

No. 798,161.

PATENTED AUG. 29, 1905.

E. R. CARICHOFF.
CONTROLLER FOR ELECTRIC CIRCUITS.

APPLICATION FILED JUNE 30, 1904.

2 SHEETS—SHEET 1.

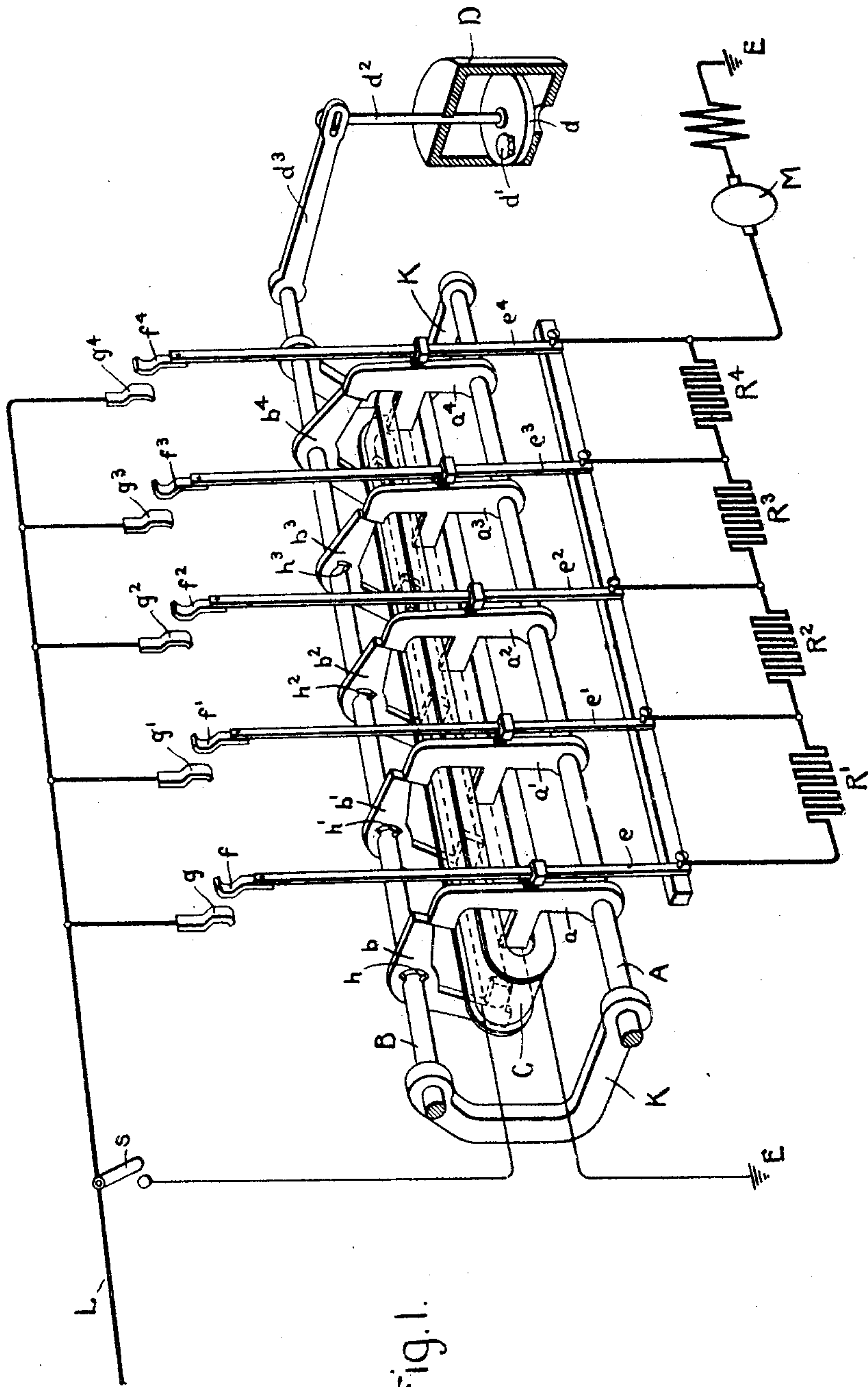


Fig. 1.

WITNESSES.

J. Ellis Glen.
Helen Arford

INVENTOR.

Eugene R. Carichoff.
By Allen S. Davis
Att'y.

No. 798,161.

PATENTED AUG. 29, 1905.

E. R. CARICHOFF.
CONTROLLER FOR ELECTRIC CIRCUITS.

APPLICATION FILED JUNE 30, 1904.

2 SHEETS—SHEET 2.

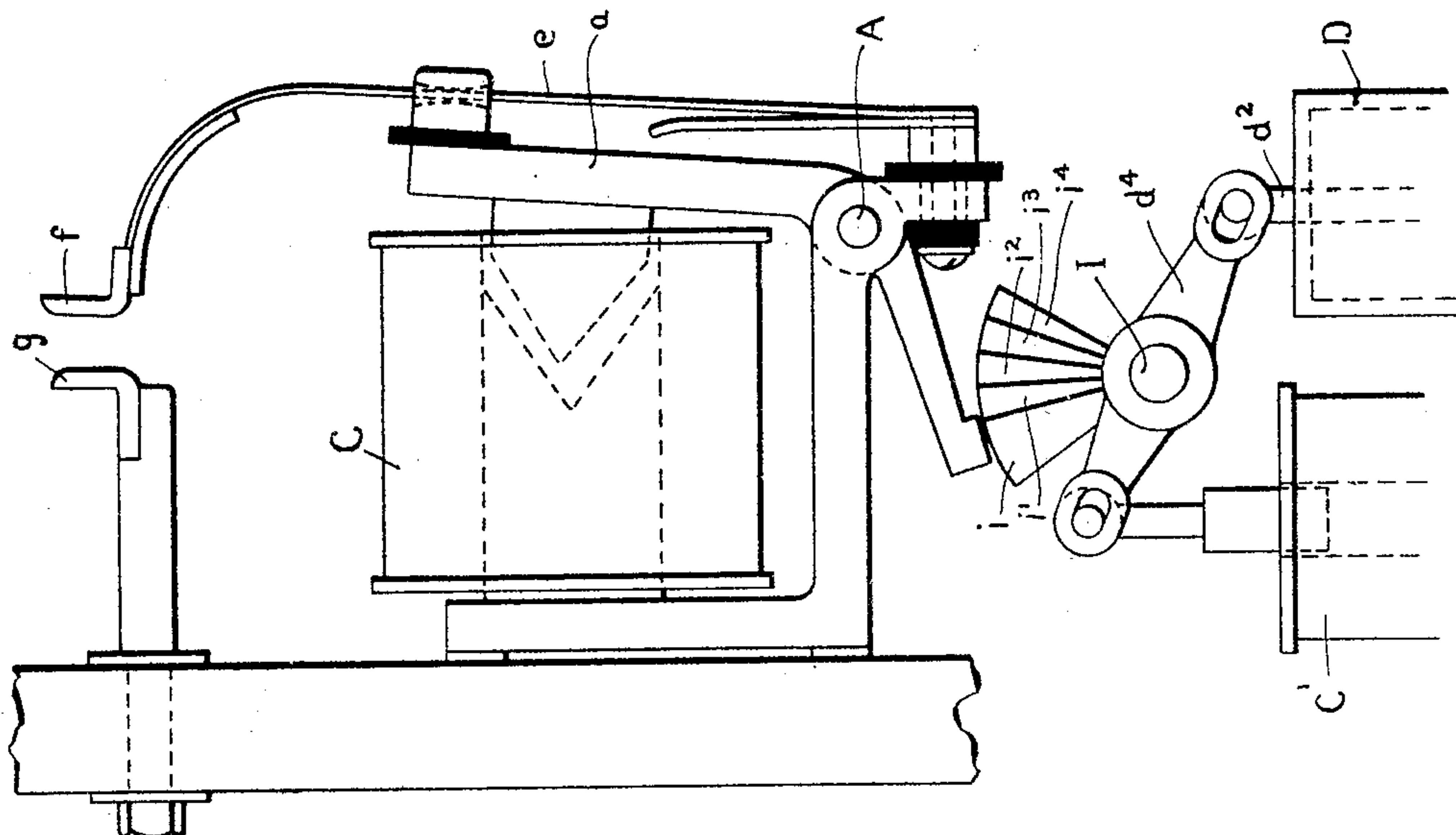


Fig. 3.

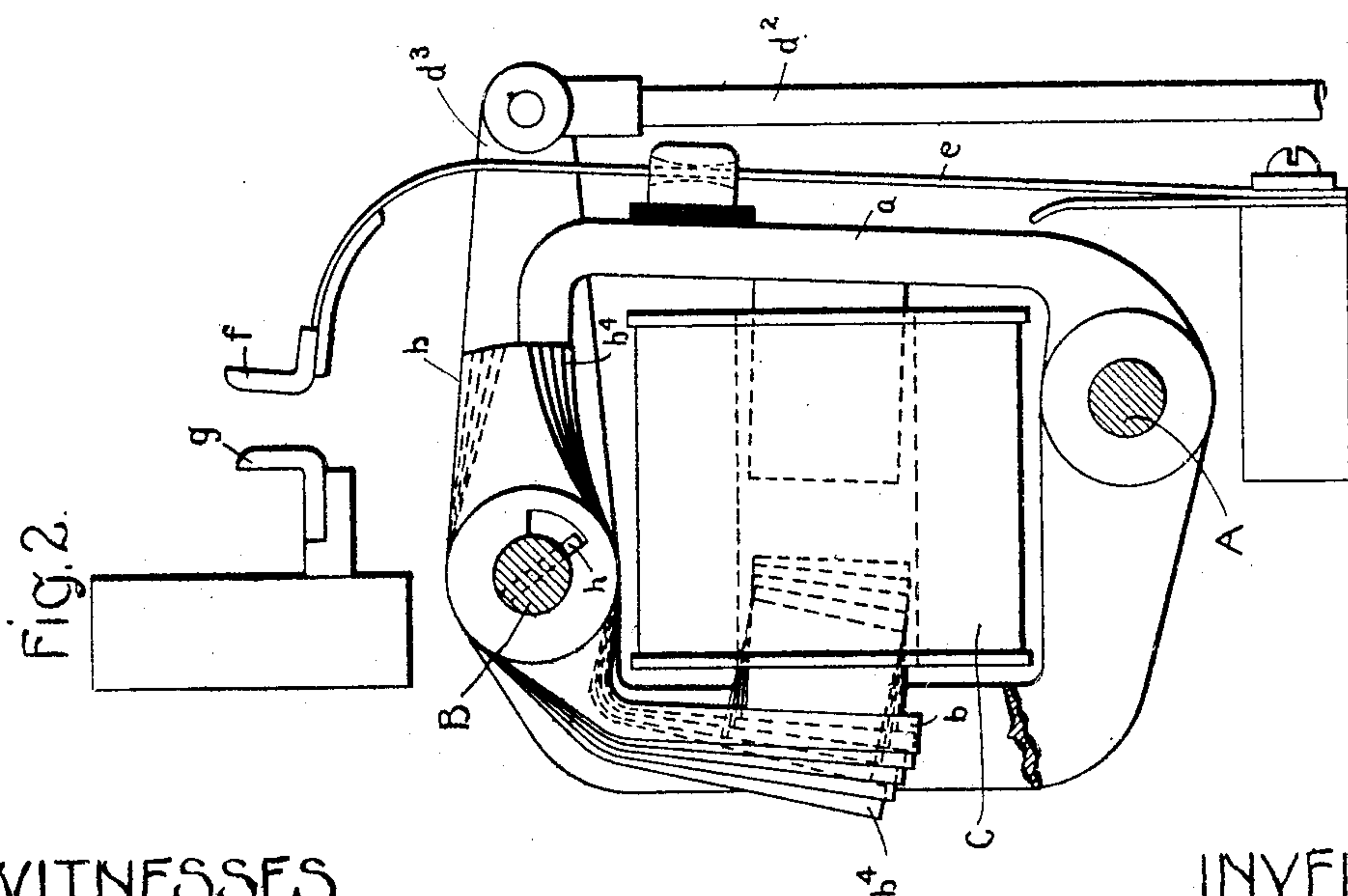


Fig. 2.

WITNESSES.

J. Ellis Glen.
Helen Axford

INVENTOR.

Eugene R. Carichoff.

By Allen B. Davis

Atty.

UNITED STATES PATENT OFFICE.

EUGENE R. CARICHOFF, OF EAST ORANGE, NEW JERSEY, ASSIGNOR TO
GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

CONTROLLER FOR ELECTRIC CIRCUITS.

No. 798,161.

Specification of Letters Patent.

Patented Aug. 29, 1905.

Application filed June 30, 1904. Serial No. 214,694.

To all whom it may concern:

Be it known that I, EUGENE R. CARICHOFF, a citizen of the United States, residing at East Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Controllers for Electric Circuits, of which the following is a specification.

My invention relates to the control of electric translating devices, and is particularly adapted for use in controlling the circuits of electric motors.

In a former application, Serial No. 179,796, filed by me November 4, 1903, I have disclosed a system of control for electric circuits embodying as one of its features a controller arranged to make the desired changes in an electric circuit in predetermined order and at a predetermined rate by means of a plurality of normally open switches, together with means for simultaneously placing the switches under strain, tending to cause them to close, and means for automatically regulating the closing of the switches in succession.

The particular arrangement illustrated and described in the above-mentioned application consists of a single shaft, upon which a plurality of switches are flexibly mounted. The shaft is rotated to place all the switches simultaneously under strain, and a series of obstructing devices are utilized for preventing the closing of the switches. As the obstructing devices are serially moved out of engagement with the several switches, the switches close in a predetermined order and at a rate determined by the rate at which the obstructing devices are moved.

My present invention consists in an improvement in the controlling-switch disclosed in my former application and comprises a single magnet-winding acting upon a plurality of armatures, each of which is operatively connected to a normally open switch. When the magnet-coil is energized, all the armatures are placed under strain; but the movement of the several armatures is prevented by a plurality of obstructing devices, which as they are serially disengaged from the armatures permit the successive closing of the several switches. By means of this arrangement the necessity for a flexible connection for each switch is removed, the magnetic pull exerted by a single coil taking the place of the pulls

exerted by the several springs in the switch shown in my former application.

My invention will best be understood by reference to the accompanying drawings, in which—

Figure 1 shows a perspective view of a controlling-switch arranged in accordance with my invention. Fig. 2 shows a side elevation of the same, and Fig. 3 shows a modification thereof.

Referring first to Figs. 1 and 2, I have shown my controlling-switch connected to control the circuit of a motor by cutting out successive resistance-sections. It will be understood, however, that my invention is applicable to the control of any circuit in which it is desired to make a plurality of changes in predetermined order.

In Fig. 1, M represents an electric motor having four resistance-sections R' to R^4 , adapted for connection in series with it. L represents a line-wire or other suitable source of current for the motor. C represents a magnet coil or winding, the circuit of which is controlled by the switch s . The coil C is provided with a plurality of armatures a to a^4 , which are loosely journaled on the shaft A, which is supported from the end pieces K K. The shaft A may be either journaled in the end pieces or rigidly secured thereto. B represents a second shaft, which is journaled in the end pieces K K and which carries a second series of armatures b to b^4 , which engage the several armatures a to a^4 , overlapping their upper ends by unequal amounts. All of these armatures b to b^4 , except the last, are connected to shaft B by means of a pin-and-slot connection, the shaft being provided with a plurality of pins h to h^3 , which engage slots of different lengths on the armatures, and thereby permit a movement of the armatures relative to the shaft. The first armature b is provided with a long slot, so as to have the greatest amount of relative movement. The last armature b^4 is rigidly secured to the shaft. The shaft B carries an arm d^3 , to which is secured, by means of the rod d^2 , the piston d of a dash-pot D. The piston d is provided with a check-valve d' , which permits a free downward movement of the piston and retards its upward movement. Each armature a has secured to it a flexible rod e , which carries at its tip a switch-contact f , which when the ar-

mature *a* is drawn inward engages a stationary contact *g*, and thereby connects the line-wire *L* to a terminal of one of the resistance-sections *R*.

5 The operation is as follows: When coil *C* is energized by closing the switch *s*, the coil *C* exerts a pull upon the armatures *a* to *a*⁴, tending to draw them inward, and thereby to close the several switches. The armatures *a* to *a*⁴ are in engagement with the armatures *b* to *b*⁴, which prevent their inward movement, and consequently prevent the switches from closing. The armatures *b* to *b*⁴, however, are also drawn inward by the coil *C*. This tends to rotate the shaft *B*, so as to raise the arm *d*³ and the dash-pot piston *d*. The dash-pot piston consequently moves upward at a rate predetermined by the adjustment of the dash-pot until the first armature *b* becomes disengaged from the armature *a*. Armature *a* moves quickly inward, closing the motor-circuit at the contacts *f* and *g* with a snap movement. The motor consequently starts with all the resistances in series. The rotation of shaft *B* continues, however, under the torque exerted by the remaining armatures *b*¹ to *b*⁴, which have been brought nearer coil *C* by the rotation of the shaft. The rotation of shaft *B* after the armature *b* has moved inward into engagement with the central member of armature *a* is provided for by the pin-and-slot connection. As shaft *B* continues its rotation, retarded by dash-pot *D*, the other armatures *a*¹ *a*², &c., are successively released from their engagement with the armatures *b*¹ *b*², &c. The switches *f*¹ *f*², &c., are consequently closed successively, cutting out resistance-sections in the circuit of motor *M*. Finally, when switch-contact *f*⁴ is in its closed position the motor is connected directly across the line with all the resistances cut out. When it is desired to stop the motor, the circuit of coil *C* is opened by means of switch *s*. The armatures *a* *a*¹, &c., are drawn into the position shown in Fig. 1 by the spring action of the flexible rods *e* *e*¹, &c., the motor-circuit thus being opened with a quick break. The shaft *B* and its armatures are returned to the position shown by the weight of the arm *d*³ and the piston *d*. This weight may be supplemented by a spring, if desired. It is not essential that the same coil should perform the two functions of placing the several armatures under strain and of removing the obstructing devices therefrom. Thus in Fig. 3 the coil *C* acts simply to place the several armatures *a* *a*¹, &c., under strain, while the function of removing the obstructing devices is performed by an additional coil *C'*, which acts upon a lever *d*⁴, upon the other end of which the dash-pot *D* acts. The lever *d*⁴ is secured to shaft *I* and by its movement produces a rotation of the shaft. The shaft *I* carries a plurality of obstructing devices *i* to *i*⁴, which as shaft *I* is rotated permit the suc-

cessive closing of the several armatures *a* *a*¹, &c., in the same manner as has been heretofore described.

Obviously magnet-winding *C* instead of being a single coil composed of turns each of which surrounds all the armatures may be composed of a greater number of short turns, each surrounding one or more armatures, so as to form a plurality of coils connected in series.

Other changes in the construction and arrangement of parts may be made without departing from my invention, and I aim in the appended claims to cover all such modifications.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In combination, a plurality of switches, a magnet-winding, a plurality of armatures for said winding adapted to be placed under strain when said winding is energized, operative connections between said armatures and said switches, and means for automatically regulating the movement of said armatures to move said switches in succession independently of the exciting-current of said magnet-winding.

2. In combination, a motor, a resistance, a plurality of switches adapted to control the amount of resistance in the motor-circuit, a magnet-winding, a plurality of armatures for said winding adapted to be placed under strain when said winding is energized, operative connections between said armatures and said switches, and means for automatically regulating the movement of said armatures to move said switches in succession independently of the exciting-current of said magnet-winding.

3. In combination, a plurality of switches, a magnet-winding, a plurality of armatures therefor adapted to be placed under strain when said winding is energized, operative connections between the several armatures and switches, means for obstructing the movement of the armatures, and means for serially removing the obstructing means from the armatures.

4. In combination, a plurality of fixed contacts, a magnet-winding, a plurality of armatures therefor adapted to be placed under strain when said winding is energized, movable contacts carried by the several armatures, means for obstructing the movement of said armatures, and means for serially removing the obstructing means from the armatures so as to permit the movable contacts serially to engage the fixed contacts with a snap action.

5. In combination, a plurality of normally open switches, a magnet-winding, a plurality of armatures therefor adapted to be placed under strain when said winding is energized, operative connections between the several armatures and switches, means for obstructing

the movement of the armatures, and magnetically-operated means for serially removing the obstructing means from the armatures at a predetermined rate.

5 6. In combination, a plurality of normally open switches, a magnet-winding, a plurality of armatures therefor adapted to be placed under strain when said winding is energized, operative connections between the several ar-
10 matures and switches, means for obstructing the movement of the armatures, and means operated by said magnet-winding for serially removing the obstructing means from the ar-
matures.

15 7. In combination, a magnet-winding, two sets of armatures therefor adapted to be placed simultaneously under strain when said winding is energized and one set being arranged to obstruct the movement of the second set,
20 a shaft arranged to be rotated by the strain on the first set and by its rotation to move

the armatures of the first set serially out of engagement with the second set, and a plurality of switches operatively connected to the armatures of the second set.

25 8. In combination, a magnet-winding, a plurality of armatures therefor adapted to be placed under strain when said winding is energized, obstructing means for said armatures adapted to be placed under strain when said
30 winding is energized and by its movement successively to release said armatures, means for retarding said movement, and a plurality of switches operatively connected to said ar-
matures.

35 In witness whereof I hereunto set my hand this 28th day of June, 1904.

EUGENE R. CARICHOFF.

Witnesses:

ROBERT TILESTON,
LEO C. FOSS.