Sept. 1, 1964 C. V. DI PIETRO 3,146,693

DUPLEX BROILER

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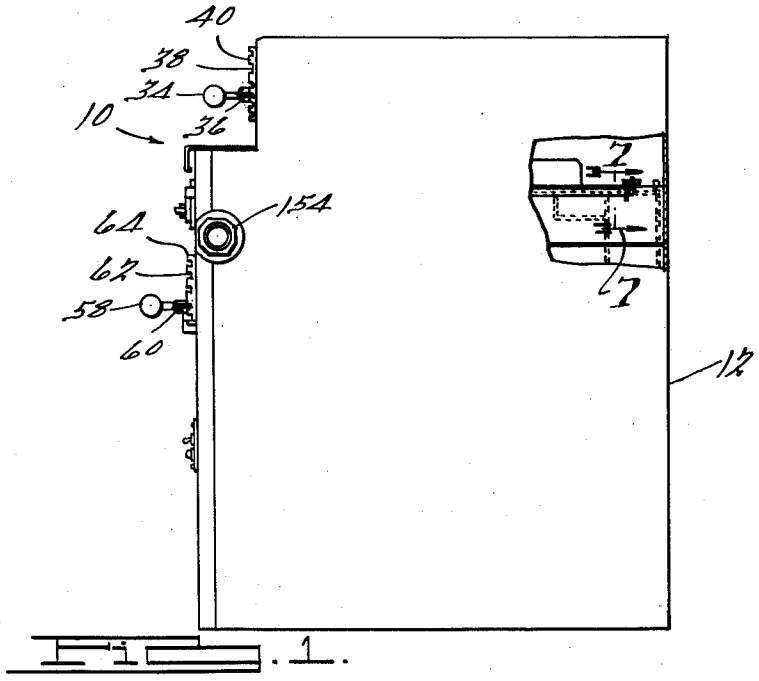


Fig. 1.

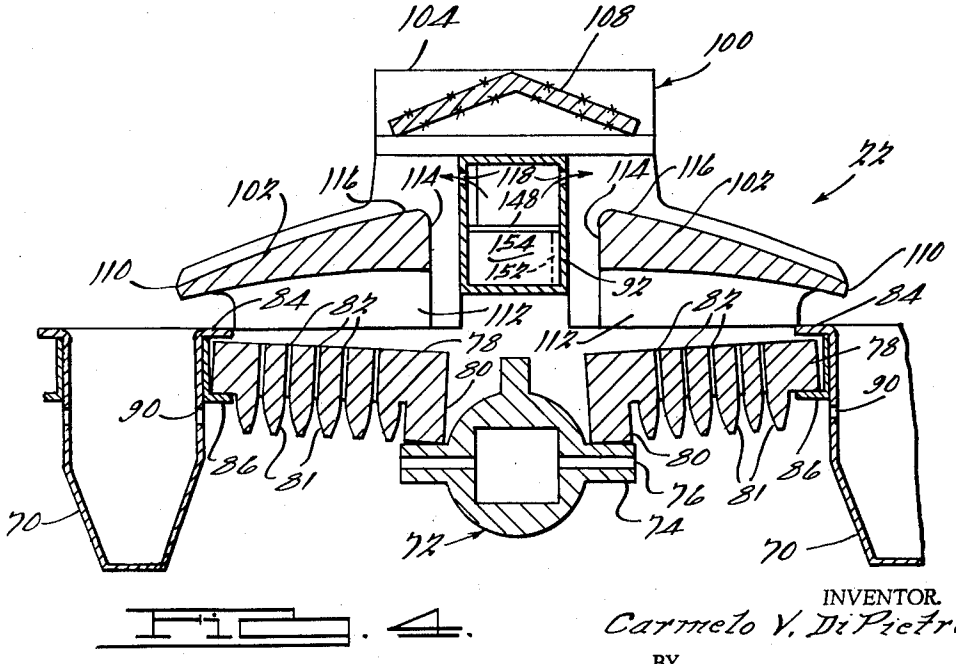


Fig. 4.

INVENTOR.
Carmelo V. Di Pietro.
BY
Harmas, Dickey & Pierce.
ATTORNEYS.

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DUPLEX BROILER

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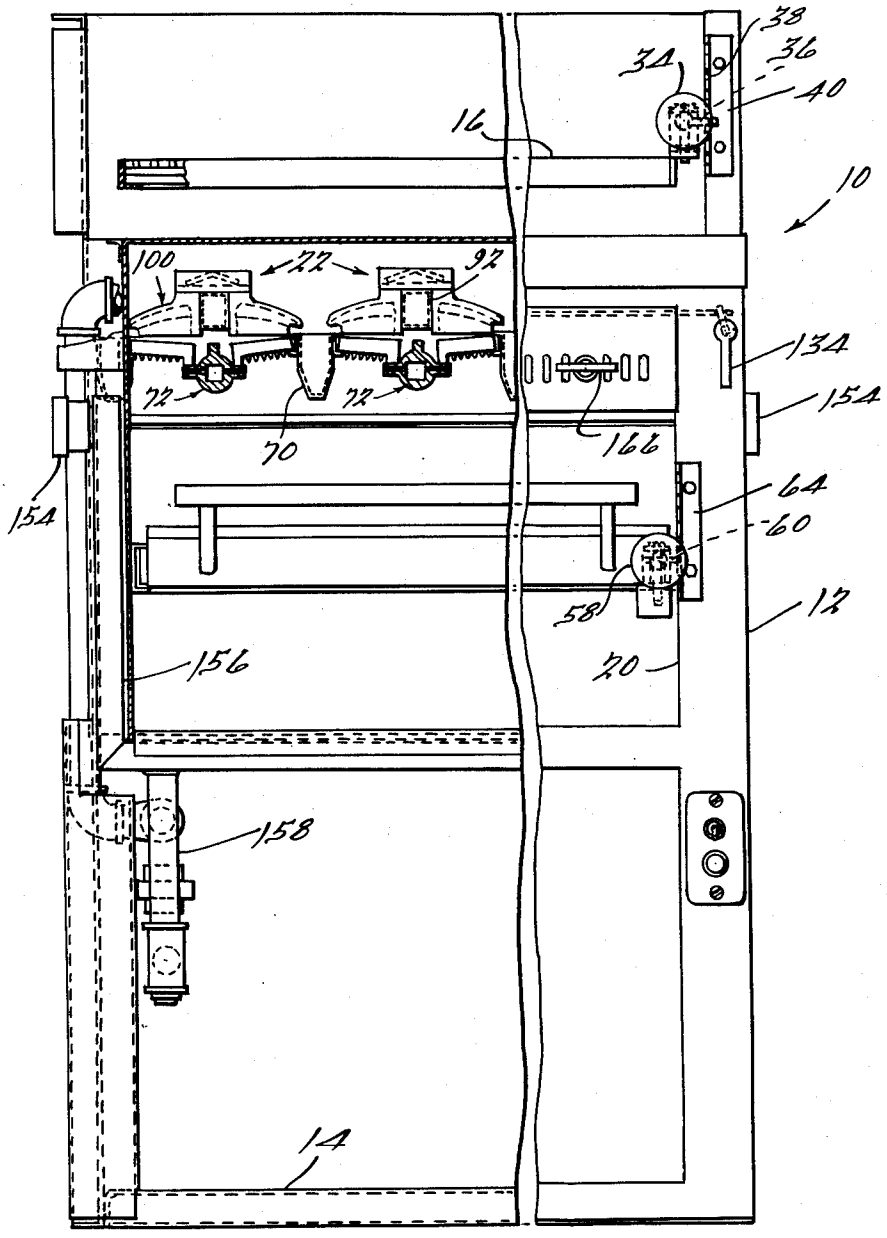


FIG. 2.

INVENTOR.
Carmelo V. Di Pietro.

BY
Harness, Dickey & Pierce
ATTORNEYS

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DUPLEX BROILER

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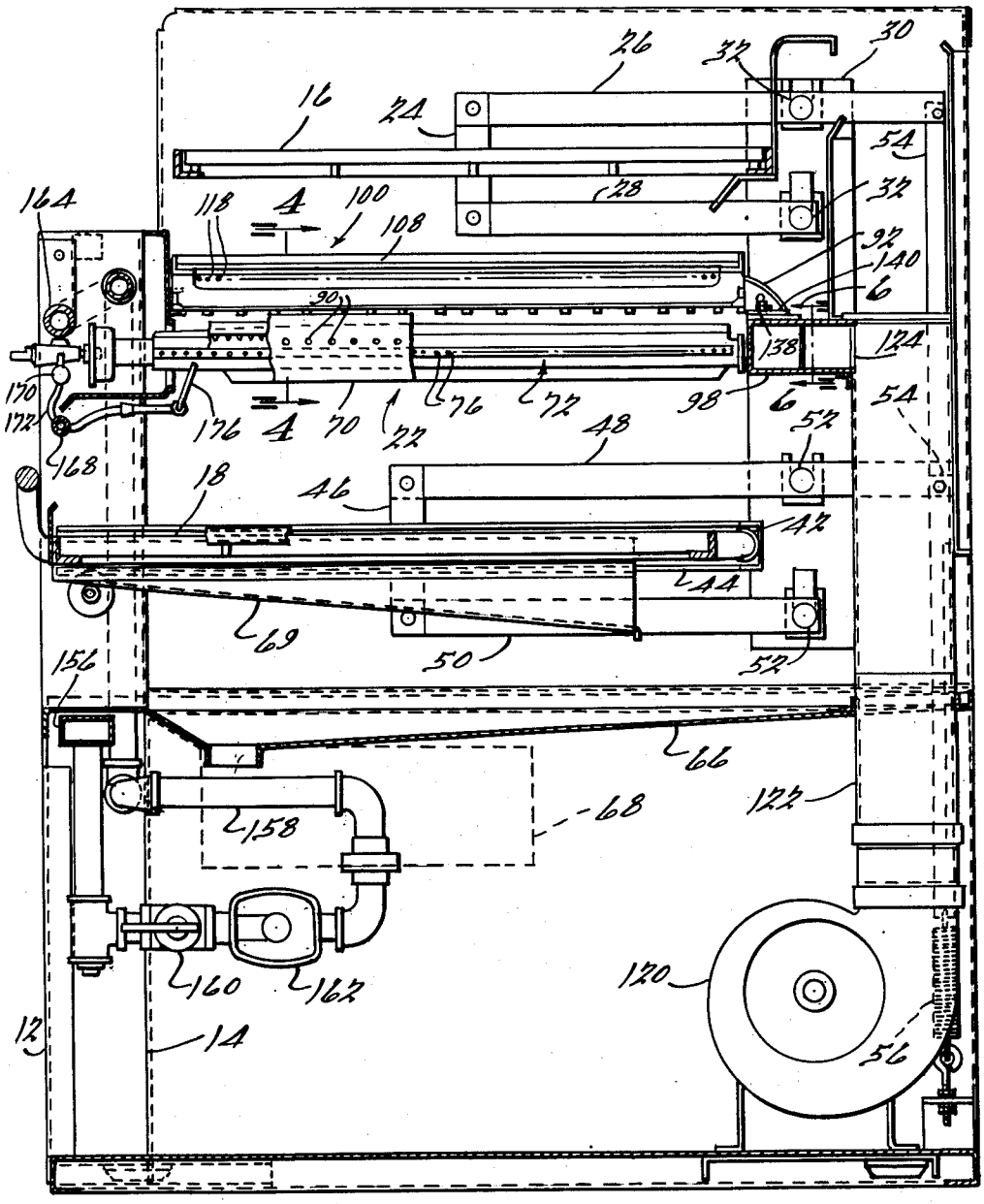


FIG. 3.

INVENTOR.
Carmelo V. Di Pietro
BY
Harness, Dickey & Pierce.
ATTORNEYS

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DUPLEX BROILER

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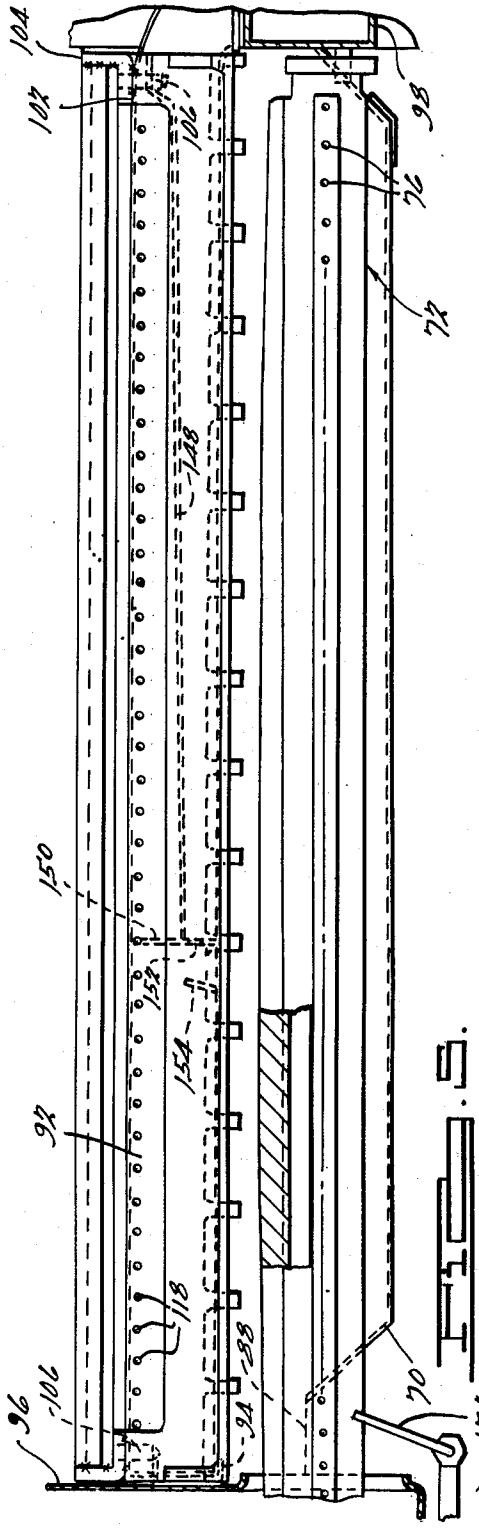


FIG. 5.

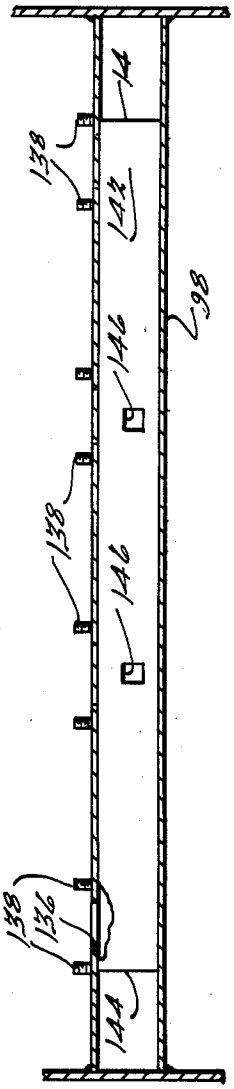


FIG. 6.

INVENTOR.
Carmelo V. Di Pietro.
BY
Barnes, Dickey & Pierce,
ATTORNEYS.

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DUPLEX BROILER

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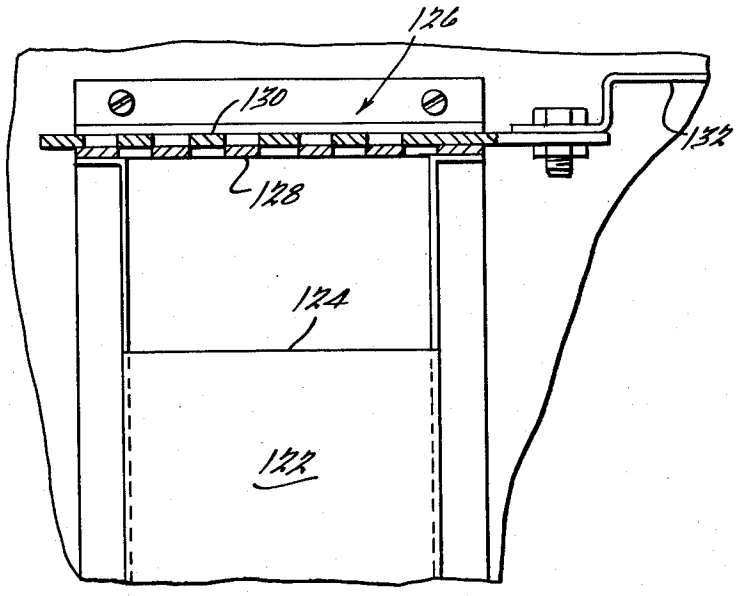


FIG. 7.

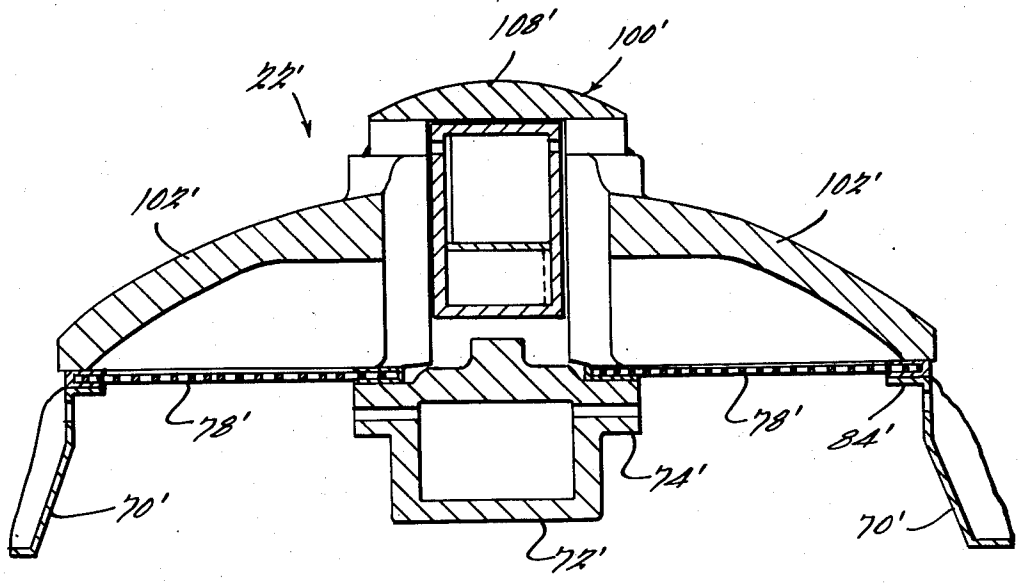


FIG. 8.

INVENTOR.
Carmelo V. Di Pietro.

BY
Harness, Dickey & Pierce
ATTORNEYS

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DUPLEX BROILER

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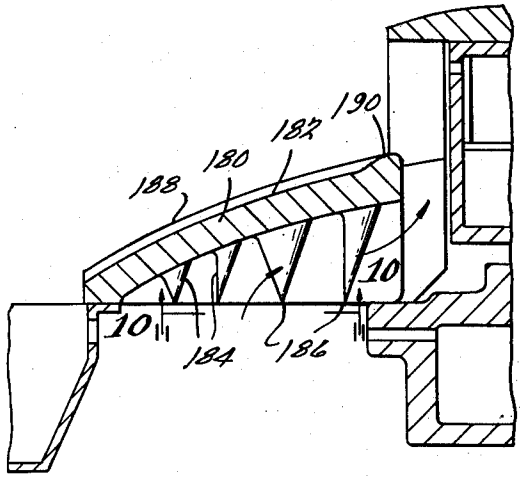


FIG. 9.

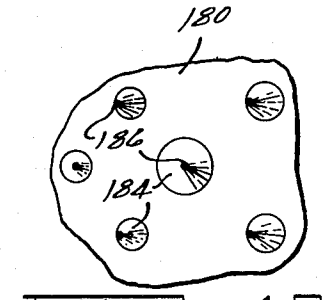
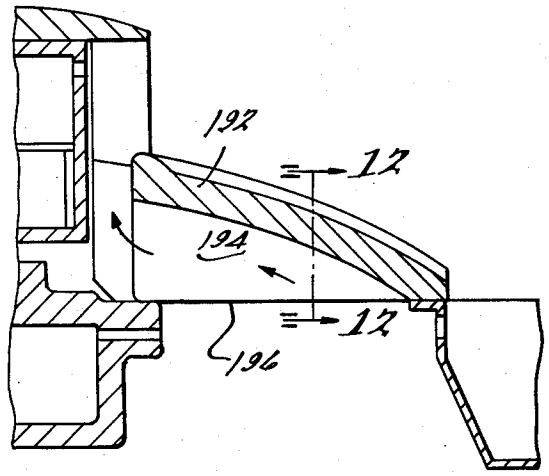


FIG. 10.

FIG. 11.



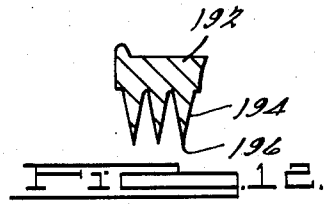


FIG. 12.

INVENTOR.
Carmelo V. Di Pietro
BY
Harness, Dickey & Pierce,
ATTORNEYS.

United States Patent Office 3,146,693 Patented Sept. 1, 1964

3,146,693

DUPLEX BROILER

Carmelo V. Di Pietro, Birmingham, Mich., assignor to Anetsberger Brothers, Inc., Northbrook, Ill., a corporation of Illinois

Filed May 4, 1962, Ser. No. 192,495
7 Claims. (Cl. 99—446)

The present invention relates to broilers and more particularly to an improved duplex broiler in which a single burner assembly is used to provide heat for two vertically spaced grids.

It is an object of the present invention to provide an improved duplex type broiler so constructed and arranged that the upper and lower grids may be used simultaneously with no intermingling of the flavors and in which, by properly adjusting the grids and the air supply, meats may be broiled at high temperatures with complete control of the flame resulting from the burning of drippings of the meats being broiled.

It is also an object of the present invention to provide an improved broiler construction in which complete burning of the grease drippings from the meat on the upper grid is accomplished and the heat from the burning grease is employed to increase the efficiency of the equipment while distributing air over the whole upper radiant surface of the upper radiants to aid in the combustion of the grease and reduce the carbon content which otherwise causes contamination of the food.

Another object of the present invention is to provide an improved duplex broiler having a burner and radiant assembly disposed between upper and lower grids and including a lower radiant disposed to radiate heat to items on the lower grid and having a plurality of apertures therethrough and upper radiants supported above said lower radiants and adapted to be heated by hot gases passing upwardly thereto through the apertures in the lower radiants.

It is also an object of the present invention to provide such an improved duplex broiler construction including means for supplying air to and mixing it with hot gases passing to the upper radiant through the apertures in the lower radiant and directing the mixture of air and hot gases over the upper surface of portions of the upper radiant in a direction generally parallel to the upper grid to provide control of the flame from grease drippings burning on the upper radiant.

It is also an object of the present invention to provide an improved broiler including a grid adapted to support items to be broiled and a plurality of alternately arranged radiants and grease troughs extending below and substantially completely across said grid and including an air duct disposed between a pair of spaced parallel portions of the radiant and having a plurality of longitudinally spaced apertures disposed to direct air substantially horizontally over the upper surfaces of the adjacent portions of the radiants to control the flame of grease drippings burning thereon and provide improved combustion thereof.

Another object of the present invention is to provide an improved broiler which is simple in design, economical of manufacture and operation, and provides improved and efficient broiling without contamination of the items being broiled.

Other and more detailed objects of the present invention will be apparent to those skilled in the art from a consideration of the following specification, the appended claims and the accompanying drawings wherein:

FIGURE 1 is a side elevational view of a broiler constructed according to a preferred embodiment of the present invention, with parts broken away;

FIGURE 2 is an enlarged broken view partly in front elevation and partly in section;

FIGURE 3 is an enlarged vertical sectional view showing parts broken away;

FIGURE 4 is an enlarged broken transverse sectional view showing details of the radiants and burner and associated structure, and taken substantially along the line 4—4 of FIGURE 3;

FIGURE 5 is an enlarged broken longitudinal sectional view showing parts broken away and showing details of the radiants and burner and associated structure;

FIGURE 6 is an enlarged sectional view of the structure illustrated in FIGURE 3 taken substantially along the line 6—6 thereof;

FIGURE 7 is an enlarged sectional view of the structure illustrated in FIGURE 1 taken substantially along the line 7—7 thereof;

FIGURE 8 is an enlarged sectional view similar to FIGURE 4 showing a modified form of the present invention;

FIGURE 9 is a broken sectional view similar to FIGURE 8 showing another modified form of the present invention;

FIGURE 10 is a broken bottom view of that portion of the apparatus illustrated in FIGURE 9 indicated by the line 10—10 thereof;

FIGURE 11 is a broken sectional view similar to FIGURE 8 showing a further modified form of the present invention; and,

FIGURE 12 is a broken sectional view of the structure illustrated in FIGURE 11 taken substantially along the line 12—12 thereof.

Referring to the drawings, the improvements of the present invention are herein illustrated and described with relation to a duplex broiler generally indicated at 10 and comprising a cabinet or housing 12 including a suitable frame 14. Supported in the housing 12 at suitable elevations for convenient use by an operator are an upper grid 16 and a lower grid 18 both adapted to support items to be broiled. The housing 12 is open at the top and front to provide ready access to the upper grid 16 and has a large front opening 20 (see FIGURE 2) to provide access to the lower grid 18. Intermediate the grids 16 and 18 is a radiant and burner assembly generally indicated at 22 suitably supported at a fixed elevation on the housing 12.

To permit individual adjustment of the grids 16 and 18 relative to the radiant and burner assembly 22, each of the grids 16 and 18 are supported by a counterbalanced parallelogram link arrangement (see FIGURE 3) holding the grid in horizontal position while permitting movement vertically toward and from the radiant and burner assembly 22. In the case of the upper grid 16 this is accomplished by vertical bars 24 secured at opposite sides of the grid 16 and pivotally connected to upper and lower parallel links 26 and 28 pivotally supported on the frame 14 through frame elements 30 as indicated at 32. At the front of the grid 16 is a latch handle 34 movable to selectively position a latch blade 36 in the notches 38 of a vertically extending latch plate 40. The lower grid 18, to permit it to be moved outwardly through the housing front opening 20 for easy access, is carried on rollers 42 in a channel frame 44 which is mounted for vertical movement in the same manner as the grid 16 by vertical bars 46 pivotally connected to upper and lower parallel links 48 and 50 pivotally mounted on the frame elements 30 as indicated at 52. The upper links 26 and 48 are extended beyond their pivotal connections to the frame element 30 and connected through tie bars 54 to counterbalance springs 56. The vertical position of the channel frame 44 carrying the lower grid 18 is similarly

adjusted by a latch handle 58 which selectively positions a latch blade 60 in the notches 62 of a latch plate 64.

The drippings from the lower grid 18 are caught in grease pan 66 extending therebelow which funnels the drippings to a removable grease drawer represented at 68 which is suitably supported in the housing 12 and a grease pan baffle 69 is provided movable with the grid 18 to prevent dripping on the floor when the grid 18 is pulled out. Below the upper grid 16 the housing 12 carries a plurality of parallel laterally spaced grease troughs 70 extending from front to rear. Between each pair of troughs 70, the radiant and grid assembly 22 includes a burner 72 extending parallel thereto midway therebetween and having horizontal flanges 74 at opposite sides thereof provided with a plurality of uniformly spaced horizontally extending gas jet openings 76.

At each side of each burner 72 and extending between the burner 72 and the adjacent trough 70 is a lower radiant 78 preferably formed of a ceramic material and generally flat but including a depending flange 80 at one edge thereof providing a leg adapted to support one side of the lower radiant on the horizontal flange 74 of the burner. The lower radiant also has uniformly spaced, over the lower surface thereof, a plurality of downwardly extending generally cone-shaped portions 81 which increase the radiant surface. Intermediate these depending cone-shaped projections 81 the radiants 78 have a plurality of apertures 82 extending upwardly therethrough. The outer edge of each radiant 78 is received between an outwardly extending flange 84 at the top of the trough 70 and the horizontally extending leg of an angle 86 extending horizontally along and secured to the trough 70 below the flange 84. It will now be seen that the troughs 70 are maintained at a high temperature by combined effect of the heat radiated from the lower radiants 78 and the direct heat from the combustion of gas from the jets 76 in the combustion area generally defined by the burner 72, the lower radiant 78 and the trough 70. This high temperature of the troughs 70 insures that any grease drippings will continue to burn in the troughs 70 until only an ash remains which may be cleaned out by dropping it through the slot 88 (see FIGURE 5) provided at the front of each trough 70 by terminating the bottom short of the front end. To facilitate complete combustion in the troughs 70, the side walls thereof facing the radiants 78 are provided with a plurality of apertures 90 spaced therealong below the angles 86.

Disposed in spaced parallel relation above each burner 72 is a rectangular air duct 92, the closed forward end of which is supported by an angle 94 on a frame element 96 (see FIGURE 5). The rear end of each duct 92 is supported upon and communicates with a transversely extending manifold 98 supported on the frame elements 30. An upper radiant 100 fits over and is supported on each air duct 92. In the preferred embodiment illustrated each radiant 100 is fabricated and includes a pair of cast iron radiant halves 102 disposed at opposite sides of the air duct 92 and each overlying one of the lower radiants 78. The radiant halves 102 are secured together by angles 104 extending across the tops thereof at opposite ends and resting on the top of the air duct 92, the angles being secured to the radiant castings 102 by bolts 106 (see FIGURE 5). The top of the air duct 92 is shielded by an angle-shaped cap plate 108 extending between and secured to the angles 104 and disposed with its high point at the center and with downwardly sloping surfaces at each side directing any drippings falling thereon toward the upper surfaces of the radiant halves 102 which in turn slope downwardly and outwardly terminating in edges 110 disposed over the troughs 70.

At their lower sides the radiant castings 102 have a plurality of transversely extending ribs 112 spaced longitudinally thereof. Intermediate the ribs 112 the undersurface of the castings 102 slopes slightly upward toward the center of the radiant 100. Intermediate its ends, the castings 102 are spaced from the air ducts 92 to provide passages 114 extending upwardly therethrough at opposite sides of the air ducts 92. Also, intermediate the opposite ends the upper surfaces 116 of the castings 102 are disposed in spaced relation below the cap plate 108 permitting gases flowing upwardly through the passages 114 to pass laterally outwardly between the cap plate 108 and the upper surfaces 116 of the castings 102. To facilitate and direct control of this flow, and to control the flame resulting from grease burning on othe upper surface 116 of the radiant castings 102, the air ducts 92 are provided with a plurality of apertures 118 in the opposite side walls adjacent the top of the duct 92 for directing a plurality of horizontally disposed jets of air between the cap plate 108 and the upper surface 116 of the castings 102.

Air is supplied to the air duct 92 from a blower 120 mounted in the lower portion of the housing 12 and supplying air under pressure to a stack 122 which is in open communication with the manifold 98 at the back center portion thereof as shown at 124 in FIGURE 3, this opening 124 also being shown in FIGURE 7. The air pressure supplied to the manifold 98 is controlled by an adjustable by-pass valve 126 illustrated in FIGURE 7 permitting more or less of the air to be by-passed or vented from the top of the stack 122. As there illustrated, the by-pass valve 126 comprises a stationary slotted plate 128 extending transversely of the stack 122 and a movable similarly slotted plate 130, the position of which is adjusted through suitable linkage 132 by a control handle 134 disposed at the front of the broiler housing (see FIGURE 2). In the position illustrated in FIGURE 7 it will be appreciated that the by-pass valve 126 is closed and maximum pressure is applied to the manifold 98. The construction of the manifold 98 is best illustrated in FIGURES 3 and 6 where it will be seen that it has apertures 136 at the top front portion thereof individual to the air ducts 92 which are secured thereto by studs 138 extending through plates 140 carried by the ducts 92 and receiving suitable nuts (not shown). The manifold has a centrally disposed baffle 142 extending longitudinally through the central portion thereof and terminating in spaced relation to the ends thereof to permit air to flow around the ends 144 of the baffle 142 to the front side thereof. To facilitate uniform distribution to the apertures 136, the baffle is also provided with openings 146 permitting a limited flow therethrough.

The air ducts 92, as best illustrated in FIGURES 4 and 5, in order to facilitate uniform flow to the apertures 118 thereof has a longitudinally extending baffle 148 extending downwardly and forwardly from the rear end thereof and having its forward end positioned by upwardly and downwardly turned leg portions 150 and 152. Forwardly of the forward end of the baffle 148 the air duct 92 has a baffle 154 extending upwardly from the bottom with a slight angle toward the rear to facilitate reversing the flow of a substantial part of the air to cause it to flow rearwardly above the baffle 148. From the foregoing it will be appreciated that the air is pre-heated before it is discharged through the air duct openings 118.

The broiler 10 is constructed so that it may be connected in a bank of gas operated units and for this purpose has gas connections 154 at opposite sides thereof connected by a large gas line 156. From this line gas is delivered to the burners 72 through a line 158 provided with a main valve 160, and a pressure regulator 162 and leading to a manifold 164 extending across the front of the broiler from which the gas supply to each burner 72 is controlled by a knob 166 (see FIGURE 2) on the front of the broiler. A pilot manifold 168 is supplied from the main burner manifold 164 through a line 172 controlled by a valve 170. At each burner 72 there is a line 174 from the pilot manifold 168 and a pilot light line 176 to each side of the burner 72.

With the above described construction the upper and

lower grids may be used simultaneously with no intermingling of flavors, even when the lower grid **18** is used for the broiling of fish or other odorus food. Also, by properly controlling the adjustable grids and the air supply, meats may be broiled at high temperatures with absolute flame control. At the same time the complete burning of the grease drippings from the meat on the upper grid **16** makes use of the heat from this burning and increases the efficiency of the equipment. At the same time the distribution of the air over the whole upper radiant surface of the upper radiants aids in the combustion of the grease and reduces the carbon content which otherwise causes contamination of the foods. By this combustion of the grease a charcoal broiler type broiling is produced and well marked, tasty foods are provided without contamination of soot, ashes or charcoal.

In FIGURE 8 there is illustrated a modified embodiment of the present invention which could be produced at lower cost. In the radiant and burner assembly **22'** there illustrated, the lower radiant **78'** is formed of perforated metal and could be wire mesh or expanded metal. It similarly extends between and is supported upon the burner **72'** and the grease trough **70'**, one edge portion resting on the burner flange **74'** and the opposite edge being supported on the trough flange **84'**. The upper radiants **100'**, although specifically different than the radiants **100**, are generally the same and include cast radiant halves **102'** provided with a cap **108'** through which they are welded together at their opposite ends.

In the above described embodiments, and more so in the embodiment of FIGURES 1 through 7 than in the modification of FIGURE 8, a major portion of heating of the upper radiants is accomplished by radiation from the lower radiants. If desired, the apertures **82** may be omitted with the result that substantially all of the heating of the upper radiants is by radiation from the lower radiants. Also, a large area contact may be provided to facilitate heating of the upper radiants or, as illustrated in FIGURES 9 to 12, inclusive, the upper and lower radiants may be integrally formed. FIGURES 9 and 10 illustrate one such radiant construction.

In the construction there illustrated the radiant **180** has an arcuately outwardly and downwardly sloping upper surface **182** similar to that of the above described radiants **102** and **102'**. The lower surface of the radiant **180** has a plurality of laterally and longitudinally spaced downwardly extending projections **184** terminating in relatively sharply pointed lower ends **186**. These projections **184** provide a large surface on the lower side of the radiant **180** and the pointed ends **186** thereof attain a high temperature and function similarly to the above described projections **81** on the lower radiants **78** to radiate heat to items on the lower grid. In the construction illustrated the radiant **180** has raised end portions **188** to guide grease away from the ends and has a longitudinally extending raised portion **190** to guide grease away from the upper edge thereof.

The radiant **192** shown in FIGURES 11 and 12 differs from the radiant **180** in that its lower surface is provided with a plurality of thin, closely-spaced fins **194** extending transversely of the lower side thereof and uniformly distributed longitudinally thereof. These thin fins **194** taper to a relatively sharp lower edge **196**.

The radiants **180** and **192** may be formed of any suitable material including, by way of illustration, cast iron, ceramic, carbides, etc.

While only certain specific embodiments of the invention have been illustrated and described herein, it will be readily appreciated by those skilled in the art that numerous modifications and changes may be made without departing from the spirit and scope of the present invention.

What is claimed is:

1. A double broiler comprising a pair of vertically spaced grids adapted to support items to be broiled, a burner and radiant assembly disposed between said grids and adapted to supply heat to items on both of said grids, said burner and radiant assembly comprising lower radiants supported in openly facing relation to the lower of said grids and adapted to radiate heat to items on said lower grid, means for heating said lower radiants, said lower radiants having a plurality of small apertures extending upwardly therethrough to permit hot gases to flow upwardly through said lower radiants, upper radiants supported above said lower radiants and adapted to be heated by said hot gases and adapted to radiate heat to items on the upper of said grids, said upper radiants having upper surface portions adapted to receive and ignite hot grease which drips thereon, and means for flowing air over said surface portions in a direction generally parallel to said upper grid to control the flame resulting from burning grease and substantially reduce the carbon content of the products of combustion, said means for heating said lower radiants comprising a gas burner having generally horizontally directed burner jets disposed adjacent the lower surfaces of said lower radiants, a grease trough assembly comprising a plurality of spaced parallel grease troughs disposed substantially horizontally between said upper and lower grids and having closed ends, a said gas burner being disposed substantially equidistant between each adjacent pair of said grease troughs, a said lower radiant extending across each space between a said gas burner and a said grease trough and supported thereon, said grease troughs being open at the upper sides thereof and co-operating with said lower radiants and said burners to define a combustion area at each side of each of said burners below said lower radiants.

2. A double broiler comprising a pair of vertically spaced grids adapted to support items to be broiled, a burner and radiant assembly disposed between said grids and adapted to supply heat to items on both of said grids, said burner and radiant assembly comprising lower radiants supported in openly facing relation to the lower of said grids and adapted to radiate heat to items on said lower grid, means for heating said lower radiants, said lower radiants having a plurality of small apertures extending upwardly therethrough to permit hot gases to flow upwardly through said lower radiants, upper radiants supported above said lower radiants and adapted to be heated by said hot gases and adapted to radiate heat to items on the upper of said grids, said upper radiants having upper surface portions adapted to receive and ignite hot grease which drips thereon, and means for flowing air over said surface portions in a direction generally parallel to said upper grid to control the flame resulting from burning grease and substantially reduce the carbon content of the products of combustion, said means for heating said lower radiants comprising a gas burner having generally horizontally directed burner jets disposed adjacent the lower surfaces of said lower radiants, a grease trough assembly comprising a plurality of spaced parallel grease troughs disposed substantially horizontally between said upper and lower grids and having closed ends, a said gas burner being disposed substantially equidistant between each adjacent pair of said grease troughs, a said lower radiant extending across each space between a said gas burner and a said grease trough and supported thereon, said grease troughs being open at the upper sides thereof and co-operating with said lower radiants and said burners to define a combustion area at each side of each of said burners below said lower radiants, each of said upper radiants spanning the space between adjacent grease troughs and having said upper portions thereof each sloping toward and adapted to drain excess grease therefrom into one of said grease troughs where it may continue to burn.

3. A double broiler comprising a pair of vertically spaced grids adapted to support items to be broiled, a burner and radiant assembly disposed between said grids and adapted to supply heat to items on both of said grids,

said burner and radiant assembly comprising lower radiants supported in openly facing relation to the lower of said grids and adapted to radiate heat to items on said lower grid, means for heating said lower radiants, said lower radiants having a plurality of small apertures extending upwardly therethrough to permit hot gases to flow upwardly through said lower radiants, upper radiants supported above said lower radiants and adapted to be heated by said hot gases and adapted to radiate heat to items on the upper of said grids, said upper radiants having upper surface portions adapted to receive and ignite hot grease which drips thereon, and means for flowing air over said surface portions in a direction generally parallel to said upper grid to control the flame resulting from burning grease and substantially reduce the carbon content of the products of combustion, said means for heating said lower radiants comprising a gas burner having generally horizontally directed burner jets disposed adjacent the lower surfaces of said lower radiants, a grease trough assembly comprising a plurality of spaced parallel grease troughs disposed between said upper and lower grids, a said gas burner being disposed substantially equidistant between each adjacent pair of said grease troughs, a said lower radiant extending across each space between a said gas burner and a said grease trough and supported thereon, said grease troughs being open at the upper sides thereof and co-operating with said lower radiants and said burners to define a combustion area at each side of each of said burners below said lower radiants, each of said upper radiants spanning the space between adjacent grease troughs and having said upper portions thereof each sloping toward and adapted to drain excess grease therefrom into one of said grease troughs where it may continue to burn, each of said grease troughs having apertures in the side walls thereof opening thereinto from the upper portion of said combustion areas to facilitate complete burning of greases in said troughs.

4. A broiler comprising a grid adapted to support items to be broiled, a plurality of alternately arranged radiants and substantially horizontal grease troughs having closed ends, each said radiant and grease trough extending below and substantially completely across said grid, each said radiant including a pair of spaced parallel portions each having an upper surface sloped to drain excess grease and the like into one of said grease troughs for burning therein, means supporting said grease troughs in a grease igniting relation with said radiants, and an air duct disposed between said spaced parallel portions of each pair thereof and having a plurality of longitudinally spaced apertures disposed to direct substantially horizontally extending jets of air over the upper surfaces of the adjacent of said portions of said radiants.

5. A broiler as defined in claim 4 wherein the bottoms of said grease troughs are disposed substantially below the upper surfaces of said portions of said radiants so that the flame of grease burning in said troughs will not objectionably affect items on said grid, and wherein the jets of air from adjacent air ducts meet over said troughs.

6. A broiler, comprising a grid adapted to support items to be broiled, a plurality of radiants and substantially horizontal grease troughs having closed ends and disposed parallel to each other and extending below and substantially completely across said grid, each said radiant having an upper surface sloped to drain excess grease and the like into one of said grease troughs for burning therein, means supporting said grease troughs in a grease igniting relation with said radiants, and an air duct disposed adjacent each said radiant and having a plurality of longitudinally spaced apertures disposed to direct substantially horizontally extending jets of air over the upper surfaces of the adjacent of said portions of said radiants.

7. A broiler, comprising a grid adapted to support items to be broiled, and a burner and radiant assembly disposed below and extending substantially completely across said grid, comprising spaced, parallel burner means, radiants associated with each said burner means to protect the same from grease and the like dripping from said grid and each having an upper surface sloped to drain excess grease away from said burner means, a substantially horizontal, closed ended grease trough disposed in an adjacent, grease igniting relation with each said burner means and the associated said radiant for receiving such excess grease drained from the adjacent said upper surface for igniting it, and secondary air supply means selectively controllable to effect proper combustion of excess grease collected in said grease troughs.

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