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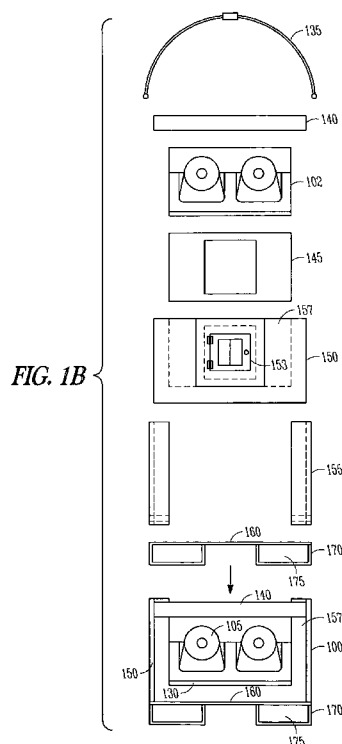
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(54) Title: LIGHT WEIGHT AND COLLAPSIBLE WEAPONS CONTAINER

(57) Abstract: A munitions container includes an inner container and an outer container formed of a fibrous material. A form is positioned within the inner container and receives munitions. The outer container is placed on a rigid baseplate.





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## LIGHT WEIGHT AND COLLAPSIBLE WEAPONS CONTAINER

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### Cross-Reference to Related Applications

This application claims the benefit of U.S. Application No. 12/408,873, filed March 23, 2009, the disclosure of which is incorporated herein by reference in its entirety.

10

### Technical Field

The present invention relates to weapons containers, and in an embodiment, but not by way of limitation, a light weight and collapsible weapons container.

15

### Background

Robust, airtight containers are required for safe storage and transport of munitions and/or weapons. Typical munitions containers are made out of steel, and are therefore rigid and heavy, and are not collapsible or disposable after use. They also occupy a fixed volume whether they are loaded with munitions or they are empty. The same shipping volume is therefore required whether being shipped to the point of use (*e.g.* a Navy ship or a battlefield) or being returned empty from the point of use. Additionally, the mass of an empty container may be comparable to or even much larger than the mass of the munitions themselves. Thus, in light of these shortcomings, the art would benefit from an improved munitions container.

25

### Brief Description of the Drawings

30

**FIGS. 1A and 1B** are exploded views of an example embodiment of a weapons container.

**FIG. 2A** is a side cross sectional view of a weapons container.

**FIG. 2B** is a plan view of a weapons container.

**FIG. 2C** is an end view of a weapons container.

**FIG. 3** is a side view of a first weapons container stacked on a second weapons container.

**FIG. 4A** is a plan view of a collapsed weapons container.

**FIG. 4B** is a end view of a collapsed weapons container.

5 **FIG. 4C** is a side view of a collapsed weapons container.

**FIG. 5** is a cross section of a fabric for a container wall.

**FIG. 6** is a flowchart of an example embodiment of a process to manufacture a collapsible weapons container.

10 **FIG. 7** is a flowchart of another example embodiment of a process to manufacture a collapsible weapons container.

### **Detailed Description**

In the following detailed description, reference is made to the accompanying drawings that show, by way of illustration, specific embodiments  
15 in which the invention may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice the invention. It is to be understood that the various embodiments of the invention, although different, are not necessarily mutually exclusive. For example, a particular feature, structure, or characteristic described herein in connection with one embodiment  
20 may be implemented within other embodiments without departing from the scope of the invention. In addition, it is to be understood that the location or arrangement of individual elements within each disclosed embodiment may be modified without departing from the scope of the invention. The following detailed description is, therefore, not to be taken in a limiting sense, and the  
25 scope of the present invention is defined only by the appended claims, appropriately interpreted, along with the full range of equivalents to which the claims are entitled. In the drawings, like numerals refer to the same or similar functionality throughout the several views.

This disclosure relates to a light weight and collapsible weapons and  
30 munitions container that can be assembled in the field (*e.g.*, a munitions plant). The container is made of fabric and polymeric materials, and includes sparsely located metal reinforcements around the outside perimeter of the container. The container is collapsible after use. The munitions container has improved chemical and moisture resistance. The materials and construction of the

container decreases the overall weight of a munitions container system, as compared to prior art munitions container systems.

5 In an embodiment, a munitions container includes an inner container and an outer container. The inner and outer containers are formed out of a fibrous material. The munitions container further includes a form for receiving munitions that is placed within the inner container. The outer container rests on a rigid baseplate. At least a portion of the fibrous material comprises fiber of greater than 10 grams per denier.

10 In a particular embodiment, the inner container and the outer container include at least two layers of the fibrous material **510** and at least one layer of a polymeric material **520** bonded to the at least two layers of the fibrous material as illustrated in **FIG. 5**. The bond **530** between the fibrous material and the polymeric material is able to withstand a force of at least 50 psi in shear. The layers of fibrous material can include a fibrous web within the layers of fibrous material. The layers of fibrous material and the layer of polymeric material have a density of less than 100 kg per cubic meter. The inner container and the outer container that are constructed of such a fibrous/polymeric layered fabric are capable of sustaining a blunt or cutting impact of at least 15 kJ/kg of mass and up to 150 kJ/kg of mass.

20 **FIG. 1** is an exploded view of an example embodiment of a weapons container **100**. A partially assembled embodiment of the container is shown at **102**, and a fully assembled embodiment of the container is shown at **100** in **FIG. 2B**. Munitions and/or weapons **105** are positioned in a rack or support **110**. The munitions and support are then positioned in a lower protective form **115**. In an embodiment, the lower protective form **115** is constructed of a foam or foam-like material, which can be disposed of after the munitions are removed from the container **100**. This reduces the amount of material that is returned to the munitions plant with the emptied container **100**. Retention straps **120** are placed over the munitions **105** and lower protective form **115** to secure the munitions within the lower protective form. An upper protective form **125** is then placed over the munitions, lower protective form, and retention strap assembly. Like the lower protective form, the upper protective form can be made of foam or a foam-like material that can be disposed of after the removal of the munitions from the container **100**. The assembly of the munitions, lower protective form,

25  
30

and upper protective form are secured to a base cradle plate **130** via the retention straps **120**, and this assembly is shown at **102**.

The bomb or base cradle plate **130** is a subassembly of the container **100** which when removed may be attached to a portable cart for transport to a host aircraft or other destination. Suitable lift points **180** (**FIG. 2B**) are provided to allow the cradle plate **130** to be hoisted into and out of the container **100**. The bomb cradle plate **130** may be made from aluminum or from a lightweight aluminum honeycomb material.

The assembly **102** is placed into a bladder **145**. The bladder **145** is preferably made out of a sturdy polymer-based material. The bladder can be made from a coated fabric using heat sealed seams. The bladder is airtight, and in one embodiment, the bladder is made airtight via a zipper such as a type used on a diving dry suit. As an alternative to first placing the assembly **102** into the bladder **145**, the airtight bladder **145** is first inserted into the outer container **150**, and then the assembly **102** is placed into the bladder **145** that is now inside the outer container **150**. The bladder can include a cutout portion that matches an access port in the outer container **150**. The bladder and access port can be joined and sealed by a gasket and retaining plate. An outer door **153** on the access port would include an airtight seal. Breather and bleeder valves could also be part of the access port door.

The outer container **150** can be manufactured out of a flexible sturdy material such as a liquid crystal polymer fabric. The fiber fabric can be coated with a flame and chemical resistant layer. A liquid crystal polymer fiber fabric has very high strength and a high modulus. One example of a liquid crystal polymer fiber fabric that may be suitable is Vectran® and 1500 denier Vectran®, although the scope of the embodiment is not limited in this respect. The outer container **150** further includes the access door **153**. An access port at the aft end of the bladder allows access into the airtight compartment where the munitions are stored. The access door and port also allow access to a storage area for munitions BIT cables, dessicants, and records. Rigid structure posts **155**, which in one embodiment are made out of metal, are positioned around the outer container **150**, such as at the four corners of the outer container. A foam or foam-like material **157** is placed into the outer container **150** such that it surrounds and secures the bladder **145** and the contents within the bladder. In an

embodiment, the foam 157 is a mixture of two or more compounds, which are injected into the outer container 150 via ports and tunnels 540 (See FIG. 5) in the wall of the flexible material of the outer container, and which solidify around the bladder 145, thereby securing the bladder and its contents. The foam can be  
5 an expandable rigidizing urethane foam. The foam bonds to the fabric, creating a structure that strongly resists bending. A top plate 140 is placed over the outer container 150, and one or more retention straps 135 secure the outer container to a base weldment 160. The retention straps pass around the container and are terminated at the base weldment. A tensioning device can be used to tighten the  
10 retention straps. The base weldment can include footing 170, which can be configured with an opening 175 to receive the forks of a fork lift truck. There can be one or more openings 175 on any and all sides of the munitions container 100.

FIG. 2A shows a side cross sectional view of the weapons container 100.  
15 In FIG. 2B, the munitions 105 are positioned within the container 100, straps 135 are shown, and side access ports 175 for the forks of a fork lift truck are also illustrated. FIG. 2B is a plan view of the container 100, and it illustrates, among other features, lift points 180 that are coupled to the base cradle plate 130, and that can receive a hook or other device for lifting the base cradle plate 130 out of  
20 the outer container 150. FIG. 2C shows an end view of the container 100, including the access door 153.

FIG. 3 is a side view of one container 100A stacked on a second container 100B. In an embodiment, the stackability of the containers is made possible by recesses 185 in the base weldment 160. The recesses 185 receive the  
25 rigid supports 155 in an interlocking fashion, thereby aligning and securing the top container 100A on the bottom container 100B, and transferring the weight of other containers through the rigid supports 155.

FIG. 4A illustrates a plan view of a container 100 in a collapsed state with no weapons therein. FIG. 4A illustrates the base cradle plate 130 placed on  
30 the base weldment 160. The retention straps 135 secure the base cradle plate 130 to the base weldment 160. FIG. 4C shows a side view of the retention straps 135 securing the base cradle plate 130 to the base weldment 160. FIG. 4B illustrates an end view of the collapsed container 100. FIG. 4B, like FIGS. 4A and 4C, shows the base cradle plate 130 strapped to the base weldment 160,

and further shows the supports **155**, the lifting eyes **180**, and the access door **153** stowed within the fork lift truck openings **175** in the footing **170**.

Reusable elements of the container **100** include the base weldment **160** and footing **170**, the rigid supports **155**, the bomb cradle base plate **130**, the  
5 lifting eyes **180**, and the access door **153**. Disposable elements include the outer container **150**, the cover panel **140**, and the lower and upper protective foam elements **115**, **125**.

**FIGS. 6 and 7** are flowcharts of example processes **600** and **700** for manufacturing a light weight and collapsible weapons and munitions container.  
10 **FIGS. 6 and 7** include a number of process blocks **605 – 695** and **705 – 755** respectively. Though arranged serially in the examples of **FIGS. 6 and 7**, other examples may reorder the blocks, omit one or more blocks, and/or execute two or more blocks in parallel using multiple processors or a single processor organized as two or more virtual machines or sub-processors. Moreover, still  
15 other examples can implement the blocks as one or more specific interconnected hardware or integrated circuit modules with related control and data signals communicated between and through the modules. Thus, any process flow is applicable to software, firmware, hardware, and hybrid implementations.

Process **600** includes forming an inner container at **605** and forming at  
20 outer container at **655**. The formation of the inner container includes placing one or more munitions into a first form at **610**, placing one or more first retention straps over the munitions to secure the munitions to the first form at **615**, placing a second form over the munitions and the one or more first retention straps at **620**, and placing the munitions, the first form, the one or more  
25 first retention straps, and the second form onto a base cradle plate at **625**. The munitions, the first form, the one or more first retention straps, the second form, and the base cradle plate are placed into a bladder at **630**. The outer container is formed at **655** by securing a fabric to a plurality of rigid posts at **660**, placing the fabric and rigid posts onto a base weldment at **665**, placing a third  
30 form into the main container between the bladder and the fabric at **670**,

placing a top cover on the main container at **675**, and securing the main container to the base weldment with one or more second retention straps at **680**. The process **600** further includes installing an access door into the outer container at **685**, and injecting foam into the outer container at **690** so that it



surrounds the inner container. At **695**, the foam is injected into the main container via ports and tunnels in the fabric.

Process **700** includes forming an inner container of a fibrous material at **705**, forming an outer container of the fibrous material at **710**, placing a form within the inner container to receive munitions at **715**, and placing the outer container on a rigid baseplate **720**. A portion of the fibrous material comprises fiber of greater than 10 grams per denier (**725**). At **730**, the forming of the inner container and outer container comprise forming at least two layers of the fibrous material. At **735**, the inner container and the outer container are formed such that they comprise at least one layer of a polymeric material bonded to the at least two layers of the fibrous material. At **740**, the bond formed between the fibrous material and the polymeric material is able to withstand a force of at least 50 psi in shear. At **745**, a fibrous web is positioned between the at least two layers of fibrous material. The at least two layers of fibrous material and the at least one layer of polymeric material comprise a density of less than 100 kg per cubic meter (**750**). At **755**, the inner container and the outer container are formed such that the inner container and the outer container are capable of sustaining a blunt or cutting impact of at least 15 kJ/kg of mass and up to 150 kJ/kg of mass.

In the foregoing detailed description of embodiments of the invention, various features are grouped together in one or more embodiments for the purpose of streamlining the disclosure. This method of disclosure is not to be interpreted as reflecting an intention that the claimed embodiments of the invention require more features than are expressly recited in each claim. Rather, as the following claims reflect, inventive subject matter lies in less than all features of a single disclosed embodiment. Thus the following claims are hereby incorporated into the detailed description of embodiments of the invention, with each claim standing on its own as a separate embodiment. It is understood that the above description is intended to be illustrative, and not restrictive. It is intended to cover all alternatives, modifications and equivalents as may be included within the scope of the invention as defined in the appended claims. Many other embodiments will be apparent to those of skill in the art upon reviewing the above description. The scope of the invention should, therefore, be determined with reference to the appended claims, along with the full scope

of equivalents to which such claims are entitled. In the appended claims, the terms “including” and “in which” are used as the plain-English equivalents of the respective terms “comprising” and “wherein,” respectively. Moreover, the terms “first,” “second,” and “third,” etc., are used merely as labels, and are not  
5 intended to impose numerical requirements on their objects.

The abstract is provided to comply with 37 C.F.R. 1.72(b) to allow a reader to quickly ascertain the nature and gist of the technical disclosure. The Abstract is submitted with the understanding that it will not be used to interpret or limit the scope or meaning of the claims.

10

### Claims

1. A munitions container comprising:  
5 an inner container; and  
an outer container;  
wherein the inner container comprises:  
a first form to receive munitions; and  
a base cradle plate for receiving the form and the  
10 munitions; and  
wherein the outer container comprises:  
a main container comprising a fabric material, the main  
container for receiving the inner container;  
one or more rigid supports for the main container;  
15 a top cover for the main container; and  
a base weldment to receive the main container.
2. The munitions container of claim 1, comprising:  
a first retention strap for securing the munitions to the first form;  
20 a second form for placement over the first retention strap and the  
munitions;  
a bladder for receiving the inner container;  
an access door coupled to the main container;  
a third form positioned between the bladder and the main  
25 container; and  
a second retention strap to secure the main container to the base  
weldment.
3. The munitions container of claim 1, wherein the rigid supports are placed  
30 on one or more corners of the main container.
4. The munitions container of claim 1, wherein the base weldment, the one  
or more rigid supports, the base cradle plate, and the access door are  
manufactured out of a reusable material.

5. The munitions container of claim 2, wherein the main container, the top cover, and the first and second forms are manufactured out of a disposable material.
- 5
6. The munitions container of claim 1, comprising a footing coupled to the base weldment, the footing comprising an opening for fork lift access.
7. The munitions container of claim 6, wherein the footing is configured to allow fork lift access from any side of the munitions container.
- 10
8. The munitions container of claim 6, comprising one or more lifting eyes coupled to the base cradle plate.
- 15
9. The munitions container of claim 8, wherein when there are no munitions in the munitions container, the munitions container is configured such that the bomb cradle plate is secured to the base weldment, and the rigid supports, lifting eyes, and access door are configured such that they are storable in the footing.
- 20
10. The munitions container of claim 2, wherein the access door comprises one or more breather or bleeder valves.
11. The munitions container of claim 2, wherein the bladder comprises a zipper, and the zipper is configured to form an airtight seal.
- 25
12. The munitions container of claim 1, wherein the base weldment comprises one or more recesses for receiving the rigid supports.
13. The munitions container of claim 2, wherein the first form and the second form comprise a foam or foam-like material.
- 30
14. The munitions container of claim 1, wherein the fabric material comprises a liquid crystal polymer fiber fabric.

15. A method to containerize munitions comprising:  
forming an inner container by:  
placing one or more munitions into a first form;  
placing one or more first retention straps over the  
5 munitions to secure the munitions to the first form;  
placing a second form over the munitions and the one or  
more first retention straps; and  
placing the munitions, the first form, the one or more first  
retention straps, and the second form onto a base cradle plate; and  
10 forming an outer container by:  
placing the munitions, the first form, the one or more first  
retention straps, the second form, and the base cradle plate into a bladder; and  
forming a main container by:  
securing a fabric to a plurality of rigid posts;  
15 placing the fabric and rigid posts onto a base  
weldment;  
placing a third form into the main container  
between the bladder and the fabric;  
placing a top cover on the main container; and  
20 securing the main container to the base weldment  
with one or more second retention straps.
16. The method of claim 15, comprising installing an access door into the  
main container.  
25
17. The method of claim 15, wherein the third form comprises an injected  
foam, and the injected foam comprises a liquid mixture that solidifies after  
injection into the main container.
- 30 18. The method of claim 17, wherein the foam is injected into the main  
container via ports and tunnels in the fabric.
19. The method of claim 15, wherein the first form and the second form  
comprise a foam or a foam like material.

20. The method of claim 15, wherein the fabric comprises a liquid crystal polymer fiber fabric.
- 5 21. A munitions container comprising an inner container and an outer container, the inner container comprising:
- a first form to receive the munitions;
  - a first retention strap for securing the munitions to the first form;
  - a second form for placement over the first retention strap and the
- 10 munitions; and
- a first base plate for receiving the first form, the first retention strap, the second form, and the munitions; and
- the outer container comprising:
- a bladder for receiving the inner container;
- 15 a main container including an access door, the main container for receiving the airtight bladder and inner container;
- one or more rigid supports for placing on the main container;
  - a third form positioned between the air tight bladder and inner
- walls of the main container;
- 20 a top cover for the main container;
- a second base for the main container; and
  - a second retention strap to secure the main container to the base
- weldment.
- 25 22. The munitions container of claim 21, wherein the first form and the second form comprise a foam or foam like material.
23. The munitions container of claim 21, wherein the third form comprises a mixture that is injected into the munitions container between the airtight bladder
- 30 and the inner walls of the main container.
24. The munitions container of claim 21, wherein the bladder comprises a zipper for rendering the bladder airtight.

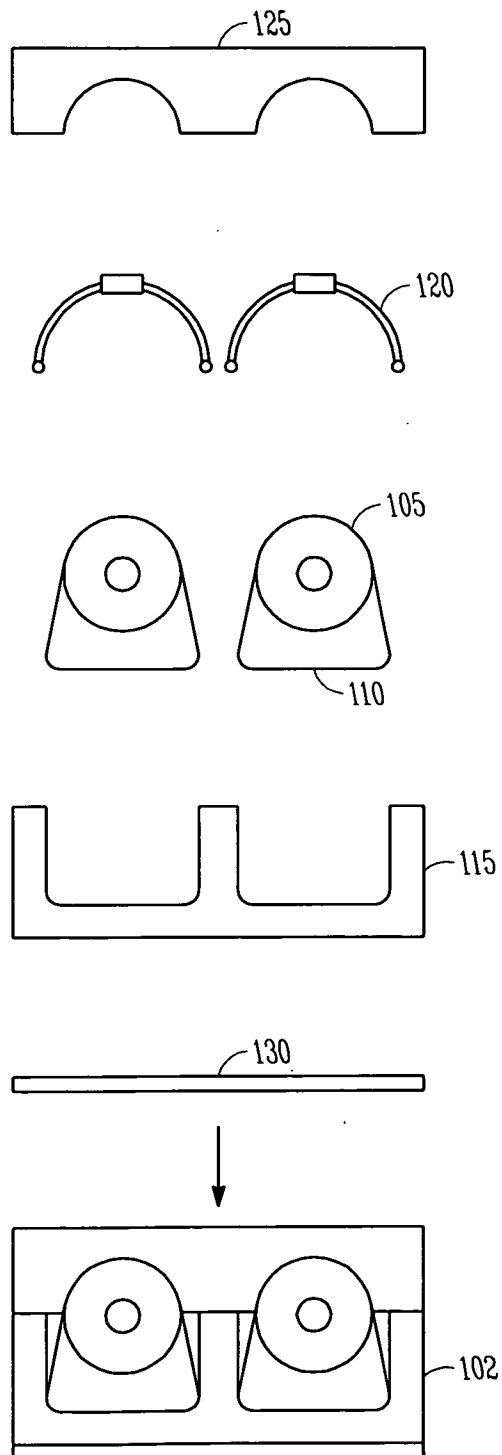
25. The munitions container of claim 21, wherein the one or more rigid supports are placed on one or more corners of the main container.
26. A munitions container comprising:
- 5                   an inner container formed of a fibrous material;  
                  an outer container formed of the fibrous material;  
                  a form for placement within the inner container and for receiving munitions; and  
                  a rigid baseplate for receiving the outer container;
- 10                  wherein a portion of the fibrous material comprises fiber of greater than 10 grams per denier.
27. The munitions container of claim 26, wherein
- 15                  the inner container and the outer container comprise at least two layers of the fibrous material; and
- the inner container and outer container comprise at least one layer of a polymeric material bonded to the at least two layers of the fibrous material.
28. The munitions container of claim 27, wherein the bond between the
- 20                  fibrous material and the polymeric material is able to withstand a force of at least 50 psi in shear.
29. The munitions container of claim 27, wherein the at least two layers of fibrous material comprise a fibrous web positioned between the at least two
- 25                  layers of fibrous material.
30. The munitions container of claim 27, wherein the at least two layers of fibrous material and the at least one layer of polymeric material comprise a density of less than 100 kg per cubic meter.
- 30
31. The munitions container of claim 26, wherein the inner container and the outer container are capable of sustaining a blunt or cutting impact of at least 15 kJ/kg of mass and up to 150 kJ/kg of mass.

32. A method to containerize munitions comprising:  
forming an inner container of a fibrous material;  
forming an outer container of the fibrous material;  
placing a form within the inner container to receive munitions;  
5 and  
placing the outer container on a rigid baseplate;  
wherein a portion of the fibrous material comprises fiber of  
greater than 10 grams per denier.
- 10 33. The method of claim 32, wherein forming the inner container and outer  
container comprise forming at least two layers of the fibrous material; forming  
the inner container and the outer container such that they comprise at least one  
layer of a polymeric material bonded to the at least two layers of the fibrous  
material.
- 15 34. The method of claim 32, wherein the bond formed between the fibrous  
material and the polymeric material is able to withstand a force of at least 50 psi  
in shear.
- 20 35. The method of claim 32, comprising positioning a fibrous web between  
the at least two layers of fibrous material.
36. The method of claim 32, wherein the at least two layers of fibrous  
material and the at least one layer of polymeric material comprise a density of  
25 less than 100 kg per cubic meter.
37. The method of claim 32, comprising forming the inner container and the  
outer container such that the inner container and the outer container are capable  
of sustaining a blunt or cutting impact of at least 15 kJ/kg of mass and up to 150  
30 kJ/kg of mass.



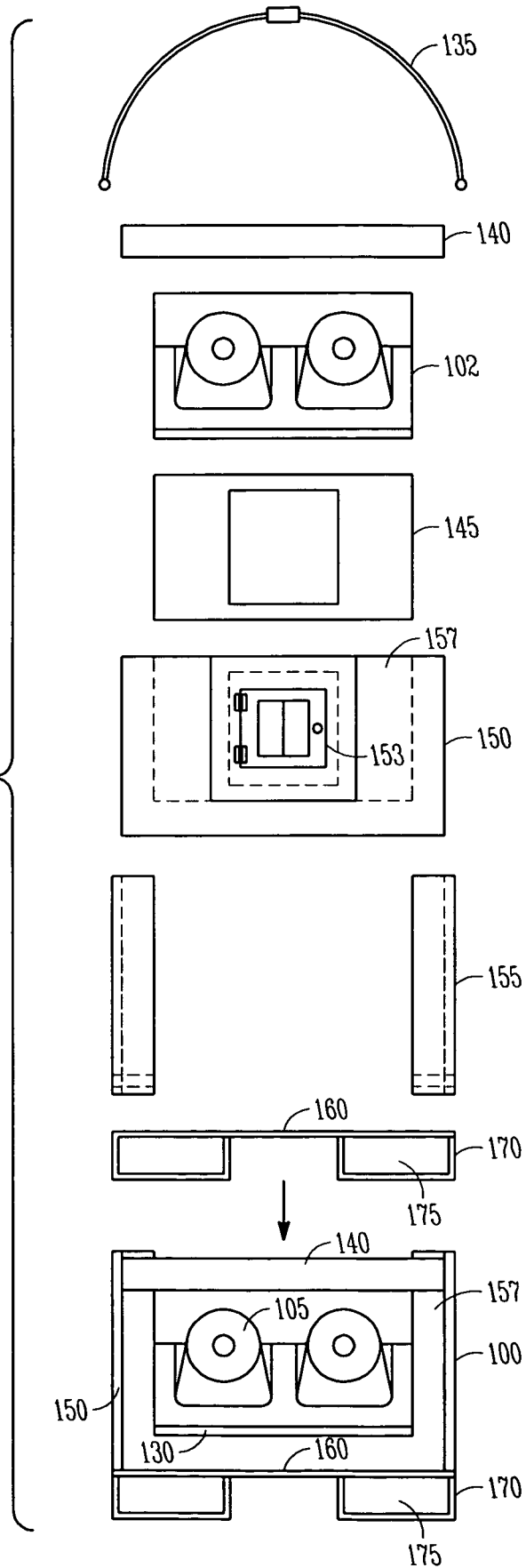
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**FIG. 1A**



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FIG. 1B



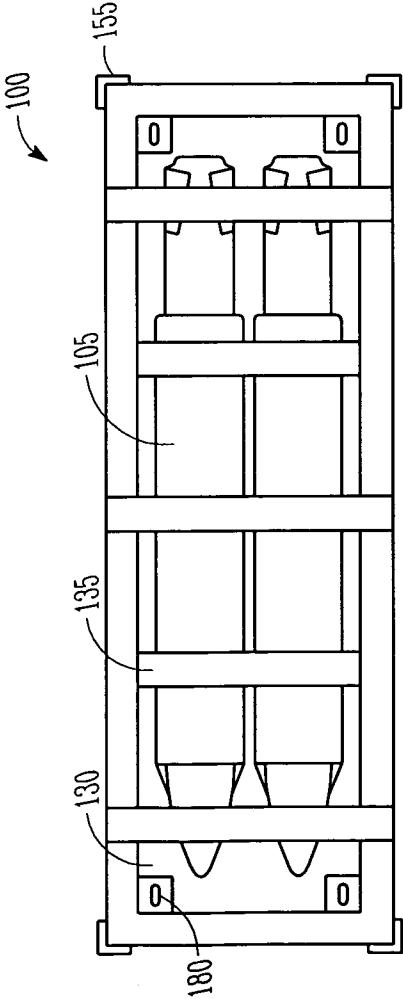


FIG. 2B

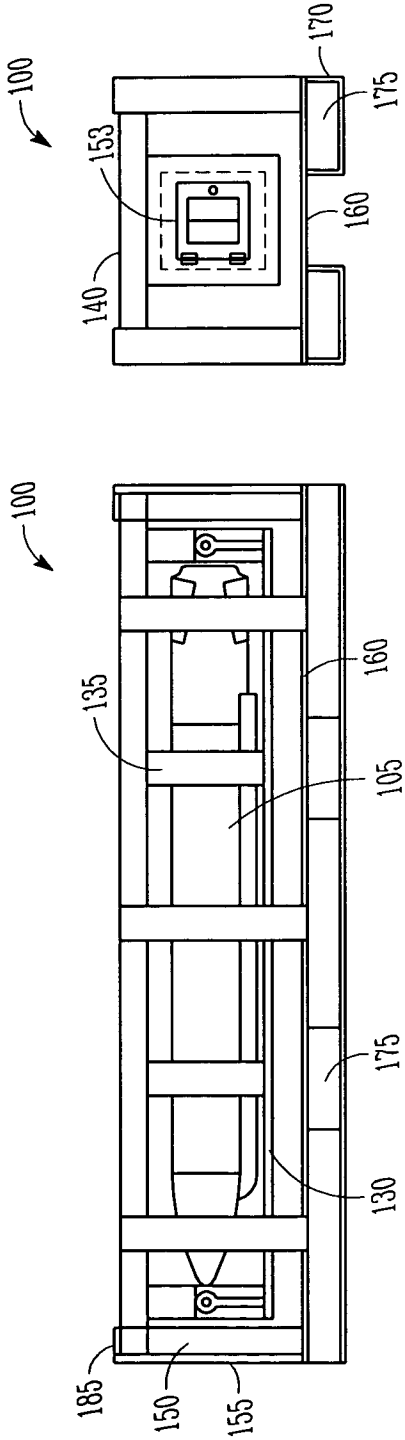


FIG. 2A

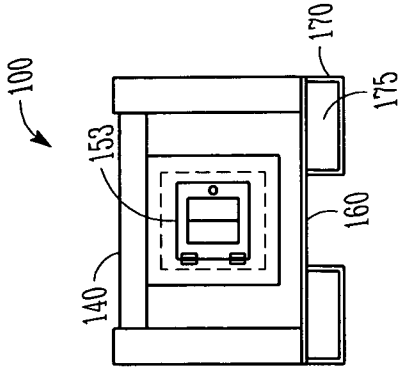
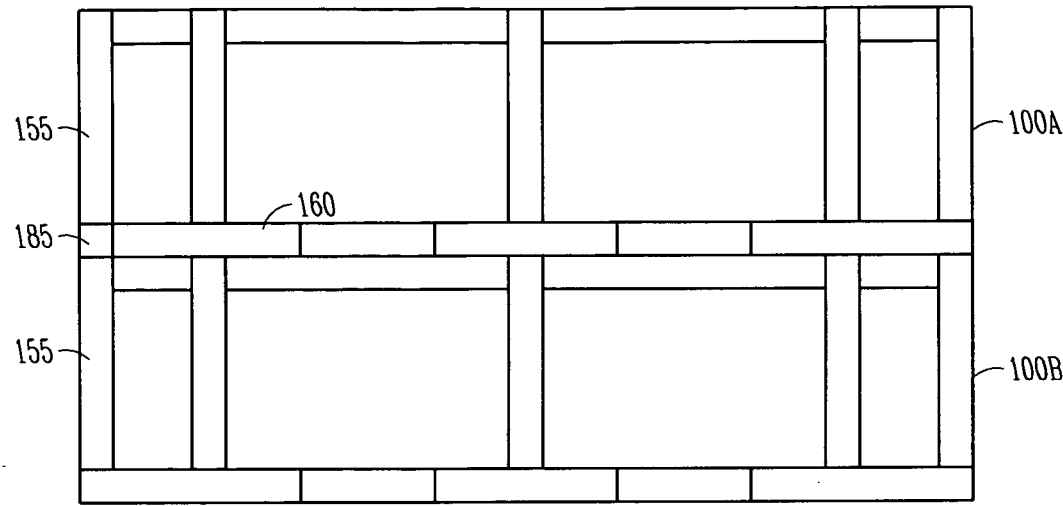


FIG. 2C



*FIG. 3*

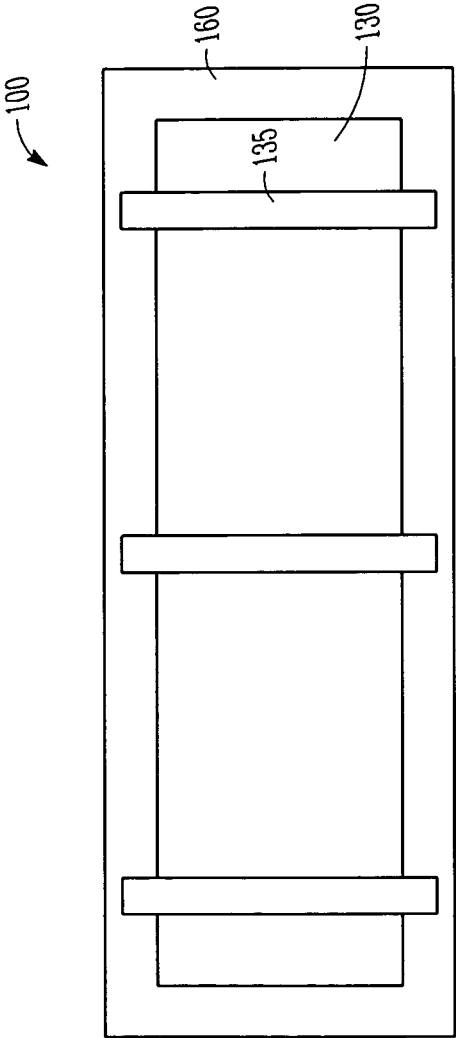


FIG. 4A

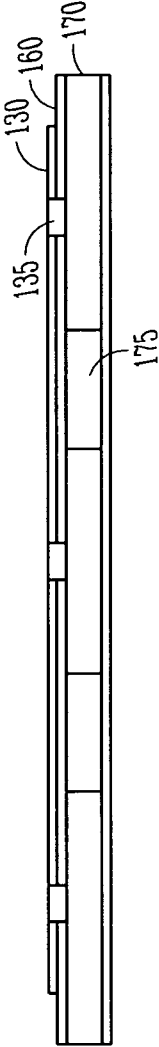


FIG. 4C

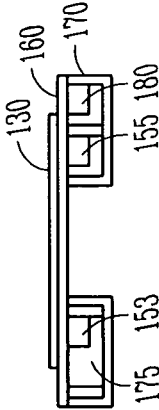
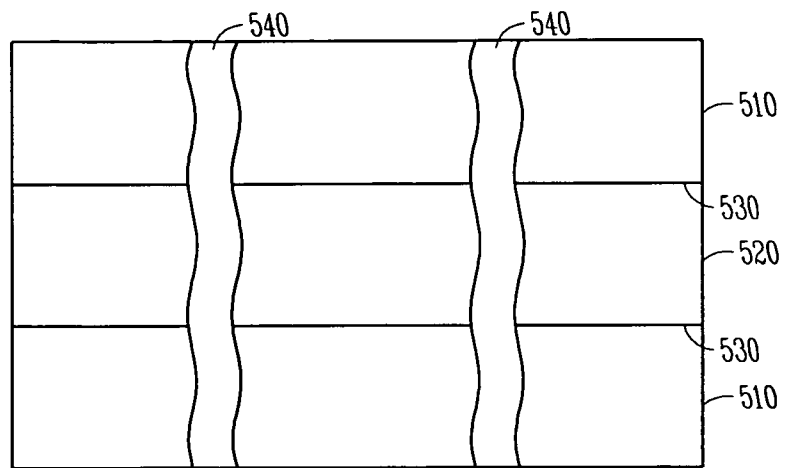


FIG. 4B

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*FIG. 5*

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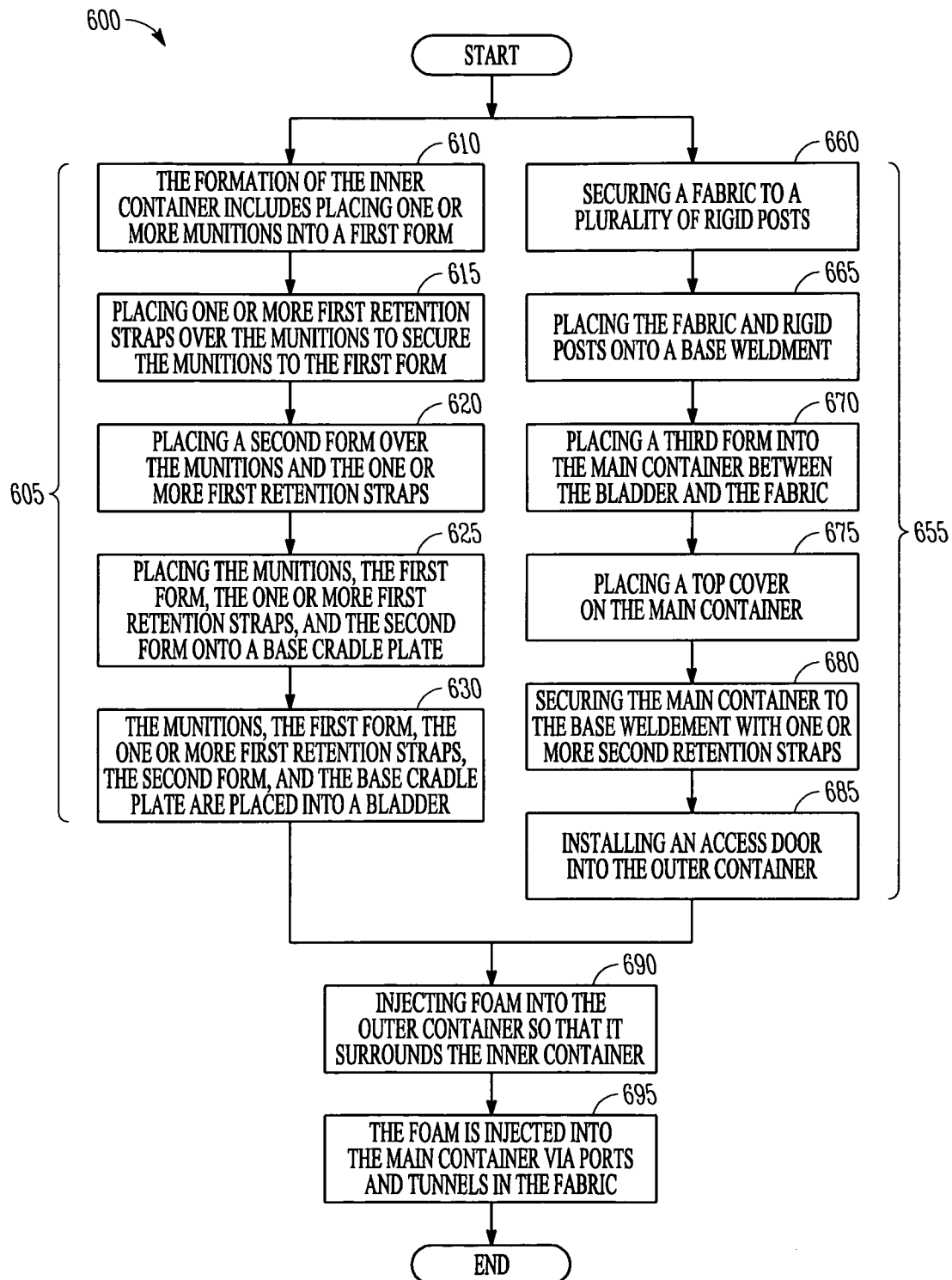


FIG. 6

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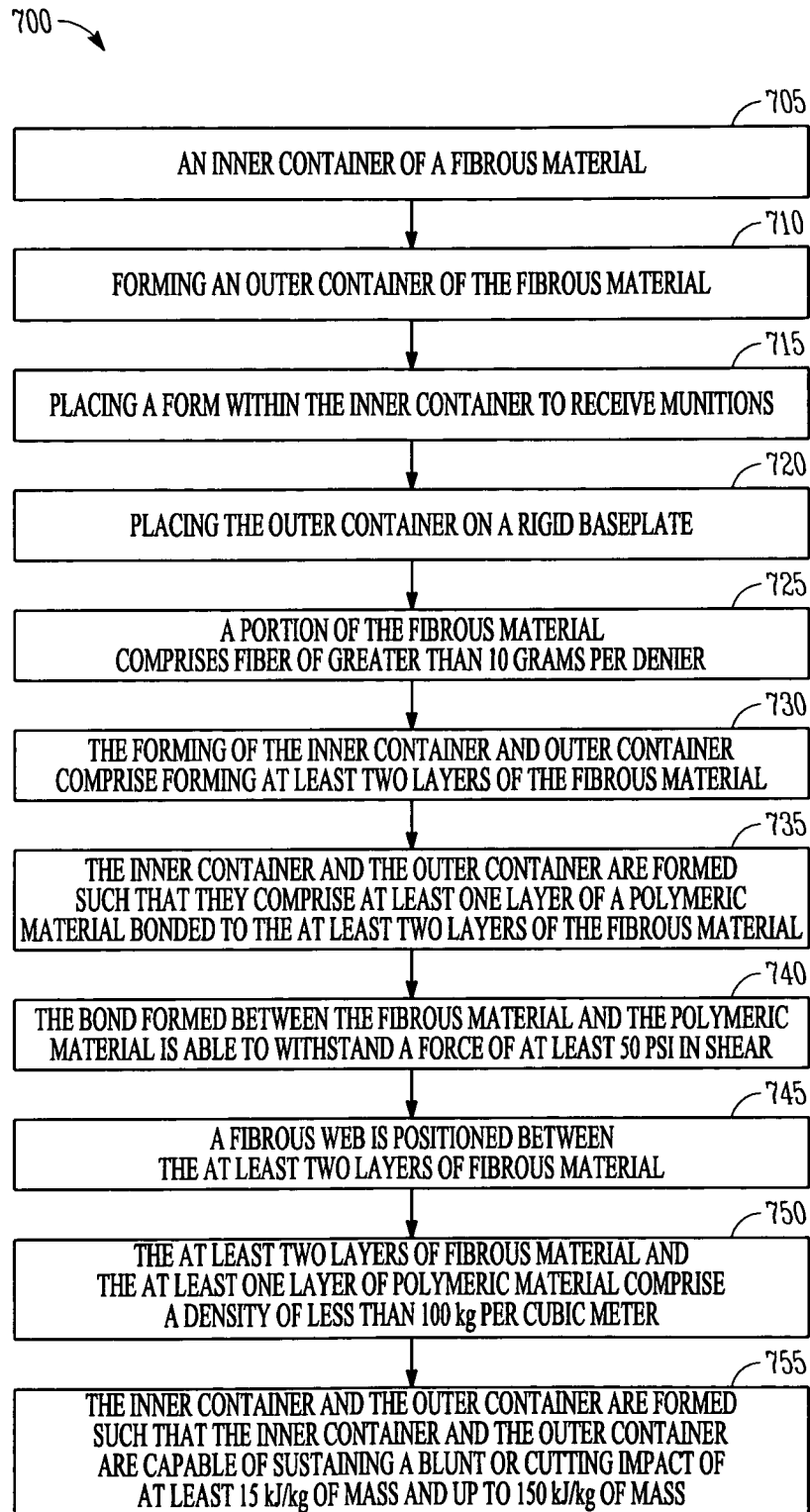


FIG. 7



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 10/00611

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - F42B 39/00; B65D 19/00

USPC - 206/3, 600

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

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC(8) - F42B 39/00; B65D 19/00

USPC - 206/3, 600

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

USPC - 206/3, 317, 523, 577, 600; 220/9.4; 53/422 (keyword limited)

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

Databases: USPTO PubWEST(PGPB,USPT,EPAB,JPAB); Google Scholar

Search terms: munition, explosive, packaging, foam, fabric, fiber, flexible, collapsible, shell, container, blast, impact, resistance, transport, storage

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                  | Relevant to claim No. |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| X         | US 2008/0223857 A1 (PALLEY et al.) 18 September 2008 (18.09.2008), entire document                                                                                                  | 26-30, 32-36          |
| --        | especially fig 1G, 8A-8F, 10A-10I, para [0003], [0065], [0067], [0074], [0076], [0078], [0080]-[0082], [0084], [0087]-[0088], [0093], [0099], [0107], [0134], [0137]-[0138], [0151] | -----                 |
| Y         |                                                                                                                                                                                     | 1-25, 31, 37          |
| Y         | US 4,184,801 A (NICOLOFF et al.) 22 January 1980 (22.01.1980), fig 26-31, col 8 ln 5-7, col 9 ln 37-68, col 10 ln 1-27                                                              | 1-25                  |
| Y         | US 5,660,913 A (COPPAGE) 26 August 1997 (26.08.1997), col 5 ln 10-53                                                                                                                | 31, 37                |
| Y         | US 5,865,334 A (RUIZ et al.) 02 February 1999 (02.02.1999), fig 2A                                                                                                                  | 7                     |
| Y         | US 2009/0026196 A1 (LEEDEKERKEN) 29 January 2009 (29.01.2009), fig 4A-4E, 6B, para [0012]-[0013], [0025], [0027]                                                                    | 9                     |
| Y         | US 6,357,582 B1 (FISCHER) 19 March 2002 (19.03.2002), col 4 ln 60-67, col 5 ln 1-4                                                                                                  | 10                    |
| Y         | US 2002/0064318 A1 (MALONE et al.) 30 May 2002 (30.05.2002), para [0017], [0022]                                                                                                    | 11, 24                |
| Y         | US 2008/0137997 A1 (PERKINS) 12 June 2008 (12.06.2008), fig 1-3, para [0023-0025], [0031]                                                                                           | 12                    |

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

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

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"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

"&amp;" document member of the same patent family

Date of the actual completion of the international search

18 October 2010 (18.10.2010)

Date of mailing of the international search report

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