(No Model.) 2 Sheets—Sheet 1.

G. M. STERNBERG.

ELECTRIC VALVE CONTROLLER.

No. 373,103. Patented Nov. 15, 1887.

Fig 1

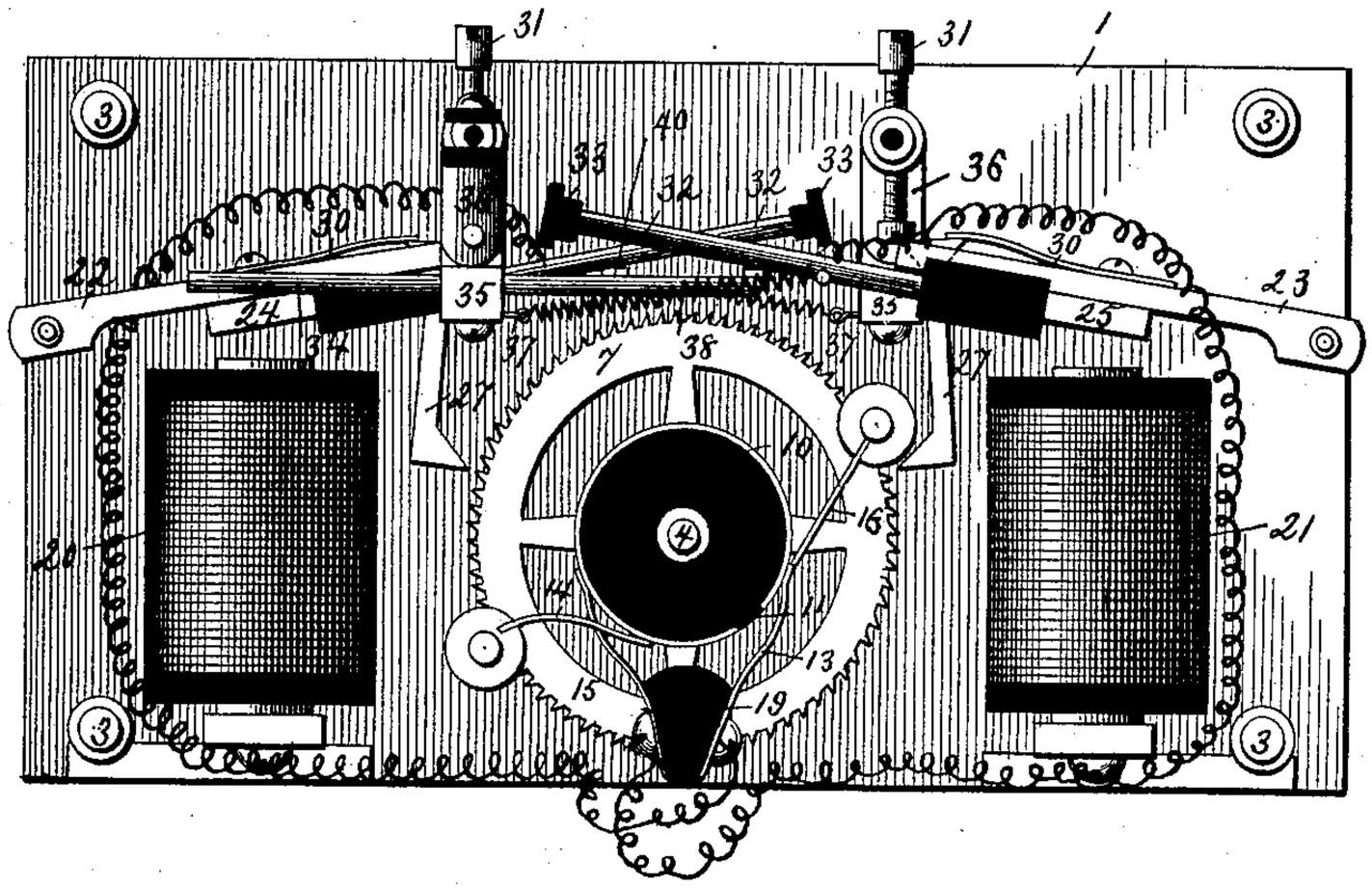
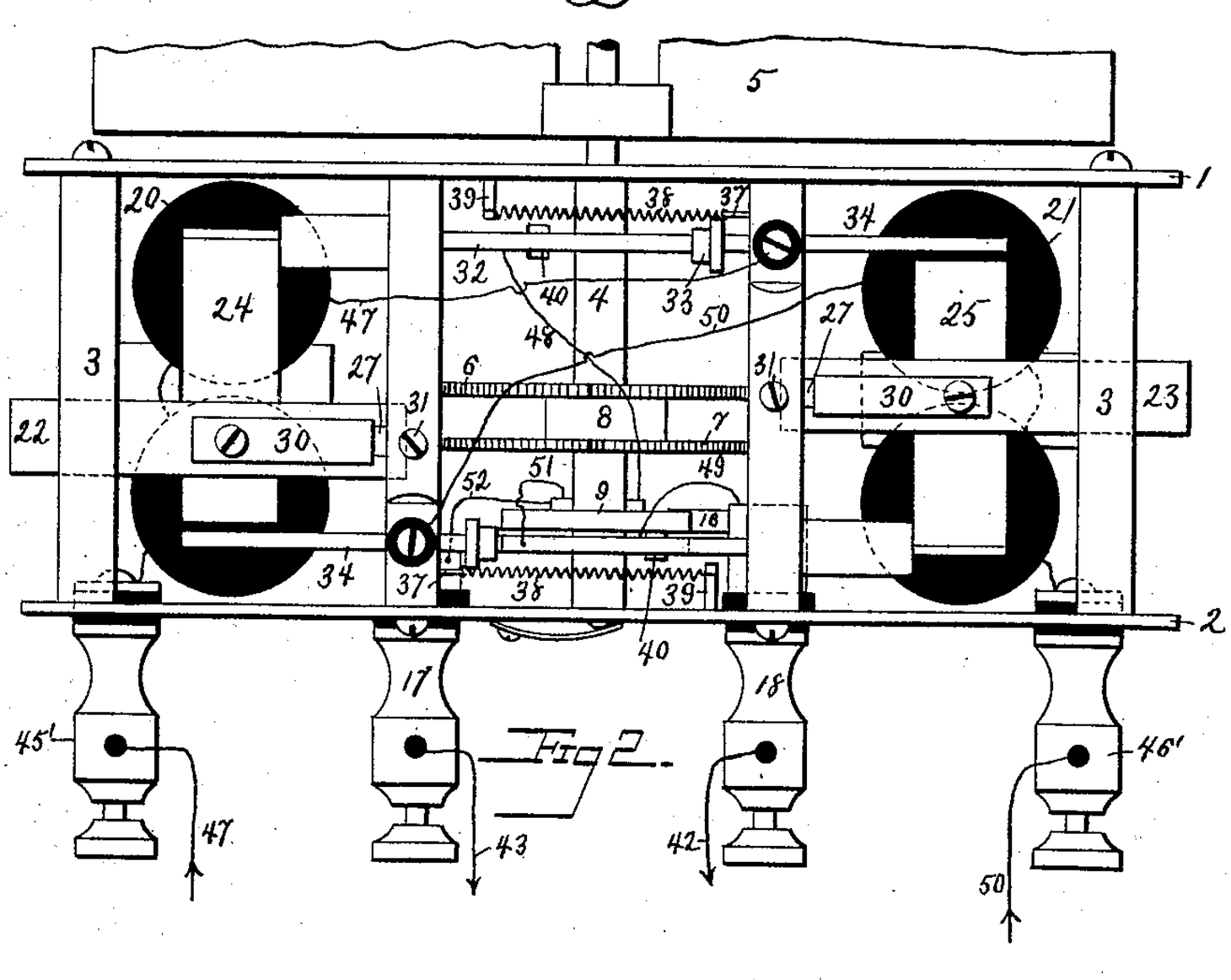


Fig 2.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

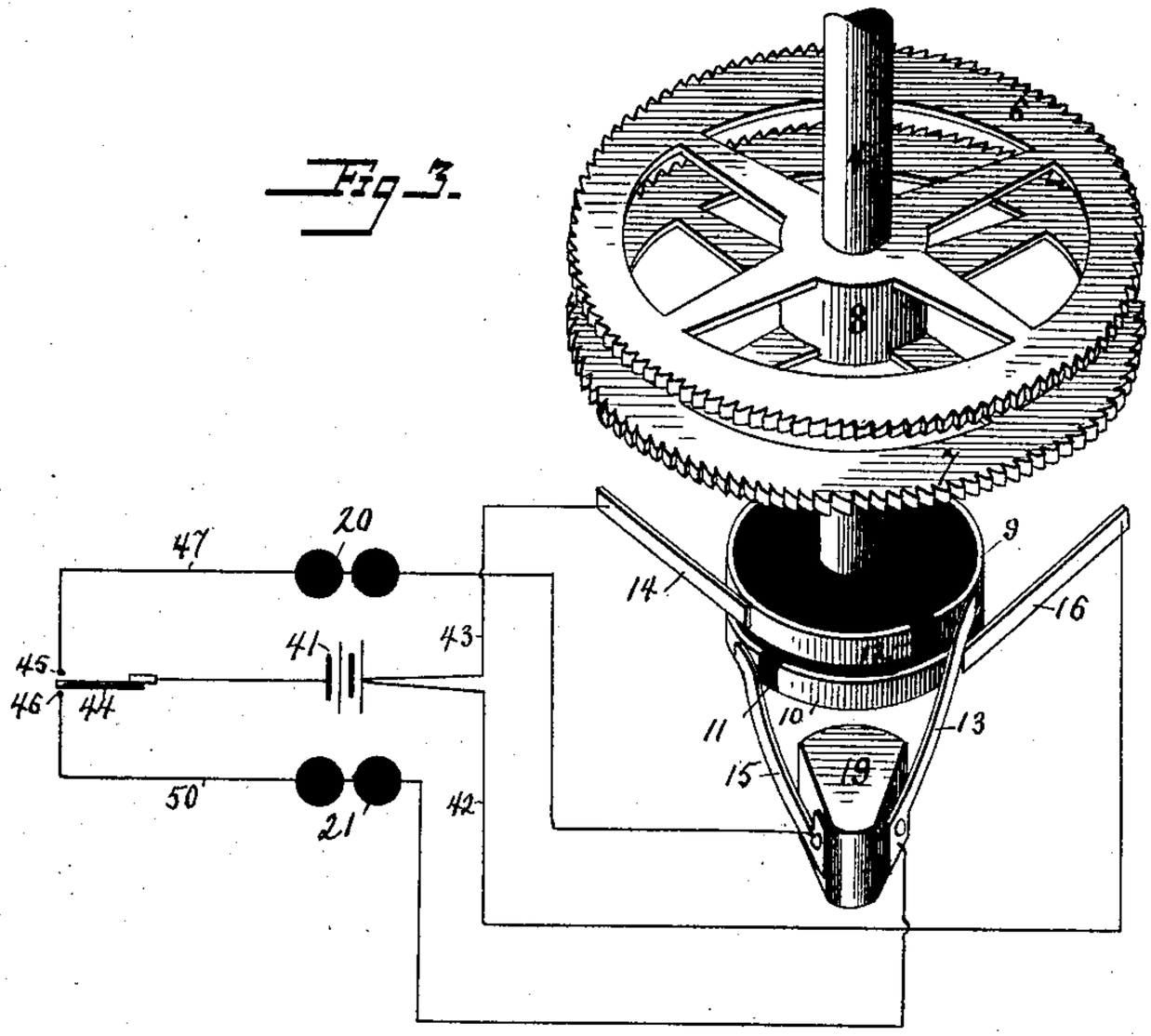


Fig. 4.

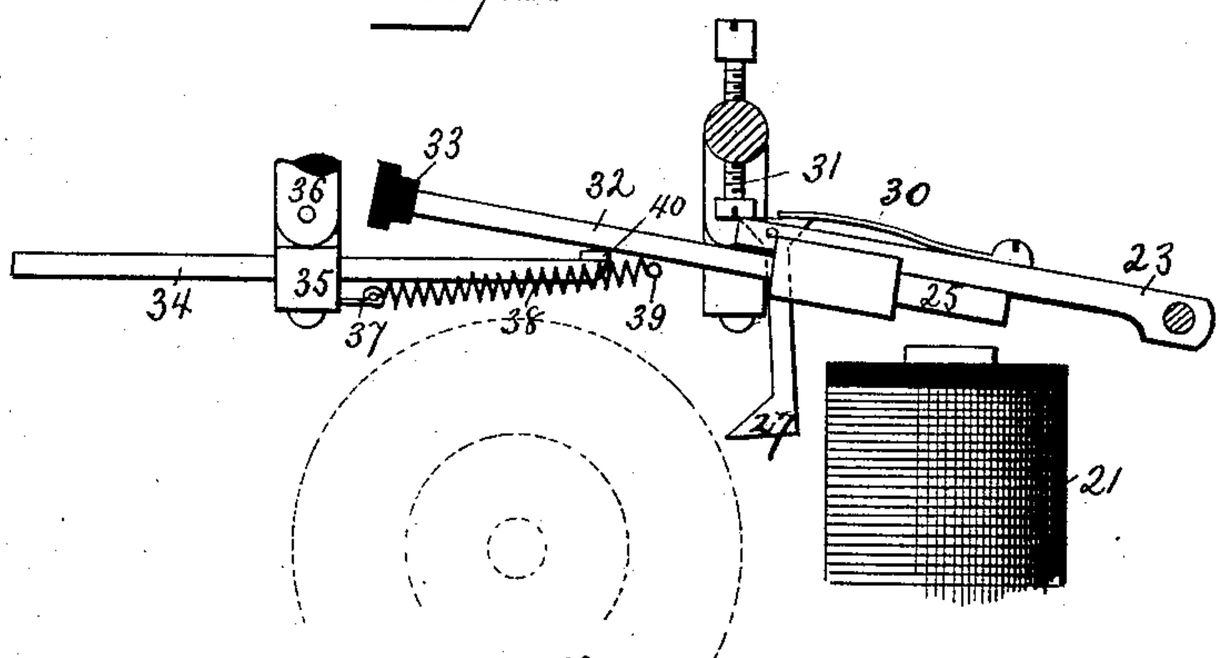
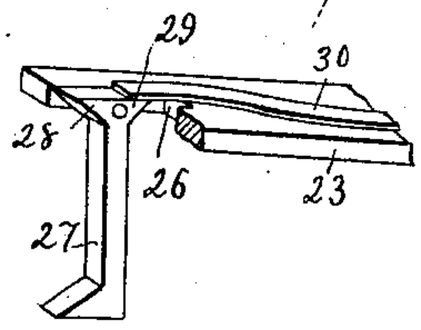


Fig. 5.



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UNITED STATES PATENT OFFICE.

GEORGE M. STERNBERG, OF THE UNITED STATES ARMY.

ELECTRIC VALVE-CONTROLLER.

SPECIFICATION forming part of Letters Patent No. 373,103, dated November 15, 1887.

Application filed April 5, 1887. Serial No. 233,776. (No model.)

To all whom it may concern:

Be it known that I, GEORGE M. STERNBERG, of the United States Army, temporarily residing in Baltimore, Maryland, have invented certain new and useful Improvements in Electric Temperature-Regulators, of which the following is a specification.

My invention relates to electric temperature-regulators of that class in which two electro-magnets, both in circuit with a suitable thermostat, actuate a valve or other device for admitting heated air or cold air into the space the temperature of which it is intended to control, so as to be maintained uniform, the operation being entirely automatic. In apparatus of this kind as heretofore constructed the admission-valve could not be controlled from every position which it occupied, either accidentally or intentionally. It could only be actuated from two particular positions—namely, either when closed entirely or when entirely open.

It is the object of my invention to so construct a temperature-regulator as to admit of the automatic control of the admission-valve from any one of its two limit positions or from any intermediate position, whereby the regulation of temperature becomes gradual and continuous.

The accompanying drawings, which form a part of this specification, illustrate one form which my apparatus may assume.

I show in Figure 1 an inverted bottom view of my apparatus; in Fig. 2. a side view of the same; Fig. 3, a perspective view of a portion of the apparatus with circuit-connections indicated diagrammatically; Fig. 4, a plan view of the actuating mechanism, and in Fig. 5 a perspective view of a detail of construction.

The temperature-governor is mounted in the frame composed of top and bottom plates, 1 2, held a suitable distance apart by posts 3. A shaft, 4, stepped in the lower plate extends up and through the upper plate, and carries at its free end a controlling-valve, 5. Fast upon said shaft, and within the frame, are two toothed wheels, 6 7, of equal size, and separated from each other by a collar, 8. Below these wheels the shaft carries two disks of insulating material, 9 10, each provided with a metal facing around its edge, with a small insulating-space, 11 and 12, which break the continuity, respectively, of the metal facings of disks 9 10.

Upon the metal facing of disk 9 bear two brushes, 13 14, and upon metal facing of disk 10 the brushes 15 16, the brushes 14 and 16 being mounted each in a metal post connected with the insulated binding-posts 17 18, respectively, as will be seen by reference to Figs. 1 and 2, while brushes 13 and 15 are mounted upon a segmental post, 19, of insulating material.

Two electro-magnets, 20 21—one on each side of the toothed wheels—are arranged for actuating the armature-levers 22 23, provided with armatures 24 25, respectively. At the free end of each armature-lever there is a slot, 26, in which is pivoted a pawl, 27, provided with a head shaped with two laterally-projecting spurs, 28 29, upon one of which, 29, a spring, 30, fixed to the armature, impinges, tending to throw the pawl forward to bring it into engagement with one of the toothed wheels 6 7.

When the armature is in its elevated position, as shown in Fig. 1, the spur 28 of the pawl-head is forced against the end of one of the adjusting-screws 31, whereby the pawl is thrown back out of engagement with the toothed wheel against the action of spring 30; but when the armature is attracted spur 28 is relieved of the pressure of the adjusting-screw 31, and spring 30 is free to throw the pawl forward. This part of the operation will be more readily understood by reference to Figs. 4 and 5. From each armature extends a metal rod, 32, provided with a head, 33, and extending over a metal rod, 34, mounted adjustably in a boss, 35, which is pivoted to an insulated stud, 36. To the boss 35 or to a pin, 37, projecting from the same, is secured one end of a helical spring, 38, the other end of which is secured to a pin, 39, fast in the frame. The tendency of this spring is to force a rod, 34, in contact with rod 32, and a piece of platinum, 40, secured to the end of rod 34 is provided for making electrical contact with a platinum-faced portion of rod 32. It will now be seen that when one of the armatures is attracted pawl 27, being freed from the pressure of the adjusting-screw 31, will be thrown forward into engagement with one of the toothed wheels by spring 30, and rod 32, moving with the armature, will

press upon the overlapping end of rod 34, will force said rod to turn against the action of spring 38, and will maintain contact with said rod until head 33 impinges against rod 34, causing a break of contact at 40, which breaks the circuit to the electro-magnet actuating the armature in question. Thereupon spring 38 will again establish contact at 40, and the rheotomic action will continue until the circuit of the magnet is interrupted at some other point.

There being two electro-magnets and two pawls operated by the same, each actuating one of the toothed wheels upon shaft 4, and the relation of these pawls to the wheels being such that each will operate to turn the shaft in opposition to the other, it will be clear that if by proper thermostatic arrangement provision is made to close the circuit to one magnet or to the other, according to the increase or decrease of temperature, the device will operate to turn the valve in one direction or in the other in accordance with the changes of temperature.

In Fig. 3 the circuits, as connected with the magnets and with a thermostat, are diagrammatically indicated. There is a battery, 41, one pole of which is connected by branch wires 42 43 with brushes 14 and 16, respectively, and the other pole is connected with the vibratory element 44 of a thermostat, which is arranged to make and break contact with points 45 or 46, one connected with magnet 20 and brush 15 and the other with magnet 21 and brush 13.

The whole operation may now be traced as follows: Suppose the prevailing temperature be such as it is desired to maintain, then thermostatic arm 44 will be in position shown in Fig. 3—that is, it will be out of contact with both points 45 46. If the temperature increases, arm 44 will be thrown against point 45, and the current from battery 41 will proceed from its positive pole over 44 and 45 through magnet 20, brush 15, metal facing of disk 10, and out by brush 16 and branch wire 42, back to the negative pole of the battery. Magnet 20, being thus energized, will operate its armature 24. The pawl 27, pivoted in the same, will turn wheel 7 and therewith shaft 4 and its attached valve 5 in a direction to close the inlet-opening for the heated air. This operation will continue until stopped in one of two ways: first, the decreased influx of heated air to the thermostat may break contact with points 45, or, second, by the rotation of shaft 4 brush 16 comes in contact with the insulating-section 11 of the metal face of disk 10. In both cases magnet 20 becomes inert and the operation stops. In the second case the valve is entirely closed, admitting of a cooling of the space the temperature of which it is desired to control by my apparatus. If the temperature falls below the normal, arm 44 of the thermostat will make contact with points 46, and the circuit will be closed from the positive pole of the battery over 44 and 46 to magnet 21, and brush 13 to metal face of disk 9, and brush 14 and branch wire 43, back to the negative pole of the battery. Magnet 21 being now energized, it will actuate its armature, as hereinbefore described, to rotate shaft 4, to open valve 5, to admit of an increase of temperature.

It will be seen that my temperature-governor is in a condition to operate the valve from any position which it may occupy in either direction, and that it will continue to turn said valve to one of its limit positions unless the operation be interrupted by the action of the thermostat.

The circuits, which are clearly indicated in Fig. 3, may also be traced in Fig. 2, where the binding-posts 45′ and 46′ are supposed to be connected with points 45 and 46 of the thermostat, while binding-posts 17 and 18 are supposed to be connected with branch wires 42 and 43, respectively. If, then, the current enters at 45′, it passes first to magnet 20, which it leaves by wire 47, connecting with rod 34, then by platinum contact 40 to rod 32, leaving the same by wire 48, connecting with the brush 15, mounted upon the segmental insulating-stud 19. From there it passes to the metal facing of disk 10, and by brush 16 and wire 49 to binding-post 18, from whence it returns to the negative pole of the battery by wire 42.

If the current enters at binding-post 46′, it proceeds to magnet 21, then by wire 50 to rod 34 of the second set, then from rod 32 to brush 13 by wire 51. From brush 13, as will now be understood, the current passes through metal facing of disk 9 and out by brush 14 and by wire 52 to binding-post 17, from whence it returns by wire 43 back to the negative pole of the battery.

While I prefer to use the rheotome, composed of the rods 32 and 34, it will be understood that I am not limited to the use of this particular rheotome; nor do I mean to confine myself to the exact details of construction herein shown and described. Thus it is not necessary that the valve be secured to the shaft to which the toothed wheels 6 and 7 are secured, since I may use multiplying-gearing so arranged that one revolution of the wheels will cause only a partial rotation of the shaft to which the valve is immediately connected.

In some cases it may be found that the springs 38 are not sufficient for withdrawing the armatures from the magnets, and in such cases separate retractile springs will be employed.

I am aware that it has been proposed to employ, with a partially-turning shaft of an electric valve-regulating device, two electro-magnets in a circuit including a thermostat, the position of which determines whether one or the other magnet shall be energized, or whether both shall remain inactive, such magnets operating as they are energized to shift the shaft from one extreme of position or movement to the other, thereby completely shutting or entirely opening the valve, according as the shaft was moved. My invention, however, differs from such earlier devices, in that I employ, with the valve-regulating shaft, the

thermostat and a circuit controlled thereby, electric actuating devices, also controlled by the thermostat, and which when in circuit move the shaft between its extremes of movement by a gradual motion, so that, should the circuit at any time be broken by the thermostat when the shaft is in a position between its extremes of movement, it will remain in such intermediate position, with the valve more or less open or closed, in which position the valve will remain until the thermostat again makes circuit, when the shaft may be turned in either direction to a greater or less degree, according as the thermostat makes contact, a result which has not heretofore been attained.

Having now fully described my invention, what I desire to secure by Letters Patent is—

1. In an electric valve-operating apparatus, the combination of a rotary shaft adapted to change the position of a valve, electric actuating devices which turn said shaft gradually in either direction between its extremes of movement, a thermostat, and a circuit in which are situated both the thermostat and the actuating devices, the latter being controlled between the extremes of movement of the shaft entirely by the thermostat, whereby, should the thermostat break the circuit when the shaft is at any point between such extremes, it will be stopped in such intermediate position, substantially as described.

2. In a temperature-governor, the combination of a rotary valve-shaft, two electro-magnets, a thermostat controlling circuits to said magnets, and interposed mechanical connections between the magnets and shaft for rotating the latter in either direction by a gradual step-by-step motion, substantially as described.

3. In a temperature-governor, the combination of a rotary valve-shaft, two electro-magnets, a thermostat controlling circuits to the magnets, interposed mechanical connections between the magnets and shaft for rotating the latter in either direction by a gradual step-by-step motion, and means for interrupting the said motion, whereby the valve may be stopped in any position, substantially as described.

4. In a temperature-regulator, a rotary valve-shaft, two electro-magnets, two circuit-preserving disks upon said shaft, and mechanical connections between the shaft and magnet, and circuit-connections, as described, whereby the shaft may be rotated from any position in either direction, substantially as described.

5. In a temperature-regulator, the combination of a valve-shaft carrying two toothed wheels with a rheotome actuating a pawl for each wheel and a thermostat for shifting the circuit from one rheotome to the other according to the changes of temperature, substantially as described.

6. In a temperature-regulator, a valve-shaft actuated by electric actuating devices, including a rheotome, whereby it is closed gradually, a thermostat controlling the circuit to the actuating devices, whereby the amount of motion of the valve is dependent on the contact of the thermostat, and means, substantially as described, for automatically breaking the circuit independently of the position of the thermostat when the desired limit of movement of the valve is attained, substantially as described.

7. In a temperature regulator, the combination of a rotary valve-shaft, two metal-faced disks carried by said shaft, each having an insulated space corresponding to limits of position of the valve, two contact-brushes bearing upon each disk, two rheotomes adapted, substantially as described, to move the valve in either direction by a gradual motion, and a thermostat shifting the circuit from one rheotome to the other according to changes of temperature, the insulated portions of the disk-faces insuring that the valve shall be stopped at determined positions in either direction of movement regardless of the position of the thermostat.

8. In a temperature-regulator, the combination of a valve-shaft carrying a toothed wheel for rotating the same with a pawl pivoted to the armature of a magnet and having laterally-projecting spurs on opposite sides of its point, and an adjustable back-stop adapted to engage with one of said spurs for throwing the pawl out of engagement with the wheel when the armature is retracted, and a spring engaging with the other spur for throwing the pawl in engagement with the wheel when the armature is attracted, substantially as described.

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

GEORGE M. STERNBERG.

Witnesses:
MURRAY HANSON,
WILLIAM H. BERRY.