Nov. 30, 1937. F. G. CRONE 2,100,709

THERMOSTATIC REGULATOR FOR GAS HEATING

Filed Sept. 15, 1936

Fig. 1.

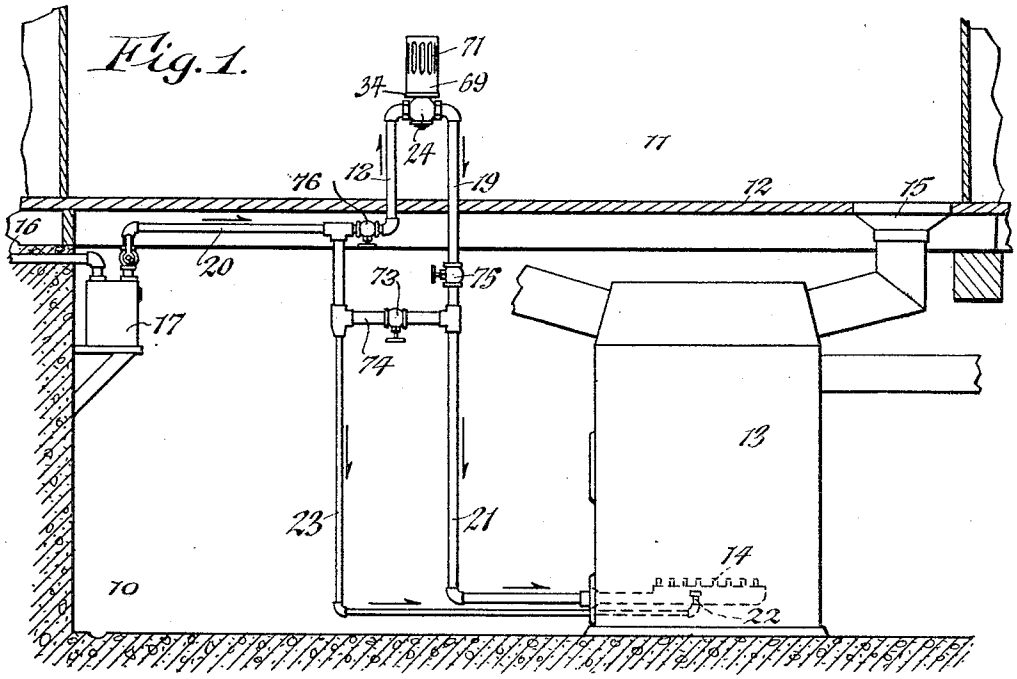


Fig. 2.

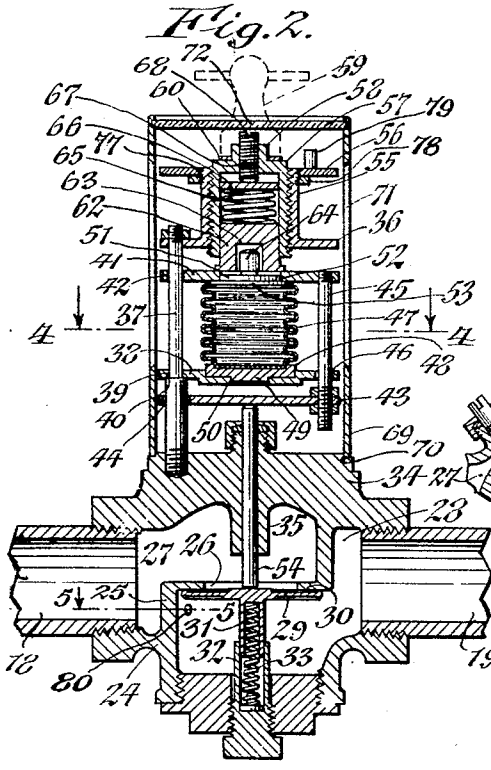


Fig. 3.

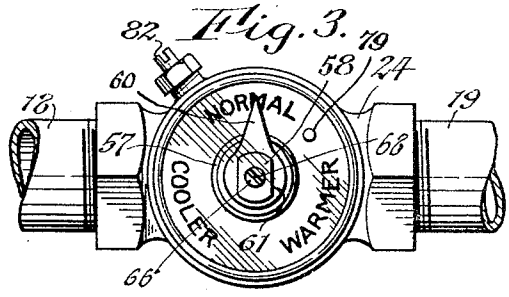


Fig. 5.

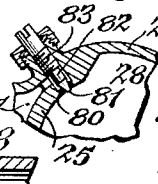
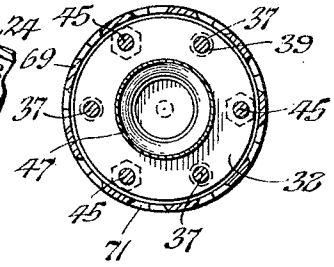


Fig. 4.



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THERMOSTATIC REGULATOR FOR GAS HEATING

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2 Claims. (Cl. 236—99)

This invention relates to a mechanism for automatically controlling the supply of fuel gas to a gas furnace for heating a building and more particularly to a controlling device of this character which does not require the use of an electric current.

As is well known the supply of electricity sometimes fails and this necessarily interferes with the proper function of a gas burning furnace if its operation is dependent on the supply of electricity.

It is therefore one of the objects of this invention to provide a mechanism of simple and efficient construction whereby the supply of gas to the burner of a heater is automatically controlled without the use of electricity and in which only a thermostatically operated valve is arranged in the room or space to be heated and all the remaining parts of the heating plant are located in the space or cellar below the floor of the heated room, and thereby not only eliminate therefrom unnecessary mechanism and improving the appearance of the same but also permitting the space of the room to be occupied more advantageously.

A further object of this invention is to provide an improved non-electric thermostatically operated valve which automatically controls the flow of gas to the gas burner of the heater in accordance with the desired temperature for which the same has been set without the use of electricity, which improvements consist mainly in simplification of the mechanism, increasing its efficiency and rendering the parts easier to assemble and dismember for inspection and adjustment and also to protect the same against tampering.

In the accompanying drawing:

Fig. 1 is a fragmentary vertical section of the cellar and overhead room of a house equipped with a gas heating system embodying my invention.

Fig. 2 is a vertical section of the thermostatic valve for automatically controlling the flow of gas to the heater in accordance with my improvements.

Fig. 3 is a top plan view thereof.

Fig. 4 is a horizontal section taken on line 4—4, Fig. 2.

Fig. 5 is a fragmentary section taken on line 5—5, Fig. 2.

The house or building shown in the drawing and containing an installation of a gas heating system containing this invention comprises a lower compartment, basement or cellar 10, and a living room or upper compartment 11 over the cellar and separated therefrom by a floor or horizontal partition 12.

In the cellar is arranged a gas operated furnace for heating or warming the living room which furnace may be of any suitable construction and as there shown comprises an air heating chamber 13, a main gas burner 14 for heating the air in this chamber, and a register 15 which is connected with the air heating chamber and delivers heated air into the living room to be heated.

The gas for the furnace burner is supplied from the exterior of the building by a supply pipe 16 to a meter 17 in the cellar and conducted thence by suitable piping to the burner 14, which piping for present purposes includes a loop arranged within the living room 11 or other space to be heated and having inlet and outlet branches 18, 19 extending from the cellar to the living room and preferably through the floor 12, an inflow pipe section 20 connecting the meter with the inlet branch 18 and an outflow pipe section 21 connecting the outlet branch 19 with the furnace burner 14, as shown in Fig. 1.

A small pilot burner 22, which burns constantly, is preferably arranged adjacent to the main burner for relighting the latter when the supply of gas to the same is resumed after having been shut off as the result of the automatic operation of the control mechanism constituting the present improvement. This pilot burner is connected by a branch conduit 23 with the gas inflow pipe section 20.

Normally the gas to the main burner 14 is automatically controlled by a non-electric thermostatically operated valve mechanism which embodies my invention and which is arranged in the room to be heated so as to be responsive to the temperature therein and is connected with the inlet and outlet branches 18, 19 of the main gas supply conduit. In its preferred form this thermostatic valve mechanism, as shown in Figs. 2, 3, and 4, is constructed as follows:—

The numeral 24 represents the hollow body of the automatically operated valve mechanism which contains a partition 25 having a port 26 and forming an inlet chamber 27 connected with the inlet branch pipe 18 and an outlet chamber 28 connecting with the outlet branch 19 of the gas supply conduit. Within the outlet chamber 28 is arranged a valve disk or closure 29 which is movable toward and from a seat 30 on the underside of the partition 25. The valve disk is guided in its movement by a stem 31 on its underside sliding in a guideway 32 mounted on the lower

part of the valve body and when not subjected to pressure which moves the valve disk away from its seat this disk is yieldingly held in its closed position against the seat by a spring **33** interposed between the bottom of said guideway and the bottom of a recess in said valve stem, as shown in Fig. 2.

Above the valve body is arranged a frame which is mounted on this body and adapted to support the thermostatic mechanism which actuates the valve disk. This frame may be variously constructed but preferably comprises a lower circular plate or base **34** forming the top of the valve body which is provided with a depending neck **35** arranged in the upper part of the valve body, an upper circular plate or head **36** and a plurality of upright posts **37** connected at their lower and upper ends, respectively, with the marginal parts of said base and head.

The numeral **38** represents a lower stationary supporting disk or plate which is provided in its marginal part with openings **39** which receive the posts **37** and which rests on upwardly facing shoulders **40** formed on said posts, as shown in Figs. 2 and 4. Above the lower supporting disk **38** is a vertically movable or floating upper disk **41** which slides on the posts **37** by means of guide openings **42** arranged on the marginal part of this disk and receiving the upper parts of these posts.

Below the stationary supporting disk **38** is arranged a lower vertically movable or floating lower disk **43** which is guided on the posts **37** by means of openings **44** formed in the edge or marginal part of this lower floating disk and receiving the lower parts of these posts.

The lower and upper floating disks **43**, **41** are connected at their marginal parts by a plurality of upright tie rods **45** so that, in effect, these disks and rods together form a floating cage, which can be readily removed from the valve mechanism and replaced as a unit when this becomes necessary and thus facilitate inspections and repairing of the mechanism. The rods **45** pass through openings **46** in the lower stationary supporting disk **38**, and therefore guide this cage.

Between the lower supporting disk **38** and the upper cage disk **41** is arranged a thermostatic element consisting preferably of a flexible metal bellows **47** which contains a thermostatic liquid having the property of expanding and contracting in response to variations in temperature and thus lengthening and shortening the bellows accordingly. At its lower end this bellows is provided with a head **48** detachably resting on the supporting disk **38** and provided with a centering projection **49** which engages with a centering opening **50** in the supporting disk, and at its upper end this bellows is provided with an upper head **53** which bears detachably against the underside of the upper floating cage disk **41** and is provided with a centering projection **51** which engages with a centering opening **52** in this floating disk. By this means the bellows is reliably held in its centered position within the floating cage and still can be readily removed therefrom when desired for repairing or other purposes.

When the bellows lengthens due to expansion of the liquid therein as the surrounding temperature rises, the upper and lower disks **41**, **43** and the tie rods **45** of the floating case are raised and when this temperature lowers and the thermostatic liquid cools and contracts the bellows shortens and the floating cage is lowered.

During the downward movement of the floating cage this movement is transmitted to the valve closure disk **29** by a vertical shifting rod **54** slidable axially through the neck **35** and bearing at its lower end against the top of the valve disk **29** while its upper end bears against the underside of the lower cage disk **43**. As the cage is lowered due to lowering of the surrounding temperature, the valve disk is moved away from its seat and thereby permits more gas to pass to the main burner for increasing the heating effect of the furnace. During such action the spring **33** is compressed or put under increased tension and when the floating cage again rises due to increasing temperature, the resilience of the spring **33** again moves the valve disk **29** toward its seat and thus reduces the amount of gas passing to the main burner and checking the heating effect of the furnace accordingly.

Means are provided for resisting the expansion of the bellows and adjusting this resistance for the purpose of regulating the thermostatic effect of the valve mechanism in accordance with the degree of heat desired in the space or room to be heated.

In its preferred form these regulating means are constructed as follows:—

The numeral **55** represents an upright adjusting tube projecting upwardly from the central part of the upper frame head **36** and preferably formed integrally therewith. In its bore this adjusting tube is provided with an internal screw thread and at its upper end the same is provided with a dial or indicator plate **56**, the upper side of which may be inscribed with any suitable marks or scale to indicate different temperatures, such for example as "normal", "cooler" and "warmer" now appearing on this dial. Within this adjusting tube is arranged a vertically adjustable follower **57** preferably of tubular form which has an external screw thread engaging with the internal thread of the adjusting tube so that upon turning the follower in one direction or the other the same will be moved toward or from the upper disk of the floating cage. Rotation of this follower may be affected in various ways, for instance, as shown in Figs. 2 and 3, by providing the upper end of the follower with a flat sided boss **58** which is adapted to be engaged by the correspondingly shaped socket of a detachable key or wrench **59**, shown by dotted lines in Fig. 2. At its upper end the adjustable follower is also provided with a laterally projecting pointer **60** which traverses the dial marks or scale on the upper side of the dial plate **56** and thus permits of setting the regulating valve according to the temperature desired and also indicating the position of the regulating valve at any particular time. This pointer is preferably connected with the follower by providing its inner end with a flat sided opening **61** which receives the correspondingly shaped boss **58** of the follower and thus compels these members to turn together.

Within the lower part of the follower is arranged a vertically movable plunger **62** which bears with its lower end against the top of the upper cage disk **41** and is provided at its lower end with a centering recess **63** which receives a centering pin **64** on the upper side of the upper centering projection **52** of the bellows. The numeral **65** represents an adjusting spring arranged within the follower **57** and interposed between the plunger **62** and a bearing disk **66** in the upper part of the follower. The position of this bearing disk relative to the follower for varying the tension on the spring **65** may be adjusted by a fine

adjusting screw 67 working in a threaded opening in the upper end of the follower and the boss 58 and engaging its lower end with the top of the bearing disk 66 while its upper end is provided with a nick or slit 68 to permit of turning the same by engagement therewith of a screw driver or other tool. The valve closing spring 33 is comparatively light while the valve regulating spring 65 is relatively heavy so as to preponderate over the strength of the valve closing spring.

Assuming that the temperature in the room or space to be heated by the furnace is at the desired degree for which the automatic regulating mechanism has been set then the bellows 47 will be expanded and raise the floating cage the requisite extent to permit the closure spring 33 to raise the regulating valve disk 29 to its highest position in which it engages the valve seat 30 and completely shuts off the gas through the regulating valve, as shown in Fig. 2, a flame being, of course, maintained adjacent to the main burner by the pilot light 22.

When the temperature in the room drops below normal the thermostatic liquid in the bellows contracts thereby shortening the bellows and permitting heavy regulating spring 65 to force the floating cage downwardly, which movement is transmitted by the shifting rod 35 to the valve disk 29 and causes the latter to be opened in opposition to the light spring 33, thereby permitting the flow of gas through the regulating valve and the lighting of same at the main burner to be resumed for continuing the heating of the room. It is to be understood that when a rise in temperature occurs in the room which is being heated, that this does not necessarily cut off the flow of gas entirely inasmuch as the regulating mechanism at this time may only shut the regulating valve partly and thus reduce the supply of gas to the main burner in proportion to the reduction in temperature and also increase the same, as required to maintain the room at approximately the temperature which is desired.

By varying the resistance to the expansion of the bellows and consequently to the closing movement of the regulating valve it is possible to maintain the room at whatever temperature may be desired inasmuch as an increase in this resistance will delay the closing of the regulating valve 29 and consequently increase the heating effect of the furnace and a decrease in this resistance will cause the regulating valve to close earlier and thus reduce the heating effect of the furnace.

The coarse adjustment of the resistance of the regulating spring 65 to the closing movement of the regulating valve 29 is first effected by moving the follower 57 lengthwise in the adjusting tube 55 and thereafter the fine adjustment of the resistance of this spring is effected by moving the adjusting screw 67 lengthwise on this follower, thereby rendering it possible to easily set the automatic regulating valve to suit the temperature desired.

For the purpose of preventing easy tampering with the regulating mechanism an enclosing casing for the same is provided which preferably consists of a tubular shell 69 which is placed around the upper parts of the regulating mechanism and frictionally engaged at its lower end with an annular shoulder 70 on the base 34 of the supporting frame and provided adjacent to its upper end with vertically elongated openings or windows 71 through which the upper parts of the regulating mechanism may be observed, and a transparent pane or window 72 of glass or the like secured in the upper end of the shell and permitting reading of the dial from the exterior of the instrument. This casing can be readily removed when it is desired to inspect, adjust or repair any parts of the regulating mechanism.

If for any reason it is desired to use the furnace without the regulating mechanism this can be done by opening a by-pass valve 73 in a by-pass pipe 74 which connects the delivery section 21 of the main gas supply pipe with the pilot branch pipe 23 or other available part of the piping between the meter and the valve regulating mechanism, and also closing valves 75, 76 arranged respectively in the outlet branch pipe 19 and the outlet branch pipe 18 of the regulating valve.

For the purpose of enabling the dial 56 and pointer to be easily placed in the proper position to indicate the temperature which is obtained in any particular position of the pointer, means are provided for setting the dial into the required position relative to the pointer, which means preferably consist of a screw threaded joint 77 between the dial and the adjusting tube 55, as shown in Fig. 2. By turning the dial on this tube the proper designation thereon may be brought into line with the pointer to indicate the required setting of the automatic regulating valve to obtain the necessary flow of gas for maintaining the room at the desired temperature. After the dial is set in the desired position the same is securely held in place on the adjusting tube by a threaded clamping ring or nut 78, as shown in Fig. 2.

For the purpose of preventing the indicator from making more than one turn relative to the dial, stop means are provided which preferably consist of a stop pin 79 arranged on the dial in the path of the pointer so that the latter will engage this stop pin and be arrested thereby upon turning the pointer nearly a complete rotation in either direction, thereby avoiding the possibility of effecting a wrong setting of the regulating valve for obtaining a certain heating effect.

In addition to the pilot burner 22, or as a substitute therefor, it is desirable to provide a by-pass as a part of the regulating valve whereby a small amount of gas is supplied directly to the main burner 14 for the purpose of maintaining at least a small flame at this burner in case the regulating valve 29 either cuts off the supply of gas entirely or reduces the flow of gas to the main burner to a small amount and thereby ensuring ignition of the gas when it again flows in greater volumes and thus avoid the possibility of accidents. For this purpose a by-pass 80 is provided in the partition 25 which provides permanent communication between the inlet and outlet chambers 27 and 28 of the valve body, which by-pass is adjustable as to capacity by a needle valve 81 movable toward and from a seat 82 on the valve body and having its stem 83 connected by a screw joint 84 with the valve body and its outer end accessible from the exterior of the valve body so that it can be readily adjusted, as shown in Fig. 5.

In case the building has no furnace which supplies heat to a plurality of rooms this apparatus can be used in connection with a heater which is used for heating an individual room.

By means of this regulating mechanism it is possible to burn gas economically to obtain the desired heating effect and no attention need be given to the heating apparatus from the time it is first lighted in fall until it is turned off the

following spring, thereby not only effecting a considerable economy in fuel but also saving personal attention.

In the event that the thermostatic bellows give out the regulating valve 29 will be moved against its seat 30 by the spring 33 and held there to prevent the passage of gas, thus preventing accidents when this occurs.

I claim as my invention:

1. A gas regulating mechanism comprising a valve body having a port, a valve closure for controlling said port, and thermostatically responsive means for controlling said valve closure including a shifting rod guided on said body and engaging its inner end with said valve closure, a frame mounted on said body and having upright guide posts, a lower stationary supporting plate mounted on said posts, a floating cage having a lower plate guided on said posts below said lower supporting plate, an upper plate guided on said posts above said lower supporting plate and tie rods connecting said lower and upper plates, a bellows interposed between said stationary supporting plate and said upper cage plate and containing a thermostatic liquid, spring means for resisting the expansion of said bellows, including an adjusting tube mounted on said frame, an adjustable follower connected by a screw joint with said tube, a spring arranged in said follower and bearing at one end against said bellows, and an adjusting screw arranged on said follower and bearing against the other end of said spring.

2. A gas regulating mechanism comprising a valve body having a port, a valve closure for controlling said port, and thermostatically responsive means for controlling said valve closure including a shifting rod guided on said body and engaging its inner end with said valve closure, a frame mounted on said body and having upright guide posts, a lower stationary supporting plate mounted on said posts, a floating cage having a lower plate guided on said posts below said lower supporting plate, an upper plate guided on said posts above said lower supporting plate and tie rods connecting said lower and upper plates, a bellows interposed between said stationary supporting plate and said upper cage plate and containing a thermostatic liquid, spring means for resisting the expansion of said bellows, including an adjusting tube mounted on said frame, and adjustable follower connected by a screw joint with said tube, a plunger arranged in said follower and bearing against said bellows, a spring arranged in said follower and bearing at one end against said plunger, a bearing plate engaging the other end of said spring, and an adjusting screw mounted on said follower and engaging said bearing plate.

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