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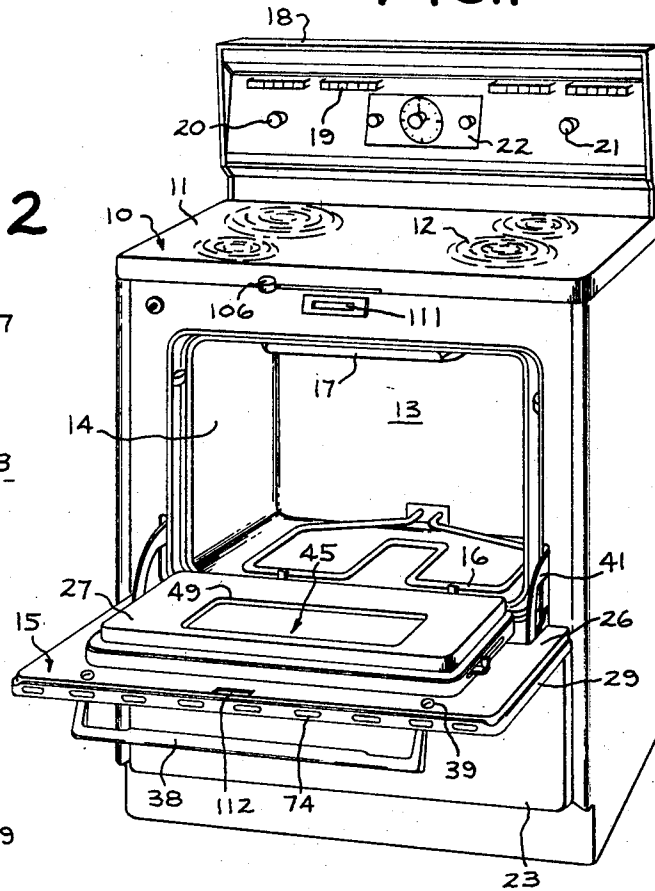
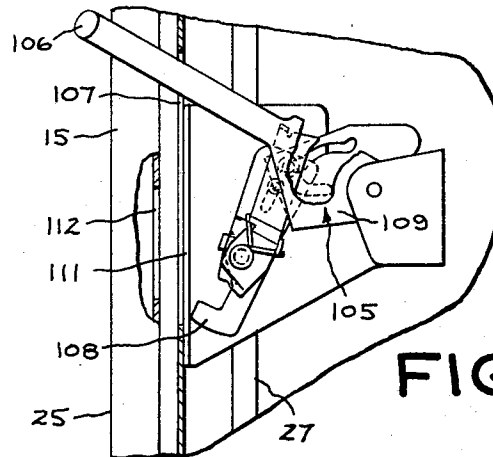


FIG.6



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Aug. 13, 1968

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TRACK SYSTEM FOR SHUTTER OF WINDOWED OVEN DOOR

Filed June 7, 1967

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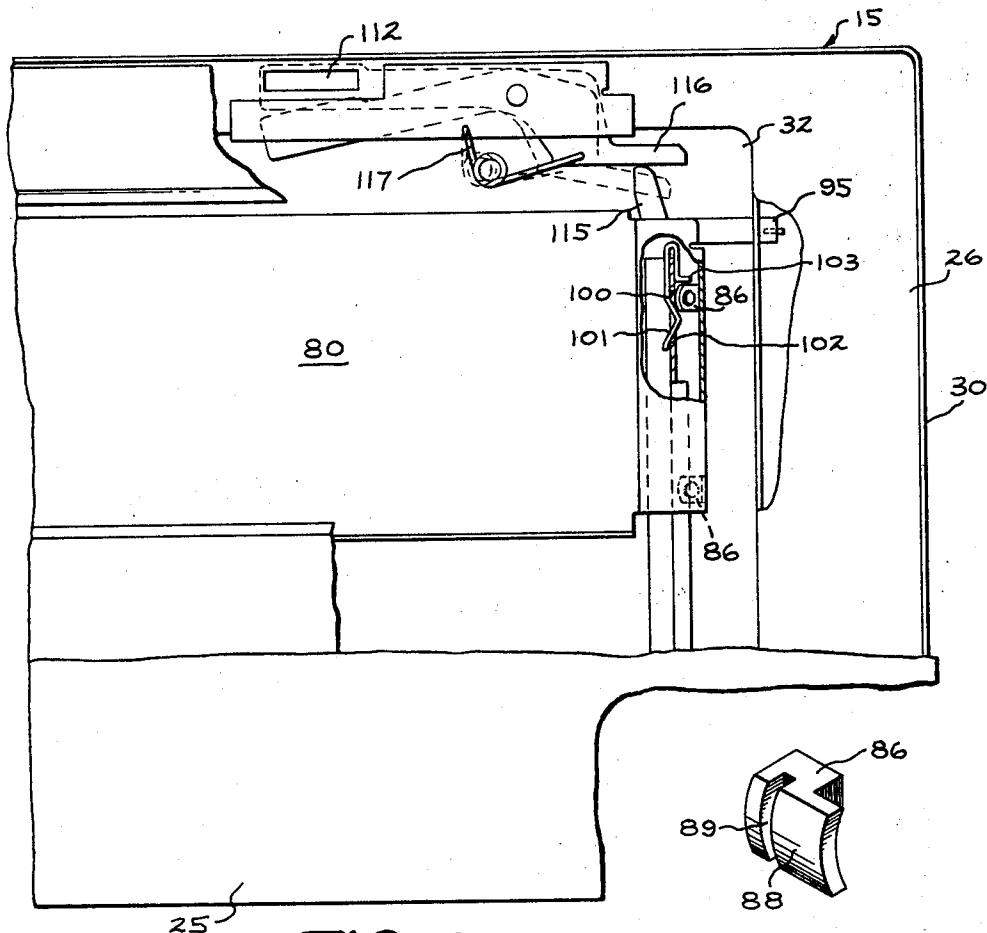


FIG. 4

FIG. 5

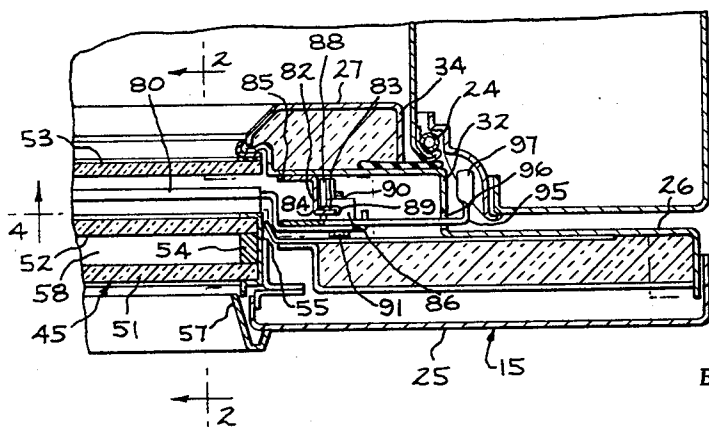


FIG. 3

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TRACK SYSTEM FOR SHUTTER OF WINDOWED OVEN DOOR

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ABSTRACT OF THE DISCLOSURE

A door for a high temperature oven where there is a transparent window in the door and a manually movable shutter located within the door so that in one position the shutter closes the window and in a second position it is retracted into the door structure. The shutter is supported and guided by a track which cooperates with slide members on the shutter so as to permit freedom of movement of the shutter on the track under high temperature conditions.

Cross-reference to related patent

This invention is an improvement over the invention in Patent No. 3,311,106 to Howard B. Baughman and Kermit B. Keeling, Sr., entitled "Windowed Oven Door" which issued on Mar. 28, 1967, and is assigned to General Electric Company, the assignee of the present invention.

Background of the invention

Housewives have become accustomed to the convenience of a window in their oven door so that they may observe the food while it is being cooked. This avoids the necessity of opening the oven door in order to judge the degree of doneness of the food. However, in recent years housewives have been given the opportunity of owning a self-cleaning oven that operates on the principle of pyrolysis for decomposing the food soil and grease spatter that accumulate on the oven walls during normal cooking operations. Such a self-cleaning oven is taught in the patent to Bohdan Hurko No. 3,121,158, which is likewise assigned to the assignee of this invention. Such self-cleaning ovens operate at a high temperature range above the normal cooking temperature range of between 150° F. to 550° F. generally somewhere within the range of about 750° F. and 950° F. The conventional oven door windows were not capable of confining the increased amount of heat energy to the oven cavity, and hence they were omitted in the early models of self-cleaning ovens in order to take full advantage of the self-cleaning oven features. The above-cited Baughman et al. Patent 3,311,106 teaches the use of a movable shutter built into the door structure so that in one position the shutter blocks the window and serves as both a thermal radiation barrier and a visual barrier during the high temperature operation. During normal cooking operations this shutter would be retracted into the door structure so that the window would provide the convenience of the oven door windows in standard ovens. The shutter of the present invention is designed, according to a principal object thereof, so that thermal expansion will not allow it to distort and become jammed.

Summary of the invention

The present invention, in accordance with one form thereof, relates to a door construction for a high temperature oven where the door includes a window opening that is closed with a plurality of transparent panes that are sealed along their periphery to the door structure. A manually movable shutter is located within the door and in one position the shutter blocks the window opening and in a second position it is retracted into the door

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structure. Track means in the door support and guide the shutter. The track means includes a pair of parallel rails fixed to the door and a plurality of slide members of inherent lubricity being carried by the shutter at the extremities thereof. Each slide member has a rounded portion for engaging the rail with a generally line contact and also includes a slot for receiving the rail therein.

Brief description of the drawing

Our invention will be better understood from the following description taken in conjunction with the accompanying drawings and its scope will be pointed out in the appended claims.

FIGURE 1 is a perspective view of a free-standing domestic range having a windowed oven door embodying the present invention.

FIGURE 2 is a cross-sectional, elevational view on an enlarged scale looking from the right side of the oven door of FIGURE 1 to show the movable shutter located in its raised position, as well as the nature of the rails on which the shutter is supported and guided. This view is taken on the line 2—2 of FIGURE 3.

FIGURE 3 is a fragmentary, cross-sectional, plan view adjacent the right top corner of the oven door taken on the line 3—3 of FIGURE 2.

FIGURE 4 is a fragmentary, elevational view of the innermost portion of the door taken on the line 4—4 of FIGURE 3 with the front door panel, part of the insulation and other small elements so as to be able to see the shutter in the raised positions and the nature of its cooperation with one of the rails of the track system of the present invention.

FIGURE 5 is a perspective view of an enlarged scale of one of the slide members which are fastened to the shutter at the extremities thereof for engagement with the rail of the track system.

FIGURE 6 is a fragmentary, cross-sectional plan view of an oven door latching mechanism for locking the oven door in the closed position during the high temperature operation.

Description of the preferred embodiment

Turning now to a consideration of the drawings and in particular to FIGURE 1 there is shown for illustrative purposes a free-standing electric range 10 having a top cooking surface 11 with a plurality of surface heating elements 12, a baking oven 13 formed by a box-like oven liner 14 and a front-opening, drop-door 15. While the oven door of the present invention is shown as being installed on an electric oven it will be readily apparent to those skilled in this art that the invention is not limited to use with an electric oven. It may be used just as well with an oven heated by gas or perhaps other energy sources. It could also be used with a built-in oven or in fact any type of high temperature cavity. The oven cavity is supplied with two standard heating elements; namely, a lower baking element 16 and an upper broiling element 17 located adjacent the top wall of the oven liner. There is also a mullion unit 24 shown in FIGURE 3 which encircles the front portion of the oven liner and serves to replenish the heat lost through and around the door during the heat cleaning operation to obtain generally uniform wall temperatures throughout. The back edge of the top cooking surface 11 is supplied with a backsplash 18 which supports a control panel including multiple switches 19 for controlling the surface heating elements 12, an oven selector switch 20, an oven thermostat 21 and an oven timer 22 which may time both the cooking operations as well as the oven cleaning cycle. Preferably, the heating elements and their control switches and oven timer will be arranged and operated as described in the aforementioned Hurko patent to provide the normal cooking

operations as well as the high temperature oven cleaning operations. Positioned beneath the oven 13 is a pull-out drawer 23 which is a storage drawer for cooking utensils and the like. However, in a gas oven this space is usually allotted to a separate broiler compartment.

As is best seen in FIGURE 2, the oven door 15 is of generally sheet metal fabricated construction having three main elements; an outer, decorative door panel 25, an inner door liner 26 and a floating inner panel 27 supported from the inner door liner 26. The outer door panel 25 is of shallow-pan shape by virtue of the fact that it has a slight, rearwardly-turned peripheral flange 29. The inner door liner is also of shallow-pan shape, and is of mating construction with the outer door panel 25 by virtue of the fact that it has a front-turned peripheral flange 30 which telescopes within the flange 29 of the outer door panel 25. The inner door liner 26 includes a generally rectangular, central, outward embossment 32 of such a size as to fit closely within the front opening of the oven frame, as is best seen in FIGURE 3.

The floating door panel 27 is likewise of shallow-pan shape having a front-turned peripheral flange 34, and it covers an area that is slightly less than the area of the outward embossment 32 of the inner door liner 26. A high temperature gasket 35 of woven fiberglass or the like is sandwiched between the periphery of the door panel 27 is fastened to the inner door liner 26 by means of several fastening means widely spaced around the periphery thereof, such as fastener 36 and bracket 37 which is integral with the floating panel 27. A more detailed explanation of this fastening means may be found in the patent of Clarence Getman No. 3,189,020 entitled "Oven Door With Floating Inner Panel" which is also assigned to the General Electric Company, the assignee of the present invention.

The oven door 15 is supplied with a stationary door handle 38 adjacent the top portion thereof. The handle is fastened to the door by a pair of screws which extend through the door and have heads 39 that are visible on the inner side of the door in FIGURE 1. Moreover the oven door 15 is hinged to the range body along the bottom edge of the door by means of hinge levers 41 and hinge pins (not shown).

Looking at FIGURE 2, the present invention relates to a high temperature transparent window 45 formed in the oven door 15 and used by the housewife for viewing the food while it is being cooked in the oven. This window is so constructed that it is protected by means of a shutter which serves both as a radiation barrier and a visual barrier during a high temperature operation. The door also has an interlocking means with an oven door latching system so as to preclude the operation of the high temperature cycle unless the oven window is first protected by the movable shutter as will be better understood hereinafter.

A window opening is formed in each of the three door elements; namely, the outer door panel 25, the inner door liner 26, and the floating inner panel 27. Thus, there is a window opening 47 in the outer door panel 25, window opening 48 in the inner door liner 26 and finally a matching window opening 49 in the floating inner panel 27. It is well to provide a plurality of glass panes or transparent sheets in the window opening so as to improve the thermal insulating properties and retard heat transfer to the exterior of the oven. Moreover, it is well to provide for the sealing of the window so as to prevent the escape of odors, vapors as well as convection currents of hot air. It is particularly important to prevent the condensation of oven vapors on the inner surfaces of the glass panes which would otherwise tend to soil the glass and obscure viewing into the oven cavity.

Turning attention to FIGURE 3, it will be appreciated that there are three glass panes 51, 52 and 53. The two frontmost panes 51 and 52 are separated by a continuous spacer frame 54 and they are held together by an outer

frame 55 of U-shaped transverse cross-section which slips around the periphery of the two panes to form a sealed glazing unit 58. A decorative trim frame 57 of acute angular shape in transverse cross-section extends around the periphery of the front edge of the outermost glass pane 51, and it is likewise held in place by the outer frame 55. This glazing unit sub-assembly 58 is shown as being fastened to the back side of the outer door panel 25 by means of support flanges 58 and 59, as is best seen in FIGURE 2.

The third glass pane 53 is shown in FIGURE 2 as being fastened over the window opening 48 in the inner door liner 26 from the inner side thereof by means of fastening screws 36 and clip members 61. Moreover, there is a decorative trim frame 64 assembled around the peripheral edge of the glass sheet 53 so as to mask the peripheral edge of the glass sheet from view. This trim frame 64 telescopes into the window opening 49 of the floating inner panel 27. A suitable sealing gasket 62 is sandwiched between the glass pane 53 and the trim frame 64, again to seal the glass against the escape of gases and vapors around the edges thereof.

Notice that thermal insulation 66 of fiberglass or the like material substantially fills the inner panel 27. A second layer of insulation 67 is located between the outer door panel 25 and the inner panel 26, but it does not completely fill this cavity. As is best seen in FIGURE 2, there is a front air channel 69 formed between the inner surface of the outer door panel 25 and an insulation guard 70 which holds the insulation 67 in place. Suitable air inlet openings 72 are formed in the bottom edge of the door to permit room air to rise through the air chamber 69. Moreover, the top edge of the door is provided with suitable air outlet openings 74, which are best shown in FIGURE 1. A second insulation guard 76 is mounted against the layer of insulation 67 so as to confine this layer between the two insulation guards 70 and 76.

Attention is directed to a second chamber 78 that is formed between the second insulation guard 76 and the inner surface of the embossment 32 of the inner door liner 26. This chamber 78 extends upwardly between the second and third glass panes 52 and 53. The purpose of this chamber 78 is to accommodate a reflective shield or shutter 80 which is shown in the raised position in FIGURE 2 but which is capable of being retracted into the lower portion of the door so as to be completely out of view so as to enable the housewife to see into the oven cavity 13. This shutter 80 is of generally rectangular configuration and formed of aluminum sheet metal which tends to expand and contract depending upon its operating temperature but especially during a heat cleaning operation. The temperature of the innermost transparent pane 53 during a heat cleaning operation might be as high as 900° F., and the temperature of the shutter 80 might be as high as 650° F., while the temperature of the outer pane 51 might be somewhere between 200° F. and 300° F.

One of the most difficult problems in the design of a window for the oven door of a self-cleaning oven has been the design of a suitable supporting and guiding means for the window shutter. The design must be such that the thermal expansion of the shutter will not cause it to distort and become jammed. Also the wearing of the parts should be minimized. Frictional forces should be minimal and any rasping noises due to the rubbing action of the shutter upon its supporting structure should be eliminated.

The present invention contemplates the use of a track system on which the shutter 80 is capable of sliding action. This track system includes a pair of vertical rails 82, 82 of generally Z-shape in transverse cross-sectional view, as is best seen in FIGURE 3. Each rail 82 is positioned inboard of the related vertical side of the shutter 80. The rail 82 has a head 83 and an L-shaped base with flanges 84 and 85 respectively. The flange 85 is

adapted to be connected by means of welds or suitable fastening means (not shown) to the inner surface of the embossment 32 of the inner door liner 26. Since the cooperation between each side of the shutter 80 and the related rail 82 is identical for both sides, only the right side of the shutter is shown, and that is in FIGURES 3 and 4. Adjacent the upper and lower extremity of each vertical side of the shutter 80 is fastened a slide member 86 as is best seen in FIGURE 4, and its configuration can best be understood from the perspective view of FIGURE 5. Each slide member 86 is a block-like form that has an arcuate surface 88 that is adapted to cooperate with the flange 84 of the base of the rail 82. Moreover, there is a slot 89 formed in each slide member 86, and this slot lies in a plane that is perpendicular to the longitudinal axis of the arcuate surface 88. This slot 89 is adapted to receive the head 83 of the rail 82 as is best seen in FIGURE 3. The slide member also contains a through opening 90 for receiving a fastening screw 91 therethrough as is best seen in FIGURE 3 so that the slide member may be attached to the side edge of the shutter 80 and serve as the supporting means between the shutter 80 and the rail 82. The preferred embodiment of the slide member 86 is formed of a non-metallic material that is impregnated with graphite and is sold under the trade name Graphitar that is sold by the U.S. Graphite Company of Saginaw, Michigan. Such a material as a characteristic lubricity which is not effected by high temperatures in the vicinity of 900° F. in that it does not lose its low friction characteristic. This cooperation between the four slide members 86 and the two rails 82 of the track system gives positive location of the shutter and prevents any jamming action that might be caused by thermal expansion of the shutter. Notice that any expansion of the shutter tends to move the slide member 86 in a direction away from the rail head 83 and base flange 84 so that the shutter is not prevented from expanding, but instead is permitted to expand without altering the positive location of the shutter within the door assembly.

Whenever metal surfaces are exposed to the high temperatures of the heat cleaning operation in the vicinity of 700° F. to 900° F. the metal surfaces become chemically clean and ten to gall or bind together almost as if there were a magnetic attraction between them such that relative movement therebetween becomes very difficult and exasperating to the housewife. In the event the shutter is cocked in an angular position relative to the track system there is still merely a line-contact between the base flange 84 of the rail support and the slide member so that easy sliding action takes place. Hence, the line contact between the slide member and the base flange of the rail is almost the same as a line contact between a roller and a supporting surface.

Notice that the upper corners of the shutter 80 are each provided with an outward, side extension 95 which extends through an elongated slot 96 in the side of the embossment 32 of the door to form a handhold 97 so that the housewife may grasp the handhold on each side of the embossment and raise or lower the shutter as is desired.

It is felt best to provide a detent means for holding the shutter in its raised position, and this is accomplished by the use of a clip member 100 which is slipped over the top edge of the base flange 84 of the rail 82 as is best seen in FIGURE 4. This clip member has a wide V-shaped spring portion 101 which extends through a slot 102 in the base flange 84 of the rail, and it is in a position to be engaged by the slide member 86 as the shutter 80 is raised. The slide member forces the spring portion 101 to deflect inward as the slide member passes upwardly beyond the spring portion and the slide member abuts the top flange 103.

FIGURE 6 merely shows a door latch mechanism 105 which is adapted to be built into the range body above the

front of the oven liner 14 so that the oven door may be locked and may not be opened during the high temperature heat cleaning operation. The specific door latching mechanism is fully disclosed in the patent to Clarence Getman No. 3,189,375 which is assigned to the same assignee as is the present invention. The mechanism includes a handle 106 which extends through an elongated, horizontal slot 107 in the front of the range body for example beneath the cooktop 11 as is best seen in FIGURE 1. A complete description of this door latch mechanism is not deemed necessary here since it does not form part of the present invention. It does however include a latching bolt 108 pivoted to a mounting bracket 109 by means of pin and slot connections which are shown in dotted lines therein. When the door lock handle 106 is moved from left to right for latching the door, the latching bolt 108 is caused to swing in a horizontal plane and reach out of the range body through an elongated slot 111 for engaging in a keeper slot 112 that is formed in the inner surface of the inner door panel 26 as is best seen in FIGURE 1.

As is taught in the beforementioned Baughman et al. Patent No. 3,311,106, the oven door 15 is provided with a mechanical door latch interlocking system to insure that the door latch 105 cannot be closed unless the movable shutter 80 is first raised to its window blocking position as shown in FIGURE 2. One side of the upper edge of the shutter 80 is provided with a finger member 115 which is capable of engaging an L-shaped interlocking member 116 which is a pivoted member that is normally biased by spring means 117 into a position to cover or close the keeper slot 112 in the door. If the shutter is not raised, this interlocking member fills the keeper slot and prevents the pivoted bolt member 108 of the door latching mechanism from entering the keeper slot and hence the door latch handle 106 cannot be moved to its closed position. There are suitable switch means (not shown) which must be closed by the door latch mechanism in the closed position before the heat cleaning circuit can be established and the heat cleaning cycle initiated.

Modifications of this invention will occur to those skilled in this art, therefore, it is to be understood that this invention is not limited to the particular embodiments disclosed but that it is intended to cover all modifications which are within the true spirit and scope of this invention as claimed.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. In a door construction for a high temperature oven having an oven cavity formed by a box-like oven liner and a front-opening access door, the door including a window opening that is closed with a plurality of transparent panes, and peripheral sealing means between two adjacent panes to form a dead air space and prevent condensation from forming therebetween, a movable shutter interposed between the sealed pair of panes and a third pane, the shutter in a first or open position being hidden in the door construction to expose the transparent window and permit viewing into the oven cavity during normal cooking operations in the oven, the shutter in a second closed position being visible to block the transparent window and form both a thermal radiation barrier and a visual barrier during a high temperature operation of the oven; the invention comprising track means in the door for supporting and guiding the shutter, the track means including a pair of parallel Z-shaped rails positioned inboard of the vertical sides of the shutter, each Z-shaped rail having a head portion and a base portion, the head portions facing in opposite directions from each other, the shutter including at least two slide members of characteristic lubricity at each side of the two opposite sides adjacent the corners thereof for inter-engagement with each rail head respectively, each slide member having a slotted portion for receiving the head of said rail therein and an arcuate bearing face having generally line contact with the base of the rail so

as to prevent binding of the shield with relation to the track.

2. In a windowed oven door design for a high temperature oven where the window is furnished with a plurality of transparent panes that are sealed around their peripheral edges to the door structure, a movable shutter disposed within a plane between certain of said panes, the shutter in a first position being retracted into the door structure so as to expose the window and permit viewing therethrough, the shutter in a second position being raised to block the window and form both a thermal radiation barrier and a visual barrier during a high temperature operation of the oven; the invention comprising means for supporting and guiding the shutter within the door, said means comprising a track integral with the door and slide members integral with the shutter for traversing the said track, the track comprising a pair of parallel rails where each rail has a head and a base, the two rail heads being directed in opposite directions from each other, each slide member being a self-lubricating block having a rounded bearing surface for making generally line contact with the rail base and a slot in a plane perpendicular to the said line of contact for receiving the same rail head.

3. In an oven door having a window built therein, said door comprising an outer door panel with a first window opening, at least one transparent pane sealed over the said first window opening, an inner door panel with a second window opening, at least one transparent pane sealed over the said second window opening, and means for attaching the inner and outer door panels together, and a shutter positioned within the door and movable between a first position retracted within the door structure and a second position blocking the view through the window; the invention comprising supporting and guiding means for the movable shutter, said means including track means fixed within the door and slide members carried by the shutter adjacent the extremities thereof for following the said track means, the track means being formed by a pair of parallel rails adjacent the opposite sides of the shutter, each rail having a supporting base portion and a head portion, the two head portions facing in opposite directions toward the opposite sides of the door, each slide member being a lubricant impregnated member with

a rounded surface for engaging the base of the rail with a line contact, and a slot formed in each slide member to receive the rail head therein.

4. In an oven door as recited in claim 3 wherein the top portion of at least one of the rails is provided with detent means which is engageable with the topmost slide member of the shutter for releasably holding the shutter against gravity in the second position blocking the view through the window.

5. In an oven door having a window built therein, said door comprising an outer door panel with a first window opening, at least one transparent pane sealed over the said first window opening, an inner door panel with a second window opening, at least one transparent pane sealed over the said second window opening, and means for attaching the inner and outer door panels together, and a shutter positioned within the door and movable between a first position retracted within the door structure and a second position blocking the view through the window; the invention comprising supporting and guiding means for the movable shutter, said means including track means fixed within the door and track followers carried by the shutter adjacent the extremities thereof, the track means being formed by a pair of generally parallel rail members adjacent the opposite sides of the shutter, each rail having a supporting base portion and a guiding portion, the two guiding portions facing in opposite directions and toward the adjacent side of the door, each follower being a lubricant impregnated member with a rounded surface for engaging the rail with a generally line contact, each follower and rail member having an inter-engaging relationship so that the follower is guided by the rail, whereby when the shutter is subjected to thermal expansion each follower tends to move away from its adjacent rail while remaining in inter-engagement therewith.

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