(No Model.) 3 Sheets—Sheet 1.

C. F. GOODHUE.

AUTOMATIC HEAT REGULATING APPARATUS.

No. 516,198. Patented Mar. 13, 1894.

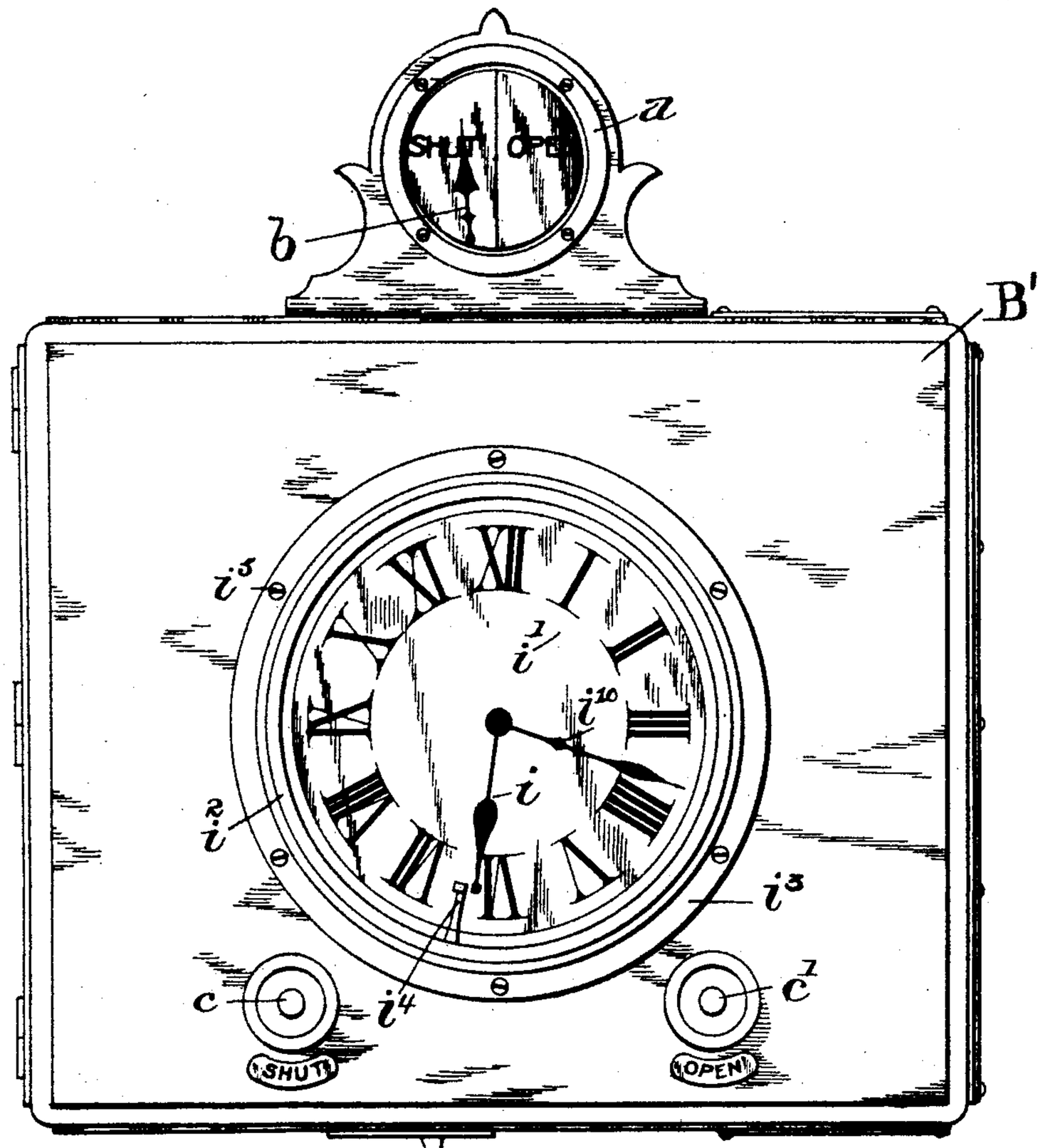

Fig. 1.

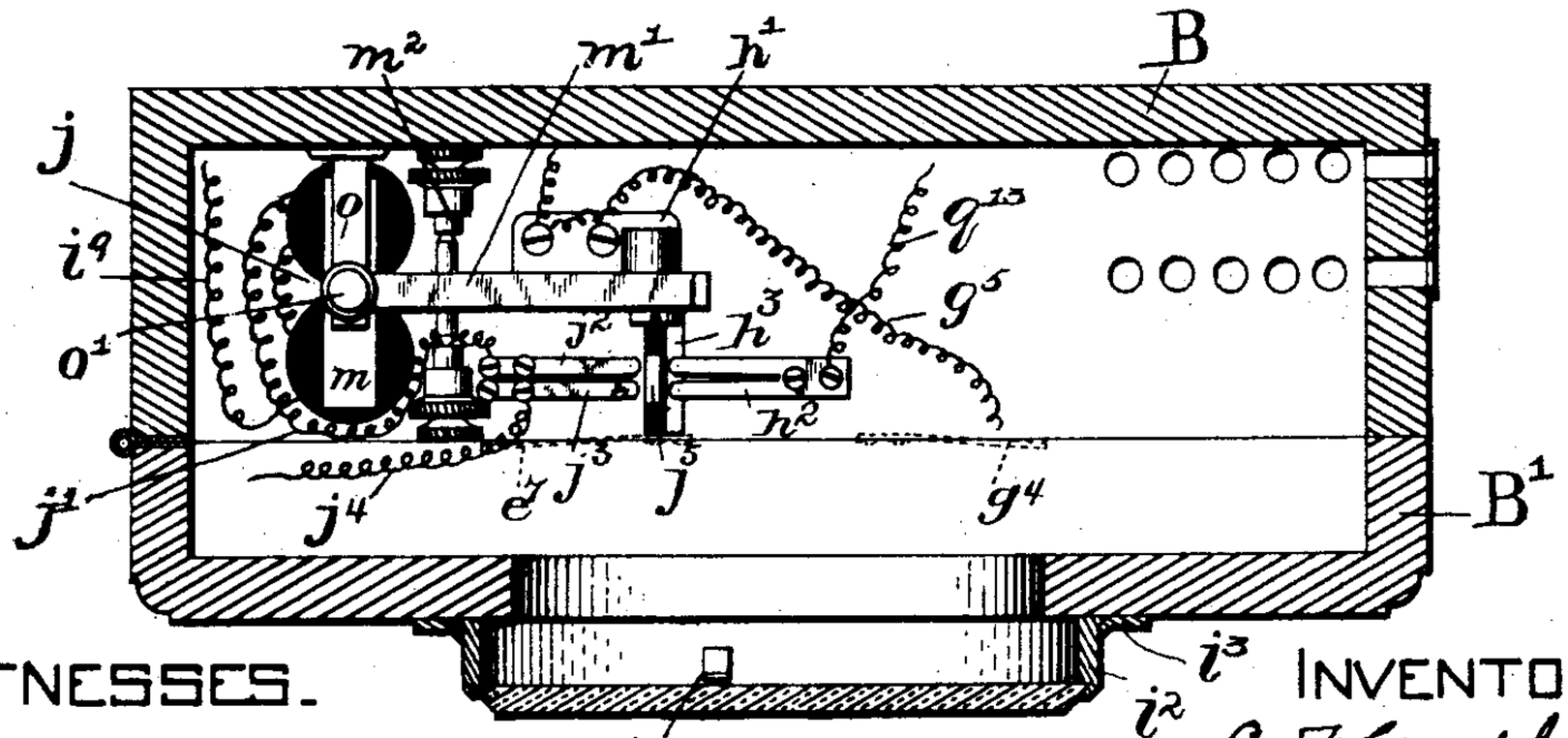

Fig. 3.

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Fig. 2.

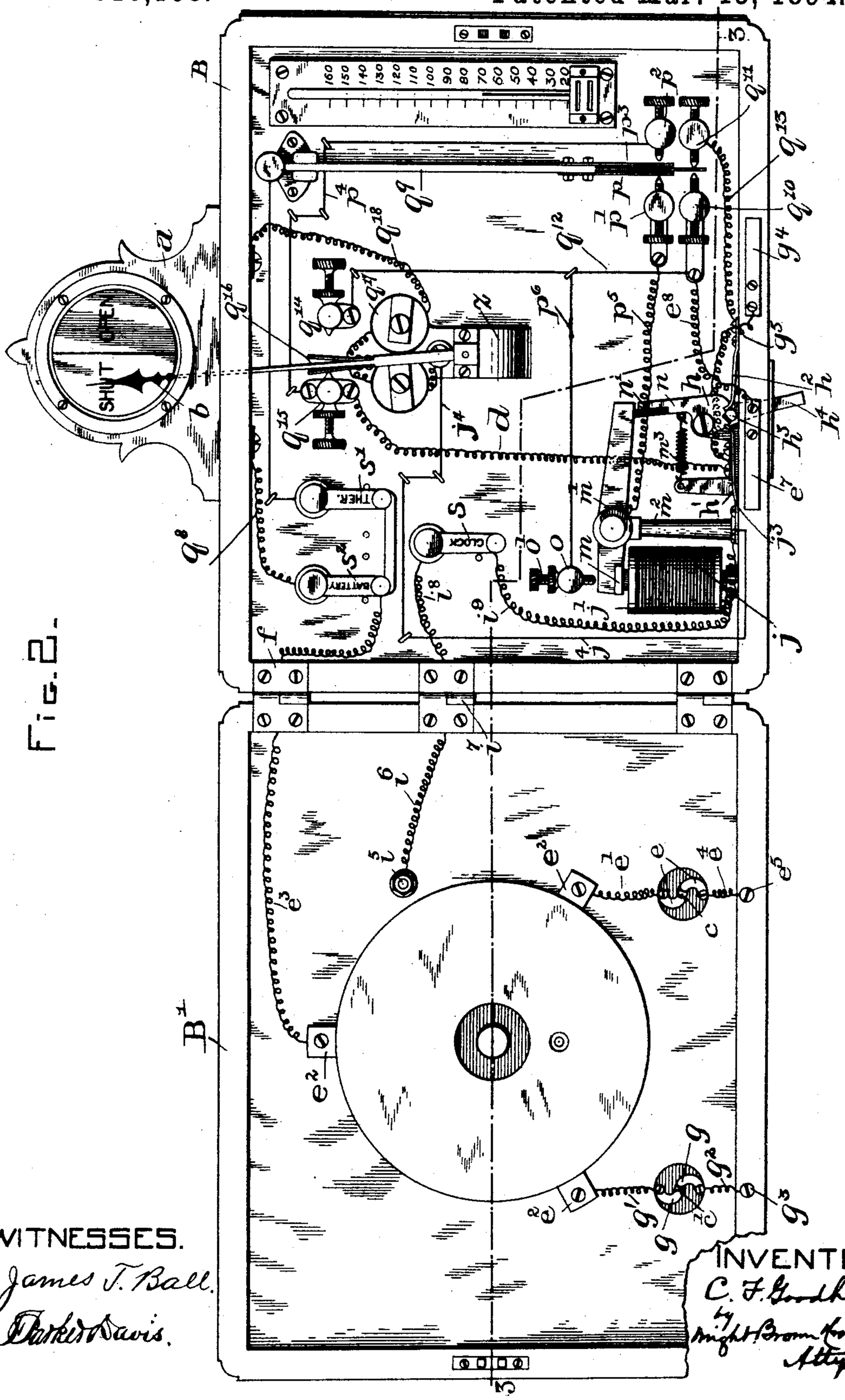

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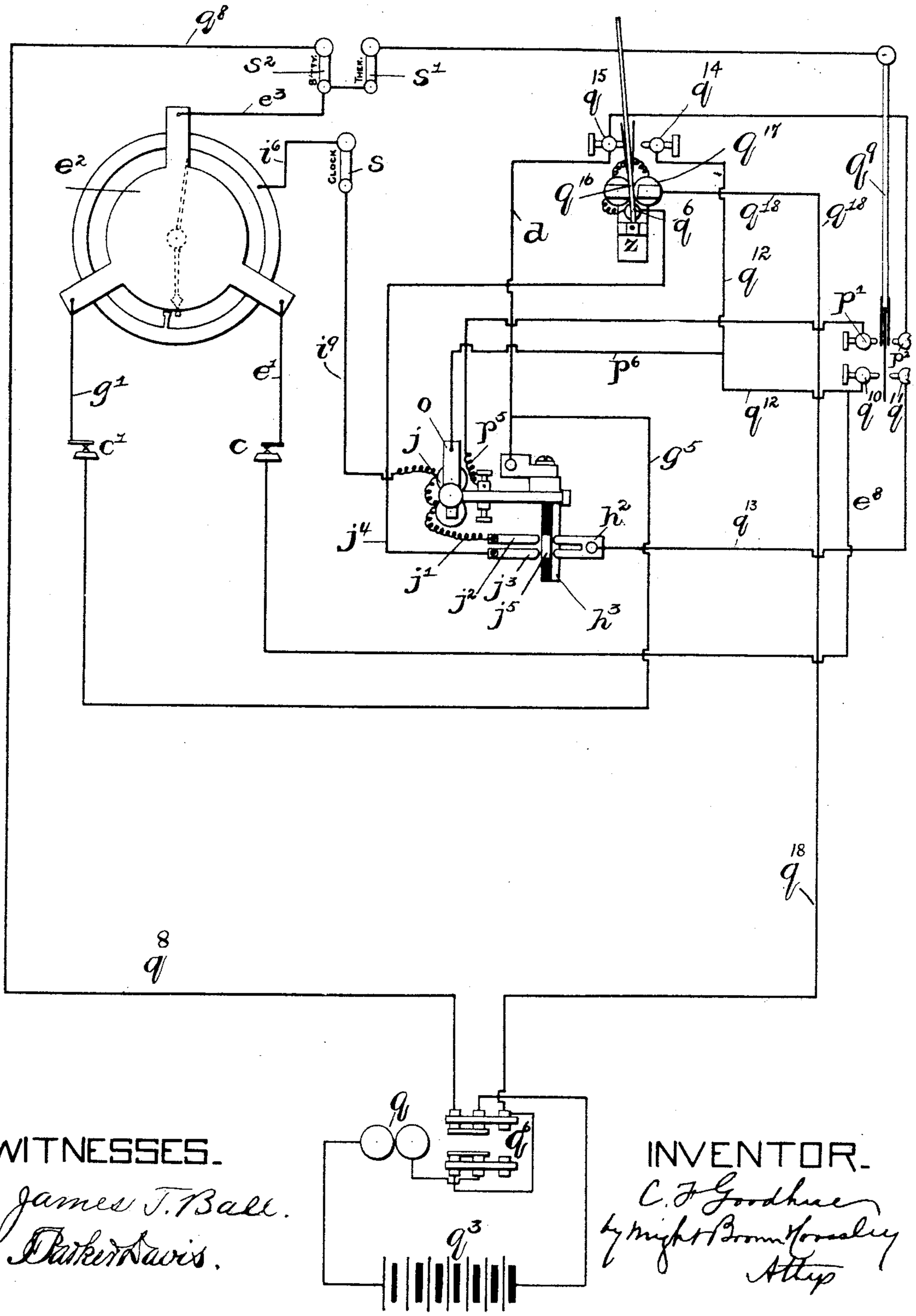
FIG. 4.



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UNITED STATES PATENT OFFICE.

CHARLES F. GOODHUE, OF BOSTON, MASSACHUSETTS.

AUTOMATIC HEAT-REGULATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 516,198, dated March 13, 1894.

Application filed May 11, 1893. Serial No. 473,793. (No model.)

To all whom it may concern:

Be it known that I, CHARLES F. GOODHUE, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Automatic Heat-Regulating Apparatus, of which the following is a specification.

This invention relates to certain improvements on the automatic heat-regulating apparatus shown and described in Letters Patent of the United States No. 473,699, granted to me April 26, 1892.

The objects of the present invention are chiefly as follows: To combine with the apparatus shown in said patent an indicator, which will show the condition of the draft-regulating device. To combine with said apparatus means whereby the draft-regulating device may be operated at will and independently of the thermostat. To provide means whereby the thermostatic contact through which the damper is opened may be cut out of circuit, as, for instance, at night, when a low temperature is to be maintained until morning. To provide means whereby the said thermostatic contact may be automatically restored to operative condition at a predetermined time. To provide emergency thermostatic devices, whereby the temperature is prevented from falling beyond a certain limit when the apparatus is adjusted for night service.

The accompanying drawings illustrate the improvements.

Figure 1 shows a front elevation of the apparatus. Fig. 2 shows a similar elevation, with the cover of the inclosing box or case thrown back on its hinges. Fig. 3 shows a section on line 3—3 of Fig. 2, the cover being represented as closed. Fig. 4 shows a diagrammatic view.

The same letters of reference indicate the same parts in all the figures.

My improved apparatus is employed in conjunction with a motor such as illustrated in my former patent, or one of any suitable construction and operatively connected with the damper or draft-regulating device of a furnace or other heater. The connection may be made in the manner shown in my former patent, or in any other suitable manner. An illustration and description of the motor is not here given, in view of the full disclosure in my earlier patent, to which reference is made.

In the diagrammatic view, Fig. 4, the electro-magnet q, which controls the detent of the motor, is indicated as being included within an electric circuit embracing a battery or other source of electricity, indicated at q^3, and a current-reverser q^6 is shown, of the same construction and operation as that shown and described in my former patent. Wires q^8 and q^{18} connect the current-reverser with a thermostatic arm q^9 and an electro-magnet q^{17} respectively. The thermostatic arm or bar q^9 has its free end located between two contacts q^{10} q^{11}, which are electrically connected respectively with contacts q^{14} q^{15}, between which a polarized armature q^{16} is adapted to oscillate, the latter being located between the poles of the electro-magnet q^{17}, and said armature and electro-magnet constituting parts of a polarized relay, of which z is the permanent magnet. The connection between the contact q^{10}, which will be termed the high-temperature thermostatic contact, and the contact q^{14}, which will be termed the "open" contact, is by a wire q^{12}. The connection between the contact q^{11}, which will be termed the low-temperature thermostatic contact, and the contact q^{15}, which will be termed the "shut" contact, is by a wire q^{13}, a switch which will be hereinafter described, and a wire d.

The operation of the parts described up to this time is the same as in the construction shown in my former patent, variation in temperature influencing the thermostatic arm or bar q^9, and causing it to connect with one or the other of the contacts q^{10} or q^{11}, according as the temperature rises or falls, and complete a circuit through the polarized relay, and the current-reverser, by which the polarized armature q^{16} is caused to shift with each change of the dampers. In the present construction, I utilize the oscillations of this polarized armature, for indicating the condition of the damper. A casing a is mounted on the upper side of the box B, and incloses a dial, on which are inscribed the words "Shut" and "Open," with a vertical dividing line between them. An index hand B is fastened to the polarized armature q^{16}, and ex-

tends over said dial. When the apparatus operates to close the damper, the polarized armature is shifted, and the hand *b* stands over the word "Shut," to indicate that the damper is closed. When the damper is opened by the operation of the apparatus, the hand *b* is shifted to the other side of the dividing line, and stands over the word "Open." I provide for manually completing the circuit for either closing or opening the damper independently of the thermostat, by push-buttons *c* and *c'*, mounted in the cover B' of the box, and designated "Shut" and "Open." The circuit closed by the "shut" push-button *c* will first be traced. Said push-button is arranged to connect a pair of contact-strips *e*, when pressed inward. One of said strips is connected by a wire *e'* with a metal frame e^2 fastened to the inside of the cover B', and a wire e^3 attached to a different part of said frame connects the latter with the battery-wire q^8, a hinge *f* between the cover and box being utilized as a conductor. The other one of the contact-strips *e* is connected by a wire e^4 with a screw e^5 fastened in the edge of the cover B'. A resilient contact-strip e^7 is fastened in a recess in the edge of the box B, in a position to be engaged by the screw e^5 when the cover B' is closed. A wire e^8 connects said strip e^7 with the wire q^{12}. It will be seen that, upon pressing the button *c* when the polarized armature is against the "open" contact and the damper consequently open, a circuit is completed and the damper closed, whereupon the polarized armature shifts and so indicates the condition of the damper.

The agencies by which the push-button *c'* completes a circuit will next be recited. Said push-button is adapted to connect a pair of contact-strips *g* when it is pressed in. One of said strips is connected by a wire *g'* with the frame e^2 before mentioned, and the course thence to one pole of the battery is the same as before described, viz., wire e^3, hinge *f* and wire q^8. The other contact-strip *g* is connected by a wire g^2 with a screw g^3 fastened in the edge of the cover, and a resilient contact-strip g^4 is fastened in a recess in the edge of the box B, in position to be engaged by the screw g^3 when the cover is closed. A wire g^5 connects said strip g^4 with the wire *d*. It will now be seen that, upon pressing the button *c'* when the polarized armature is against the "shut" contact q^{15} and the damper consequently shut, a circuit is completed and the damper is opened, whereupon the polarized armature is shifted and so indicates the condition of the damper.

When the furnace is to be adjusted for the night, if the damper is not already closed, the push-button *c* is pressed, and the damper thereby closed. Provision is made for maintaining the damper closed through the night. This consists in a metallic switch *h*, pivoted to a bracket *h'* fastened on the inner side of the box B.

The switch forms part of the connection between the low-temperature thermostatic contact q^{11} and the "shut" contact q^{15}, as follows: The wire q^{13} is connected with a contact-strip h^2 fastened to the inner side of the box B, and the switch has a lateral arm h^3, whose metallic portion engages the contact-strip h^2. The wire *d* is connected with the bracket *h'*. The switch has a handle h^4, projecting from the box; and, when the damper has been closed for the night, the switch is turned by this handle, and the contact between the lateral arm h^3 and the strip h^2 is broken. This cuts the low-temperature contact q^{11} out of circuit, and hence, when the thermostatic arm is moved against it under influence of the low-temperature, no action of the apparatus takes place.

Means are provided for automatically restoring the low-temperature contact to the circuit at a predetermined time, and thereby causing the damper to be opened. The instrumentalities employed to accomplish this object will be enumerated: A clock-movement is supported on the frame e^2, and operates hands i i^{10}, working over a clock-face i' on the exterior of the cover B'. It will be remembered that a wire e^3, in connection with one pole of the battery, attaches to the frame e^2. The short hand *i* is in electrical connection with the supporting-frame, and consequently with said wire e^3. A bezel i^2 supports a crystal over the clock-face i', and said bezel is fitted to a rim i^3 fastened on the cover B', so as to turn on said rim. The bezel carries on its inner side a contact-finger i^4, projecting over the clock-face, and the short hand *i* of the clock is formed for electrical contact with said finger as it passes over the same. The bezel is in electrical connection with the rim i^3, and said rim is electrically connected by a bolt i^5, extending through the cover B' with a wire i^6, but is insulated from the frame e^2. The wire i^6 is connected, through a hinge i^7 between the box and cover, with a wire i^8 in the box, and the latter wire is connected with a wire i^9. The wire i^9 is connected with an electro-magnet *j*, and the said magnet is connected by a wire *j'* with one of a pair of contact strips j^2 j^3 fastened on the inner side of the box, said strips being insulated from each other. The other one of said strips j^3 is connected by a wire j^4 with the permanent magnet of the polarized relay. The lateral arm h^3 of the switch *h* carries a contact-piece j^5, insulated from its metallic portion and adapted to engage the strips j^2 j^3 when the switch is shifted for night adjustment and make connection between said strips. The clock-bezel is set with the contact-finger i^4 at the hour at which it is desired that the damper shall be opened, say at six o'clock in the morning. When six o'clock arrives, the short hand *i* contacts with the finger i^4, and it will be observed that a circuit is thereby completed, by which the damper is opened and the index-finger *b* shifted to the "open" side of the indicator.

It will be remembered that, when the switch was shifted for the night adjustment, the low-temperature thermostatic contact was cut out of circuit. Means are provided for automatically restoring said contact to circuit when the clock-circuit is established. The arrangement for accomplishing this is as follows: An armature m, arranged to be influenced by the electro-magnet j, is supported on the end of a lever m', which is pivoted intermediate of its ends to a standard m^2, erected in the lower side of the box B. That arm of the lever on the side of the pivot opposite the armature is the heavier, so that, when the lever is free, the armature is held away from the electro-magnet by gravity. The switch h has an upward-projecting arm n, which is arranged to stand under the lever m' and sustain the same, when the switch is in its normal adjustment or that adjustment when the clock is cut out and the low-temperature thermostatic contact cut in. The switch is held in this position by a spring m^3, connecting it above its pivot with an arm of the bracket h'. When the switch is shifted for the night adjustment, its arm n is carried beyond the end of the lever m', and said lever drops below the arm n, and the armature m is moved away from the electro-magnet j. The arm n now stands against the end of the lever. When the clock-circuit is made, the electro-magnet j is energized, and draws down the armature m, thereby disengaging the lever from the arm n of the switch, whereupon the latter is returned to its normal position by the spring m^3, and the low-temperature thermostatic contact is restored to circuit, and the apparatus is in condition to be thermostatically controlled. Insulation n' on the end of the arm n prevents electrical connection between said arm and the lever m'.

A post o, carrying a set-screw o', affords means for limiting and adjusting the amount of movement of the armature m away from the electro-magnet.

Auxiliary thermostatic devices are provided, to be rendered operative in case of an emergency, such as the temperature falling lower than desired during the night. The thermostatic arm or bar q^9 carries a pair of resilient strips p p^3, fastened to its opposite sides and arranged for engagement with high and low temperature contacts p' and p^2. The strip p stands normally against the high-temperature contact p', while the strip p^3 stands normally away from the low-temperature contact p^2, and only a very low temperature will cause said latter strip to reach the contact p^2. The latter is connected by a wire p^4 with the "shut" contact q^{15}, and hence, upon said strip encountering the contact p^2, a circuit is completed which causes the damper to be opened. The high-temperature contact p' is connected by a wire p^5 with the standard m^2, and a wire p^6 connects the post o with the "open" contact q^{14} through the wire q^{12}. While the night adjustment is maintained, the "open" contact q^{14} and the high-temperature contact p' are electrically connected through the wires q^{12} and p^6, the post o, the screw o' the armature lever m', the standard m^2, and the wire p^5. The damper having been operated by reason of a connection being made between the strip p^3 and the contact p^2, the consequent increase in temperature is checked by the strip p being returned against the contact p', which completes a circuit whereby the damper is closed again.

During the day adjustment, it will be remembered that the armature lever m' is supported by the switch-arm n. Said lever is thereby held out of contact with the screw o', and the high-temperature emergency contact p' is cut out of circuit. The said emergency contact makes connection with the strip p^3 while the connection between the thermostatic arm and the contact q^{10} is broken, so that the damper will be closed before the temperature can rise to the day limit. Hence the necessity of cutting the contact p' out of circuit through the day.

Switches s s' and s^2 are provided, whereby the clock, the thermostat, or the whole apparatus may be cut out of circuit. Thus an adjustment may be affected, whereby the apparatus is solely under the control of the push-buttons c c', and the clock-circuit may be used or not, as desired.

In the present construction, the thermostatic arm is inclosed within the casing or box B, to protect it, and the box is perforated so that the temperature will be the same within as without.

It is evident that the invention might be carried out by other means than those here shown, and hence I am not limited to the particular form in which I have here chosen to illustrate the invention.

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

1. A temperature-controlling apparatus, comprising in its construction an electric circuit adapted to render operative damper-controlling mechanism, and embracing a thermostatic circuit-closing device, a polarized relay having a vibratory armature, and a current-reverser; and an indicator consisting of a dial suitably inscribed to designate conditions of the damper, and an index carried by the armature of the polarized relay.

2. A temperature-controlling apparatus, comprising in its construction an electric circuit adapted to render operative damper-controlling mechanism, and embracing a thermostatic circuit-closing device, a polarized relay having a vibratory armature, and a current-reverser; and means for establishing the circuit independently of the thermostatic device.

3. A temperature-controlling apparatus, comprising in its construction an electric circuit adapted to render operative damper-controlling mechanism, and embracing a thermo-

static circuit-closing device, a polarized relay having a vibratory armature, and a current-reverser; and means for establishing the circuit independently of the thermostatic device, such means being manually controlled, as by push-buttons.

4. A temperature-controlling apparatus, comprising in its construction an electric circuit adapted to render operative damper-controlling mechanism, and embracing a thermostatic circuit-closing device, a polarized relay having a vibratory armature, and a current-reverser; and means for automatically establishing the circuit at a predetermined time and independently of the thermostatic device.

5. A temperature-controlling apparatus, comprising in its construction an electric circuit adapted to render operative damper-controlling mechanism, and embracing a thermostatic circuit-closing device, a polarized relay having a vibratory armature, and a current-reverser; and means for automatically establishing the circuit at a predetermined time and independently of the thermostatic device, such means including a clock having a movable bezel which carries a contact-finger adapted to make connection with a hand of the clock.

6. A temperature-controlling apparatus, comprising in its construction an electric circuit adapted to render operative damper-controlling mechanism, and embracing a thermostatic circuit-closing device, a polarized relay having a vibratory armature, and a current-reverser; means for automatically establishing the circuit at a predetermined time and independently of the thermostatic device; and a switch arranged to be manually operated, to cut the thermostatic device out of circuit and the said timing means in circuit.

7. A temperature-controlling apparatus, comprising in its construction an electric circuit adapted to render operative damper-controlling mechanism, and embracing a thermostatic circuit-closing device, a polarized relay having a vibratory armature, and a current-reverser; means for automatically establishing the circuit at a predetermined time and independently of the thermostatic device; a switch arranged to be manually operated, to cut the thermostatic device out of circuit and the said timing means in circuit; and means controlled by the clock-circuit for restoring the switch to its normal adjustment.

8. A temperature-controlling apparatus, comprising in its construction an electric circuit adapted to render operative damper-controlling mechanism, and embracing a thermostatic circuit-closing device, a polarized relay having a vibratory armature, and a current-reverser; means for automatically establishing the circuit at a predetermined time and independently of the thermostatic device; a switch arranged to be manually operated, to cut the thermostatic device out of circuit and the said timing means in circuit; an electro-magnet in the clock-circuit; and an armature for said electro-magnet and carried by a lever which co-acts with the switch, whereby it holds the latter as manually adjusted and releases it when the electro-magnet is energized.

9. A temperature-controlling apparatus, comprising in its construction an electric circuit adapted to render operative damper-controlling mechanism, and embracing a thermostatic circuit-closing device, a polarized relay having a vibratory armature, and a current-reverser; means for automatically establishing the circuit at a predetermined time and independently of the thermostatic device; a switch arranged to be manually operated, to cut the thermostatic device out of circuit and the said timing means in circuit; an electro-magnet in the clock-circuit; an armature for said electro-magnet and carried by a lever which co-acts with the switch, whereby it holds the latter as manually adjusted and releases it when the electro-magnet is energized; and an auxiliary thermostatic device, arranged to be cut in and out of circuit by the armature-lever.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 22d day of April, A. D. 1893.

CHAS. F. GOODHUE.

Witnesses:
A. D. HARRISON,
F. PARKER DAVIS.