No. 791,885. PATENTED JUNE 6, 1905.

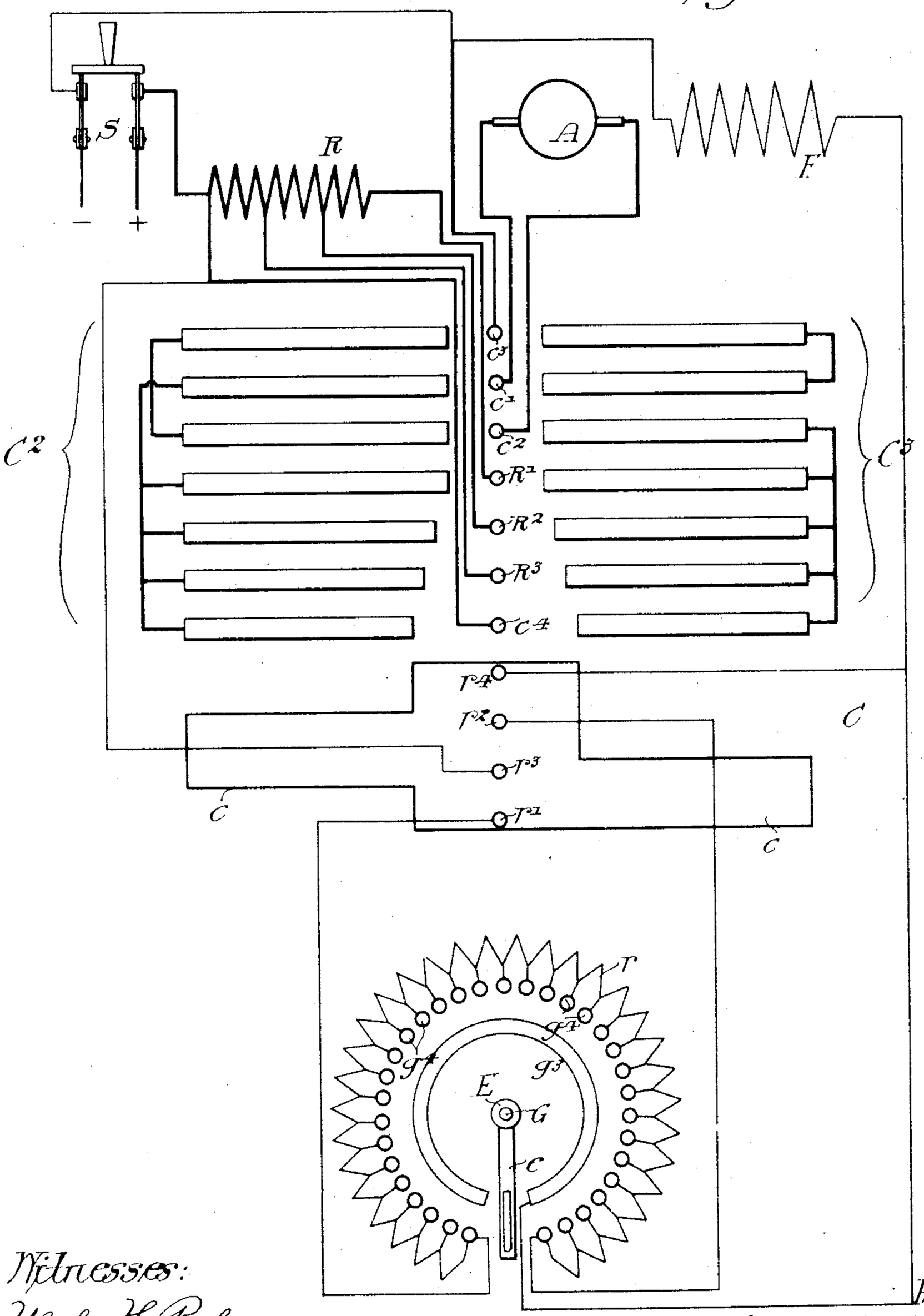
A. C. EASTWOOD.

CONTROLLER FOR ELECTRIC MOTORS.

APPLICATION FILED SEPT. 14, 1904.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses:
Wesley H. Rule
Louis H. Buck.

Inventor:
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2 SHEETS—SHEET 2.

Fig. 2.

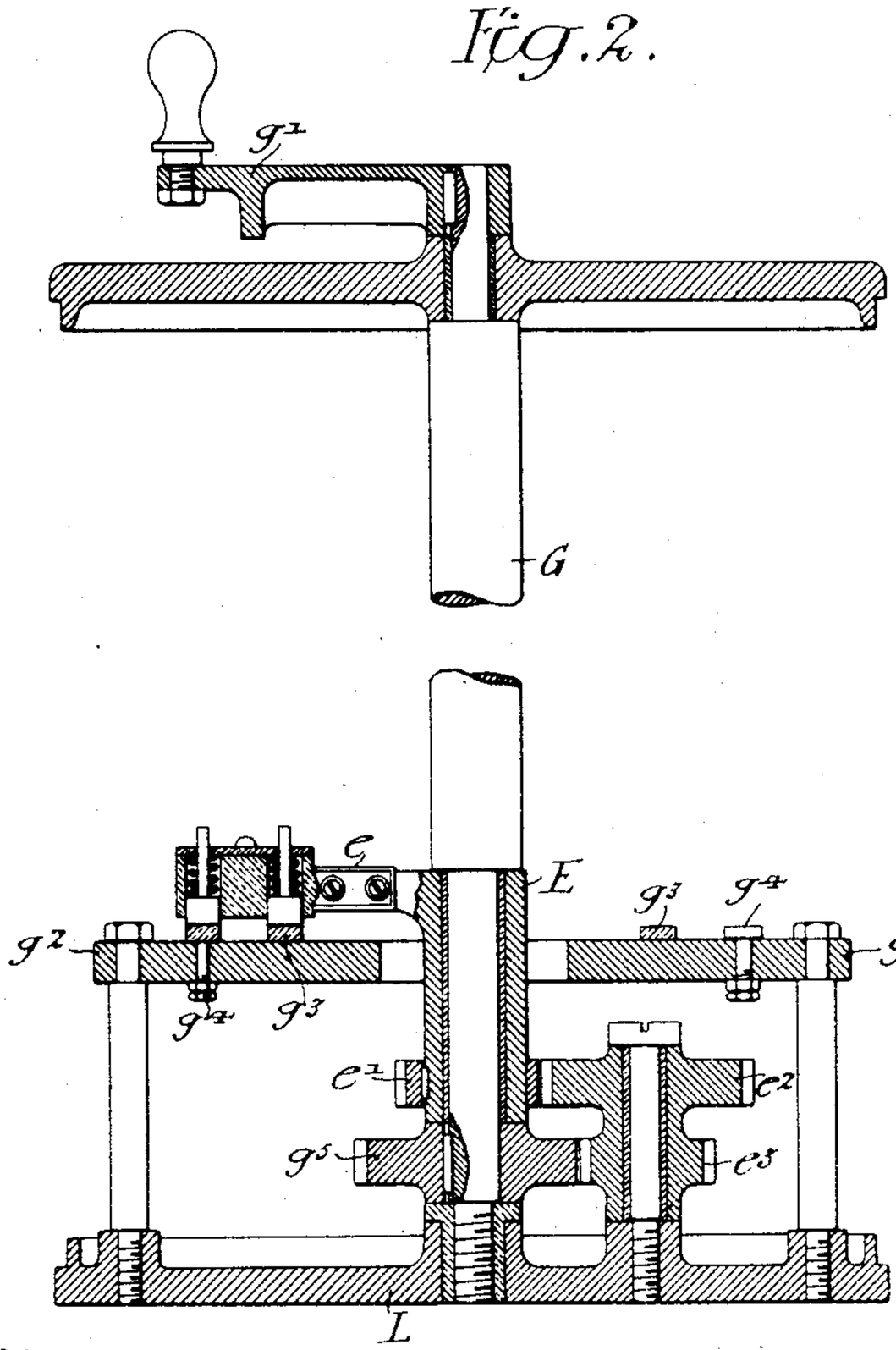


Fig. 3.

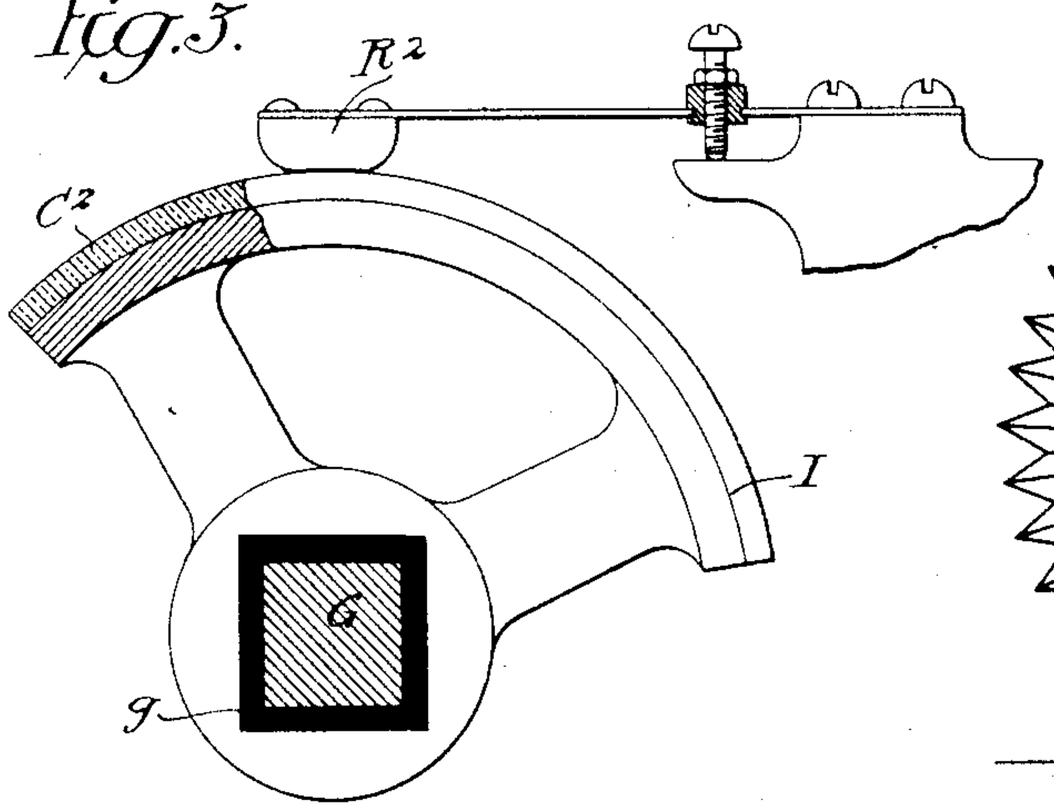
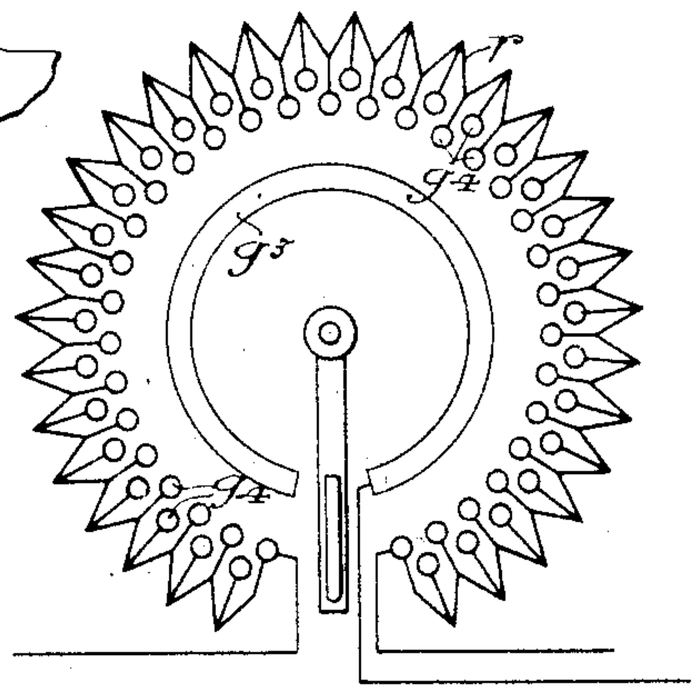


Fig. 4.



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UNITED STATES PATENT OFFICE.

ARTHUR C. EASTWOOD, OF CLEVELAND, OHIO.

CONTROLLER FOR ELECTRIC MOTORS.

SPECIFICATION forming part of Letters Patent No. 791,885, dated June 6, 1905.

Application filed September 14, 1904. Serial No. 224,431.

To all whom it may concern:

Be it known that I, ARTHUR C. EASTWOOD, a citizen of the United States, residing in Cleveland, Ohio, have invented certain Improvements in Controllers for Electric Motors, (Case A,) of which the following is a specification.

My invention relates to certain new and useful improvements in controllers for electric motors, having particular application to that class of motors known as "variable-speed direct-current" motors, in which the speed is varied by varying the strength of the field. Such motors are commonly used for the driving of machine-tools, printing-presses, &c., and it is advisable that the controllers for governing their operation should be provided with a large number of steps or running-points, so that the speed or the motor may be accurately adjusted, so that the driven machine will operate at its maximum efficiency for the particular work in hand.

One object of the invention is to provide a controller which while being of a relatively simple and inexpensive construction shall have a large number of steps or running-points for varying the resistance in circuit with the motor-field winding.

A further object of the invention is to provide a device for governing a motor which shall partake of the characteristics of both the drum and plane contact types of controller in order to render possible the convenient varying of the resistance in both the armature and field circuits of the motor.

Another object of the invention is to so construct the various parts of the device and the connections between them that the same bank of resistance and contacts may be made use of in varying the motor-field in both directions of operation of the controller.

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

Figure 1 is a diagram of the connections in my improved controller between it and a shunt-wound motor. Fig. 2 is a sectional view of the controller-drum, showing part of the same broken away; and Figs. 3 and 4 are views illustrating details of my invention.

In the above drawings, A is the armature, and F the field-winding of a shunt-motor, S being the main switch connecting the apparatus with a source of current-supply. A bank of starting resistance is illustrated at R, and this is divided into a number of sections connected, respectively, to fingers R' R^2 R^3 of a controller C. In the case illustrated this consists of a suitable framework having a spindle G supported in bearings and revoluble by means of a handle g'. Adjacent to the lower end of the spindle is a plate g^2, of insulating material, carrying a contact-segment g^3 and a series of contact-buttons g^4, concentrically placed relatively to said spindle, there being carried by this latter, but movable independently thereof, a radial contact-arm e for bridging said buttons and segment. Said arm projects from a sleeve E, to which is keyed a pinion e', connected, through two pinions e^2 and e^3, with a pinion g^5, keyed to the spindle G, the whole being so proportioned that a given angular movement of the handle g' causes approximately twice as much angular movement of the arm e.

A bank of resistance r is connected at various points to the contact-buttons g^4, its ends being respectively connected to fingers r^2 and r'. These fingers, together with a number of others hereinafter noted, are supported in a line parallel with the spindle G of the controller, so as to engage contact-segments carried by said spindle in the well-known manner, as illustrated in Figs. 1 and 3. Of said segments there are two groups C^2 and C^3, extending in opposite directions from the line of "off" position, and a single segment c, extending through said line in both directions around the controller-barrel. Placed to engage this last segment are the two fingers r' and r^2, as well as a finger r^3, connected directly to the positive side of main switch S, and a fourth finger r^4, connected to one end of the field-winding and to the segment g^3 on plate g^2, it being noted that said segment c is so shaped that while the controller is in its off position all of the four fingers r' to r^4 engage it. When the controller is operated in one direction, fingers r^2 and r^3 remain on it, and when the controller is operated in the op-

posite direction fingers r' and r^3 bear upon it. Of the remaining fingers two (c' and c^2) are respectively connected to the armature-terminals, while two others c^3 and c^4 are connected to the negative and positive terminals of switch S, and the remainder are connected to the bank R of starting resistance. The segments C^2 and C^3 are interconnected in the well-known way to serve as a reversing-switch for the motor and as a means of gradually cutting out the starting resistance as the controller-drum is turned, it being noted that they are so placed that one of the fingers r' or r^4 is disengaged from the segment c at the same time or just after finger c^4 engages its segment, and so cuts out the last section of resistance R.

It will be seen that when the controller-drum is in the off position, as indicated, the finger r^3 is in connection with the finger r^4, and hence with one end of the field-winding F. Since the other end of the field is connected directly to the negative side of the main switch, the bank r of resistance is short-circuited, and said field is excited to its maximum value. As above noted, the shape of the segment c is such that this condition holds till all of the armature resistance R has been short-circuited by the engagement of the fingers R' R^2, &c., with the corresponding contact-segments as the drum is moved in either direction from its off position. By the time this has occurred the brush carried by the arm e should be in engagement with the first contact g^4 of the group. If the controller-drum is being moved to the right at this point, the segment c now open-circuits the finger r^4, so that current flows from the finger r^3 to finger r^2, thence to one end of the resistance r, through the same to the contact g^4, with which the brush on arm e is in contact, through the brush to the segment g^3, to the field-winding F and through this to the negative side of the switch S. When the drum is in the full "on" position, the brush of arm e is in contact with the extreme end button g^4 of the resistance r, so that all of this is in series with the field-winding F and the motor will be running at maximum speed. As the drum is moved toward the off position the resistance in the field-circuit will be gradually cut out, the starting resistance R cut into the armature-circuit, and this latter finally opened as the drum returns to the off position. Motion of the drum in the reverse direction produces a similar cycle of operations, though with the current-flow reversed in the armature A, the contact-segment c in this case open-circuiting the finger r^2, so that current passes through the resistance r from the end opposite that which is connected to the finger r'.

From the above it will be seen that by my invention the entire field resistance r, together with all of the contact-buttons g^4 in connection therewith, are made use of in both directions of operation of the controller, thus rendering available a large number of running-points with a simple and relatively inexpensive construction.

In Fig. 4 I have shown a special arrangement of the contact-buttons g^4, in which these are staggered in order that a greater number of them may be engaged for a given angular movement of the contact e.

I claim as my invention—

1. A system including a motor, a controller including fixed and movable contacts, a bank of resistance and the motor-armature being connected to certain of said fixed contacts, and a second bank of resistance with the motor-field being connected to others of said contacts, certain of the movable contacts being supported in drum form, and said two sets of fixed contacts being supported in different lines at an angle to each other, with a device for causing the movable contact or contacts for the field and its resistance to move over their respective fixed contacts at a higher speed than that at which the movable contacts for the armature and its resistance move in engagement with their fixed contacts, substantially as described.

2. A controller including fixed and movable contacts, a bank of armature resistance connected to certain of said fixed contacts and a bank of field resistance connected to others of said contacts, contacts connected to serve as a reversing-switch, with a device for causing the movable contacts of the field resistance to move over their respective fixed contacts at a higher speed than that of the movable contacts of the armature resistance over their fixed contacts, substantially as described.

3. A controller having two sets of fixed and movable contacts, certain of said fixed contacts being arranged in a series lying in a plane substantially at right angles to the line of the remainder, and certain of the movable contacts being connected to serve as a reversing-switch, resistance connected to said series of contacts for limiting the field-current, and armature resistance connected to said remaining contacts, with mechanism intermediate of the two sets of movable contacts whereby one is operated at a speed different from the other, substantially as described.

4. A controller having fixed and movable contacts, certain of said movable contacts being arranged in drum form, and including reversing-switch contacts and a contact-arm, certain of the fixed contacts having connected to them resistance for limiting the field-current of a motor and being placed in one plane so as to be engaged by said arm, and others of the fixed contacts having connected to them armature resistance, with gearing between the contact-arm and the drum whereby one of said parts may be operated at a speed different from the remainder, substantially as described.

5. A controller having a spindle, segmental

contacts carried thereby, including contacts arranged to form a reversing-switch, a contact-arm operated from said spindle, fixed contacts placed to coact with said segmental contacts, a starting-rheostat connected to the fixed contacts, a series of contact-buttons placed to coact with the contact-arm, and a field-rheostat connected to said buttons, substantially as described.

6. A controller having a spindle, segmental contacts thereon, a contact-arm geared thereto, a line of contact-fingers placed to engage the segmental contacts, and forming therewith a reversing-switch, a starting-rheostat connected to the contact-fingers, a series of contact-buttons supported in a plane substantially at right angles to the spindle, and placed to coact with the contact-arm, and a field-rheostat connected to said buttons, 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:
WILLIAM F. BEATON,
MURRAY C. BOYER.