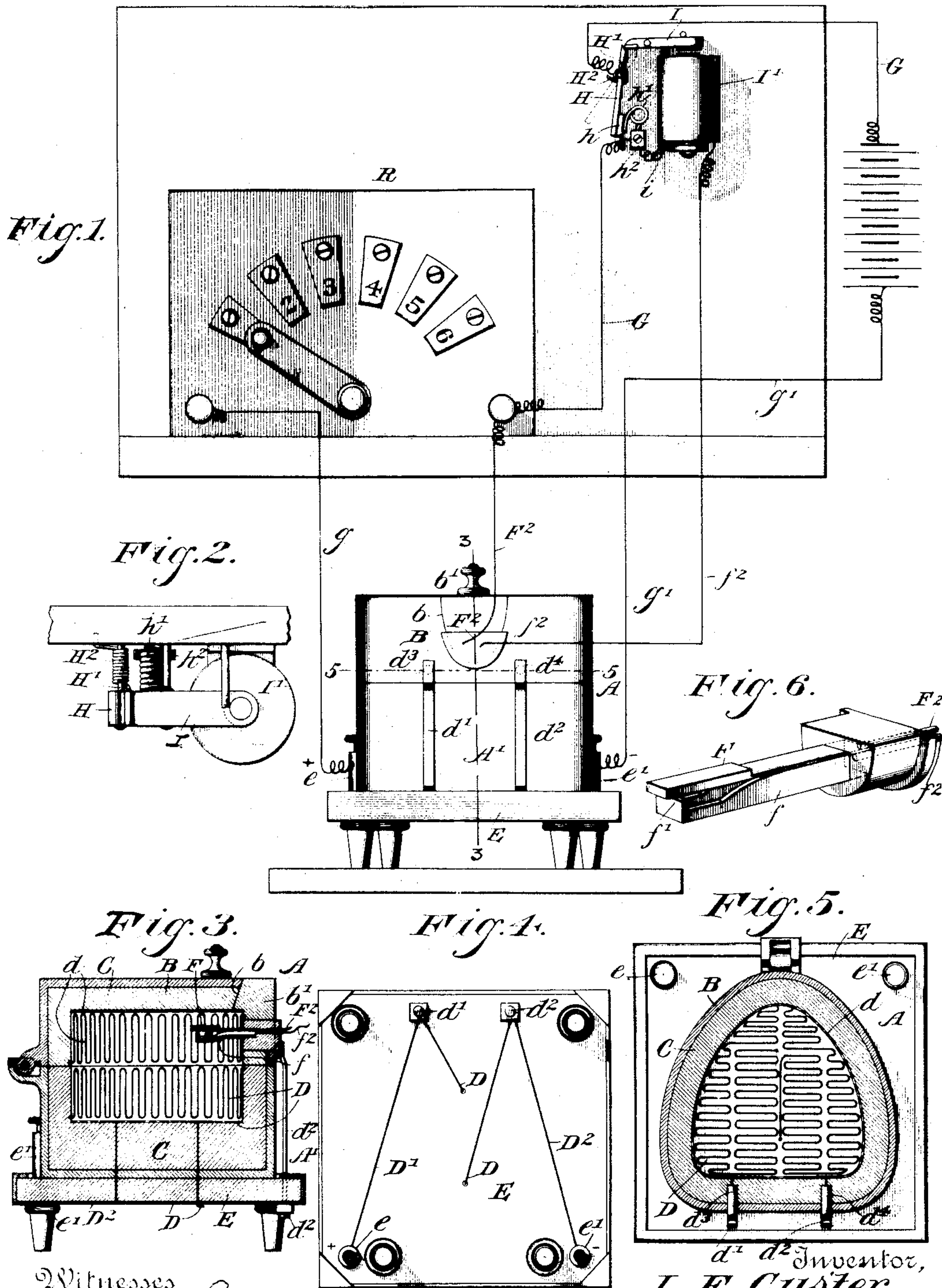


(No Model.)

L. E. CUSTER.
THERMO CONTROLLED ELECTRICAL HEATER.

No. 541,724.

Patented June 25, 1895.



Witnesses
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UNITED STATES PATENT OFFICE.

LEVITT E. CUSTER, OF DAYTON, OHIO.

THERMO-CONTROLLED ELECTRICAL HEATER.

SPECIFICATION forming part of Letters Patent No. 541,724, dated June 25, 1895.

Application filed December 22, 1894. Serial No. 532,646. (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 Thermo-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 electrical muffles and thermal regulators, especially designed for dental uses in the making of artificial teeth and plates. Its objects are to enable the muffle to be rapidly and equally heated, the heat gradually increased by increasing the current; to produce independent circuits through the parts of the muffle and to automatically cut off the current upon the attainment of the desired temperature so that absolute safety and accuracy of the work done will be insured.

To these ends the invention consists in the novel constructions and combinations of parts hereinafter described and claimed.

Referring to the drawings, Figure 1 is a diagrammatic view of the apparatus. Fig. 2 is a detail plan view of the electro-magnetic cut-out. Fig. 3 is a vertical section of the muffle on line 3 3, Fig. 1. Fig. 4 is a bottom plan view of the muffle. Fig. 5 is a section view of the muffle on line 5 5, Fig. 1. Fig. 6 is a detail.

A designates the muffle, consisting of two similar halves A, B, hinged together at rear, each consisting of an exterior metallic shell having a thick internal lining of refractory and non-conducting material C. The entire surface of the walls and bottom of the cavity in half A is thickly covered with a resistance, preferably formed of an endless mat of platinum wire D or other conductor of high resistance and fusing point which is bent or coiled upon itself in any desired manner so that contiguous portions of the wire do not contact, and the entire length of the wire is substantially visible, the object being to get the greatest length of wire possible around the walls and bottom of the recess in part A, the wire being retained in position by partially embedding it in the lining, at the time of

molding the latter, or in other suitable manner, so that a great portion of the resistance will be exposed, the object being to have as much surface of resistance exposed as is possible while having it sufficiently embedded in place to prevent its short circuiting by buckling. The side walls and roof of cavity in part B are similarly covered by an endless resistance d , which should be of equal electrical resistance to D. By thus covering the inner walls of the muffle with resistance of great length I obtain a great heat with less liability of burning out the resistance, than can be attained when only a small part of surface is covered by resistance, or the latter is of large cross-section. Part A is mounted on a base E of non-heat and non-electric conductivity, such as asbestos provided with binding posts e, e' , and with two upright spring contact pieces d', d^2 . Post e is connected by a wire D' to the lower end of piece d' and also to one terminal of the resistance D in part A, the other terminal of such resistance being connected to a wire D^2 which has an electrical connection with the lower end of piece d^2 and with the opposite binding post e' . The posts e, e' , are electrically connected with the generator as hereinafter described so that a current is established through resistance D when the circuit is closed. One terminal of resistance d is electrically connected to a contact point d^3 , the other to a contact point d^4 , said points slightly projecting from the part B in positions to contact with the upper ends of pieces d', d^2 , when part B is closed on part A, whereupon (if the main circuit is closed), a current is also established through resistance d . Thus it will be seen that a current can be established through resistance A at any time, irrespective of the position of part B. Thus part A can be dried out or heated while part B is open, and as soon as part B is closed a current is also established through resistance d (the main circuit being closed) the current through d being made or broken automatically by closing or opening part B. If it is desired to cut out resistance d when part B is closed, it can be readily done by holding either finger d' or d^2 out of contact with its point, in any convenient manner. Thus I am enabled to cut out half the resistance, (and diminish temperature accordingly)

in the muffle, while in fusing porcelain, for which the muffle shown is especially designed, all the resistance should be in circuit.

The two resistances being independent and in multiple the amount of current passed through the muffle will be double the amount that could be passed if the resistances were in series. Consequently the amount of heat developed in the muffle will be greatly increased by the described construction, over the ordinary series connection of resistances usually employed.

Another important feature of construction of the muffle is the fact that the entire surface of the interior walls, top and bottom, of the chamber is covered by resistance and the heat developed therein is diffused equally through all parts of the chamber so that whatever is in the chamber is heated equally. This equal diffusion of heating surface is of the utmost practical importance in dental work and I believe myself to be the first to construct an electrical muffle whose walls were entirely covered by resistance.

The parts A, B, are so shaped that the chamber therein is adapted to the shape of the articles to be treated in the muffle, and in the present instance the chamber is of proper size to hold a set of dental-plates, or false-teeth. An opening *b* is made in part B, opening into the top of the chamber, for the insertion of a cut-off which consists of two pieces *F, f*, of highly refractory metallic conductors, such as platinum, which are secured to a refractory plug, one above the other, see Fig. 3, the upper piece *F* having its inner end weighted, so that it will drop by gravity and contact with the upturned end *f'* of the lower piece *f*, unless it is positively kept out of contact therewith. The outer extremities of pieces *F, f*, are respectively connected to wires *F², f²*, hereinafter referred to.

The drawings illustrate a battery generator, but in practice an incandescent or other current may be employed. The current passes from one pole of the generator through wire *G* to a resistance box *R*, and from the latter through wire *g* to the post *e*, then through the muffle, as described, and back to the generator, or ground, through wire *g'*. The resistance box *R* is of any suitable construction, arranged as usual so that the intensity of the current can be regulated at will of the operator.

In order to cut off the current at the proper time, a cut-out is placed in the circuit between the battery and resistance, or at other desired point. This cut-out consists of a metallic conductor plate *H* which is pivoted on a pin *H'* in electrical connection with wire *G*, and when the circuit is closed the lower end of plate *H* is in contact with a piece *h* mounted on a conducting spring *h'* fastened to a binding post or block *h²* electrically connected to the other portion of wire *G*. Thus when plate *H* is in contact with piece *h* an electrical circuit is established through wire

G, pin *H'*, plate *H*, piece *h*, spring *h'*, and block *h²* to the resistance box. A spring *H²* is placed on pin *H* and tends to rock plate *H* out of contact with piece *h*, and when the plate *H* is released from its locking device the springs *H²* and *h'* will throw it out of contact with piece *h* and thus break the circuit. Plate *H* is normally kept in contact with piece *h* however by means of the armature *I* of an electro-magnet *I'*. The armature is pivoted in such position that, when there is no current in the magnet-coil, its outer end engages the upper end of plate *H* and keeps its lower end in contact with piece *h* as shown in full lines Fig. 1, thus maintaining the electrical circuit. Upon the energizing of the magnet however the armature being attracted disengages plate *H* and the springs throw the plate out of contact with piece *h*, breaking the circuit, as indicated in dotted lines Fig. 1. Wire *F²* is electrically connected with wire *G* at any convenient point, and wire *f²* is connected to one terminal of the coils of magnet *I'*, the other terminal thereof connecting by a short wire *i* with block *h²*, or wire *G*.

The tongues *F, f*, are normally separated by a small piece of non-conducting substance, the fusing point of which should be the same as or slightly greater than the temperature to be attained in the muffle. For example, when the muffle is used to fuse porcelain, the block should be of porcelain or other substance which will fuse when the porcelain under treatment is properly melted. Upon the fusing of this block the tongues *F, f*, contact, whereupon a shunt circuit is established through wires *F²*, pieces *F, f*, wire *f²*, the magnet-coils and wire *i*, whereupon the magnet being energized the armature is attracted, releasing plate *H* which is thrown out of contact with piece *h*, and the main circuit thus broken, and remaining so until plate *H* is restored to normal position, and the electrical shunt circuit opened, as by separating tongues, *F, f*.

The tongues are removably introduced into the muffle through opening *b*, and the opening may be closed by a removable plug *b'*, which can be removed to facilitate placing or removal of the fusible circuit maker, and to examine the progress of the work in muffle.

The operation of the apparatus is clear from the foregoing, and I do not confine myself to the specific apparatus herein shown and described.

When the muffle is used for fusing porcelain, as the fusing point of high fusing porcelain and of platinum are nearly the same, the inner surface of the muffle should be covered with the platinum wire as compactly arranged as is possible while at the same time preventing a short circuit between adjoining portions of the wire, so that an individual strand of wire will not have to be so highly heated as where there are but few of them, because of the large radiating surface.

Having thus described my invention, what

I therefore claim as new, and desire to secure by Letters Patent thereon, is—

1. The combination of an electrical heater, and a cut-out in the main circuit, controlled by an auxiliary or shunt circuit; with a thermo-circuit-closer interposed in the auxiliary circuit and subjected to the temperature of the heater, whereby when the heater reaches a desired temperature the auxiliary circuit is closed, and causes the cut-out to break the main circuit, substantially as described.

2. The combination of an electrically heated muffle; an electro-magnetic circuit-breaker interposed in the main circuit with the muffle; with a thermo-circuit closer within the muffle an electrical connection between one pole of the thermo-circuit closer and the main circuit, and an electrical connection between the other pole of the thermo circuit-closer and the electro-magnetic circuit-breaker, whereby when the temperature in the muffle reaches a desired point the shunt-circuit is closed, actuating the electro-magnetic-circuit-breaker, and thereby cutting out both the main and shunt circuits, substantially as described.

3. The combination of an electrical supply, a rheostat a muffle, and an electro-magnetic circuit-breaker all interposed in the main circuit; with a thermo-circuit-closer subjected to the temperature of the heater, and a shunt circuit including the thermo-circuit-closer and electro-magnetic circuit breaker, substantially as described and for the purpose set forth.

4. In combination with an electrical heater, and an electrical cut-out or circuit-breaker in the main circuit, with a fusible non-conducting block subjected to the temperature of the heater and a shunt or auxiliary electrical circuit including the circuit-breaker, opened normally by said block, but closed upon the fusing thereof, whereby the main circuit is broken upon the establishment of the shunt or auxiliary circuit, substantially as described.

5. The combination of a muffle provided with electrical heating devices, the main circuit and an electro-magnetic circuit-breaker interposed in the main circuit; with a thermo-circuit-closer attached to the muffle and an auxiliary circuit including the thermo-circuit-closer and the electro-magnetic-circuit-breaker, whereby when the temperature in the muffle reaches a predetermined point the thermo-circuit closer closes the auxiliary circuit, whereupon the electro-magnetic-circuit-breaker opens the main circuit, substantially as described.

6. The combination of the electrically heated muffle, and the main electric circuit; with a spring actuated circuit-breaking plate arranged in the main circuit; an electro-mag-

net for releasing said plate, allowing it to break the main circuit, a thermo-contact maker in the muffle and a shunt circuit including such contact maker and the electro-magnet, substantially as and for the purpose described.

7. The combination of the electrically heated muffle, the rheostat, the connections between the muffle and rheostat and between them and electrical supply; with the oscillating spring actuated plate in the main circuit, the electro-magnet for releasing said plate, to break the circuit, a thermo-contact-maker in the muffle, and electrical connections between the main circuit, said thermo-contact-maker, and the electro-magnet, substantially as and for the purpose described.

8. The combination of an electrical heater, and a cut-out in the main circuit controlled by an auxiliary or shunt circuit; with the thermo-electric-circuit-maker interposed in the shunt circuit, and subjected to the temperature of the heater, said thermo-circuit-maker comprising two conducting points normally separated by a fusible block, substantially as and for the purpose set forth.

9. In an electro-magnetic circuit-maker a pivoted plate H and a piece h mounted on a spring h' contacting therewith, and electrical connections whereby a direct circuit is established through the plate, piece, and spring, when the plate and piece are in contact; in combination with an electro-magnet, its armature pivoted and adapted to hold the plate in contact with the piece against, and tension the spring, until the electro-magnet is magnetized, and a shunt circuit for energizing the magnet, substantially as and for the purpose specified.

10. The combination of the electrically heated muffle, constructed substantially as described, the electric supply, the rheostat, and the electrical connections between said supply, rheostat, and muffle; with a pivoted plate and spring contact piece forming part of the main circuit, a spring for throwing said plate out of contact, an armature for locking said plate in circuit, an electro-magnet for causing said plate to release the armature, a thermo-circuit maker in the muffle, and a shunt circuit including said thermo-circuit-maker and the electro-magnet, 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:

ZEIGLER F. LOUIS,
J. H. SEILER.