(No Model.) 2 Sheets—Sheet 1.

W. A. CONNELLY.

AUTOMATIC ELECTRIC HEAT REGULATOR.

No. 391,783. Patented Oct. 30, 1888.

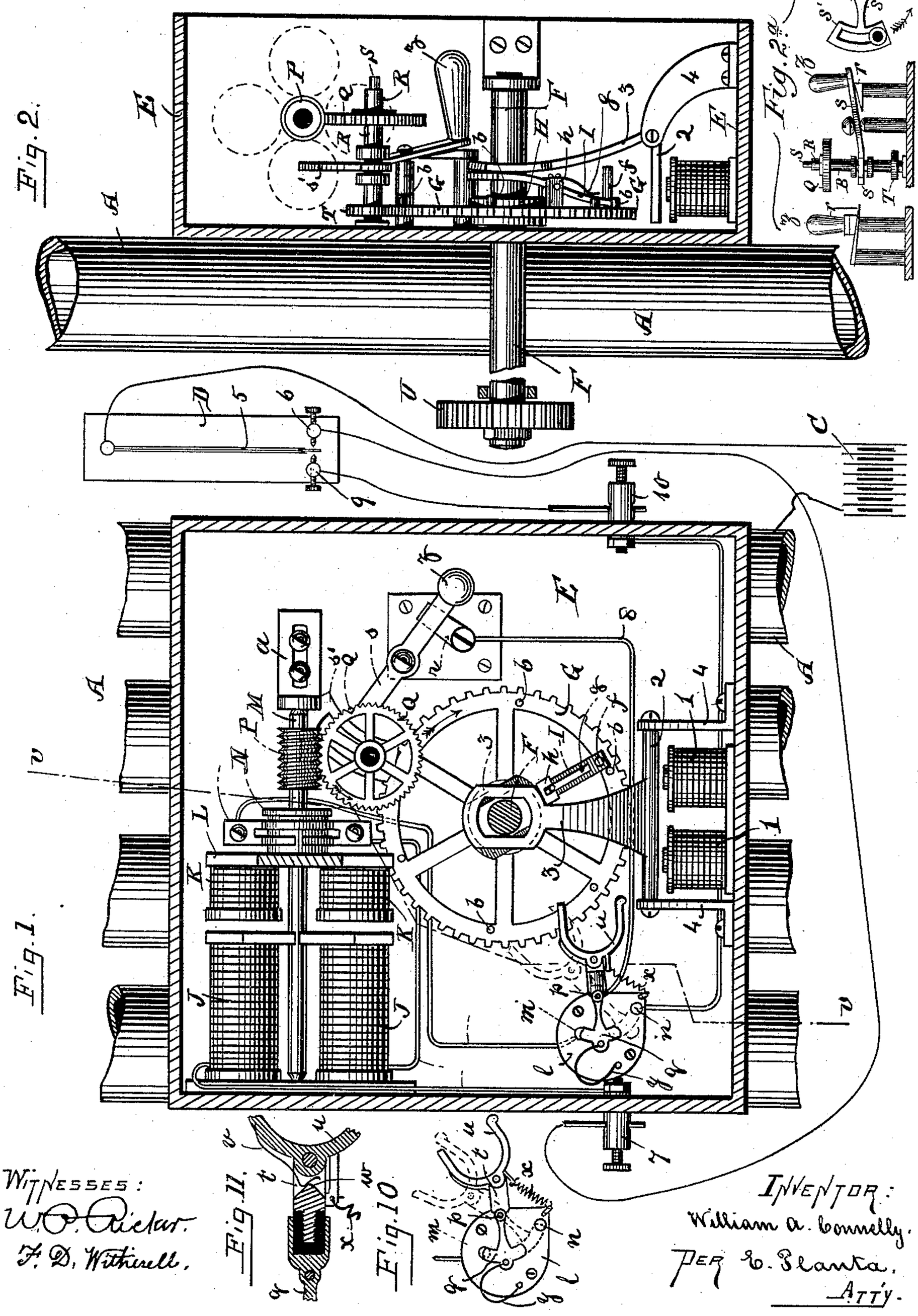

Fig. 1.

Fig. 2.

Fig. 2a.

Fig. 11.

Fig. 10.

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(No Model.) 2 Sheets—Sheet 2.

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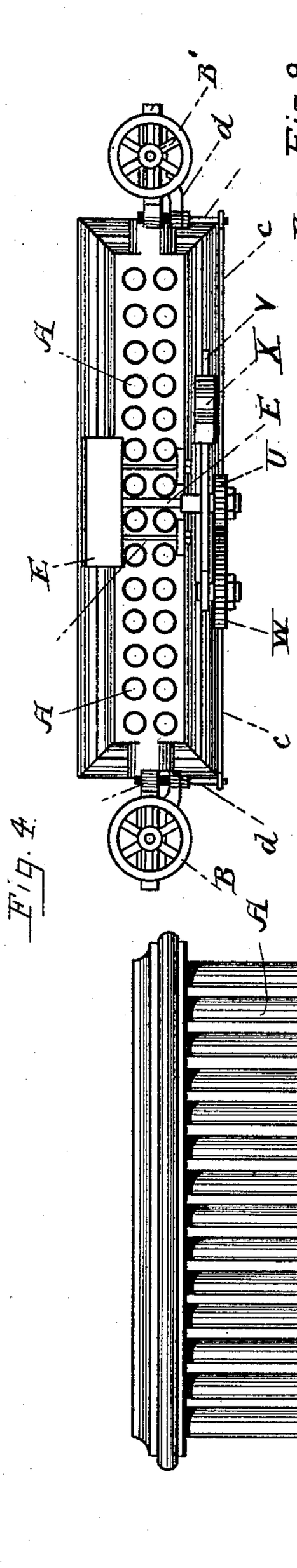

Fig. 4.

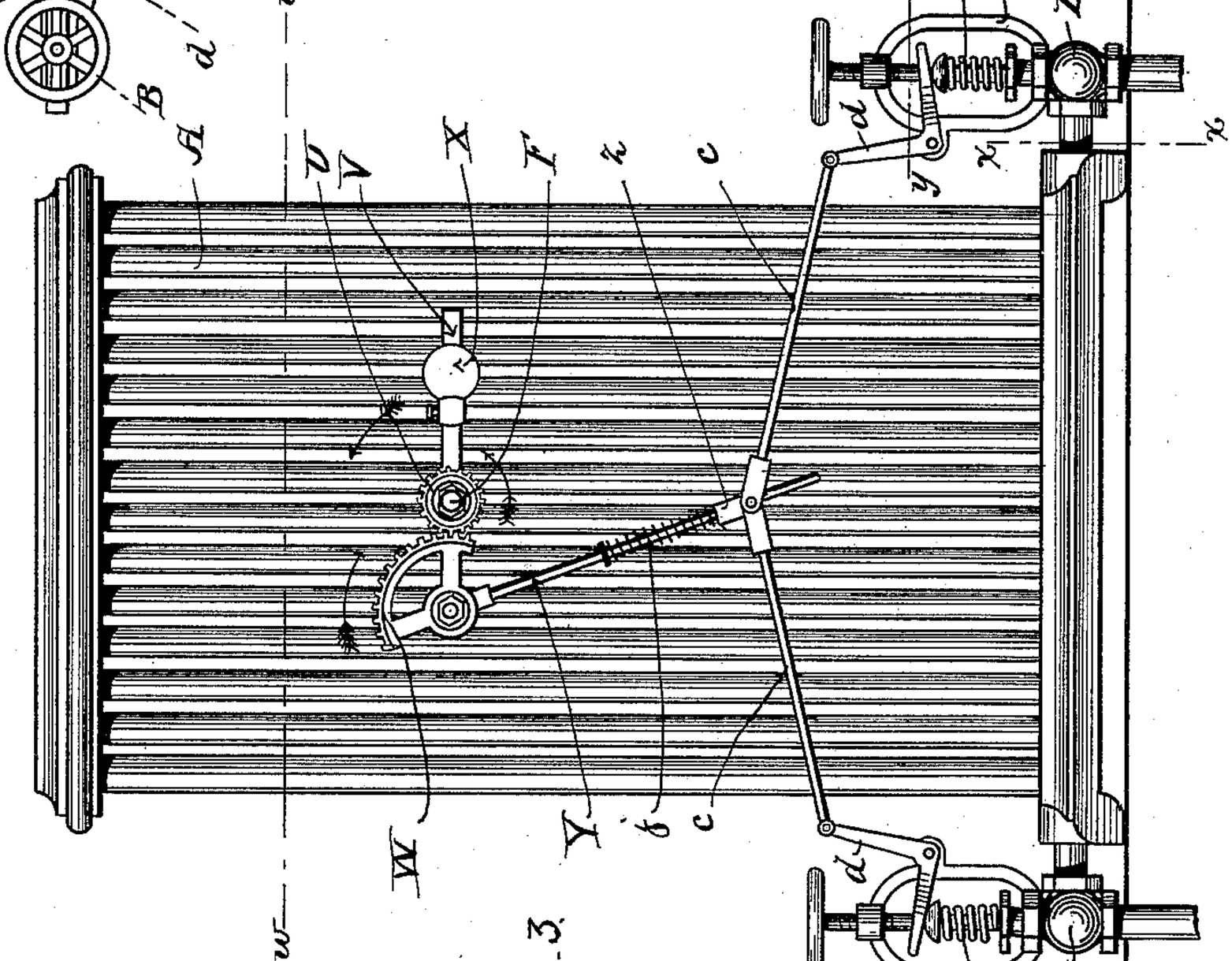

Fig. 3.

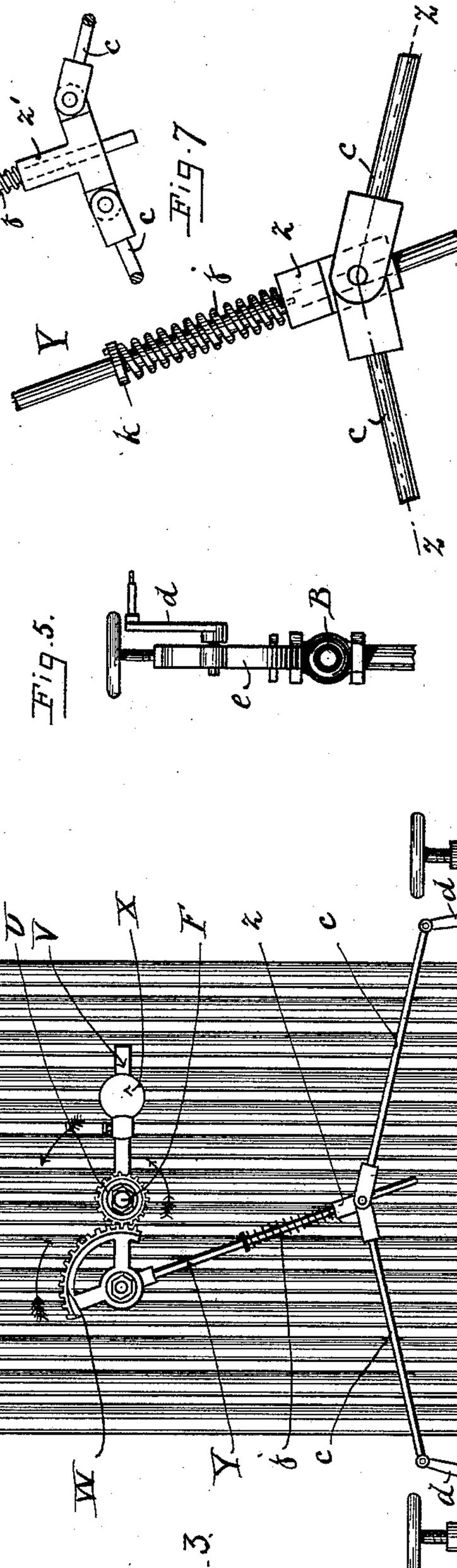

Fig. 9.

Fig. 7

Fig. 5.

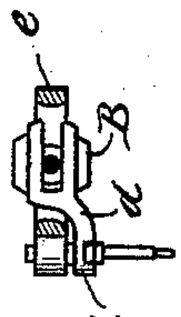

Fig. 6

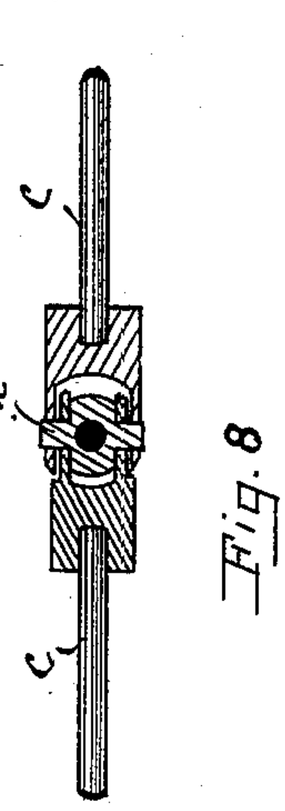

Fig. 8

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UNITED STATES PATENT OFFICE.

WILLIAM A. CONNELLY, OF BOSTON, ASSIGNOR OF ONE-HALF TO JOHN BUCKLEY, OF SOUTH BOSTON, MASSACHUSETTS.

AUTOMATIC ELECTRIC HEAT-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 391,783, dated October 30, 1888.

Application filed March 19, 1888. Serial No. 267,596. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM A. CONNELLY, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented a new and useful Improvement in Heat-Regulating Apparatus, of which the following is a specification.

The object of my invention is to produce a device for automatically regulating the valves of a radiator employed for heating a room or other place, so as to maintain an even temperature, or for the regulation of dampers or ventilators.

The invention consists of certain details of construction, as hereinafter fully set forth, and pointed out in the claims.

Figure 1 represents a front view, partly in section, of a device embodying my invention secured to the pipes of a radiator. Fig. 2 is a vertical transverse section taken on the line *v v* of Fig. 1. Fig. 2ª represents an end view, side view, and plan, respectively, of the switch for throwing the worm-wheel into or out of gear with the worm on the driving-shaft. Fig. 3 represents the rear of a radiator with the device applied thereto. Fig. 4 is a horizontal section taken on the line *w w* of Fig. 3. Figs. 5 to 11 are detail views of various parts.

A represents a radiator; B B′, the supply and return valves; C, a battery, and D a thermostat.

E is a casing secured to the pipes of the radiator A by means of clamps, and F is a shaft that passes through the casing and extends beyond the rear of the radiator. Upon this shaft F is mounted, but so as to revolve independently of the shaft, a cog-wheel, G, provided near its edge with a series of pins, *b*, and upon the shaft is also mounted a plate, H, provided at its lower end with ears *h*, in which is pivoted a pawl, I, the tail of which is held in contact with the face of wheel G by a spring, *g*. This end of the pawl is provided with a pin or stud, *f*. When the wheel G is caused to revolve, the shaft F is carried with it by one of the pins *b* coming into contact with the end of the pawl I. A motor, preferably consisting of two field-magnets, J, and an armature consisting of four spools, K, is mounted upon a plate, L, which is secured to a shaft, M. Upon this shaft are also mounted a commutator, N, and a worm, P. The shaft M is journaled at one end in the casing E, and at the other end in an adjustable bearing, *a*, and is caused to rotate by the action of the electric current in the magnets. The worm P is in gear with a worm-wheel, Q, mounted upon a sleeve, R, supported upon a shaft or pin, S, secured to the back of the casing E. On the sleeve R is also mounted a pinion, T, which is in gear with the cog-wheel G.

On the end of the shaft F that extends to the rear of the radiator is secured a pinion, U, (see Fig. 3,) and an arm, V, is also fulcrumed upon the shaft. On one end of arm V is mounted a cog-segment, W, that is in gear with the pinion U. The other end of the arm is provided with an adjustable weight, X, the number of teeth in the segment W being about double the number of teeth in the pinion U. Connected to the cog-segment W is a rod, Y, the lower end of which passes through a block, Z, which forms the fulcrum of a toggle-joint formed by rods *c c*, the outer ends of which are connected to bell-crank levers *d d*, that operate the valves B B′. These bell-crank levers are fulcrumed on the yoke *e* of the valve, (see Fig. 5, which is a section taken on line *x x* of Fig. 3,) and the end is bent in and forked to fit around the valve-stem, as shown in Fig. 6, which is a section taken on line *y y* of Fig. 3, a spring, *i*, being placed around each of the valve-stems to assist in opening the valves.

The block Z and ends of the rods *c c* are connected together, as shown in enlarged view in Fig. 7, which is a side view, and in Fig. 8, which is a section taken on line Z Z of Fig. 9, and to compensate for the expansion and contraction of the rods, so as to keep the valves firmly seated, I place around the rod Y a spiral spring, *j*, which is kept from sliding upward by a washer, *k*, secured to the rod Y.

Instead of connecting the rods, as above described, a block, Z′, of T form might be employed, as shown in Fig. 9.

In the casing E is secured a switch-plate, *l*, of wood or other non-conducting material, (also shown detached in Fig. 10,) provided with two contact-points, *m n*, the fulcrum *p* of the switch-bar *q* forming a third, the point *m* connecting with the motor, the point *n* connecting with the electric magnets 1 1, and the

point *p* with the insulated plate *r* of another switch, *s*. The switch-bar *q* consists of a piece of metal fulcrumed on the post *p*, one end of the bar being made T-shaped to make the connections with the points *m n*. The other end is formed hollow, in which is inserted a block of rubber or other insulating material, into which is secured an eye, *t*, to which is hinged a hook, *u*, provided with a spring, *v*, (see Fig. 11,) at the back, the end of which rests upon the projection or point *w*, to retain the hook in the various positions to which it is moved. A compensating-spring, *x*, is secured to a small projection on the hook and to the plate *l*, and another compensating-spring, *y*, is held at one end to the end of the switch-bar *q* by being slipped over a pin, on which it is free to turn, and at its other end it is held to the plate *l* by a pin in like manner. The object of the spring *y* is to complete the throw of the switch-bar *q* and to maintain the contact in its required positions. The spring *x* is to draw the fork into a straight position when the switch-bar is in contact with the point *n*.

The switch *s* consists of a bar provided at one end with a slotted segment, *s'*, set on a skew, which fits in a groove in the sleeve R, so that when the switch-bar is moved one way or the other by the handle *z* it will move the sleeve R one way or the other, thus throwing the gear T into or out of gear with the wheel G, and makes or breaks the electric circuit by contact with the plate *i*.

1 1 are electric magnets secured to the casing. Above these magnets is an armature, 2, pivoted in bearings 4 4. To the armature is connected a lever, 3, the upper end of which is in contact with the upper end of the pawl I.

The operation is as follows: The valves being in their normal position open, as shown, steam or hot water passing through the radiator raises the temperature of the room or apartment to the point required when the composite strip 5 of the thermostat is drawn over into contact with the point 6, when the electric current from the battery C will pass through the thermostat to the binding-point 7, which is insulated from the casing E, and thence to and through the motor, causing it to revolve, and thence to the switch at the point *m*, the switch being in its normal position, as shown in Fig. 1. Then it passes through the switch-bar *q* and fulcrum-post *p* to the wire 8, that connects with the insulated plate *r*, and grounds through the switch *s* the body of the case E and pipes of the radiator A, which are used as a return-circuit. As the motor revolves, the worm P turns the worm-wheel Q, and, through sleeve R and pinion T, communicates motion to the wheel G, which as it revolves causes the pawl I (by means of the pin *b*) to rotate with it until the pin *f* on the pawl comes into contact with one of the prongs of the fork *u* and throws it over to the position shown in full lines in Fig. 10. The wheel continues to revolve and makes a complete revolution, when the pin *f* on the pawl I will strike the other arm of the fork and throw it over to the position shown in dotted lines in Fig. 10, which moves the switch-bar *q* into contact with the point *n* and throws it out of contact with the point *m*, thereby breaking the circuit and stopping the motor. The revolution of the wheel G, turning the shaft F, causes the segment W to be forced down by the pinion U, and as the segment is thus forced down the two arms *c c* of the toggle-joint are forced outward and operate the bell-cranks *d*, thus closing the valves. When the temperature of the room falls below the required point, then the tongue of the thermostat D makes contact with the point 9, and the electric current passes to the insulated binding-post 10, thence to the electro-magnets 1 and to the post *n*, from which it passes through the switch-bar *q* to the post *p*, and by wire 8 to the plate *r*, thence through switch *s* to the body of the casing, as before described. As the current passes through the magnets 1 1, they draw down the armature 2, connected to lever 3, which forces in the upper end of the pawl I and raises it from contact with the pin *b* on the wheel G, which is loose on the shaft F, so that the shaft F is free to revolve in the reverse direction and return to its original position, thereby opening the valves by the action of the counter-weight X. As the shaft revolves, it carries the pawl I with it, and as the pawl revolves it strikes the opposite side of the prong of the fork and causes the switch to be thrown into its original position in contact with the point *m*.

In case of failure of the apparatus to work, the circuit can be broken by means of the switch *s* being turned by the hand so as to throw the pinion T out of gear with the wheel G, and the valves B B' can then be operated by hand in the ordinary manner.

Although I have shown and described the apparatus as applied to a radiator, it can be applied to any system of valves or dampers to regulate the temperature of a room or other place.

What I claim as my invention is—

1. In a heat-regulating apparatus, a shaft, F, provided on its outer end with a pinion, U, and arm V, carrying weight X, and cog-segment W, to which is secured a rod, *y*, the block Z, rods *c c*, and bell-crank levers *d d*, in combination with an electric motor and gears for imparting motion to the shaft F, substantially as shown and described.

2. In a heat-regulating apparatus, the pawl I, mounted on a plate, H, secured to the shaft F, in combination with the wheel G, provided with pins *b*, pinion T, sleeve R, worm-wheel Q, and worm P, mounted upon shaft M, to which a rotary motion is imparted by an electric motor, substantially as shown, and for the purposes described.

3. The electro-magnets 1 1, armature 2, and lever 3, in combination with the pawl I, wheel

G, shaft F, arm V, and weight X, substantially as shown, and for the purposes described.

4. The switch *q*, fulcrumed at *p*, and provided at its outer end with a fork, *u*, in combination with a pawl, I, and wheel G, whereby the latter is free to make about one and a quarter revolution before the switch is thrown, substantially as shown and described.

5. In a heat-regulating apparatus, a shaft provided with a pinion in gear with a toothed segment mounted upon a weighted arm and connected by a rod to two rods that form a toggle-joint, and bell-crank levers, in combination with an electric motor and gears for imparting a rotary motion to the shaft and operating the valves, substantially as shown and described.

6. In a heat-regulating apparatus, a wheel provided with pins and a plate carrying a pawl, the wheel being mounted loosely upon and the plate rigidly secured to the operating-shaft, in combination with an electric motor and gears for closing the valves and throwing the switch over in one direction, thereby stopping the motor, and electric magnets, armature, and lever for releasing the pawl, thereby allowing the shaft to be turned by a weighted lever and gears, so that the valves will open and the switch be thrown in the other direction, substantially as shown and described.

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

WILLIAM A. CONNELLY.

Witnesses:

CHAS. STEERE,

E. PLANTA.