No. 795,570. PATENTED JULY 25, 1905.

S. G. M. ANDERSON.

CURRENT CONTROLLER.

APPLICATION FILED JAN. 27, 1904.

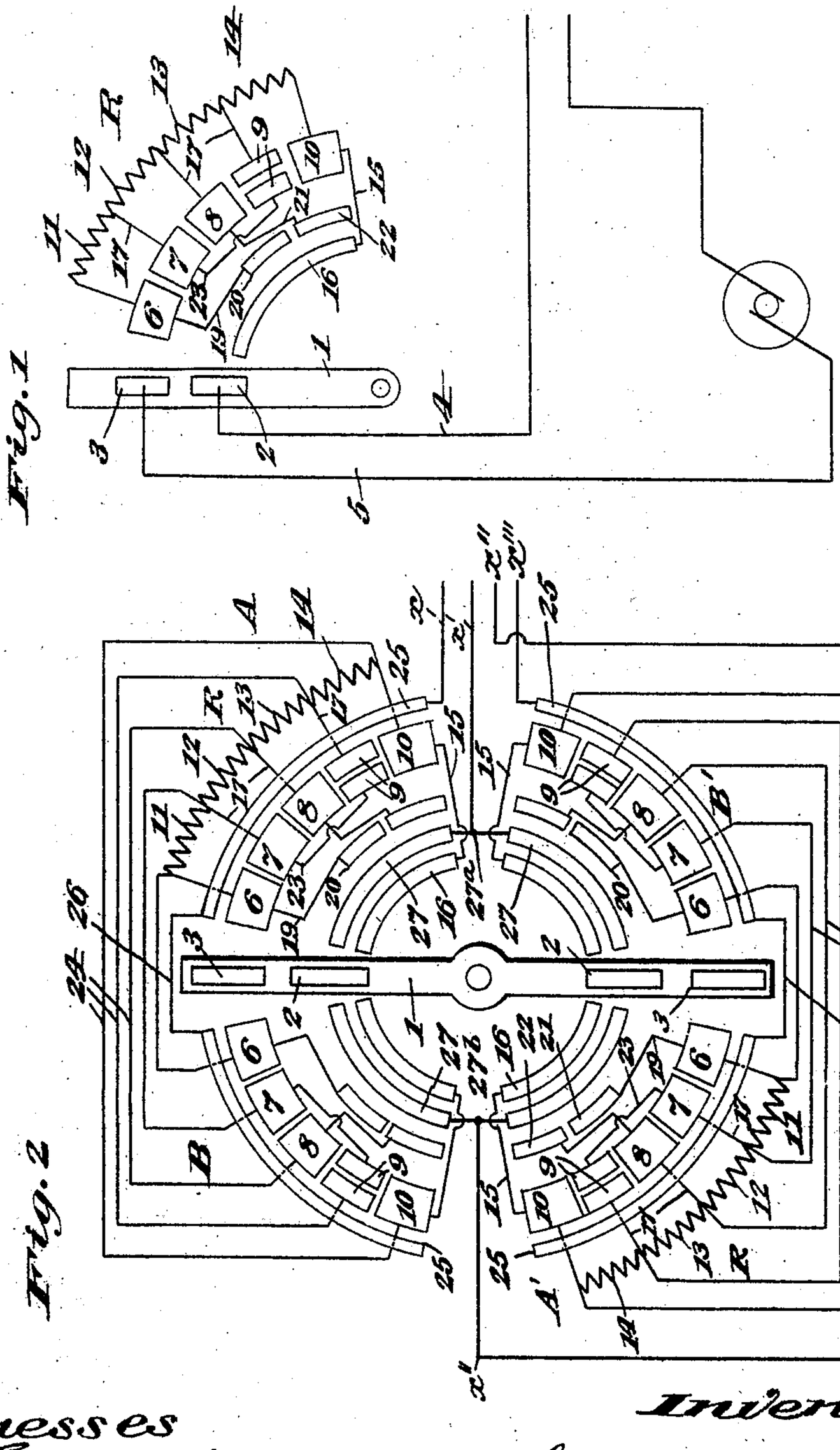

Fig. 1

Fig. 2

Witnesses

J. D. Coplinger

Walter D. Prosman

Inventor

Soren G. M. Anderson

By Clarence W. Chamberlain

Attorney

UNITED STATES PATENT OFFICE.

SWEN G. M. ANDERSON, OF CHICAGO, ILLINOIS.

CURRENT-CONTROLLER.

No. 795,570. Specification of Letters Patent. Patented July 25, 1905.

Application filed January 27, 1904. Serial No. 190,781.

To all whom it may concern:

Be it known that I, SWEN G. M. ANDERSON, a citizen of the United States of America, and a resident of the city of Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Current-Controllers, of which the following is a specification.

This invention relates to certain improvements in current-controlling devices such as are adapted for use in connection with electric motors and the like for gradual variation of the current strength in the motor or other circuits, so that the operation of the motor or other device in connection with which the controller is used may be conveniently and safely controlled; and the object of the invention is to provide a device of this general character of a simple and inexpensive nature and of a compact and durable structure, whereby the required variation of the inserted resistance in the motor-circuit may be accomplished with less liability of excessively heating such inserted resistance.

The invention consists in a current-controlling device comprising a resistance adapted for series connection in a circuit to be controlled and means for dividing said resistance into equal sections and for inserting said sections in parallel in the circuit, whereby as the several sections of the resistance are included in parallel the inserted resistance will be lessened by increase in cross-section, so that excessive heating of the resistance is avoided.

The invention also consists in a device of this character wherein the resistance-sections are adapted to be included in the circuit both in series and in parallel and wherein is provided means whereby the resistance may be divided and subdivided into gradually-decreasing but relatively equal sections and whereby said sections are included in parallel in the circuit to be controlled.

The invention also contemplates certain novel features of the arrangement of the several parts of the improved current-controlling device whereby the construction thereof is simplified and the device is adapted for more convenient operation and is otherwise better adapted for use, all as will be hereinafter fully set forth.

The novel features of the invention will be carefully defined in the claims.

In the accompanying drawings, which serve to illustrate my invention, I have shown in Figure 1 a diagraphic representation of a simple form of the improved controlling device such as might be utilized for controlling an inserted resistance in a simple circuit, while in Fig. 2 I have shown a more complete embodiment of my improvements in a reversible controller such as is adapted for reversing and varying the inserted resistance in both the armature and field circuits of a motor or the like.

Referring first to Fig. 1, 1 indicates a movable contact bar or arm having contacts 2 and 3 in electrical communication with circuit-conductors 4 and 5, respectively. The contact bar or arm is adapted in its movement to traverse two series of contacts, of which one series or set includes the contacts 6, 7, 8, 9, 9, and 10, with which the contact 3 on arm 1 is adapted for successive communication as said arm is moved. The other series or set includes the contacts 16, 20, and 22, which are adapted for electrical communication with contact 2 on arm 1 as the arm is moved, as will be hereinafter explained.

R indicates a resistance formed of equal sections 11, 12, 13, and 14, connected electrically end to end for insertion in series in the circuit, and one end of section 11 at one terminal of the resistance is connected with the contact 6, while the opposite terminal of said resistance at the end of section 14 thereof is connected with contact 10, which in turn is connected by a conductor 15 with the contact 16 of the other set traversed by contact 2 on arm 1.

At the connection between each two adjacent resistance-sections are arranged conductors 17 17 17, which lead, respectively, to the contacts 7 and 8 and to one of the contacts 9, which are intermediate the contacts 6 and 10, with which the resistance-terminals have connection, and from the contact 6 is extended a conductor 19, electrically connected with the contact 20 of the other set of contacts, the contact 8 of the first-named set having a conductor 21 extended to the contact 22 of the last-named set.

The contacts 9 9 are arranged one above the other and are designed to be simultaneously engaged by the contact 3 when arm or bar 1 is properly moved, and, as above stated, one of these contacts 9 has connection by way of conductor 17 with the connection between the resistance-sections 13 and 14. The other contact 9 has a conductor 23 extended to the contact 7 of the same series.

The contact 16 is adapted for electrical

communication with contact 2 on arm 1 at all times when contact 3 communicates with the several contacts 6, 7, 8, 9, 9, and 10; but the contacts 20 and 22 are adapted to be successively engaged by said contact 2 as the arm 1 is moved and are so proportioned and located that when contact 3 engages contacts 6 and 7 contact 2 will not communicate with either contact 20 or 22; but when contacts 3 and 8 are in communication contact 2 will communicate with contact 20, and when contacts 9 9 are engaged by contact 3 contact 2 will engage both of the contacts 20 and 22. By this arrangement the two series of contacts 6, 7, 8, 9, 9, and 10 and 16, 20, and 22 form a set of contacts wherein certain of said contacts are grouped opposite to each other for simultaneous communication with the contact devices of arm 1, and the arrangement is such that certain of the said groups thus produced comprise graduated numbers of contacts, the number of contacts in the respective groups being gradually increased from one end of the set to the other. For example, the contacts 7 and 16—two in number—are comprised in one group, the contacts 8, 20, and 16—three in number—are in the next adjacent group, and the five contacts 9, 9, 20, 22, and 16 are in the succeeding group.

When arm 1 stands in the position shown in Fig. 1, neither contact 2 nor 3 thereon will be in electrical communication with either contact of the corresponding set, so that the circuit at such times will be open; but when said arm is moved to engage contacts 3 and 6 the contacts 2 and 16 will come into communication, so that current will then flow from contact 3 to contact 6, thence to one terminal of resistance R, through the several sections of the same to the other terminal thereof, and thence to contact 10 and by conductor 15 to contact 16, whence it will pass to contact 2 on arm 1, whereby it will be seen that the circuit will be closed with the four resistance-sections inserted in series therein. When arm 1 is again moved to bring contact 3 into communication with contact 7, the first section 11 of resistance R will be cut out, while the remaining three sections 12, 13, and 14 will remain in series in said circuit, the current-flow in this position being from contact 3 to contact 7, thence by conductor 17 to section 12 of resistance R, through sections 12, 13, and 14 thereof to contact 10, and by way of conductor 15 to contacts 16 and 2. When arm 1 is further moved, contacts 3 and 8 are placed in communication and contact 2 is brought into communication with contact 20, and in this position of the parts the series connection of the second resistance-section 12 with sections 13 and 14 will be opened and the entire resistance will be divided in two equal portions or halves which will be connected in parallel in the circuit, so as to further lessen the inserted resistance and at the same time, by reason of the increased cross-section afforded by the parallel connection of the two halves of the resistance, to lessen the liability of excessive heating of the resistance as the same is lessened. In this position of the parts the current-flow will be from contact 3 to contact 8, thence by conductor 17 to the connection of resistance-sections 12 and 13, at which point the current will be divided, one half flowing through resistance-sections 13 and 14, contact 10, conductor 15, and contact 16 to contact 2, while the other half of the current flows through resistance-sections 12 and 11 to contact 6 and by way of conductor 19 and contact 20 flows to contact 2 of arm 1, where the two portions of the current are reunited. By this arrangement it will be seen that simultaneously with the cutting of the series connection of section 12 with sections 13 and 14, which ordinarily would result in excessive heating of the included sections, owing to the full current strength being thrown thereon, the sections 12 and 11 are inserted in the circuit in series with each other and in parallel with the sections 13 and 14, so as to increase the cross-section of the inserted resistance, and thereby prevent excessive heating thereof. A further movement of arm 1 serves to cut the series connection between sections 13 and 14 and also serves to cut the series connection between sections 11 and 12, whereby the resistance is further lessened, and simultaneously with the opening of said series connections the several equal sections 11, 12, 13, and 14 are included in parallel in the circuit, so as to effect a still further increase of cross-section, whereby the heating effect of the current traversing the shortened resistance is avoided. In this position of arm 1 contact 3 is in communication with each of the contacts 9 9, and contact 2 at the same time rests on contacts 16, 20, and 22, so that the current flowing from contact 3 is equally divided, one portion or half passing to each contact 9. Since one contact 9 has connection by way of conductor 17 with the connection between resistance-sections 13 and 14, it follows that the half of the current supplied to said contact 9 will pass by way of said conductor 17 to the connection between sections 13 and 14, where it will divide into quarters, one quarter of the current strength flowing through the section 14 to contact 10 and by way of conductor 15 to contacts 16 and 2, while the other quarter flows through resistance-section 13 and by way of the corresponding conductor 17 to contact 8, from which it flows by conductor 21 to contacts 22 and 2. The current supplied to the other contact 9 flows thence by way of conductor 23 to contact 7, thence by conductor 17 to the point of connection between resistance-sections 12 and 11, at which point it is also divided into quarters, one quarter of the

full current strength flowing through section 12 to contact 8 by way of the corresponding conductor 17 and thence by way of conductor 21 to contacts 22 and 2, while the other quarter flows through section 11 to contact 6 and thence by conductor 19 to contacts 20 and 2, at which point the four quarters of the current are reunited. A further movement of the arm 1 will serve to completely cut out the inserted resistance, so as to permit the full current strength to traverse the circuit-conductors, such movement of arm 1 serving to bring the contacts 3 and 10 into communication and to simultaneously bring the contacts 2 and 16 into coincidence, so that in this position of the parts the current will flow from contact 3 to contact 10 and thence by way of conductor 15 to contacts 16 and 2. Upon a reverse movement of the arm 1 it will be evident that a reverse actuation of the device may be effected, so as to gradually increase the inserted resistance until a point is reached at which the circuit may be safely broken.

In Fig. 2 I have shown a construction consisting, substantially, of a duplication of the parts above referred to, which is adapted for use in controlling the insertion of resistances in a plurality of circuits—as, for example, in the field and armature circuits of a motor—and also for effecting a reversal of the circuit connections of such circuits, so that the motor or other device in connection with which my improvement is used may be readily reversed. In this construction the arm 1 is centrally pivoted, and each end thereof is provided with contacts 2 and 3, similar to the contacts 2 and 3 in the preceding arrangement, and said opposite ends of the arm 1 are each adapted, when the arm is moved in one direction, to traverse an arrangement of contacts A and A′, respectively, similar to those contacts traversed by the arm in the preceding arrangement, and when said arm is moved in the opposite direction to traverse other similar series of contacts B and B′, respectively, which are, however, arranged in an order reverse to the contacts A and A′, so that the proper successive contacts and connections may be made as the arm 1 is moved. In this arrangement of the device there is a resistance R, divided in sections and connected up in a way similar to that above described with relation to Fig. 1, for use with each of the series A and A′ of contacts, with which opposite ends of arm 1 are adapted for communication through contacts 2 and 3. The series B and B′ of contacts which are opposite to and correspond with said first-mentioned series A and A′ have reversed circuit connections and are designed when employed to reverse the direction of the current-flow. In connection with the contact series B and B′ the resistances R R of the series A and A′, respectively, are employed, there being conductors 24, extended from the several resistance-sections to the respective contacts 6, 7, 8, 9, and 10 of each series B and B′. In connection with the contacts of the series A, A′, B, and B′, which correspond with those described with reference to the construction shown in Fig. 1, I employ two additional contacts 25 and 27 in connection with each of said series, the contact 25 being adapted for communication with contact 3 on arm 1 whenever said arm is moved to close the circuit through that particular group of contacts, and the contact 27 being similarly adapted for engagement with contact 2 on arm whenever said arm is adjusted to close the circuit. The contacts 25 25 of the two upper opposite series A and B are electrically connected by a conductor 26 and are connected with a conductor x of the circuit to be controlled, which conductor x may be, for example, one of the line conductors. In a similar way the contacts 25 25 of the two lower opposite series A′ and B′ are electrically connected through a conductor 26 and are also connected with another conductor x''' of the circuit to be controlled, which conductor x''' may be connected with one field-terminal of a motor. The contacts 27 27 of one group A and B′ of each of the upper and lower series of contacts are also connected electrically, as seen at 27^a, and have connection with another circuit-conductor x', which may lead to one side of the armature of the motor, and the corresponding upper and lower contacts 27 27 of the series B and A′ are connected by a conductor 27^b and are also connected with another circuit-conductor x'', which may lead from the other side of the armature of the motor to be controlled. The employment of the contacts 25 and 27 in the respective duplicate series A, A′, B, and B′ serves when the arm 1 is moved to close the circuit through one series of contacts to prevent short-circuiting of the resistance-sections through the circuit connections of one of the other series, such as would be liable to occur were no means provided for switching the current through the particular series of sections which are desired to be used. In the operation of this form of the device when the upper end of arm 1 is swung to the right the contacts 2 and 3 thereof will traverse their respective sets of contacts included in the group A, while simultaneously the lower contacts 2 and 3 of the arm will traverse the contacts included in group A′, so that the current will flow from conductor x to contact 25 of group A and thence to contact 3 of arm 1 and through the several other contacts and circuit connections of group A described with relation to Fig. 1 to contact 2 at said upper end of the arm 1, whence it will flow to contact 27 and by way of conductor 27^a to conductor x' and thence to the armature-terminal with which

said conductor has connection. From the other armature-terminal the current will flow by way of conductor x'' to conductor 27^b, thence to contact 27 of group A′, to contact 2 at the lower end of arm 1, thence through the several circuit connections of group A′, (dependent on the position of arm 1 and above described with reference to the construction shown in Fig. 1,) to contact 3 at said lower end of arm 1, thence to contact 25 of group A′, and thence by conductor 26 to the contact 25 of group B′, whence it will flow by way of conductor x''' to the field of the motor. In such an arrangement the other field-terminal would be connected with the line conductor. In this way it will be seen that the first movement of the arm 1 to make connection through contacts of groups A and A′ will serve to insert the entire resistance connected with group A in the armature-circuit and will simultaneously insert the entire resistance of group A′ in circuit with the field-windings, and as the arm 1 is further moved the series connections of the several resistance-sections of each group will be simultaneously broken and said sections will be included in parallel with the armature and field, so as to gradually reduce the resistance. The reverse movement of the arm 1 when the same is in contact with contacts 10 10 of groups A and A′, at which point the resistances are entirely cut out of armature and field circuits, will serve to gradually increase the inserted resistance, so as to slow down the motor, and when the arm has been moved to a central position between groups A and B the circuit will be open and further movement of the arm in that direction will cause its contacts 2 and 3 to traverse the contacts of the groups B and B′, so as to effect a reversal of the direction of current-flow for reversing the motor. As the contacts of arm 1 traverse the contacts of groups B and B′ the current will flow from conductor x to contact 25 of group A and will pass by conductor 26 to the contact 25 of group B, whence it will pass to contact 3 and thence through the circuit connections of group B (dependent on the position of the arm) to contact 2, thence to contact 27, conductor 27^b, and by way of conductor x'' to the armature, from which it will be seen that the direction of current-flow through the armature will be reversed.

From the above description it will be seen that the improved circuit-controlling means constructed according to my invention is of an extremely simple and inexpensive nature and is especially well adapted for use, since it permits of cutting down the inserted resistance to a very low degree without danger of excessively heating the resistance, and it will be obvious from the above description that the device is capable of some modification without material departure from the principles and spirit of the invention, and for this reason I do not wish to be understood as limiting myself to the employment of the precise form and arrangement of the several parts herein set forth in carrying out my invention in practice.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. A current-controlling device comprising a plurality of resistance-sections having series connections including contacts and provided with parallel connections also including contacts, the contacts of said series and parallel connections being arranged in a set of groups, the number of contacts in the respective groups being gradually increased from one end of the series to the other and means arranged to traverse the said set of contact groups for variably inserting the resistance-sections in a circuit to be controlled.

2. A current-controlling device comprising two contact groups, circuit-closing means adapted for closing the circuit through the contacts of each group, resistance-sections having circuit connections adapted for including said sections in series or in parallel in a circuit to be controlled, said circuit connections being extended from the contacts of one group to the contacts of the other group and means for controlling the said circuit connections.

3. A current-controlling device comprising two contact groups, circuit-closing means for closing a circuit through the contacts of either group, a resistance the sections of which have circuit connections adapted for including said sections in series or in parellel in a circuit to be controlled, said circuit connections having communication with the contacts of each group and means for controlling the said circuit connections.

4. A current-controlling device comprising two contact groups, a resistance the sections of which have circuit connections adapted for including said sections in series or in parallel in a circuit to be controlled, said circuit connections having communication with the contacts of each group, and means for closing a circuit to be controlled through either group of contacts and for simultaneously controlling the circuit connections of said resistance-sections.

5. A current-controlling device comprising two contact groups having reversely-arranged connections with a circuit to be controlled, a resistance the sections of which have circuit connections adapted for including said sections in series or in parallel in a circuit to be controlled, said circuit connections having communication with the contacts of each group, and means for closing the circuit to be controlled through either group of contacts, and for simultaneously controlling the circuit connections of said resistance-sections.

6. A current-controlling device comprising a set of resistance-sections having reversely-arranged circuit connections including grouped contacts and adapted for including said sections in series or parallel in a circuit to be controlled, a contact part movable in one direction to traverse one group of contacts and adapted, when reversely moved, to traverse the other group of contacts and means controlled by the movement of said part and controlling the circuit-connections of said resistance-sections.

7. The combination of a field-circuit, resistance-sections adapted for insertion therein, an armature-circuit, other resistance-sections adapted for insertion in said armature-circuit, one of the sets of resistance-sections being adapted for series or parallel connection in its respective circuit and means for variably inserting the resistance-sections in said circuits.

8. The combination of a field-circuit, resistance-sections adapted for insertion in series or parallel therein, an armature-circuit, other resistance-sections adapted for insertion in series or parallel in said armature-circuit and means for variably inserting the resistance-sections in said circuits.

9. A current-controlling device comprising two sets of resistance-sections, one set having connections for insertion in series or in parallel in an armature-circuit and the other set having connections for insertion in series or in parallel in a field-circuit, means for similarly varying the insertion of the sections of each set and means for reversing the current-flow through said sections.

In witness whereof I have set my hand this 21st day of January, A. D. 1904, in the presence of two subscribing witnesses.

SWEN G. M. ANDERSON.

Witnesses:

C. K. CHAMBERLAIN,

A. S. PHILLIPS.