

(No Model.)

2 Sheets—Sheet 1.

S. H. SHORT.  
ADJUSTABLE RHEOSTAT.

No. 448,682.

Patented Mar. 24, 1891.

FIG. II.

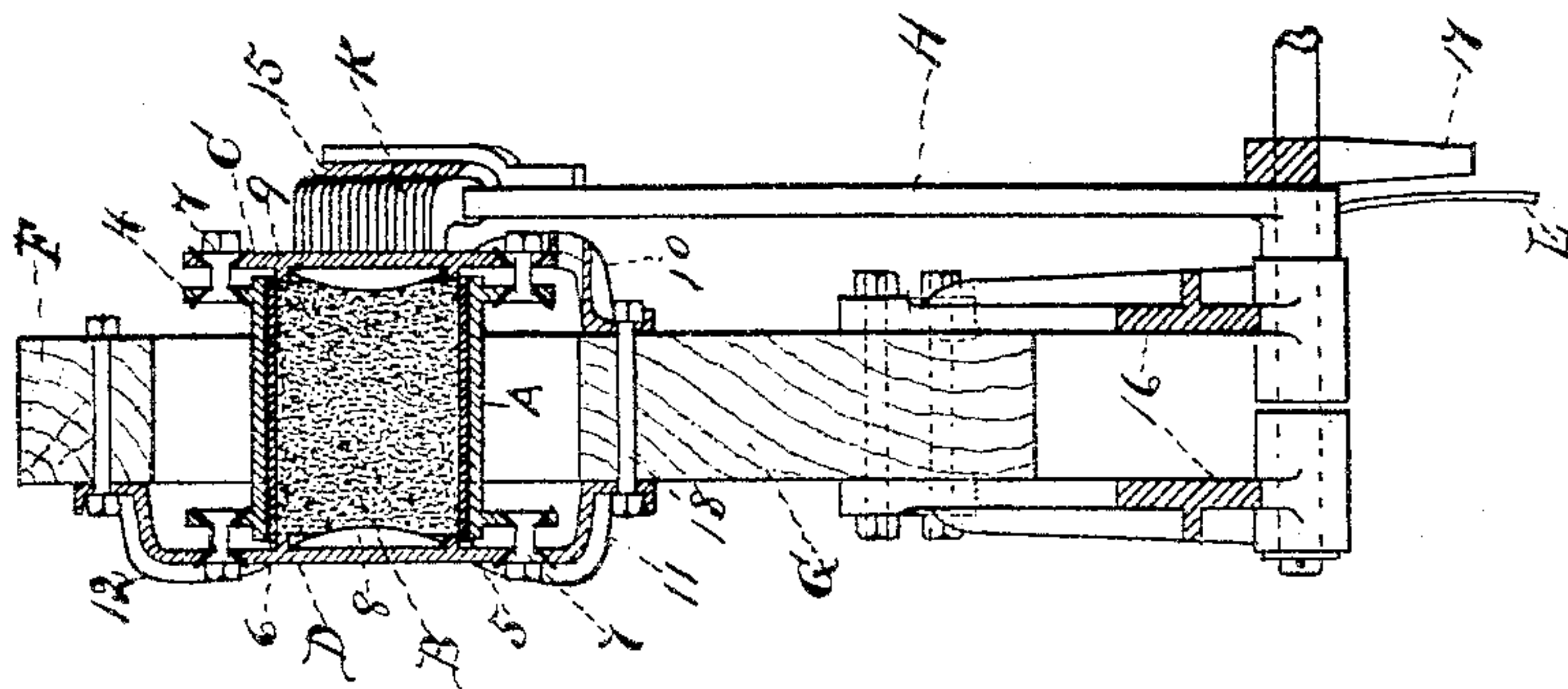
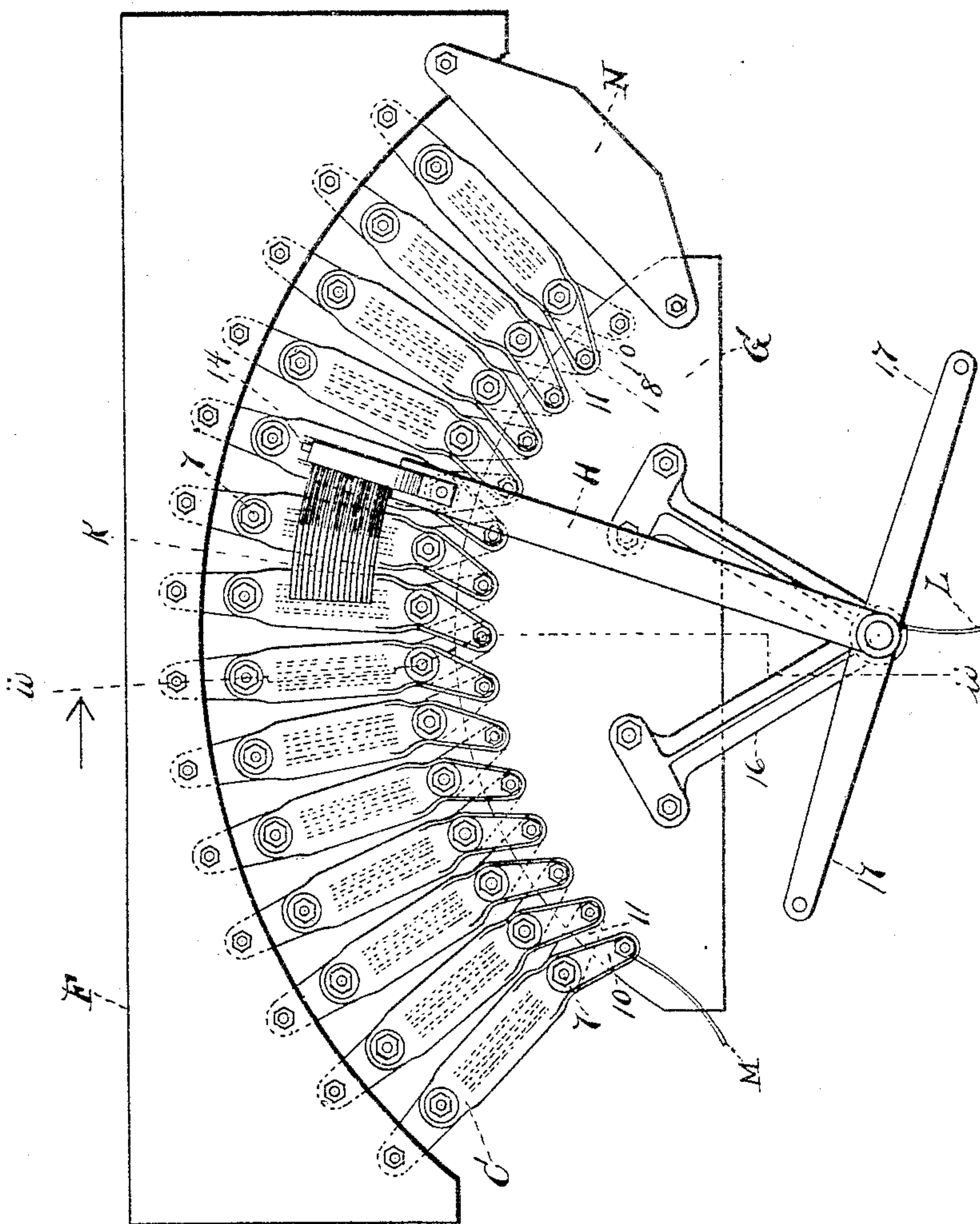


FIG. I.



Witnesses

R. E. Auld.  
G. F. Downing

Inventor

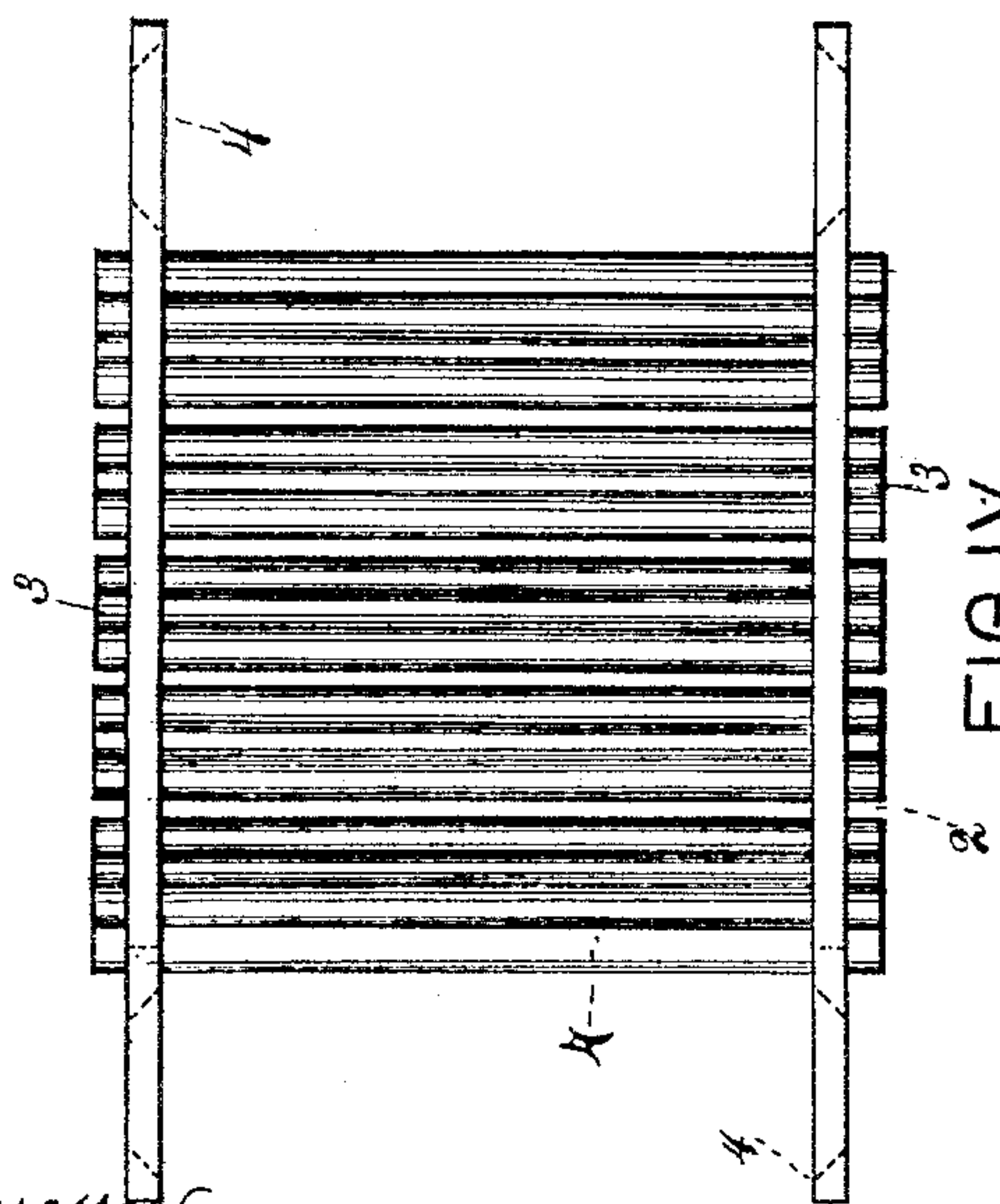
Sidney H. Short.  
By his attorney  
H. A. Simpson

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FIG. III.



Witnesses

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FIG. IV.

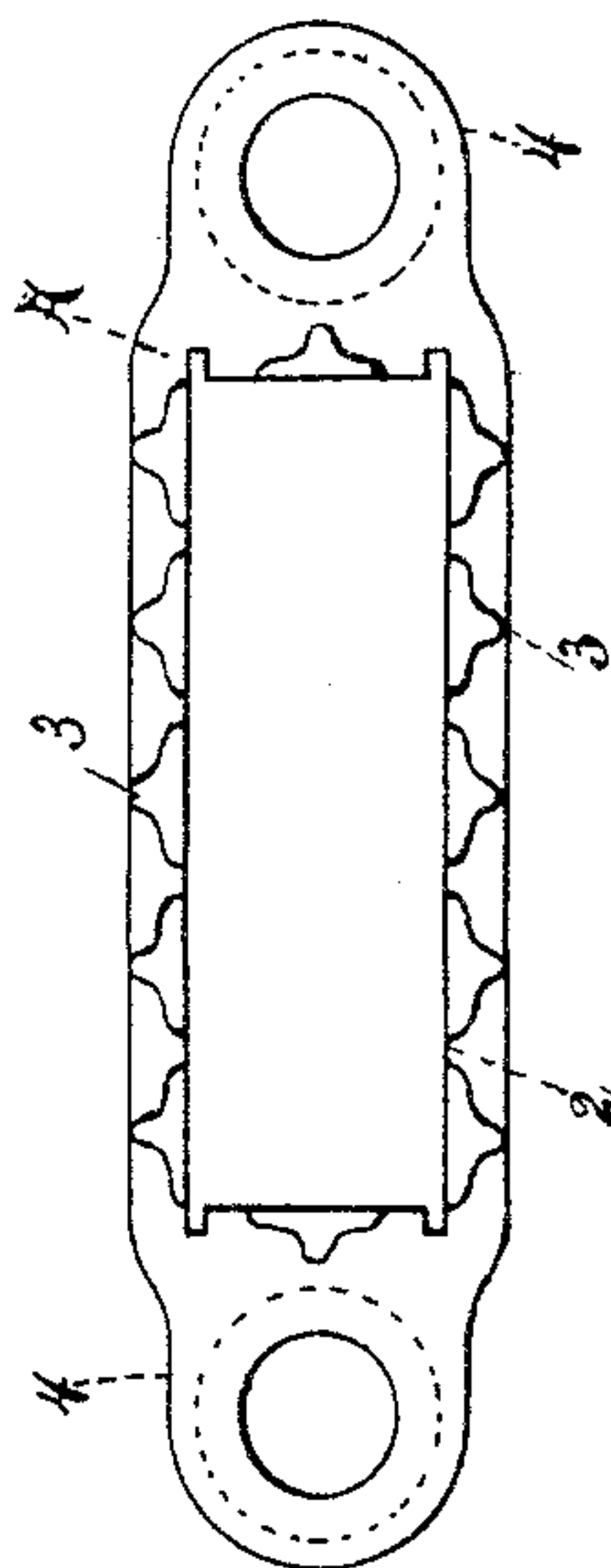


FIG. VII.

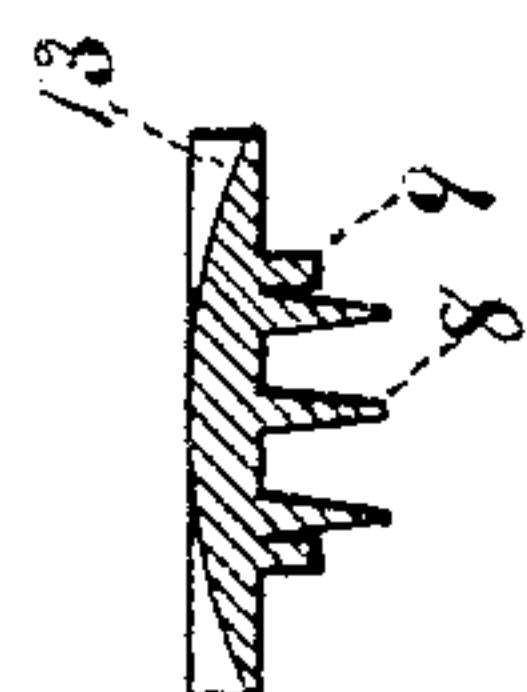


FIG. V.

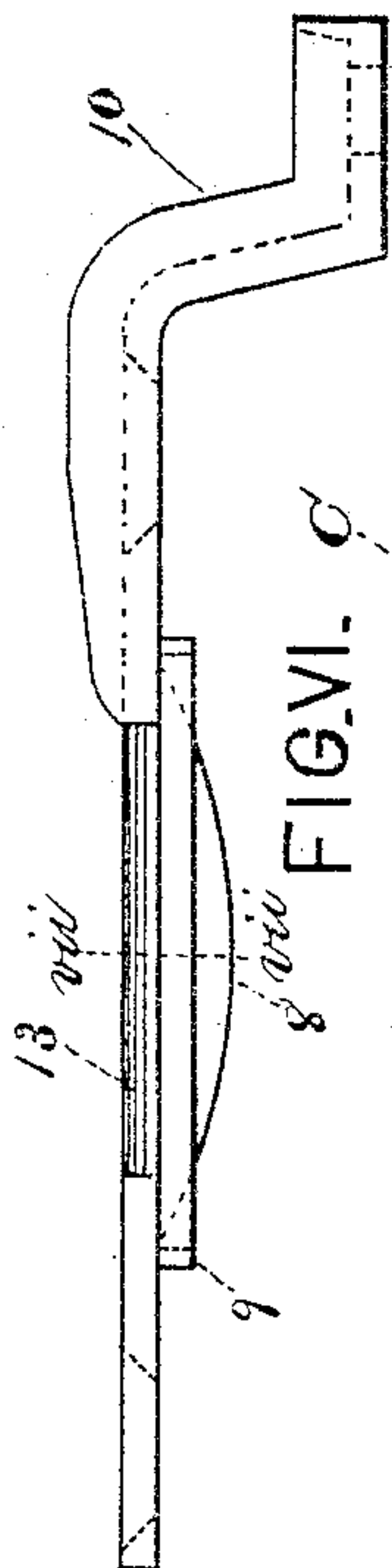


FIG. VI.

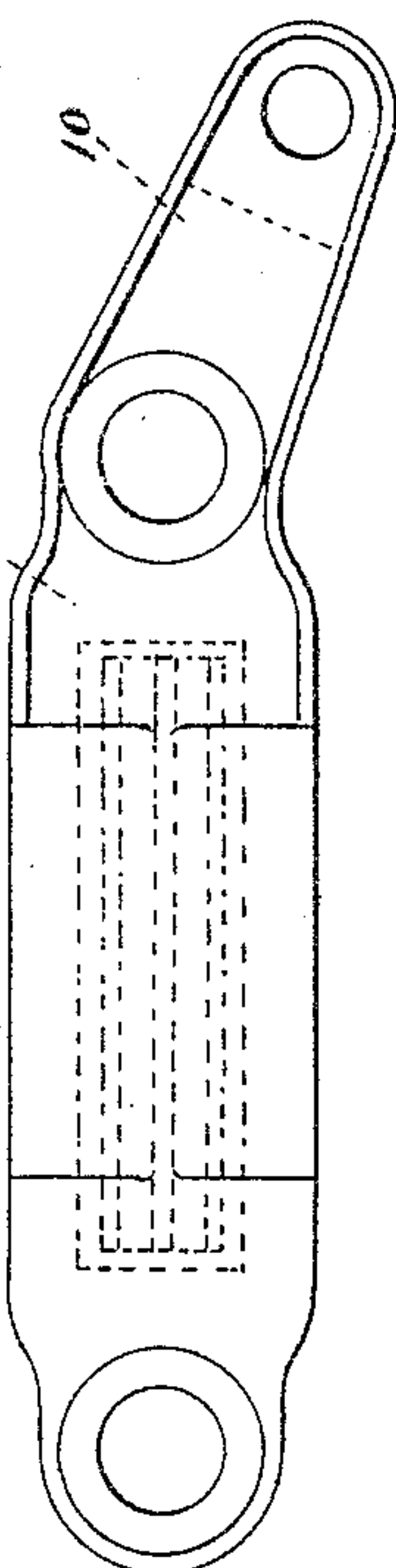


FIG. VIII.

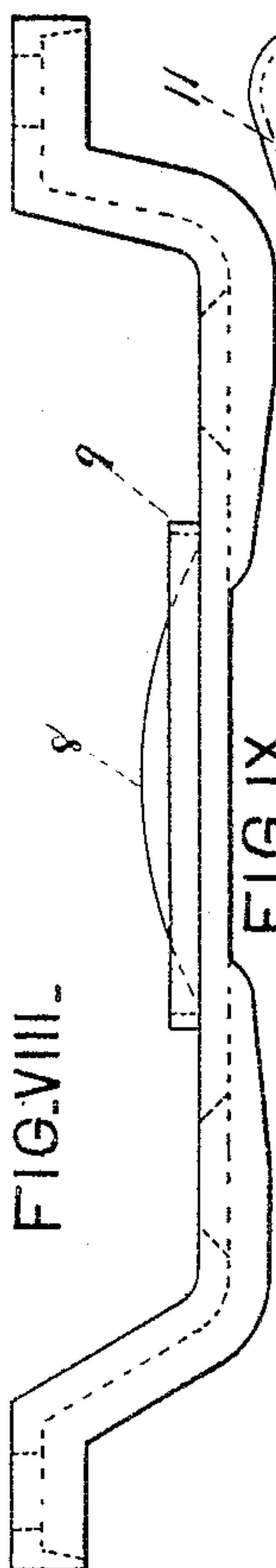
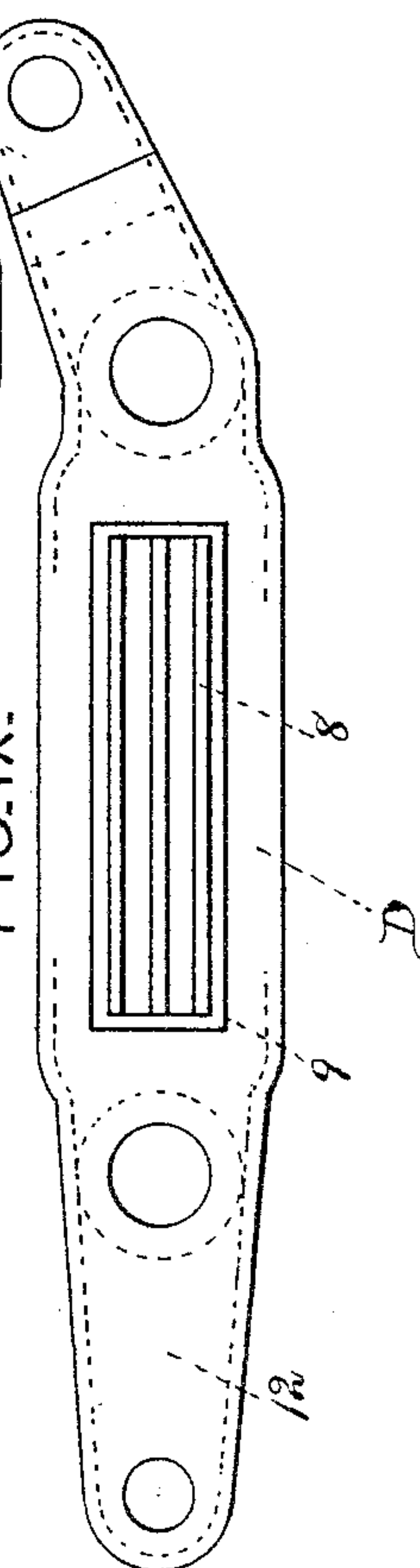


FIG. IX.



Inventor

Samuel H. Short.  
By A. S. Symmes.  
Att'y.



# UNITED STATES PATENT OFFICE.

SIDNEY H. SHORT, OF CLEVELAND, OHIO, ASSIGNOR TO THE SHORT ELECTRIC RAILWAY COMPANY, OF SAME PLACE.

## ADJUSTABLE RHEOSTAT.

SPECIFICATION forming part of Letters Patent No. 448,682, dated March 24, 1891.

Application filed November 15, 1890. Serial No. 371,507. (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; 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 appertains to make and use  
10 the same.

This invention relates more particularly to an adjustable rheostat for the motor-cars of electric railways, but is not restricted to such rheostats.

15 It consists in a number of insulating-receptacles filled between electrodes or conducting end plates with subdivided conducting or semi-conducting material—like carbon-powder, for example—and provided with contacts, in combination with connections for  
20 electrically connecting the contacts of said receptacles in series with one another and a traveling contact which moves over the afore-said contacts and breaks the contact with the  
25 plates as it connects progressively said receptacles in series in the circuit through the said traveling contact.

The invention also comprises certain improvements which are designed to be used in  
30 connection with each other in a rheostat having a switch-arm or contact traveling over a series of contact-plates, but which are included severally as well as collectively for use in any form of rheostat to which they or  
35 any of them may be adapted. They may be stated as follows:

First. The plate or electrode at one or at each end of a body of subdivided conducting material—such as carbon-powder, which constitutes the resistance proper—is provided  
40 with a number of conducting projections, which penetrate the said body of conducting material and serve to improve the electrical connection and to maintain it should the  
45 said conducting material settle. Preferably the end plate is of conducting material and is in contact with the subdivided conductor; but the invention extends generally to an end plate or electrode provided with a number of  
50 conducting projections. Preferably, also, the

projections are tapering or wedge-shaped, so as to penetrate the conducting material and pack better, and are of an elongated flat or fin-like form, so as to expose a comparatively large surface to the subdivided conductor. The invention extends to the use of  
55 one or more of such tapering or fin-like or tapering and fin-like projections.

Second. The insulating-receptacles are made with metal casings lined with insulating material, and these casings are ribbed or similarly formed externally, so as to increase the radiating and heat-conducting surface, and thus to keep down the temperature of the receptacle and its contents. The walls  
60 of the casing may be slotted or entire.

Third. The insulating-receptacle is made oblong (and preferably rectangular) in cross-section—that is, in section in a plane parallel with the end plates—thereby favoring the abstraction of heat by diminishing the comparative thickness of the receptacle.  
65

Fourth. One or both of the end plates for retaining the subdivided conducting material in the insulating-casing (of whatever description) are provided with a projection which fits said receptacle and bears upon the subdivided conducting material therein, as well as with one or more conducting projections which penetrate the said conducting material.  
70 Such end plate is secured by bolts to the casing.

Fifth. The end plates or electrodes at one end (or it may be at both ends) of one or more insulating-receptacles containing subdivided conducting material are provided thereon  
75 with contacts for the switching means, said contacts being preferably integral with the end plates or electrodes. Such contacts are included in the invention irrespective of their precise position on the end plates or electrodes as well as when placed in line with the subdivided conducting or resistance material. By arranging the resistance (or each of a number of resistances) between two plates or electrodes, one (or both) of which is provided  
80 with a contact for the switching means, a very compact instrument is obtained, particularly if the contact be on that part of the plate which is directly in line with the resistance. Compactness can be secured in this way with  
85 90 95 100



different resistances. This feature is included therefore in the invention with one or more resistances in general as well as with one or more resistances of subdivided conducting material.

Sixth. The contacts on the resistances for the switching means are preferably rounded, and the traveling contact for use therewith preferably consists of a number of plates flexibly mounted and arranged to bear edge-wise on the contacts over which they travel.

Seventh. The resistance or resistances are supported between side walls with free spaces around the resistances or their casings, which spaces are open at the ends, so as to allow a free circulation and a natural draft should the resistances become warm. So far as I am aware this arrangement of resistances between walls which form a sort of flue admitting of such draft is new, broadly, and is included in the invention with resistances in general as well as those composed of subdivided conducting material, the casings for the latter being of metal exteriorly ribbed or otherwise or of other material.

Eighth. The end plates or electrodes are provided with conducting extensions so disposed that those belonging to adjacent resistances overlap when they are arranged in series, and these overlapping extensions are bolted together, so that the bolts electrically connect the resistances in series. The extensions are preferably formed integral with the end plates or electrodes, but may be attached thereto in any suitable way.

Ninth. The end plates are made of about the same width as the insulating-receptacles and are provided with projections depthwise of the same, whereby they may be bolted to ears on the receptacles or to the outside support.

The invention further comprises certain additional constructions, combinations, and improvements, as hereinafter set forth.

In the accompanying drawings, which form part of this specification, Figure I is a plan of an adjustable rheostat constructed in accordance with the invention. Fig. II is a vertical section on line *ii* of Fig. I. Figs. III and IV are a side and an end view, respectively, of the casing for an insulating-receptacle. Figs. V, VI, and VII are respectively a side view, a plan, and a cross-section on line *vii* of an upper end plate; and Figs. VIII and IX are respectively a side view and a plan of a lower end plate.

The metal (cast-iron) casing A for each resistance B is made, as shown, with open ends and with sides having slots 2 therein and ribs 3 on their outsides. This casing is oblong in cross-section or plan, as seen in Fig. IV. Lugs 4 are provided on the narrow sides of the casing for fastening the end plates or electrodes C and D to the casing A. The casing A is lined with insulating material, (see Fig. II,) consisting of, say, an outer layer of mica 5 and an inner layer 6 of asbestns. The me-

tallic end plates or electrodes C and D are each secured to lugs 4 by bolts 7, with insulation under their heads and nuts, so that the end plates are insulated from the casing A. Each end plate is provided with projections 8 in the form, as shown, of wedge shaped fins curved on the bottom, and also with projections 9, which fit within the open end of the casing A. One of the end plates or electrodes having been secured in position on the casing, the latter is filled with the resistance B in the form of a body, Fig. II, of subdivided conducting material—say hard carbon or charcoal or other carbon in powder, or it may be other subdivided material of appropriate conductivity—and the other end plate is applied and bolted. The subdivided conducting material may be crowded into the insulating-receptacle constituted by the lined casing A and its end plates, if desired. The projections 9 bear upon the resistance material B, and the projections 8 by penetrating into the body of said material improve the electrical connection, and also serve to maintain it should the subdivided conductor or resistance material settle away from one of the end plates. By connecting the end plates C and D in circuit the said circuit will be completed through the resistance or subdivided conductor B. Inasmuch as this latter is insulated from the casing A, it is evident that one of the end plates need not be insulated therefrom, but may be made in one piece with the said casing. The slots 2 may be omitted, the casing being made solid or entire. It will be observed that as thus far described a resistance has been secured whose small width comparatively (due to the oblong form) and the ribbed exterior of whose metal casing favor the dissipation of the heat generated by the electric current. The receptacle for the resistance material or subdivided conductor B is made very simply, the plates which form the ends of the receptacle constituting also the electrodes to convey the current to the said material. An efficient and durable electrical connection is at the same time made between the end plates or electrodes C and D and the resistance material B.

The end plates C and D are provided with conducting bracket-extensions 10, 11, and 12, respectively, which are shown integral with the end plates or electrodes, and which are bolted to supporting-blocks F G of the non-conducting material—as wood, for example. The end plates with their extensions constitute brackets for upholding the resistance. Spaces are preferably left between the outside of the casing A and the walls of the said blocks F and G, so that the air may have free access to all sides of the casing, and the spaces, moreover, are preferably left in free communication with the outside atmosphere, so that the current may draw through.

When the casing A is placed vertically in the space between the blocks F G, as it is designed to arrange it, although it may be oth-



erwise placed and still be within the invention, the draft which would naturally take place will be lengthwise of the ribs 3 and assist in carrying off the heat from the casing.

5 To increase the compactness and simplicity of the apparatus, one of the end plates or electrodes is provided with or is made to serve as the contact for the switching means or at least as the supporting means for such  
10 contact, and it is moreover arranged that the said contact shall be over or in line with the subdivided conductor or resistance B. As shown the outer surface of the end plate C is rounded at 13 (see Fig. VII) in order to serve  
15 as the contact. Other forms of contact may be employed. It is preferred to employ a movable switching-arm H to connect in and cut out the resistance, said arm being provided with a traveling contact K to bear upon  
20 the contact 13 of the resistance. A traveling contact of any suitable form may be used; but preferably the new or improved form shown is employed. It consists of a number of plates flexibly mounted on the end 14 of  
25 the arm H, which forms a journal for said plates. The plates bear at their edges against the opposing contacts and are held against the same by springs 15, one for each plate. The arm H itself is journaled in a bracket  
30 16 and is provided with operating-arms 17.

One such resistance as above described could be used by itself; but preferably a number of them are employed electrically connected in series and so arranged that the contact K travels over them progressively. The  
35 bearing edges of the plates of contact K are made of such length as to bear upon the contacts 13 of, say, two adjacent resistances at the same time. The series of resistances are  
40 secured to blocks F G, common to the series in the slot or groove between them. In order to facilitate the connection of the resistances in series, the bracket-extension 10 of one resistance is made to overlap the extension 11  
45 of the adjacent resistance, the extensions 10 and 11 being set obliquely in opposite directions, and the same bolt 18 mechanically and electrically connects the end plate C of a resistance with the end plate D of the adjacent  
50 one, as well as secures the said plates to the block F. One wire L of the exterior circuit is connected with the traveling contact K through the switching-arm H, as shown, the other wire M of said circuit being connected  
55 with one of the resistances. The plate N is insulated from the resistances, and the contact K rests thereon when it is desired to open the circuit or disconnect it entirely from the resistances.

60 In operation the contact K travels over the contacts 13 of the resistances, connecting the different subdivided conductors or bodies B of resistance material progressively in series with each other in the circuit of the wires L and M or cutting them progressively out of  
65 the circuit, according to the direction in which the arm H is moved.

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

1. An electrical resistance comprising a body of subdivided conducting material—like carbon-powder, for example—held in an insulating-casing, and metallic end plates in contact with the subdivided conducting material  
75 and provided with a number of conducting projections which penetrate said material, in combination with switching means, substantially as described.

2. An adjustable rheostat comprising a number of electrical resistances, each consisting of a body of subdivided conducting material—like carbon-powder, for example—held in an insulating-casing, and electrodes or end plates in contact with the subdivided conducting material and provided with a number of conducting projections which penetrate  
85 said material, in combination with switching means and electrical connections, whereby said resistances may be progressively included in an exterior circuit, substantially as described.

3. An electrical resistance comprising, in combination with a body of subdivided conducting material held in an insulating-casing, an end plate in contact with the subdivided material and having one or more tapering wedge-shaped conducting projections which penetrate said material, and switching means, substantially as described.

4. An electrical resistance comprising, in combination with a body of subdivided conducting material held in an insulating-casing, an end plate having one or more elongated flat or fin-like conducting projections which penetrate said body, substantially as described.

5. In an electrical resistance, an insulating-receptacle for holding the resistance material, composed of a skeleton frame of metal provided with an interior lining of insulating material and subdivided conducting material held within the lining, substantially as described.

6. An electrical resistance comprising an exteriorly-ribbed casing of metal lined with insulating material, a body of subdivided conducting or resistance material in said casing, and conducting end plates in contact with the resistance material, substantially as described.

7. An adjustable rheostat comprising a number of electrical resistances, each composed of a body of subdivided conducting material in an exteriorly-ribbed casing of metal lined with insulating material and provided with electrodes, in combination with switching means, substantially as described.

8. The combination, with an insulating-casing and a body of subdivided conducting material therein, of an end plate having a projection which fits said casing and bears upon said body, and provided also with one or more projections which penetrate the said



body, said end plate being bolted to the casing, substantially as described.

9. In combination with switching means, a resistance comprising subdivided conducting material in an insulating-receptacle and an electrode or end plate provided with a contact integral therewith for the said switching means, substantially as described.

10. The combination, with switching means, of subdivided conducting material constituting an electrical resistance interposed between two plates, one of which is provided with a contact thereon and integral therewith and in operative relation to the said switching means, substantially as described.

11. In combination with switching means, a number of electrical resistances, each composed of subdivided conducting material and interposed between two plates, one of which is provided with a contact integral therewith and in operative relation to the switching means, substantially as described.

12. A number of electrical resistances, each composed of subdivided conducting material interposed between two plates, with a contact on one of said plates and integral therewith, in combination with a traveling contact and electrical connections whereby said resistances may be included in or cut out of circuit progressively, substantially as described.

13. A number of electrical resistances, each comprising a body of subdivided conducting material, and an electrode-plate provided with a contact thereon and integral therewith, in combination with electrical connections and a traveling contact movable over the aforesaid contacts, substantially as described.

14. An oblong insulating-casing filled with subdivided conducting material and provided with lugs on the narrow sides, in combination with oblong end plates making contact with the subdivided material and having projections above said lugs to which they are bolted, substantially as described.

15. An electrical resistance composed of subdivided conducting material, in combination with an insulating-casing inclosing said

conductor, and end plates or electrodes in contact with the subdivided conductor and having bracket-extensions integral with said end plates or electrodes, substantially as described.

16. An electrical resistance comprising an insulating-casing, a body of subdivided conducting material therein, and end plates provided with bracket-extensions integral therewith, in combination with an insulating-block interposed between said extensions, which are fastened thereto, substantially as described.

17. A resistance comprising an insulating-casing, a body of subdivided conducting material therein, and end plates provided with bracket-extensions, in combination with insulating-blocks between which the resistance is placed and to which said extensions are fastened, substantially as described.

18. The traveling contact composed of a series of pivoted plates on edge, in combination with one or more electrical resistances provided with opposing contacts and a spring for each traveling contact-plate for maintaining electrical connection with the opposite contacts, substantially as described.

19. A resistance provided with convex contacts, in combination with a traveling contact composed of pivoted plates on edge and a separate spring for each plate for impelling the same against the convex contacts, substantially as described.

20. A series of connected electrical resistances provided with convex contacts, in combination with a traveling contact composed of pivoted mounted plates on edge and a spring for each plate for impelling the same against the convex contacts, substantially as described.

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

SIDNEY H. SHORT.

Witnesses:

A. B. CALHOUN,  
C. J. LEEPHART.