



(51) International Patent Classification:
H05B 3/06 (2006.01)

[US/US]; 5445 Heritage Drive, Nashport, OH 43830 (US).

(21) International Application Number:
PCT/US2011/044692

(74) Agent: **KONDAS, Brian, E.**; Calfee, Halter & Griswold LLP, 800 Superior Ave., Ste 1400, Cleveland, OH 44114 (US).

(22) International Filing Date:
20 July 2011 (20.07.2011)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/365,815 20 July 2010 (20.07.2010) US

(71) Applicant (for all designated States except US): **OWENS CORNING INTELLECTUAL CAPITAL, LLC** [US/US]; One Owens Corning Parkway, Toledo, OH 43659 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **CAMPEN, Scott, A.** [US/US]; 12129 Valley Trail, Knoxville, TN 37934 (US). **KUNKLER, William, A.** [US/US]; 161 Claren Drive, Heath, OH 43056 (US). **SEWARD, Jason, M.**

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,

[Continued on next page]

(54) Title: AN APPARATUS AND METHOD FOR INSULATING AN APPLIANCE

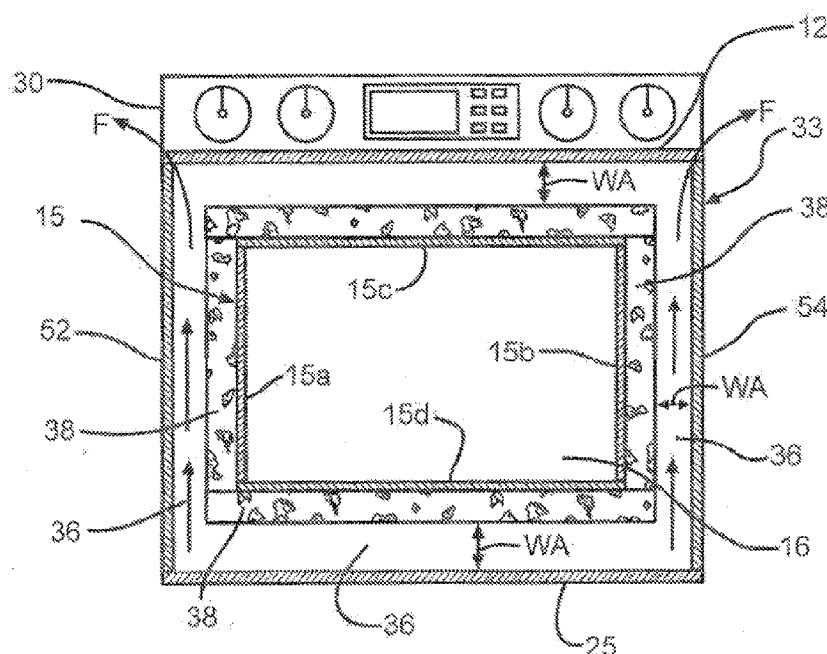


FIG. 2

(57) Abstract: An appliance has an insulation assembly. The appliance includes a liner defining an appliance chamber. A source of heat is positioned to heat an interior the chamber. An insulation assembly is positioned exterior to the chamber. Insulation includes loose-fill insulation material. The insulation including the loose-fill insulation material is positioned in the insulation assembly.



LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, **Published:**
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, — *with international search report (Art. 21(3))*
GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *of inventorship (Rule 4.17(iv))*

AN APPARATUS AND METHOD FOR INSULATING AN APPLIANCE

[0001] This application claims the benefit of US Provisional Patent Application No. 61/365,815, filed July 20, 2010, which is hereby incorporated by reference.

Background

[0002] The present invention relates to using high temperature insulation. It finds particular application in conjunction with using high temperature insulation with an appliance and will be described with particular reference thereto. It will be appreciated, however, that the invention is also amenable to other applications.

[0003] Household appliances, such as for example, ranges, ovens, hot water heaters, dryers and dish washers, can use high heat levels for various purposes, including food preparation, drying and self-cleaning. The high heat levels can be produced within confined chambers. Various energy sources, including electricity, natural gas and propane can be used to produce the high heat levels.

[0004] The confined chambers are typically positioned within a cabinet or an enclosure. The cabinet or enclosure typically includes side panels, a top panel and a bottom panel. In some instances, the cabinet or enclosure can also include a back panel and a front panel having a pivoting front door. High temperature insulation can be positioned adjacent to the confined chamber. The high temperature insulation is used to control the flow of heat from the confined chamber to the outside of the cabinet or enclosure.

[0005] The present invention provides a new and improved apparatus and method for using high temperature insulation with an appliance.

Summary

[0006] In one aspect of the present invention, it is contemplated that an appliance has an insulation assembly. The appliance includes a liner defining an appliance chamber. A source of heat is positioned to heat an interior the chamber. An insulation assembly is positioned exterior to the chamber. Insulation includes loose-fill insulation material. The insulation including the loose-fill insulation material is positioned in the insulation assembly.

Brief Description of the Drawings

[0007] In the accompanying drawings which are incorporated in and constitute a part of the specification, embodiments of the invention are illustrated, which, together with a general description of the invention given above, and the detailed description given below, serve to exemplify the embodiments of this invention.

[0008] **FIGURE 1** illustrates a perspective view of an oven;

[0009] **FIGURE 2** illustrates a schematic representation of a front view, partially in cross-section, of an oven illustrating insulation assemblies positioned around an oven chamber in accordance with one embodiment of an apparatus illustrating principles of the present invention;

[0010] **FIGURE 3** illustrates a schematic representation of a side view, in cross-section, of the oven illustrated in **FIGURE 2** in accordance with one embodiment of an apparatus illustrating principles of the present invention;

[0011] **FIGURE 4** illustrates a schematic representation of a side view, in cross-section, of the insulation assembly of **FIGURE 2** in accordance with one embodiment of an apparatus illustrating principles of the present invention;

[0012] **FIGURE 5** illustrates a schematic representation of a side view, in cross-section, of an insulation assembly in accordance with a second embodiment of an apparatus illustrating principles of the present invention;

[0013] **FIGURE 6A** illustrates a schematic representation of a side view, in cross-section, of an insulation assembly shown in an unfinished condition in accordance with a third embodiment of an apparatus illustrating principles of the present invention;

[0014] **FIGURE 6B** illustrates a schematic representation of a side view, in cross-section, of the insulation assembly of **FIGURE 6A** shown in a finished condition in accordance with one embodiment of an apparatus illustrating principles of the present invention;

[0015] **FIGURE 7A** illustrates a schematic representation of a side view, in cross-section, of an insulation assembly in accordance with a fourth embodiment of an apparatus illustrating principles of the present invention;

[0016] **FIGURE 7B** illustrates a schematic representation of a side view, in cross-section, of an insulation assembly in accordance with a fifth embodiment of an apparatus illustrating principles of the present invention;

[0017] **FIGURE 8A** illustrates a schematic representation of a front view, partially in cross-section, of the oven illustrated in **FIGURE 2** illustrating an alternate insulation configuration; and

[0018] **FIGURE 8B** illustrates a schematic representation of a front view, partially in cross-section, of the oven illustrated in **FIGURE 2** illustrating an alternate insulation configuration.

Detailed Description of Illustrated Embodiment

[0019] The description and figures disclose high temperature insulation assemblies for appliances. Generally, the high temperature insulation assemblies are configured to insulate the external surfaces of an appliance from the heat generated by a heat source within a heated and confined chamber. The term "appliance" as used herein, is defined to mean a piece of equipment configured for performance of a particular task. Various non-limiting examples of appliances include ranges, ovens, hot water heaters,

dryers and dish washers. The term "insulate", as used herein, is defined to mean substantially retard the flow of heat.

[0020] With reference to **FIGURE 1**, one example of an appliance **10**. While the embodiment illustrated in **FIGURE 1** illustrates the appliance **10** to be in the form of an oven, it should be appreciated that in other embodiments, the appliance **10** may take other forms (e.g., a hot water heater). The oven **10** includes a substantially flat, top cooking surface **12**. A plurality of heating elements or burners **14** are typically positioned on the top cooking surface **12**, although the heating elements or burners **14** are optional. The oven **10** may include a plurality of burner controls **26** configured to control the heat level produced by the burners **14**. The oven **10** can also include a control panel **28** for controlling the temperature generated within an appliance chamber **16** (e.g., an oven chamber). In the illustrated embodiment, the burner controls **26** and control panel **28** are mounted on a backsplash **30**. However, it should be understood that the burner controls **26** and the control panel **28** can be positioned in other locations of the oven **10**. The backsplash **30** is located on a back edge of the cooking surface **12**. The backsplash **30** typically extends away from the cooking surface **12** in an upwardly and perpendicular direction. Although the illustrated embodiment shows a backsplash **30**, it should be appreciated that in other embodiments, the oven **10** may not have a backsplash **30**. While the illustrated embodiment shows the oven **10** having a top cooking surface **12** with a plurality of burners **14**, it should be appreciated that other types of ranges or ovens, such as the non-limiting example of a wall oven without a top cooking surface can be used.

[0021] With reference to **FIGURES 1–3**, the oven **10** includes a pair of opposed side panels **52, 54**, a back panel **24**, a bottom panel **25**, and a front panel **32**. The opposed side panels **52, 54**, back panel **24**, bottom panel **25**, front panel **32**, and cooking surface **12** are configured to form an outer oven cabinet **33**. The outer oven cabinet **33** may be finished with any desired finish. In certain embodiments, the panels **52, 54, 24, 25, 32** and the cooking surface **12** can have an aesthetically pleasing finish, such as for example a painted finish, a porcelain enamel finish or a brushed stainless steel finish.

[0022] The front panel **32** includes a pivotally connected, insulated oven door **18**. The oven door **18** is hinged at a lower end to the front panel **32** such that the oven door

can be pivoted away from the front panel **32** and the oven chamber **16**. Optionally, the oven door **18** may include a window **19**. The window **19** is typically made of glass, in order that the user can view the contents of the oven chamber **16** during its use. Optionally, the oven door **18** may include a handle **21** configured to facilitate moving the oven door **18** from an open position to a closed position and visa versa.

[0023] With reference to **FIGURES 2 and 3**, the oven cabinet **33** supports an inner appliance liner **15** (e.g., an inner oven liner). The inner oven liner **15** includes opposing liner side panels **15a**, **15b**, a liner top panel **15c**, a liner bottom panel **15d**, and a liner back panel **15e**. The opposing liner side panels **15a**, **15b**, liner top panel **15c**, liner bottom panel **15d**, liner back panel **15e**, and oven door **18** are configured to define the oven chamber **16**.

[0024] With reference again to **FIGURES 2 and 3**, the exterior surfaces of the oven liner **15** are covered by a plurality of insulation assemblies **38**. The insulation assemblies **38** are placed adjacent to and, optionally in contact with, the exterior surfaces of the oven liner **15** and are configured to retain heat generated within an interior of the oven chamber **16**. In one embodiment, a heat source is positioned to heat the interior of the oven chamber **16**. The insulation assemblies **38** are also configured to reduce the rate of heat transfer to the outer oven cabinet **33**. The insulation assemblies **38** may be retained in position against the exterior surfaces of the oven liner **15** by retaining structures (not shown), including the non-limiting examples of straps, wire and metallic panels. The insulation assemblies **38** will be discussed in more detail below.

[0025] An air gap **36** may be formed between the insulation assemblies **38** and the outer oven cabinet **33**. In certain embodiments, the air gap **36** can be configured as another insulative layer, thereby further reducing the rate of heat transfer between oven chamber **16** and the oven cabinet **33**. The use of the air gap **36** may supplement the insulation assemblies **38** to minimize the surface temperatures on the outer surfaces of the oven cabinet **33**. The air gap **36** has a width **WA**. In the illustrated embodiment, the width **WA** of the air gap **36** is in a range of from about 0.50 inches to about 1.50 inches. In other embodiments, the width **WA** of the air gap **36** can be less than about 0.50 inches or more than about 1.50 inches. While the illustrated embodiment of the oven **10** shows

the widths **WA** of the air gaps **36** adjacent the panels **52**, **54**, the back panel **24**, the bottom panel **25**, and the front panel **32** to be approximately the same dimension, it should be appreciated that in other embodiments, the widths **WA** of the air gaps **36** adjacent the panels **52**, **54**, the back panel **24**, the bottom panel **25**, and the front panel **32** may be different dimensions.

[0026] With reference again to **FIGURE 2**, hot air can enter or be formed within the air gap **36** during use of the oven **10**. The hot air flows within the air gap **36** in a generally upward direction as indicated by the arrows **F**. The hot air exits the oven **10** through gaps between the side panels, **52**, **54**, and the top cooking surface **12**. Optionally, chimney structures (not shown) can be positioned in the air gap **36** to facilitate the flow of the hot air from the air gap **36**. The chimney structures can have any desired shape or configuration.

[0027] With reference to **FIGURE 4**, a first embodiment of an insulation assembly **38** includes a first enclosure material **60**, a second enclosure material **62** and an insulation layer **64** positioned therebetween. Generally, the first enclosure material **60** and the second enclosure material **62** are configured to form an insulation cavity within which the insulation layer **64** is positioned. In the illustrated embodiment, the first enclosure material **60** and the second enclosure material **62** are formed from either a rigid or flexible non-woven web of fibrous mineral material, such as the non-limiting example of glass fibers. However, in other embodiments the first enclosure material **60** and the second enclosure material **62** can be formed from other desired materials sufficient to form an insulation cavity, including the non-limiting examples of woven fibrous mineral materials and metallic materials, such as for example foil. In yet other embodiments, the enclosure materials, **60**, **62**, can be formed from porous materials to facilitate filling of the insulation cavity with the insulation layer **62**. While in the illustrated embodiment, the first enclosure material **60** and the second enclosure material **62** are formed of the same material, it should be appreciated that in other embodiments the first enclosure material **60** and the second enclosure material **62** can each be formed from different materials.

[0028] The enclosure materials, **60, 62**, have a material weight. In the illustrated embodiment, the material weight of the enclosure materials, **60, 62**, is in a range of from about 40.0 grams per square meter to about 90.0 grams per square meter. Alternatively, the material weight of the enclosure materials, **60, 62**, can be less than about 40.0 grams per square meter or more than about 90.0 grams per square meter.

[0029] As illustrated in **FIGURE 4**, the first enclosure material **60** has a thickness **T1**. The thickness **T1** is in a range of from about 0.01 inches to about 0.08 inches. In other embodiments, the thickness **T1** may be less than about 0.01 inches or more than about 0.08 inches. Similarly, the second enclosure material **62** has a thickness **T2**. In the illustrated embodiment, the thickness **T2** is in a range of from about 0.01 inches to about 0.08 inches. In other embodiments, the thickness **T2** can be less than about 0.01 inches or more than about 0.08 inches. While the illustrated embodiment shows the thicknesses **T1** and **T2** to be about the same, it should be appreciated that in other embodiments, the thicknesses **T1, T2** may be different from each other.

[0030] The first enclosure material **60** has a major face **70** and opposing end faces **72, 74**. Similarly, the second enclosure material **62** has a major face **76** and opposing end faces **78, 80**. The end face **72** of the first enclosure material **60** and the end face **78** of the second enclosure material **62**, are arranged to overlap each other thereby forming a structure having a closed end and an open end. A plurality of retention members **82** are positioned in the overlapped portion to maintain the overlapped arrangement. In the illustrated embodiment, the retention members **82** are staples. However, in other embodiments, the retention members **82** can be other structures, devices or mechanisms, such as for example clips, clamps, wires or high temperature zippers. In still other embodiments, the overlapped ends, **72, 78** can be connected by high temperature adhesives.

[0031] Once the overlapped end of the structure is formed, the first enclosure material **60** and the second enclosure material **62** define an insulation cavity **84** within the structure. As discussed in more detail below, the insulation cavity **84** within the structure is filled with loose-fill insulation material before the open end is closed. The loose-fill insulation material within the insulation cavity **84** forms the insulation layer **64**.

[0032] The loose-fill insulation used to form the insulation layer **64** can be any loose-fill insulation, such as a multiplicity of discrete, individual tufts, cubes, flakes, or nodules. The term "tuft", as used herein, is defined to mean any cluster of insulative fibers. The loose-fill insulation material can be made of glass fibers or other mineral fibers, and can also be organic fibers, thermoplastic fibers or cellulose fibers. In the illustrated embodiment, the loose-fill insulation material is binderless. However, in other embodiments, the loose-fill insulation material can include a binder material, including the non-limiting example of a high-temperature binder. In the illustrated embodiment, the loose-fill insulation material has an average fiber diameter in a range of from about 0.1 microns to about 20.0 microns. Without being held to the theory, it is believed that the relatively small average diameter of the fibers within the loose-fill insulation material provides increased insulative value (R value) over loose-fill insulation materials having larger average fiber diameters. Alternatively, the loose-fill insulation material can have an average fiber diameter less than about 0.1 microns or more than about 20.0 microns.

[0033] The loose-fill insulation material is inserted into the open end of the insulation cavity **84** formed by the first enclosure material **60** and the second enclosure material **62**, thereby forming the insulation layer **64**. As discussed below, after the loose-fill insulation is inserted into the insulation cavity **84**, the open end is closed and the insulation cavity **84** is enclosed by, for example, the retention member **82**. In the illustrated embodiment, the insulation layer **64** has a density in a range of from about 3.0 pounds per cubic foot (hereafter "pcf") to about 6.0 pcf. In other embodiments, the insulation layer **64** can have a density less than about 3.0 pcf or more than about 6.0 pcf.

[0034] Once the insulation layer **64** is formed, the end faces, **74**, **80**, of the first and second enclosure materials, **60**, **62**, are overlapped and maintained in an overlapped arrangement by a plurality of retention members **82** in the same manner as described above. The first and second enclosure materials, **60**, **62**, the insulation layer **64** and the overlapped end faces, **72**, **78**, **74** and **80** form the (enclosed) insulation assembly **38**. The insulation assembly **38** has a thickness **T3**. In the illustrated embodiment, the thickness **T3** is in a range of from about 0.50 inches to about 3.0 inches. Alternatively, the thickness **T3** can be less than about 0.50 inches or more than about 3.0 inches. The

insulation assembly **38** can have any desired width and length. The insulation assemblies **38** are positioned within the oven **10** and against the exterior surfaces of the inner oven liner **15** as discussed above.

[0035] During normal cooking operation, the oven chamber **16** will be heated to a cooking temperature in a range of from about 250° F (121° C) to about 500° F (260° C). When operating in a self-cleaning mode, the oven chamber **16** will be heated to a temperature in a range of from about 750° F (398° C) to about 900° F (482° C). For commercial or industrial ovens, the temperature within the oven chamber **16** can reach as high as 1600°F (871°C). The heat from within the oven chamber **16** can radiate from the oven chamber **16** and the flow of the heat can be retarded by the insulation assemblies **38** and optionally by the air gap **36**. In this manner, the insulation assemblies **38** and the air gap **36** cooperate to retard the amount of heat that is transferred to the oven cabinet **33**. Heat exposure tests, such as the UL858 Standard for Household Electric Ranges and ANSI Z21.1 Standard for Household Cooking Gas Appliances, require that the maximum allowable surface temperature be 152° F for a painted metal surface, 160° F for a porcelain enamel surface, or 172° F for a glass surface. In addition to meeting the maximum surface temperatures requirements for heat exposure tests, the reduced heat transfer rate of the configuration of the insulation assemblies **38** and the air gap **36** also advantageously provides for reduced power necessary for cooking and self-cleaning modes of operation, and protection of sensitive electronic controls from excessive exposure to high heat.

[0036] During self-cleaning mode, insulation including a binder (e.g., fiberglass insulation or loose-fill insulation) exposed to the relatively higher temperatures has been found to produce an unpleasant odor and/or smoke. Binderless insulation (e.g., binderless loose-fill insulation) has been found to eliminate the undesirable odor and/or smoke at relatively higher temperatures (e.g., during self-cleaning mode).

[0037] With reference to **FIGURE 5**, a second embodiment of an insulation assembly is illustrated generally at **138**. In this embodiment, a single continuous enclosure material is configured to form an insulation cavity. The insulation assembly **138** includes an enclosure material **160** and an insulation layer **164**. In the illustrated

embodiment, the enclosure material **160** and the insulation layer **164** are the same as, or similar to, the first enclosure material **60** and the insulation layer **64** discussed above and illustrated in **FIGURE 4**. However, in other embodiments, the enclosure material **160** may be different from the first enclosure material **60** and the insulation layer **164** can be different from the insulation layer **64**.

[0038] As illustrated in **FIGURE 5**, the enclosure material **160** has a formed end **186** and an overlapped end **188**. In the illustrated embodiment, the formed end **186** has the approximate cross-sectional shape of a rectangle. However, in other embodiments, the formed end **186** can have other cross-sectional shapes, including the non-limiting example of a rounded cross-sectional shape. As further shown in **FIGURE 5**, the overlapped end **188** includes end faces **174, 180**. The end faces **174, 180** are overlapped and connected together by a plurality of retention members **182**. In the illustrated embodiment, the retention members **182** are the same as, or similar to, the retention members **82** discussed above and illustrated in **FIGURE 4**. However, in other embodiments, the retention members **182** may be different from the retention members **82**. Once assembled, the insulation assemblies **138** are positioned in the oven **10** as described above and illustrated in **FIGURES 2 and 3**.

[0039] With reference to **FIGURES 6A and 6B**, a third embodiment of an insulation assembly is illustrated generally at **238**. In this embodiment, opposing enclosure materials are configured to form an insulation cavity. The insulation assembly **238** includes a first enclosure material **260**, a second enclosure material **262** and an insulation layer **264**. In the illustrated embodiment, the enclosure materials, **260, 262**, and the insulation layer **264** are the same as, or similar to, the enclosure materials **60, 62**, and the insulation layer **64** discussed above and illustrated in **FIGURE 4**. However, in other embodiments, the enclosure materials **260, 262** may be different from the enclosure materials **60, 62**, and the insulation layer **264** may be different from the insulation layer **64**.

[0040] As illustrated in **FIGURE 6A**, the enclosure material **260** has end flaps **272 and 188**. Similarly, the enclosure material **262** has end flaps **278, 280**. The end flap **272** of the first enclosure material **260** and the end flap **278** of the second enclosure

material **262** are joined. The end flaps **272, 278** are joined using a plurality of mechanical fasteners **282** (e.g., staples). However in other embodiments, the end flaps **272, 278**, can be joined using other processes and structures.

[0041] Once the end flaps **272, 278** are joined, the first enclosure material **260** and the second enclosure material **262** define an insulation cavity **284**. The insulation cavity **284** is subsequently filled with loose-fill insulation material. Once the insulation layer **264** is formed, the end flaps **274, 280** are joined, thereby forming the insulation assembly **238**. The end flaps **274, 280** are joined in the same manner as described above.

[0042] With reference to **FIGURE 6B**, the joined end flaps **272, 278** are rotated or folded such as to be adjacent the second enclosure material **262** and the joined end flaps **274, 280** are also rotated or folded such as to be adjacent the second enclosure material **262**, thereby forming the insulation layer **264**. Once assembled, the insulation assemblies **238** can be positioned in the oven **10** as described above and illustrated in **FIGURES 2 and 3**.

[0043] With reference to **FIGURE 7A**, a fourth embodiment of an insulation assembly is illustrated generally at **338**. The insulation assembly **338** is formed from a pack of fibrous loose-fill insulation material **364**. In the illustrated embodiment, the fibrous loose-fill insulation material **364** is the same as, or similar to, the loose-fill insulation material **64** discussed above and illustrated in **FIGURE 4**. However, in other embodiments, the fibrous loose-fill insulation material **364** may be different from the fibrous loose-fill insulation material **64**.

[0044] With reference again to **FIGURE 7A**, the insulation assembly **338** having the fibrous loose-fill insulation material **364** can be formed in any desired manner. In one example of a forming process, individual tufts of the fibrous loose-fill insulation material **364** can be entangled with other individual tufts of the fibrous loose-fill insulation material **364** by the process of needling. One example of the needling process is disclosed in the US Patent Application Publn. No. 2007/0014995 (Chacko et al.) published January 18, 2007, the disclosure of which is incorporated herein by reference. However, it should be appreciated that the insulation assembly **338** having the entangled

fibrous loose-fill insulation material **364** can be formed in any desired manner. The process of entangling the fibrous loose-fill insulation material **364** is configured to provide strength to the fibrous loose-fill insulation material **364** such that the insulation assembly **338** generally retains its shape.

[0045] After the insulation assembly **338** having the entangled fibrous loose-fill insulation material **364** is formed, the insulation assembly **338** can be cut to any desired shape and size using any desired cutting process, including the non-limiting example of die cutting.

[0046] The insulation assembly **338** having the entangled fibrous loose-fill insulation material **364** has a density. In the illustrated embodiment, the insulation assembly **338** has a density in a range of from about 3.0 pcf to about 6.0 pcf. In other embodiments, the insulation assembly **338** can have a density less than about 3.0 pcf or more than about 6.0 pcf.

[0047] With reference to **FIGURE 7B**, a fifth embodiment of an insulation assembly is illustrated generally at **438**. The insulation assembly **438** is formed from a pack of fibrous loose-fill insulation material **464**. In the illustrated embodiment, the fibrous loose-fill insulation material **464** is the same as, or similar to, the loose-fill insulation material **64** discussed above and illustrated in **FIGURE 4**. However, in other embodiments, the fibrous loose-fill insulation material **464** can be different from the fibrous loose-fill insulation material **64**.

[0048] The pack of fibrous loose-fill insulation material **464** is entangled with fibers **490** having a longer length than the fibers of the fibrous loose-fill insulation material **464**. The entangled fibers **490** are configured to provide strength to the fibrous loose-fill insulation material **464** such that the pack generally retains its shape. In addition to having a longer length than the fibers of the fibrous loose-fill insulation material **464**, the entangled fibers **490** also have a larger average diameter than the average diameter of the fibers of the fibrous loose-fill insulation material **464**. In the illustrated embodiment, the average diameter of the entangled fibers **490** is in a range of from about 10 microns to about 30 microns. In other embodiments, the average diameter

of the entangled fibers **490** can be less than about 10 microns or more than about 30 microns.

[0049] With reference again to **FIGURE 7B**, the entangled fibers **490** have an average length in a range of from about 0.50 inches to about 3.0 inches. However, it should be appreciated that in other embodiments, the average length of the entangled fibers **490** can be less than about 0.50 inches or more than about 3.0 inches.

[0050] The fibrous loose-fill insulation material **464** and the entangled fibers **490** can be formed together in any desired proportions. In the illustrated embodiment, the proportion of the fibrous loose-fill insulation material **464** is in a range of from about 20.0% to about 95.0% by weight and the proportion of the entangled fibers **490** is in a range of from about 5.0% to about 80.0% by weight. However, in other embodiments, the proportion of the fibrous loose-fill insulation material **464** can be less than about 20.0% or more than about 95.0% and the proportion of the entangled fibers **490** can be less than about 5.0% or more than about 80.0%.

[0051] With reference again to **FIGURE 7B**, the pack having the entangled fibers **490** and the fibrous loose-fill insulation material **464** may be formed in any desired manner. In one example of a forming process, the entangled fibers **490** may be entangled with the fibrous loose-fill insulation material **464** by the process of needling. One example of the needling process is disclosed in the US Patent Application Publn. No. 2007/0014995 (Chacko et al.) as discussed above. However, it should be appreciated the pack having the entangled fibers **490** and the fibrous loose-fill insulation material **464** can be formed in any desired manner.

[0052] After the pack having the entangled fibers **490** and the fibrous loose-fill insulation material **464** is formed, the pack may be cut to any desired shape and size using any desired cutting process, including the non-limiting example of die cutting.

[0053] The pack having the entangled fibers **490** and the fibrous loose-fill insulation material **464** has a density. In the illustrated embodiment, the pack has a density in a range of from about 3.0 pcf to about 6.0 pcf. In other embodiments, the pack has a density less than about 3.0 pcf or more than about 6.0 pcf.

[0054] With reference to **FIGURE 8A**, another embodiment of an oven **510** is illustrated. In this embodiment, a plurality of insulation cavities **592a**, **592b**, **592c**, **592d** are formed proximate (adjacent) to and around an oven liner **515** and defined by veil walls **593a**, **593b**, **593c**, **593d**, respectively. It is contemplated that the veil walls **593a**, **593b**, **593c**, **593d** include the material discussed above for the enclosure material. The veil walls **593a**, **593b**, **593c**, **593d** are spaced from a wall defining the oven liner **515** to create the insulation cavities **592a**, **592b**, **592c**, **592d** defined by the veil walls **593a**, **593b**, **593c**, **593d** and respective walls of the oven liner **515**. Therefore, in this embodiment, the loose-fill insulation material **565** directly contacts an exterior surface of the oven liner **515** walls and the veil walls **593a**, **593b**, **593c**, **593d**. The insulation cavities **592a**, **592b**, **592c**, **592d** are configured to be filled with loose-fill insulation material **565**. In the illustrated embodiment, the loose-fill insulation material **565** is the same as, or similar to, the loose-fill insulation material forming the insulation layer **64** discussed above and illustrated in **FIGURE 4**. However, the loose-fill insulation material **565** can be different from the loose-fill insulation material forming the insulation layer **64**.

[0055] The loose-fill insulation material **565** may be inserted into (e.g., blown into) the insulation cavities **592a**, **592b**, **592c**, **592d** by an applicator **594**. The applicator **594** can have any desired shape, size, or configuration. In still other embodiments, the loose-fill insulation material **565** can be inserted into the insulation cavities **592a**, **592b**, **592c**, **592d** by other desired structures, mechanisms, or devices, including the non-limiting example of a pressurized hopper (not shown).

[0056] While the insulation cavities **592a**, **592b**, **592c**, **592d** illustrated in **FIGURE 8A** are shown as having substantially rectangular forms, it should be appreciated that in other embodiments, the insulation cavities **592a**, **592b**, **592c**, **592d** can be any shape, size, or configuration sufficient to retain the loose-fill insulation material **565** in an insulating orientation against the inner oven liner **515**.

[0057] With reference to **FIGURE 8B**, another embodiment of an oven **610** is illustrated. In this embodiment, an air gap **636** is formed around an oven liner **615** and insulation cavities **692a**, **692b**, **692c**, **692d** are formed around the air gap **636**. The

insulation cavities **692a**, **692b**, **692c**, **692d** are configured to be filled with loose-fill insulation material **665**. In the illustrated embodiment, the loose-fill insulation material **665** is the same as, or similar to, the loose-fill insulation material forming the insulation layer **64** discussed above and illustrated in **FIGURE 4**. However, the loose-fill insulation material **665** may be different from the loose-fill insulation material forming the insulation layer **64**.

[0058] The loose-fill insulation material **665** may be inserted into the insulation cavities **692a**, **692b**, **692c**, **692d** by any desired manner including using the applicator **594** as illustrated in **FIGURE 8A**.

[0059] While the insulation cavities **692a**, **692b**, **692c**, **692d** illustrated in **FIGURE 8B** are shown as having substantially rectangular forms, it should be appreciated that in other embodiments, the insulation cavities **692a**, **692b**, **692c**, **692d** can be any shape, size, or configuration sufficient to retain the loose-fill insulation material **665** in an insulating orientation against the inner oven liner **615**.

[0060] The air gap **636** is used as a further insulator to limit the conductive heat transfer between oven liner **615** and the outer oven cabinet **633**. The use of the air gap **636** supplements the insulation material **665** to minimize the surface temperatures on the outer surfaces of the outer oven cabinet **633**. In the embodiment shown in **FIGURE 8B**, the air gap **636** has a width **WA2**. In this embodiment, the width **WA2** is in a range from about 0.50 inches to about 1.5 inches. In another embodiment, the width **WA2** can be less than about 0.50 inches or more than about 1.5 inches.

[0061] While the present invention has been illustrated by the description of embodiments thereof, and while the embodiments have been described in considerable detail, it is not the intention of the applicants to restrict or in any way limit the scope of the appended claims to such detail. Additional advantages and modifications will readily appear to those skilled in the art. Therefore, the invention, in its broader aspects, is not limited to the specific details, the representative apparatus, and illustrative examples shown and described. Accordingly, departures may be made from such details without departing from the spirit or scope of the applicant's general inventive concept.

I/We claim:

1. An appliance having an insulation assembly, the appliance comprising:
a liner defining an appliance chamber;
a source of heat positioned to heat an interior the chamber;
an insulation assembly positioned exterior to the chamber; and
5 insulation, including loose-fill insulation material, positioned in the insulation assembly.
2. The appliance as set forth in claim 1, wherein:
the insulation assembly includes at least one enclosure material configured to form an insulation cavity; and
the insulation is positioned in the insulation cavity.
3. The appliance as set forth in claim 2, wherein:
the insulation assembly includes a plurality of the enclosure materials configured to enclose the insulation cavity; and
the insulation is positioned in the enclosed insulation cavity.
4. The appliance as set forth in claim 2, wherein:
one of the enclosure materials overlaps another one of the enclosure materials to form the insulation cavity.
5. The appliance as set forth in claim 2, wherein:
the loose-fill insulation material is blown into the insulation cavity.
6. The appliance as set forth in claim 2, wherein:
the insulation cavities are defined by respective walls of the appliance chamber and respective ones of the enclosure material.
7. The appliance as set forth in claim 1, wherein the loose-fill insulation includes individual tufts entangled with each other.

8. The appliance as set forth in claim 1, wherein:
the loose-fill material is entangled with fibers.
9. The appliance as set forth in claim 8, wherein:
the loose-fill insulation material has an average fiber diameter in a range of from
about 0.1 microns to about 20 microns;
the entangled fibers have an average diameter in a range of from about 10 microns
5 to about 30 microns; and
the entangled fibers have a length in a range from about 0.50 inches to about 3.0
inches.
10. The appliance as set forth in claim 2, further including:
an air gap between the liner and the insulation assembly.
11. The appliance as set forth in claim 2, further including:
an air gap exterior to both the liner and the insulation assembly.
12. The appliance as set forth in claim 2, further including:
an outer appliance cabinet, the insulation assembly limiting a temperature of the
outer appliance cabinet to about 152°F if the outer appliance cabinet is painted, to about
160°F if the outer appliance cabinet is porcelain, and to about 172°F if the outer
5 appliance cabinet is glass, when a temperature in the appliance chamber is about 900°F.
13. A method for insulating a chamber in an appliance, the method
comprising:
defining an appliance chamber by a liner;
positioning a source of heat to heat an interior of the appliance chamber;
5 positioning an insulation assembly exterior to an appliance chamber; and
positioning insulation, including loose-fill insulation material, in the insulation
assembly.
14. The method for insulating a chamber in an appliance as set forth in
claim 13, further including:

- positioning the insulation assembly to define an insulation cavity defined by enclosure material;
- 5 enclosing the insulation, including the loose-fill insulation material, in the insulation cavity; and
- positioning the insulation assembly adjacent to the liner.

15. The method for insulating a chamber in an appliance as set forth in claim 13, further including:
- positioning the insulation assembly to define an insulation cavity between an enclosure material and the liner; and
- 5 blowing the insulation, including the loose-fill insulation material, into the insulation cavity.

16. The method for insulating a chamber in an appliance as set forth in claim 13, further including:
- entangling individual tufts of the loose-fill insulation material with one of each other and other fibers.

17. The method for insulating a chamber in an appliance as set forth in claim 13, further including:
- positioning the insulation assembly to provide for an air gap between the insulation and the liner.

18. An insulation assembly for an appliance, the insulation assembly comprising:
- at least one enclosure material configured to form an insulation cavity; and
- insulation, including loose-fill insulation material, positioned in the insulation
- 5 cavity.

19. The insulation assembly as set forth in claim 18, wherein:
- the enclosure material encloses the insulation in the insulation cavity.

20. The insulation assembly as set forth in claim 18, wherein:
a liner of an associated appliance chamber defines one side of the insulation cavity; and
the enclosure material forms a plurality of additional ones of the sides of the
5 insulation cavity.

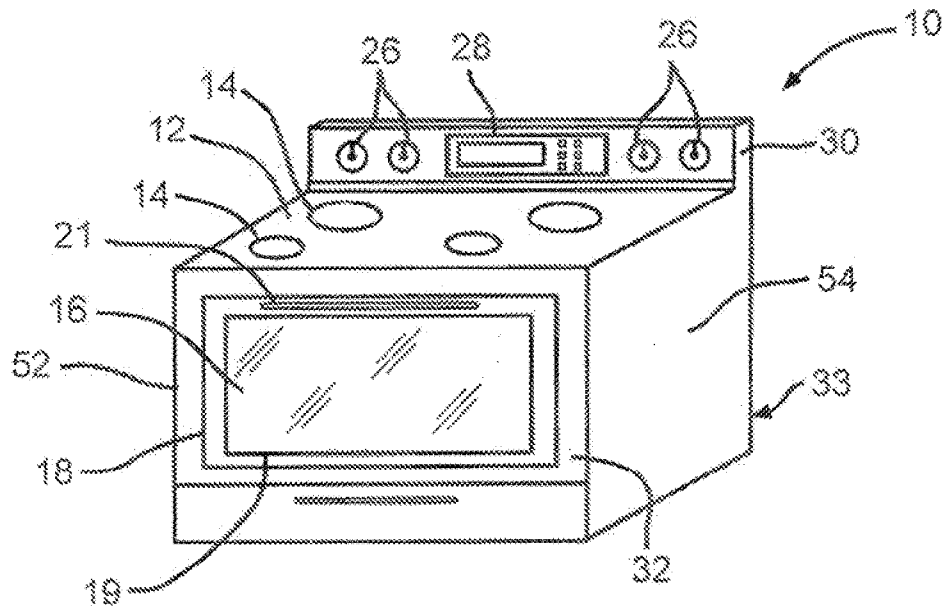


FIG. 1

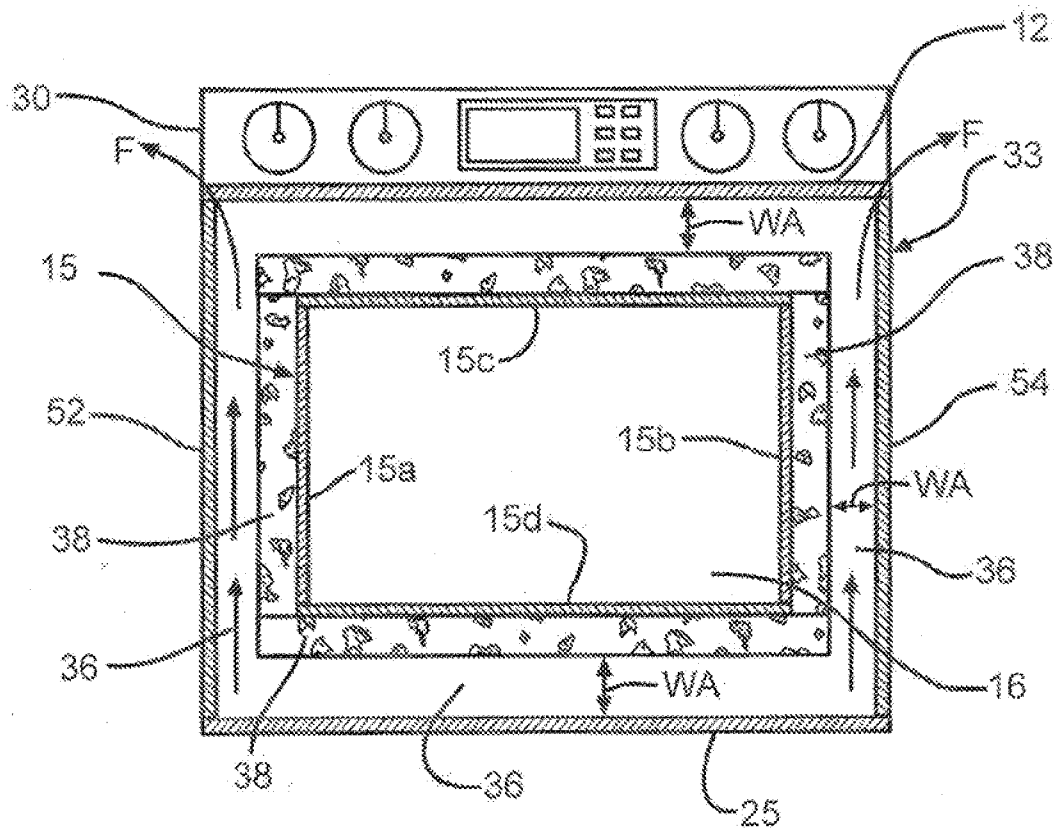
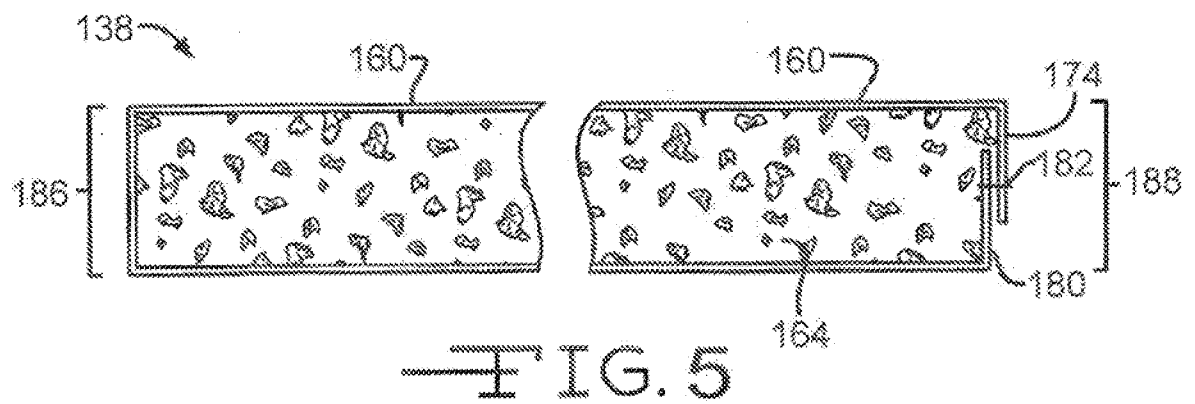
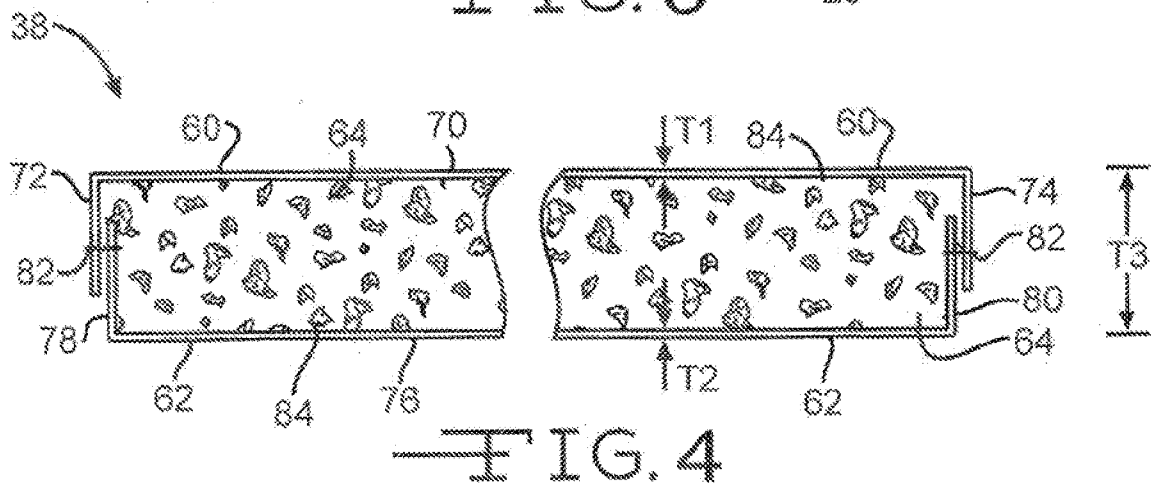
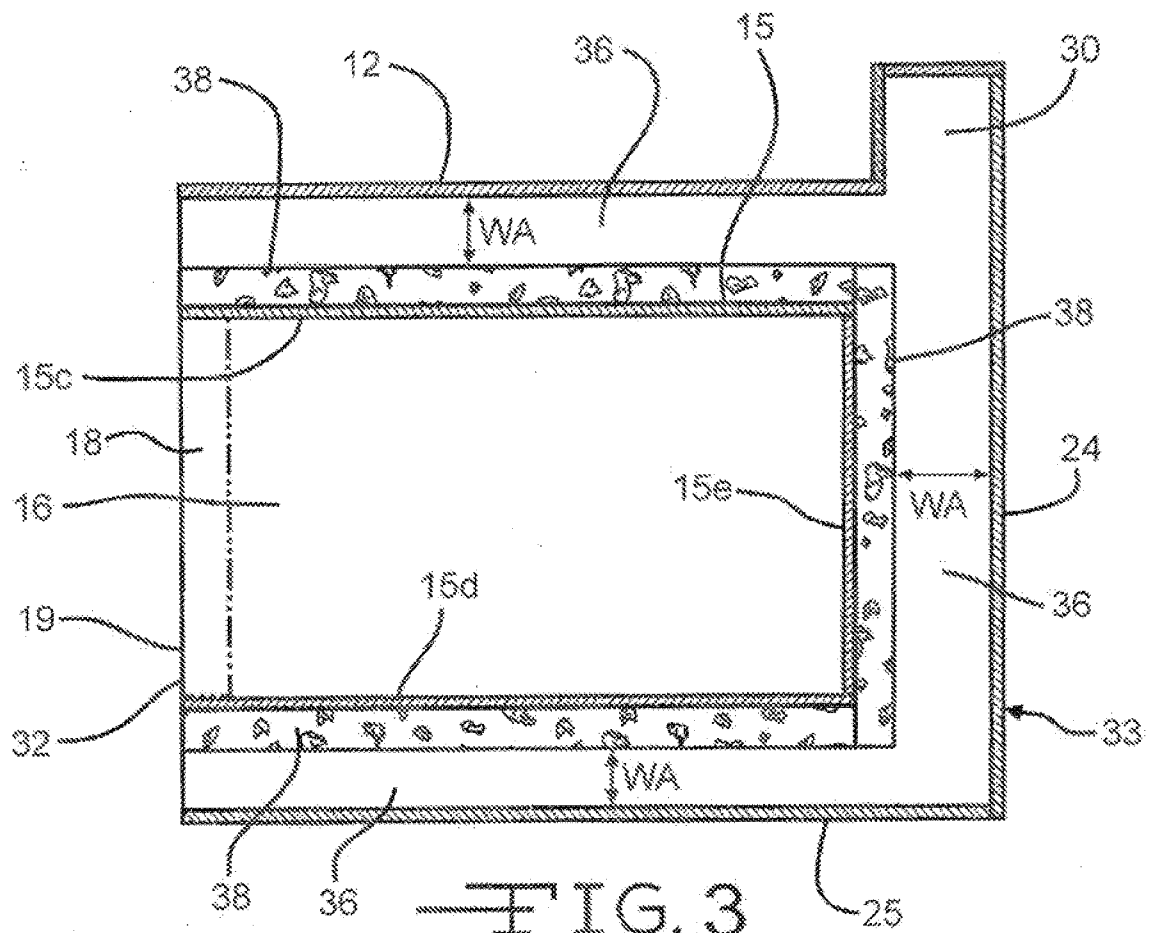


FIG. 2



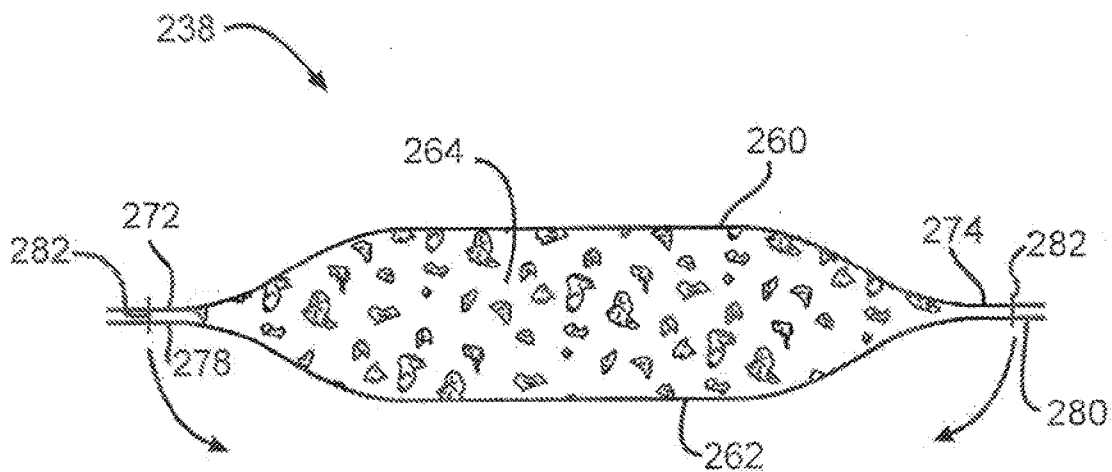


FIG. 6A

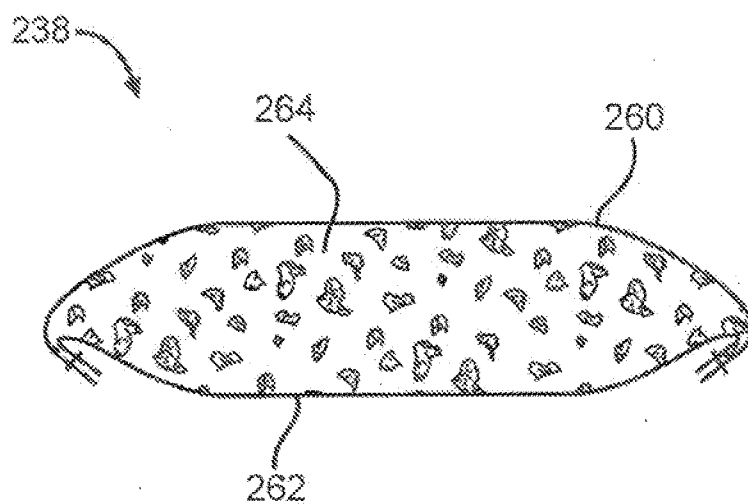


FIG. 6B



FIG. 7A

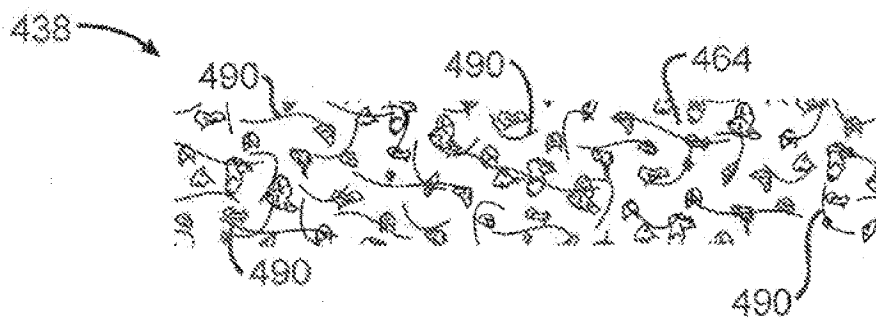
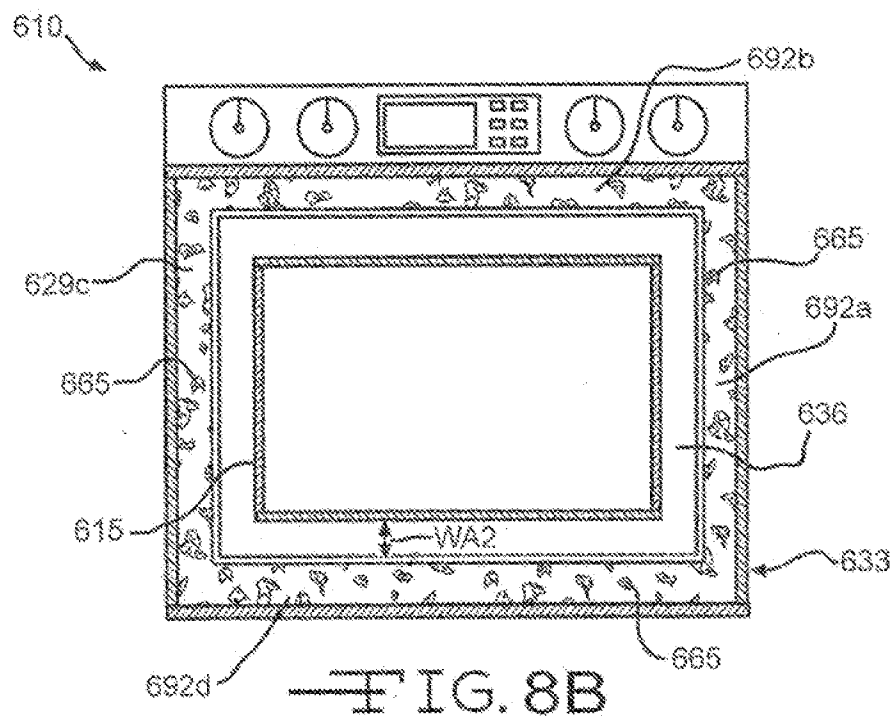
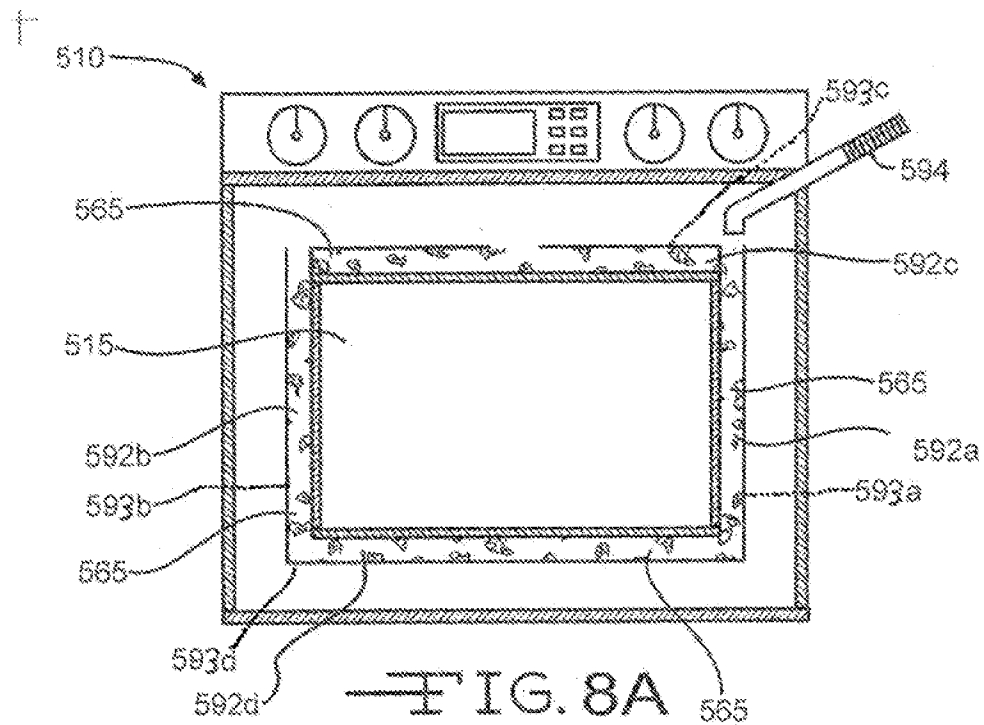


FIG. 7B



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2011/044692

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - H05B 3/06 (2011.01)

USPC - 219/531

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC(8) - A01H 5/02; A47B 96/04; H05B 3/06 (2011.01)

USPC - 126/1R; 219/531; 312/400

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Questel Orbit, Google Patent, Google

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3,342,976 A (KJELLBERG) 19 September 1967 (19.09.1967) entire document	18-19
Y		1-17, 20
Y	US 2008/0246379 A1 (CHOUDHARY et al) 09 October 2008 (09.10.2008) entire document	1-17, 20
Y	US 2005/0160711 A1 (YANG) 28 July 2005 (28.07.2005) entire document	5, 7-9, 15-16
A	US 3,121,158 A (HURKO) 11 February 1964 (11.02.1964) entire document	1-20
A	US 2008/0280131 A1 (CHACKO et al) 13 November 2008 (13.11.2008) entire document	1-20

☐ Further documents are listed in the continuation of Box C.


* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

25 October 2011

Date of mailing of the international search report

03 NOV 2011

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450

Facsimile No. 571-273-3201

Authorized officer:

Blaine R. Copenheaver

PCT Helpdesk: 571-272-4300

PCT OSP: 571-272-7774