(No Model.) 3 Sheets—Sheet 1.

C. L. CLARKE.

ELECTRIC VALVE OPERATOR.

No. 327,525. Patented Oct. 6, 1885.

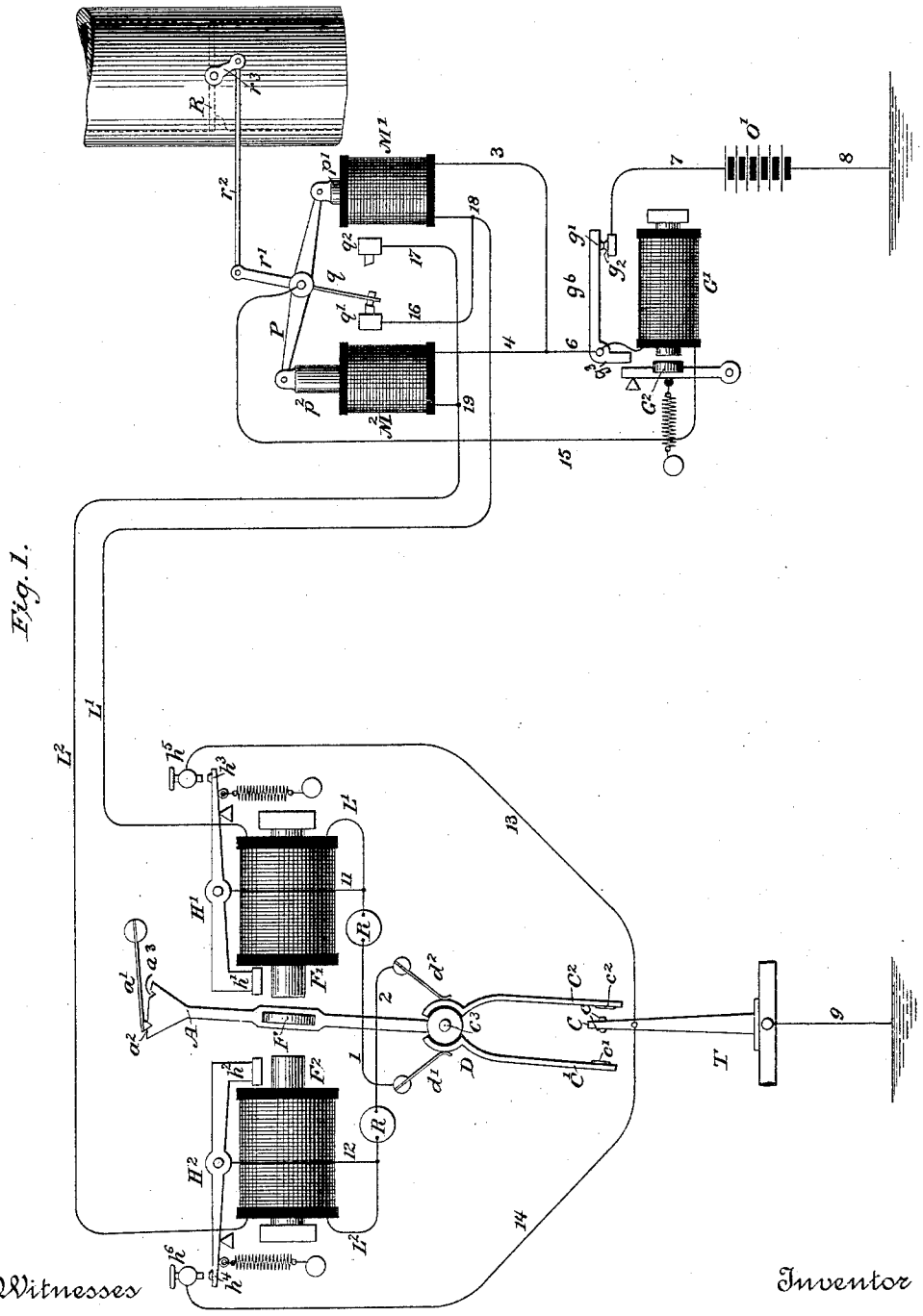


Fig. 1.

Witnesses

Wm A. Skinkle

Carrie E. Ashley

Inventor

Charles L. Clarke.

By his Attorneys

Pope & Edgecomb

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 3 Sheets—Sheet 2.

C. L. CLARKE.

ELECTRIC VALVE OPERATOR.

No. 327,525. Patented Oct. 6, 1885.

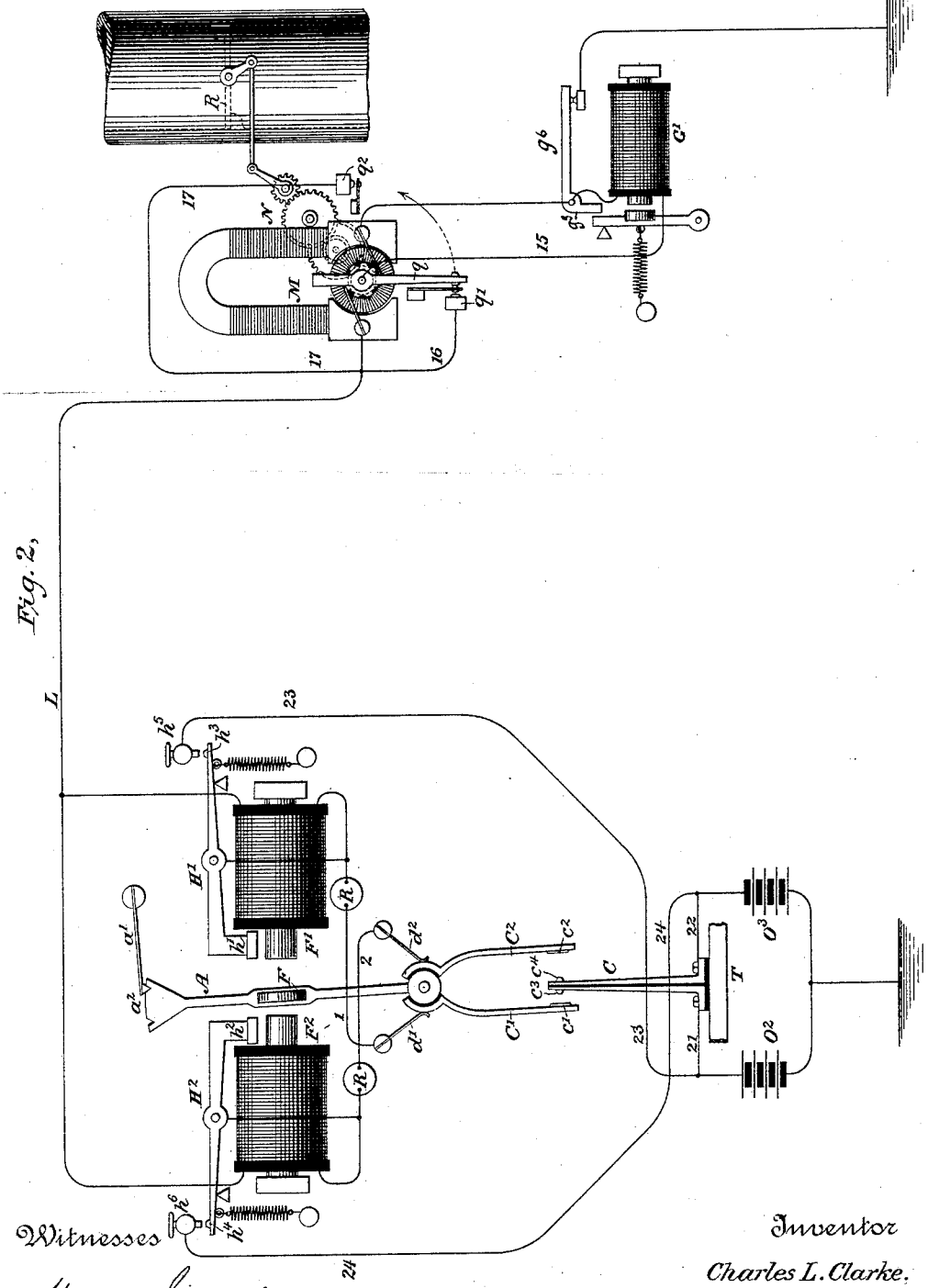


Fig. 2.

Witnesses

Wm A. Skinkle

Carrie E. Ashley

Inventor

Charles L. Clarke.

By his Attorneys

Pope & Edgecomb

N. PETERS, Photo-Lithographer, Washington, D. C.

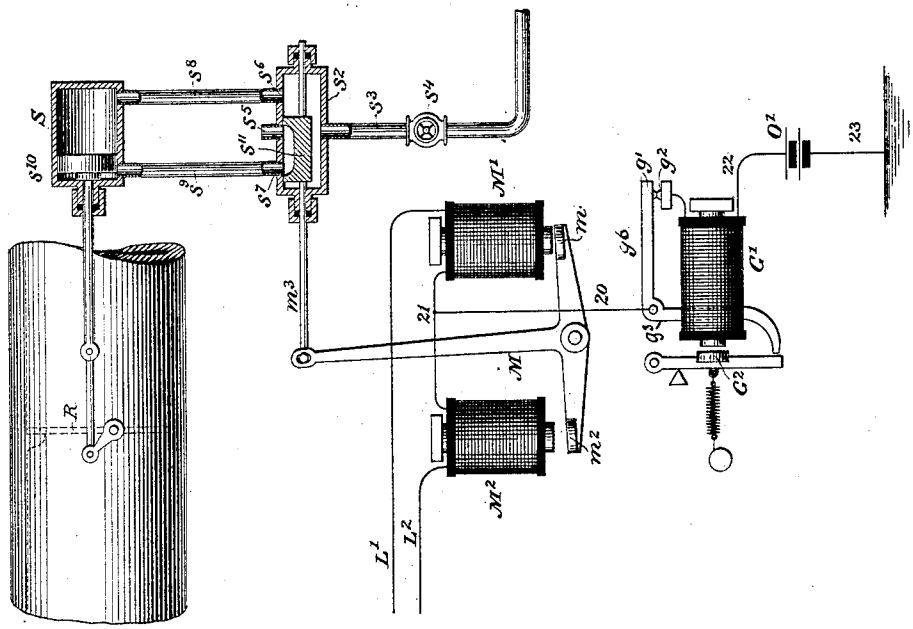
(No Model.) 3 Sheets—Sheet 3.

C. L. CLARKE.

ELECTRIC VALVE OPERATOR.

No. 327,525. Patented Oct. 6, 1885.

Fig. 3.



Witnesses

Wm A. Skinkle.

Carrie E. Ashley

Inventor

Charles L. Clarke,

By his Attorneys

Pope & Edgeco

N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

CHARLES L. CLARKE, OF NEW YORK, N. Y.

ELECTRIC VALVE-OPERATOR.

SPECIFICATION forming part of Letters Patent No. 327,525, dated October 6, 1885.

Application filed December 1, 1884. Serial No. 149,261. (No model.)

To all whom it may concern:

Be it known that I, CHARLES L. CLARKE, a citizen of the United States, residing in New York, in the county and State of New York, have invented certain new and useful Improvements in Automatic Electric Valve-Operators, of which the following is a specification.

My invention relates to the class of apparatus employed for automatically controlling the expenditure of varying forces—such, for instance, as heat and pressure.

The object of the invention is to provide convenient and efficient means for opening and closing valves, stop-cocks, and other similar devices through the instrumentality of apparatus located at a distance therefrom and controlled by the variations in the force which it is desired to regulate.

The invention consists in organizing apparatus in substantially the following manner: Applied to a thermometer, pressure-gage, or other device responding to or affected by the force which it is desired to control, are two contact arms or points. Through one or the other of these points a circuit is completed by the operation of the meter, gage, or other device when it is subjected to or is influenced by a predetermined increase in the force or pressure. The circuit which is thus completed causes a shunt-circuit to be established around the points at which the first connection is made. These points are then separated and retained in their newly-acquired position. The circuit-connections are meanwhile complete through electro-magnetic devices which respond in the proper manner to operate the stop-cock, valve, or other corresponding device. When this device has been thus operated, the main circuit-connections are temporarily interrupted through the action of an electro-magnet which is automatically placed in circuit at the completion of the operation.

In the accompanying drawings, Figure 1 is a diagram illustrating an organization of apparatus illustrating my invention. Figs. 2 and 3 illustrate modifications of the same.

Referring to Fig. 1, A represents a lever designed to be moved in one direction or the other through the instrumentality of a thermostat or thermometer, T, responding to variations in temperature. A pressure-gage or other device of a corresponding nature may be substituted for the thermometer. At the moving end of the thermometer-arm C there are placed two circuit-closing points, *c*. These points are designed to impinge against one or the other of two contact-points, c' or c^2. The contact-points c' and c^2 are respectively carried upon two insulated arms, C′ and C^2. These arms are supported from an arbor, c^3, and they are capable of being moved in the direction of movement of the arm C. It is designed, however, that the movements of these arms shall be controlled by two electro-magnets, F′ and F^2. These electro-magnets are respectively included in conductors L′ and L^2, through one or the other of which an electric circuit is completed when the arm C is caused to impinge against one or the other of the arms C′ or C^2. The same impulse which thus vitalizes the electro-magnet F′ or F^2 is also caused to traverse the coils of a corresponding magnet, M′ or M^2, at the distant point where the valve R or other device to be controlled is located. For the purpose of thus completing the circuit-connections, the arms C′ and C^2 are constructed with curved contact-surfaces at the points where they are united with their support D. Against these two contact-surfaces two brushes, d' and d^2, respectively, impinge. The brush d' is connected by a conductor, 1, with the line L′, and the brush d^2 is connected by a conductor, 2, with the line L^2. After traversing the coils of the magnets M′ and M^2, respectively, the conductors L′ and L^2 are connected by conductors 3 and 4, respectively, with a conductor, 6.

The conductor 6 is connected with an arm, g', which rests upon a contact, g^2, and the point g^2 is connected with one pole of a battery, O′, by a conductor, 7. The remaining pole of this battery is connected with the earth by a conductor, 8. The contact-points *c* of the thermometer or circuit-closing arm C are connected with the earth by a conductor, *g*. When, therefore, one of the points *c* is brought into contact with the corresponding point, c' or c^2, a current from the battery O′ will be sent through the line L′ or L^2 and the corresponding electro-magnets. As the contact which will be thus made at the points *c* is liable to be

delicate and somewhat uncertain, and as it is necessary to immediately separate these points, I prefer to employ a second circuit-closing device, H′ or H², in connection with the arms C′ and C², respectively. These devices are respectively constructed to complete a shunt-circuit around the corresponding point when a circuit is closed thereby. This is effected in the following manner: Applied to the electro-magnet F′, which is included in the conductor L′, is an armature and armature lever, H′. The armature responds quickly, when the circuit is closed through the electro-magnet by the contact of the point *c* with the point *c′*, and carries a contact-point, h^3, supported upon the lever against a contact-stop, h^5. The armature-lever H′ is connected by a conductor, 11, with the conductor L′, between the point *c′* and the electro-magnet. The stop h^5 is connected with the arm C by a conductor, 13. When the electro magnet F′ is first vitalized, therefore, the points h^3 and h^5 complete a shunt-circuit around the primary contacts *c* and *c′*, and this circuit will, it is evident, remain complete until the electro-magnet is caused to be demagnetized by the interruption of the circuit at some other point. In like manner an armature and an armature-lever, h^2, is applied to the electro-magnet F², and a contact-point, h^4, and stop h^6 are respectively connected with the conductor L² and the arm C by conductors 12 and 14.

The armature F, carried upon the lever A, which extends from the axis c^3, responds to the magnetism induced in the electro-magnet F′ or F². The lever A is thus actuated. Thus, if the contact is made between the points *c* and c^2, the electro-magnet F² will be vitalized, the shunting device h^2 actuated, and then the lever A will be impelled toward the magnet F². The contact-point c^2 will thus be carried away from the point *c*, but the circuit will remain complete through the points h^6 and h^4.

A pawl, *a′*, is applied to the lever A, and this pawl, by entering a corresponding notch, a^2 or a^3, upon the lever, serves to retain the same in the position which it is caused to assume by the action of the electro-magnets.

By closing the circuit around the points *c* before they are separated, all chance of the occurrence of a spark at these points is obviated.

It remains now to describe the method of operating the valve and of interrupting the circuit after this operation is completed.

The circuit of the main line L′ is completed through the coils of the electro-magnet M′ to the lever g^6 of a circuit-interrupting device, which will be hereinafter described. From this device the circuit is continued to the conductor 7, and thus to the battery O′, as already described. In like manner the line L² is connected through the electro-magnet M² with the conductor 4, and thus with the conductor 6 and battery O′. When, therefore, the connections of the main line L′ or L² are completed by the action of the arm C, the corresponding electro-magnet, M′ or M², will be vitalized. These electro-magnets are designed to open or to close the valve R accordingly as the magnet M² or M′ is vitalized. For this purpose the cores *p′* and p^2 of these electro-magnets are preferably so made as to move into and out of the coils, and they are respectively pivoted to the extremities of a pivoted beam, P. When the coils of one electro-magnet are traversed by a current of electricity, the corresponding core will be drawn within the same in a well-known manner, the other core being withdrawn from its coils by the movement of the beam P. The beam will thus be tilted in one direction or the other, accordingly as the arm C is moved in one direction or the other. Considering that the arm C is operated by changes in temperature, and that these changes are to be controlled by the opening and the closing of the valve R, it is necessary to provide means for communicating the movement of the beam P to the valve R. For this purpose a link, r^2, is pivoted at one end to an arm, *r′*, extending from the beam P, and at the other end to an arm, r^3, extending from the axis of the centrally-pivoted valve R. Any other well-known mechanical device may be employed for thus communicating the movements of the beam to the valve.

After the valve has been operated it is essential that the circuit should be interrupted. For this purpose the interrupting device already referred to is employed. This device consists of an electro-magnet, G′, included in a conductor, 15, leading from the lever g^6 to the beam P. The electro-magnet G′ is provided with an armature, G². When the electro-magnet is vitalized, the armature and its lever are drawn forward, and the latter, by striking against a right-angled extension, g^3, of the lever g^6, serves to raise a contact-point, *g′*, carried at its extremity from a corresponding resting-contact, g^2, thus interrupting the connections of the battery O′. The current which caused the magnet G′ to be vitalized will be thus interrupted, and the lever G³ will fall back. For the purpose, however, of preventing the circuit-interrupter from operating before the valve R has been moved, the electro-magnet G′ is constructed to respond slowly, and in addition it is included in a shunt-circuit around the electro-magnets M′ and M², and the connections of which are incomplete so long as the beam P is moving. This is accomplished by connecting the conductor 15 through the beam P with an arm, *q*, attached thereto. The arm *q* moves between two contact-stops, *q′* and q^2. When in the position shown in the drawings, the contact-point at the extremity of the arm *q* impinges against the stop *q′*, and when the beam is tilted by the action of the electro-magnet F², the arm *q* leaves the point *q′* and is carried into contact with the stop q^2. The contact-stop *q′* is connected by a conductor, 16, with the line L′ at a point, 18, between the line and the magnet M′. The stop q^2 is connected by a conductor,

17, with the line L^2 at a point, 19, between the line and the magnet M^2. At the first movement of the beam P, before the electro-magnet G′ has had opportunity to respond, the connections of the conductor 15 are thus interrupted, and the beam completes its movement before these connections are again completed. At the limit of the movement of the beam, however, the electro-magnet G′ becomes vitalized, and the connections of the battery O′ are temporarily interrupted. The armature-lever H' or H^2 of the corresponding electro-magnet, F' or F^2, thereupon falls away, thus interrupting the circuit at another point before it is again completed at the points g' and g^2.

In Fig. 2 a modification of the invention is illustrated, in which the parts are organized to be operated by currents transmitted over a single main line, and an electric motor is substituted for the magnets employed for operating the valve. In this modification two batteries, O^2 and O^3, are employed, and they have their positive and negative pole respectively connected with two insulated points, c^3 and c^4, upon the arm C by conductors 21 and 22. The point c^3 is designed to make contact with the point c', and the point c^4 with the point c^2, and to thereby complete a circuit from the corresponding battery through the electro-magnet F' or F^2.

Shunt-circuits are established around these points in the manner described with reference to Fig. 1, the point h^5 being connected with the conductor 21 by a conductor, 23, and the point h^6 with the conductor 22 by a conductor, 24.

A positive or a negative current will be sent to line accordingly as the arm C is moved toward the right hand or toward the left.

Instead of two main lines, only one, L, is employed. The connections of the line L are through the coils of an electric motor, M, the armature of which is constructed to revolve in one direction when traversed by currents in one direction, and to revolve in the opposite direction when traversed by currents in the opposite direction.

Connected with the armature through any suitable train of wheels, N, is the valve R, and this valve will be operated by the revolution of the armature. A contact-arm, q, moves with the armature of the motor, and at or near the limit of movement of the valve this arm strikes against a contact-point, q' or q^2, accordingly as it is moved in one direction or the other. The two conductors 16 and 17 respectively connect these points with the main line L, and the arm q is connected with the conductor 15, in which the electro-magnet G′ is included. The operation of this organization will be apparent without further description.

In Fig. 3 a modification in the valve-moving apparatus is illustrated. The object of this modification is to operate a valve through the agency of a pneumatic or steam device. For this purpose the electro-magnets M′ and M^2, described in connection with Fig. 2, are provided with armatures m' and m^2, respectively. These armatures are carried upon arms of a pivoted lever, M. The extremity of the lever M has pivoted to it a valve-rod, m^3, which carries a valve, s^{11}. The valve s^{11} moves to and fro in a valve-box, s^2, which is supplied with compressed air or steam through a pipe, s^3, provided with a stop-cock, s^4. The valve-box is provided with an exhaust-opening, s^5, and two escape-openings, s^6 and s^7. Two tubes, s^8 and s^9, lead from the openings s^6 and s^7, respectively, to the respective ends of a piston-cylinder, S. This cylinder is provided with a piston, s^{10}, capable of moving to and fro by reason of the pressure exerted by the steam or air allowed to enter through the pipes s^8 and s^9. The valve s^{11} is constructed to place one or the other of these pipes in communication with the exhaust-opening s^5 through its aperture, accordingly as it stands at one end or the other of the box. At the same time the remaining pipe communicates with the box, and thus with the supply of steam or air.

The valve or damper R is coupled in the usual manner with the piston s^{10}, through a link and piston-rod, and thus the damper will be closed or opened, accordingly as the piston is at one end or the other of the piston-cylinder, and it is evident the movements of the piston will be controlled by the movements of the armature-lever M.

In this modification the conductors L′ and L^2 are shown as connected with the earth through a conductor, 20, leading from a point, 21. The conductor 20 is connected with the contact-point g', and the corresponding point. g^2, is connected by a conductor, 22, through the coils of the electro-magnet G′, with one pole of the battery O′. The remaining pole of this battery is connected with the earth by a conductor, 23.

I claim as my invention—

1. The combination, substantially as hereinbefore set forth, of a circuit-closing arm, two contact-arms, two electro-magnets for controlling the positions of said contact-arms, means, substantially such as described, for moving said contact-arms when said circuit-closing arm has impinged against one or the other through the agency of said electro-magnets, a valve and electro-magnetic devices, substantially such as described, for operating said valve through the agency of said circuit-closing and contact arms.

2. The combination, substantially as hereinbefore set forth, of a circuit-closing arm operated by variations in a force, two contact-arms applied thereto and capable of moving in one direction or the other according to the direction of movement of said circuit-closing arm, a detent for normally retaining said arms in one or the other of two positions, two electro-magnets, means for vitalizing one or the other of the same accordingly as said circuit-closing arm is actuated by an increase or a

decrease in the expenditure of the force, a circuit-closing device applied to each of the electro-magnets and serving, when the corresponding electro-magnet is vitalized, to complete a shunt-circuit around the points through which its circuit is closed, a valve, and means, substantially such as described, for opening or closing said valve accordingly as one or the other of said electro-magnets is vitalized.

3. The combination, substantially as hereinbefore set forth, of a circuit-closing arm operated by variations in a force, two contact-arms applied thereto and capable of moving in one direction or the other accordingly as said circuit-closing arm is moved in one direction or the other, two electro-magnets, means for vitalizing one or the other of the same accordingly as said circuit-closing arm is actuated by an increase or a decrease in the expenditure of the force, a circuit-closing device applied to each of said electro-magnets and serving to complete a shunt-circuit around the corresponding contact-points, and a valve operated through the instrumentality of said circuit-closing and contact arms.

4. The combination, substantially as hereinbefore set forth, of an arm responding to variations in heat or pressure, two electro-magnets through one or the other of which an electric circuit is completed by the action of said arm, a valve, damper, or other device for controlling said force, mechanical connections between said electro-magnets and said valve whereby the latter is opened or closed accordingly as one or the other electro-magnet is vitalized, and means, substantially such as described, for automatically causing said magnet to be demagnetized after it has so operated said valve.

5. The combination, substantially as hereinbefore set forth, of a circuit-closing arm responding to variations in temperature, pressure, or other force, a valve, damper, or other device for governing said force, an electro-magnetic device for operating said valve or device, an electric circuit in which said electro-magnetic device is included, a circuit-interrupting device, an electro-magnet for actuating the same, a shunt-circuit around said electro-magnetic device, in which said electro-magnet is included, and connections for the same, and a circuit-closing device actuated by said electro-magnetic device, whereby said shunt-circuit is completed when said valve has been moved a predetermined distance in one direction or the other.

6. The combination, substantially as hereinbefore set forth, of a battery, an electric circuit, a circuit-closing device, an electro-magnet included in said circuit, an arm moved by said electro-magnet, a circuit-interrupting device through which the connections of said circuits are made, an electro-magnet for operating said interrupting device, a shunt-circuit around the first-named electro-magnet, in which the second electro-magnet is included, and a circuit-closing arm operated by the first-named electro-magnet, whereby the connections of said shunt-circuit are controlled.

7. The combination, substantially as hereinbefore set forth, of a battery, an electric circuit for the same, a device for controlling the connections of said circuit, a valve, damper, stop-cock, or other similar device, an electro-magnetic device included in said circuit for operating said valve or similar device, a circuit-interrupting device included in said circuit, an electro-magnet for operating said interrupting device, a shunt or branch of said circuit, in which shunt or branch said electro-magnet is included, and means for completing the connections of said branch when said valve or similar device has been operated.

8. The combination, substantially as hereinbefore set forth, of a battery, two circuits therefor, a circuit-closing lever whereby one or the other of said circuits may be completed, two electro-magnets respectively included in said circuits, their armatures, an armature-lever supporting said armatures, a valve, damper, or other similar device operated by said lever, a shunt or branch circuit of the first-named circuits, the connections of which are automatically completed by the movement of said lever.

9. The combination, substantially as hereinbefore set forth, of the battery O′, the circuit-closing arm T, the contact-arms C′ and C^2, the conductors L′ and L^2, the electro-magnets F′ and F^2, respectively included in said conductors, the electro-magnets M′ and M^2, also respectively included in said conductors, the armature-lever P, applied to the last-named electro-magnets, the valve or similar device, R, operated by the movements of said lever, the arm q, and contact-points q' and q^2, the electro-magnet G′, and the conductor including the same, and the circuit-interrupting points g' and g^2, operated by said electro-magnet G′.

10. The combination, substantially as hereinbefore set forth, of a normally-open electric circuit, a circuit-closing device responding to variations in temperature, pressure, or other force, a valve or other device for controlling said force, electro-magnetic devices controlled by the operation of said circuit-closing device for operating said valve or other device, and a circuit-interrupter serving to automatically interrupt said circuit when said valve or other device has been operated by the completion of the circuit.

In testimony whereof I have hereunto subscribed my name this 28th day of November, A. D. 1884.

CHARLES L. CLARKE.

Witnesses:

DANL. W. EDGECOMB,

CHARLES A. TERRY.