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A. GOLDSTEIN & H. E. RICE.

THERMOSTAT.

APPLICATION FILED MAY 23, 1903.

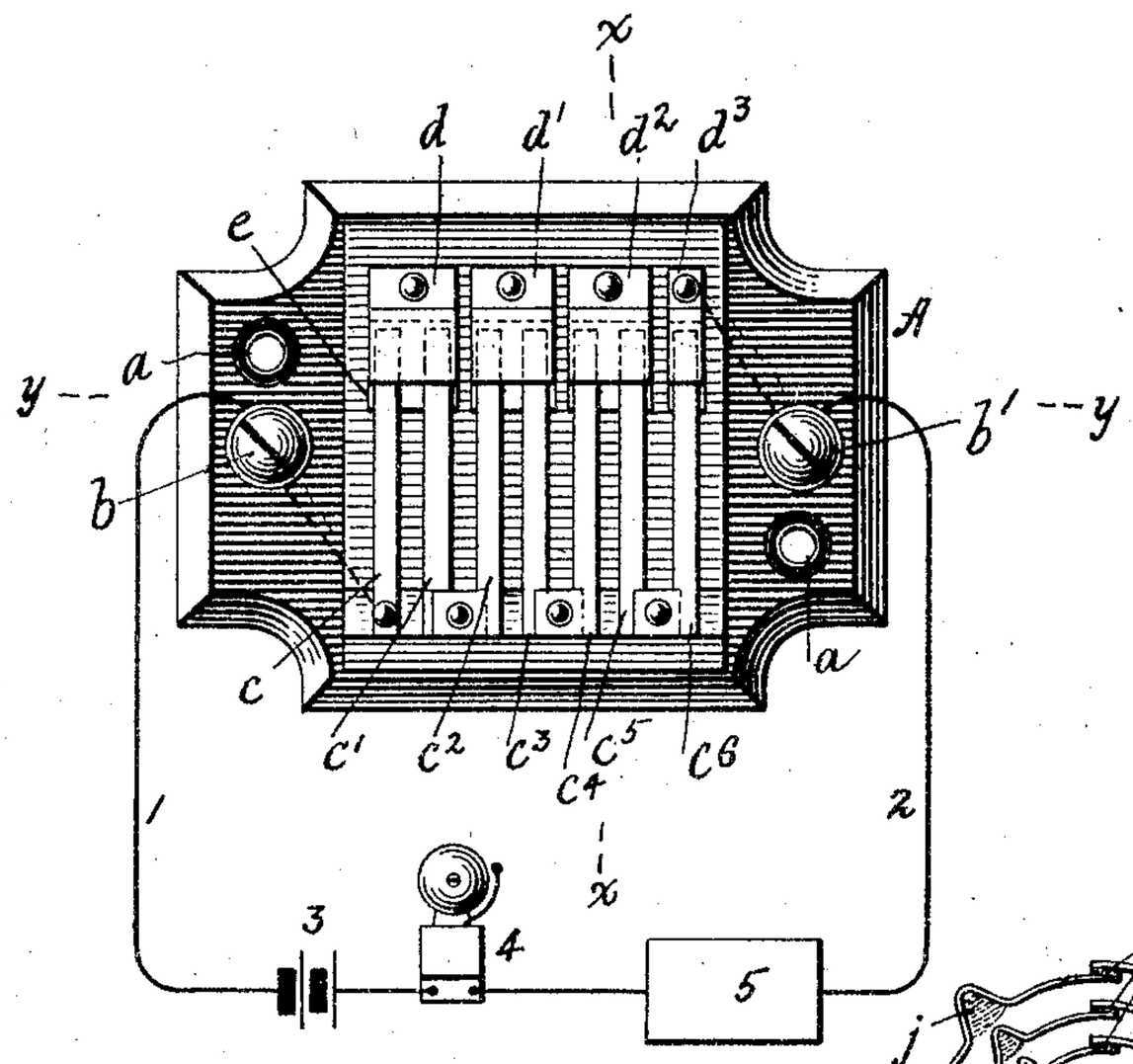

Fig. 2.

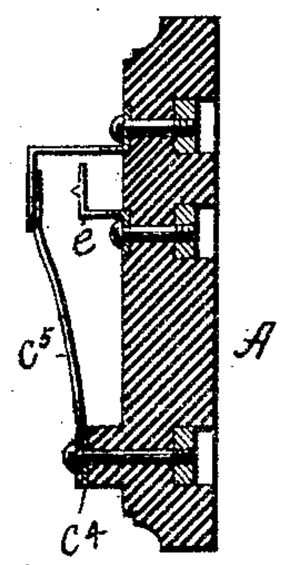

Fig. 4.

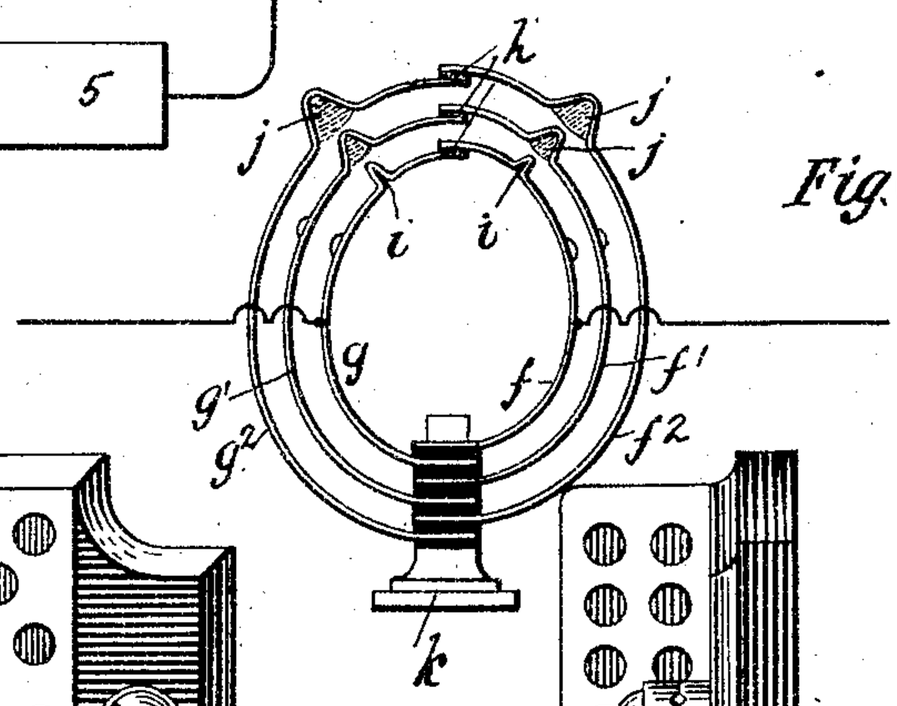

Fig. 6.

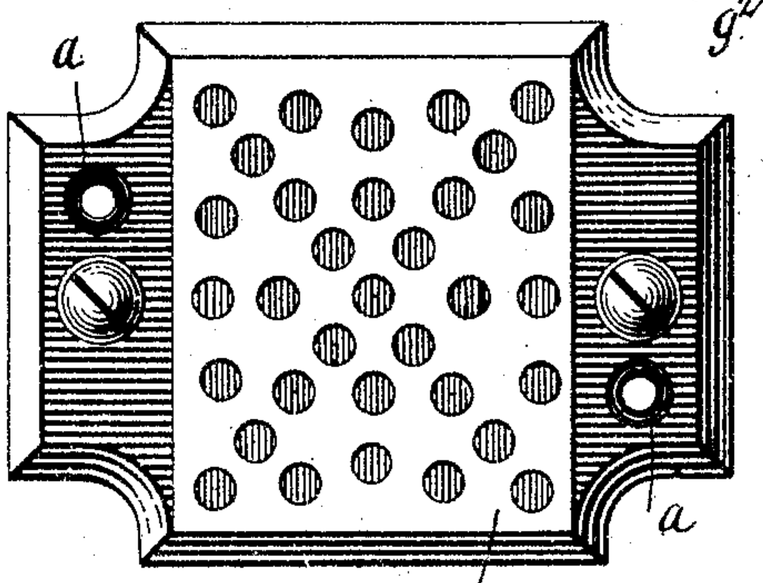

Fig. 1.

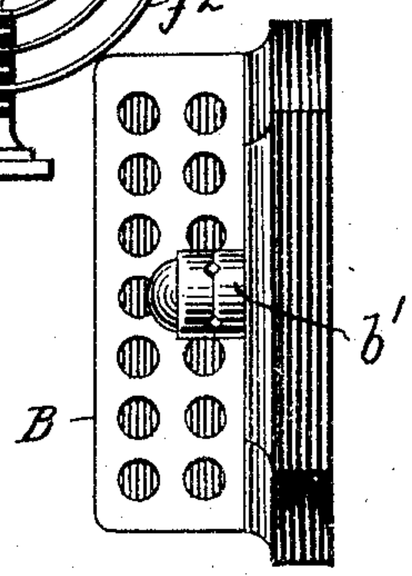

Fig. 3.

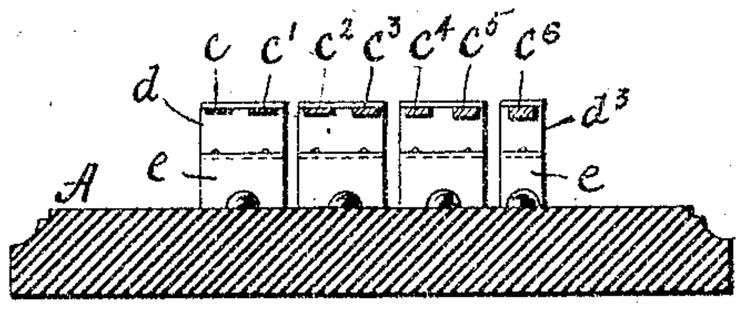

Fig. 5.

Witnesses
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No. 778,779. Patented December 27, 1904.

UNITED STATES PATENT OFFICE.

ALBERT GOLDSTEIN, OF NEW YORK, N. Y., AND HORACE E. RICE, OF PHILADELPHIA, PENNSYLVANIA.

THERMOSTAT.

SPECIFICATION forming part of Letters Patent No. 778,779, dated December 27, 1904.

Application filed May 23, 1903. Serial No. 158,416.

To all whom it may concern:

Be it known that we, ALBERT GOLDSTEIN, residing in the city, county, and State of New York, and HORACE E. RICE, residing in the city and county of Philadelphia, State of Pennsylvania, citizens of the United States, have invented certain new and useful Improvements in Thermostats, of which the following is a full, clear, and exact description.

This invention relates to thermostats or devices adapted to control an electric circuit and operative upon the application of heat.

The object of the invention is to provide a device of this character which when subjected to heat will open and close the electric circuit a number of times in comparatively quick succession.

A further object is to produce such a device in the simplest and cheapest form.

In the accompanying drawings, Figure 1 is a face view of the thermostat. Fig. 2 is a similar view with the protecting-casing removed and showing the circuits. Fig. 3 is an end view. Fig. 4 is a section on line *x x* of Fig. 1. Fig. 5 is a section on line *y y* of Fig. 1, and Fig. 6 is a modification.

Referring to the drawings by letter, A indicates a base, preferably of insulating material, such as porcelain, and consisting of a flat plate having holes *a* for fastening-screws, and provided at each extremity with binding-posts *b b'* for the terminals of an electric circuit.

B is a protecting cover or casing for the mechanism. It is made of open or skeleton work to freely admit heat existing in the immediate vicinity. The thermostat mechanism itself consists of a series of spring-tongues indicated, respectively, by the letters *c*, c', c^2, c^3, c^4, c^5, and c^6. These tongues are electrically connected together in pairs at one end, and in case there are an odd number, as will be usual, the odd tongue is placed at one end of the series, as indicated at c^6. These tongues are preferably mounted in a row with their secured ends along one edge of the base-plate, the manner of securing them being by means of rivets, as shown, screws, or in any other suitable manner. When these tongues are made of equal thicknesses of metal, the various pairs can be stamped out of sheet metal, and thus be integral, but, as shown in the drawings, each tongue is of a distinct piece of metal, and the pairs are joined by overlapping lugs at the bases of the tongues. However, this detail is not of vital importance, and any mechanical arrangement can be adopted that best serves the purpose. The tongues are all arranged parallel to one another and extend across the face of the base-plate. Along that edge of the base-plate toward which the tongues project are secured a number of angle-plates having the general form of the letter Z and indicated by *d*, d', d^2, and d^3. The spring-tongues project under the overhanging portions of these plates, the first two tongues being beneath plate *d*, the next two beneath the plate d', the next two beneath plate d^2, and the last tongue beneath plate d^3.

The ends of the tongues are secured under tension to the under surface of the angle-plates by films of solder or other fusible material. Immediately beneath or behind the ends of the tongues are a number of anvil-plates *e*, one for each of the angle-plates and bearing the same relation to the tongues as exists between the angle-plates and the tongues, so that in case the solder by which any tongue is attached to an angle-plate becomes fused the tongue will separate from the angle-plate and make contact with the anvil immediately beneath it. The series of tongues are so constructed that they will conduct heat unequally—that is to say, one tongue will conduct heat more rapidly than the other, so that the solder which holds them will fuse at different times and cause the tongues to spring from the angle-plates to the anvils in succession instead of all at once. Preferably we arrange that the first tongue of the series shall be the first affected and that the others shall operate in regular succession; but this particular order is not essential for all purposes. There are various ways of constructing the thermostat to obtain this successive action of the tongues. One way is to make the tongues of different kinds of metal or alloys, having relatively different heat conductivities. Another way is to give

the tongues different forms, so that those surfaces which are most exposed will absorb heat more quickly than those less exposed. Another way is to vary the mechanical tension or strain on the respective fusible solder-joints or vary the sensitiveness of the respective tongues by the relative amounts of insulating material placed in contact with same for the purpose of retardation or by varying the relative amounts of fusible solder used to retain the respective tongues in the normal position. In the drawings we have illustrated the tongues as having the same surface exposed outwardly to the heat, while the various tongues are successively thicker from the first to the last, those at the end of the series being thus slower to heat up than those at the beginning.

A thermostat of this character can be either on a normally closed or a normally open circuit. As shown it is used on a normally closed circuit. An ordinary alarm-circuit is illustrated by the wires 1 and 2 in which are connected a battery 3, an alarm or indicator 4, and a repeating transmitter or other apparatus 5. The circuit through the thermostat may be traced from the binding-post b to the tongue c, thence through the angle-plate d to the tongue c', thence successively through tongue c^2, angle-plate d', tongue c^3, tongue c^4, angle-plate d^2, tongue c^5, tongue c^6, angle-plate d^3, and finally to binding-post b'.

The outer faces of the angle-plates may be covered with asbestos or other suitable non-heat-conducting material, and, in fact, all parts except the spring-tongues may be so protected in order to confine the heat to the tongues themselves to avoid fusing the solder by conduction of heat from other parts.

The operation of the thermostat is as follows: Heat entering through the skeleton cover attacks all of the tongues at practically the same instant. Tongue c, being the first to heat up sufficiently to fuse the solder which holds it to the angle-plate, is the first to act. It leaves the angle-plate and makes contact with the anvil beneath it, thus breaking the circuit. A short interval thereafter, depending upon the mechanical conditions, tongue c' is released and moves into contact with the same anvil, thus restoring the circuit, which then leads through the anvil. Tongue c^2 is next to be released and breaks the circuit, tongue c^3 then moving again restores the circuit, tongue c^4 then breaks the circuit, c^5 then restores the circuit, and c^6 breaks the circuit and leaves it open. Thus the circuit is opened and closed a number of times in more or less quick succession. This action can be taken advantage of in various ways in fire-alarm and other signaling systems. A succession of interruptions may also be used to operate a transmitter in a certain manner—as, for instance, described in another application, filed May 23, 1903, Serial No. 158,417.

We desire to call special attention to the fact that each interruption of the circuit by the thermostat is caused directly by the heat, as distinguished from a thermostat which merely sets into motion an apparatus, such as a train of gears or combination of multiple levers, which thereafter operate like an automatic make-and-break switch. We point out this distinction, not because we are aware that the latter construction is old, but merely to show the fundamental difference in operation of the two devices, as we believe we are the first to devise a theremostat capable of interrupting the same circuit a number of times in succession.

It is not essential to the invention that the successive opening and closing of the circuit shall be effected by independent tongues for each operation, as each tongue may be designed to both open and close the circuit and follow one another in regular periodic sequence, the necessary time constant between operations being secured by any suitable mechanical means. For example, Fig. 6 shows a number of bow-springs f, f', f^2 and g, g', and g^2 arranged in pairs and connected by solder-plugs h, adapted to fuse in succession. The circuit is continuous through the pair f g. When they are released, they make contact with f' and g'; but the time interval between the contacts is controlled by a lug i, entering a wax-filled cavity j, which delays the actual contact between the two springs. When the second pair are released, the same operation is repeated and likewise for the third and any others that may be used. With the release of each pair of springs the circuit is broken and completed. It is understood that all of the springs are insulated from each other at the fastening-post k.

Having described our invention, we claim—

1. A thermostat provided with a plurality of circuit-interrupters of varying sensitiveness to heat, relatively to each other, in combination with a circuit in which said interrupters are arranged in series.

2. A thermostat provided with a plurality of circuit-interrupters of graduated sensitiveness to heat, in combination with a circuit in which said interrupters are arranged in series.

3. In a thermostat, a plurality of circuit-interrupters each of which is independently controlled by fusible material in combination with a circuit in which said interrupters are arranged in series, and means for graduating the application of heat to the fusible material.

4. In a thermostat, a series of exposed spring-tongues, each of which is held under tension by fusible material, said tongues being constructed to conduct heat to the fusible material respectively holding them at different rates.

5. A thermostat embodying a spring under tension, a contact with which said spring is adapted to engage when released and means

for delaying such contact after the release of the spring, for the purpose set forth.

6. A thermostat embodying a spring, a body of fusible material holding said spring under tension, a contact with which said spring is adapted to engage when released and means for delaying such contact after the release of the spring, as set forth.

7. A thermostat embodying a contacting element, a body of fusible material holding said element under tension, a contact with which said element is adapted to engage when released and another fusible body determining the interval within which said contacts shall be made after said element is released.

In witness whereof we subscribe our signatures in presence of two witnesses.

ALBERT GOLDSTEIN.
HORACE E. RICE.

Witnesses:
FRANK S. OBER,
WALDO M. CHAPIN.