(No Model.) 2 Sheets—Sheet 1.

C. W. JOHNSON.

ELECTRICAL APPARATUS FOR REGULATING TEMPERATURE.

No. 359,392. Patented Mar. 15, 1887.

Fig. 1.

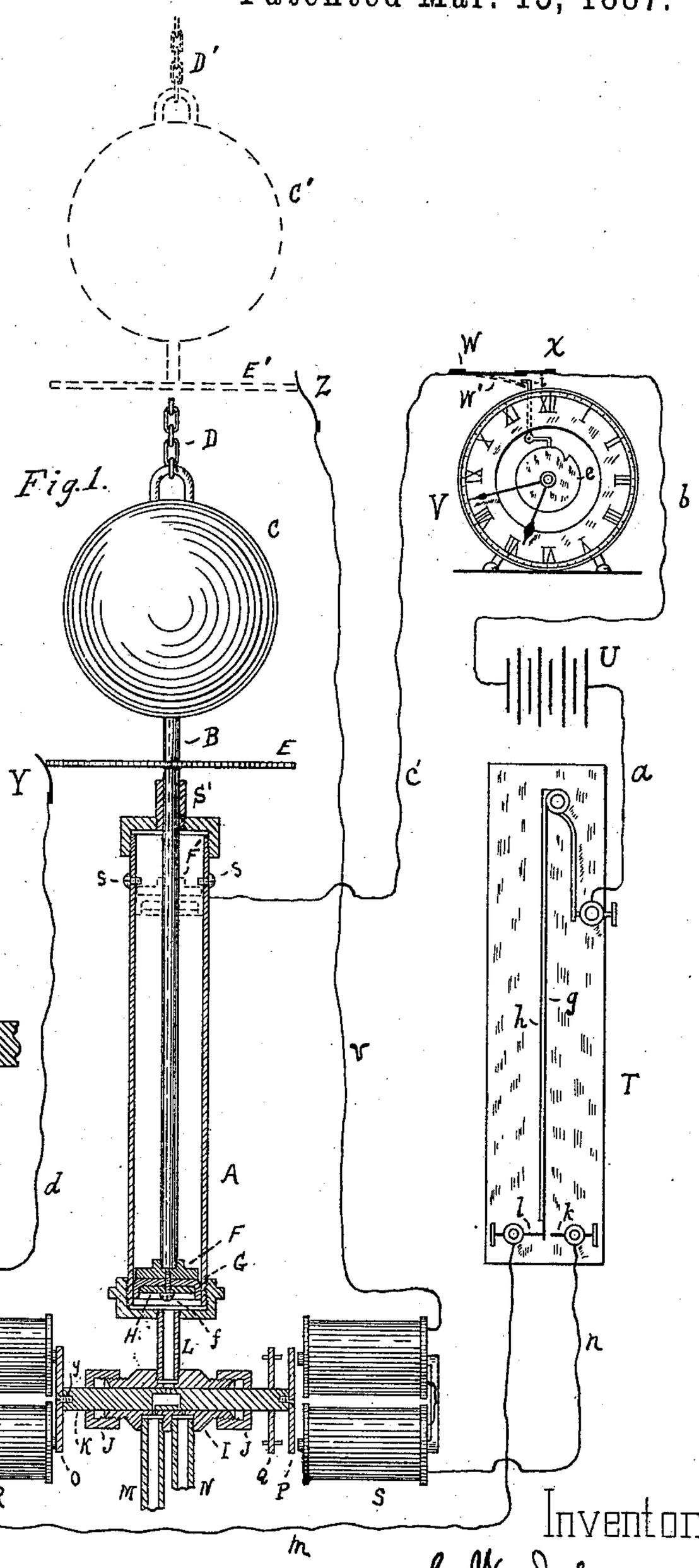
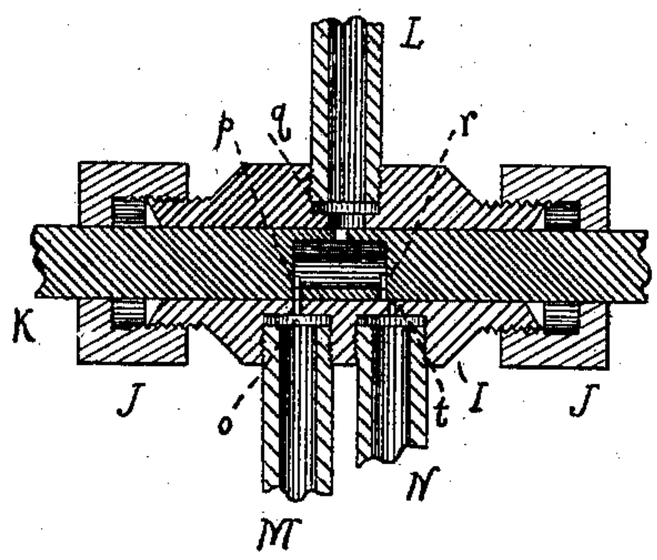


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

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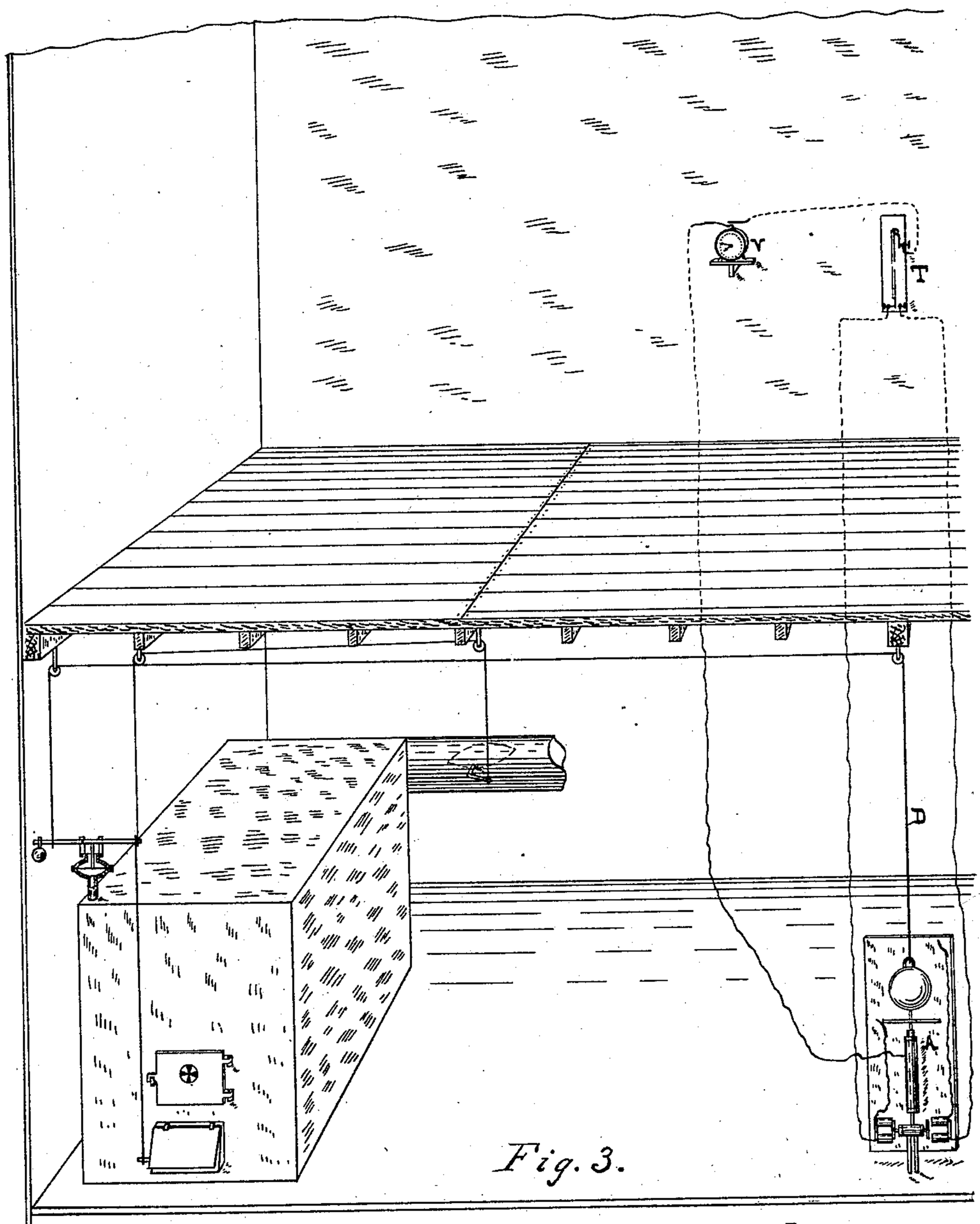

Fig. 3.

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UNITED STATES PATENT OFFICE.

CHARLES W. JOHNSON, OF HOLYOKE, MASSACHUSETTS.

ELECTRICAL APPARATUS FOR REGULATING TEMPERATURE.

SPECIFICATION forming part of Letters Patent No. 359,392, dated March 15, 1887.

Application filed December 13, 1886. Serial No. 221,371. (No model.)

To all whom it may concern:

Be it known that I, CHARLES W. JOHNSON, of Holyoke, in the county of Hampden and Commonwealth of Massachusetts, have invented a new and useful Improvement in Apparatus for Regulating Temperature, of which the following is a specification, reference being had to the accompanying drawings, forming part thereof.

My invention relates to apparatus for co-operating with any of the well-known mechanisms for automatically and simultaneously opening and closing the dampers and draft-openings of the furnace which generates the steam or heats the air or water by which buildings are heated, such apparatus being electrically connected with and operated by a thermostat located in the room or apartment to which heat is conducted.

The object of my invention is to simplify the construction of such apparatus and thus lessen its cost, and at the same time to broaden its range of usefulness by combining therewith a time mechanism, as hereinafter more fully described.

To these ends my invention consists in the regulating apparatus, constructed as hereinafter described; in the means by which said apparatus is automatically operated by a thermostat, and in the combination, with such an apparatus, of a time mechanism, by means of which the action thereof can be suspended and caused to be automatically resumed at any predetermined time thereafter.

Referring to the drawings, in which like letters designate like parts throughout, Figure 1 is a view, partly in section, of the regulating apparatus, also showing the manner of electrically connecting it with the thermostat, battery, and time mechanism. Fig. 2 is an enlarged view, in longitudinal vertical section, of the valve mechanism forming part of the regulating apparatus. Fig. 3 is a diagram illustrating the practical operation of the apparatus, as hereinafter described.

Referring to Figs. 1 and 2, the letter A designates a vertical cylinder, within which is mounted a piston-rod, B, said rod bearing at its upper end the weight C; also, secured to said rod above the cylinder is the circuit-closing disk E, the operation of which will be presently described. To the piston-head F are secured, by means of screw *f*, the cup-shaped packing-disk G and washer H, as shown; or the head may be otherwise made to closely fit the bore of the cylinder.

L designates a pipe connecting the bore of the cylinder with an inlet water-pipe, M, and an escape-pipe, N, through the medium of a valve, of which I is the shell and K the spindle, adapted to slide freely within said shell. Stuffing-boxes J are secured to the shell at each end for holding any suitable packing and lubricant to make a tight joint, and yet permit the spindle to have freedom of movement therethrough. The shell I is provided with screw-threaded sockets in its upper and lower sides to receive the ends of pipes L M N, and the said pipes are inserted therein in such manner as to leave a small space between the ends of the pipes and the bottom of the sockets, as shown. The said sockets communicate with the interior of the shell I by means of ducts, as shown, that of pipe L having a diameter corresponding substantially with the bore of said pipe, whereas those of pipes M and N (lettered *o* and *t*, respectively) are only of about one-fourth the diameter of those pipes.

The spindle K is provided with an interior chamber having ducts *p* and *r*, corresponding in size to and adapted to co-operate with ducts *o* and *t*, and having duct *q* communicating with pipe L. The said ducts *p*, *q*, and *r* are so located with respect to ducts *o* and *t* that when ducts *o* and *p* are in alignment duct *t* will be closed, and when ducts *r* and *t* are in alignment duct *o* will be closed, whereas duct *q* will remain in open communication with pipe L in either position. Pipe M communicates with the street-main, or with a reservoir of water so located as to give the water a "head" equal to that of the ordinary street-main; and it follows from the construction and arrangement of ducts just described that when spindle K is moved to the position shown in Figs. 1 and 2, with ducts *o* and *p* in alignment, the water will enter cylinder A and raise piston B and weight G to the position indicated by dotted lines in Fig. 1, and that when said spindle is moved to place ducts *r* and *t* in alignment, thus closing duct *o*, the water will escape from the cylinder by means of pipe N,

which may lead to a sewer or to a catch-basin, thus permitting weight C to descend by gravity.

Stop-screws *s* may be inserted through the shell of the cylinder, as shown in Fig. 1, to prevent the piston-head from contacting with the cap at the end of the cylinder in its upward movement; or the guide *s'* could be extended through and below the cap to act as a stop and thus dispense with said screws.

The regulating apparatus as thus far described will preferably be located near the furnace, as indicated in Fig. 3, and the weight C will be connected by means of the chain or rope D with any of the well-known mechanisms for simultaneously opening and closing the draft-openings and dampers of the furnace. I have shown in Fig. 3 an example of such mechanisms, and have also shown one manner of connecting the weight C therewith. The only essential condition of the manner of making such connection, however, is that the weight C in its ascent shall cause the drafts, &c., to be opened and permit the fire to burn freely, and that in its descent it shall close the said drafts.

It now remains for me to describe the means by which I provide for automatically operating valve K, and, through the cylinder and weight, regulating the amount of heat generated by the furnace.

R and S designate electro-magnets situated opposite each end of spindle K, and to the ends of said spindle are secured armatures O and P. As previously stated, the spindle is free to move lengthwise; but it is prevented from axial movement by the guide Q, secured thereto, said guide moving against the face of fixed ways, as shown in Fig. 1.

T designates a thermostat, which is or may be of the ordinary construction, having the combined steel and rubber rod *g h* suspended between the adjustable points *k l*. This thermostat is to be located in one of the rooms or apartments to which heat is conducted from the furnace, as shown, for example, in Fig. 3.

U in Fig. 1 designates an electric battery, which may be located anywhere in the building. The battery is connected with the thermostat and with the apparatus by the wires *a* and *b c'*, respectively, and the thermostat is connected with magnets R and S by wires *m* and *n*, respectively, said wire *m* leading from point *l* of the thermostat, and wire *n* from point *k* thereon.

The letter *d* designates a wire leading from magnet R to a point where it will contact, by means of its tip Y, with disk E in its lowest position, as shown by full lines in Fig. 1, and *v* designates a similar wire leading from magnet S, adapted to contact, by means of its tip Z, with said disk in its highest position, as indicated by dotted lines in said figure, thus providing for two independent circuits.

For convenience, I will hereinafter refer to the circuit closed by the disk in its lowest position through wire *d*, magnet R, wire *m*, and point *l* as the "cold circuit," the furnace-drafts being then closed, and to that closed by said disk in its highest position through wire *v*, magnet S, wire *n*, and point *k* as the "warm circuit," the drafts being then open.

The operation is as follows: Supposing the weight C to be in its lowest position, the drafts of the furnace to be closed, the rod of the thermostat to be at some point between points *k* and *l*, and the duct *o* of pipe M closed, the said parts will remain in this position until the lowered temperature of the apartment containing the thermostat causes the rod of the latter to contract, and thus bring its lower end in contact with point *l*. This movement of said rod closes the cold circuit, and by means of armature O moves valve K to the position shown in Figs. 1 and 2. The water will now enter cylinder A, as previously described, and will elevate piston B and weight C and open the furnace-drafts. As soon as disk E ceases to contact with tip Y of wire *d* the cold circuit is broken; but the valve will remain open to pipe M until said disk reaches its highest position, where it contacts with tip Z of wire *v*, and until the higher temperature causes the rod of the thermostat to expand sufficiently to bring its lower end against point *k*, thus closing the warm circuit, when the valve, through armature P, is moved to a position to close duct *o* and open ducts *r* and *t*. The water will then escape through pipe N, and the weight will descend and close the drafts again. The thermostat, therefore, in thus alternately closing the warm and cold circuits, regulates and equalizes the temperature. By adjusting both points *k* and *l* toward either the warm or cold side of the thermostat, and by adjusting rod *g h* accordingly, the temperature can be retained at a higher or lower mean, but regulated within such mean, as above described.

It will be observed that the apparatus shown and described is simple in construction and yet positive in operation, no springs or other parts liable to get out of order being employed. By connecting pipe M to the street-main all trouble connected with the water-supply is avoided, and the only attention that need be given to the apparatus is to see that the battery is kept in working order.

In connection with the apparatus as thus described I have also devised means for still further increasing its usefulness, which consists in so combining a time mechanism therewith that, the circuit being broken for the purpose of temporarily suspending the operation of the regulating apparatus, the same can be automatically closed again at any predetermined time thereafter and cause the apparatus to resume its regulating action.

In the drawings I have shown such time mechanism located between the battery and the apparatus upon wire *b c'*; but it will be understood that it could as well be located at

some point of wire *a*, connecting the battery with the thermostat.

In the example shown the circuit breaking and closing device consists of a spring-switch, W, which in contacting with tip X closes the circuit, and when withdrawn from such contact, as indicated by the dotted line W′, breaks the same. Adjacent to said switch I locate a common time or alarm clock, which in this instance is provided with a notched disk, *e*, adjustably secured to the spindle which moves the hands, so as to turn therewith and yet be capable of adjustment independently thereof. A pawl, *i*, is pivoted to the clock in such manner that its short arm rests upon the periphery of the disk, while its long arm extends upwardly to a point where it is adapted to hold the spring-switch in its retracted position by means of a tooth upon the end of said pawl, as shown. By this construction and arrangement it is obvious that when the notch in the periphery of the disk is moved beneath the end of the short arm of said pawl, in the movement of the disk with the clock-hands, the tension of the spring-switch will cause the pawl to rock sufficiently to release said switch, which immediately contacts with tip X and closes the circuit. By the use of a time mechanism in this manner I am enabled to set the regulating apparatus in position to open the furnace-drafts, break the circuit by means of switch W, adjust disk *e* so that the circuit will be closed in, say, half an hour, fill the furnace with coal, and leave it. The open drafts permit the coal to become thoroughly ignited in the half-hour, at the end of which time the switch is released, the circuit is closed, and the regulating apparatus resumes its control of the drafts, as previously described. Again, I am enabled to break the circuit at night with the drafts closed, thus keeping a slow fire during the night, and adjust disk *e* in such manner as to close the circuit and open the drafts at any hour in the morning and start the regulating apparatus into operation.

It will be observed that I thus materially increase the automatic capacity of the apparatus. So far as this feature of my invention is concerned, I do not wish to limit myself to the particular devices described for thus closing the circuit at a predetermined time, as I believe myself to be the first to utilize a time mechanism with a temperature-regulating apparatus of the kind described.

I am aware that the use of a thermostat to control and operate mechanism for opening and closing furnace-drafts is not new with me, and I therefore do not claim such combination, broadly; but the particular apparatus herein shown and described is new with me, and in its simplicity and cheapness of construction and in its positive operation said apparatus overcomes many serious objections incident to the mechanisms heretofore employed.

It is obvious that modifications in the details of the regulating apparatus could be made without departing from the spirit of my invention.

I claim—

1. The combination, with mechanism for simultaneously opening and closing the draft and check doors of a heating-furnace, an electric battery, and a thermostat, of a temperature-regulating apparatus consisting of a weight connected to the draft-operating mechanism, a cylinder having a piston supporting said weight, water supply and escape pipes communicating with the bore of said cylinder, a valve for alternately opening and closing said pipes, electro-magnets for co-operating with armatures upon said valve to move the latter in opposite directions, and wires connecting said cylinder, piston, battery, and thermostat with each magnet, whereby said valve is automatically operated to admit water to the cylinder and to permit it to escape therefrom, substantially as described.

2. In a temperature-regulating apparatus, a vertical cylinder having a piston supporting a weight at its upper end, said weight being operatively connected with mechanism for opening and closing the draft and check doors of a furnace, water supply and escape pipes communicating with the bore of said cylinder, a slide-valve for alternately opening and closing said pipes, armatures connected to opposite ends of said valve, one or more electro-magnets located adjacent to each armature, a circuit-closing disk secured to the piston above the cylinder, a wire connecting said disk when in its lowest position with one set of magnets, a wire connecting said disk when in its highest position with the other set of magnets, an electric battery, a thermostat, and wires connecting the battery with the cylinder and with the thermostat, and also wires connecting the thermostat with each set of magnets, combined and operating substantially as described, whereby said thermostat is adapted to operate said valve, in the manner set forth.

3. The combination, with a temperature-regulating apparatus automatically operated by means of an electric battery and a thermostat, of means for breaking and closing the circuit for connecting and disconnecting the battery, and a clock mechanism controlling said means, whereby the operation of the regulating apparatus may be suspended and caused to be automatically resumed at a predetermined time, substantially as set forth.

4. In a temperature-regulating apparatus, the combination of cylinder A, having piston B, supporting weight C above its upper end, and having pipe L leading from its lower end, of water-pipe M, escape-pipe N, shell I, valve K, having ducts *p*, *q*, and *r*, arranged substantially as shown, and means for electrically operating said valve, substantially in the manner set forth.

5. In a temperature-regulating apparatus, cylinder A, piston B, weight C, pipes L, M,

and N, shell I, valve K, having the ducts *p q r*, arranged substantially as shown, and having armatures O P secured to its opposite ends, in combination with electro-magnets R and S, arranged and operating substantially in the manner set forth.

6. The combination, with a temperature-regulating apparatus, an electric battery for operating and a thermostat for governing the same, and wires connecting said parts, of a switch for breaking the circuit and disconnecting the battery, and a time or alarm clock located adjacent to said switch and comprising means for closing the same at a predetermined time, substantially as and for the purposes set forth.

7. The combination, with mechanism for opening and closing the draft-openings of a furnace, an apparatus, constructed substantially as herein described, connected with and operating said mechanism, an electric battery, a thermostat located in the room or apartment which receives heat from the furnace, and wires operatively connecting said apparatus, battery, and thermostat with each other, of the circuit breaking and closing switch W and clock mechanism V, said clock mechanism comprising the notched disk *e* and pawl *i*, for automatically closing the circuit at a predetermined time, substantially in the manner set forth.

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