

Nov. 2, 1965

R. L. PERL

3,215,816

OVEN

Filed March 20, 1962

4 Sheets-Sheet 1

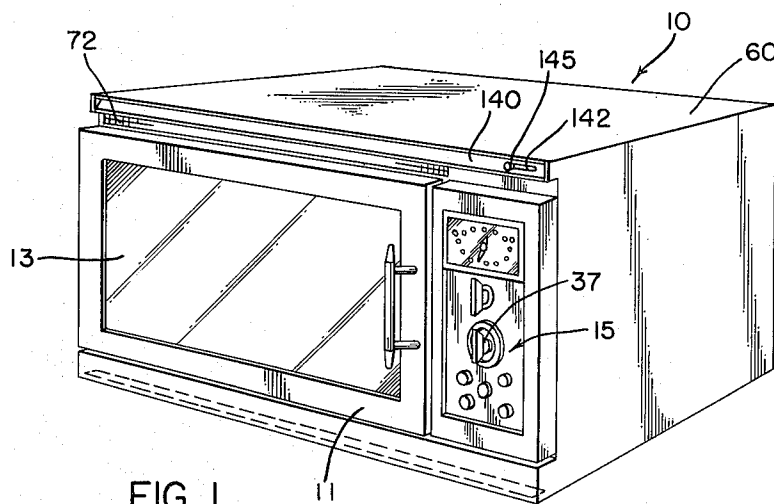


FIG. 1

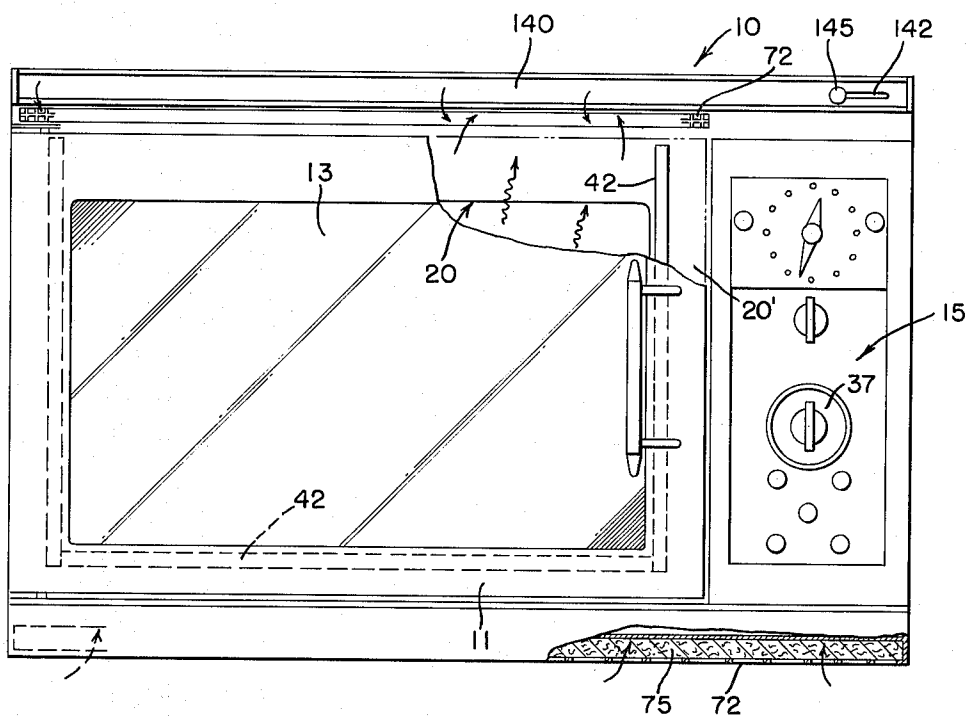


FIG. 2

INVENTOR.
RICHARD L. PERL

BY
Oberlin, Maky & Donnelly
ATTORNEYS

Nov. 2, 1965

R. L. PERL

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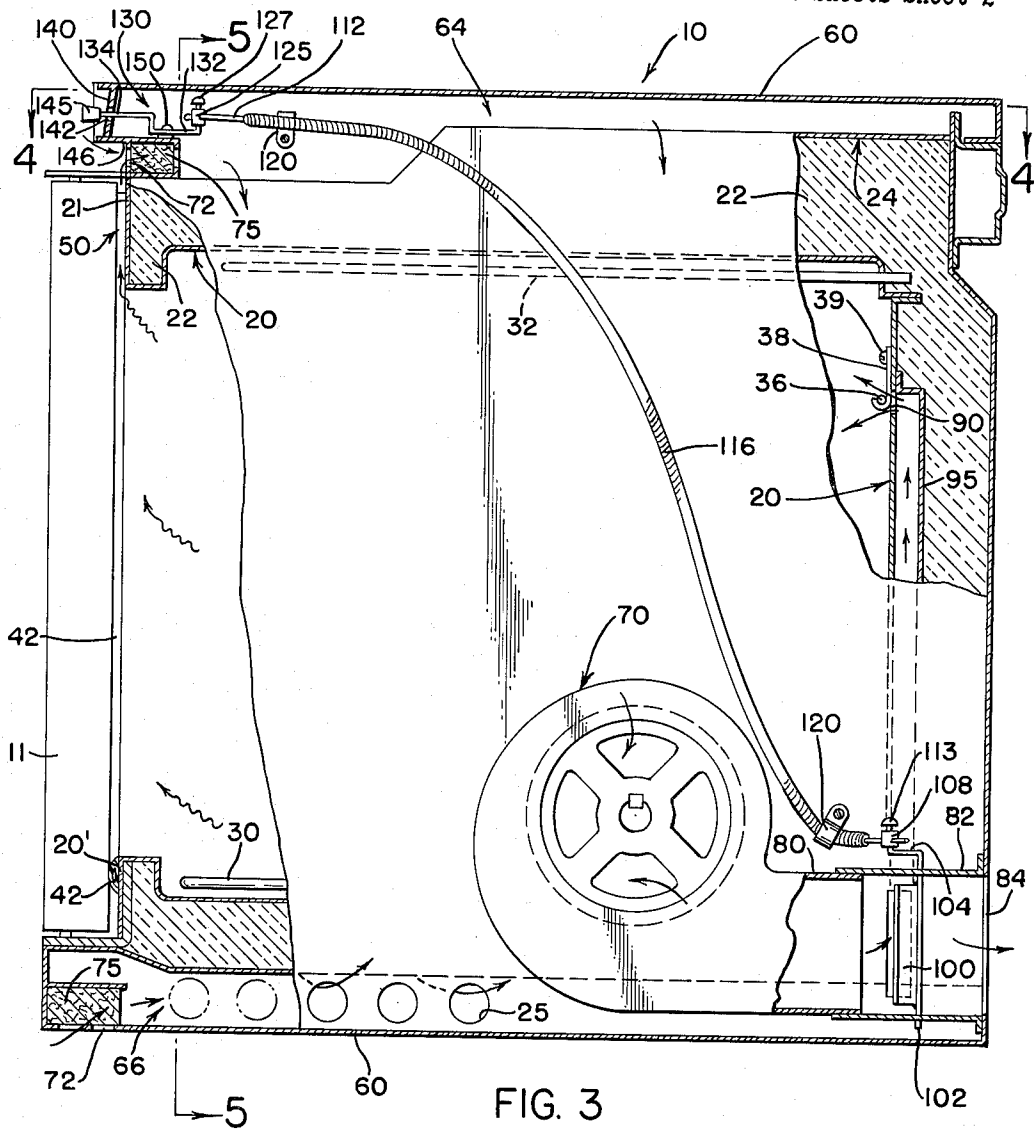


FIG. 3

INVENTOR.
RICHARD L. PERL

BY
Oberlin, Maky & Donnelly
ATTORNEYS

Nov. 2, 1965

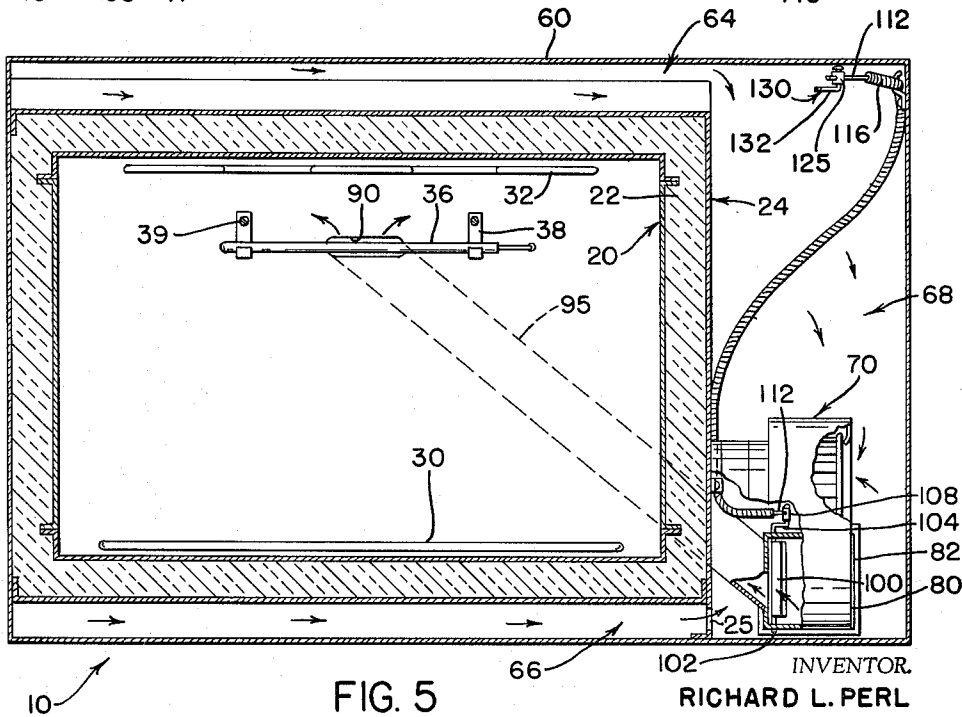
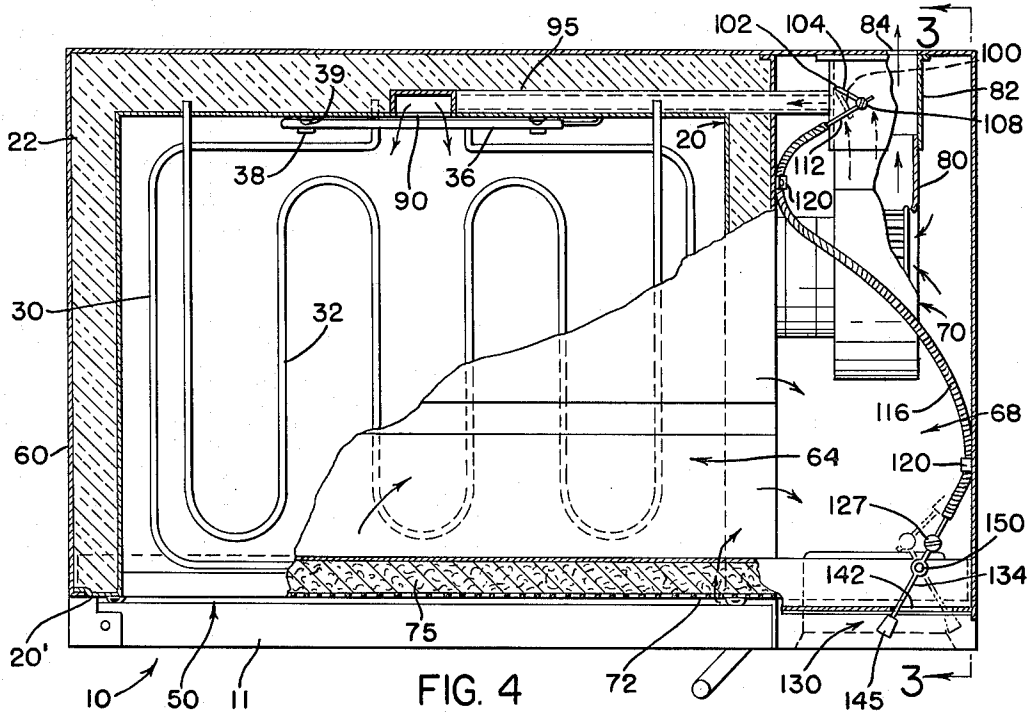
R. L. PERL

3,215,816

OVEN

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4 Sheets-Sheet 3



INVENTOR.
RICHARD L. PERL
BY
Oberlin, Maly & Donnelly
ATTORNEYS

3,215,816

4 Sheets-Sheet 4

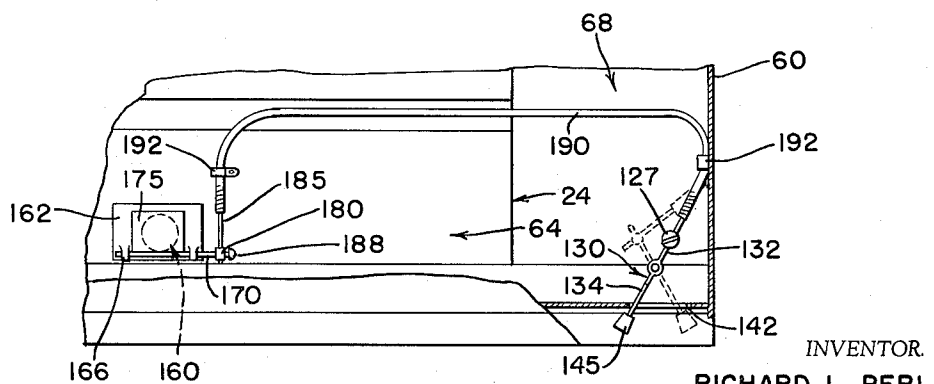
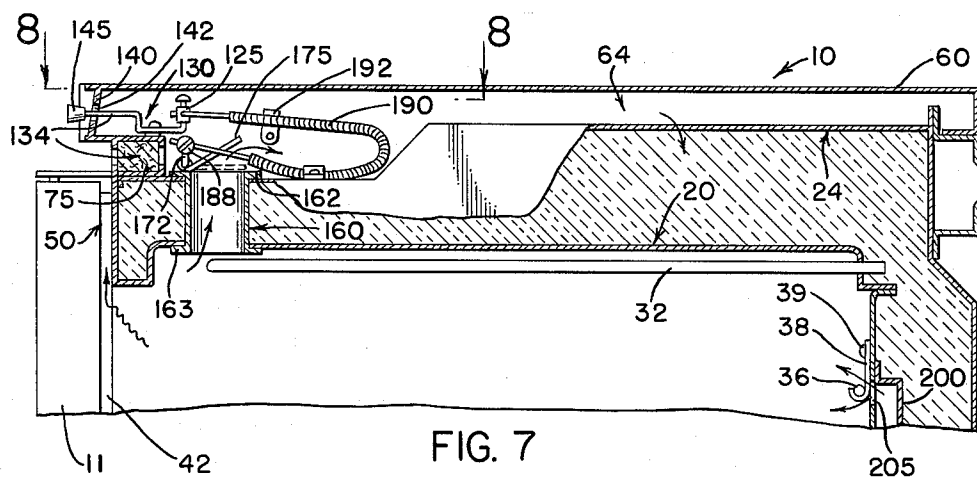
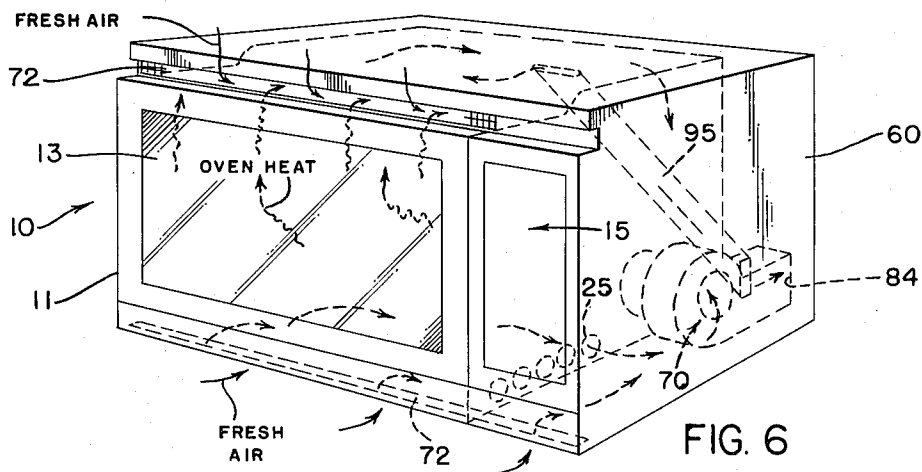


FIG. 8

INVENTOR.
RICHARD L. PERL
BY
Cherlin, Maky & Donnelly
ATTORNEYS

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3,215,816
OVEN

Richard L. Perl, Mansfield, Ohio, assignor to The Tappan Company, Mansfield, Ohio, a corporation of Ohio
Filed Mar. 20, 1962, Ser. No. 180,972
7 Claims. (Cl. 219-400)

This invention relates to an oven and, more particularly, to a forced air cooling system for an electric oven.

In modern oven designs, particularly of the built-in variety, it is desirable that some manner of venting or cooling the oven be provided. Conventional venting is usually accomplished by means separate from the oven itself, for example, a fan mounted in a wall, ceiling or window, and is often inadequate, with only general environmental exhaust available in any such installation. The design and structural problems involved in built-in type ovens are obviously not the same or as readily solved as those encountered in the venting of a cooking top, where an exhaust hood may be used to advantage, and accordingly it is quite common to find kitchens wherein the only effective venting is confined to the cooking top.

It is an object of this invention to provide an electric oven, suitable for built-in installation, having power exhaust means incorporated therein for direct and positive removal of the escaping oven gases.

A further object is to provide such an oven wherein ambient air is drawn through the structure to cool the outer walls of the oven liner and internal equipment, such as the usual oven controls.

Yet another object is to provide an oven capable of exhausting an area beneath the same, whereby this oven can be installed in association with a lower cooking top or the like and additionally provide force venting for the latter.

Yet another object of this invention is to ensure satisfaction thereon a clock timer and suitable controls as a broiler, by providing a selectively operable control which functions to enable air to flow over the usual thermostatic bulb, thereby depressing the temperature of the same and thus achieving the desired influential effect of the thermostat on the control circuit responsive thereto.

Still another object of this invention is to provide an electric oven wherein broiling can be performed while the oven door is in its normal, fully closed position.

Other objects and advantages of the present invention will become apparent as the following description proceeds.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and the annexed drawings setting forth in detail certain illustrative embodiments of the invention these being indicative, however, of but a few of the various ways in which the principle of the invention may be employed.

In said annexed drawings:

FIG. 1 is a perspective view of an oven according to this invention;

FIG. 2 is a front elevation view, partly broken away and in section, of the oven shown in FIG. 1;

FIG. 3 is a side elevation view partially in section taken on lines 3-3 of FIG. 4;

FIG. 4 is a plan view partially in section taken on line 4-4 of FIG. 3;

FIG. 5 is a front elevation view partially in section taken on line 5-5 of FIG. 3;

FIG. 6 is a perspective view of the oven according to this invention, showing more clearly the air flow pattern therein;

FIG. 7 is a side elevation view partly in section showing a modified form for controlling the flow of air over the thermostat bulb; and

FIG. 8 is a fragmentary plan view partially in section taken on line 8-8 of FIG. 7.

Referring now to the drawings, wherein all like parts are designated by like reference characters, an oven designated generally by reference numeral 10 is provided with a door 11 which opens outwardly to the left, as viewed in FIG. 1, the door being hinged in a conventional manner as shown in FIG. 4. The door 11 preferably includes a central, glass portion 13 to permit viewing of the interior of the oven in conventional fashion. To the right of the oven door, as viewed in FIG. 1, there is a vertically coextensive control panel 15 which has mounted thereon a clock timer and suitable controls as shown in FIGS. 1 and 4 of the drawings.

The interior of the oven is defined by an oven liner 20 which is substantially surrounded by thermal insulating material 22, the insulating material 22 providing the required heat retention for the liner 20. The insulating material 22 is confined in position surrounding liner 22 by an outer liner 24, the latter being in continuous spaced relationship with inner liner 20.

Mounted within the inner liner 20 are electric heating elements 30 and 32, the former being mounted adjacent the bottom of the liner and the latter being mounted adjacent the top of said liner. In a manner well known in the art, the upper heating element is generally used only for broiling. As will be understood, heating elements 30 and 32 are connected by suitable wiring to a source of electricity, in normal fashion.

A temperature responsive means, comprising in the form shown a thermostat bulb 36, preferably of the type employing an expandable fluid, is mounted on the vertical, back wall of the liner 13 by means of mounting brackets 38, two of which are preferably employed, the brackets being mounted on said back wall by any suitable means such as, e.g., bolts 39. The thermostat bulb 36 performs its normal function as a temperature responsive device operative through an associated switch device in the oven circuit and, being responsive to the temperature within liner 20. The thermostat bulb 36 is thus connected to a conventional thermostat temperature control switch 37 mounted in the control panel 15. It will be noted that thermostat bulb 36 is mounted relatively closely adjacent the upper heating element 32, which results in the thermostat reaching a significantly higher temperature when the upper heating element 32 is fully energized during the broiling cycle than when the oven is heated only by the lower heating element 30, the latter being the normal situation when the oven controls are set to positions other than broiling.

The thermostatic bulb 36 contains an expandable fluid which is commonly used in similar environments, the fluid expanding as the temperature adjacent thereto rises and eventually reaching a state of expansion, corresponding to a preselected temperature, sufficient to operate the control circuit thereby to shut off the heating element controlled thereby. In addition to temperature control of the oven in this usual manner, there is also a conventional high safety setting to protect the expandable fluid in the thermostatic bulb from decomposition at excessively high temperatures.

In existing electric ovens which applicant is familiar with, the thermostatic bulb is protected from reaching excessively high temperatures during the broiling cycle, during which the noted safety is the only operative control, by maintaining the oven door slightly ajar thereby allowing, through natural circulation, a sufficient amount of air to flow over the thermostatic bulb to maintain the temperature of the fluid therein below the design upper

limit. This slightly open position of the oven door during the broiling cycle is obviously undesirable in that relatively high temperature oven exhaust gases emanate from the oven through the open door into the atmosphere around the oven, thereby significantly raising the temperature thereat. The present invention overcomes this undesirable condition by providing a novel thermostat bulb cooling arrangement which can be selectively operated during the broiling cycle thereby enabling the same to be performed with the oven door in its normal, fully closed position. This thermostat bulb cooling arrangement will be described in more detail hereinbelow.

The oven liner 20 is in the form shown provided with resilient sealing strips 42 mounted on the outwardly extending flange portion 20' about the sides and the bottom of the oven cavity. The side and bottom sealing strips serve to preclude passage of air either outwardly or inwardly to the oven cavity along the bottom and sides thereof when the door 11 is in a closed position.

It should be particularly noted that in the form shown the top of the door 11 is not sealed when closed, attention being drawn to FIG. 3 wherein there is shown a space 50 which permits the escape of gases from the oven cavity while cooking. The manner in which these gases are exhausted will be described in more detail hereinbelow.

The oven 10 is provided with an outer shell-like casing 60 which forms the top, bottom, sides and back wall of the oven. As can best be seen in FIG. 5, casing 60 is spaced from the outer liner 24 adjacent the top, bottom and one side thereof, thereby forming plenum chambers therebetween, namely, top plenum chamber 64, bottom plenum chamber 66 and side plenum chamber 68. The top and bottom plenum chambers 64 and 66 openly communicate with the side plenum chamber 68, the outer liner wall 24 separating the bottom and side chambers being provided with preferably circular openings 25 to afford such communication therebetween. As will be explained in more detail hereinbelow, air is induced to flow in said plenum chambers by means of a centrifugal blower 70 which is mounted in the lower portion of chamber 68 in any suitable manner.

The front of the oven 10 is provided with openings 72 adjacent the top and bottom thereof which communicate with the top and bottom plenum chambers, respectively, to provide a source of air for flow therethrough.

Filter elements indicated at 75 are preferably provided immediately adjacent top and bottom openings 72 for the usual purpose of filtering out undesirable constituents from the air flowing therethrough. The filters 75 are loosely positioned so that the same can be easily removed for repair, cleaning or replacement.

As set forth above, a space 50 is provided between the door 11 and the oven liner to permit the escape of gases from the oven cavity. As shown by arrows in FIG. 3, gases flowing upwardly through space 50 flow through openings 72 into the upper plenum chamber 64, intermingling thereat with the ambient air drawn through the openings 72, the combined air then flowing into and through side plenum chamber 68 under the inducement of blower 70.

As set forth above, the centrifugal blower 70 is mounted in the bottom of chamber 68, said blower 70 functioning to induce the flow of air through the plenum chambers and to expel the air exteriorly of the oven. To accomplish the latter function, blower 70 is formed with a rectangularly shaped outlet or duct 80 which in turn is telescoped within a rectangular sleeve or coupling 82. Sleeve 82 is mounted on the back casing wall by any suitable means such as, e.g., bolts (not shown). The dimensions of the sleeve 82 are substantially equal to the dimensions of an opening 84 formed in the back casing wall, whereby the air induced by blower 70 is expelled outwardly of the oven through the opening 84. If desired, means may be provided to vary the opening in sleeve 82 or duct 80 to thereby regulate the flow of air therethrough.

To summarize the invention thus far described, it will be seen that actuation of blower 70 will cause ambient air to flow through top and bottom openings 72. The oven gases will escape through space 50 and through top openings 72, the combined air stream then flowing over the top and down the side of the outer liner 24, the entire air flow pattern being shown in FIG. 6. As the air flows through plenum chamber 68, it serves the important function of cooling the control components for the oven, which is located both in and immediately behind the control panel 15. Cooling of the outer control knobs is also facilitated, thereby precluding the same from becoming uncomfortably hot to the touch.

As previously mentioned, thermostat bulb 36 is mounted relatively closely adjacent the upper heating element 32 whereby it is subjected to the high heat of heating element 32 when actuated for broiling. In order to protect against overheating of bulb 36, I have provided a novel means for relatively cooling the same.

The novel thermostat cooling means in the preferred embodiment of FIGS. 1-6 comprises, in general, means for selectively enabling a portion of the forced air emanating from the outlet of blower 70 to flow directly over thermostat 36 thereby cooling the same and affording desired functioning thereof. Specifically, the inner, rear lining wall 20 is provided in the area adjacent thermostat bulb 36 with an elongated slot 90 through which air flows directly over the bulb. As shown in FIGS. 4 and 5, slot 90 is approximately one-third the length of thermostat 36 although, as will be obvious, the length thereof could be substantially changed without significantly affecting the intended result.

The forced air from blower 70 is conveyed to the slot opening 90 by means of an inclined tube or duct 95, said duct communicating at its upper end with slot 90 and at its lower end with sleeve 82. As can best be seen in FIG. 4, in the form shown the duct 95 is shaped in the form of an inverted U, said duct being mounted on the rear inner liner wall by any suitable means such as, e.g., welding.

Means are provided associated with the lower end of the duct to selectively open or close the duct from communication with sleeve 82, thereby permitting or precluding, respectively, air from ultimately directly contacting thermostat 36. Such means in the preferred form shown in FIGS. 1-6 comprises a pivotably mounted, lever operated duct closing member or door 100. The door 100 is preferably welded to a vertically extending pin 102 which extends through aligned openings in the top and bottom walls of sleeve 82 whereby rotation of pin 102 causes rotative movement of door 100 thereabout. As can best be seen in FIG. 4, door 100 is adapted to be variably positioned, from a dotted line, closed position to a solid line, open position.

Referring now to the means whereby door 100 can be selectively opened or closed, the upper end of pin 102 is laterally offset as shown at 104, such offset portion having mounted on the end thereof a preferably cylindrical member 108 having a wire-receiving opening extending transversely therethrough through which cable 112 extends, said wire 112 being subsequently prevented from being withdrawn from the opening by any suitable means such as, e.g., screw means 113. It will thus be seen that horizontal movement of wire 112, noting FIG. 4, will cause rotative movement of door 100.

The wire 112 extends upwardly through a flexible housing 116, the wire and housing terminating in the upper part of chamber 68. The cable housing 116 is supported in chamber 68 by suitable mounting brackets 120 which are mounted on outer liner wall 24 and outer casing wall 60. The upper end of wire 112 extends through a cylindrical member 125 similar to member 108 referred to above, the member 125 being similarly provided with a screw means 127 to clamp the wire in said member.

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The cylindrical member 125 is mounted on one end 132 of a lever generally indicated at 130. The opposite end 134 of lever 130 extends outwardly through a slot 142 in a front facing member 140, said opposite end 134 being provided on the extreme outer end thereof with a control knob 145. The lever 130 is pivotally mounted on pivot pin 150 which is mounted on rearwardly extending flange 146 which forms a part of front facing member 140. It will thus be seen that pivotal movement of lever 130 about pivot pin 150 will cause wire 112 to be moved laterally, as clearly shown in FIG. 4. Referring to FIG. 4, it will thus be seen that movement of lever 130 from its solid line position to its dotted line position will cause wire 112 to move into its dotted line position whereby the opposite end of said wire causes door 100 to assume its dotted line, closed position. In this closed position of door 100, air is prevented from entering duct 95. When wire 112 is moved to its solid line, FIG. 4 position by means of control knob 145, door 100 will be moved to an open position thereby permitting air to enter duct 95 thereby passing over and directly cooling thermostat bulb 36. After directly contacting thermostat bulb 36, the air flows from the oven cavity through space 50. As set forth above, the door 100 will desirably be open when the oven is being employed as a broiler, at which time heating element 32 is actuated. The amount of air flowing over thermostat bulb 36 is sufficient to accomplish the intended result of cooling said bulb to a level whereat broiling can be performed while the oven door 11 is in its normal, fully closed position.

FIGS. 7 and 8 illustrate a modified form for controlling the flow of air over the thermostat bulb 36. Parts which are identical in both the FIGS. 1-6 embodiment and the FIGS. 7-8 embodiment have been indicated by the same reference characters. The modified form in general comprises a duct and a pivotably mounted closure therefor mounted relatively closely adjacent the top and front of the oven. Specifically, a duct 160 is mounted in the upper insulated oven wall, said duct having flanges 162 and 163 adapted to contact outer and inner liner walls 24 and 20, respectively, thereby preventing vertical movement of the duct 160. The upper flange 162, as can be seen in FIG. 8, is preferably rectangular in form and has integrally formed thereon and extending upwardly therefrom a pair of spaced, apertured members 166 which are adapted to loosely receive therethrough a pin 170. The pin 170 has secured thereto in the intermediate portion thereof a door 175 which, when in closed position, completely covers the duct opening. It will thus be seen that rotation of pin 170 will correspondingly cause rotation of door 175.

The pin 170 has an upwardly extending end portion 172 which is adapted to be connected to member 180 and to be moved therewith. The member 180 is centrally transversely apertured similar to member 108 previously described whereby a wire 185 extends therethrough, said wire being held in place in member 180 by screw means 188. The wire 185 is in a housing 190 which is supported by brackets 192 mounted on the outer liner wall 24 and the casing wall 60.

The opposite end of the wire 185 is secured to member 125 which in turn is secured to lever 130, such structure being specifically described below in reference to the preferred embodiment of FIGS. 1-6.

It will thus be seen that in the FIGS. 7-8 embodiment when lever 130 is moved by means of control knob 145 from its solid to its dotted line position, FIG. 8, wire 185, through member 180 and pin 170, will cause door 175 to move from its solid line, open position to its dotted line, closed position as shown in FIG. 7. Such movement of door 175 will close the duct 160 thereby preventing flow of air outwardly of the oven cavity there-through.

A duct 200 is mounted on the rear inner lining wall, as

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can be seen in FIG. 7, the duct communicating with the oven cavity through slot 205 provided in said rear wall adjacent thermostat bulb 36. As contrasted to the duct 95 in the FIGS. 1-6 embodiment, however, duct 200 in the FIGS. 7-8 embodiment does not communicate with the forced air from blower 70. Rather, duct 200 preferably communicates with the ambient air exteriorly of the casing 60 by means of, e.g., an opening in the rear casing wall (not shown). Such communication enables ambient air to be drawn into duct 200 over the thermostat bulb 36 when duct 160 is in an open position. It will be understood that although air is preferably drawn through duct 200 from an opening in the outer casing, other provisions could be made to provide duct 200 with a source of drawn air during the period when duct 160 is open.

The operation of the FIGS. 7-8 embodiment is as follows: when the upper heating element 32 is actuated for the broiling cycle, control knob 145 will be moved from its dotted line position to its solid line position, as shown in FIG. 8. This will cause door 175 to open thereby permitting the gases from the oven cavity to escape through duct 160 into the upper plenum chamber 64. The opening of duct 160 will cause induced air flow upwardly through duct 200 and into contact with thermostat bulb 36 thereby cooling the same. The moving of the drag knob 145 and lever 130 to their solid line position will close duct 160 thereby shutting off communication of the oven cavity with the upper plenum chamber 64, except for the relatively small amount of air flowing outwardly of the oven cavity through space 50. This relatively small amount of air flow through space 50 is not sufficient to draw quantities of air through duct 200 significant enough to affect the temperature of thermostat bulb 36.

It will thus be seen that the objects of this invention have been accomplished. There has been provided a forced air cooling system which effects direct and positive removal of the escaping oven gases. The cooling system also functions to cool the oven control mechanisms, and is additionally able to exhaust an area beneath the oven, e.g., a lower cooking top, and thereby protect this cooling of the thermostat bulb in the manner described enables broiling to be performed while the oven door is in a closed position.

Further the cooling system functions to selectively produce a flow of relatively cool air locally over the thermostat bulb whereby the resultant cooling is sufficient to permit broiling by the upper heating element when the oven door is in its normal, closed position.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims or the equivalent of such be employed.

I, therefore, particularly point out and distinctly claim as my invention:

1. In an oven comprising an outer casing, an open oven cavity substantially fully surrounded by insulation within said cavity, means for heating said oven cavity, an oven door in association with said oven cavity, an open space being provided at the top of said door when said door is closed to permit the escape of gases from the interior of said oven cavity, and an oven control panel at the front of said casing; a plurality of plenum chambers between said casing and the exterior of said oven cavity, one of which is behind said control panel, an air inlet opening to said plenum chambers in the front of said casing below said oven cavity, an air inlet opening to said plenum chambers in the front of said casing above said oven cavity adjacent said open space effective to receive the gases escaping therethrough as well as ambient air, an air outlet from said plenum chambers in the rear of said casing, and blower means within said casing effective to draw air and gases into said plenum chambers through said inlet openings and expel them through said

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outlet opening, thereby cooling said control panel and exterior of the oven cavity as well as removing the escaping oven gases.

2. In combination with an electric oven having an oven opening, an upper broil element, a door for said oven opening, sealing means disposed about the sides and bottom of the oven opening for engagement with the closed door, said sealing means serving to space the door slightly outwardly from said opening by virtue of the interpositioning thereof between the oven opening and the door in the normal closed condition of the latter, whereby an outlet for gases and vapors from the oven is provided at the top of the normally closed door, a temperature responsive device mounted within the oven for control of the same, and means for producing a flow of relatively cool air locally over said device when the upper broil element is operative, the resulting cooling of said device being sufficient to permit broiling by use of the upper element with the oven door in its normal closed position.

3. In an oven comprising an outer casing, an open oven cavity within said casing, heating element means positioned within said cavity, temperature responsive means positioned within said oven cavity, a plurality of plenum chambers between said casing and the exterior of said oven cavity therewithin, blower means within said casing for establishing forced air circulation through said plenum chambers, duct means mounted in the top wall of said oven cavity and affording communication between said oven cavity and one of said plurality of plenum chambers, air passage means associated with a side wall of said cavity, said air passage means having an end portion communicating with air exteriorly of said oven cavity and an opposite end portion communicating directly with the interior of said cavity adjacent said temperature responsive means, ambient air flowing through said air passage means thus being directed to said temperature responsive means for relative cooling effect on the latter.

4. The combination of claim 3 further including adjustable closure means associated with said duct means to open or close said duct means, and means to selectively move said closure means for such opening and closing of said duct means.

5. In an oven comprising an outer casing, an open oven cavity within said casing, means for heating said oven cavity, temperature responsive means positioned within said oven cavity, an oven door associated with said cavity, outlet means communicating with said oven cavity for re-

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moval of gases and vapors therefrom, a plurality of plenum chambers between said casing and the exterior of said oven cavity therewithin, blower means within said casing for circulating air through said plenum chambers, air passage means having an end portion in direct communication with the interior of said cavity adjacent said temperature responsive means for blowing cooling air thereover and an opposite end portion in communication with said blower at the outlet side thereof.

6. The combination of claim 5 further including adjustable closure means associated with said air passage means to open or close the same, and means to selectively move said closure means.

7. In an oven comprising an outer casing, an open oven cavity within said casing, means for heating said oven cavity, temperature responsive means positioned within said oven cavity, an oven door associated with said cavity, outlet means communicating with said oven cavity for removal of gases and vapors therefrom, a plurality of plenum chambers between said casing and the exterior of said oven cavity therewithin, blower means within said casing for circulating air through said plenum chambers, air passage means associated exteriorly with said cavity affording communication between the interior of said cavity adjacent said temperature responsive means and a source of air exteriorly of said cavity, said blower means inducing air flow through said air passage means into said cavity over said temperature responsive means for cooling the same.

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RICHARD M. WOOD, *Primary Examiner.*