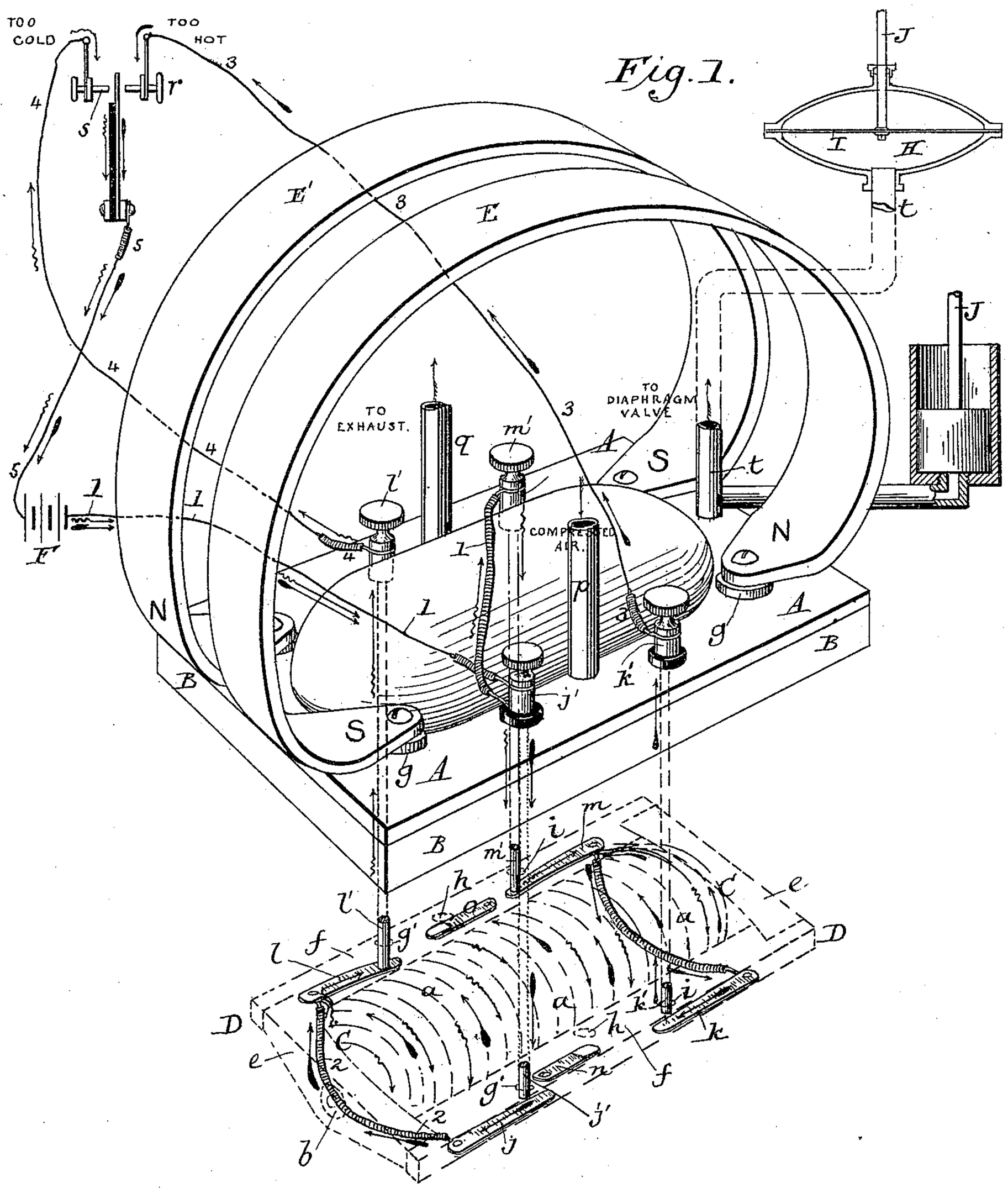
(No Model.) 3 Sheets—Sheet 1.

L. F. EASTON.

ELECTRIC TEMPERATURE REGULATOR.

No. 405,151. Patented June 11, 1889.

Fig. 1.



Attest:
Sidney P. Hollingsworth
Horace A. Dodge.

Inventor:
Lucien F. Easton,
by Dodge Bros,
his Attys.

(No Model.) 3 Sheets—Sheet 2.

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ELECTRIC TEMPERATURE REGULATOR.

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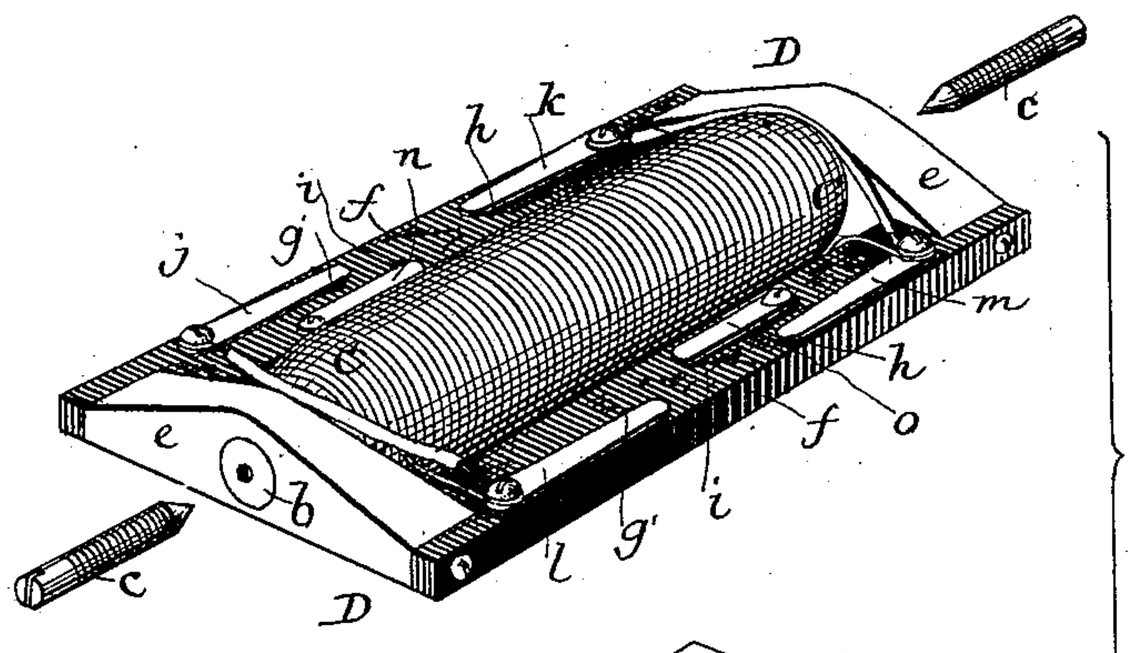
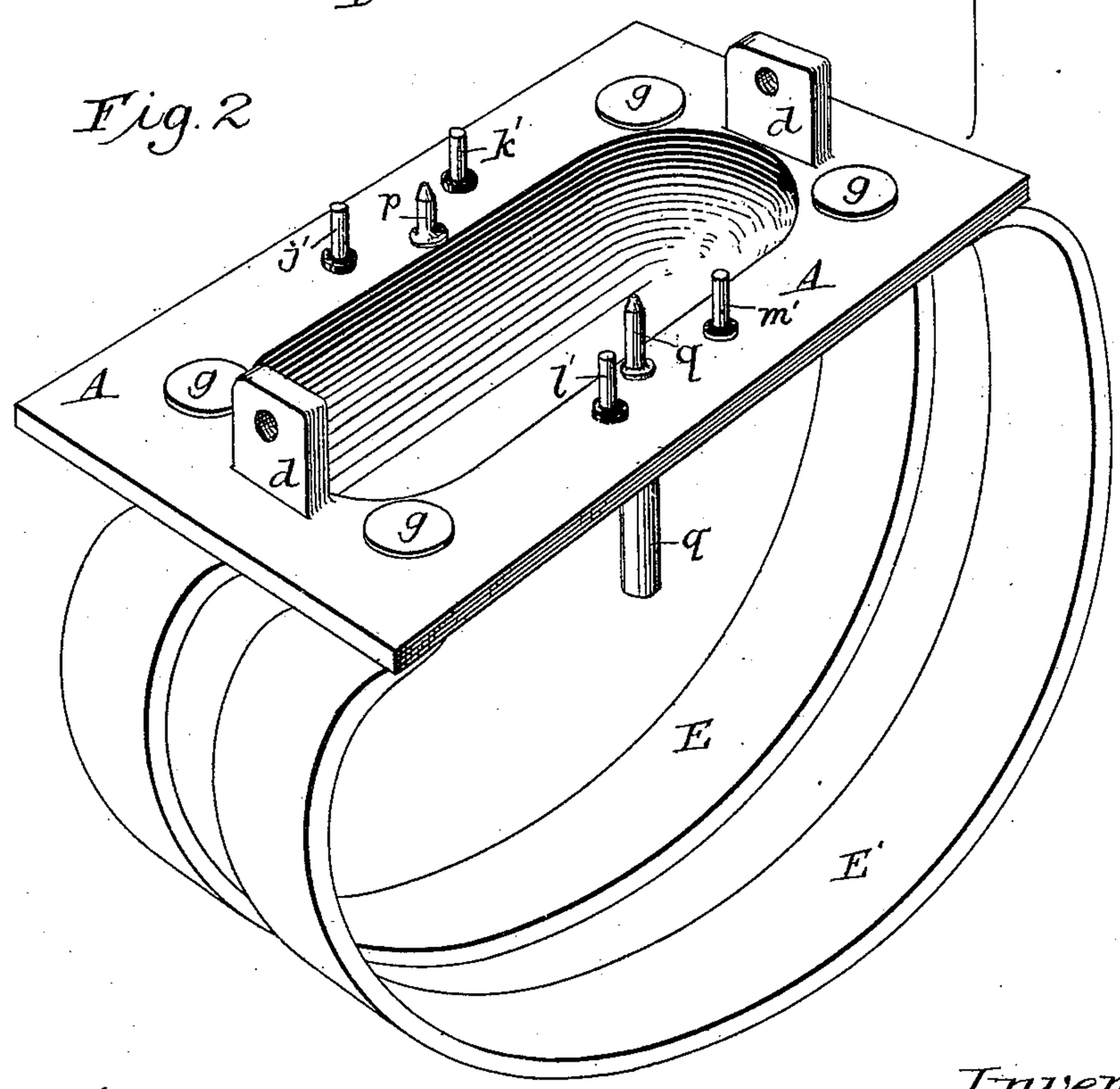


Fig. 2



Attest.

Sidney P. Hollingsworth

Horace A. Dodge.

Inventor:

Lucien F. Easton,

by Dodger Sons,

his Attys.

(No Model.) 3 Sheets—Sheet 3.

L. F. EASTON.

ELECTRIC TEMPERATURE REGULATOR.

No. 405,151. Patented June 11, 1889.

Fig. 3

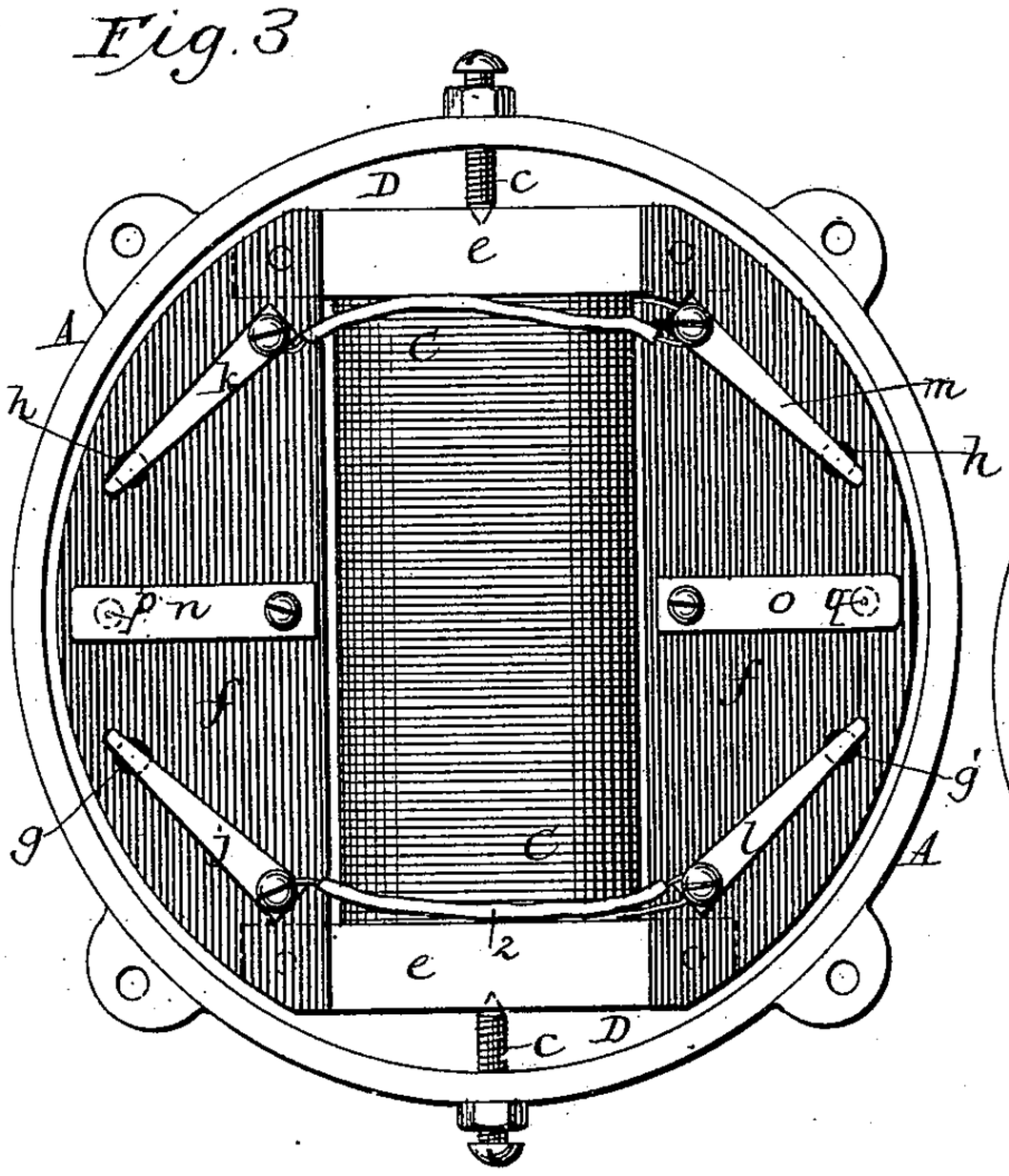


Fig. 5

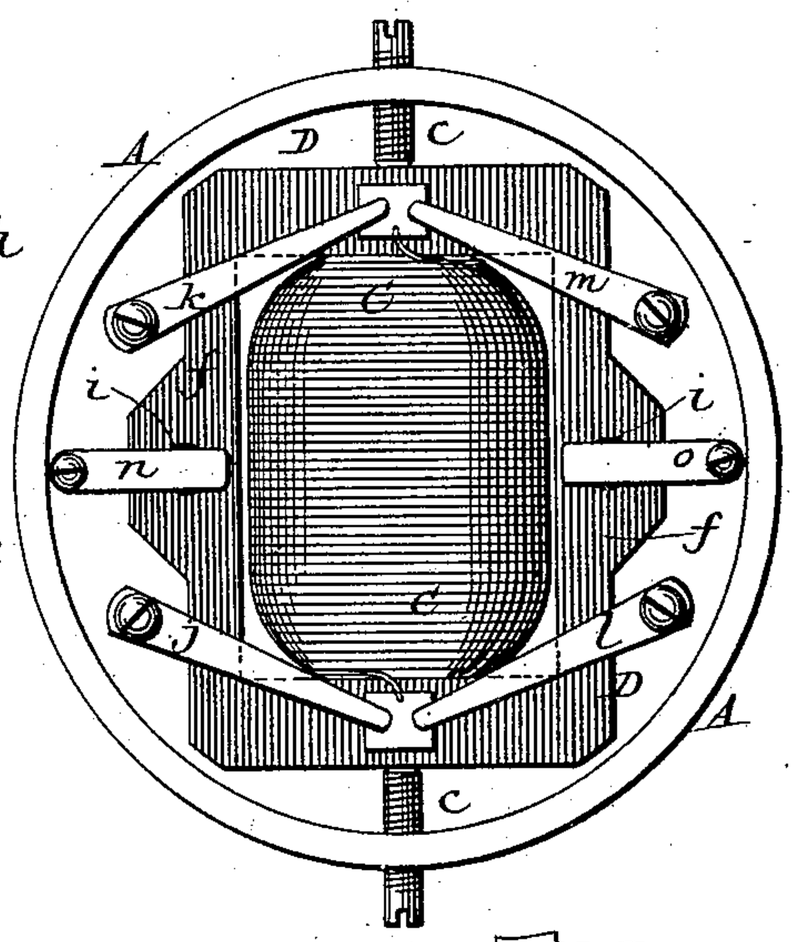
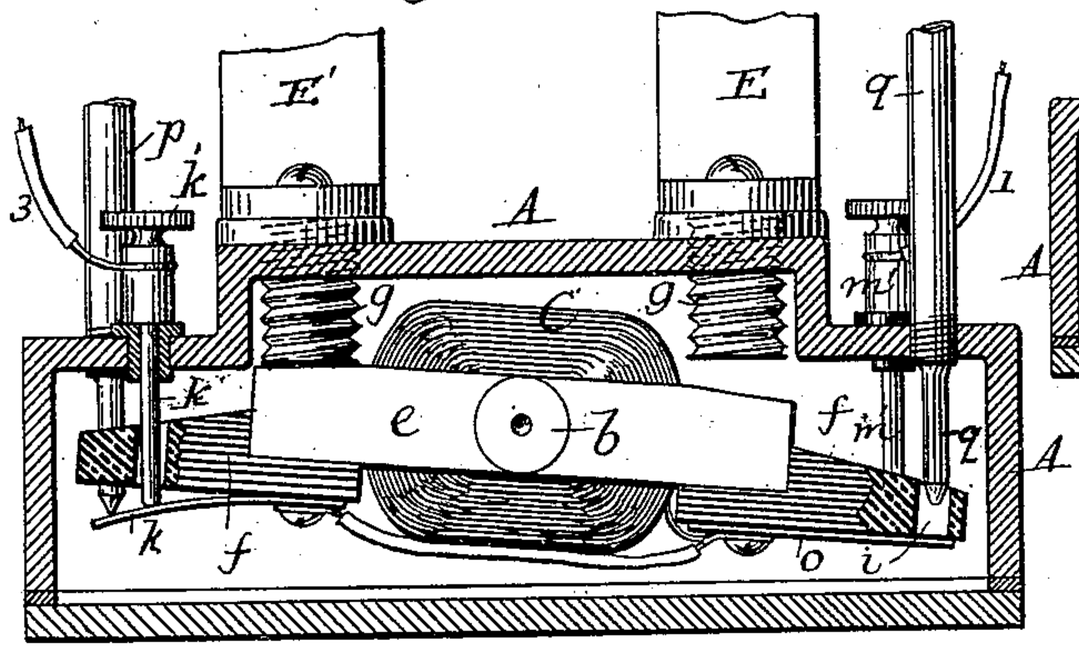


Fig. 4.



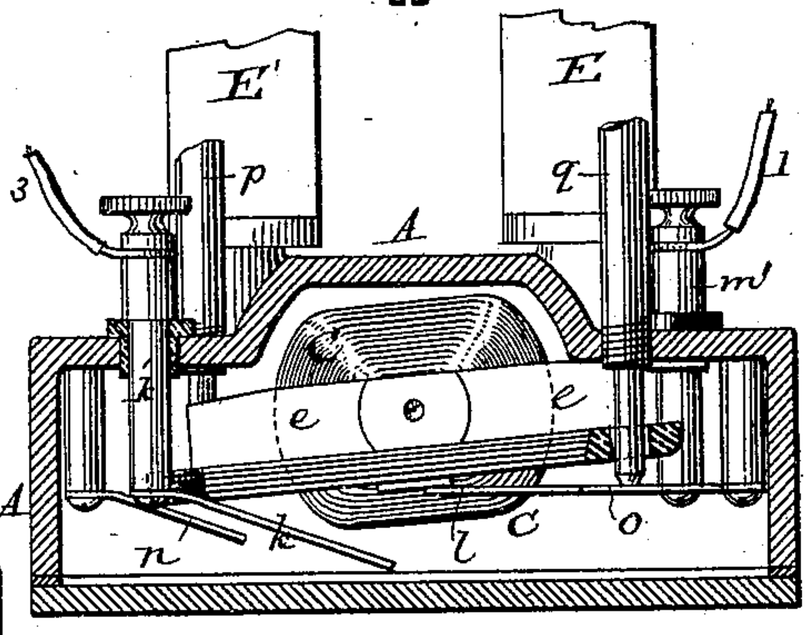


Fig. 6

Attest:

Sidney R. Hollingsworth

Horace A. Dodge.

Inventor:

Lucien F. Easton,

by Dodger Sons,

his Attys.

UNITED STATES PATENT OFFICE.

LUCIEN F. EASTON, OF LA CROSSE, WISCONSIN.

ELECTRIC TEMPERATURE-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 405,151, dated June 11, 1889.

Application filed April 18, 1888. Serial No. 271,006. (No model.)

To all whom it may concern:

Be it known that I, LUCIEN F. EASTON, of La Crosse, in the county of La Crosse and State of Wisconsin, have invented certain new and useful Improvements in Electric Temperature-Regulators, of which the following is a specification.

My invention relates to apparatus for controlling valves, dampers, ventilators, and the like; and it consists, essentially, in a novel construction of valve actuated by electro-magnetic force for controlling the admission and escape of air to and from a cylinder or chamber containing the piston or diaphragm by which the valve, damper, ventilator, or other device is actuated and controlled.

In the annexed drawings, Figure 1 is a perspective view of my apparatus; Fig. 2, a perspective view of the electro-magnetic valve, showing the parts separated to illustrate their construction more clearly; Figs. 3 and 4, plan and sectional views of the apparatus in circular form, showing the parts secured within the box instead of to the cover; Figs. 5 and 6, similar views of a modified arrangement.

The purpose of my invention is to provide means for automatically regulating the temperature of rooms and halls, and the special point to which the present invention relates is the automatic opening and closing of pipes by which air is delivered to or permitted to escape from a cylinder or chamber containing a piston or diaphragm, which, under the action of the air, actuates the valve, damper, or other heat-regulating device.

In this apparatus I make use of any well-known electric battery or generator and thermostatic circuit-closer, as in prior plans, and so far as these are conducive to a clear understanding of the present invention they will be explained herein.

Referring again to the drawings, A indicates a metallic plate, to which is screwed or otherwise hermetically secured a cap or box B, the box being readily removable to afford access to the parts carried by the plate A. For greater compactness of construction the central portion of the plate A is pressed outward, as shown in Figs. 1 and 2, to afford space for the coil *a* of an electro-magnet C, which is wound upon a core *b*, carried at its ends by pointed screws *c*, passing through lugs *d*, cast on plate A, and entering sockets formed in the pole-pieces *e* of electro-magnet C, preferably in line with the axis of the bobbin. The core *b* is advisably of cylindrical form, and the pole-pieces *e* are in the form of cross-bars extending each way from and at right angles to the body of the core, as shown in Figs. 1 and 2. The outer extremities of the two pole-pieces *e* are connected by side bars *f*, of gutta-percha or other non-magnetic and non-conducting substance, the side bars with the core and pole-pieces forming a tipping or oscillating frame D. Directly beneath the ends of each pole-piece *e* are iron or steel plugs *g*, screwed or otherwise secured to the plate A, and constituting the poles of two permanent horseshoe-magnets E E′, each magnet extending lengthwise of plate A or parallel with one of the side bars *f*, the two being arranged with their poles reversed—that is to say, the positive pole of one and the negative pole of the other magnet being at the same end of the plate A or opposite the extremities of the same pole-piece of the electro-magnet C. From this arrangement it follows that if a current of electricity be passed through the coil or helix of the electro-magnet C in one direction each pole-piece will have one extremity over a pole of like polarity and its other extremity over a pole of opposite polarity; hence the tipping-frame will rock upon its pivots, like poles repelling and unlike poles attracting each other, the core of the electro-magnet constituting in effect a polarized armature for the permanent magnets E E′.

If, now, means be provided for causing the electric current to pass through the helix alternately in opposite directions, the frame will be caused to rock with each reversal, as will be readily understood. The means by which I secure this result will be understood upon referring to Figs. 1 and 2, in which it will be seen that the side bars *f* are each provided with three holes *g′*, *h*, and *i*, the holes *g′* and *h* being covered or overlapped by contact-springs *j* and *k* and *l* and *m*, and the holes *i* being covered or overlapped by spring plates or strips *n* and *o*, faced with leather, rubber, or other suitable material, to enable them to fit closely upon and seal alternately the mouths of two small tubes *p* and *q*, which

pass through plate A and through the holes *i*, as illustrated in Figs. 4 and 6.

Secured to and passing through but insulated from plate A are four metal stems *j' k' l' m'*, the outer ends of which are fashioned into binding-posts, and the inner ends of which, as also of the tubes *p* and *q*, project such distance beyond the inner face of plate A that when the oscillating frame E is tipped the stems and tube at one side shall pass entirely through the holes *g*, *h*, and *i* of the side bar *f*, which is thus carried toward plate A, the stems making contact with the contact-springs and pressing against and being closed by the valve plate or strip covering or extending over said holes. When the frame D thus tips and makes the connections at one side, its bar *f* at the opposite side moves above or beyond the ends of the stems and tube at said opposite side, carrying the contact-springs and the valve strip or plate above and clear of the stems and tube at said side, and thereby simultaneously destroying the contacts and opening the tube thereof. This action of course occurs alternately at opposite sides as the frame rocks or tips from side to side, and hence one tube is closed as the other is opened and one pair of contacts is established as the other pair is destroyed.

F indicates a galvanic battery, for which, however, any other source of electricity may be substituted. From the positive pole of the battery a wire or conductor 1 passes to binding-post *j'* and thence to binding-post *m'*, or it may be divided and have one branch passed to each post, as found convenient. The stem of binding-post *j'* makes contact with contact-spring *j* when frame D rocks toward said post, and, similarly, the stem of post *m'* makes contact with contact-spring *m* when the frame D rocks toward post *m'*. From contact-spring *j* a wire or conductor 2 extends to and connects with contact-spring *l*, which makes contact with the stem of binding-post *l'* when rocking frame D tips toward said post, the spring *l* being also electrically connected with one end of the helix *a* of electro-magnet C. The other end of the helix or coil *a* makes electrical connection with contact-spring *m*, and passing thence to the contact-spring *k* makes electrical connection therewith. From this explanation it will be seen that when the frame D is so rocked as to bring the springs *j* and *k* into contact with the stems of binding-posts *j'* and *k'* a path will be furnished for the current from the positive pole of the battery or generator by conductor 1, post *j'*, contact-spring *j*, and conductor 2 to one end of the helix, whence it will traverse said helix and pass by contact-spring *k* to binding-post *k'*, from which a circuit is completed to the negative pole of the battery or generator in a manner presently to be explained, the current in such case taking the path indicated by heavy darts in Fig. 1. If, however, the frame D be tipped in the opposite direction, so as to break the connection between the springs *j k* and the posts *j' k'*, contact will be made between the springs *l m* and the posts *l' m'*, and a path will be afforded for the current from the positive pole of battery F by wire or conductor 1 to binding-post *m'*, and thence to spring *m*, which, being in electrical connection with one end of the coil or helix *a*, will convey the current thereto. Passing through the coil or helix in a direction the reverse of that above described, the current leaves the helix at the point of connection with spring *l*, passing thence to post *l'*, whence it passes to the negative pole of the battery or generator by a path that will now be described, as shown by wavy arrows.

G indicates a thermostatic circuit-closer, which may be of any suitable and well-known type, but which is here represented in the form of a bimetallic bar, held stationary at one end and arranged to bend or turn toward one or the other of two contact-points *r s*, as the temperature rises or falls above or below the prescribed limits. To permit adjustment or variation of these points, they may conveniently be made in the form of screws. From contact-point *r* a wire or conductor 3 extends to binding-post *k'*, and from contact-point *s* a wire or conductor 4 passes to binding-post *l'*, so that when the frame D is tipped to make contact between plates *j k* and post *j' k'* the closing of the circuit between thermostatic circuit-closer G, which is electrically connected by wire or conductor 5 with the negative pole of the battery or generator, affords a path for the current from the positive pole of the battery by line 1, post *j'*, contact-spring *j*, conductor 2, contact-spring *l*, helix *a*, contact-spring *k*, binding-post *k'*, line or conductor 3, contact *r*, thermostatic circuit-closer G, and wire or conductor 5 to the negative pole of the battery. When this occurs, the core of the electro-magnet, becoming so polarized that like poles of the electro-magnet and the permanent magnet E are in contact or in close proximity, the repulsion that follows, aided by the attraction of unlike poles of magnet E', causes the frame D to tip away from posts *j' k'* and to destroy the electrical contact therewith, and consequently break the circuit. While the contact remains unbroken between posts *j' k'* and springs *j k* the tube *p* remains closed by the valve plate or strip *n* and the tube *q* stands open; but when the frame tips so as to break the connections *j' j* and *k' k* the tube *p* is opened and tube *q* is closed, as above explained.

Opening through the plate A into the close box B is a third tube *t*, which communicates with a chamber H, containing a diaphragm I, for which chamber and diaphragm a cylinder and piston may obviously be substituted. The diaphragm or piston has attached to it a rod J, which extends to and actuates the valve, damper, or other device requiring to be controlled. Tube *p* communicates, preferably, with a chamber containing air un-

der pressure, and tube q with a chamber from which air is exhausted, though the tube q may open directly to the atmosphere and the tube p communicate either with a chamber containing air under compression or a chamber from which the air is exhausted. These variations have nothing to do with the present invention, but are mentioned merely to better explain the purposes of said invention.

When tube p is opened and tube q is closed, the air, entering box B through tube p, passes by tube t to chamber H, and, moving the diaphragm I before it, actuates the valve or damper in one direction. When tube p is closed and tube q opened, the air escapes or is exhausted from chamber H through tubes t and q, permitting or causing the valve, damper, or other device to move in a direction the reverse of its first movement.

As stated, I prefer to employ both pressure and exhaust or suction, because I obtain thereby a positive action in both directions, and consequently greater certainty of operation. It is, however, obvious that the electro-magnetic valve may be employed in various connections, and that the tipping-frame with its contacts and connections may be employed in various places where it is desired to reverse the polarity of an electro-magnet.

In Figs. 3 and 4 I have illustrated the same general construction, but have shown a circular instead of a rectangular case, and have represented the polarized armature as carried by the box instead of its plate or cover.

In Figs. 5 and 6 the same form is shown as in Figs. 3 and 4; but the contact-fingers j k and l m and the valve-strips n and o are in these figures represented as secured to the box or casing and as projecting inward to proper points to complete the circuits and close the pipes in their due order, the edge of the rocking frame serving to lift the fingers and strips when the frame is tipped.

In practice I find it convenient to place the instrument in series with incandescent lamps where such lamps are used.

Instead of providing insulated binding-posts j' and m' for connection with the battery, the stems may be advantageously screwed, soldered, or otherwise directly applied to the metallic plate or box without insulation, thus permitting connection to be made with the latter at any point.

Having thus described my invention, what I claim is—

1. The herein-described apparatus for regulating temperature, consisting of a chamber containing a diaphragm or piston, the latter connected with a controlling-valve or damper, box A B, provided with air-supply tube p, exhaust-tube q, and tube t, communicating with the chamber containing the diaphragm or piston, permanent magnets E E′, having their poles reversed and extended into the box, rocking frame D, composed of core b, helix or coil a, and side bars f, contact-springs j k and l m, carried by said bars f, valves n and o, also carried by said bars, binding-posts j' k' and l' m', extending into holes in the side bars f, a battery or electric generator, a thermostatic circuit-closer, line, or conductor with the helix 1, connecting the positive pole of the generator with posts j' m', conductor 2, connecting springs j and l with helix a, conductor 3, connecting binding-post k' with contact-point r of the circuit-closer G, conductor 4, connecting post l' with contact-point s of said circuit-closer, and conductor 5, connecting said circuit-closer with the negative pole of the battery.

2. In combination with box or chamber A B, provided with tubes p, q, and t, permanent magnets E E′, oscillating frame D, consisting of core b, coil a, and side bars f f, contact-springs j k and l m, carried by said bars, valve plates or strips n o, also carried thereby, binding-posts j' k' and l' m', a battery or electric generator, a thermostatic circuit-closer, and electric conductors connecting one pole of the battery with posts j' m', and connecting the other pole with the thermostatic circuit-closer, and other conductors connecting the contact-points of the thermostatic closer with the binding-posts k' and l', respectively.

3. In a temperature-regulator substantially such as described, the combination of permanent magnets E E′, a battery or generator, and an armature for said magnets provided with a helix, and contact-springs movable with said armature and arranged, substantially as described and shown, to reverse the flow of the electric current through the helix.

4. In a temperature-regulator, the combination, with a close chamber containing a diaphragm or piston, of a second close chamber communicating therewith, a valve controlling communication between said chambers, an electro-magnetic armature carrying said valve and having its poles placed opposite the poles of reversed permanent magnets, and contact-springs actuated by the armature and serving to reverse the flow of the electric current through the armature-helix when the armature changes its position.

5. In a temperature-regulator, the combination of a close box or casing, an inlet-pipe communicating with a pressure-tank, an exhaust-pipe communicating with a vacuum-tank, a pipe opening from the box or chamber into a chamber containing a piston or diaphragm, permanent magnets having their poles reversed and extended into the interior of the box or chamber, an oscillating electro-magnetic armature placed within the box and having its poles opposed to those of the permanent magnets, a battery, a thermostatic circuit-closer, and contacts and circuit-connections, substantially such as described and shown, adapted to cause a flow of electricity through the helix of the armature in one or the other direction as the circuit-closer makes

contact with one or the other of its two contact-points.

6. In a temperature-regulator, the combination of pernanent magnets and an oscillating electro-magnetic armature provided with perforated insulating-bars, contact-springs carried by said bars, and binding-posts connected with the poles of a generator and extending into the perforations of the bars, whereby they are caused to alternately make and break contact with the contact-springs, and thus to change the direction of the current through the helix of the armature.

7. In a temperature-regulator, the combination, with permanent magnets, of an oscillating electro-magnetic armature, a perforated bar carried thereby, a valve-plate carried by said bar and overlapping the perforations therein, and a tube or pipe extending into the perforation and adapted to be sealed by the valve when the armature moves toward the tube and to be unsealed thereby when the armature moves in the opposite direction.

In witness whereof I hereunto set my hand in the presence of two witnesses.

LUCIEN F. EASTON.

Witnesses:
W. E. LOCKERBY,
T. PEUNT.