(No Model.)

G. M. STERNBERG.

ELECTRO MAGNETIC REGULATOR FOR VALVES.

No. 355,892. Patented Jan. 11, 1887.

Fig 1.

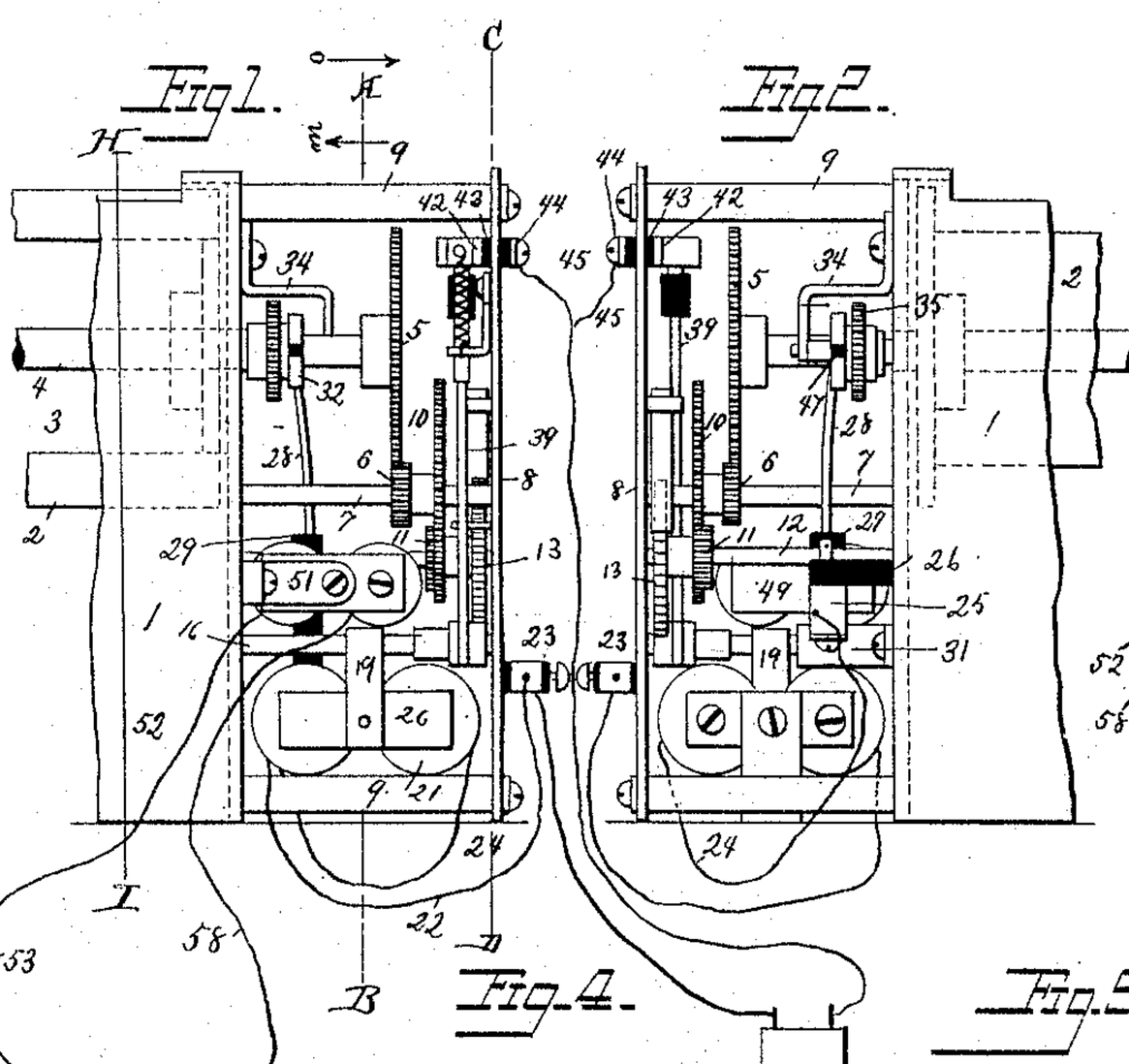


Fig 2.

Fig 3.

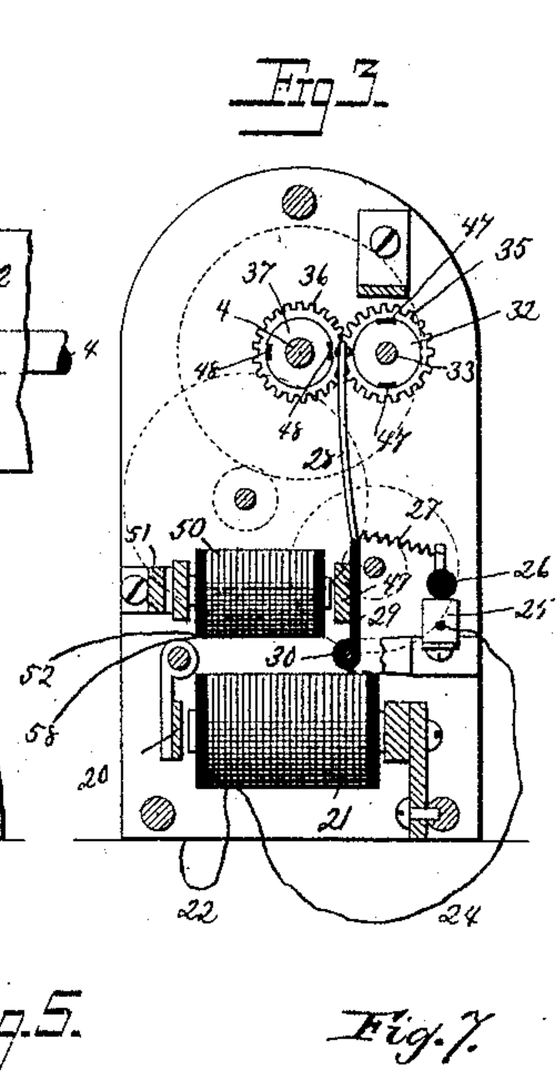


Fig 4.

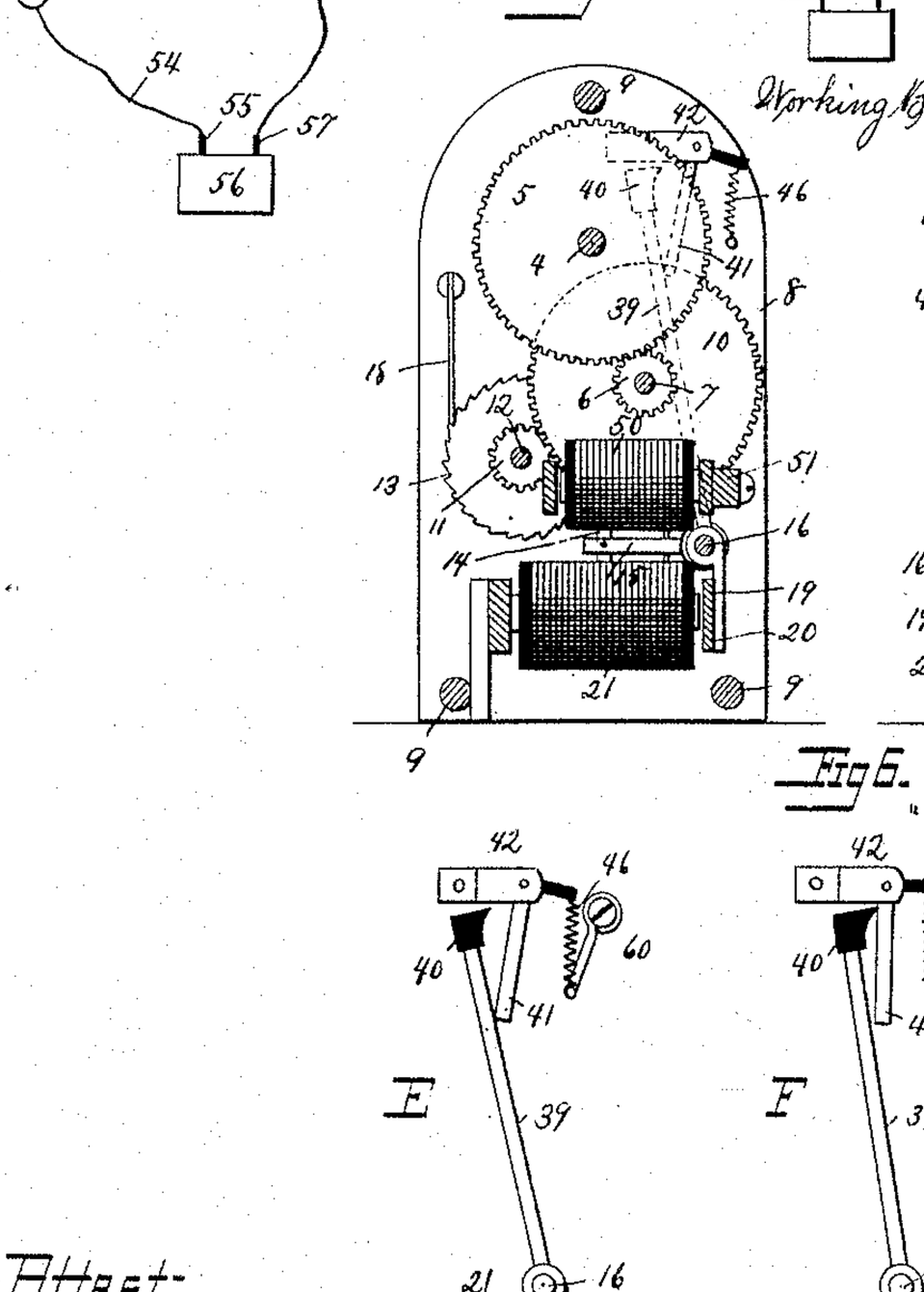


Fig 5.

Working Battery

Fig 7.

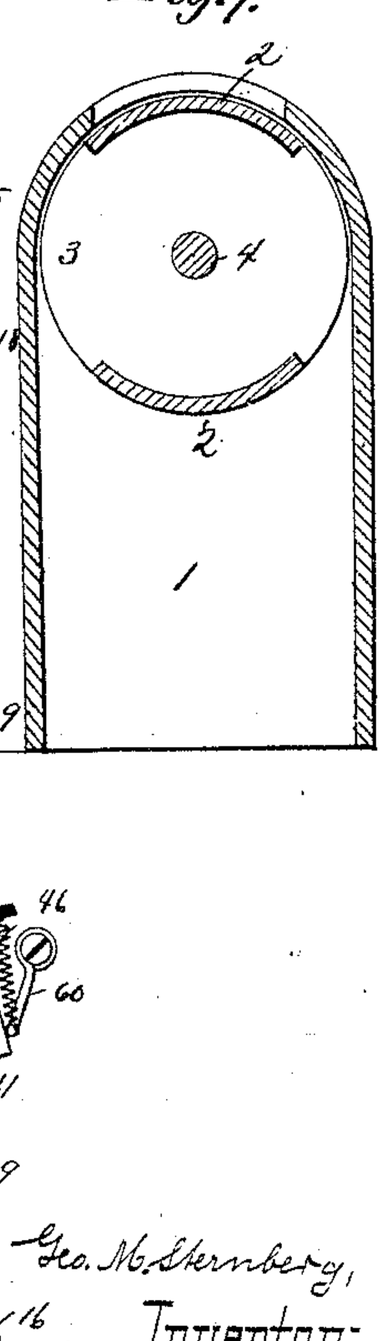
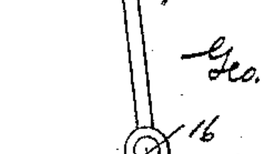


Fig 6.



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UNITED STATES PATENT OFFICE.

GEORGE M. STERNBERG, OF THE UNITED STATES ARMY.

ELECTRO-MAGNETIC REGULATOR FOR VALVES.

SPECIFICATION forming part of Letters Patent No. 355,892, dated January 11, 1887.

Application filed August 16, 1886. Serial No. 211,044. (No model.)

To all whom it may concern:

Be it known that I, GEORGE M. STERNBERG, of the United States Army, a citizen of the United States, residing temporarily at Baltimore, in the State of Maryland, have made certain new and useful Improvements in Electro-Magnetic Regulators for Valves and Dampers, of which the following is a specification.

My invention relates to improvements in valve or damper regulators of that particular class wherein valve or damper operating mechanism is both controlled and operated by electricity, to which end the invention consists, first, in peculiarly-constructed valve-operating mechanism and means for actuating said mechanism by electricity to open or close a valve or damper connected therewith; second, in valve-operating mechanism adapted to be actuated by an electro-magnet and means for throwing said magnet into and out of circuit with its source of power; third, in valve-actuating mechanism adapted to be operated by an electro-magnet, means to throw said magnet into and out of circuit with its battery, and means to cause said magnet, when so in circuit with its battery, to be intermittently and rapidly magnetized and demagnetized, and thereby to impart a continuous forward step-by-step movement to the valve or damper; and, finally, it consists in the construction, arrangement, and combination of the several parts for service, substantially as hereinafter set forth, and illustrated in the accompanying drawings, in which—

Figures 1 and 2 represent elevations, partly in section, of opposite sides of a conduit, a valve therein, and connected valve operating mechanism constructed in accordance with my invention. Fig. 3 represents a sectional view, taken on the line A B of Fig. 1, looking in the direction indicated by the arrow *m*. Fig. 4 is a similar sectional view, taken on said line A B, looking in the direction indicated by the arrow *o*. Fig. 5 is a sectional view taken on the line C D of said Fig. 1. Fig. 6 illustrates the circuit-breaking device of the valve-operating magnet in the various positions it assumes when in operation. Fig. 7 is a vertical sectional view, taken on the line H I of Fig. 1, showing the relation of the rotary valve to the pipe or conduit.

Similar figures of reference in the several drawings denote similar parts.

In the present embodiment of my invention I have illustrated and shall hereinafter confine my description to a valve or damper arranged within the delivery pipe or conduit of a heater or furnace, to the mechanism employed to operate said valve, and to the means whereby the increase or decrease of temperature above or below a predetermined degree in the apartment or apartments which are connected with said delivery pipe or conduit shall automatically set such valve-operating mechanism in operation to open or close said valve to or against the passage of heated air from the heater or furnace to said apartment or apartments.

While thus confining the description in the present case to the particular branch named, I yet do not limit myself solely to this adaptation of my invention, as it will be apparent from the description hereinafter contained that the device may be used in connection with valves or dampers of every class and description.

Referring to the drawings, I show a delivery pipe or conduit, 1, provided with a cylindrical valve, 2, having its periphery cut away at 3 to provide a passage for fluids therethrough.

The valve 2 is mounted upon a rotatable shaft, 4, which is journaled in the sides of the pipe or conduit 1, and extends at one end beyond the outer surface of said pipe, and is provided at said end with a spur-gear wheel, 5, the teeth of which are engaged by a gear-pinion, 6, rigidly secured to a shaft, 7, which is journaled at one end in the side of the pipe or conduit 1 and at the opposite end in a plate or frame, 8, that is supported at a distance from said side by studs 9, which project therefrom.

To the shaft 7, at one side of the pinion 6, I rigidly secure a spur-gear wheel, 10, which is engaged and rotated by a pinion, 11, mounted upon a shaft, 12, which is journaled in the side of the conduit 1 and frame 8, respectively; and to said shaft 12 I secure a ratchet-wheel, 13, the teeth of which are engaged by a pawl, 14, that is pivoted in the free end of a rock-arm, 15, which projects from a rock-shaft, 16, journaled at opposite ends in the side of the con-

duit 1 and frame 8, respectively. A spring, 17, which is connected at its opposite ends to the pawl 14 and arm 15, respectively, maintains said pawl in proper position as regards the ratchet-wheel 13, backward movement of which wheel is prevented by a spring-pressed dog, 18, pivoted to the frame 8 and engaging the teeth of said wheel.

The mechanism described is operated by and in the following means and manner, viz: To the rock-shaft 16 is rigidly secured a rock-arm, 19, to the opposite end of which is secured an armature, 20, which operates in the magnetic field of an electro-magnet, 21, supported by one of the studs 9. One of the terminals of the magnet 21 is connected by a conductor, 22, with a binding-post, 23, secured to and properly insulated from the frame 8. The opposite terminal of said magnet is connected by a conductor, 24, with a binding-post, 25, which projects from an insulating-stud, 26, rotatably fixed in the side of the pipe or conduit 1.

The post 25 is in electric communication through a spring, 27, with a vibrating metallic arm, 28, secured at its lower end in a rock-arm, 29, formed of any desired non-conducting material, which projects from a short rock-shaft, 30, journaled at its opposite ends, respectively, in the side of the pipe or conduit 1 and a bracket, 31, secured thereto. The upper end of the arm 28 is held by the spring 27 normally in contact with a contact making and breaking wheel 32, which is mounted upon a short shaft, 33, journaled in the side of the conduit 1, and a bracket, 34, secured thereto. A gear-wheel, 35, is secured to said shaft 33, and is engaged and rotated by a similar gear-wheel, 36, which is mounted upon the main shaft 4 of the valve 2. A circuit making and breaking wheel, 37, is secured upon the shaft 4 in position to be engaged by the upper end of the rock-arm 28 at times and for a purpose presently to be explained.

As has been shown, the electric circuit is complete from the magnet 21 to the bracket 34 and side of the conduit 1, from which points the current passes through the frame 8 and shaft 16 to a rock-arm, 39, which projects from the rock-shaft 16 and is provided upon its upper end with an insulating-block, 40, for a purpose hereinafter set forth.

From the arm 39 the current passes to a swinging arm, 41, which is pivoted in a frame, 42, secured to an insulating-block, 43, fixed in the frame 8. A binding-post, 44, insulated from the plate 8, communicates with the frame 42, from which a conductor, 45, extends to battery. The arm 41 normally rests in contact, by gravity or by means of a spring, 46, with the arm 39, so that when the circuit is closed through either of the wheels 32 or 37, as will be explained, the magnet 21 will be energized and will attract its armature 20, the movement of which operates to rock the shaft 16 and swing the rock-arms 15 and 39, moving the ratchet-wheel 13 and the mechanism and valve connected therewith. At the same time forward movement of the arm 39 will bring the insulator 40 upon its upper end into contact with the arm 41, thus breaking circuit through the electro-magnet 21 and permitting the parts named to regain their normal position, and thus again close the circuit through the magnet 21, whereby the operation above described is repeated, said magnet being alternately magnetized and demagnetized, thereby moving the valve forward until one of the insulating-plates 47 or 48, which are secured in the peripheries of the wheels 32 or 37, is brought into contact with the end of the arm 28, when the forward movement of said valve-operating mechanism will be checked, the circuit being broken.

By reference to Fig. 6 the various positions assumed by the rock-arms 39 and 41 in the above-described operation will be apparent. In said figure, at E, said arms are shown in their normal position, the lower end of the arm 41 bearing against the arm 39. At this time it will be remembered that the magnet is in circuit with its battery. At F, I show the arm 39 as moved forward by the energizing of the magnet 21, and the insulating-block 40 thereon in light contact with the arm 41. It will be observed from said Fig. 6 that the armature 20 is at this time very near the poles of the magnet 21, and that consequently the block 40 has moved through the major portion of its limit of movement, while the arm 41 has been moved a minor portion only of its limit of movement.

At G, I have shown the armature in full contact with the poles of the magnet, the arm 39 moved to the full limit of its forward movement, the block 40 thereon bearing against the arm 41 near the fulcrum thereof, while said arm has been moved to the full limit of its movement. An adjustable stop, 60, is provided to limit the throw of the arm 41.

I deem the construction as above described of great importance, as I am thereby enabled to attain ends otherwise quite impossible to attain—viz, the maintenance of contact between the arms 39 and 41 during the major portion of the limit of movement of the former, the abrupt breaking of such contact and the return of the arm 39 to its normal position, as shown at E in said Fig. 6, before contact is again established between the arm 41 and the body of the arm 39, to facilitate which latter movement a spring may be connected to said arm 39.

I will now describe the means whereby the magnet 21 is thrown into and out of circuit with its operating-battery. To this end I provide the peripheries of the circuit closing and breaking wheels 32 and 37 with short plates or blocks of insulating material 47 and 48, arranging said blocks 47 and 48 upon opposite sides of the wheels 32 and 37, respectively. I so arrange said wheels with relation to each other that when one of the insulating-blocks

of either of said wheels is in contact with the arm 28 the insulating-blocks upon the remaining wheel will lie in a plane parallel to said arm, or in a plane perpendicular to the plane of the blocks first named. (See Fig. 3.) It will thus be apparent that as the valve 2 and wheels 32 37 rotate in unison a quarter-revolution of said valve will operate to bring the blocks 47 and 48 upon the wheels 32 and 37 alternately into contact or position to be thrown into contact with the arm 28.

It is also apparent from the above description that if the arm 28 when in contact with one of said wheels 32 or 37 bears upon one of the insulating-plates of said wheels, it (said arm 28) will when brought into contact with the remaining wheel bear upon the periphery of said wheel at a point intermediate of the insulating-blocks therein; hence it follows that the valve being open when the arm 28 (which is normally in contact with one of the insulating-blocks 47 of the wheel 32) is brought into contact with the wheel 37 between the insulating-blocks 48 thereof, the circuit will be closed through the magnet 21, as hereinbefore described, and that said magnet will by its intermittent action move the valve 2 forward in step-by-step motion one-fourth of a full revolution, thus closing said valve, and at the same time move one of the insulating-blocks 48 of said wheel 37 forward and into contact with said arm 28, thereby breaking the circuit through the magnet 21. If now the arm 28 be returned to its normal position—*i. e.*, contact with the wheel 32—it will impinge upon said wheel at a point intermediate of the insulating blocks or plates 47 therein, and thus again close the circuit through the magnet 21, which circuit will remain closed until the said magnet has by its intermittent action, as before described, moved one of the insulating-blocks 47 into contact with the arm 28, at which time the valve will be open.

I provide that the arm 28 shall be automatically moved into contact with the wheel 37 when the temperature of the apartment or apartments wherewith the pipe 1 connects rises above a predetermined degree. To this end I secure an armature, 49, to the rock-arm 29, and in the magnetic field of an electro-magnet, 50, which is secured to a stud, 51, that projects from the side of the pipe or conduit 1. One of the terminals of the magnet 50 is connected by a conductor, 52, with one end of a thermostat, 53, the opposite end of which is connected by a conductor, 54, with one of the poles, 55, of a battery, 56. The opposite pole, 57, of said battery is connected by a conductor, 58, with the remaining terminal of the magnet 50.

By this construction, when the temperature of the room wherein the thermostat is located rises beyond a predetermined degree, the circuit through the magnet 50 and battery 56 will be closed through the medium of said thermostat, and said magnet thus energized will draw the rock-arm 29 forward and its arm 28 into contact with the wheel 37, thereby throwing the valve-operating magnet 21 into circuit with its battery and closing the valve 2, in manner hereinbefore described, to the passage of air therethrough. The falling of the temperature in said apartment below the desired degree will, through said thermostat, break the circuit through the magnet 50, and thereby permit the arm 28 to be returned through the medium of the spring 27 to its normal position—*i. e.*, contact with the wheel 32—which will again close the circuit through the magnet 21, and through the action of said magnet open the valve to the passage of heated air therethrough.

From the foregoing description the operation of my invention will be obvious, and therefore requires no special description.

It will be observed that the working-battery requires to be of greater power than the controlling-battery, the latter having simply to establish circuit through the magnet 21 of the working-circuit, and also that the working battery is in operation only so long as is necessary to open or close the valve, and it thus has an interval of rest both when the controlling-circuit is completed by means of the thermostat and when it is broken thereby.

If desired, the circuit may be closed through the magnet 50 through the medium of a switch, which may be operated by hand independent of the thermostat.

Various modifications of the within-described invention may be made without departing from the purpose and intent thereof, which contemplates the provision of a valve or damper of any and all descriptions provided with actuating mechanism operating by an electro-magnet, in which the magnet is thrown into and out of an electric circuit through the medium of a second electro-magnet, which latter magnet may be automatically or otherwise thrown into and out of circuit with its controlling-battery.

Having thus described my invention, I claim—

1. A valve or damper, an intermittently-energized electro-magnet to operate said valve, and an electro-magnet to throw said valve-operating magnet into and out of circuit with its battery, substantially as described.

2. A valve or damper, an intermittently-energized electro-magnet, and connections between said magnet and valve to operate said valve in continuous step-by-step motion, and another electro magnet controlling said operating-magnet and controlled by heat-indicating devices interposed in the circuit of said latter magnet, substantially as described.

3. A valve or damper, an intermittently-energized electro-magnet, connections between said valve and magnet for operating said valve in continuous step-by-step motion, and another electro-magnet controlling said operating-magnet and controlled by heat-indicating devices interposed in the circuit of said latter magnet, substantially as described.

4. The combination, with a valve or damper, of an intermittently-energized electro-magnet for operating the same, a working electric circuit connected with said magnet, and a controlling electro-magnet in another circuit and including a thermostat, substantially as described.

5. The combination, with a valve or damper and circuit-breaking wheels connected thereto, of a controlling electro-magnet in a circuit including a thermostat, and an operating electro-magnet in another circuit, including the circuit-breaking wheels, the arrangement being such that upon closing the controlling-circuit the operating-circuit will be automatically closed and the valve operated until the circuit is broken by the circuit-breaking wheels, substantially as described.

6. The combination, with a valve or damper and circuit-breaking wheels connected therewith, of a controlling electro-magnet in one circuit, an operating electro-magnet in another circuit, including said circuit-breaking wheels, mechanism connected with said operating-magnet to move the valve, and a circuit-breaker included in said operating-circuit and automatically operated by said operating-magnet to impart intermittent action thereto, substantially as described.

7. The combination of a valve or damper, mechanism for operating it, and circuit-breaking wheels turning in unison therewith, with an intermittently-energized operating electro-magnet, and connections to actuate said valve, an automatic circuit-breaker to control said operating-magnet, and a controlling electro-magnet to throw said circuit-breaking wheels successively into circuit with the operating-magnet, substantially as described.

8. The combination, with a vibrating circuit-breaking arm having an insulated terminal, of another vibrating arm normally in electric contact with the first, the arrangement being such that the contact is maintained throughout the greater portion of the movement and then suddenly broken, substantially as described.

9. The combination, with a vibrating circuit-breaking arm having an insulated terminal, of another vibrating arm the end of which is normally in electric contact with the first arm, the arrangement being such that upon the movement of the first arm the insulating material thereon impinges upon the second arm near its pivotal point, substantially as described.

10. The combination, with a valve or damper and electrically-operated mechanism, substantially as described, of two circuit-breaking wheels connected and operated thereby, each wheel having insulating-spaces on opposite sides of the wheel, and the spaces on the two wheels arranged perpendicular to each other, substantially as described.

11. The combination, with a valve or damper and electrically-operated mechanism, substantially as described, of two circuit-breaking wheels connected and operated thereby, each wheel having insulating-spaces on opposite sides of the wheel, and the spaces on the two wheels arranged perpendicular to each other when in a position of rest, and an arm vibrating between said wheels and arranged to make contact with one or the other, substantially as described.

12. The combination, with two circuit-breaking wheels having insulating-spaces, of an arm vibrating between said wheels, the said arm and one or the other of the wheels being included in one electric circuit, and another electric circuit including the magnet controlling said arm, substantially as described.

13. The combination, with a valve or damper and mechanism for operating it, of two circuit-breaking wheels connected to the damper, an arm vibrating between the wheels, an electro-magnet in a working-circuit including said arm and one or the other of the wheels, and another circuit including a magnet and thermostat controlling said arm, the arrangement being such that when said arm is moved into contact with either one of the circuit-breaking wheels the operating-circuit turns the damper through a partial rotation, substantially as described.

14. The combination, with a valve or damper and mechanism for operating it, of an operating electro-magnet and armature to actuate said mechanism, an automatic circuit-breaker carried by said armature to intermittently interrupt the circuit through said magnet, circuit-breaking wheels and vibrating arm in the circuit of said operating-magnet, and a device to move said arm into contact with either of said wheels, the arrangement being such that the circuit is controlled by the circuit-breaking wheels and arm and is intermittently opened and closed by the automatic circuit-breaker, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GEORGE M. STERNBERG.

Witnesses:
W. C. DUVALL,
WM. H. H. KNIGHT.