No. 693,791. Patented Feb. 18, 1902.

A. C. EASTWOOD.

ELECTRIC CONTROLLER.

(Application filed Oct. 21, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 2.

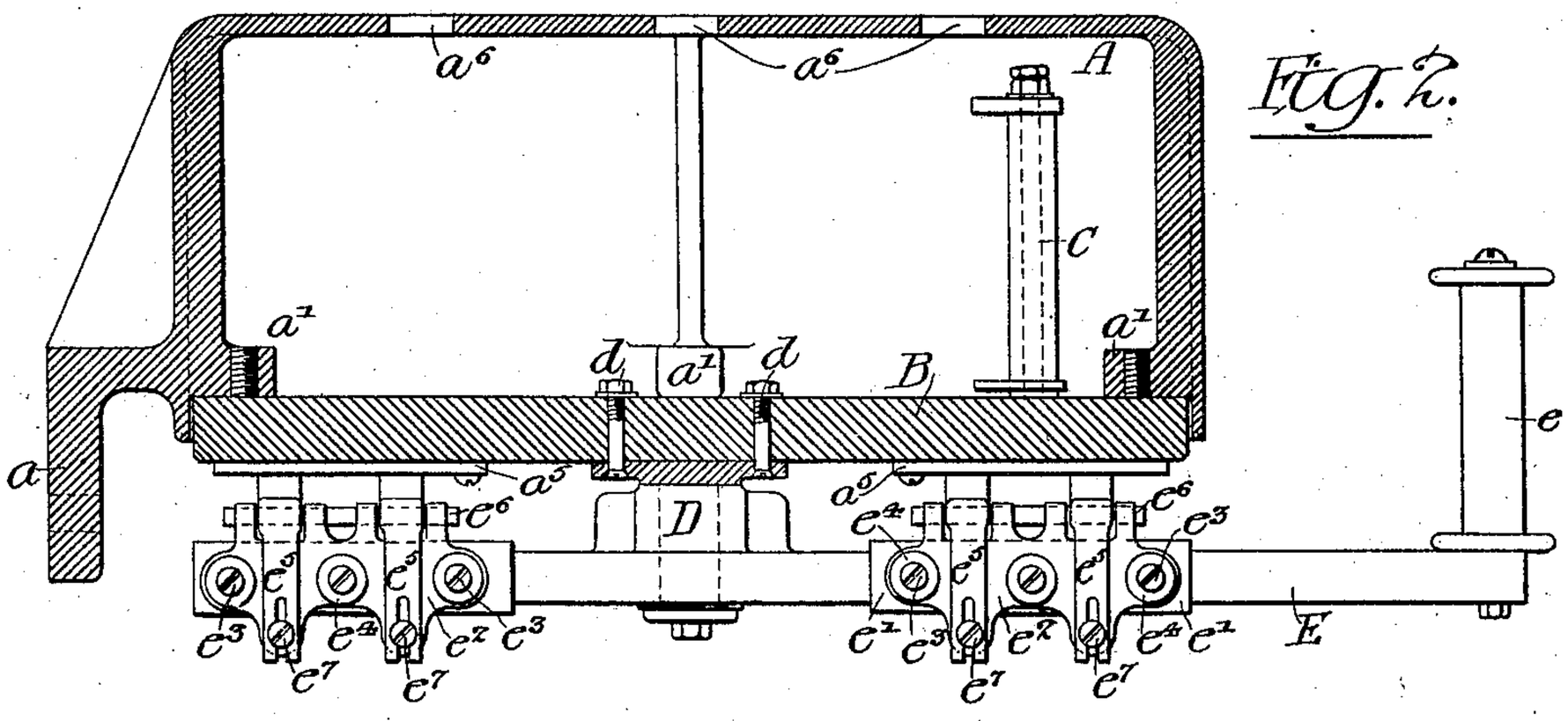

Fig. 1.

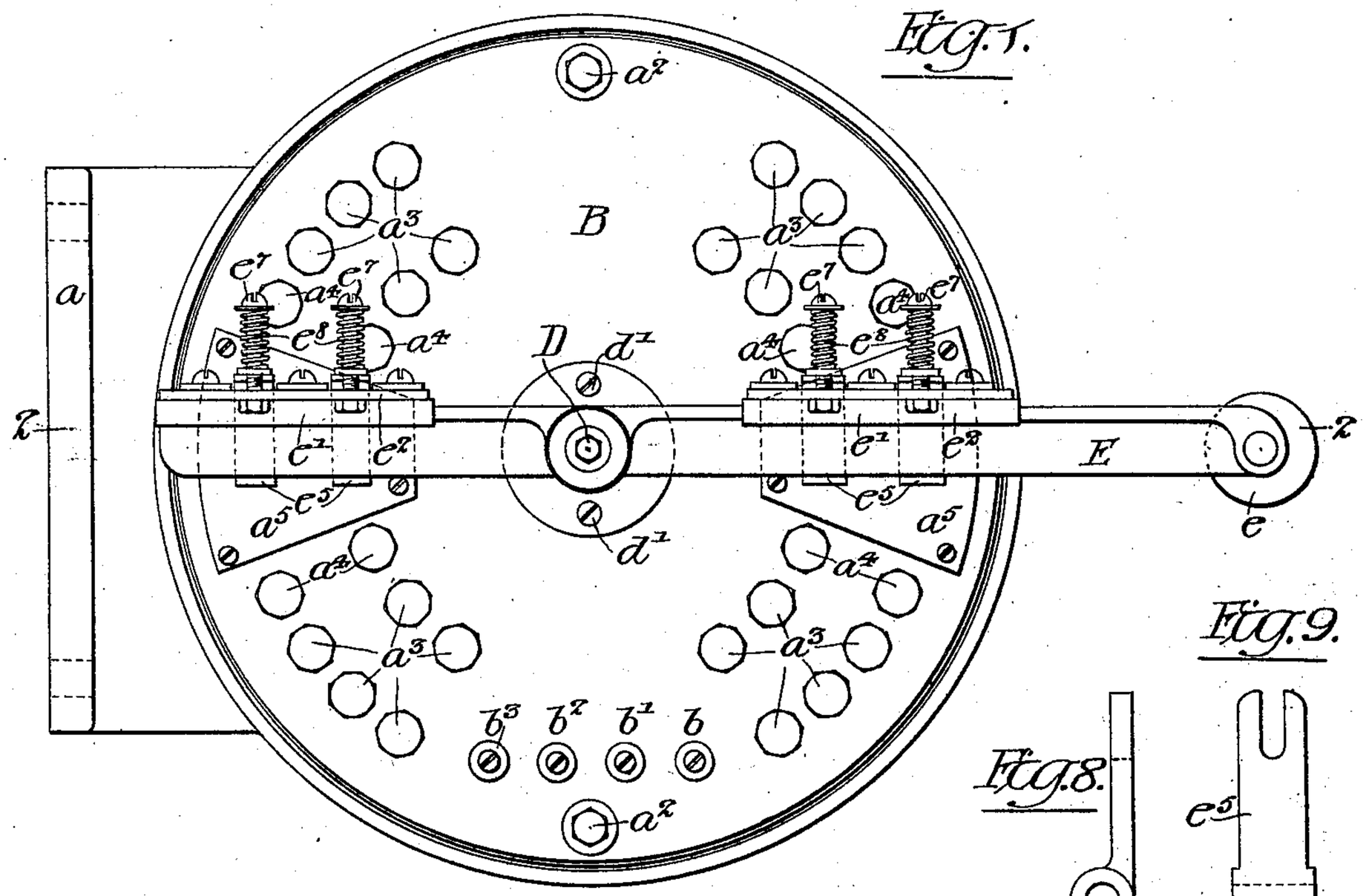

Fig. 9.

Fig. 8.

Fig. 10.

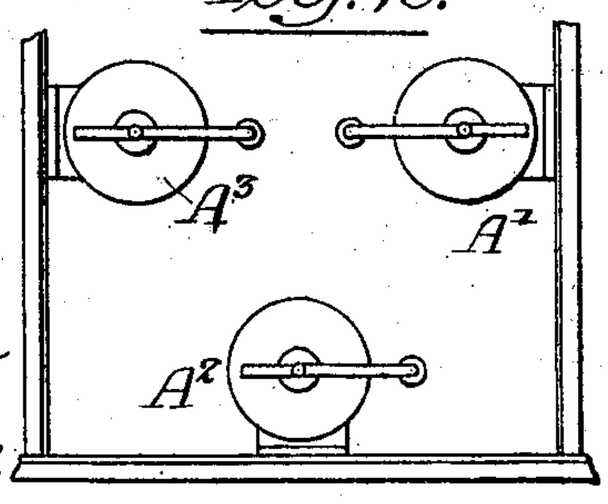

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Fig. 7.

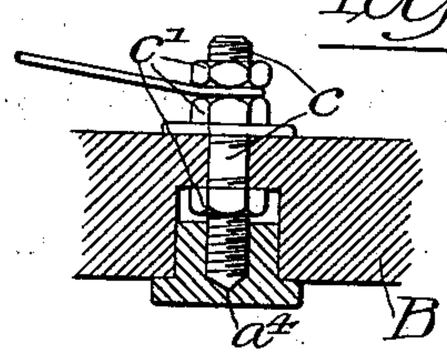


Fig. 4.

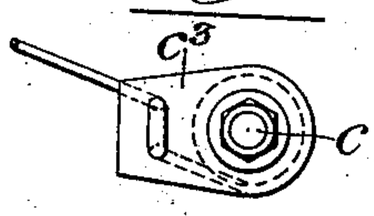


Fig. 3.

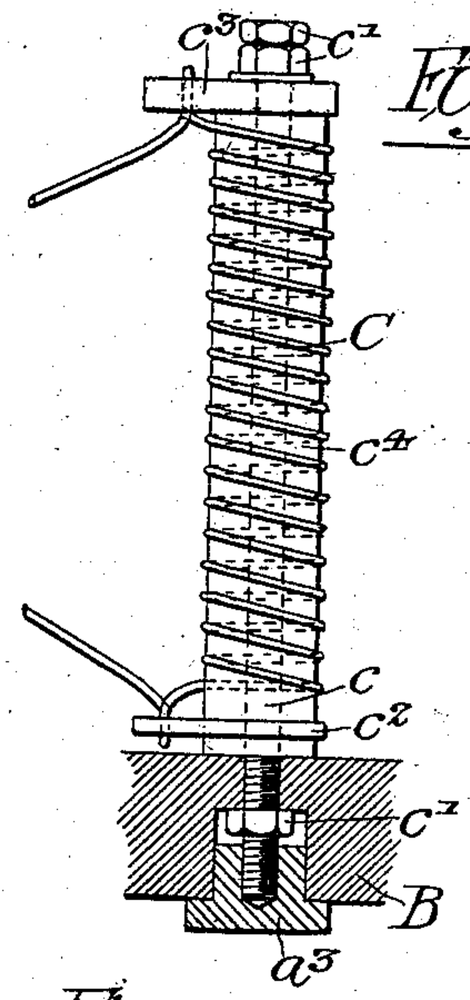


Fig. 5.

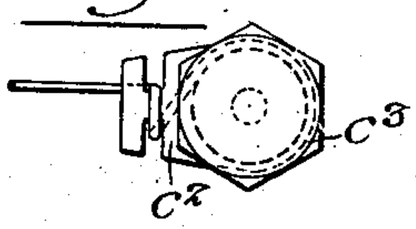
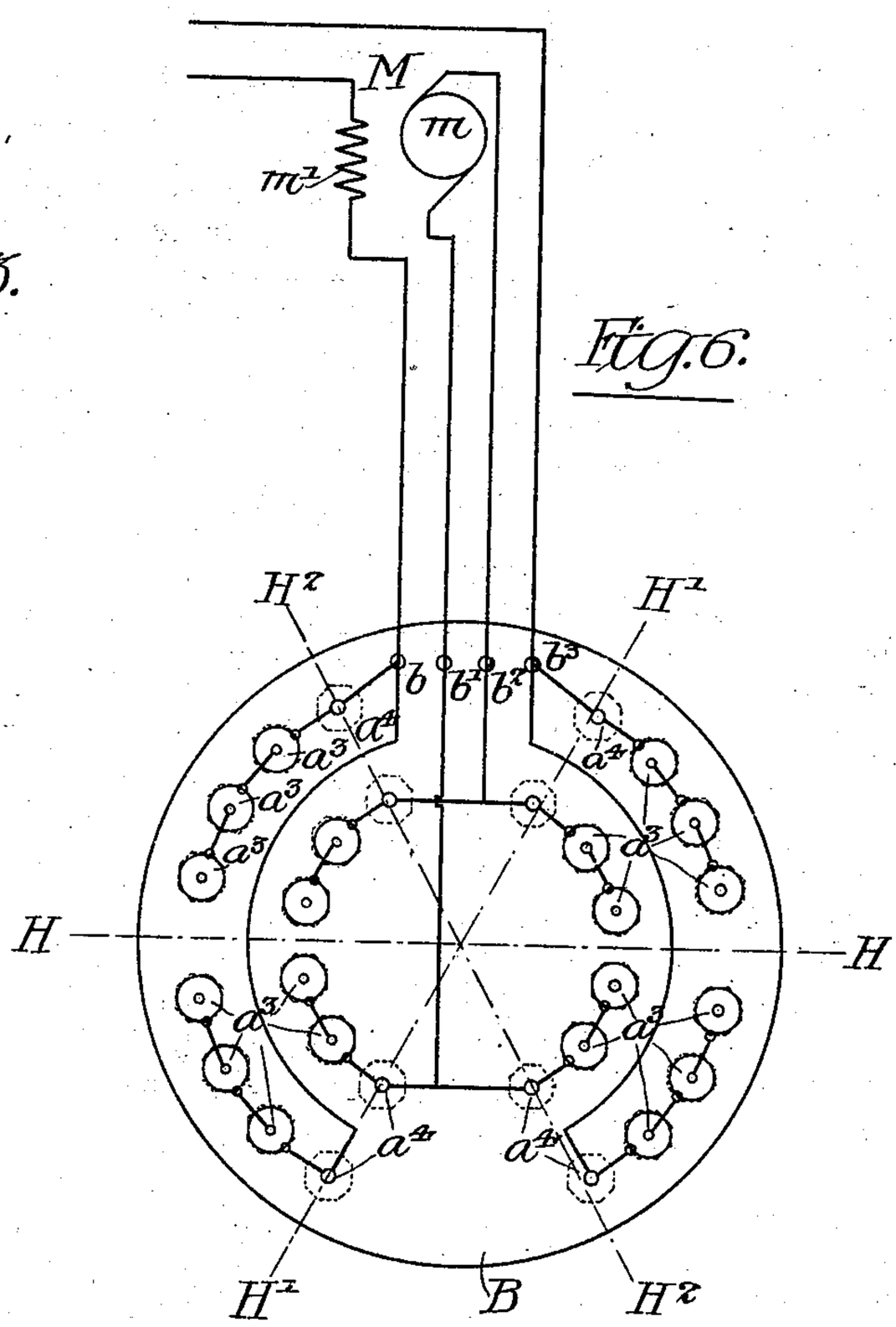


Fig. 6.



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UNITED STATES PATENT OFFICE.

ARTHUR C. EASTWOOD, OF CLEVELAND, OHIO, ASSIGNOR TO ELECTRIC CONTROLLER & SUPPLY COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

ELECTRIC CONTROLLER.

SPECIFICATION forming part of Letters Patent No. 693,791, dated February 18, 1902.

Application filed October 21, 1901. Serial No. 79,430. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR C. EASTWOOD, a citizen of the United States, residing in the city of Cleveland, State of Ohio, have invented certain Improvements in Electric Controllers, of which the following is a specification.

My invention relates to certain new and useful improvements in controlling devices for electric motors, the main object thereof being to produce a controller of the fewest possible number of component parts consistent with simplicity and reliability of operation.

A further object of the invention is to provide a device of the character described which shall be readily accessible for inspection and repair and at the same time adaptable to a variety of operating conditions to a degree hitherto unattained by other similar devices.

These objects I attain as hereinafter set forth, reference being had to the accompanying drawings, in which—

Figure 1 is a front elevation of my improved controller. Fig. 2 is a sectional view of the same, taken on the line 2 2, Fig. 1. Fig. 3 is a side elevation of the preferred form of resistance unit used in connection with and forming part of my improved controller. Figs. 4 and 5 are plan views of the top and bottom of the resistance unit shown in Fig. 3. Fig. 6 is a diagrammatic view of the electrical circuits and connections when my controller is used in connection with a series motor. Fig. 7 is a detail view showing my preferred means for attaching the contact-buttons to the face of my controller. Figs. 8 and 9 are side and front views, respectively, of the form of contact-finger used on my controller; and Fig. 10 is a view showing my controller as used in various parts of a structure similar to a crane-cage.

In the above drawings, A is a casing of iron or any other fireproof material, approximately cylindrical in shape and having a foot or base section *a*, through which are holes (shown in dotted lines) for the attachment of the casing to any desired support. Openings a^6 are provided in the rear face of the said casing for purposes of ventilation, and the front edge of the casing has a recess extending around its entire circumference, into which is set a circular plate or disk B of insulating material, preferably slate or marble.

The casing A is provided with four lugs a', three of which are shown in Fig. 2 of the drawings, the fourth being cut away in the section. These are mounted symmetrically with respect to the center of the disk B and are ninety degrees apart, the line through one pair being parallel to the base of the supporting-foot *a*. The disk B is held to the casing A by two screws a^2, diametrically opposite to each other, and consequently adapted to engage any opposite pair of the lugs a'. There are contact-buttons a^3 a^4 mounted upon the outer face of the plate or disk B, and these are arranged to extend in four groups, the whole being placed on the arcs of two concentric circles. Fixed to the disk B at two diametrically opposite points are dead-plates a^5, of insulating material, there being in the present instance a group of seven of the above-mentioned contact-buttons arranged, as shown, both to the right and left of each plate. The buttons are attached or held to the plate B as shown in Fig. 7 or as in Fig. 3, each one being screwed onto a rod *c*, extending through the plate B and for a greater or less distance on its other side. These are held in position by nuts c', the nut on one end of each rod being sunk below the surface of the plate in a counterbored recess. This end of the rod which extends through the plate B is threaded into the buttons a^3 and a^4, it being noted that these buttons are preferably of a form which admits of a wrench being used to turn them. With the exception of the eight contact-buttons a^4 nearest the dead-plates a^5 all of the buttons are in electrical contact with resistance-coils C, these latter being wound upon tubular cylinders of insulating material carried on the rods *c* and provided with end pieces c^2 and c^3 for the attachment of the wire with which they are wound. The plate c^3 is of insulating material, while the plate c^2 is of metal, this latter being in electrical contact with the rod *c*, thus electrically connecting one end of each coil of resistance with the rod *c*, upon which it is carried. The other end of each coil is ex-

tended to the coil adjacent to it, being clamped by means of the two nuts c' at its end to the interior rod c. The rod c is of magnetic material and as used in connection with the resistance-coil shown is fully described and claimed in my application for patent, Serial No. 76,660, filed September 26, 1901.

D is a spindle or pintle mounted centrally on the disk B and held in place by screws d. Mounted on this spindle and constructed to turn about as a center is an arm E, provided at one end with a handle e, preferably of wood or other insulating material. On this arm and insulated therefrom by a plate of some electrical non-conductor e' are metallic finger-carriers e^2, held to the arm E by screws e^3, but kept from electrical connection with the same by means of fiber bushings e^4. These finger-holders e' carry fingers e^5, pivoted to them by a rod or bar e^6, about which they are free to turn. The upper part of the fingers is recessed or slotted, and through this slot passes a screw e^7, held in the carrying-plate e', having upon it a spring e^8, constantly pressing against the upper end of the fingers, and thereby keeping the lower end or face thereof in good contact with the buttons a^3 and a^4. From this construction it will be seen that while there is free electrical connection between the fingers of each pair these pairs are insulated both from each other and from the operating-lever E.

Mounted on the base of the spindle D are upwardly-projecting stops or plugs d', preventing excessive motion of the arm E in either direction, it being thus impossible for the fingers carried by said arm to be moved beyond the extreme segments farthest from the dead-plates a^5.

There are terminals b, b', b^2, and b^3 upon the face of the disk B for the connection of conducting-wires from a source of electrical supply and from a motor to be operated.

Fig. 6 shows the various electrical connections when my controller is employed to operate a series motor. Here a^3 a^3 represent contact-buttons, to which are attached resistance units of the form shown at C in Fig. 3, and a^4 designates contact-buttons which are not attached to resistance units, but are held in place by short rods or studs, as clearly shown in Fig. 7.

In Fig. 6 the line H H represents the position of the operating-lever E when no current is flowing. H′ H′ represent the position of the lever when all the resistance is cut out and the armatures running at full speed, while H^2 H^2 represent the position of the lever when all the resistance is cut out and the armature is running at full speed in the reverse direction, m representing the armature, M a series motor, and m' the field-winding of the same.

By inspection of the connections shown diagrammatically in the above figure it will be noted that the direction of current through the armature has been reversed, while its direction through the field has remained the same during the movement of the operating arm or lever from the position indicated by the line H′ H′ to that indicated by the line H^2 H^2. The direction of rotation of the armature has therefore been reversed. As the operating-arm is moved toward these latter extreme positions the resistance-units are cut out one by one until when the positions indicated are reached current is flowing directly from the main to the motor and the armature is running at full speed.

In view of my arrangement of the lugs a' for the attachment of the plate B, as set forth above, it is evident that in mounting the controller the operating-arm E can have any one of four positions ninety degrees apart with respect to the base a, and this possibility is a matter of great convenience in installing the controllers, as shown in Fig. 10, where A′ represents the controller as supported from above—as, for instance, in an operator's cab or cage of an electric crane. A^2 shows the controller mounted on the wall of the cab with the operating lever or arm parallel to the base a, and A^3 represents the controller placed on the floor of the cage. It will be seen that by but the change of two screws the arrangement and relative position of the operating-lever of my controller can be altered to accommodate it to situations and structures in which it has hitherto been extremely difficult, if not impossible, to secure a convenient arrangement of apparatus.

In the operation of my controller the electric current passing through the wire coiled upon the insulating-tube c^4, Fig. 3, sets up a magnetic field through the rod c of magnetic material, the lines of force filling the space between adjacent contact-buttons and completing their circuit through the magnetic rod of an adjacent coil. Owing to this construction as the fingers e^5 pass from button to button any arc forming between the latter and said fingers or between adjacent buttons is instantly blown out and any injury to either fingers or contact-buttons prevented. Each resistance-coil therefore acts as the blow-magnet for its own and the adjacent contact-buttons.

I claim as my invention—

1. In an electric controller, the combination of a casing, a plate of insulating material thereon, resistance units mechanically attached thereto, contact-buttons on the plate electrically and mechanically connected to said resistance units, an operating-lever carrying contact-fingers pivoted to the plate, said fingers being insulated from said operating-lever and connected to each other in pairs and means for limiting the motion of the operating-lever, substantially as described.

2. The combination in an electric controller of a casing, a plate of insulating material carried thereby, contact-buttons on the plate, units of resistance electrically connected to the said contact-buttons, an operating-lever carrying metallic finger-holders, means for

insulating said holders from the lever, fingers pivoted to the said holders and constructed to bear upon the contact-buttons, with means for causing said fingers to press upon said contact-buttons, substantially as described.

3. The combination in an electric controller of a casing, a plate of insulating material carried thereby, contact-buttons on the plate, units of resistance electrically connected to the said contact-buttons, an operating-lever carrying metallic finger-holders, means for insulating said holders from the lever, L-shaped fingers pivoted to the said holders having one end constructed to bear upon the contact-buttons and carried by the holders, having springs placed to bear against the other end of said fingers, substantially as described.

4. The combination of a plate of insulating material, an operating-lever mounted on one face thereof, contact-fingers carried by said lever but insulated therefrom, contact-buttons on the plate and resistance-coils electrically and mechanically connected to the contact-buttons and extending from the face of said plate opposite to that having the contact-buttons, substantially as described.

5. In an electric controller, the combination of a plate of insulating material having upon it contact-buttons, an operating-lever carrying contact-fingers constructed to engage said buttons and resistance units connected to the contact-buttons, said units performing the double function of resistance-coils and blow-magnets, substantially as described.

6. In an electric controller, the combination of a plate of insulating material having upon it contact-buttons, an operating-lever carrying contact-fingers constructed to engage said buttons and resistance units having cores of magnetic material electrically and mechanically connected to the contact-buttons, said contact-fingers being in a magnetic field from the resistance units when the controller is in operation, substantially as described.

7. In an electric controller, the combination of a plate of insulating material, resistance units mounted on said plate at right angles to the plane thereof and carried solely by said plate, said units being symmetrically placed in groups on arcs of two concentric circles, contact-buttons mechanically and electrically attached to the resistance units, an operating-arm and contact-fingers carried thereby, said fingers being connected to establish electrical connection between two groups of contact-buttons similarly located on arcs of the inner and outer concentric circles, substantially as described.

8. In an electric controller, the combination of a plate of insulating material, units of resistance, contact-plates, dead-blocks and a spindle all carried by said plate and rigidly fixed thereto, an operating-arm carried by and revoluble about said spindle, contact-fingers on the operating-arm electrically connected in pairs, a metallic casing surrounding the resistance units and carrying the insulating-plate, lugs on said casing ninety degrees apart, two diametrically opposite screws in the plate of insulating material placed to engage any two diametrically opposite of said lugs, substantially as described.

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

ARTHUR C. EASTWOOD.

Witnesses:
C. W. COMSTOCK,
HERBERT I. GLIDDEN.