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(54) Title: APPARATUS FOR THERMALLY INSULATING A CYLINDRICAL BARREL AND MONITORING THE TEMPERATURE THEREOF

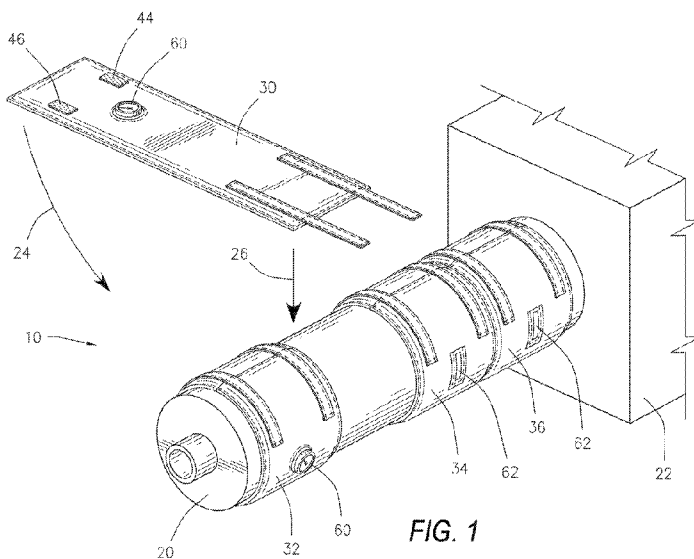


FIG. 1

(57) Abstract: An apparatus for thermally insulating a cylindrical barrel and monitoring the temperature thereof. The apparatus includes a plurality of flexible covers, each flexible cover circumnavigating the cylindrical barrel. Each of the plurality of flexible covers includes a temperature sensing element thereon.



**APPARATUS FOR THERMALLY INSULATING A CYLINDRICAL  
BARREL AND MONITORING THE TEMPERATURE THEREOF**

CROSS REFERENCE TO RELATED APPLICATIONS

This application is based on and claims priority to U.S. Patent Application Serial No.  
5 14/590,420 filed January 6, 2015 and U.S. Continuation-in-Part Patent Application No.  
14/662,930 filed March 19, 2015, the contents of which are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention.

The present invention relates to an apparatus for thermally insulating a cylindrical barrel  
10 and monitoring the temperature thereof.

2. Prior Art.

It is known in the plastics and polymer industries to utilize injection and/or  
extrusion equipment to form or manufacture components and products. Plastic or polymer resins  
along with additives are subjected to hot temperatures in order to convert the plastic or polymer  
15 resins into a flowable material. The material is injected or forced under pressure through a barrel  
before directing into a mold cavity or die. The barrel may include a rotating screw which mixes  
the materials and moves them through the barrel. Thereafter, the molten plastic or resin leaves the  
barrel and enters the mold or die.

In order to insure optimum flow characteristics, the barrels are often equipped with heating  
20 or cooling mechanisms in order to control the temperature of the compound. Assignee's prior  
patent, U.S. Patent No. 6,486,445, entitled "Vacuum Cast Ceramic Fiber Insulated Band Having  
Heating and Cooling Elements," illustrates an example of a ceramic fiber insulated band. The  
flow characteristics of the fluid material are dependent upon the ability to control the heat applied  
to the barrel as the fluid passes therethrough.

25 Assignee's prior pending patent application, U.S. Patent Application Serial No.  
14/590,420 filed January 6, 2015 entitled "MODULAR HEATING AND COOLING  
ELEMENTS FOR CONTROLLING TEMPERATURE OF MATERIALS IN A FLOWABLE  
STATE," provides an example of an apparatus for controlling the temperature of materials in a  
flowable state as they flow through a barrel wherein individual temperature controlling  
30 mechanisms are both removable and replaceable.

It would be desirable to provide an apparatus for thermally insulating a cylindrical barrel in  
order to retain the heat characteristics inside the barrel and of the materials therein.

It would also be desirable to provide an apparatus for thermally insulating a cylindrical barrel to prevent accidental burn injury to personnel.

It would also be desirable to provide an apparatus for thermally insulating a cylindrical barrel which also is capable of monitoring the temperature of the outside of the barrel and indirectly monitoring the temperature of the material within the barrel.

It would also be desirable to provide an apparatus for thermally insulating a cylindrical barrel and monitoring the temperature thereof which incorporates alerts or alarms in the event that a temperature is outside of an acceptable range.

#### SUMMARY OF THE INVENTION

The present invention is directed to an apparatus for thermally insulating a cylindrical barrel and monitoring the temperature thereof.

The apparatus includes a plurality of flexible covers which, when in use, surround and encase a barrel. The covers are axially aligned with each other and also axially aligned with the barrel.

Each flexible cover has a length at least as long as the circumference of the barrel.

Each cover is removable and attachable to itself in order to hold the apparatus in place surrounding the barrel. Each cover includes a pair of attachment pads and a pair of attachment straps. The attachment pads and attachment straps each have hook and loop fasteners so that when the flexible cover is brought into place around the barrel, the flexible cover will be held in place.

In a preferred embodiment, each cover includes a pair of opposing external flexible sheets with insulation material therebetween.

Each cover includes a temperature sensing element thereon. The temperature on the outside of the cover is monitored, which also provides an indirect indication of the temperature of the materials in the barrel.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 illustrates a perspective view of an apparatus for thermally insulating a cylindrical barrel and monitoring the temperature thereof;

Figure 2 illustrates a top view of one of the covers of the apparatus apart from the barrel; and

Figure 3 illustrates a sectional view taken along section line 3-3 of Figure 2.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings in detail, Figure 1 illustrates a perspective view of an apparatus

10 for thermally insulating a cylindrical barrel and monitoring the temperature thereof. The apparatus 10 includes at least one flexible cover, to be described in detail. As shown in Figure 1, a plurality of the flexible covers 30, 32, 34 and 36 are shown. A greater or lesser number of covers may be used within the spirit and scope of the invention. Each of the covers 30, 32, 34 and  
5 36, when in use, surrounds and encases a barrel 20. The covers may surround a base heater barrel or may surround cylindrical heaters or coolers surrounding the barrel. One cover 30 is shown apart from the barrel 20.

The barrel 20 may include a rotating screw (not shown) to move materials therethrough. Various raw materials which are used for parts or components to be molded or manufactured may  
10 be mixed and prepared within a plastic injection and/or extrusion machine 22. In one non-limiting example, plastic beads are fed into the injection and/or extrusion machine 22 along with colorants or other additives.

During the injection and/or extrusion process, the ability to maintain control over the temperature of the materials is critically important. The materials pass from the injection and/or  
15 extrusion machine 22 through the barrel 20 and into a mold or die (not shown) at the opposed end of the barrel 20.

In the present embodiment, the barrel 20 is in the form of a cylinder although other embodiments, such as a square or oval cross section, are possible within the spirit or scope of the invention.

20 The covers 30, 32, 34 and 36, when installed around the circumference of the barrel 20, are axially aligned with each other and also axially aligned with the barrel 20. The arrows 24 and 26 illustrate the direction in order to move the cover 30 to install around the barrel 20.

Each cover is flexible and has a length at least as long as the circumference of the barrel. One cover 30 is shown in a top view in Figure 2 apart from the barrel 20.

25 Each cover 30, 32, 34 and 36 is removable and attachable to itself in order to hold the apparatus in place surrounding the barrel 20.

As shown, each flexible cover 30, 32, 34 and 36 includes a pair of attachment pads 40 and 42 and a pair of attachment straps 44 and 46.

The attachment pads 40 and 42 and the attachment straps 44 and 46 each have hook and  
30 loop fasteners so that when the flexible cover 30 is brought in place around the barrel 20, the flexible cover will be held in place around the barrel 20. No fasteners or other attachments are necessary to secure the cover to the barrel.

Thereafter, in order to remove the cover 30, the attachment straps 44 and 46 may be

separated from the attachment pads 40 and 42.

Figure 3 illustrates a sectional view taken along section line 3-3 of Figure 2. Each cover 30, 32, 34 and 36 may be fabricated from a single monolithic material. Alternatively, in a preferred embodiment, each cover includes a pair of opposing external flexible sheets 50 and 52 with insulation 54 therebetween. The insulation 54 may be a variety of materials including ceramic, fiber-glass mat or Nomex felt. The opposed external sheets 50 and 52 may be secured together at the edges to retain the insulation 54 therein.

Each flexible cover has a temperature sensing element thereon. As seen in Figure 1, covers 30 and 32 include a temperature sensing element in the form of a thermometer 60. Covers 34 and 36 include a temperature sensing element in the form of a thermal chemical sensor 62 which changes colors depending on a change in temperature. For example, the thermal chemical sensor 62 may normally be a green color unless a certain selected temperature is reached, in which case the sensor turns to another color, such as red.

The thermometer 60 may be secured to the external sheet 50 of the cover or may be retained in a recess 64 in the flexible cover 30.

The thermometer 60 may also have a transmitter therewith in order to transmit the temperature sensed to a receiver. Alternatively, or in addition thereto, the temperature sensing element may be connected to an alarm to activate a sound or other signal if the temperature exceeds a certain set temperature point.

Accordingly, the temperature on the outside of the cover 30 is monitored, which also provides an indirect indication of the temperature of the materials in the barrel 20. If an excess temperature is detected by the temperature sensing element, corrective action can be taken. Likewise, if a temperature below a desired range is detected, corrective action can be taken.

Returning to a consideration of Figure 1, use of a plurality of flexible covers 30, 32, 34 and 36 with a plurality of temperature sensing elements, permits detection of the axial position on the barrel of an unacceptable temperature deviation.

The present invention not only assists in maintaining the heat characteristics of the barrel and the materials therein, but prevents accidental burn injury to personnel coming into contact with the barrel 20.

Whereas, the present invention has been described in relation to the drawings attached hereto, it should be understood that other and further modifications, apart from those shown or suggested herein, may be made within the spirit and scope of this invention.

WHAT IS CLAIMED IS:

- 1           1.       An apparatus for thermally insulating a cylindrical barrel having flowable materials  
2 passing therethrough and for monitoring the temperature thereof, said apparatus comprising:  
3                   at least one flexible cover circumnavigating said cylindrical barrel; and  
4                   said at least one flexible cover having a temperature sensing element thereon.
  
- 1           2.       An apparatus as set forth in Claim 1 wherein said at least one flexible cover  
2 includes a plurality of covers aligned with each other and axially aligned with said barrel.
  
- 1           3.       An apparatus as set forth in Claim 1 wherein said temperature sensing element is a  
2 thermometer.
  
- 1           4.       An apparatus as set forth in Claim 3 wherein said thermometer is received in a  
2 recess in said flexible cover.
  
- 1           5.       An apparatus as set forth in Claim 1 wherein said temperature sensing element is a  
2 thermal chemical sensor which changes colors depending on the change in temperature.
  
- 1           6.       An apparatus as set forth in Claim 1 wherein each said at least one flexible cover is  
2 removable.
  
- 1           7.       An apparatus as set forth in Claim 6 wherein said removable cover has attachment  
2 straps and attachment pads.
  
- 1           8.       An apparatus as set forth in Claim 7 wherein said attachment straps and said  
2 attachment pads include hook and loop fasteners.
  
- 1           9.       An apparatus as set forth in Claim 1 wherein said at least one flexible cover  
2 includes flexible insulation material between a pair of opposing external flexible sheets.
  
- 1           10.      An apparatus as set forth in Claim 9 wherein said insulation material is chosen from  
2 the group consisting of ceramic fiber, glass mat or Nomex felt.

1           11.    An apparatus as set forth in Claim 1 wherein each said at least one flexible cover  
2    has a length of at least as long as the circumference of said barrel.

1           12.    An apparatus for thermally insulating a cylindrical barrel having flowable materials  
2    therethrough and for monitoring the temperature thereof, said apparatus comprising:

3                    a plurality of removable flexible covers, each of said plurality of flexible covers  
4    circumnavigating said cylindrical barrel, said plurality of covers aligned with each other and  
5    axially aligned with said barrel;

6                    each of said flexible covers having a temperature sensing element thereon; and

7                    each of said flexible covers having insulation between a pair of opposing external  
8    sheets.

1           13.    An apparatus as set forth in Claim 12 wherein said temperature sensing element is a  
2    thermometer.

1           14.    An apparatus as set forth in Claim 12 wherein said temperature sensing element is a  
2    thermal chemical sensor which changes colors depending on the change in temperature.

1           15.    An apparatus as set forth in Claim 12 wherein said thermometer is received in a  
2    recess in said flexible cover.

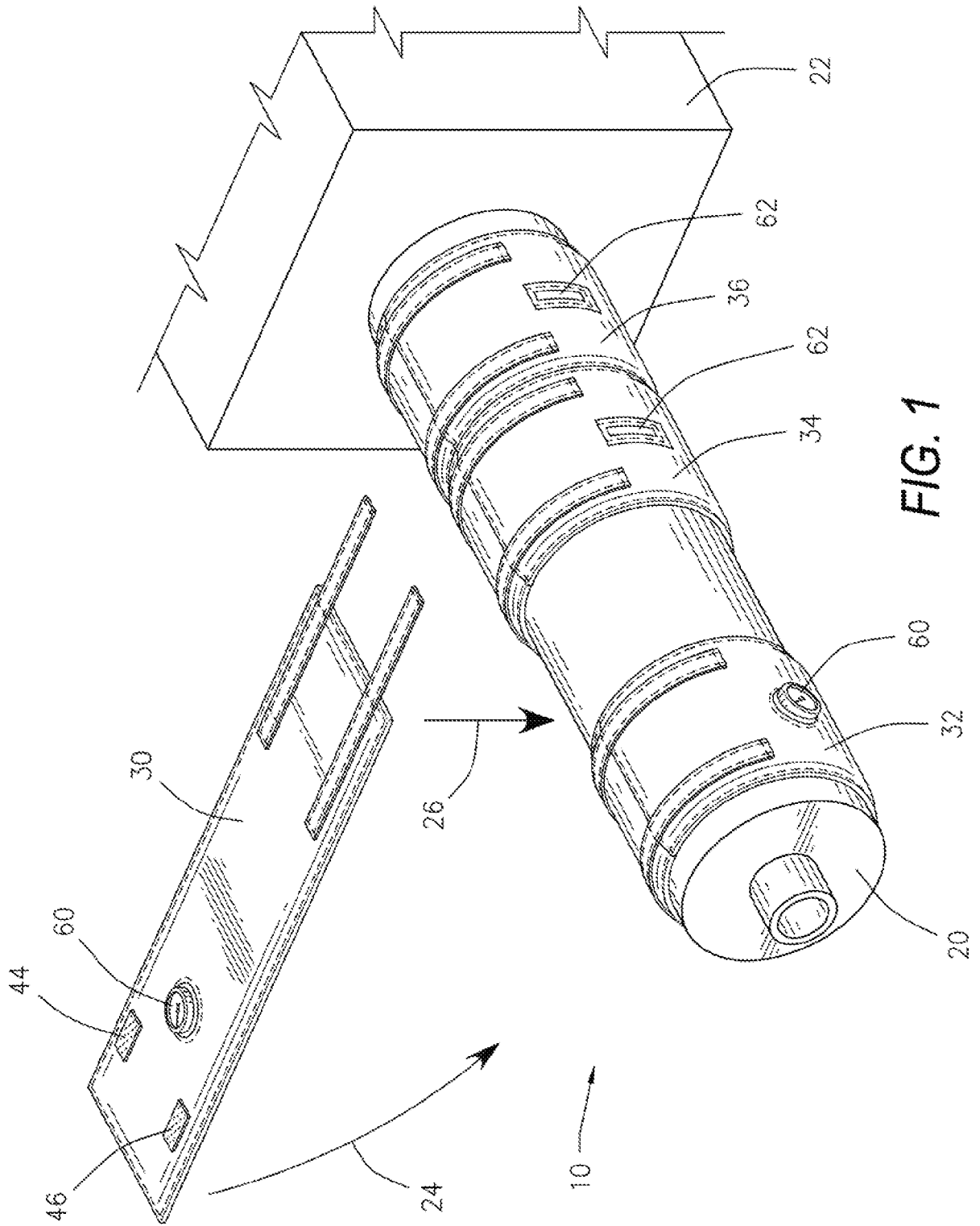


FIG. 1



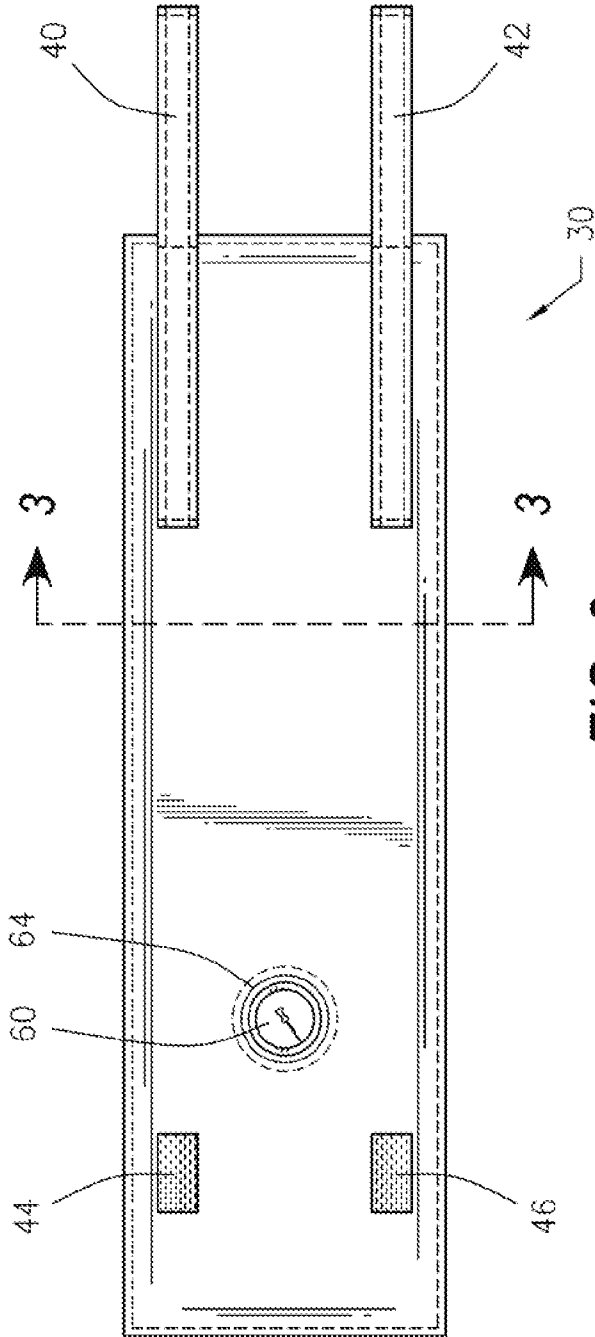


FIG. 2

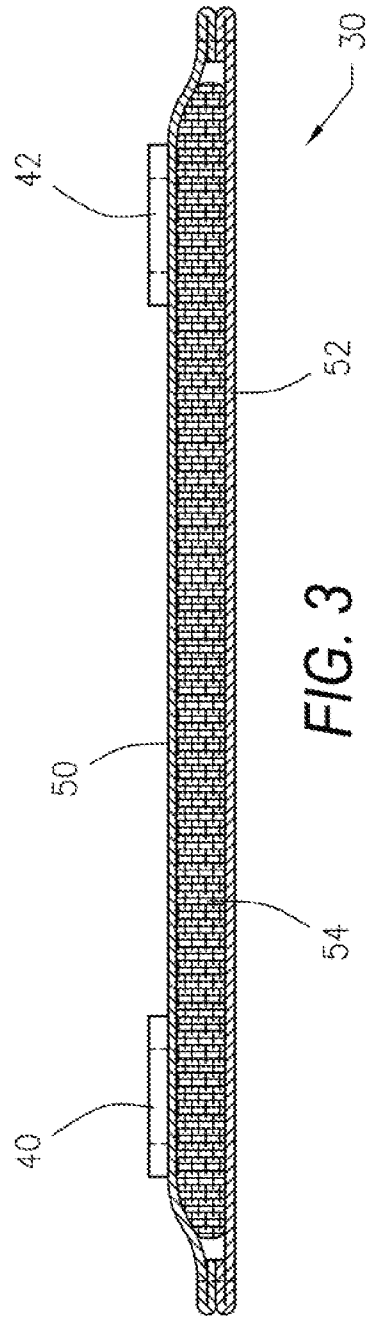


FIG. 3

## INTERNATIONAL SEARCH REPORT

International application No.  
**PCT/US2016/012136****A. CLASSIFICATION OF SUBJECT MATTER****F16L 59/14(2006.01)i, B29C 33/02(2006.01)i, B29C 45/73(2006.01)i, B29C 47/78(2006.01)i**

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)

F16L 59/14; C04B 35/64; B28B 3/00; H05B 3/40; F24H 1/10; B29C 47/78; F27B 14/00; B29C 33/02; B29C 45/73

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) &amp; keywords: barrel, cover, thermometer, strap, insulation material, and pad

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5974227 A (SCHAVE, FLOYD D.) 26 October 1999 See abstract, column 9, line 11 - column 11, line 29, and figures 2-4B.	1-5,9-11
Y		6-8,12-15
Y	WO 2008-002022 A1 (AON INSTRUMENT CO., LTD.) 03 January 2008 See abstract, page 7, line 6 - page 9, line 9, and figure 1.	6-8,12-15
A	US 2007-0222125 A1 (GRAJEWSKI, FRANZ) 27 September 2007 See abstract, paragraphs [0026]-[0033], and figures 1-2.	1-15
A	US 2011-0221088 A1 (FUSE, KENICHI) 15 September 2011 See abstract, paragraphs [0021]-[0030], and figures 1-5.	1-15
A	US 2004-0074891 A1 (PENDERGRAFT, GORDON M.) 22 April 2004 See abstract, paragraphs [0032]-[0037], and figures 1-2.	1-15

 Further documents are listed in the continuation of Box C. See patent family 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 application or patent but published on or after the international filing date

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

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

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

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

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

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

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

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**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/US2016/012136**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5974227 A	26/10/1999	CA 2258612 C	21/09/2004
		EP 0908075 A2	14/04/1999
		EP 0908075 A4	03/05/2000
		EP 0908075 B1	01/09/2004
		US 5832178 A	03/11/1998
		US 6049658 A	11/04/2000
		WO 97-50278 A1	31/12/1997
WO 2008-002022 A1	03/01/2008	KR 10-0680568 B1	02/02/2007
US 2007-0222125 A1	27/09/2007	AT 503395 A2	15/10/2007
		AT 503395 A3	15/01/2009
		DE 102006013691 B3	13/09/2007
		IT RM20070128 A1	25/09/2007
US 2011-0221088 A1	15/09/2011	JP 05200044 B2	15/05/2013
		JP 2011-189568 A	29/09/2011
		US 8388874 B2	05/03/2013
US 2004-0074891 A1	22/04/2004	AU 2003-290728 A1	03/06/2004
		CN 1723110 A	18/01/2006
		JP 04567457 B2	20/10/2010
		JP 2006-506248 A	23/02/2006
		KR 10-1015519 B1	16/02/2011
		KR 10-2005-0071679 A	07/07/2005
		US 6486445 B1	26/11/2002
		US 6903308 B2	07/06/2005
		WO 2004-043676 A2	27/05/2004
		WO 2004-043676 A3	15/07/2004