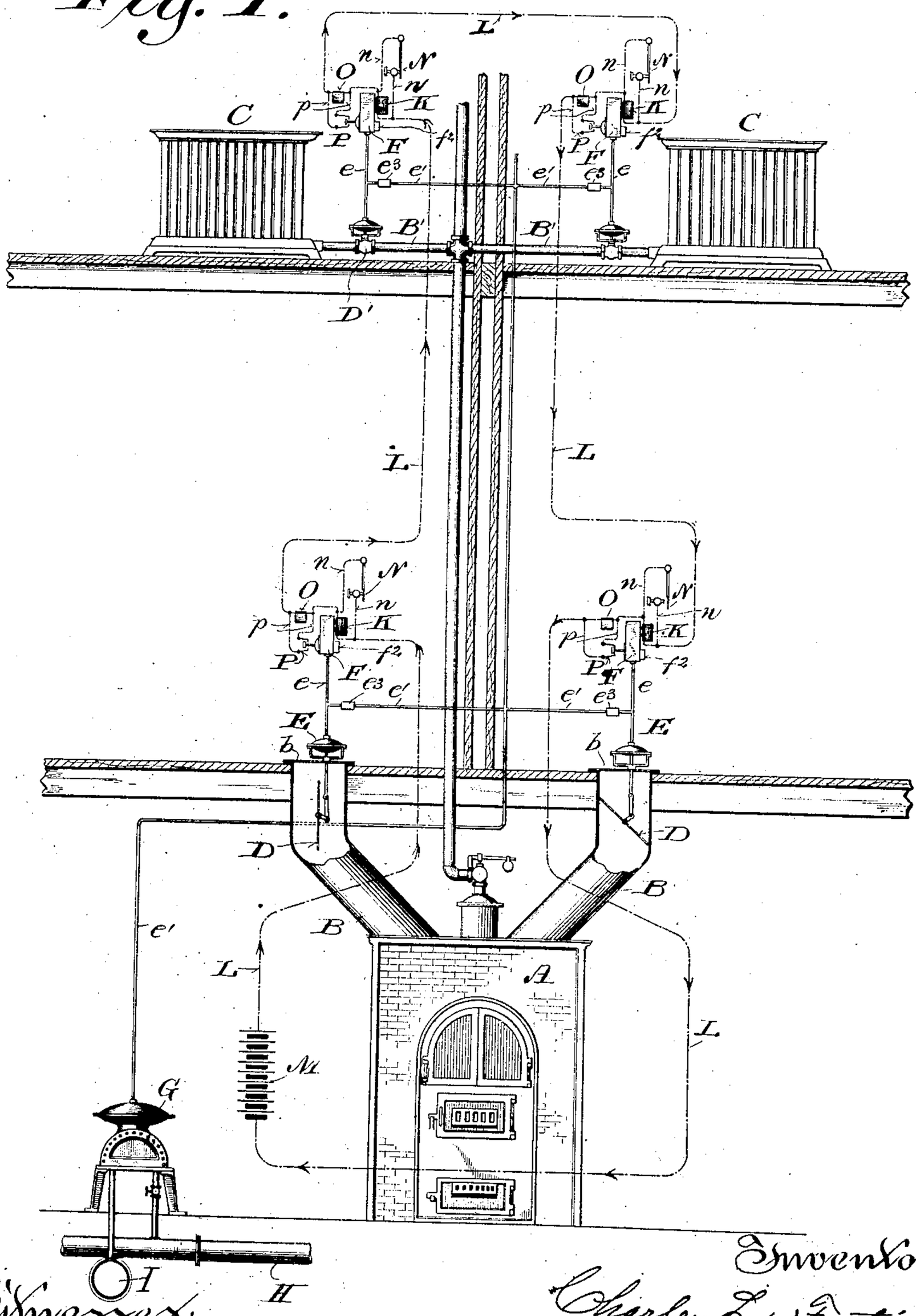
(No Model.) 2 Sheets—Sheet 1.

C. L. FORTIER.

HEAT REGULATING APPARATUS.

No. 594,346. Patented Nov. 23, 1897.

Fig. 1.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

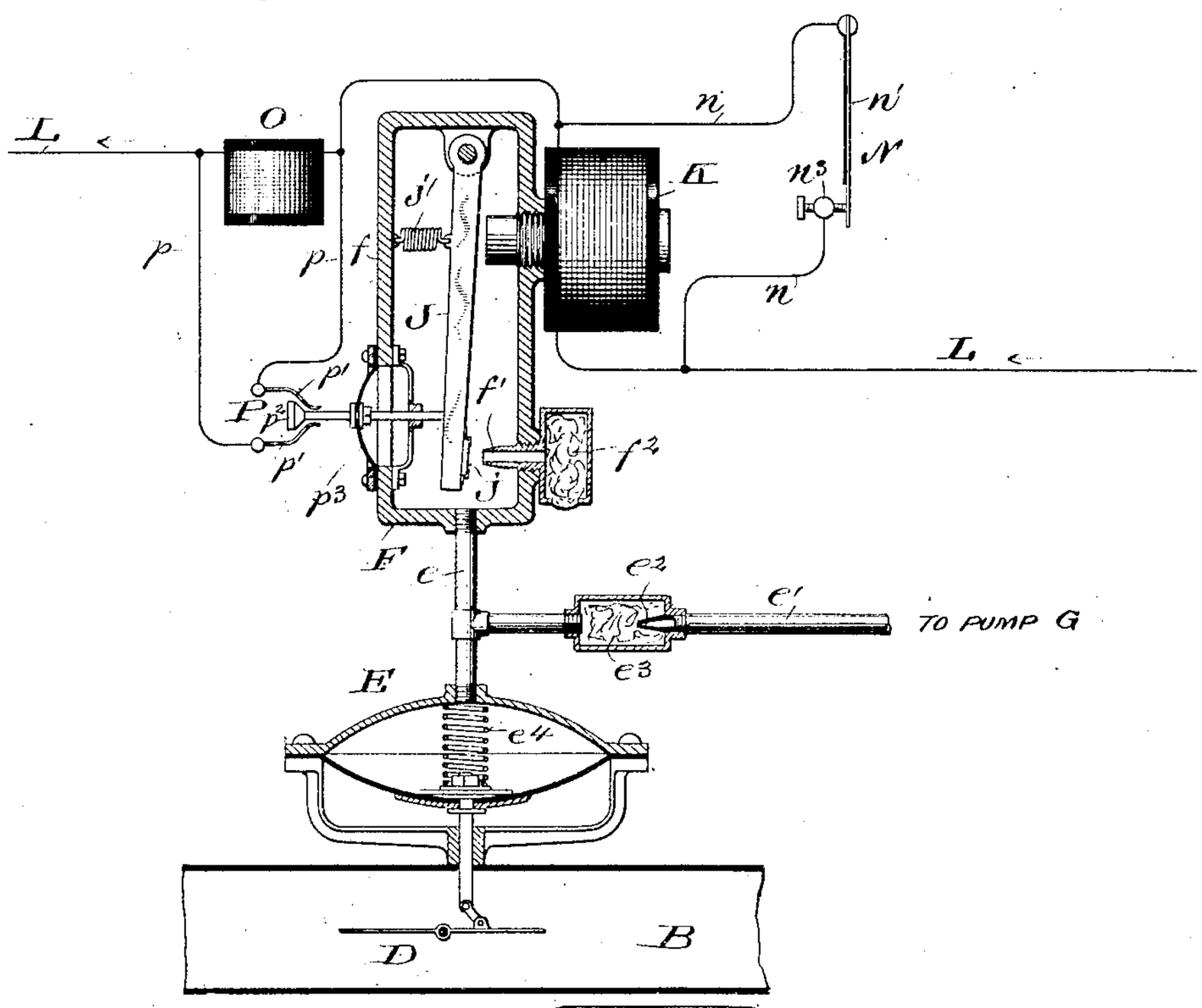
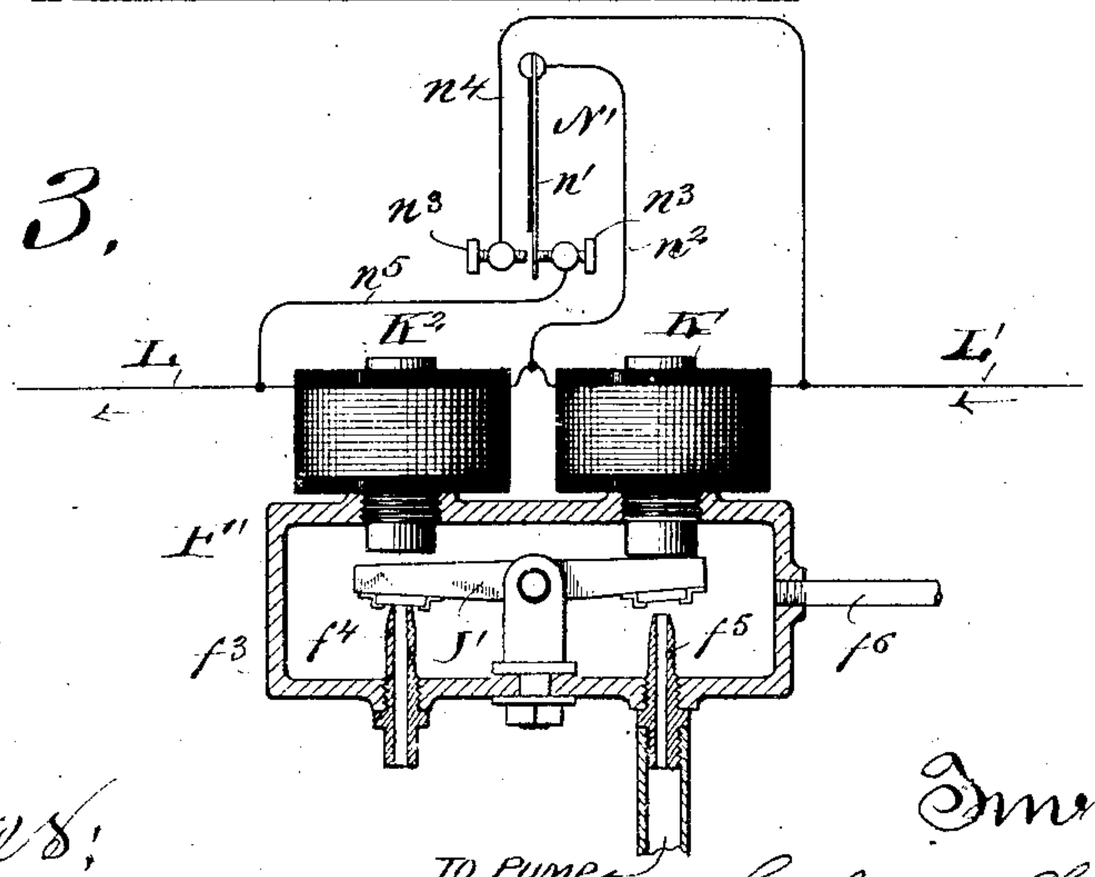


Fig. 3.



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UNITED STATES PATENT OFFICE.

CHARLES L. FORTIER, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO THE JOHNSON ELECTRIC SERVICE COMPANY, OF WISCONSIN.

HEAT-REGULATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 594,346, dated November 23, 1897.

Application filed September 12, 1896. Serial No. 605,556. (No model.)

To all whom it may concern:

Be it known that I, CHARLES L. FORTIER, of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Heat-Regulating Apparatus; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

The main objects of my invention are to employ a continuous electric current for the operation or control of heat-regulating apparatus; to prevent sparking at thermostats, particularly when currents of high potential are used; to facilitate testing the circuit and repairing breaks and removing grounds therein; to avoid waste of energy or rapid consumption of electrodes when batteries are used to supply current; to dispense with springs, permanent magnets, and circuit-breakers, and generally to improve the construction and operation of apparatus of the class to which my invention relates.

It consists of certain novel features in the construction and arrangement of component parts of the apparatus, as hereinafter particularly described, and pointed out in the claims.

In the accompanying drawings like letters designate the same or similar parts in the several figures.

Figure 1 is a diagram and elevation of one form of apparatus embodying my improvements. Fig. 2 is a detail view, on an enlarged scale, of one of the electromagnetic valves in connection with a thermostat and main heat-regulating valve or damper; and Fig. 3 is a similar view of a modified form of the electromagnetic valve and its electrical connections.

Referring to Fig. 1, A designates a heater, which may be of any common or suitable form. In the present instance I have shown for the purpose of illustration a combination hot-air and steam or hot-water heater, which is connected with certain rooms or apartments of a building by hot-air pipes B B and with radiators C C in certain other apartments by steam or water pipes B' B'; but the application of my invention is by no means confined to this combination of the two modes of heating and the arrangement of apparatus shown.

The hot-air pipes B B open in the usual way into the apartments to be heated through suitable registers *b b* and are provided with controlling or regulating valves or dampers D D, while the pipes B' B' are provided near the radiators to which they lead with valves D' D'.

The several valves or dampers D D' are connected with suitable motors E E, by which they are directly actuated under the control of thermostatically-controlled electromagnetic valves F F, or the heat-regulating valves or dampers may be constructed and arranged to be operated directly by electromagnetic devices controlled by thermostats in a manner similar to that shown in the drawings.

The motors, consisting in the present case of expansion-chambers and flexible diaphragms, as shown in Fig. 2, are connected by pipes *e e* with the valves F F and by pipes *e' e'* with a pump G, which may have connections, as shown, with a water-main H and sewer I and be operated automatically by liquid-pressure.

As shown in Fig. 2, the valves F each comprise an air-tight case or chamber *f*, having a port or passage *f'* communicating through a filter f^2 with the atmosphere, an armature lever or arm J, pivoted within said case and provided with a valve *j* for closing the port or passage *f'*, and an electromagnet K, the core of which projects through said case into proximity with said arm or lever, so that when the magnet is energized it will draw said valve *j* against its seat and close the port or passage *f'*, a spring *j'* acting on said arm or lever in opposition to said magnet and tending to hold the valve open.

The main heat-regulating valves or dampers D D' of the apparatus, as shown in Figs. 1 and 2, are designed to be operated by a vacuum or by exhausting the chambers of the motors E, and for this purpose the pipes *e' e'* have restricted ports or passages, as at e^2, Fig. 2, of smaller area than the ports or passages *f'*, so that when the latter are open the motors will be supplied with air faster than they are exhausted, and consequently will be inflated, allowing springs e^4, as shown in Fig. 2, to open the valves or dampers D D'.

Filters e^3 e^3 are provided between the restricted ports e^2 and the motors and cham-

bers of valves E, and, with the filters f^2, prevent dust and dirt from entering and clogging said ports and air-passages and thus interrupting or interfering with the operation of the apparatus.

The coils of the magnets K K are connected in series by wires L L with a battery M or other convenient source of electricity.

N N are single-point thermostats placed in shunts n n, tapping the circuit L L on opposite sides of the magnets K K.

O O are coils having a resistance approximately equal to that of the magnets K K. They are placed in the main circuit L L and associated with the several electromagnetic valves K K and with shunts p p, containing automatic circuit-controllers P P and tapping the main circuit on opposite sides of the said resistance-coils O O.

The circuit-controllers P P for closing the shunts p p and cutting out the resistances O O whenever the associated shunts n n are opened by the thermostats N N, and thereby maintaining an approximately constant resistance in the main circuit L L, may each conveniently consist, as shown in Fig. 2, of two spring-contacts p' p', to which the shunt-wires p p are attached, a movable head p^2, having a stem projecting through the valve-case f into the path of the armature lever or arm J, and a flexible diaphragm p^3, attached to said stem in or over an opening in said valve-case.

Referring to Fig. 3, showing a modification of a part of the apparatus, F′ designates an electromagnetic valve mechanism for controlling the admission and release of the actuating fluid to and from the motor and the operation of the valve or damper connected therewith. It comprises an air-tight chamber or case f^3, having supply and exhaust ports or passages f^4 and f^5, and a service connection f^6, leading into the expansion-chamber of the motor. It has a pivoted armature lever or arm J′, provided with valves controlling the ports or passages f^4 and f^5 and arranged to open one and close the other alternately.

K′ and K² are electromagnets, the cores of which project through said valve-case into proximity with opposite ends of said armature-lever. The coils of said magnets are connected in series with each other and with the battery or other source of electricity by the main-circuit wires L L′.

N′ is a two-point thermostat, the expansion-strip n' of which is connected by a wire n^2 with the main circuit between the two magnets and the contacts n^3 n^3 of which are connected by wires n^4 and n^5 with the main circuit outside of said magnets, thereby forming shunts by which the coil of either one of the magnets is cut out of the main circuit, according to the position of the expansion-strip n' of the thermostat. In this form of the device a separate resistance-coil is dispensed with, since the coil of one of the magnets is always in circuit and affords the required resistance to prevent depletion of battery or consumption of electric energy. This form of the device also avoids the necessity of springs and permanent magnets, as the current flowing through the coil which is not shunted holds the opposite valve to its seat, and while the expansion-strip n' is out of engagement with both contacts n^3 n^3 current passes through the coils of both magnets, so that the one by which the armature-lever J′ is attracted when this condition occurs will hold it by reason of its closer proximity therewith against the other magnet. The arrangement of the valve-controlling magnets of both forms of the apparatus in a continuous electric circuit in series with each other and the provision of the thermostatically-controlled shunts around the several magnets enables me to dispense with the circuit-breakers employed in other systems of this class.

The form of apparatus shown in Fig. 2 admits of the use of a single-point thermostat, by which it is well known to those familiar with the subject that temperature can be regulated within closer limits than by the double-point or contact thermostats commonly used. By a slight modification a fluid under pressure may be employed with this form of valve instead of a vacuum.

The form and arrangement of the valve mechanism and its connections shown in Fig. 3 is suitable for use either with a fluid under pressure or a vacuum, with this advantage, however, over the other form that in one position the port or passage leading from the valve-chamber to the pump will be closed, and in that position there will be no waste in the fluid energy.

My improved arrangement of the electric connections of the apparatus admits of its operation by current of high potential, and when it is accessible and convenient the circuit L may be supplied with current from an electric-light plant or other source of strong current without detriment to the operation of the lights or other apparatus supplied by such current. When a sufficiently powerful current is employed, the intermediate fluid-motors between the electromagnetic valves and the main heat-regulating valves or dampers may be dispensed with and the magnets arranged to operate the heat-regulating valves or dampers directly. Accidental breaks or grounds in the electric circuit may be easily located by grounding one side of the battery or generator and tapping the wire leading from the opposite side with a ground connection at different points. In this way an intervening break or ground in the circuit can be easily detected.

My improved apparatus, as shown in Figs. 1 and 2, operates as follows: When the temperature in any apartment controlled by the system is at or below the point for which the apparatus is set and the expansion-strip n' of the thermostat engages the contact n^3, cur-

rent is shunted through the wires *n n* around the coil of the associated magnet K, which is thus deënergized. The armature lever or arm J, being thus released, is drawn away from the core of the magnet by the spring *j''* and the valve *j* is removed from its seat, thereby opening the port or passage *f'*. Air is thereupon admitted through the valve-chamber and pipe *e* to the diaphragm-chamber of the associated motor faster than it is exhausted by the pump through the restricted passage e^2 in pipe *e'*. The motor is thus inflated, and the spring e^4, acting on the diaphragm in opposition to the pump, opens the main valve or damper D, as shown in Fig. 2 and the lower left-hand portion of Fig. 1, thereby admitting the heating medium through the pipe B into the apartment with which it communicates, containing the thermostat. When the armature-lever J is retracted by its spring *j'*, it engages the stem of the movable member p^2 of the circuit-controller and thrusts it out of engagement with the contact-springs *p' p'*, thereby opening the shunt *p p* and compelling the current to pass through the resistance-coil O when the thermostatic shunt *n n* is closed and the coil of magnet K is cut out of circuit. In this way the resistance of the circuit is kept substantially constant or sufficient to prevent waste or unnecessary consumption of current and interference with the operation of lights or other apparatus which may be supplied from the same source of current. When the temperature is raised in this apartment to or slightly above the degree for which the apparatus is set, the expansion-strip *n'* of the thermostat is deflected out of engagement with its contact n^8 and the shunt *n n* opened. Current is thus compelled to pass again through the magnet K, which, being energized thereby, attracts the lever or arm J, closing the port *f'* by the valve *j*. The supply of air through the valve-chamber to the motor E being thus cut off, the chamber of the motor is exhausted by the action of the pump through the pipe *e'*, collapsing the diaphragm, compressing the spring e^4, and closing the valve or damper D, as shown in the lower right-hand portion of Fig. 1, thereby cutting off the heating medium from the apartment to which the pipe B leads. When the arm J is attracted by magnet K and the valve-chamber is exhausted by the pump, the diaphragm p^3 is collapsed or drawn in, carrying the head p^2 of the circuit-controller into engagement with the contact-springs *p' p'*, thereby closing the shunt *p p* around the resistance-coil O. When the temperature in said apartment falls to or slightly below the degree for which the thermostat is set, the operation of the apparatus as first described will be repeated, opening the damper and admitting the heating medium again into said apartment.

With the form of electromagnetic valve and the arrangement of circuit connections shown in Fig. 3 the operation of the apparatus is similar to that of the apparatus shown in Fig. 2, and will be readily understood by those familiar with the subject without further explanation.

Various changes may be made in the details of the apparatus within the spirit and intended scope of my invention.

I claim—

1. The combination with a heat-regulating valve or damper, of an electromagnet for controlling the operation of said valve or damper, an electric circuit connecting the coil of said magnet with a source of electricity and a shunt containing a thermostat and tapping said circuit on opposite sides of said magnet, substantially as and for the purposes set forth.

2. The combination with a number of heat-regulating valves or dampers, of electromagnets for controlling the operation of said valves or dampers, an electric circuit connecting the coils of said magnets in series with a source of electricity and a shunt for each magnet containing a thermostat and tapping said circuit on opposite sides of said magnet, substantially as and for the puposes set forth.

3. The combination with a heat-regulating valve or damper, of an electromagnet for controlling the operation of said valve or damper, an electric circuit connecting the coil of said magnet with a source of electricity, a thermostat in a shunt tapping said circuit on opposite sides of said magnet, a resistance in said circuit, and a shunt around said resistance containing an automatic circuit-controller which is arranged to cut out said resistance whenever the thermostat is opened, substantially as and for the purposes set forth.

4. The combination with heat-regulating valves or dampers, of electromagnets for controlling their operation, an electric circuit connecting the coils of said magnets in series with a source of electricity, a shunt around each magnet containing a thermostat, a resistance in said circuit for each magnet, and a shunt around said resistance containing an automatic circuit-controller arranged to open said shunt whenever the associated thermostatic shunt is closed, substantially as and for the purposes set forth.

5. The combination with heat-regulating valves or dampers, of electromagnets controlling the operation thereof, an electric circuit connecting the coils of said magnets in series with a source of electricity, and single-point thermostats having their expansion-strips connected with said circuit on one side and their contacts connected with said circuit on the other side of said magnets, substantially as and for the purposes set forth.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

CHARLES L. FORTIER.

Witnesses:
CHAS. L. GOSS,
FRANK A. KREHLO.