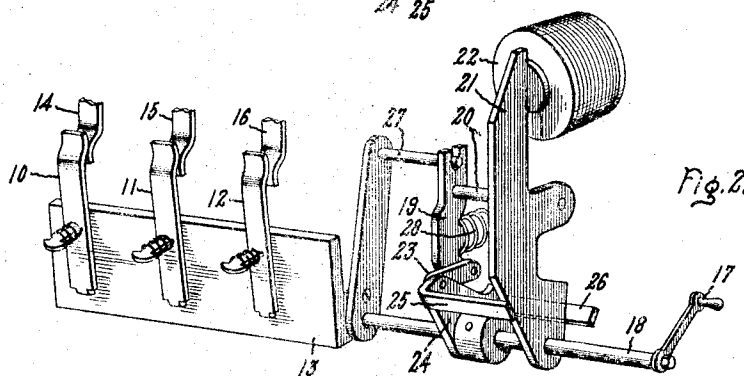
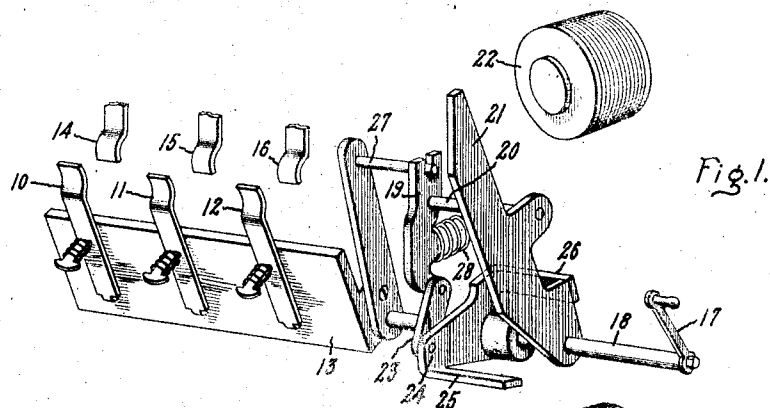
G. R. TOWNSEND

1,633,833

MOTOR CONTROLLER

Filed April 1, 1925

2 Sheets-Sheet 1



Inventor:
George R. Townsend,
by *Alexander S. Hunt*
His Attorney

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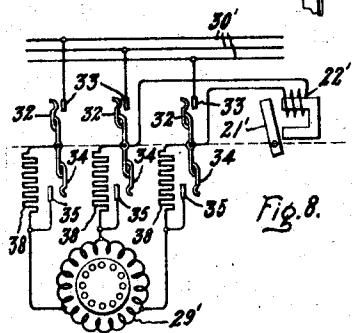
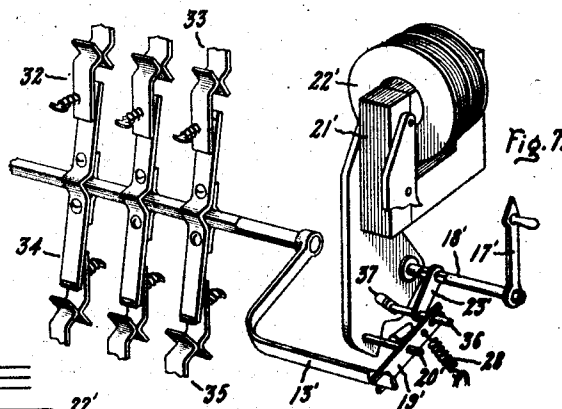
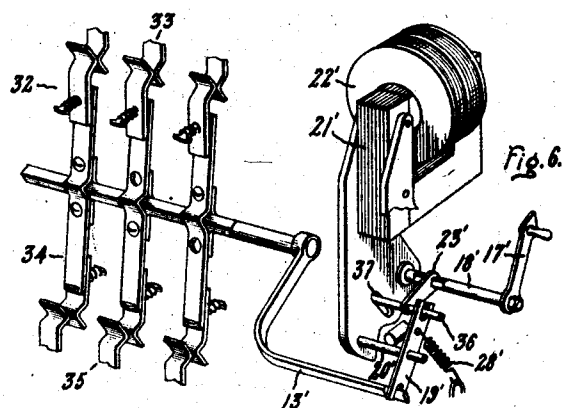
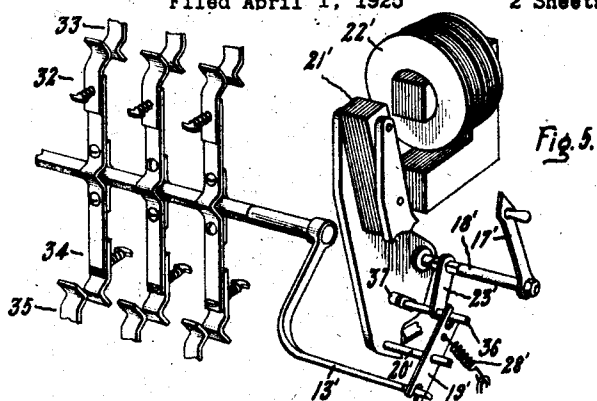
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G. R. TOWNSEND

MOTOR CONTROLLER

Filed April 1, 1925

2 Sheets-Sheet 2



Inventor :
George R. Townsend,
by *Wm. S. Smith*
His Attorney.

UNITED STATES PATENT OFFICE.

GEORGE R. TOWNSEND, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

MOTOR CONTROLLER.

Application filed April 1, 1925. Serial No. 19,980.

My invention relates to improvements in motor controllers, particularly motor controllers intended for the automatic establishment of motor running connections after the establishment of the motor starting connections.

One of the objects of the invention is to provide an improved starting switch or controller having a plurality of positions and a single operating means, together with improved connections between the operating means and the switch contact mechanism whereby movement of the operating means in one direction to a final position effects a movement of the switch contact mechanism to one operating position, for example the starting position, and either a reverse movement of the operating means or a release of the operating means will effect an automatic operation of the switch contact mechanism to establish another connection, for example, the running connections for the motor.

Another object of the invention is to provide a simple and effective connection between the operating means and the switch contact mechanism whereby the motor running connections cannot be established unless the motor starting connections are first established.

Another object of the invention is to provide an improved arrangement whereby a single electromagnet is effective to hold the switch contact mechanism in the running position so that upon failure of the power supply the switch or controller will assume the initial position so as to disconnect the motor from the source of supply, the single electromagnet also being effective to cooperate with the connections between the operating means and the switch contact mechanism whereby the contact mechanism is held in the starting position against a strain to the running position while the operating means is held in the first operated position.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, reference is had to the following description taken in connection with the accompanying drawings, wherein Fig. 1 is a skeleton view

of the construction and arrangement of a motor controller in accordance with the invention, the various parts being in their respective positions when the switch handle or operating means is in the initial or open position. Fig. 2 is a similar view showing the relative positions of the various parts when the switch handle has been moved to effect the establishment of the motor starting connections. Fig. 3 is another similar view showing the relative positions of the various parts when the switch handle has been either released or moved slightly in the reverse direction so as to thereby effect the establishment of the motor running connections. Fig. 4 is a very simplified diagram of a motor control system showing the controller employed in effecting the starting and running connections for the controlled motor. Figs. 5, 6 and 7 are similar skeleton views of another form of motor controller in accordance with the invention, the figures corresponding respectively to Figs. 1, 2 and 3 showing the relative positions of the various parts of this form of the controller when the controller is in the "off" or initial position, the starting position and the running position, respectively, and Fig. 8 is a simplified diagram corresponding to Fig. 4, showing the controller of Figs. 5, 6 and 7 employed to effect the starting and running connections of a three phase alternating current motor.

Referring to Figs. 1 to 4 inclusive, the controller comprises a plurality of cooperating contacts, the movable contacts 10, 11 and 12 being resiliently mounted on and carried by the rotatably mounted member 13. The contacts 10, 11 and 12 cooperate respectively with the contacts 14, 15 and 16, the contacts 14 and 15 being slightly closer their cooperating contacts 10 and 11 than the contact 16 is with respect to the contact 12. The controller is operated by means of the handle 17 which is secured to the shaft 18.

In accordance with my invention I have provided improved connections between the operating means comprising the handle 17 and shaft 18 and the movable contacts 10, 11, and 12, whereby when the handle is moved directly from the position shown in Fig. 1 to the position shown in Fig. 2, the

contacts 10 and 11 will be brought into engagement with their cooperating contacts 14 and 15 but the contact 12 will be held out of engagement with the contact 16. These connections include the lever 19 which is pivotally mounted on the pin 20 which is carried by the armature 21 of an electromagnet 22. The armature 21 is mounted on the shaft 18 for rotation with respect thereto, and the member 13 is also mounted on the shaft 18 for rotation with respect thereto. The lever 19 has a pivotal connection at one end thereof with the link 23, the other end of the link being connected to the member 24 which has two arms 25 and 26 which cooperate with the armature 21 of the electromagnet. The upper end of the lever 19 cooperates with the pin 27 which is carried by the member 13. The spring 28 cooperates with the lever 19 and is located between the pin 20 and the pivotal connection of the lever 19 with the link 23. This spring is arranged to be put under a strain during the movement of the switch contact mechanism to the starting position so as to become effective to move the contact mechanism to the running position when the handle 17 is either released or moved slightly in the reverse direction.

The operation of this form of my invention is as follows: Assume that the controller is in the "off" position as indicated in Fig. 1 and that it is desired to effect the proper starting of the motor 29 (Fig. 4); the handle 17 will be moved directly from the position indicated in Fig. 1 to the position indicated in Fig. 2, thereby moving the armature 21 to the attracted position through the action of the arm 25, and at the same time moving the contacts 10 and 11 into engagement with the contacts 14 and 15 through the action of the hereinbefore described connections between the handle and the contact mechanism. The parts will now be in their respective positions as indicated in Fig. 2 and the spring 28 will be placed under a strain to move the lower end of the lever 19 clockwise, and thus in turn place the member 13 under a strain for clockwise movement about the shaft 18 through the connection between the upper end of the lever and the member 13. The motor will now be connected to the source of supply 30, the resistor 31 being included in the motor armature circuit and the winding of the electromagnet 22 being energized so as to magnetically hold the armature 21. The motor starting connections will be maintained as long as the operator holds the controller handle 17 in the full forward position, but as soon as the operator releases his grasp upon the handle 17, or if he moves the handle slightly in the reverse direction, the various parts will assume their respective positions as shown in Fig. 3. It will

thus be seen that by reason of the holding effect of the electromagnet on the armature 21, the spring 28 is effective to move the member 13 a further distance in the clockwise direction about the shaft 18. This brings the contact 12 into engagement with the corresponding contact 16 and short-circuits the starting resistor 31. The arm 26 comes into engagement with the armature 21 and arrests further movement of the shaft 18 in the return direction towards the starting position. The switch will now be magnetically held in the running position by means of the electromagnet 22.

It will thus be seen that the controller is required to be operated properly even by an unskilled operator, since all that he need to know about the starting of the motor is that the handle 17 must be thrown from its initial position as indicated in Fig. 1 to the full forward position as indicated in Fig. 2 and thereafter the motor running connections are automatically established independently of any further operation on the part of the operator. It will also be observed that in case there is a failure of power, the switch will automatically return to the "off" position from the running position, and it will also be observed that in case the power supply had failed previous to the operation of the controller to the starting position, the running connections cannot be established until after the power supply is restored. That is because of the fact that the holding effect of the electromagnet is necessary in order to permit the strain of the spring 28 to become effective to throw the switch from the starting position to the running position, and if there is a failure of the power supply, the electromagnet will not hold the armature 21 and permit the running connections to be established.

It is believed that a clear understanding of the features of construction and the principles of operation of the form of my invention as shown in Figs. 5, 6 and 7 will be had from an explanation of the operation of the arrangement. Parts having functions similar to corresponding parts of the arrangement of Figs. 1 to 3 inclusive, are numbered similarly. Thus, the shaft 18, the lever 19, the armature 21, electromagnet 22, member 13, and other parts of the arrangement of Figs. 1, 2 and 3 correspond respectively to the shaft 18', the lever 19', the armature 21', the electromagnet 22', the member 13' of the arrangement of Figs. 5 to 7 inclusive, the lever 23' takes the place of the link 23, and this lever is secured to the shaft 18' so as to rotate therewith. The member 13' is secured to a switch shaft having two sets of contacts, the upper set 32 being arranged to make engagement with the corresponding set of stationary contacts 33 and the lower set 34 being arranged to make

engagement respectively with the set of stationary contacts 35. The contacts 32 and 33 comprise the motor starting contacts and the contacts 34 and 35 comprise the motor

and 7 as the preferred form of my invention, since it lends itself more readily to large scale production. I appreciate that under certain conditions it may be desirable to control the automatic establishment of the motor running connections in accordance with some predetermined condition, as for example in accordance with the current taken by the motor or the arrangement may be such that the motor running connections cannot be established until a definite interval of time after the establishment of the motor starting connections. Those skilled in the art will readily understand the manner in which such automatic limiting action may be had in the controller. However, since this is not of the essence of the invention, such arrangements have not been shown or described.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof.

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

1. A motor controller having a plurality of cooperating contacts for establishing starting and running connections, an operating shaft having a handle for operating the contacts, an electromagnet having an armature for holding the said contacts in the running position, the said armature being mounted on the said shaft for rotation with respect thereto, a lever carried by and pivotally mounted with respect to said armature, the said lever having one end operatively connected with said contacts and the other end operatively connected with said shaft, and a spring associated with said lever, the connections being such that operating the said handle from the initial position to a second position moves the said armature to the attracted position, places the said spring under strain and moves the said contacts to establish the starting connections, the strain of the spring being thereupon effective by reason of the holding effect of said armature to operate the said lever and move the said contacts to establish the running connections when the said handle is released.

2. A motor controller having a plurality of cooperating contacts and operating means therefor for establishing starting and running connections, the said operating means comprising a shaft, an electromagnet having an armature mounted on the said shaft for rotation with respect thereto, operating connections between the said shaft and contacts comprising an operating member connected to said shaft, a lever carried by the said armature and pivotally mounted with respect thereto, the said lever having one end connected with the said contacts and the other end con-

The operation of this form of the invention is as follows: Assume that the switch handle 17' is in the "off" or initial position as indicated in Fig. 5 with the sets of contacts 32 and 34 out of engagement with their respective stationary contacts, in order to connect the three phase alternating current motor 29' to the three phase source of supply 30', the handle 17' will be first moved to the full forward position. The lever 23' will rotate clockwise with the shaft 18', the one end of the pin 36 carried by the end of the lever 23' moving in the slot 37 in the armature 21' and by reason of the operative connection between the pin 36 and the slotted upper end of the lever 19', the lever 19' will be moved counter-clockwise against the strain of the spring 28'. This will cause the lever 19' to rotate about the pin 20' carried by the armature 21' and a resultant motion will be imparted to the member 13'. The movement of the pin 36 in the slot 37 in the armature 21' effects a movement of the armature to the attracted position, thus moving the pin 20' in the clockwise direction about the shaft 18'. This in turn effects a clockwise rotation of the member 13' with respect to the shaft 18' and brings the set of contacts 32 into engagement with the corresponding stationary contacts 33. The electromagnet 22' is energized to hold the armature 21 against the strain of the spring 28', and the motor is connected to the three phase source of supply through the starting resistor 38. The parts of the controller will now be in their respective positions indicated in Fig. 6 and the motor starting connections will be maintained as long as the operator retains the handle 17' in the full operated position.

If the operator releases the handle or moves the handle backward a slight distance, the strain set up in the spring 28' during the establishment of the motor starting connections is effective to now rotate the member 13' a further distance in the clockwise direction and bring the set of running contacts 34 and 35 into engagement. This effects the short-circuiting of the starting resistors 38 and connects the motor directly to the source of supply. The parts will now be in their respective positions as indicated in Fig. 7 and the running connections will be established until there is either a failure of the supply circuit or until the operator moves the handle from the running position to the "off" or initial position, thus restoring the parts to their respective positions indicated in Fig. 5.

I regard the arrangement of Figs. 5, 6

connected with said shaft, and a spring associated with the said lever, whereby operating the said shaft in one direction moves the said armature to the attracted position, places
5 the said spring under strain and moves the said contacts through said operating connections to establish the motor starting con-

nections, and the said spring operates the said lever to move the said contacts to establish the motor running connections upon
10 a subsequent reverse movement of said shaft.

In witness whereof, I have hereunto set my hand this 31st day of March, 1925.

GEORGE R. TOWNSEND.