

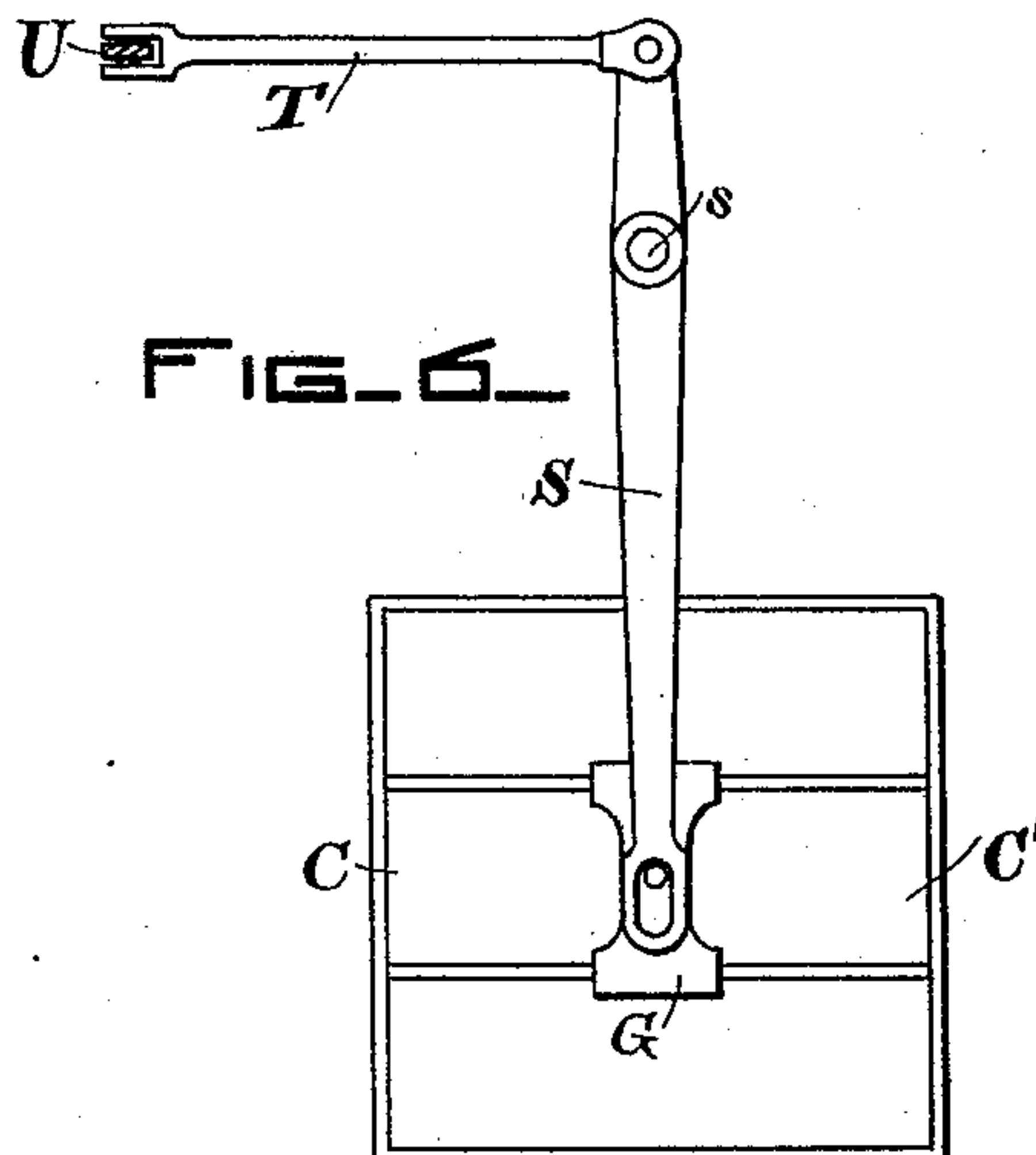
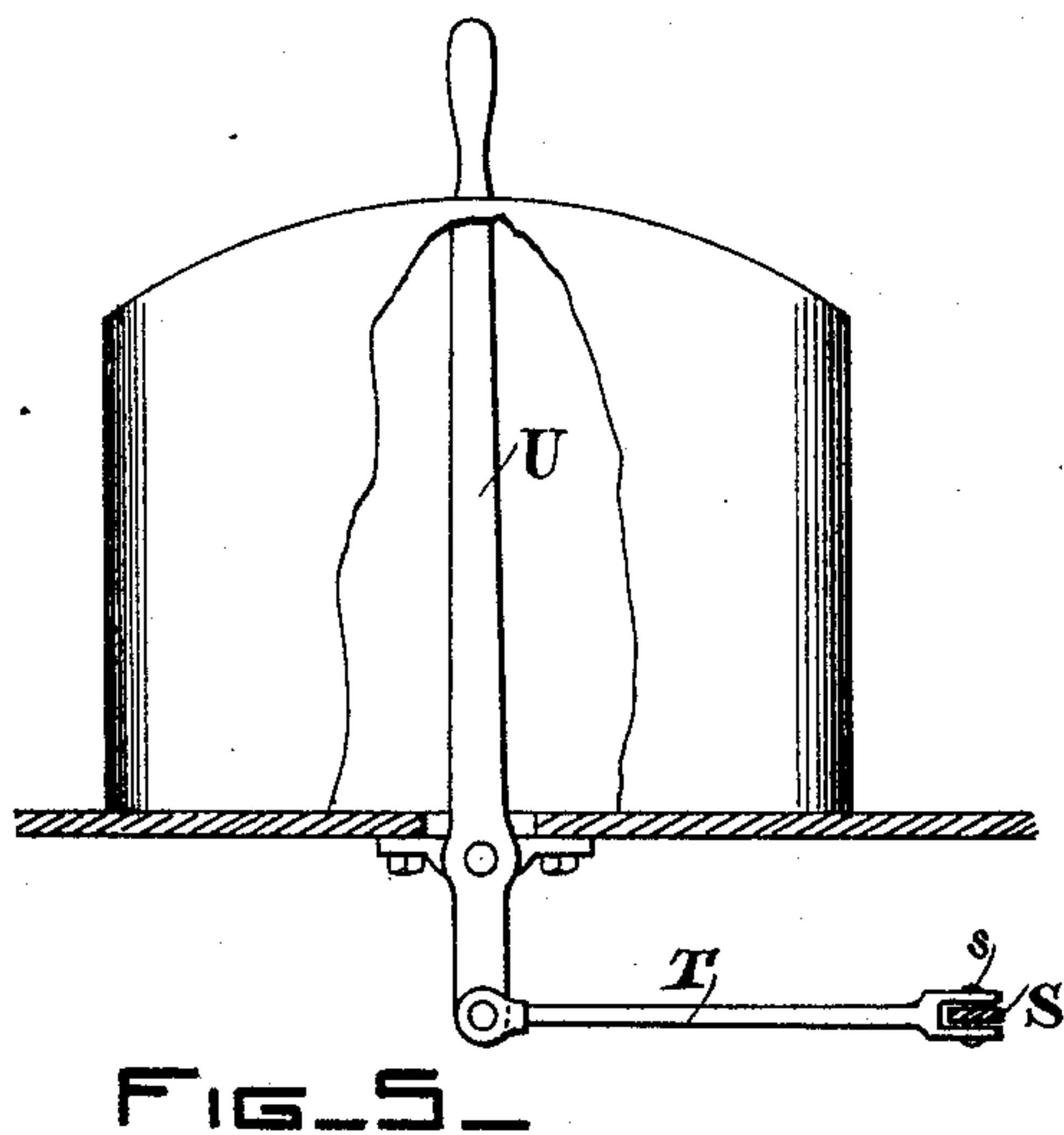
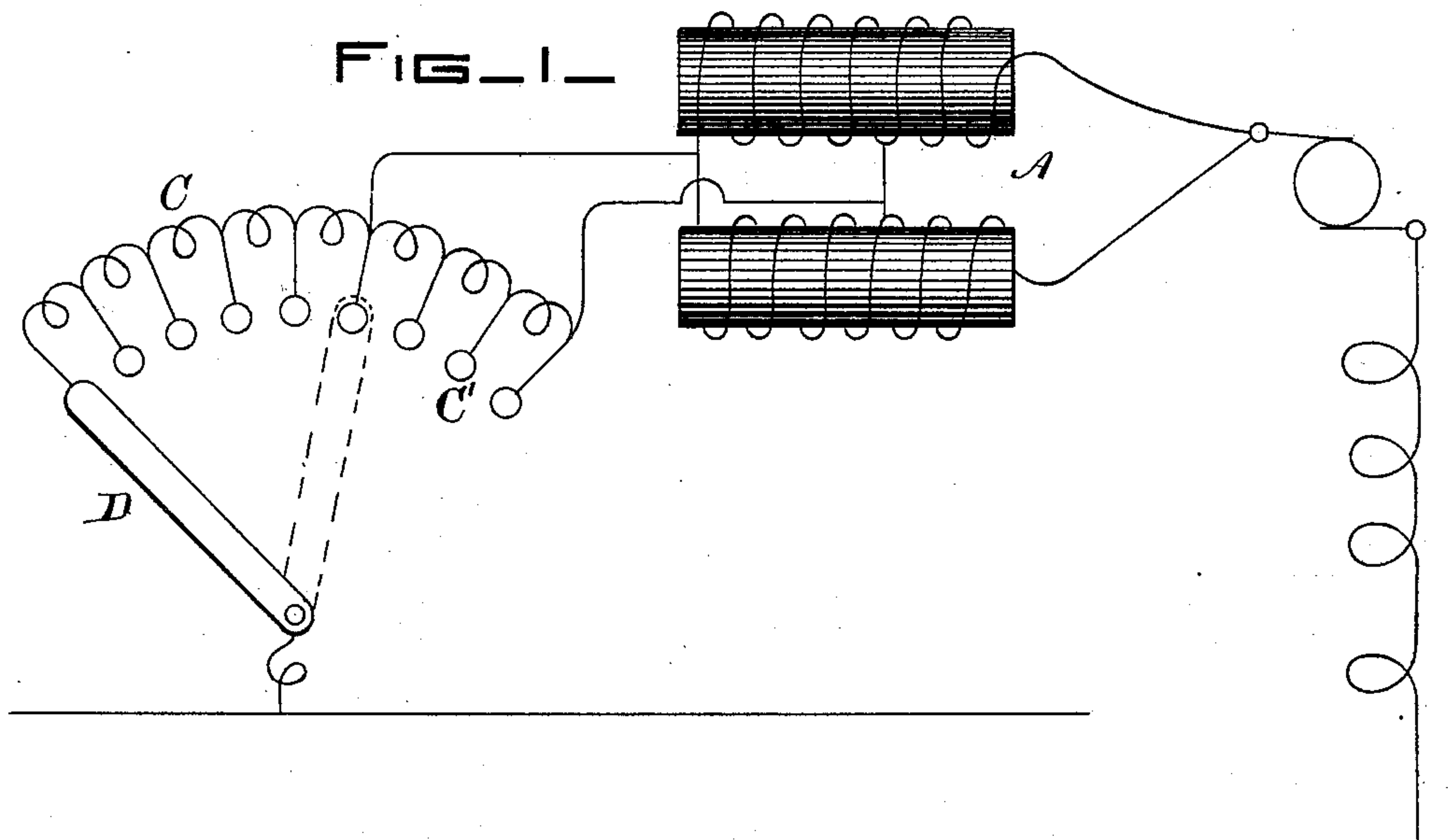
(No Model.)

2 Sheets—Sheet 1.

F. O. BLACKWELL.
RHEOSTAT.

No. 467,078.

Patented Jan. 12, 1892.



WITNESSES:

*Alfred
E. Pearson*

INVENTOR:

*Francis O. Blackwell,
by Bentley & Knight.*

ATTYS.

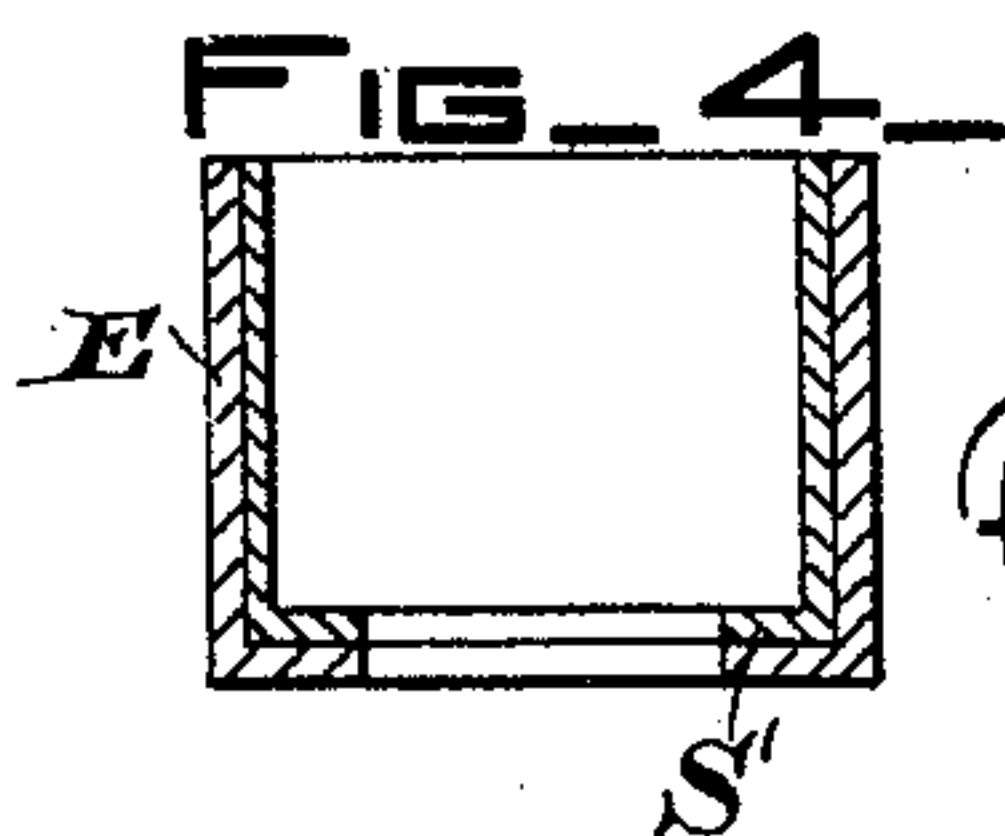
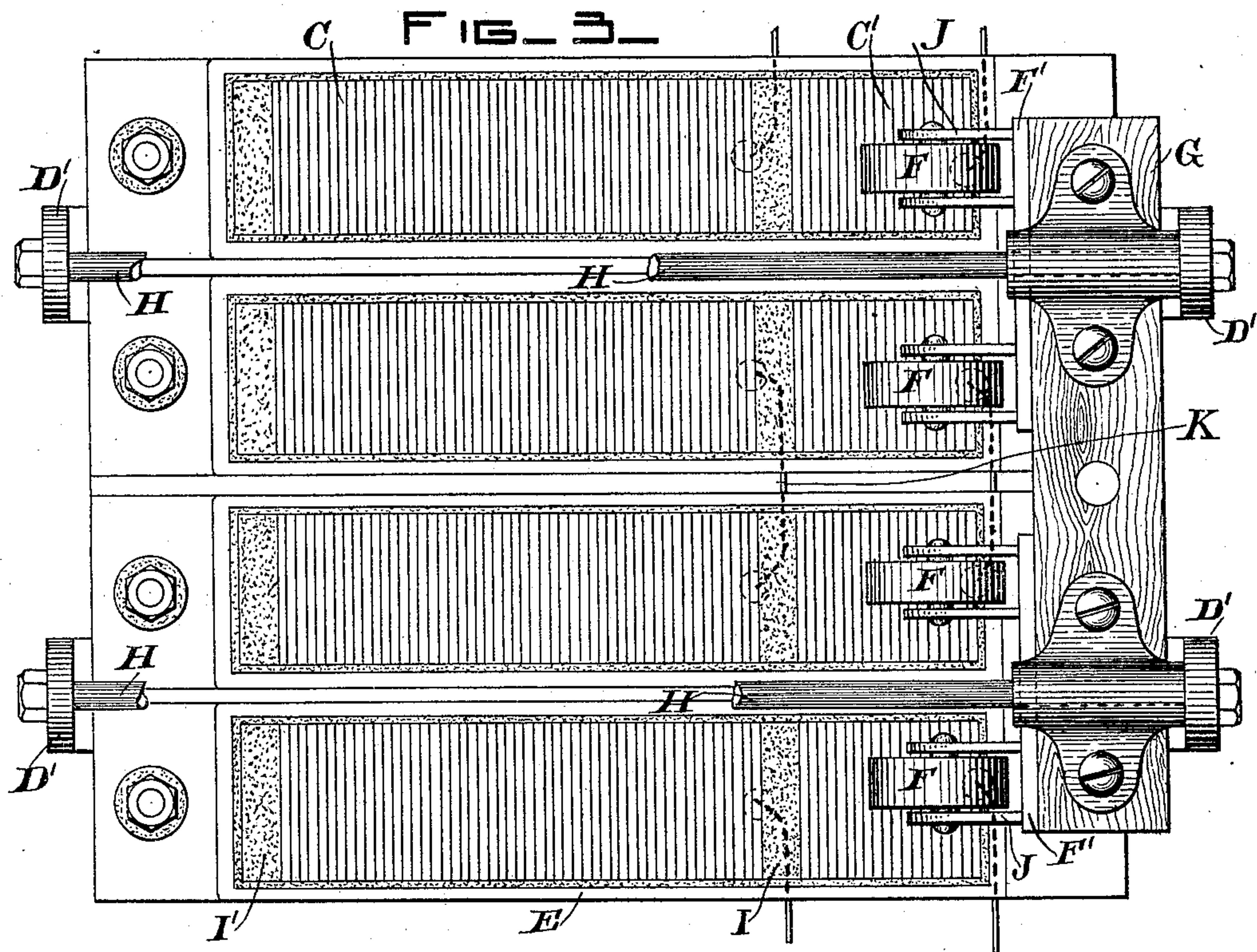
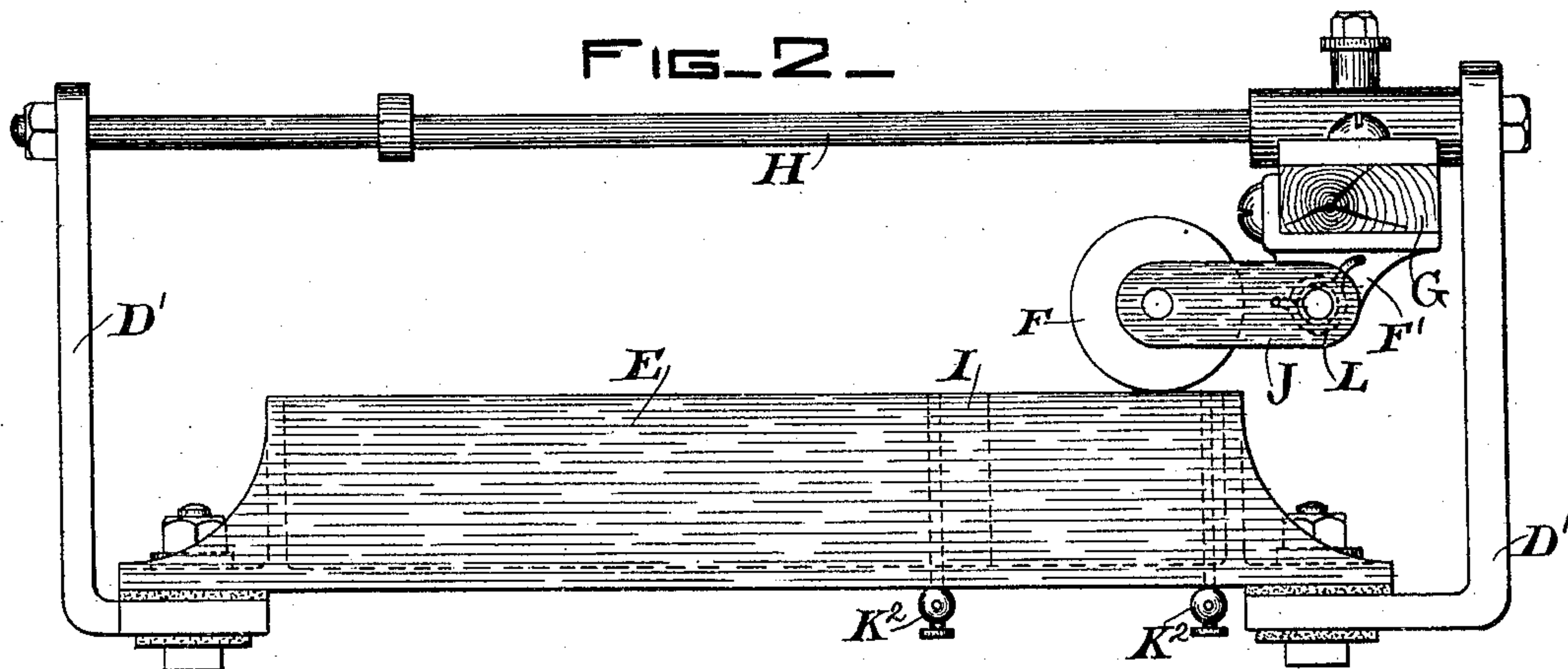
(No Model.)

2 Sheets—Sheet 2.

F. O. BLACKWELL.
RHEOSTAT.

No. 467,078.

Patented Jan. 12, 1892.



WITNESSES:

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INVENTOR:

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UNITED STATES PATENT OFFICE.

FRANCIS O. BLACKWELL, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO THE THOMSON-HOUSTON ELECTRIC COMPANY, OF CONNECTICUT.

RHEOSTAT.

SPECIFICATION forming part of Letters Patent No. 467,078, dated January 12, 1892.

Original application filed June 5, 1889, Serial No. 313,180. Divided and this application filed January 12, 1891. Serial No. 377,539.
(No model.)

To all whom it may concern:

Be it known that I, FRANCIS O. BLACKWELL, a citizen of the United States, residing at Boston, county of Suffolk, and State of Massachusetts, have invented a certain new and useful Improvement in Resistances for the Regulation of Electric Motors, of which the following is a specification, this application being a division of my application for electric-motor regulation, Serial No. 313,180, filed June 5, 1889.

My invention relates to a resistance-box and resistance for the regulation of electric motors, and particularly those which are used for propelling cars upon an electric railway. It belongs to that class of resistances which consists of a series of metal plates set edgewise and cut into and out of circuit by a traveling contact.

The specific points of novelty are hereinafter pointed out in the claims, and for an understanding of them reference is made to the accompanying drawings, wherein—

Figure 1 is a diagram of a motor and resistance connections. Fig. 2 is a side view of the resistance-box and traveling contact. Fig. 3 is a plan view of the same. Fig. 4 is a detail sectional view of the box holding the resistance plates and box, and Figs. 5 and 6 are views showing a convenient form of mechanism for throwing the resistance into and out of circuit when the same is used on an electric car.

The improvements forming the subject of this application have been already illustrated and described in connection with certain other improvements in motor-regulation in my application, Serial No. 313,180, filed June 5, 1889. As therein pointed out, it has been found that when cutting out field-magnet coils an extra current is induced which tends to injure the insulation. To avoid this I provide a resistance which can be cut into and out of the main line to vary the resistance of the motor-circuit as a whole, and a secondary resistance through which the field-magnet coils may be gradually cut out. This is illustrated in Fig. 1, in which—

A represents a motor having the two limbs of the field-magnet coils in series with the ar-

mature, but in multiple arc with one another. C is a resistance adapted to be inserted in series with the motor by means of the lever D. As the lever D is moved from the full to the dotted line position it varies the resistance of the motor-circuit as a whole. On reaching the dotted-line position the resistance is cut out, and the further movement of the lever cuts out a section of the field-magnets through the secondary resistance C'. The secondary resistance allows the gradual cutting out of the field, and the extra current tending to injure the insulation is thereby avoided.

The specific construction of the rheostat is shown in Figs. 2, 3, and 4. As illustrated, it comprises main and secondary resistances corresponding to the two portions C C' in the diagram Fig. 1.

Other features of construction are well adapted for the regulation of motors generally, and in claiming them I should not be understood as limiting myself to a particular system of regulation only, such as seen in the diagram.

The resistance preferably consists of thin iron plates set edgewise in a box in superficial contact and provided with contact-rollers adapted to pass over the plates; but instead of making one large long pile of the plates I arrange them in separate series or rows, each contained in an independent box E, complete in itself and insulated from the supporting-frame D'. The plates are insulated from the box by means of fire-proof insulation, such as mica or asbestos. The boxes E and rows of plates are placed side by side, arranged in pairs, and a series of contact-rollers are adapted to travel over them. These contact-rollers F are fastened in pairs to an insulating-traveler G, which is adapted to move over the boxes on guides H, the rollers of each pair being electrically connected through a metal bracket F', from which they are hung, or other suitable means. The rows of plates then being considered as arranged in pairs, the individual rows of each pair are connected electrically by rollers F and the pairs themselves in series by a wire or wires K. It will thus be seen that as the piece G with the rollers attached moves over the boxes of plates

more or less of the plates will be brought into series and the resistance of the circuit thereby controlled. At one point in the series of resistance-plates blocks of insulating material
 5 I will be inserted. These blocks will be similar to the end blocks I', which are made of slate or similar non-combustible material, so that the circuit may be interrupted upon them without damage.

10 As will be seen in Fig. 4, the box E is open completely at its upper surface to permit the rollers to pass over the edges of the plates and has a similar narrower opening at the bottom. This allows a circulation of air with-
 15 out interruption from the contact device, while at the same time it affords a corner or ledge S' for holding the plates. The electrical connections with the plates are preferably made from the bottom, as seen in Fig. 2, where the
 20 binding-posts K² are attached to certain plates of the series and extend outward through the opening in the bottom of the box. The contact device therefor does not interfere with the flexible connections which lead from the
 25 binding-posts to the motors upon the truck and other parts of the vehicle. The electrical connections with the plates of the resistance correspond with the diagram in Fig. 1. The main resistance C of the diagram corresponds
 30 to the larger box of plates. The resistance C' is represented by the smaller portion of the plates, and the contact-rollers attached to the traveling bridge G is the same in function as lever D. The rollers will first cut out the
 35 whole of the main resistance, and then by their further movement will cut out a part of the field-magnet coils through a resistance offered by the plates at the right-hand end of the box. As seen in Fig. 2, the rollers are
 40 journaled on the end of short pivoted arms J, held down in contact with the surface of the plates by a spring L. The arm J is attached to the under side of the bridge G. By this arrangement there is no tendency of the
 45 guide to bind by reason of the pressure of the springs downward upon the plates, no matter which direction it may be moving.

When the resistance is used in electric-railway service, it will be preferably placed upon
 50 the car-body, and a convenient form of mechanism for moving the bridge G back and forth over the boxes is seen in Figs. 5 and 6. A

lever S, pivoted at s, is connected at one end of the bridge by a pin and slot. To its other end is pivoted a link T, which is itself piv- 55
 oted to the lower end of a lever U, journaled to the front end of the car-platform and thrown transversely to one side or another to control the resistance, as desired.

What I claim as new, and desire to secure 60
 by Letters Patent, is—

1. The combination, with a resistance composed of a series of metallic plates in contact with one another, of a contact passing over said plates, consisting of a roller journaled on 65
 an arm which is movable on a center eccentric to the roller.

2. An artificial resistance composed of separate rows or series of plates in contact arranged in pairs and a contact-maker which 70
 connects electrically the rows of each pair while the pairs themselves are permanently connected in series, as described.

3. The combination, with an electric motor having a sectional field and an electrical resistance consisting of a number of plates in 75
 contact with one another, of a supplementary resistance in circuit between the terminals of different sections of the field and a common controlling device for both the main and sup- 80
 plementary resistances.

4. The combination, with an electrical resistance consisting of a number of plates in contact with one another, of a controlling device adapted to move over the surface of the 85
 plates and bring more or less of them into circuit, and a terminal piece in line with said plates, consisting of slate or other non-combustible insulation adapted to form the terminal of the series and receive the final contact. 90

5. The combination, in an artificial resistance, of a series of plates in contact with one another, a casing therefor of insulating non-combustible material open at the bottom, but having a ledge or ledges for supporting the 95
 plates and a contact device passing over the upper surface of the plates.

In testimony whereof I have hereto set my hand this 8th day of January, 1891.

FRANCIS O. BLACKWELL.

Witnesses:

E. L. RAWSON,
 G. R. BLODGETT.