Feb. 16, 1943. P. S. MARTIN 2,311,408

THERMOSTATIC DRAFT REGULATOR AND SYSTEM

Filed March 22, 1939 2 Sheets-Sheet 1

Fig. 1.

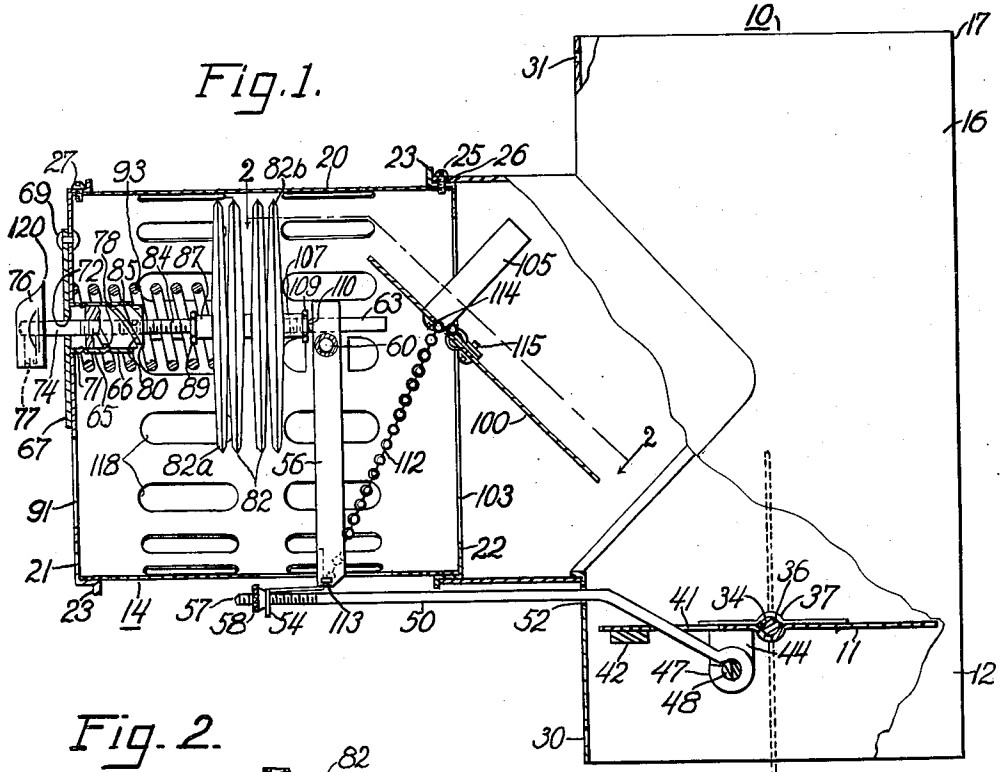
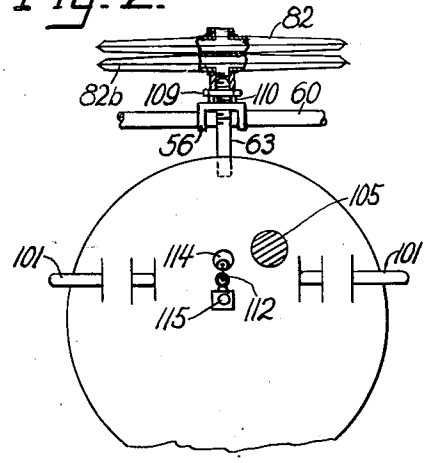


Fig. 2.



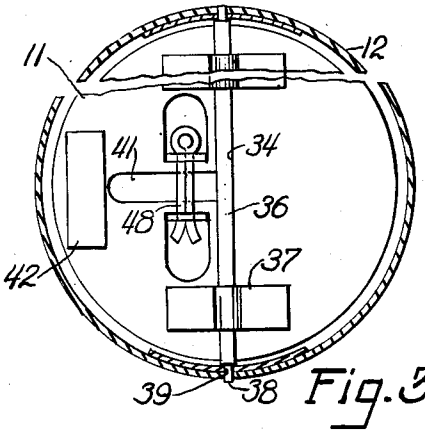


Fig. 3.

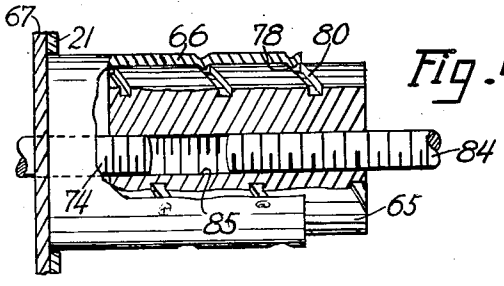


Fig. 4.

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Fig. 5.

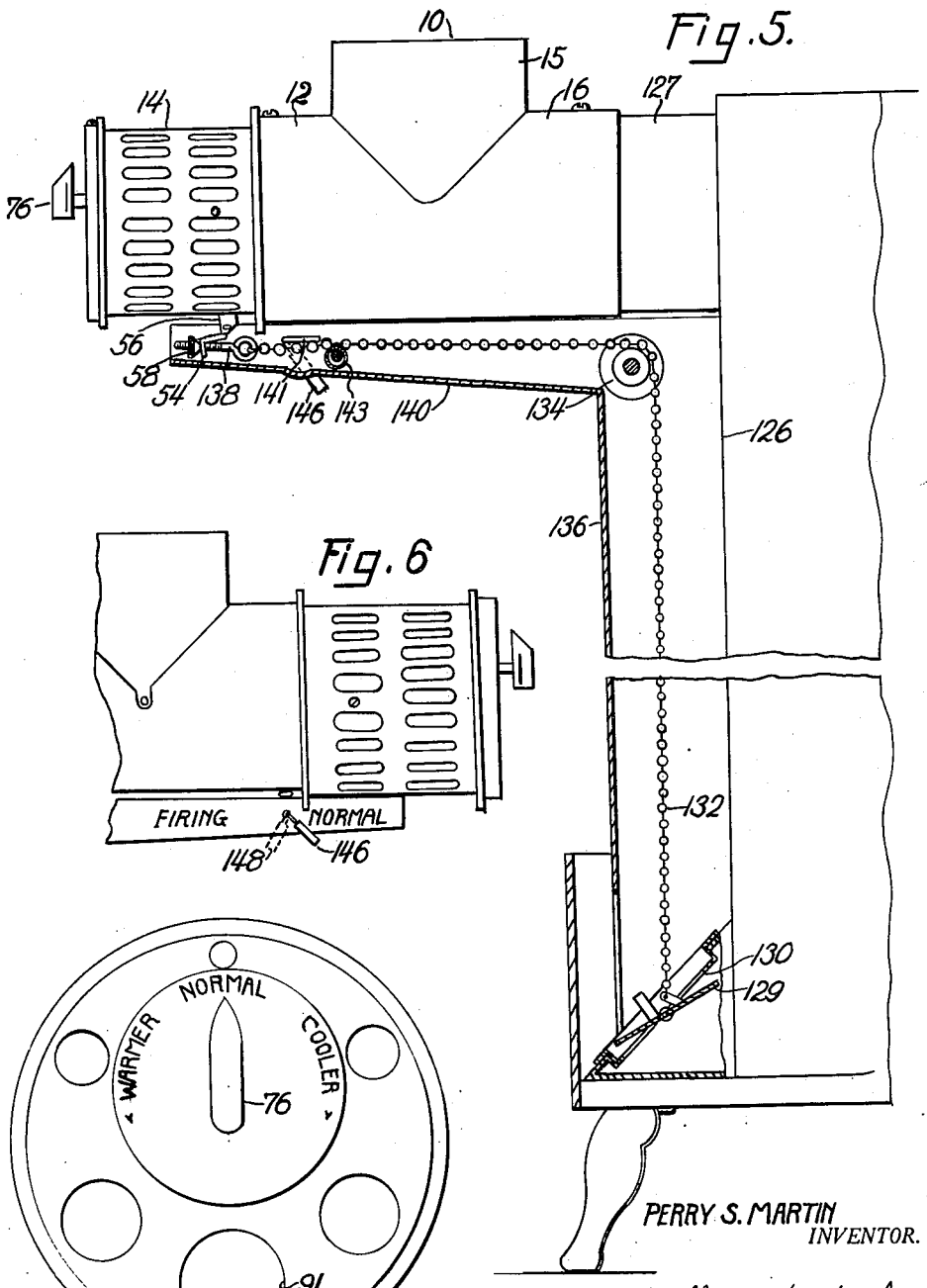


Fig. 6

Fig. 1a

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UNITED STATES PATENT OFFICE

2,311,408

THERMOSTATIC DRAFT REGULATOR AND SYSTEM

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Application March 22, 1939, Serial No. 263,513

11 Claims. (Cl. 236—16)

This invention relates to wood or coal burning heating stoves of the type most commonly used in schools, churches and residences and the primary object is to provide an improved thermostatic temperature control regulator which will be more quickly and accurately responsive to changes in the temperature of the room being warmed by the stove and in addition will, to a great extent, anticipate such changes thereby maintaining a more even temperature.

It has been common practice for many years in poultry raising to equip coal and wood burning chick brooders with self-regulating dampers but strange to say no temperature regulator has yet been devised which has come into popular use for wood or coal stoves used in the heating of residences, schools and churches. Of course gas and oil stoves as well as central heating systems have been provided with automatic temperature regulators for several years but the common wood burning heating stove, particularly the small sheet iron heater used in residences has generally been neglected in this respect perhaps because it was believed to be an unnecessary expense and also because of the first difficulty of installing and then the uncertainty of operating available controls.

It is an object of my invention to provide a very low price regulator which may be easily installed and adjusted by almost anyone knowing a little about the dampers of an ordinary stove. It is a further object to provide a temperature regulator unit of attractive design which may be installed quickly and without any tools other than possibly a screw driver. Specifically, it is an object of my invention to build a thermostatic damper control in a smoke pipe T joint which joint thus equipped may be put in operative position merely by substituting it for a short section taken from the existing smoke pipe; incidentally the unit is adapted to be mounted in any one of the three outlets of the T joint whereby it is easily adapted to either a top or side opening stove without any structural change of the unit or stove. An important advantage resulting from my invention is that the cost of repairs is slight, since the unit can be quickly detached and mended or replaced by a new unit while the other is being repaired.

An object of my invention is to provide a regulator unit wherein when the check draft is open the flue draft causes a rapid flow of air from the room around the thermostat on all sides whereby the unit is quickly responsive to room temperature changes. Another object is to provide means whereby while the check damper is closed and very little air is passing the thermostat a sudden rise in the temperature of the flue gases quickly causes the thermostat to open the damper, thus checking the fire a little and anticipating too great a rise in room temperature; the action on the fire is intermittent with the result that the fire is prevented from racing or overheating the stove.

A still further object of my invention is to provide a thermostatic regulator unit primarily subject to normal room temperature but which is mounted in a position where it is influenced to a desired degree by action of a controlled amount of heat from the flue gases and yet is out of the streams of hot air rising from the heater.

It is an important object of my invention to provide simple means for securing a proper initial adjustment of the regulator and separate means for changing the regulator setting to obtain varying room temperatures without altering the initial adjustment.

A further important object of my invention is to provide a draft damper and check damper which respond to sudden flue drafts to counteract each other's effect on the fire and independently of the thermostat to which one or both may be connected; thus in gusty weather the operation of the control is not seriously affected.

In the drawings:

Figure 1 is a central sectional elevation of my thermostatic control unit.

Figure 1*a* is an end view of the control unit.

Figure 2 is a plan view partly in section and taken on line 2—2 of Figure 1.

Figure 3 is a horizontal sectional view showing the draft damper in plan view.

Figure 4 is an elevation, partly in section, of the adjusting nut and its associated parts.

Figure 5 is an elevation, partly in section, of a stove with my regulator unit secured to a back opening and attached to a main draft damper pivoted in a lower opening.

Figure 6 is an elevation of the control unit.

The preferred form of my invention consists of an ordinary T joint 10, having a draft damper 11 pivoted in one vertical branch 12 and a thermostatic control unit 14 mounted in the horizontal branch 15 while the second vertical branch 16 is free of any equipment so that when ready for installation the end 17 either may be crimped in the usual manner for insertion in a smoke pipe or may be left as it is for receiving the crimped end of a smoke pipe not shown. It is understood that the device as just described is

adapted for a stove having its smoke outlet in the top but the device is so designed that when the outlet is in the back of the stove as is often the case, the thermostatic control 14 may easily be shifted to the now horizontally arranged branch 16 while the branch 15, now vertical, is connected to the smoke pipe and the branch 12 is connected to the stove. See Figure 5 for this arrangement.

The thermostatic control unit 14 consists of a cylindrical casing 20 having on its control end a cap 21 and on its damper end a cap 22, each cap having a substantial rim 23 which strengthens and stiffens the case and also facilitates assembly and mounting in the T joint. The cap 22 is dimensioned to fit tightly in the T joint but to assure the unit remaining firmly in place I add a screw 25 which projects through a hole 26 in the T joint rim and is threaded in the cap and in the margin of the casing end; a screw 27 may also be used to fix the cap 21 in place. Additional screw holes 30 and 31 are provided in opposite end margins of the vertical portions 12 and 16 in positions corresponding to that of the hole 26 so that all three ends of the T are alike and may be interchangeably secured to a stove, to the thermostatic unit or to a smoke pipe as conditions require.

The damper 11 is a disc of metal having a diametrical groove 34 for receiving its supporting shaft 36 which is held in place by strips 37, 37 secured to the disc and the shaft is provided with end pintles 38, 38 which fit in bearings 39, 39 on opposite sides of the branch 12. The disc contains a substantially radial slot 41 extending from the shaft 36 almost to a weight 42 secured near the margin of the damper so as to bias it to open position. Near the shaft and on opposite sides of the slot two apertured ears 44 are stamped out of the disc and bent downward to receive between them the link rod eye 47 which is held in place by a cotter pin 48.

The link rod 50 slants upward from the cotter pin, through the slot 41, to a point above the weight 42, then horizontally through an opening 52 of the T joint wall out to the bracket 54 at the end of the regulator lever 56 where the rod terminates in a threaded portion 57 slidably supported by the bracket. A knurled hand nut 58 on the rod end 57 bears against the bracket and serves as means for adjusting the effective length of the link, thereby controlling the amount of opening for any given setting of the thermostatic control unit at normal room temperature. It will be understood that the rod end 57 slides freely in the bracket so that the damper is not prevented from moving when actuated by a sudden draft as caused by a gust of wind or the opening of a door on a windy day.

The regulator lever 56, of channel shape cross-section as shown in Figure 2, is supported on the shaft 60 which passes through its flanges and is positioned substantially above the diameter of the casing 20. The web of the lever has at the top a hole in which rests the stud 63 forming one end of the thermostatic assembly, the other end being the cylindrical adjusting nut 65 journalled in the tubular bearing sleeve 66 fixed to the cap 21 by means of the name plate 67 to which it is sweated; in making the unit the sleeve is first fixed to the name plate 67 which is then secured to the cap as by a rivet 69 with the sleeve engaging in the aperture 71 of the cap. The name plate is apertured at 72 coaxially of the sleeve to accommodate the short shaft 74 fixed securely to the adjusting nut and connecting it with the control knob 76 which may be held in place by a set screw 77.

The sleeve 66 is indented to form on its inner surface one or a series of helically arranged lugs 78 which cooperate with a large pitch helical groove 80 in the surface of the adjusting nut so that the nut may be moved axially by rotating it in the sleeve bearing, thereby adjusting the axial position of the thermostatic assembly. The assembly consists of one or more pairs of thermostatic wafers or elements 82 connected in tandem in a well known manner and adjustably connected to the nut 65 by means of a threaded stud 84 having one end loosely screwed into the axial bore 85 of the nut and having the other end screwed into the short tube 87 on the first wafer 82*a* where it is locked by a nut 89. The structure just described permits the distance between the assembly and the adjusting nut to be adjusted as necessary simply by holding the control knob stationary and turning the assembly to screw the stud 84 into or out of the adjusting nut 65; an opening 91 in the cap 21 just below the name plate gives access to the assembly for making this adjustment. A helical spring 93 enclosing the sleeve 66 and compressed between the cap and the wafer 82*a* prevents the thermostat assembly from turning easily.

As best shown in Figure 2 the check damper 100 is pivoted by two pins 101 on the apertured cap 22 an appreciable distance above the diametrical axis so that the damper is biased to close the cap opening 103. The weight of the damper alone is not always sufficient to keep it closed as desired and therefore I add to the closing effect by means of a weight 105 which weight however is so mounted as to have a closing effect that decreases in value as the damper moves from vertical or closed position toward horizontal or wide open position. Thus the force required of the thermostat assembly is a maximum for first opening the check damper and is a minimum when the damper is wide open.

The stud 63 resting in a hole at the top of the regulating lever is screwed into the short tube 107 on the wafer 82*b* and is locked in place by the nut 109. When the thermostat assembly expands it presses the locknut 109 against the lugs 110 on the short arm of the regulating lever 56 and causes the lever to turn clockwise. The lower end of the lever is connected not only to the draft damper 11 by means already described but is also connected to the check damper 100 by a chain 112. This chain slopes upwardly from the cotter pin 113 connecting it to the end of the lever, passes through a small hole 114 in the damper and terminates at a bolt 115 which secures it to the damper.

It will be noted that the weight 105 projects an appreciable distance from the damper 100 with the result that when the damper is closed the weight will be exposed to a great extent to the stream of hot gases from the fire and will conduct a considerable amount of heat from the gases to the damper which in turn will radiate a portion of the heat to the thermostatic unit; in addition it should be noted that when closed the damper presents a maximum heat radiating surface to the thermostats. Since the wafer 82*b* presents an almost equally large surface to the damper it responds quickly and causes the damper to open a little. The opening of the damper reduces its effective radiating surface

with respect to the thermostat assembly and becomes substantially zero when the damper is wide open, at which time the thermostats are affected almost solely by the room temperature. Another factor causing the damper to open quickly is the hole 114 which allows a small but effective amount of heat to be radiated from the hot gases directly to the wafer 82b.

Still another reason the thermostat responds quickly while the check damper is closed is that at this time there is very little movement of air about the wafers and through the casing 20 so that most of the heat conducted by the metal parts surrounding the wafers has a greater effect than when the air is in motion as in the case when the check damper is open, during which time air from all about the unit flows through the holes 118 of the casing against the wafers and past the damper into the flue. It will now be appreciated that my thermostat unit is responsive mainly to the fire while the check damper is closed and mainly to the room temperature while the check damper is open.

An important advantage of having the thermostat responsive directly to the heat of the fire when the check damper is closed and responsive to the room temperature at other times is that this prevents racing of the fire and reduces the range of hunting, as for example when the room is cold and the burning is increasing at too rapid a rate for the stove. Since the damper 11 will then be wide open and the damper 100 will be closed leaving the thermostat in a dead air space already two or more degrees hotter than at the same level in the room, the rapidly mounting heat will be conducted through the metal of the pipe and cause the operation of the thermostat to check the too rapid fire increase by temporarily closing the damper 11 and opening the damper 100 as illustrated in Figure 1. The advantage is most appreciated when the fire is being started in a relatively cold room and during gusty weather. At such times the check damper will be opened and closed intermittently but at much shorter intervals than would be possible with the thermostats mounted differently with the result that the average rate of burning is held down to the most advantageous value.

The control unit described in the preceding paragraph may be assembled very quickly and easily, chiefly for the reason that it is built in four separate parts, namely, one, the T joint 10 with or without the damper 11 and link 50; two, the cap 22 carrying the weighted damper 100 and chain 112; three, the casing 20 in which is pivoted the regulator lever 56; and four, the cap 21 with the thermostat assembly. A quick method of putting these four parts together is to push the cap 22 on the casing 20 and connect the chain 112 to the lever 56.

Part four, consisting of the control elements is now put on the casing 20 having first been assembled by first riveting the name plate 67 and sleeve 66 in position on the cap 21, then screwing the adjusting nut 65 with the shaft 74 into the sleeve and thereafter attaching the control knob 76 to the shaft 74. Now holding the control knob the thermostat assembly is attached to the cap by screwing its terminal bolt 84 into the adjusting nut the approximate distance necessary, first having positioned the helical spring 93 between the cap and the wafer. The control assembly is now inserted into the case 20 with the stub shaft 63 resting in a hole at the top of the regulator lever and the cap 21 is pushed or driven into place and locked by means of the screw 27.

The assembled control unit consisting of parts two, three, and four now is placed in the T joint by pushing the cap 22 into the end 15 (or 16 as in Figure 5) while guiding the link rod 50 through the end of the bracket 54, the nut 58 having been removed. The unit is secured in proper position by means of the screw 25 and the nut 58 is screwed on the rod 50 to the desired position.

It will be appreciated that the unit may be easily disassembled in part or altogether merely by removing the screws 25 or 27 and the nut 58 and then pulling the parts from each other as desired; the rims 23 greatly facilitate the separating of the parts.

In order to set the regulator the room should first be warmed up to the desired degree so that the thermostats are expanded as they would be at the desired normal temperature. Now holding the pointer 120 at "normal" position, reach through the hole 91 with the finger, a pencil or other instrument and turn the thermostat assembly to the right or left as may be necessary until the check draft damper stands about half open. Further adjustment may be necessary depending upon the draft provided by the chimney, since if the draft is strong the damper should be adjusted a little wider open, while if the draft is poor it may be necessary to rotate the thermostat assembly until the damper is nearly closed at the selected temperature. Having once adjusted the damper to "normal," that is, with the pointer 120 preferably vertical, the temperature of the room may thereafter be regulated as desired simply by turning the knob 76 toward "warmer" or "cooler" as shown in Figure 1a.

Referring to Figure 5, my improved regulator unit is shown mounted on a stove 125 having in its back wall 126 a smoke outlet collar 127 which supports the unit. In this modification no draft damper is placed in the T joint 10 but instead the control unit is connected by a chain 129 to the main draft damper 130 pivoted in the opening 131 near the bottom of the stove. The chain 129 passes upwardly and over a pulley 134 mounted near the top of the chain guard 136 and then horizontally to the regulator lever 56 to which it is adjustably connected by a screw-eye 138 carried in the bracket 54 and being adjustable by means of the knurled nut 58.

In the horizontal portion 140 of the chain guard is pivoted a bell crank 141 directly above the portion of the chain between the screw-eye 138 and the pulley 143. The purpose of this bell crank is indicated in Figure 6 which shows the exposed end of the bell crank provided with a handle 146 adapted to swing from a position indicated by the word "normal" written or embossed on the side of the chain guard to an opposite position indicated by the word "firing" and also shown at 148 by dotted lines. During normal operation of the stove the bell crank is out of engagement with the chain or merely rests on it as shown in Figure 5 but before opening the stove to add fuel the handle 146 is moved to position 148. This movement presses the bell crank down and in effect shortens the chain thereby closing the damper 129 and at the same time moving the lever 56 sufficiently to permit the damper 100 to close thus preventing the stove from smoking while fuel is being added. After refueling has been completed and the door closed, the handle 146 must be returned to "normal"

position. It will be understood that the dampers and thermostat control have been adjusted so that the stove holds the room at a desired temperature when the control knob 76 is set at "normal," "warmer" or "cooler" as desired.

Referring again to Figure 1, it is understood that the pitch of the groove 80 is so much greater than the pitch of the threads on the stud 84 that turning of the knob 76 through the control range moves the nut 65 only a negligible amount axially relative to the stud 84.

It will be appreciated that my control unit can be made at a very low cost, is very easy to install and adjust, may be quickly detached and separated for repairs and is adaptable for either vertical or horizontal opening connections.

It will also be seen that my control unit is mounted out of the streams of warm air flowing up the sides of the stove and is therefore mainly responsive to the room temperature during normal operation of the stove at which times the check damper is usually open and on the other hand my control is so mounted as to be mainly responsive to the heat of the stove during such times that the check damper is closed, as for example when the fire is starting or when fresh fuel has been added to a low fire.

What I claim is:

1. A damper control device for a solid fuel burning space heater having a flue, comprising a casing adapted to communicate with said flue and having therein a plurality of series of ventilating openings, a thermostat in said casing located between said series of openings so as constantly to be affected by changes in room temperature, and a damper governed by said thermostat, located between said flue and said openings for increasing and decreasing the flow of air thru said openings to said flue to control the rate of combustion of fuel in said heater and to shield the thermostat from the radiant heat of the flue when the damper is entirely closed, whereby when the damper is moved to reduce the draft on the heater the flow of flue air thru the casing openings cools the thermostat approximately to room temperature, and when the damper is moved to increase the draft on the furnace, the lessened flow of air thru the casings allows the heat in the flue to raise the temperature surrounding the thermostat to somewhat above the room temperature.

2. In combination with a heating stove having a smoke outlet, a T connection fitted to said outlet, a cylindrical casing fitted to the free branch of said T to admit air to the flue to check the draft, a check damper pivoted proximate the end of said casing for controlling the flow of air through the casing to the flue, a thermostat mounted in the casing and therefore away from the stove so that the check damper is positioned between the thermostat and the hot flue gases, and means operatively connecting the thermostat to the check damper whereby when the check damper is closed the thermostat is in a substantially dead air space and when the check damper is open, air at substantially room temperature passes through the casing to the flue and shields the thermostat from the temperature of the flue gases.

3. A damper control unit comprising a stove pipe T, two of the branches of which are adapted to connect a stove with its flue, a cap at the free end of the third branch of the T, a thermostatic element mounted in said third branch, a check damper controlled by said thermostatic element and positioned between the thermostatic element and the other two ends of the T, said third branch of the T having openings spaced about its circumference to admit air to the flue, between the flue and the thermostatic element whereby the element is more nearly responsive to the average temperature of the air in the room when the check damper is open and is responsive to the stove heat conducted through the metal of the T when the check damper is closed.

4. In a thermostat control, a casing, an expanding and contracting wafer type thermostat within the casing, a body having a manually controlled high pitch screw connection with the casing to move the body toward or away from the thermostat, a low pitch screw connection between the thermostat and body to afford fine control of one end of the thermostat by rotating the thermostat on said screw connection while the movement of the body provides coarse adjustment of said anchored end, and a spring directly engaging the casing and the thermostat to resist rotation of the thermostat as the body is axially moved by its manual control.

5. In combination, a flue, a check damper for admitting air to the flue to check the draft, a thermostat operatively connected to the check damper and positioned proximate thereto on the side opposite the flue so as to be cooled by the room air when the damper is opened and to be affected by heat radiated from the check damper when closed, and an elongated heat conducting weight projecting from the check damper on the flue side thereof to project a maximum distance toward the flue when the check damper is closed and a minimum distance when the damper is open, whereby when the check damper is closed a large amount of heat is conducted to the check damper to affect the thermostat and when the check damper is open the weight is cooled by the flow of air through the check damper to the flue, and the thermostat is then controlled by the temperature of the thus flowing air.

6. A damper control device for a solid fuel burning space heater having a flue, comprising a heat conducting casing adapted to communicate with said flue, a damper movable to establish or to close communication between the casing and the flue, and thermostatic means within the casing for operating the damper, said casing having a peripherally arranged series of closely spaced openings located between the flue and said thermostatic means, whereby conduction of heat thru the casing walls to the thermostatic means is prevented, when the damper is in open position, by the cooling of the zone of the casing in which said openings are located by air flowing thru said peripheral series of openings in such zone.

7. In a device for maintaining substantially constant room temperature by controlling the draft regulating means of a solid fuel burning space heater; a damper, power transmitting means connected to said damper, a thermostat operating said power transmitting means, and means capable of conducting heat for spacing the thermostat from the source of heat, said last named means including means for directing a draft of room temperature air between the thermostat and the source of heat when the heat requirements of the room are substantially satisfied, whereby the position of the damper is governed almost entirely by room temperature when the room is normal.

8. In a device of the character described, a metal casing adapted to be connected to the flue

of a stove, a check damper closing the end of the casing nearest the flue, a thermostat within the casing controlling the main draft of the stove and also the check damper, said casing having a series of openings between the thermostat and the check damper and a second series of openings between the thermostat and the end of the casing distant from the flue to admit room temperature air to the thermostat.

9. The device of claim 8 in which the far end of the casing carries means for adjusting the thermostat, the casing is cylindrical, the thermostat is of wafer type anchored above the axis of the casing to allow flow of air thru the casing beneath and at both sides of the wafer thermostat.

10. In a low-priced control device for a wood-burning room heater having an air passage therethrough from its air inlet to its flue, a damper for modifying the flow of air through said wood-burning heater and consequently the temperature of such heater, a wafer-type thermostat spaced laterally from the heater by a metal support capable of conducting heat from the heater to the thermostat, said support including means for directing a draft of room temperature air between the thermostat and the heater to cool the thermostat approximately to room temperature when the room is warm, whereby the position of the damper is governed almost entirely by room temperature when the temperature of the room is normal.

11. In combination, a domestic space heater for heating a single room, an air conveying inclosure in proximity thereto but spaced laterally from the heater to avoid upward currents of heated air from the heater surface, a thermostat within said inclosure exposed to the room temperature air of the space to be heated and mechanism operated by said thermostat for regulating the draft of the space heater, including means for increasing or decreasing the flow of room temperature air through said inclosure.

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