March 24, 1942. C. B. HARRELL 2,277,515

THERMOSTATIC DRAFT CONTROL

Filed July 22, 1940 2 Sheets-Sheet 1

Fig. 1.

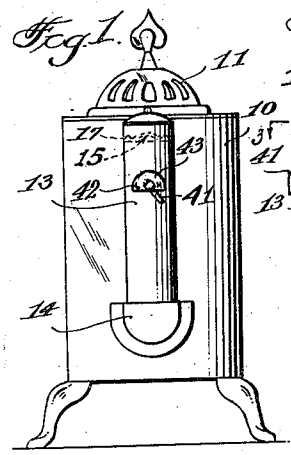


Fig. 2.

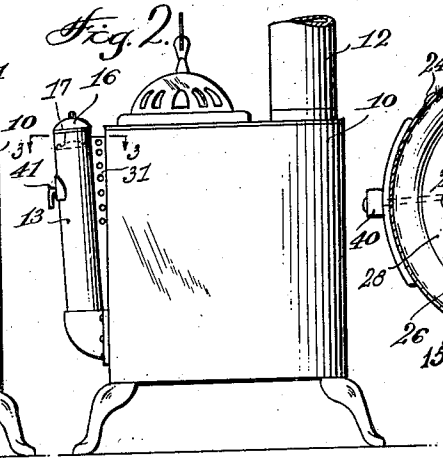


Fig. 3.

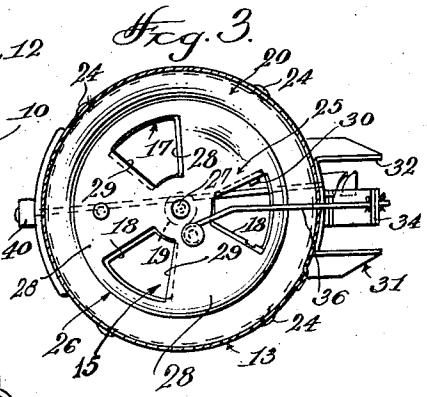


Fig. 5.

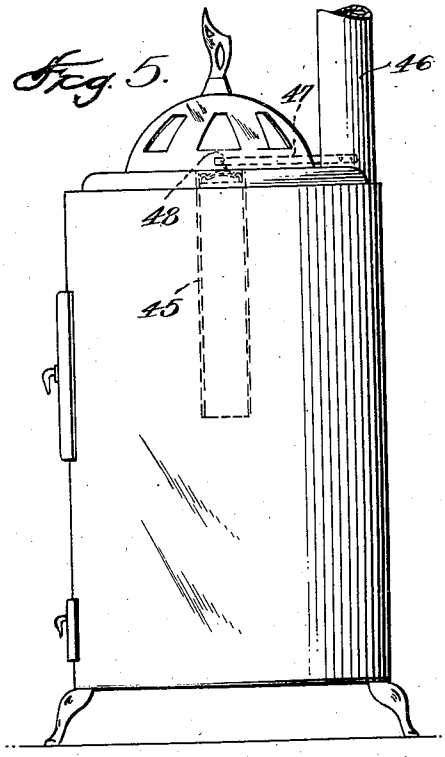
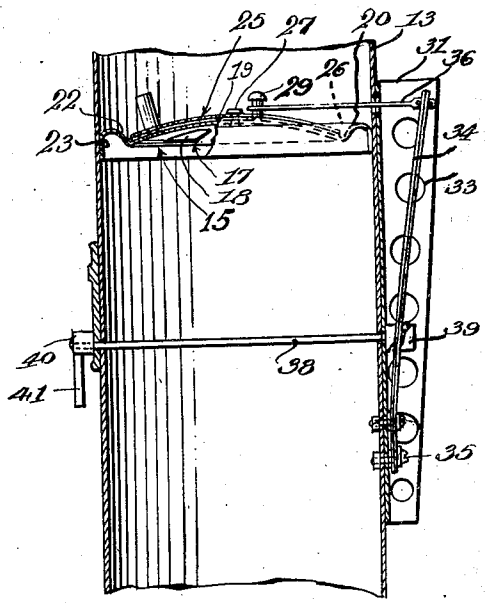


Fig. 4.



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Fig. 6.

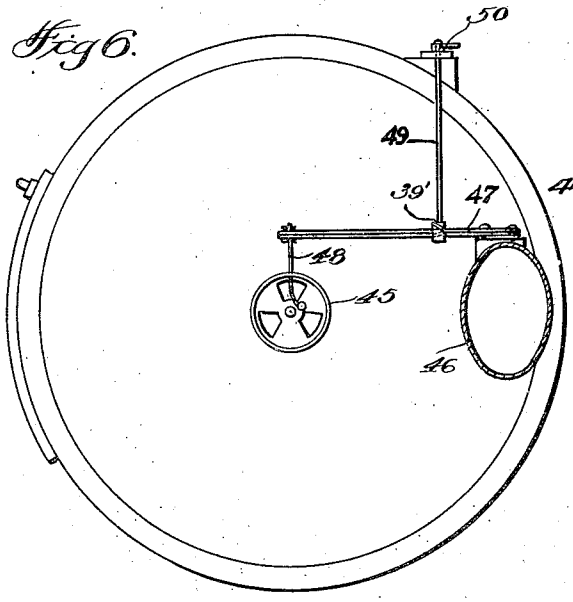


Fig. 7.

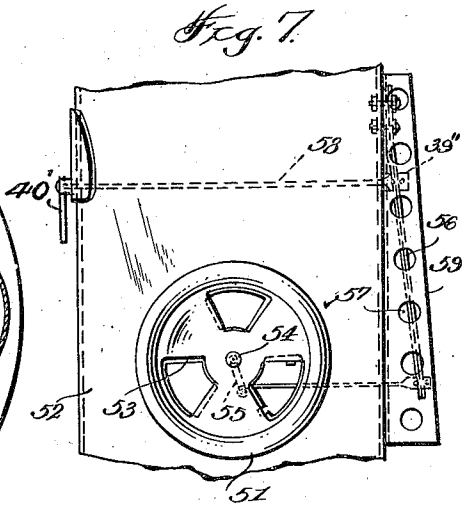


Fig. 8.

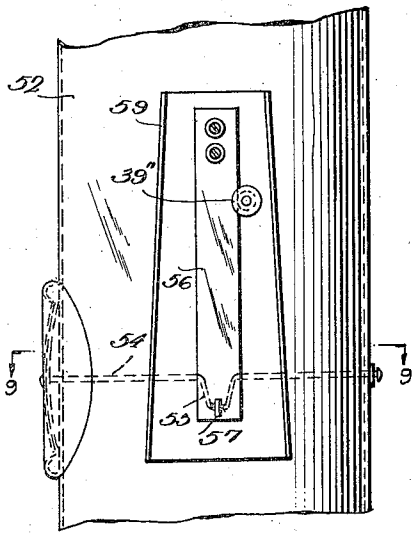
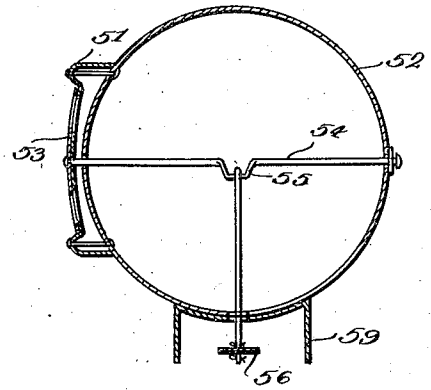


Fig. 9.



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UNITED STATES PATENT OFFICE

2,277,515

THERMOSTATIC DRAFT CONTROL

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Application July 22, 1940, Serial No. 346,827

2 Claims. (Cl. 236—96)

The invention relates to means for controlling the draft to space heaters, and particularly to the control of the draft in stoves for heating living rooms and the like, or other places, and which will be responsive in a novel way to the requirements of a given space for heat, in order to maintain it at or near a predetermined temperature, as distinct from devices that operate in response to the temperature within the heater itself to control a damper or the like, as a safety appliance or to maintain the unit at a predetermined heat production condition.

An important aim of the invention is to present an improvement in construction of such devices, to the end that the functioning of the device will be more dependable for controlling room temperatures, and which will enable the production of the article so as to occupy an extremely small place in an inconspicuous and safe position, where it will be liable in a minimum degree to damage or derangement by being struck by articles, implements or particles of fuel, as well as obviating the need for projecting parts which might represent liability of accidental operation of the device, or engagement in clothing or objects, with resultant damage or impairment of function of the device.

It is also an aim of the invention to present such construction in which a very simple control and regulating means may be provided of the most extreme simplicity, whereby any ordinary person may be able to adjust the device to secure its best function. Another important aim of the invention is to present a construction which will be extremely simple, so that its parts may be produced at a low cost and assembled with a minimum of expense for labor in production, and which will have but few parts, adapted to be produced by conventional methods from low cost materials and at a low cost for production and assembly.

A further important aim of the invention is to present such an article which is adapted, without material change, to use upon various types of stoves, furnaces, and other equipment and heaters, adaptable to wood-burning stoves, coal stoves, and burners of other fuel, as will appear hereinafter.

It is a further advantage of the invention that it will respond to cooling of rooms incident to ventilation, and generally operate as a part of a room unit, as distinct from a mere burner or combustion device. It is an important aim of the invention to present a novel means for controlling or regulating and changing the function of the device in operating a damper or draft shutter, so that the automatic function of the device may be definitely established at will, within any desired range of operation in relation to an arbitrary room temperature desired by the operator.

Additional objects, advantages and features of invention reside in the arrangement, construction and combination of parts involved in the embodiment of the invention, as will be more readily understood from the following description and accompanying drawings, wherein

Figure 1 is a front view of a simple wood-burning stove, in which the invention is incorporated, although the invention is also applicable to coal burning and other forms of stoves and furnaces, as well as being adapted to control liquid fuel valves and other elements, these variations not being illustrated, since they will be readily understood and apparent from the present disclosure and knowledge of construction of various types of heaters in the art.

Figure 2 is a side elevation of the stove shown in Figure 1;

Figure 3 is a fragmentary cross section on the line 3—3 of Figure 2.

Figure 4 is a vertical longitudinal sectional view of the draft flue taken in the major plane of the stove, as shown in Figures 1 and 2;

Figure 5 is an elevation of the adaptation of the device to use upon a down-draft coal stove.

Figure 6 is a top view of the last mentioned stove with the ornamental cover removed.

Figure 7 is a fragmentary elevation of a portion of a smoke pipe, with my invention incorporated thereupon to function as a check-draft automatically.

Figure 8 is an elevation at right angles to Figure 7.

There is illustrated in Figures 1 and 2 a common form of wood-burning stove, often called "King Heaters," having a stoking door 11 in the top thereof, and a smoke pipe 12 leading out of the top at the rear, while at the forward end of the stove means for admitting air by a down-draft flue 13 is provided, the flue 13 opening into the lower part of the combustion chamber of the stove by means of a usual fitting 14 secured to the front end of the stove, and upon which the flue 13 is erected, the latter being formed of common rolled iron sheeting, after the common practice in the production of stove-pipe. In the present instance the flue 13 is enlarged gradually toward its upper end, where it is of circular form, closed by a manually operable draft shutter 15

of any usual construction by which an arbitrary limitation of draft through the tube may be effected, as required, or, the draft may be entirely cut off thereby, these functions being well understood in such appliances.

The flue 13 is located very close to the front of the stove at its lower end, but is inclined outwardly therefrom at its upper part, affording a space at 16, within which my automatic control device is mounted, so that the flue 13 serves as a guard for the more or less delicate thermostat device, its mounting, and connections between the same and the draft shutter in the flue, as will be described.

Set across the flue 13 near its upper end there is a stationary, circular port plate 17 comprising three sector-shaped portions 18 joined at the center by a small circular integral disc portion 19, and connected at their outer parts by a continuous annular portion 20, the intervals between these sector portions constituting ports 21 coextensive with the sector portions 18 in the same annular zone. The port plate generally is in the form of a segment of a sphere, the spherical portion extending into the rim 20 a distance, but stopping short of the outer edge or periphery of the rim 20, being bounded by an upwardly pressed portion of the plate, as at 22, extending entirely around the plate, the peripheral edge of the plate terminating in a downwardly turned approximately cylindrical flange 23. This plate is made with a diameter which is slightly less than the interior diameter of the flue at its upper extremity, and is secured in place by being pressed into the flue end, which is tapered downwardly, until the metal of the flue is slightly expanded or pushed outwardly, this forming a sufficiently permanent attachment of the plate 17 in place in the flue, although it may be welded or otherwise secured in accordance with familiar practices. After one method, parts of the flange 23 are pressed outwardly at suitable intervals by a tool, so that the metal of the flue is slightly distended or indented to receive such outwardly pressed portions of the flange, as indicated in Figure 3, at 24. A shutter 25 is provided, corresponding generally in form to that part of the plate 17 which lies inwardly of the upwardly pressed boundary wall 22 of the plate, having however, a rim portion 26 of slightly less diameter than the inner surfaces of the boundary flange 22, so that the shutter may be free to rotate within the flange 22 without interfering or friction. This shutter is also in the form of a segment of a sphere, approximately, but preferably formed on a slightly longer radius, so that while its center may rest upon the disc 19 at the center of the plate 17, its outer edge portion will clear the plate 17 so that the shutter may rotate freely thereon without requiring a spacer. It is pivoted upon the plate 17 by means of a usual rivet 27 or other pivot element, as may be found desirable. The shutter is formed with three vanes 28, and corresponding ports 29 all of which are adapted to register respectively with the sector parts and ports of the port plate 17, as may be seen. Set rigidly in one of the vanes there is a wrist pin 29 or stud, upstanding from the vane. One of the vanes 28 has an ear 30 extended from one edge, and bent downwardly so as to lie within one of the ports of the plate 17, serving as a stop to limit movement of the shutter in respective directions by engaging the edges of the ports. In the present instance, the edges of the ports through which the ear is projected may be notched to receive the ear therein, so that the shutter may lie in registration with the sectors and ports of the plate 17, when in open position, and so that the ports in the plate 17 may be completely closed when the shutter is at the opposite limit of its movement. It will be noted from Figure 3, that one of the sectors of the plate 17 extends forwardly, or on a radius coincident with the major vertical plane of the stove and gas flue assembly, and the pin 29 is located on that vane of the shutter which is registered with the right hand sector of the plate 17 when the shutter is in open position, and the shutter is movable from that open position clockwise, in order to close. On the rear side of the flue 13—that is, next to the stove—there is mounted a channel-shaped guard piece 31, substantially U-shaped in cross section, the body web portion being secured against the rear face of the flue 13 by welding or otherwise. Its flanges 32 are foraminate as at 33, to permit free circulation of air laterally therethrough, for a purpose to be made clear. A resilient bi-metallic bar or strip 34 is mounted at the lower end portion of the guard piece, and in practice, a strip approximately six inches in length has been used, the upper end of which extends slightly above the shutter level, and the lower end is secured fixedly in relation to the flue, and in spaced relation to the guard piece 31 and the flue 13, by any approved fastening, at 35. In the present instance, washers are inserted between the strip and the guard piece, and suitable bolts and nuts engaged through the strip 34. The washers, guard piece, and flue are used to clamp the strip 34 in position by means of nuts engaged on the inner end of the bolt within the flue. The upper end of the strip is the oscillating portion, and in the present instance, it is considered material to have that part of strip 34 with the highest coefficient of expansion presented toward the stove, the arrangement being such that direct radiation of heat from the surface of the stove will be incident upon the strip 34 without impeding material other than air. The upper end of the strip is apertured, and has pivotally connected thereto a link 36, which in the present instance, may be formed of heavy wire stock with an eye portion engaged around the wrist pin 29. This link extends radially from the strip 34 inwardly, through a suitable aperture in the guard piece 31 and flue for a distance, and is then offset and extended in a parallel direction to the eye portion thereon, so that in inward sliding-movement of the link, it will clear the pivot pin 27 of the shutter.

The bi-metallic strip 34 normally is curved away from the flue 13 at the upper end of the strip, and it will be seen that when heated, the expansion of the outer element of higher coefficient of expansion will cause the upper end of the strip to move inward toward the flue, pushing the wristpin of the shutter so as to rotate the shutter clockwise and toward closed position, in a degree corresponding to the effect of heat on the bi-metallic strip, and proportional to the temperature at which the end of the strip is positioned by the heat acting thereon, counteracted by the draft of air which will pass upwardly between the flue and the stove, acting in a measure to cool the thermostatic element so that the effect of heat from the stove radiated will not be cumulative to an undesirable extent. When the thermostatic element cools off, it will tend to curve outward again, drawing the shutter counter-

clockwise and opening the ports of the plate 17, thereby supplying more oxygen to the stove, the fuel in which will burn with greater intensity and tend to raise the temperature of the room correspondingly.

In order to adjust the function of the damper to suit the requirements of such individuals or special climatic conditions, size of the room, and other factors, I have provided means for varying the function of the bi-metallic strip. This consists of a shaft 38, mounted revolubly across the flue 13, extending from front to rear, the rear end extending also through the web body of the channel-shaped guard piece 31, slightly to one side of the bi-metallic strip 34, and having fixed thereon a concentric worm grooved cam 39, the periphery of this cam extending beyond the adjacent edge of the strip 34, a distance, so that the edge portion of the strip sets in the worm groove of the cam, and whereby rotation of the cam will press the engaged edge portion of the strip rearwardly from the direction of the flue, or will allow it to move forwardly toward its normal initial psition. The forward end of the shaft 38 is provided with a hand lever 40, the hub of which is formed with a pointer 41, arranged in indicating relation to a dial or other indicia 42 formed on a semi-circular bearing fitting 43 attached to the front side of the flue exteriorly thereof. The cam groove is of such lead that movement of the lever 40 over an angle of 180 degrees will effect the full range of adjustment of the bi-metallic strip, and the indicia 42 is corelated to the effect produced on the bi-metallic strip by the cam, in its result in moving the shutter.

The device being installed as illustrated, it will be understood that with a fire maintained in the stove, the heat radiated to the thermostatic strip 34 will tend to cause the upper end thereof to move forwardly toward the flue and operate the shutter to close the ports through the plate 17, and that, initially, when a fire is started, the cool thermostatic strip will hold the shutter in open position so that a maximum draft is afforded to enable proper starting of the fire and its maintenance until the resultant of the effect of heat radiation and thermal air circulation about the strip will operate the shutter to moderate the fire when the temperature of the room has risen sufficiently to minimize the counteracting effect of air circulation opposed to the heating of the strip by radiation from the stove.

In Figure 5, the application of the invention to use upon a down-draft pipe for one type of coal-stove, commonly used, as illustrated, in which a central flue 45 is mounted in the top of the stove and normally open at its upper end, but closed by a shutter operating upon a port plate of the same construction as the port plate and shutter previously described. The stove has a smoke pipe 46 leading upwardly therefrom at the rear, and upon the side of this there is suitably fixed the face of a bi-metallic strip 47 extending forwardly beside the opening at the upper end of the flue, 45, and having a link connection 48 from its forward extremity to the shutter, the strip being properly disposed and arranged to effect closing of the shutter at high temperatures and opening thereof at low temperatures, as desired. The cam adjustment in this instance, for controlling action of the thermostatic strip comprises a shaft 49, suitably mounted on the top of the stove and extended at right angles from the strip 47, beyond the side of the stove, where it is provided with an operating handle 50, in accordance with the previous disclosure. At its inner end a cam 39' corresponding to that before described, is fixed on the shaft and engaged with the edge of the strip 47 for the operation previously described.

In Figures 7 and 8, the manner of embodying this invention upon a smoke pipe as a check draft is illustrated, in this instance, a specially formed port plate 51 is suitably shaped to be mounted upon the side of the pipe, and having sectors and ports therethrough corresponding in front elevation to those shown in Figures 1 to 4, is secured upon the smoke pipe 52. A shutter 53 is mounted pivotally over the plates 51 by means of a shaft 54 extending diametrically across the smoke pipe and mounted revolubly therein conventionally. This shaft is formed with a crank 55 centrally of the pipe, and suitably fixed on the exterior of the pipe in accordance with the prior disclosure, there is a bi-metallic strip 56, its point of attachment being located a distance vertically from the level of the shaft 54, and its swinging end being located closely adjacent the same level of the shaft 54, and connected to the crank 55 by means of a link 57 extended slidably through a small aperture in the side of the pipe. A cam adjustment for the bi-metallic strip 56 is provided in a shaft 58, mounted revolubly in the pipe 52, one end extending through the pipe beside the strip 56 and having a cam 39'' thereon engaged with the strip as before described, the opposite end of the shaft being provided with the operating hand lever 40', which may be coordinated with an index device as described in connection with Figures 1 to 4. If desired, a guard piece 59 may be incorporated with the bi-metallic strip 56, constructed in a form similar to that of the guard piece 31 before described.

It will be understood that while I have described with great particularity a specific embodiment of the invention, this is purely exemplary, and various changes in form, arrangement, size, and construction of parts, as well as substitution of equivalents may be carried out without departing from the spirit of the invention, as more particularly set forth in the appended claims.

I claim:

1. An automatic draft control for stoves and the like consisting of a flue member, a thermostatic bi-metallic strip fixed at one end in relation thereto and having its opposite end free to swing under variations of temperature, a port plate in the flue, a shutter movable thereon to close the port plate and to open the same, operative connections between the swinging end of said bi-metallic strip and said shutter, said strip extending beside said flue in spaced relation, a shaft revolubly mounted across the flue, adjacent an intermediate portion of the strip, substantially at right angles to the strip, and having a spiral groove cam thereon, the groove receiving an edge portion of the bi-metallic strip, a pointer lever on the opposite end of the shaft, and a channel guard device mounted between the flue and said bi-metallic strip, open at the top and bottom and having side flanges provided with vertically spaced apertures.

2. In a stove, an automatic draft control therefor, consisting of a stove body having a combustion chamber and a bottom air inlet thereto, a flue fixed in relation to the stove communicating at its one end with said draft inlet and extending

upwardly therefrom, a port plate fixed across the flue, a shutter movable thereon to close the port plate and open the same, a bi-metallic strip arranged longitudinally of the flue, and secured in fixed spaced relation thereto at a distance from the shutter and having an end portion arranged to swing adjacent the shutter under action of heat variations, a link connection between the swinging end of the bi-metallic strip and said shutter, for operation of the latter by variations of temperatures, said flue being mounted in close spaced relation to the stove body, said strip being at the side of the flue next adjacent the stove, a channel-shaped guard device on the flue partly closing the space between the flue and stove, whereby an air draft is formed adjacent the bi-metallic strip, a shaft revolubly mounted across the flue substantially at right angles to said strip and with one end extended through the flue beside the strip and spaced therefrom, a spiral cam screw device fixed on the shaft beside the strip and receiving a strip edge in said groove, and the opposite end of the shaft having an operating handle thereon outwardly of the flue.

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