

(No Model.)

2 Sheets—Sheet 1.

G. K. CUMMINGS.
RESISTANCE DEVICE.

No. 593,988.

Patented Nov. 23, 1897.

Fig. 6.

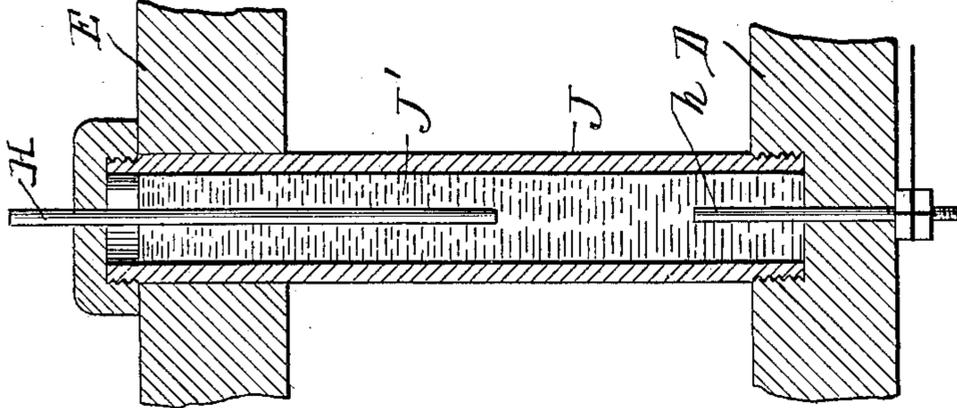


Fig. 2.

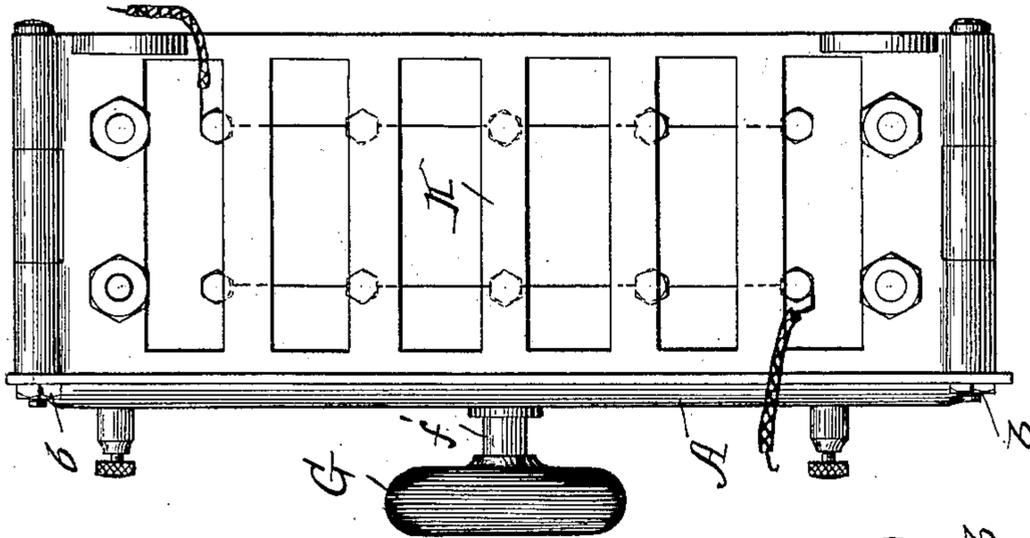
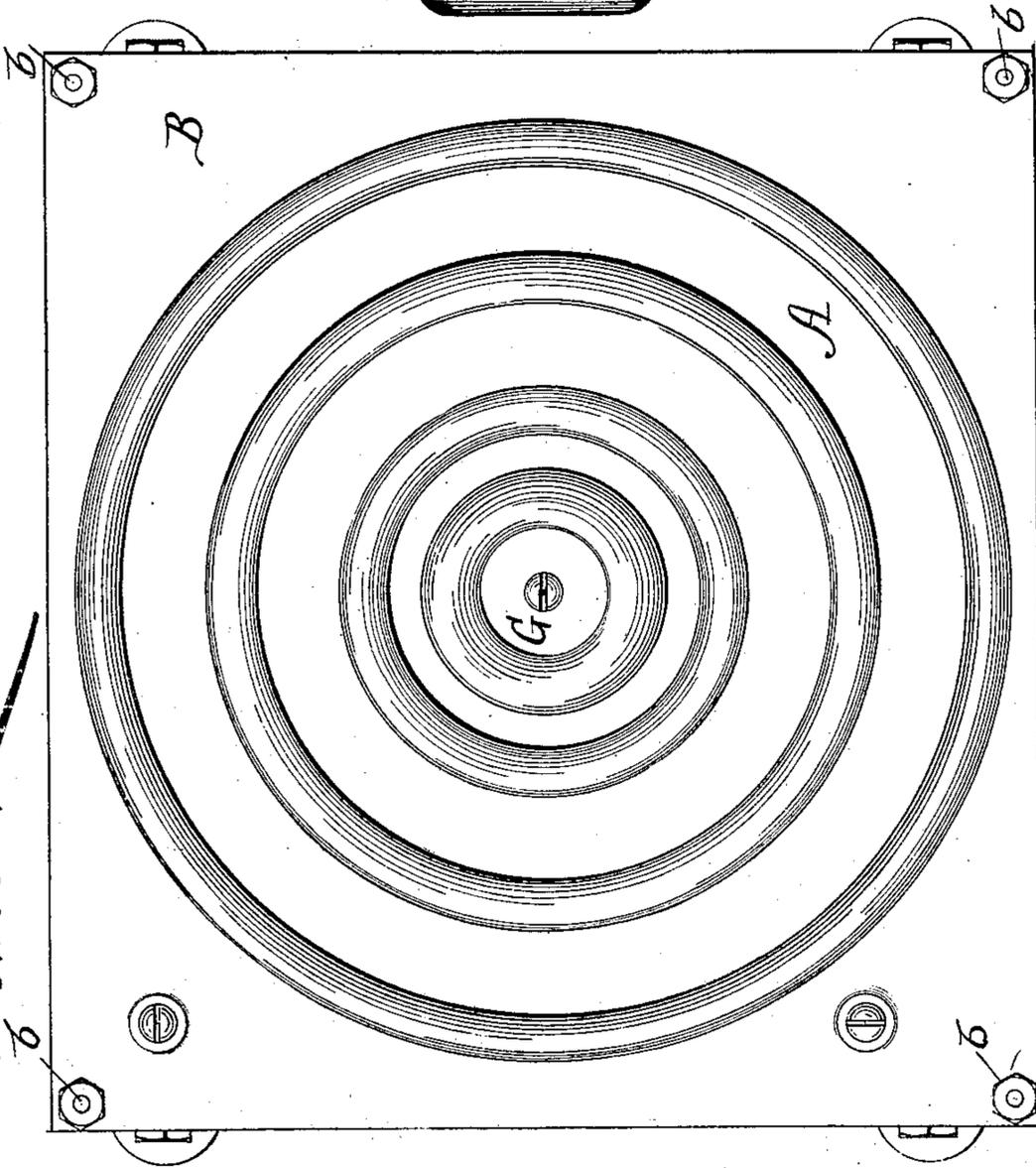


Fig. 1.



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(No Model.)

2 Sheets—Sheet 2.

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Fig. 5.

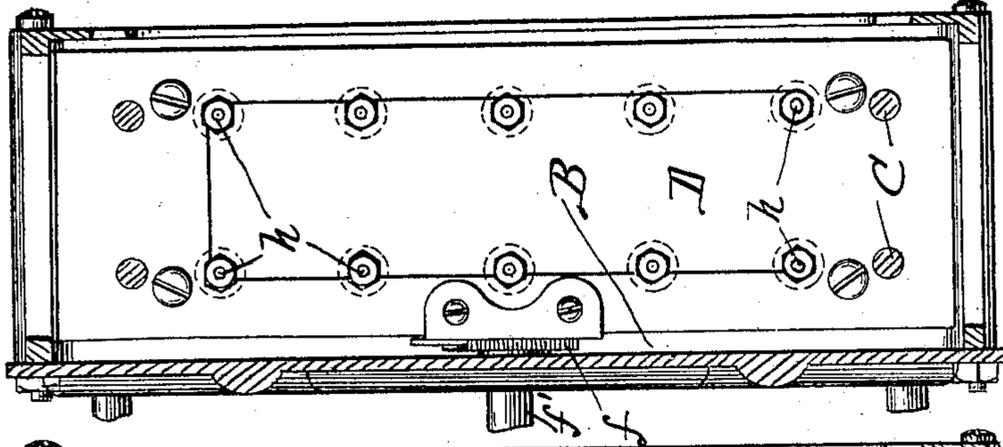


Fig. 4.

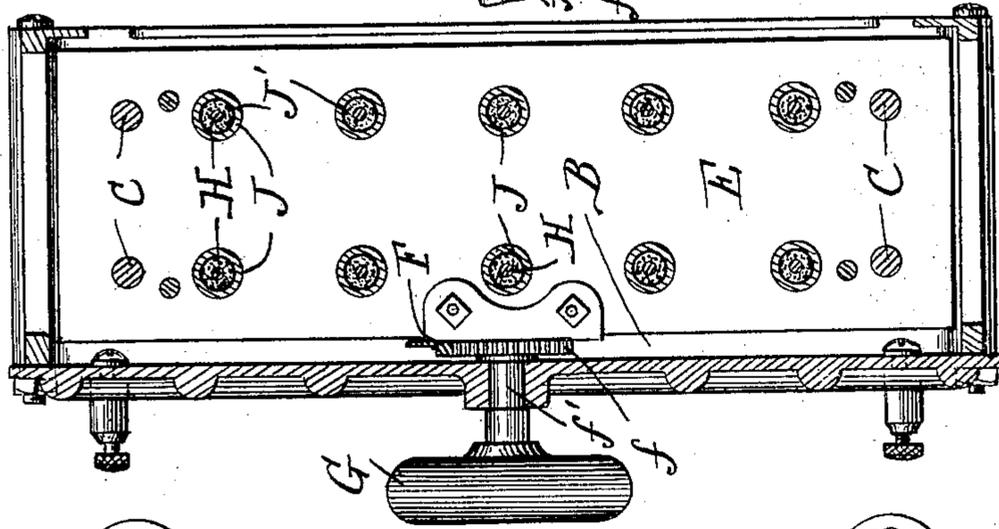
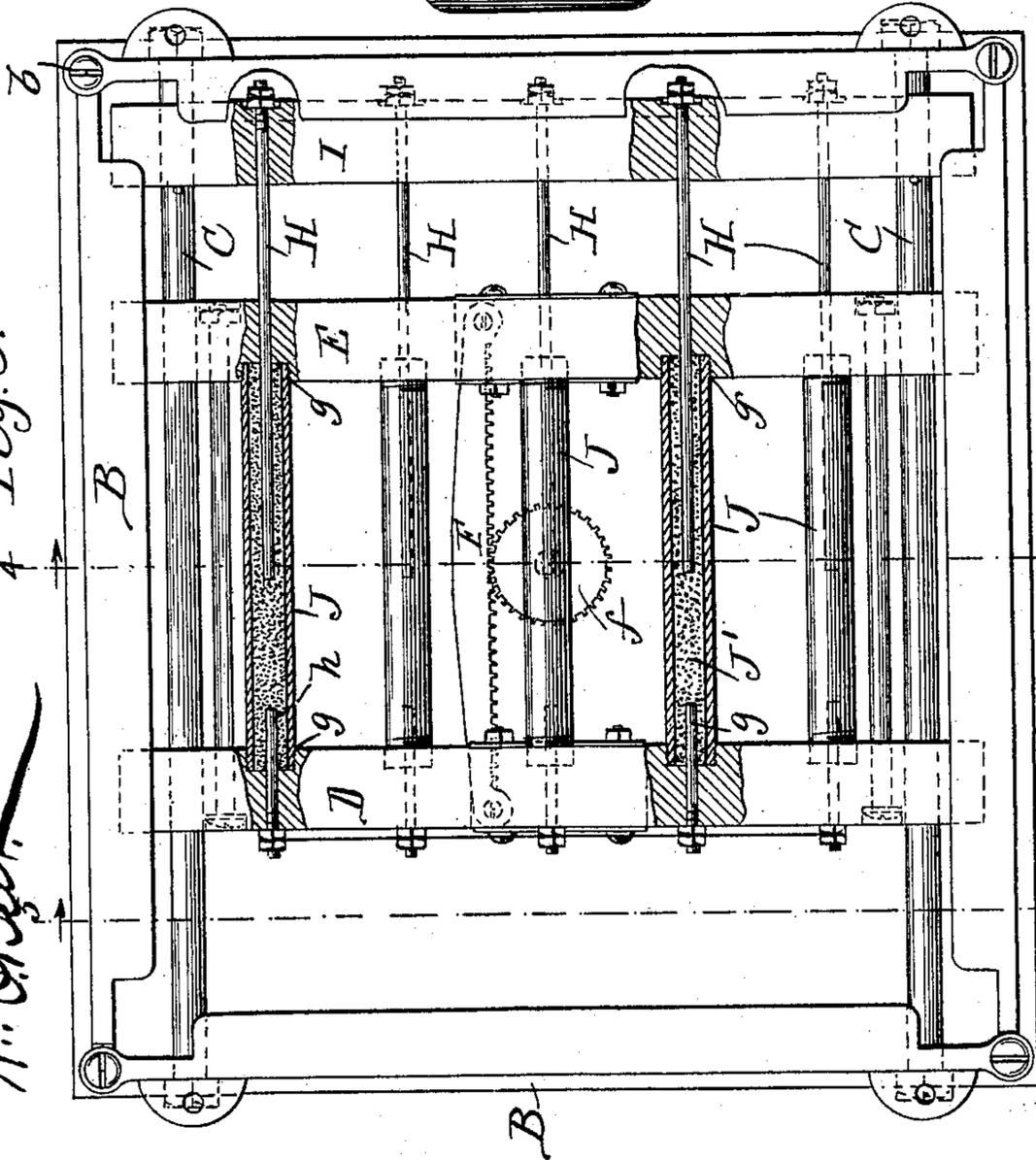


Fig. 3.



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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 connect-
ed therewith are substantially alike, and I
will therefore only describe one of them. A
rod H, which forms one of the terminals, ex-
tends into one end of the tube, and it is se-
cured 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 there-
by 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 particu-
lar purposes for which they are intended, and
they may be cast or fashioned with irregular
exteriors to increase the heat-radiating sur-
faces. They are preferably made of metal
and lined or coated with enamel or other in-
sulating 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 re-
sistance material in the tube, so that a suffi-
cient "carrying capacity" may at all times
be provided between the ends of the termi-
nals, whether they be close together or far
apart.

The contact-rods may be connected in se-
ries, in multiple, in multiple series, or in se-
ries multiple, as desired, and in any combi-
nation where a number of members are em-
ployed each member thus bears an equal
share of the total energy consumed in resist-
ance.

The wheel or handle G, which may be of
any desired construction, is preferably con-
structed so that one turn or revolution there-
of 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 mem-
bers 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 tem-
perature without danger of fire, the exterior
of the device being heated only by conduc-
tion 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 termi-
nals, 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 unneces-
sary 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 em-
ployed in connection with my invention,
which contemplates the employment of a liq-
uid or semiliquid resistance material *J'*, in
which the terminal H is adapted to be ad-
justed 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 mul-
tiple series, in which cases the passage of the
current does not depend upon any one con-
tact, but it divides its path proportionally to
any defects that may occur in the electro-
mechanical 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 there-
fore 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—

1. In an electrical resistance device, the combination with the cross-pieces, of the terminal rods supported on said cross-pieces, two
15 of said cross-pieces being movable, a number 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 containing
45 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 adjusted to increase or decrease the resistance
55 between the ends of the terminals, substantially as described.

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Witnesses:

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