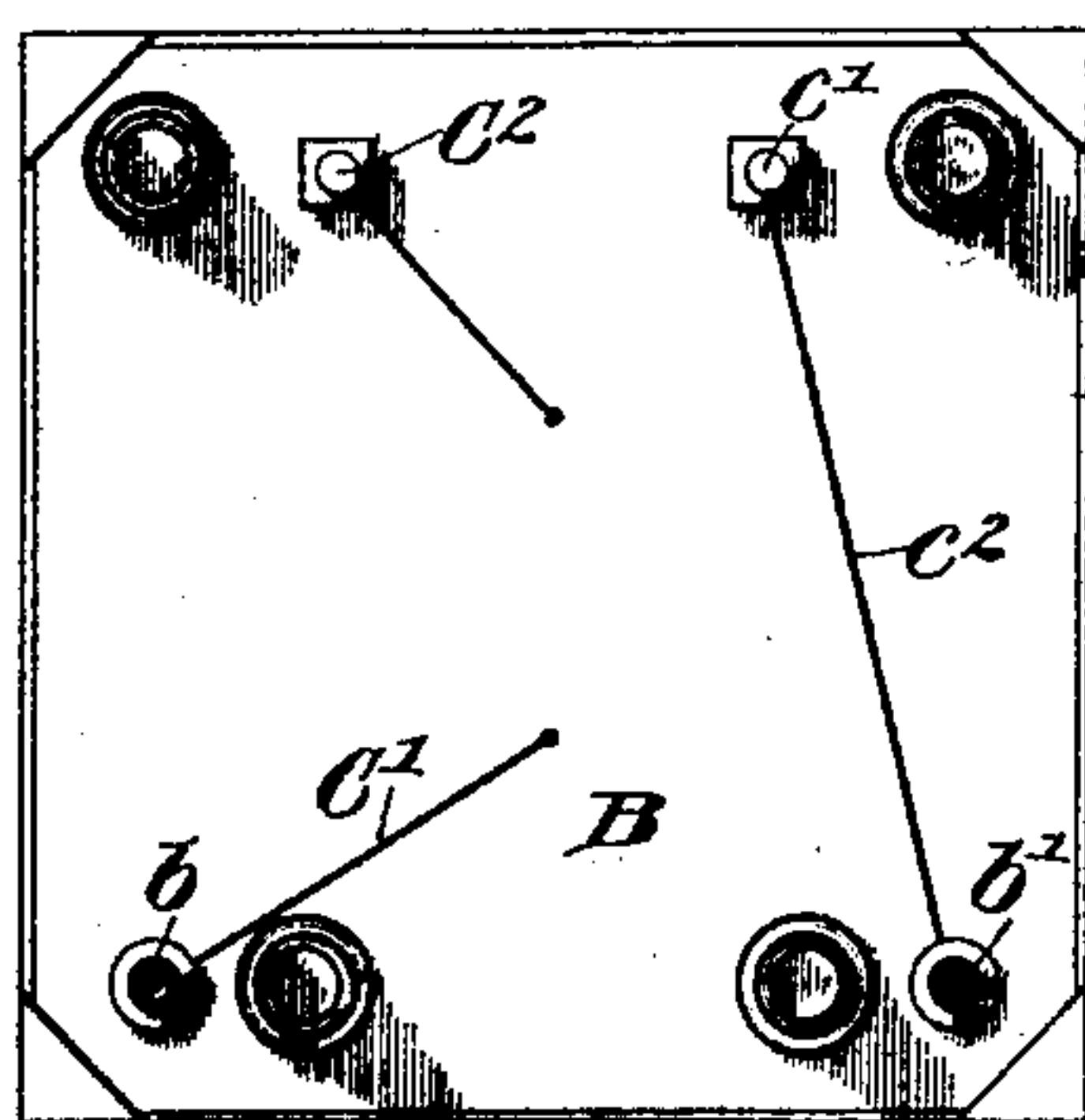
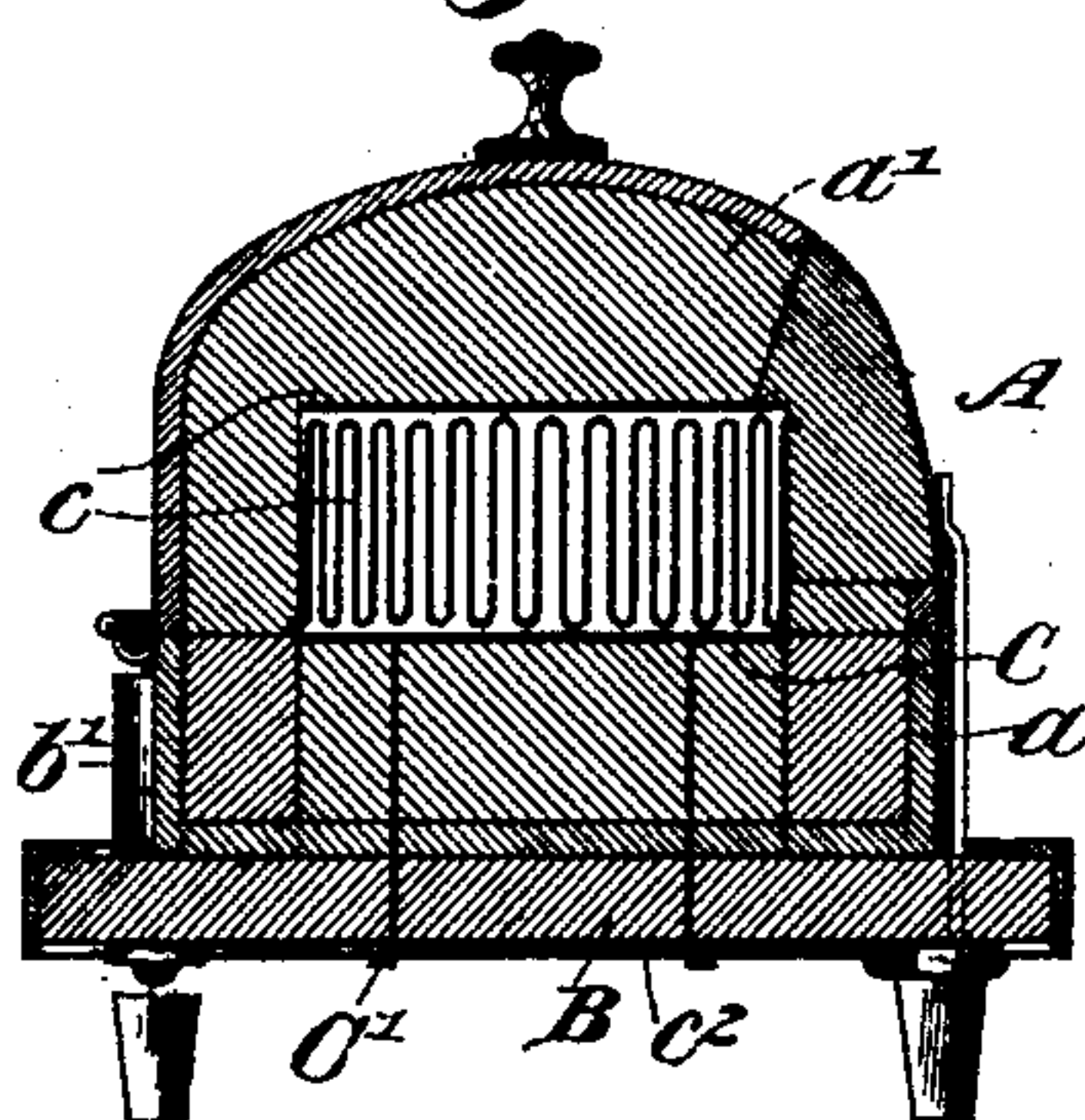
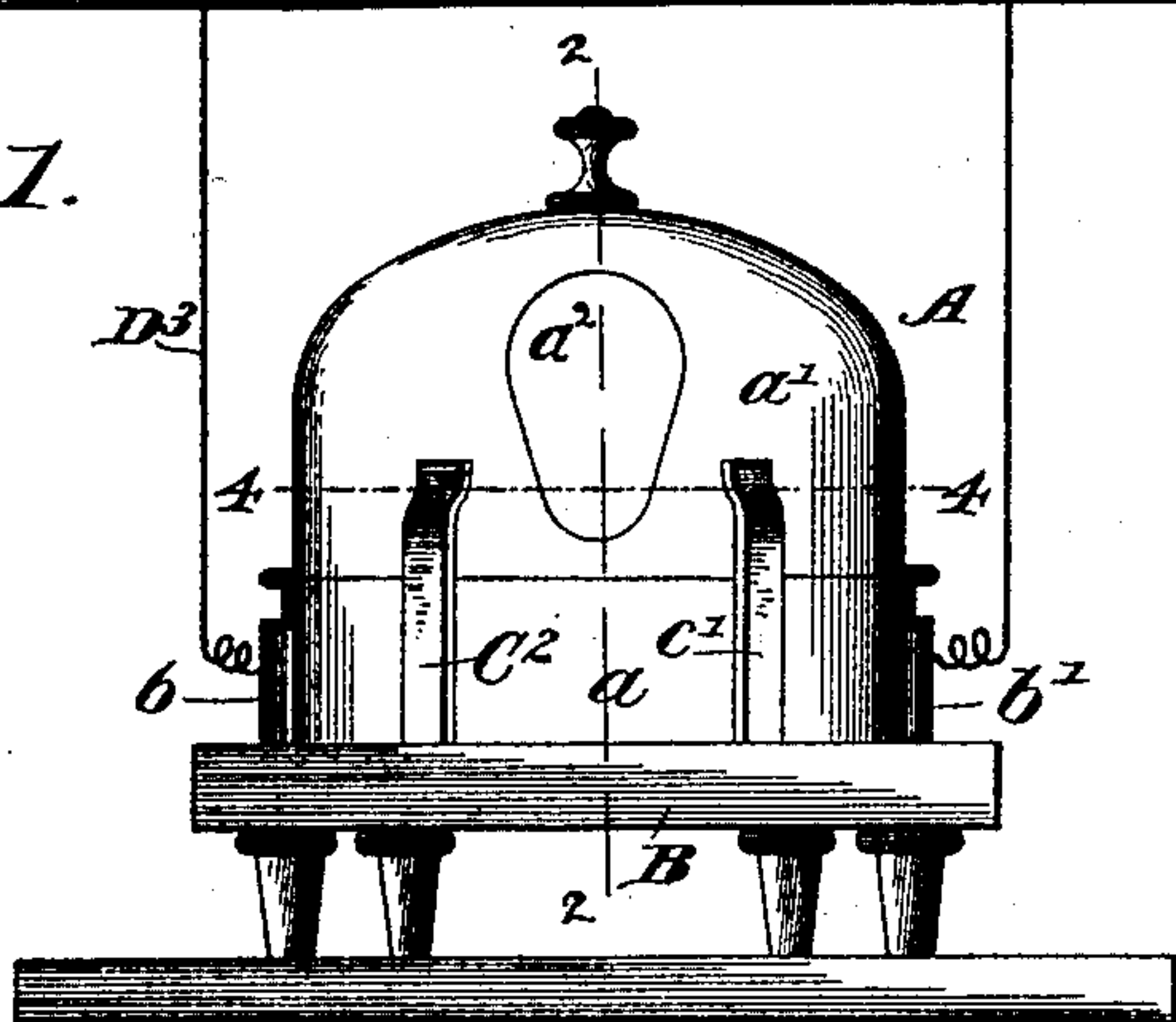
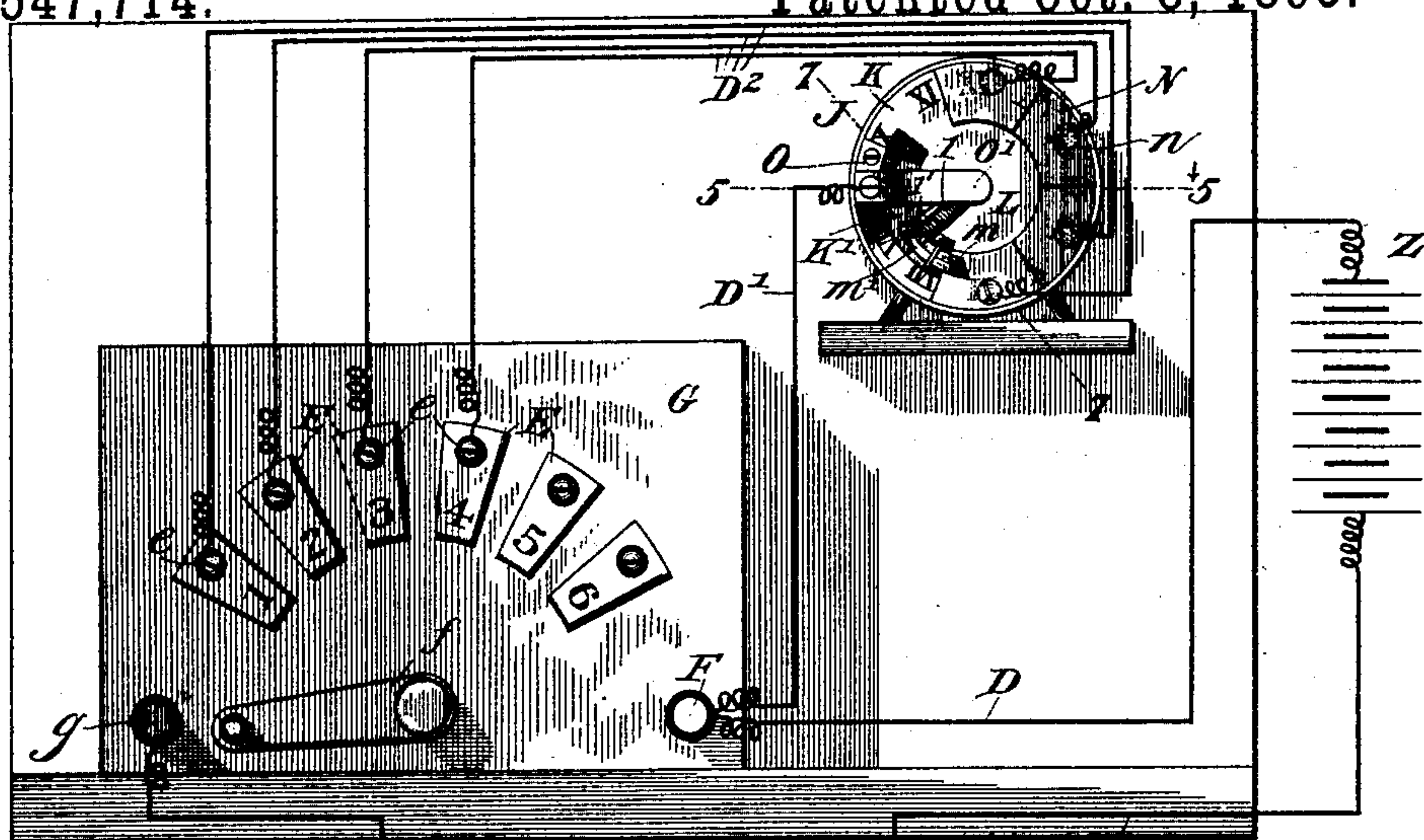


L. E. CUSTER.  
TIME CONTROLLED ELECTRIC HEATER.

No. 547,714.

Patented Oct. 8, 1895.



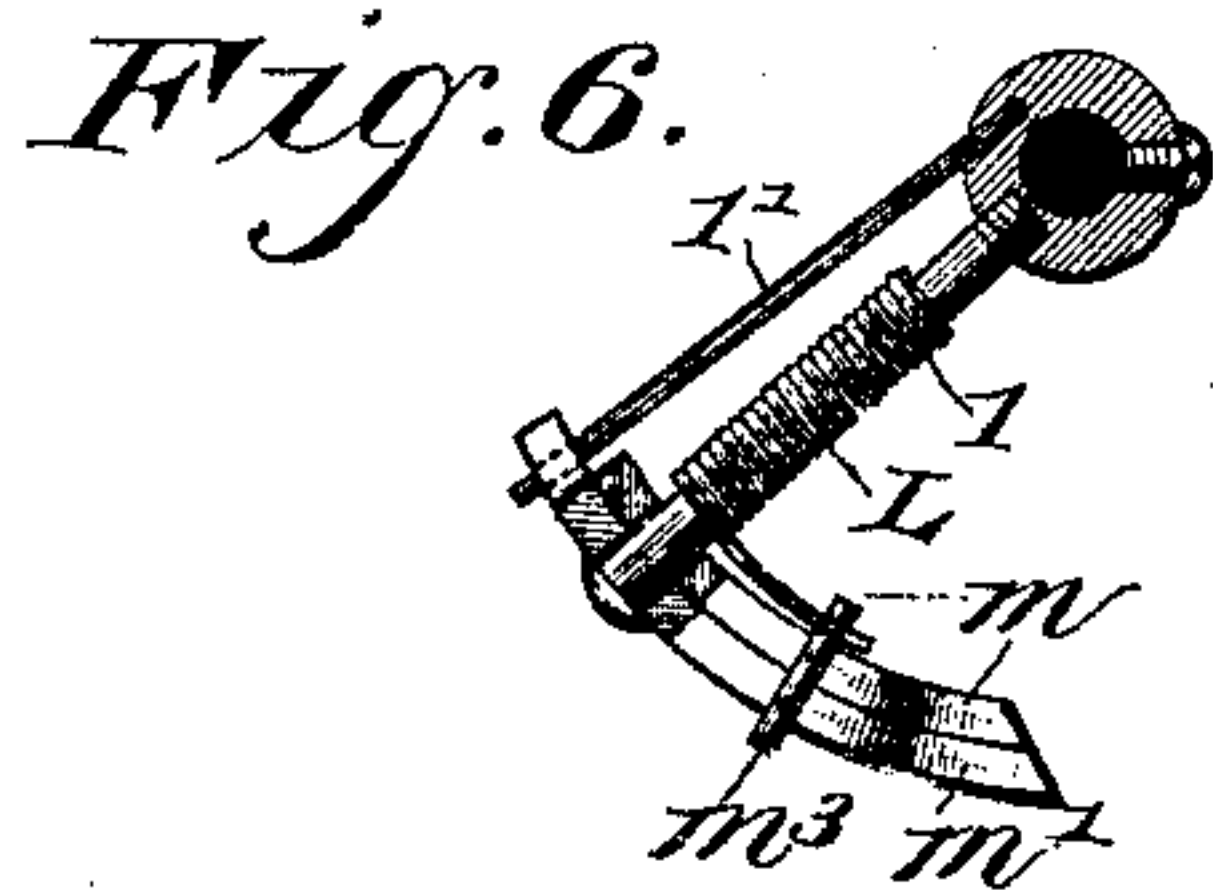
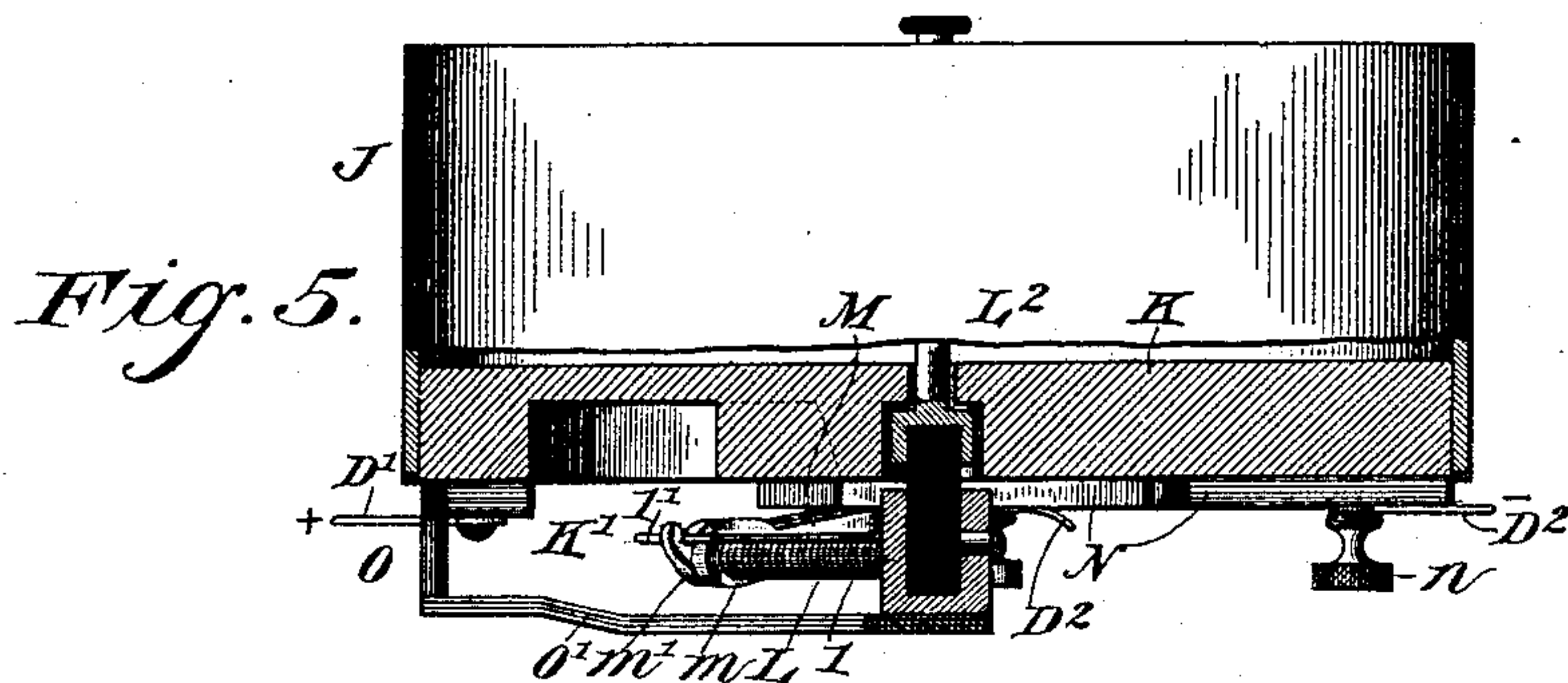
Witnesses;  
J. M. Withersow  
James R. Mansfield.

By Alexander & Lowell  
Attorneys

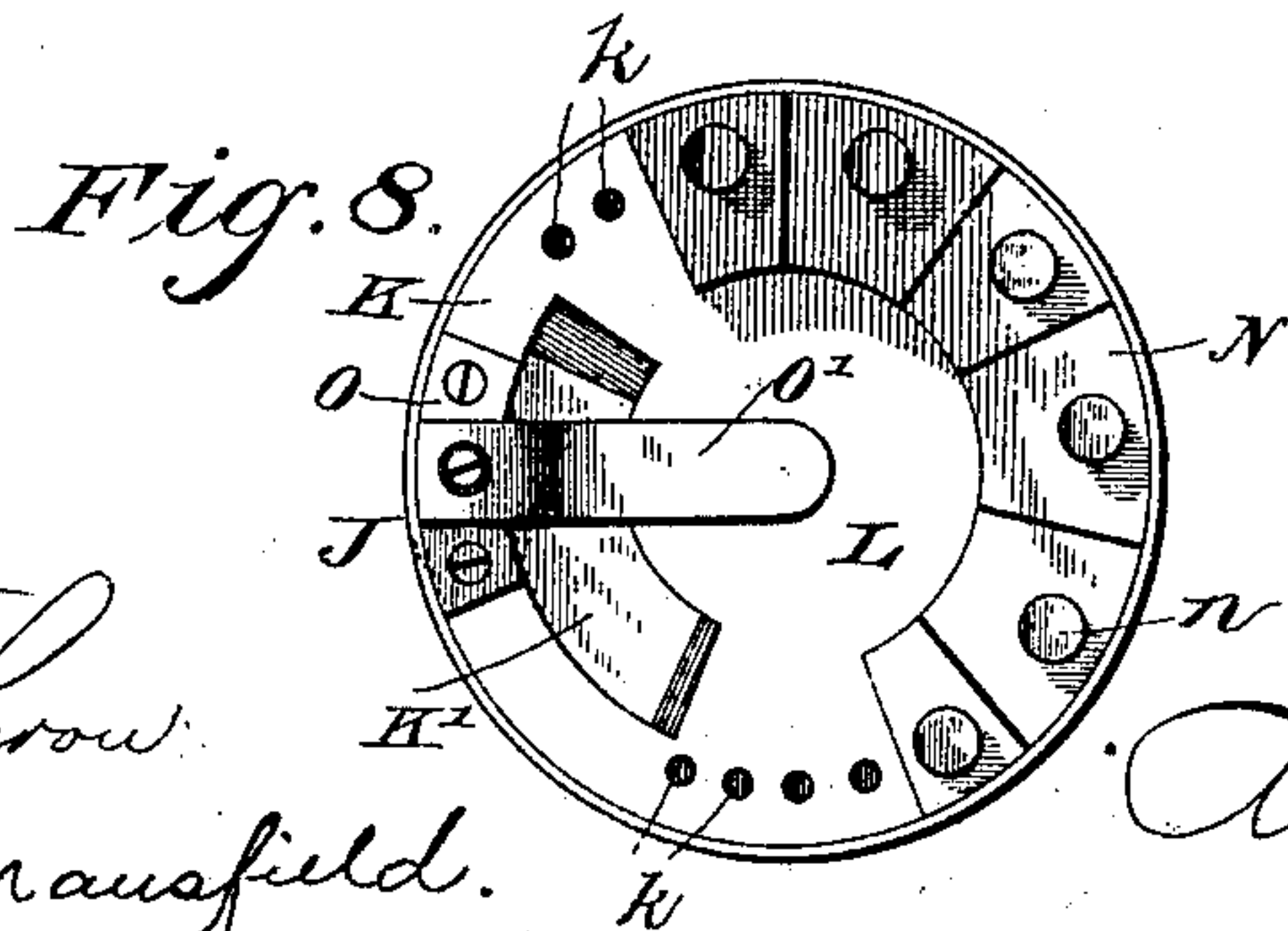
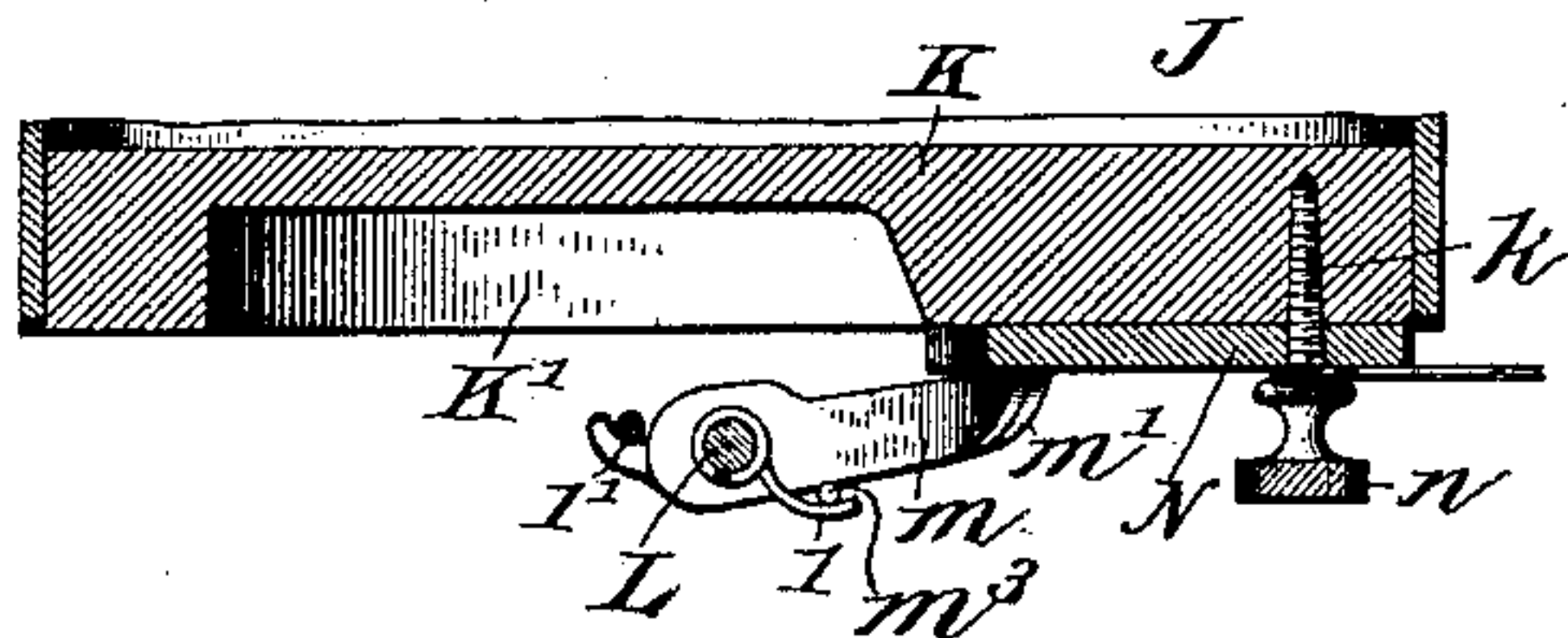
L. E. CUSTER.  
TIME CONTROLLED ELECTRIC HEATER.

No. 547,714.

Patented Oct. 8, 1895.



*Fig. 7.*



Witnesses;

*James R. Mansfield.*

Inventor,

*L. E. Custer.*

*Alexander & Sowell*  
Attorneys



# UNITED STATES PATENT OFFICE.

LEVITT E. CUSTER, OF DAYTON, OHIO.

## TIME-CONTROLLED ELECTRIC HEATER.

SPECIFICATION forming part of Letters Patent No. 547,714, dated October 8, 1895.

Application filed December 22, 1894. Serial No. 532,647. (No model.)

*To all whom it may concern:*

Be it known that I, LEVITT E. CUSTER, of Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Time-Controlled Electrical Heaters; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form part of this specification.

This invention is an improvement in time-controlled electrical heaters or muffles especially designed for dental purposes, its object being to enable the temperature of the heater to be automatically controlled by clock mechanism, which latter can be so adjusted beforehand that the current can be cut off after a predetermined run, can be gradually increased or diminished at intervals, as is desired in the treatment of the matter in the muffle, or kept at uniform strength, as desired.

The invention therefore consists in the novel construction and combination of parts hereinafter described and claimed.

Referring to the drawings, Figure 1 is a view of the complete apparatus. Fig. 2 is a vertical section through the muffle on line 2 2, Fig. 1. Fig. 3 is a bottom view of the muffle. Fig. 4 is a section on line 4 4, Fig. 1. Fig. 5 is a sectional view of the regulator on line 5 5, Fig. 1. Fig. 6 is a detail sectional view of the hand and brush. Fig. 7 is a detail section on line 7 7, Fig. 1. Fig. 8 is a detail face view of the regulator.

A designates the muffle, G a rheostat, and J a time-regulator and circuit-breaker, all included in an electrical circuit with a battery Z or with, preferably, an incandescent-light current.

The muffle A consists of two parts  $a$   $a'$ , hinged together, each internally lined with refractory material and having a cavity which when the parts are closed forms a heating-chamber. The part  $a$  is mounted on an insulating-base B, of suitable material, on which are two binding-posts  $b$   $b'$ . A resistance C, preferably a coil of platinum wire, substantially covers the entire surface of the cavity in part  $a$ , one end of such wire being electrically connected by a wire  $C'$  to post  $b$ , the other end being electrically connected to a

spring-contact finger  $C^2$ . The cavity in part  $a'$  is similarly provided with a resistance-coil  $c$ , the ends of which are connected to exterior contact-points, one of which contacts with the upper end of finger  $C^2$ , while the other end contacts with a similar finger  $c'$ , attached to the base, and the lower end of finger  $c'$  is connected by wire  $c^2$  with post  $b'$ . Thus a current flowing from  $b$  to  $b'$  will traverse the resistance in part  $a$ , then the resistance in part  $a'$ , the resistances being in series, and the circuit being broken when the muffle is opened or either finger  $C^2$   $c'$  held out of contact with the corresponding contact on part  $a'$ . The coils in parts  $a$   $a'$  should be made as close as possible, and preferably are partly exposed, as shown, so that their heat is directly radiated and convected into the chamber. The plug  $a^2$  (shown in the top of heater) is fully described in my other application, Serial No. 532,646, filed December 22, 1894. Post  $b$  is connected by a wire  $D^3$  to one post  $g$  of the rheostat G, which is of any suitable construction; but its several contact-plates E E are provided with binding-screws  $e$  for attachment of wires hereinafter described. The other post F of the resistance-box is connected to the battery or electrical supply by a wire D, and it is also electrically connected to the hand-adjustable contact-piece  $f$  as usual; but this latter is cut out of the circuit when the time-regulator is used. This regulator, as shown, consists of an ordinary time-piece having a dial-plate K of non-conducting material. On the outer end of the minute-hand shaft  $L^2$  is attached a hand L, which should be insulated from the shaft (so that the current may not traverse the clockwork) either in the manner shown or other suitable way.

On the outer end of hand L is attached a brush M, which is adapted to sweep over a series of contact-pieces N on the face of the plate as the hand moves around. This brush may be of any suitable construction. As shown it consists of two light metallic plates  $m$   $m'$ , pivoted side by side, having their lower ends beveled to make good contact with the pieces N, and one slightly longer than the other, so that there will be no breaking of the circuit or sparking when the brush passes from one contact-piece to the other. Plate  $m$  is pressed



toward the dial by a spring  $l$ , and plate  $m$  by a spring  $l'$ . Plate  $m$  also has a finger  $m^3$ , which overlies plate  $m'$  and prevents it rising above plate  $m$ . A bracket  $O$  is attached to the edge of the dial-plate  $K$  and carries a brush or contact-finger  $O'$ , which extends over the hand  $L$  and contacts with the hub end thereof. Bracket  $O$  is connected by a wire  $D'$  with post  $F$ , and the pieces  $N$  are electrically connected, as hereinafter described, to the contact-pieces of the rheostat. In practice the pieces  $N$  are segments of an annulus whose diameter is equal to the diameter of the circle described by brush  $M$ , and the length of the segments is proportional to the number of minutes the brush  $M$  is to contact therewith. For five minutes contact the segment would be one-twelfth of a circle, and for other lengths of time in proportion. Four segments  $N$  are shown secured to the dial-plate, which will, when the plates are traversed by the brush, close the circuit for about thirty-five minutes. The plates are slightly separated, and are, as shown, successively connected by wires  $D^2$  to the contact-pieces  $E$  of the box, so that as the brush traverses the successive plates the current is directed through successively greater or fewer resistance-coils in the rheostat. Thus the segments may be so connected that the intensity of the current shall be increased by degrees or diminished by degrees. By connecting the plates in series to each other or to one contact-piece a uniform current may be maintained. By increasing or lessening the length or number of segments the time duration of current may be lengthened or shortened. For convenience the binding-posts  $n$  of segments  $N$  may be used as the securing device also, as indicated in the drawings, and the dial-plate  $K$  may have a series of perforations  $k$  near its periphery for attachment of the segments. Thus, by having a series of detachable segments of varying sizes, the instrument can be quickly adjusted for regulating the current as desired for any length of time. Where only a certain duration and regulation of current is desired, the segments may be permanently attached to the dial-plate.

I do not confine myself to the precise construction shown, as many changes would be obvious to a mechanic, the principal feature being an electrical circuit maker, controller, and breaker controlled by clock mechanism.

In operation the segments are adjusted for a proper duration of current and connected to the rheostat so as to give the desired strength of current at the proper times and for desired duration. Then the article to be treated is placed in muffle and the latter closed. Thereupon as soon as the minute-hand brings the brushes in contact with the segments the circuit is closed and the current from battery flows through wires  $D$   $D'$ , finger  $O'$ , hand  $L$ , brush  $M$ , segments  $N$ , wires  $D^2$ , the rheostat, and wire  $D^3$  to and through the muffle, and thence through wire  $D^4$  to the battery. When

the hand moves the brushes off the last segment the current is broken. The dial-plate may be recessed, as at  $K'$ , so that when the brush passes off the last segment it will drop quickly away from it and possibility of sparking by slow separation be obviated. Obviously where no variation of current is desired the segments may be in direct electrical connection with the muffle, or the rheostat omitted.

I do not herein claim the muffle or heater *per se*, reserving it for subject-matter of another application.

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

1. The combination with an electro-receptive device or muffle, a rheostat, and mechanism actuated by clock work for throwing the various resistances of the rheostat successively into the circuit, substantially as and for the purpose specified.

2. The combination of a rheostat having separate resistances, with an electrical circuit maker, regulator, and breaker, comprising stationary contacts respectively electrically connected with separate resistances of the rheostat, and a movable contact which is operated by clock-work and electrically connected in main circuit, substantially as and for the purpose set forth.

3. The combination with an electro-receptive device, and an electrical supply in circuit; with a rheostat interposed in the circuit and a circuit-controller for said rheostat actuated by clock work—substantially as and for the purpose set forth.

4. The combination with an electro-receptive device, an electrical supply, and a rheostat in circuit, with mechanism for shifting the circuit through the rheostat operated by clock-work, substantially as and for the purpose described.

5. The combination of an electro-receptive device, a rheostat and an electrical supply, with mechanism actuated by clock-work for making and regulating the duration of the current through the electro-receptive device and rheostat and for also shifting the current through varying resistances of the rheostat, substantially as described.

6. The combination with an electro-receptive device, an electrical supply and a rheostat in circuit, with a clock a brush moved by the minute hand thereof and electrically connected with the electrical supply, a series of contact plates arranged to be traversed by said brush, and electrical connections between said plates and the rheostat coils, substantially as described.

7. An electrical circuit maker, regulator, and breaker comprising a movable brush operated by clock-work, and a series of removable and adjustable segments adapted to be traversed by said brush detachably attached to the dial plate and insulated both from the dial and each other, and a stationary arm contacting with said brush, and electrical con-



nections for completing a circuit through the arm, brush, and segments, substantially as described.

8. The combination of a clock, a brush moved by one hand thereof, and an electrical connection between said brush and an electrical supply, with a series of contact plates adapted to be traversed by said brush, independent resistances respectively connected to said contact plates, and an electrical heater or receptive device in circuit with the resistances, substantially as described.

9. The herein described muffle consisting of the two chambered parts *a, a'*, the resistance coils therein, the insulating base, the contact springs thereon, the binding posts, and the connections substantially as described whereby the current is caused to traverse the coils in series; in combination with the clock-controlled rheostat and electrical supply, substantially as described.

10. The herein described regulator consisting of the insulated dial plate, the segments attached thereto, the stationary arm thereon, the rotating arm moved by clock-work and the brushes *m, m'*, controlled by springs *l, l'*, mounted on said arm and adapted to estab-

lish electrical connection between the arm and segments, substantially as described.

11. The herein described regulator consisting of the insulated dial plates, the segments attached thereto, the stationary arm thereon, the rotating arm moved by clock-work and adapted to establish electrical connection between the arm and segments, in combination with a rheostat and electrical connections between said segments and the rheostat coils, substantially as described.

12. The combination of a clock provided with a face plate having a depression or cavity therein, and the arm *L* carrying the brushes *m, m'*, with the insulated plates *K*, the arm *O* attached thereto contacting arm *L*, and the insulated segments detachably attached to the plate and adapted to be contacted by the brushes, all substantially as and for the purpose set forth.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

LEVITT E. CUSTER.

Witnesses:

JOS FERNEDING,  
THOMAS ROBINSON.