W. M. CONNELLY.

CONTROLLER FOR ELECTRIC MOTORS.

APPLICATION FILED JAN. 26, 1909.

955,137.

Patented Apr. 19, 1910.

2 SHEETS—SHEET 2.

Fig. 3.

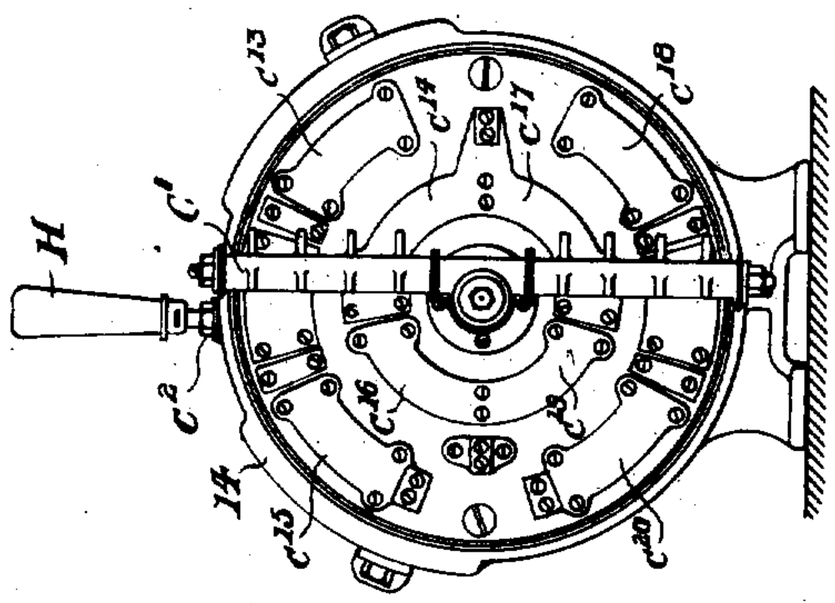
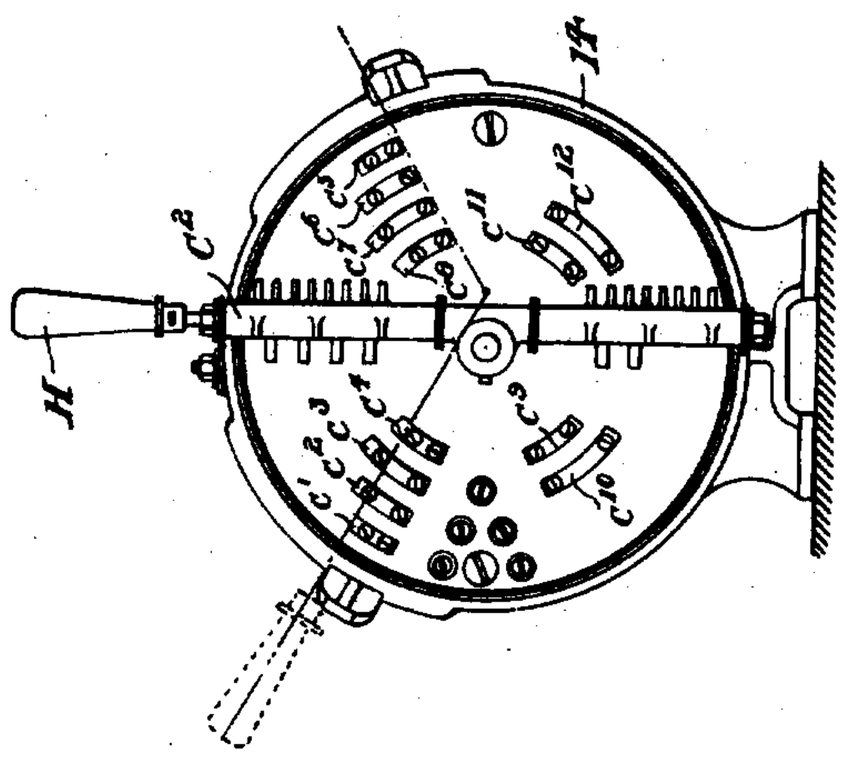


Fig. 4.

Fig. 5.



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2 SHEETS—SHEET 1.

Fig. 1.

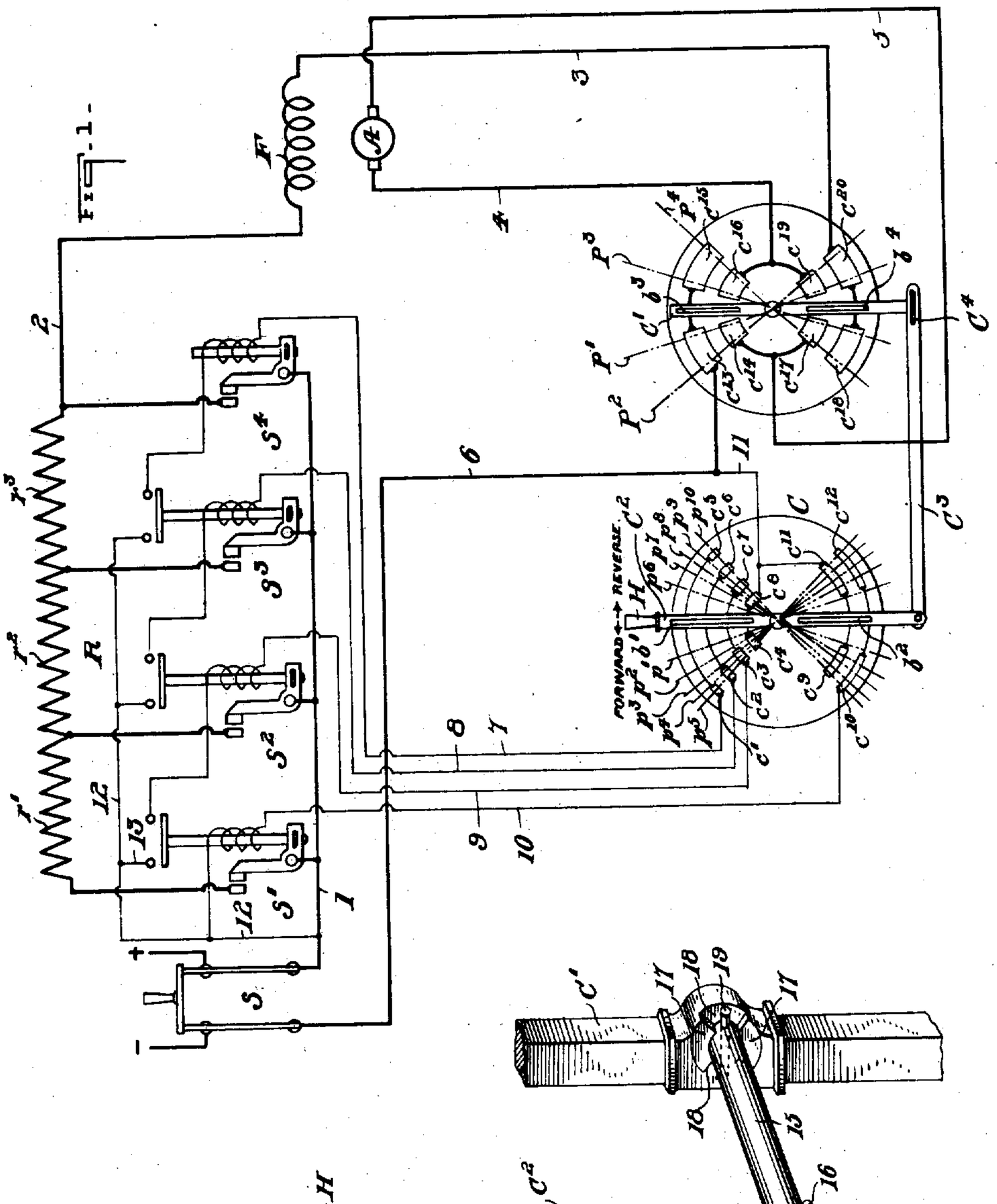

Fig. 2.

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WILLIAM M. CONNELLY, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE ELECTRIC CONTROLLER AND MANUFACTURING COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

CONTROLLER FOR ELECTRIC MOTORS.

955,137. Specification of Letters Patent. **Patented Apr. 19, 1910.**

Application filed January 26, 1909. Serial No. 474,214.

To all whom it may concern:

Be it known that I, WILLIAM M. CONNELLY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented or discovered new and useful Improvements in Controllers for Electric Motors, of which the following is a specification.

My invention relates to hand controllers for electric motors and has for its object the provision of means for causing arcs to be formed at the contacts of magnetically-controlled switches rather than at those on the hand controller, by which the said switches are governed.

Referring to the accompanying drawings, Figure 1 is a diagrammatic showing of a motor control system embodying the principles of my invention; Fig. 2, a perspective of the central portion of a pair of connected controller arms which I prefer for actual use; and Figs. 3, 4, and 5, front, side, and rear elevations of a hand controller provided with my improvements.

Referring first to Fig. 1, S is a main knife switch and S′, S², S³ and S⁴ are magnetically operated switches.

A is the armature of the motor to be controlled, and F, its field.

C is a diagrammatic view of the hand controller. The arm C′ of the hand controller C is arranged to be moved by the arm C², through the connecting rod C³. The slot C⁴ is provided in the connecting rod which allows a certain movement of the arm C² before movement of the arm C′ takes place. If the arm C² is moved in the forward direction, it will reach the position p' before any movement of the arm C′ takes place, and by the time the arm C² has reached position p^2, the arm C′ will have reached the position P′, which is the first running point of the controller. As the arm C² is advanced to the successive positions p^3, p^4, and p^5, the arm C′ advances toward the position P². In coming to the off-position, the arm C² moves through the whole distance allowed by the slot C⁴ before the arm C′ starts to move, and the arm C² will leave the fixed contact p' before the arm C′ can leave the fixed contact P′. This causes the magnets of all the magnetically-operated switches to be deënergized and provides a short interval of time between the opening of these switches and the opening of the connections between the arm C′ and the contact P′. This time interval allows the magnetically-operated switches to open and break the motor circuit. If the arm C′ and the arm C² should leave their fixed contacts at the same time, the short time required for the magnetic switch to open would throw the arc on the contacts of the hand controller, especially if the hand controller arm is moved quickly to the off position. The delayed motion of the arm C′, which is accomplished by my invention, forces the magnetically-operated switches always to break the motor circuit, thus preventing any arcing on the hand controller contacts.

On moving the controller arm C² to position p^2, the arm C′ will be in the position P′ and the following circuits will be established: from the positive side of the switch S through the wire 12, the operating solenoid of the switch S′, the wire 10, the contacts c^{10} and c^{12}, the brush b^2, the contact c^{11} and the wires 11 and 6 to the negative side of the switch S. This closes the magnetic switch S′ and establishes a motor circuit as follows: from the positive side of the switch S through the switch S′, the starting resistance R, the wire 2, the series field F, the wire 3, the contact c^{20}, the brush b^4, the contact c^{19}, the wire 4, the armature A, the wire 5, the contact c^{14}, the brush b^3, the contact c^{13}, and the wire 6 to the negative side of the switch S. This circuit starts the motor in the forward direction with all of the starting resistance in circuit. If the controller arm C² is moved to position p^3, a control circuit is established through the wire 12, the wire 13, the auxiliary contacts of the switch S′, the operating solenoid of the switch S², the wire 9, the contact c^3, the brush b', the contacts c^4 and c^8, and the wires 11 and 6 to the negative side of the switch S. This closes the second accelerating switch S² which short circuits part r' of the starting resistance R, tending to accelerate the motor A. On further movement of the controller handle to positions p^4 and p^5, similar circuits are established, closing switches S³ and S⁴, cutting out the remainder of the starting resistance sections r^2 and r^3 and placing the motor directly across the line. If now the controller handle is brought quickly to the off-position, the control circuits of the switches S′, S²,

S^3, and S^4 will be broken before the brushes b^3 and b^4 of arm C′, leaving their contacts c^{13}, c^{14}, and c^{19}, c^{20}, respectively. If now the controller arm C^2 is moved in the reverse direction, until the arm reaches the position p^7, the arm C′ will have reached the position p^3. The switch S′ now closes by a circuit through its operating coil, the wire 10, the contact c^{10}, the brush b^2, the contact c^9, and the wires 11 and 6 to the negative side of the switch S. This closes the motor circuit from the positive side of the switch S, through the switch S′, the starting resistance R, the wire 2, the series field F, the wire 3, the contact c^{20} and c^{18}, the brush b^4, the contact c^{17}, the wire 5, the armature A in the reverse direction to that before, the wire 4, the contact c^{16}, the brush b^3, the contact c^{15} and c^{13}, and the wire 6 to the negative side of the switch S. This reverses the direction of the armature A. The switches S^2, S^3, and S^4 are closed as before by advancing the arm C^2 to the positions p^8, p^9, and p^{10} respectively Bringing the operating handle H again to the off position to stop the motor, the arm C^2 leaves its fixed contacts before the arm C′ leaves its fixed contacts, thus again bringing the rupture of the motor circuit on the magnetically-operated switches and preventing the breaking of the motor circuit on the contacts or contact brushes of the arm C′.

Although I have shown this device as used with a simple magnetic switch controller with hand reverses, it is possible to use it with a magnetic switch controller employing any system of automatic acceleration, or in connection with any special features used in connection with this class of controllers. The motor to be controlled may be either series, shunt, or compound wound.

My invention may be used with alternating current motors as well as direct current motors.

Although I have shown certain means of obtaining the delayed motion of the contact arm C′ carrying the motor circuit, it is to be understood that this action may be obtained by any number of mechanical devices without departing in any way from the spirit of the invention.

Referring now to Figs. 2, 3, 4, and 5, I show the manner in which I prefer to embody my invention. 14 represents a drum-like casing having on one end the fixed contacts c^2 to c^{12} and on the other end the fixed contacts c^{13} to c^{20}. The arm C^2 which coöperates with the contacts c^2 to c^{12} and the arm C′ which coöperates with the contacts c^{13} to c^{20} are carried on the ends of the shaft 15 which occupies a central or axial position in the casing. The arm C^2 is secured rigidly to the shaft 15 by the pin 16, but the arm C′ is loosely mounted thereon. The arm C′ has a pair of lugs or shoulders 17, having between them at diametrically opposite positions the depressions or spaces 18 into which the pin 19, extending through the shaft 15, projects. When the arm C^2 is moved the arm C′ will lag behind, no matter in what direction the former is moved. It is clear that the arms connected as shown in Figs. 2–5 will produce the same results as those described in connection with the diagrammatic showing on Fig. 1.

I claim—

1. An electric circuit, a magnetically-operated switch having contacts in the said circuit, a second switch also having contacts in the said circuit, a third switch having contacts for governing the magnet of the first switch, and a lost motion connection between the second and third switches, by means of which the third switch may operate to open the circuit of the winding of the first switch before the contacts of the second switch are separated.

2. An electric circuit, a magnetically controlled switch having contacts in the said circuit, a controller casing having thereon contacts in the said circuit and in the circuit of the winding of the said switch, arms having brushes for closing the said contacts, a shaft connecting the said arms, and means for causing the shaft to rotate idly for a limited distance and then to cause the rotation of the arm having contacts in the first named circuit.

Signed at Chicago, Illinois, this 23 day of January 1909.

WM. M. CONNELLY.

Witnesses:
HARRY W. EASTWOOD,
C. S. WATKINS.