

(No Model.)

2 Sheets—Sheet 1.

G. K. CUMMINGS.
RESISTANCE DEVICE.

No. 593,988.

Patented Nov. 23, 1897.

Fig. 6.

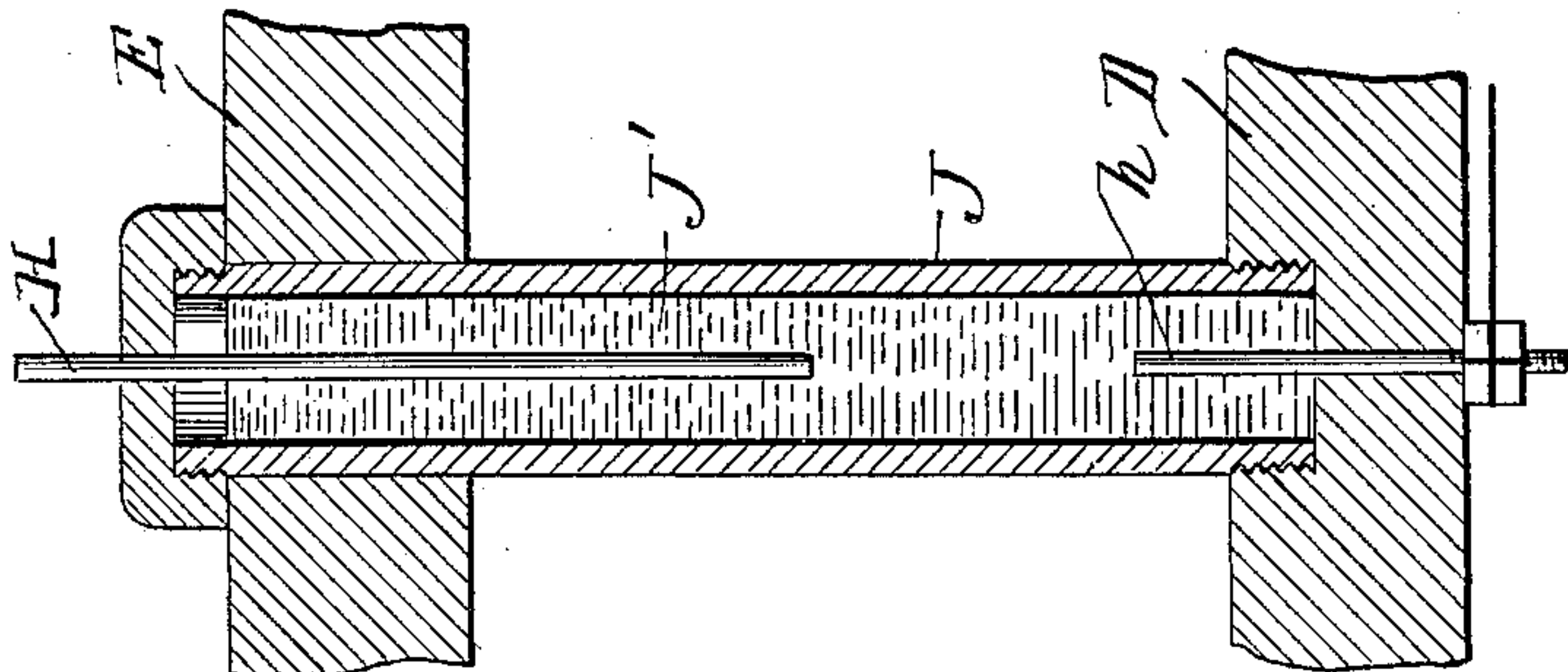


Fig. 7.

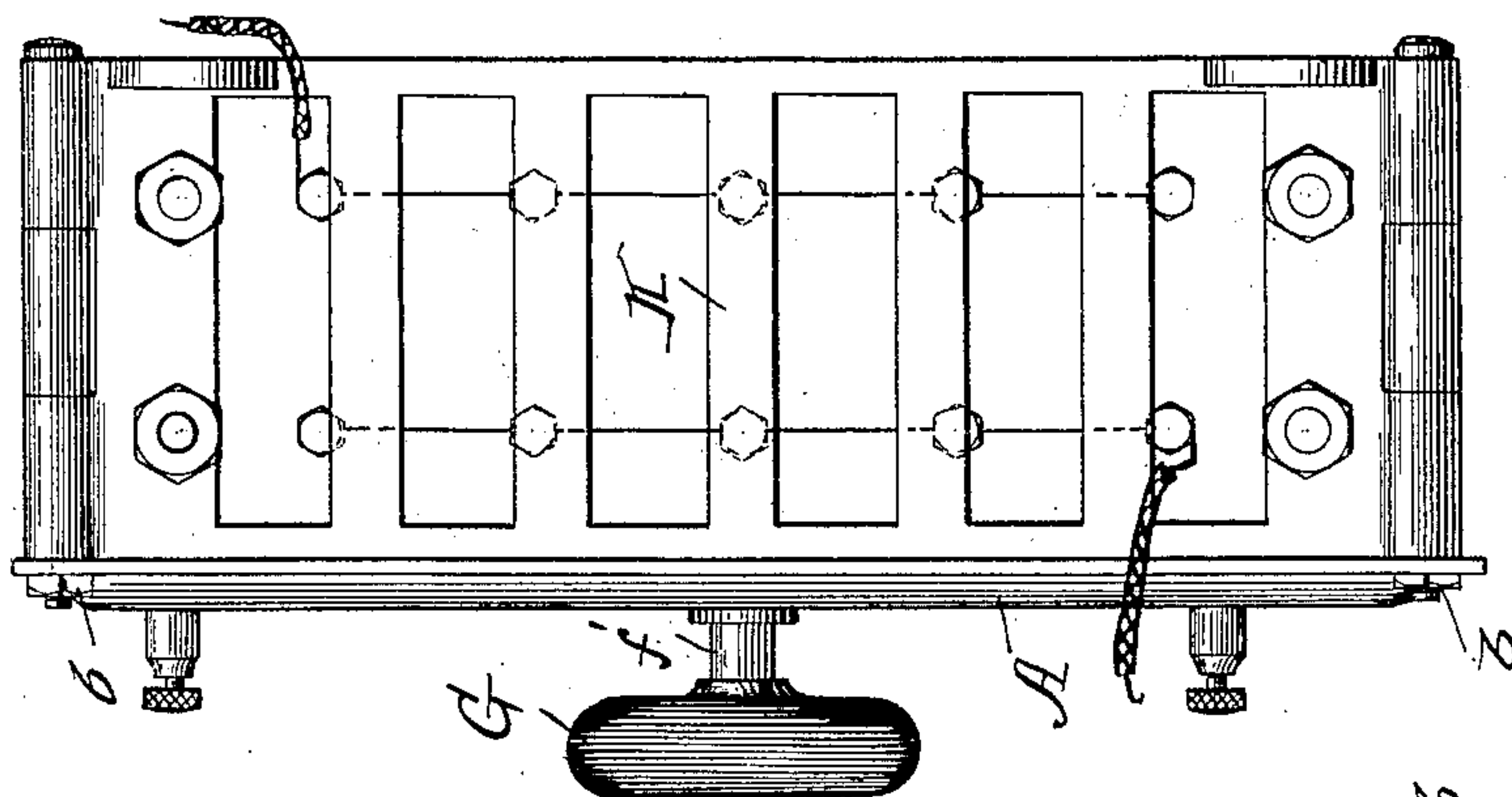
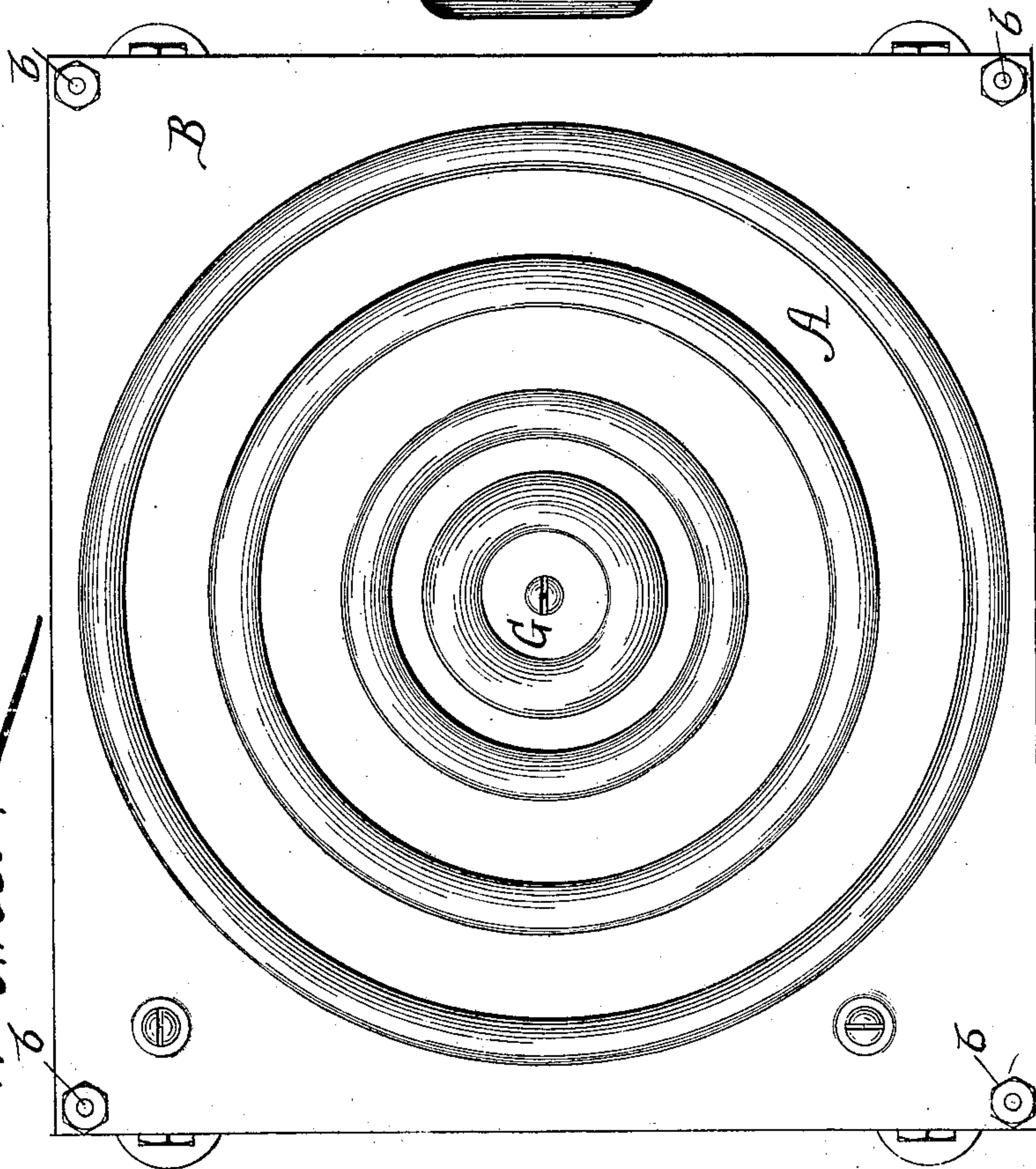


Fig. 1.



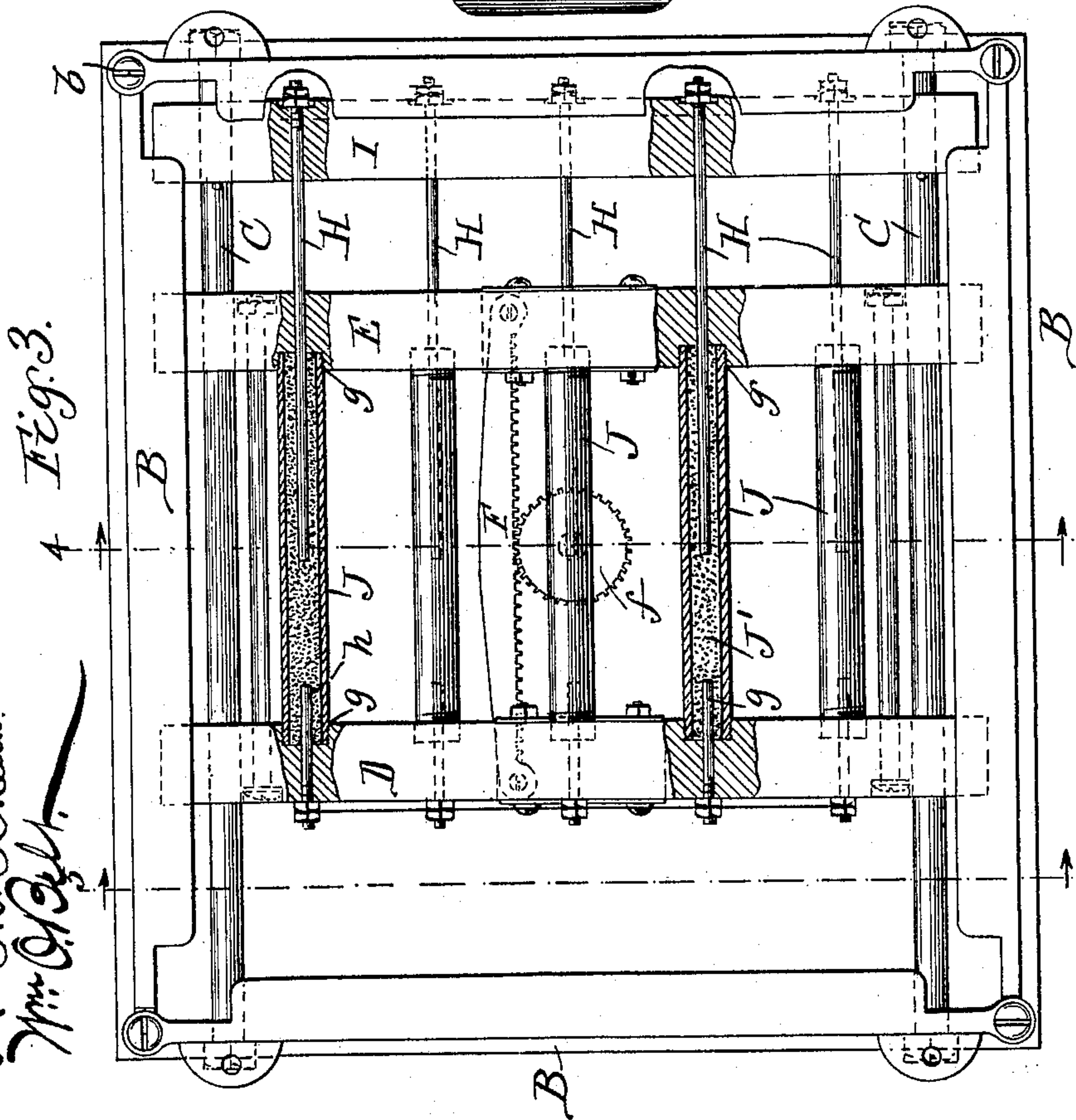
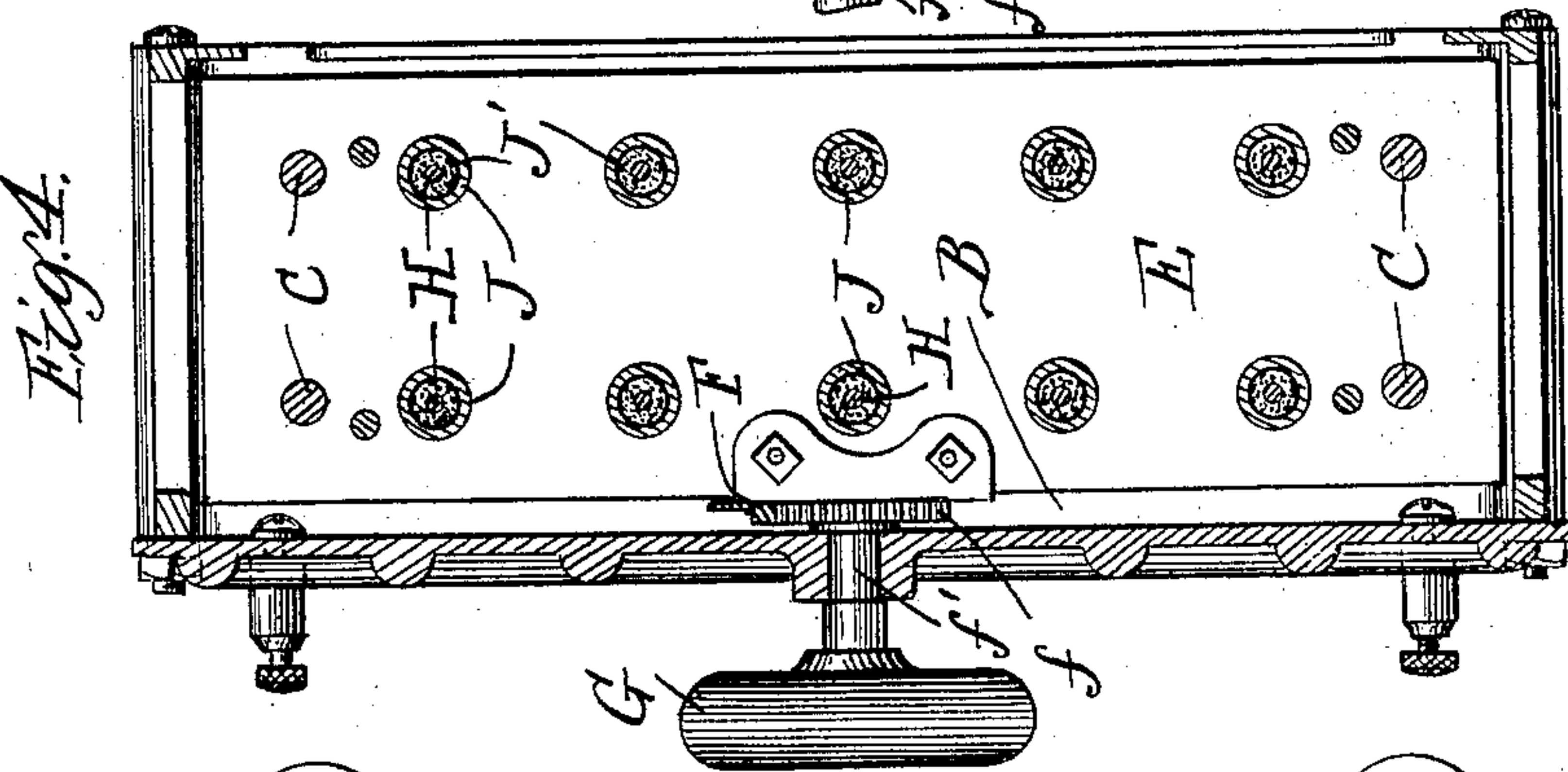
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2 Sheets—Sheet 2.

No. 593,988.

Patented Nov. 23, 1897.



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UNITED STATES PATENT OFFICE.

GEORGE K. CUMMINGS, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE GRAPHITE RHEOSTAT COMPANY, OF SAME PLACE.

RESISTANCE DEVICE.

SPECIFICATION forming part of Letters Patent No. 593,988, dated November 23, 1897.

Application filed December 23, 1895. Serial No. 573,041. (No model.)

To all whom it may concern:

Be it known that I, GEORGE K. CUMMINGS, a citizen of the United States, residing in Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Resistance Devices, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to certain new and useful improvements in electrical resistance devices which may be employed for regulating an electric current by offering more or less resistance to its passage or used as an electric heating device.

The object of the invention is to provide a resistance device composed of a number of resistance members the total resistance of which can be varied by slight gradations, and a further object is to provide a simple and inexpensive construction and arrangement of parts which can be readily manipulated to accomplish the results sought for.

With these and other ends in view the invention contemplates a number of resistance members, one form of which is filled with a suitable resistance material and two terminals arranged in the resistance material of each member, one of which terminals is adapted to be adjusted in the material, whereby the total resistance may be permanently varied by connecting said members in series, in multiple, in multiple series, or in series multiple, and yet the total resistance may also be readily varied irrespective of the method of connecting the members.

The term "member" as used by me in this specification is to be understood as indicating a portion of a total resistance that has attached thereto two electric connections, through which such portion or member may have electrical connection with the circuit.

The invention consists also of certain other features of construction and details which will be fully described hereinafter.

In the accompanying drawings, forming a part of this application, Figure 1 is a front view of the device. Fig. 2 is a side elevation. Fig. 3 is a view, partly in section, with the front plate removed. Fig. 4 is a sectional

view on the line 4 4 of Fig. 3. Fig. 5 is a sectional view on the line 5 5 of Fig. 3, and Fig. 6 is a detail view of a modified form of a member.

Referring to the drawings, in which like letters of reference denote corresponding parts in all the figures, A designates the front plate, which is secured to the frame B by means of the screw-rods *b* at the corners of said frame. Two or more transverse rods C are secured to opposite sides of said frame, and movable cross-pieces D E are mounted on said rods. A rack-bar F is secured at its ends to the cross-pieces and is arranged to mesh with a ratchet-wheel *f*, which is mounted on a suitable shaft *f'* and is operated by means of the wheel G.

In the drawings I have illustrated the resistance members in the form of tubes or cylinders J, which is a convenient construction, but my invention is not limited to any particular form or construction of the members, for it is obvious that many other forms may be employed. For example, I may employ a rod of some resistance material and a box containing mercury adapted to be adjusted on said rod, one wire being connected to the box and the other to the rod in some suitable manner, or instead of the box containing mercury I may use a brush. The members may be embodied in many other forms, which it is unnecessary for me to mention here. The tubes J are mounted between the cross-pieces D E, and the ends of the tubes are fitted in recesses *g* in the faces of the cross-pieces, being preferably provided with a screw-thread for this purpose. I may employ any number of these tubes more than one, and it is not at all essential that they should be of any particular form or configuration, the only requirement being that they shall contain a sufficient quantity of resistance material for the purposes of the invention. The tubes are filled with suitable resistance material J', and I have found that powdered graphite, from fifty per cent. to ninety per cent. pure, is the preferred material, as it accomplishes the results of my invention in a superior manner. I would have it understood, however, that I do not hereby limit myself to any particular resistance material.

Each of the members and the parts connected therewith are substantially alike, and I will therefore only describe one of them. A rod H, which forms one of the terminals, extends into one end of the tube, and it is secured at its other end to a stationary cross-piece I at one side of the frame. It will thus be observed that as the wheel G is operated the ratchet-wheel *f*, meshing with the rack F, moves the two cross-pieces D E on the rods C, and the tube J is adjusted farther on or off of the long terminal rod H. Referring particularly to Fig. 3 of the drawings, if the ratchet-wheel *f* is turned to the left the short rod *h* will be moved farther away from the long rod H, and the resistance afforded by the material between the terminals is thereby increased, and if the wheel *f* is turned to the right the rod *h* is brought closer to the rod H and the resistance decreased.

Although I have shown and described the tubes as arranged and adapted to be adjusted on the rods H, it is obvious that the cross-pieces D E may be made stationary and the cross-piece I movable, so that the rods H can be adjusted in the tubes.

As hereinbefore stated, the tubes J may be of any form or shape adapted to the particular purposes for which they are intended, and they may be cast or fashioned with irregular exteriors to increase the heat-radiating surfaces. They are preferably made of metal and lined or coated with enamel or other insulating substance. The electric current is carried to the terminals in a suitable manner, and it is regulated by the resistance offered by the amount of granulated or powdered material between the adjacent ends of the rods *h* H, the density of said material being substantially constant. The shorter rod *h* does not move into the tube, but when the cross-pieces D E are operated the tube is moved onto the long rod H, and the resistance of the material between the contact-rods is increased or decreased in exact ratio to the length of the movement of the tube. It is essential that there should be sufficient resistance material in the tube, so that a sufficient "carrying capacity" may at all times be provided between the ends of the terminals, whether they be close together or far apart.

The contact-rods may be connected in series, in multiple, in multiple series, or in series multiple, as desired, and in any combination where a number of members are employed each member thus bears an equal share of the total energy consumed in resistance.

The wheel or handle G, which may be of any desired construction, is preferably constructed so that one turn or revolution thereof will move the tube throughout its entire limit of movement, but this of course may be varied as desired.

I have shown in the drawings a number of tubes, all of which are constructed alike, and

any number of them may be employed. In order that the device may not be too bulky in size, I prefer to proportion the parts for a comparatively high temperature of the members and to use a resistance material not only of a high resistance, but one which will not easily fuse and which is capable of remaining unchanged in its chemical and structural formation upon the application of very high temperatures.

As the actual radiating-surfaces of the tubes are protected by the frame, it is evident that they may be safely heated to a very high temperature without danger of fire, the exterior of the device being heated only by conduction by the air-currents passing through the openings in the sides K of the frame.

By the use of my improved construction I entirely avoid the sparking and arcing at the contact-points which usually occur in devices of this character, as well as the liability of forming rough and uneven electrical terminals, which tend to decrease the brilliancy of the light supplied by the current, and the gradations are so uniform and small and the decrease of brilliancy so gradual that the eye cannot detect any jump or unevenness of light when the resistance is increased or decreased, but merely an even gradation.

It will be observed that in decreasing the total resistance of the device it is unnecessary to cut out any member whereby the practical heat-radiating surface of the device is increased, and that portion of the member which is not active electrically is in the best possible juxtaposition to the active portion for the purpose of aiding in dissipating the heat from the active portion.

In Fig. 6 I have illustrated another of the many forms of members which may be employed in connection with my invention, which contemplates the employment of a liquid or semiliquid resistance material *J'*, in which the terminal H is adapted to be adjusted after the manner of a plunger. The construction of parts and operation of this device are substantially similar in every way to that hereinbefore described and I will not enter into a detailed description thereof.

Where large currents are required to be passed through the device, I find it desirable to connect the members in multiple or multiple series, in which cases the passage of the current does not depend upon any one contact, but it divides its path proportionally to any defects that may occur in the electromechanical construction of the device.

By using a number of resistance members I am able to provide a device in which all of said members may be adjusted to provide a total gradation of resistance, and I am therefore also able to construct my device in a convenient and advantageous manner, so that it will not be likely to burn out. If desired, one or more of the members may be entirely cut out of the circuit.

I am aware that changes in the form and

proportion of parts and details of construction of the invention may be made without departing from the spirit or sacrificing the advantages thereof, and I therefore reserve
5 the right to make all such changes as fairly fall within the scope and spirit of the invention.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—
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1. In an electrical resistance device, the combination with the cross-pieces, of the terminal rods supported on said cross-pieces, two of said cross-pieces being movable, a number
15 of tubes containing electric resistance material of constant density supported between the movable cross-pieces, and means for adjusting the tubes on some of the terminal rods, substantially as and for the purpose described.
20

2. The combination of a frame, the cross-pieces movably secured in said frame, a number of tubes arranged between said cross-pieces and containing suitable resistance material, a terminal rod secured in one end of
25 each tube, and another terminal rod arranged in the other end of each tube, and means for moving said cross-pieces to adjust the tubes on some of said terminal rods, substantially as described.
30

3. The combination of a frame, the cross-

pieces movably secured in said frame, a number of tubes arranged between said cross-pieces and containing suitable resistance material, a terminal rod secured in one end of
35 each tube, another terminal rod arranged in the other end of each tube, a rack-bar secured between said cross-pieces, and a ratchet-wheel arranged in engagement with said rack-bar and adapted to be operated to move the
40 cross-pieces, substantially as described.

4. The combination of a frame, the rods secured in said frame, the movable cross-pieces mounted on said rods, a number of tubes secured between said cross-pieces and contain-
45 ing an electric resistance material, a terminal rod rigidly secured in one end of each tube, a stationary cross-piece, a terminal rod arranged in the other end of each tube and secured to the stationary cross-piece, a rack-bar
50 connecting the movable cross-pieces, a ratchet-wheel arranged in engagement with said rack-bar, and a handle for operating said ratchet-wheel whereby the tubes may be ad-
55 justed to increase or decrease the resistance between the ends of the terminals, substantially as described.

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Witnesses:

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