(No Model.) 2 Sheets—Sheet 1.

D. W. THOMPSON.

COMMUTATING DEVICE.

No. 401,801. Patented Apr. 23, 1889.

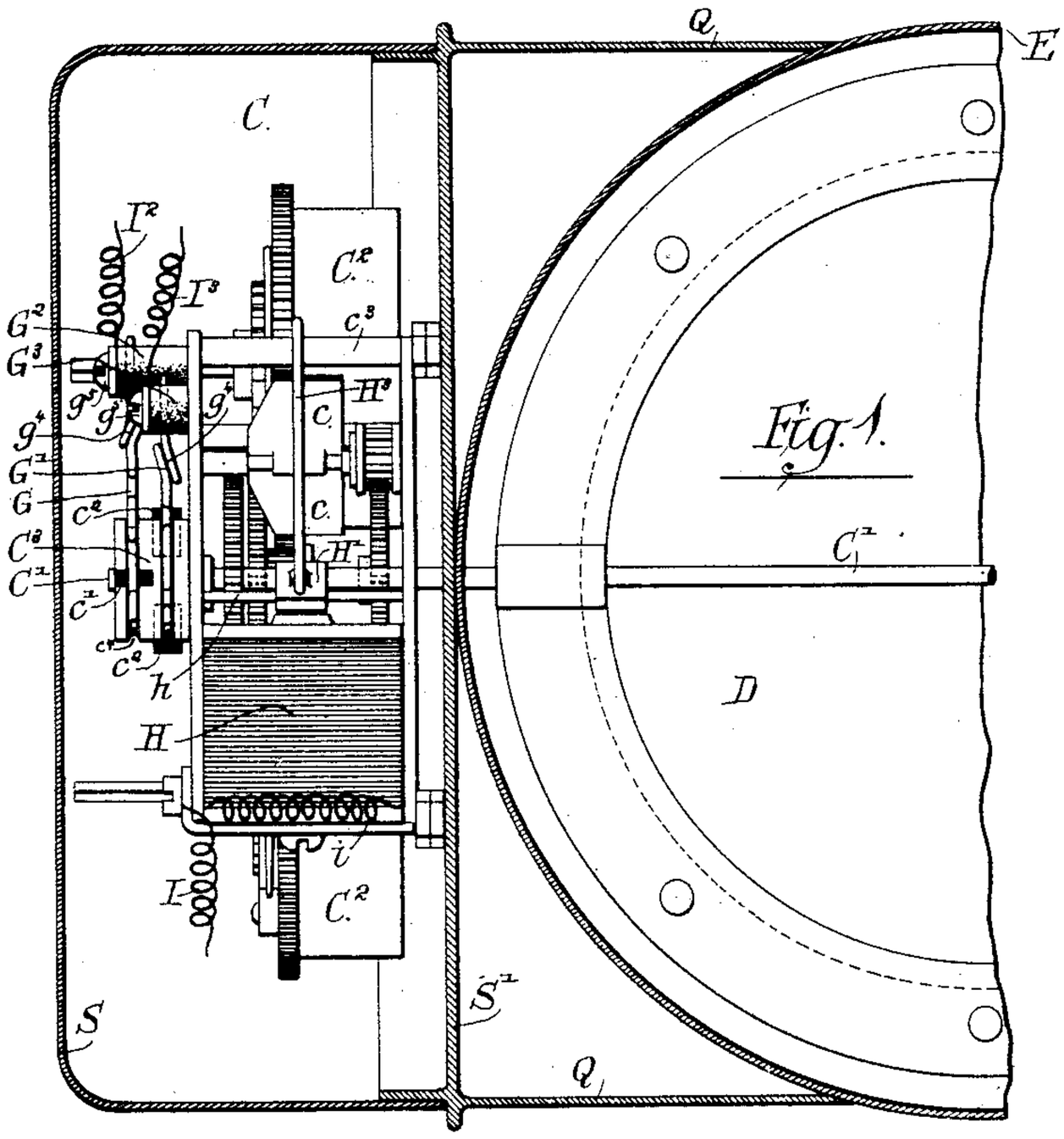
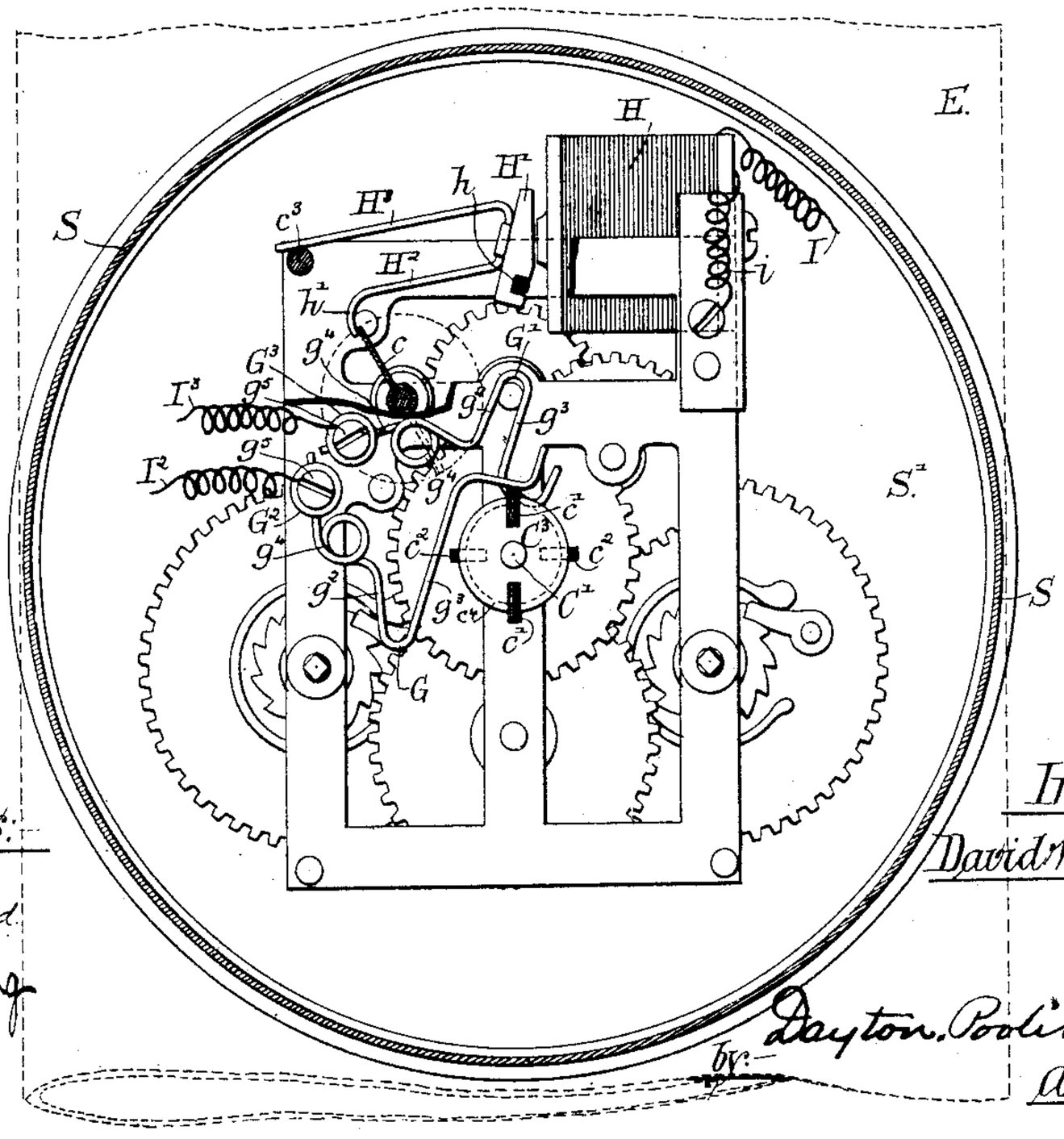


Fig. 1.

Fig. 2.



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(No Model.)

2 Sheets—Sheet 2.

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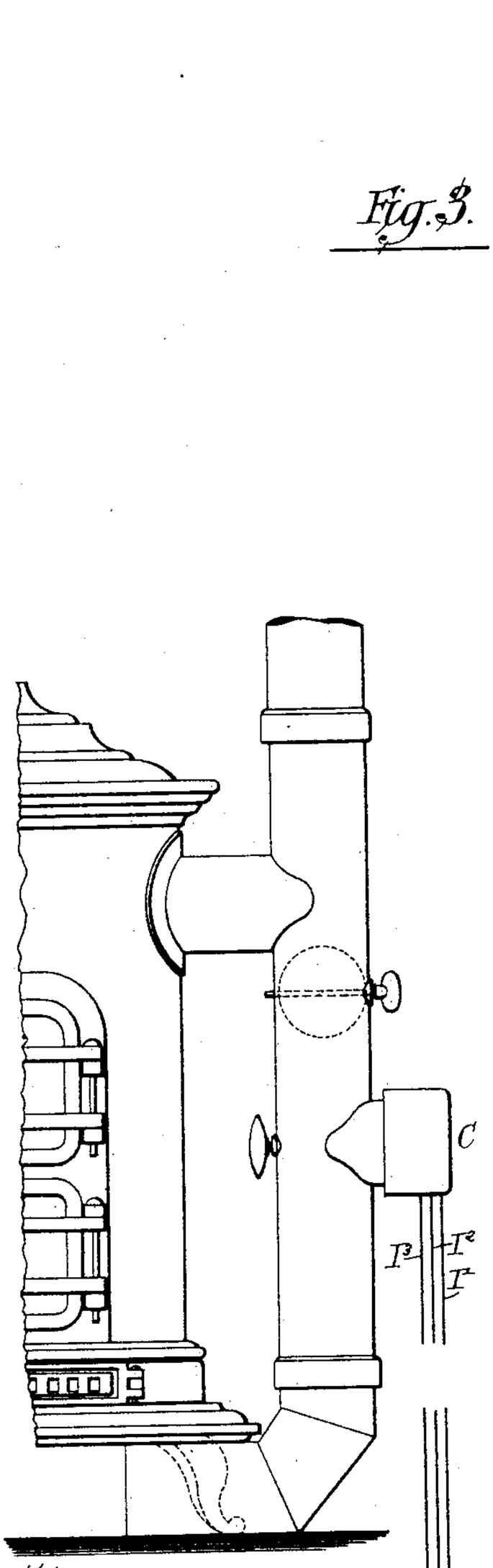
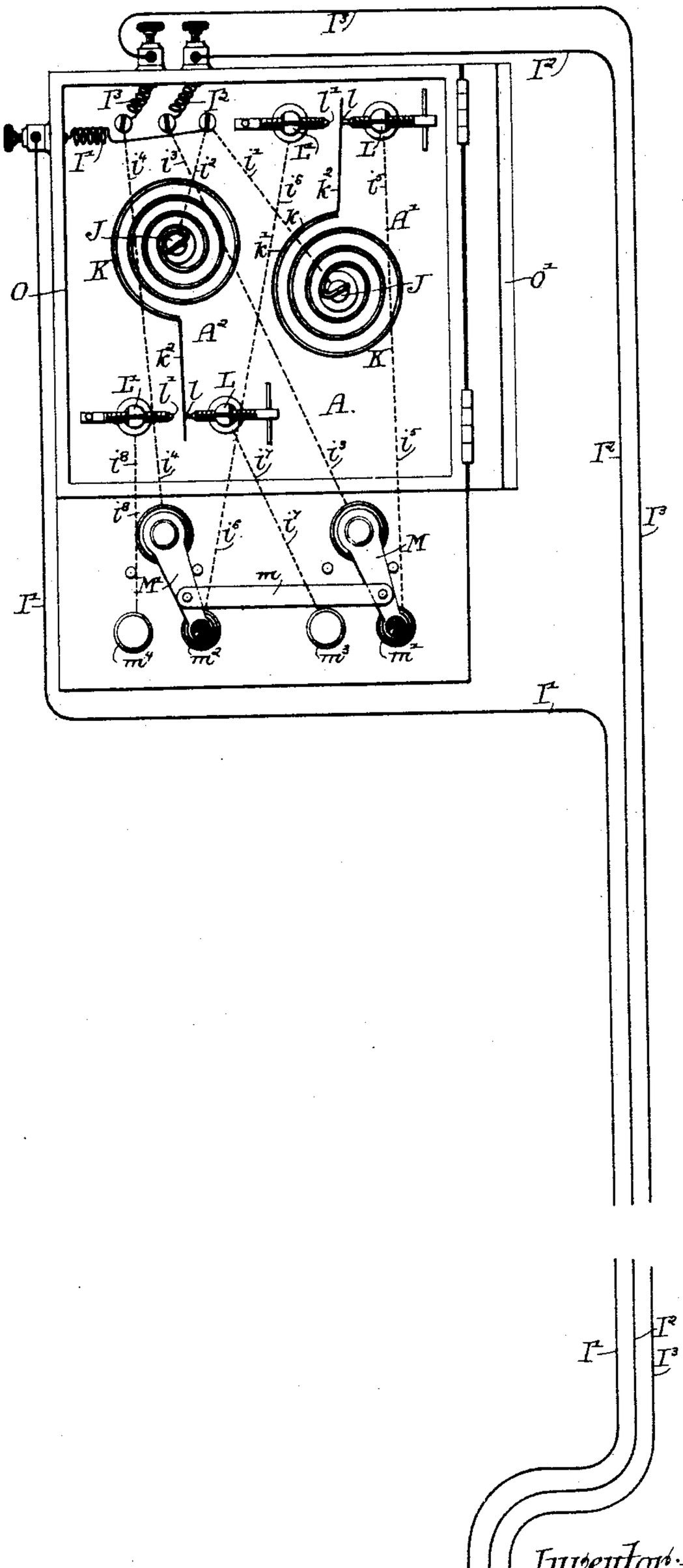
Fig. 3.





Witnesses:-
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Inventor:-
David W. Thompson.
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UNITED STATES PATENT OFFICE.

DAVID W. THOMPSON, OF ENGLEWOOD, ILLINOIS.

COMMUTATING DEVICE.

SPECIFICATION forming part of Letters Patent No. 401,801, dated April 23, 1889.

Application filed May 29, 1888. Serial No. 275,498. (No model.)

To all whom it may concern:

Be it known that I, DAVID W. THOMPSON, of Englewood, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Commutating Devices; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in commutators and brushes, more especially intended for use in temperature-regulating apparatus of that class embracing a valve or damper, the opening or closing of which affects the temperature of a room or apartment, a motor actuating the said valve or damper, a thermostat, and electrical connections between the thermostat and the motor, whereby the latter is controlled from the former.

The invention consists in the matters hereinafter described, and pointed out in the appended claims.

In the accompanying drawings illustrating my invention, Figure 1 illustrates, in sectional plan view taken through a smoke-pipe and motor-case, the several novel features comprising the invention. Fig. 2 is a face view of the motor with the cover of the case removed. Fig. 3 is a diagram illustrating a thermostat and circuits connecting the same with the motor.

As illustrated in the said drawings, C indicates, as a whole, the motor; D, the valve, which is actuated by the motor; E, the pipe in which the valve is placed. The motor C is provided with a shaft, C′, which extends through the pipe E and supports the valve D, which in this instance is a simple disk or butterfly-valve. The said motor consists of an ordinary clock-work driven by coiled actuating-springs C^2 C^2 and provided with a regulating-fan, *c*. Upon the shaft C of the motor is mounted a cylindric commutator or distributer, C^3, consisting of a cylindric block of metal provided with insulating blocks or sections c' c' c^2 c^2. The insulating-sections c' c' are arranged diametrically opposite each other, while the insulating-sections c^2 c^2 are arranged diametrically opposite each other at points intermediate to the sections c' c'.

G G′ are spring arms or brushes attached to the frame of the motor and resting at their free ends upon the distributer C^3. The brush G acts upon the insulating-sections c' c', while the brush G′ acts upon the insulating-sections c^2 c^2.

The brushes G G′ are herein shown as attached, respectively, to separate insulating-posts G^2 G^3, attached to the frame of the motor. The brushes, as herein shown, in themselves embrace features of novelty, and consist of strips of metal or wire provided with double bends *g g′*, forming parts g^2 g^3, which are generally at right angles to the end portions of the brushes. The presence of the said transverse parts obviously enables the brushes to be lengthened or shortened by bending said transverse parts or the curved portions of the brushes connecting them, thereby enabling the parts of the brushes in contact with the distributer to be accurately adjusted with relation to said distributer. The said distributer C is constructed and operates generally in the same manner as do other similar distributers, to complete an electric circuit through one or the other of the brushes G G′ and a conductor having electrical connection with the metal body of the distributer.

As an improved construction in a commutator of this kind, I have herein shown insulating blocks or sections c' c' c^2 c^2 as extended radially outward beyond the adjacent surfaces of the cylindric block in which they are secured. In distributers made as heretofore, in which the surfaces of the insulating-sections are flush with the adjacent surfaces of the block, the action of the brushes upon the distributer as the latter is revolved is liable to drag the particles of metal from the body of the distributer over the surfaces of the insulating-sections, thereby preventing the complete electrical insulation of the brushes from the metal body of the distributer, and causing an electric leak, or the passage of a weak current, which, although not sufficiently strong to actuate the motor, serves in time to exhaust the battery. In a distributer made as herein shown, however, the brushes will be lifted free from the surface of the metal part of the distributer at the time the insulating-sections pass beneath them, so that any dragging of the metal particles over the insulat-

ing-sections will be prevented, and a complete interruption of the electric circuit will take place whenever the brushes rest in contact with the insulating-sections.

When the distributer is provided with projecting insulating-sections, made as above described, it is obviously desirable that the brushes should have considerable degree of elasticity, in order to enable them to properly pass over the projecting teeth formed by the sections. For this purpose I have herein shown the brushes G G′ as provided near their points of attachment to the posts G^2 G^3 with spiral coils g^4 g^4, and this construction is herein claimed as a separate improvement. For varying the pressure upon the distributer of the ends of the brushes the posts G^2 G^3 are herein shown as being connected with the frame of the motor in such manner as to enable the said posts to be turned so as to swing the free ends of the brushes toward and from the distributer, the said posts being, as a convenient construction, made tubular and secured to the frame by means of screws g^5 g^5, which may be loosened to allow the turning of the posts, and tightened to secure the posts in their changed positions.

H is an electro-magnet mounted upon the frame of the motor, and H′ an armature for said magnet. Said armature stands vertically, and is pivoted at its lower end upon a pivot-rod, *h*. The armature is also provided with a rigid arm, H^2, having at its end a detent or hook, *h*′, constructed to engage the regulating-fan *c* of the motor at the time the armature is free from the magnet.

H^3 is another rigid arm attached to the armature and extending outwardly over a stationary part or rod, c^3, of the motor, which rod forms a stop to limit the downward movement of the said arm H^3 and of the detent-arm H^2. In this construction of the parts the weight of the armature, in connection with the weight of the arms H^2 and H^3, is relied upon to hold the armature free from the magnet at the time the current is not passing through the same, and to cause the engagement of the detent *h* with the regulating-fan. It will of course be understood, however, that a single arm may be employed in place of the two arms shown, and that a stop for limiting the backward movement of the armature and the downward movement of the detent may be otherwise located than as shown. It will also be understood that the said detent may be arranged to engage a revolving part of the clock-work other than the regulating-fan.

In motor-controlling devices of the kind above described, as heretofore made, the armature is held or drawn away from the pole of the magnet by means of a spiral or other spring. An adjusting device for the spring is required in order to enable the tension of the same to be accurately adjusted, and by reason of changes in the spring itself and the liability of shifting of the screw with which the spring is connected, and other reasons, it becomes necessary to occasionally adjust the spring to produce perfect action of the device. By employing the arm H^3, attached to the armature and extending outwardly therefrom in such manner that its weight will swing the armature away from the pole of the magnet, I am enabled to dispense with the spring, thereby obtaining a more simple and cheap construction, while at the same time obtaining a uniform action without possibility of the devices getting out of adjustment in use. By reason of the advantages obtained by the construction in the motor in the particular above described, this novel construction of the armature is herein claimed as a part of my invention. A conductor, *i*, extends from the electro-magnet H to the frame of the clock-work, and has electrical connection through said frame, the shaft C′, and the metal body of the distributer C^3, with one or the other of the brushes G G′.

I is another conductor leading from the coil of the electro-magnet to the battery B.

I′ is a conductor leading from said battery to a thermostat, which is indicated in the drawings as a whole by the letter A′, Fig. 1, said thermostat being constructed in a manner set forth and claimed in a separate application for patent, Serial No. 251,386, filed by me October 4, 1887.

I^2 I^3 are conductors leading from said thermostat and connected, respectively, with the brushes G G′.

The thermostat, which I have indicated as a whole by the letter A, is, as herein shown, duplex, or provided with two separate and independently-operating thermostats, A′ A^2, attached to or contained in a single board or case. Each one of these thermostats A′ A^2 is capable of independently operating the motor by completing an electric circuit through one or the other of the conductors I^2 I^3, and said thermostats are exactly alike, two of them being employed in connection with a switch for placing either one or the other in circuit with the battery and the electro-magnet which controls the motor, in order that one may be adjusted to move the valve or damper at one temperature and the other at another temperature, whereby the apparatus is adapted for maintaining an apartment or house at one temperature in the day-time and at another temperature at night without other change than the shifting of the switch.

The thermostats A′ A^2 are of familiar construction, and contain in themselves no features of novelty. The parts of the two thermostats are lettered alike in the drawings, and a description of one applies to the other. Each of said thermostats embraces a supporting-post, J, a spirally-coiled compound strip, K, attached at its center to the post and provided with a radial metallic extension or arm, k^2, at its outer end, and two contact-points, *l l*′, supported by posts L L′ upon the case, said contact-points being arranged at opposite sides of the arm k^2. The compound spiral

strip K consists of two layers, k k', of materials, which expand to different extent under the influence of heat, the materials used in the device shown being steel and hard rubber. Variations in temperature operate, in a thermostat thus made, to swing the arm k^2 into contact with one or the other of the contact-points l l'. The post J of the thermostat is connected with the battery-wire I' by conductors i' i^2, while the posts L L', sustaining the contact-points l l' of both thermostats, are connected, respectively, with the conductors I^2 I^3.

M M' are two switches, which are preferably connected by an insulated cross-bar, m, so that they will move together. The pivots of said switches are connected directly with the conductors I^2 I^3 by wires i^3 i^4, while the contact-points m' m^2, belonging to each switch, are connected with the posts L L' of one thermostat, as A', by wires i^5 i^6, and the contact-points m^3 m^4 are connected with the posts L L' of the other thermostat, as A^2, by wires i^7 i^8. The contact-points l l' are so adjusted that when the temperature in the apartment in which the thermostat is placed is below that desired the end k^2 of the spiral coil K will rest in contact with the contact-point l, while as soon as the desired temperature is reached the end k^2 will be swung or moved by the action of the coil into contact with the contact-point l'. One pair of insulating-sections, c' c', of the distributer C is so arranged that when the damper D is closed the brush G will rest upon one or the other of said insulating-sections. The other pair of insulating-sections, c^2 c^2, is so arranged that when the damper D is turned at right angles to its closed position, to give the greatest opening to the pipe, the brush G' will rest upon one of said sections c^2 c^2. The brush G is connected by the conductor I^2 with the contact-point l, as may be traced by the full and dotted lines in the drawings. The brush G' is similarly connected by means of the conductor I^3 with the contact-point l'. When the temperature in the room is below the point desired and the end k^2 of the thermostat is in contact with the point l, a circuit broken at one point may be traced from the battery through the conductor I', the thermostat-coil K, the contact-point l, the switch M, the conductor I^2, the brush G, the metal body of the commutator and the frame of the motor, the conductor i, the coil of the magnet H, and the conductor I back to the battery. At such time, however, the damper D is shut, and the brush G rests upon the insulating-section c', as illustrated in the drawings, the circuit above traced being broken by the said insulating-section. It is of course understood that in the particular arrangement of the parts herein shown for controlling the draft through the stove the most intense heat is produced when the damper is closed.

When the desired temperature in the room is reached, it becomes necessary to open the damper D to check the draft through the stove, and this is accomplished when the parts are in the position shown in the drawings, and above described, as follows: As soon as the temperature is exceeded for which the thermostat (which is in circuit) is set the arm k^2 thereof swings into contact with the contact-point l'. A circuit is thereby established from the battery through the conductor I', the coil and thermostat, the contact-point l', the conductor I^3, the brush G', the body of the commutator (in contact with which the said brush G' at this time rests) the conductor i, the coil of the electro-magnet H, and the conductor I to the battery. As soon as this circuit is established the core of the electro-magnet will be energized, the armature H' will be attracted, the detent h' lifted, the regulating-fan released, and the motor will begin to turn and thereby give rotary movement to the damper D. The motor will continue to turn and move the damper as long as the brush G' rests in contact with the metal part of the distributer, and until the said brush G' encounters and is lifted free from the body of the distributer by one of the insulating-sections c^2. These sections c^2 being arranged at an angular distance of a quarter of a circle from the insulating-sections c', the brush G' will remain in contact with the metal part of the distributer during one-fourth of the revolution of the shaft C' and the damper D. The motion of the clockwork is interrupted as soon as the insulating-section c^2 is brought beneath the brush G' by the breaking of the current and the dropping of the detent h' into engagement with the regulating-fan.

After the damper has been opened, as above stated, the parts will remain in the same position, with both branches of the battery-circuit interrupted or broken, until the temperature of the apartment falls below the point for which the thermostat is adjusted, when the arm k^2 of the thermostat will swing into contact with the contact-point l and a circuit will be completed through the said contact-point, the conductor I^2, the brush G, and the electro-magnet, thereby allowing the shaft C' to make another quarter-turn to close the air-inlet pipe.

The features of construction above described in the thermostats and circuits connecting the same with the motor are claimed in said separate application, Serial No. 251,386, and form no part of the present invention.

It will of course be understood that the motor arranged and operating as described may be connected with and constructed to turn a valve or damper in any desirable or convenient manner—as, for instance, the valve or damper may operate to check or increase the heat given out by the heating apparatus either by being opened or closed, and the valve may be employed to control the smoke-pipe of a

stove or furnace or the draft-aperture thereof, a duct supplying warm air to the apartment, a steam-heating pipe, the shutter of a ventilating-aperture, or other movable part or valve, the movable part of which influences the temperature in an apartment or building.

A special and important advantage is gained by the employment of distributer-brushes G G′, made with two or more bends forming transverse parts, allowing the length of the brushes to be changed, for the reason that by moving the ends of the brushes which bear upon the insulating-sections back and forth toward or from the brush-supports the insulating-sections may be made to break the circuit and thereby arrest the motion of the valve as it turns at any point desired in the rotation of the valve—as, for instance, if it is found that the valve does not stop when exactly parallel with the sides of the passage, so as to give greatest opening thereto, the brush may be shifted so as to effect the stopping of the valve at the exact point desired. By the construction in the valve described, therefore, a means is provided for perfectly adjusting the position of the valve in its open and closed position without reference to the accuracy of the angular adjustment of the distributer-sections with relation to the damper.

As a further and separate improvement, I provide the commutator C^3 with two circumferential grooves, c^4 c^4, in which the ends of the brushes rest. Said grooves serve to hold in place the brushes, and are of especial utility when the brushes are made of wire, as in the apparatus illustrated.

I claim as my invention—

1. The combination of a commutator consisting of a cylindric metal body having insulating-sections extending radially outward beyond the cylindric surface of the body, and brushes bearing upon said commutator, substantially as described.

2. The combination of a commutator consisting of a cylindric metal body having insulating-sections extending radially outward beyond the cylindric surface of the body, and brushes resting at their free ends against the commutator, said brushes consisting of wires provided with spiral coils, whereby the brushes may bend or yield to allow the passage of their free ends over said projecting insulating-sections, substantially as described.

3. The combination of a cylindric commutator provided with insulating-sections in its cylindric surface, and brushes bearing thereon provided with transverse parts or bends between their points of support and their ends which are in contact with the commutator, whereby the parts of the brushes which bear upon the commutator may be adjusted relatively to the insulating-sections, substantially as described.

4. The combination of a commutator consisting of a cylindric metal body provided with projecting insulating-sections and having circumferential grooves, and wire brushes, the free ends of which engage said grooves, substantially as described.

5. The combination, with the frame, of the motor and the revolving cylindric distributer provided with insulating-sections extending radially outward beyond the surface thereof, brushes resting at their free ends against the distributer, and parts supporting the brushes having rotative connection with the frame of the motor, whereby the brushes may be adjusted to give greater or less pressure upon the commutator, substantially as described.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

DAVID W. THOMPSON.

Witnesses:

C. CLARENCE POOLE,

E. BERTINE ELLIAS.