No. 885,147. PATENTED APR. 21, 1908.

C. A. DRESSER.

# CONTROLLING DEVICE FOR ELECTRIC MOTORS.

APPLICATION FILED OCT. 24, 1903.

2 SHEETS—SHEET 1.

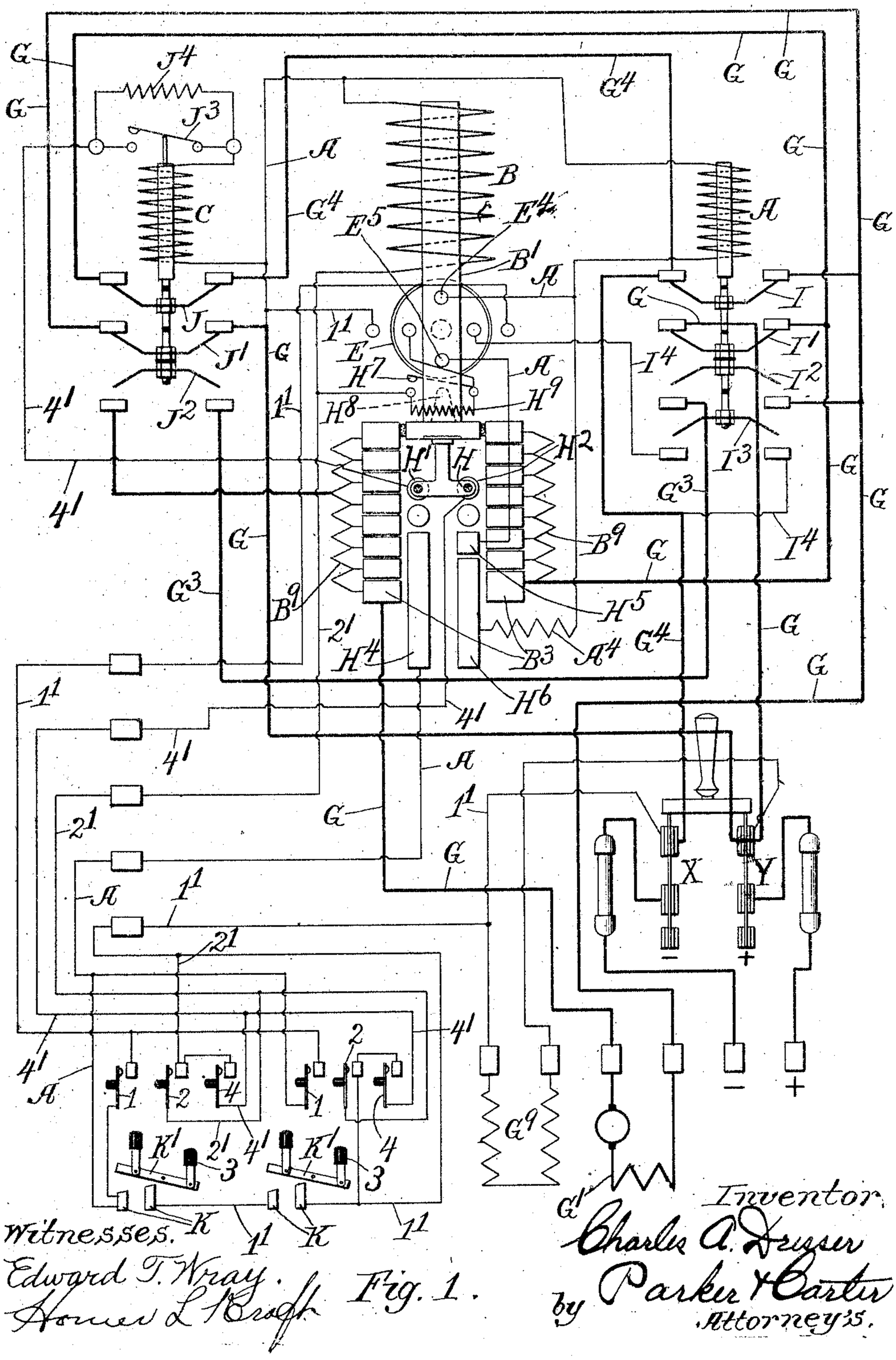


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Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 2.

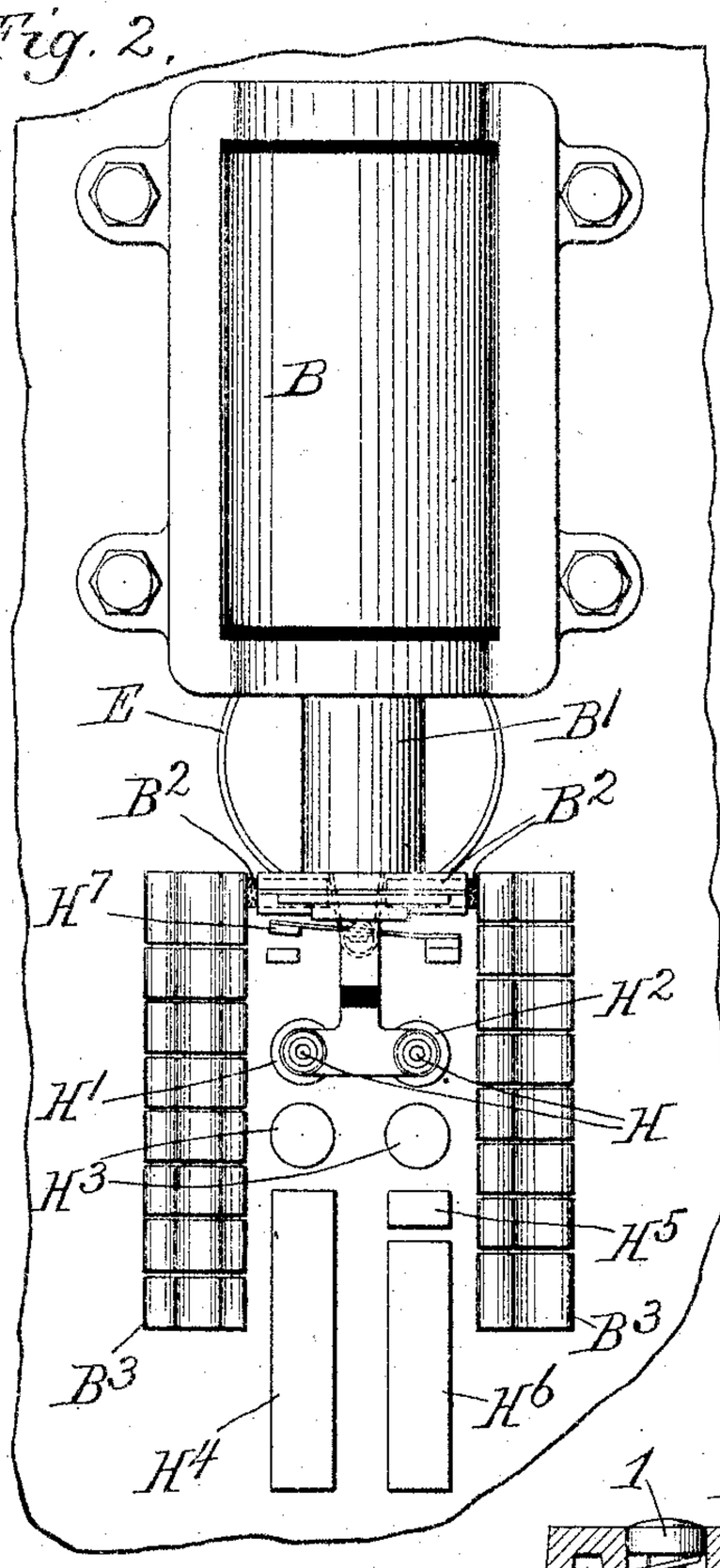



Fig. 3.

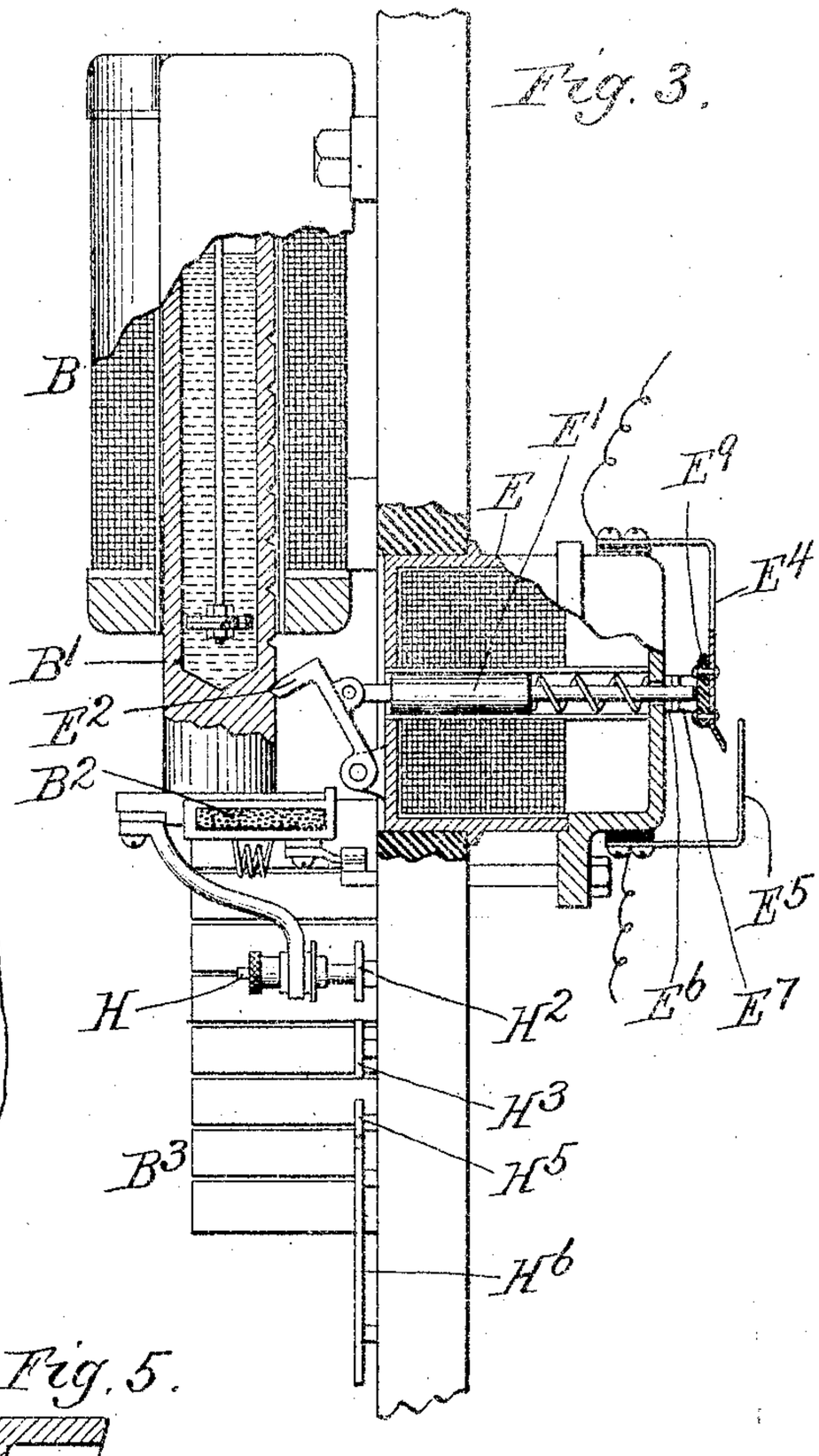



Fig. 5.

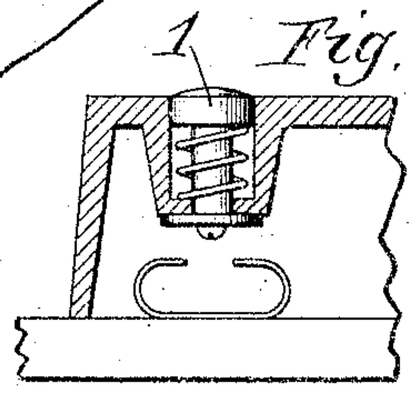



Fig. 4.

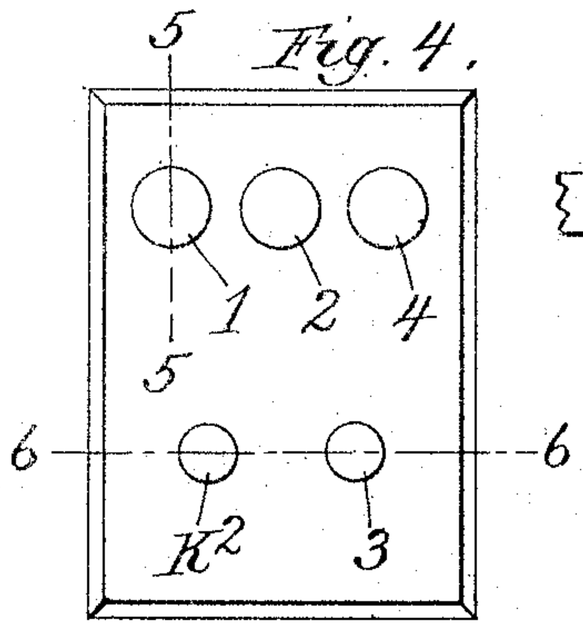



Fig. 6.

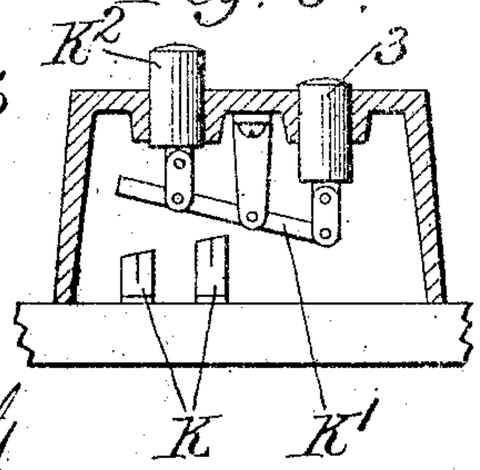
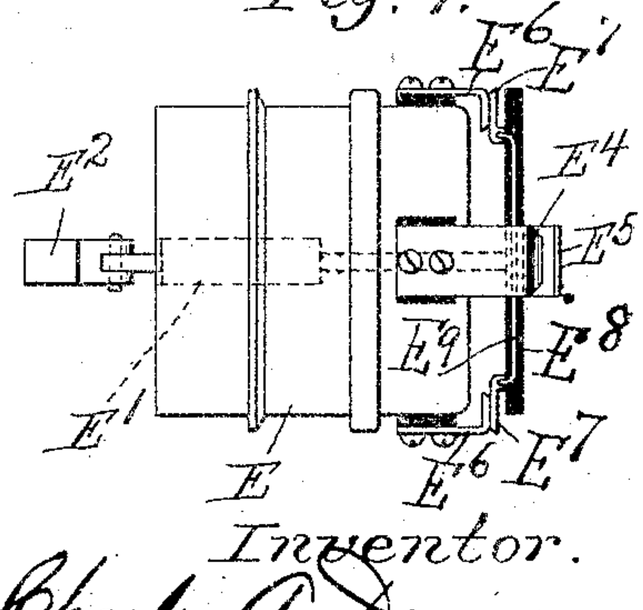



Fig. 7.

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# UNITED STATES PATENT OFFICE.

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## CONTROLLING DEVICE FOR ELECTRIC MOTORS.

No. 885,147. Specification of Letters Patent. Patented April 21, 1908.

Application filed October 24, 1903. Serial No. 178,368

*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 a Controlling Device for Electric Motors, of which the following is a specification.

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

The accompanying drawings illustrate one construction embodying the invention.

Figure 1 is a diagrammatic view illustrating the invention and the circuit relation of the parts; Fig. 2 is a view of the main controlling solenoid; Fig. 3 is a side view of Fig. 2 with parts broken away; Fig. 4 is a plan view of the push-buttons or switches; Fig. 5 is a sectional view taken on line 5—5, Fig. 4; Fig. 6 is a sectional view taken on line 6—6, Fig. 4. Fig. 7 is a view of the magnet E as seen from above.

Like letters refer to like parts throughout the several figures.

The present invention is adapted to be used for controlling motors in connection with any driven mechanism, and is particularly adapted to be used with motors for driving flat bed and other printing presses.

There is shown in the drawings an ordinary compound wound motor, but it is of course evident that any other kind of motor may be used.

A controlling device is provided for the motor comprising a solenoid B provided with a core having a contact device provided with brushes $B^2$ which engage a series of resistance contacts $B^3$ associated with the resistance $B^9$. There are provided certain other electro magnetic devices such as the solenoids A and C. A solenoid or magnet E is associated with the core $B^1$ of the solenoid B, and is provided with a core $E^1$ to which is connected an engaging device $E^2$ adapted to engage the core $B^1$ in any suitable manner, as by means of the notches shown. The core of this solenoid is normally moved forward by a spring and when energized is moved back so as to release the core $B^1$ and permit it to drop.

Back of the magnet or solenoid E are certain circuit controlling devices or switches controlled by the core $E^1$ or a part associated therewith. One of these circuit controlling devices consists of the two contacts $E^4$ and $E^5$ which are normally apart but which are brought into contact when the core $E^1$ is moved by the energizing of the magnet. The circuit controlled by these contacts is one of the circuits that pass through the solenoid A. The other circuit controlling device, associated with the solenoid E, consists of the contacts $E^6$ and the movable contacts $E^7$. The contacts $E^7$ are associated with a non-conducting piece $E^8$ which is engaged by the core of solenoid E. A conductor $E^9$ passes along the insulating piece $E^8$ and connects contacts $E^7$ (see Fig. 3). The circuit controlled by these contacts is one of the circuits passing through the solenoid B.

Associated with the core $B^1$ of solenoid B is a circuit controlling device comprising the brushes H H insulated from the core and adapted to coöperate with a series of contacts. When the core is in its normal position these brushes engage contacts $H^1$ and $H^2$. After the core drops they then engage the dead contacts $H^3$, and the live contacts $H^4$, $H^5$ and $H^6$. A switch $H^7$ is also controlled by the core $B^1$ by means of a projection or the like $H^8$. Around the terminals of this switch is a resistance $H^9$.

The magnet or solenoid A has a core provided with the switches I, $I^1$, $I^2$ and $I^3$. When the core is drawn up switches I and $I^1$ are moved so as to complete the circuits at this point, while switches $I^2$ and $I^3$ are moved to open the circuits. When the core of the solenoid is deënergized and the core falls the circuits are opened at I and $I^1$ and closed at $I^2$ and $I^3$ insulated from each other. This solenoid A controls the circuit through the motor armature.

The solenoid C is provided with a core to which are connected the switches J, $J^1$ and $J^2$ insulated from each other. When the core of solenoid C is up the circuit is completed through switches J and $J^1$ and opened through switch $J^2$, and when the core falls the circuit is opened through J and $J^1$ and closed through $J^2$. At the top of solenoid C is a switch $J^3$ around the terminals of which is a resistance $J^4$. This switch is operated by the lifting of the core of solenoid C so as to cut the resistance in circuit with said solenoid.

The series field coils of the motor are shown at $G^1$ and the shunt coils at $G^9$. The device is controlled and operated by a series of

switches 1, 2, 3 and 4, located at a distant point from the apparatus, and when the device is used with a press there will be a series of these switches located at different points around the press. These switches may be of any desired style and switches 1, 2 and 4, as herein shown, consist of a push-button (see Fig. 5) returned to its normal position by a spring, and adapted when pressed to engage spring contacts to close the circuit. This arrangement permits the full solenoid current to pass through the switches.

The switch 3 is illustrated in Fig. 6, and consists of a push-button connected to a pivoted conducting piece $K^1$. This conducting piece is provided at the other end with a push-button $K^2$. When the push-button $K^2$ is pressed the connecting piece $K^1$ engages the contacts K so as to complete the circuit between said contacts. When the switch 3 is operated the circuit between these contacts is broken. The current is admitted to the device through the terminals X and Y of the main switch.

When the circuits are properly connected and the starting switch 1 is operated a circuit is completed through magnet E and its core moved to release the core $B^1$ of solenoid B. The core then drops and by means of contacts $H^4$, $H^5$ and $H^6$ completes the circuit through solenoid A which draws up its core and completes the circuit through the armature of the motor. As core $B^1$ falls it gradually cuts the resistance out of the armature circuit. To slow down the motor switch 2 is operated to complete the circuit through solenoid B causing it to draw up its core. Before the core is fully drawn up, the switch at the bottom breaks the circuit through solenoid A and its core drops breaking the motor circuit and short circuiting the motor armature.

In order to instantly stop the apparatus the emergency switch 3 is pressed. This opens the circuit at contacts K so as to break the circuit through solenoid A and its core drops opening the armature circuit, and short circuiting the armature through the resistance $B^9$. This also completes a circuit through solenoid B, which draws up its core.

To reverse the motor switch 4 is operated. This first completes the circuit through solenoid C, which draws up its core and completes the armature circuit so that such circuit is reversed, the current passing to the armature through the resistance $B^9$. When the finger is removed from the switch it is opened and the motor is stopped. The motor circuit is shown in heavy lines and the switch circuits in light lines. The circuits will be traced as follows when switch 1 is operated: from terminal X through conductor $1^1$, through contacts K, to switch 1, thence by conductor $1^1$ to the magnet E, thence through said magnet by conductor $1^1$ to conductor G and thence to terminal Y. The energizing of magnet E releases the core $B^1$ and it drops.

When the brushes H engage contacts $H^4$ and $H^5$ a circuit is completed through the solenoid A which is traced as follows: from terminal X through conductor $1^1$ to contacts K; thence by conductor A to contacts $H^4$, thence through brushes H to contact $H^5$, thence by conductor A to the switch at the back of magnet E, which remains closed as long as switch 1 is closed, and then by conductor A to solenoid A, and thence by conductor A to conductor G, and thence to terminal Y. The solenoid A is now energized and pulls up its core completing the circuit through the armature of the motor which is traced as follows: from terminal X by conductor G to switch I, thence by conductor G to the armature of the motor, thence by conductor G to contacts $B^3$, thence through the contact device on the end of core $B^1$ to the contacts $B^3$ on the right, thence by conductor G to switch $I^1$, thence by conductor G to terminal Y. When the brushes H pass to contact $H^6$ the circuit through the switch at the back of solenoid E is cut out of the circuit through solenoid A, which then passes through resistance $A^4$ and thence to the solenoid. When this resistance is in circuit the current is sufficient to hold up the core of A but not sufficient to pull it up. When the core of solenoid B reaches the limit of its downward movement the motor will be operating at full speed without resistance in the armature circuit.

When it is desired to gradually stop the motor switch 2 is operated. The circuit will then be traced as follows: from terminal X through conductor $1^1$ to conductor $2^1$, then through switch 2, and thence by conductor $2^1$ to solenoid B, then by conductor A to conductor G, and thence to terminal Y. The solenoid B is then energized and draws up its core gradually cutting resistance into the armature circuit. When the brushes H pass from the contacts $H^4$ and $H^5$ the circuit through solenoid A is broken and its core drops, opening the armature circuit which connects to the source of supply, and closing a short circuit through the armature. This circuit will be traced as follows: from the armature of the motor by conductor G to contacts $B^3$, then through resistance $B^9$ on the left to switch $J^2$, which is now closed as the core of solenoid C is down, thence by conductor $G^3$ to switch $I^2$, associated with the solenoid A, thence by conductor G to the armature. The motor is now instantly stopped. When the core of solenoid B reaches its initial or maximum up position its movement is stopped by engagement with a suitable stopping part.

When it is desired to instantly stop the motor when it is running at full speed the emergency switch 3 is operated. This breaks

the circuit between contacts K, thus breaking the circuit through solenoid A; the core of this solenoid drops and by means of switch $I^3$ completes a circuit through solenoid B which is traced as follows: from terminal X by conductor $G^4$ to conductor $I^4$, thence through switch $I^3$ to conductor $I^4$, thence through switch $H^7$ and contacts $E^8$ and $E^7$, back of magnet E, to solenoid B, thence by conductors A and G to terminal Y. The core of solenoid B is then moved to its initial position. When the core reaches its initial position the switch $H^7$ is lifted so as to cut the resistance $H^9$ into the circuit. This resistance reduces the current but leaves it sufficient to hold the core of solenoid B up, but not sufficient to lift it. This circuit, it will be noted, is closed through this resistance at all times when the apparatus is not in operation, and prevents accidental dropping of the core of solenoid B. This circuit also prevents the motor from being started up with the resistances out of circuit in case the current supply for any reason fails while the motor is operating and is then turned on again; it will be noted that in such event the solenoid of core B would be down and all resistance would be out of circuit, and if the current was turned on it would pass through the motor without resistance and injure it. In this construction if the current fails under such conditions and is then turned on, the circuit through solenoid B is completed as soon as the current is turned on, as the core of solenoid A would then be down, and the solenoid at once draws up its core so as to bring the parts to their initial protective position. When it is desired to reverse the motor the switch 4 is operated. The motor cannot be reversed except when the core of solenoid B is in its initial or maximum up position, and it is necessary to always stop the motor by bringing the core to this position before it is possible to reverse it. This prevents the sudden reversal of the motor when running forward, as is often done by the operators of printing presses for the purpose of suddenly stopping the parts, and injury due to this cause is prevented.

When the core of solenoid B is in its initial position and switch 4 is operated the circuit is traced as follows: from terminal X through conductor $1^1$ to conductor $2^1$, thence to one terminal of switch 2, thence through switch 4 to conductor $4^1$, thence by conductor $4^1$ to brushes H, thence by conductor $4^1$ to switch $J^3$, thence through solenoid C to conductor A, thence through conductor G to terminal Y. The core of solenoid C is then drawn up and completes the armature circuit so that the current passes through it in a reverse direction, thus reversing the motor. This circuit will be traced as follows: from terminal X through conductor $G^4$ to switch J, thence by conductor G to the contacts $B^3$ on the right, thence across to the contacts on the left, thence by conductor G to the motor armature, thence by conductor G to switch $J^1$ and thence by conductor G to terminal Y. The motor will thus be reversed and will continue to run in this direction as long as the switch 4 is held closed. When this switch is released the circuit through solenoid C is opened and it drops, thus breaking the circuit through the armature. This also short circuits the armature through the resistance $B^9$ which circuit has heretofore been traced.

The switches I and $I^1$ and J and $J^1$, associated with solenoids A and C, constitute what may be called a double pole switch, having parts independently controlled by different solenoids, and this arrangement permits the use of the same set of contacts and resistances for forward movement and reverse movement. The solenoid A, for example, moves the double pole switch to open the circuit and the solenoid C moves it so as to close the circuit in a reverse direction, and in each instance both connections between the armature to the terminals X and Y are broken. It will thus be seen that this device gives perfect control of the motor by a comparatively simple arrangement of the parts, and insures the protection of the motor from accidents and from carelessness of the operator.

The particular form of device herein shown has been described in detail, but it is, of course, evident that the parts may be greatly varied in form, construction and arrangement and that some of the parts may be omitted and others used with the parts herein shown without departing from the spirit of the invention; I do not, therefore, limit myself to the construction shown.

Claims:

1. A controlling device for motors comprising a series of resistance contacts with resistance coils associated therewith, a movable device adapted to move therealong, a lock for said movable device having an electro magnetic control, an electro magnetic controlling device for said movable device, adapted when energized to move said movable device to cut resistance into the motor circuit, a controlling switch at a distant point for controlling said electro magnetic device, and means for reversing the motor so that the current passes through the same resistance contacts and resistances used when the motor is running forward.

2. A controlling device for motors comprising a series of resistance contacts with resistance coils associated therewith, a movable device adapted to move therealong, an electrically operated switch device in the motor circuit means for controlling said switch device from a distant point said switch device having a controlling circuit completed by said movable device when in

its maximum up position, and comprising two switches insulated from each other and adapted to be moved simultaneously, said switches adapted to make and break the motor circuit at two different points.

3. A controlling device for motors comprising an electrically controlled resistance in the motor circuit, controlled from a distant point, an electrically controlled switch device in the motor circuit comprising two switches insulated from each other, and adapted to be moved simultaneously, said switches adapted to make and break the motor circuit at two different points, a second electrically controlled switch device having two switches adapted to coöperate to close the motor circuit when the switches of the first switch device are open the controlling circuits for said electrically controlled switches being independent of the position of said switches.

4. A controlling device for motors comprising a series of resistance contacts with resistances associated therewith, a contact device adapted to move therealong, a controlling solenoid for said contact device, two solenoids each operating switches associated with the motor circuit, two switch devices associated with said contact device and adapted to control the circuits through both of said solenoids said switch devices adapted to be operated by means of said contact device when intermediate its maximum up and down positions.

5. A controlling device for motors comprising a series of resistance contacts with resistances associated therewith, a contact device adapted to move therealong, a controlling solenoid for said contact device, an electrically controlled switch for reversing the direction of the current through the motor armature and means for preventing this reversal except when the contact device is in its maximum up position.

6. A controlling device for motors comprising a series of resistance contacts with resistances associated therewith, a contact device adapted to move therealong, a controlling solenoid for said contact device, two electrically controlled switches associated with the armature circuit of the motor, one adapted when operated to break both of the connections between the motor armature and the source of supply, and the other adapted when operated to close these connections so that the current through the armature is reversed, and means for controlling said device from a distant point the controlling circuits for the electrically controlled switches being independent of the position of said switches.

7. A controlling device for motors comprising a series of resistance contacts with resistances associated therewith, a contact device adapted to move therealong so as to cut resistance into or out of the motor circuit, two circuits leading through said controlling solenoid, one adapted to be closed at a distant point, and the other normally closed when the current is turned on.

8. A controlling device for motors comprising a series of resistance contacts with resistances associated therewith, a contact device adapted to move therealong, a controlling solenoid for controlling said contact device, two circuits through said solenoid, one normally open, and the other normally closed, and means at a distant point for closing one of said circuits and for opening the other circuit.

9. A controlling device for motors comprising a series of resistance contacts with resistances associated therewith, a contact device adapted to move therealong, an electro magnetic controlling device therefor, two electrically controlled switches adapted to be controlled from a distant point so as to vary the motor circuit through the said contacts and resistances to cause the armature to be rotated in either direction a circuit controlling device associated with the contact device and adapted when in one position to break the circuit through one of said electrically controlled switches, and when in another position to break the circuit through the other electrically controlled switch.

10. A controlling device for motors comprising a series of resistance contacts with resistances associated therewith, a contact device adapted to move therealong, a solenoid provided with a core to which said contact device is connected, a releasing magnet associated with said core and adapted to be controlled from a distant point, two electrically controlled switches arranged to break both connections to the armature circuit and reverse them, and means for preventing one of said electrically controlled switches from being operated when the contact device is in its initial position.

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