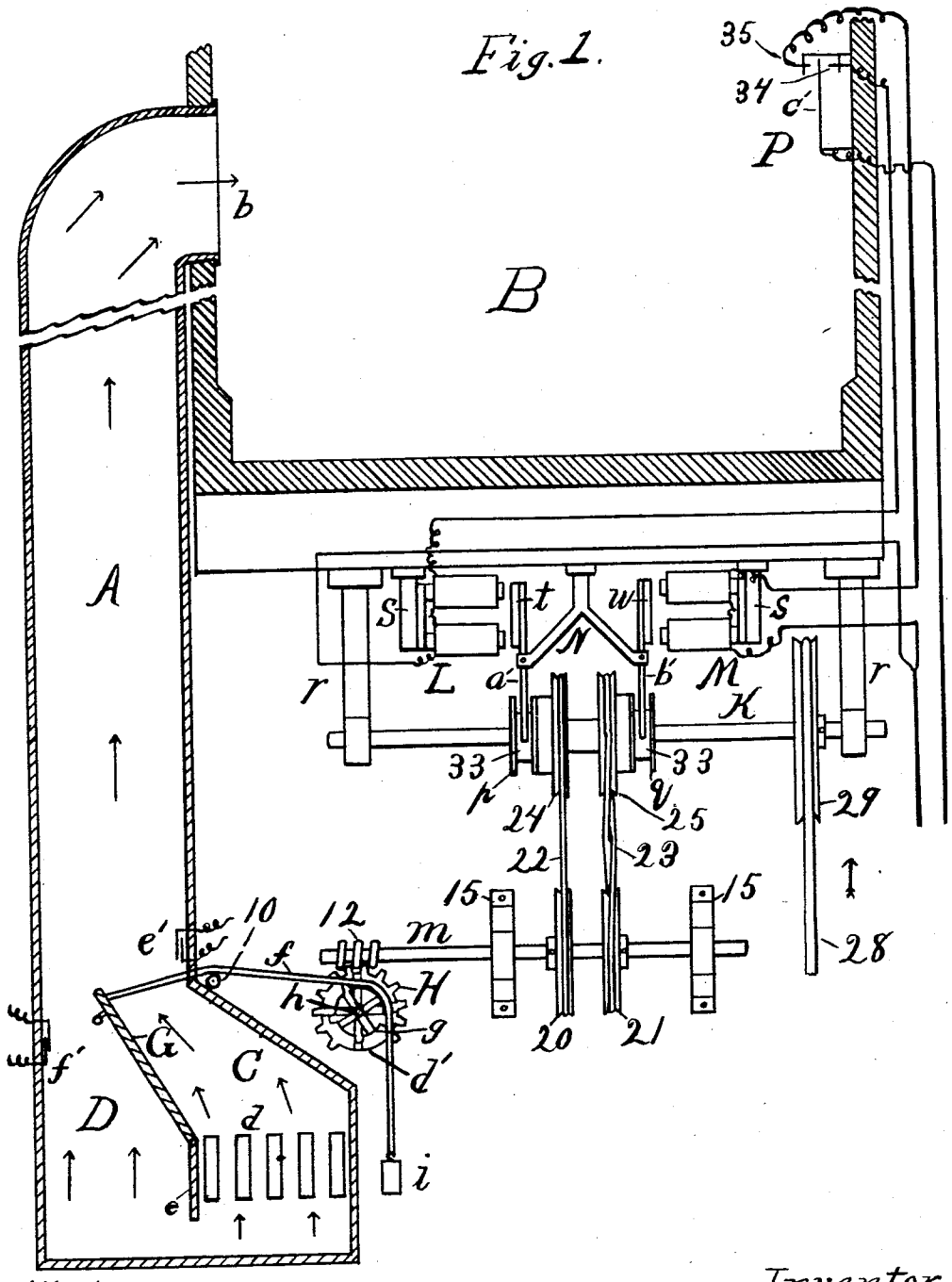
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H. R. WHITE.

TEMPERATURE REGULATING APPARATUS.

No. 590,407. Patented Sept. 21, 1897.

Fig. 1.



Witnesses.
B. L. Marden.
Richd. N. Little

Inventor.
Henry Russell White
by F. C. Teschemacher
Attorney.

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Fig. 2

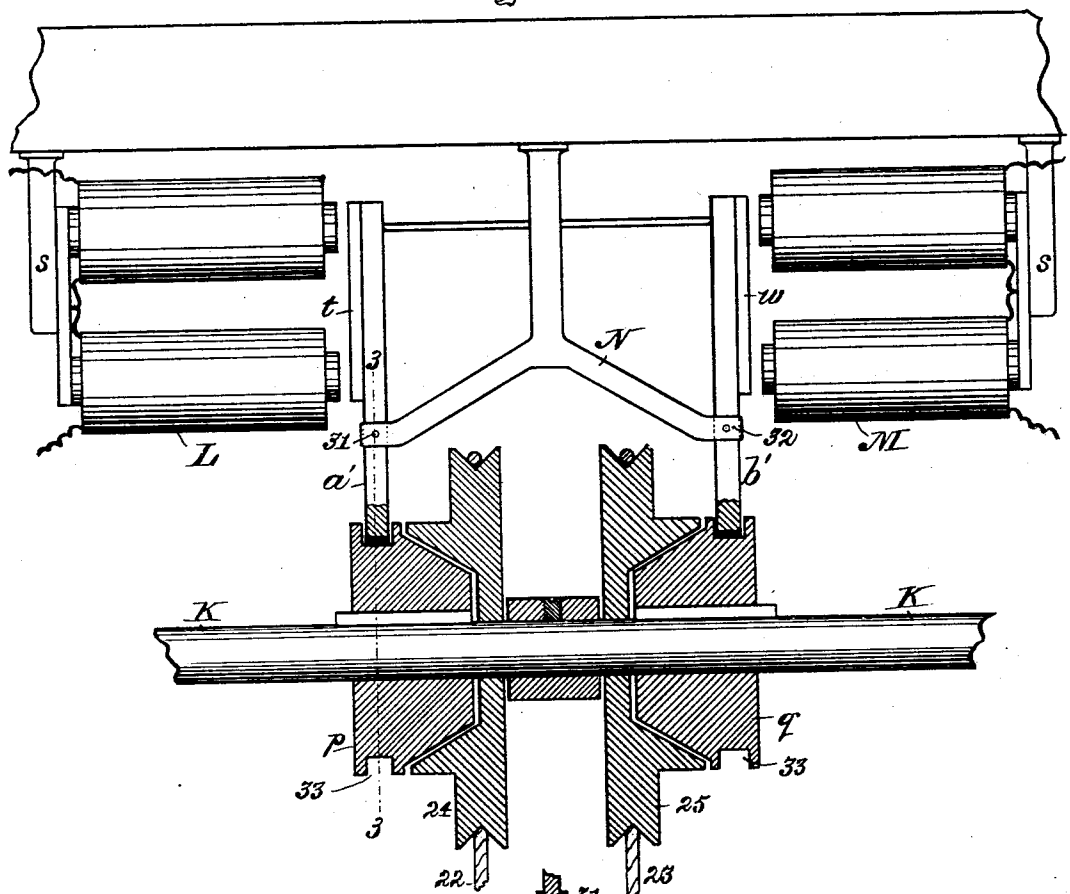
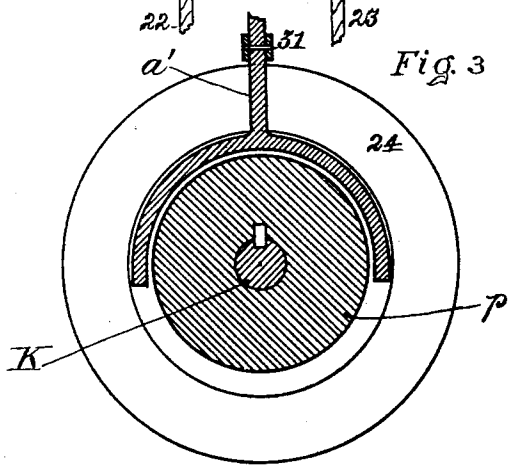


Fig. 3



WITNESSES:

B. L. Marden.

J. L. Hendry

INVENTOR

Henry Russell White

BY P. B. Teschemacher

ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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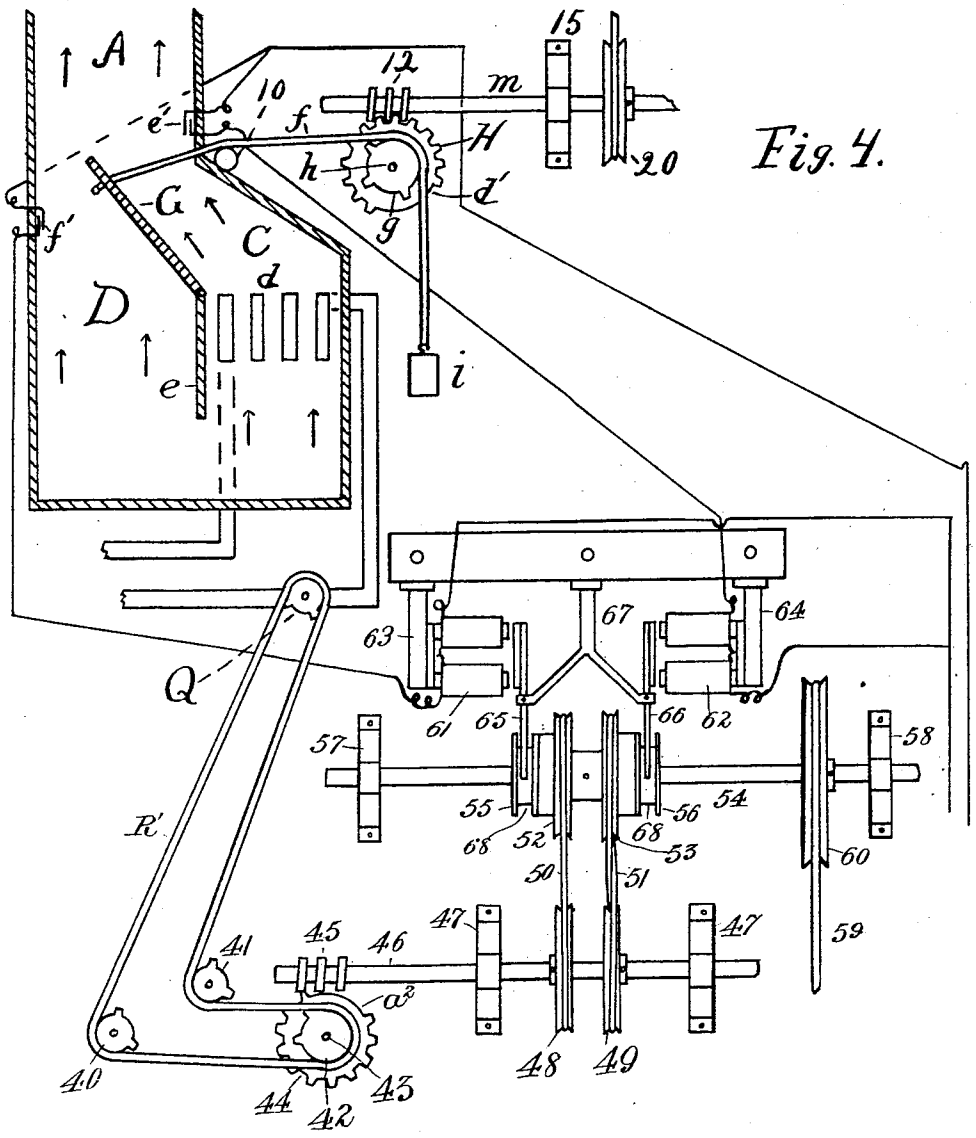


Fig. 4.

Witnesses
B. L. Marden.
Rich & H. Little

Inventor
Henry Russell White
by P. Teschemacher
Attorney

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

HENRY RUSSELL WHITE, OF ARLINGTON, MASSACHUSETTS.

TEMPERATURE-REGULATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 590,407, dated September 21, 1897.

Application filed May 29, 1896. Serial No. 593,668. (No model.)

To all whom it may concern:

Be it known that I, HENRY RUSSELL WHITE, a citizen of the United States, residing at Arlington, in the county of Middlesex and State of Massachusetts, have invented certain Improvements in Temperature-Regulating Apparatus, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a side elevation of my valve-operating mechanism applied to an air-mixing valve or damper for regulating the supply of heated air to the air-shaft of a building through which heated air is supplied to one or more apartments thereof. Fig. 2 is an enlarged sectional elevation of a portion of the mechanism shown in Fig. 1. Fig. 3 is a vertical section on the line 3 3 of Fig. 2. Fig. 4 is a sectional elevation of the lower portion of the vertical pipe or air-shaft illustrated in Fig. 1, showing the secondary electric circuits and a second valve-operating mechanism connected therewith.

My invention has for its object to provide a simple, effective, and reliable automatic heat-controlled mechanism for operating valves and dampers; and to this end my invention consists in certain novel features and combinations of parts, as hereinafter fully set forth, and definitely pointed out in the claims.

In the said drawings, A represents a vertical pipe or air-shaft through which heated air is supplied to an apartment B through an opening or register *b*. This air-shaft A communicates at its bottom with a hot-air chamber C, in which the air is warmed by contact with steam-coils *d* or in any other preferred manner, and also with a passage D, which receives cool or partially-warmed air from any suitable source of supply.

G is a valve or damper hinged at its bottom to a partition *e*, which separates the passage D from the chamber C, said valve being adapted to entirely shut off the supply of heated air from the chamber C to the shaft A, or the supply of cool air from the passage D, or when moved into an intermediate position, as shown in Fig. 1, to permit of the mixing of the heated and cool air in any desired proportions.

To the valve G, near its upper edge, is secured a chain *f*, which passes over a pulley 10 and thence over a sprocket-wheel *g*, secured to a shaft *h*, supported in suitable bearings, (not shown,) a weight *i* being secured to the end of the chain to partly balance the weight of the valve G when in a position intermediate between the extremes of its movement.

To the shaft *h* is also secured a toothed wheel H, with which engages a worm 12 on a shaft *m*, supported in bearings in brackets 15 15 and having secured thereto two pulleys 20 21, which are adapted to be rotated in opposite directions by belts 22 23, the latter being crossed, said belts passing over pulleys 24 25, loosely mounted upon a shaft K and adapted to be connected with said shaft in such manner as to be rotated thereby by means of clutches *p q*, which may be of any suitable or approved construction, those here shown being friction-clutches of conical form splined on the shaft K and adapted to be forced into correspondingly-shaped cavities in the loose pulleys 24 25.

The shaft K is supported in bearings in hangers *r r* and is rotated in one direction only by means of a belt 28, passing over a pulley 29, receiving motion from any suitable source of power, and in this manner the sprocket-wheel *g* can be rotated in either direction to open or close the valve G by operating the proper clutch by means of mechanism which I will now describe.

L M are a pair of electromagnets which are secured to hangers *s s*, the armatures *t w* of these magnets being secured to levers *a' b'*, pivoted at 31 32 to the two branches of a hanger N, and each of these levers *a' b'* is bifurcated at its lower end, as shown in Fig. 3, and fits within an annular groove 33 in one of the clutches *p q*, whereby as either magnet is energized the clutch connected with its armature-lever will be brought into engagement with its pulley to rotate the same as desired.

To the wall of the apartment B is secured a thermostat P of any suitable or approved construction and having suitable contact-points 34 35, wired, respectively, to the electromagnets L M, as shown in Fig. 1, said contact-points being made adjustable toward or from the compound metallic strip *c'* of

the thermostat P in order that the electric circuits in which said magnets are included may be closed at any predetermined degree of heat to energize the magnets and operate the clutches, which, through the connections described, open or close the valve or damper G.

The toothed wheel H has a wide space d' between two of its teeth, as shown in Fig. 1, which prevents the worm 12 from rotating said wheel in either direction beyond the distance required to fully open or close the valve G, the weight i, acting on the chain f, causing the last tooth of the wheel H to remain in contact with the worm ready to be engaged thereby when the direction of motion of the shaft m is reversed.

The operation of my valve-operating mechanism is as follows: The thermostat may be supposed to be set so that with the temperature at 70° Fahrenheit the strip c' will not touch either of the contact-points 34 35. If, however, the temperature of the room falls—for instance, to 68°—the strip c' will touch the contact-point 34, thus closing the circuit through the magnet L, attracting its armature, and causing the clutch P to engage the pulley 24, when the shaft m will be rotated in the proper direction to open the valve G and allow the heated air to pass from the chamber C into the air-shaft A and thence into the apartment B, the temperature of which will thereupon rise, causing the thermostat-strip c' to break contact at 34, leaving the valve G in a position partly open. Should this position be too far open and the apartment continue to grow warm, a temperature will be reached—for example, 72°—when the thermostat-strip c' will make contact on the opposite side at 35 and close the circuit through the magnet M, when its armature will be attracted, causing the clutch q to engage the pulley 25, when the shaft m will be rotated in a direction contrary to that previously described, causing the valve G to move toward a closed position to cut off more or less of the supply of heated air from the chamber C. In this manner the movement of the regulating-valve, and consequently the temperature at which the supply of air enters the apartment, is kept under positive and constant control.

e' f', Figs. 1 and 4, represent contact-points of secondary electric circuits which are adapted to be closed by the valve G when the latter is near the termination of its movement in either direction, whereby valve-operating mechanism (shown in Fig. 4 and similar to that above described and operated by the same power) may be controlled to open or close another valve Q, Fig. 4, or give warning by a bell or otherwise to the janitor or person having charge of the apparatus, and the said second valve may in a similar manner set in action mechanism controlling a third valve, and so on.

The mechanism which operates the valve Q consists of a chain R', which passes over guide-wheels 40 41 and thence over a sprocket-wheel 42, secured to a shaft 43, supported in suitable bearings and carrying a toothed wheel 44, with which engages a worm 45 on a shaft 46, supported in brackets 47 47 and having secured thereto two pulleys 48 49, which are adapted to be rotated in opposite directions by belts 50 51, the latter being crossed, said belts passing over pulleys 52 53, loosely mounted upon a shaft 54 and adapted to be connected with said shaft in such manner as to be rotated thereby by means of clutches 55 56, which may be of any suitable or approved construction, those here shown being friction-clutches of conical form splined on the shaft 54 and adapted to be forced into correspondingly-shaped cavities in the loose pulleys 52 53. The shaft 54 is supported in bearings in hangers 57 58 and is rotated in one direction only by means of a belt 59, passing over a pulley 60, said belt 59 receiving motion from the same source of power which operates the shaft K, Fig. 1, of the valve mechanism first described, and in this manner the sprocket-wheel 42 can be rotated in either direction to open or close the valve Q by operating the proper clutch 55 or 56. The clutches 55 56 are operated, respectively, by electromagnets 61 62, secured to hangers 63 64 and included in the secondary electric circuits controlled by the valve G, the armatures of said magnets 61 62 being secured to levers 65 66, pivoted to the two branches of a hanger 67, each of these levers being bifurcated at its lower end and fitting within an annular groove 68 in one of the clutches 55 56, whereby as either magnet is energized the clutch connected with its armature-lever will be brought into engagement with its pulley to rotate the same as desired. The toothed wheel 44 has a wide space a^2 between two of its teeth, which prevents the worm 45 from rotating said wheel in either direction beyond the distance required to fully open or close the valve Q.

In other systems of valve-controlling mechanism in common use for regulating the supply of heated air to rooms either a step-by-step motion is given to the valve or the valve is wholly closed or wholly opened and no intermediate position of the valve is possible. With my improved construction the motion imparted to the valve is continuous and positive, and the valve may at any time be left at any point intermediate between open and closed positions, the entire mechanism being under the positive control of a thermostat and motor in a simple, effective, and practical manner.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a heat-regulator, the combination of a driven shaft having two wheels or pulleys loosely mounted thereon, each provided with clutch mechanism, a second shaft having two wheels or pulleys fast thereon, connections between the loose wheels of the first shaft

and the fast wheels of the second shaft so arranged that when one clutch is in operation the two shafts will revolve in the same direction and when the other clutch is in operation they will revolve in opposite directions, mechanism for connecting the second shaft with a valve or damper to be operated, and a thermostat for controlling the operation of the clutches, substantially as described.

2. In a heat-regulator, the combination of a driven shaft having two wheels or pulleys loosely mounted thereon, each provided with clutch mechanism, a second shaft having two wheels or pulleys fast thereon, connections between the loose wheels of the first shaft and the fast wheels of the second shaft so arranged that when one clutch is in operation the two shafts will revolve in the same direction and when the other clutch is in operation they will revolve in opposite directions, mechanism for connecting the second shaft with a valve or damper to be operated, said mechanism consisting of a worm on said second shaft and a toothed wheel engaged by said worm and connected with a valve or damper, and a thermostat for controlling the operation of the clutches, substantially as described.

3. In a heat-regulator, the combination of a driven shaft having two wheels or pulleys loosely mounted thereon, a second shaft having two wheels or pulleys fast thereon, connections between the loose wheels of the first shaft and the fast wheels of the second shaft so arranged that when one clutch is in operation the two shafts will revolve in the same direction, and when the other clutch is in operation they will revolve in opposite directions, mechanism for connecting the second shaft with a valve or damper to be operated, two independent electric circuits and magnets included therein for controlling said clutch mechanisms, and a thermostat for closing said electric circuits, whereby the valve-actuating mechanism is operated to open and close the valve or damper, substantially as described.

4. In a valve-operating mechanism, the combination with a valve or damper, of a shaft carrying a toothed wheel and a sprocket-wheel, a weighted chain attached to said valve and passing over said sprocket-wheel, a shaft provided with a worm engaging said toothed wheel and having two pulleys fast thereon, a revolving shaft K having two loose pulleys each provided with an electrically-controlled clutch, said pulleys being connected with the two pulleys on the worm-shaft, one by means of a straight belt and the other by a crossed belt, whereby the worm-shaft may be rotated in opposite directions by the shaft K, a separate electric circuit and a magnet included therein for controlling each clutch, and a thermostat for closing said electric circuits, whereby the valve-actuating mechanism is operated to open or close the valve or damper, substantially as described.

Witness my hand this 28th day of May, A. D. 1896.

HENRY RUSSELL WHITE.

In presence of—
P. E. TESCHEMACHER,
B. L. MARDEN.