A sliding shielded window arrangement for a self-cleaning oven door having an outer glass panel and a pair of aligned inner glass panels forming a sealed hot air cavity. The door structure supporting the glass panels includes an inner panel defining with a spaced outside panel of the door a vertical air flow channel in the shield well. A plain or uninsulated flat plate reflective shield is movable in the channel to a raised blocking position adjacent the outer glass panel such that when the shield is in its raised position it defines a relatively large air wash channel for the exposed inner glass panel and a relatively small cool air channel communicating respectively with a pair of front and rear laminar air flow passages to provide an air barrier for the door area above the outer glass panel to attain allowable outer panel temperatures.

4 Claims, 6 Drawing Figures
SHIELDED WINDOW ARRANGEMENT FOR A HEAT CLEANING OVEN DOOR

The present invention relates to windowed oven doors and more particularly to an oven door sliding shield arrangement for use with household ranges incorporating self-cleaning ovens.

It has been proposed to provide windowed doors for self-cleaning ovens with an insulated sliding shutter located between a pair of glass sheets which normally occupies a space below the window level between adjacent panels of the oven door for manually elevating the shutter into radiation obstructing position between the glass sheets. Such a prior art device is disclosed in U.S. Pat. No. 3,500,815 issued Mar. 17, 1970 to R. P. DeWese et al. who further discloses ventilation ports allowing the flow of cooling air behind the front panel of the door and the outermost glass sheet. The prior art, however, has failed to achieve a windowed oven door for a self-cleaning range having an uninsulated flat plate sliding shield which will maintain outer panel temperatures at a reduced temperature level with the oven heated to a self-cleaning temperature while allowing the shield to operate mechanically with little or no effort on the part of the range operator.

It is an object of the present invention to provide in an oven door having spaced inner and outer window panes an uninsulated reflective sliding flat metal shield between the panes and closer to said outer pane than to said inner panes to reduce panel temperatures. It is another object of the present invention to provide a shielded windowed oven door having air passages on both the inner and outer surfaces of the shield in combination with a fixed laminar air flow panel thereabove to insure cold air wiping of the area above the window prior to its exit through a suitable vent.

It is still another object of the invention to provide a compact linkage arrangement for raising and lowering the sliding shield of an oven window such that a minimum of space is required and which allows the shield to be raised in unison with the locking of the oven door.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

FIG. 1 is a perspective view of a domestic range having an oven with a window door and latch handle.

FIG. 2 is a front elevational view of the door with a portion of the front panel and outer window broken away with the shield in the up position.

FIG. 3 is a vertical sectional view of the door showing the air flow paths with the shield in the up position.

FIG. 4 is a fragmentary section showing the door interlock in the shield down position.

FIG. 5 is a fragmentary section view showing the interlock in the raised shield position.

FIG. 6 is a fragmentary underneath view of the lock partially closed.

Referring now to the drawings, there is shown in FIG. 1 a free standing range 10 having a front-opening drop door 12 which encloses an oven cavity 14, (FIG. 3) surrounded by an oven door jamb surface 16. The oven has heating means (not shown) which are employed for baking and broiling and for raising the temperature of the oven to a self-cleaning level which is approximately 750° F. to 950° F. for removing food soil and grease splatter that accumulates on the walls of the oven liner during normal cooking, with the appropriate setting of the controllers 18 and timer 20 on rear control panel 21. The cook top surface 22 having a front collar 23 has a plurality of surface cooking units therein such as a pair of front burners 24, 25 and a pair of rear burners 26, 27.

Reference may be had if desired to prior patents and publications disclosing self-cleaning ovens as for example the U.S. Pat. No. 3,121,158 issued to Hurko. It will suffice to say that in order to initiate a self-cleaning cycle, the oven door 12 is locked closed by a hook-type locking slider plate member 158 which engages the strike portions 169 of an operating link 156 by swinging in a horizontal plane about a slot 167 and vertical pivot pin 169 arrangement (FIGS. 4 and 5). The slider plate 158 extends through an access slit 165 and is swung by means of lever handle 162 so as to be pulled inwardly the distance of slot 167 in a manner to be explained.

As seen in FIG. 3 the oven door 12 is of generally sheet metal construction including an outer or front door panel 32, an intermediate door panel 34 and a rear panel member 36 including a rear liner panel or shield 38. The outer panel 32 is provided with a window opening 40 aligned with the window opening 42 in intermediate panel 34 and window opening 44 in door liner 38. The opening 40 is covered by a sheet of tempered glass 46, the glass being held in place by a suitable frame 48 and glass support trim 50. The outer panel 32 is bent rearwardly about its upper and lower edges to provide a rearwardly extending flange 52 which overlies rearwardly extending flange 54 of intermediate panel 34 and is suitably secured as by machine screws 55 while the leg of flange 54 interlocks by means of tabs 53 with the forwardly extending flange 56 of inner door panel 36. The inner door panel 36 has a lower channel-shaped stiffening rib 58 spot welded or otherwise secured to inner panel 36 such that intermediate panel spacer screws 60 are threaded therein. An upper channel shaped rib 62 is suitably secured as by screws 64 and 66 to inner door panel 36 and liner 38 while speed nut screws 68 securely inner 38 to panel 36. Spacer screws 61 are provided to support intermediate door panel 34 in spaced relation from the rib 62.

The window openings 42 and 44 are covered by paired heat resistant glass sheets 72 and 74 having a peripheral separator 76 and supported by a U-shaped window holding frame member 78 and trim members 80 and 82 to provide a sealed hot air cavity 84 therebetween. The upper intumescence flange 52 of front panel 32 supports an L-shaped exit vent member 86 whose depending leg 88 supports oven door handle member 90 in spaced relation by means of through bolts 92 and spacers 94. The horizontal leg 96 of the vent member 86 has an integrally molded off-set deflector 98 supported by spaced partitions 100 defining a series of slotted exit air slots 102 (FIG. 2) for a purpose to be explained.

A laminar air flow plate 104 is vertically supported by means of spacer bolts 105 so as to be spaced substantially equidistant from front panel 32 and inter-
mediate panel 34 thereby dividing the upper casing into front and rear vertical air flow passages 108 and 110 for a purpose to be described. The upper edge of plate 104 is curved inwardly to upper exit ports 106 for discharging the combined air from both front and rear air passages.

A vertically sliding flat metal reflective uninsulated shield 116, shown in FIG. 3 in its upward or raised position completely shielding the outer window 46, is dimensioned such that it can be received in the lower pocket or shield well 112. The shield 116 is formed from heat reflective sheet material which in the preferred form is unanodized aluminum, and when in its raised position its upper edge 118 is located above and in rearwardly spaced overlapping relation to the lower edge portion 120 of the laminar air flow plate 104 and that the amount of overlap is typically one-fourth inch.

Referring now to FIG. 2 of the drawings, the mechanism which controls movement of the shield 116 to its raised and lowered positions and also coordinates movement of the door locking apparatus will be described.

Manually operated linkage is provided for transporting the shield 116, of generally rectangular form, upwardly into its blocking position adjacent the inner face of outermost glass panel 46. The shield operating means is a linkage mechanism having a combination of links which are so constructed and proportioned as to length that a small horizontal motion of the operating lever arm or handle 162 will cause the linkage mechanism attached to the shield to follow an arcuate path on an enlarged scale. The form of applicant's linkage includes a pair of shield links 122 and 124 and an operating link 126. The lower shield link 122 is straight while the upper shield link 124 is generally L-shaped and has a stationary pivot 128 approximately intermediate its relatively short leg 129 attached to the intermediate door panel 34 and a movable pivot 130 directly connected at the free end of its relatively long leg 131 attached to the shield 116 adjacent its upper edge 118. The upper L-shaped link 124 is formed such that when it is in its shield lowered position, shown in phantom or dash dot lines in FIG. 2 and indicated in the drawings by the primed numerals, will have its long leg 131 disposed substantially parallel to and below the lower horizontal edge 133 of the window 46 and its short leg 129a, 129b disposed substantially parallel and to the right of the shield right edge 134 so as not to obstruct the view of the oven cavity through the visible door openings.

The straight link 122 has a stationary pivot 136 attached to the intermediate door panel 34 and a movable pivot 138 at its free end attached to the shield 116 adjacent the midpoint of its lower edge 140. It will be noted that when the shield is in its lowered position the stationary pivots 128 and 136 together with the shield movable pivots 130 and 138 form a parallelogram with the imaginary hypotenuse of the right triangle (defined by long leg 131 and short leg portion 129a) being equal in length to the link 122.

The third operating link 126 is formed in the shape of a double-L member having its intermediate horizontal leg 142 provided with an elongated curved slot 144 for the reception of a fixed stud 146 operative to allow for substantially horizontal sliding movement of the double-L member 126. The member 126 has a vertically depending leg 148 having a pivot pin 150 linked with the free end of short leg portion 129b. The upper horizontal leg 154 of the double-L member 126 is inwardly offset at 155 to provide a stem member 156 (FIGS. 4 and 5) for engagement by the pivotal slider plate member 158 of the oven door latch assembly 160.

The latching assembly 160 includes a locking handle or lever arm 162 shown in its left or door unlocked position in FIG. 4 and its right or door locked position in FIG. 5. The handle 162 has a downwardly offset cam plate 163 the bottom surface of which slidably engages the upper surface of slide plate 158. When the oven door is closed the latch hook portion 164 of slider plate 158 extends through a horizontal keeper slit 166 in the door. As the lock handle 162 is swung from left to right the slider plate 158 is cammed into position to engage the free end or strike 168 of stem member 156. When the slider plate 158 can swing no further to the right, because of its engagement with the strike 168, which has been moved to its full line raised shield position, (FIG. 2), the camming action pulls a downwardly struck tab 175 of the slider plate into a notch 176 of underlying latch mounting bracket 177 shown in FIG. 6 as viewed from the underside of the mechanism. The rearward travel of the slider plate 158 by means of the elongated slot 167 causes the oven door to be pulled shut and sealed against a suitable oven seal (not shown) made from woven fiberglass, asbestos or the like. If the oven door is not closed the slider plate 158 travels far enough to the left such that the tab 175 will miss the notch 176 in the lock assembly thereby preventing the handle 162 from swinging all the way to the right. The lock assembly is provided with interlock switch means (not shown) interposed in the power circuit to the oven heating means and which closes the circuit to the heating means only when the oven door is closed and locked. When the hook 164 of slider plate 158 engages the strike 168, it can go no further to the left, thus as the handle 162 is swung further to the right the slider plate 158 begins to travel toward the rear thereby closing and sealing the oven door against the jamb 16 and actuates the interlock switch means.

It will be seen in FIG. 3 that the shield well 112 serves as a lower room air flow duct in the oven door 12 having an entrance means in the form of a series of intake ports 170 located in lower peripheral flange 52.

When the shield 116 is in its raised position during the high temperature heat cleaning operation ambient temperature room air enters through the lower intake ports 170, as seen by the arrows, and flows upwardly through the duct 112 which communicates with a front air flow channel 172, formed between the front glass pane 46 and the shield 116, and a rear air flow channel 174 formed between the shield 116 and the glass pane 72.

Attention is directed to front channel 172 which is relatively small in width in relation to rear channel 174 which is relatively large in width. In the preferred form front channel 172 is approximately one-fourth inch in width but in no case is it less than one-eighth inch in width which has been found to be the minimum width to provide a heated air flow channel not requiring
forced air means to maintain a positive air flow. The relatively large rear channel 174 is approximately three-fourths in width or the order of three times the size of front channel 172. Because the reflective shield 116 is a single metal sheet when it is heated from the oven by reflection and convection it is heat-conducting so that air within front channel 172 is heated by the shield during its passage therethrough to insure a rising convection flow and thus does not require forced air means to maintain a positive air flow therein.

The relatively larger air flow in rear channel 174 is heated to a higher temperature by virtue of contacting glass panel 72 to provide an air wash coolant for the glass panel 72. It will be noted that when the relatively cool air of channel 122, in comparison to the warm air in channel 174, reaches the upper laminar flow panel 104, the lower edge 120 of which is overlapped by the upper edge 118 of shield 116, the channel 122 relatively cool air is divided as indicated by flow arrows 180 and 182 such that the flow 180 is directed into front laminar air flow passage or duct 108 and the flow 182 is directed into rear laminar air flow passage or duct 110.

By virtue of this arrangement a portion of the relatively cool air from channel 172 is diverted or segregated into front laminar duct 108 to act as an air barrier layer to maintain the upper area of outer door panel 32 at a relatively cool reduced temperature while the remaining air from channel 172 is mixed in rear laminar flow passage 110 with the higher temperature air wash flowing from rear channel 174 to partially cool the air wash. At the upper edge of laminar flow panel 104 the relatively cool air from passage 108 and the relatively warm air from passage 110 are united and mixed just prior to passing through upper flange ports 106 and exiting into the room through discharge air vents 102.

It will be seen that at the conclusion of the heat-cleaning operation the lock handle 162 is rotated to the left causing rotation of the slider plate 158 and disengagement of the latch lock 164 from the strike 168. Because of the arrangement of the lock means 122 and 124 wherein their movable pivots 130, 138 are located at spaced fixed points one above the other on the shield 116 which are to the left or the far side of shield center line 117 with respect to the stationary pivots 128, 136 in this way the leverage of lower leg 131 and link 122 is of such a magnitude that the gravitation effect in the shield 116 will cause the links to swing in a downward direction to move the shield to its lowered dash line position.

While the embodiment of the present invention as herein described constitutes a preferred form, it is to be understood that other forms may be adopted.

I claim:

1. In a door for enclosing a heat-cleaning oven, the combination comprising a front panel, a rear panel and an intermediate panel each having registering window openings in the upper half thereof, said front panel and said intermediate panel being spaced apart to define a lower well below the window level and an upper pocket above the window level, an outer glass sheet covering the window opening in said front panel, at least one inner glass sheet covering the window openings in said intermediate panel and said rear panel, a movable flat plate shield in said well of a dimension larger than the window openings having a reflective surface adapted to face said oven, means for raising and lowering said shield from said well into an air flow space between said outer glass sheet and said inner glass sheet, said shield in its raised window blocking position dividing the air flow space into front and rear vertical positive convection flow air channels, said raised shield being spaced closer to said outer glass sheet than to said inner glass sheet whereby said rear channel depth is comparatively large relative to said front channel depth, said front panel having ambient air inlet openings adjacent its lower edge and air outlet openings adjacent its upper edge providing a continuous air flow passage communicating between the lower well, the air flow space and the upper pocket; a laminar air flow panel positioned in the upper pocket in substantial alignment with said outer glass sheet, said shield when in its raised window blocking position extending upwardly with its upper portion in spaced rearward lapping relation with the lower portion of said laminar panel, said laminar panel dividing the upper pocket into front and rear laminar flow air ducts of substantially equal air flow capacity whereby the ambient air flowing in said front channel after air washing the front side of said shield and the back side of said outer glass sheet is distributed between said front and rear ducts while the ambient air flowing in said rear channel after air washing the back side of said shield and the front side of said inner glass sheet flows upwardly through said rear duct such that said front panel and the front side of said outer glass sheet are maintained at reduced temperatures during a heat-cleaning operation in said oven.

2. In a door for enclosing a heat-cleaning oven, the combination comprising a front panel, a rear panel and an intermediate panel each having registering window openings in the upper half thereof, said front panel and said intermediate panel being spaced apart to define a lower well below the window level and an upper pocket above the window level, an outer tempered glass sheet covering the window opening in said front panel, a pair of tempered glass sheets covering the window openings in said intermediate panel and said rear panel respectively providing a sealed air cavity between said pair of glass sheets, a movable flat plate reflective shield in said well of a dimension larger than the window openings, means for raising and lowering said shield from said well into an air flow space between said outer glass sheet and said pair of glass sheets, said shield in its raised window blocking position dividing the air flow space into front and rear vertical positive convection flow air channels, said raised shield being spaced sufficiently close to said outer glass sheet to provide an air flow path for said rear channel approximately three times greater in depth than said front channel, said front panel having ambient air inlet openings along its lower edge and outlet openings along its upper edge providing a continuous air flow path between the lower well, the air flow space and the upper pocket; a laminar flow panel positioned in the upper pocket in substantial alignment with said outer glass sheet, said shield when in its raised window blocking position extending upwardly with its upper portion in spaced rearward lapping relation with the lower portion of said laminar panel, said laminar panel dividing the upper pocket into front and rear laminar flow air ducts of substantially equal air flow capacity
whereby the ambient air flowing in said front channel after air washing the front of said shield and the back of said outer glass sheet is distributed between said front and rear ducts while the ambient air flowing in said rear channel after air washing the back of said shield and the front of said intermediate panel glass sheet flows upwardly through said rear duct such that said front panel and the front of said outer glass sheet are maintained at reduced temperatures during a heat-cleaning operation in said oven.

3. A heat-cleaning oven door of hollow sheet metal construction having at least a pair of spaced apart first and second panels with registering rectangular window openings in the upper half of each said panel, inner and outer glass sheets covering the window openings in said panels, a rectangular heat reflective shield carried by the door and adapted to be moved from a lowered hidden position between said panels to a raised visible position between said glass sheets, link means pivoted to said shield, an operating link positioned above said window openings for reciprocal movement in a horizontal plane between said first and second panels, one end of said operating link pivotally connected to said link means, the free opposite end of said operating link providing a strike portion, a rotatable lock handle operative to rotate a slider plate on the oven body for locking the door in its closed heat-cleaning position against the oven body, said slider plate having a latch hook portion which will pass through a registering slot in the door in an unlocked angular position, said latch hook adapted to engage said operating link strike portion such that upon rotating said handle in a first direction said slider plate is rotated into position to engage said strike portion causing horizontal movement of said operating link in said first direction together with movement of said link means resulting in elevation of said shield to its raised visible position between said glass sheets, said latch hook adapted to disengage said operating link strike portion upon rotating said lock handle in a second direction causing horizontal movement of said operating link in said second direction together with movement of said link means due to gravitational force on said shield whereby said shield is lowered to its hidden position between said panels.

4. A heat-cleaning oven door of hollow sheet metal construction having at least a pair of spaced apart first and second panels with registering rectangular window openings in the upper half of each said panel, inner and outer glass sheets covering the window openings in said panels, a rectangular heat reflective shield carried by the door and adapted to be moved from a lowered hidden position between said panels to a raised visible position between said glass sheets, first and second swinging links pivoted to said shield at spaced fixed points one above the other, said first swinging link being an L-shaped lever such that in the shield lowered position its relative long leg is aligned with and spaced below the lower edge of said window opening and its relatively short leg is aligned with and spaced to one side of said window opening, said L-shaped lever connected to said second panel by means of a fixed upper pivot located approximately midway between said L-shaped lever's right-angled corner and the free end of its relatively short leg, said second swinging link pivotally connected to said second panel by means of a fixed lower pivot located vertically below said fixed upper pivot a distance equal to the vertical spacing of said shield spaced fixed points, pin means adjacent the upper edge of said door, an inverted double-L shaped operating link having an elongated slot engaged on said pin means for reciprocal movement in a horizontal plane, the free lower end of said inverted double-L link pivoted to the free end of said L shaped lever relatively short leg, the free opposite end of said operating link forming a strike portion, a rotatable lock handle operative to rotate a slider plate on the oven body for locking the door in its closed heat-cleaning position against the oven body, said slider plate having a latch hook portion which will pass through a registering slot in the door in an unlocked angular position, said latch hook adapted to engage said operating link strike portion upon rotating said lock handle in a first direction causing horizontal movement of said operating link in said first direction together with upward pivoting of said swinging links resulting in movement of said shield to its raised visible position between said glass sheets, said latch hook adapted to disengage said operating link strike portion upon rotating said lock handle in a second direction causing free horizontal movement of said operating link in said second direction together with downward pivoting of said swinging links due to the gravitational force on said shield whereby said shield is lowered to its hidden position between said panels.

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