

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
23 September 2004 (23.09.2004)

PCT

(10) International Publication Number
WO 2004/081476 A1

(51) International Patent Classification⁷: **F26B 25/06**,
25/08

COLE, David, J. [US/US]; 42531 Saltz Road, Canton,
MI 48187 (US). **ANDREWS, Jeffrey, C.** [US/US]; 2612
Homplace, Dearborn, MI 48124 (US).

(21) International Application Number:
PCT/US2004/007415

(74) Agents: **DEGRAZIA, Gregory, D.** et al.; Howard and
Howard Attorneys, PC, Suite 101, 39400 Woodward Av-
enue, Bloomfield Hills, MI 48304-5151 (US).

(22) International Filing Date: 11 March 2004 (11.03.2004)

(25) Filing Language: English

(81) Designated States (*unless otherwise indicated, for every
kind of national protection available*): AE, AG, AL, AM,
AT, AU, AZ, BA, BB, BG, BR, BW, 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, NA, 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.

(26) Publication Language: English

(30) Priority Data:
60/453,560 11 March 2003 (11.03.2003) US

(71) Applicant (*for all designated States except US*): **DURR
INDUSTRIES, INC.** [US/US]; 40600 Plymouth Road,
Plymouth, MI 48170 (US).

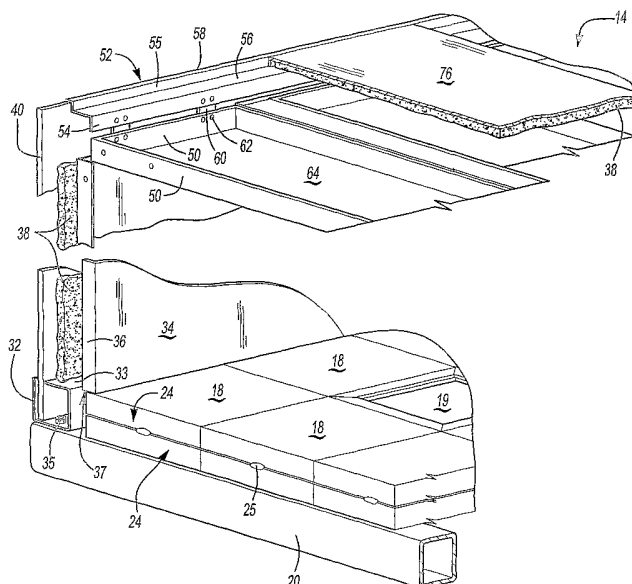
(72) Inventors; and

(75) Inventors/Applicants (*for US only*): **ROESLER, Bruce**
[US/US]; 3649 Loon Lake, Wixom, MI 48393 (US).
COOK, Lawrence, A. [US/US]; 650 Candela, Com-
merce Township, MI 48382 (US). **SMITH, Douglas,
G.** [US/US]; 34615 Pinetree, Livonia, MI 48150 (US).

(84) Designated States (*unless otherwise indicated, for every
kind of regional protection available*): ARIPO (BW, GH,
GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),
Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), Euro-
pean (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR,
GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK,

[Continued on next page]

(54) Title: MODULAR PAINT OVEN



(57) Abstract: An oven assembly for drying paint on a product transported by a conveyor includes a plurality of modules (10) positioned in a generally abutting relationship. Each of the modules (10) includes a roof (14), side walls (12), and a floor (16) having a length and a width. The floor (16) is formed from abutting floor panels (24) reinforced by a plurality of support members (20) spaced along the length of the floor (16) and having a length greater than the width of the floor (16). The side walls (12) include an inner side wall panel (34) disposed in an overlapping relationship with the floor (16) and a side wall cladding panel (40) supported by the support members (20) along the width of the floor (16) thereby concealing thermal insulating material disposed between the inner side wall panel (34) and the side wall cladding panel (40).



TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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.

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*

MODULAR PAINT OVEN

RELATED APPLICATIONS

5 [00001] This application claims priority to United States Provisional Patent Application No. 60/453,560 filed March 11, 2003.

BACKGROUND OF THE INVENTION

 [00002] Automotive and industrial paint are typically baked at temperatures between 200 and 400° F in ovens positioned at the end of paint application
10 booths in production painting facilities. These ovens typically include an oven housing that encloses heating apparatus for applying either radiant or convection heating as is known to those of skill in the art.

 [00003] Preferably, these ovens are constructed from modules that are manufactured at a fabricating facility and transferred to the production paint facility. The
15 modules are then affixed together to form the oven housing through which a conveyor transfers the products that have been painted. A typical module includes side walls, a roof and a floor, and has a length of between about 20 and 40 feet. Thermal insulation is sandwiched between inner and outer panels to prevent heat from escaping from the housing while in operation. Present designs include significant structural components
20 that have proven to unnecessarily add cost to the construction of the oven. Structural members are welded to wall panels in both vertical and horizontal directions prior to applying the outer panels. These structural members, which are fashioned from heavy gauge steel, add a significant amount of material costs to the oven, which has proven unnecessary, particularly in light of increasing steel costs.

25 [00004] A typical automotive paint oven is known to be up to several hundred feet long. Thus, unnecessary structural components included in each module

will add cost to the oven several times over. Therefore, a simple construction that reduces unnecessary structural components would be desirable to reduce the overall material usage and cost of the oven.

SUMMARY OF THE INVENTION

5 [00005] The present invention relates to an oven assembly for drying paint on a product transported by a conveyor. A plurality of modules are positioned in a generally abutting relationship, each having a roof, side walls, and a floor defining a length and a width. The floor is formed from abutting floor panels reinforced by a plurality of support members spaced along the length of the floor. The support members
10 have a length greater than the width of the floor. The side walls include an inner side wall panel disposed in an overlapping relationship with the floor and a side wall cladding panel supported by the support members along the width of the floor concealing thermal insulating material disposed between the inner side wall panel and the side wall cladding panel.

15 [00006] It has been determined that the heavy structural members associated with prior art ovens are not necessary, primarily because the oven does not provide structural support but merely retains heat to cure the coating applied to the product. Therefore, the present invention provides a light weight alternative that is easily manufactured at a remote location and transferred to the location intended for use.

20

BRIEF DESCRIPTION OF THE DRAWINGS

[00007] Figure 1 shows a perspective view of the inventive oven module;

[00008] Figure 2A shows a partial perspective view showing the intersection of the walls, floor, and roof of the inventive oven module;

25 [00009] Figure 2B shows a perspective view of a floor panel;

[00010] Figure 3 top sectional view of inner wall and the outer wall cladding;

[00011] Figure 4 shows a partial top view of a preferred layout roof panels and explosion panels;

5 [00012] Figure 5 shows a side, longitudinal, sectional view of intersection between the roof panel and the explosion panel;

[00013] Figure 6 shows a perspective view of adjacent oven modules; and

[00014] Figure 7 shows a front view of the oven having a floor radiant heat assembly in place.

10

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[00015] An oven module of the present invention is generally shown at 10 in Figure 1. The module 10 includes side walls 12, a roof 14, and a floor 16.

[00016] As best shown in Figures 2A and 2B, the floor is fabricated from
15 a plurality of floor modules 18. The floor modules 18 are generally rectangular in shape and preferably are arranged longitudinally with respect to the length of the oven module 10. Preferably, three rows of floor modules 18 are positioned in an abutting relationship to form the entirety floor 16 (see also Figure 1). The floor modules 18 are supported by
20 support member 20 that extend across the width of the oven module 10 preferably positioned beneath the seam 22 formed between abutting floor modules 18. A hot air inlet 19 is disposed in the floor 16, the purpose of which will be explained further below.

[00017] Each floor module 18 is formed from two floor panels 24, one of which is best represented in Figure 2B. Each floor panel 24 includes a panel base 26 having an upward extending panel flange 28 that is generally perpendicular to the panel
25 base 26. Each panel flange 28 terminates in a terminal flange 30 that is generally

perpendicular to the panel flange 28 so that the floor panel 24 defines a box-like structure. Each floor panel 24 is filled with thermal insulating material (not shown) and mated to a second floor panel 24 so that the terminal flanges 30 of the two panels 24 abut enclosing the box-like sections and sealing the thermal insulating material inside. The
5 two floor panels 24 are either spat or stitch welded 25 together at the seam defined by the abutting terminal flanges 30 to form the floor module 18. The combination of the box like structures 24 and the support members 20 provide ample structural support to the assembly 10.

[00018] The support member 20 has a length that exceeds the width of the
10 three abutting floor panels 24 as best shown in Figures 1 and 2A. A generally U-shaped channel 32 is secured to opposing ends of the support member 20 that extend beyond the width of the floor 16. The U-shaped channel 32 includes an upper, horizontal lip 33 that partially encloses the U-shaped channel 32. The U-shaped channel 32 extends along the length of the oven module 10, the purpose of which will be explained further below. The
15 interaction between the floor panels 24, the support member 20, and the U-shaped channel 32 is shown best in Figure 3A. Preferably, the U-shaped channel 32 is bolted or similarly fastened to each of, or some of, the support members 20 with fastener 35.

[00019] Referring again to Figure 2A, the side wall 12 is formed from a plurality of side wall panels 34 each having a panel base 37 with a flange 36 extending
20 outwardly from the panel 34 at a generally 90 degree angle defining the perimeter of the panel 34. The flange 36 defines a box-like enclosure with the panel base 35 to receive thermal insulating material 38. The insulating material is fastened to the side wall panels 34 with a welded pin (not shown) having a washer disposed upon a distal end.

[00020] The side wall panels 34 define the interior surface of the side wall
25 12 of the oven module housing 10. The side wall panels 34 are positioned inboard of the

generally U-shaped channel 32 in an overlapping relationship with a side edge of the floor modules 18 defining the longitudinal sides of the floor 16 as best shown in Figure 2A. The side wall panels 34 are welded or otherwise secured to the floor 16 as will be described further below. It should be understood that adjacent wall panels 34 are also welded together at the seam 39 (Figure 1) defined by abutting wall panels 34 so that an airtight side wall 12 is formed.

[00021] Cladding panels 40 shown are received by the generally U-shaped channel 32 to cover the thermal insulating material 38 retained by the side wall panels 34. The horizontal lip 33 pinches the cladding panels 40 to the U-shaped channel 32 to secure the cladding 40 to the module 10. The side wall cladding panels 40 are positioned in an abutting relationship to fully conceal the thermal insulating material 38, but are not otherwise adjoined by welding or fastening. However, metal screws (not shown) may be used to provide additional retention to the wall panels 34. As best shown in Figure 3, a side flange 42 extends along vertical edges of each cladding panel 40 in a generally perpendicular relationship to a cladding panel base 40 in a direction facing the inner side wall panels 34. A first terminal flange 44 extends in an inboard direction from one of the side flanges 42 at generally perpendicular relationship and a second terminal flange 46 extends in an outboard direction from the other side flange 42, also in a generally perpendicular relationship to the side flange. The first terminal flange 44 and the second terminal flange 46 of adjacent cladding panels 44 overlap enclosing the seam formed by the abutting cladding panels 40 to prevent the thermal insulating material 38 from becoming exposed during the varying thermal expansion and contraction of the adjacent cladding panels 40, which could result in a gap between the adjacent cladding panels 40.

[00022] Referring now to Figures 2A and 4, the roof 14 of the oven module 10 is formed from roof panels 64, and explosion panels 48 that are generally

rectangular, the length of which is oriented to extend between each of the side walls 12.

A roof flange 50 extends upwardly from a roof panel base 51 along the perimeter of each of the roof panels 48. A support member 52 extends along the entire length of the oven module 10 along the intersection between each side wall 12 and the roof 14. The support member 52 includes an inner vertical support wall 54, a first horizontal wall 56 and a second horizontal wall 58, each of which are generally perpendicular to the inner vertical support wall 54. The second horizontal wall 58 is positioned outboard of the first horizontal wall 56, the purpose of which will be explained further below. An outer vertical support wall 55 joins the two horizontal walls 56, 58. The inner vertical support wall is affixed to the roof flange 50 of the roof panels 64 by connecting panel 60 and rivets, welds or equivalent fasteners 62 fixedly attaching the connecting panels 60 with the first horizontal wall 56 and a roof flange 50. The connecting panels 60 are spaced as necessary along the length of the oven module 10, but not necessarily to each of the roof panels 48, and preferably not to any of the explosion panels 48.

15 **[00023]** As shown in Figure 4, the explosion panels 48 are spaced lengthwise of the oven module 10 intermittently between roof panels 64. Figure 4 shows these explosion panels 48 positioned between every roof panel 64. However, the explosion panels 48 may be positioned between every other roof panel 64, every second roof panel 64, or even every fourth roof panel 64 as necessary.

20 **[00024]** Figure 5 shows a functional interface between the roof panel 64 and the explosion panel 48. A first member 66 has an upwardly extending wall 68 is affixed to the roof panel 64. A second member 70 has a second upwardly extending wall 72 abutting the first upwardly extending wall 68 and is affixed to the explosion panel 48. The members 66, 68 are also preferably positioned between each explosion panel 48.

25 The second upwardly extending wall 72 has a reverse bend 74 that overlaps the first

upwardly extending wall 68 of the adjacent first member 66 thereby adjoining the first member 66 to the second member 70. For retention, a button punch (not shown) squeezes the reverse bend 74 to pinch the first upwardly extending wall 68. In the event of an explosion, the button punch releases and the explosion panel 48 lifts upwardly to provide a pressure release from the explosion thereby preventing structural damage to the oven module 10. Therefore, the seam formed between the explosion panels 48 and the wall panels 34 is preferably not welded to allow the explosion panels 48 to lift upwardly.

[00025] Referring again to Figure 2A, each wall cladding panel 40 engages the second horizontal wall 58 and the outer vertical support wall 55 of the support member 52 and is retained as previously stated by the generally U-shaped channel 32 at the bottom. A roof cladding panel 76 rests upon the first horizontal wall 56 of the support member 52 so that all of the thermal insulating material 38 is now covered. A molding 78 (Figure 1) conceals the seams formed between the support member 52, the wall cladding 40, and the roof cladding 76 and assists retaining the wall cladding panels 40 to the module 10.

[00026] As best shown in Figure 6, expansion joints 80 are positioned between adjacent modules 10 as needed. Expansion joints may be positioned between every other module 10, every other second module 10, or every other third module 10 depending on the thermal expansion properties expected of the final oven design. The expansion joints 80 reduce the structural stress associated with the thermal expansion of the materials. Preferably, the expansion joint 80 is formed from a heat resistant fabric, however, other resilient materials may also be used.

[00027] The preferred oven 10 substrate material is aluminized steel. Aluminized steel is known to those of skill in the art to provide a more durable substrate than does galvanized steel and is less expensive than stainless steel.

[00028] During the assembly process, the floor 16 is first assembled using the components set forth above. Upon welding the seams between each of the floor panels 24, the floor 16 becomes airtight. After the floor 16 is assembled, conveyor supports 82 are affixed to the upper surface as needed as best seen in Figure 7.

5 Additional ribbing (not shown) may also be welded to the underside of the panels 24 below the conveyor supports 82. Each of the side walls 12 are also manufactured separately using the components set forth above. Temporary braces (not shown) secure the walls 12 in an upright position at appropriate spaced distances when the walls 12 are set upon the floor 16 in the overlapping relationship described above so that the walls 12

10 can be welded in place to provide an airtight seam. Once the walls 12 are in place, the roof panels 48 are welded in place and the support members 52 are affixed to the roof panels 48.

[00029] Once all the panels 24, 34, and 48 are in place, the thermal insulating material 38 is positioned on the exterior surfaces of the side wall panels 34 and

15 the roof panels 48. After the insulating material 38 is in place, the wall cladding panels 40 are secured in the generally U-shaped channel 32 and upon the second horizontal wall 58 of the support member 52. Once the wall cladding panels 40 are in place, the roof cladding panels 76 are placed upon the roof panels 48 and the molding 78 is positioned to cover the seam between the wall cladding panels 40 and the roof cladding panels 76.

20 [00030] Each module is completed in a similar fashion and transported to the production painting facility where several modules are affixed together to form the entirety of the oven assembly. Depending upon the heating zone, the radiant heat ducts or convection heat ducts are put in place to either provide radiant or convection heat as desired.

25 [00031] As disclosed in United States Patent No. 5,568,692, one preferred

method of heating the oven through convection heat is from the floor 12. As shown in Figure 7, a radiant wall 83 overlays the floor 12 and is supported by spacers 84 positioned between the radiant wall 83 and the floor 12. Heated air is pumped through a space 85 defined by the radiant wall 82 and the floor 12 via heated air inlet 19. The heated air
5 transmits heat through the radiant wall 83 to heat the oven assembly 10. Optionally, air supply ducts 86 are included to provide fresh air and remove solvent laden air from the oven.

[00032] The invention has been described in an illustrative manner, and it is to be understood that the terminology which has been used is intended to be in the
10 nature of words of description rather than of limitation.

[00033] Obviously, many modifications and variations of the present invention are possible in light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims, wherein reference numerals are merely for convenience and are not to be in any way limiting, the invention may be practiced
15 otherwise than as specifically described.

CLAIMS

What is claimed is:

1. An oven assembly for drying paint on a product transported by a conveyor, comprising:

5 a plurality of modules positioned in a generally abutting relationship, wherein each of said modules includes a roof, side walls, and a floor having a length and a width:

said floor formed from abutting floor panels reinforced by a plurality of support members spaced along said length of said floor and having a length
10 greater than said width of said floor;

said side walls including an inner side wall panel disposed in an overlapping relationship with said floor and a side wall cladding panel supported by said support members along said width of said floor thereby concealing thermal insulating material disposed between said inner side wall panel and said side wall cladding panel.
15

2. An assembly as set forth in claim 1, wherein each of said floor modules define an inner cavity having a thermal insulator disposed therein.

3. An assembly as set forth in claim 1, further including a generally U-shaped channel extending along said length of said floor and supported by said support
20 members for receiving said side wall cladding panel thereby retaining said side wall cladding panel to said assembly.

4. An assembly as set forth in claim 1, wherein said roof includes roof panels spaced apart and fixedly attached between said side walls thereby supporting said side
25 walls in a space relationship.

5. An assembly as set forth in claim 4, further including relief panels disposed between said roof panels and being releasably retained to said roof panels thereby providing explosion relief to said assembly.

5 6. An assembly as set forth in claim 5, further including a radiant wall overlying said floor at a spaced location defining a heated air channel therebetween being fluidly connected to a source of heated air thereby heating said radiant floor.

7. An assembly as set forth in claim 1, further including air ducts affixed to
10 at least one of said roof and said inner wall panel for providing air to said assembly.

8. An assembly as set forth in claim 1, further including a support member extending at least between said roof panels and providing an abutment surface for receiving said side wall cladding panels thereby retaining said side wall cladding panels
15 to said assembly.

9. An assembly as set forth in claim 8, including roof cladding panels overlaying said roof at a spaced location thereby defining a space for receiving thermal insulating material.
20

10. An assembly as set forth in claim 1, wherein adjacent of said modules are adjoined by a flexible member thereby enabling said modules to expand and contract.

11. A method of manufacturing an oven assembly for drying paint on products transported on a conveyor, comprising the steps of:

assembling a floor from a plurality of insulating panels;

fixedly attaching inner wall panels to opposing sides of said floor;

5 fixedly attaching a roof to an opposite end of said inner side panels from said floor thereby defining module with a heating chamber within said floor, said inner wall panels, and said roof;

providing insulating material to said roof and said inner side wall panels and concealing said insulating material with cladding panels; and

10 providing a support removably attached to at least two of said roof, said inner side wall panels, and said floor thereby enabling said module for transportation to a remote location.

12. The method as set forth in claim 11, further including the step of forming
15 a first set of weld seams between said roof and said side walls and second set of weld seam between said side walls and said floor.

13. The method as set forth in claim 12, wherein said step of providing a support is further defined by affixing said support over said first set of seams and said
20 second set of seams thereby securing said assembly for transportation to a remote location.

14. The method as set forth in claim 11, further including the step of providing support members at spaced locations beneath said floor thereby supporting said
25 assembly.

15. The method as set forth in claim 11, further including the step of providing a clasp for receiving said side wall cladding panels thereby retaining said side wall cladding panels to said assembly.

5 16. The method as set forth in claim 15, further including the step of fixedly attaching said clasp to said support members.

17. The method as set forth in claim 11, further including the step of providing a radiant wall at a spaced location over said floor thereby forming a hot air
10 conduit between said floor and said radiant wall thereby providing heat to said assembly.

18. The method as set forth in claim 11, further including the step of providing an air duct for providing air to said assembly and affixing said air duct to one of said floor, said side walls, and said roof.

15

19. The method as set forth in claim 11, further including the step of transferring a plurality of modules to the remote location.

20. The method as set forth in claim 11, further including the step of adjoining
20 adjacent of said modules with a flexible member thereby enabling said modules to expand and contract.

21. The method as set forth in claim 20, further including the step of removing said support from said module when said module has arrive at the remote
25 location.

22. The method as set forth in claim 11, further including the step of installing a conveyor in said heating chamber for transferring products through said assembly.

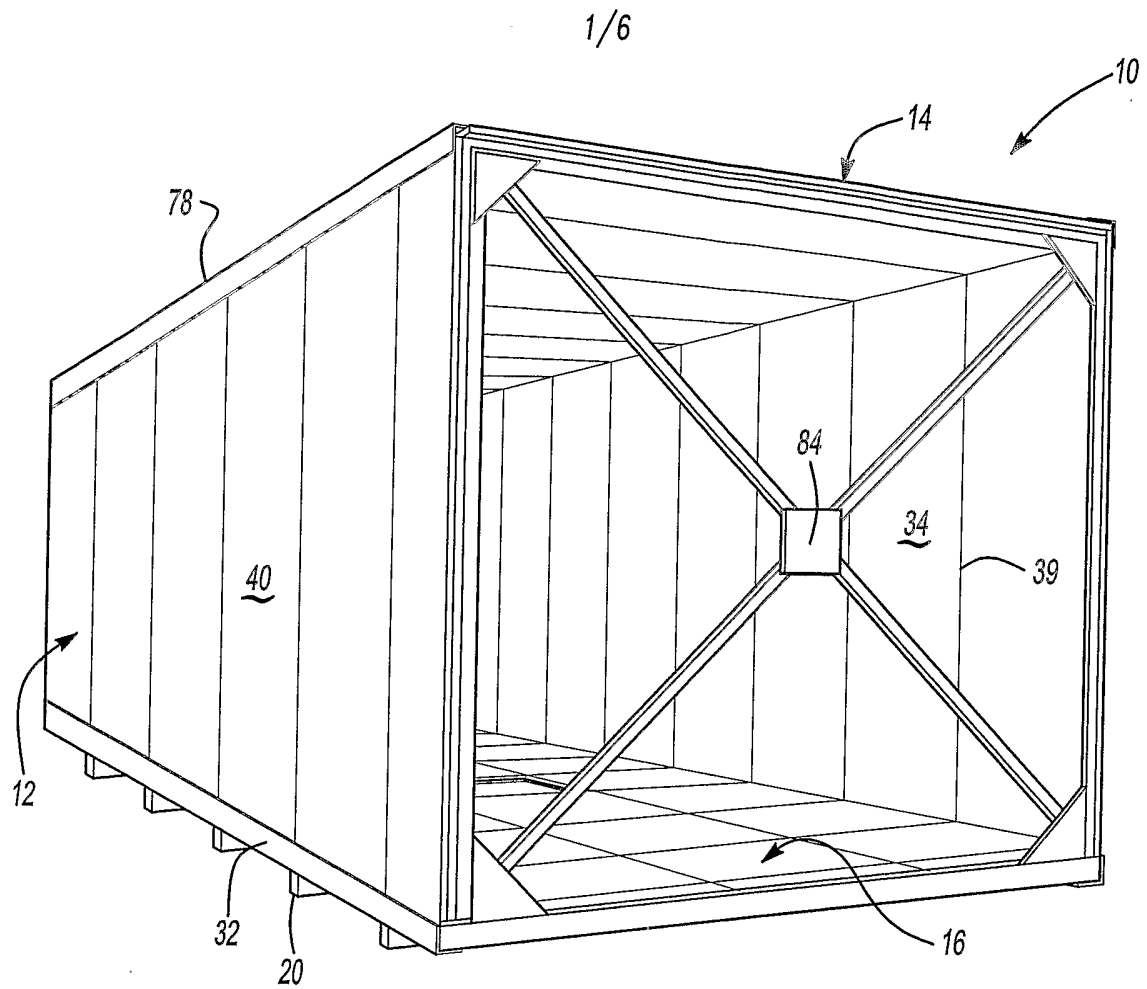


Fig-1

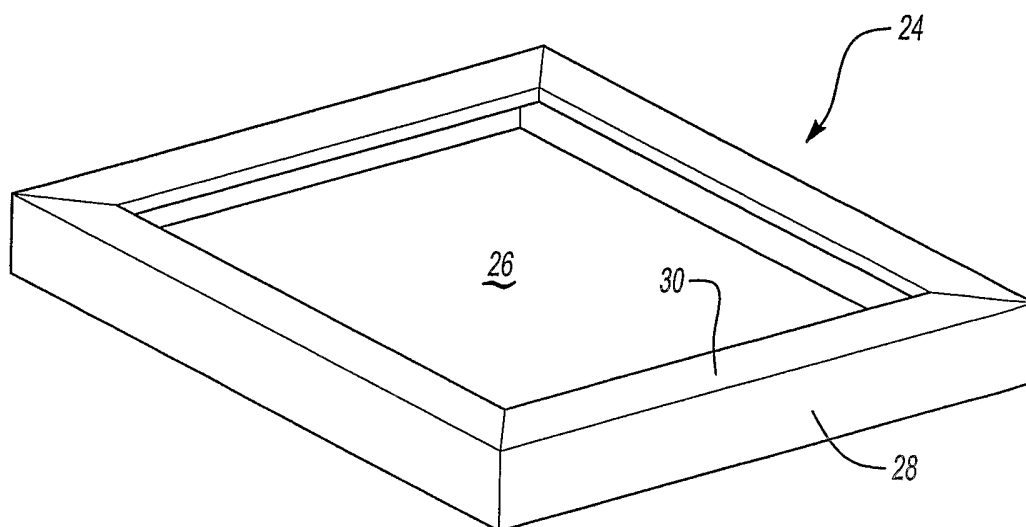


Fig-2B

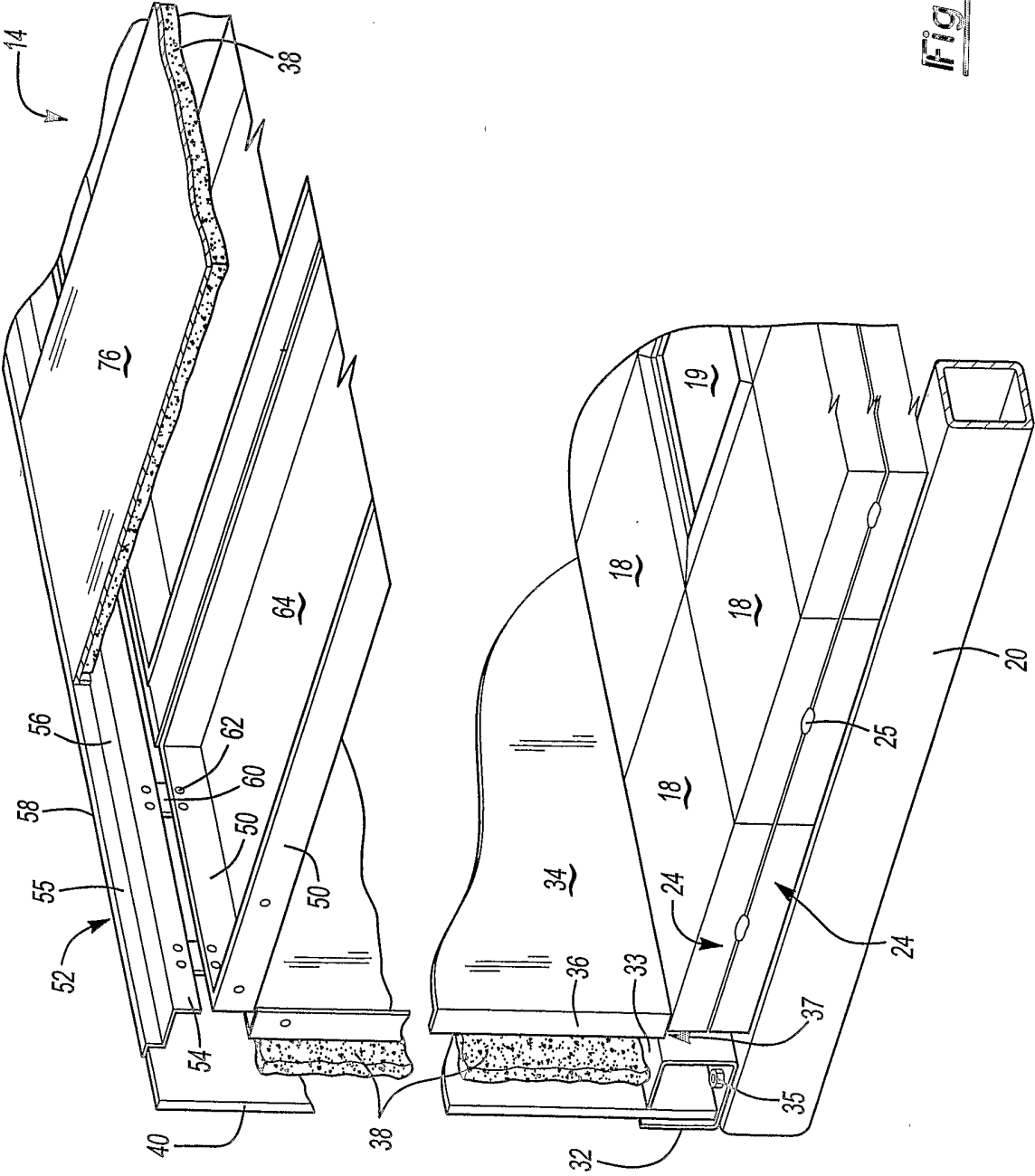
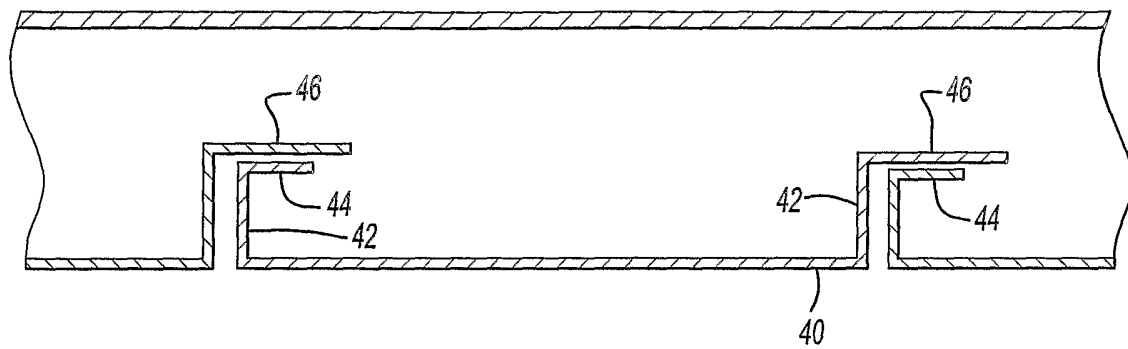
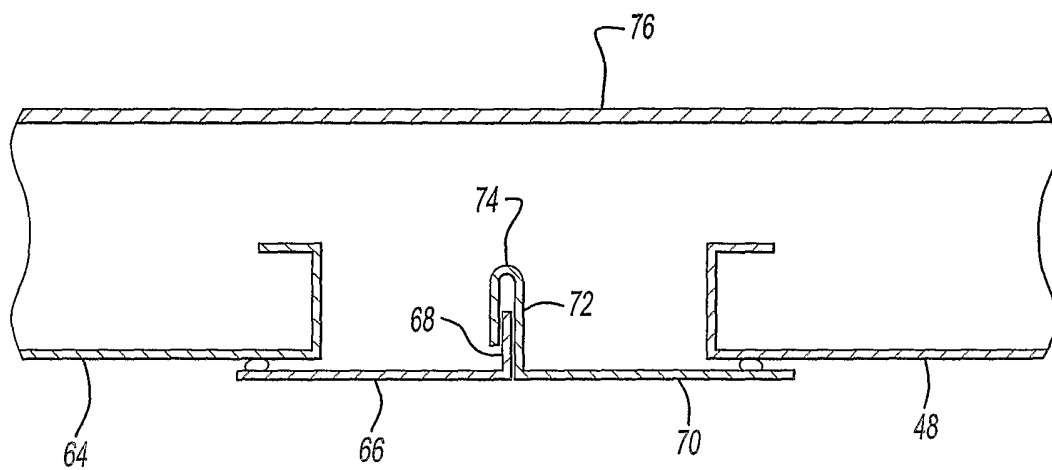


Fig-2A

3/6

Fig-3Fig-5

4/6

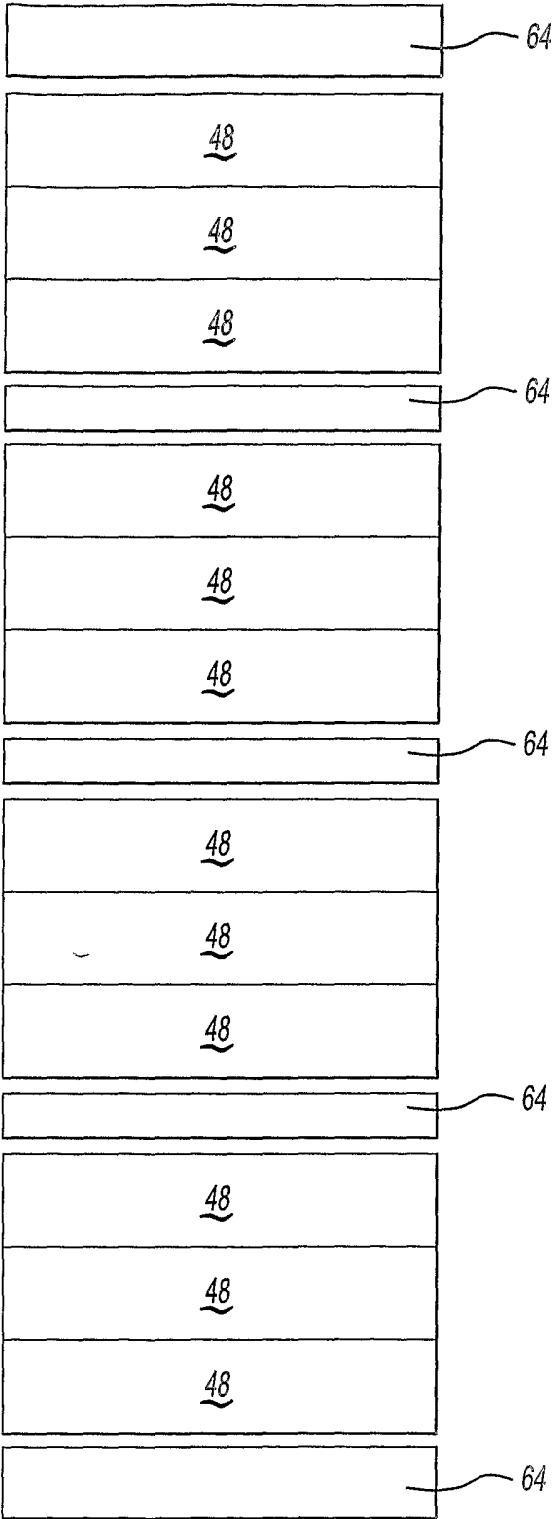
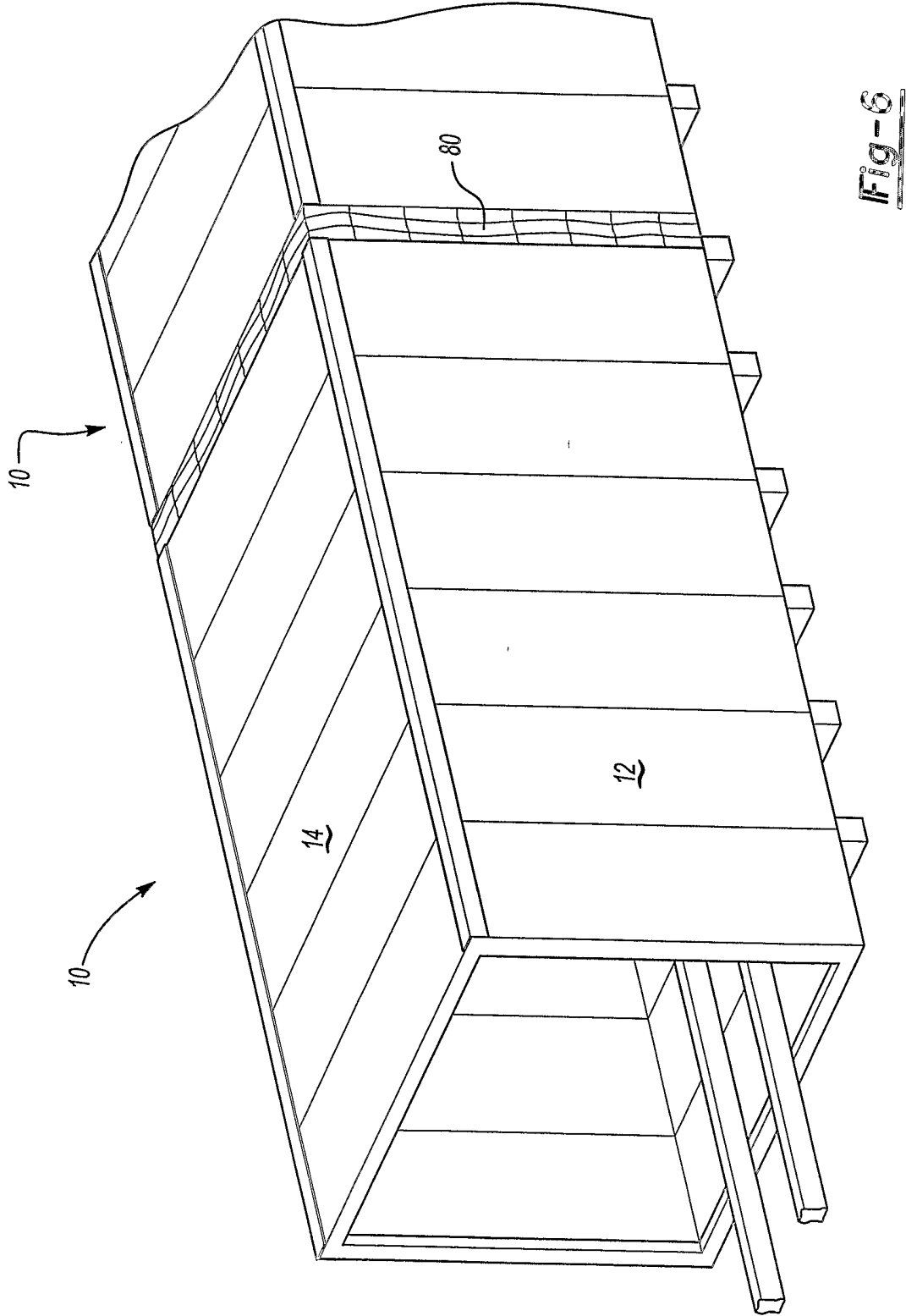
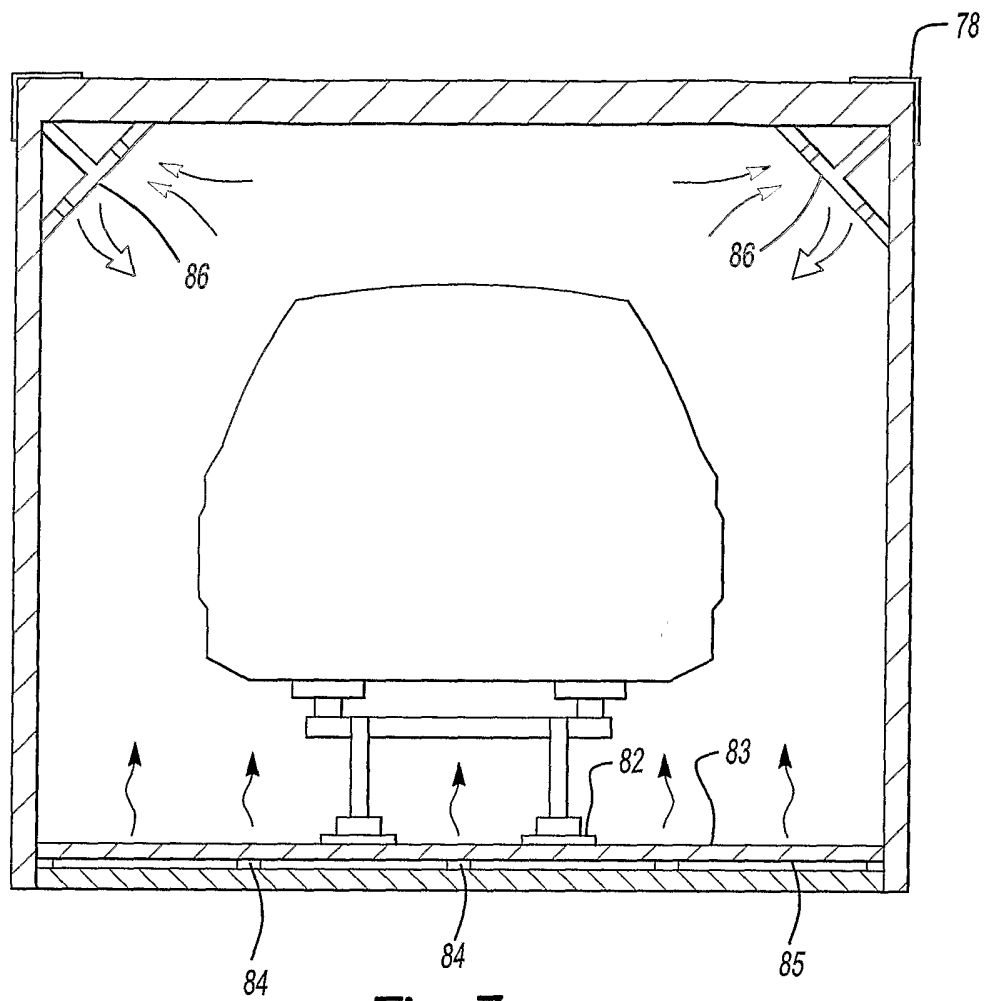


Fig-4



6/6

Fig-7

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US2004/007415

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 F26B25/06 F26B25/08

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 F26B B05B

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.
X	US 4 731 016 A (DIXON JAMES M) 15 March 1988 (1988-03-15)	11-13, 19-22
Y	column 2, line 34 - column 3, line 19; figures	14,17,18
A		5,9
Y	DE 93 06 821 U (EISENMANN MASCHINENBAU KG) 15 July 1993 (1993-07-15)	14
A	the whole document	1,3,4, 15,16
Y	US 5 568 692 A (GORE ANTHONY R ET AL) 29 October 1996 (1996-10-29)	17,18
A	cited in the application the whole document	6,7
	----- -/--	

☒ 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.
- *&* document member of the same patent family

Date of the actual completion of the international search

13 August 2004

Date of mailing of the international search report

23/08/2004

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

Silvis, H

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US2004/007415

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 22 13 888 A (SCHAEFER GMBH FRITZ) 4 October 1973 (1973-10-04) the whole document -----	1,3,8, 10,11, 15,19,20
A	EP 1 125 639 A (WAGNER INTERNAT AG) 22 August 2001 (2001-08-22) figures 1,2 -----	1
A	GB 199 836 A (JULIUS JUDELSON) 2 July 1923 (1923-07-02) the whole document -----	3,4,8,9
A	EP 0 867 674 A (THOMAS ROBERT METALL ELEKTRO) 30 September 1998 (1998-09-30) the whole document -----	11
A	DE 198 58 305 C (DUERR SYSTEMS GMBH) 13 April 2000 (2000-04-13) -----	
A	EP 0 095 717 A (PICOT ERNEST) 7 December 1983 (1983-12-07) -----	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US2004/007415

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 4731016	A	15-03-1988	CA 1298748 C	14-04-1992
DE 9306821	U	15-07-1993	DE 9306821 U1	15-07-1993
US 5568692	A	29-10-1996	AU 4363396 A BR 9510331 A CA 2204642 A1 EP 0786066 A1 WO 9615415 A1	06-06-1996 10-11-1998 23-05-1996 30-07-1997 23-05-1996
DE 2213888	A	04-10-1973	DE 2213888 A1	04-10-1973
EP 1125639	A	22-08-2001	IT MI200000091 A1 EP 1125639 A1 US 2001020445 A1	25-07-2001 22-08-2001 13-09-2001
GB 199836	A	02-07-1923	NONE	
EP 0867674	A	30-09-1998	DE 19712619 C1 CZ 9800908 A3 DE 59811527 D1 EP 0867674 A2 PL 325574 A1	07-01-1999 14-10-1998 15-07-2004 30-09-1998 28-09-1998
DE 19858305	C	13-04-2000	DE 19858305 C1	13-04-2000
EP 0095717	A	07-12-1983	FR 2527757 A1 AT 18300 T DE 3362269 D1 EP 0095717 A1 ES 8402925 A1 JP 1618348 C JP 2043115 B JP 58214778 A ZA 8303740 A	02-12-1983 15-03-1986 03-04-1986 07-12-1983 16-05-1984 12-09-1991 27-09-1990 14-12-1983 29-02-1984