Nov. 25, 1969 S. H. TORREY ET AL 3,480,000

SELF-CLEANING GAS OVEN

Filed May 31, 1968 3 Sheets-Sheet 1

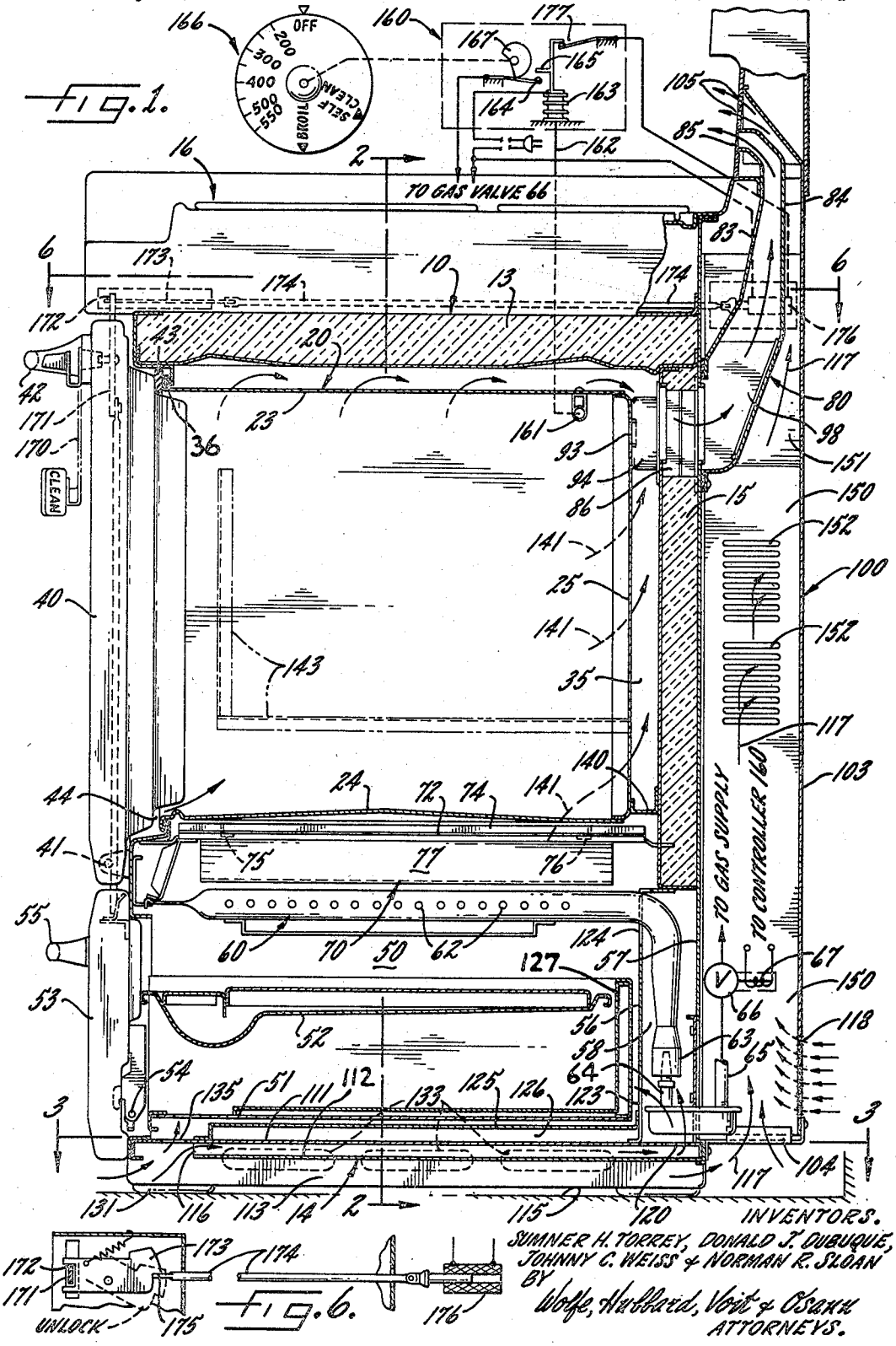


Fig. 1.

Fig. 6.

INVENTORS.
SUMNER H. TORREY, DONALD J. DUBUQUE,
JOHNNY C. WEISS & NORMAN R. SLOAN
BY
Wolfe, Hubbard, Voit & Osann
ATTORNEYS.

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Filed May 31, 1968 3 Sheets-Sheet 2

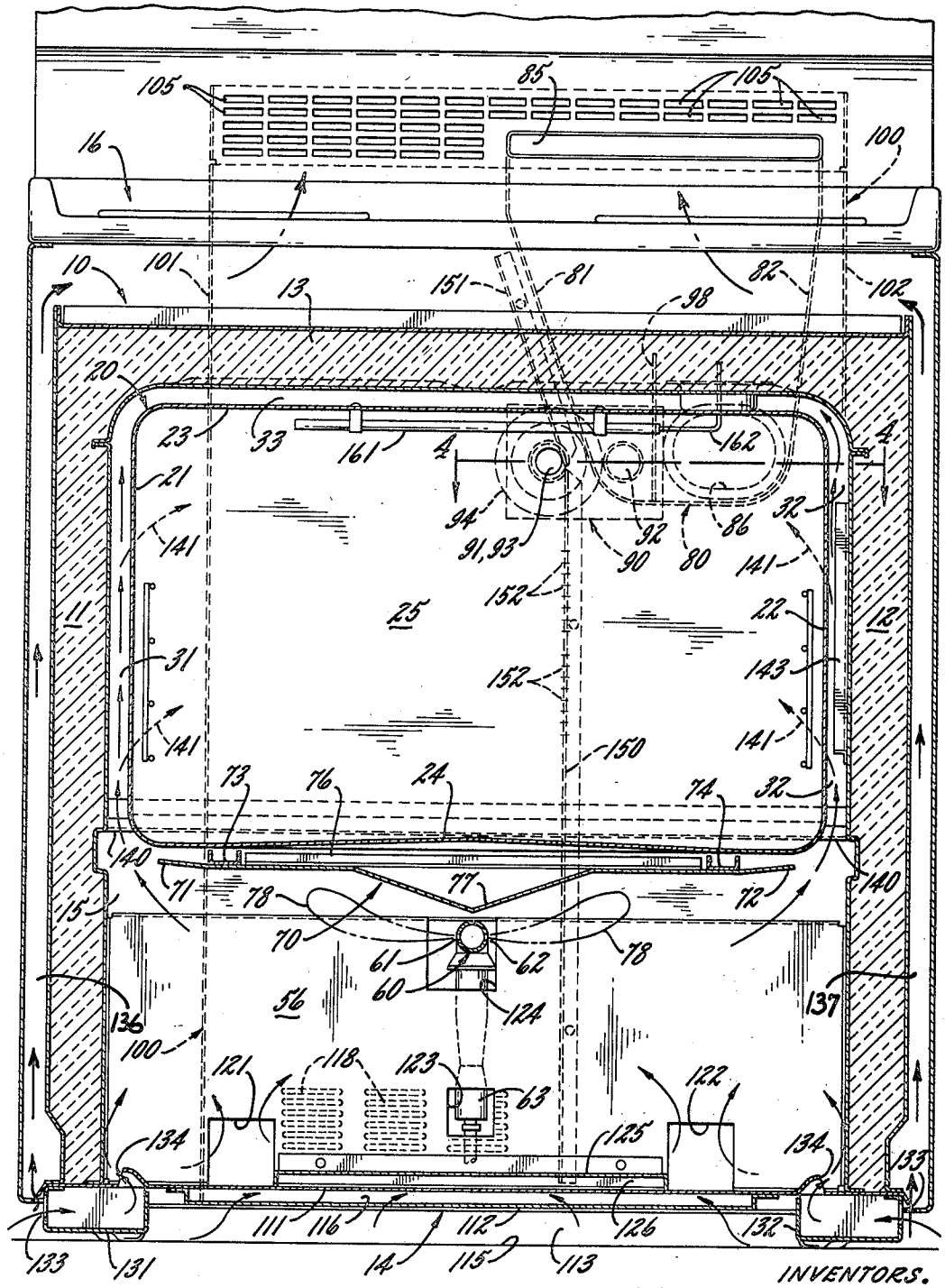


Fig. 2.

INVENTORS.
SUMNER H. TORREY, DONALD J. DUBUQUE,
JOHNNY C. WEISS & NORMAN R. SLOAN
BY
Wolfe, Hubbard, Voit & Osann
ATTORNEYS.

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Fig. 3.

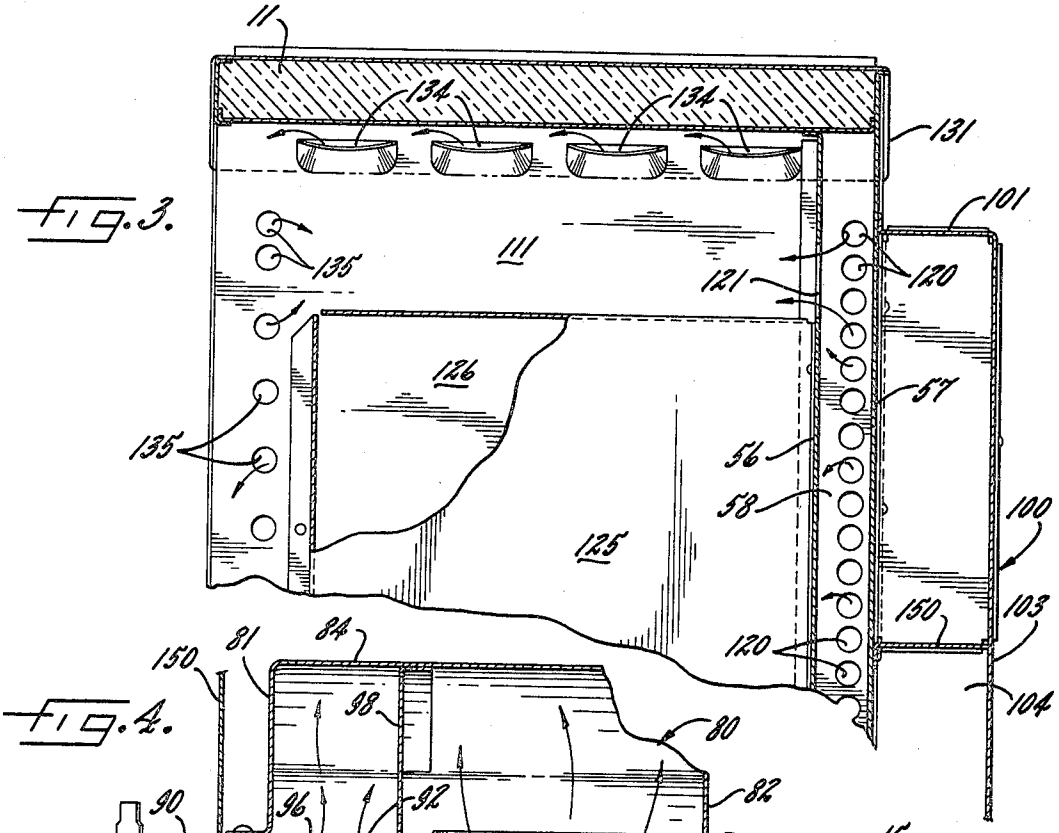
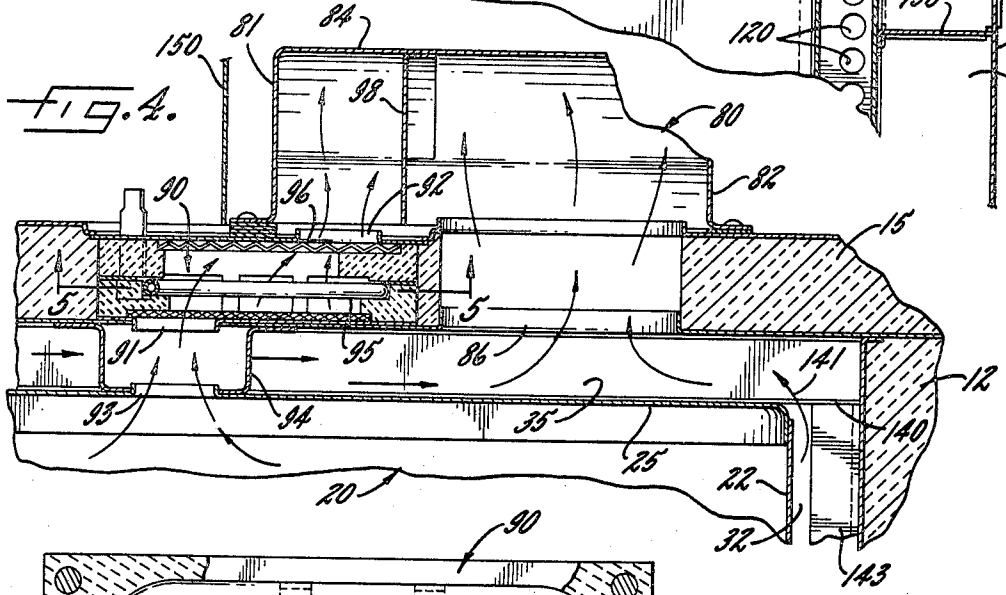


Fig. 4.



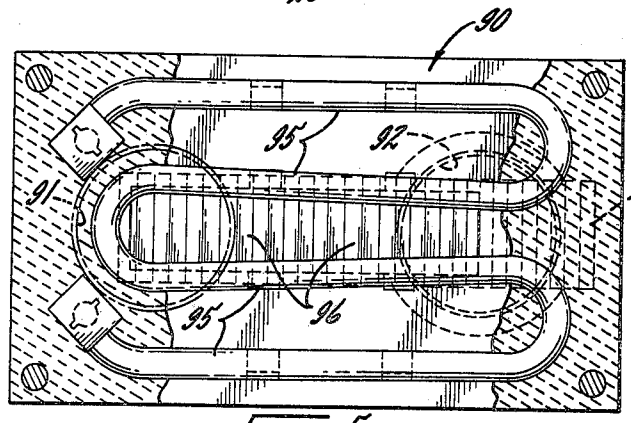


Fig. 5.

INVENTORS.
SUMNER H. TORREY,
DONALD J. DUBUQUE,
JOHNNY C. WEISS
& NORMAN R. SLOAN
BY
Wolfe, Hubbard, Voit & Osann
ATTORNEYS.

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SELF-CLEANING GAS OVEN

Sumner H. Torrey and Donald J. Dubuque, Kankakee, Johnny C. Weiss, Bourbonnais, and Norman R. Sloan, St. Anne, Ill., assignors to Geo. D. Roper Corporation, Kankakee, Ill., a corporation of Delaware

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U.S. Cl. 126—39 16 Claims

ABSTRACT OF THE DISCLOSURE

A self-cleaning gas range having a muffled oven liner with a broiler compartment and broiler burned below it, the hot air and products of combustion from the burner passing around the oven liner both for normal oven cookery and for raising the temperature of the liner to a self-cleaning level with provision for securing equalized distribution of heat. Special means are provided for venting the hot air from the burner and the products of decomposition from the oven liner, as well as for preventing passage of heat downwardly to the floor, particularly when the burner is turned to its high range during the self-cleaning cycle.

It is an object of the invention to provide a self-cleaning gas range having a broiler and in which the same burner is employed for broiling, for even cookery and for self-cleaning of the oven liner. It is an object to provide a self-cleaning gas range which is simple, safe and efficient and which does not require the opening or closing of ports or redirection of the heated air during the cooking and self-cleaning modes. It is a more specific object to provide a self-cleaning range in which the cooking cavity is muffled in both the cooking and self-cleaning modes but in which an even temperature distribution is achieved, with avoidance of hot spots, during both of the modes without necessity for resorting to forced air circulation.

It is another object of the invention to provide a self-cleaning gas range having means for venting the hot air and products of combustion from the burner and means for venting the products of decomposition from the oven liner for combined discharge tempered by cooling air while inhibiting any direct flow between the heated air space and the cooking cavity. It is an object of the invention in one of its aspects to provide a novel catalytic cell between the cooking cavity and vent for oxidizing the products of decomposition to make possible direct venting into the room.

It is yet another object of the present invention to provide a self-cleaning gas range which is rapid and efficient in the self-cleaning mode and which achieves self-cleaning temperatures (on the order of 750–900° F.) using a burner of limited B.t.u. rating and so constructed that surface temperatures and radiated heat from the oven structure are reduced to a minimum. It is a general object of the present invention to provide a gas range of the self-cleaning type which is simple and inherently economical in construction thereby reducing the premium usually thought necessary for the self-cleaning feature.

Other objects and advantages of the invention will become apparent upon reading the attached detailed description and upon reference to the drawings in which:

FIGURE 1 is a right-hand side elevation of a range constructed in accordance with the present invention and with certain parts broken away, or in section, to reveal the details of construction;

FIG. 2 is a vertical section looking along the line 2—2 in FIG. 1;

FIG. 3 is a horizontal section taken through the bottom portion of the range looking along the line 3—3 of FIG. 1;

FIG. 4 is a fragmentary section looking along the line 4—4 in FIG. 2 and showing the catalytic cell and the associated vent openings;

FIG. 5 is a sectional view taken through the catalytic cell along the line 5—5 in FIG. 4; and

FIG. 6 is a diagram showing the door latching mechanism as viewed along the line 6—6 of FIG. 1.

While the invention has been described in connection with a preferred embodiment, it will be understood that we do not intend to be limited to the particular embodiment shown but intend, on the contrary, to cover the various alternative and equivalent constructions included within the spirit and scope of the appended claims.

Turning now to the drawings, there is shown, in FIGS. 1 and 2, a self-cleaning range having a box-like frame **10** made up of side walls **11**, **12**, a top wall **13**, bottom wall **14**, and back wall **15**. Above the top wall is a cooking top **16** equipped with the usual top burners and controls but which latter are well understood and do not require any showing or discussion. The frame is of double-walled construction with thermal insulation or lagging being indicated by appropriate cross hatching.

Spaced inwardly from the walls of the frame is an oven liner **20** in the form of a hollow metal-walled receptacle havng side walls **21**, **22**, a top wall **23**, a bottom wall **24**, and a back wall **25**. The oven liner is spaced inwardly from the walls of the frame to define side hot air passages **31**, **32**, respectively, a top passage **33**, and a back hot air passage **35**. An asbestos rope seal **36** is employed behind the front periphery of the oven liner so as to seal the juncture of the oven liners. The frame, and the hot air passages **31**, **32** and **33**. The cooking cavity is enclosed at the front by a door **40** which is pivoted along its lower edge at a hinge axis **41**, and which has a handle **42** at the top. A gasket **43** seals the door with respect to the oven liner except for a gap **44** at the center of the lower run of the gasket which permits limited access of air to the cooking cavity.

In accordance with the present invention, a broiler compartment is provided below the oven liner having a burner and a broiler rack in direct communication between the broiler compartment and the hot air passages surrounding the liner and with venting at the top of the back passage so that the hot air and products of combustion of the burner heat the oven liner during cooking and for self-cleaning purposes. Thus as will be noted in the drawings, the walls of the frame are extended downwardly to define a broiler compartment **50**. Slidably mounted within the compartment is a broiler drawer **51** having suitable supports for a broiler pan **52**. The front of the broiler compartment is enclosed by a door **53** which is hinged, along its lower edge, to the drawer at a hinge axis **54** and which has a handle **55**. Panels **56**, **57**, forming an extension of the back wall **15** of the range enclose the rear of the compartment and define a rear chamber **58**.

Extending forwardly and backwardly within the broiler compartment, and centered therein, is a tubular type burner **60** having orifices **61**, **62**, along its respective sides and terminating in a venturi **63** located in the rear chamber. Centered within the venturi is a nozzle **64** supplied by a line **65**. Gas flow to the burner is controlled by a solenoid valve **66** having a coil **67**. It will be understood that conventional means may be provided for igniting the gas at the burner orifices when the valve **66** is turned on. For the discussion which follows it may be assumed that there is a standing pilot.

In accordance with one of the features of the invention, there is interposed between the burner and the oven

liner a protective baffle in the form of a rectangular plate of metal which is of substantially the same dimension as the bottom wall **14** of the oven liner and which extends laterally substantially all the way to the side hot air passages **31**, **32**, on each side of the liner. Thus the hot air and products of combustion from the burner are guided into the side air passages without direct impingement upon the bottom of the oven liner to prevent development of hot spots during high temperature cooking and during operation in the self-cleaning mode. In the present instance the baffle, indicated at **70**, extends generally parallel to the bottom of the oven liner and terminates in lateral edges **71**, **72**, which are spaced only a small amount inwardly of the side passages **31**, **32**. The baffle plate is supported by front-to-back extending channel members **73**, **74**, and is braced laterally by a pair of light angles **75**, **76**. While the baffle plate is generally flat, it is preferably deformed downwardly at its center into shallow trough shape as indicated at **77** to facilitate flow of heated air laterally away from the burner. Using this type burner, tongues of flame, indicated at **78**, extend outwardly a substantial distance from the burner tube and cover a large area of the baffle **70**. Such burner and baffle construction not only results in heated air being directed efficiently up along the sides of the oven liner, but the large area covered by the flame, serves to distribute the heat evenly over a large broiling area on the broiler rack **52**.

In carrying out the invention a vent opening is provided along the top edge of the rear hot air passage **35**, with the spent hot air and products of combustion being directed into a vent housing which has a vent discharging above the level of the cooking top. Additionally, the oven liner is provided with a second vent opening, adjacent the first vent opening, and which also communicates with the vent housing for discharge of the products of decomposition during the self-cleaning cycle. Thus, referring to FIGS. 1 and 2 of the drawings, a vent housing, or flue, **80** is provided having side walls **81**, **82**, which are divergently arranged and front walls **83**, **84**, which converge toward one another, terminating in a long horizontal vent **85**. Communication between the hot air passage **35** and the vent housing occurs through a vent opening **86** which is in the form of a collar which penetrates the insulated layer in the rear wall of the frame.

Venting of the oven liner into the vent housing occurs via a catalytic cell **90** in the form of a rectangular cartridge having front and back vent openings **91**, **92**, respectively (see FIG. 4). The front opening **91** of the catalytic cell is coupled to an alined opening **93** in the oven liner by means of a collar **94**. The products of decomposition, during self-cleaning, are directed past an electric heating element **95** and thence through a catalytic screen **96**. The heating element may have a rating of about 180 watts and the screen may be in the form of platinum plated mesh or may be in the form of strands covered with a suitable oxidizing catalyst. It may be noted that the catalytic screen is not required to handle the hot air and products of combustion from the burner but is only required to take care of the more limited flow of organic vapors which escape from the oven liner during the self-cleaning operation and also to some extent during normal oven cookery, serving to oxidize such vapors into a harmless state, both colorless and odorless, suitable for discharge directly into the kitchen. In order to inhibit any flow or circulation between the hot air passages and the oven liner, notwithstanding the fact that they discharge into the same vent housing, a vertical baffle or shield **98** is provided between the vent openings and which extends upwardly only a portion of the height of the vent housing. Discharge of the hot air from the burner and the products of decomposition from the oven liner into a common vent housing is not only economical but insures that the oxidized products of decomposition are well diluted by the air from the burner before being discharged at the vent **85** at the top of the range.

For the purpose of insuring that the back of the range remains at a cool temperature, for tempering the discharge from the vent, and for inducing flow of air along the bottom of the range, as will be described, a vertical chimney structure **100** is provided having side walls **101**, **102**, a back wall **103**, a bottom entryway **104** and discharge openings **105** at the top, adjacent to, and partially surrounding, the vent **85**.

It is desirable, when the flame is at a high level during the self-cleaning cycle, and particularly when the broiler pan **52** is not present, to inhibit direct passage of heat downwardly from the burner flame in the direction of the floor. Thus in accordance with the present invention, the bottom wall **14** of the frame is in the form of a plurality of layers of metal which are spaced to form horizontal air spaces in which flow of air is induced both by the chimney **100** and by the air requirements of the burner **60**. Thus, referring to the drawings, the bottom wall of the frame is formed of a first layer of metal **111** and a second layer of metal **112** which are so spaced as to provide a first cool air passage **113** along the floor **115** and a second cool air passage **116** between the two layers. The first air passage **113**, open at the front, communicates with the lower inlet opening **104** of the chimney to provide upward flow along the path **117**. Additional air is admitted to the chimney through slots **118**. Turning attention next to the cool air passage **116**, circular openings **120**, formed along the rear edge of metal plate **111**, provide communication between the space **116** to the venturi chamber so that primary air is drawn through the space **116**. Additionally, the back wall member **56** is formed with openings **121**, **122** along its lower edge, an opening **123** adjacent the venturi, and an opening **124** which clears the horizontal run of the burner. Thus, secondary as well as primary, air may be drawn through the passage **116**. To lower the temperature at the bottom of the range still further, a metal plate **125** is superimposed upon the plate **111** to provide a dead air space **126** which is centered directly under the burner. To further insure an acceptable floor and back wall temperature, an L shaped aluminized steel deflector **127** is preferably superimposed inside the broiler drawer **51**. This prevents the broiler drawer bottom and back from absorbing too much heat and acting as a re-radiator in the event that the broiler pan **52** is not present. It will be seen then, that as a result of the broiler drawer deflector, dead air space and the two separate currents of moving air flowing through the spaces **113**, **116**, the radiation of heat directly downward from the frame, even in the absence of the broiler rack or broiler drawer, is effectively obstructed so that very little heat reaches the floor. To minimize the heat reaching the floor via a conductive path, the frame is supported upon hollow, horizontally extending legs, **131**, **132**, having inlet openings **133**, formed along the sides and vent openings **134** which permit air to pass into the broiler compartment. Still further air enters the broiler compartment via a series of openings **135** at the front of the plate **111**. Cooling air is also admitted into the hollow side walls **136**, **137** along a path shown by the arrows in FIG. 2 with discharge at the cooking top.

In accordance with one of the useful features of the present invention, free communication exists between the side hot air passages **31**, **32** and the rear hot air passage **35** at the back of the oven liner, and a barrier is provided along the lower edge of the liner preventing direct flow of heated air from the broiler compartment into the rear hot air passage. This barrier, indicated at **140**, is preferably in the shape of a channel which spans the distance between the lower rear edge of the oven liner and the opposing wall of the frame. Thus hot air is directed "around the corner" with a horizontal component as indicated by the arrows **141** (see both FIGS. 1 and 2). As a result

the heated air is required to take a longer and more efficient path in passing from the burner to the vent opening and overheating at the back passage **35** is avoided.

As will be noted in FIG. 2, the vent opening indicated at **86**, is not centered with respect to the oven but is located almost at the extreme right-hand edge thereof. Therefore to prevent the flow of heated air from being concentrated in the right-hand passage **32**, an obstruction vane **143** is provided in the form of a light angle having both horizontal and vertical portions (see FIG. 1) and which extends a little over half the width of the passage **32**. The degree of obstruction, resulting in throttling of the heated air, is tailored to equalize the amount of the heated air flowing along each side of the liner.

In order to concentrate the chimney action in the region of the vent housing, the chimney **100** is provided with a verticlaly extending partition **150** which diverges at the top as indicated at **151**, to follow the contour of the vent housing. Additional cooling air is permitted to enter the chimney space surrounding the vent housing via louvers **152** which are formed in the partition.

It is one of the features of the present construction that the same control thermostat which permits setting of the cooking temperature is utilized for establishing a self-cleaning temperature at the end of its settable range. As diagrammatically shown in FIG. 1, the oven controller, indicated at **160**, has a bulb **161** mounted within the cooking cavity and connected by capillary **162** to an expansible bellows **163** which may take any desired physical shape. Contacts **164**, **165**, which are in series with the coil **67** in the gas valve, are controlled jointly by a manual control knob and by the position of the bellows. Thus, as shown diagrammatically in FIG. 1, the control knob, indicated at **166**, suitably calibrated in terms of temperature, determines the position of a cam **167** which is associated with the relatively stationary contact **164**. With the knob set within its cooking range, the set temperature will be maintained, as is conventional. It is one of the features of the present control arrangement that the same knob, moved to the high "cleaning" end of its range, causes the contacts, and the connected gas valve, to cycle at a rate which will both establish and maintain the desired self-cleaning temperature. Such a self-cleaning temperature may, for example, be within the range of 750°–900° F. The thermostatic cycling insures that the self-cleaning temperature will remain within a relatively narrow range avoiding high temperature peaks.

To maintain the oven door and broiler door locked during the time that the high self-cleaning temperature exists, a lock is provided including a manual locking arm **170** mounted in the door and which rotates a striker **171** engaging a slot **172** above the door. For maintaining the striker captive, a locking lever **173** is used (FIG. 6) having a cooperating latching rod **174** which is biased forwardly. The lever **173** has a point of drop-off **175** for the latching rod to prevent rotation in the unlocking direction. A solenoid, indicated at **176**, is manually energized to move the rod **174** to its retracted position. However, a pair of contacts **177**, which are mechanically coupled to the bellows **163** and which are in series with the solenoid, are opened by the bellows under high temperature conditions thereby to disable the solenoid until the temperature again falls to a safe level after the cleaning cycle has been completed. For more detailed reference to the locking arrangement and control circuitry, reference is made to copending application Ser. No. 733,422 filed May 31, 1968.

The above design of self-cleaning range has been found to be highly efficient in its self-cleaning operation, achieving a self-cleaning temperature over all soilable areas of the oven cavity. Most noteworthy is the fact that the same muffling and air flow are employed for normal cooking and baking, an even heat being achieved within the cavity without necessity for forced air circulation. It has been found that a burner of relatively modest B.t.u. rating may be employed for both baking and self-cleaning, for example, a burner rated within the range of, say, 23,000 to 27,000 B.t.u. per hour. The range is inherently economical to construct since muffle type heating is employed in both operating modes. While temperatures of up to 900° are achieved during the self-cleaning procedure, the outside of the range remains at a relatively cool and safe temperature. Moreover, while the products of decomposition, in completely oxidized form, are emitted at the top of the range, such products are intimately surrounded at point of exit by a flow of cool air to temper the discharge. Transfer of heat to the floor by either radiation or conduction is effectively prevented. Indeed, the present design of range may be used in confined quarters or even built in without any hazard to the surroundings.

We claim as our invention:

1. In a self-cleaning range, the combination comprising a box-like frame having walls, an oven liner defining an enclosed cooking cavity and spaced inwardly from the walls of the frame to define hot air passages surrounding said liner, said walls defining a broiler compartment below the oven liner, a broiler burner in said broiler compartment having a gas valve connected to a source of gas, a rack for holding a foodstuff below the broiler burner, the broiler compartment being in direct communication with the hot air passages so that the hot air and products of combustion from the broiler burner pass upwardly into the air passages for heating of the oven liner, means at the upper end of the air passages for venting the hot air, an oven controller for cycling the valve to maintain a predetermined cooking temperature in the cooking cavity and capable of adjusting the gas flow to raise the liner to a self-cleaning temperature, the frame being of double-walled construction having thermal insulation between the walls, and heat insulating means extending over the bottom of the broiler compartment to prevent downward passage of heat toward the floor when the burner is on full and particularly in the absence of the broiler pan.

2. The combination as claimed in claim **1** in which a protective baffle in the form of a rectangular plate of metal is interposed between the burner and the oven liner, said baffle having substantially the same dimension as the bottom of the oven liner and extending substantially to the side air passages for guiding of the hot air and products of combustion from the burner into the side air passages while keeping such air from directly impinging upon the bottom of the oven liner.

3. The combination as claimed in claim **1** in which the burner is in the form of a straight tube having orifices along the sides thereof and capable of shooting long horizontal tongues of flame substantially to the lateral edges of the baffle upon opening of the valve to achieve a high self-cleaning temperature.

4. The combination as claimed in claim **1** in which the oven controller includes a bulb in the cooking cavity and a bellows connected thereto via a capillary, a pair of contacts connected to the valve, said contacts having a control knob for progressively positioning the same and located in the path of movement of the bellows for cycling the valve at a set temperature including a self-cleaning temperature on the order of 700°–850° F.

5. The combination as claimed in claim **1** in which the heat insulating means at the bottom of the broiler compartment is in the form of a plurality of layers of metal spaced to form horizontal air spaces and means for creating a flow of cooling air into at least one of the air spaces.

6. The combination as claimed in claim **1** in which means defining a cooling air chimney is provided at the back of the frame and in which the insulating means at the bottom of the broiler compartment includes a plurality of layers of metal spaced to form horizontal air spaces, at least one of the air spaces being in communication with

the chimney to induce flow of cooling air therein below the broiler compartment.

7. The combination as claimed in claim 1 in which the insulating means at the bottom of the broiler compartment consists of a plurality of layers of metal spaced to form first and second horizontal air spaces, said burner having a venturi for mixing primary air with the gas, said first air space communicating with the venturi and with the broiler compartment for inducing the flow of cooling air through the first air space, and means defining a cooling air chimney at the back of the range in communication with the second air space for inducing flow of cooling air therethrough.

8. In a self-cleaning range, the combination comprising a box-like frame having walls, an oven liner defining an enclosed cooking cavity and spaced inwardly from the walls of the frame to define side hot air passages and a back hot air passage surrounding said liner, said walls defining a broiler compartment below the liner, a broiler burner in said broiler compartment having a gas valve connected to a source of gas, a rack for holding a foodstuff below the broiler burner, an oven controller for cycling the valve to maintain a predetermined cooking temperature in the cooking cavity and capable of adjusting the gas flow to raise the liner to a self-cleaning temperature, the side and back air passages being in direct communication with one another, means defining a vent opening at the top of the back air passage, and a barrier extending along the lower edge of the back air passage so that the hot air and products of combustion from the burner are directed up the side air passages and thence around the back of the liner for exiting through the vent opening.

9. The combination as claimed in claim 8 in which the vent opening is offset to one side with respect to the center of the back air passage and in which an obstruction vane is provided in the air space on such side for throttling the flow of hot air thereby tending to equalize the flow of air in the air spaces at the two sides.

10. In a self-cleaning range, the combination comprising a box-like frame having walls, an oven liner defining an enclosed cooking cavity and spaced inwardly from the walls of the frame to define side and back hot air passages surrounding said liner, said walls defining a broiler compartment below the oven liner, a broiler burner in said broiler compartment having a gas valve connected to a source of gas, a rack for holding a foodstuff below the broiler burner, an oven controller for cycling the valve to maintain a predetermined cooking temperature in the cooking cavity and capable of adjusting the gas flow to raise the liner to a self-cleaning temperature, the broiler burner being in direct communication with the hot air passages so that the hot air and products of combustion from the burner pass upwardly into the air passages, means defining a hollow chimney at the back of the frame for conducting cooling air, a vent housing in said chimney having a vent at its upper end, the frame being of double-walled construction having thermal insulation between the walls, and means defining a vent opening at the top of the back air passage communicating with the vent housing for discharge of the heated air.

11. The combination as claimed in claim 10 in which means defining a second vent opening is provided between the cooking cavity and the vent housing for venting of the products of decomposition during a self-cleaning cycle.

12. The combination as claimed in claim 11 in which a catalytic cell is interposed between the second vent opening and the vent housing.

13. The combination as claimed in claim 9 in which the two vent openings are spaced closely side by side for common discharge into the vent housing and in which a vertical barrier is provided in the vent housing extending at least a portion of the way to the vent to inhibit direct passage of the products of combustion and the products of decomposition between the back air space and cooking cavity.

14. The combination as claimed in claim 11 in which the chimney extends to the top of the vent housing and terminates in openings adjacent the vent for discharge of cooling air from the chimney thereby to temper the stream of heated air issuing from the vent.

15. The combination as claimed in claim 12 in which the catalytic cell is in the form of a hollow cartridge having a first opening on one side communicating with the oven cavity and having a second opening on the opposite side communicating with the vent housing, the second opening being covered by a screen of catalytic material and said cartridge having an electric heating element therein in the path of flow for raising the temperature of the products of decomposition from the cooking cavity prior to passage of such products through the catalytic screen.

16. In a self-cleaning range, the combination comprising a box-like frame having walls, an oven liner defining an enclosed cooking cavity, and spaced inwardly from the walls of the frame to define back and side hot air passages surrounding said liner and in communication with one another, means defining a broiler compartment below the oven liner communicating with at least the side passages, a broiler burner in said compartment having a gas valve connected to a source of gas, a rack for holding a foodstuff below the broiler burner, a hot air vent at the top of said back air passage, an oven controller including a settable manual control and a temperature responsive member in the oven cavity for cycling the gas valve automatically to maintain the predetermined temperature for which the control has been set, said control having a "baking" range, "broil" setting and "self-cleaning" setting selectively available upon incremental advancement of the control, said burner being constructed and arranged to direct the flame and the hot air therefrom laterally outward toward the side hot air passages to facilitate flow of hot air therethrough.

References Cited

UNITED STATES PATENTS

3,364,912	1/1968	Dills et al.
3,417,742	12/1968	Perl.
3,422,809	1/1969	Perry.

CHARLES J. MYHRE, Primary Examiner

U.S. Cl. X.R.

126—21, 41