No. 814,946. PATENTED MAR. 13, 1906.

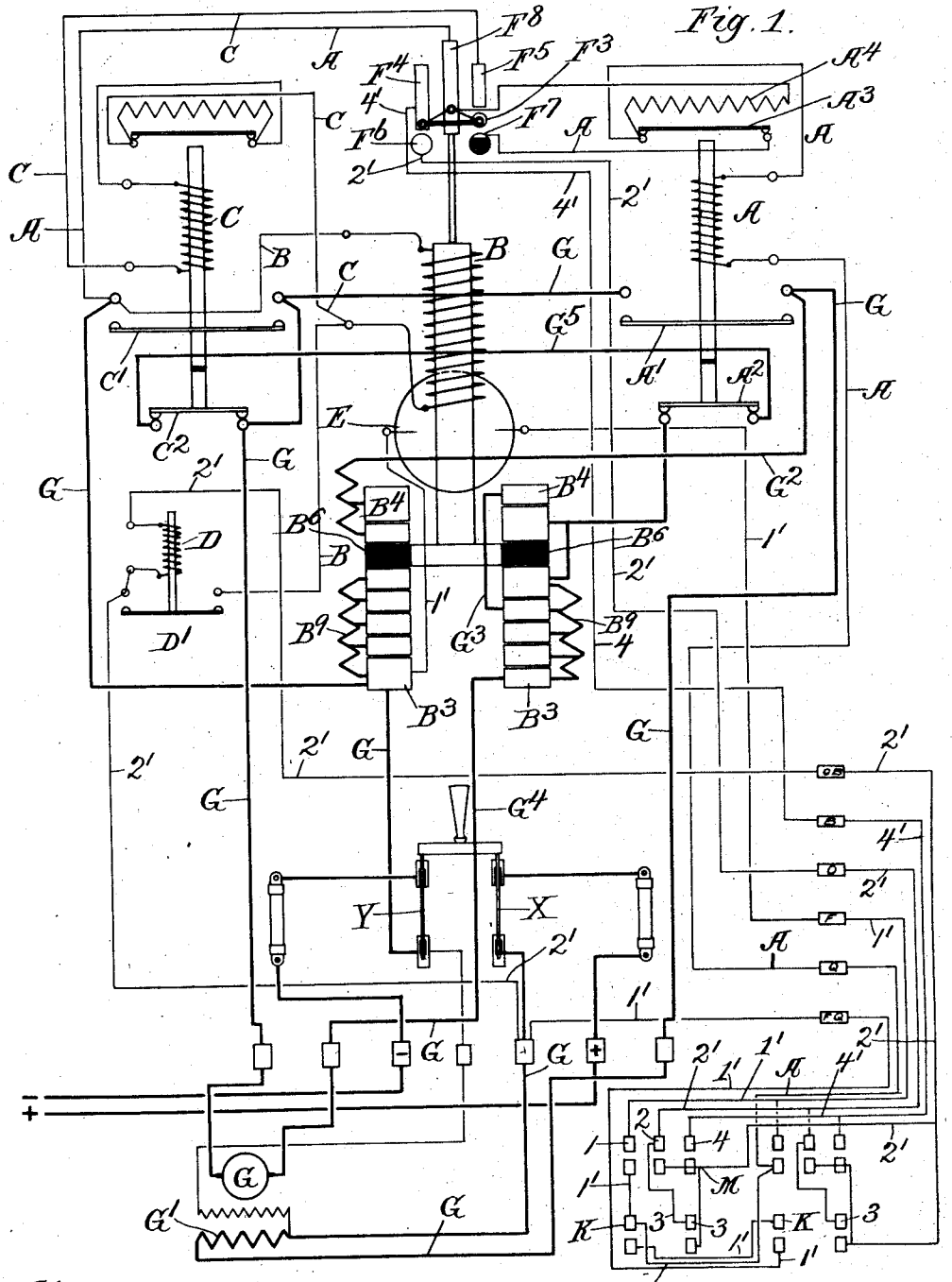
C. A. DRESSER.

CONTROLLING DEVICE FOR MOTORS.

APPLICATION FILED SEPT. 12, 1903.

2 SHEETS—SHEET 1.

Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 2.

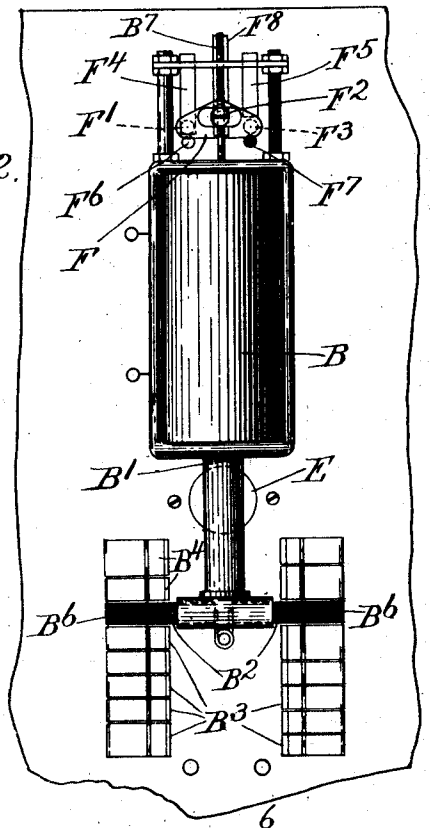



Fig. 3.

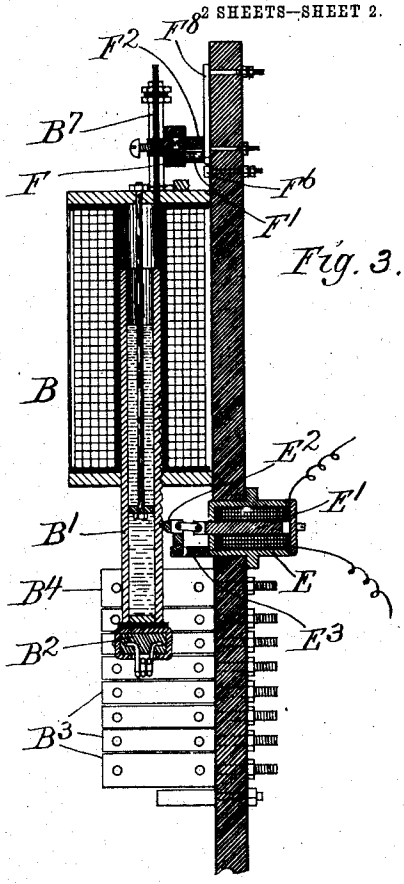



Fig. 4.

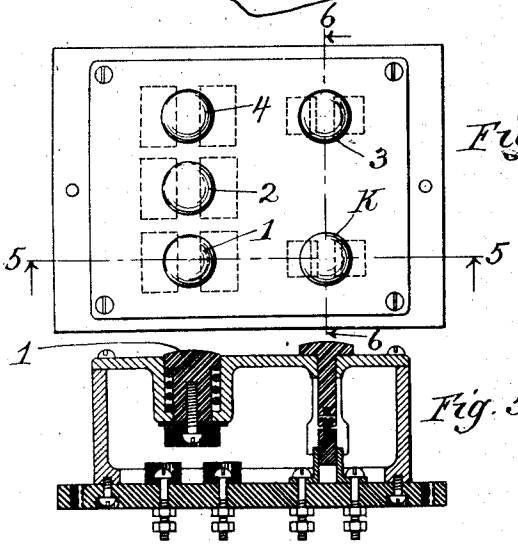
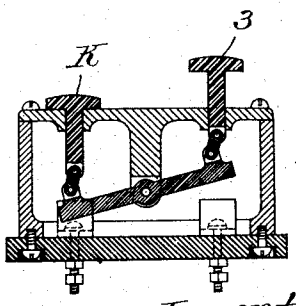



Fig. 5.




Fig. 6.

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# UNITED STATES PATENT OFFICE.

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## CONTROLLING DEVICE FOR MOTORS.

No. 814,946. Specification of Letters Patent. Patented March 13, 1906.

Application filed September 12, 1903. Serial No. 172,874.

*To all whom it may concern:*

Be it known that I, CHARLES A. DRESSER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Controlling Devices for Motors, of which the following is a specification.

My invention relates to controlling devices for motors, and has for its object to provide a new and improved device of this nature.

My invention is illustrated diagrammatically in the accompanying drawings, wherein—

Figure 1 is a diagrammatic view of the controlling device, showing the various circuits. Fig. 2 is a view showing one form of main controlling-solenoid. Fig. 3 is a longitudinal section therethrough. Fig. 4 is a view showing one arrangement of controlling-switches. Fig. 5 is a section on line 5 5, Fig. 4. Fig. 6 is a section on line 6 6, Fig. 4.

Like characters refer to like parts throughout the several figures.

My present invention is particularly adapted to be used in connection with motors where it is desired to control the motor from a distant point—as, for example, where the motor is used to operate printing-presses or the like; but it is of course evident that my invention may be used with motors driving any mechanism where such control is desirable.

Referring now to the diagrammatic view, Fig. 1, I have shown a series of electromagnetic devices A, B, C, and D, which in the present instance are shown as solenoids adapted to control certain circuits. The solenoid B may be of any desired construction, and I have shown one form in Figs. 2 and 3. In this construction the solenoid is provided with a core B′, to which is attached suitable brushes $B^2$, which engage a series of contacts $B^3$, to which the resistance-coils $B^9$ are connected, the arrangement being such that when the core falls the resistance will be cut out of the motor-circuit and when the core is lifted resistance will be cut into the motor-circuit. A second series of contacts $B^4$ is associated with said brushes, and resistance-coils are associated with these contacts. Intermediate between the two sets of contacts are the dead-contacts $B^6$, which are out of circuit. When the brushes are on these contacts, there is no circuit through the motor. Associated with the core B′ is a holding device adapted to be controlled from a distant point. This holding device is arranged so as to hold the core in certain predetermined position and may be of any suitable construction. As herein shown, it consists of a magnet or solenoid E, provided with a core E′, to which is connected an engaging part $E^2$, pivoted to a supporting-piece $E^3$ and adapted to engage notches or the like associated with the core B′. When the magnet E is energized, the core E′ is drawn inwardly, so as to release the core B′. When the current through the magnet E is broken, the core moves outwardly and the engaging device $E^2$ engages the core B′. I have shown the core B′ as hollow and as provided with a piston which works in a fluid, so as to prevent too rapid movement of the core.

At the top of the solenoid B is a switch device operated by the movement of the core thereof. This switch device is connected to a rod $B^7$, which is engaged by the core so as to be lifted and lowered. Connected with the rod $B^7$ is a piece F, to which is connected three brushes F′, $F^2$, and $F^3$. These brushes coöperate with contacts $F^4$, $F^5$, $F^6$, $F^7$, and $F^8$. It will be seen that by this arrangement any of the contacts may be electrically connected with the contact $F^8$ and that the connection will depend upon the position of the parts.

The other solenoids illustrated in Fig. 1 may be of any of the ordinary types, and I have not illustrated them in detail.

Associated with the core of solenoid A are the switches A′ and $A^2$, insulated from each other. The switch A′ completes a circuit when the core is drawn up and the switch $A^2$ completes a circuit when the core is down.

The solenoid C is provided with similar switches C′ and $C^2$. The core of the solenoid D is provided with a switch D′, which closes a circuit when the core is drawn up. I have shown the motor G as a compound motor; but it is of course evident that any other kind of a motor may be used. The motor is controlled by the switches 1, 2, 3, and 4, of which I have shown two sets. Any desired number of sets of these switches may be used, the sets being located at various points, so that the motor may be controlled from these various points. When it is desired to start the motor, the "on" switch—that is, switch 1—is operated. This closes the circuit through the magnet E, causing it to release the core of

solenoid B, which core then drops, gradually cutting out resistance to start the motor. The first movement, however, of the core of solenoid B completes, by means of the switch at top of said solenoid, the circuit through solenoid A, causing it to draw up its core and complete the armature-circuit of the motor by means of the switch A'. When it is desired to slowly stop the motor or slow it down, the "off" switch, or switch 2, is operated. This closes the circuit through solenoid D, which draws up its core and closes the circuit through solenoid B. Said solenoid then draws up its core to the neutral or dead point, gradually cutting in resistance and slowing down the motor. When the neutral or dead point is reached the circuit through the motor will be broken; but I prefer to arrange the parts so that the switch at the top of solenoid B breaks the circuit through solenoid A just before the neutral point is reached, so that the core of said solenoid will drop and break the motor-circuit by means of the switch A', thus taking care of the spark. When it is desired to suddenly stop the motor, as in the case of emergency, the emergency-switch 3 is operated. Under these conditions the motor is operating with the resistance cut out. The operation of the emergency-switch 3 opens the circuit through magnet A, allowing its core to fall. This instantly opens the armature-circuit by the switch A' and then short-circuits the armature by the switch $A^2$, and the resistance associated with the controller is in this short-circuit. This suddenly stops the motor. The operation of this switch also closes the circuit through the solenoids B and D, causing the solenoid B to draw up its core until it reaches the neutral or dead point.

To reverse the motor, the reversing-switch 4 is operated. This closes the circuit through the solenoid D, which draws up its core and closes the circuit through solenoid B, causing the said latter solenoid to draw up its core. The switch at the top of solenoid B breaks the circuit through solenoid A and closes the circuit through solenoid C, which draws up its core and completes the circuit of the motor, so that the current is reversed through the armature, and the motor is consequently reversed. If the core B' of solenoid B is arranged so that the engaging device $E^2$ will not hold it when it is lifted above the neutral point, it will be seen that the motor will run backward as long as switch 4 is held closed and that as soon as switch 4 is open the core B' will drop to the neutral point, thus stopping the motor. It is of course evident that by proper arrangement of the core B' it can be locked in position by the engaging device $E^2$ while the motor is running backward, and under these conditions it is necessary to operate the switch 2 to stop the motor. Both switches K are normally closed, so the current can pass through them—that is, the circuit is normally completed at this point, as shown in Figs. 5 and 6. The switches K are only opened when the emergency-switches 3 are operated, and in referring to Figs. 4, 5, and 6 it will be noted that the operation of switch 3 opens the circuits at the contacts K and closes said circuits at contacts 3.

Referring now to the circuits illustrated diagrammatically in Fig. 1, it will be seen that when switch 1 is closed the circuit will be as follows: from terminal X through conductor 1' to switch K on the right, which is then closed, thence through said switch and conductor 1' to switch K on the left, which is also closed, thence through conductor 1' to switch 1, thence by conductor 1' to magnet E, thence by conductor 1 to the bottom contact $B^3$, and thence to terminal Y. When the switch at the top of solenoid B reaches the point where the brush $F^3$ engages contact $F^5$, the circuit through solenoid A is completed. This circuit is traced as follows: from terminal X through conductor 1' to switch K, thence by conductor A to magnet A, thence by conductor A to the switch at the top of magnet B, and thence by contact $F^8$ and conductor A to conductor G, and thence to terminal Y. When the core of the magnet A is down, the current through said magnet passes along switch $A^3$, but when said core is up it engages said switch and lifts it so as to break the circuit and cause the current to pass through the resistance $A^4$. These resistances cut down the current, but leave it sufficient to hold up the core. When switch 2 is operated, the circuits are traced as follows: from the terminal X through conductor 2 to magnet D, thence by conductor 2' to said switch, thence by conductor 2 to contact $F^6$ at the top of solenoid B, thence to contact $F^8$ and conductors A and G to terminal Y. The magnet D being energized by the current flowing through this circuit draws up its core and completes the circuit through the solenoid B, which circuit will be traced as follows: from terminal X through conductor 2' to switch D', thence through conductor B to solenoid B, thence through conductors B and G back to terminal Y.

When the emergency-switch 3 is closed, the switch K is opened, Fig. 6, thus opening the circuit through magnet A, which passes through the said switch K. Said magnet then becomes deënergized and its core instantly drops, breaking the armature-circuit. The circuit closed by switch 3 will be traced as follows: from terminal X through conductor 2' to the point M near switch 4, thence to switch 3, thence by conductor 3' to one of the contacts of switch 2, and thence by conductor 2' to contact $F^6$, thence through contacts $F^8$ and conductors A and G to the terminal Y. The circuit is thus completed through solenoid D, which draws up its core

and completes the circuit through solenoid B, which circuit has heretofore been traced.

When the reverse-switch 4 is closed, the circuit will be traced as follows: from terminal X by conductor 2′ to solenoid D, thence by conductor 2′ to switch 4, thence by conductor 4′ to contact $F^4$, thence to contact $F^8$, and thence by conductors A and G to terminal Y. The circuit through solenoid D is thus completed, and it draws up its core, completing the circuit through solenoid B, heretofore traced. Solenoid B then draws up its core. The switch at the top of solenoid B then completes the circuit through solenoid C, said circuit being traced as follows: from terminal X through conductor 2′ to switch D′ of solenoid D, thence by conductor B to the one terminal of solenoid B, thence by conductor C through solenoid C to contact $F^5$ at the top of solenoid B, thence to contact $F^8$, and thence by conductors A and G to terminal Y. The core of solenoid C is thus drawn up, breaking the armature-circuit by switch $C^2$ and completing it by switch C′, so that the current passes therethrough in a reverse direction.

The circuit through the armature when the motor is running forward is as follows: from terminal X through conductor G to the series field-coil G′, thence by conductor G to switch A′, thence by conductor G to the armature of the motor, thence by conductor G to the lower right-hand contact $B^3$, thence through the brushes across to the lower left-hand contact $B^3$ through resistance $B^4$, and thence by conductor G to terminal Y.

When the circuit is closed by the switch C′, the circuit through the armature is traced as follows: from terminal X through conductor G to series field-coil G′, thence by conductor G to the terminal of switch A′, which switch is now open, thence by conductor $G^2$ to the resistance-contact $B^4$ on the left, thence through the brushes connected with core B′ to the resistance-contact $B^4$ on the right, thence by conductor $G^3$ to the lower contact $B^3$ on the right, thence through the resistance to the lower contact $B^3$ on the right, and thence by conductor $G^4$ to the armature G, and thence by conductor G to switch C′, and thence by conductor G back to terminal Y. It will thus be seen that in this latter instance the current passes in a reverse direction through the armature. When the motor is running forward and the emergency-switch is operated, the armature-circuit is broken by the switch A′ associated with solenoid A and disconnected from the circuit. The armature is short-circuited by switch $A^2$. The circuit through the armature in this event is traced as follows: from armature G through conductors G and $G^4$ to contact $B^3$, and thence through the resistance associated with said contacts, then to switch $A^2$, thence by conductor $G^5$ to switch $C^3$, and thence by conductor G back to the armature. By means of this controller it will be seen that the motor can be reversed at a distant point.

It will further be seen that, for example, if the motor is running forward it cannot be then reversed until it has been stopped and that it takes two actions under such conditions to reverse it, the first action being the operation of switch 2 and the second action being the operation of switch 4. This prevents the motor from being suddenly reversed while running forward at full speed and requires it to be first stopped at the dead or neutral point, and hence the jar, severe arcing, and the strain which would result if the device were capable of sudden reversal are thus prevented. In other words, this is a protective feature which prevents injury to the motor and to the device which it is driving due to carelessness of the operator in suddenly attempting to reverse the motor while it is running forward at full speed.

As herein shown, the switch 3 is connected with the switch K, (see Figs. 4, 5, and 6,) so that when the switch 3 is closed the switch K is opened. During the normal operation of the device the switch K is closed and the switch 3 opened, said switch K being opened only when it is desired to suddenly stop the motor.

I claim—

1. A controlling device for motors comprising a solenoid, a core therefor provided with a contact device, a series of contacts along which said core is adapted to move, an intermediate point where said contact device normally stands when the motor is not running and means for returning said contact device to said intermediate point when moved in either direction therefrom.

2. A controlling device for motors comprising two sets of contacts, a contact device adapted to move therealong, an intermediate neutral contact, or contacts, engaged by said contact device when the motor is idle, means controlled from a distant point for moving the contact device in one direction from the neutral contacts and a separate means controlled from a distant point for moving the contact device in the other direction, whereby the contact device cannot be moved from one set of contacts to the other without being stopped at the neutral contacts.

3. A controlling device for motors comprising a series of forward resistance-contacts and a series of reversing resistance-contacts, an intermediate neutral contact, or contacts, a contact device normally associated with the neutral contacts, an electromagnetic device for controlling said contact device, two switches located at a distant point, one adapted when operated to cause the contact device to move to the neutral point and the other adapted when operated to move the contact device along the reversing-contacts.

4. A controlling device for motors comprising two sets of resistance-contacts, one for starting the motor forward and the other for reversing it, an intermediate neutral point, a solenoid provided with a core, a contact device associated with said core and adapted to be moved along said contacts, a stop device for the contact device, inoperative when the contact device is moving along the reverse-contacts but adapted to stop the contact device at the neutral point.

5. A controlling device for motors comprising two sets of resistance-contacts, one for starting the motor forward and the other for reversing it, an intermediate neutral point, a contact device adapted to move along said contacts, a controlling-solenoid therefor, a circuit-controlling device in the motor-circuit, a switch device controlled by said solenoid and adapted to cause the circuit-controlling device to break the motor-circuit when the contact device is moved toward the neutral point.

6. A circuit-controlling device for motors comprising two sets of resistance-contacts, one for starting the motor forward and the other for reversing it, a neutral point between said contacts, a contact device adapted to move along said contacts, an electromagnetic controlling device therefor, two electrically-controlled switches in the motor-circuit, one adapted to be actuated when the contact is moved in one direction from the neutral point and the other adapted to be actuated when the contact is moved in the other direction from the neutral point.

7. A circuit-controlling device for motors comprising two sets of resistance-contacts, one for starting the motor forward and the other for reversing it, a neutral point between said contacts, a contact device adapted to move along said contacts, an electromagnetic controlling device therefor, two electrically-controlled switches in the motor-circuit, one adapted to be actuated when the contact is moved in one direction from the neutral point and the other adapted to be actuated when the contact is moved in the other direction from the neutral point, and a circuit-controlling device associated with said contact device and adapted to control said switches.

8. A controlling device for motors comprising two sets of resistance-contacts, one for starting the motor forward and the other for reversing it, an intermediate neutral point, a contact device adapted to be moved along said contacts, a controlling-solenoid therefor, two circuits associated with said solenoid, one adapted when closed to cause the contact device to move along the forward contacts and the other adapted when closed to cause the contact device to move along the reverse-contacts.

9. A controlling device for motors comprising two sets of resistance-contacts, one for starting the motor forward and the other for reversing it, an intermediate neutral point, a contact device adapted to be moved along said contacts, a controlling-solenoid therefor, two circuits associated with said solenoid, one adapted when closed to cause the contact device to move along the forward contacts and the other adapted when closed to cause the contact device to move along the reverse-contacts, two electrically-operated switches in the motor-circuit, one controlled by each of said solenoid-circuits.

10. A controlling device for motors, comprising a series of resistance-contacts, a movable device adapted to move therealong, a controlling-solenoid for said movable device, a switch in the motor-circuit, a controlling-switch at a distant point adapted when moved to cause the switch in the motor-circuit to be opened and the solenoid to be energized so as to move the movable device to its initial position.

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