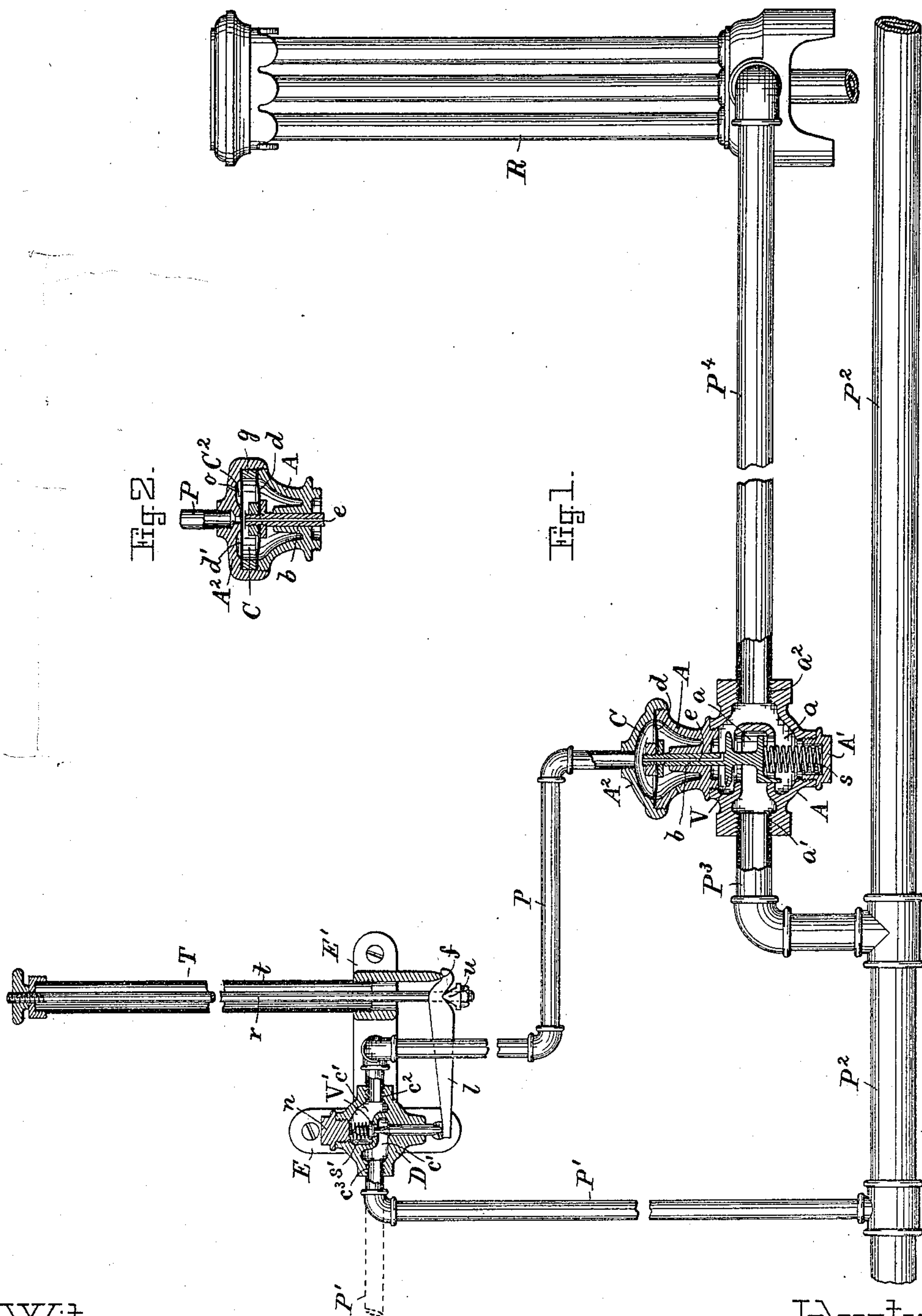


(No Model.)

N. CURTIS.
HEAT REGULATOR.

No. 441,648.

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Witnesses

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HEAT-REGULATOR.

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To all whom it may concern:

Be it known that I, NELSON CURTIS, of Boston, in the State of Massachusetts, have invented a new and useful Improvement in Heat-Regulators, of which the following is a specification.

The invention is particularly applicable to the heating of railroad-cars, factories, and large buildings heated by steam supplied from boilers containing steam at high pressure; and its object is to regulate the steam within the radiators in the car or apartment to be heated by the pressure of the steam itself as well as by a thermostat within the car or apartment.

The invention consists, as hereinafter more particularly set forth, in the combination, with the inlet-valve of the radiating system and a spring operating to move the valve in one direction, of a diaphragm or diaphragms operating to move it in the opposite direction, the said diaphragm, where one is used, being exposed to and operated by the back-pressure of steam within the system, and also exposed to and operated by steam or similar motive power flowing from the same or a different source through an independent pipe containing a valve controlled by a thermostat, and where two are used one being controlled by the back-pressure of steam within the system and the other being controlled by the steam or similar motive power flowing, as in the other case, from the same or a different source through an independent pipe containing a thermostatic valve.

The advantages of the invention are obvious, for it is clear that the radiators of the heating system will take longer time to cool and consequently the apartment take a longer time to cool if the inlet-valve is closed leaving the heating system filled with steam under high pressure than if it is closed leaving it filled with steam at low pressure. Indeed, where steam of high pressure is used the temperature of the apartment heated will often continue to increase after steam has been cut off. The thermometer rises while the steam-pressure gage runs down. By my invention this difficulty is substantially obviated, and substantial uniformity may be obtained in the temperature of the apartment.

In the drawings, Figure 1 is a sectional elevation of apparatus embodying my invention. Fig. 2 represents in sectional elevation a modification of construction.

A is a casting containing a chamber *a*, provided with valve *V* and suitable port and seat therefor, and having two hollow arms or projections *a'* and *a''*, threaded within to connect said chamber with pipes belonging to the steam-heating system on either side of said valve. *A'* is a cap for said chamber *a*, and forms a seat for a spring *s*, that presses against the valve *V* to open it. *C* is an expansion-chamber in said casting *A*, formed, as shown, by a cap *A''*, and a flexible side or diaphragm *d*, the latter being rigidly connected with valve *V* by the valve-stem *b*, which is hollow, thereby affording a passage-way *e*, as shown, from chamber *a* on the low-pressure side of valve *V* to expansion-chamber *C*. *P* is a pipe entering said expansion-chamber *C* through cap *A''*, as shown.

D is a casting containing a valve-chamber *c'*, provided with thermostatic valve *V'* and a suitable port and seat therefor. This valve *V'* is normally kept upon its seat by a spring *s'*, which is compressed by cap *n*, closing the chamber *c'*. It is provided with a stem which passes through a hole in casting *D*, and bears against one end of a lever *l*, which has at its other end a knife-edge fulcrum *f*.

T is a thermostat consisting of a tube *t* and rod *r*, made, respectively, of metals having different rates of expansion, and put together in the ordinary manner. The rod *r* passes through the lever *l*, as shown, and also through a knife-edge bearing-piece *u*, to which it is secured by a nut, as shown.

E and *E'* are two plates with ears for attaching the casting *D* and thermostat *T* in position in the apartment containing the heating system. The casting *D* has, as shown, two hollow arms or projections *c''* and *c'''*, threaded within to connect, respectively, the chamber *c'* on the low-pressure side of the thermostatic valve *V'* with pipe *P*, leading to the expansion-chamber *C*, and on the high-pressure side of said thermostatic valve *V'* to connect said chamber *c'* with pipe *P'*, leading either to the steam-heating system on the high-pressure side of valve *V* or to an independent and

separate reservoir of any suitable fluid under a pressure higher than that of steam admitted to the expansion-chamber C through passage-way *e*, and remaining therein.

5 P^2 is a main pipe connecting with the boiler (not shown) of the steam-heating system. With the pipe P^2 in car-heating apparatus or in buildings containing several rooms to be heated by steam-heating apparatus to which
10 this invention is applied is connected for each car or room a branch pipe P^3 , leading to the chamber *a* on the high-pressure side of the valve V.

P^4 is a pipe leading from the chamber *a* on
15 the low-pressure side of the valve V to the radiator R in each car or room. For the purposes of this invention, therefore, the valve V may be considered as the inlet-valve in a system of steam-heating pipes and radiators
20 connecting directly with the boiler that supplies the steam to be used for heating purposes; and, in like manner, the valve V' may be considered as a thermostatic valve in a pipe leading either from the same boiler or
25 from an independent reservoir (not shown) containing steam, compressed air, &c., to the expansion-chamber C.

In operation steam at substantially full boiler-pressure enters the pipe P^3 , flows
30 through the valve V, which it finds open under the force of spring *s*, and fills the pipe P^4 and the radiator R. Passing through valve V, it also passes through minute passage-way *e* to the expansion-chamber C, where, acting upon
35 the expansible side of the chamber or diaphragm *d*, it forces valve V toward its seat, thereby reducing the steam-pressure to the limit determined by the adjusted force of said spring; and if in the meantime the tem-
40 perature of the room or car is above that at which spring *s'* holds the thermostatic valve V' upon its seat, that valve will open and admit either steam at substantially full pressure from the boiler or other fluid under high pressure
45 from an independent reservoir (not shown) to expansion-chamber C, to act upon said diaphragm *d* and close valve V, thus cutting off the steam flowing to the radiator, as above described. Valve V' returns to its seat under
50 the force of spring *s'* when the temperature falls below the normal. The course of the steam, thus flowing through the boiler and closing the valve V in the manner last described, is through pipe P^2 , pipe P' , valve V',
55 and pipe P to chamber C, where it exerts its force against the diaphragm *d*. When compressed air or other independent fluid under pressure is used, it flows from a reservoir through pipe P' , (the pipe P' shown in dotted
60 lines is substituted for the pipe P' connecting with pipe P^2), valve V', and pipe P to chamber C. When steam is thus cut off from the radiating system, the temperature of the apartment sooner or later begins to fall, whereat
65 thermostat T contracts to permit valve V' to close and cut off the high-pressure fluid flow-

ing from pipe P^2 . The minute passage-way *e* now affords a relief for the high-pressure fluid already in chamber C, to allow diaphragm *d* to return to its normal position and permit
70 the spring *s* to open valve V.

It is obvious that the minute passage-way *e* in the apparatus shown at Fig. 1 also affords a relief for water in expansion-chamber C that may result from condensed steam when
75 there is no pressure through said passage-way *e*; and it is also obvious that said passage-way might be contrived otherwise than by making the valve-stem *b* hollow.

In the modification shown at Fig. 2 two dia-
80 phragms *d* and *d'*, separated by a ring *g*, are secured to the top of the casting A by cap A^2 , thus forming an expansion-chamber C between two diaphragms and a second expansion-chamber C^2 above diaphragm *d'*. The
85 pipe P is directly connected with the upper chamber C^2 alone. The hollow valve-stem *b* is rigidly attached to the lower diaphragm *d*, as in the apparatus shown at Fig. 1, and above diaphragm *d*, near its center, there projects
90 upward an extension of the valve-stem *b*, against which the upper diaphragm *d'* strikes under the force of steam, compressed air, &c., entering chamber C^2 through pipe P, and thus
95 closes valve V. A minute passage-way *o* allows the escape from the upper chamber C^2 of fluid under pressure contained therein after the thermostatic valve has closed.

In the operation of the modified apparatus shown at Fig. 2 steam or hot air, &c., enter-
100 ing chamber C^2 does not at any time enter the radiators, as may be the case in the apparatus shown at Fig. 1.

I claim—

1. In a steam-heating system, the combina-
105 tion, with the inlet-valve of the radiating system and a spring operating to move said inlet-valve in one direction, of a diaphragm or diaphragms operating to move said inlet-valve in the opposite direction, the said diaphragm
110 or diaphragms being provided with two pipes, one communicating with the main steam system on the low-pressure side of said inlet-valve and the other containing a thermostatic valve and communicating with the main
115 steam system on the high-pressure side of said inlet-valve or with other high-pressure-fluid system, substantially as described, whereby the said inlet-valve is controlled by the back-
120 pressure of steam in said radiators or by the temperature of an apartment, substantially as described.

2. The combination, with valve-chamber *a*, provided with hollow arms *a'* and *a''*, valve V, spring *s*, valve-stem *b*, chamber C, provided
125 with a flexible side or diaphragm *d*, and passage-way *e*, connecting said chamber C with said valve-chamber *a*, of pipe P, valve-chamber *c'*, provided with hollow arms *c''* and *c'''*, valve V', and a thermostat controlling said
130 valve V', substantially as described.

3. The combination, with casting A, pro-

vided with chamber *a*, valve *V*, spring *s*, valve-stem *b*, chamber *C*, provided with flexible side or diaphragm *d*, and minute passage-way *e*, connecting said chambers, of pipe *P*, casting
5 D, provided with valve-chamber *c'*, valve *V'*, spring *s'*, bearing upon said valve *V'* in one direction, lever *l*, bearing upon the stem of

said valve *V'* in the opposite direction, fulcrum *f*, and thermostat *T*, substantially as described.

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Witnesses:

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