

Oct. 6, 1964

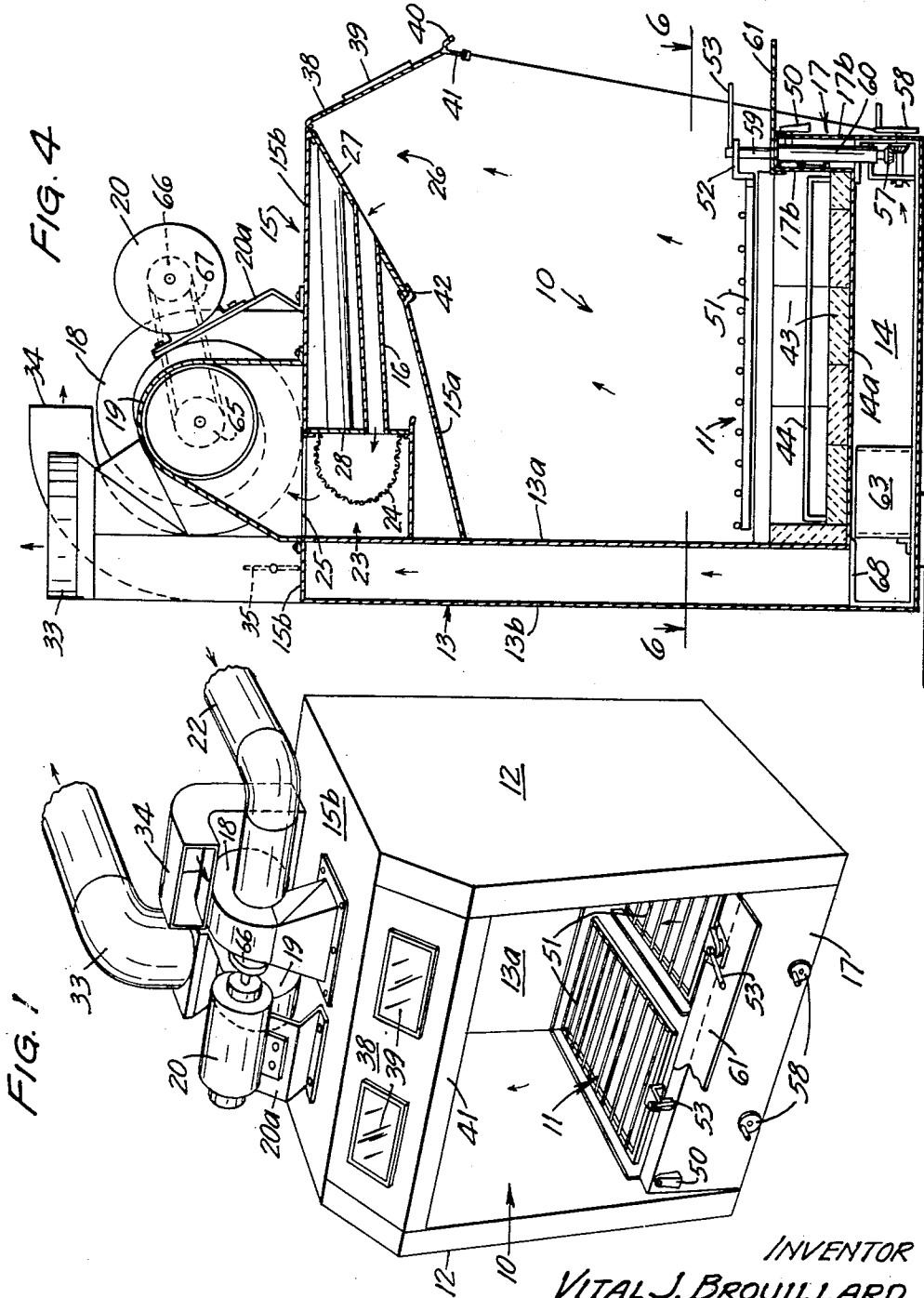
V. J. BROUILLARD

3,151,607

BROILER

Filed April 15, 1959

4 Sheets-Sheet 1



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Oct. 6, 1964

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FIG. 2

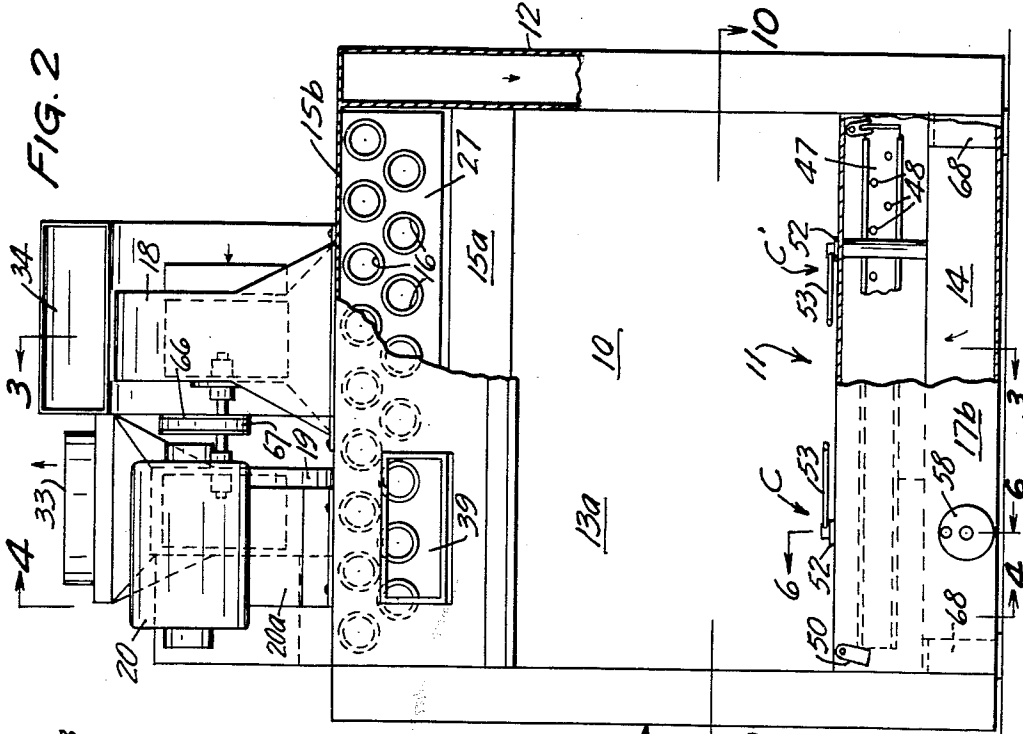
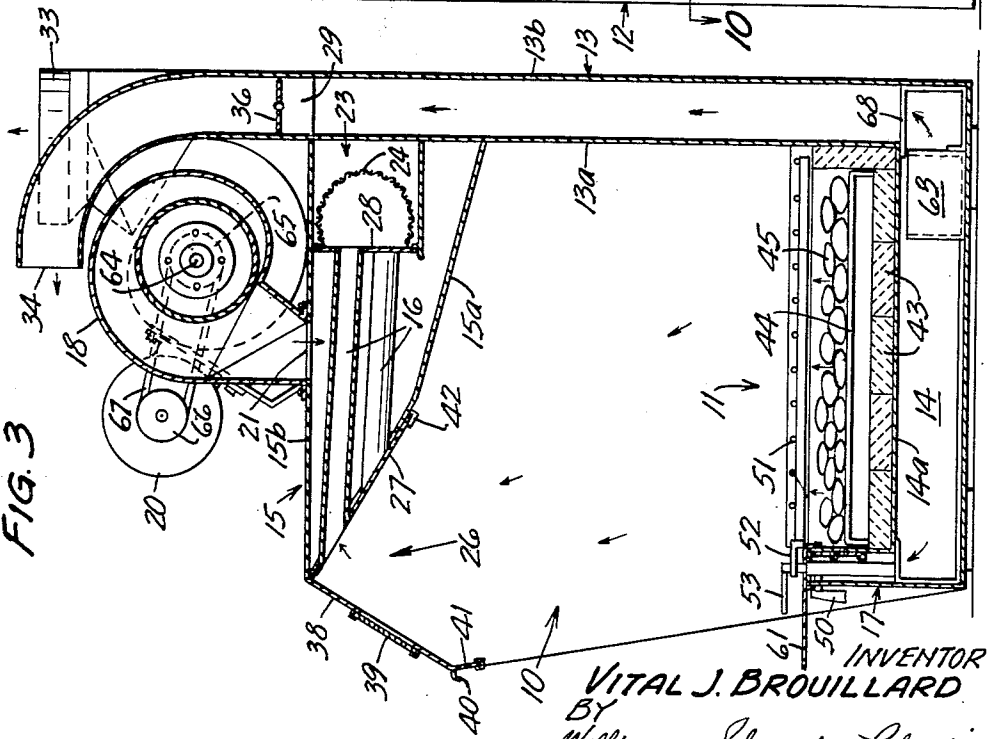


FIG. 3



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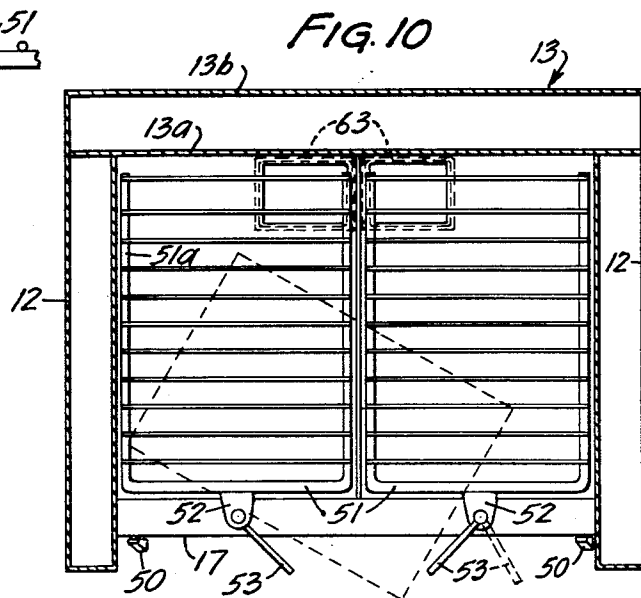
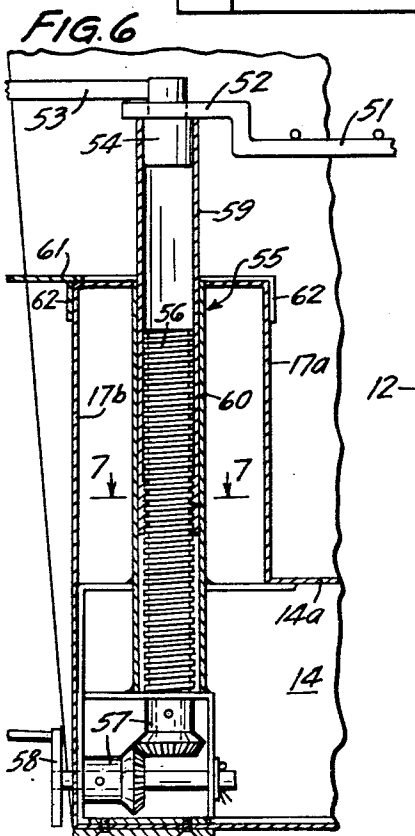
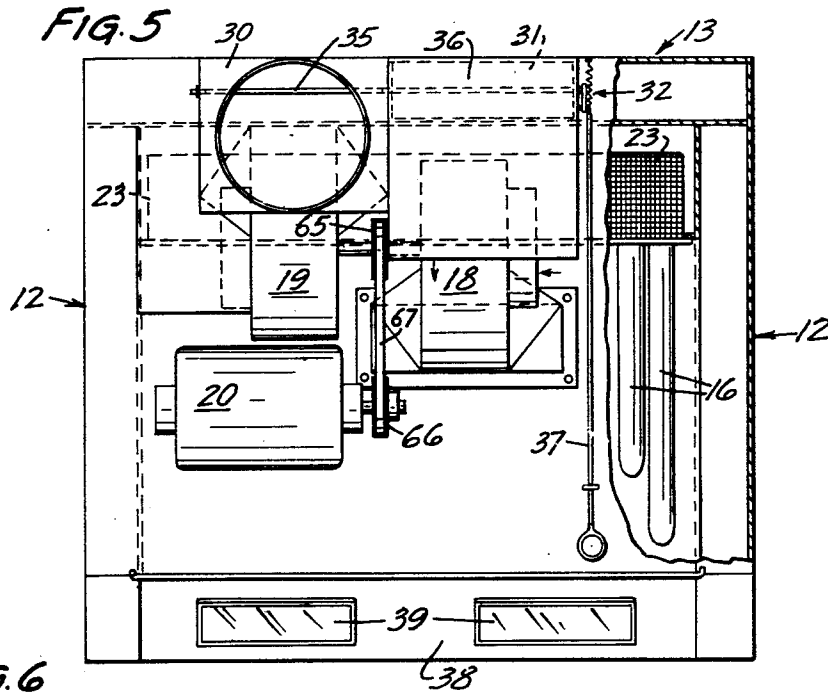
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4 Sheets-Sheet 3



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FIG. 8

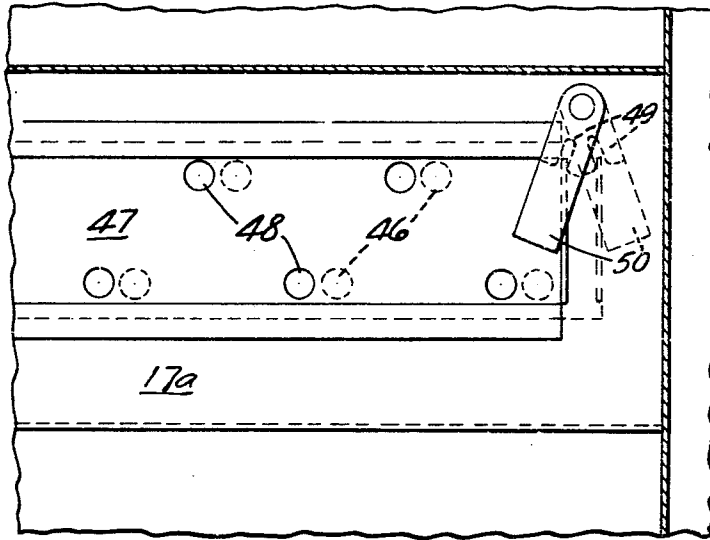


FIG. 9

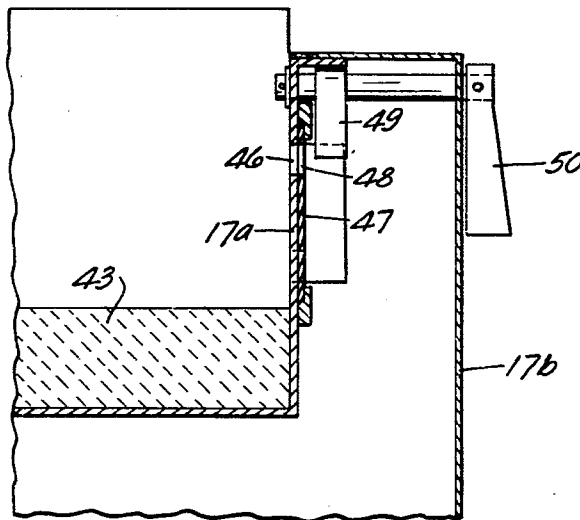
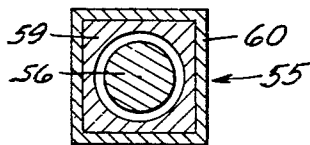


FIG. 7



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Filed Apr. 15, 1959, Ser. No. 806,600
12 Claims. (Cl. 126-6)

This invention relates in general to cooking apparatus and in particular to indoor grills or open hearth broilers. In recent years, indoor open hearth grills for food cooking have become quite popular and the future prospects are that they will become even more popular. Unfortunately, the grills which have been installed up to the present time and which are presently available for installation have numerous disadvantages which seriously impair the value and enjoyment thereof.

One serious disadvantage is that the grills now employed rely almost exclusively on the room air to support the combustion in the grill which results in a negative or backup pressure in the room and a back draft which frequently blows the smoke fumes and vapors back into the room, smoking and smelling up the house and sometimes causing damage to the house furnishings.

Another disadvantage is that the broilers presently available are either of the open variety which throws an intense amount of heat into the room, frequently at times when this heat is not desired, or the grills are substantially enclosed and must be supplied with heavy insulation or refractory material which substantially increases the cost and weight of the grills or broilers.

Therefore, an important object of my invention is an indoor grill or broiler which employs atmospheric or outside air as distinguished from indoor or room air to support the combustion in the fire pit of the broiler and also to prevent the negative or backup pressures which might otherwise occur.

Another object is a broiler of the class described in which circulating atmospheric air is employed as the insulating means for the structure enclosing the broiler.

Still another object is a broiler of the class described in which the incoming outdoor air is heated, which heated air may be selectively employed to assist in the fire pit combustion or to assist in heating the room if desired, or may also be discharged into the room in which the broiler is located to eliminate undesirable backup or negative pressures.

Still another object is a broiler of the class described which is especially designed to trap, condense and filter the smoke fumes and vapors emanating from the combustion chamber of the broiler in such fashion as to minimize the amount of objectionable grease and odors which are discharged to the outside atmosphere, which filtering medium is readily adapted to removal and cleaning thereof.

Still another object is a broiler of the class described which features an adjustable door which when the broiler is in use is employed as a baffle to assist in forming a fume and smoke trap to channel the smoke fumes and vapors and products of combustion into the condensation and trap system and which, when the broiler is not in use, serves as a closure for the condensation and trap system to prevent the odors therefrom from emanating into the surrounding room when the broiler is not in use.

Still another object is a broiler of the class described in which the door above described is supplied with transparent, tinted window media of noncombustible material to facilitate the viewing of the cooking by the cook or operator with reduced eye strain.

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A further object is a broiler of the class described which features vertically adjustable and removable food-supporting grills which are easy to clean and remove, which may be used singly or in combination, and which may be swung to the front of the broiler within easy reach of the cook for seasoning, tasting and sampling.

These and other objects and advantages of my invention will more fully appear from the following description made in connection with the accompanying drawings, wherein like reference characters refer to the same or similar parts throughout the several views, and in which:

FIG. 1 is a perspective view of the broiler of my invention;

FIG. 2 is a front elevational view in partial broken away section;

FIG. 3 is a side view in vertical section taken along the lines 3-3 of FIG. 2;

FIG. 4 is a side view in vertical section taken on the line 4-4 of FIG. 2;

FIG. 5 is a top plan view thereof;

FIG. 6 is an enlarged detail elevational view in partial section of the height adjusting mechanism for the grill;

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

FIG. 8 is an enlarged fragmentary front elevational view of the damper mechanism for the combustion chamber;

FIG. 9 is an enlarged detailed side view of the damper mechanism for the combustion chamber; and

FIG. 10 is a top horizontal sectional view taken on the line 10-10 of FIG. 2, showing the grills and the pivotal movements thereof.

Referring to the drawings which show a preferred embodiment of my invention, the open hearth broiler of my invention consists of a cooking chamber 10 having a suitable fire pit or combustion chamber 11 located in the lower portion thereof, said cooking and combustion chambers being enclosed by a pair of vertical hollow side walls 12, a hollow back wall 13, a hollow bottom 14, a hollow roof 15 having enclosed therein a plurality of heat exchanger and condensation tubes 16, and a hollow upstanding front wall 17 enclosing the combustion chamber only, leaving an opening thereabove for gaining access to the interior of the cooking chamber. The interior of the roof 15 is in direct flow communication with the hollow interior of the vertical side walls 12 which in turn directly communicate with the hollow interior of the bottom 14, the interior of the bottom 14 in turn directly communicating with the interior of the back wall 13 and front wall 17 of the broiler.

It should be understood that in the form shown in the drawings, there is no direct communication between the interior of the roof 15 and the back wall, nor between the side walls and the back wall, all of the circulated air having to first pass through the bottom before entering the back wall.

Mounted atop the roof 15 of the broiler are a pair of blowers 18 and 19 which are driven by a common driving mechanism such as the motor 20 mounted atop the roof also by means of a motor mounting bracket 20a, one of said blowers 18 serving as an air intake mechanism for drawing outside atmospheric air into the broiler, the other blower 19 serving as an exhaust mechanism to eliminate the indrawn air and products of combustion and fumes from the broiler to the outside atmosphere, and to alternatively and selected deliver all or part of the indrawn air into the room in which the broiler is located.

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The intake blower housing is in direct flow communication with the interior of the hollow roof of the broiler and is adapted to direct the air thereinto through the air intake opening 21 in the top or outer wall 15b of the roof (as best seen in FIG. 3) so as to cause the fresh incoming air to pass across or around the condensation tubes 16 and become heated thereby and pass directly from the hollow roof into either of the hollow sides of the broiler, the arrangement being such that the incoming air splits approximately equally into two equal portions so that the flow down either side of the broiler is of substantially equal intensity. The outside air is drawn into the intake blower housing and roof of the boiler through suitable ducts such as 22 which may provide direct communication between the intake blower and the outside air.

The exhaust blower which is also mounted atop the roof is in flow communication with the condensation tubes 16 disposed inside the hollow roof 15, a collection chamber or trap 23 supplied with a filter 24 being disposed in flow communication intermediate the tubes and the exhaust blower to collect, condense and eliminate the majority of the grease and dust which is removed from the cooking chamber and normally exhausted to the outside atmosphere by means of the exhaust blower. The filtered smoke and fumes are discharged from the trap to the exhaust blower through an exhaust port 25, provided in the outer panel 15b of the roof. The trap chamber 23 extends substantially the full width of the broiler, and the filter member 24 encloses the ends of all of the tubes 16 so that all of the gases discharged therefrom into the trap must pass through the filter. All this is best seen in FIG. 4. The bottom or inner wall 15a of the hollow roof serves also as the upper interior roof or ceiling of the cooking chamber 10 as best seen in the side views 3 and 4 inclined upwardly from back to front of the broiler so as to form a generally inverted V-shaped exhaust hood indicated generally by 26 in the front upper portion of the cooking chamber for ready collection and removal of the products of combustion, smoke and fumes therein.

A plurality of condensation, exhaustion and heat exchange tubes 16 are horizontally disposed in tiers and in spaced apart parallel relationship within the hollow roof, the forward ends of said tubes being preferably of bell-shaped configuration and slightly inclined to correspond to the angle of inclination of the roof and are in direct flow communication with the inverted V-shaped exhaust hood 26. The other or backward end of these tubes is in direct flow communication with the trap itself. The front and back ends of the tubes 16 are preferably affixed or welded to common header plates 27 and 28, the tubes and header plates preferably functioning as a single removable and insertable unit to facilitate cleaning of the tubes and to provide easy access to the trap chamber. It is also important to note that the tubes are inclined downwardly towards the trap to insure that any grease condensing in the tube interiors will drain directly into the trap and not back into the cooking chamber. It is, of course, understood that the interior of the tubes are sealed off from the roof interior and do not communicate therewith.

The hollow back wall 13 is in direct flow communication with a pair of adjacent independent discharge conduits or ducts 33 and 34 having a common wall 29 and has a pair of adjacent discharge openings 30 and 31 therein, which openings have a pair of spring tensioned interconnected dampers or cross-mounted damper mechanism 32 mounted adjacent said openings to control the air flow therethrough. One of said openings 30 communicates directly with the exhaust duct 33 leading to the outside atmosphere and the other opening 31 communicates directly with a register duct 34 which communicates directly with the room to discharge warm air thereinto. The interconnected damper arms 35 and 36 are disposed 90 degrees out of phase with one another so that when one is disposed horizontally to completely close the opening corresponding thereto, the interconnected adjacent damper arm is dis-

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posed vertically to permit maximum flow through its opening. Damper operating means such as operating handle 37 are also provided for operating said dampers so that they do not necessarily have to be always disposed vertically or horizontally but both may be disposed at an incline so that there may be a partial flow of air from the hollow back through both simultaneously to permit a partial flow of hot air into the room and the remainder to pass through into the exhaust system.

The upper front marginal edge of the broiler is provided with a swingable door 38 having a plurality of transparent windows 39 of non-combustible material, which door is pivotally mounted to the front marginal edge of the roof. In open operation position, as best seen in FIGS. 3 and 4, the door 38 is detachably held by suitable latch means 40 carried by a cross supporting member 41 which spans the width of the broiler and is affixed to the side walls 12. In this position the door acts as a baffle and serves to define the inverted V-shaped fume and smoke collecting exhaust hood indicated generally by the numeral 26 and assists in directing the smoke and fumes into the tubes 16. In closed non-operating position, as indicated by the dotted position shown in FIG. 3, the door is held against the front header plate 27 by suitable latch means 42 carried by the inner roof panel 15a. In some instances it is preferable to have the door 38 detachable as well as swingable in order to facilitate the removal of the tubes 16 and header plates therefor. In assuming this closed position, the door 38 encloses and shuts off communication between the tubes 16 and trap 23 with the cooking chamber and room interior and prevents undesirable odors from emanating therefrom.

The combustion area in the form shown comprises a pair of adjacent combustion chambers or fire pits (indicated generally by C and C') which may be operated simultaneously or singly as desired. Each combustion chamber includes a hearth portion formed by a course of refractory material such as fire brick 43 which lines the bottom and back thereof and is supported by the inner panels 13a and 14a of the hollow back wall and hollow bottom respectively, and by the combustion support members 68 therebelow. Atop each hearth is seated in spaced apart relationship a grate member 44 adapted to support a fuel 45 such as charcoal briquets or wood.

The inner panel 17a of the hollow front wall 17 provides the front closure for the combustion chambers and is provided with a plurality of air admitting apertures 46 therein (as best seen in FIGS. 8 and 9). Each combustion chamber is provided with a sliding damper plate 47 having apertures 48 therein, said plates being slidably mounted on said inner panel 17a and independently operated by means of pivotally mounted damper plate engaging and motivating members 49 which are, in the form shown, manually operated by means of damper handles 50 carried externally of the broiler on the front face of the outer panel 17b. The apertures 46 and 48 and their respective cooperating members 17a and 47 are located and positioned in such fashion that air may be admitted to the combustion chambers from the hollow front wall in adjustable amounts by simply sliding the damper plates back and forth, bringing the apertures 46 and 48 into partial or total register with one another. It should be understood that it is within the contemplation of this invention to include a damper system such as that above described on the rear portion of the combustion chambers and communicating either with the hollow bottom and back wall or possibly both.

A pair of food-supporting grills 51 are provided, one for use with each combustion chamber. Each grill is preferably pivotally mounted to enable it to be swung into more accessible position. In the form shown, each grill, as best seen in FIG. 6, is provided with a mounting bracket 52 which is rigidly secured to the main supporting frame or yoke 51a of the grill, said bracket having rigidly secured thereto an outwardly extending operating

handle 53 and a downwardly extending pivotally mounted cylindrical supporting member or boss 54.

Each grill is supported by a vertically adjustable grill supporting mechanism housed within the hollow front wall 17 and indicated generally by the numeral 55. This supporting mechanism 55 is shown in enlarged detail in FIG. 6 and includes an elongate, vertically disposed exteriorly threaded, stationary rotatable screw member 56 drivingly engaged with a pair of intermeshed bevel gears 57 and manually motivated by a crank wheel 58 carried outwardly of the broiler on the front face of the front wall 17. The screw member 56 is telescopically and threadedly engaged with a vertically movable, interiorly threaded sleeve member 59 having a cylindrical bore and a rectangular outer periphery, the interior diameter of its bore corresponding to and being slightly greater than the outer diameter of the grill pivot member 54. The upper end of the sleeve member 59 pivotally but snugly and removably receives and seats the grill pivot member 54, and securely supports the grills thereon to maintain the same in substantially horizontal position above the fire in the combustion chamber. The movable sleeve member 59 is telescopically and slidably enclosed within a stationary, rectangular outer sleeve member 60 which prevents rotation of the movable sleeve member 59 and enables it to move vertically up and down to selectively adjust the height of each of the grills.

As an optional but preferable additional feature of my broiler, an elongate drip pan 61 is provided which overlies the front wall 17 and extends outwardly therefrom, and is located intermediate the top of the front wall 17 and the grill. The drip pan is provided with a pair of longitudinally extending depending flanges 62 which fit over and engage the outer faces of the front wall to removably maintain the drip pan on the front wall. The drip pan is provided with suitable cut-outs or openings which register with the telescoped members of the grill supporting mechanism and permit the movable sleeve 59 to pass freely therethrough.

As another optional but preferred feature (as seen in FIGS. 3 and 10), I provide an ash receptacle 63 in the hearth portion, which receptacle is seated in a suitable opening in the back corner of the hearth. The receptacle may be of the type that can be lifted bodily out of the opening, or it may be connected at its bottom to an ash removing chute or the bottom may be removable or openable to permit the ashes to fall freely into some sort of ash removing receptacle.

It should also be noted that in the embodiment shown, the blowers 18 and 19 are driven by the two speed motor 20 through the medium of a common drive shaft 64, the driving power being transmitted therebetween through the blower sheave 65 and motor drive pulley 66 which are drivingly interconnected by a drive belt 67.

In operation after suitable installation of the boiler in a room, the fire is ignited in the fire pit on the grates beneath the grills and the motor is turned on causing the intake and exhaust blowers to operate simultaneously. The intake blower draws in air from the outside atmosphere through the intake conduit and delivers this incoming air to the hollow roof of the broiler causing it to flow over and around the condenser tubes disposed therein, to become heated thereby, the air flow being split into substantially two equal portions which pass down both hollow sides of the broiler, the two columns of air being reunited in the hollow bottom portion of the broiler beneath the hearth.

The damper means controlling the air flow from the hollow bottom into the fire pit are adjusted to the setting desired to admit the amount of warmed air necessary beneath the grate so that a portion of the air enters the hollow bottom therefrom into the fire pit to assist in the combustion of the fuel therein. The remaining air passes directly from the hollow bottom portion into the hollow back portion of the broiler from which it may be discharged entirely into the room through the room register

or exhausted entirely back out into the outside atmosphere through the exhaust conduit or it may be divided so that a portion is exhausted to the outside and a portion is directed into the room.

The products of combustion, including smoke, fumes, vapors and the like are drawn upwardly by the forced draft created by the exhaust blower and are collected in the hood area defined by the open door acting as a baffle and the forward header plate, and are then drawn through the condensing and heat exchange tubes into the trap chamber, where the vapors, fumes and the like are filtered by the grease filter and then exhausted to the outside.

During cooking, the grills may be raised or lowered as desired to maintain the desired distance between the food supported thereon and the fire by simply turning the crank wheel 58. If for any reason it is necessary or desirable to have access to the food resting on the back portion of the grills, such as to season the food, turn it over or to see how well done it is, the grills may easily be swung horizontally 90 degrees to the side on its pivotal mounting (as best seen in FIG. 10) by applying pressure to the grill handles 53, so that the length of the grill parallels the front of the broiler and presents the contents thereof in readily available fashion, with the drip pan provided therebelow catching the drippings from the grill.

From the foregoing description, the advantages of my invention are readily apparent. The air flow passing through the sides, bottom and back of the broiler serves to adequately insulate the broiler so that no special insulating medium is required, and thereby reducing the weight and expense of the broiler. In addition, the air admitted to the combustion chamber and also admitted into the room serves to eliminate the negative pressure which would normally be formed when the sole source of supply of oxygen for the combustion of the fuel is taken from the room itself and, therefore, eliminates any back draft or any passage of smoke, fumes or vapors into the room itself. The indrawn circulated air discharged into the room serves not only to eliminate negative or backup pressures, but also effectively heats the room containing the broiler. The grills are readily adjustable for height and location, and the majority of the noxious grease and soot is removed from the fumes and vapors before discharging them to the outside air, so as not to create a nuisance insofar as the surrounding neighborhood is concerned. The condenser tubes and grease trap are readily removable and accessible for cleaning and may be closed off when not in use. Thus, the net effect and result of using the broiler of my invention is a pleasant one with little or no objectionable smoke, grease or vapors finding their way back into the room during use and no rancid, stale, pungent odors emanating therefrom when the broiler is not in use.

Although the description of my invention has been directed primarily to use as an open hearth broiler, it is to be understood that my invention includes within its scope other uses, such as simply an exhaust hood for such as burners and noxious gases in laboratories where they are both a problem.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the various parts without departing from the scope of my invention.

What I claim is:

1. Indoor open hearth apparatus comprising hollow wall structure heated by and enclosing a combustion chamber having a relatively large access opening therein which remains open and communicates with the room housing said apparatus during use and provides a person access to said chamber during use, duct means providing direct communication between said hollow wall structure and the outside atmosphere for delivering fresh outside air to said hollow wall structure, duct means providing direct communication between said hollow wall structure and the outside atmosphere for conveying said air directly

back to said outside atmosphere after said air has passed through said hollow wall structure and has been heated thereby, and dampered means for admitting heated air from said hollow wall structure to said room.

2. The apparatus of claim 1 including damper means for admitting heated air from said hollow wall structure to said combustion chamber to support combustion therein.

3. The apparatus of claim 1 wherein said dampered means admits the heated air to said room at a location adjacent to said access opening whereby said heated air is substantially immediately short-circuited back into said combustion chamber through said access opening without significantly disturbing the room air and without significantly increasing the temperature of said room.

4. The apparatus of claim 1 including tubular heat exchange means mounted in said hollow wall structure and sealed therefrom, said heat exchange means communicating with said combustion chamber for receiving the gaseous products of combustion therefrom, duct means communicating with said heat exchange means and the outside atmosphere for exhausting said gaseous products to the outside atmosphere, said heat exchange means being positioned in the path of travel of the fresh air entering said hollow wall structure and contacted thereby whereby the incoming air is heated and the products of combustion cooled by said contact.

5. The apparatus of claim 4, including grease trap means interposed between said heat exchange means and said last named duct means.

6. The apparatus of claim 4, wherein said heat exchange means is mounted in a hollow roof portion of said chamber and communicates with the upper portion of said chamber adjacent said access opening, and including baffle means dependably mounted on said roof portion adjacent said access opening and movable between a closed position in which said baffle means closes said heat exchange means and prevents communication with said chamber and an open position wherein said heat exchange means is in communication with said chamber and said baffle means is positioned to deflect and direct upwardly flowing gaseous products to said heat exchange means.

7. Indoor open hearth apparatus comprising hollow wall structure heated by and enclosing a combustion chamber having a relatively large access opening therein which remains open and communicates with the room housing said apparatus during use and provides a person access to said chamber during use, a fire pit located in the bottom portion of said chamber, said structure including side walls, a roof, and a bottom underlying said fire pit, air intake and exhaust openings in said wall structure, said openings and said wall structure being so arranged that air entering same through said intake opening passes through all of said wall structure to said exhaust opening, first duct means providing direct communication between said intake opening and the outside atmosphere for conveying fresh outside air directly to said wall structure for cooling said structure and heating said air, second duct means providing direct communication between said exhaust opening and the outside atmosphere for conveying heated air from said wall structure back to said outside atmosphere, third duct means communicating with the outside atmosphere and said chamber for conveying gaseous products from said chamber to the outside atmosphere, closable dampered means for admitting heated air from said wall structure unpoluted by said gaseous products to said room, damper means for admitting heated air from said wall structure to said fire pit to support combustion therein, and blower means for effecting a forced draft in said duct means and wall structure.

8. Indoor open hearth apparatus comprising hollow wall structure heated by and enclosing a combustion chamber having a relatively large access opening therein

which remains open and communicates with the room housing said apparatus during use and provides a person access to said chamber during use, a fire pit located in the bottom portion of said chamber, said wall structure including side walls on opposite sides of said opening, a back wall opposite said opening, a top wall, and a bottom wall underlying said fire pit, said top wall communicating with both of said side walls, both of said side walls communicating with said bottom wall, and said bottom wall being in flow communication with said back wall, said back wall having an air exhaust opening therein, said top wall having an air intake opening therein whereby air entering said hollow wall structure through said intake opening passes successively through said top wall, side walls, bottom wall and back wall and is discharged through said exhaust opening, said air being heated in the course of its passage through said wall structure, first duct means providing direct communication between said intake opening and the outside atmosphere for conveying fresh outside air to said wall structure, second duct means providing direct communication between said exhaust opening and the outside atmosphere for conveying heated air from said wall structure directly back to said outside atmosphere, said back wall having a second opening therein communicating with said room for admitting heated air to said room, damper means for opening and closing said second opening, said bottom wall having an opening therein communicating with said fire pit for admitting heated air thereto to support combustion, damper means for said opening in said bottom wall, said top wall having a second opening therein, third duct means communicating with said last named second opening and said second duct means, a third opening in said top wall communicating with said combustion chamber for receiving gaseous products therefrom, fourth duct means mounted in said top wall and sealed therefrom and communicating with said second and third openings in said top wall whereby gaseous products from said chamber pass successively through said fourth, third and second duct means for discharge to the outside atmosphere, and blower means for creating a forced draft in said duct means and hollow wall structure.

9. Indoor open hearth apparatus comprising hollow wall structure heated by and enclosing a combustion chamber having a relatively large access opening therein which remains open and communicates with the room housing said apparatus during use and provides a person access to said chamber during use, duct means providing direct communication between said hollow wall structure and the outside atmosphere for delivering fresh outside air to said hollow wall structure, duct means providing direct communication between said hollow wall structure and the outside atmosphere for conveying said air directly back to said outside atmosphere after said air has passed through said hollow wall structure and been heated thereby, said duct means and hollow wall structure providing a continuous air conduit system, and means for admitting a portion of the air in said system to said room adjacent said access opening whereby the air admitted to said room substantially immediately passes from its point of entry into said room into said combustion chamber through said access opening without materially mixing with and changing the temperature of the other air in said room.

10. Indoor open hearth apparatus comprising a combustion chamber having a relatively large access opening therein which remains open and communicates with the room housing said apparatus during use and provides a person access to said chamber during use, hollow wall structure heated by and substantially completely enclosing said combustion chamber except for said access opening, said wall structure including inner walls exposed to and defining said combustion chamber and outer walls exposed to the room housing said apparatus, first duct means providing direct communication between said hol-

low structure and the outside atmosphere for delivering fresh outside air to said hollow structure, second duct means providing direct communication between said hollow wall structure and the outside atmosphere for conveying the fresh air admitted to said wall structure from said first duct means directly back to said outside atmosphere after said air has passed through said hollow wall structure and been heated thereby, said wall structure being so arranged and said first and second duct means being connected thereto in such fashion that air entering said hollow wall structure from said first duct means passes through all of said hollow structure to said second duct means, third duct means communicating with said second duct means and said combustion chamber for exhausting the gaseous products of combustion from said chamber to the outside atmosphere, closable dampered means for admitting heated air from said wall structure unpolluted by said gaseous products to said room, and blower means adapted to create a forced draft in each of said duct means and said hollow wall structure.

11. The apparatus of claim 10, including damper means for admitting heated air from said wall structure to said combustion chamber to support combustion therein.

12. The apparatus of claim 10, wherein said blower means is capable of moving the air through said wall structure at a rate sufficient to remove substantially all of the heat therefrom whereby the moving air substantially completely insulates the outer walls from the inner walls and maintains the outer walls at safety touchable temperatures during use.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,151,607

October 6, 1964

Vital J. Brouillard

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 7, line 70, for "combination" read -- combustion --; column 9, line 29, for "safety" read -- safely --.

Signed and sealed this 19th day of January 1965.

(SEAL)

Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents