No. 680,471. Patented Aug. 13, 1901.

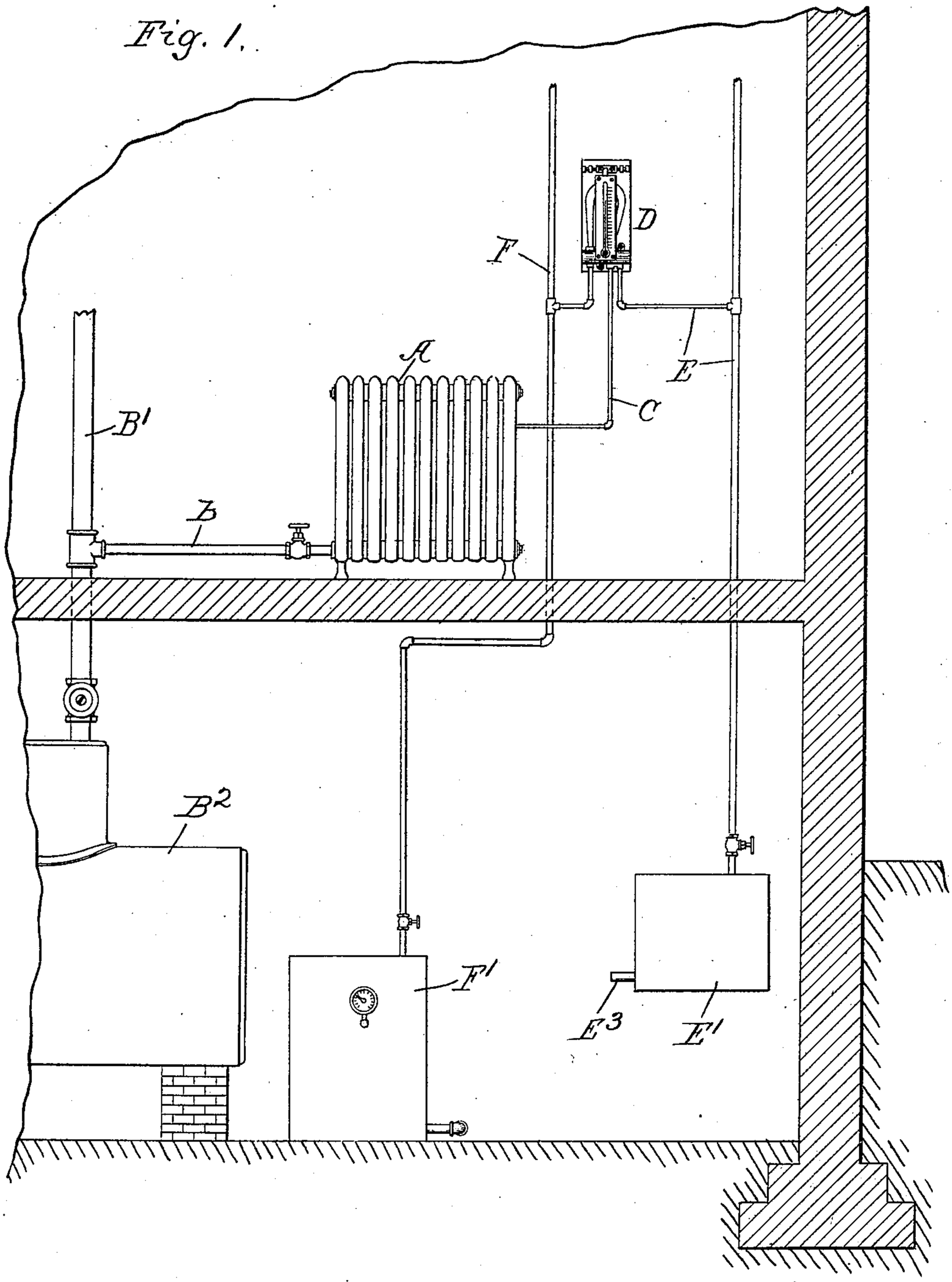
C. G. ARMSTRONG.

HEAT REGULATING DEVICE.

(Application filed Sept. 2, 1898.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.



Witnesses.
Edward T. Wray.
Homer L. Kraft

Inventor:
Charles G. Armstrong

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(No Model.) 3 Sheets—Sheet 2.

Fig. 2

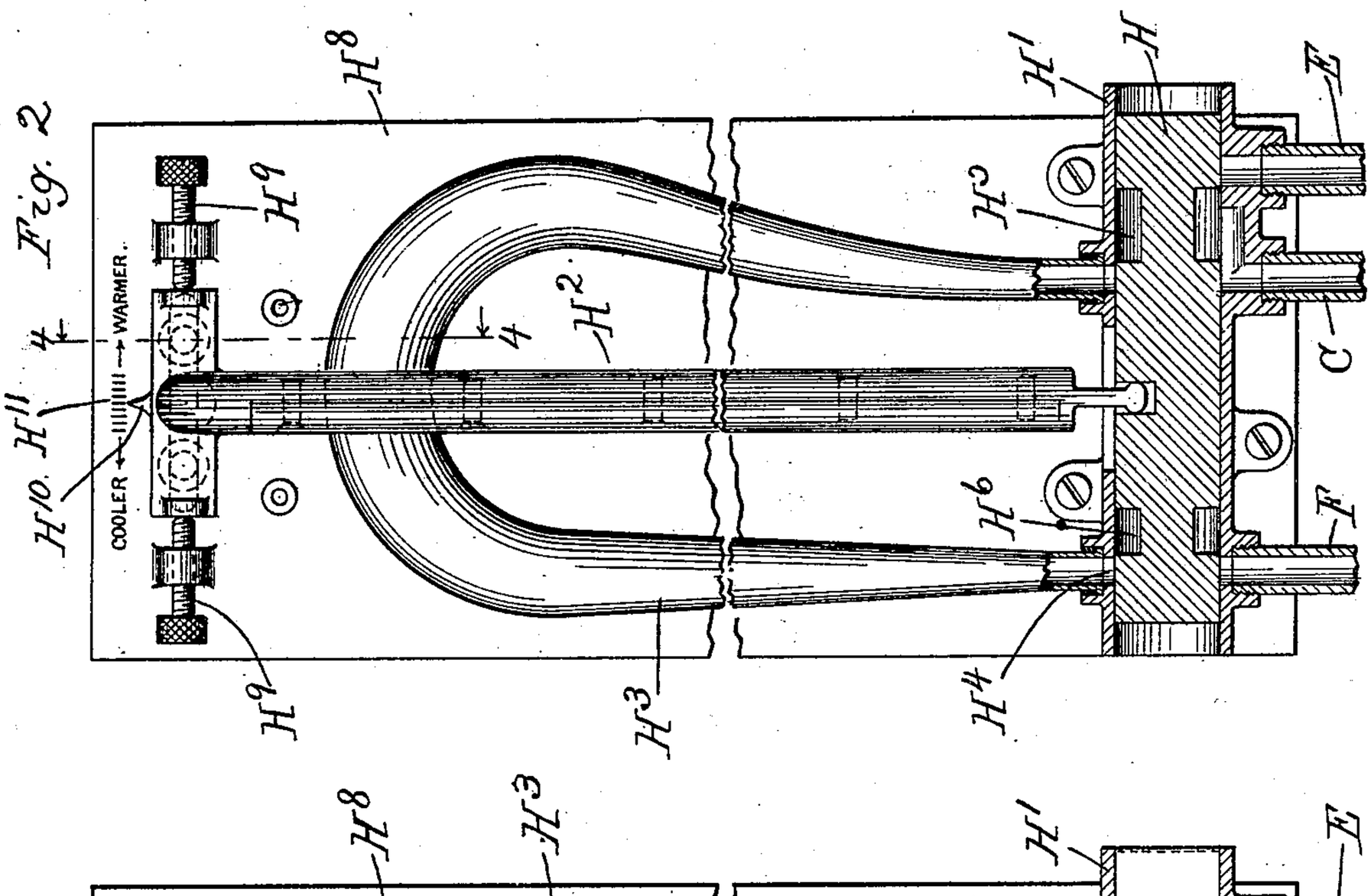

Fig. 3.

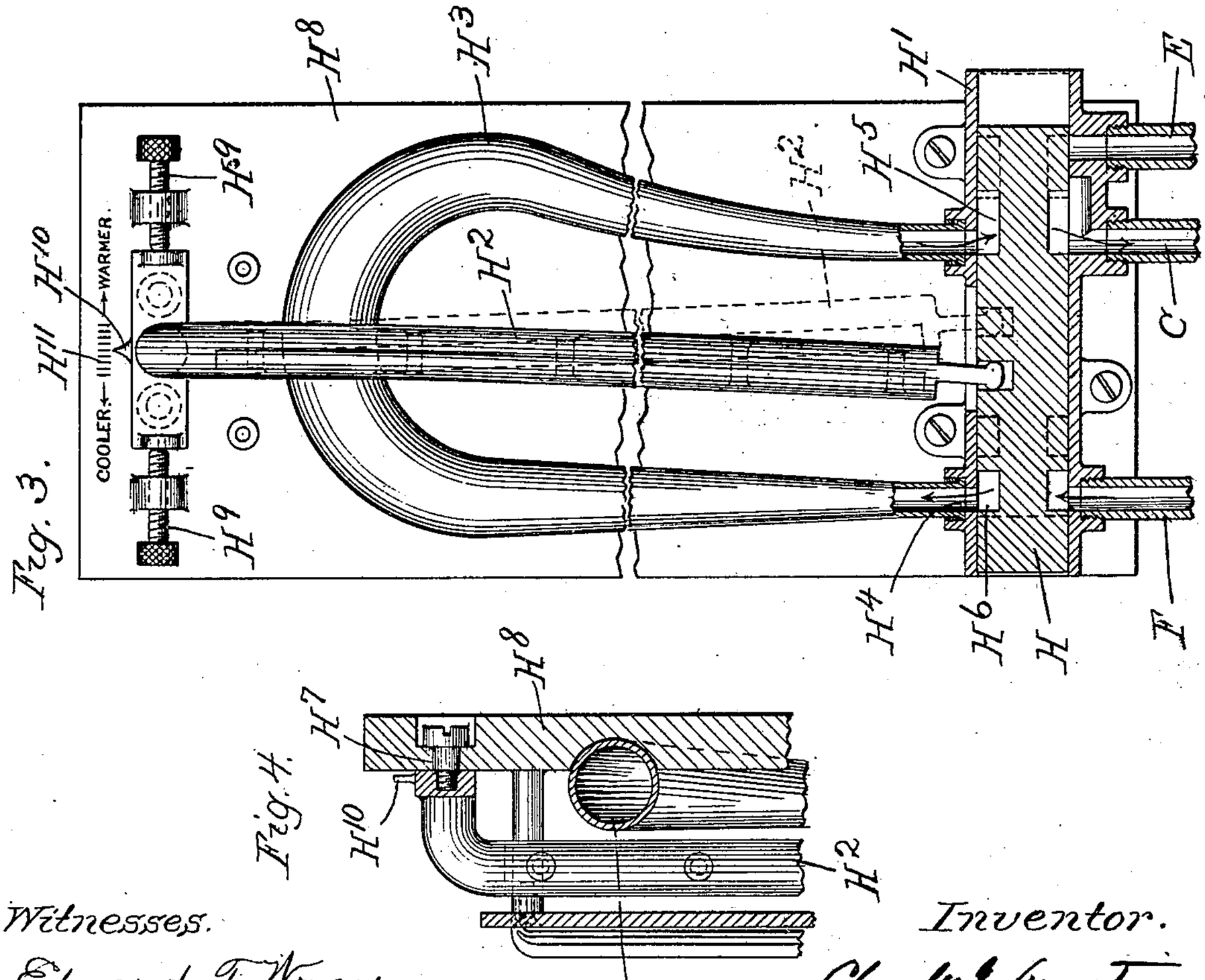

Fig. 4.

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3 Sheets—Sheet 3.

Fig. 5.

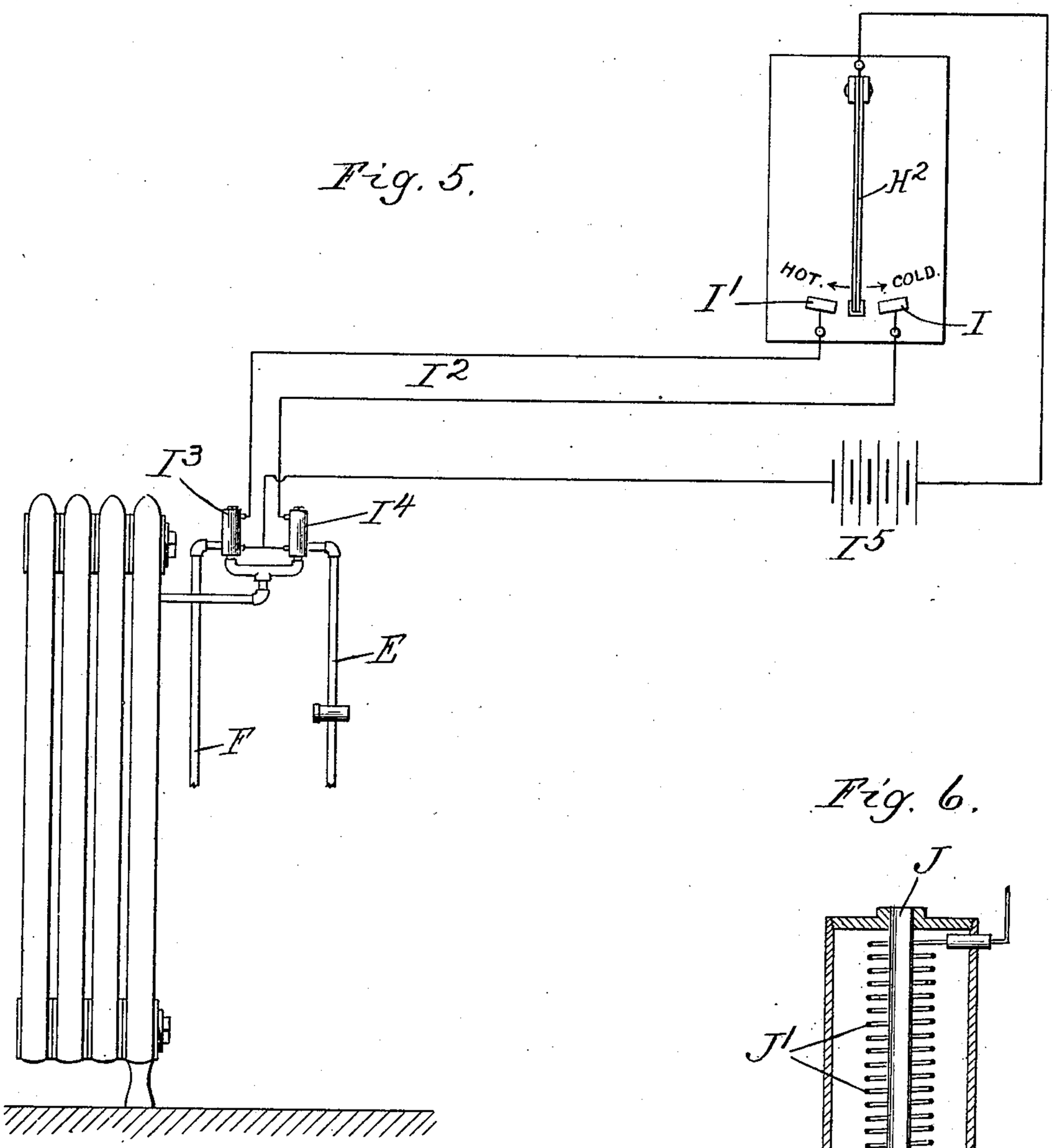

Fig. 6.

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UNITED STATES PATENT OFFICE.

CHARLES G. ARMSTRONG, OF CHICAGO, ILLINOIS, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO JAMES E. HEG, OF RAHWAY, NEW JERSEY.

HEAT-REGULATING DEVICE.

SPECIFICATION forming part of Letters Patent No. 680,471, dated August 13, 1901.

Application filed September 2, 1898. Serial No. 690,062. (No model.)

To all whom it may concern:

Be it known that I, CHARLES G. ARMSTRONG, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Heat-Regulating Devices, of which the following is a specification.

My invention relates to a temperature-regulating device, and has for its object to provide a new and improved device for this purpose.

My invention is illustrated in the accompanying drawings, wherein—

Figure 1 is a diagrammatic view of a portion of a steam-heating system embodying my invention. Fig. 2 shows the regulating device proper in part section. Fig. 3 is a view similar to Fig. 2, showing the parts differently disposed. Fig. 4 is a section on line 4 4, Fig. 2. Fig. 5 is a diagrammatic view showing a modified construction. Fig. 6 is a section through one of the electrically-operated valves shown in Fig. 5.

Like letters refer to like parts throughout the several figures.

In steam-heating systems as now commonly used the radiators are provided with valves for permitting the escape of the air confined in the radiators, so as to allow the steam to enter. When air is confined in the radiators, such air prevents the steam from entering the coils occupied by it, and hence prevents the heating of the radiator. It is customary to provide an automatic valve which permits the escape of all the air in the radiator and is then automatically closed as soon as the steam begins to escape. This construction allows the entire radiator to be filled with steam at all times, regardless of the heat required at any given time. It is customary to make radiators of such heating capacity that they will have radiating-surface sufficient to heat the apartment during the coldest weather liable to occur during the season. It will therefore be seen that if the entire heating-surface of the radiator is used at all times, as is now the case, too much heat is given out during the greater part of the heating season.

It is one of the objects of my present invention to provide means for regulating and controlling the amount of radiating-surface of any given heater or radiator, this regulating and controlling to be accomplished automatically and being dependent upon the temperature desired in the apartments to be heated.

Referring now to Fig. 1, I have shown a radiator A, connected by the pipe B with the heating-main B′, connected with the boiler B^2. Leading from the radiator is a pipe C, which may exhaust into the air, but which is preferably connected by the exhaust-pipe E with some suitable pump or other exhaust device E′, the regulating device proper, D, being associated with said exhaust-pipe in any desired manner, so as to be located at a convenient point in the room. It is of course evident that any exhaust device may be used, and for purposes of illustration I have simply shown such exhaust device diagrammatically. An air-supply pipe F also leads from the radiator to some suitable source of air-supply F′, which for purposes of illustration is shown as a tank, the regulating device being associated with said air-supply pipe in any desired manner. In the construction shown in Fig. 1 the pipe C is common both to the exhaust from the radiator and the admission thereto.

Referring now to Fig. 2, I have shown diagrammatically and in detail one form of the regulating device proper. As illustrated in this figure, I provide a suitable controlling device or valve H, contained in a suitable casing or cylinder H′, to which are connected the pipes C, E, and F. Associated with the part H is a suitable device which responds to variations in temperature. It is of course evident that any construction may be used, and for purposes of illustration I have shown a simple thermostat H^2, made of metals expanding unequally under varying temperature. Associated with the thermostat H^2 is a tube or passage-way H^3, some part of which is of greater cross-sectional area than the inlet H^4. The part or valve H is provided with suitable ports H^5 and H^6, adapted to control the passage of the air or steam through the pipes C, E, F, and H^3. The thermostat H^2 is movably mounted at its upper end, so that it may be adjusted to act when the temperature in the room reaches any given point. This re-

sult may be obtained in any convenient manner. As herein illustrated, the thermostat is held in position by means of the projection H^7, which extends through the support H^8 and works in a suitable groove, so that the thermostat may be shifted laterally. Two set-screws H^9 are associated with the thermostat, and adjustment may be had by adjusting these set-screws in any desired manner. A suitable indicator H^{10} is associated with the thermostat and is opposed to a suitable scale H^{11}, divided into degrees representing temperature, so that the device may be adjusted to operate when the temperature in the room reaches any given point.

I have illustrated a simple form embodying my invention; but it is of course evident that many other constructions may be used instead of the construction herein illustrated and that many variations may be made without in any manner departing from the spirit of my invention, and I therefore do not wish to be limited in any manner by the construction shown.

I have shown a modified construction in Fig. 5. This figure shows an electrically-operated device. Associated with the thermostat H^2 are two electrical contacts I I', which are connected by conductors I^2 with electrically-operated valves I^3 I^4, the thermostat H^2 being included in the circuit. A source of electric supply or battery I^5 is connected with the circuit and may be located at any convenient place. The electrically-operated valves may be of any suitable construction.

In Fig. 6 I have shown a sectional view of one of these valves. In this valve the valve-stem J is made of some suitable composition having a high coefficient of expansion. This valve-stem is surrounded by a coil J' of wire, preferably of high resistance. The position of the valve J^2 with relation to its seat J^3 is controlled by means of the contraction and expansion of the stem J, due to variations in temperature.

I have illustrated a steam-heating system showing steam coils or radiators; but it is of course evident that my invention may be applied to other heating systems, and when I use the term "radiator" I use it in its broad sense and mean to include the heaters of all such heating systems. I have also illustrated my invention as applied to a single-pipe system; but it is of course evident that it may be applied to a system where a separate return-pipe is used. I have not illustrated these various forms, for the reason that the application of my invention to them will be clear to those versed in the art.

It is of course evident that some of the parts herein illustrated may be omitted and others used with parts not herein shown without departing from the spirit of my invention.

The use and operation of my invention are as follows: As illustrated in Fig. 2, the controlling device is in its normal or inactive position. If now the area of the heating-surface of the radiator is so great as to produce a higher temperature in the apartment than that for which the regulating device is adjusted, the lower end of the thermostat H^2 will be moved to the left and the parts will occupy the position illustrated in Fig. 3. In this position the source of air-supply is connected by pipe F, port H^6, pipe H^3, port H^5, and pipe C with the radiator, and the air is forced into such radiator, thus forcing back the steam and reducing the active heating-surface of the radiator by expelling the steam from some of the coils. As the air admitted into the radiator would soon expel all of the steam if the connection with the source of air-supply was allowed to continue for any length of time, some suitable means should be provided for cutting off the air-supply before the lowering of the temperature of the room causes the thermostat H^2 to act. It is of course evident that various constructions may be used for this purpose, and, as herein illustrated, I have provided the passage-way or pipe H^3 with an enlarged portion in proximity to the thermostat. When the air under pressure flows from the pipe F to the enlarged part of the pipe or passage-way H^3, it suddenly expands, and this expansion cools the pipe H^3. This sudden cooling of the pipe H^3 in view of its association with the thermostat H^2 at once affects the thermostat and causes it to move back to the position shown in Fig. 2, thus cutting off the supply of air. This action preferably cuts off the supply of air before the radiating-surface of the radiator is reduced the proper amount, and the high temperature in the room will cause the device to again act in the manner above described until the radiating-surface is reduced the proper amount. I have found in practice that the great difficulty in reducing the area of the heating-surface of the radiator in this manner is that too much air is liable to enter the radiator, and hence I so adjust the regulating device as to only permit a small amount of air to enter at any given movement of the valve H. When so adjusted, the valve moves over, admits a little air, and is moved back again automatically, and this intermittent operation is continued, admitting a small portion of air at a time until the radiating-surface is reduced sufficiently to reduce the temperature in the room the proper amount. The device then remains in the normal position shown in Fig. 2. The construction for producing this intermittent action might be properly called a "retarding device" as it retards the action of the regulating device so as to prevent undue action of the same. If now the radiating-surface is reduced too great an amount to provide sufficient heat, the temperature of the room will lower below the normal, and the end of the thermostat will be moved to the left, the parts taking the position illustrated in the dotted lines in Fig. 3. When in this position, the pipe C from the radiator is connected with the exhaust-pipe

E, thus permitting the air to pass from the radiator, so as to increase the active heating-surface. The air in this case passes through pipe C, then through port H^5, and then through exhaust-pipe E. The passage of air, which, because of being in the radiator, is warm, heats the valve H and affects the thermostat, so as to cause it to move to the left and cut off the exhaust. I desire to so locate and adjust the parts that this heat will affect the thermostat, so as to cause it to act intermittently, as above described, in referring to the admission of air into the radiator, thus preventing the exhaust of too much air. It will be seen that by a proper manipulation and regulation of the parts the temperature in the room may be automatically controlled and the effective heating-surface of the radiator or heater varied, so as to be just sufficient to produce the temperature desired.

I have not attempted to show the exact and proper disposition of the parts to produce this result, for the reason that this disposition of parts would depend upon the conditions to be met and would readily occur to and would be readily produced by those conversant with the art when the conditions in which the device is to act are ascertained.

Referring now to Figs. 5 and 6, I have shown an electrically-operated device. In this construction when the temperature of the room rises above the temperature for which the device is adjusted the thermostat moves over and makes contact with the contact I'. This completes the circuit through the valve I^3 and heats the coil J' surrounding the valve-stem J. The heating of this valve-stem causes it to expand, so as to move the valve J^2 away from its seat J^3. This opens the passage way leading from the source of air-supply to the radiator and admits air into the coils of said radiator, so as to reduce its active heating-surface. The rush of cool air through the valve contracts the valve-stem and causes the valve to close after a small amount of air has entered the radiator. If the area of the active heating-surface has not been sufficiently reduced, the thermostat still remains in position to keep the circuit closed and the valve is again opened, the intermittent action before described being obtained. After the heating-surface is reduced sufficiently to reduce the temperature in the room the proper amount the thermostat is moved so as to break the circuit. If the temperature is reduced too much, the thermostat makes contact with the contact I and the valve I^4 is operated so as to open the exhaust-passage and allow a portion of the air to be exhausted.

Referring to the intermittent action of the device of my invention, it will be seen that the action is what may be described as a step-by-step action for the introduction or withdrawal of the air or heating fluid. When, for example, the air is being admitted, it is admitted a small portion at a time by a step-by-step intermittent action, and hence a too-great introduction or withdrawal is guarded against.

I claim—

1. A temperature-regulating device for heating systems, comprising a controlling and regulating device for connecting the radiator with a source of air-supply or an exhaust device, said controlling and regulating device responsive to variations in temperature in the apartment to be heated, and adapted for regulating the admission of air into the radiator when the radiator is connected with the source of air-supply and for producing an intermittent or step-by-step admission of the air into the radiator.

2. A temperature-regulating device for heating systems, comprising a controlling and regulating device for connecting the radiator with a source of air-supply and an exhaust device, said controlling and regulating device responsive to variations in temperature in the apartment to be heated, and responsive to the flow of air passing to the radiator when the radiator is connected with the source of air-supply and adapted to produce an intermittent or step-by-step admission of the air.

3. A temperature-regulating device for heating systems, comprising a source of air-supply and an exhaust device, suitable connections leading from the radiator to said source of air supply and exhaust, a thermostatic device associated with these connections and adapted to control said connections in response to variations in temperature in the apartment to be heated, and to produce an intermittent or step-by-step admission to said radiator when connected with the source of air-supply.

4. A temperature-regulating device for heating systems, comprising a source of air-supply and an exhaust device, suitable connections leading from the radiator to said source of air supply and exhaust, a thermostatic device associated with these connections and adapted to control said connections in response to variations in temperature in the apartment to be heated, a regulating device associated with said thermostatic device and adapted to modify its action so as to produce an intermittent admission of the air into said radiator.

5. A temperature-regulating device for heating systems, comprising a source of air-supply and an exhaust device, suitable connections leading from the radiator to said source of air-supply and exhaust device, a thermostatic device associated with these connections and adapted to control said connections in response to variations in temperature in the apartment to be heated, said thermostat located in proximity to a portion of the connection leading from the source of air-supply to the radiator whereby it is affected by the passage of the air so as to act to check said passage before the temperature in the apartment is varied the proper amount.

6. A temperature-regulating device for heating systems, comprising a source of air-supply and an exhaust device, suitable connections leading from the radiator to said source of air-supply and exhaust device, suitable valve mechanism for controlling said connections, a thermostatic device adapted to operate said valve mechanism in response to variations in temperature in the apartment to be heated, said thermostat associated with the connection to the radiator so that the passage of material through said connection adjacent to the thermostatic device affects the thermostatic device and causes it to act upon said valve mechanism before the temperature in the apartment is reduced the proper amount.

7. A temperature-regulating device for heating systems, comprising a controlling device for connecting the radiator with a source of air-supply or an exhaust device, said controlling device responsive to variations in temperature in the apartment to be heated, and comprising automatic means for controlling intermittently or step by step the exhaust or the admission of the air, so as to prevent too great variation in the area of active heating-surface of the radiator.

8. A temperature-regulating device for heating systems, comprising a device for automatically varying the effective heating area of the heater, a controller responsive to variations in temperature in the apartment to be heated, and means comprised in said controlling device for regulating the action of the device for automatically varying the effective area of the heater, said means producing an intermittent or step-by-step action of such device.

9. A temperature-regulating device for heating systems, comprising a controlling device for connecting the radiator with a source of air-supply and an exhaust device, said controlling device responsive to variations in temperature in the apartment to be heated, and adapted to regulate the admission of air into the radiator when the radiator is connected with a source of air-supply and to automatically or by a step-by-step action vary the application of air to the radiator.

10. A temperature-regulating device for heating systems, comprising a device for automatically varying the effective heating area of the heater, a controller responsive to variations in temperature in the apartment to be heated, and means associated with said controller for regulating the action of the device for automatically varying the effective area of the heater, said means adapted to produce a varying or step-by-step action of such device.

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