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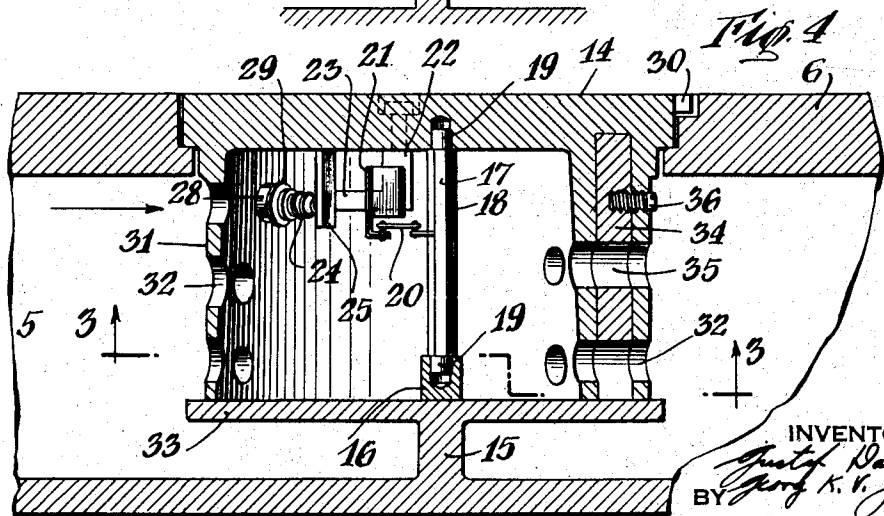
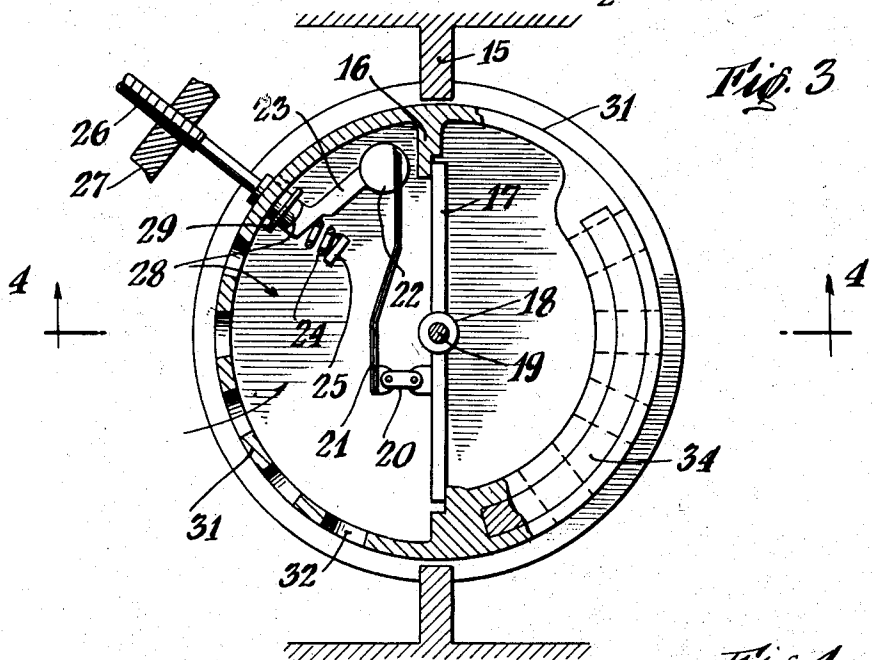
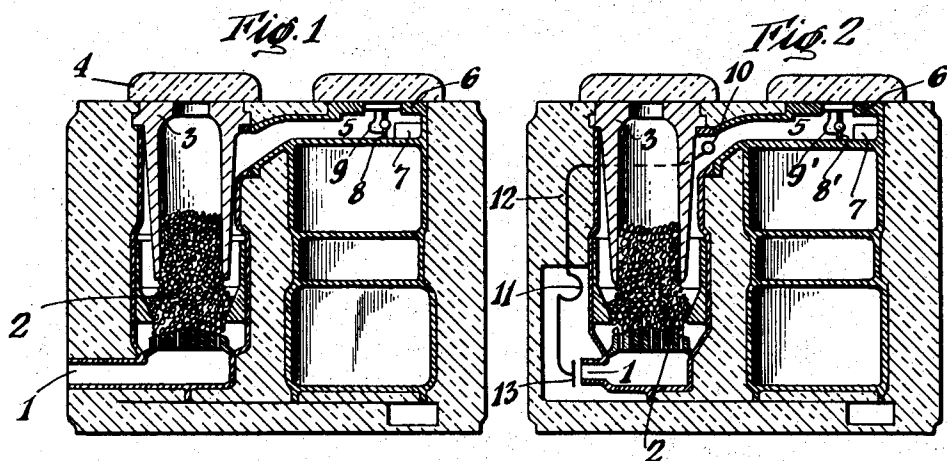
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DRAFT REGULATOR

Filed June 17, 1937

4 Sheets-Sheet 1



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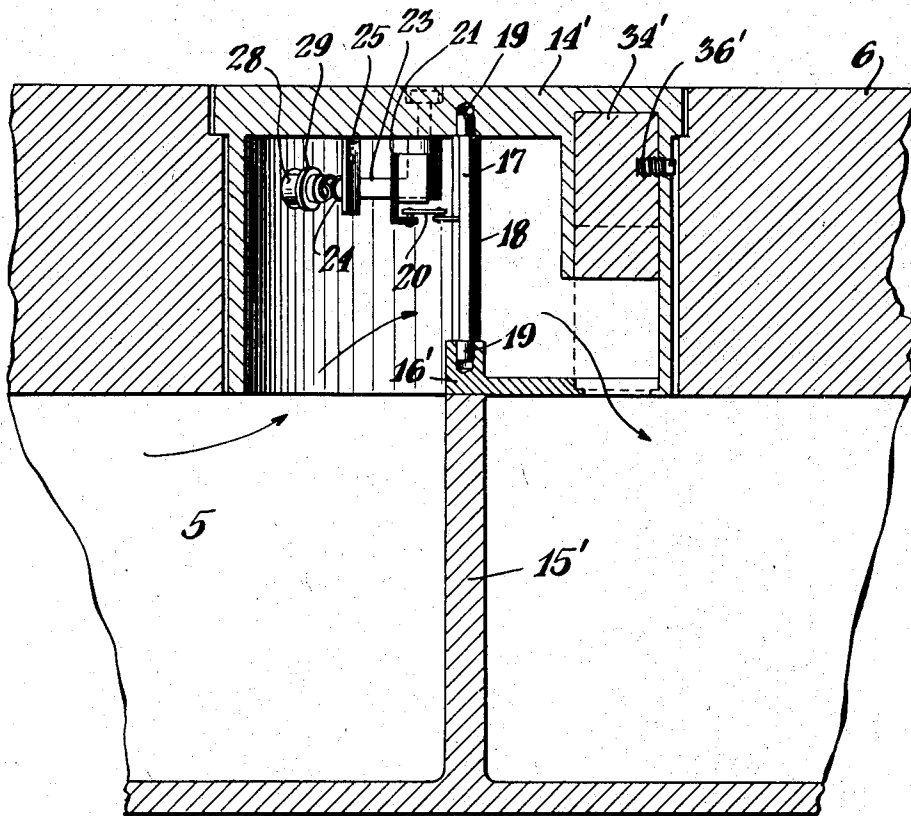
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Fig. 5



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Fig. 6

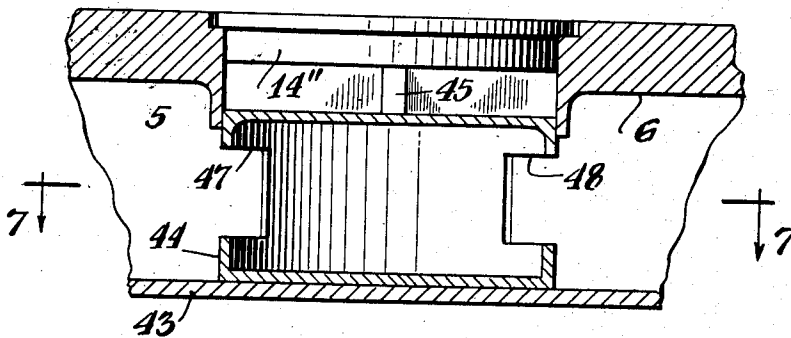


Fig. 7

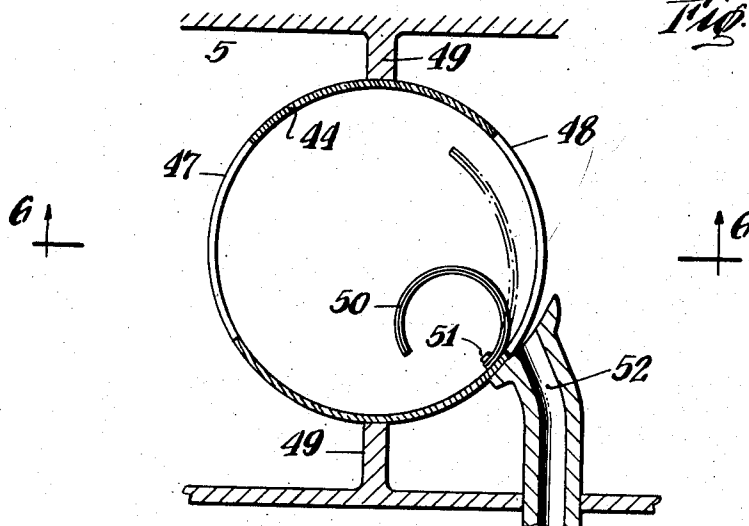
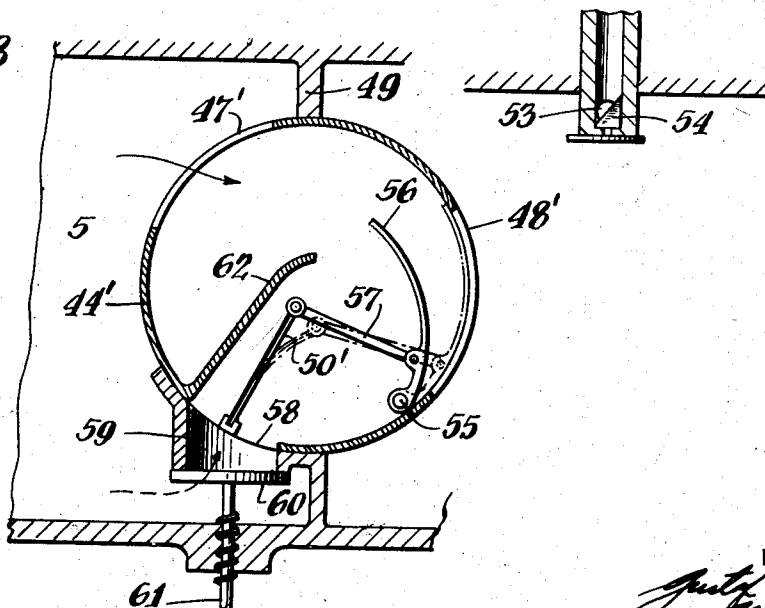


Fig. 8



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DRAFT REGULATOR

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Fig. 10

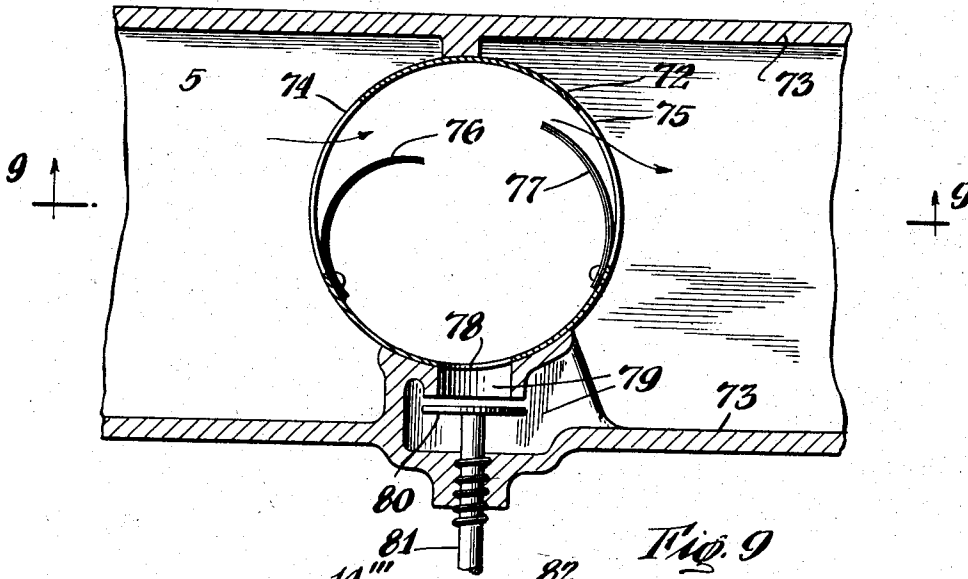


Fig. 9

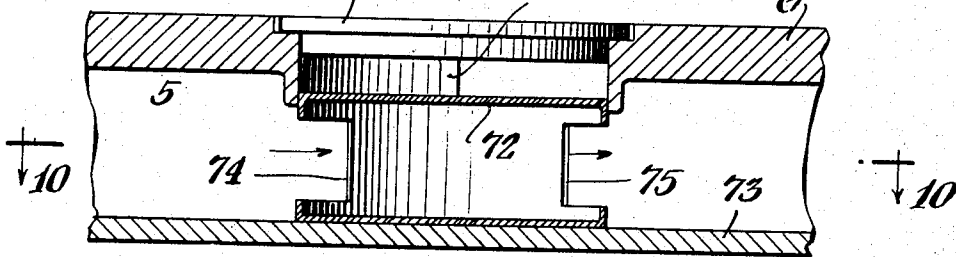
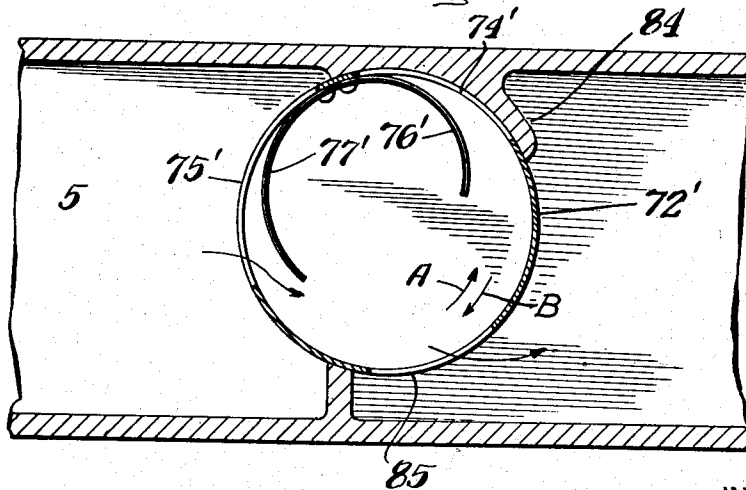


Fig. 11



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DRAFT REGULATOR

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In Sweden June 22, 1936

3 Claims. (Cl. 236—93)

The present invention refers to combustion devices, and particularly to continuously burning devices with intermittent heat output such as cooking stoves and the like, and provided with thermostatic means for regulating the draft. The combustion has hitherto usually been regulated by means of a thermostatically operated valve in the air inlet to the fire box. However, such a device has the disadvantage that it becomes inoperative when the ashpit door is left open, which often happens when the stove is attended by unskilled persons. On such occasions a too rapid combustion is obtained and the internal parts of the stove may be destroyed by excessive heat.

It has heretofore been proposed to arrange the draft regulating device in the flue, which conducts the combustion gases from the fire box. This device will then reduce the draft through the fire box when the temperature of the combustion gases increases and prevents too rapid combustion, even if the ashpit door is left fully open.

Devices of this kind hitherto known, however, do not operate satisfactorily, principally because condensation and soot collect in the flue, thus hindering operation of the movable member of the draft regulating device. According to the present invention this trouble is obviated by the flue in which the movable member of the draft regulating device is located being heat insulated. By this means the flue attains such a high temperature, even at very slight heat output from the stove, that condensation and soot are prevented from depositing therein.

If the invention is applied to a continuously burning stove or the like with intermittent heat output the flue must be insulated at least during the periods of non-output. During these periods the temperature of the flue will rise high enough to burn away the soot and other deposits.

It is not necessary that the flue be insulated throughout its entire length. It is most important that the part of the flue between the fire box and the movable member of the regulating device is well insulated.

The movable draft regulating member may be located in any part of the flue. In combustion devices with one or several places of heat output at which the combustion gases give off their heat, such as cooking stoves, it may be placed in the part of the flue between the place of heat output which is first passed by the combustion gases and the chimney of the combustion device.

This location is to be preferred, partly because the temperature of the flue there is relatively low and partly because the regulating member is protected against particles of ash or fuel flying about in the fire box.

The placing of the movable draft regulating member in the flue also has the advantage that the member can be placed near to the heat sensitive member of the regulating device or even be built together therewith to form one unit. In this way the connection between the two members will be as simple as possible. However, there are also reasons for placing the members separately. In cooking stoves of the kind that has one hot plate in intimate heat transmitting contact with the fire, at least one other hot plate which receives heat from the flue gases and at least one oven, the heat sensitive member may preferably be in relatively good heat transmitting connection with these parts of the stove and also with the flue gases. The heat resistance between the heat sensitive member and the above mentioned parts of the stove is selected in such a way that the different parts of the stove are maintained at the desired temperature. To accomplish this the heat sensitive member may be placed relatively near the hot plate that receives its heat directly from the fire where the temperature is comparatively high. The movable member, however, preferably may be placed farther along in the direction of the flue gas current, where the temperature is somewhat lower. This is possible owing to the fact that the flue is heat insulated so that no deposits of soot and tar will take place during periods of reduced heat output when the heating effect of flue gas is small.

On the other hand the heat sensitive member should not be in too good heat conducting relation with the heat accumulating parts of the combustion device, especially when these parts have a great heat accumulating capacity. It is, however, of the greatest importance that the heat sensitive member is in relatively good heat transmitting contact with the combustion gases, especially when the parts of the combustion device have a low heat conductivity as in the common heat accumulating cooking stoves.

This will be easily understood when the mode of operation of a heat accumulating stove of the common type is considered. Assume that the thermostat has been adjusted for average heat emission and that the hot plate that is in communication with the heat accumulator and also

the heat accumulator in its entirety are cooled down due to intense heat output. If the heat sensitive member is in good heat conducting connection with the heat accumulating parts of the stove but in relatively poor heat transmitting connection with the combustion gases, the draft regulating valve will then be automatically set to admit a large air supply. This results in a rapid combustion in the fire box but, owing to the comparatively high heat conduction resistance existing between the fire and the hot plate, the temperature of the latter will rise slowly. As the hot plate thus remains comparatively cool, the kitchen staff will very likely adjust the thermostat to allow higher heat emission, thus further increasing the supply of air to the fire box. Perhaps the ashpit door will also be opened. A very high temperature will then arise in the fire box before the heat accumulator is heated high enough for the thermostatic device to limit the air supply or before the ashpit door is closed again.

It is thus, on one hand, desired to have a good heat conducting connection between the heat sensitive member and the parts of the stove so that the temperature of these parts will influence the sensitive member and, on the other hand, it is desired to have a poor heat conducting connection between the heat sensitive member and the stove parts and a relatively good heat transmittance between the member and the combustion gases in order to obviate damage of the stove. However, these demands are irreconcilable. According to one embodiment of the invention a draft regulating device is therefore arranged in the flue in such a way that its heat sensitive member is in good heat transmitting contact with the flue gases but in poor heat conducting communication with the heat accumulating parts of the combustion device and that its draft regulating member remains entirely or very nearly open at all normal flue gas temperatures but closes entirely or almost entirely when the flue gases have reached a certain permissible maximum temperature. For the regulating of the temperature during normal use of the combustion device another draft regulating means is arranged with its heat sensitive member in good heat conducting connection with the parts of the combustion device. The draft regulating member of the latter regulating means is preferably located in the air inlet of the fire box, but may also be placed in the flue. Obviously the different heat sensitive members may act upon the same draft regulating member.

The draft through the fire box can be regulated in different ways. The resistance to flow of flue gases in the flue can be varied, for instance by restricting the passage by means of a valve, or the draft can be short-circuited by admission of atmospheric air through a regulated opening in the flue pipe. Of course it is also possible to combine these two regulating methods.

The accompanying drawings show several embodiments of the invention applied to heat accumulating cooking stoves.

Figs. 1 and 2 are cross-sectional views of two stoves, which are designed according to the invention;

Fig. 3 is a cross-sectional view of a thermostatic regulating device which is built into a lid arranged in a hot plate and is taken on the line 3—3 of Fig. 4;

Fig. 4 is a cross-sectional view taken on the line 4—4 of Fig. 3;

Fig. 5 is a cross-sectional view of a modification of the device shown in Figs. 3 and 4;

Fig. 6 is a cross-sectional view of a further embodiment of a regulating device and is taken on the line 6—6 of Fig. 7;

Fig. 7 is a cross-sectional view taken on the line 7—7 of Fig. 6;

Fig. 8 is a cross-sectional view of a further regulating device;

Fig. 9 is a cross-sectional view of an embodiment of the thermostatic regulating device having two heat sensitive members and is taken on the line 9—9 of Fig. 10;

Fig. 10 is a cross-sectional view taken on the line 10—10 of Fig. 9; and

Fig. 11 is a cross-sectional view of a further regulating device with two heat sensitive members.

Referring more particularly to Fig. 1, reference character 1 designates a permanently open air supply pipe to the ashpit and 2 indicates the fire box. The walls of the fire box and of a fuel magazine projecting into the same, constitute a heat accumulator. The top of the fuel magazine forms a hot plate 3, which may be covered by an insulating lid 4 when not in use. The flue gases pass from the fire box through a heat insulated flue 5, above which another hot plate 6 is arranged which may be covered by an insulating lid. From flue 5 the flue gases pass through an opening 7 into the chimney. Below the hot plate a throttle valve 8 is arranged which, when closed, as shown in Fig. 1, entirely closes the flue. The valve 8 is actuated by a bimetal strip 9 in such a way that it is opened when the temperature of the flue gases decreases, and is closed upon an increase in flue gas temperature. As this increases or decreases, respectively, the draft through the fire box and consequently the supply of air to same, the valve tends to maintain a constant flue gas temperature, and prevents the temperature of the fire box from rising or falling beyond permissible limits.

Fig. 2 shows a stove of exactly the same construction as the one shown in Fig. 1. The corresponding parts are marked with the same reference characters as in Fig. 1. In this case a regulating device 8', 9' is arranged in the flue 5, but the bimetal strip of this device is made and arranged in such a way as to keep the valve 8' nearly open at flue gas temperatures below a certain value. When this limit is reached, the valve is rapidly closed. This operation is obtained because the bimetal strip has a certain tension in open position and possesses high sensitivity. In this case the valve 8' thus acts as a safety valve, closing the flue at too high flue gas temperatures. In this way, damage to the fire box, caused by too high combustion temperatures, is avoided. During normal use the temperature of the parts of the stove and the fire box is regulated by means of a thermostatic regulating device of well-known type. Such a device is shown diagrammatically in Fig. 2. A receptacle 10 together with a Bourdon tube 11 and a tube 12 of small bore connecting these two parts, form a closed system which is filled with mercury. The receptacle 10 is placed in the flue 5 in heat transmitting connection with the heat accumulating parts and also with the flue gases, being inserted in a tube running crosswise through the flue. When the temperature of the

receptacle rises, the mercury expands, pressing on the walls of the Bourbon tube so that this tube becomes straighter. A valve disc 13, arranged at the free end of the Bourbon tube and disposed before the air inlet opening 1 to the ashpit, is thus moved closer to the opening and the air supply is reduced. When the temperature of the receptacle 10 falls, the air supply is increased by the Bourbon tube becoming more curved, so that the valve disc 13 is withdrawn from the opening. This regulating device thus tends to maintain a constant temperature in the fire box and the heat accumulator. However, owing to the high heat capacity of the heat accumulator the temperature will oscillate considerably. If, however, the temperature rises too much, the regulating device 8', 9' starts functioning, preventing the internal parts of the stove from being damaged.

Figs. 3 and 4 show on a larger scale one embodiment of the regulating device according to the invention. A lid 14 is arranged in the hot plate 6, located immediately above the flue 5. Under the lid there is a partition 15 in the flue, closing the flue with the exception of an opening immediately below the lid 14. In this opening a flange 16 extends from the underside of the lid, in contact with the edges of the opening. The flange is provided with an opening, in which a throttle valve 17 is arranged on a vertical shaft 18, by means of which the opening can be closed. The valve 17 is supported on journal bearings 19 in the lid and in the flange 16, and by means of a link 20 is connected to one end of a bimetallic strip 21, the other end of which is fixed in a rotatable holder 22 supported by the lid 14. The holder is provided with a lever 23, enabling it to be turned and kept in a certain position. The free end of the lever 23 is fixed between a spring 24, pressing against a pin 25, extending from the underside of the lid 14, and an adjusting screw 26. This screw is adjustably mounted in a part 27 of the hot plate 6 and suitably connected with a lever (not shown) on the front side of the stove, by means of which it can be turned and adjusted. The adjusting screw 26 acts upon the lever 23 by means of an intermediate part 28, which is slidably mounted in the lid and arranged opposite the regulating screw 26 when the lid 14 is in its proper position. The intermediate part 28 is provided with a collar 29, preventing it from being pushed out from its bearing by the spring 24 when the lid 14 is removed and the intermediate part is no longer kept in position by the adjusting screw 26. In order to insure that the lid 14 is in its proper position when inserted in the hot plate, a projecting stud 30 is provided on the edge of the lid and is receivable in a corresponding recess in the hot plate. However, the adjusting screw may also be arranged in bearings in the lid 14 so as to make it removable together with the lid.

When the bimetal strip is cold it keeps the valve 17 open, but shuts the same as the temperature is increased. When the temperature has reached a certain value, the valve is entirely closed, as shown in Fig. 3. However, by setting the holder 22 in different positions, it is possible to change the position of the bimetal strip so as to make the valve close at different temperatures. As long as the temperature of the flue gases is below a certain value, the valve is kept open and flue gases pass freely through the opening in the flange 16. If, on the other hand, the temperature of the flue gases should rise above the maximum limit, the valve is closed, thus preventing

the flue gases from escaping. The size of the free opening and, consequently, the draft is reduced when the temperature rises, and increased when the temperature falls and the valve thus tends to maintain a constant temperature of flue gases. If desired, the bimetal strip may be arranged in such a way that the valve is adjusted within wide temperature limits, or kept entirely open at lower temperatures and closed rapidly, when the maximum permissible temperature is reached.

The advantage of the embodiment of the invention shown in Figs. 3 and 4, is that the lid and the regulating device constitute one unit, exchangeable when necessary. In order to prevent the valve and the regulating device from being damaged when the lid is carelessly handled, the lid is provided with an annular flange 31 at the edge, provided with holes 32 for the passage of flue gases. The annular flange can preferably be made to fit tightly against a flat bottom 33 in the partition wall 15, but this is not necessary.

In the part of the annular flange that is located on the same side as the outlet of the flue gases, a slide valve body 34 is arranged in a cavity. The valve body is provided with openings 35 to match the holes 32 for the flue gases when the valve body is in its upper position, as shown in Fig. 4. However, the openings 32 and 35 have such relative positions and the valve body is dimensioned in such a way that the openings 32 are shut by the valve body when it is in its lowest position.

The valve body is kept in its upper position by a pin 36, made from a metal, fusible at a certain temperature, which temperature the escaping flue gases are not to exceed. If the flue gases reach this temperature limit, the pin melts and, owing to its own weight, the valve body falls down to its lowest position shutting off the passage of flue gases through the openings 32. Instead of a number of holes, it is, of course, possible to provide one single opening in the flange 31, which can be closed by the valve body 34.

The construction of the regulating device illustrated in Figs. 3 and 4 is naturally only shown as an example and may be varied in many different ways within the limits of the invention. For instance, as shown in Fig. 5, the hot plate 14' may be made thicker than indicated in Fig. 4, and the height of the lid, including the flange 16', may be made equal to the thickness of the hot plate. This makes the opening in the partition wall unnecessary and the upper edge of the wall may thus be straight and in contact with both the hot plate and the lid. The advantage of this arrangement is that it allows the hot plate to slide freely due to heat expansion of the other parts of the stove. In this case, however, the flue gases must enter the lid from beneath, pass the valve, and escape downwards on the other side of wall 15'. This necessitates, of course, the elimination of the plate 33, but the flange 16' is still in close contact with the wall 15' as shown in Fig. 5.

In the regulating device according to Figs. 3 to 5 the desired temperature of the flue gases is obtained by setting the holder 22 in a certain position by means of the lever 23 and the adjusting screw 26. However, especially when the temperature is to be regulated from a place at some distance, the use of such a method for variation of the regulating temperature is rather impractical. The variation of the regulation temperature is attained in a simpler and more reliable way if the regulating device is con-

structed as shown in Figs. 6 and 7. In this regulating device the heat sensitive member is arranged in variable heat transmitting communication with the outer atmosphere by air in variable quantities being admitted to the flue in such a way as to contact the heat sensitive member.

In Figs. 6 and 7, 5 indicates the heat insulated flue, which is bounded on its lower side by an oven wall 43, and 6 is the hot plate placed above the flue. A cylindrical structure 44 is inserted in the flue in such a way that there is a low rate of heat transmission between the cylinder and the hot plate. By means of a bar 45 the cylinder is connected to a lid 14'', covering an opening in the hot plate 6 so that the cylinder can be removed through this opening together with the lid. Two diametrical openings 47 and 48 are provided in the walls of the cylinder, and a partition 49 is arranged in the flue in contact with the cylinder so that the gases, flowing through the flue, have to pass through these openings. At the outlet opening 48 a bimetallic strip 50 is fixed by means of a screw 51. The shape of the bimetal strip, when cold, is such that it does not prevent the flue gases from passing through the opening 48, as shown in full lines in Fig. 7. When heated, the strip expands, as shown in dash lines, reducing the area of the passage of flue gases and, at a certain temperature, entirely closes the opening. A pipe 52, in communication with the atmosphere, opens into the flue immediately behind the bimetal strip 50. Air is admitted to this pipe through an opening 53, which by means of a rotary slide valve 54, can be entirely or partly closed, thus regulating the quantity of air which is drawn through the pipe by the reduced pressure in the flue. In order to make the slide valve 54 easy of access, it is arranged at the front side of the stove. The position of the outlet opening of the pipe 52 is such as to bring the air flowing from the pipe in contact with the bimetal strip 50.

When passing through the cylinder 44 the flue gases flow around and heat the bimetal strip. When the temperature of the flue gases rises, the bimetal strip expands, reducing the area of the flue gas passage, and at a certain temperature entirely closing the opening 48. The draft through the fire box is thereby cut off and the temperature is not further increased. Should the flue gas temperature thereafter fall, the passage through the opening 48 is opened so that the draft is restored and the generation of heat in the fire box is increased, thus counteracting the fall in temperature. The bimetal strip thus tends to maintain a constant flue gas temperature. As the bimetal strip is in heat transmitting contact, partly with the combustion gases, and partly with the atmosphere through pipe 52, it has a temperature lying between the flue gas temperature and the temperature of the atmosphere. The more intimate the heat transmitting communication between the bimetal strip and the atmosphere is, the higher flue gas temperature is required for giving the bimetal strip the temperature which makes it close the opening 48. It is, therefore, obvious that, if the transmission of heat to the atmosphere is increased by cool air being admitted to the bimetal strip from the pipe 52, this will result in increased flue gas temperature. The flue gas temperature, determined by the regulating device, can thus be varied by variation of the admission of air through the pipe 52.

However, if the transmission of heat from the bimetal strip to the atmosphere is constant, it is possible to regulate the flue gas temperature at which the opening 48 is closed, by variation of the transmission of heat from the flue gases to the bimetal strip. The poorer this heat transmission is, the higher must the temperature of the flue gases be before the bimetal strip attains the temperature required to make it close the opening 48. In the device shown in Fig. 8 the desired flue gas temperature is obtained by variation of the transmission of heat from the flue gases in such a way as to allow a greater or smaller quantity of flue gases to flow around the bimetal strip. For this purpose, the cylindrical structure 44' is provided with two inlet openings 47' and 58 for the flue gases. The opening 58 is arranged in alignment with a passage 59, which can be partly or entirely closed by a valve disc 60. The bimetal strip 50' is located opposite the opening 58 and by means of a link 57 connected to a valve 56 so that the valve is moved towards the outlet opening 48' when the temperature of the bimetal strip rises whereby the flow of flue gases is reduced. When the valve 60 is closed, all of the flue gas is directed through the openings 47' and 48', and hence affect the bimetal strip only to a slight degree. The resistance to heat transmission existing between the flue gases and the bimetal strip is then high, and a high flue gas temperature is required to heat the bimetal strip to such a degree that it is able to close the valve 56. In order to hinder the flue gases from contacting the bimetal strip when the valve 60 is closed, a partition 62 is arranged in the cylinder to shield the strip from the gases flowing through the opening 47'.

When the valve 60 is opened, the flue gases flow through the passage 59 and the opening 58 and directly strike the bimetal strip. Owing to the good heat transmission then occurring between the strip and the flue gases the latter may have considerably lower temperature and still be able to close the valve. The temperature of the gas needs to be only a few degrees above the temperature at which the bimetal strip closes the valve. By adjusting the valve 60 to different positions by means of a spindle 61, the quantity of flue gases flowing through the passage 59 and consequently the transmission of heat to the bimetal strip can be varied. The better the heat transmission is, the lower is the flue gas temperature maintained by the regulating device.

However, the variation of the regulating temperature may also be effected by using a regulating device with two or more heat sensitive members operating at different regulating temperatures or between different limits of temperature. Such a regulating device is shown in Figs. 9 and 10.

In the flue 5 of the stove, a cylindrical structure 72 or the like is in fluid-tight contact with the walls 73 of the flue, the upper of these walls consisting of the hot plate 6 of the stove. The walls of the cylinder are provided with two openings 74 and 75 through which the flue gases flow in the direction indicated by the arrows in Fig. 10. Inside the box, at the inlet opening 74, a bimetal strip 76 is arranged in such a way that when heated by the flue gases it becomes deformed and reduces the free area of the opening and at a certain temperature, for instance slightly above 300° C., completely closes the opening. In the same way another bimetal strip 77 is arranged in front of the outlet opening 75, but this

strip is constructed in such a way that it closes the opening 75 at a lower temperature, for instance slightly above 250° C. In the cylinder 72 there is another opening 78 placed opposite a channel 79 arranged in a part of the wall of the flue pipe that fits tightly against the cylinder. The channel 79 opens into the flue or the outlet side of the cylinder 72, and may be closed by means of a valve 80, which may be adjusted from the front side of the stove by means of a spindle 81 threaded in the wall of the flue.

Any flue gases flowing through the flue 5 are forced to pass through the opening 74 and thereafter through either of the openings 75 or 78, or through both of them. When the channel 79 is completely closed by the valve 80, all of the flue gases, having passed the opening 74, passes through the opening 75. The bimetal strip 77, however, closes this opening when the flue gases have attained a temperature slightly above 250°, causing the draft to cease and the development of heat in the fire box of the range to be reduced. The temperature of the flue gases can thus not rise higher than slightly above 250°, nor can the temperature fall considerably below this temperature, and the bimetal strip 77 tends to maintain a constant temperature of the flue gases of about 250°. The regulating temperature of the bimetal strip is thus about 250.

If it is desired to obtain an increased emission of heat in the stove, the temperature of the flue gases may, however, be raised by opening the valve 80. The flue gases can then pass through the channel 79 and flow through the flue to the chimney of the stove in spite of the fact that the opening 75 is closed. Their temperature may now rise to slightly above 300°, at which temperature the bimetal strip 76 closes the opening 74. The bimetal strip 76 thereafter tends to maintain the flue gases at about 300°, which is the regulating temperature of this bimetal strip.

It is thus possible, by adjusting the valve 80 to closed or open position to obtain regulation at a temperature of the flue gases of either 250° or 300°. In view of the fact that for this adjustment no mechanical actuation whatsoever of the bimetal strips is required from the outside, the structure with the bimetal strips contained therein may be made as a separate unit that is easy to remove from the stove. For this purpose the cylinder is attached by means of a rod 82 to the lid 14' that covers an opening in the hot plate 6, this opening having a slightly larger diameter than the cylinder so that this may be lifted, together with the lid, through the opening and removed for cleaning or examination.

In the embodiment of the invention above described, the openings 74 and 75, through which the flue gases flow, are arranged in series. It is, however, also possible to arrange the openings 74' and 75' in parallel, as shown in Fig. 11. To do this, the bimetal strip regulating at the higher temperature is arranged so that it may be rendered inoperative. This may be done by closing the opening 74', regulated by this strip, by means of some suitable arrangement. In the arrangement shown in Fig. 11, the cylinder fits tightly against the walls of the flue so that with the exception of the openings in the cylinder the flue is completely shut off. Part of the wall 84 of the flue has a cylindrical surface corresponding to the outer surface of the cylinder 72' and has a greater peripheral extent than the opening 74'. If the cylinder is in the position shown in Fig. 11, the opening 74' is situated opposite

the last mentioned surface which will thus completely cover the opening 74'. The opening 75' that is regulated by the bimetal strip 77', regulating at the lower temperature, is uncovered in this position of the cylinder and is in a position to receive the flue gases which can enter the cylinder through this opening only. For the escape of the flue gases from the cylinder an additional opening 85 is arranged. The flue gases will thus pass through the openings 75' and 85 and hence are regulated by the bimetal strip 77, so that their temperature remains constant at about 250°, which is the regulating temperature of this bimetal strip.

The cylinder 72' is arranged in such a way that it can be turned in the direction shown by the arrow A to such a position that both the openings 74' and 75' become uncovered and may serve as inlets. The dimensions of the openings are such that, when turning the cylinder to this position, the opening 85 remains open. The flue gases may thus pass into the cylinder through the openings 74' and 75' and escape from it through the opening 85. When the flue gas temperature has risen to slightly above 250° the opening 75' is, however, completely closed by the bimetal strip 77', and the flue gases may thereafter only pass through the opening 74', but in doing so they are regulated by the bimetal strip 76' arranged at that opening so that their temperature remains constant at about 300°. Hence, in this embodiment of the invention it is thus possible to adjust the temperature of the flue gases, as required, to the higher or the lower regulating temperature.

Cylinder 72' may also be rotated in a clockwise direction from the position shown in Fig. 11, as indicated by the arrow B, so that opening 75' is closed by the wall 84. In this position, opening 85 constitutes the inlet to cylinder 72' and opening 74' constitutes the outlet. Hence, the flow of flue gas is controlled solely by the bimetal strip 76', which regulates at the higher temperature.

It has been supposed in the above, in connection with Figs. 9 and 10, that the valve 80 has either been completely closed, in which case the regulation has taken place at the lower regulating temperature (250°), or else completely open, in which case the regulation has taken place at the higher regulating temperature (300°). In the former case the bimetal strip 77 alone, and in the latter case the bimetal strip 76 alone, has been supposed to effect the regulation. This is, however, not actually the case in practice. When the valve 80 is closed it is principally the bimetal strip 77 that effects the regulation but also the bimetal strip 76 has some influence as this also becomes deformed at temperatures below 300°. At a temperature of the flue gases of 250° the free end of the bimetal strip 76 is, however, situated at a comparatively long distance from the opening 74, and therefore these deformations have little influence on the regulation. If the valve 80 is opened somewhat, part of the flue gases will pass through the channel 79 and a small amount of flue gases through the opening 75. In order to bring about that the same total amount of flue gases will pass through the flue at the same difference in pressure, it is then necessary to reduce the effective area of opening 75, which means that this must be further throttled by the bimetal strip 77. In order to do this it is, however, necessary that the temperature of the flue gases should rise somewhat. This, on the

other hand, entails that the bimetal strip 76 further approaches its closed position and greatly affects the regulation. If the valve 80 is opened, this thus entails as a consequence that the influence of the bimetal strip 77 on the regulation is reduced while the influence of the bimetal strip 76 increases, causing the regulating temperature to rise. The more the valve is opened, the bigger the influence of the bimetal strip 76 on the regulation, and the bigger the rise of the regulating temperature. With a wholly open valve the flue gas temperature is regulated practically exclusively by this bimetal strip.

When the valve 80 is opened the regulating temperature thus rises continually from about 250° to about 300° and any intermediate regulating temperature may be obtained if the valve is opened to a suitable degree. It is further evident that the bimetal strip 76 or 77 does not actually regulate at a certain temperature but within a certain range of temperature lying about 300° or 250°, respectively. In the same way a continual alteration of the regulating temperature may naturally be obtained in the arrangement according to Fig. 11 by turning the cylinder 72'.

It has been shown in the above how a member sensitive to temperature (the bimetal strip 76 or 77, respectively), is rendered inoperative by opening a by-pass channel around the opening regulated by the member, or by closing this opening. It is, however, possible to render the members sensitive to temperature inoperative in other ways, for instance by shielding them from the influence of the flue gases by means of screens. The bimetal strips may also be rendered inactive by being held in closed or open position.

Any number of members sensitive to temperature, regulating at different temperatures and actuating the same or separate regulating organs, may be used, these members being put out of action in proper order as the regulating temperature shall be raised or lowered.

While we have shown several embodiments of our invention, it is to be understood that this has been done for purposes of illustration only, and that the scope of our invention is not to be

limited thereby, but is to be determined by the appended claims viewed in the light of the prior art.

What we claim is:

1. In a combustion device, a flue, means for heat insulating said flue, a bimetallic thermostatic element disposed in said flue adjacent to an opening therethrough and constructed and arranged so that change in shape of said element due to temperature changes varies its distance from said opening to regulate the flow of gas through the opening, and means for subjecting said element to variable quantities of air at substantially atmospheric temperature.

2. In a combustion device; a flue, a restrictive opening in said flue, a temperature responsive element positioned to cover and uncover said opening as the temperature varies to control the flow of flue gases, means for subjecting said element to air at substantially atmospheric temperature, and means for varying the quantity of air to which said element is thus subjected.

3. In a stove, a fire box, a hot plate heated directly by the fire in said box, an adjoining hot plate member extending from said hot plate, an oven, a flue beneath said plate and its adjoining member, said flue leading from said fire box to an outlet, said oven and said plate member being positioned in heat exchange relation with said flue, a moveable draft regulating member in said flue positioned between said fire box and said outlet, means for heat insulating that portion of said flue that extends between said fire box and said regulating member, in a manner whereby a sufficiently high temperature may be maintained in said portion to prevent any deposit of soot or condensation within said flue in an amount that would obstruct the free movement of said regulating member, and means responsive to variations in temperature for operating said regulating member, said responsive means being in direct metallic heat transfer relation with said oven and said plate and its adjoining member, and in proximate heat transfer relation with the gases in said flue.

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