United States Patent [19]

Klemp et al.

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[54] **MICROWAVE OVEN DOOR ASSEMBLY**

[75] Inventors: **Eldon J. Klemp**, Mayer; **Vernon E. Cassibo**, New Hope, both of Minn.

[73] Assignee: **Litton Systems, Inc.**, Beverly Hills, Calif.

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[21] Appl. No.: **382,910**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 292,529, Sept. 27, 1972, abandoned.

[52] **U.S. Cl.** ..... **219/10.55,** 174/35 GC

[51] **Int. Cl.** **H05b 9/06**

[58] **Field of Search** ..... 219/10.55; 174/35 GC

[56] **References Cited**

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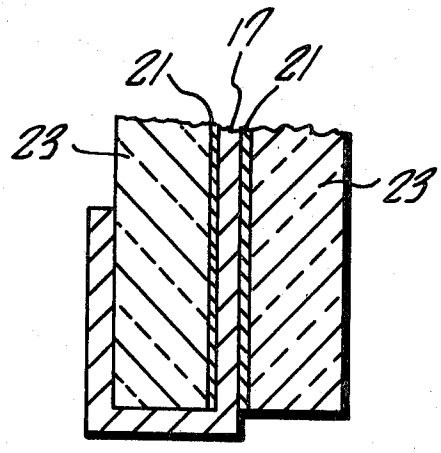
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Primary Examiner—J. V. Truhe
Assistant Examiner—Hugh D. Jaeger
Attorney, Agent, or Firm—Alan C. Rose; Robert M. Vargo; Alfred B. Levine

[57] **ABSTRACT**

A microwave cooking oven door assembly is disclosed in which the entire door assembly is made of a bonded laminar construction which is self-supporting and shatterproof. The door assembly comprises a relatively thin sheet of metal having an array of closely spaced perforations formed therein. The array of perforations functions as a viewing window to the inside of the oven cavity. In one embodiment, the sheet of metal is sandwiched between a pair of glass panels and bonded thereto by layers of adhesive material. In another embodiment, the metal sheet is positioned between a glass panel and a thin film of polycarbonate, and bonded thereto by layers of adhesive material. The layers of adhesive material can be either coextensive with the laminar sheets and panels, or they can extend only around the borders thereof. In both embodiments the laminated construction is subjected to thermal compression to enable the various layers to adhere to each other.

3 Claims, 3 Drawing Figures



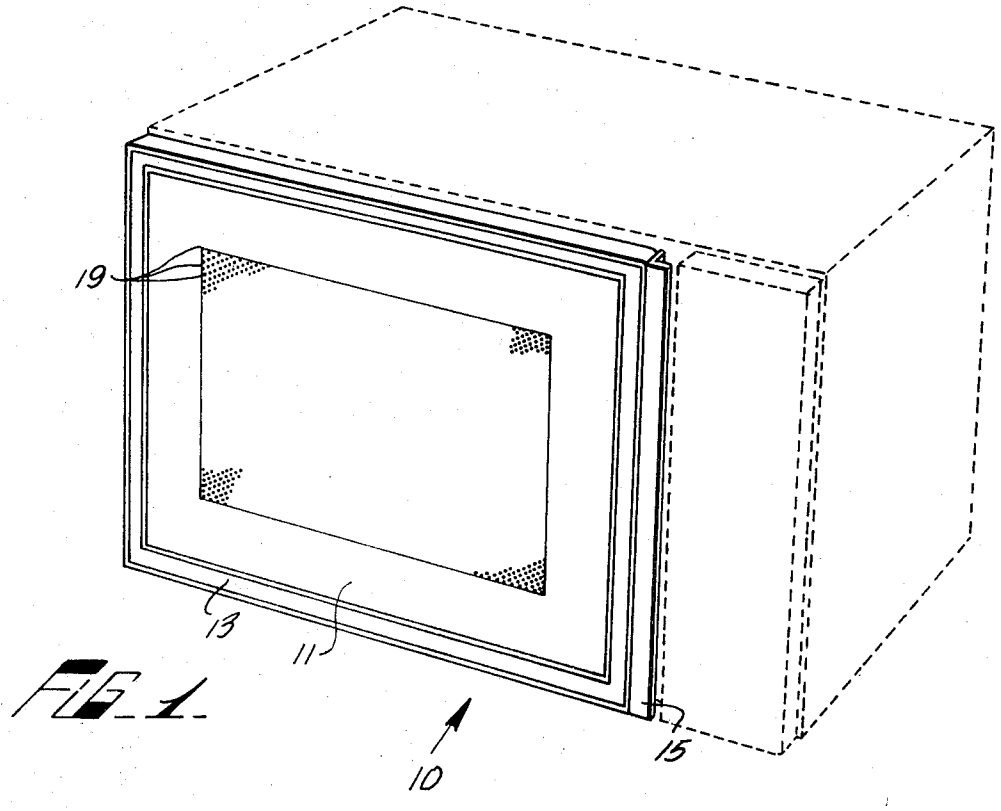


FIG. 1

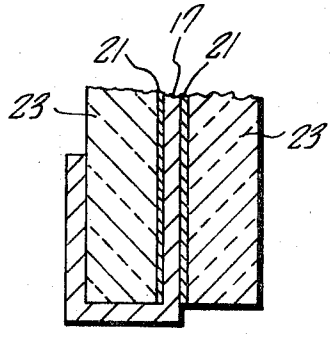


FIG. 2

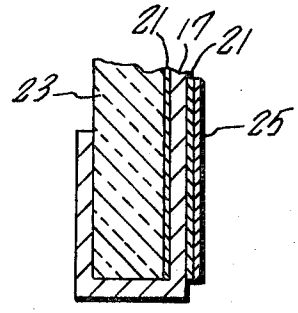


FIG. 3

MICROWAVE OVEN DOOR ASSEMBLY

CROSS REFERENCE TO RELATED APPLICATIONS

The present application is a continuation-in-part of U.S. Pat. application Ser. No. 292,529 filed Sept. 27, 1972, now abandoned.

FIELD OF THE INVENTION

The present invention relates generally to microwave cooking ovens and more particularly to the oven door construction.

DESCRIPTION OF THE PRIOR ART

Heretofore, prior microwave oven doors have been constructed of a plurality of bulky metal panels screwed or riveted together over the entire peripheries thereof. The central portions of the doors usually included relatively thick, perforated metal screens. The performations served as viewing holes in the insides of the oven cavities. More recent oven doors have glass panels sandwiched over the metal screen to prevent any objects from protruding through the screen perforations. Again, such panels were usually screwed or riveted over the metal screens at points about the peripheries thereof.

The main shortcoming with prior oven doors is that the many pieces involved in each door made the assembly complex and costly. The tolerance buildup alone in uniting all of the panels made the assembly thereof quite cumbersome.

Another serious shortcoming with prior oven doors is that no matter how tight the glass or plastic panels were attached to the metal panels, condensation, grease, and other particles would form or collect between the metal screen and these panels. As a result, the metal screens would become rusted or corroded, and very unsightly.

A major shortcoming with the prior screens is that the visibility through the windows is very poor. This poor visibility is attributed to the relatively large thickness of the screens. Conventional prior metal screens are approximately 0.03 inches thick. This thick construction makes it quite difficult to form the apertures in a closely spaced relationship. This, of course, adversely affects the resolution of the view. Moreover, this thick construction makes the apertures relatively deep. As a result, it is virtually impossible to look through the apertures from a side angle. The only way a person can view the interior of the oven cavity in prior ovens is to view the oven from a point directly perpendicular to the screen.

SUMMARY OF THE INVENTION

The present invention obviates the above-mentioned shortcomings by providing a laminated door assembly that is simple in construction, easy to keep clean, and efficient in operation.

In its broadest aspect, the present invention comprises a relatively thin sheet of selfsupporting, shatterproof, and perforated metal sandwiched between a pair of panels and bonded thereto by a pair of adhesive layers located therebetween. The primary advantage of the present invention is that the number of panels utilized in the door construction is substantially reduced. This simple construction greatly reduces the number of critical tolerance points required in the assembly over those required in prior door assemblies.

Another very important advantage of the present invention is that the laminated construction with its core of sheet metal is very strong in spite of being simple and lightweight. This is extremely beneficial to the consumer because of its inherent safety advantages.

Another advantage of the present invention is that the sheet of perforated metal is much thinner than prior door constructions. This thin construction makes it possible for the perforations to be formed in a more closely spaced array. As a result, the visibility in the oven cavity is greatly improved, especially from directions other than perpendicular to the screen.

Another important advantage of the present invention is the laminated construction of the door. In one embodiment, the metal sheet is sandwiched between a pair of glass panels, while in another embodiment, the metal sheet is positioned between a glass panel and a thin film of polycarbonate. Both constructions provide a clean, integral design quite different from prior constructions.

The layers of adhesive material can be either coextensive with the laminar sheets and panels, or they can extend only around the borders thereof. This type of bonding is completely novel in microwave oven door constructions.

The features of the present invention which are believed to be novel are set forth with particularity in the appended Claims. The present invention, both as to its organization and manner of operation, together with the further advantages thereof, may best be understood by reference to the following description, taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a microwave cooking oven door of the present invention;

FIG. **2** is a fragmentary sectional view of the first embodiment of the present invention; and

FIG. **3** is a fragmentary sectional view of the second embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, FIG. **1** shows a microwave oven door assembly generally indicated by arrow **10** comprising a laminated door panel **11** having a metal frame **13** mounted about the periphery thereof. One side of the metal frame **13** has an L-shaped handle **15** connected thereto. The advantages of the metal frame **13** and the handle **15** are described and claimed in assignee's co-pending U.S. Pat. application, Ser. No. 266,059, filed June 26, 1972.

As shown in FIG. **2**, the door panel **11** comprises a relatively thin sheet of self-supporting, shatterproof metal **17** having an array of closely spaced perforations **19** formed therein. The sheet of metal **17** is preferably made of aluminum, however, other types of conductive metal can be utilized. The thickness of the metal is preferably 20 thousandths of an inch. The sheet of metal **17** is sandwiched between a pair of adhesive layers **21** which are preferably made of a transparent epoxy resin material. In the embodiment shown in FIG. **2**, the three sheets **17** and **21** are positioned between a pair of glass panels **23**. The glass panels **23** are preferably fully tempered and three sixteenths of an inch thick.

The glass panels **23** may also be tinted or clear. In the preferred embodiment, the glass panels **23** are tinted a solid color around a 2 inch border about its periphery, shown at **24.**

The sheet of metal **17,** and the glass panels **23** are all coextensive to form the laminated panel **11,** with the periphery of the metal sheet **17** being bent around one of the glass panels **23.** The layers of adhesive material **21** can either be coextensive with the entire metal sheet **17,** or only extend around the border **24** thereof, to provide the bonding for the metal sheet **17** with the outer panels. In forming the laminated panel **11,** as shown in FIG. **2,** the metal sheet **17** and glass panels **23** are assembled with the layers of adhesive material therebetween, as shown in FIG. **2,** and subjected to thermal or non-thermal compression until the sheets and panels are bonded together. After which, the metal frame **13** is mounted about the periphery of the laminated panel **11.**

In the embodiment shown in FIG. **3,** an identical sheet of metal **17** is provided between the layers of adhesive material **21.** As above, the layers **21** can be coextensive with the sheet **17** or they can extend around the border **24.** This embodiment differs from that shown in FIG. **2** in that the sheet **17** is positioned between a glass panel **23** and a thin film **25** of polycarbonate. In this embodiment, the polycarbonate film **25** is preferably utilized as the interior side of the door, while the glass panel **23** functions as the exterior side of the door.

The thin film **25** of polycarbonate is preferably between 10 and 20 thousandths of an inch thick, and is transparent so as not to interfere with the viewing perforations **19** of the metal sheet **17.**

As with the first embodiment, the three layers **17, 23** and **25** along with the layers of adhesive material **21** are compressed, either thermally or non-thermally, until an integral bonded construction is produced.

It should be noted that various modifications can be made to the apparatus while still remaining within the purview of the following claims.

What is claimed is:

1. A door assembly for sealing the opening of a microwave oven cavity, the cavity opening extending through the front face of the oven, comprising:

a relatively thin sheet of self-supporting, shatterproof metal 20 thousandths of an inch thick extending in a plane over the entire opening of the oven cavity and over the front face of the oven forming said opening:

a glass panel coextensive with said sheet of metal on the side of said sheet opposite the front face of the oven;

a second panel of non-metal material coextensive with and bonded to said sheet on the side of said sheet facing the front face of the oven, said panel completely extending over the opening of the oven cavity and over the front face of the oven forming said opening; and

a first quantity of adhesive material located about the periphery of said glass panel bonding said glass panel to said sheet of metal, and a second quantity of adhesive material located about the periphery of said second panel bonding said second panel to said sheet of metal to form an integral laminated door.

2. The invention of claim **1** wherein said sheet of metal includes an array of perforations formed over an extended area thereof.

3. The invention of claim **1** wherein said second panel is of a polycarbonate material.

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