(No Model.)

L. F. EASTON.

ELECTRIC TEMPERATURE REGULATOR.

No. 430,633. Patented June 24, 1890.

Fig. 1.

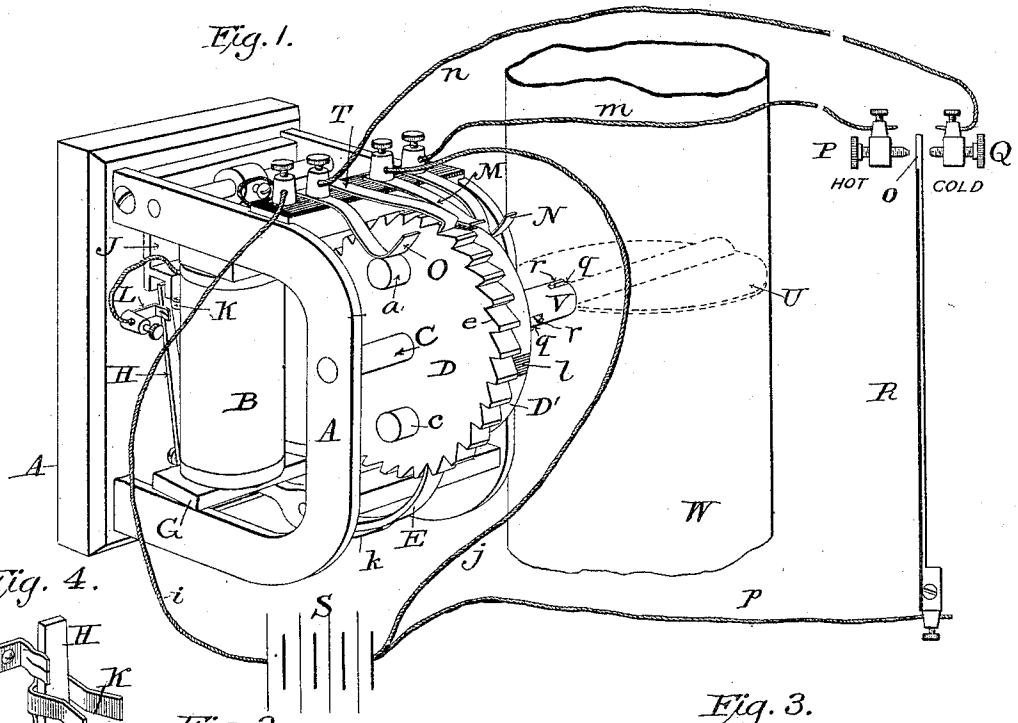


Fig. 4.

Fig. 2.

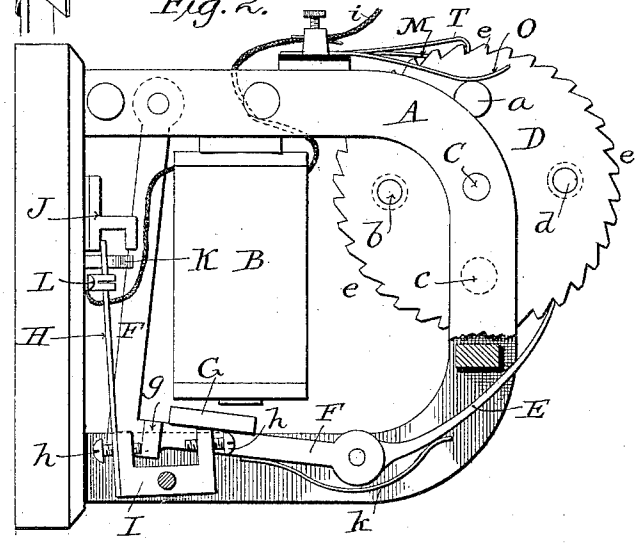
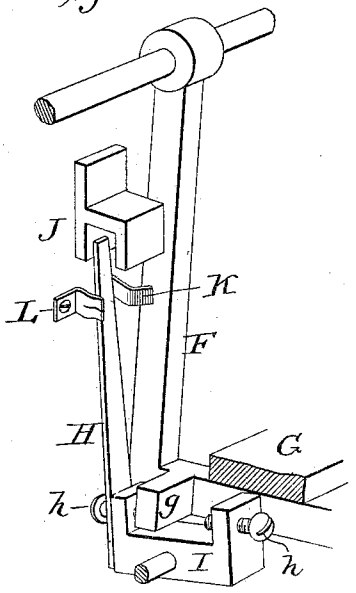


Fig. 3.



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UNITED STATES PATENT OFFICE.

LUCIEN F. EASTON, OF LA CROSSE, WISCONSIN.

ELECTRIC TEMPERATURE-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 430,633, dated June 24, 1890.

Application filed March 31, 1888. Serial No. 269,146. (No model.)

To all whom it may concern:

Be it known that I, LUCIEN F. EASTON, of La Crosse, in the county of La Crosse and State of Wisconsin, have invented certain new and useful Improvements in Electric Temperature-Regulators, of which the following is a specification.

My invention relates to mechanism for controlling dampers, valves, ventilators, and the like; and it consists in a novel construction of the actuating-electromotor and the connection through which it gives motion to the valve, damper, or other device.

In the drawings hereto annexed, Figure 1 is a perspective view of the apparatus complete, as applied to control a damper or butterfly-valve; Fig. 2, a side elevation of the motor, the frame being partially broken away to show the working parts; Fig. 3, a perspective view of the device by which the circuit is alternately completed and destroyed, to cause the vibration of the armature of the motor. Fig. 4 is a detail.

The motor employed is of that well-known type in which an armature is alternately attracted and released by an electro-magnet included in a circuit which is alternately closed and broken, to cause such attraction and release of the armature, and the invention is designed to render certain the action of the circuit-closer.

A indicates a frame, of metal or other suitable material, which may be varied in form as desired, and in which is mounted in a fixed position an electro-magnet B.

C indicates a shaft, journaled in frame A or in or upon bearings carried thereby, and provided with a combined ratchet and contact or circuit wheel D D′, from opposite faces of which project studs or blocks *a*, *c*, *b*, and *d*. Rotary motion is given to this wheel, always in the same direction, by means of a pawl or dog E, which alternately engages with and rides back over the teeth *e* of said wheel, being carried by a vibrating or oscillating lever F, which lever is preferably hung from its upper end so as to swing like a pendulum, and carries an armature G of soft iron, which moves to and fro within the attractive field of the magnet. The lever F is of L shape, and, owing to the location of the armature upon its shorter arm, and to the added weight of the dog or pawl E at the outer end of said arm, it swings back of its own weight far enough to carry the dog back over a tooth (one or more) of the wheel D D′, and to move the armature some distance from the core or cores of the electro-magnet. When, therefore, the magnet is energized and the armature attracted, the lever is drawn forward, and its dog or pawl, acting against a tooth of the wheel, carries said wheel forward, such forward motion continuing until the lever reaches a stop or until the magnet is rendered inactive by interruption of the circuit. The completion and interruption of the circuit are effected by a swinging arm H, carried by an oscillating yoke I, between the two arms of which yoke plays a lug *g*, projecting from the lever F, as shown in Fig. 2. As the lever F completes its movement in either direction the lug *g* comes into contact with one or the other arm of yoke I, or with one or the other of two screws *h*, each passing through an arm of the yoke, and rocks the yoke upon its pivot, thereby moving arm H. The free end of the arm H plays between two walls of a recessed block J, by which wall its movement in either direction is limited, it being apparent, however, that any other form of stop device may be employed.

K indicates a spring-plate arranged to bear against the side or edge of the arm H, its face being inclined both ways from a medial point, so that as the arm H passes said point the plate will move forward and prevent the return of the arm until force is exerted sufficient to press back the spring-plate. This plate K may be made with a single leaf, as in Fig. 3, or with two leaves, as in Fig. 4, the latter being advantageous only in the event of the arm H becoming sufficiently loose to swing away from the leaf at one side, which is not likely to happen.

S indicates a galvanic battery, or it may be any other known source of electricity, though a battery is best suited to the particular use herein referred to. One pole of said battery or generator is connected by a wire or conductor *i* with one of the helices of the electro-magnet B, the other end of which helix is connected with a spring-finger L. This finger L is arranged in such position that when lever F moves back, and in so

moving acts upon yoke I, the arm H shall make contact with said finger, such contact continuing until the lever F again advances to near the limit of its forward movement, when it acts upon yoke I and moves arm H out of contact with finger L, the arm H being held thus out of contact by the spring-plate K until the lever F in completing its next backward movement again acts upon the yoke and again carries arm I into contact with spring-finger L. The circuit is completed from spring-finger L through arm H, yoke I, lug *g*, lever F, dog E, wheel D D′, to a contact-spring M, which is insulated from frame A, bears upon wheel D D′, and is connected by a wire or conductor *j* with the second pole of the battery or generator, as illustrated in Fig. 1, the dog E being kept always in contact with the wheel D D′ by a spring *k*. The circuit-wheel D D′ is formed with alternate conducting and non-conducting portions, (or it may be merely cut away between the conducting portions,) so that at certain points in the revolution of the wheel the contact-spring will not bear upon a conducting portion thereof, and the circuit will consequently be interrupted. Such breaks or interruptions are not required where a continuous rotation is desired, but are provided for the purpose of arresting the motion of the wheel when a given result is attained.

In the drawings I have represented four insulated portions *l*, arranged at regular intervals about the circumference of the wheel, or ninety degrees from center to center, the device being shown in shape for imparting a quarter-turn to a common butterfly-valve or damper; but this is only one of various arrangements that may be adopted.

The insulating-blocks *l* are in line with the four lugs or studs *a b c d*, and at opposite sides of wheel D D′ are two spring-fingers N and O, the bearing points or faces of which are in line with the bearing-face of spring-finger M, from which it follows that whenever one of the insulated portions *l* of the wheel is beneath finger M one of the studs *a*, *b*, *c*, or *d* will be in contact with one or the other of the spring-fingers N O.

From the finger N a wire or conductor *m* passes to an adjustable contact-point P, and from finger O a like wire or conductor *n* passes to an adjustable contact-point Q, between which two points plays the extended metal bar *o* of a bimetallic or other composite bar R, such as are commonly employed in thermostats, and which will bend toward one or the other of the points N O under variations of temperature. Finally, a wire or conductor *p* connects bar *o* of the thermostat with a pole of the battery or generator S. The contact-point P is so set or adjusted relatively to the bar *o* of the thermostat that contact shall be made between them when the desired heat is reached, and contact-point Q is similarly adjusted for the desired lowest limit of temperature, said points being preferably made in the form of screws to facilitate adjustment.

W indicates a pipe—as, for instance, the smoke-pipe of a furnace—and U a damper or valve therein, the stem of which is connected with shaft C of the motor. To facilitate such connection and enable it to be made without difficulty or nice alignment, I provide a clamping sleeve or thimble V, somewhat larger in internal diameter than the shaft or the damper-spindle, furnished at each end with slots *q*, those at one end being at right angles to or alternately with those at the other end. These slots receive through-pins *r*, carried by the shaft and the damper-spindle, respectively, and while connecting said parts and insuring their rotation in unison permit a considerable deviation from true alignment—a matter of considerable importance in the practical use and general adoption of the apparatus.

Assuming the parts to be in the positions indicated in Fig. 1—that is to say, with the finger M resting upon one of the insulated portions *l* of wheel D D′, the finger O in contact with stud *a* of said wheel, and the valve or damper closed, so that the fire may burn but little and cause a fall of temperature—the action will be as follows: The bar R of the thermostat answering to a fall in temperature and moving toward contact-point Q will make contact therewith as soon as the predetermined point of fall is reached, causing a circuit to be completed from battery S by conductor *i* to the helix of electro-magnet B, thence by plate L, arm H, yoke I, stud *g*, lever F, dog E, wheel D D′, stud *a*, finger O, conductor *n*, point Q, arm R, and conductor *p* back to battery S. The circuit being thus completed or closed, the electro-magnet attracts the armature and causes the dog E to advance the wheel one tooth, the circuit being broken at the end of such advance by the shifting of arm I out of contact with plate L. When such break occurs, the lever F swings back, carrying dog E with it, the dog engaging a fresh tooth of the wheel preparatory to another advance, and the lever in swinging back throws arm I again into contact with plate L, thus again completing the circuit and causing the lever and dog again to advance. As the wheel rotates, and by the time it has advanced a distance of one or two teeth, the stud *a* rides off the finger O and destroys the path through the thermostat; but at the instant that this path is destroyed, or just before, a short circuit is perfected by reason of the insulated block *l* being carried from beneath finger M and permitting said finger to bear directly upon the conducting body of wheel D D′. It will thus be seen that after the circuit is once completed by the thermostat, if only for a moment, a short path is established for the current around or independent of the thermostat, and this is quite important, because in the advance thereof the thermostat, if subjected suddenly to a draft of cold air, as from an open

door or window, might interrupt the circuit and leave the valve or damper only partially moved and the motor in such condition that it could not again operate unless adjusted by hand.

The operation just described would cause the valve or damper to be opened, the wheel making a quarter-revolution and then coming to rest by reason of interruption of the circuit through the arrival of an insulated section *l* beneath finger M. Each half-revolution will carry one of the studs *a* or *c* into contact with finger O and each intermediate quarter-revolution will carry one of the studs *b* or *d* into contact with finger N, the studs *a b c d* being placed alternately on opposite sides of wheel D D′.

The opening of the valve and consequent freer burning of the fire, by rise of temperature, will result in the movement of arm R to point P and the current will be as before, except that from wheel D D′ it will pass by lug *b* to finger N, thence by wire *m* to point P, to strip *o* of bar R, and thence by wire *p* to battery, the mechanical operation being the same as just described. A detent T prevents backward rotation of the wheel.

It is apparent that any well-known form of thermostat may be used—as, for instance, a mercury-column, a balanced thermometer, or the like; and while I prefer the compound bar I do not mean to be understood as restricting myself in any of my claims to its use.

The lever F may be arranged in any desired position and furnished with a spring or counter-weight, if necessary, to retract it.

Having thus described my invention, what I claim is—

1. The combination, with the valve, damper, or like device, and with a thermostatic circuit-closer and battery or electric generator, of a motor consisting of an electro-magnet, a lever provided with an armature movable within the field of the magnet, a dog carried by the lever, a circuit-wheel actuated by said dog and provided with alternate conducting and non-conducting portions and with projecting lugs or studs, a circuit-closer arranged in the path of the lever and actuated thereby to altenately open and close the circuit, conducting-fingers connected with opposite contact-points of the thermostatic circuit-closer and arranged in the paths of the projecting studs of the circuit-wheel, a contact-finger connected with a pole of the battery and arranged to bear upon the circuit-wheel, and electric conductors connecting one pole of the battery or generator with the thermostat and with the contact-finger which bears upon the circuit-wheel and connecting the other pole with the helix of the electro-magnet.

2. The herein-described motor, consisting of electro-magnet B, lever F, provided with dog E, armature G and lug *g*, yoke I, arm H, carried by said yoke, contact-plate L in electrical connection with the helix of the magnet, ratchet-wheel D, finger M, arranged to bear upon said wheel, and a battery or generator having its poles connected with the helix of the magnet and with the finger M, respectively.

3. In a motor of the class described and shown, the combination, with the oscillating lever F, having lug *g*, of the circuit-closer, consisting of yoke I, arm H, spring-detent K, and contact-plate L.

In witness whereof I hereunto set my hand in the presence of two witnesses.

LUCIEN F. EASTON.

Witnesses:
W. E. LOCKERBY,
T. PEUNT.