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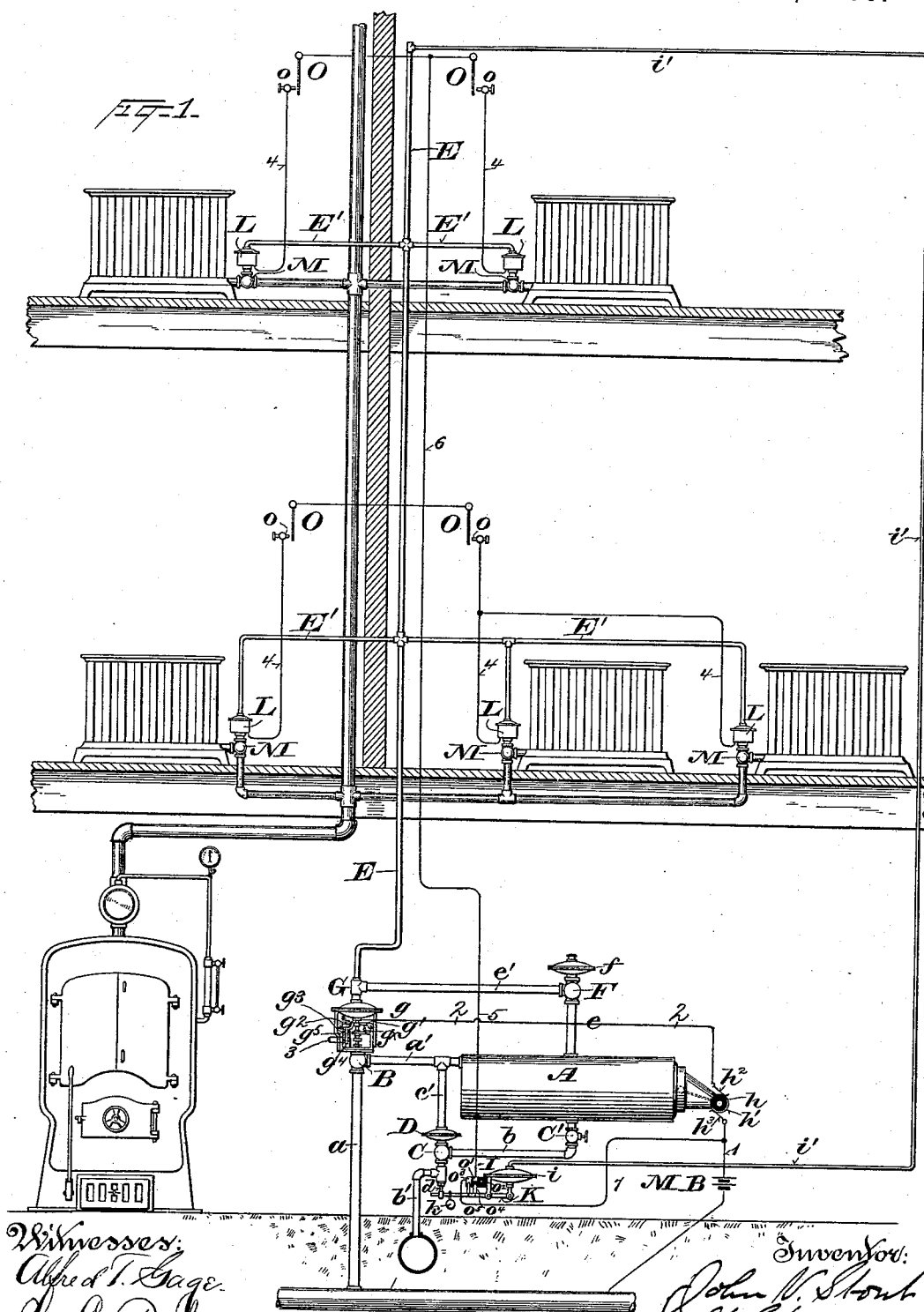
4 Sheets—Sheet 1.

J. V. STOUT.

APPARATUS FOR HEAT REGULATION.

No. 552,013.

Patented Dec. 24, 1895.



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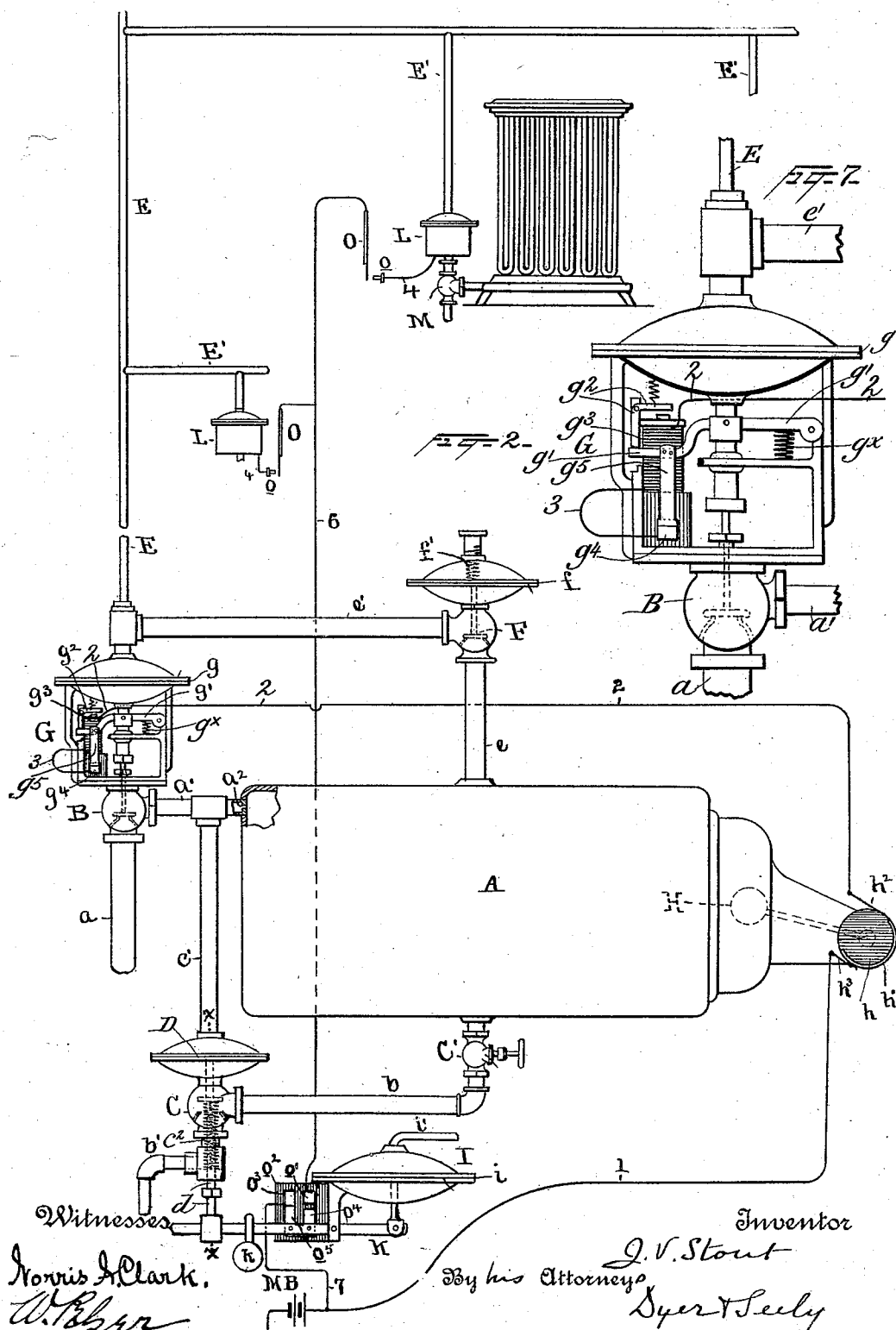
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J. V. STOUT.
APPARATUS FOR HEAT REGULATION.

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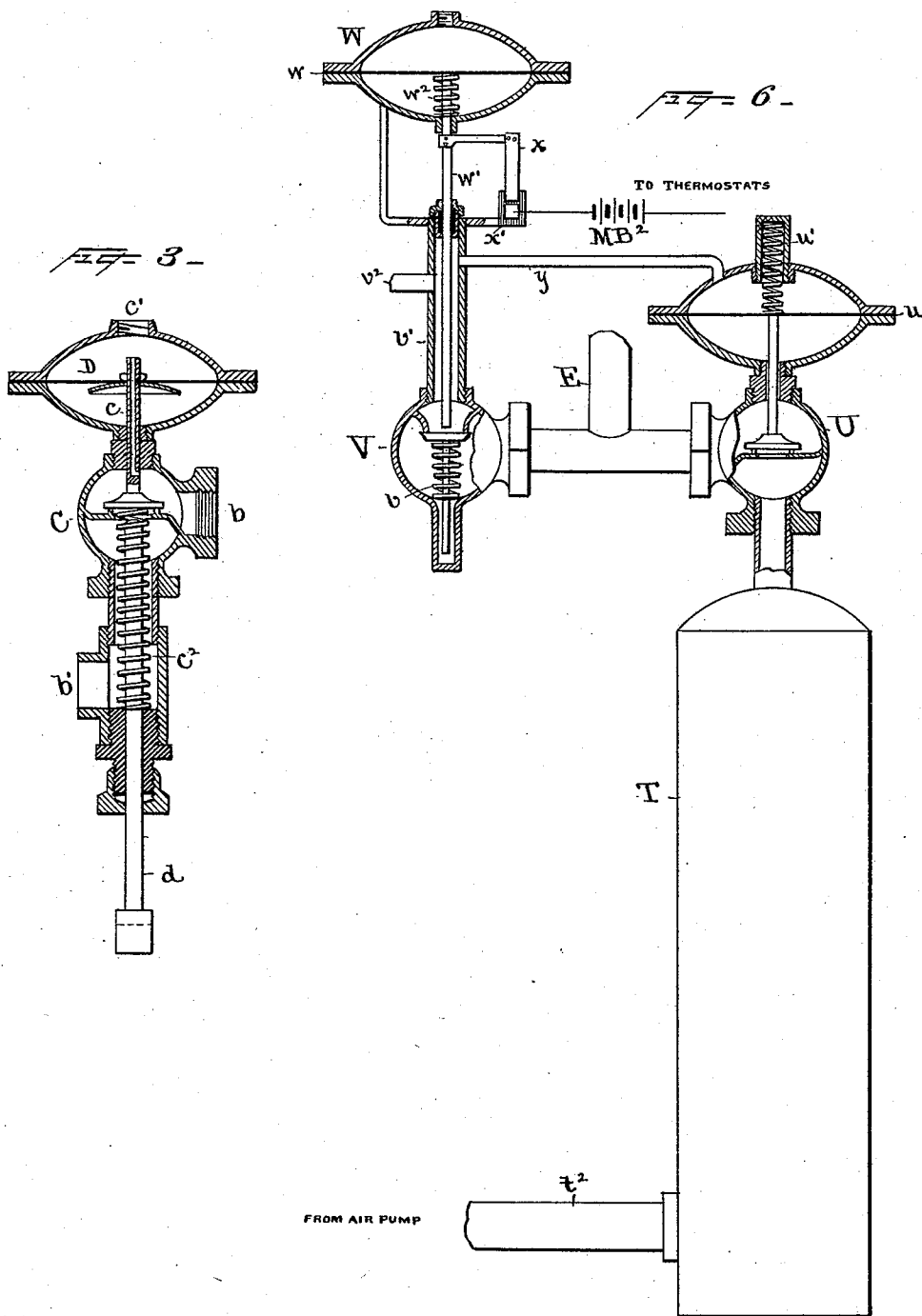
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4 Sheets—Sheet 3.

J. V. STOUT.
APPARATUS FOR HEAT REGULATION.

No. 552,013.

Patented Dec. 24, 1895.



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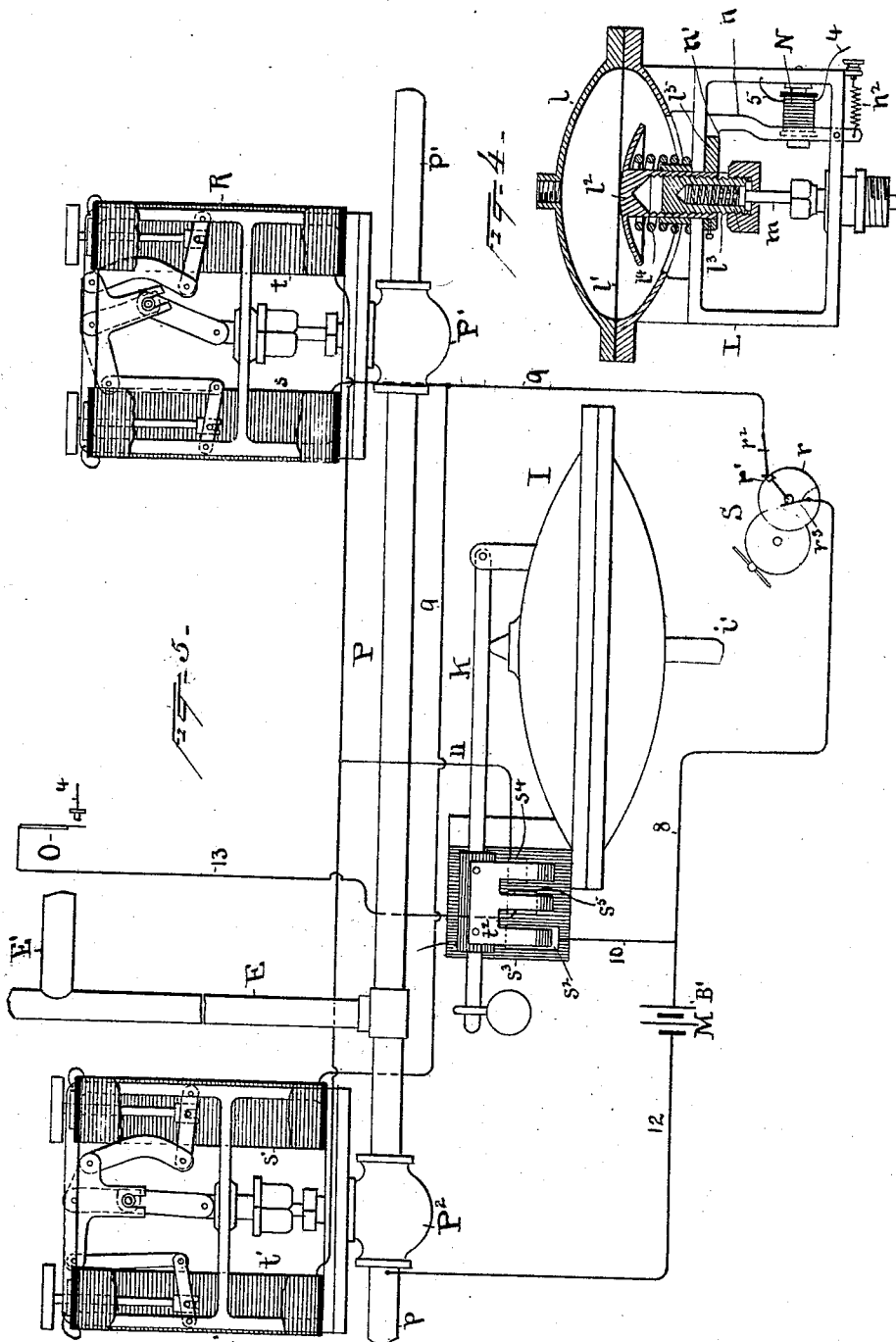
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4 Sheets—Sheet 4.

J. V. STOUT.
APPARATUS FOR HEAT REGULATION.

No. 552,013.

Patented Dec. 24, 1895.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR HEAT REGULATION.

SPECIFICATION forming part of Letters Patent No. 552,013, dated December 24, 1895.

Application filed February 15, 1893. Serial No. 462,508. (No model.)

To all whom it may concern:

Be it known that I, JOHN V. STOUT, a citizen of the United States, residing at Easton, in the county of Northampton and State of Pennsylvania, have invented a certain new and useful Improvement in Apparatus for Heat Regulation, of which the following is a specification.

The object I have in view is to produce apparatus for regulating and controlling the application of artificial heat to buildings, which will be less costly in construction and more efficient and reliable in operation than apparatus heretofore employed for effectively accomplishing the same purpose.

While constituting a single comprehensive system of heat regulation, my apparatus presents several independent features of novelty, possessing individually advantages which can be utilized in systems of heat regulation differing widely from the specific system in which I preferably employ them, and I wish it understood that so far as these independent features of novelty are concerned my invention is not limited to the specific system described.

In carrying out my invention I apply periodically—for instance, at intervals of fifteen or thirty minutes, more or less, according to the length of time required to effect definite changes in temperature under the particular conditions of use—any suitable form of power, such as fluid-pressure or an electric current, to move valves or dampers or registers controlling the application of steam, hot water or hot air. The valve or damper operating motors are controlled by thermostats, each of which determines whether the one or more valves or dampers under its control shall alter the conditions of heat application existing at the moment of the application of the power. I prefer to apply the power so that it will tend to move all the valves or dampers in one direction—for instance, will tend to close them—against the pressure of springs which tend to move them in the opposite direction and to arrange electromagnetically-operated detents controlled by the thermostats so that they will lock the valves or dampers in the

position to which the power moves them or will allow them to be retracted by the springs, according to the conditions of temperature existing at each thermostat when each application of the power is made.

Another feature of importance in my apparatus when the thermostats are arranged to exercise their control through electromagnets is the periodic closing of the thermostatic circuit by automatic apparatus acting independently of the one or more thermostats in circuit and maintaining the circuit open during the intervals, so that the circuit will be under the control of the thermostats only for brief periods of time, preventing the putting into operation of the apparatus and the depletion of the battery by manipulation of the thermostats, accidental grounds or other causes.

In my preferred form of apparatus a retarded controller is employed, which is worked by the power but has a retarded action, and which acts to first close the thermostatic circuit and then to withdraw the power, the withdrawal of the power causing this retarded controller to retract and again break the circuit, which remains open until the power is again applied. An arrangement for opening the thermostatic circuit by the operation of the apparatus independently of the thermostats themselves also enables me to use single-point thermostats without waste of battery-power, and this simplifies the apparatus and makes possible a finer adjustment at the thermostats. The periodic application of the power may be made in various ways, some of which are herein after described. I prefer to employ a fluid-pressure, which is admitted to a system of pipes extending to the valve or damper-operating motors, and a single supply-valve and single exhaust-valve can be used for the whole system of a building or for the valves or dampers controlled by two or more thermostats. This is made possible by the periodic application of the power and by the fact that the valves or dampers are not kept in one position by the maintenance of the pressure, as in the most perfect systems heretofore proposed. The difficulties arising from the leak-

age of the pipes and the multiplicity of pressure-supply and exhaust valves heretofore employed are also avoided.

In my system, when the power is applied in the form of fluid-pressure, the retarded controller before mentioned is a motor worked by that pressure after the valve or damper-operating motors have operated, and acting to open the exhaust-valve of the system.

The invention is illustrated in the accompanying drawings in an apparatus for operating the valves of steam or hot-water radiators.

Figure 1 is a general view of a heat-controlling system as applied to a building and embodying one form of my apparatus. Fig. 2 is an enlarged view of a portion of the apparatus shown in Fig. 1. Fig. 3 is an enlarged sectional view of the exhaust-valve of the system shown in Figs. 1 and 2, the section being taken on the line xx of Fig. 2. Fig. 4 is a vertical section of one of the valve-operating motors. Fig. 5 is a view illustrating a modified form of apparatus. Fig. 6 illustrates another modification of my system. Fig. 7 is an enlarged detail view of the controller G.

Referring to Figs. 1 to 4, inclusive, A is a tank in which air-pressure is produced by the admission of water thereto at its top through pipe a , the valve B, pipe a' and opening a^2 . Valve B is the water-supply valve. The water is withdrawn from the bottom of the tank through pipe b , valve C and pipe b' . Valve C is the exhaust-valve. The pipe b is provided with a hand-valve C' , by adjusting which the time required to empty the tank can be regulated so as to determine the length of time between the periods of applying the pressure. The stem c of the exhaust-valve C is connected with a diaphragm D (see Fig. 3) whose upper side is connected by a pipe c' with the water-supply pipe a' . The opening a^2 being smaller than the pipe c' , the opening of the water-supply valve B to admit water to the tank produces pressure upon the diaphragm D and closes the exhaust-valve against the pressure of a spring c^2 , Fig. 3, which tends to lift the exhaust-valve from its seat. The exhaust-valve is opened by the upward movement of a rod d which passes up through the bottom of the valve-case and the spring c^2 . The stem c of the exhaust-valve is hollow to permit air to pass into the tank through the pipes b' c' and opening a^2 when the water is running out, or a small opening through the diaphragm D may be used for that purpose, there being no packing around the stem c where it passes through the upper side of the valve-case.

The air pressure is delivered from the tank to the house-pipe E through the pipe e , valve F and pipe e' . Valve F is the pressure-supply valve. Its stem is connected with a diaphragm f and is forced downwardly by an adjustable spring f' . The chamber beneath the diaphragm f opens into the valve-case above the valve F. When the pressure in the tank

reaches a definite point, determined by the strength and adjustment of the spring f' , it lifts the valve F and enters the house-pipe E. It also acts on the under side of the diaphragm f and holds the valve F open until the pressure is removed or reduced to a point below that required to operate the valve or damper actuating motors and the retarded controller.

The operation of the water-supply valve B is governed by a controller G, which has the following features: The stem of the valve B is connected with a diaphragm g , the chamber on whose upper side is connected with the pressure-supply pipe e' . The admission of pressure by the valve F to the pipe e' forces the diaphragm g downwardly and closes the water-supply valve B. It carries down with it a lever g' against the pressure of a spring g^x . This lever g' is locked in its lower position by the retraction of the armature g^2 of an electromagnet g^3 . The lever g' also carries a leaf-spring g^5 , which closes a break in the circuit of the magnet g^3 at a contact-plate g^4 when in its lower position. The circuit of the magnet g^3 is not only closed at the plate g^4 , but is also controlled by a float H, located as shown, and under the influence of the fluid in tank A, which float by its movement partially rotates a disk h mounted outside the tank on the spindle with which the float is connected. The disk h is of insulating material, but carries on its periphery a metal plate h' , with which co-operate contact-springs h^2 h^3 , so that when the float falls to a certain point the spring h^2 h^3 will be electrically connected by the plate h' . The circuit from the battery M B when closed at the contact-plates g^4 and h' extends *via* wire 1, spring h^3 , plate h' , spring h^2 and wire 2 to the magnet g^3 , and thence by wire 3 to plate g^4 and through lever g' to the frame of the water-supply-valve controller G, returning through the pipes with which such frame is connected to the other pole of the battery, which is also grounded on such pipes.

I is the retarded controller. It comprises a chamber having a central diaphragm i , with the upper side of which is connected a pipe i' , preferably extending to the outer end of the house-pipe E, as shown in Fig. 1, in order to utilize the friction in the pipe to retard the movement of the diaphragm until after the valve-operating motors have been worked; but it is evident that any of the well-known retarding devices applicable to this class of mechanism can be used. The diaphragm i is connected by a rod extending from its under side with one end of a lever K, which is connected at its opposite end with the rod d which lifts the exhaust-valve. An adjustable weight k is carried by the lever K which opposes the action of the diaphragm i .

Enough of the apparatus has now been described to warrant an explanation of the production of the air-pressure, its application to the house-pipe and its withdrawal therefrom.

When the parts are in the position shown in

Figs. 1 and 2 there is no pressure in the house-pipe, the exhaust-valve C is open and the water is running out of the tank. The water continues to discharge and the float to fall until both contact-springs $h^2 h^3$ rest on the plate h' . This closes the circuit to the magnet g^3 of the water-supply-valve controller, which attracts its armature g^2 and releases the lever g' , when the water-supply valve B is opened by its lifting-spring. The upward movement of the lever g' breaks the circuit of the magnet g^3 at the contact-plate g^4 and prevents waste of battery-power. Water commences to run into the tank through the opening a^2 , and filling the pipe c' exerts a pressure on the diaphragm D and closes the exhaust-valve C. The flow of water from the tank is stopped, and although the water-pressure on both sides of the diaphragm D is soon equalized the pressure of water on top of the valve C prevents the spring c^2 from lifting that valve. The water rises in the tank, compressing the air therein. The rise of the water also lifts the float and disconnects the springs $h^2 h^3$, opening at that point the circuit to the magnet g^3 . When the necessary air-pressure is produced in the tank, it lifts the pressure-supply valve F and enters the house-pipe, holding the valve F open by pressure on the diaphragm f . The moment the valve F opens, the pressure passing through pipe e' acts on the diaphragm g and closes the water-supply valve B, which is locked in its closed position by the armature-lever g^2 engaging the end of lever g' . After acting on the valve-operating motors connected with the house-pipe the pressure reaches the retarded controller I and acts on the upper side of the diaphragm i , which pushes down the adjacent end of the lever K and raises its opposite end, pushing up the rod d and lifting the exhaust-valve C from its seat, said valve being held open by the spring c^2 . The moment the exhaust-valve is opened the air-pressure escapes from the house-pipe and the tank by passing through the opening a^2 , pipe c' , hollow stem c , valve C and pipe b' , when the pressure-supply valve F closes. The withdrawal of the pressure from the house-pipe also releases the retarded controller I, the lever K falling back and retracting the rod d . The opening of the exhaust-valve C also starts the flow of water from the tank through the pipe b , valve C and pipe b' , such flow being regulated by the hand-valve C', so as to admit pressure to the house-pipe at the desired intervals. The escaping water only partly fills the exhaust-pipes, so that air can readily enter through the pipe b' and pass upwardly through the hollow stem c , pipe c' , and opening a^2 into the tank as the water is withdrawn therefrom. The apparatus has now resumed the condition illustrated by Figs. 1 and 2 and the operation is repeated as already described.

From the house-pipe E branches E' extend to the operating-motors L of the radiator-

valves M. Each of these motors (see Fig. 4) is composed of a chamber l , having a central diaphragm l' , with which is connected a plunger l^2 connected adjustably and yieldingly through a spring-box l^3 with the valve-stem m . The house-pipe is connected with the top of the chamber l and the pressure is exerted on top of the diaphragm l' , pushing the plunger l^2 downwardly against the tension of spring l^4 , which tends to lift it. On the lower end of the plunger l^2 is a lug l^5 , which, when the plunger is depressed, passes below a horizontal shoulder n' on the upper end of the detent or armature-lever n of the electromagnet N, which shoulder engages with the lug and prevents the lifting of the plunger by the spring l^4 if the armature-lever is at the time the plunger moves retracted by its spring n^2 . If, however, the magnet N is then energized and is holding its armature forward, the plunger rises after the pressure is removed from the diaphragm l' without any engagement between the lug l^5 and the shoulder n' . If when the pressure acts on the diaphragm l' the plunger is already depressed and the valve M is held closed by the locking of the plunger, the pressure will, due to the spring-box l^3 , push the plunger forward a little so as to release the armature-lever n , permitting the magnet to attract its armature if the circuit to the magnet is then closed.

The circuit to each magnet N or to two or more of such magnets is controlled by a thermostat O, which closes that circuit at a contact-point o , a wire 4 extending from the point o to the magnet N, and a wire 5 extending from the magnet to the frame of the valve-operating motor, as shown in Fig. 4, for returning the current through the pipes of the system. A wire 6 connects all the thermostats with a stationary contact-plate o' , which is mounted on the board o^2 of insulating material, on which is also mounted a stationary plate o^3 . The board o^2 is in proximity with the lever K, which is moved by the retarded controller I, and two leaf-springs $o^4 o^5$ on the lever K engage with the stationary plates o' o^3 . These springs $o^4 o^5$ are connected together, but are insulated from the lever K. A wire 7 runs from the battery M B to the stationary plate o^3 . The spring o^5 is always in contact with the plate o^3 , but the spring o^4 does not make contact with the plate o' , except when the lever K is lifted. It will be seen then that the thermostatic circuit is kept open by the lever K, except when that lever is lifted by the retarded controller I, and hence that during the intervals between the working of the retarded controller the closing of the circuit at any thermostat does not energize the magnet connected with it or produce any waste in battery-power. When, however, the retarded controller does work, it completes the break in the thermostatic circuit under its control and places that circuit under the control of the thermostats, each of which then

closes the circuit to the magnet or magnets it controls, or leaves that circuit open, according to the temperature acting on the thermostat.

It will now be understood that when the air-pressure is supplied to the house-pipe each valve-operating motor will be acted on and the valve moved by it will be closed unless already in that position. Thus valves at which the thermostatic circuits are closed will retract after the pressure is removed, while those valves at which the thermostatic circuits are opened will be locked in a closed position, and in this way the position of the valve or valves controlled by each thermostat will be maintained or changed according to the temperature requirement, and the regulation and control of the heat will be accomplished.

Since the magnets N do not have to overcome any friction in moving their armatures, they can be made small and be wound to a high resistance and will require only a weak current to operate them.

Another advantage of my system which has not before been alluded to is that, by reason of the use of a single pressure-supply valve and a single exhaust-valve, the house-pipe may consist of a single line of pipe from which branches are taken at different points, this admitting of the employment of a main pressure-supply pipe common to a number of valve-operating motors.

Referring now to the modified form of apparatus illustrated by Fig. 5, the house-pipe is represented at E, and one of the branch pipes E' is shown, which extends to a valve-operating motor like that shown in Fig. 4. One thermostat O is also illustrated; but it will be understood that the system is intended to work a number of valve-operating motors controlled by a number of thermostats, as in the case of the system illustrated by Fig. 1. The house-pipe E rises from a pipe P with which it is connected between a pressure-supply valve P' and an exhaust-valve P². These valves are controlled by two of my well-known toggle-valve-controlling apparatus R R' of the character described in my Patent No. 476,573. The pipe p to the left of the exhaust-valve P² extends to the open air, while the pipe p' to the right of the pressure-supply valve P' is connected with any suitable source of fluid-pressure supply, which may be live or exhaust steam, air, water, or the like. S is a time mechanism, which may be any suitable form of clock-movement and which carries a wheel r having an insulated contact-point r' on its periphery. With this contact-point co-operate two contact-springs r² r³, the spring r³ being always in electrical connection with said contact-point r', while the spring r² makes connection with said point r' once to each revolution of the wheel r. The speed of rotation of the wheel r is such that the circuit will be closed at that wheel between the springs r² r³ as often as it is desired to supply the house-pipe with the fluid-pressure. This

may be, as before explained, at intervals of fifteen or thirty minutes, more or less, according to the conditions under which the apparatus is used. A wire 8 extends from one pole of the battery M B' to the spring r³. From the spring r³ a wire 9 runs and is divided into two branches, one of which extends to the opening-magnets s of the toggle apparatus R, and the other of which extends to the closing-magnets s' of the toggle apparatus R', the other terminals of these two magnets being grounded on the pipes through cut-outs, (not shown,) as explained in the patent referred to. From the same pole of the battery a wire 10 extends to a contact-plate s², mounted on a board s³. From another contact-point s⁴ on this board runs a wire 11, which has two branches, one of which extends to the closing-magnets t of the toggle apparatus R, and the other to the opening-magnets t' of the toggle apparatus R', the other terminals of said magnets being grounded, as in case of magnets s s'. From the other pole of the battery extends a wire 12 to one of the pipes to complete the circuits. The board s³ is provided with a third contact-plate s⁵, from which a wire 13 extends to the thermostats O, wires 4 extending from the contact-points of the thermostats to the magnets of the valve-operating motors, and from such magnets to the pipes, as explained in connection with Figs. 1, 2, and 4. The retarded controller I is similar to the same device described in connection with Fig. 1, being connected by a pipe i' with the end of the house-pipe. The lever K, which is thrown upwardly by this retarded controller, carries a three-pronged plate t² with the ends of the prongs bent inwardly toward the board s³. One of the prongs is always in contact with the plate s², so as to make a constant electric connection between the wire 10 and the pronged plate t². In the upward movement of the lever K the pronged plate first makes contact with the plate s⁵, connected with the thermostatic circuit, and subsequently makes contact with the plate s⁴, connected with the closing and opening magnets, respectively, of the toggle apparatus R and R'.

In the position of the parts shown in Fig. 5 the time movement S has just closed the circuit at the springs r² r³, thus closing the circuit to the opening-magnets s of the apparatus R and to the closing-magnets s' of the apparatus R'. The opening-magnets s have attracted their armature, opening the pressure-supply valve P', while the closing-magnets s' have attracted their armature, closing the exhaust-valve P². In this position of the parts the pressure enters the house-pipe E and passes through the several branches E' to the valve-operating motors, which are worked as before explained in connection with Figs. 1, 2, and 4. Before the pressure reaches the retarded controller I, the movement of the clock-work S breaks the circuit between the springs r² r³, the contact-point r' making but a

momentary connection between such springs. When the pressure reaches the retarded controller I, that device operates and throws upwardly the lever K, first closing the thermostatic circuit at the plate s^5 and placing that circuit under the control of the thermostats for the purpose before explained in connection with Figs. 1, 2, and 4. The continued upward movement of the lever K closes the circuit to the closing-magnets t of the apparatus R and to the opening-magnets t' of the apparatus R', thus causing a reverse movement of these two apparatus, resulting in the closing of the supply-valve P' and the opening of the exhaust-valve P², when the pressure in the house-pipe E and its various branches is at once discharged into the open air. This release of the pressure causes the retarded controller I to resume its normal position, the lever K falling to its lowermost position and opening first the circuit to the magnets t t' , and subsequently the thermostatic circuit. This condition of affairs continues until the time movement S brings the contact-point r' again under the spring r^2 , when the operation already described is repeated.

Referring now to the modified form of apparatus illustrated by Fig. 6, T is a tank from which extends a pipe t^2 to an air-pump. The pressure-supply valve U is connected with this tank. This valve is of the character of the pressure-supply valve F described in connection with Figs. 1 and 2. Its stem passes upwardly and is connected with the under side of a diaphragm u , and is forced downwardly by an adjustable spring u' . It will be understood that there is no packing around the stem of the valve U where it passes upwardly into the diaphragm-case, thus permitting the pressure when the valve U is raised to act on the under side of the diaphragm u and to keep the valve open, notwithstanding a reduction in the pressure, until it is closed by the means presently to be described. With the upper side of the valve U is connected the house-pipe E, which extends by means of branches to the various valve-operating motors, as before explained in connection with the other figures. This house-pipe is also connected with the under side of the exhaust-valve V, which is held upwardly to its seat by a spring v . From the upper side of the exhaust-valve V extends the exhaust-pipe v' having an exhaust-opening v^2 . The retarded controller W has, as in other instances, a diaphragm w . The chamber on the upper side of this diaphragm is connected with the end of the house-pipe, so that the diaphragm w will be acted on after the valve-operating motors. The lower side of the diaphragm w is connected with a rod w' extending down into the exhaust-pipe v' through a stuffing-box and terminating just above the exhaust-valve V. A spring w^2 acts to return the diaphragm w and the rod w' to their normal position, as shown in the drawings. The rod w' carries a contact-spring x , which is normally out of

contact with an insulated contact-plate x' . This plate x' is connected with one pole of the battery M B², the other pole of such battery being connected with the thermostats. The thermostatic circuit is thus normally open at the plate x' , but when the spring x touches that plate the thermostatic circuit is closed at that point and placed under the control of the thermostats. From the exhaust-pipe v' a pipe y extends to the chamber on the upper side of the diaphragm u with which the pressure-supply valve U is connected. The operation of this apparatus is as follows: When the pressure in the tank T reaches a predetermined degree, the pressure-supply valve U opens, admitting the pressure to the house-pipe E. The valve-operating motors are worked by this pressure, which then reaches the retarded controller W and forces down the diaphragm w , causing the spring x to make contact with the plate x' and place the thermostatic circuit under the control of the thermostats. The continued downward movement of the diaphragm brings the rod w' in contact with the exhaust-valve V, opening such exhaust-valve and permitting the escape of the pressure from the house-pipe. As the escaping air enters the pipe v' , it passes through the pipe y to the upper side of the diaphragm u , forcing such diaphragm downwardly and closing the pressure-supply valve U, so as to trap part of the retained pressure in the tank T, which otherwise would have been almost entirely exhausted before the valve U would close. The intervals between the opening of the valve U will be determined by the speed or adjustment of the pump, and may in that manner be given any desirable duration.

I am aware that it is old in automatic heat-regulating apparatus to arrange a clock in connection with the apparatus to open the thermostatic or battery circuit during the hours of the night, when it is not desired to maintain the temperature, the regulating apparatus being during that time out of operation. Such an arrangement, however, does not involve the periodic feature of my invention, that feature relating to periods during the time when the apparatus is in operation of such length as to produce, under the particular conditions of use, only such slight extreme variations in temperature as are permissible in automatic heat regulation. A contrivance similar in principle to that referred to for throwing the apparatus out of operation during the hours of the night is also as well applicable to my system as to other systems.

Having described my invention and set forth its merits, what I claim is—

1. In a temperature regulating apparatus, the combination with a heat controlling valve or damper, of a motor arranged to actuate said valve or damper, means for affecting the operation of said motor, and automatic means operating independently of said means affect-

ing the operation of the motor for supplying fluid pressure periodically to said motor, substantially as and for the purposes described.

2. In a temperature regulating apparatus, the combination with a heat controlling valve or damper, of a motor arranged to actuate said valve or damper, means including a thermostat for affecting the operation of said motor upon said valve or damper, and automatic means operating independently of said thermostatic means for supplying fluid pressure periodically to said motor, substantially as and for the purposes described.

3. In a temperature regulating apparatus, the combination with a heat controlling valve or damper, of a motor arranged to actuate said valve or damper, means including a thermostat for affecting the operation of said motor upon said valve or damper, a source of fluid pressure, and means operating independently of the thermostatic means to automatically establish communication at predetermined intervals between said motor and source of fluid pressure, substantially as and for the purposes described.

4. In a temperature regulating apparatus, the combination with a heat controlling valve or damper, of an intermittently operating motor for actuating said valve or damper, a detent for holding said valve or damper in a certain position, and means including a thermostatic device for controlling the operation of said detent, substantially as and for the purposes described.

5. In a temperature regulating apparatus, the combination with heat controlling valves or dampers, of motors arranged to actuate the same, means including thermostats for affecting the operation of said motors on said valves or dampers, a source of fluid pressure connected with said motors, and a single supply valve common to said motors and arranged to automatically establish communication at stated intervals between said motors and the source of fluid pressure independently of the thermostatic means, substantially as and for the purposes described.

6. In a temperature regulating apparatus, the combination with heat controlling valves or dampers, of motors for actuating the same, means including thermostats for affecting the operation of said motors on said valves or dampers, a source of fluid pressure connected with said motors, and a single exhaust valve common to all the motors and automatically operated at stated intervals independently of the thermostatic means, substantially as and for the purposes set forth.

7. In temperature regulating apparatus, the combination with heat controlling valves or dampers, of motors for operating the same, means including thermostats for affecting the operation of said motors upon said valves or dampers, a source of fluid pressure connected with said motors, and single supply and exhaust valves common to the several motors and arranged to operate at stated intervals

independently of the thermostatic means, substantially as and for the purposes set forth.

8. In temperature regulating apparatus, the combination with a heat controlling valve or damper and means for operating the same, including an electro-magnet, and a thermostat having contacts in circuit with the windings of said magnet, of an electric generator in circuit with said thermostat, and automatically operating means arranged to intermittently close and open the circuit at frequent intervals independently of said magnet and thermostat, substantially as and for the purposes described.

9. In temperature regulating apparatus, the combination with a heat controlling valve or damper and of means for operating the same, including an electro-magnet, and a thermostat having contacts in circuit with the windings of said magnet, of an electric generator in circuit with said thermostat, means between said thermostat and generator to open and close the circuit, and a motor arranged to automatically actuate said means to close and open the circuit at frequent intervals independently of said magnet and thermostat, substantially as and for the purposes described.

10. In temperature regulating apparatus, the combination of a heat controlling valve or damper and means for operating the same, the said means including an electric circuit provided with an electro-magnet, a thermostatic circuit controller, and a device independent of said thermostatic circuit controller arranged to cause a current of electricity to pass periodically through said circuit, substantially as and for the purposes set forth.

11. In temperature regulating apparatus, the combination with a heat controlling valve or damper and a motor for actuating the same, of a source of power for operating said motor, means for supplying the power to the motor at predetermined intervals, a retarded controller arranged to automatically deprive the motor of power after it has been actuated thereby, and means affecting the operation of said motor on said valve or damper, substantially as and for the purposes set forth.

12. In heat regulating apparatus, the combination with one or more heat controlling valves or dampers and motors for actuating the same, of a source of power connected with such motors and arranged to supply the power thereto at predetermined intervals, an electric circuit provided with means including thermostats for affecting the operation of such motors on said valves or dampers, and means operated by the same power to close the thermostatic circuit when the power is applied to the motors, substantially as and for the purposes set forth.

13. In heat regulating apparatus, the combination with one or more heat controlling valves or dampers and motors for actuating the same, of a source of power connected with such motors and arranged to supply the power

thereto at predetermined intervals, an electric circuit provided with thermostatic means for affecting the operation of such motors on said valves or dampers, and a retarded controller connected with the same source of power and arranged to first close the thermostatic circuit and then to release the power from said motors, substantially as and for the purposes set forth.

14. In heat regulating apparatus, the combination with a heat controlling valve or damper and a motor for actuating the same, of an electric circuit provided with means including a single point thermostat for affecting the operation of such motor upon said valve or damper, means for closing the thermostatic circuit at predetermined intervals, and means for opening said circuit independently of the thermostat itself, substantially as and for the purposes set forth.

15. In heat regulating apparatus, the combination with a heat controlling valve or damper, of a motor containing a plunger connected with said valve or damper, a source of fluid pressure connected with said motor and arranged to move said plunger in one direction, a spring acting in the opposite direction on said plunger, a detent arranged to lock the plunger in one position, and an electric circuit provided with a thermostat and an electro-magnet controlling the operation of said detent, substantially as and for the purposes set forth.

16. In heat regulating apparatus, the combination of the heat controlling valves or dampers, and motors for actuating the same, of a source of fluid pressure, a pipe connecting the motors with said source of fluid pressure, a valve controlling the admission of fluid pressure to said pipe and motors and arranged to be automatically opened by a predetermined pressure, and means affecting the operation of said motors upon said valves or dampers, substantially as and for the purposes set forth.

17. In heat regulating apparatus, the combination with heat controlling valves or dampers and motors for actuating the same, of a source of fluid pressure, a pipe connecting the motors with said source of pressure, a pressure supply valve arranged to admit the pressure to said pipe when a predetermined pressure has been attained at the source, and an exhaust valve arranged to be opened by the pressure in said pipe to release the pressure therein after it has actuated said motors, substantially as and for the purposes set forth.

18. In heat regulating apparatus, the combination with heat controlling valves or dampers and motors for actuating the same, of a source of fluid pressure, a pipe connecting the motors with said source of pressure, a pressure supply valve arranged to admit the pressure to said pipe when a predetermined pressure has been attained at the source, an exhaust valve for releasing the pressure from said pipe and motors, and a retarded controller connected with said pipe and arranged to open said exhaust valve after the motors have been actuated by said pressure, substantially as and for the purposes set forth.

19. In heat regulating apparatus, the combination with heat controlling valves or dampers and motors for actuating the same, of a tank having water supply and discharge connections provided with valves, means of opening the water supply valve when the water in said tank falls to a certain level, and of closing the same when the pressure is released from the tank, means for opening the exhaust valve when the pressure is released from said tank and of closing the same when water is admitted to the tank, and a connection between said tank and motors provided with a pressure supply valve which is constructed and arranged to open when a certain pressure is produced in said tank, substantially as and for the purposes set forth.

20. In heat regulating apparatus, the combination with heat regulating valves or dampers and motors for actuating the same, of a closed tank having water supply and discharge connections provided with valves which are arranged to automatically admit and discharge water from said tank periodically, a pipe connecting said motors with said tank and provided with a valve which is adapted to open automatically when a certain predetermined pressure is produced in said tank, an electric circuit provided with thermostats controlling the effect of said motors upon said valves or dampers, and a retarded controller connected with said pipe and arranged to close the electric circuit at predetermined intervals when the motors are subjected to fluid pressure, substantially as and for the purposes set forth.

This specification signed and witnessed this 4th day of February, 1893.

JOHN V. STOUT.

Witnesses:

E. H. SHAWDE,
CHARLES KUMMER.