

March 17, 1970

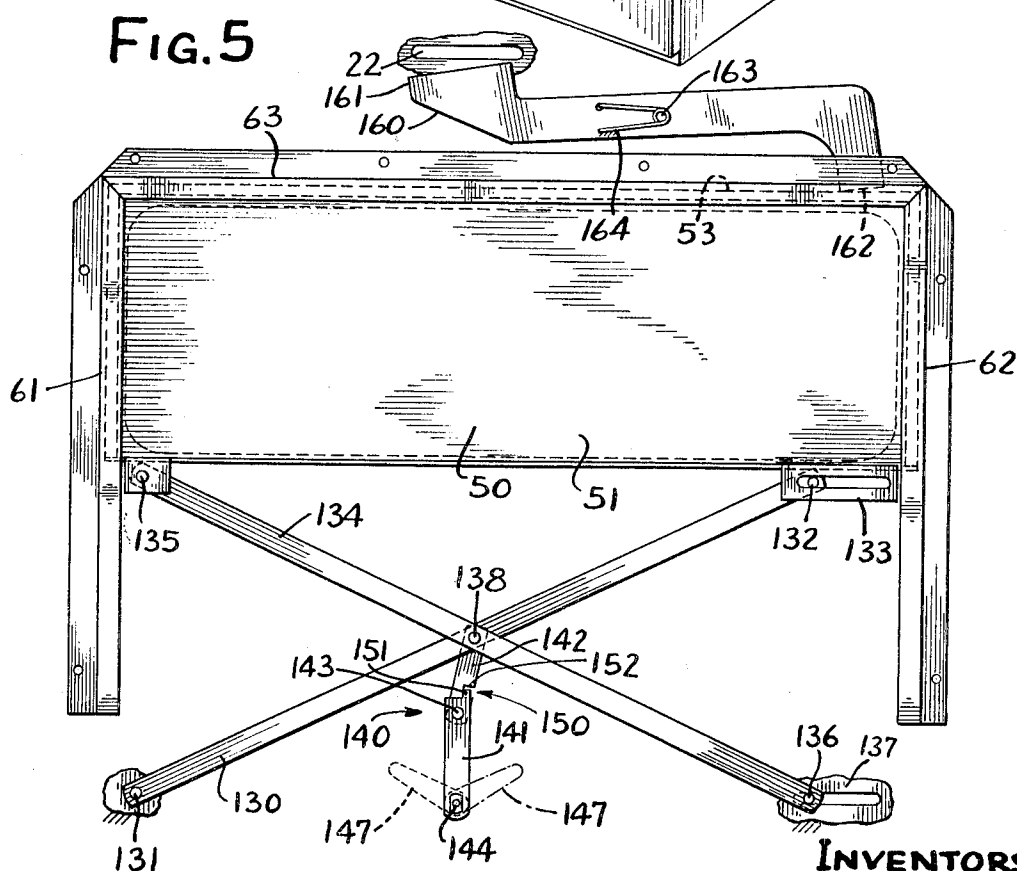
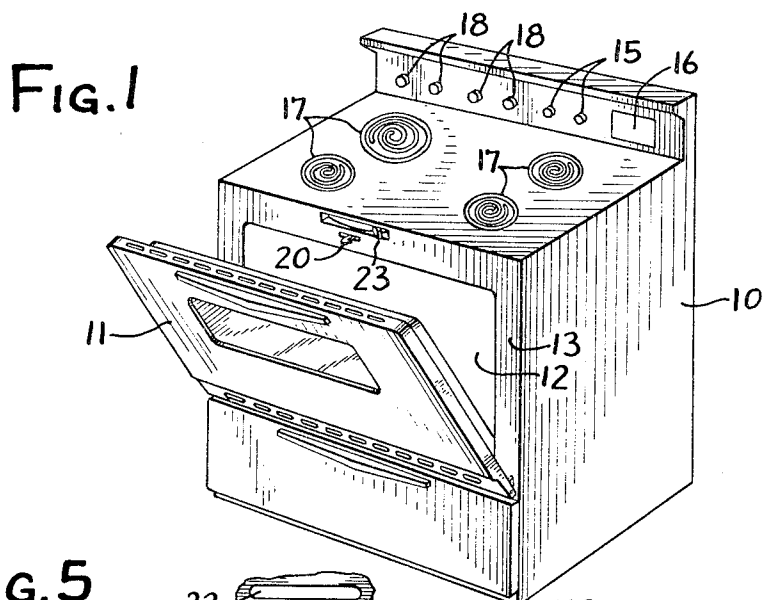
R. P. DE WEESE ET AL

3,500,815

WINDOWED DOOR FOR SELF-CLEANING OVEN

Filed May 21, 1968

3 Sheets-Sheet 1



INVENTORS

RAYMOND P. DE WEESE
ELMER H. MEISINGER
FRANK D. PRINDLE

by: Wolfe, Hubbard, Voit & Osann
ATTYS.

March 17, 1970

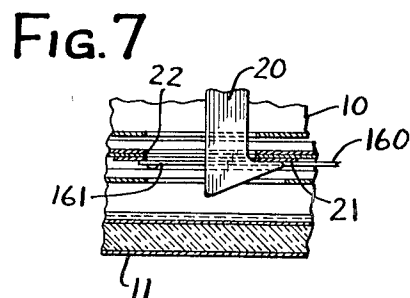
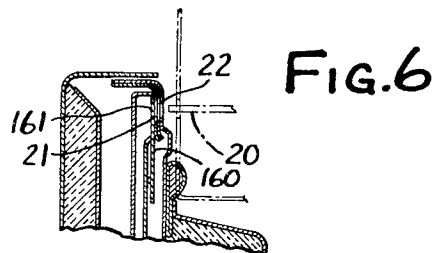
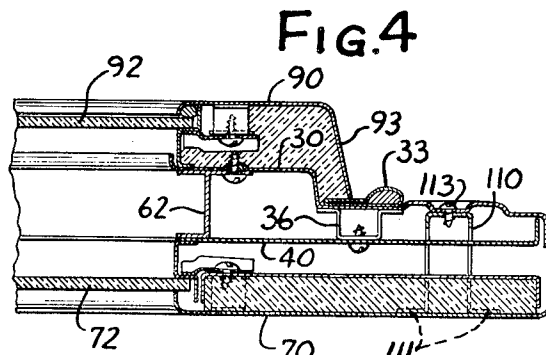
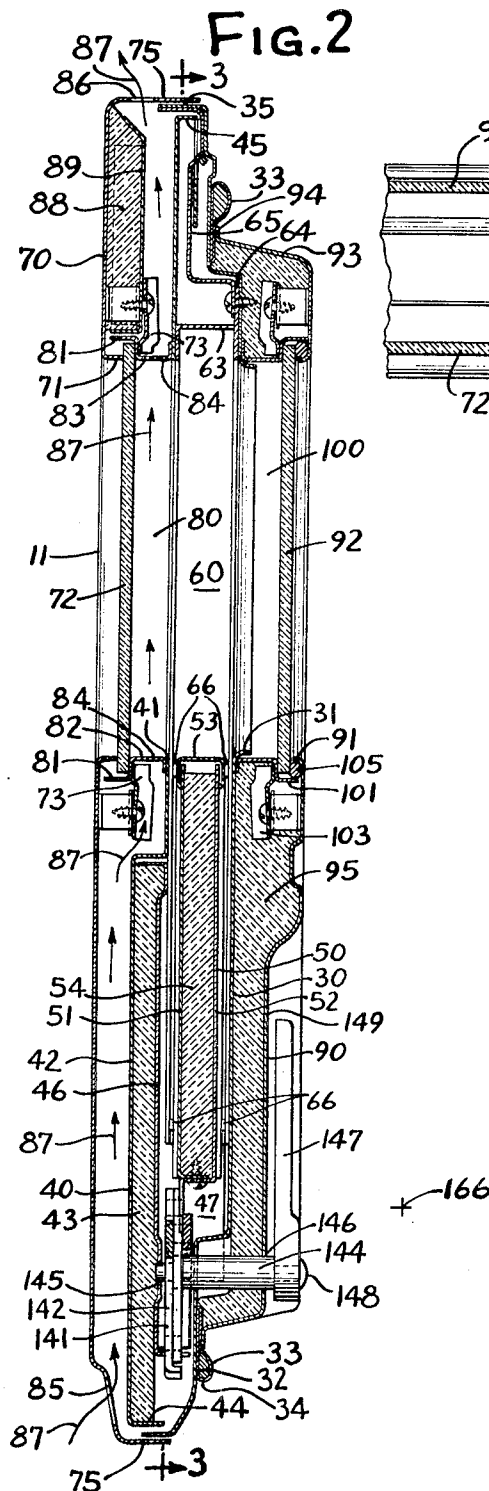
R. P. DE WEESE ET AL

3,500,815

WINDOWED DOOR FOR SELF-CLEANING OVEN

Filed May 21, 1968

3 Sheets-Sheet 2



INVENTORS
 RAYMOND P. DE WEESE
 ELMER H. MEISINGER
 FRANK D. PRINDLE

by: Wolfe, Hubbard, Voit & Osann
ATTYS

1

2

3,500,815

WINDOWED DOOR FOR SELF-CLEANING OVEN

Raymond P. DeWeese, Elmer H. Meisinger, and Frank D. Prindle, Kankakee, Ill., assignors to Geo. D. Roper Corporation, Kankakee, Ill., a corporation of Delaware

Filed May 21, 1968, Ser. No. 733,217

Int. Cl. F24c 15/04

U.S. Cl. 126—200

12 Claims

ABSTRACT OF THE DISCLOSURE

A door for a self-cleaning oven formed of spaced panels having registering window openings, enclosed front and back by sheets of glass with a shutter normally occupying a pocket below window level between adjacent panels with linkage for manually elevating the shutter into radiation-obstructing position in the window. Ports are provided for flow of cooling air behind the front panel and an interlock is provided for preventing start of the self-cleaning cycle unless the shutter is in place.

It is an object of the invention to provide a windowed door for a self-cleaning oven which is highly efficient minimizing loss of heat from the oven cavity either by way of conduction, convection or radiation. It is a related object to provide a door for a self-cleaning oven which permits temperatures on the order of 900° F. to be achieved inside the oven while maintaining the front of the oven at a safe low temperature level. It is another object of the invention to provide, in a door of the present type, a shutter which not only obstructs and reflects radiation from inside the oven but which is internally insulated so as to prevent any appreciable conduction of heat from the inside surface of the shutter to the outside.

It is another object of the invention to provide a windowed door for an oven in which the radiation-obstructing shutter has a linkage for raising and lowering which is extremely compact, occupying a narrow space at the lower edge of the door but which nevertheless has a large stroke with a toggle arranged to support the shutter in its elevated position, permitting use of a window of maximum size.

In one of the aspects of the invention it is an object to provide an effective interlock to prevent the start of a self-cleaning cycle unless and until the shutter is in its fully upraised position; once in this position, with the range in its locked cleaning mode, the shutter position cannot be altered. This is accomplished in the present instance by an obstructing member which consists of a single pivoted lever and a shutter raising handle located on the inside of the closed and locked door.

It is yet another object to provide a windowed door for a self-cleaning oven which is efficient, yet inherently simple to make and assemble.

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 perspective view of a range having a door utilizing the present invention;

FIG. 2 is a sectional view looking along the line 2—2 in FIG. 3;

FIG. 3 is a sectional view looking along the line 3—3 in FIG. 2;

FIG. 4 is a fragmentary section looking along the line 4—4 in FIG. 3;

FIG. 5 is a diagram showing the shutter elevating linkage in the upraised, toggled position and with the interlock engaged;

FIG. 6 is a fragmentary elevation looking along the line 6—6 in FIG. 3 and showing the interlock in obstructing position; and

FIG. 7 is a fragmentary section looking along the line 7—7 in FIG. 3 showing the interlock in non-obstructing position and the lock engaged.

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 we intend to cover, on the contrary, the various alternative and equivalent constructions included within the spirit and scope of the appended claims.

Turning now to FIGURE 1, there is shown a range 10 of the free-standing type having a door 11 constructed in accordance with the present invention which encloses an oven cavity 12 surrounded by a facing or jamb surface 13. The oven has heating means (not shown) which are employed for baking and for raising the temperature of the oven to a self-cleaning level, on the order of 750°–900° F. or above, with appropriate setting of the controls 15 and timer 16. To complete the structure, heating elements 17 are provided on the cooking top under the control of the usual control knobs 18.

Reference may be made, if desired, to prior patents and publications disclosing self-cleaning ovens as, for example, Hurko Patent 3,121,158. It will suffice to say that incident to initiating a self-cleaning cycle the oven door 11 is locked closed by a hook type locking member 20 which engages a member 21 through an access slot 22 (FIG. 7), the member 20 being projectable from the jamb surface upon throwing of a locking arm 23. In ovens of the self-cleaning type the lock member is held in its locking position until the temperature within the oven cavity is again reduced to a safe level.

In accordance with the present invention a door is provided having a window in the upper portion thereof and which is distinguished by a liner panel and intermediate panel spaced from one another to form a storage pocket for an insulated shutter with means for transporting the shutter upwardly into radiation-obstructing position. Spaced outwardly from the intermediate panel to define a space for conducting cooling air is a front panel, and spaced rearwardly from the liner, and insulated therefrom, its a door plug, the front panel and door plug having registering openings each covered by a sheet of heat-resistant glass. Thus, turning particularly to FIG. 2, the door 11 has a liner panel 30 providing a window opening 31 of generally rectangular shape. The liner panel is bordered by a flat land surface 32 upon which is seated a gasket 33 to seal the joint with the oven jamb surface 13 about the top and sides of the door. The gasket 33 is preferably interrupted at 34 along the bottom edge of the door to permit a small amount of air to enter during the self-cleaning cycle. The edges of the panel 30 are bent forwardly as shown at 35 to provide a peripheral flange for mating with a similar flange on a front panel as will be discussed.

Spaced forwardly from the liner panel 30 and mounted on pillars 36, which are four in number, is an intermediate panel 40 providing a window opening 41 and having a forwardly offset portion 42 for defining a space 43 behind it, which is filled with insulation. The intermediate panel is flanged at the bottom and top as indicated at 44, 45. A retainer panel 46 serves to enclose the space 43 to confine the insulation and to serve as a mounting plate for shutter-elevating linkage to be described. The structure described thus far defines a pocket 47 which accommodates an insulated shutter 50 slightly larger than the window opening. The shutter has spaced front and back walls 51, 52 and a periphery 53 defining a central space 54

which is preferably packed with insulation. The walls 51, 52 are both made of heat-resistant sheet material, as for example, steel, and at least the rear wall is provided with a heat-reflecting surface which may, for example, be aluminized. The front wall may be decoratively finished as desired.

To conduct the shutter upwardly and downwardly, track structure 60 is provided having vertical track members 61, 62 of channel-shaped cross section bridged by a channel shaped top member 63. The track members surround the window opening and serve as a rigid spacing member between the panels 30, 40 on each side. The track structure is held in place by an integral flange 64 clamped under an auxiliary clamping member 65. For the purpose of facilitating movement of the shutter and to take up the excess space within the channels, the shutter is provided with anti-friction shoes in the form of graphite pads 66.

In carrying out the present invention a front panel 70 is provided having a window opening 71 aligned with the window openings 31, 41 and covered by a sheet of heat-resistant glass 72, the glass being held in place by suitable clamps 73. The front panel is bent rearwardly about its edges to provide a rearwardly extending flange as indicated at 75 which overlies the flanges 35 on the liner panel and which is secured to the latter by means of recessed screws 76. To provide rigid seating of the front panel, with respect to the intermediate panel, while permitting passage of air through the interspace and behind the glass window 72, a spacer frame 80 is provided formed of metal of channel cross section which is shaped to surround and generally conform to the shape of the window opening. The spacer frame 80 preferably has a forwardly extending flange 81 which defines a receptacle for seating the sheet of glass 72. Moreover, the spacer frame 80, and particularly the lower and upper runs thereof indicated at 82, 83, has a set of perforations 84 occupying approximately fifty percent of the area for conducting cooling air along the inner surface of the glass. For admitting cooling air along the lower edge of the outer panel 70, such panel is provided with a set of slot-like apertures 85. A set of apertures 86 formed in the upper run of flange 75 provides venting at the top of the door structure. Cooling air thus flows along the path of the arrows 87, entering at the bottom and exiting at the top. Since the cooling air is heated by the time that it reaches the top of the door ready for discharge, means are provided for preventing direct thermal contact between the heated air and the upper portion of the outer panel. This is accomplished in the present instance by a body of insulation 88 held in place by an insulation retainer 89.

Mounted at the rear of the door is a door plug 90 of rectangular "pan" shape having a window opening 91 which registers with the window openings in the panels previously described and which is covered by a sheet of heat-resistant glass 92. The plug 90 is of "drawn" construction having a sidewall 93 terminating in a lip 94 of smaller profile than the liner panel and which serves to clampingly hold in place the strip of gasketing material 33 previously mentioned. The space 95 between the oven plug and the liner panel is preferably filled with insulation.

Interposed between the door plug 90 and the liner panel 30 is a second spacer frame 100, similar to the spacer frame 80 and having a rearwardly extending flange 101 which serves as a receptacle for the glass window 92, the spacer frame and window being clamped securely to the door plug by means of clamps 103. A resilient gasket 105 interposed between the glass window 92 and the door plug seals the glass and prevents passage of the products of decomposition into the door structure during a self-cleaning cycle.

In carrying out the present invention a first set of internal pillars are provided for connecting the front panel subassembly to the liner panel so that the spacer frame

on the front panel assembly engages the intermediate panel about the periphery of the window and in juxtaposed relation the guide tracks. Moreover, a second set of pillars are provided for connecting the door plug assembly to the liner panel so that the spacer frame which forms a part of the door plug assembly bears against the liner panel in the region around the window and, again, aligned with the guide tracks so that there is bottomed seating of all of the superimposed members upon one another about the periphery of the window thereby to rigidify the door structure and to enable easy assembly. Thus in assembling the present door, the liner panel and intermediate panel are first secured together with the channel shaped track assembly between them and with the shutter and control mechanism, to be described, mounted between them. For securing the front panel to the liner panel, pillars 110 are provided which are preferably spot welded at 111 to the front panel and which form a seat for the forwardly facing, inside surface of the liner panel. A screw 113 penetrating a registering opening in the liner panel screws into a suitably tapped hole in the surface 112. A total of six of such pillars 110 may be used. Similar, but shorter, pillars 120 are used to secure the door plug to the liner panel. Such pillars indicated at 120, and four in number, are spot welded to the liner panel as indicated at 121 to provide a supporting surface 122. A suitable machine screw penetrating a registering opening in the door plug engages the pillar 120, drawing the door plug up tight so that the spacer frame 100 bears against the rear surface of the liner panel and so that the gasketing material 33 is simultaneously clamped into position against the land surface on the liner panel. Not only do the pillars 110, 120 insure easy assembly to form a rigid and securely clamped door unit, but they permit easy disassembly whenever it may be necessary to have access to the interior of the door, for example, when it becomes necessary to clean the inside surfaces of the glass windows 72, 92.

It is one of the features of the present construction that a manually operated linkage is provided for transporting the shutter 50 upwardly into its obstructing position between the windows. Such linkage, shown in FIGS. 3 and 5, is preferably of the lazy tongs type actuated by a pair of toggle links which in turn are operated by a manual operating arm occupying a shallow recess in the surface of the door plug. Thus, the lazy tongs linkage includes a first link 130 having a pivot 131 which is relatively stationary and having a second pivot 132 which engages a slotted member 133 at the lower edge of the shutter. In crossed relation is a second link 134 which is pivoted at 135 to the lower edge of the shutter, and which has a second pivot 136 which engages a slotted stationary member 137. To insure equalized movement of the two links, they are connected, at their centers, by a pivot 138. To elevate the point of pivoting 138, a toggle linkage 140 is provided having a first toggle member 141 and a second toggle member 142 pivoted together at a common pivot 143. Toggle member 141 is secured, at its lower end, to a shaft 144 which is journaled in suitable openings 145, 146 in the panel members 46, 90, respectively. A manual operating arm 147 secured to the shaft 144 by a screw 148 occupies a shallow recess 149 formed in the door plug.

For the purpose of defining a relative position of the two toggle links 141, 142, which is just beyond the vertical dead center position, a stop 150 in the form of a tang 151 on one of them which bottoms in a groove 152 in the other. Thus, in operation, throwing the arm 147 from its normal position to its shutter-raising position causes rotation of the shaft 144 in the counterclockwise direction producing extension of the two toggle members 141, 142 and elevation of the central pivot 138. This causes the two links 131, 134 to expand with scissor-like action raising the upper points of pivoting, 132, 135 of the links so that the shutter occupies a radiation-obstructing posi-

tion between the windows 72, 92. Since the toggle links rotate slightly overcenter, before bottoming of the stops 151, 152 occurs, the shutter is stably held in its upraised position without any special latching means and without resorting to friction. The shutter is lowered with equal ease simply by reversing the direction of movement of the actuating arm 147. When the shutter is in its lowered position, the upper edge indicated at 53 in FIG. 2 spans the pocket and lies flush with respect to the spacer frame 82 and window edge 31 thereby to provide a smooth finished appearance when viewed through the front window 72.

In accordance with one of the aspects of the present invention, a mechanical interlock is provided at the upper edge of the door for normally covering the access slot 22 to prevent entry of the hook or locking member 20. This is accomplished in the present instance by an obstructing member 160 having a slot obstructing portion 161 at one end an engageable portion 162 at the other, the member being pivoted centrally at 163. A spring 164 normally biases the obstructing member in the direction of the arrow 165 so that the slot is obstructed as shown in the fragmentary view, FIG. 6. Thus in the event that someone attempts to operate the lever 21 (FIG. 1) by swinging it into its locking position, the projection of the locking member or hook 20, reacting with the obstructing member causes the door 11 to be pressed outwardly thus signalling to the user that the shutter has not been raised as required. The door is then opened about its lower hinge (not shown but having a center 166), and the shutter actuating arm is swung to its alternate position, expanding the linkage, raising the shutter and causing the obstructing member 160 to be rotated about the central pivot 163 so that the end 161 thereof moves out of register with respect to the slot 22. Subsequent movement of the locking lever 21 will then cause the hook 20 to move through the slot for hooking onto the hook engaging member 21 which forms a part of the door structure.

It is found that a door constructed as described above not only inhibits loss of heat by radiation, conduction or convection, but presents an exterior panel surface which remains at a safety low temperature in spite of the fact that the oven cavity may be raised to a temperature of 800° F. or more for a period which is as variable but which may be long as several hours. It is to be particularly noted that the shutter, in addition to providing a radiation reflecting surface 52, which insures proper cleaning of the interior window surface 92, is filled with insulation to inhibit thermal conduction which may have the effect of raising the temperature of the outer surface 51 of the shutter beyond safe limits. The rigid insulated shutter which fits tightly within the tracks 60 has the further advantage, in the event of breakage of the inner glass, of inhibiting passage of outside air into the oven cavity to form a possibly explosive mixture. It will be appreciated that since the inner surface 52 of the shutter is subjected to a high level of thermal radiation, notwithstanding use of the aluminized surface, and is less than one hundred percent efficient, a portion of such radiation is absorbed to raise the temperature of the inner surface of the shutter. However, due to the presence of the insulation 54, the outer surface 51 is kept below a temperature at which any harmful degree of radiation can occur. Thus one's hand may be placed directly in front of the window during the self-cleaning cycle without feeling more than a gentle warmth, and there is no risk of overheating and possibly damaging a piece of kitchen furniture which may be inadvertently placed in front of the oven during the time that self-cleaning is going on. Moreover, the surface 51 of the shutter may be decoratively finished to provide an attractive appearance when elevated into view without risk that the decoration will become scorched by overheating.

The arrangement is highly compact since the lazy tongs linkage occupies only a very small space at the lower edge of the shutter which, in turn, permits, a maximum window

size; yet the linkage provides a long stroke necessary to move the shutter to its fully upraised position. Positive mechanical interlocking is provided by placing the obstructing member 160 directly in the path of movement of the upper edge of the shutter. Upon engagement, the obstructing member is rotated against the force of its biasing spring 164 as the toggle linkage 141, 142 approaches and as it moves beyond its dead center position with a high degree of mechanical advantage. The fact that the shutter remains upraised when the actuating arm 147 is released is proof positive that the linkage has been moved beyond center and that the mechanical interlock has been fully actuated.

What is claimed is:

1. In a door for enclosing a self-cleaning oven, the combination comprising a liner panel and an intermediate panel having registering window openings in the upper half thereof, the members being spaced apart to define a pocket below the window level, a front panel spaced forwardly of the intermediate panel, a door plug spaced rearwardly of the liner panel, said front panel and door plug each having registering window openings, sheets of high temperature glass covering the window openings in the front panel and door plug, a rectangularly shaped shutter in said pocket of a dimension larger than the window openings, said shutter being formed of spaced layers of heat resistant material defining a central space substantially filled with thermal insulation, tracks for guiding the shutter upwardly, and manually operated means for elevating the shutter along the tracks into a position fully obstructing the window openings thereby to obstruct direct radiation of heat from the oven.

2. The combination as claimed in claim 1 in which the inner layer of heat resistant material has a heat reflecting surface.

3. The combination as claimed in claim 1 in which the door plug is pan shaped having a lip of smaller outer dimension than the door liner to define a peripheral land surface for seating of the door against the oven structure, a layer of gasketing material held captive between the lip on the door plug and the door liner in a position overlying the land surface.

4. The combination as claimed in claim 1 in which the elevating means includes a lazy tongs linkage arranged below the shutter and coupled to it with a manual operator for extending the lazy tongs linkage thereby to move the shutter into its obstructing position.

5. The combination as claimed in claim 4 in which the manual operating means is in the form of a pair of toggled links having an accessible manual operating handle and so arranged that the toggle links move beyond their dead center position as the shutter reaches the upper limit of its movement, thereby to sustain the shutter in upraised position.

6. The combination as claimed in claim 1 in which the front panel is provided with openings along its lower and upper edges to permit the air which enters at the bottom to flow between the sheet of glass mounted in the front panel and the shutter when the shutter is in the raised position.

7. The combination as claimed in claim 1 in which the track is in the form of a spacer frame of channel cross section sandwiched between the door liner panel and the intermediate panel in a position juxtaposed to the other two spacer frames, and fastener means for maintaining the assembly made up of the spacer frames and panels solidly bottomed upon one another to rigidify the construction.

8. In a door for enclosing a self-cleaning oven having a manually operated locking member projectable from the oven jamb for entering into the oven door structure for engaging and locking the same, the combination comprising a door liner panel presenting a flat marginal surface for flatly engaging the oven door jamb, an intermediate panel, said panels having registering window openings

near the top portion thereof and spaced apart to define a pocket below the window level, a front panel spaced forwardly of the intermediate panel and a door plug spaced rearwardly of the liner panel and both supporting glass windows alined with the window openings in the liner panel and intermediate panel, a pair of vertical track members leading from the pocket to the space between the glass windows, a shutter mounted in the track members and normally occupying a position recessed in the pocket, a lock engageable member behind the liner panel and adjacent the periphery and having an access slot for entry of the projectable locking member on the jamb of the oven, a movable obstructing member mounted adjacent the slot and biased into normal obstructing position to prevent entry of the projectable locking member, manual means for elevating the shutter along said tracks into a position between the glass windows to prevent direct radiation of heat therethrough, and means for coupling the obstructing member to the shutter so arranged that when the shutter moves into its upper position the obstructing member is moved against the force of bias to a position clear of said slot thereby to permit entry of the projectable locking member for locking of the door during a self-cleaning cycle.

9. The combination as claimed in claim 8 in which the movable obstructing member is in the form of a centrally pivoted lever having one end normally positioned obstructingly adjacent the slot and the other end arranged in the path of movement of the shutter to effect rocking of the lever during the last portion of movement of the shutter.

10. In a door enclosing a heated cavity the combination comprising an outer door panel having a window opening, an inner door panel having a registering window opening, a first sheet of heat resisting glass, a second sheet of heat resisting glass, a void between the glass sheets and a heat insulating shutter formed of spaced layers of heat resistant material defining a central space substantially filled with thermal insulation, such shutter being movable between the glass sheets so as to obstruct direct radiation of heat from the heated cavity.

11. In a door for enclosing a self-cleaning oven, the combination comprising a liner panel and an intermediate panel having registering window openings near the top, a guide frame including vertical inwardly facing track members along the lateral edges of the window opening and extending downwardly to define a pocket below window level, an insulating shutter having its lateral edges slidably fitted in said track members, a front panel spaced forwardly of the intermediate panel and having a registering window opening covered by a first sheet of heat-resistant glass, a first spacer frame behind the first sheet of glass including clamping means for clamping the spacer

frame to the front panel to provide a front subassembly, a door plug having a registering window opening covered by a second sheet of glass, means including a second spacer frame having clamps for clamping the second spacer frame and sheet of glass to the door plug to provide a door plug subassembly, mating flanges at the periphery of the liner panel and front panel, first mounting means including pillars between the front panel and the liner panel for clamping the front panel assembly so that the first spacer frame bears against the intermediate panel in the region of the tracks, and second mounting means including pillars for clamping the door plug subassembly with respect to the door liner panel so that the second spacer frame bears against the door liner panel in the region of the tracks to provide a solid stack of superimposed structural elements about the window all the way from the front panel to the door plug thereby to rigidify the central portion of the door, and manual means for elevating the shutter along the tracks into radiation-obstructing position between the glass windows.

12. In a door for enclosing a self-cleaning oven, the combination comprising a liner panel and an intermediate panel having registering window openings in the upper half thereof, the members being spaced apart to define a pocket below the window level, a front panel spaced forwardly of the intermediate panel, a door plug spaced rearwardly of the liner panel, said front panel and door plug each having registering window openings, sheets of high temperature glass covering the window openings in the front panel and door plug, a rectangularly shaped heat insulating shutter in said pockets of a dimension larger than the window openings, said shutter having inner and outer walls uniformly spaced from one another and with the space between the walls being occupied by thermal insulating material to inhibit transfer of conducted heat from the inner wall to the outer wall through the thickness dimension, tracks for guiding the shutter upwardly, and manually operated means for elevating the shutter along the tracks into a position fully obstructing the window openings thereby to obstruct direct radiation of heat from the oven, said front panel having openings along its lower and upper edges to permit air entering at the bottom to flow between the sheet of glass mounted in the front panel and the outer wall of the shutter when the shutter is in the raised position.

References Cited

UNITED STATES PATENTS

3,311,106	3/1967	Boughman et al.	126—200
3,396,717	8/1968	Winkler et al.	126—200

KENNETH W. SPRAGUE, Primary Examiner