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TEMPERATURE REGULATING MEANS

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2 Sheets-Sheet 1

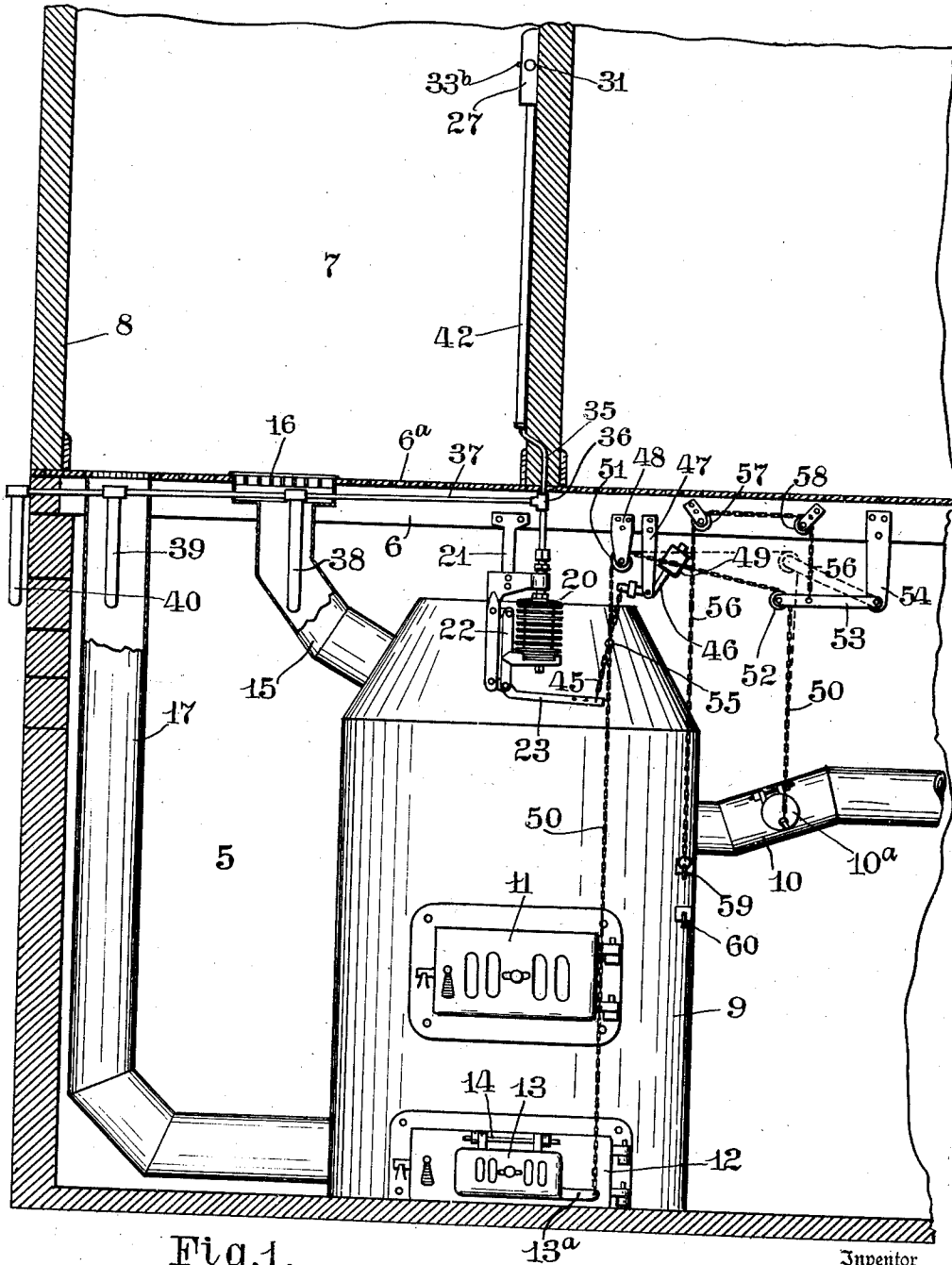


Fig. 1.

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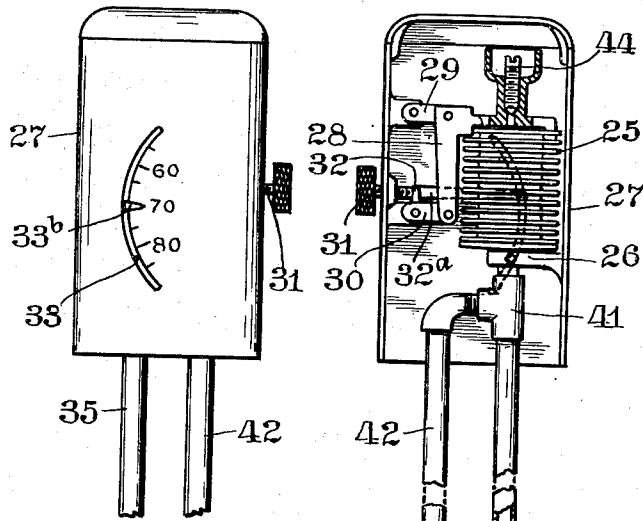


Fig. 3.

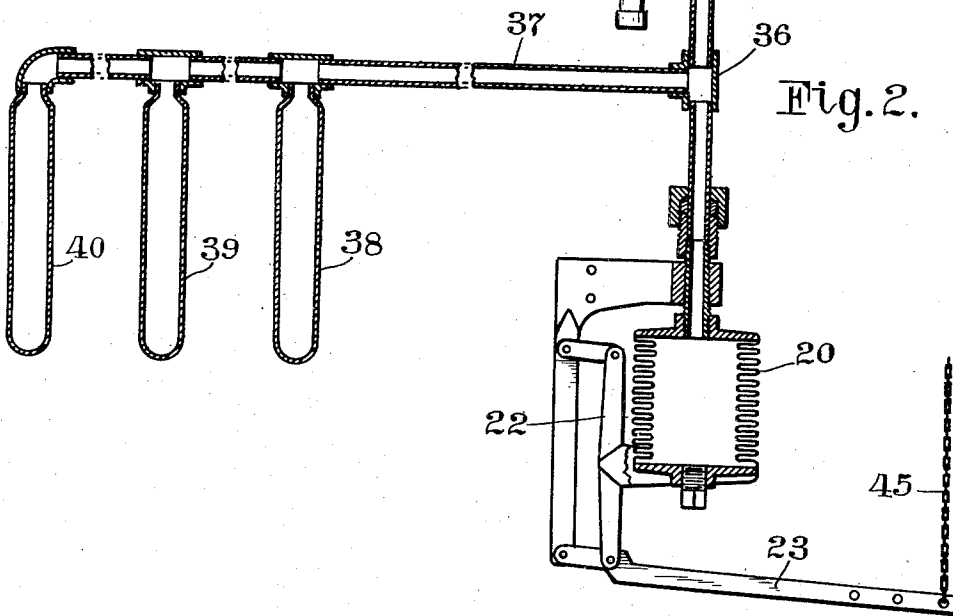


Fig. 2.

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## UNITED STATES PATENT OFFICE

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## TEMPERATURE REGULATING MEANS

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3 Claims. (Cl. 236—91)

An object of the invention is to provide improved means whereby the power for automatically controlling and regulating the production of heat consists of a liquid having a sufficient coefficient of expansion by heat, said liquid confined in a container system including two communicating expansible and contractible members, one of which adapted to actuate the source of heat or heat production means and the other in the enclosure to be warmed adapted to be adjusted to control the temperature range of operation of the first mentioned member. A further object of the invention is that such means shall be the sole means for automatically controlling the heat production and regulation thereby dispensing with the aid of electricity or other artificially produced power. Other objects will appear from the disclosure herein.

The invention is embodied in the example herein shown and described, the features of novelty being finally claimed.

In the accompanying drawings—

Figure 1 exhibits somewhat diagrammatically a general view mainly in elevation with parts in section of my invention as installed in a house or other building.

Fig. 2 is a detail view on a larger scale with parts in full, parts in section and parts broken out of the liquid regulating system.

Fig. 3 is a detail view showing that side of the housing for the thermo-regulating element containing the scale indicator for setting that element to obtain and maintain a substantially given room temperature.

In the views 5 designates the cellar of a house or other building; 6 one of the beams carrying the floor 6<sup>a</sup>; and 7 a room or enclosure to be heated. An exterior wall of the house is designated 8.

The character 9 designates an ordinary hot air furnace having smoke flue 10 containing a gravity check valve 10<sup>a</sup>; fuel feed door 11; and ash pit door 12 hinged on a vertical axis, and a draft door 13 of light weight connected to said ash pit door 12 by a horizontal hinge pin 14 so as to be actuated by gravity in closing. The furnace also has a hot air flue 15 for conveying heated air through a register 16 to the enclosure above and a flue 17 for returning air from the enclosure above through a grating to the air heating chamber of the furnace. The construction thus described is that commonly employed in the type of air heating apparatus in which coal, gas or oil may be the fuel and further details thereof hardly need added description.

My apparatus for regulating the room tempera-

ture comprises a liquid container system including a vertical metallic corrugated resilient member 20 supported fixedly at its upper head on a bracket 21 fastened to the floor beam 6 conveniently near the top of the furnace and engaging at its lower end a movable bar 22 hingedly supported on said bracket so that when the member 20 is expanded or contracted from a neutral position a lever 23 connected with the lower end of said bar 22 moves with the lower end of said member 20.

The liquid container system also includes in the room or enclosure above a similar corrugated resilient liquid containing member 25 supported fixedly at its lower end on a bracket 26 in a suitable housing 27 having sufficient openings permitting circulation of air thereabout and a movable cover at the top.

The upper end or head of said member 25 carries an arm 28 hingedly connected by upper and lower links 29 and 30 respectively to suitable ears in the housing so that said member 25 is capable of expansion upward and contraction downward. To effect such movement and adjust the member for predetermining the temperature to be obtained by the apparatus there is provided an adjusting screw 31 having a knurled head, said screw threaded in the housing 27 so that its end shall press on a lug 32 fixed on the link 30. Preferably the member 25 is so installed that pressure is required to effect its adjusting contraction, and when pressure is relieved the resilience thereof and internal pressure effects its expansion as when adjusting screw is turned in the releasing direction. The lug 32 has an arm extension 32<sup>a</sup> the free end of which is oscillated in an arcuated slot 33 in the side of the housing 27, said end of the arm having a bent pointer 33<sup>b</sup> that co-operates with a scale to indicate the temperature to be obtained and maintained in the room.

The two bellows-like members 20 and 25 are communicatingly connected by a vertical pipe 35 in which is interposed a T-pipe connection 36 carrying a lateral pipe 37 slightly inclined (see Fig. 1) and containing three bulbs 38, 39 and 40. The bulb 38 is extended into the hot-air flue, the bulb 39 in the air return flue and the bulb 40 located in the atmosphere externally of the building.

For the purpose of enlarging the volume of liquid in the system and the surface for heat transference a T-connection 41 having a length of pipe 42 attached thereto can be added.

After installation the system is filled with a liquid having a satisfactory coefficient of expansion.

sion so as to be responsive to ordinary atmospheric variations of temperature. I have used with satisfactory results a liquid called "Prestone", and which I understand to be mainly glycol and used as an anti-freeze for automobile radiators and has a high boiling point. The liquid employed should be such that it is immune to freezing at any probable temperature when the atmosphere bulb is employed. Further it is desirable that the boiling point of the liquid should be sufficiently high so that in the event of an emergency giving too excessive heat to liquid will not boil and injure or burst the apparatus of the thermo-sensitive system. While the apparatus is working there will ordinarily be sufficient heat from the furnace in the neighborhood of the apparatus to prevent freezing in the extremest temperature. The liquid can be supplied to the system by pressure through a suitable opening such as that shown as closed with a screw plug 43 in the bottom of the member 20 or through an opening such as that shown in the top of the member 25 closed by a screw plug 44. When the system is filled by pressure at the bottom opening the air is forced out at the top opening, the latter being first opened by removing its plug 44. The liquid containing system should be filled excluding air and, if after charging the system through the larger opening there remains any unsupplied space, the completion of the charging can be effected through the small opening closed by the plug 44 at the top of the chamber member 25.

Referring again to Fig. 1 the lower lever 23 has connected to one of the three holes therein, according to the throw needed, one end of a chain 45 that extends to and is connected with one arm of a bent lever 46 fulcrumed in a bracket 47 affixed to the floor beam. Each arm of said lever 46 is provided with a weight adjustable thereon as shown at 48 and 49 respectively the weight of the longer arm, plus its weight 49, being preponderate, and exerting a constant pressure upward on the chamber 20.

Connecting a lateral lug 13<sup>a</sup> on the lower end of the draft door 13 and an eye on the check valve 10<sup>a</sup> is a chain 50 which is passed upward from the draft door over a pulley 51 hung from the floor beam and a pulley 52 journaled in the free end of arm 53 pivoted at the end of a bracket 54 secured to the floor beam. The chain 50 is connected with the chain 45 at a ring 55 so that when one of the chains moves, either up or down, the other is drawn with it. It will be observed that as the weight 49 of the arm departs from a vertical line through its pivot its power increases and therefore compensates for the increasing pull of the rising draft door thus reducing the power required to operate the latter.

Connected to the arm 53 is a chain 56 that is extended upward and over the pulleys 57 and 58 secured in brackets to the floor beam and thence downward to one of the other of two hooks 59 and 60 located, one spaced above the other, on the furnace shell so that by drawing down the free end of chain 56 and attaching the same to the lower hook the apparatus is placed in condition for operation by the temperature. If the temperature in the room is below that which is desired the check valve 10<sup>a</sup> will be closed and the draft valve opened, or partially according to the amount of heat required to obtain the desired room temperature.

The chain 50 is of such length that when the chain 56 is pulled down and engaged with the lower hook 60 the check door 10<sup>a</sup> is raised to make

a maximum opening and the draft door 13 will be closed provided the door 13 is maximally open the check 10<sup>a</sup> will be completely closed and in operation the draft and check open or close in inverse proportion to each other.

In installation chain 56 is of such length and hooks 59 and 60 are of such position apart that when chain 56 is connected to hook 59 check 10<sup>a</sup> will be closed regardless of the position of door 13.

In the operation it will be observed that when the upper bellows-like member is manually contracted a portion of the liquid is transferred to the lower bellows-like member in the cellar and conversely when said upper bellows-like member is expanded a portion of the liquid in the lower bellows-like member is transferred into the upper bellows-like member 25 by reason of the weight 49 and the lower bellows-like member contracted. It follows from these transfers of liquid that the lever 23 is lowered and raised, respectively, and therefore the extent of the operation of the draft door and opening produced thereby regulated. If then the upper bellows-like member is fixed by the setting screw 44 for a given room temperature, variations of the position of the lever 23 is actuated only by variations in the room temperature because of the expanding and contracting character of the liquid confined in the system including said bellows-like members.

From this characteristic of my invention it will be plain that after the bellows-like member 25 is set no force other than that inherent in the system and its members is required to control the production of heat and the regulation of the room temperature.

The view Fig. 1 represents the apparatus in non-operative or firing or stoking position. In the last two conditions this is for the purpose of preventing smoke from issuing through door 11 while open. When in cold weather, just after the fire is established, and the bellows-like member 25 adjusted to obtain the room temperature desired the free portion of the chain 56 is drawn down and engaged with the lower hook 60, thus opening the check valve 10<sup>a</sup>, independently of the draft door 13 because the distance or portion of chain from the checking opening around the system of pulleys to the draft door is lengthened by reason of the diminished angle in the chain at the pulley 52. Thereafter the outside temperature, if sufficiently low, causes contraction of the liquid in the bulb 40 and the collapsing of bellows 20 thereby drawing up chain 50 and opening the draft door also closing check damper 10<sup>a</sup> rapidly stimulating the fire and raising heat. The temperature of the heated air in flue 15 expands the liquid in bulb 39 thereby expanding element 20 gradually and thereby lowering chain 50 and draft door and proportionally opening check damper 10<sup>a</sup>. When the temperature of the heated air in hot air flue 15 is sufficiently high to bring room temperature to the predetermined temperature the draft door will be completely closed. As the room comes to the proper temperature the liquid in the room's container 25 expands and expands the element 20 thereby keeping the draft door closed. When the room temperature is set, for example at 70 degrees, the heated air passing through flue 15 must be at a much higher temperature, say 80 degrees, to bring the room temperature to that needed to maintain the 70 degrees temperature in the room. When the liquid of member 25 is expanded sufficiently to close the draft door damper as the room temperature rises the liquid of the system

of the room expands counteracting the contraction of the liquid of the bulb 38 in the flue 15; and as the furnace cools down by reason of the closing of the damper so that when the room temperature reaches 70 the temperature of the air passing through flue 15 will be sufficient to maintain the room temperature at that degree. If not so the liquid in bulb 38 will be contracted sufficiently to open the draft door to increase combustion and heat air in flue 15 to the necessary temperature.

The temperature of the air passing through flue 15, to maintain the desired room temperature, varies inversely to the external atmospheric temperature. Decreasing outside temperature contracts the liquid in bulb 40 and the thermo-sensitive system. The contraction of the liquid in bulb 40, as indicated, contracts collapsible member 20 and stimulates combustion thereby increasing the temperature of air passing through flue 15 thus causing expansion of liquid in bulb 38, and thermo-sensitive system.

More heat must be supplied to an enclosure on a windy day than on a still day to maintain the same temperature even though the outside temperature is the same in both cases. High wind forces cold air into the room or enclosure to be heated, and coming in contact with warm air, the cold air seeks the floor and is drawn down flue 17, in the construction of the heating system shown, contracting the liquid in bulb 39 making it necessary for more heat to be supplied to the enclosure through flue 15 to expand liquid in bulb 38 and counteracting said contraction of liquid in bulb 39.

The forms, sizes, proportions and materials of the parts can be changed without departing from the gist of the invention as claimed.

What I claim is:

1. Means for regulating the temperature of a room, said means including a heating element having a discharge into and a return conductor from the room, a system of communicatingly connected container elements filled with and confining a liquid expansible by heat, said system including a thermostatic element in the room in which the temperature is to be regulated, one of said containers located in the discharge of the heating medium of the heating element, a second

of said containers in the path of the return of the heating medium to the heating element, and a third of said containers exposed to the external atmosphere, and means actuated by expansion and contraction of the liquid in said system for regulating the heat produced by said heating element.

2. Means for regulating the temperature of a room, said means including a heating element having a discharge into and a return conductor from the room, a system of communicatingly connected container elements filled with and confining a liquid expansible by heat, said system including a thermostatic element in the room in which the temperature is to be regulated and means whereby said thermostatic element can be adjusted to obtain a predetermined room temperature, one of said containers located in the discharge of the heating element, a second of said containers located in the path of the return of the heating medium to the heating element, and a third of said containers exposed to the external atmosphere, and means actuated by expansion and contraction of the liquid in said system for regulating the heat produced by the heating element.

3. Means for regulating the temperature of a room, said means including a heating element, having a discharge into and a return conductor from the room, a system of communicatingly connected container elements filled with and confining a liquid expansible by heat, said system including a thermostatic element in the room in which the predetermined temperature is to be maintained, one of said containers located in the discharge to the room of the heating medium of the heating element, a second of said containers located in the path of the return of the heating medium to the heating element, and a third of said containers exposed to the external atmosphere, and means actuated by expansion and contraction of the liquid in said system for regulating the heat produced by said heating element, said last named means including a resilient bellows-like member, a lever actuated thereby, and means for compensating for variations of strain of the regulator for the heat producing element.

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