

(No Model.)

2 Sheets—Sheet 1.

S. H. SHORT.

RHEOSTAT FOR ELECTRIC MOTOR CARS.

No. 459,794.

Patented Sept. 22, 1891.

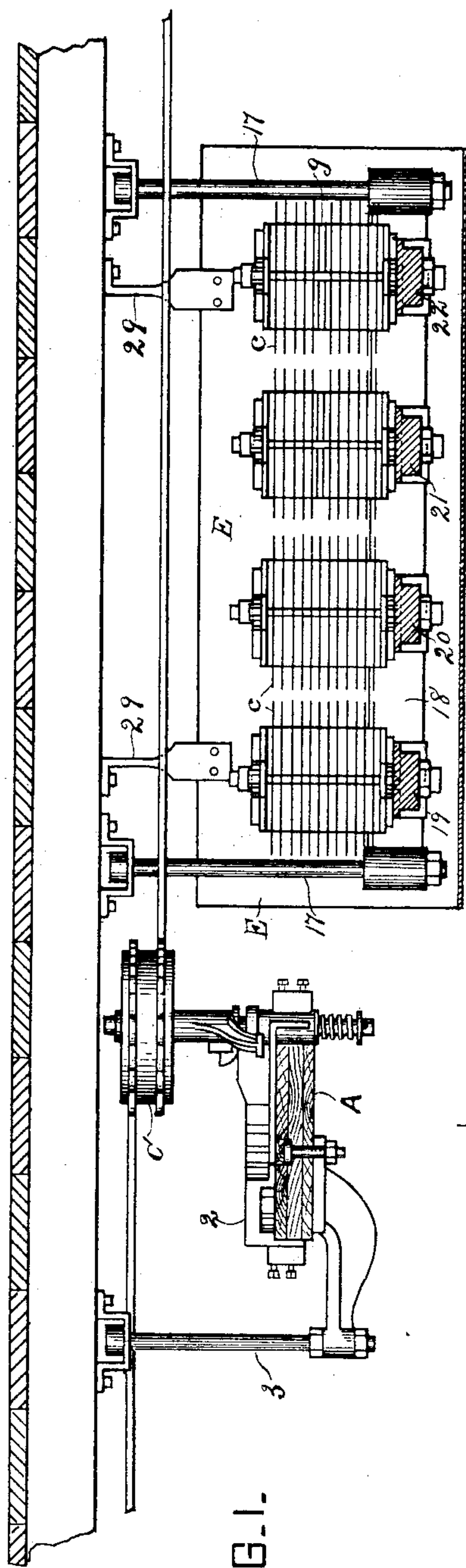


FIG. I.

Witnesses

R. Q. Auld.  
G. F. Downing.

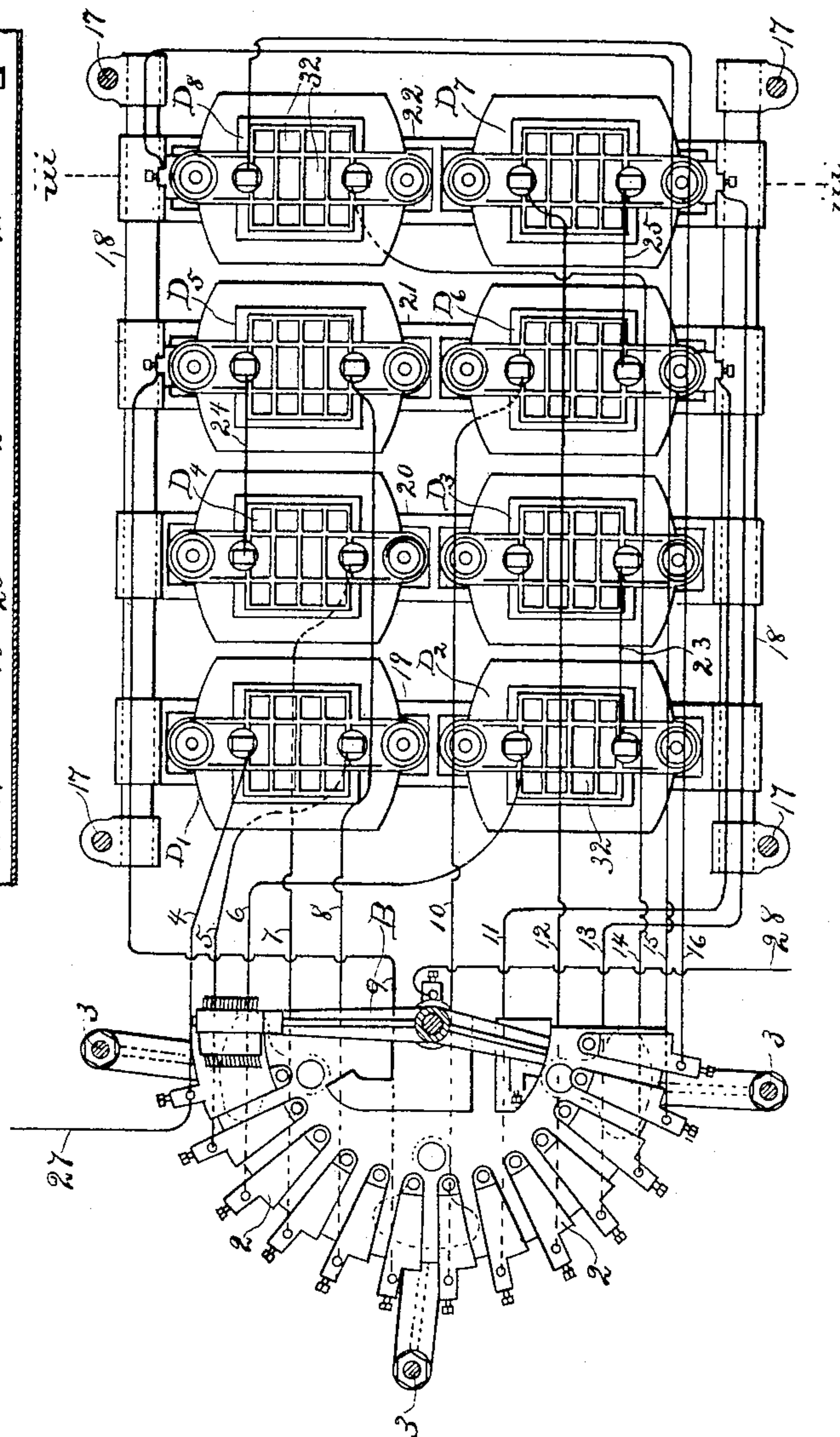


FIG. II.

Inventor

Sidney H. Short

By H. A. Seymour

Atty:

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FIG. III.

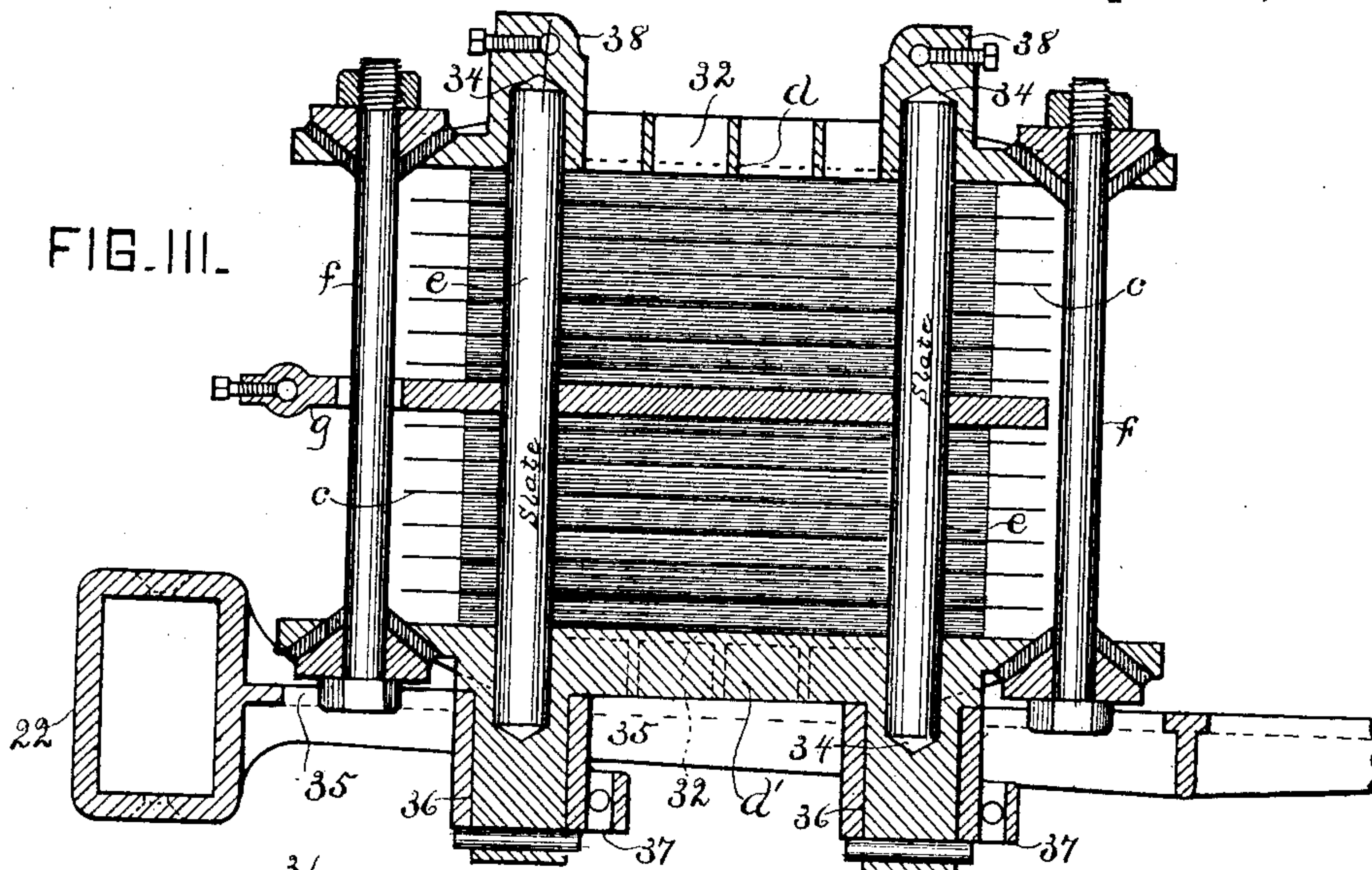


FIG. V.

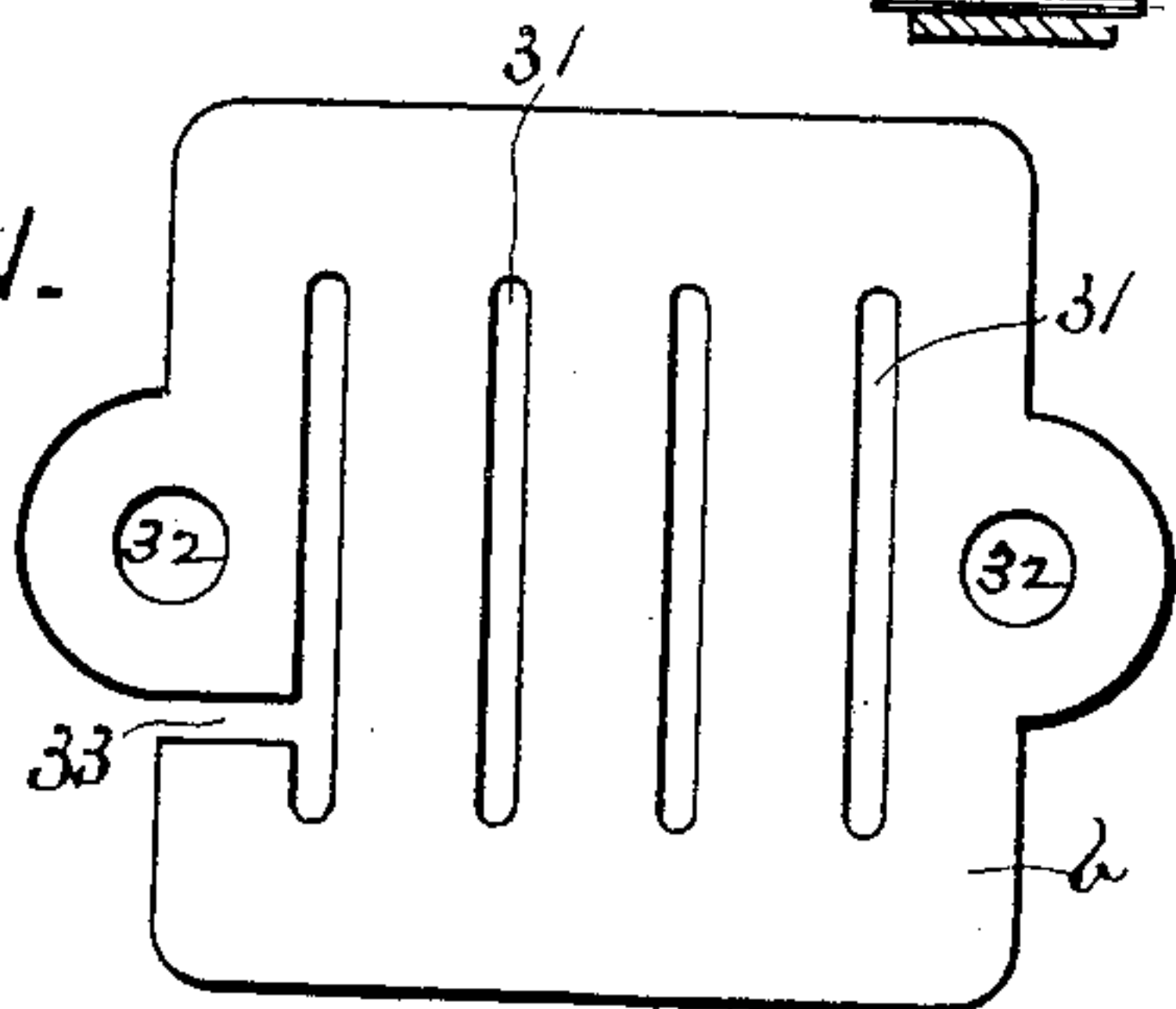


FIG. IV.

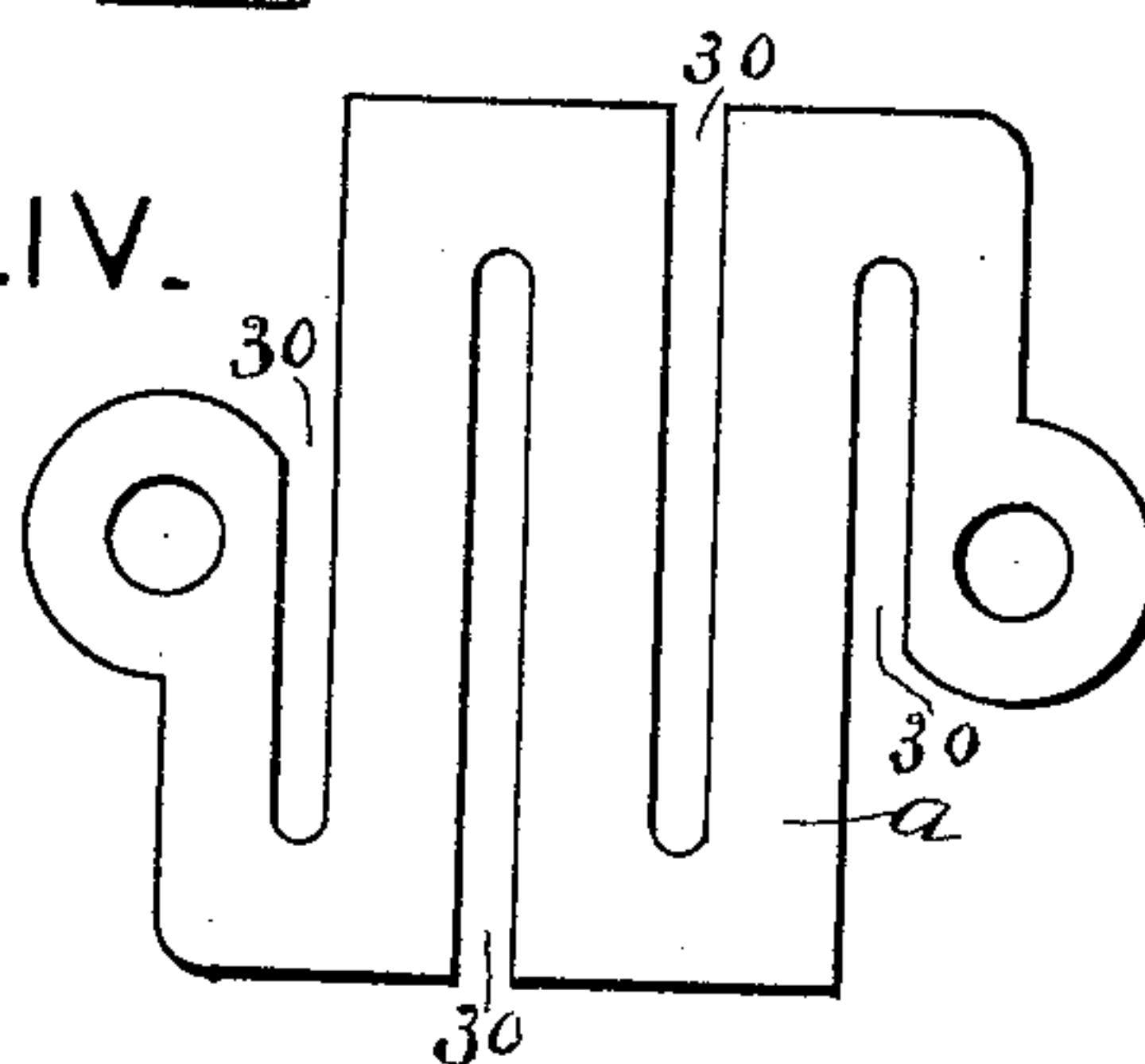


FIG. VI.

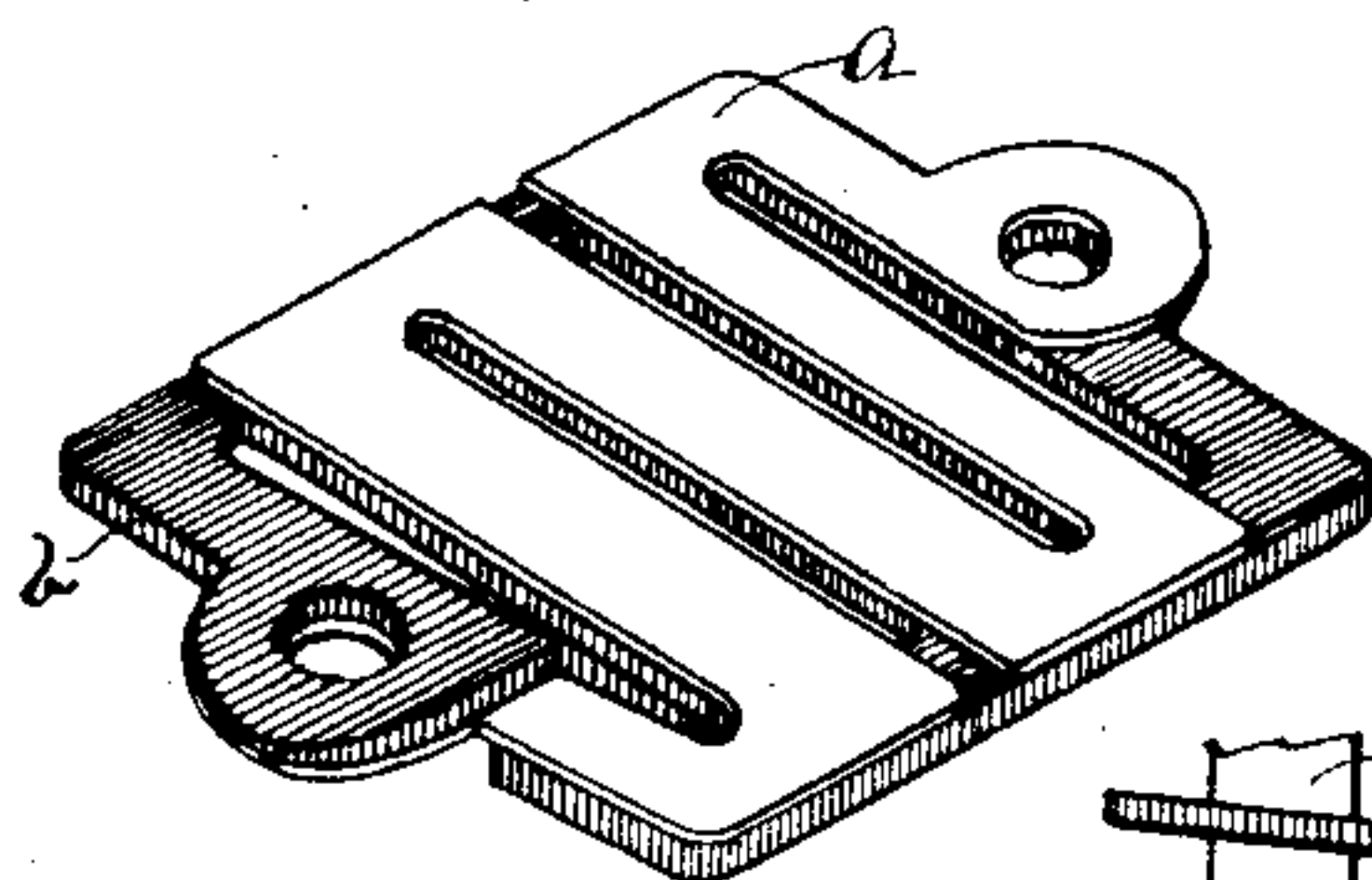


FIG. VII.

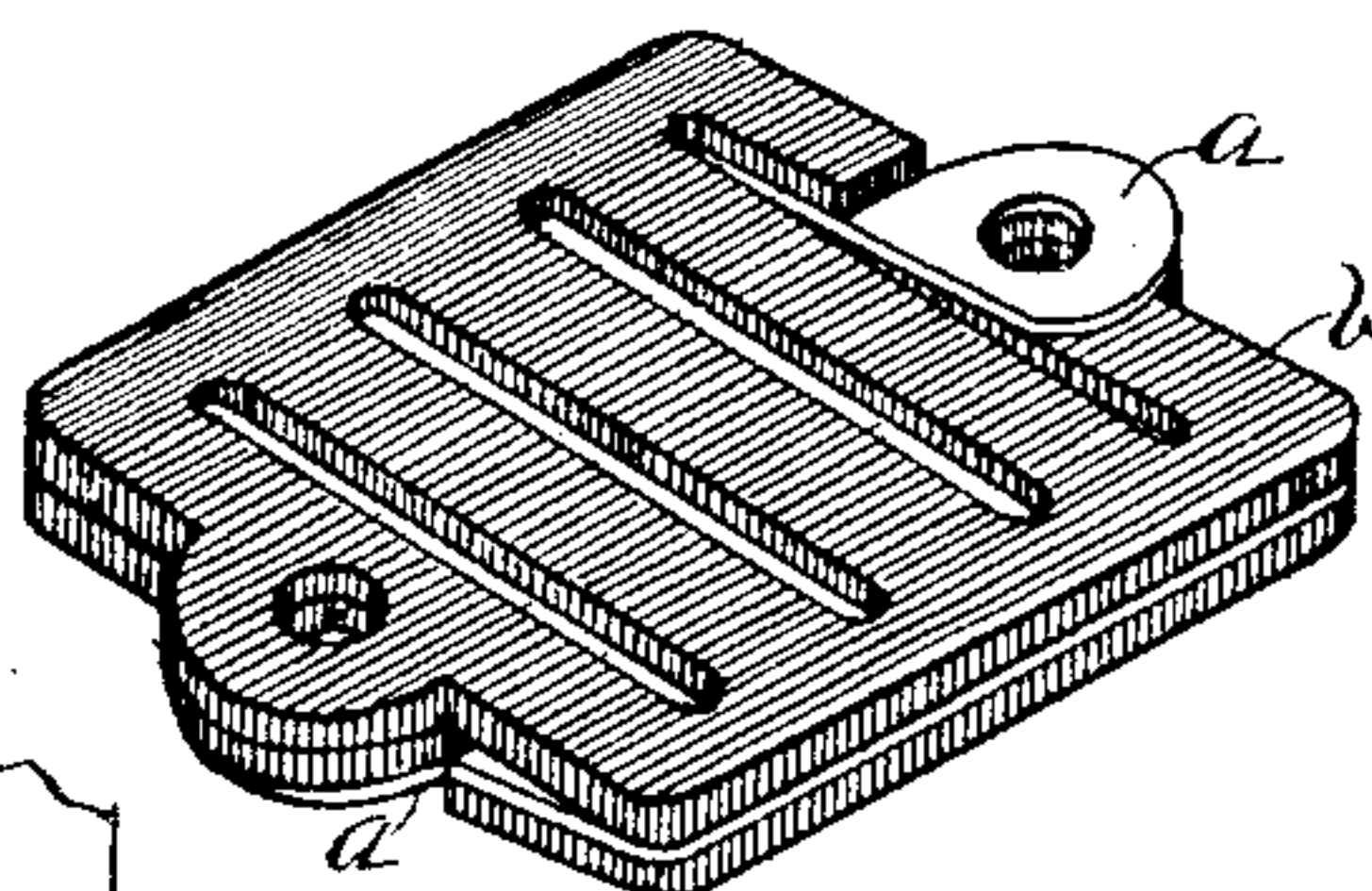
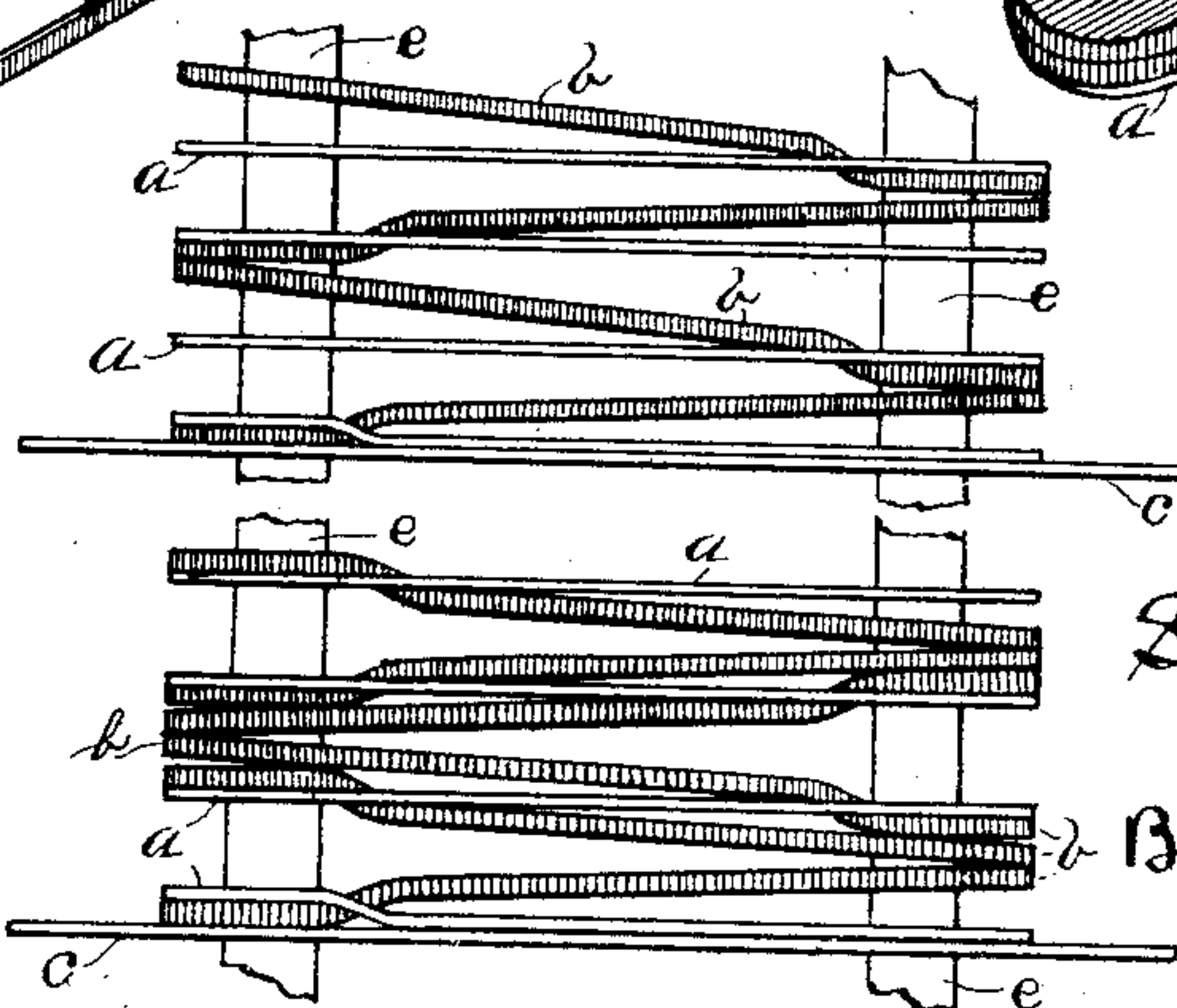


FIG. VIII.



Witnesses

R. E. Aubd.  
G. F. Downing.

Inventor.

Sidney H. Short

By H. A. Seymour  
Atty.



# UNITED STATES PATENT OFFICE.

SIDNEY H. SHORT, OF CLEVELAND, OHIO.

## RHEOSTAT FOR ELECTRIC-MOTOR CARS.

SPECIFICATION forming part of Letters Patent No. 459,794, dated September 22, 1891.

Application filed March 17, 1891. Serial No. 385,392. (No model.)

*To all whom it may concern:*

Be it known that I, SIDNEY H. SHORT, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and  
5 useful Improvements in Adjustable Rheostats for Electric-Motor Cars; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it ap-  
10 pertains to make and use the same.

This invention relates more particularly to the adjustable rheostats or rheostatic-current regulators used on electrically-propelled cars or vehicles; but each of the improvements  
15 constituting said invention is included for all the uses to which it may be adapted.

Heretofore in motor-car rheostats it has been customary to have the contact-board in immediate connection with the resistances.  
20 This is objectionable because the sparking on the contact-board tends to heat the resistances, and also because the compactness of the apparatus tends to prevent free access of air. In accordance with the present inven-  
25 tion the contact-board is separated from the resistances with which it is in electrical communication by suitable conductors, and the resistances or the contact-board, or both, are exposed to the air outside of the car-body,  
30 preferably under the same. Further, to increase the cooling effect a number of separate resistances are used, and also a flue arranged in the direction of the car's motion, in which or in the line of which one or more resist-  
35 ances are placed. With the arrangement of the rheostat outside of the car, whether an air duct or flue is used or not, the motion of the car produces an air-current over the ex-  
40 posed resistances of the rheostat, whereby the same is constantly cooled, not merely by radiation, but by actual convection of heat. The same effect is also produced upon the switch-board, which is similarly placed, and by reason of the separation of the rheostat  
45 from the switch-board both are prevented from heating each other and both are cooled separately and effectively.

The invention also comprises a special form of resistance comprising one or more of the  
50 following features: First, it is composed of an assemblage of plates (preferably resistance-plates of iron with insulating-plates in-

terposed) with openings through the same, so placed as to register with one another and form air-spaces through the resistance; sec-  
55 ond, heat-conducting plates (preferably of a metal which is a good conductor of heat, like copper) are placed between the resistance-plates, beyond which they project; third, pencils of slate (or other suitable non-conducting  
60 material) are inserted through holes in the plates which are clamped by bolts between end plates.

The invention also comprises the particular constructions, combinations, and arrange-  
65 ments of parts, as hereinafter set forth.

In the accompanying drawings, which form part of this specification, Figure I is a partial view in longitudinal section of a car provided with an adjustable rheostat in ac-  
70 cordance with the invention. Fig. II is a plan of said rheostat. Fig. III is a vertical section on line *iii* of Fig. II of one of the resistances on a larger scale. Figs. IV and V are plans of one of the resistance-plates and  
75 of one the insulating-plates, respectively; and Figs. VI, VII, and VIII are views showing in detail the manner of assembling the plates of a resistance.

The contact-board consists of a non-con-  
80 ducting base A, a series of contacts 2, a switching-arm B, which travels over said contacts, and means of operating said switching-arm in the form of a sprocket-wheel C, fast on the shaft of said arm. The contact-board is sup-  
85 ported by the hanger-rods 3 from the under side of the car and is separate from the resistances. It is exposed to the air, so that the contacts will be kept cool.

The resistances D' to D<sup>s</sup>, inclusive, are sepa-  
90 rated from the contact-board and are in electrical communication with the contacts 2 through the conductors 4 to 16, inclusive. They are exposed to the air under the car-body. As shown, they are each composed of  
95 an assemblage of plates, as hereinafter more particularly described, and four of them are double. They are suspended under the car-body by means of the hanger-rods 17, which uphold the wooden side bars 18, the metallic  
100 cross-bars 19 to 22, inclusive, and the resistances arranged by twos on said cross-bars.

The resistances are connected with each other in series in the following manner: The



resistances  $D^1$  and  $D^2$  rest upon and are electrically connected at the bottom by the cross-bar 19. The resistances  $D^2$  and  $D^3$  are electrically connected at the top by the wire 23.

5 The resistances  $D^3$  and  $D^4$  are electrically connected at the bottom by the cross-bar 20, on which they rest. The resistances  $D^4$  and  $D^5$  are electrically connected at the top by the wire 24. The resistances  $D^5$  and  $D^6$  are electrically connected at the bottom by the cross-bar 21, on which they rest. The resistances  $D^6$  and  $D^7$  are electrically connected at the top by the wire 25. The resistances  $D^7$  and  $D^8$  are electrically connected at the bottom by the cross-bar 22, on which they rest. The conductor 4 from the first of the contacts 2 runs to the top of the resistance  $D^1$ , the conductor 5 from the second contact to the cross-bar 19, the conductor 6 to the top of resistance  $D^2$ , the conductor 7 to cross-bar 20, the conductor 8 to the top of resistance  $D^3$ , the conductor 9 to the middle of resistance  $D^3$ , the conductor 10 to the cross-bar 21, the conductor 11 to the middle of resistance  $D^4$ , the conductor 12 to the top of resistance  $D^5$ , the conductor 13 to the middle of resistance  $D^5$ , the conductor 14 to cross-bar 22, the conductor 15 to the middle of the resistance  $D^6$ , and the conductor 16 to the top of the resistance  $D^8$ . By turning the switch-arm B, therefore, more or less of the resistances are included in the circuit between the conductor 27, which connects with the first of the contacts 2, and the conductor 28, which connects with the switching-arm B. To make a strong draft over the resistances and at the same time to protect the resistances from dirt, they are inclosed in a flue E, composed of a sheet-metal trough fastened to the bottom of the car by the hangers 29 and open at both ends.

40 The general arrangement just described or one or more of the features of such arrangement which are claimed herein as being within the invention which it is desired to secure by Letters Patent may be used with resistances of various forms or constructions. It is specially designed, however, to use resistances composed of an assemblage of plates with perforations through the same for permitting an interior circulation of air, and also with heat-conducting plates projecting beyond to assist in conducting away the heat from the interior of the resistance to the air which flows over the projecting margins of the heat-conducting plates. As shown, each resistance is composed of the resistance-plates  $a$ , of, say, wrought-iron, the insulating-plates  $b$ , of, say, mica or asbestos, the heat-conducting plates  $c$ , of, say, copper, the clamping-plates  $d$   $d'$ , of, say, bronze, the non-conducting pencils  $e$ , of, say, slate, and the clamping-bolts  $f$ , of, say, wrought-iron or steel. The resistances  $D^6$  and  $D^7$  also have electrode-plates  $g$ . All the plates, including the heads  $d$   $d'$ , are slotted or perforated. The resistance-plates  $a$  have slots 30, which extend alternately from opposite edges, so as to form

each plate into a sort of coil. The insulating-plates, the heat-conducting plates, and the electrode-plates each have slots or perforations 31, and the heads are made with perforations 32. When the plates are assembled, these slots or perforations register with each other and form air-passages. The insulating-plates are slit at 33, so that the adjacent perforated end can be slipped over the perforated end of a resistance-plate, as shown in Figs. VI and VII, the remaining portion of the insulating-plate lying on the opposite side of the resistance-plate. One or more insulating-plates may be thus arranged relatively to each resistance-plate, or two or more plates can be arranged as shown in Fig. VII.

In assembling the plates they are strung on the pencils  $e$ , and the resistance-plates are so turned that they are in contact with each other alternately at opposite ends, as shown in Fig. VIII. In the upper part of this figure the insulating-plates are arranged according to Fig. VI and in the lower part according to Fig. VII. At suitable intervals the heat-conducting plates  $c$  are interposed, and one or more electrode-plates  $g$  may also be introduced. The heads  $d$   $d'$  are larger than the intermediate plates, and are clamped together by the insulated bolts  $f$ , which are out of contact with the intermediate plates. The heads are provided with sockets 34, which receive the ends of the pencils  $e$ . The cross-bars 19 to 22 are provided with perforations 35, and also with holes 36, to receive the sockets on the bottom of the heads  $d'$  and binding-posts 37 for the conductors from the contact-board. The heads  $d$  each have binding-posts 38.

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

1. The combination, with an electric-motor car and an exposed rheostat located outside of the car in an open flue or air-duct running lengthwise the car-body, of a switch-board also located outside of the car and separated from the rheostat, electric connections between the rheostat and switch-board, and operating mechanism for the latter within convenient reach of the motor-man, substantially as described.

2. The combination, with an electric-motor car and an exposed rheostat located under the car-body in an open flue running lengthwise of the said car-body, of a switch-board also located under the car-body and separated from the rheostat, electric connections between the rheostat and switch-board, and operating mechanism for the latter within convenient reach of the motor-man, substantially as described.

3. A rheostatic element composed of a series of plates with laminae of insulating material between them, said plates and insulating laminae having openings through the same, forming interior air-spaces, substantially as described.

4. A resistance comprising an assemblage



of plates strung on non-conducting pencils and clamped between heads or end plates, substantially as described.

5 5. A rheostatic element comprising clamping-heads, clamping-bolts for the same, non-conducting pencils between said heads, and resistance-plates and insulating-plates strung on the pencils and clamped between the heads, substantially as described.

10 6. A rheostatic element comprising clamping-heads, clamping-bolts for the same, resistance-plates and insulating-plates alternating with the same, and heat-conducting plates, all clamped between the said heads, substantially as described.

15 7. A rheostatic element comprising in combination socketed heads, non-conducting pencils fitted in said sockets, and resistance-plates strung on said pencils, substantially as described.

20 8. The resistances comprising each an as-

semblage of resistance - plates, insulating-plates, and heat-conducting plates, in combination with means to support the same under the car-body, so as to be exposed to the air, 25 and a separate contact-board, substantially as described.

9. A rheostatic element comprising the slotted resistance-plates, the perforated or slotted insulating-plates between the resistance-plates, the perforated or slotted heat-conducting plates introduced at intervals between the resistance - plates, and the perforated heads for binding or clamping the plates together, substantially as described. 30

In testimony whereof I have signed this specification in the presence of two subscribing witnesses. 35

SIDNEY H. SHORT.

Witnesses:

E. H. MORRISON,

A. B. CALHOUN.