J. B. CRANDON.

DAMPER REGULATING APPARATUS.

APPLICATION FILED SEPT. 16, 1908.

965,569. **Patented July 26, 1910.**

3 SHEETS—SHEET 1.

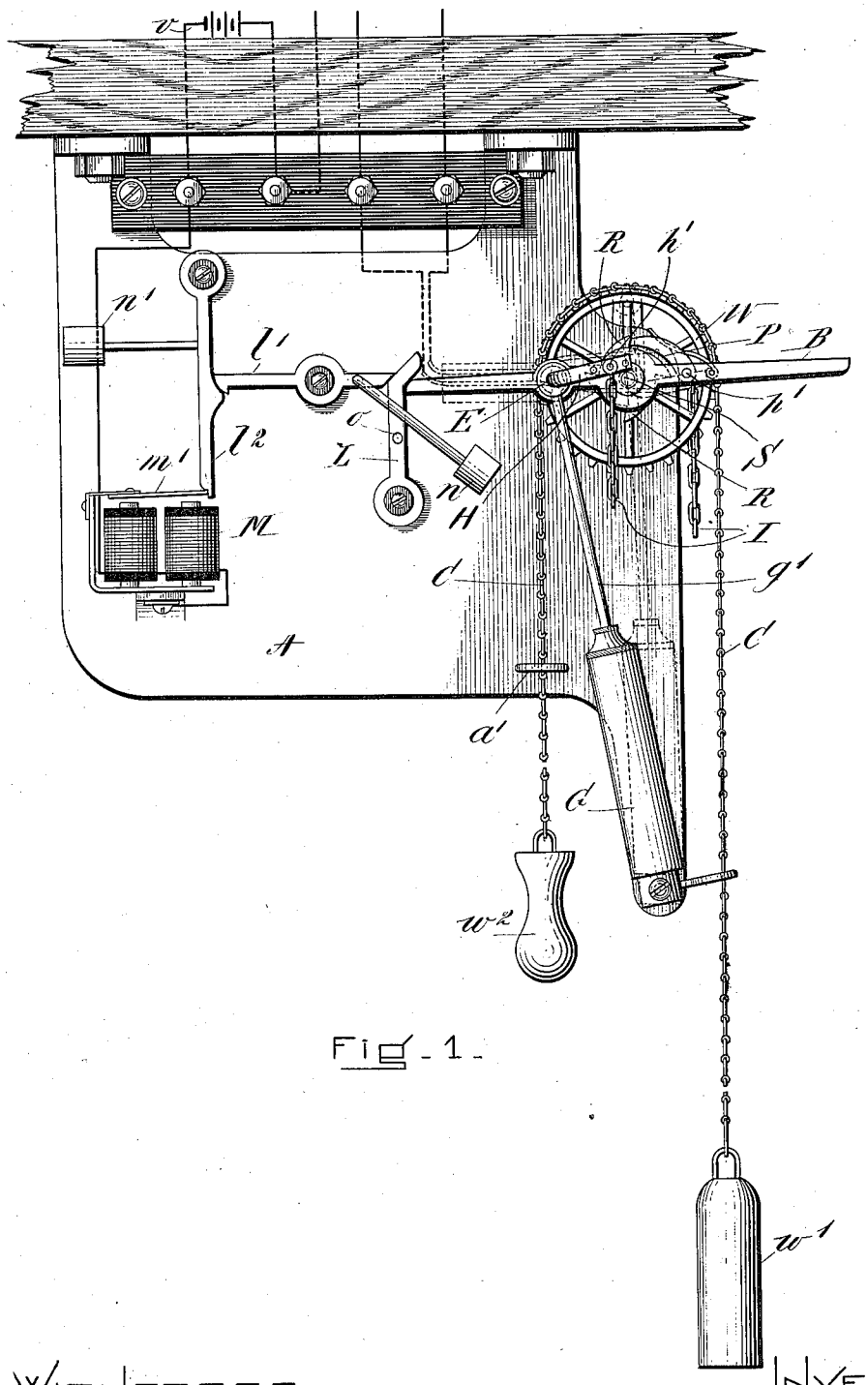

Fig. 1.

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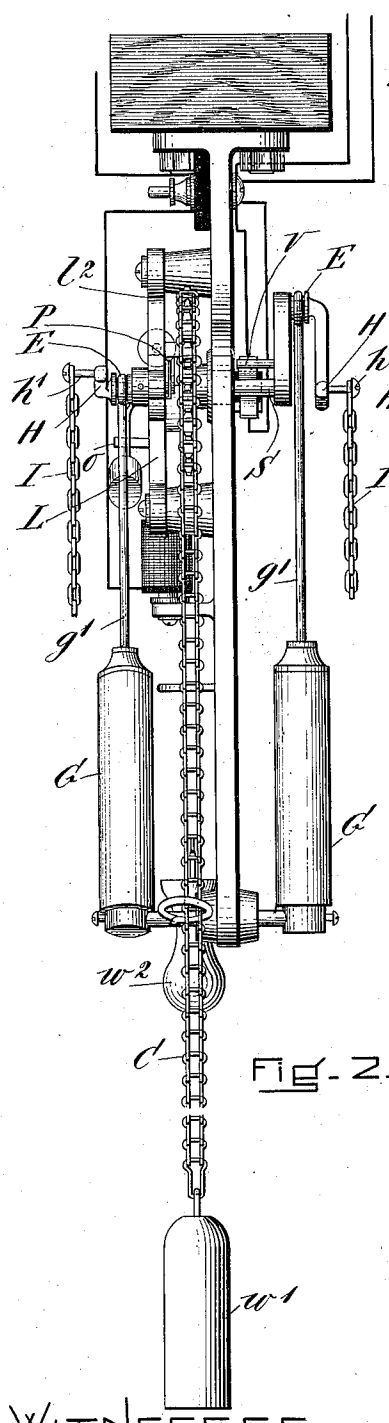

Fig. 2.

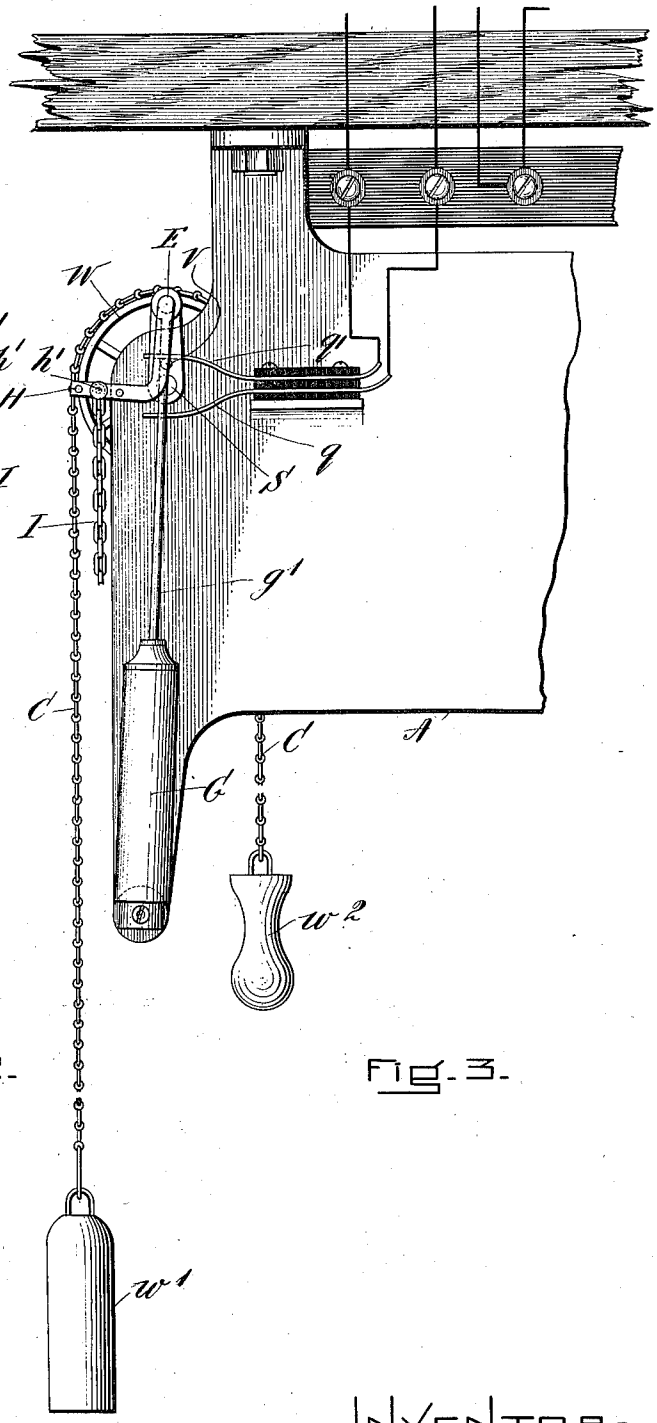

Fig. 3.

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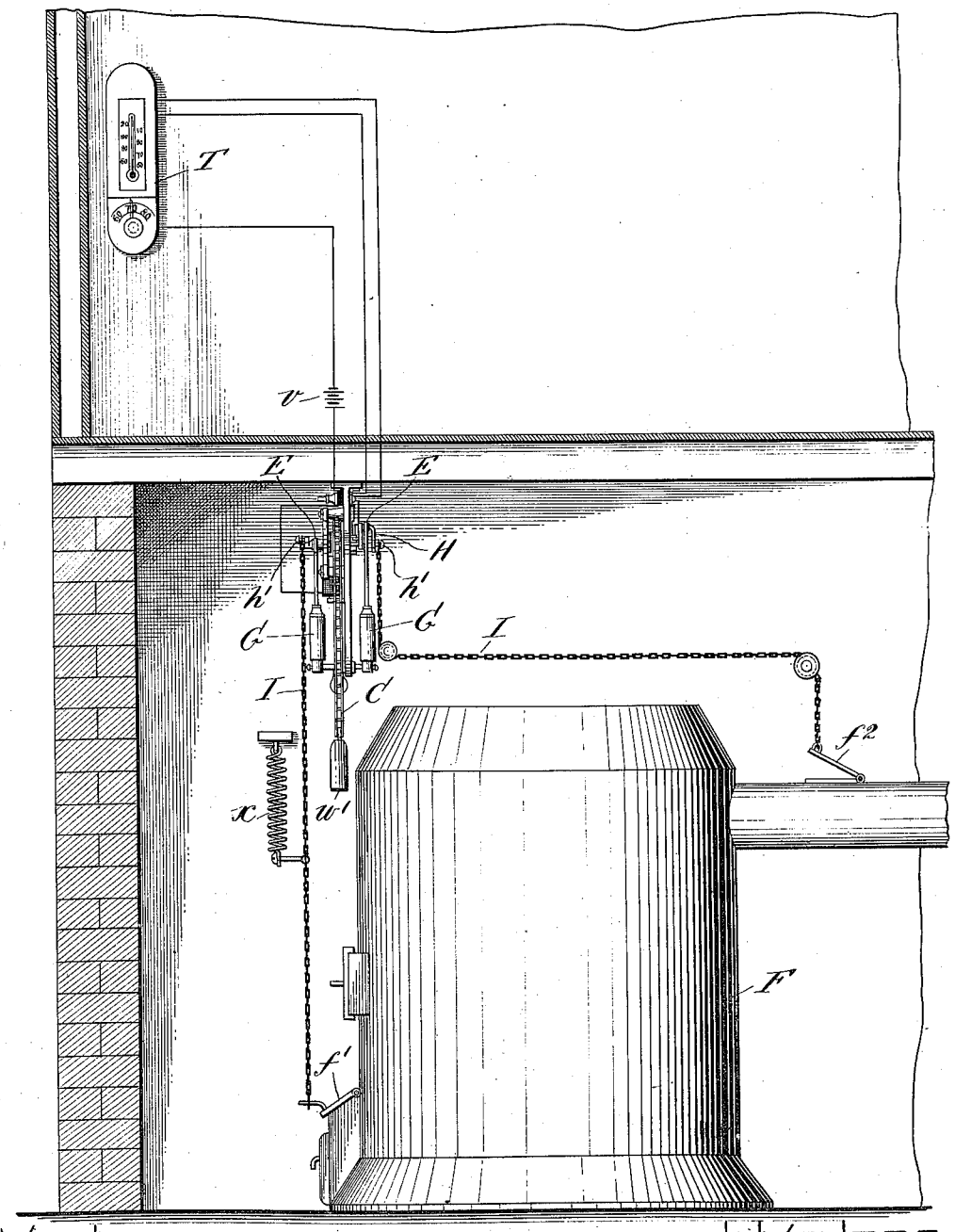

FIG. 4.

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UNITED STATES PATENT OFFICE.

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DAMPER-REGULATING APPARATUS.

965,569. Specification of Letters Patent. Patented July 26, 1910.

Application filed September 16, 1908. Serial No. 453,274.

To all whom it may concern:

Be it known that I, JOSEPH B. CRANDON, a citizen of the United States of America, and resident of North Walpole, in the county of Cheshire and State of New Hampshire, have invented certain Improvements in Damper-Regulating Apparatus, of which the following is a specification.

The invention relates to apparatus for automatically operating dampers or valves for regulating heat in buildings, in which a thermostat is adjusted to operate at a predetermined maximum and minimum degree of heat to close an electrical circuit which, acting through electrical apparatus, sets in operation mechanism which opens or closes the dampers or valves of heating apparatus.

Heretofore in apparatus of this character, a relatively strong current of electricity has been required to operate the releasing devices, and when released the damper operating devices make objectionable noise.

This invention consists in the improved construction of the releasing mechanism by which only a very small electric current is needed to operate the electrical release, and in the employment of devices by which the damper operating mechanism is caused to move slowly, steadily and without noise, thus obviating the two objectionable features above named.

In the drawings forming a part of this specification, Figure 1 is a front elevation of the apparatus which conveniently may be secured to a floor beam above the cellar; Fig. 2 is an elevation viewed from the right of Fig. 1; Fig. 3 is an elevation viewed from the side opposite to that shown in Fig. 1; Fig. 4 shows the apparatus connected with the dampers of a furnace in the cellar and the electrical wires connecting it with a thermostat in a room above.

Referring to the several parts of the apparatus by letters, A is a frame secured to a floor beam conveniently near to the furnace F and extending in a single plane from such fixed support. In a suitable bearing near one edge of the frame A is a shaft S, which extends through the frame, and upon one side of the frame carries a loose sprocket wheel W, the hub of which has ratchet teeth R which are engaged by a spring-controlled pawl P pivoted at p' to an escapement arm B, which is secured to the shaft S. A sprocket chain C passes over the wheel W and is provided at one end with a weight w' and at the other with a handle w^2. By pulling downward upon this handle the wheel W turns freely upon the shaft S, the pawl P riding over the ratchet teeth R, and the weight w' will be raised to a position for operating the dampers through the shaft S. The downward pull of the weight w' tends to turn the wheel W in the opposite direction, but independent movement of the wheel in this direction is prevented by the engagement with the ratchet R of the pawl P on the arm B, so that this wheel can turn only when the arm B is permitted to turn.

Upon either side of the frame A, a crank E is secured to the shaft S, at an angle of 90° to each other. Pivoted to the frame A below each of these cranks, is a cylinder G, each containing a piston, not seen, the rod g' of which, works through a packing in one end of the cylinder and is connected to one of the cranks E. These pistons are made a little smaller in diameter than the interior of the cylinders, so as to permit the passage of the liquid in the cylinder from one side to the other of the piston when it is moved up and down; but the space between the piston and cylinder is sufficiently constricted to cause the liquid to flow slowly by the piston when it is reciprocated; thus the device serves as a dashpot to regulate the speed of revolution of the shaft S, and give it a steady movement and also prevent the usual noise which occurs when the moving parts are stopped.

Outside of the connection of the piston rods g' with each of the cranks E, arms H are attached, and are arranged to extend diametrically of the shaft S upon opposite sides of the frame A. A pin or screw h' is provided in each arm H, and a chain I extends from each of these pins to the respective dampers f', f^2, of the furnace. Means are also provided for adjusting these pins h' in the arm H, radially in relation to the axis of the shaft S, so as to vary the extent of movement of the dampers in opening or closing, as may be desired.

Upon one side of the frame A a small electro-magnet M is secured, the spring controlled armature m' of which indirectly serves to hold and release the escapement arm B. Pivoted upon the same side of the frame A are also a series of latch or retaining levers L, l', l^2, each one of which has a

bearing upon one or more of the others, and the lever L has a bearing upon the end of arm B when in a horizontal position. The mutually impinging surfaces of the several levers are oppositely beveled or inclined, so that the resultant force of the pressure of one lever upon the other is largely in the direction of their length rather than at right angles thereto; consequently the friction of one lever upon the other is greatly reduced and therefore, the friction of the end of the lever l^2 which bears upon the end of the armature m' is small, and only a small current of electricity is required through the coils of the magnet M to pull down the armature and release that lever. For the purpose of returning the latch levers L, l', l^2, substantially to their normal position, that is, so as to catch the opposite end of the arm B as it is revolved by the action of the weight w' on the wheel W, counterweights n, n' are secured to the levers l', l^2, and a pin o projects from the lever L in the path of movement of the weight n.

In the room of the building where it is desired to regulate the temperature, a thermostat T is placed, and the two contact points, between which the thermotensile arm vibrates, are respectively electrically connected with spring contacts q, q', located upon opposite sides of the shaft S. The fixed end of the thermotensile arm is electrically connected through a battery U with one terminal of one of the coils of the magnet M, and one terminal of the other coil is electrically connected through the iron frame A with the shaft S, upon which is an eccentric projection, or pin, V, in a position between the two contact springs q, q', so that as the shaft S rotates, the pin V makes contact with first one spring and then the other, and puts it in circuit with the magnet M through the frame A, and also through the connecting wires with one or the other of the contact points of the thermostat, and in either case a circuit through the magnet M is completed, which will be closed as soon as the vibratory arm of the thermostat is moved against one or the other point. As soon as the magnet M is thus energized it will pull down its armature m' and release the lever l^2, which will permit the end of the escapement arm B to slide by the projecting end of the lever L, by reason of the pull of the weight w' upon the sprocket wheel W. Immediately that the end of the arm B has passed off the end of the lever L, the counterweight n will drop until its supporting rod rests upon the pin o on the lever L, thus moving the lever l' into a substantially horizontal position, and the weight n' will swing the lever l^2 to the right until it is in contact with the end of lever l', and the notch in the lower end of the lever l^2 is over the end of the armature m'. Meantime the rotation of the shaft S will move the pin V out of contact with the spring q', for example, the circuit through the magnet M will thus be opened and the armature m' released, and the spring which supports the armature will throw it up into the notch in the end of the lever l^2 which through the levers l', L, will arrest the arm B when its opposite end strikes the projecting end of the lever L, and hold the arm B until the circuit is again closed.

In case one of the dampers, f' for instance, is heavier than f^2, a spring x may be employed to counterbalance such extra weight (see Fig. 4).

In arranging the chain C upon the sprocket wheel W, it should be adjusted so that when the handle w^2 is raised into contact with the stop-guide a', the arm B will be in a substantially vertical position, and the pin V will not be in contact with either spring q or q', and consequently there will be no danger of exhausting the battery U to no purpose. It will be found convenient to have a thermometer at or near the thermostat, for the purpose of comparison.

The operation of the apparatus is substantially the same as that of several others in use, namely, as soon as the temperature at the thermostat rises above or falls below the predetermined limits at which the thermostat is set, the vibratory arm of the thermostat will move into contact with one of the contact points and close the electrical circuit through the battery, the magnet coils M, the pin V and one of the springs q, q', thereby causing the magnet M to draw down its armature m' and release the lever l^2, and thus by tripping the levers l', L, permit the weight w' to turn the wheel W, and with it the arm B, the cranks E and arms H, and through their connections by chains I, with the dampers f', f^2 reverse their positions, that is, open the one which was closed and close the one which was open; meantime while the arm B controlled by the dashpots G, G, is slowly and steadily making a half revolution, the counterweights n, n', will have returned the levers L, l', l^2, to their normal position, where they will intercept and stop the arm B as it moves up beneath the projecting end of the lever L; also the pin V will have made a half revolution and come into contact with the spring opposite to that with which it was in contact when the previous release occurred.

By constructing the frame so that it may be readily attached at one edge to a fixed support, and project at right angles thereto in a single plane, both economy and convenience are attained, for the frame may be cast as an integral structure, the driving shaft is extended through the frame and supported in a single bearing therein and the other operating parts combined with the

shaft may be conveniently and compactly disposed, a part upon one side of the frame and a part upon the other; thus each group serves to counterbalance the other, and the usual parallelepipedal form of frame is dispensed with; also the centrifugal friction brake or kindred forms of governing mechanism which have been heretofore employed in heat regulating apparatus have been ineffective and failed to obviate the very objectionable feature of noise in the operation of the dampers.

By the use of dash-pots, the piston-rods of which are directly attached to the damper operating cranks, the moving parts are operated as noiselessly as though carefully controlled by hand power.

I claim:

1. In a damper regulating apparatus, a thermostat, an electro-magnet in circuit therewith, a rotatable shaft provided with cranks respectively connected with the dampers to be operated, means to rotate the shaft, one or more dashpots combined with the cranks, an escapement arm upon said shaft, and a series of frictionally-engaging retaining levers between said arm and the armature of the magnet to engage the arm and hold the shaft from rotation while the electric circuit is open, and to release it when the circuit is closed.

2. In a damper regulating apparatus, a thermostat, an electro-magnet in circuit therewith, a rotatable shaft provided with means to alternately make and break the magnet circuit, cranks upon the shaft to operate the heat regulating dampers, means to rotate the shaft, means to regulate the speed of rotation of the shaft, an escapement arm thereon, a series of arm arresting latch-levers between said arm and the magnet armature, the mutually impinging portions of the several levers being provided with oppositely beveled surfaces.

3. In a damper operating apparatus, a thermostat, an electro-magnet in circuit therewith, a rotatable shaft, means thereon to alternately make and break the magnet circuit, cranks upon the shaft to operate the dampers, means to rotate the shaft, one or more dashpots to control the speed of the shaft, an arm upon the shaft, a series of latch-levers between said arm and the magnet armature to hold the arm from rotation when the circuit is open and to release it when the circuit is closed, and counterweights to return the latch-levers to normal position after the arm is released.

4. In a damper regulating apparatus, a thermostat, an electro-magnet in circuit therewith, a rotatable shaft provided with cranks respectively connected with the dampers to be operated, means to rotate the shaft, an escapement arm upon the shaft, a series of latch-levers between said arm and the armature of the magnet to engage the armature and said arm and hold the shaft from rotation while the electric circuit is open and to release it when the circuit is closed, and means to restore the latch-levers, automatically, to their normal position after the arm is released.

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