(No Model.) 2 Sheets—Sheet 1.

G. WESTINGHOUSE, Jr.

Apparatus for Regulating Dampers, &c.

No. 236,520. **Patented Jan. 11, 1881.**

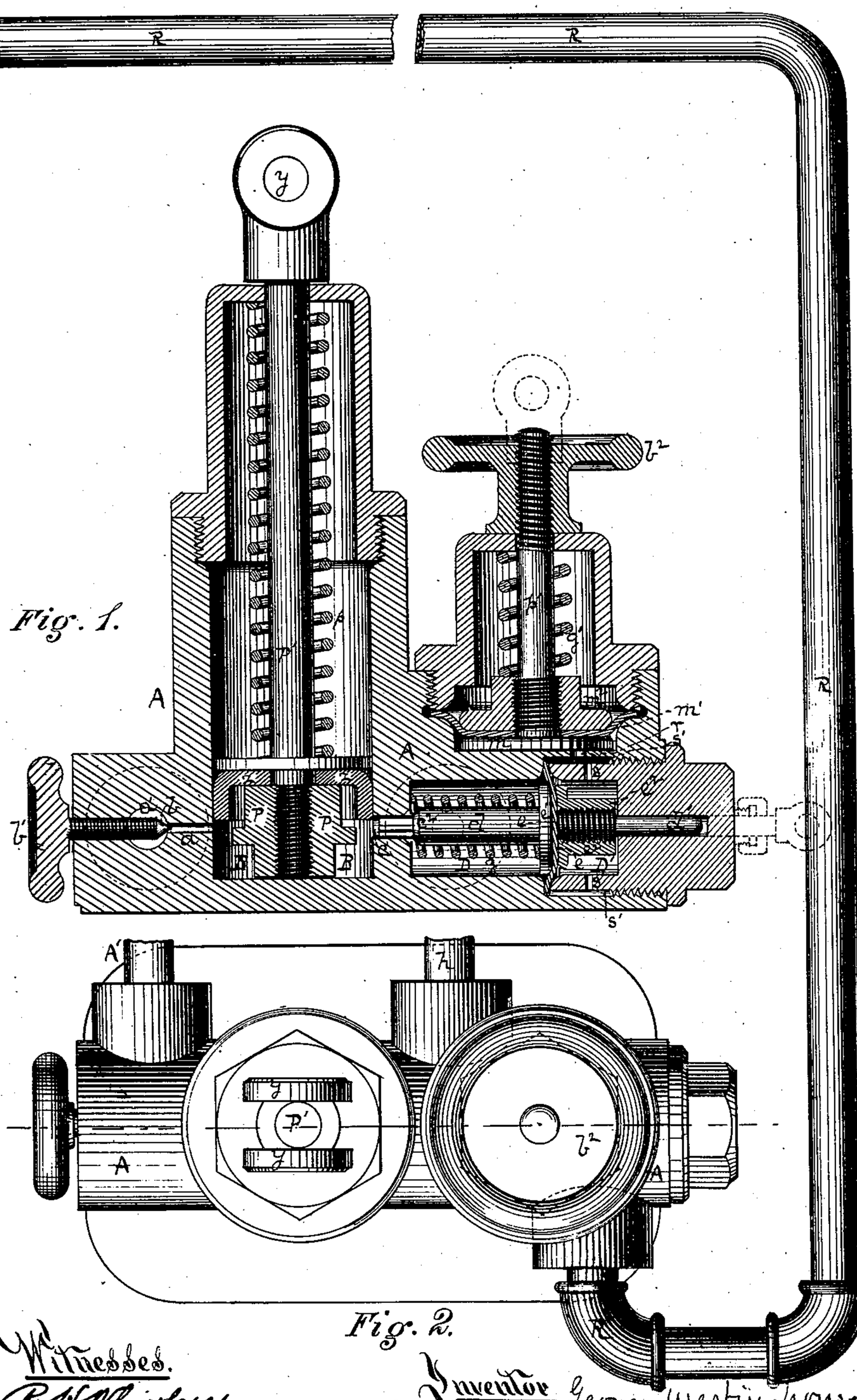

Fig. 1.

Fig. 2.

Witnesses.
R. F. Whidden
C. L. Parker

Inventor George Westinghouse Jr.
By Attorney George H. Christy

2 Sheets—Sheet 2.

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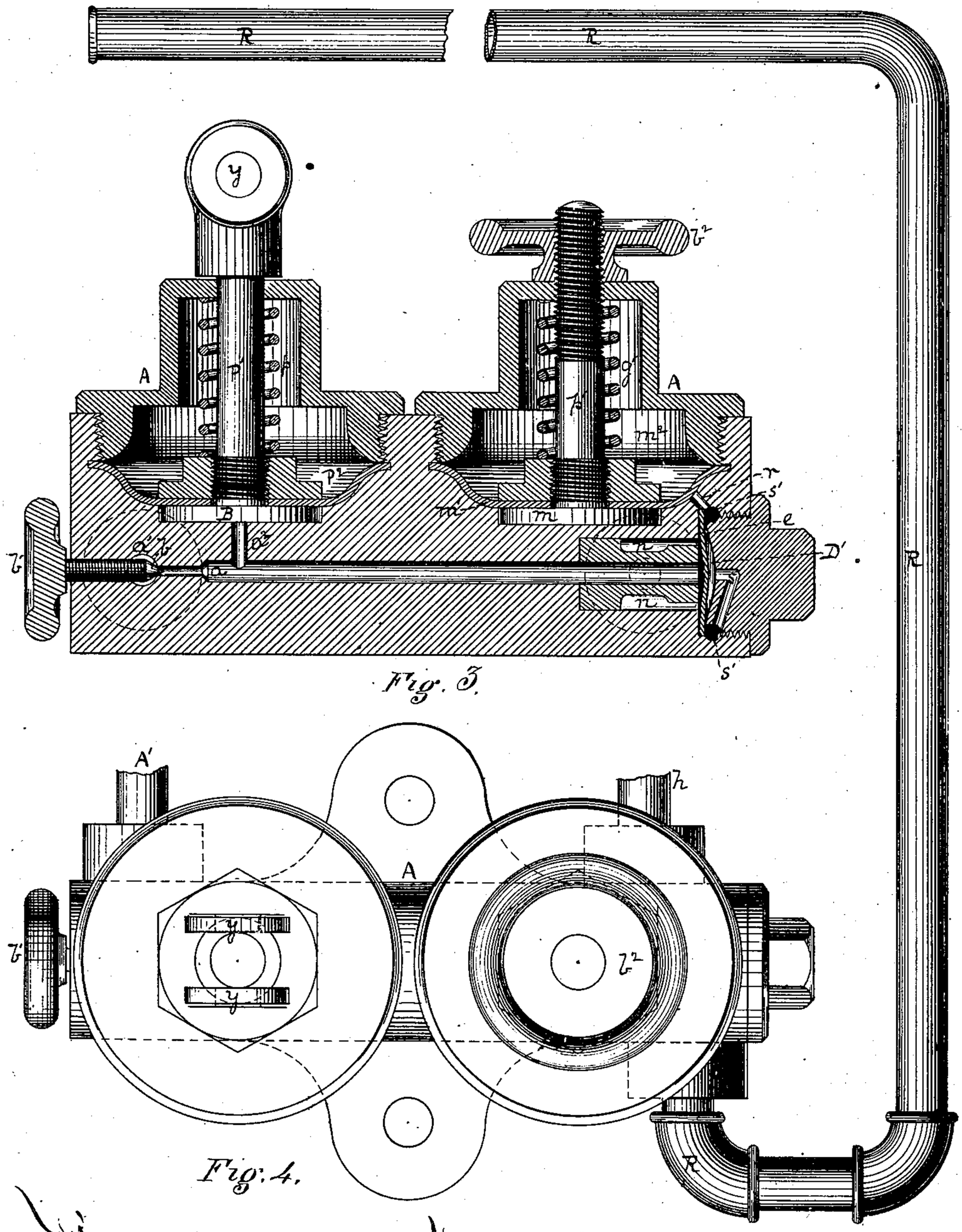

Fig. 3.

Fig. 4.

Witnesses
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UNITED STATES PATENT OFFICE.

GEORGE WESTINGHOUSE, JR., OF PITTSBURG, PENNSYLVANIA.

APPARATUS FOR REGULATING DAMPERS, &c.

SPECIFICATION forming part of Letters Patent No. 236,520, dated January 11, 1881.

Application filed November 24, 1880. (No model.)

To all whom it may concern:

Be it known that I, GEORGE WESTINGHOUSE, Jr., of Pittsburg, county of Allegheny, State of Pennsylvania, have invented or discovered a new and useful Improvement in Method of and Apparatus for Regulating Dampers and other like Appliances; and I do hereby declare the following to be a full, clear, concise, and exact description thereof, reference being had to the accompanying drawings, in two sheets, making a part of this specification, in which—like letters indicating like parts—

Figure 1 is a sectional elevation of the valve, damper, or register regulating devices which I employ; and Fig. 2 is a top or plan view thereof, and with the expansion pipe or tube added.

My present invention relates to an improved method of and apparatus for automatically regulating the effective action or operation of heat-generating, heat-supplying, or ventilating apparatus, in which the temperature of the room is to be the guide or gage by which the governing or regulating is to be done, substantially as hereinafter set forth.

In the accompanying drawings, Sheet 1, A may represent a valve-case, such as is adapted to the proper working of the devices as herein described. It has, preferably at or near one end, a pipe-connection, A′, which leads from a hydrant, raised tank, or other suitable "head," such as will give the desired operative pressure and supply. The chamber *a′*, into which this pipe opens, has a port, *a*, leading into a piston-chamber, B, and the area or size of the port-opening is regulated by means of a tapering plug or other suitable valve device, such as shown at *b*, and the adjustment thereof for the purpose of enlarging, lessening, or closing the port-opening may be effected by a hand-wheel, *b′*, or other suitable means.

The piston P is made with a cup-leather or other suitable packing, *z*, such as will be operative as against fluid-pressure from below, and either by its length below the packing or by any known form of stop-motion it is prevented from coming down so far as to cover and close the port *a*, or the port *c*, which leads therefrom. This port *c* opens into a pressure-chamber, D, which chamber is separated by a flexible diaphragm, *e*, (or equivalent packed piston,) from the expansion-chamber D′. Lengthwise of these chambers I arrange a plunger, *d*, and guiding-stem *d′*, and secure the same in proper relationship to the diaphragm *e* by a collar, *e′*, on the plunger, and a nut, e^2, on the stem thereof. The port *c*, where it enters the chamber D, is made of valve-seat form, and the adjacent end of the plunger *d* is shaped to form a valve, c^2, to seat therein, and a winged stem playing in the port *c* provides means for guiding the plunger at that end. A spring, *g*, is arranged on the plunger *d* in such manner as to lift the valve c^2 from its seat when not held to its seat by a greater force acting in the opposite direction, as presently to be described.

From the expansion-chamber D′ one or more ports, *s*, lead either directly or through an intermediate annular chamber, *s′*, to a pipe, R, and by an open port, *r*, communication is also made with a safety-chamber, *m*. This chamber has a flexible diaphragm-cover, *m′*, and room is provided above, by chamber m^2, for its necessary range of motion. A spring, *g′*, is added to press it down, and a hand-wheel, b^2, by which to turn it up.

The pipe R, closed at its outer end, may be of any desired length, and in practical use it is arranged in such part of a house as may be desired with reference to its taking and absorbing heat to such degree that it may be used as a means of indicating the point at which further elevation of temperature is not desired. Preferably it should be made of some material which is sensitive as regards changes of temperature, and it may be so made and arranged in a room as to be both ornamental and useful—as, for example, it may be arranged to represent a molding, either in the cornice or base, or on a mantel-piece or picture or clock frame. It is to be filled with any suitable expansible liquid, and enough should be put in to fill the chambers D′ and *m*, and their connecting-passages as well. For ordinary purposes a one-eighth brass pipe, made of comparatively thin brass and of considerable length, is believed to be suitable for the purpose.

The piston P is made with a stem, P′, on which is a downwardly-acting spring, *p*, and

the end of this stem is to be connected, by an eye, *y*, or otherwise, directly or by any suitable interposed devices, with the register, damper, or valve, or other device by which either the amount of heat generated or its flow or supply is to be regulated, or with any known like device by which to secure or promote ventilation. Also, the chamber D′ has a waste-port, *h*, through which fluid in the chamber may escape; but, preferably, the discharge-point of the port or of the pipe connected therewith should be at or above the level of the lower side of the packing of the piston P, so that the space below such piston shall at all times be full.

The apparatus is to be adjusted for use preferably so that at the lowest temperature desired in the room the pipe R, chambers D′ and *m*, and their connecting ports and passages shall be full, and the diaphragm *e* be under little or no tension, and the valve c^2 be a little clear of its seat; also, the plug *b* should be set so as to let the fluid-pressure through but slowly; also, the spring *g′* should be made or adjusted so as to give a greater resistance to compression than the spring *g;* and, still further, when the piston P is clear down, the register, damper, valve, or other device connected therewith, should thereby be so set as to give or result in the giving of approximately the maximum amount of heat desired. If, now, the temperature of the room by the heat supplied should be materially raised, the liquid in the pipe R will be correspondingly expanded thereby, and such expansion, operating back in the chamber D′, will shift the diaphragm *e* to the left, and thereby cause the valve c^2 to close, or partly close, the port *c*, and this latter operation will cause the pressure entering at *a* to act beneath the piston P, and, by raising it, to close, or partly close, or shift the valve, damper, register, or other device, so as correspondingly to lessen the heat-generating or heat-delivery power or capacity of the heating apparatus; and, by a still further connection of like character, the same motion may be employed to open ventilating flues or openings for the admission of cold air. If, after the supply of heat is stopped or reduced sufficiently, the liquid column in R begins to contract in consequence of a falling temperature, then the diaphragm *e* will, by the spring *g*, be shifted to the right, so as to open the port *c*, in consequence of which the piston, being relieved wholly or in part of pressure beneath, will be forced down by the spring *p*, and the valve, register, or damper will be correspondingly shifted the other way; but to prevent the bursting of the pipe R or the rupture of the diaphragm *e* in case of an over-expansion of the liquid from summer or other heat, I provide the safety-chamber *m* and its yielding cover *m′*. While the spring *g′* gives greater resistance to compression than the spring *g*, it is to be set so that it will yield before the breaking-point of R or *e* is reached. With this explanation the manner of varying the adjustments so as to get the best results (so far as variation may be necessary) will be readily understood.

It will be within my invention to substitute compressed air or steam for water as a means for actuating the piston P, and for this purpose the pipe A′ may lead to any suitable reservoir or generator or other source of supply.

I do not limit myself to precise form, proportions, or arrangements of parts, provided only the substantial and material features of construction and operation be preserved with reference to the end in view; and I would particularly state that the damper, register, or valve connection might be made from the prolonged outer end of the stem *d′*, or from the upper end of the stem *p′* of cover *m′* of the expansion-chamber *m;* or a separate connection may be run from each to a separate damper, register, or valve, the proper means being added, if necessary, for getting a comparatively long motion from a comparatively short one. Also, in lieu of piston P, a flexible diaphragm may be employed as the mechanical equivalent thereof.

One characteristic and radical feature of the present invention consists, in general terms, in the employment of the expansibility of a suitable material subject to atmospheric changes, and by virtue of such changes capable of changing its shape for the purpose of calling into action some other power or force in such manner as thereby to effect the shifting of a damper, valve, register, or other device, which latter is adapted to regulate or govern the action or operation of heat-generating or heat-supplying or ventilating apparatus; and for this purpose the pipe R may be secured at its outer end, and its inner end be affixed directly to the diaphragm, or a wire may be used in like manner, (with bell-cranks at the corners,) so that by the expansion and contraction of the pipe or wire any desired power may be brought into operation, so as to give motion to a piston, diaphragm, or equivalent device, and by virtue of such motion actuate a heat-generating or heat-supplying or ventilating device or apparatus; and as one of the powers to be so employed I include electro-galvanic force in addition to hydraulic force and the force of fluids under compression, or expansible fluids.

If an electro-magnet is used, the end of the plunger *d*, instead of closing a port, may be arranged to make or break a circuit, and thereby cause an armature of an electro-magnet to operate the valve, register, or other device in question.

I would also state that as regards the diaphragm described as means of receiving and imparting motion a bent tube is a well-known equivalent, illustrations of which will be found in steam-gages; and as illustrative of a modified structure of apparatus by the use of which the described method of operation may be employed, I have added another sheet of drawings, wherein Fig. 3 is a sectional view of a valve-

case and its operative devices, and Fig. 4 shows a top or plan view of the same with the gage-pipe R added, as in Fig. 2.

In the structure thus represented, A represents the valve-case as before. A′ is the pipe communicating with the "head" or source or reservoir of power, and which opens into the chamber *a′*, from which a port, *a*, leads to an expansion-chamber, D′.

As regards the port *a*, the plug *b* and hand-wheel *b′* perform the same function as above set forth.

From a port, *a*, a side port, a^2, leads to the chamber B, and fluid-pressure in this chamber is transmitted, through a stem, P′, (pressed down by a spring, *p*,) to the heat generating or regulating devices, in like manner as before; but instead of showing a piston in this chamber B, I have inserted its mechanical equivalent—viz., a flexible diaphragm, P^2.

From the expansion-chamber D′ a port or ports, *s*, lead to an annular chamber, *s′*, and the latter is in open communication with the pipe R, already described, and, by port *r*, with the safety-chamber *m*.

Other devices, similarly lettered, have substantially the construction and operation already set forth; but in this construction I dispense with those devices of Fig. 1 which are interposed between the port *a* and the diaphragm *e*, and so arrange the diaphragm *e* that it may be used as a valve to open and close the end of the port.

When, in the manner already described, the diaphragm *e* is pressed against the end of the port *a*, the fluid-pressure, entering from *a′*, is caused to act beneath the diaphragm P^2, and by raising it effect the desired shifting of the heat generating or regulating apparatus, and as the fluid or metal column R contracts, the pressure in *a* forces the diaphragm *e* back, and allows the fluid-pressure in B to pass out by the chamber *n* and waste-pipe *h*, connected therewith.

The safety-chamber *m* provides as against rupture or breakage, as already set forth; and in the use of this form of apparatus like modifications may be made as are above referred to in connection with Figs. 1 and 2.

Also, in the summing of my invention in the claims following, I include a movable piston within the term "diaphragm," and vice versa, each being the mechanical equivalent of the other for the purposes enumerated.

I am aware that it is not new to actuate a damper by variations of pressure caused by greater or less pressure in a steam-boiler, such pressure being transmitted directly from such boiler to the damper by a float or movable column of mercury; but I am not aware of any prior apparatus in which the moving power was derived from variations in the temperature of the atmosphere by which the apparatus itself was surrounded, nor of any in which the variations of pressure so caused operated to bring into and let out of action another motive power which, by a positive action, moved or shifted a heat-supplying or ventilating device; and my present invention is limited in accordance with the distinctions thus drawn.

I claim herein as my invention—

1. A heat-regulating apparatus having in combination a pipe, R, filled with liquid, arranged in the room the temperature of which is to be the gage, such pipe being connected with a chamber closed on one side by a flexible diaphragm, and a pressure-supply port opening either directly or through an interposed valve onto the opposite side of said diaphragm, substantially as set forth, whereby, on the greater or less opening or closing of said fluid-pressure-supply port by the movement of the diaphragm, to regulate automatically the application of fluid-pressure to an independent piston, the stem of which is adapted to connect with the regulating device.

2. The combination of a fluid-pressure supply, operating through a port, *a*, on one side of a piston having a regulator-connection, and mechanism for opening or closing such port by the expansion and contraction of a column of metal or fluid arranged to expand and contract under changes of atmospheric temperature, substantially as set forth.

3. The combination of a fluid-pressure supply, operating through a reduced port, *a*, on one side of a piston, P, a port, *c*, leading to a waste, and a valve, c^2, operated in opening and closing such port, by the expansion and contraction of a column of metal or fluid arranged to expand and contract only under changes of atmospheric temperature, substantially as set forth.

4. The combination of piston P, its fluid-pressure supply and waste ports, chambers D D′, diaphragm *e*, pipe R, and safety-chamber *m*, substantially as set forth.

5. The method of regulating and varying the position of heat-generating and heat-delivering or ventilating regulators by causing a column or line of metal, fluid, or other suitable material subject to changes of form from changes of the surrounding atmospheric temperature to actuate a movable diaphragm, or equivalent piston, and by such action to bring into and out of operation another force or power, and cause the latter to act through suitable appliances to shift the valve, damper, register, or other regulator, substantially as set forth.

6. A column or line of metal, fluid, or other suitable material subject to changes of form from changes of the surrounding atmospheric temperature, in combination with a flexible diaphragm, or equivalent piston, and a connection from such diaphragm or piston, through which to actuate a valve, damper, register, or other regulator, substantially as set forth.

7. In combination with a column of fluid acting, by its expansion and contraction under changes of the surrounding atmospheric tem-

perature, to operate either directly or through other power a heat-supplying or ventilating device, an expansion or safety chamber having a yielding side, top, or cover, whereby to provide for excess of expansion over and above what is required for the work to be done, substantially as set forth.

8. In combination with a column of fluid acting by its expansion and contraction in operating a heat-supplying or ventilating device, an expansion and safety chamber, *m*, having an adjustably-movable top, cover, or side, whereby to regulate the effective expansion of the fluid column, substantially as set forth.

In testimony whereof I have hereunto set my hand.

GEORGE WESTINGHOUSE, JR.

Witnesses:

R. H. WHITTLESEY,

GEORGE H. CHRISTY.