(No Model.)

W. H. RICHARDSON.

TEMPERATURE REGULATOR.

No. 364,957. Patented June 14, 1887.

Fig. 1.

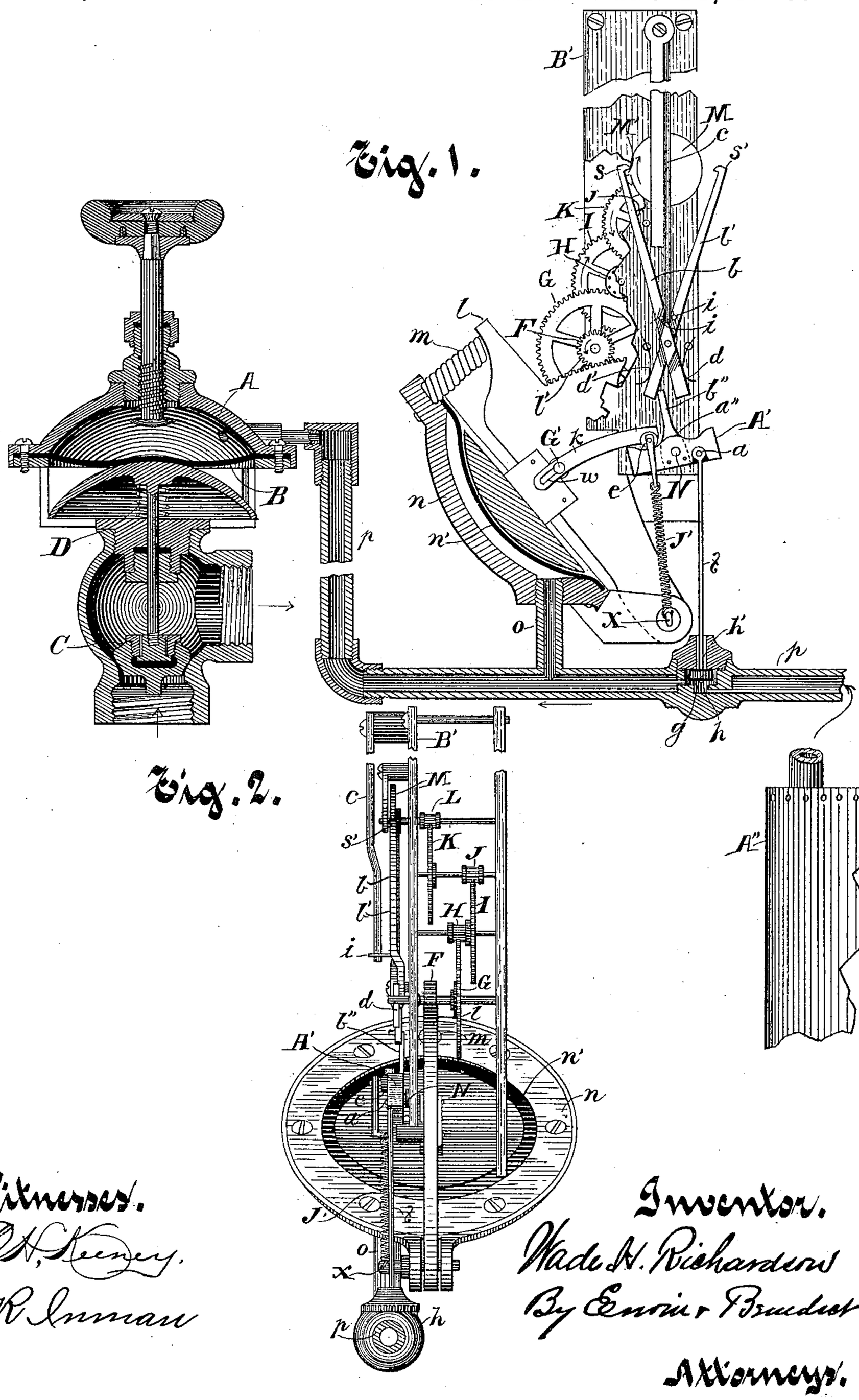

Fig. 2.

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TEMPERATURE-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 364,957, dated June 14, 1887.

Application filed May 6, 1887. Serial No. 237,310. (No model.)

To all whom it may concern:

Be it known that I, WADE H. RICHARDSON, of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Temperature-Regulators; and I do hereby declare the following to be a full, clear, and exact description of said invention, reference being had to the accompanying drawings, and to the letters or figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in temperature-regulators, and it pertains to that class in which compressed air is employed as the motive power for opening and closing steam-valves of heat-radiators and the dampers to furnaces, &c., the air employed being compressed and stored in a reservoir therefor, from which it is conducted to and operates through an expansible diaphragm in communicating the required movements to the valves or dampers. Heretofore the air-controlling valves through which the air is admitted from the air-reservoir to the expansible chamber have been controlled by electricity acting through the agency of electro-magnets, and the electric circuit has been opened and closed by the action of a thermostat, and clock-work which has been wound up at intervals by hand has also been previously employed.

By my improvements I have dispensed with the use of electric batteries, electro-magnets, and the electric circuits heretofore used, and the air-valves are controlled in their movements by the direct action of a thermostat; and my present invention pertains more especially to the mechanism employed for communicating the required movements to the air-controlling valves from the thermostat.

In the accompanying drawings, Figure 1 represents a front view, part in section, of my invention, and Fig. 2 is a side view.

Like parts are represented by the same reference-letters in both views.

The compressed air is conducted from the air-reservoir A″ to the expansible chamber A through the pipe *p*, and its admission to said chamber A is controlled by the air-valve *g*. The pipe *p*, in Fig. 1, is shown open, in which position the air passes through said pipe in the direction indicated by the arrow, when it forces down the diaphragm B, whereby the steam-valve C is closed and the admission of steam from the supply to the steam-radiator is cut off, whereby the temperature of the room is lowered. When the air is permitted to exhaust from the expansible chamber A, the valve C is raised by the action of the spiral spring D, whereby steam is admitted from the supply in the direction indicated by the arrows through the valve C to the radiator, and the temperature of the room is thereby increased. The mechanism connected with the pipe *p* upon the left, thus far described, is of the ordinary construction, and forms no part of my present invention, except only as it is used in combination therewith.

My invention pertains, as heretofore stated, more particularly to the mechanism for automatically controlling the action of the valve *g*, which I will now proceed to describe.

n is an air-chamber, which is provided with a flexible diaphragm, *n′*. When the valve *g* is in the position shown, the air enters said chamber *n* through the branch air-duct *o*, and communicates a pressure against the diaphragm *n′*; but it is prevented from moving by the chain of gears and locking mechanism, as hereinafter described, so long as a uniform temperature is maintained in the room; but as soon as the temperature has lowered past what is desired the mechanism is released by the action of a thermostat, as hereinafter described, when the diaphragm *n′* is free to be forced forward by the action of the compressed air against it, and said diaphragm is thereby forced outward.

The diaphragm *n′* is connected with a bar or lever, *l*, which is provided with a series of cogs, *l′*, which cogs engage in the teeth of the pinion F, whereby, as said diaphragm *n′* is thus moved, motion is communicated therefrom, through the chain of gears F, G, H, I, J, K, and L, to the wheel M, which is provided with a single cog or tooth, M′. Thus when the wheel M is unobstructed in its movement it is caused to rapidly rotate in the direction indicated by the arrow as the diaphragm *n′* is moved outward by the action of the compressed air until said diaphragm *n′* is at the end of its movement. As said diaphragm is thus moved forward by the compressed air it carries with it the bar *k*. The free end of the bar *k* is provided with an anti-friction roller, *e*, which

bears upon the three-armed lever A′. Lever A′ is centrally pivoted to the supporting-frame B′ upon the pin N, and when the friction-roller *e* has moved forward past the pivot M over the elevation *a″* it is drawn downward by the action of the spiral spring J′, which spring is attached at one end at a fixed point, *x*, to a stationary part of the machine, and at its other end to the free end of the bar *k*. Thus as the roller *e* passes over the pivotal support of the lever A′ the end of said lever upon the right is thrown downward with a quick positive movement, whereby the valve *g*, which is connected to said lever A′ by the valve-rod *f* and pivot *a*, is thrown downward, and the inlet-passage *h* of the pipe *p* is thereby closed and the outlet-passage *h′* is opened, thus permitting the compressed air to escape from the expansible chamber A, and also from the expansible chamber *n*. When the air is thus exhausted from the expansible chamber A, the diaphragm B is thrown upward, as heretofore stated, by the spiral spring D, thereby opening the steam-valve C. Simultaneously with the downward movement of the valve *g* the arm *b″* is inclined toward the right and the pawl *s′* is released from contact therewith, when, by the action of the spring *d′* against the lower end of the pawl *s′*, the upper end of said pawl *s′* is thrown toward the left in contact with the wheel M, and the chamber *n* being relieved from the compressed air, which exhausts through the valve *h′*, the diaphragm *n′* and the lever *l* are caused to start to move back by the action of the spiral spring *m*, when they, by such return movement, communicate a reversed movement, as before, to the chain of gears, which is immediately arrested by the pawl *s′*, which engages said cog M′ upon the right. The chain of gears are thus held in the locked position, and consequently the diaphragm *n′* and lever *l* are prevented from being drawn back by the recoil of the spring *m* so long as a uniform temperature is maintained. When, however, an excess of heat over that desired is attained, the thermostat *c* is caused thereby to be inclined toward the right, when it is brought in contact with and releases the pawl *s′* from the cog M′, when the lever *l* and diaphragm *n′* are at once drawn back to their former position shown, whereby the air-valve *g* is opened; and the air being thus admitted to the chamber A it forces down the diaphragm B again and closes the steam-valve C, as shown.

When the diaphragm *n′* is in the position shown in the drawings, the upper end of the pawl *s* is thrown in contact with the wheel M by the action of the spring *d*, while the pawl *s′* is simultaneously held out of contact with the wheel M by the arm *b″*, as shown. When the diaphragm *n′* is at the extremity of its outward movement, the arm *b″* is thrown in the opposite direction, when it is thereby brought in contact with and holds the pawl *s′* out of contact with said wheel M, while the pawl *s*, being released from contact with said arm *b″*, it is simultaneously thrown in contact with said wheel, as mentioned, by the spring *d*.

I am aware that an air-controlling valve has previously been operated by clock-work, which required winding by hand at shorter or longer intervals, according to the frequency in the change of temperature.

It is obvious that by my device the compressed air or other prime moving power which it governs serves also to operate my device; or, in other words, the air by which the steam-valves are opened and closed serves also to operate the mechanism which controls the admission of the air to and from it, and the steam-regulating valve and its operation are entirely automatic. The number of gears employed in the chain may be increased or diminished as required, according to the power of the thermostat employed, their principal function being to reduce the power exerted by the spiral spring *m* and the compressed air upon the pawls *s* and *s′*, so that they are more sensitive to the action of the thermostat.

The expansible chamber *n* is connected to the air-pipe *p* by the branch pipe *o* at a point between the air-controlling valve *g* and the expansible chamber A, whereby the same movement of the air-controlling valve *g* will simultaneously admit the air to and exhaust it from both expansible chambers A and *n*. A slot, *w*, is provided in the bar *k* around the retaining-pivot G′, which permits of a quick lateral movement of said lever *k* toward the right and left as it passes over the apex of the elevation *a″*.

It is obvious that my device may be used as a motor for winding clocks or for other purposes, and that any other elastic fluid may be used instead of compressed air.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an automatic valve-operating device, a reservoir for compressed air or other elastic fluid, a pipe communicating from said reservoir to the mechanism to be operated, and a double-seated valve located in said pipe and adapted to control the admission of the elastic fluid from said reservoir to said mechanism and the escape of the elastic fluid from said mechanism to the exterior air, in combination with the mechanism herein described for operating said double-seated valve, consisting of an expansible chamber communicating with said pipe between said double-seated valve and the mechanism to be operated, a spring counteracting the outer pressure of the compressed fluid upon the diaphragm of said expansible chamber, and mechanism for communicating the motion from the expansible diaphragm and its counteracting spring to said double-seated valve, substantially as and for the purpose specified.

2. In a temperature-regulator, the combination of a reservoir for compressed air, a pipe communicating from said reservoir to the

mechanism for operating a steam-controlling valve, a double-seated valve located in said pipe and adapted to control the admission of the compressed air from said reservoir to and from said valve-controlling mechanism, an expansible chamber communicating with said pipe between said double-seated valve and the mechanism to be operated, a spring counteracting the pressure of the compressed air upon the diaphragm of said expansible chamber, mechanism for communicating the motion from said expansible diaphragm and its counteracting spring to said double-seated valve, mechanism for locking said diaphragm at the extremity of both its outward and inward movements during the continuance of the desired uniform temperature, and a thermostat adapted as it is moved by a change of temperature to disengage the locking mechanism of said diaphragm and counteracting spring, substantially as and for the purpose specified.

3. In a temperature-regulating device, the combination, with the pipe *p*, communicating between an air-reservoir, A″, and an expansible chamber, A, of the double-seated valve *g*, located in said pipe *p*, between said reservoir A″ and chamber A, expansible chamber *n*, communicating with said pipe *p*, between said double-seated valve *g* and said expansible chamber A, and flexible diaphragm *n′*, bar or lever *l*, connected with said diaphragm *n′* and adapted to be moved forward with said diaphragm, counteracting spring *m*, affixed at one end to said arm *l*, and at its other end at a fixed point to said expansible chamber *n*, or other stationary support, arm *k*, connected at one end with said diaphragm *n′*, and at its other end with the three-arm lever A′, three-arm lever A′, supported upon a pivot, N, and provided with an elevated surface or bearing, *a″*, said arm *k* being adapted as said diaphragm *n′* is moved forward and backward to traverse the elevated surface *a″* of said lever A′, and in so doing to communicate an oscillating movement to said lever A′, valve-rod *f*, pivoted at one end to said lever A′, and connected at its other end to the valve *g*, and adapted as said lever A′ oscillates on its supporting-pivot to open and close said valve *g*, series of cog-teeth *l′*, affixed to said lever *l*, and adapted as said lever *l* is moved forward and backward to communicate a rotary movement to the chain of gears F, G, H, I, J, K, L, and M, chain of gears F, G, H, I, J, K, L, and M, said gear M being provided with a single tooth, M′, locking-pawls *s* and *s′*, adapted, respectively, to engage with said tooth M′, thermostat *c*, affixed at one end to the supporting-frame B′, and adapted to bear at its other end against said locking-pawls *s* and *s′*, springs *d* and *d′*, adapted to throw said pawls *s* and *s′* in contact with said locking-tooth M′, arm *b″*, adapted as said lever A′ is oscillated toward the right and left to be brought in contact with said pawls *s* and *s′*, respectively, whereby one of said pawls is prevented from coming in contact with said wheel or gear M while the other is in the locking position, said thermostat being adapted by a change of temperature to be alternately brought in contact with said pawls *s* and *s′*, thereby releasing the mechanism by which the double-seated valve *g* is controlled, substantially as and for the purpose specified.

In testimony whereof I affix my signature in presence of two witnesses.

WADE H. RICHARDSON.

Witnesses:

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