


Industria y Comercio

SUPERINTENDENCIA

PETITORIO

REPÚBLICA DE COLOMBIA
 MINISTERIO DE INDUSTRIA Y COMERCIO
 SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO
 DEPARTAMENTO DE PATENTES Y MARCAS
 BOGOTÁ, D.C.

**FORMULARIO UNICO DE SOLICITUD DE PATENTE
PCT
ENTRADA EN FASE NACIONAL**
SOLICITUD DE:

1

☒ Patente de Invención.

☐ Patente de Modelo de Utilidad.

☒ Capítulo I.

☐ Capítulo II.

2

**SOLICITANTE
(71)**

 Nombre: **JELD-WEN, INC.**

 sociedad constituida y existente bajo las
leyes del estado de Oregon, Estados Unidos
de América

 Dirección: 3250 Lakeport Boulevard
Klamath Falls, Oregon 97601
Estados Unidos de América

 Domicilio: Klamath Falls, Oregon,
Estados Unidos de América.

IDENTIFICACIÓN

 C.C. ☐ NIT ☐

 C.E. ☐ Otro ☐

Cual _____

Número _____

3

**REPRESENTANTE
O APODERADO**

 Nombre: **EMILIO FERRERO**
Dirección: Carrera 4ª. No. 72-35
Teléfono: 347 36 11
Fax: 211 86 50
E-mail: clientes@camyp.com.
Domicilio: Bogotá, Colombia.

IDENTIFICACIÓN

 C.C. ☒ NIT ☐

 C.E. ☐ Otro ☐

Cual _____

 Número 438.019 T.P 31.929

4

**INVENTOR (ES)
(72)**

 1. **Randy John CLARK**
1919 Manzanita,
Klamath Falls, Oregon 97601,
Estados Unidos de América

 3. **Keith Lynn LEWALLEN**
1200 Chisolm Trail, #C
Salado, Texas 76571,
Estados Unidos de América

 5. **William Robert TRANSUE**
23169 North Poe Valley Road,
Klamath Falls, Oregon 97603,
Estados Unidos de América

 2. **Gary Lee KOEPKE**
2111 Kimberly Drive
Klamath Falls, Oregon 87603,
Estados Unidos de América

 4. **Brent David OLSON**
1535 Kane Street,
Klamath Falls, Oregon 97603,
Estados Unidos de América

5

PCT (86)

 Solicitud Internacional No. PCT/US2003/034373

 Fecha: 29 de Octubre de 2003

 Publicación Internacional No. WO 2004/042181 A1

 Fecha: 21 de Mayo de 2004

6

Título (54)
PUERTA MULTICAPA CONTRA INCENDIO Y MÉTODO PARA HACERLA

7

Clasificación Internacional (51) E06B 5/16, E04B 1/94

8

Prioridad

 SI ☒ NO ☐

(33) País de Origen

US

(32) Fecha

31 de Octubre de 2002

(31) Número de Solicitud

10/284,392

9

Comprobante de pago No.: 05 - 35,936 Fecha: 16 de mayo de 2005

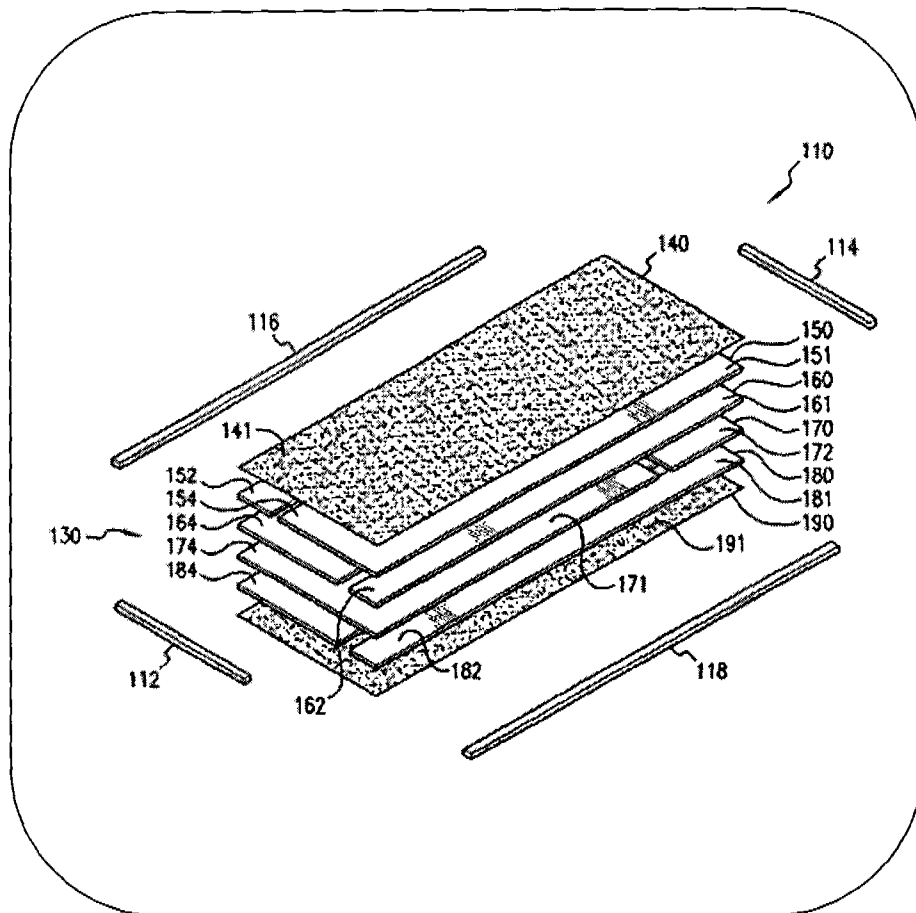
10

Anexos:

- ☒ Comprobante de pago de la tasa de presentación de la solicitud por \$ 443.000.00.
- ☐ Comprobante de pago por reivindicación de prioridad.
- ☐ Documento que acredita la existencia y representación legal cuando el solicitante sea persona jurídica.
- ☐ Poderes, si fuere el caso.
- ☐ Documento de cesión del inventor al solicitante o a su causante.
- ☐ Declaraciones.
- ☒ Copia de la solicitud internacional. (Resumen, descripción, reivindicaciones, dibujos)
- ☒ Traducción de la solicitud internacional al castellano. (Resumen, descripción, reivindicaciones, dibujos)
- ☐ Copia del examen preliminar efectuado por la IPEA.
- ☐ Traducción del examen preliminar efectuado por la IPEA.
- ☐ De ser el caso, copia del contrato de acceso.
- ☐ De ser el caso, documento que acredite la licencia o autorización de uso de conocimientos tradicionales de las comunidades indígenas.
- ☐ De ser el caso, certificado de depósito del material biológico.
- ☒ Arte final 12x12
- ☐ De ser el caso, información sobre otras solicitudes de patente o títulos obtenidos en el extranjero por el mismo titular o su causante, relacionadas parcial o totalmente con la invención de esta solicitud.
- ☒ Otros: VER HOJA ANEXA CON LESTADO DE DOCUMENTOS PRESENTADOS

11

FIGURA CARACTERÍSTICA



12

Solicito la concesión de la patente,

NOMBRE:

EMILIO FERRERO

FIRMA:

C.C. 438.019 de Usaquén T.P. 31.929

DOCUMENTOS ANEXOS

1. ☒ **Publicación Internacional WO 2004/042181 A1**

Descripción:

Páginas 1-17 en el idioma original

Páginas 1-22 en español

Reivindicaciones: Número (s) 1-40

Figuras: Número (s) 1 a 6

2. ☐ **Forma PCT/RO/101. Solicitud PCT**
3. ☐ **Forma PCT/RO/106. Invitation to Correct Defects.**
4. ☒ **Forma PCT/ISA/210. Informe de Búsqueda Internacional.**
5. ☐ **Forma PCT/ISA/220. Notificación De La Transmisión Del Informe De Búsqueda Internacional Y De La Opinión Escrita De La Administración Encargada De La Búsqueda Internacional, O De La Declaración.**
6. ☐ **Forma PCT/ISA/237. Opinión Escrita De La Administración Encargada De La Búsqueda Internacional.**
7. ☒ **Forma PCT/IB/304. Notification Concerning Submission Or Transmittal Of Priority Document.**
8. ☐ **Forma PCT/IB/306. Notification Of The Recoding Of A Change.**
Descripción De Modificación:

9. ☐ **Forma PCT/IB/308. Notice Informing The Applicant Of The Communication Of The International Application To The Designated Offices.**
10. ☐ **Forma PCT/IB/332. Information Concerning Elected Offices Notified Of Their Election.**
11. ☐ **Forma PCT/IPEA/401. PCT Demand**
12. ☐ **Forma PCT/IPEA/402. Notification Of Receipt Of Demand By Competent International Preliminary Examining Authority.**
13. ☐ **Forma PCT/IPEA/408. Written Opinion.**
14. ☐ **Forma PCT/IPEA/416. Notification Of Transmittal Of The International Preliminary Examination Report.**
15. ☐ **Forma PCT/IPEA/409. Informe Del Examen Preliminar Internacional.**
16. ☐ **Traducción Al Español Del Informe Del Examen Preliminar Internacional.**
17. ☐ **Traducción Al Español De Los Anexos Presentados Junto Con El Informe Del Examen Preliminar Internacional.**

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
21 May 2004 (21.05.2004)

PCT

(10) International Publication Number
WO 2004/042181 A1

(51) International Patent Classification⁷: **E06B 5/16**,
E04B 1/94

(21) International Application Number:
PCT/US2003/034373

(22) International Filing Date: 29 October 2003 (29.10.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
10/284,392 31 October 2002 (31.10.2002) US

(71) Applicant (for all designated States except US): **JELD-
WEN, INC.** [US/US]; 3250 Lakeport Boulevard, Klamath
Falls, OR 97601 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **CLARK, Randy,**
Jon [US/US]; 1919 Manzanita, Klamath Falls, OR 97601
(US). **KOEPKE, Gary, Lee** [US/US]; 2111 Kimberly
Drive, Klamath Falls, OR 97603 (US). **LEWALLEN,**
Keith, Lynn [US/US]; 1200 Chisolm Trail, #C, Salado,

TX 76571 (US). **OLSON, Brent, David** [US/US]; 1535
Kane Street, Klamath Falls, OR 97603 (US). **TRANSUE,**
William, Robert [US/US]; 23169 North Poe Valley Road,
Klamath Falls, OR 97603 (US).

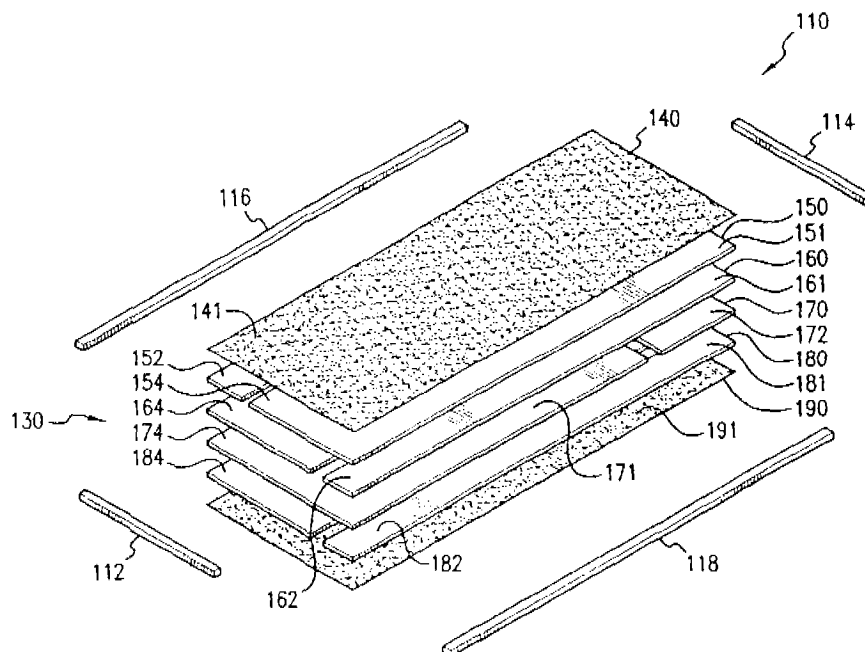
(74) Agents: **STOJKOVICH, Goran, P.** et al.; Kilpatrick
Stockton LLP, 1001 West Fourth St., Winston-Salem, NC
27101 (US).

(81) Designated States (national): AE, AG, AL, AM, AT, AU,
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU,
CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE,
GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR,
KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK,
MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT,
RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR,
TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (regional): ARIPO patent (GH, GM,
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,
ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO,
SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM,
GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: MULTI-LAYERED FIRE DOOR AND METHOD FOR THE MAKING OF SAME



(57) Abstract: A door has a core (130) that includes a porous layer (170) having a thickness and two opposing major surfaces. In one construction, the core (130) also includes three fire-retardant layers (150, 160, 180), and two of the fire-retardant layers are separated by the porous layer (170). The porous layer (170) and the fire-retardant layers (150, 160, 180) are coupled together. Other constructions include one or more fire-retardant layers in balanced or unbalanced placement around the porous layer.

WO 2004/042181 A1



Published:

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

MULTI-LAYERED FIRE DOOR AND METHOD FOR MAKING THE SAME**NOTICE OF COPYRIGHT PROTECTION**

A portion of the disclosure of this patent document and its figures contain material
5 subject to copyright protection. The copyright owner has no objection to the facsimile
reproduction by anyone of the patent document, but otherwise reserves all copyrights
whatsoever.

FIELD OF THE INVENTION

This invention relates to doors in general, and more particularly to a fire door
10 having several fire-retardant layers.

BACKGROUND

Fire doors are designed and installed in an attempt to protect lives and property
from fire, smoke, and heat by providing a barrier to withstand the fire, smoke, and heat
for a period of time. To be labeled or certified as a fire door, a door must fulfill the
15 requirements of certain codes or standards that regulate the construction and installation
of such doors. These codes or standards include, among others, the Uniform Building
Code (UBC), and codes promulgated by the National Fire Protection Association
(NFPA), and American Society for Testing and Materials (ASTM).

Private testing laboratories, such as Underwriters' Laboratories and Warnock
20 Hersey, may test for adherence to such codes or standards, and may test for additional
attributes. The laboratories may also certify that a fire door meets fire protection
requirements after conducting testing (such as destructive testing) of the door. Usually,
this certification is expressed as a fire-rating offering a specific level of protection from
fire, smoke, and/or heat for a limited amount of time. For example, a 20-minute fire-rated
25 door should, if installed correctly, maintain its structural integrity and provide a barrier to
fire, heat, and/or smoke for at least 20 minutes. So long as a door meets relevant fire
protection requirements, its design may vary to fulfill other design considerations, such as
weight, cost of manufacture, and aesthetic appearance.

An interior routed medium-density fiberboard (MDF) fire door meeting current
30 fire protection requirements generally is constructed of a one-and-one-half inch (3.81 cm)
thick sheet of MDF having a minimum density of approximately 42 pounds per cubic foot
(pcf) (673 kg/m³) and a one-eighth of an inch (0.32 cm) hardboard skin on both sides of

the MDF. A single-swing wood fire door using MDF having this thickness and density, and that is three feet (0.91 m) wide by eight feet (2.44 m) high, weighs nearly 153 pounds (69.4 kg). Not only is such a door extremely heavy, but manufacturing it can be costly and difficult as well.

5 For example, manufacturing a molded-panel fire door that meets current fire protection requirements generally requires using a mold. There are several ways known to prepare molds. One common method is to use matching castings or dies. A molded door generally has two exterior skins, and one mold is required for each skin. To make a custom-ordered door, a new mold must be created. While using molds to make a paneled
10 door is generally less costly on a high-volume basis than machining reliefs into a door, molding custom-ordered doors can significantly add to the manufacturing expense -- in some cases, this expense can become cost-prohibitive.

Manufacturing paneled wood doors without molds is known in the art. Such doors generally include two exterior skins with a core inserted between the skins. In one such
15 conventional door, the core generally includes a three-eighths-of-an-inch-thick (0.95 cm) layer of MDF, a three-eighths-of-an-inch-thick (0.95 cm) layer of expanded polystyrene, and another three-eighths-of-an-inch-thick (0.95 cm) layer of MDF. The layers of the core are adhered to one another, as are the external skins and the core. Wood side stiles and top and bottom rails are then adhered to an outer perimeter of the door. Panels are formed
20 by routing a series of grooves into the external skins.

SUMMARY OF THE INVENTION

The present invention includes multi-layered fire doors and methods for making such doors. One embodiment of the present invention provides a fire door that includes a core. The core has a porous layer having a thickness and two opposing major surfaces.
25 The core also has at least three, preferably fire-retardant, additional layers. Each of the three fire-retardant layers has a thickness and two opposing major surfaces. The porous layer and the at least three fire-retardant layers are coupled together. At least two of the at least three fire-retardant layers are separated by the porous layer from the other fire-retardant layers. The fire door can also include first and second exterior layers, each
30 having a thickness and two opposed major surfaces. A grooved first pattern can be disposed on the first exterior layer and a grooved second pattern can be disposed on the second exterior layer.

26

The fire-retardant layers may be made of any suitable material. In one embodiment, the fire-retardant layers are made of MDF having a density of at least 42 pcf (673 kg/m³). Likewise, the porous layer can be made of any suitable material. One example is a thermoplastic polymer having a density of at least 1 pcf (16 kg/m³). The thickness of each of the fire-retardant layers is the same. The thickness of the porous layer is approximately the same as the thickness of each fire-retardant layer. The first and second exterior layers can include a hardboard having a density of approximately 52 pcf (833 kg/m³). The thicknesses of the first and second exterior layers are approximately the same.

10 Another embodiment of the present invention provides a fire door that includes a core with a porous layer having a thickness of approximately three-eighths of an inch (0.95 cm) and two opposing major surfaces. The core also has at least two, preferably fire-retardant, additional layers. Each of the two fire-retardant layers has a thickness of approximately nine-sixteenths of an inch (1.43 cm) and two opposing major surfaces.

15 The porous layer and the at least two fire retardant layers are coupled together. The at least two fire-retardant layers are separated by the porous layer.

An embodiment of the present invention further provides for methods of making a door having a core with a porous layer and two opposing major surfaces and fire-retardant layers, each having a thickness and two opposing major surfaces. One embodiment of a method according to the present invention includes coupling together a porous layer and at least three fire-retardant layers. At least two of the fire-retardant layers are separated by the porous layer. The door can also include first and second exterior layers each having a thickness and two opposed major surfaces. In one embodiment, the method according to the present invention also includes forming a blank by coupling the first and second exterior layers to the core. An embodiment further includes applying a generally uniform pressure to the blank for a period of time. A further embodiment includes machining a grooved first pattern on the first exterior surface and machining a grooved second pattern on the second exterior surface.

25

30 An advantage of one embodiment of the present invention is to provide a fire-rated door that can endure a 20-minute fire test according to at least the following standards: UBC 7-2 (1997), Part I NFPA 252 (1999), UL 10C (1998), ASTM E 2072 (1999), and CAN4 S113 and WH-PN-014 (1985).

Another advantage of one embodiment of the present invention is to provide a lighter-weight fire-rated door, i.e., approximately 120 pounds (54 kg) (having dimensions of three feet (0.91 m) by eight feet (2.44 m) by one-and-three-quarters of an inch (4.45 cm), than is currently available.

5 Yet another advantage of one embodiment of the present invention is to reduce the complexity and cost of manufacturing wood, paneled fire-rated doors by forming panels in the door by machining, instead of molding.

A further advantage of one embodiment of the present invention is to increase a fire door manufacturer's flexibility in manufacturing customer-ordered wood, paneled
10 fire-rated doors by forming panels in the door by machining, rather than by molding.

Yet a further advantage of one embodiment of the present invention is to improve the insulative qualities, or R-value, of fire-rated doors.

An additional advantage of one embodiment of the present invention is to improve the sound dampening of fire-rated doors.

15 Yet another additional advantage of one embodiment of the present invention is to reduce a fire-rated door's susceptibility to warping caused by moisture.

Additional advantages of embodiments of the invention are set forth in the detailed description that follows and will become more apparent to those skilled in the art upon examination of the following.

20 BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated herein and constitute part of this specification, help to illustrate embodiments of the invention. In the drawings, like numerals are used to indicate like elements throughout.

25 Figure 1 is a front plan view of a double door system according to an embodiment of the invention.

Figure 2 is a partially-exploded orthogonal view of the door of Figure 1 prior to machining panels.

Figure 3 is a flow diagram of a method of making the door of Figure 1.

Figure 4 is a flow diagram of a method of making a door blank of Figure 1.

30 Figure 5 is a front plan view of a door according to another embodiment of the invention.

Figure 6 is a partially-exploded orthogonal view of the door of Figure 5.

DETAILED DESCRIPTION

The present invention includes doors, parts of doors, and methods of making doors. One embodiment of the present invention includes a multilayer fire door and methods of making such a door.

5 Figure 1 shows a front plan view of a door according to an embodiment of the invention. A standard-pair wood, paneled fire door 100 includes two separate but adjacent doors, 110 and 210. The door 100 can also be a single-swing door (not shown). As doors 110 and 210 are identical in material respect, only door 110 will be described in detail.

10 Door 110 has a major axis and a minor axis. The major axis extends vertically and the minor axis extends horizontally. The door 110 includes an outer peripheral frame including a bottom rail 112, a top rail 114, and a pair of side stiles 116 and 118. The top rail 114 and the bottom rail 112 extend horizontally along the minor axis and generally parallel to one another. The side stiles 116 and 118 extend vertically along the major axis
15 and generally parallel to one another. The top rail 114 and the bottom rail 112 are generally perpendicular to the side stiles 116 and 118. The top rail 114 and the bottom rail 112 are made of MDF having a density of at least 42 pcf (673 kg/m³). The side stiles 116 and 118 are made of pine or fir, preferably, having a minimum specific gravity of 0.34. The side stiles 116 and 118 can be made of another type or kind of wood.
20 Preferably, the specific gravity of that wood is a minimum of 0.34. Moreover, the rails 112 and 114, and the stiles 116 and 118 may be made of any suitable material.

The door 110 also includes hinges 120 to mount the door 110 to a hinge jamb 410 to allow the door 110 to swing open and closed. As shown in Figure 1, there are four hinges 120 mounting the door 110 to the hinge jamb 124. The number of hinges 120 can
25 vary to accommodate various design considerations, such as the weight of the door 110. A handle 122 is provided on the door 110 to operate a latch (not shown), which maintains the door 110 in a closed position. While door 210 can be opened and closed, the door 210 preferably is maintained in a closed position. The latch on door 110 maintains the door 110 in a closed position by engaging with a complementary recess (not shown) on door
30 210. A width and a height of the doors 110 and 210 can vary but, in general, should not exceed approximately three feet (0.91 m) in width and eight feet (2.44 m) in height.

In general, the above description of the door's features visible in Figure 1 comprise conventional door construction. It is included here for completeness, and to aid one of ordinary skill in the art in constructing a door according to the present invention.

Referring now to Figure 2, the door 110 includes a core 130, which is disposed
5 between a front face 140 and a rear face 190. The core 130 shown has several layers of material. The layers 150, 160, 170, 180 may be made of any suitable material. Preferably, at least three of the layers 150, 160, 180 are made of fire-retardant material. Preferably, the layers of fire-retardant material comprises MDF. Most preferably, the layers comprise MDF having a density of approximately 42 pcf (673 kg/m³). The core
10 130 includes a first fiberboard 150, a second fiberboard 160, and a third fiberboard 180. Disposed between the second and third fiberboards 160 and 180 is a layer of porous material 170. The porous layer 170 may be made of any suitable material. Preferably, the porous layer 170 is a foam sheet comprised of a thermoplastic polymer, such as expanded polystyrene, having a density of at least 1 pcf (16 kg/m³). Alternatively, the
15 porous layer 170 can be a fire-retardant material.

Each of the front face 140, the rear face 190, the first fiberboard 150, the second fiberboard 160, the third fiberboard 180, and the porous layer 170 has two major surfaces and a thickness. A height and width of each of the front face 140, the rear face 190, the first fiberboard 150, the second fiberboard 160, the third fiberboard 180, and the porous
20 layer 170 correspond generally to the height and width of the door 110.

An exemplary embodiment of such a door 110 comprises each of the front face 140, the rear face 190, the first fiberboard 150, the second fiberboard 160, the porous layer 170, and the third fiberboard 180 having dimensions of three feet (0.91 m) wide by eight feet (2.44 m) high. This exemplary embodiment also comprises the thickness of
25 both the front face 140 and the rear face 190 being one-eighth-of-an-inch (0.32 cm). In this exemplary embodiment the thickness of each of the first fiberboard 150, the second fiberboard 160, the porous layer 170, and the third fiberboard 180 is three-eighths-of-an-inch (0.95 cm). Alternatively, any other suitable dimensions can be provided.

The front face 140 and the rear face 190 may be made of any suitable material.
30 Preferably, the front face 140 and the rear face 190 are a hardboard made of wood fibers having a density of at least 52 pcf (833 kg/m³). The hardboard of the front face 140 and the rear face 190 can be made of any other suitable material, preferably, having a density

of at least 52 pcf (833 kg/m³). The thicknesses of the front face 140 and the rear face 190 shown can be the same. The thickness of the front face 140 shown is one-eighth of an inch (0.32 cm), as is the thickness of the rear face 190. Alternatively, these thicknesses can be approximately one-eighth of an inch (0.32 cm) or any other suitable thickness.

5 The two major surfaces of the front face 140 include a front-facing surface 141 and a rear-facing surface (not shown). The front-facing surface 141 and the rear-facing surface of the front face 140 are disposed on opposing sides of the front face 140. Either the front-facing surface 141 or the rear-facing surface of the front face 140 can be disposed adjacent to one of the major surfaces of the first fiberboard 150. In the embodiment
10 shown in Figure 2, the rear-facing surface of the front face 140 is disposed adjacent to the first fiberboard 150.

The first fiberboard 150 can be formed by disposing a vertical splice 152 adjacent to a main sheet 154. Alternatively, the first fiberboard 150 can be a single sheet. The vertical splice 152 can be disposed proximate the side stile 116. The width of the vertical
15 splice 152 can be any suitable dimension. For example, the width of the vertical splice 152 can be six inches (15.24 cm). The width of both the vertical splice 152 and the main sheet 154 correspond generally to the width of the door 110. Thus, the maximum dimensions of the fiberboard 150 are three feet (0.91 m) wide by eight feet (2.44 m) high. The height of the vertical splice 152 is preferably the same as the height of the main sheet
20 154. Preferably, the dimensions of the side stiles 116 and 118 are one-and-one-quarter inches (3.18 cm) by one-and-one-half inches (3.81 cm). Preferably, the dimensions of the bottom rail 112 and the top rail 114 is one-and-one-quarter inches (3.18 cm) by one-and-one-half inches (3.81 cm) by thirty-three-and-seven-eighths inches (86.04 cm).
Alternatively, any other suitable dimensions can be used.

25 The thickness of the first fiberboard 150 shown is three-eighths of an inch (0.95 cm). Alternatively, the thickness can be approximately three-eighths of an inch (0.95 cm) or any other suitable thickness. The two major surfaces of the first fiberboard 150 include a front-facing surface 151 and a rear-facing surface (not shown). The front-facing surface 151 and the rear-facing surface of the first fiberboard 150 are disposed on opposing sides
30 of the first fiberboard 150. Either the front-facing surface 151 or the rear-facing surface of the first fiberboard 150 can be disposed adjacent to the rear-facing surface of the front face 140. According to the embodiment, the front-facing surface 151 of the first

fiberboard 150 is disposed adjacent to the rear-facing surface of the front face 140. Thus, the rear-facing surface of the first fiberboard 150 is disposed adjacent to one of the major surfaces of the second fiberboard 160.

5 The second fiberboard 160 is formed by disposing a vertical 162 splice adjacent to a main sheet 164. Alternatively, the second fiberboard 160 can be a single sheet. The vertical splice 162 is disposed proximate the side stile 118. The width of the vertical splice 162 can be any suitable dimension. For example, the width of the vertical splice can be six inches (15.24 cm). The width of both the vertical splice 162 and the main sheet 164 corresponds to the width of the door 110. Thus, the maximum dimensions of
10 the fiberboard 160 are three feet (0.91 m) wide by eight feet (2.44 m) high. The height of the vertical splice 162 is the same as the height of the main sheet 164.

The thickness of the second fiberboard 160 is preferably three-eighths of an inch (0.95 cm). It can be approximately three-eighths of an inch (0.95 cm) or another, selected thickness. The two major surfaces of the second fiberboard 160 include a front-facing
15 surface 161 and a rear-facing surface (not shown). The front-facing surface 161 and the rear-facing surface of the second fiberboard 160 can be disposed on opposing sides of the second fiberboard 160. Either the front-facing surface 161 or the rear-facing surface of the second fiberboard 160 can be disposed adjacent to the rear-facing surface of the first fiberboard 150. According to the embodiment, the front-facing surface 161 of the second
20 fiberboard 160 is disposed adjacent to the rear-facing surface of the first fiberboard 150. Thus, the rear-facing surface of the second fiberboard 160 is disposed adjacent to one of the major surfaces of the porous layer 170.

Preferably, the porous layer 170 is formed by disposing a horizontal splice 172 adjacent to a main sheet 174. Alternatively, the porous layer 170 can be a single sheet.
25 The horizontal splice 172 is disposed proximate the top rail 114. Alternatively, the horizontal splice 172 is disposed proximate the bottom rail 112. The dimension of the horizontal splice 172 can be any suitable dimension. For example, the height of the splice 172 can be 16 inches (40.64 cm). The height of both the horizontal splice 172 and the main sheet 174 correspond to the height of the door 110. Thus, the maximum dimensions
30 of the porous layer 170 are three feet (0.91 m) wide by eight feet (2.44 m) high. The width of the horizontal splice 172 is the same as the width of the main sheet 174. The

thickness of the porous layer 170 shown is three-eighths (0.95 cm) of an inch. In another embodiment, it is approximately three-eighths of an inch (0.95 cm) or another thickness.

The two major surfaces of the porous layer 170 include a front-facing surface 171 and a rear-facing surface (not shown). The front-facing surface 171 and the rear-facing surface of the porous layer 170 are disposed on opposing sides of the porous layer 170. Either the front-facing surface 171 or the rear-facing surface of the porous layer 170 can be disposed adjacent to the rear-facing surface of the second fiberboard 160. According to the embodiment, the front-facing surface 171 of the porous layer 170 is disposed adjacent to the second fiberboard 160. Thus, the rear-facing surface of the porous layer 170 is disposed adjacent to one of the major surfaces of the third fiberboard 180.

The third fiberboard 180 is formed by disposing a vertical splice 182 adjacent to a main sheet 184. Alternatively, the third fiberboard 180 can be a single sheet. The vertical splice 182 is disposed proximate the side stile 116. Alternatively, the vertical splice 182 can be disposed proximate the side stile 114. The width of the vertical splice 182 can be any suitable dimension. For example, the width of the vertical splice 182 can be approximately six inches. Preferably, the width of both the vertical splice 182 and the main sheet 184 corresponds to the width of the door 110. Thus, the maximum dimensions of the third fiberboard 180 are three feet (0.91 m) wide by eight feet (2.44 m) high. The height of the vertical splice 182 is the same as the height of the main sheet 184.

The thickness of the third fiberboard 180 is preferably three-eighths of an inch (0.95 cm). Alternatively, the thickness can be approximately three-eighths of an inch (0.95 cm) or another suitable thickness. The two major surfaces of the third fiberboard 180 include a front-facing surface 181 and a rear-facing surface (not shown). The front-facing surface 181 and the rear-facing surface of the third fiberboard 180 are disposed on opposing sides of the third fiberboard 180. Either the front-facing surface 181 or the rear-facing surface of the third fiberboard 180 can be disposed adjacent to the rear-facing surface of the porous layer 170. According to the embodiment described herein, the front-facing surface 181 of the third fiberboard 180 is disposed adjacent to the rear-facing surface of the porous layer 170. Thus, the rear-facing surface of the third fiberboard is disposed adjacent to one of the major surfaces of the rear face 190.

As described above, the rear face 190 includes a hardboard preferably having a density of at least 52 pcf (833 kg/m³) and the thickness is one-eighth of an inch (0.32 cm).

Alternatively, the thickness can be approximately one-eighth of an inch (0.32 cm) or another suitable thickness. The two major surfaces of the rear face 190 include a front-facing surface 191 and a rear-facing surface (not shown). The front-facing surface 191 and the rear-facing surface of the rear face 190 are disposed on opposing sides of the rear face 190. Either the front-facing surface 191 or the rear-facing surface of the rear face 190 can be disposed adjacent to the rear-facing surface of the third fiberboard 180. According to the embodiment, the front-facing surface 191 of the rear face 190 is disposed adjacent to the rear-facing surface of the third fiberboard 180.

To enhance the aesthetic appearance of the door 110, a series of grooves 142 are disposed in the front face 140 of the door 110 forming panels 144. Alternatively, the door 110 can be flush and have no panels. As shown in Figure 1, one embodiment preferably includes twelve panels 144 formed in the front face 140 of the door 110. The number and shape of the panels 144 can vary depending on the design desired. As will be described in more detail below, the grooves 142 are formed by machining, such as routing, into the door 110. In the embodiment, the depth of the grooves 142 preferably are seven-sixteenths of an inch (1.11 cm). Thus, the grooves 142 penetrate the entire thicknesses of the front face 140 and nearly the entire thickness of the first fiberboard 150. Although not shown, panels are preferably formed in the rear face 190. In general, the depth of the grooves in the panels formed in the rear face 190 preferably are the same as that of the front face 140, but alternatively, can be different than that of the front face. Thus, the grooves in the rear face 190 penetrate the entire thickness of the rear face 190 and nearly the entire thickness of the third fiberboard 180.

As described above, a conventional door made entirely of MDF weighs approximately 153 pounds (68.85 kg). The weight of the door 110 according to the embodiment as described above is substantially less. Using a similarly dimensioned door, *i.e.*, three feet (0.91 m) wide and eight feet (2.44 m) high, with the thicknesses described above, the door 110 according to the embodiment should weigh approximately 120 pounds (54 kg). The weight of the door 110 is reduced further by the weight of the material removed by machining the grooves to form the panels in the door 110.

A method of making the door 110 according to an embodiment will be described next with reference to Figure 3. As described above, the core 130 includes the first fiberboard 150, the second fiberboard 160, the third fiberboard 180, and the porous layer

170. The method includes coupling together the porous layer 170 and the first fiberboard 150, the second fiberboard 160, and the third fiberboard 180. Preferably, coupling refers to joining by adhering surfaces together with an adhesive, such as glue or cement, as described below. A variety of commercially-available adhesives can be used, including, for example, Tightbond® 100 manufactured by Franklin International, RK-3490 manufactured by H.B. Fuller Co., and WD-1300C0-2F manufactured by Specialty Polymers, Inc. Other suitable methods of joining surfaces together can be used.

In the embodiment shown in Figure 2, two of the first fiberboard 150, the second fiberboard 160, and the third fiberboard 180 are separated by the porous layer 170. An embodiment of the method of making the core 130 of the door 110 is described in further detail below and in Figure 4.

Figure 3 is a flow chart diagram illustrating a method of making the door 110. A door blank (not shown) is first assembled as indicated by block 310. The rear face 190 can be placed on a flat surface, such as a lay-up table (not shown). Either the front-facing surface 191 or the rear-facing surface of the rear face 190 can be placed on the flat surface. According to the embodiment, the rear-facing surface of the rear face 190 is placed on the flat surface.

Preferably, an adhesive (not shown) is applied to at least one surface of each of the side stiles 116 and 118 and the bottom rail 112 and the top rail 114. As indicated by block 311 in Figure 4, the side stiles 116 and 118 and the bottom rail 112 and the top rail 114 are attached, in positions corresponding to those shown in Figure 2, on the door blank as thus far constructed.

Preferably, the adhesive is applied to both the front-facing surface 181 and the rear-facing surface of the third fiberboard 180. Alternatively, the adhesive can be applied to either the front-facing surface 181 or the rear-facing surface of the third fiberboard 180. As indicated by block 312 in Figure 4, either the front-facing surface 181 or the rear-facing surface of the third fiberboard 180 can be placed on the rear face 190. Preferably, the rear-facing surface of the third fiberboard 180 is placed on and adhered to the front-facing surface 191 of the rear face 190.

Preferably, the adhesive is applied to both the front-facing surface 171 and the rear-facing surface of the porous layer 170. Alternatively, the porous layer 170 can be

placed on the third fiberboard 180 with no adhesive applied to the porous layer 170. Alternatively, the adhesive can be applied to either the front-facing surface 171 or the rear-facing surface of the porous layer 170. As indicated by block 313 in Figure 4, either the front-facing surface 171 or the rear-facing surface of the porous layer 170 can be placed on the third fiberboard 180. Preferably, the rear-facing surface of the porous layer 170 is placed on the front-facing surface 181 of the third fiberboard 180.

Preferably, the adhesive is applied to both the front-facing surface 161 and the rear-facing surface of the second fiberboard 160. Alternatively, the adhesive can be applied to either the front-facing surface 161 or the rear-facing surface of the second fiberboard 160. As indicated by block 314 in Figure 4, either the front-facing surface 161 or the rear-facing surface of the second fiberboard 160 can be placed on the porous layer 170. Preferably, the rear-facing surface of the second fiberboard 160 preferably is placed on the front-facing surface 171 of the porous layer 170.

Preferably, the adhesive is applied to both the front-facing surface 151 and the rear-facing surface of the first fiberboard 150. Alternatively, the adhesive can be applied to either the front-facing surface 151 or the rear-facing surface of the first fiberboard 150. As indicated by block 315 in Figure 4, either the front-facing surface 151 or the rear-facing surface of the first fiberboard 150 can be placed on the second fiberboard 160. Preferably, the rear-facing surface of the first fiberboard 150 is placed on and adhered to the front-facing surface 161 of the second fiberboard 161.

As indicated by block 316 in Figure 4, either the front-facing surface 141 or the rear-facing surface of the front face 140 can be placed on the first fiberboard 150. Preferably, the rear-facing surface of the front face 140 is placed on the front-facing surface 151 of the first fiberboard 150. The door blank of the embodiment has thus been constructed.

As indicated by block 320 in Figure 3, pressure is applied to the door blank. Preferably, several door blanks are placed one atop the other and placed in a press (not shown) at the same time. Alternatively, only one door is placed in the press. A pressure in a range between 80 (550 kPa) and 110 pounds (760 kPa) per square inch (psi) is applied to the door blank for 30 minutes. Alternatively, the pressure can be in a range between approximately 80 psi (550 kPa) and approximately 110 psi (760 kPa). Alternatively, the time the pressure is applied can be approximately 30 minutes.

Alternatively, any other suitable pressure and time can be used. In general, press time will be longer when the ambient temperature is below 65 degrees F (18.33 degrees celsius). The pressure is removed from the door blank and the adhesive is allowed to adhere for at least approximately eight hours. During this time, the door blank is not manipulated. As indicated by block 330 in Figure 3, the door blank is cut to a desired width and height. Preferably, the maximum width does not exceed three feet (0.91 m) and the maximum height does not exceed eight feet (2.44 m).

As indicated by block 340, a series of grooves 142 are machined into the front face 140 to form the panels 144. Alternatively, the front face 140 can be flush with no panels. Once the panels 144 have been formed, the blank is turned over so that another series of grooves are machined into the rear face 190 to form other panels. The machining is preferably accomplished by routing. Generally, a computer program is written to control a computer numerical control (CNC) milling machine (not shown). The door blank is placed into the milling machine and one side of the door blank is milled according to the design entered into the CNC milling machine. Hardware, such as the door handle 122 is installed. The door 110 can thus be installed into a door frame 132.

Other variations to the embodiments described above are possible. For example, the thickness of any of the layers forming the door can be varied from that described above. Similarly, varying the density of the layers forming the door in the above embodiments is certainly within the ordinary skill in the art.

The embodiments shown in Figure 2 are an unbalanced core construction; that is, in the embodiments shown in Figure 2, the number of fire-retardant layers on one side of the porous layer is not equal to the number of fire-retardant layers on the other side of the porous layer. Specifically, the embodiments shown in Figure 2 include one fire-retardant layer on one side of the porous layer and two fire-retardant layers on the other side of the porous layer. The number of layers on each side of the porous layer can be varied in other embodiments. For example, there can be two layers on one side of the porous layer and three layers on the other side. As another example, there can be an equal number of layers on each side of the porous layer but the thickness of the fire-retardant layers on one side of the porous layer is different than the thickness of the fire-retardant layers on the other side.

Furthermore, a core of the door in accordance with the present invention can have a balanced construction. In other words, a balanced core construction has an equal number of layers on each side of the porous layer. For example, there can be one fire-retardant layer on each side of the porous layer. There can be more than one fire-retardant layer on each side of the porous layer. Moreover, in the balanced construction, the total thickness of fire-retardant layers on one side of the porous layer can be the same as the total thickness of fire-retardant layers on the other side of the porous layer even if the number of layers on each side differs. An example of an embodiment disclosing a balanced construction will be described below.

Figure 5 shows a front plan view of a door according to another embodiment of the invention. A standard-pair wood, paneled fire door 400 includes two separate but adjacent doors, 410 and 510. The door 400 can also be a single-swing door (not shown). As the external appearance of door 400 and door 100 are identical in material respect – including the grooves and panels, these identical details will not be repeated. Thus, only the core 430 will be described in detail below. Furthermore, as doors 410 and 510 are identical in material respect, only door 410 will be described in detail.

Referring now to Figure 6, the door 410 includes a core 430, which is disposed between a front face 440 and a rear face 490. The core 430 shown has several layers of material. The layers 450, 470, and 480 may be made of any suitable material. Preferably, at least two of the layers 450 and 480 are made of fire-retardant material. Preferably, the layers of fire-retardant material comprise an MDF. Most preferably, the layers comprise MDF having a density of approximately 42 pcf (673 kg/m³). The core 430 includes a first fiberboard 450 and a second fiberboard 480. Disposed between the first and second fiberboards 450 and 480 is a layer of porous material 470. The porous layer 470 may be made of any suitable material. Preferably, the porous layer 470 is a foam pad comprised of a thermoplastic polymer, such as expanded polystyrene, having a density of at least 1 pcf (16 kg/m³).

Each of the first fiberboard 450, the second fiberboard 480, and the porous layer 470 has two major surfaces and a thickness. A height and width of each of the first fiberboard 450, the second fiberboard 480, and the porous layer 470 correspond generally to the height and width of the door 410.

12
An exemplary embodiment of a core 430 of such a door 410 comprises each of the first fiberboard 450, the second fiberboard 480, and the porous layer 470 having dimensions of three feet (0.91 m) wide by eight feet (2.44 m) high. In this exemplary embodiment the thickness of each of the first fiberboard 450 and the second fiberboard 480 is nine-sixteenths-of-an-inch (1.43 cm) and the thickness of the porous layer 470 is three-eighths-of-an-inch (0.95 cm). Alternatively, any other suitable dimensions can be provided.

In the embodiment shown in Figure 6, the first fiberboard 450 can be formed by disposing a vertical splice 452 adjacent to a main sheet 454. Alternatively, the first fiberboard 450 can be a single sheet. The vertical splice 452 is preferably disposed proximate the side stile 416. The width of the vertical splice 452 can be any suitable dimension. For example, the width of the vertical splice can be six inches (15.24 cm). The width of both the vertical splice 452 and the main sheet 454 correspond generally to the width of the door 410. Thus, the maximum dimensions of the first fiberboard 450 are three feet (0.91 m) wide by eight feet (2.44 m) high. The height of the vertical splice 452 is the same as the height of the main sheet 454. Preferably, the dimensions of side stiles 416 and 418 are one-and-one-quarter inches (3.18 cm) by one-and-one-half inches (3.81 cm). Preferably, the dimensions of the bottom rail 412 and the top rail 414 are one-and-one-quarter inches (3.18 cm) by one-and-one-half inches (3.81 cm) by thirty-three-and-seven-eighths inches (86.04 cm).

The thickness of the first fiberboard 450 shown is nine-sixteenths of an inch (1.43 cm). Alternatively, the thickness can be any other suitable thickness. The two major surfaces of the first fiberboard 450 include a front-facing surface 451 and a rear-facing surface (not shown). The front-facing surface 451 and the rear-facing surface of the first fiberboard 450 are disposed on opposing sides of the first fiberboard 450. Either the front-facing surface 451 or the rear-facing surface of the first fiberboard 450 can be disposed adjacent to a rear-facing surface of a front face 440. According to the embodiment, the front-facing surface 451 of the first fiberboard 450 is disposed adjacent to the rear-facing surface of the front face 440. Thus, the rear-facing surface of the first fiberboard 450 is disposed adjacent to one of the major surfaces of the porous layer 470.

Preferably, the porous layer 470 is formed by disposing a horizontal splice 472 adjacent to a main sheet 474. Alternatively, the porous layer 470 can be a single sheet.

The horizontal splice 472 is disposed proximate the top rail 414. Alternatively, the horizontal splice 472 is disposed proximate the bottom rail 412. The height of the horizontal splice 472 can be any suitable dimension. For example, the height of the horizontal splice 472 can be 16 inches (40.64 cm). The height of both the horizontal splice 472 and the main sheet 474 corresponds to the height of the door 410. Thus, the maximum dimensions of the porous layer 470 are three feet (0.91 m) wide by eight feet (2.44 m) high. The width of the horizontal splice 472 is the same as the width of the main sheet 474. The thickness of the porous layer 470 is three-eighths of an inch (0.95 cm). Alternatively, the thickness can be any other suitable thickness.

The two major surfaces of the porous layer 470 include a front-facing surface 471 and a rear-facing surface (not shown). The front-facing surface 471 and the rear-facing surface of the porous layer 470 are disposed on opposing sides of the porous layer 470. Either the front-facing surface 471 or the rear-facing surface of the porous layer 470 can be disposed adjacent to the rear-facing surface of the first fiberboard 450. According to this embodiment, the front-facing surface 471 of the porous layer 470 is disposed adjacent to the first fiberboard 450. Thus, the rear-facing surface of the porous layer 470 is disposed adjacent to one of the major surfaces of the second fiberboard 480.

The second fiberboard 480 is formed by disposing a vertical splice 482 adjacent to a main sheet 484. Alternatively, the second fiberboard 480 can be a single sheet. The vertical splice 482 is disposed proximate the side stile 416. Alternatively, the vertical splice 482 can be disposed proximate the side stile 414. The width of the vertical splice 482 can be any suitable dimension. For example, the width of the vertical splice 482 can be six inches (15.24 cm). Preferably, the width of both the vertical splice 482 and the main sheet 484 corresponds to the width of the door 410. Thus, the maximum dimensions of the second fiberboard 480 are three feet (0.91 m) wide by eight feet (2.44 m) high. The height of the vertical splice 482 is the same as the height of the main sheet 484.

The thickness of the second fiberboard 480 is preferably nine-sixteenths of an inch (1.43 cm). Alternatively, the thickness can be any other suitable thickness. The two major surfaces of the second fiberboard 480 include a front-facing surface 481 and a rear-facing surface (not shown). The front-facing surface 481 and the rear-facing surface of the second fiberboard 480 are disposed on opposing sides of the second fiberboard 480.

13

Either the front-facing surface 481 or the rear facing surface of the second fiberboard 480 can be disposed adjacent to the rear-facing surface of the porous layer 470. According to this embodiment, the front-facing surface 481 of the second fiberboard 480 is disposed adjacent to the rear-facing surface of the porous layer 470. Thus, the rear-facing surface of the second fiberboard 480 is disposed adjacent to one of the major surfaces of the rear face 490.

While the present invention has been disclosed with reference to certain embodiments, numerous modifications, alterations, and changes to the described embodiments are possible without departing from the sphere and scope of the present invention, as defined by the appended claims. Accordingly, it is intended that the present invention not be limited to the described embodiments, but that it has the full scope defined by the language of the following claims, and equivalents thereof.

What is claimed is:

1. A door comprising:

5 a core comprising a porous layer having a thickness and two opposing major surfaces and at least three fire-retardant layers each having a thickness and two opposing major surfaces, wherein the porous layer and the at least three fire-retardant layers are coupled together and wherein at least two of the at least three fire-retardant layers are separated by the porous layer.

10 2. The door according to claim 1, wherein a number of the at least three fire-retardant layers disposed on one of the two opposing major surfaces of the porous layer is greater than a number of the at least three fire-retardant layers disposed on another one of the two major surfaces of the porous layer.

3. The door according to claim 1, wherein the thickness of each of the at least three fire-retardant layers is approximately the same.

15 4. The door according to claim 3, wherein the thickness of each of the at least three fire-retardant layers is approximately three-eighths of an inch (0.95 cm).

5. The door according to claim 3, wherein the thickness of the porous layer is approximately the same as the thickness of each of the at least three fire-retardant layers.

20 6. The door according to claim 5, wherein the thickness of the porous layer is approximately three-eighths of an inch (0.95 cm).

7. The door according to claim 1, wherein the porous layer comprises a thermoplastic polymer having a density of at least approximately one pound per cubic foot (16 kg/m³).

8. The door according to claim 1, wherein the porous layer comprises a fire-retardant material.

25 9. The door according to claim 1, wherein each of the at least three fire-retardant layers comprises a medium-density fiberboard.

10. The door according to claim 9, wherein a density of the medium-density fiberboard is at least 42 pounds per cubic foot (673 kg/m^3).
11. The door according to claim 1 further comprising:
a first exterior layer having a thickness and two opposed major surfaces; and
5 a second exterior layer having a thickness and two opposed major surfaces, the first and second exterior layers being coupled with the core.
12. The door according to claim 11, wherein the thickness of the first exterior layer is approximately the same as the thickness of the second exterior layer.
13. The door according to claim 12, wherein the thickness of the first exterior layer is
10 approximately one-eighth of an inch (0.32 cm).
14. The door according to claim 11, wherein the first and second exterior layers comprise a hardboard.
15. The door according to claim 14, wherein a density of the hardboard is at least 52 pounds per cubic foot (833 kg/m^3).
- 15 16. The door according to claim 11, further comprising a grooved first pattern disposed on the first exterior layer and having a first depth and a grooved second pattern disposed on the second exterior layer and having a second depth.
17. The door according to claim 16, wherein the first and second depths are approximately the same.
- 20 18. The fire door according to claim 17, wherein the first depth is approximately seven-sixteenths of an inch (1.11 cm).
19. A method of making a door having a core including a porous layer having a thickness and two opposing major surfaces and at least three fire-retardant layers each having a thickness and two opposing major surfaces, the method comprising:
25 coupling together the porous layer and the at least three fire-retardant layers, wherein at least two of the at least three fire-retardant layers are separated by the porous layer.

20. The method of making the door according to claim 19 further comprising:
disposing a number of the fire-retardant layers on one of the two opposing major
surfaces of the porous layer; and

5 disposing another number of the fire-retardant layers on another one of the two
opposing major surfaces of the porous layer, wherein the number of fire-retardant layers
is greater than the another number of fire-retardant layers.

21. The method of making the door according to claim 19, wherein the door further
includes a first exterior layer having a thickness and two opposed major surfaces and a
second exterior layer having a thickness and two opposed major surfaces.

10 22. The method of making the door according to claim 21, further comprising
coupling the first exterior layer and the second exterior layer to the core, whereby a blank
is formed.

23. The method of making the door according to claim 22, further comprising
applying a uniform pressure to the blank for a period of time.

15 24. The method of making the door according to claim 23, wherein the uniform
pressure is in a range between approximately 80 (550 kPa) and approximately 110 pounds
per square inch (760 kPa) and the period of time is approximately 30 minutes.

25. The method of making the door according to claim 24, further comprising:
machining a grooved first pattern having a first depth on the first exterior layer;

20 and

machining a grooved second pattern having a second depth on the second exterior
layer.

26. A door comprising:

25 a core comprising a porous layer having a thickness of approximately three-
eighths of an inch (0.95 cm) and two opposing major surfaces and at least two fire-
retardant layers each having a thickness of approximately nine-sixteenths of an inch (1.43
cm) and two opposing major surfaces, wherein the porous layer and the at least two fire-

retardant layers are coupled together and wherein the at least two fire-retardant layers are separated by the porous layer.

27. The door according to claim 26, wherein a number of the at least two fire-retardant layers disposed on one of the two opposing major surfaces of the porous layer is equal to a number of the at least two fire-retardant layers disposed on another one of the two major surfaces of the porous layer.

28. The door according to claim 26, wherein the porous layer comprises a thermoplastic polymer having a density of at least approximately one pound per cubic foot (16 kg/m^3).

29. The door according to claim 26, wherein the porous layer comprises a fire-retardant material.

30. The door according to claim 26, wherein the at least two fire-retardant layers comprise a medium-density fiberboard.

31. The door according to claim 30, wherein a density of the medium-density fiberboard is at least 42 pounds per cubic foot (673 kg/m^3).

32. The door according to claim 26 further comprising:
a first exterior layer having a thickness and two opposed major surfaces; and
a second exterior layer having a thickness and two opposed major surfaces, the first and second exterior layers being coupled with the core.

33. The door according to claim 32, wherein the thickness of the first exterior layer is approximately the same as the thickness of the second exterior layer.

34. The door according to claim 33, wherein the thickness of the first exterior layer is approximately one-eighth of an inch (0.32 cm).

35. The door according to claim 32, wherein the first and second exterior layers comprise a hardboard.

36. The door according to claim 35, wherein a density of the hardboard is at least 52 pounds per cubic foot (833 kg/m^3).

37. The door according to claim 32, further comprising a grooved first pattern disposed on the first exterior layer and having a first depth and a grooved second pattern disposed on the second exterior layer and having a second depth.

38. The door according to claim 37, wherein the first and second depths are approximately the same.

39. The fire door according to claim 38, wherein the first depth is approximately seven-sixteenths of an inch (1.11 cm).

40. A door comprising:

a first hardboard layer having two major surfaces and a thickness of approximately one-eighth of an inch (0.32 cm);

a first medium-density fiberboard layer having two major surfaces and a thickness of approximately nine-sixteenths of an inch (1.43 cm), one of the major surfaces of the first medium-density fiberboard layer being coupled to one of the major surfaces of the first hardboard layer;

a porous layer having two major surfaces and a thickness of approximately three-eighths of an inch (0.95 cm), one of the major surfaces of the porous layer being coupled to another one of the major surfaces of the first medium-density fiberboard layer;

a second medium-density fiberboard layer having two major surfaces and a thickness of approximately nine-sixteenths of an inch (1.43 cm), one of the major surfaces of the second medium-density fiberboard layer being coupled to another one of the major surfaces of the porous layer; and

a second hardboard layer having two major surfaces and a thickness of approximately one-eighth of an inch (0.32 cm), one of the major surfaces of the second hardboard layer being coupled to another one of the major surfaces of the second medium-density fiberboard layer.

16
16

1/6

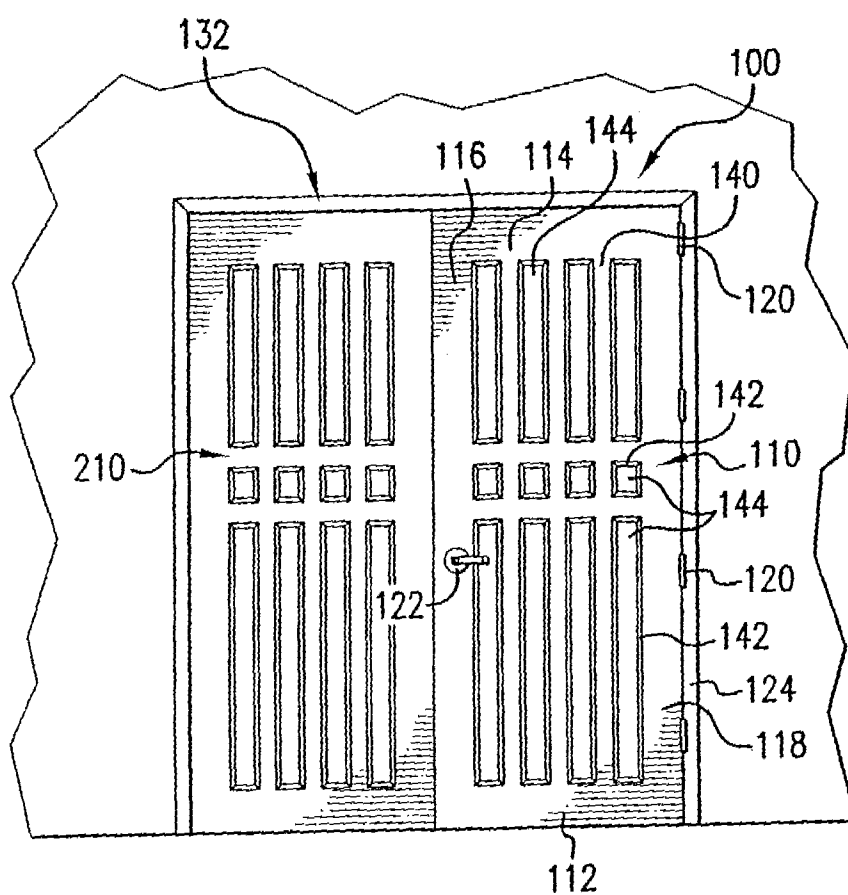
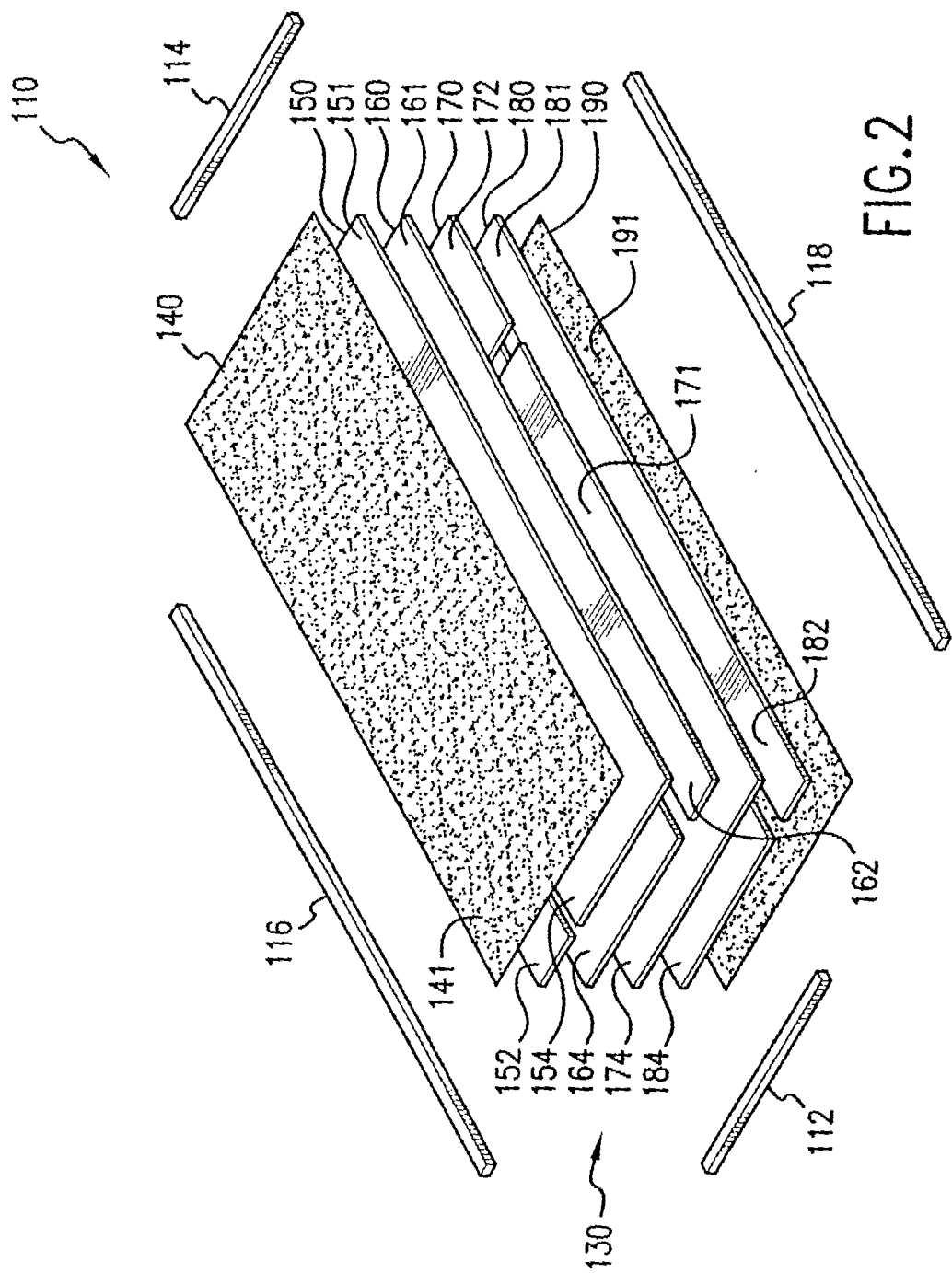


FIG. 1



18

3/6

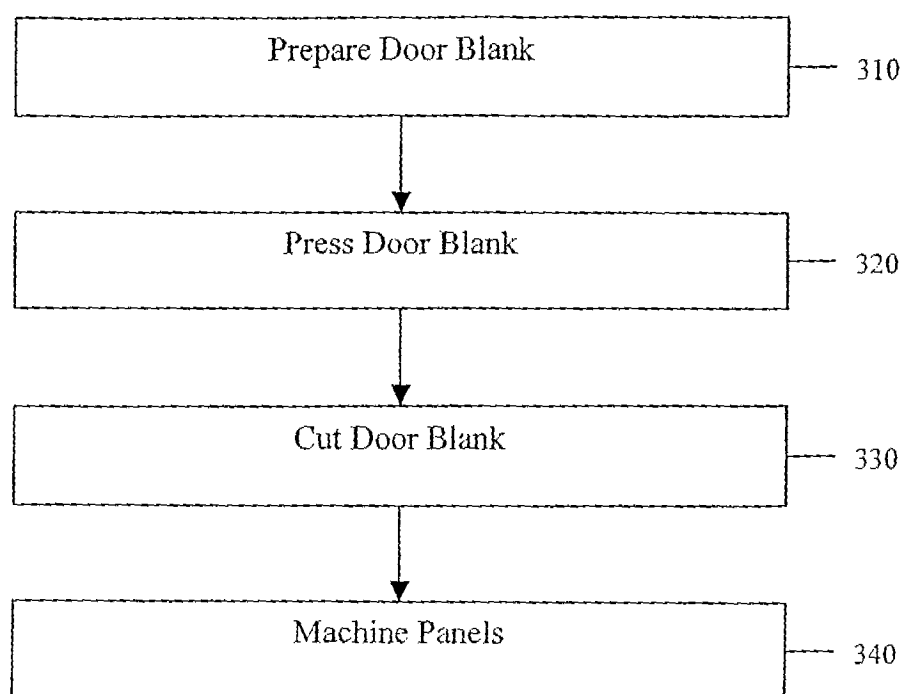


FIG. 3

4/6

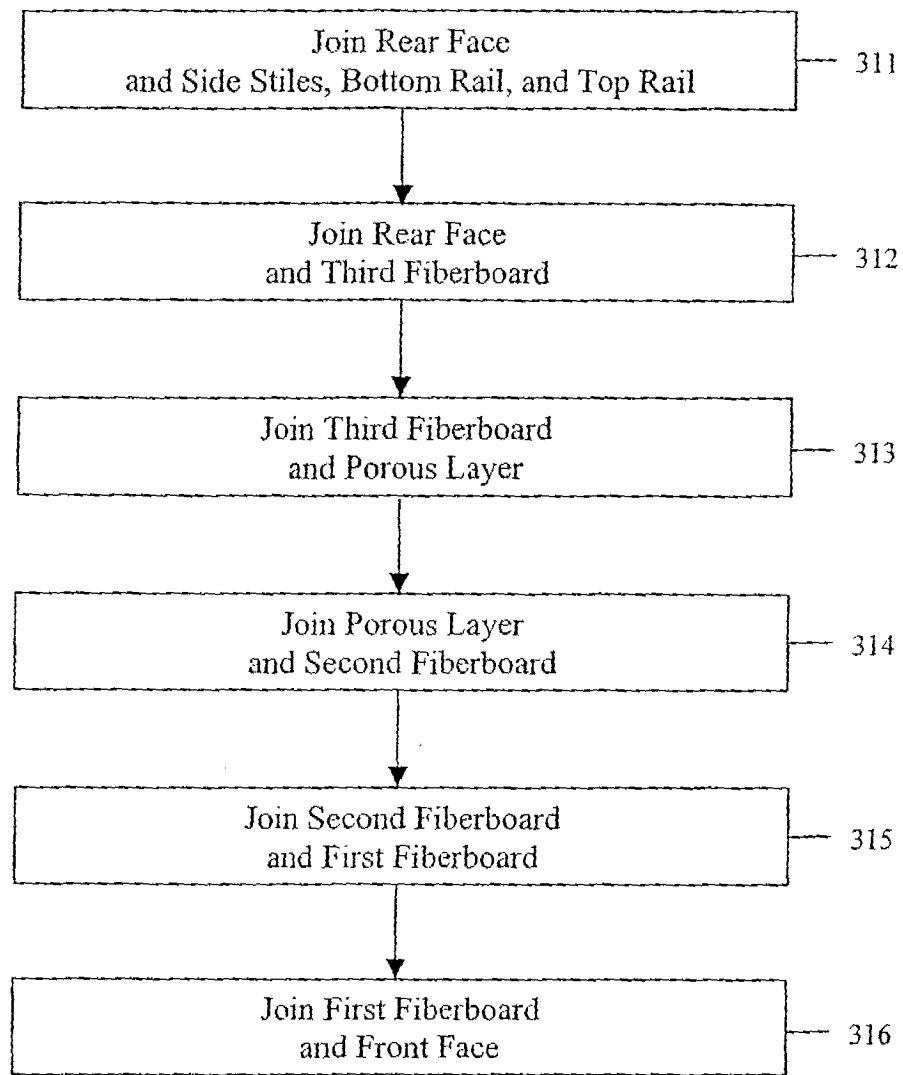


FIG. 4

20
20

5/6

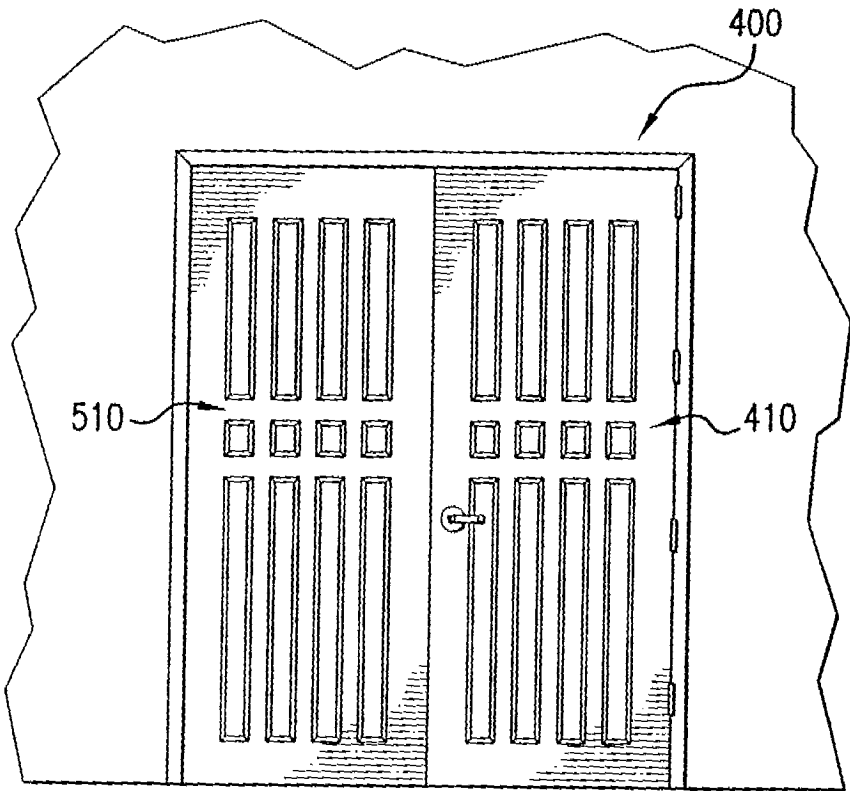


FIG.5

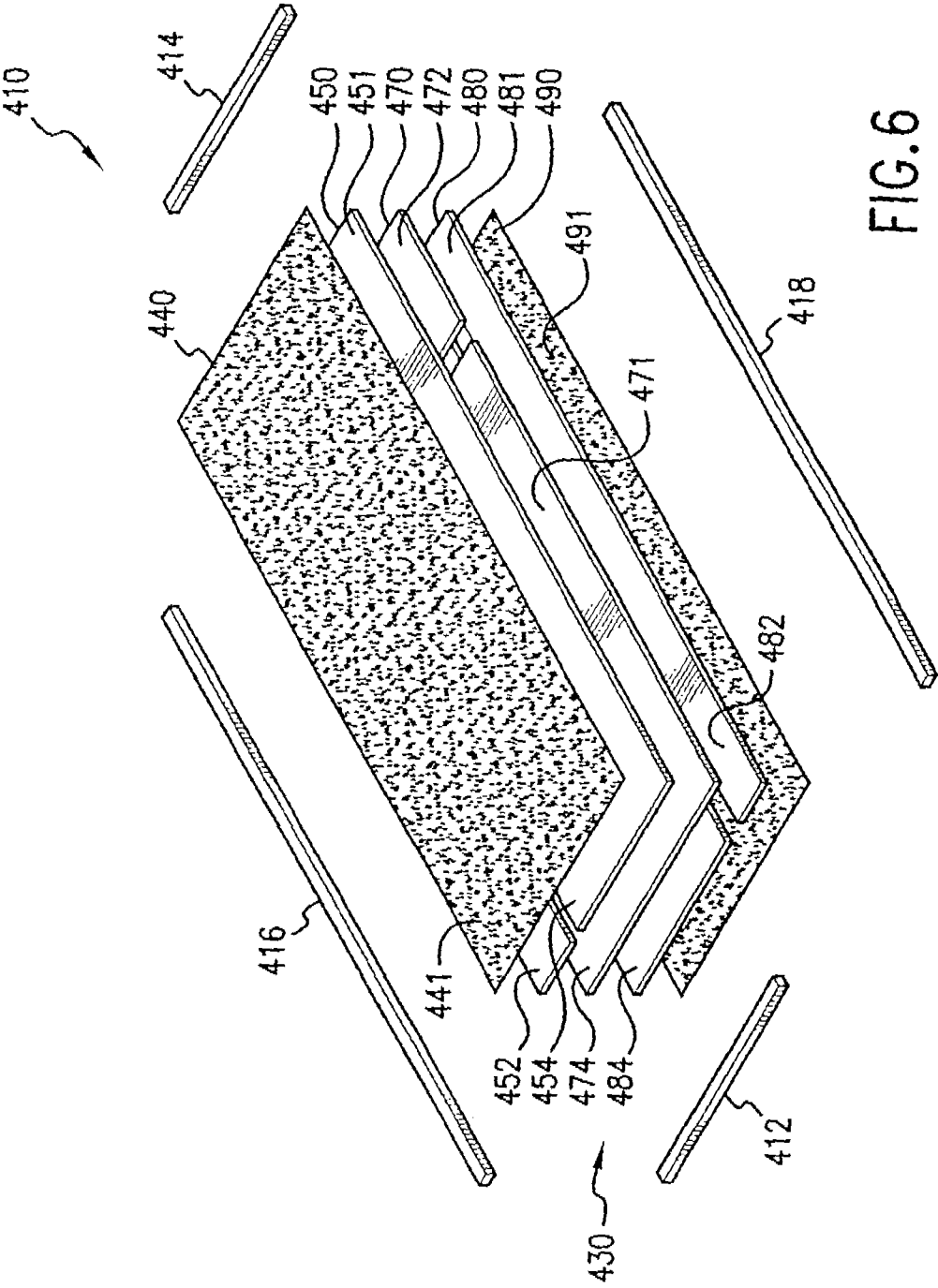


FIG. 6

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 03/34373

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 E06B5/16 E04B1/94

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 7 E06B E04B

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 practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	FR 2 416 332 A (LAURENT GEORGES) 31 August 1979 (1979-08-31) the whole document	1-8, 11-15, 19-21
Y	DE 202 13 474 U (LINDNER AG) 24 October 2002 (2002-10-24)	1-8, 11-15, 19-21, 28,29
X	page 1, paragraph 5 - page 3, paragraph 3; figures 1,2 -/-	26,27, 32-36

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* 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 document 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

Z document member of the same patent family

Date of the actual completion of the international search

10 March 2004

Date of mailing of the international search report

17/03/2004

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Depoorter, F

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US 03/34373

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4 125 664 A (GIESEMANN HERBERT) 14 November 1978 (1978-11-14)	7,8,28, 29
A	column 2, line 17 - line 55 column 3, line 50 - column 4, line 2 column 5, line 36 - column 6, line 28 column 6, line 51 - column 8, line 7 figures 1,5	1,3,19, 26,27
A	AT 372 495 B (DABE DANUBIUS BAUELEMENTE KG) 10 October 1983 (1983-10-10) the whole document	1,3, 11-14, 19, 21-24, 26, 32-35,40
A	DE 16 59 856 A (MAX FRANK GMBH & CO) 20 November 1969 (1969-11-20) page 3, paragraph 2; figure 3	1,3,11, 12,19, 26,27, 32,33
A	US 5 020 292 A (STROM HANS ET AL) 4 June 1991 (1991-06-04) column 2, line 5 - line 17 column 3, line 1 - line 48 figures	1,7-12, 19, 21-23, 26,33
A	US 5 735 098 A (SAKAI TADASHI ET AL) 7 April 1998 (1998-04-07) column 5, line 66 - column 6, line 35; figures 3A,3B	7,9,10, 26-28, 30,31
A	US 3 899 860 A (NEWELL NORMAN M) 19 August 1975 (1975-08-19) column 3, line 49 - column 4, line 34; claim 1; figures 6,7	16,17, 25,37,38

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 03/34373

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
FR 2416332	A	31-08-1979	FR 2416332 A1	31-08-1979
DE 20213474	U	24-10-2002	DE 20213474 U1	24-10-2002
US 4125664	A	14-11-1978	DE 2433724 A1	04-03-1976
			AT 355810 B	25-03-1980
			AT 537175 A	15-08-1979
			BE 831293 A1	03-11-1975
			CH 603729 A5	31-08-1978
			FR 2277664 A1	06-02-1976
			JP 1246082 C	25-12-1984
			JP 51033160 A	22-03-1976
			JP 59011616 B	16-03-1984
			NL 7508333 A	15-01-1976
AT 372495	B	10-10-1983	AT 108780 A	15-02-1983
DE 1659856	A	20-11-1969	DE 1659856 A1	20-11-1969
US 5020292	A	04-06-1991	SE 457815 B	30-01-1989
			CA 1282643 C	09-04-1991
			DE 3523764 A1	23-01-1986
			DK 294985 A ,B	05-01-1986
			FI 852587 A	05-01-1986
			FR 2567189 A1	10-01-1986
			GB 2161196 A ,B	08-01-1986
			JP 1935472 C	26-05-1995
			JP 6065839 B	24-08-1994
			JP 61024785 A	03-02-1986
			NO 852404 A ,B,	06-01-1986
			SE 8403541 A	05-01-1986
US 5735098	A	07-04-1998	JP 2915800 B2	05-07-1999
			JP 8042099 A	13-02-1996
			JP 2915801 B2	05-07-1999
			JP 8042100 A	13-02-1996
			AU 708162 B2	29-07-1999
			AU 2831595 A	15-02-1996
			CA 2154708 A1	03-02-1996
			CN 1132187 A ,B	02-10-1996
			DE 69509602 D1	17-06-1999
			DE 69509602 T2	21-10-1999
			EP 0695796 A2	07-02-1996
			SG 32438 A1	13-08-1996
			US 5624607 A	29-04-1997
US 3899860	A	19-08-1975	NONE	

PATENT COOPERATION TREATY

PCT

NOTIFICATION CONCERNING
SUBMISSION OR TRANSMITTAL
OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

From the INTERNATIONAL BUREAU

To:

STOJKOVICH, Goran, P.
Kilpatrick Stockton LLP
1001 West Fourth St.
Winston-Salem, NC 27101
United States of America

Date of mailing (day/month/year) 27 January 2004 (27.01.2004)	
Applicant's or agent's file reference MDF FireDoor	IMPORTANT NOTIFICATION
International application No. PCT/US2003/034373	International filing date (day/month/year) 29 October 2003 (29.10.2003)
International publication date (day/month/year) Not yet published	Priority date (day/month/year) 31 October 2002 (31.10.2002)
Applicant JELD-WEN, INC. et al	

- By means of this Form, which replaces any previously issued notification concerning submission or transmittal of priority documents, the applicant is hereby notified of the date of receipt by the International Bureau of the priority document(s) relating to all earlier application(s) whose priority is claimed. Unless otherwise indicated by the letters "NR", in the right-hand column or by an asterisk appearing next to a date of receipt, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).
- (If applicable) The letters "NR" appearing in the right-hand column denote a priority document which, on the date of mailing of this Form, had not yet been received by the International Bureau under Rule 17.1(a) or (b). Where, under Rule 17.1(a), the priority document must be submitted by the applicant to the receiving Office or the International Bureau, but the applicant fails to submit the priority document within the applicable time limit under that Rule, the attention of the applicant is directed to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.
- (If applicable) An asterisk(*) appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b) (the priority document was received after the time limit prescribed in Rule 17.1(a) or the request to prepare and transmit the priority document was submitted to the receiving Office after the applicable time limit under Rule 17.1(b)). Even though the priority document was not furnished in compliance with Rule 17.1(a) or (b), the International Bureau will nevertheless transmit a copy of the document to the designated Offices, for their consideration. In case such a copy is not accepted by the designated Office as priority document, Rule 17.1(c) provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

<u>Priority date</u>	<u>Priority application No.</u>	<u>Country or regional Office or PCT receiving Office</u>	<u>Date of receipt of priority document</u>
31 Octo 2002 (31.10.2002)	10/284,392	US	09 Janu 2004 (09.01.2004)

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 338.89.75

Authorized officer

A. ZOLTANSKI (Fax : 338 89 75)

Telephone No. (41-22) 338 8608

PUERTA MULTICAPA CONTRA INCENDIO Y METODO PARA HACERLA

NOTIFICACION DE DERECHOS DE AUTOR

Una porción del descubrimiento de este documento de patente y sus figuras contienen material sujeto a la protección de derechos de autor. El propietario de los derechos de autor no tiene objeción a la reproducción por fax por quien sea del documento de patente, pero de otra parte se reserva todos los de autor de cualquier manera.

CAMPO DE LA INVENCION

El invento se relaciona con puertas en general, y mas particularmente con puertas contra incendio que tienen muchas capas retardantes del fuego.

ANTECEDENTES

Las puertas contra incendio son diseñadas e instaladas en un intento por proteger vidas y propiedad de incendio, humo y calor mediante la provisión de una barrera para soportar el fuego, el humo y el calor por un período de tiempo. Para poder ser marcada o certificada como una puerta contra incendio, la puerta debe llenar los requisitos de ciertos códigos y estándares que regulan la construcción e instalación de tales puertas. Estos códigos y estándares incluyen, entre otros, el Código de Edificación Uniforme (UBC), y códigos promulgados por la Asociación de Protección de Incendio Nacional (NFPA), la Sociedad Americana para el Ensayo de Materiales (ASTM).

Laboratorios privados de ensayo, tales como Underwriters' Laboratories y Warnock Hersey, pueden ensayar para comprobación de esos códigos o estándares, y pueden ensayar para atributos adicionales. Los laboratorios pueden certificar que una puerta

contra incendio cumple los requisitos de protección de incendio después de conducir ensayos (tales como ensayos destructivos) de la puerta. Usualmente, esta certificación es expresada como una calificación de incendio, esto es que ofrece un nivel específico de protección contra incendio, humo y/o calor por un cantidad limitada de tiempo. Por ejemplo, una puerta incendio-calificada de 20 minutos debería, si se instala correctamente, mantener su integridad estructural y proveer una barrera al incendio, al calor y/o al humo por al menos 20 minutos. Mientras una puerta cumpla los requisitos de protección contra incendio relevantes, su diseño puede variar para satisfacer otras consideraciones del diseño, tales como peso, costo de elaboración, y apariencia estética.

Una puerta interior tallada contra incendio con un tablero de fibra de mediana-densidad (MDF) que cumpla los requisitos actuales de protección contra incendio generalmente es construida de una lámina de MDF de una y media pulgada (3.81 cm) de espesor, que tiene una densidad mínima de aproximadamente 42 libras por pie cúbico (pcf) (673 kg/m^3) y un tablero duro de recubrimiento de un octavo de pulgada (0.32 cm) sobre ambos lados del MDF. Una puerta contra incendio de madera de una batiente que usa MDF teniendo este espesor y densidad, y que es de tres pies (0.91 m) de ancho y ocho pies (2.44 m) de altura, pesa casi 153 libras (69.4 kg). Esa puerta no solo es extremadamente pesada, sino que su manufactura puede ser costosa y difícil también.

Por ejemplo, manufacturar una puerta contra incendio con paneles moldeados que cumpla con los actuales requisitos de incendio generalmente requiere usar un molde. Hay muchas formas bien conocidas de preparar un molde. Un método común es usar moldes o troqueles. Una puerta moldeada generalmente tiene dos recubrimientos externos, y se requiere un molde para cada recubrimiento. Para hacer una puerta a la medida, un nuevo molde debe ser creado. Mientras que el uso de moldes para hacer puertas con paneles es menos costoso en altos volúmenes que maquinar los relieves

en la puerta, puertas moldeadas hechas a la medida pueden aumentar el costo de manufactura- en algunos casos este gasto puede llegar a ser prohibitivo.

La manufactura de puertas de paneles en madera sin moldes es conocida en el arte. Tales puertas generalmente incluyen dos recubrimientos externos con un núcleo insertado entre los dos recubrimientos. En una de tales puertas convencionales, el núcleo generalmente incluye una capa de MDF de tres octavos de pulgada de espesor (0.95 cm), una capa de tres octavos de pulgada (0.95 cm) de poliestireno expandido , y otra capa de tres octavos de pulgada (0.95 cm) de MDF. Las capas del núcleo son adheridas una a la otra, como lo son los recubrimientos externos y el núcleo. Los postes laterales de madera y los rieles superior e inferior son luego pegados al perímetro exterior de la puerta. Los paneles son formados por el trazado de una serie de incisiones en los recubrimientos externos.

RESUMEN DE LA INVENCION

La presente invención incluye puertas contra incendio multicapa y métodos para hacer tales puertas. Una incorporación de la presente invención provee una puerta contra incendio que incluye un núcleo. El núcleo tiene una capa porosa que tiene un espesor y dos superficies mayores opuestas. El núcleo tiene también al menos tres capas adicionales, preferiblemente incendio-retardantes. Cada una de las tres capas incendio-retardantes tiene un espesor y dos superficies mayores opuestas. La capa porosa y las al menos tres capas retardantes son unidas entre si. Al menos dos de las al no menos de tres capas incendio-retardantes están separadas por la capa porosa de la otra capa incendio-retardante. La puerta contra incendio puede también incluir capas exteriores, primera y segunda, cada una con un espesor y dos superficies mayores opuestas. Un primer patrón de incisiones puede ser ejecutado sobre la primera capa externa y un segundo patrón de incisión puede ser dispuesto en la segunda capa externa.

Todavía una ventaja adicional de una incorporación de la presente invención es mejorara las cualidades aislantes, o valor R, de las puertas incendio-calificadas.

Una ventaja adicional de una incorporación de la presente invención es mejorar la amortiguación de ruidos de las puertas incendio-calificadas.

Todavía una ventaja adicional de una incorporación de la presente invención es reducir la susceptibilidad de una puerta contra incendio al ondulamiento causado por la humedad.

Ventajas adicionales de las incorporaciones de la invención son establecidas en la descripción detallada que continua y serán mas aparentes a aquellos habildosos en el arte una vez examinado lo que sigue.

BREVE DESCRIPCION DE LOS DIBUJOS

Los dibujos que acompañan este documento, los cuales son incorporados aquí y constituyen parte esta especificación, ayudan a ilustrar las incorporaciones de la invención. En los dibujos, son usados numerales para indicar los elementos a través del documento.

La Figura 1 es una vista frontal de un sistema de puerta doble de acuerdo a una incorporación de la invención.

La Figura 2 es una vista ortogonal parcialmente desarmada de la puerta de la Figura 1 antes del maquinado de los paneles.

La Figura 3 es una diagrama de flujo de un método para hacer la puerta de la Figura 1.

La Figura 4 es un diagrama de flujo de un método de hacer una base de la puerta de la Figura 1.

La Figura 5 es una vista frontal de una puerta de acuerdo a otra incorporación de la invención.

La Figura 6 es una vista ortogonal parcialmente desarmada de la puerta de la Figura 5.

DESCRIPCION DETALLADA

La presente invención incluye puertas, partes de puertas, y métodos para hacer puertas. Una incorporación de la presente invención incluye una puerta contra incendio multicapa y métodos para hacer tal puerta.

La Figura 1 muestra una vista frontal de una puerta de acuerdo a una incorporación de la invención. Una puerta doble estándar de paneles de maderas contra incendio 100, incluye dos puertas separadas pero adyacentes, 110 y 210. La puerta 100 puede ser también de una sola batiente (no mostrada). Como las puertas 110 y 210 son idénticas en lo que respecta a los materiales, solo la puerta 110 será descrita en detalle.

La puerta 110 tiene un eje mayor y un eje menor. El eje mayor se extiende verticalmente y el eje menor se extiende horizontalmente. La puerta 110 incluye un marco periférico externo que incluye un riel inferior 112, un riel superior 114, y un par de postes laterales 116 y 118. El riel superior 114 y el riel inferior 112 se extienden horizontalmente a lo largo del eje menor y generalmente son paralelos entre sí. Los postes laterales 116 y 118 se extienden verticalmente a lo largo del eje mayor y generalmente son paralelos entre sí. El riel superior 114 y el riel inferior 112 son generalmente perpendiculares a los postes laterales 116 y 118. El riel superior 114 y el riel inferior 112 son hechos de MDF que tiene una densidad de al menos 42 pcf (673 kg/m³). Los postes laterales 116 y 118 son hechos de pino o abeto, preferiblemente, tienen una gravedad específica mínima de 0.34. Los postes laterales 116 y 118 pueden ser hechos de otro tipo o clase de madera. Preferiblemente, la gravedad específica de esa madera es mínimo de 0.34. Mas aún, los rieles 112 y 114, y los postes 116 y 118 pueden ser hechos de cualquier material adecuado.

La puerta 110 también incluye bisagras 120 para montar la puerta 110 a una jamba 410 para permitir que la puerta 110 se abra y se cierre. Como se muestra en la Figura 1, hay cuatro bisagras montando la puerta a la jamba 124. El número de bisagras 120 puede variar para acomodar diferentes condiciones de diseños, como el peso de la puerta 110. Una manija 122 es proveída en la puerta 110 para operar un picaporte (no mostrado), que mantiene la puerta 110 en una posición cerrada. Mientras que la puerta 210 puede estar abierta o cerrada, la puerta 210 es mantenida en posición cerrada preferiblemente. El picaporte en la puerta 110 mantiene la puerta 110 en una posición cerrada al encajar en un receso (no mostrado) en la puerta 210. El ancho y alto de las puertas 110 y 210 puede variar, pero en general, no deben exceder aproximadamente de tres pies (0.91 m) de ancho y ocho pies (2.44 m) de alto.

En general, la descripción anterior de los rasgos de la puerta visibles en la Figura 1 corresponde a la construcción convencional de una puerta. Se incluyen aquí por integridad, y para ayudar a alguien con habilidades normales en el arte en la construcción de una puerta de acuerdo con la presente invención.

Refiriéndose ahora a la Figura 2, la puerta 110 incluye un núcleo 130, que es dispuesto entre una cara frontal 140 y una cara posterior 190. El núcleo 130 mostrado tiene muchas capas de material. Las capas 150, 160, 170, 180 pueden ser hechas de cualquier material adecuado. Preferiblemente, las capas de material incendio-retardante comprenden MDF. Lo mas preferible, las capas que comprenden MDF tienen una densidad de aproximadamente 42 pcf (673 kg/m³). El núcleo 130 incluye un primer tablero de fibra 150, un segundo tablero de fibra 160, y un tercer tablero de fibra 180. Dispuesta entre el segundo y el tercer tablero de fibra 160 y 180 hay una capa de material poroso 170. La capa porosa 170 puede ser hecha de cualquier material adecuado. Preferiblemente, la capa porosa 170 es una lamina de espuma constituida por un polímero termoplástico, tal como poliestireno expandido, con una densidad de al menos 1 pcf (16 kg/m³). Alternativamente, la capa porosa 170 puede ser un material incendio-retardante.

colocada en la prensa. Una presión en el rango de 80 (550 kPa) y 110 libras (760 kPa) por pulgada cuadrada (psi) es aplicada a la base de puerta por 30 minutos. Alternativamente, la presión puede estar en el rango de aproximadamente de 80 psi (550 kPa) y aproximadamente 110 psi. (760 kPa). Alternativamente, el tiempo en que la presión es aplicada puede ser aproximadamente 30 minutos.

Alternativamente, cualquier otra presión adecuada y tiempo pueden ser usados. En general, el tiempo de prensado será mas largo cuando la temperatura ambiente este debajo de los 65 grados F (18.33 °C). La presión es removida de la base de puerta y al pegante se le permite continuar su acción adherente por al menos ocho horas. Durante este tiempo, la base de puerta no es manipulada. Como se indica en el bloque 330 de la Figura 3, la base de puerta es cortada al ancho y altura deseada. Preferiblemente, el máximo ancho no excede los tres pies (0.91 m) y la máxima altura no excede los ocho pies (2.44 m).

Como se indica en el bloque 340, una serie de incisiones 142 son maquinadas sobre la cara frontal 140 para formar los paneles 144. Alternativamente la cara frontal puede ser lisa sin paneles. Una vez los paneles 144 han sido realizados, la base es volteada así que otra serie de incisiones son maquinadas en el cara posterior 190 para formar otros paneles. El maquinado es preferiblemente realizado por rebajadoras. Generalmente, un programa de computador es elaborado para hacer el manejo de una máquina de corte de control numérico computacional (CNC) (no mostrada). La base de puerta es colocada dentro de la máquina de corte y uno de los lados de la base de puerta es cortado de acuerdo con el diseño incorporado en la maquina de corte CNC. Los herrajes, tal como la manija de la puerta 122 es instalada. La puerta 110 puede así ser instalada en el marco 132.

Otras variaciones de las incorporaciones descritas arriba son posibles. Por ejemplo, el espesor de cualquiera de las capas que forman la puerta puede ser variado respecto de los descritos arriba. Similarmente, el cambio de la densidad de las capas que forman la

Lo que es reivindicado es

1. Una puerta que contiene:

Un núcleo que incluye una capa porosa que tiene un espesor y dos superficies mayores opuestas y al menos tres capas incendio-retardantes cada una con un espesor y dos superficies mayores opuestas, donde la capa porosa y las al menos tres capas incendio-retardantes son unidas entre sí y donde al menos dos de las no menos de tres capas incendio-retardantes son separadas por una capa porosa.

2. La puerta de acuerdo a la reivindicación 1, donde un número de las al menos tres capas incendio-retardantes dispuestas sobre una de las dos superficies mayores de la capa porosa es mayor que un número de las al menos tres capas incendio-retardantes dispuestas sobre la otra de las dos superficies mayores de la capa porosa.
3. La puerta de acuerdo a la reivindicación 1, donde el espesor de cada una de las al menos tres capas incendio-retardantes es aproximadamente el mismo.
4. La puerta de acuerdo a la reivindicación 3, donde el espesor de cada una de las al menos tres capas incendio-retardantes es aproximadamente tres octavos de pulgada (0.95 cm).
5. La puerta de acuerdo a la reivindicación 3, donde el espesor de la capa porosa es aproximadamente el mismo espesor de cada una de las al menos tres capas incendio-retardantes.

14. La puerta de acuerdo a la reivindicación 12, donde la primera y segunda capas exteriores están conformadas por un tablero duro.
15. La puerta de acuerdo a la reivindicación 14, donde la densidad del tablero duro es al menos 52 libras por pie cúbico (833 kg/m^3).
16. La puerta de acuerdo a la reivindicación 11, comprende además un primer patrón de incisión dispuesto sobre la primera capa exterior y que tiene una primera profundidad y un segundo patrón de incisión dispuesto sobre la segunda capa exterior y que tiene una segunda profundidad.
17. La puerta de acuerdo a la reivindicación 16, donde la primera y segunda profundidad son aproximadamente las mismas.
18. La puerta de acuerdo a la reivindicación 17, donde la primera profundidad es aproximadamente siete dieciseisavos de pulgada (1.11 cm).
19. Un método de hacer una puerta que tiene un núcleo que incluye una capa porosa que tiene un espesor y dos superficies mayores opuestas y al menos tres capas incendio-retardantes cada una con un espesor y dos superficies mayores opuestas, el método comprende:

Unir entre si la capa porosa y las al menos tres capas incendio-retardantes, donde al menos dos de las tres capas incendio-retardantes están separadas por la capa porosa.

20. El método de hacer la puerta de acuerdo a la reivindicación 19 comprende además:

31. La puerta de acuerdo a la reivindicación 30, donde la densidad del tablero de media-densidad es al menos 42 libras por pie cúbico (673 kg/m^3).
32. La puerta de acuerdo a la reivindicación 26 incluye además:
Una capa exterior que tiene un espesor y dos superficies mayores opuestas; y una segunda capa exterior que tiene un espesor y dos superficies mayores opuestas, la primera y segunda capa exterior son unidas entre si con el núcleo.
33. La puerta de acuerdo a la reivindicación 32, donde el espesor de la primera capa exterior es aproximadamente el mismo espesor de la segunda capa exterior.
34. La puerta de acuerdo a la reivindicación 33, donde el espesor de la primera capa exterior es aproximadamente un octavo de pulgada (0.32 cm).
35. La puerta de acuerdo a la reivindicación 32, donde la primera y segunda capas exteriores están conformadas por un tablero duro.
36. La puerta de acuerdo a la reivindicación 35, donde la densidad del tablero duro es al menos 52 libras por pie cúbico (833 kg/m^3).
37. La puerta de acuerdo a la reivindicación 32, comprende además un primer patrón de incisión dispuesto sobre la primera capa exterior y que tiene una primera profundidad y un segundo patrón de incisión dispuesto sobre la segunda capa exterior y que tiene una segunda profundidad.
38. La puerta de acuerdo a la reivindicación 37, donde la primera y segunda profundidad son aproximadamente las mismas.

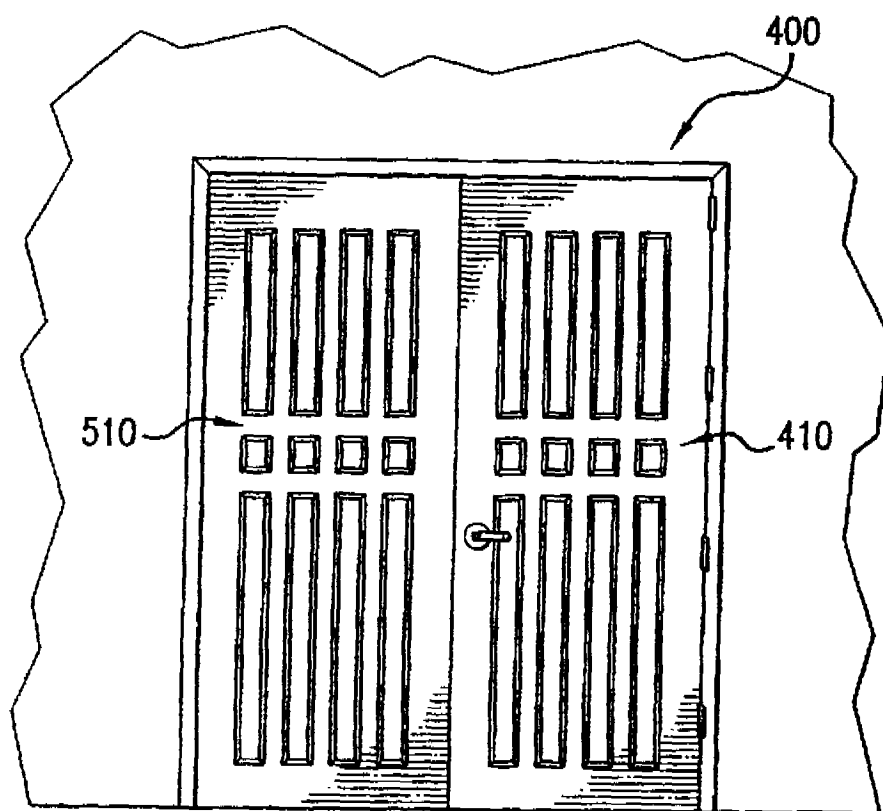


FIG. 5

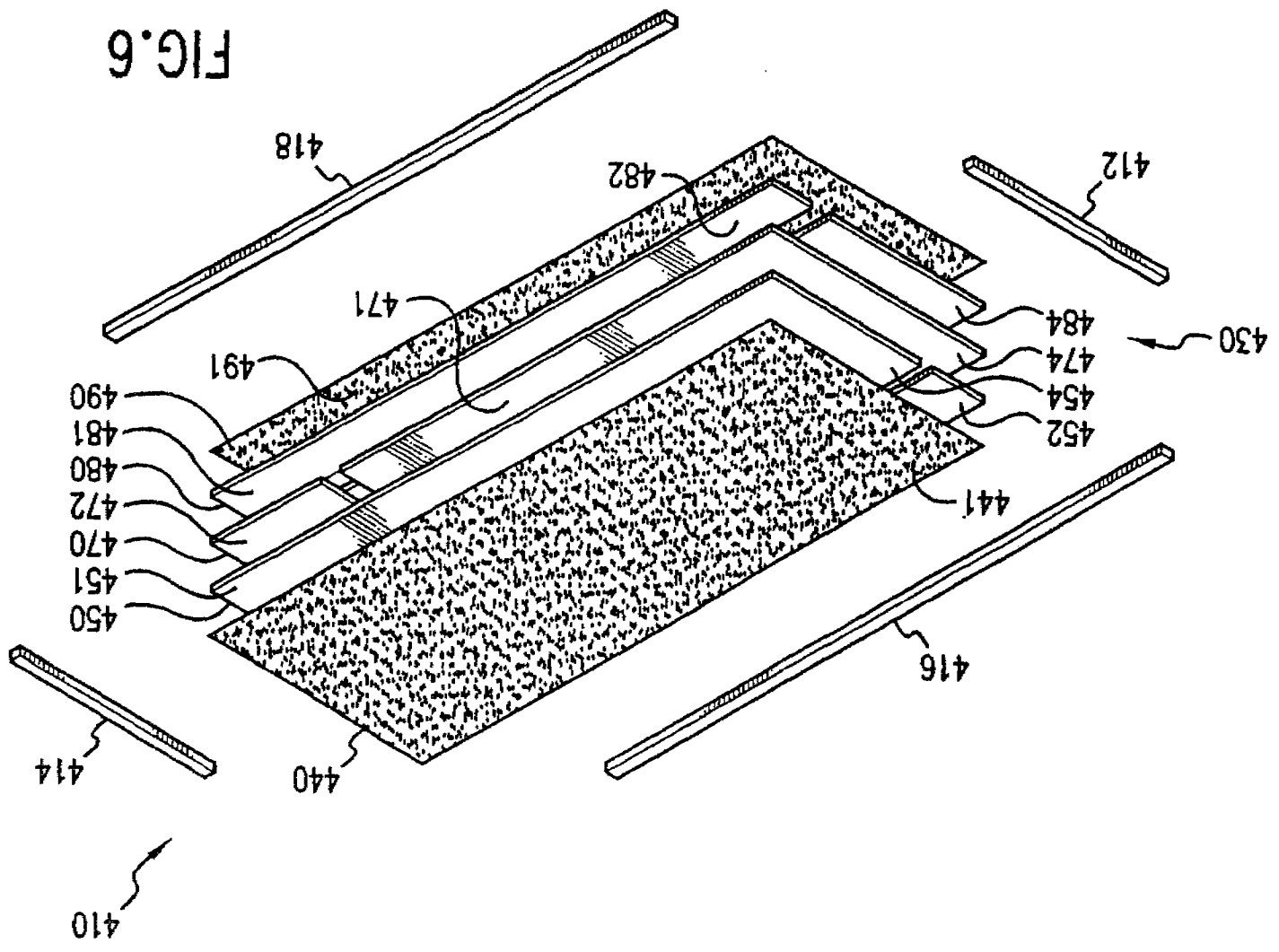
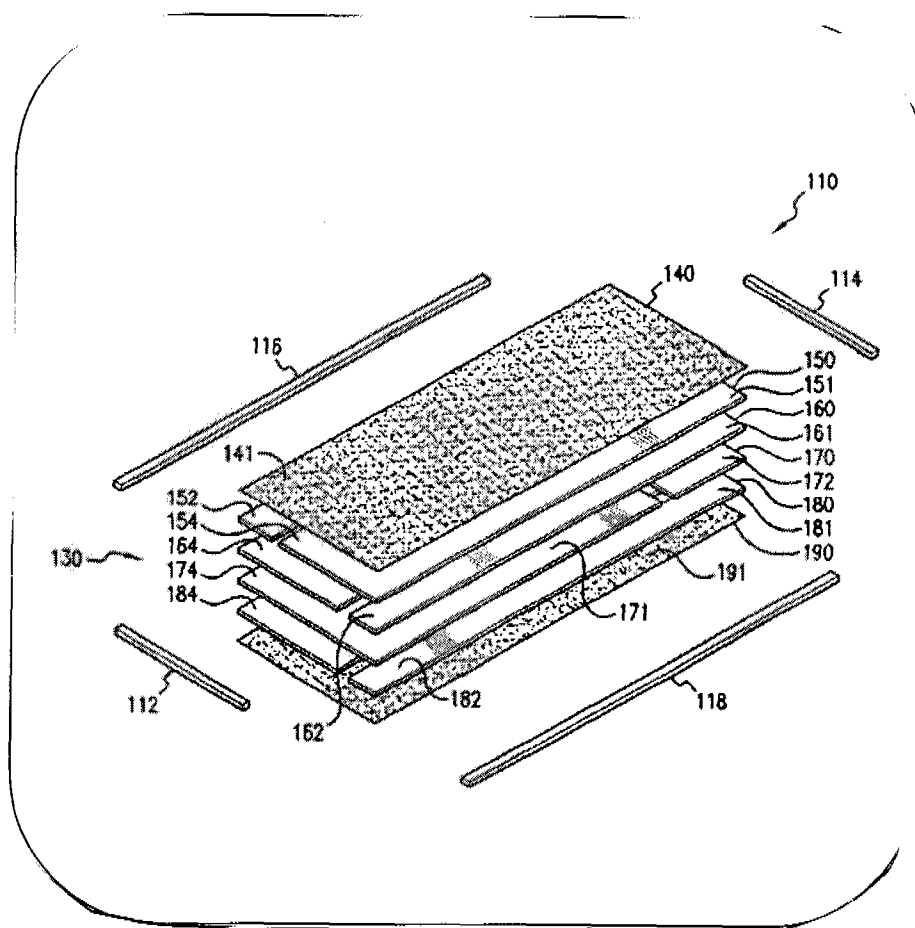


FIG. 6



61

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

NIT : 800176089-2

RECIBO OFICIAL DE CAJA : 05 - 35.936
FECHA : MAYO 16 DE 2005

***** CONSIGNACION *****

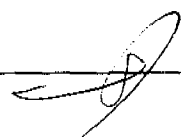
DEPOSITANTE	TIPO PAGO	BANCO	CUENTA	Nº. PAGO	FECHA PGO	Vr. PAGO
CAVELIER ABOGADOS	CONSIGNACION	BANCO POPULAR	050-00110-6	40116714	16/05/2005	39,471,000.00

***** CONCEPTO *****

SANT. RENTISTICO	CONCEPTO	TOTAL CONCEPTO
1 50005-01-01 SOLICITUDES	1 TRAMITES DE SOL. DE PATENTE DE IN	443,000.00
	TOTAL :	\$ 443,000.00

SDN: CUATROCIENTOS CUARENTA Y TRES MIL PESOS

RESPONSABLE :



RECIBO DE CAJA APLICADO AL EXPEDIENTE No.

0010 14763 - 841-001-8

62/62

REQUISITOS NECESARIOS PARA PRESENTACION Y AGILIZACION DEL TRAMITE

	USUARIO	RADICADOR
PATENTE DE INVENCION	()	()
MODELO DE UTILIDAD	()	()
- Indicación de que se solicita la concesión de una patente.	()	()
- Datos de identificación del solicitante o de la persona que se presenta la solicitud.	()	()
- Descripción de la invención.	()	()
- Dibujos de ser estos pertinentes.	()	()
- Comprobante de Pago de las tasas establecidas.	()	()

COMPLETA () INCOMPLETA ()

DISEÑO INDUSTRIAL ()

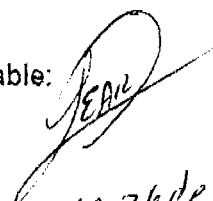
- Indicación de que se solicita el registro de Diseño Industrial	()	()
- Datos de identificación del solicitante o de la persona que presenta la solicitud.	()	()
- Representación gráfica o fotográfica del Diseño Industrial o muestra del Material que incorpora el diseño.	()	()
- Comprobante de pago de las tasas establecidas	()	()

COMPLETA () INCOMPLETA ()

ESQUEMA DE TRAZADO ()

- Indicación de que solicita el registro de un Esquema de trazado.	()	()
- Datos de identificación del solicitante o de la persona que presenta la solicitud.	()	()
- Representación gráfica del esquema de trazado	()	()
- Comprobante de pago de las tasas establecidas.	()	()

COMPLETA () INCOMPLETA ()

Firma Responsable: 
Fecha: mayo 26 de 2005

62
63

Folio 62

2020
Bogotá DC

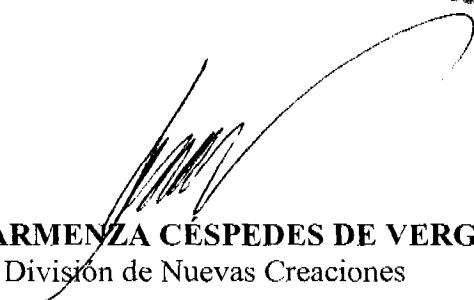
Doctor
EMILIO FERRERO
Apoderado
JELD – WEN, INC.

REFERENCIA:	Radicación No.	05-51548
	Solicitud Internacional	PCT/US2003/034373
	Fecha inicio fase nacional	31-05-2005
	Trámite	011
	Evento	378
	Actuación	416
	Oficio No.	555
	Folios	001

Teniendo en cuenta que la solicitud de privilegio de patente que se tramita bajo el expediente indicado en la referencia, reúne los requisitos de forma establecidos en la Decisión 486 de la Comisión de la Comunidad Andina, el Tratado de Cooperación en Materia de Patentes (PCT), el Reglamento y la Circular Única de la Superintendencia de Industria y Comercio, se envía el extracto de la solicitud a la Oficina de Comunicaciones para efecto de su publicación en la Gaceta de Propiedad Industrial.

Cúmplase
Dado en Bogotá DC

05 AGO 2005


ALIX CARMENZA CÉSPEDES DE VERGEL
Jefe de la División de Nuevas Creaciones

202030