W. O. HAYMOND & J. O. POTTER.

ELECTROTHERMAL CONTROLLING APPARATUS.

APPLICATION FILED JULY 7, 1909. RENEWED JULY 26, 1910.

987,228. **Patented Mar. 21, 1911.**

2 SHEETS—SHEET 1.

Fig. 1.

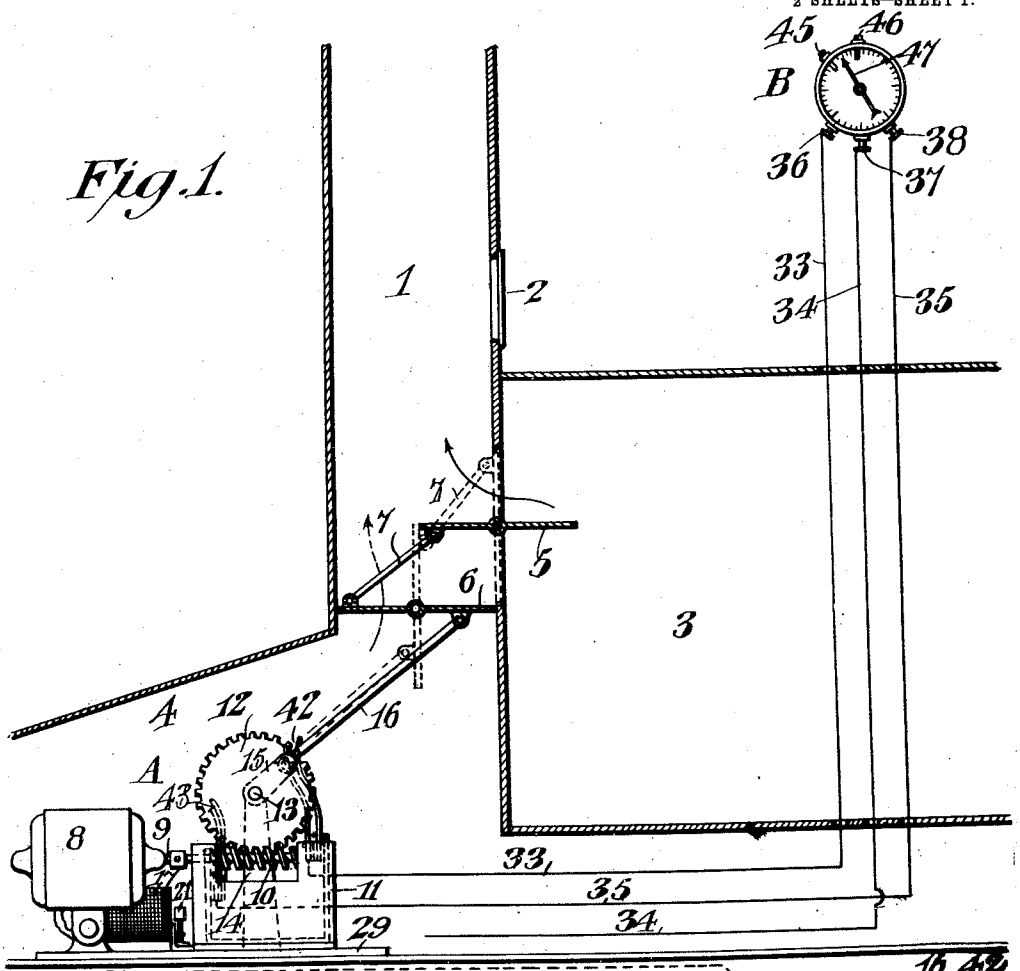


Fig. 2.

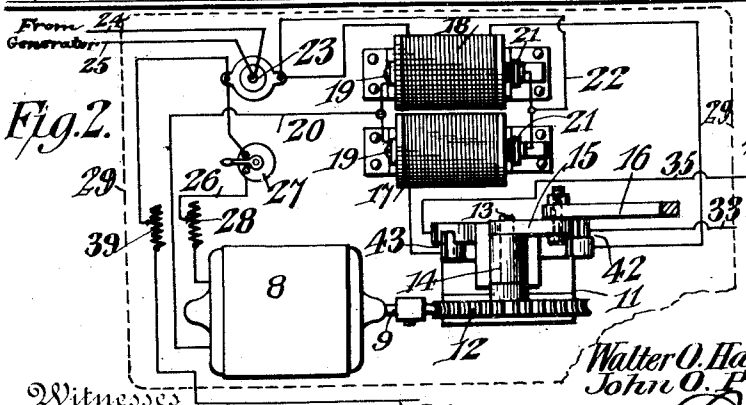
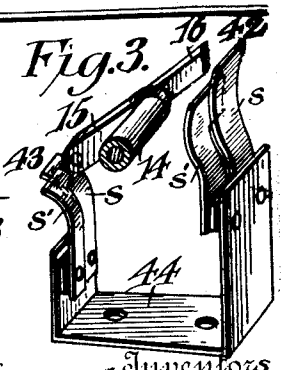


Fig. 3.



Witnesses

Jas. F. McCathran

C. Bradway.

Inventors

Walter O. Haymond,

John O. Potter,

By

E. G. Siggers

Attorney

W. O. HAYMOND & J. O. POTTER.

ELECTROTHERMAL CONTROLLING APPARATUS.

APPLICATION FILED JULY 7, 1909. RENEWED JULY 26, 1910.

987,228. **Patented Mar. 21, 1911.**

2 SHEETS—SHEET 2.

Fig. 7.

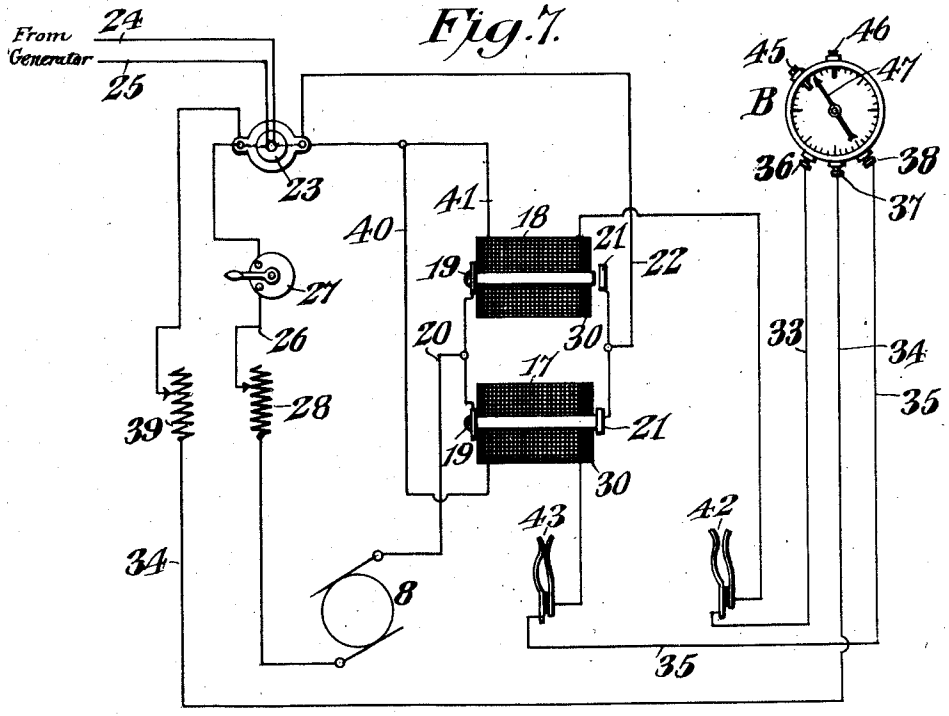


Fig. 4.

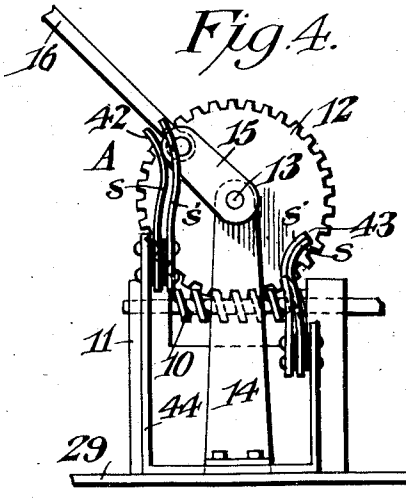


Fig. 5.

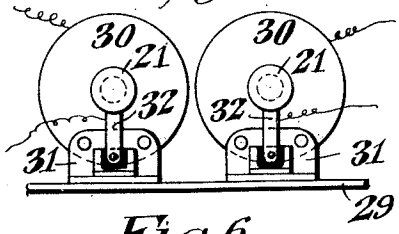
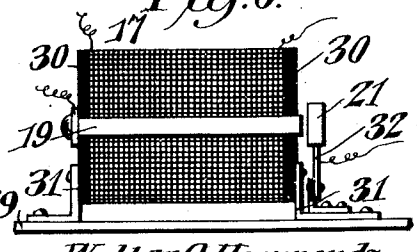


Fig. 6.



Witnesses

Jas. E. McCathran

C. Bradway.

Walter O. Haymond, Inventors

John O. Potter,

By E. G. Siggers

Attorney

UNITED STATES PATENT OFFICE.

WALTER O. HAYMOND AND JOHN O. POTTER, OF MUNCIE, INDIANA.

ELECTROTHERMAL CONTROLLING APPARATUS.

987,228. Specification of Letters Patent. Patented Mar. 21, 1911.

Application filed July 7, 1909, Serial No. 506,341. Renewed July 26, 1910. Serial No. 574,004.

To all whom it may concern:

Be it known that we, WALTER O. HAYMOND and JOHN O. POTTER, citizens of the United States, residing at Muncie, in the county of Delaware and State of Indiana, have invented a new and useful Electrothermal Controlling Apparatus, of which the following is a specification.

This invention relates to a controlling apparatus designed for use in connection with heating systems whereby the supply of hot and cold air or other media can be automatically regulated to maintain a temperature in a room or rooms of a house or building approximately uniform.

The invention has for its objects to improve and simplify the construction and operation of apparatus of this character so as to be comparatively simple and inexpensive to manufacture and install, reliable and efficient in use, and so designed as to require very little current to operate the same.

With such and other objects in view, as will appear as the description proceeds, the invention comprises the various novel features of construction and arrangement of parts which will be more fully described hereinafter and set forth with particularity in the claims appended hereto.

In the accompanying drawings, which illustrate one embodiment of the invention, Figure 1 is a sectional view in elevation, showing the application of the regulating apparatus to a hot air box and dampers for controlling the heated and temperate air. Fig. 2 is an enlarged plan view of the damper operating device. Fig. 3 is a perspective view of the switches included in the thermostatic circuit for controlling the operating motor. Fig. 4 is a side view of the switches and means for operating the same. Fig. 5 is a view of the circuit controller for the motor. Fig. 6 is a longitudinal section of one of the controllers. Fig. 7 is a diagrammatic view of the circuit connections.

Similar reference characters are employed to designate corresponding parts throughout the views.

In the present instance, we have elected to illustrate the invention in connection with a heating system in which hot and cold air are separately admitted to the heating flue or duct, according to the required temperature in the room or rooms supplied by such duct, but it is to be understood that the invention is not necessarily limited to this use.

Referring to the drawings, 1 designates the duct which may supply one or more rooms with air through a register 2 and this duct is adapted to communicate with a hot air chamber 3 or cold air chamber 4, the communication between the duct and chambers being controlled by butterfly valves or dampers 5 and 6 which are operatively connected with a link 7 in such a manner that when one valve is open, the other is closed or vice versa, with the result that either hot or cold air is admitted to the duct 1. The dampers are actuated by an apparatus designated generally by A which includes an electric motor 8 whose shaft 9 is connected with a worm shaft 10 mounted in a frame 11, and meshing with the worm on the shaft is a wheel 12 which is secured to a short rotary shaft 13 journaled in a pedestal or standard 14. The shaft 13 has secured thereto a crank arm 15 which is connected by a link 16 with the damper 6 so that as the crank arm turns, the valves will be oscillated to and from open or closed position, the link and crank arm being so proportioned that when the valves are in either extreme position, the crank arm will be on its dead center.

The electrical system includes two independent circuits, one for the motor and the other for the thermostat. For opening and closing the motor circuit, electro-magnets 17 and 18 are employed, the windings of which are included in the thermostatic circuit so as to be energized when the temperature in a given room reaches a predetermined minimum or maximum point. The cores 19 of the electromagnets are included in the motor circuit and are connected by a wire 20 with one terminal of the motor, and associated with each core is an armature 21 which forms the movable element of a switch. These armatures are connected with a wire 22 that leads to one terminal of a connecting box 23 or equivalent means which affords connection between the lower thermostatic circuits with an external supply circuit, the wires of which are designated 24 and 25. The other terminal of the connecting box is connected by a wire 26 with the motor and in this wire is a cut-out

switch 27 and also an adjustable resistance 28 for controlling the speed of rotation of the motor. As shown in Figs. 5 and 6, the cores of the electro-magnets are insulated from the supporting plate 29 in which the various devices of the apparatus are mounted, the winding of each electro-magnet being confined between disks 30 of insulating material, and these disks are attached to brackets 31 for securing the electro-magnets on the base plate 29. The armatures 21 are each carried by a spring 32 so arranged as to hold the armature spaced from its core while permitting the armature to be drawn toward and in engagement with the latter when the electro-magnet is energized.

In the room to be heated is arranged a thermostatic indicator designated generally by B which is of substantially the same construction as the indicator disclosed in the United States Letters Patent No. 898,643, granted to us September 15, 1908. The thermostatic circuit is of the three-wire type and consists of wires 33, 34 and 35 connected, respectively, with the binding posts 36, 37 and 38 of the indicator B. The wire 34 forms a common return for the current and is connected with one of the terminals of the connecting box 23 and includes an adjustable resistance 39 whereby the current can be regulated. The wires 33 and 35 are connected, respectively, with electro-magnets 18 and 17, while the electro-magnets are, in turn, connected by wires 40 and 41 with the other terminal of the connecting box. It will thus be seen that the windings of the electro-magnets are arranged in shunt relation. Included in the wires 33 and 35 are switches or circuit breakers 42 and 43 each consisting of a pair of insulated springs so designed as to engage each other under their normal tension. These contact springs are mounted on a bracket 44, Figs. 3 and 4, secured to the base plate 29 in such relation to the crank arm 15 of the damper operating mechanism that the said arm is adapted to open the switches alternately during the actuation of the said mechanism. The contact springs *s* are disposed in the path of the crank arm and are adapted to be moved outwardly thereby to separate from the springs *s'*. The springs *s* are arranged at diametrically opposite points from the center of rotation of the crank arm so that when the latter reaches either dead center, it will open one of the switches and thereby cut out the electro-magnet that is maintaining the motor in circuit. The binding posts 36 and 38 of the indicating device B are electrically connected with adjustable contacts 45 and 46 with which the needle 47 is adapted to engage as the temperature falls and rises.

In describing the method of operation, let it be assumed that the cold air supply has been cut off and the hot air supply opened to the duct 1, and the temperature in the room supplied by the register 2 is rising. The needle or hand 47 is consequently moving from the contact 45 to the contact 46 by the expansion of the thermostat connected with such needle. It will be observed that the switch 43 is closed so that as soon as the circuit through the thermostat is completed by the maximum rise in temperature, current will flow through the path consisting of the wires 24, 40, and electro-magnet winding 17, wire 35, contact 46, needle 47, the common return wire 34 and wire 25, and supply circuit. The electro-magnet 17 being thus energized, causes the motor circuit to be completed so that current will flow through the path consisting of the wires 24, 22, armature 21, and core of the electro-magnet 17, wire 20, motor 8, wires 26 and 25. The motor is thus actuated so that the power-transmitting mechanism or gear between it and the damper is brought into operation for reversing the latter to the dotted line position, thus admitting cold air to the duct 1 and closing off the hot air. As the crank arm 15 turns during this movement of the dampers, the switch 42 automatically closes, and when the crank arm reaches its opposite dead center, the switch 43 will be opened to thus cut out the electro-magnet 17 which controls the motor switch. When this electro-magnet is thus cut out of circuit, the motor circuit, in turn, is opened by the armature 21 separating from the core 19 of the magnet 17. When the temperature falls to a minimum point, the needle 47 engages the contact 45 so that the circuit including the electro-magnet 18 will be closed, which actuates the other motor switch to again connect the motor in circuit. The dampers are consequently reversed to admit hot air to the room and the operating device will then be in the position shown in Fig. 1.

From the foregoing description, taken in connection with the accompanying drawings, the advantages of the construction and of the method of operation will be readily apparent to those skilled in the art to which the invention appertains, and while we have described the principle of operation of the invention, together with the apparatus which we now consider to be the best embodiment thereof, we desire to have it understood that the apparatus shown is merely illustrative, and that such changes may be made when desired as are within the scope of the claims appended hereto.

Having thus described the invention, what we claim as new, and desire to secure by Letters Patent, is:—

1. In a thermal regulating system, the combination of a device controlling the flow of the heating medium, an electric motor,

a worm and wheel mechanism operatively connected with the motor, a crank associated with the wheel, a connection between the crank and said device, a thermostat, separate circuits for the motor and thermostat, electro-magnets included in the thermostat circuit, switches controlled by the electro-magnets for opening and closing the motor circuit, and switches included in the thermostat circuit and arranged to be alternately engaged and opened by the said crank arm driven by the motor to cut out the active electro-magnet and open the motor circuit when the said device has reached the end of its movement.

2. In a system of the class described, the combination of a device for controlling the supply of heating medium, an electric motor, a worm connected with the shaft thereof, a wheel meshing with the worm and operatively connected with the said device, a pair of switches arranged at opposite sides of the axis of the wheel and each including a pair of springs normally contacting with each other, a device rotating with the wheel for alternately engaging one member of each switch to open the same by separating the members, an electro-magnet connected with each switch, a thermostat connected with each switch and electro-magnet for closing the circuit through one of the switches and one of the electro-magnets, a circuit for the motor in which the cores of the electro-magnets are included, and armatures associated with the cores for forming switches for closing the motor circuit when either electro-magnet is energized.

3. In a system of the class described, the combination of a damper operating mechanism, a motor for actuating the same, a plurality of electro-magnets, a circuit for the motor in which the cores of the electro-magnets are connected in shunt relation for current to pass therethrough, contacts connected in the said circuit and arranged to engage the cores for completing the circuit through either of the latter, a thermostatic device, a three-wire thermostat circuit connected therewith, the said device including means for providing a path for current through the same when the temperature rises or falls to a predetermined position, the windings of the electro-magnets being included in two of the wires of the thermostat circuit, switches included in each of the last-mentioned wires and tending normally to close, and a rotatable member included in the said mechanism for opening one switch or the other to cut out the active electro-magnet when the motor has completed the operation of the said damper actuating mechanism.

In testimony, that we claim the foregoing as our own, we have hereto affixed our signatures in the presence of two witnesses.

WALTER O. HAYMOND.
JOHN O. POTTER.

Witnesses:
HARRY LESTER JANNEY,
CLIFTON L. WALLING.