No. 736,490. PATENTED AUG. 18, 1903.

A. M. BUTZ.

ELECTRIC DAMPER REGULATOR.

APPLICATION FILED FEB. 24, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

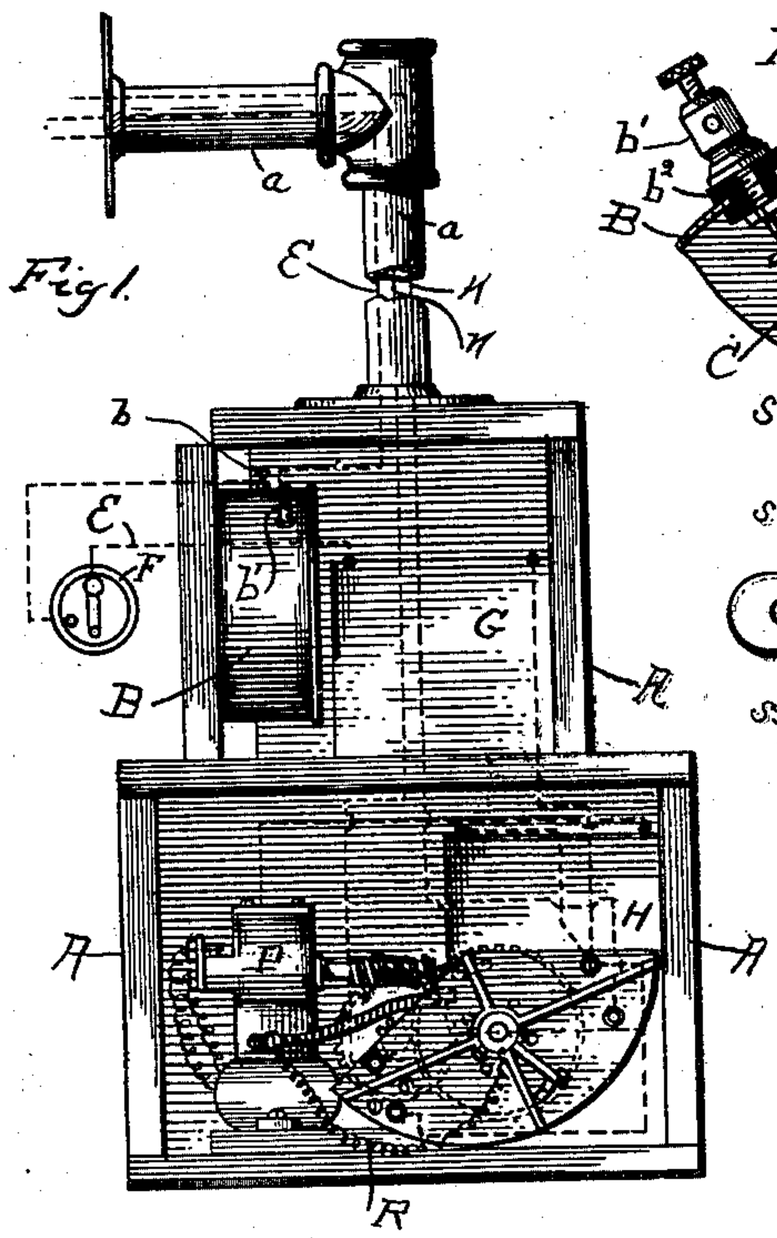


Fig. 7.

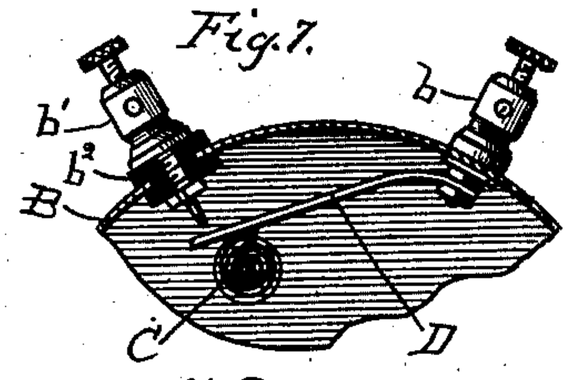


Fig. 8.

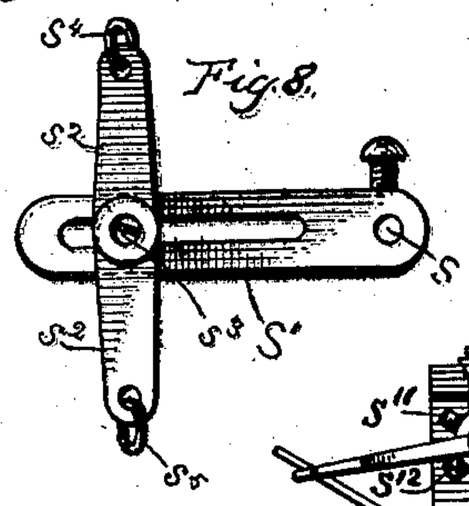


Fig. 2.

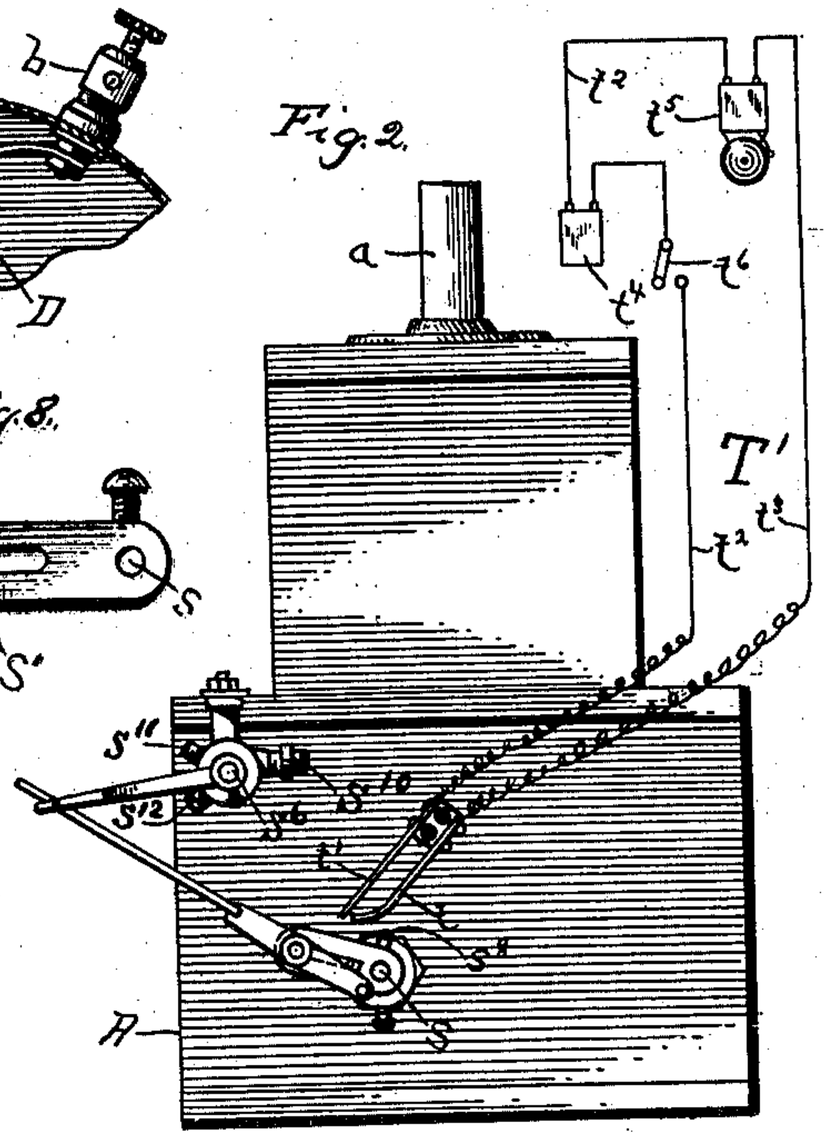
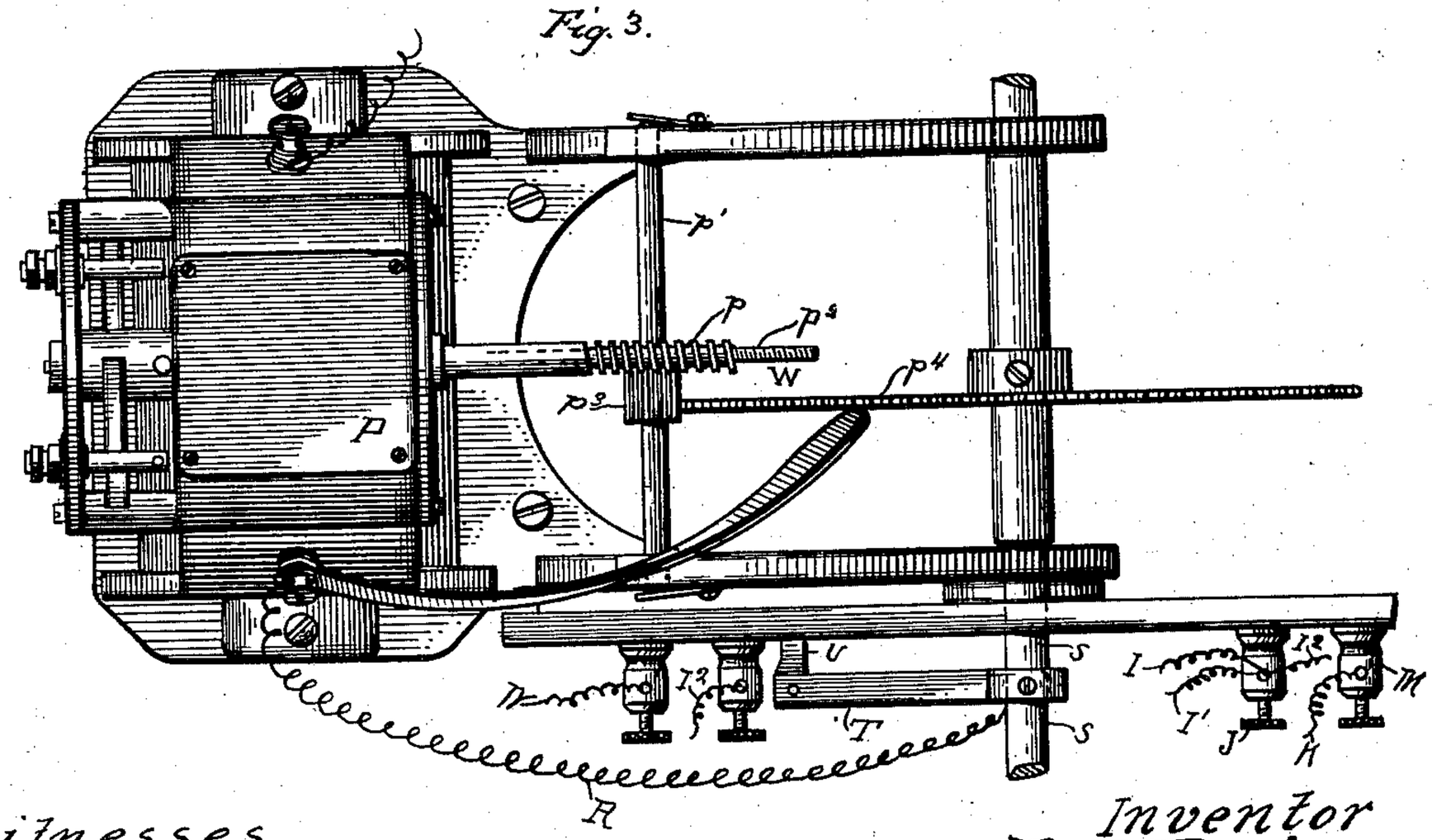


Fig. 3.



Witnesses.

Otto E. Johnson.

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ELECTRIC DAMPER REGULATOR.

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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 4

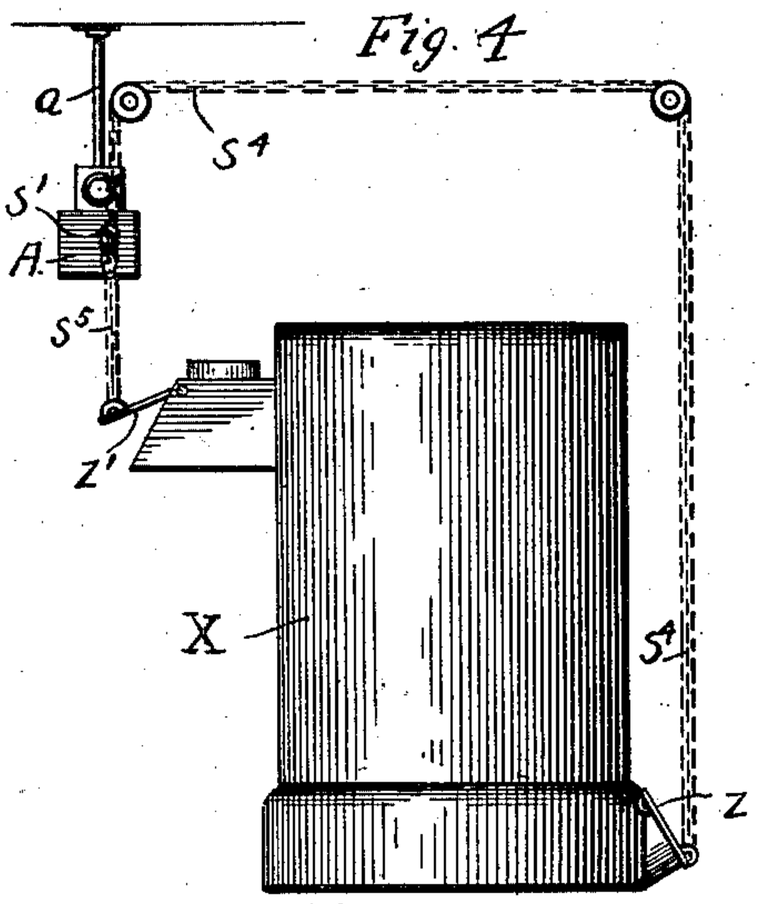


Fig. 5.

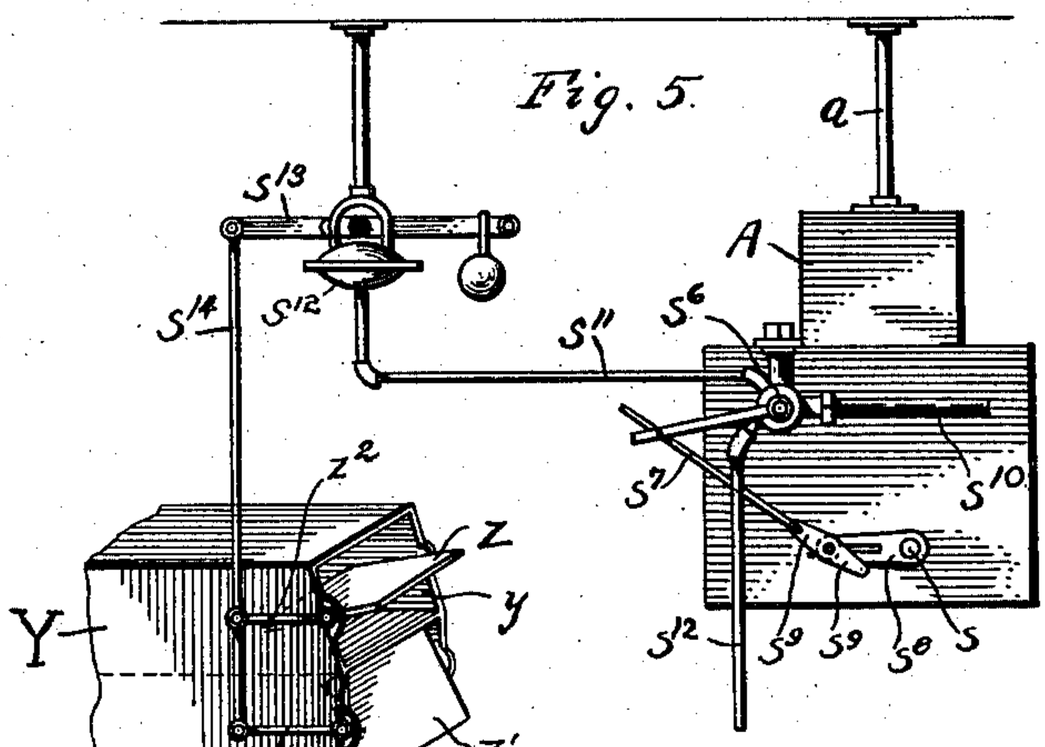
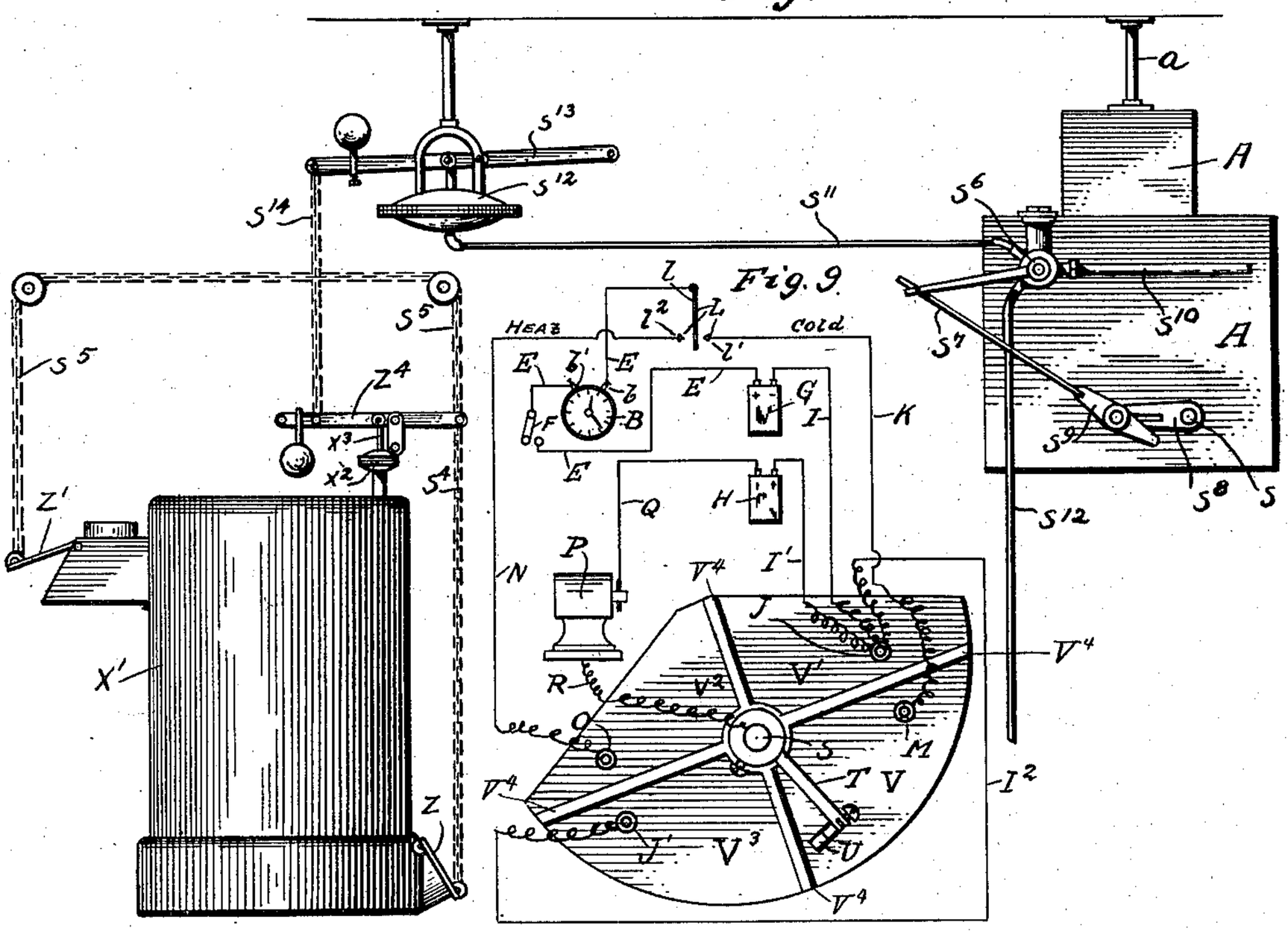


Fig. 6.



Witnesses.

Otto E. Johnson.
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No. 736,490. Patented August 18, 1903.

UNITED STATES PATENT OFFICE.

ALBERT M. BUTZ, OF OAKPARK, ILLINOIS.

ELECTRIC DAMPER-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 736,490, dated August 18, 1903.

Application filed February 24, 1902. Serial No. 95,373. (No model.)

To all whom it may concern:

Be it known that I, ALBERT M. BUTZ, a citizen of the United States, residing at Oakpark, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electric Damper-Regulators, of which the following, when taken in connection with the drawings accompanying and forming a part hereof, is a full and complete description, sufficient to enable those skilled in the art to which it pertains to understand, make, and use the same.

The object of this invention is to obtain a regulator which will be automatically actuated upon the closing of one of a plurality of electric circuits in which the motor of the apparatus is placed, to obtain a regulator which will be certain in its operation and not require the use of spring-actuated clockwork, (thereby avoiding the winding of a spring,) to obtain a regulator which will actuate a signal located at any desired point, thereby giving information of the operation of the apparatus, and to obtain a regulator which is economical in construction, durable, and not liable to get out of order.

In the drawings referred to as forming a part of this specification, Figure 1 is a front elevation of a regulator embodying this invention, with the front of the casing thereof removed to expose the operative mechanisms contained within the case to view. Fig. 2 is a rear elevation of the regulator illustrated in Fig. 1, showing the main shaft of the apparatus and adjacent mechanisms, including a signal-circuit. Fig. 3 is a top plan view of the motor of the regulator and of the movable parts connected thereto and actuated thereby. Fig. 4 is a side elevation of a furnace and a front elevation of a regulator embodying this invention connected thereto. Fig. 5 is a perspective view of flues or passage-ways provided with dampers and a rear elevation of a regulator embodying this invention, with connections between the dampers of the flues and the regulator. Fig. 6 is a side elevation of a boiler and furnace, a rear elevation of a regulator embodying this invention, and of connections between the dampers of the furnace and the regulator, such connections being a modification of the connection illustrated in Fig. 4. Fig. 7 is a vertical sectional view of a portion of an alarm-clock case, showing electric terminals mounted on such clock-case and showing the alarm-spring of the clock arranged to close the switch between the terminals when such alarm-spring is released. Fig. 8 is a front elevation of a crank-arm and connection of the main shaft of the regulator; and Fig. 9 is a diagram of the several batteries, electric circuits, terminals, switch, alarm-clock, motor, and connecting mechanism of the apparatus.

A reference-letter applied to designate a given part is used to indicate such part throughout the several figures of the drawings wherever the same appears.

A is the casing of the regulator embodying this invention.

B is an ordinary alarm-clock.

b b' are electric terminals mounted on the casing of clock B. One of such terminals is insulated from the case of clock B, as by insulating material b^2, Fig. 7.

C, Fig. 7, is the alarm-spring of clock B.

D is an electric conductor attached to terminal *b* and resting on spring C, so as to be forced into electrical contact with terminal *b'* by the unwinding of the spring C. No addition to or change of an ordinary alarm-clock other than the placing of the terminals *b b'* and electric conductor D in such clock, as described and illustrated in Fig. 7, is required to adapt the same for use in this apparatus, and when the clock is so arranged the unwinding of the alarm-spring C at the time for which the clock is set closes at such point the circuit extending through the clock, as, say, conductor E in Figs. 1 and 9.

F is a switch in conductor E.

G is an electric generator and may consist of a primary battery.

H is an additional electric generator and may also consist of a primary battery.

I is an electric conductor forming part of an electric circuit.

I^2 is a conductor forming part of an electric circuit.

J J' represent binding-posts.

K is a conductor forming part of an electric circuit.

L is a thermostat.

l is the movable expansible member of thermostat L, and *l'* and l^2 are electric contact-points of thermostat L.

M and O are respectively binding-posts.

N is a conductor forming part of an electric circuit.

P is an electric motor.

Q and R are respectively conductors forming part of an electric circuit.

S is a rotatable shaft.

T is a crank-arm rigidly secured to shaft S to rotate therewith.

U is a brush attached to crank T, forming an electric conductor in an electric circuit and in electric contact with conductors V, V', V^2, and V^3 consecutively as shaft S rotates, carrying therewith the crank-arm T. Conductors V, V', V^2, and V^3 consist of copper or other metal plates secured on backing V^4, such backing being made of fiber, vulcanite, or other non-electric conducting material. (See Figs. 1 and 9.)

W is a train connecting the motor P to shaft S. Train W may consist of worm *p*, shaft *p'*, gear-wheel p^2, attached to shaft *p'* and intermeshing with worm *p*, and pinion p^3, attached to shaft *p'* and intermeshing with gear-wheel p^4 on shaft S. Worm *p* may be cut on the main shaft of the motor P, so that the rotation of the motor will produce corresponding but slower rotation of shaft S.

X is a furnace, and X' is a boiler and furnace.

Y is the casing of air-flues *y y'*.

Z Z' are dampers.

Conductor E electrically connects expansible member *l* of thermostat L with one of the poles of electric generator G, (clock B and switch F being interposed on conductor E, as hereinbefore described.) Conductor I electrically connects one of the poles of electric generator G—as, say, the negative pole—with terminal J, and conductor I' electrically connects one of the poles of electric generator H—as, say, the positive pole—with such terminal J. Conductor I^2 electrically connects terminal J with terminal J'. Conductor K electrically connects one of the contact-points *l'* of thermostat L, Fig. 9, with terminal M. Conductor N electrically connects contact-point l^2 of thermostat L, Fig. 9, with terminal O. Conductor Q electrically connects the motor P with one of the poles—say the negative pole—of electric generator H, and conductor R electrically connects the motor P with shaft S.

The casing A may be secured to a side wall or to a joist or other timber by the pipe *a*, and when so secured the several conductors E K N may be placed in such pipe, as illustrated in Fig. 1 of the drawings. By means of the foregoing-described mechanisms, electric circuits, and generators shaft S is made to rotate a half-turn each time the movable member *l*, Fig. 9, of thermostat L is forced into alternate electric contact with contact-points *l' l²*, and to connect the shaft S with the several dampers which I desire to operate by my regulator I employ the following-described mechanisms:

S', Figs. 4 and 8, is a crank-arm rigidly attached to shaft S to rotate therewith, and S^2 is a rotatable link adjustably mounted on crank S', as by bolt S^3.

S^4 is a flexible connection—as, say, a chain or cable—connected to one end of the link S^2 and extending to and connected with damper Z, and S^5 is a flexible connection extending from the opposite end of link S^2 to damper Z'. The dampers Z Z' are connected up relative to each other and the crank S' so that when one of such dampers is open the other thereof is closed. Where the dampers Z Z' are placed at some distance from the casing A, I at times use a pneumatic or hydraulic connection thereto from the regulator embodying this invention, as illustrated in Figs. 5 and 6 of the drawings, as a substitute for or in addition to the flexible connection S^4 and S^5. In such case the three-way cock S^6 or its equivalent is mounted (preferably on casing A) so as to be connected, as by connection S^7, with crank-arm S^8, Figs. 5 and 6, on shaft S, as, say, through intervening swivel S^9. Three-way cock S^6 is provided with inlet-pipe S^{10}, outlet-pipe S^{11}, and waste-pipe S^{12}. Outlet-pipe S^{11} communicates with the diaphragm S^{12}.

S^{13} is a lever connected to and actuated by diaphragm S^{12}, and S^{14} is a flexible connection from lever S^{13} to the apparatus sought to be moved thereby, as, say, the crank-arms Z^2 Z^3 of the dampers in flues *y y'*, Fig. 5, or lever Z^4 in the apparatus illustrated in Fig. 6. The flexible connections S^4 and S^5 are attached to lever Z^4 and to the dampers Z Z' in the construction illustrated in Fig. 6.

It will be observed that the thermostat L is provided with movable member *l* and contact-points *l' l²*, and by placing the electric conductor connecting with movable member *l* of the thermostat L common to or as return-conductors of the circuits in which are placed the electric conductors attached to contact-points *l' l²* of such thermostat L there are obtained two circuits, which may be respectively termed a "heat-closing" circuit and a "cold-closing" circuit. In the construction illustrated in the drawings the conductor R, motor P, conductor Q, electric generators G H, the alarm-clock B, the switch F, and the conductors I, I', and E are common to both the heat and cold circuits.

When the switch F is open, both circuits are inoperative, and when the switch F is closed and the alarm-spring C is wound both circuits are inoperative; but when switch F is closed and the spring C is unwound both circuits are operative and will alternately be closed by the movable member *l* coming into electrical contact with contact-points *l'* and *l²*. When such movable member *l* is in electric contact with contact-point *l'*, what I term the "cold-circuit" is closed, and the motor is

operated to open the damper of the furnace and close the damper of the check-draft to obtain additional heat therefrom, and when the movable member *l* is in electric contact with contact-point l^2 what I term the "heat-circuit" is closed, and the motor is actuated to close the damper of the stove and to open the check-dampers to obtain less heat from the furnaces.

The cold-circuit contains the following elements: contact-point *l'*, conductor K, terminal M, conductor V, brush U, crank-arm T, shaft S, conductor R, motor P, conductor Q, generator H, conductor I', terminal J, conductor I, generator G, conductor E, switch F, clock B, and movable member *l* of thermostat L.

The heat-circuit contains the following elements: contact-point l^2, conductor N, terminal O, conductor V^2, and from thence to movable member *l* of thermostat L over the same elements as in the cold-circuit, such elements being common to both circuits and the heat-circuit being in operative condition only when the shaft S is turned one-half around from the position thereof illustrated in Figs. 1 and 9 and brush U is in electrical contact with conductor V^2.

In the construction illustrated by the drawings auxiliary circuits are formed as the brush U on shaft S is brought into electrical contact with the conductors V' and V^3, respectively, in the rotation of shaft S. These auxiliary circuits may be respectively termed an auxiliary "heat-circuit" and an auxiliary "cold-circuit." The auxiliary cold-circuit comprises shaft S, crank-arm T, brush U, conductor V', terminal J, conductor I', electric generator H, conductor Q, motor P, and conductor R. The auxiliary heat-circuit comprises shaft S, crank-arm T, brush U, conductor V^3, terminal J', conductor I^2, terminal J, conductor I', electric generator H, conductor Q, electric motor P, and conductor R.

X^2, Fig. 6, is a steam-diaphragm connected to the boiler X', so that steam will enter the casing thereof to actuate such diaphragm and lever Z^4 by means of connecting-piston X^3 when a determined pressure of steam has been generated in boiler X'. Lever Z^4 is thus actuated to close the damper Z and open the damper Z' by the upward movement of piston X^3 and also by the upward movement of the weighted end of the lever S^{13}.

To actuate the lever S^{13}, the tube S^{11} (or conduit S^{11}) is connected to three-way cock S^6, so that communication is established between the inlet or supply pipe S^{10} to such outlet-pipe S^{11} and to diaphragm S^{12} to thereby supply air or water under pressure to such diaphragm S^{12} and raise the weighted end of lever S^{13}, when the thermostat of the apparatus is operated by obtaining a determined raise in temperature thereof. When steam at a determined pressure is generated in boiler and furnace X', the weighted end of lever Z^4 is raised by steam-diaphraghm X^2—that is to say, damper Z is closed and damper Z' is open, Fig. 6—when a given temperature is obtained at the thermostat L of the apparatus, and in addition thereto such damper Z is closed and damper Z' is open when a given pressure of steam is generated in the boiler. This arrangement prevents the rapid generation of a greater pressure of steam than is required to sufficiently warm the several halls, chambers, rooms, or other places designed to be heated by the boiler X'.

The several parts of the apparatus illustrated in Figs. 1 and 9 being in the positions illustrated in such figures, with brush U in electric contact with conductor V, the switch F closed, and spring C, Fig. 7, unwound, and assuming the temperature about thermostat L to be lowered, the operation of the apparatus is as follows: Expansible movable member *l* of thermostat L will be forced by such change of temperature into electrical contact with contact-point *l'*, and what I have hereinbefore termed the "cold-circuit" (comprising *l'*, K, M, V, U, T, S, R, P, Q, H, E, F, B, and *l*) will be closed, and an electric current from generators G H will thereupon pass over such circuit and actuate motor P, and such motor will actuate shaft S, and through the connections hereinbefore described the dampers Z of the furnace and boiler will be opened and dampers Z' of the check-draft will be closed. As shaft S rotates, (under the above-named conditions,) brush U is brought into electrical contact with conductor V', (after such brush has passed over the electrical conductor V,) and thereby the auxiliary cold-circuit, hereinbefore described and comprising S, T, U, V', J, I', H, Q, P, and R, is closed, and motor B continues to be operated by generator H, (generator G being thus cut out from operating,) and a shorter circuit is established, from which circuit the thermostat L, conductors K E, clock B, and switch F are cut out. Both generators G H are thus used to start the motor P into operation, and upon its being so started the generator H continues to operate the motor until the brush U passes entirely over the conductor V'. Sufficient momentum of motor P and shaft S is obtained to carry brush U into electrical contact with conductor V^2, at which time shaft S has made a half-revolution and dampers Z Z' or three-way cock S^6 are operated as described. When the electrical brush U is in electric contact with conductor V^2, the movement of the expansible member *l* of thermostat L into electrical contact with contact-point l^2 (by a rise in the temperature of the air surrounding such thermostat) will close what has been herein termed the "heat-circuit" (comprising l^2 N O V^2 S R P Q H I' J I G E F B *l*) and such generators G H will actuate the motor P to move shaft S toward its initial position. In the last-described movement of shaft S the generators G H are both in the circuit named, which starts the motor P, and both continue to be in such circuit until the

brush U is in electrical contact with electric conductor V^3, at which time the auxiliary heat-circuit (comprising S, T, U, V^3, J′, I^2, J, I′, H, Q, P, and R) is closed, and thereafter such motor P is actuated by the generator H until the brush U has passed over and away from such conductor V^3 and such brush and shaft S have returned to their initial positions, as shown in Figs. 1 and 9. The shaft S in returning to its initial position, as described, again actuates the dampers Z Z′ and (when the same is attached thereto) the three-way cock S^6 or its equivalent to return them, respectively, to their initial positions.

When the damper Z of steam-generator X′ is opened by the above-described operation of the thermostat L and electric generators G H and motor P and steam is generated therein to above a determined pressure, such damper is closed by the movement of diaphragm X^2 and lever Z^4, as has been hereinbefore described.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an electric regulator for dampers, a main electric circuit and an auxiliary electric circuit comprising the combination of electric conductors, a shaft, an electric motor which moves the shaft, an electric brush connected to the shaft and moved thereby, a thermostat in the main circuit, electric generators in the auxiliary circuit and additional electric generators in the main circuit, a series of electric conductors with which the electric brush is successively brought into electric contact in the revolution of the shaft, such electric brush and conductors constituting a switch between the circuits, to cut out the main circuit containing the thermostat and the additional electric generators and to close the auxiliary circuit containing the first-named electric generators: substantially as described.

2. In an electric damper-regulator, a plurality of main electric circuits and a plurality of auxiliary electric circuits, comprising the combination of a shaft, an electric motor which moves the shaft, such motor interposed in all the circuits, an electric brush connected to the shaft and moved thereby, a thermostat common to the main circuits, electric conductors interposed in the circuits to obtain a conductor corresponding with a circuit, generators in the auxiliary circuits and common thereto, and additional generators together with the first-named generators common to the main circuits, the electric conductors comprising plates over which the brush is successively moved by the rotation of the shaft, such brush and conductors constituting switches between the circuits, and the several parts related so that the main circuits are successively closed by the thermostat and respectively cut out by the rotation of the shaft, and the auxiliary circuits are successively closed and cut out by the rotation of the shaft: substantially as described.

3. The combination with a water-supply pipe, a waste-water pipe, a service-pipe and mechanism to control the flow of water from the supply-pipe to the service-pipe and from the service-pipe to the waste-pipe, of a plurality of main circuits and a plurality of auxiliary electric circuits comprising a shaft, a connection between the shaft and the controlling mechanism of the water-pipes, an electric motor which moves the shaft, such motor interposed in all the electric circuits, an electric brush moved by the shaft, a thermostat common to the main circuits, electric conductors interposed in the circuits to obtain in each circuit a conductor corresponding thereto, such conductors respectively comprising plates so arranged that the brush is successively brought into electric contact therewith in the rotation of the shaft, electric generators in and common to the auxiliary circuits, additional electric generators in and common to the main circuits, the several parts related so that the brush and conductors constitute switches and so that the main circuits are successively closed by the thermostat and respectively cut out by the rotation of the shaft, and the auxiliary circuits are successively closed and cut out by the rotation of the shaft; substantially as described.

4. The combination of a plurality of main electric circuits and a plurality of auxiliary electric circuits comprising a shaft, an electric motor which moves the shaft, such motor interposed in all of the circuits, an electric brush connected to the shaft and moved thereby, an alarm-clock interposed in the main circuits by means of electric terminals in the clock, one of such terminals adjacent to the alarm-spring of the clock and an electric conductor connected to the remaining terminal and arranged relative to the alarm-spring to rest thereon, the terminals, alarm-spring and conductor assembled relatively to each other so that when the alarm-spring is unwound the greater diameter thereof closes the circuit by forcing the conductor into electric contact with the terminal adjacent to the spring, a thermostat common to the main circuits, electric conductors interposed in corresponding circuits, electric generators in the auxiliary circuits and common thereto and additional electric generators in the main circuits and common thereto, such electric conductors respectively consisting of metal plates and constituting switches with the several parts related so that the main circuits are closed by the thermostat and cut out by the rotation of the shaft and brush, and the auxiliary circuits are closed and cut out by the rotation of such shaft and brush: substantially as described.

5. In an electric regulator for dampers, electric circuits and auxiliary electric circuits

comprising the combination of an electric motor, a train actuated by the motor, a crank-arm rigidly attached to the driven shaft of the train, a swivel adjustably mounted on the crank-arm, a damper, a connection between the swivel and the damper, a series of electric conductors, an electric brush electrically connected to the driven shaft of the train, such brush arranged to be successively brought into electrical contact with the conductors of the series by the rotation of the driven shaft of the train, electric generators in the circuits, a thermostat and an alarm-clock interposed in the first-named electric circuits, and an open switch to the clock, such switch comprising terminals and a conductor resting on the spring and arranged relative to the alarm-spring so as to be closed against one of the terminals when the spring is unwound; substantially as described.

ALBERT M. BUTZ.

In presence of—
CHARLES TURNER BROWN,
CORA A. ADAMS.