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(71) Applicant: **ILLINOIS TOOL WORKS INC.** [US/US]; 155 Harlem Avenue, Glenview, Illinois 60025 (US).

(72) Inventors: **SIEWERT, Paul**; c/o Illinois Tool Works Inc., 155 Harlem Avenue, Glenview, Illinois 60025 (US). **SLOVIK, Rachell L.**; c/o Illinois Tool Works Inc., 155 Harlem Avenue, Glenview, Illinois 60025 (US). **LUDWIG, Christopher J.**; c/o Illinois Tool Works Inc., 155 Harlem Avenue, Glenview, Illinois 60025 (US).

(74) Agent: **HAUPTMAN, Benjamin J.**; Lowe Hauptman & HAM, LLP, 2318 Mill Road, Suite 1400, Alexandria, Virginia 22314 (US).

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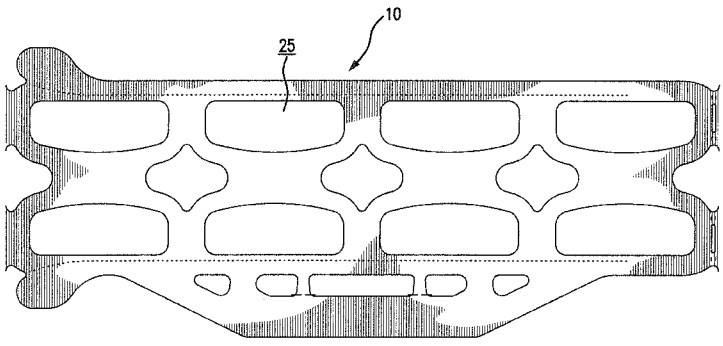

FIG. 3

(57) Abstract: A flexible carrier (10) for carrying a plurality of containers within a plurality of corresponding container receiving apertures (25) is formed using a rotary die (50) within a rotary die press (40) resulting in carriers (10) having complex configurations including close tolerance cuts and complex perforation patterns.

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METHOD AND APPARATUS FOR PRODUCING A CONTAINER CARRIER WITH A ROTARY DIE PRESS

PRIORITY CLAIM

This application claims priority to U.S. Provisional Applications, Serial No. 62/026,303, filed on 18 July 2014, and Serial No. 62/134,416, filed on 17 March 2015. These U.S. Provisional Applications are hereby incorporated by reference herein in their entirety and are made a part hereof, including but not limited to those portions which specifically appear hereinafter.

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

This invention relates to a flexible carrier for carrying a plurality of containers manufactured using a rotary die.

DESCRIPTION OF PRIOR ART

Conventional container carriers are often used to unitize a plurality of similarly sized containers, such as cans, bottles, jars and boxes and/or similar containers that require unitization. Flexible plastic ring carriers are one such conventional container carrier.

Flexible plastic ring carriers having a plurality of container receiving apertures that each engage a corresponding container may be used to unitize groups of four, six, eight, twelve or other suitable groups of containers into a convenient multipackage.

Typically, flexible ring carriers are manufactured in a generally continuous string by feeding an extruded sheet of plastic material, such as low density polyethylene through a vertically reciprocating punch press. As a result, traditional presses punch discrete rows of carriers in which each carrier is connected to adjacent carriers within a row. Depending on the size of the carrier being formed, and the width of the web of carrier material, a plurality of rows may be formed simultaneously in the web of material. To minimize problems associated with indexing variation as the web of material passes through the punch

press, adjacent rows of carriers have been punched spaced from each other. As the web passes out of the punch press, the carriers are provided in discrete rows, and are subsequently wound onto separate supply reels or spools or fan folded into boxes.

Marketing demands have tended toward the packaging of more containers in a single package. As a result, there is a demand for larger carriers, such as, for example, twelve-pack carriers in which two arrays of six container receiving apertures are provided on each side of a central web. Even with relatively small containers, a two row twelve-pack carrier of this type is significantly long.

For speed and efficiency in manufacture, it is common to punch at least one entire carrier with each stroke of the press, and index the web forward by at least one carrier length in preparation for the next stroke. As the length of the carriers increases, the indexing stroke increases, and errors in indexing are magnified. An additional problem is that the punched rows of carriers can "wander" exiting the punch press, resulting in misalignment of the unpunched portion of the web, and malformation of portions in subsequent carriers punched in the web.

As can be appreciated, the location, size and shape of the container receiving apertures for holding the containers are critical to proper functioning of the carrier. An undersized, oversized, wrongly located, or malformed container receiving aperture may inadequately retain a container, allowing the container to fall from the carrier. Failure of a carrier in the automatic machinery attaching a carrier to the containers can cause significant difficulties, and significantly curtail output. Failure during transport of the assembled package, at best, is inconvenient

As partially described above, punch presses have speed limitations; are noisy; require costly dies; require sophisticated indexing; and are limited in the shapes that can be punched at high speeds. There is therefore a need for an alternative method of manufacture for such plastic ring carriers.

SUMMARY OF THE INVENTION

The present invention is directed to a flexible carrier for packaging containers that is manufactured using a rotary die and a rotary die press. According to preferred embodiments of this invention, a sheet of plastic material is directed through a rotary die press and three or more rows or "lanes" of container carriers are formed in a generally continuous manner.

The resulting carrier may include complex detail, close tolerance cuts, complex perforation patterns, including non-linear perforations, all with less scrap. Indexing complex multi-lane container carriers is also no longer an issue with the invention as described herein.

BRIEF DESCRIPTION OF THE DRAWINGS

The above-mentioned and other features and objects of this invention will be better understood from the following detailed description taken in conjunction with the drawings wherein:

Fig. 1 is a side view of a rotary die press according to one preferred embodiment of this invention;

Fig. 2 is a side elevational view of a carrier produced in accordance to one preferred embodiment of this invention;

Fig. 3 is a side elevational view of a carrier produced in accordance to one preferred embodiment of this invention;

Fig. 4 is a side elevational view of a carrier produced in accordance to one preferred embodiment of this invention; and

Fig. 5 is a side elevational view of a carrier produced in accordance to one preferred embodiment of this invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

Fig. 1 shows a side view of a rotary die press for forming a plurality of flexible containers and a resulting unitized package. Figs. 2-5 show flexible carriers 10 manufactured with the rotary die according to embodiments of this

invention. However, the drawing is exemplary, and the invention is not limited to the flexible carriers 10 shown. For example, the flexible carrier 10 may be alternatively configured and used to unitize six, eight or any other desired number of containers.

Each flexible carrier 10 manufactured in accordance with the present invention preferably includes one or more layers of a flexible sheet 30 having a width and length defining therein a plurality of container receiving apertures 25, each for receiving a container. The plurality of container receiving apertures 25 are preferably arranged in longitudinal rows and longitudinal ranks so as to form an array of container receiving apertures 25, such as two rows by four ranks for an eight container multipackage as shown in Figs. 2-4. The container receiving apertures 25 are preferably generally rectangular, elongated, circular, oval or other preferred shapes, as shown in Fig. 2-5, however, all container receiving apertures 25 generally include one or more radiused corners.

According to one preferred embodiment of this invention, such as shown in Fig. 1, one or more layers of a generally continuous roll of flexible plastic sheet 30 are fed into a rotary die press 40 to form the carrier 10 through a rotary die 50. The rotary die 50 cuts a desired configuration of the carrier and one or more waste modules extract and remove resulting slugs from the process. Such carriers are preferably formed in three or more rows or "lanes" of container carriers and are formed in a generally continuous manner.

A preferred embodiment of the rotary die 50 used in accordance with this invention is manufactured using D2 hardened tool steel but can be manufactured from a variety of tool steels and powdered metal alloys. Such rotary dies 50 are preferably single piece dies and include one or more curved blades forming a periphery and internal detail features of the container carriers 10 to be cut. Such detail features may be positioned in close proximity to each other in the rotary die 50 and may include tightly radiused corners, non-linear perforations,

cuts formed right up to a periphery of the carrier and closely adjacent details.

The resulting carrier 10 may include complex detail, close tolerance cuts, complex perforation patterns, including non-linear perforations, all with less scrap. Indexing complex multi-lane container carriers is also no longer an issue with the invention as described herein. Various embodiments of such carriers are shown in Figs. 2-5.

The rotary die press 40, as shown in Fig. 1, preferably includes an infeed 45 for the plastic sheet 30; a rotary die 50 for forming a generally continuous string of carriers 10 from the plastic sheet 30; one or more winding and unwinding modules 70 for transferring the plastic sheet 30 and/or the generally continuous string of carriers 10 through the rotary die 50 at a desired speed and tension; one or more waste modules 60 for evacuating and redirecting scrap generated from the punching process; and an outfeed for transferring the generally continuous string of carriers from the rotary die press to a collection station 80, such as a reel stand for rolling spools or reels 90 of the generally continuous string of carriers or a box for fanfolding (not shown) the generally continuous string of carriers. As used herein, the term "module" may include an integrated feature of the rotary die press or a separate component for accomplishing the described purpose.

As shown in Fig. 1, the subject invention enables three simultaneous reels 90 of container carrier 10 to be processed and wound from a single sheet of material 30. The rotary die press 40 as described permits multiple lanes of container carrier 10 be formed in a footprint much smaller than traditional one and two lane punch presses.

In the above-described apparatus, a preferred method for manufacturing a flexible carrier may include moving a plastic sheet of material 30 through a rotary die press 40 at a desired speed and tension. As the plastic sheet of material 30 travels through the rotary die press 40, a plurality of slugs of material may be removed from the plastic sheet of material with a rotary die 50 to form a

generally continuous web. During this die-cutting process, the tension within the generally continuous web may be controlled by a combination of rollers, feedback loops and load cells. At least three lanes of a generally continuous string of container carriers are preferably formed from the continuous web with the rotary die.

The resulting generally continuous string of container carriers are then preferably fanfolded into a carton (not shown) and/or wound onto reels 90 applying each lane of the at least three lanes of container carriers to a plurality of containers at a collection station. Subsequently, the container carriers may be applied to a plurality of containers to form individual multipackages. In one preferred embodiment of this invention, the rotary die press 40 may be positioned directly upstream of an applicating machine (not shown) for direct transfer and application of the generally continuous string of container carriers, without the need for intermediate collection in cartons and/or reels.

As described above, the slugs may be removed from the rotary die press 40 using one or more waste modules 60. In this manner, the subject invention is much different from traditional applications of rotary dies 50 in that the web and not the slugs are the desired result of the process. Traditionally, the slugs have been cut and retained in process and the web has been recycled for later regrind and/or disposal. Here, the slugs are the waste product formed during the process and the web is wound or fanfolded in the resulting generally continuous string of container carriers 10.

The package resulting from the flexible carrier 10 includes a plurality of unitized flexible containers. Flexible carriers 10 are generally applied to containers by stretching the flexible sheet surrounding the container receiving apertures 25 around containers, and requiring the stretched carrier 10 to recover, thereby providing a tight engagement.

While in the foregoing specification this invention has been described in relation to certain preferred embodiments thereof, and many details

have been set forth for purpose of illustration, it will be apparent to those skilled in the art that the flexible carrier 10 and the rotary die and rotary die press are susceptible to additional embodiments and that certain of the details described herein can be varied considerably without departing from the basic principles of the invention.

CLAIMS:

1. A method for manufacturing a flexible carrier comprising:

moving a plastic sheet of material through a rotary die press;

removing a plurality of slugs of material from the plastic sheet of material with a rotary die to form a generally continuous web;

controlling a tension within the generally continuous web; and

forming at least three lanes of a generally continuous string of container carriers from the continuous web with the rotary die, wherein each container carrier of the generally continuous string of container carriers includes at least one of tight radii and non-linear perforations.

2. The method of Claim 1 further comprising:

applying each lane of the at least three lanes of container carriers to a plurality of containers.

3. The method of Claim 1 further comprising:

fanfolding the at least three lanes of the generally continuous string of container carriers into a carton.

4. The method of Claim 1 further comprising:

removing the slugs from the rotary die press using one or more waste modules.

5. The method of Claim 1 wherein the generally continuous string of container carriers are wound onto a reel.

6. The method of Claim 1 further comprising:

transferring the generally continuous string of carriers from the

rotary die press to a collection station.

7. The method of Claim 1 wherein the rotary die includes one or more curved blades forming a periphery and internal detail features of the continuous string of carriers.

8. A method for manufacturing a flexible carrier comprising:

moving a plastic sheet of material through a rotary die press;

forming at least three lanes of a generally continuous string of container carriers with a rotary die by removing a plurality of slugs of material from the plastic sheet, wherein each container carrier of the generally continuous string of container carriers includes a plurality of non-linear perforations; and

transferring the generally continuous string of container carriers to a collection station.

9. The method of Claim 8 further comprising:

controlling a tension of the generally continuous string of container carriers within the rotary die press.

10. The method of Claim 8 further comprising:

applying each lane of the at least three lanes of container carriers to a plurality of containers.

11. The method of Claim 8 further comprising:

fanfolding the at least three lanes of the generally continuous string of container carriers into a carton.

12. The method of Claim 8 further comprising:

removing the slugs from the rotary die press using one or more

waste modules.

13. The method of Claim 8 wherein the generally continuous string of container carriers are wound onto a reel.

14. The method of Claim 1 further comprising:

transferring the generally continuous string of carriers from the rotary die press to a collection station.

15. A method for manufacturing a flexible carrier comprising:

moving a plastic sheet of material through a rotary die press;

continuously controlling a tension of the plastic sheet of material as it is presented to and punched by a rotary die; and

forming at least three lanes of a generally continuous string of container carriers with the rotary die, wherein each container carrier of the generally continuous string of container carriers includes at least one of tight radii and non-linear perforations.

16. The method of Claim 15 wherein the rotary die includes one or more curved blades forming a periphery and internal detail features of the continuous string of carriers.

AMENDED CLAIMS
received by the International Bureau on 30 November 2015 (30.11.2015)

1. A method for manufacturing a flexible carrier comprising:

moving a plastic sheet of material through a rotary die press;

removing a plurality of slugs of material from the plastic sheet of material with a rotary die to form a generally continuous web;

controlling a tension within the generally continuous web;

forming at least three lanes of a generally continuous string of container carriers from the continuous web with the rotary die, wherein each container carrier of the generally continuous string of container carriers includes at least one of tight radii and non-linear perforations; and

fanfolding the at least three lanes of the generally continuous string of container carriers into a carton.

2. The method of Claim 1 further comprising:

applying each lane of the at least three lanes of container carriers to a plurality of containers.

3. The method of Claim 1 further comprising:

removing the slugs from the rotary die press using one or more waste modules.

4. The method of Claim 1 wherein the generally continuous string of container carriers are wound onto a reel.

5. The method of Claim 1 further comprising:

transferring the generally continuous string of carriers from the rotary die press to a collection station.

6. The method of Claim 1 wherein the rotary die includes one or more curved blades forming a periphery and internal detail features of the continuous string of carriers.

7. A method for manufacturing a flexible carrier comprising:

moving a plastic sheet of material through a rotary die press;

forming at least three lanes of a generally continuous string of container carriers with a rotary die by removing a plurality of slugs of material from the plastic sheet, wherein each container carrier of the generally continuous string of container carriers includes a plurality of non-linear perforations;

transferring the generally continuous string of container carriers to a collection station;

controlling a tension of the generally continuous string of container carriers within the rotary die press; and

fanfolding the at least three lanes of the generally continuous string of container carriers into a carton.

8. The method of Claim 7 further comprising:

applying each lane of the at least three lanes of container carriers to a plurality of containers.

9. The method of Claim 7 further comprising:

removing the slugs from the rotary die press using one or more waste modules.

10. The method of Claim 7 wherein the generally continuous string of container carriers are wound onto a reel.

11. The method of Claim 1 further comprising:

transferring the generally continuous string of carriers from the rotary die press to a collection station.

12. A method for manufacturing a flexible carrier comprising:

moving a plastic sheet of material through a rotary die press;

continuously controlling a tension of the plastic sheet of material as it is presented to and punched by a rotary die; and

forming at least three lanes of a generally continuous string of container carriers with the rotary die, wherein each container carrier of the generally continuous string of container carriers includes at least one of tight radii and non-linear perforations.

13. The method of Claim 12 wherein the rotary die includes one or more curved blades forming a periphery and internal detail features of the continuous string of carriers.

14. The method of Claim 12 further comprising:

controlling a tension of the generally continuous string of container carriers within the rotary die press.

15. The method of Claim 12 further comprising:

fanfolding the at least three lanes of the generally continuous string of container carriers into a carton.

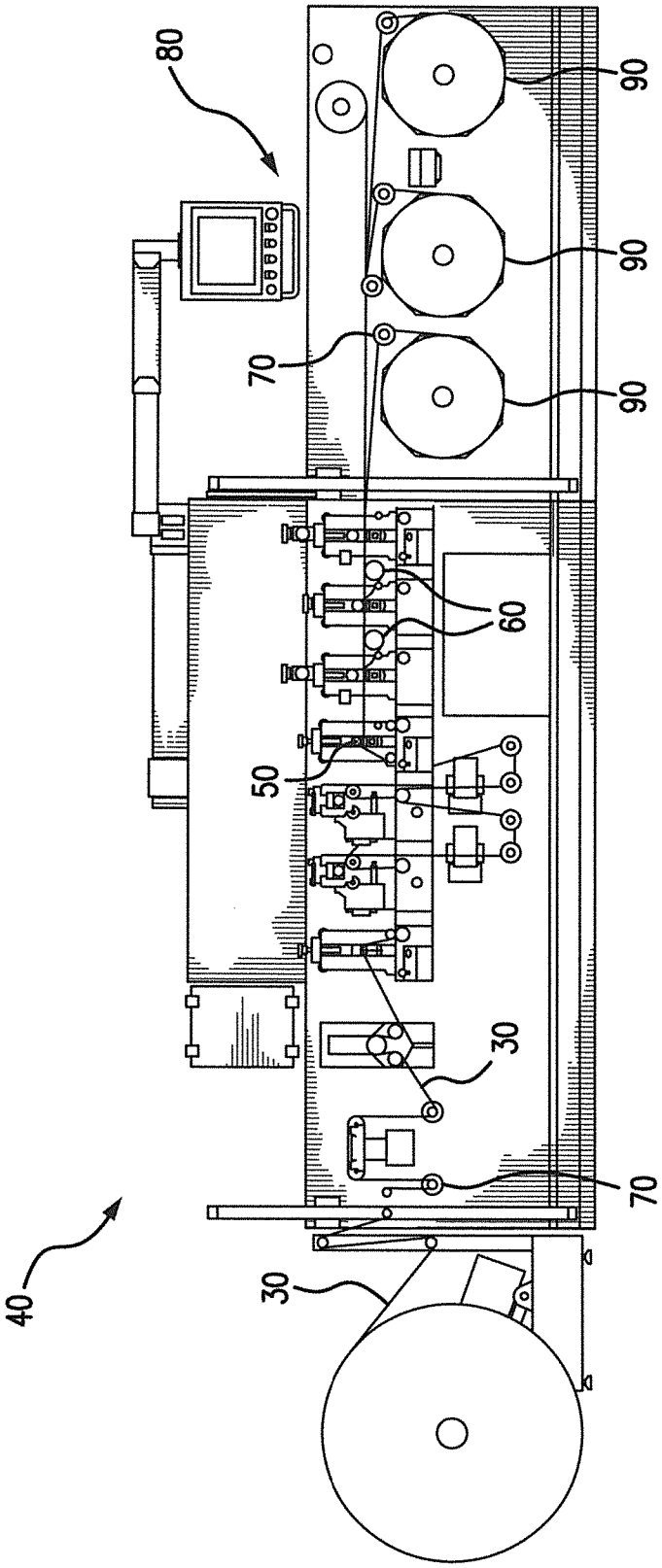

FIG. 1

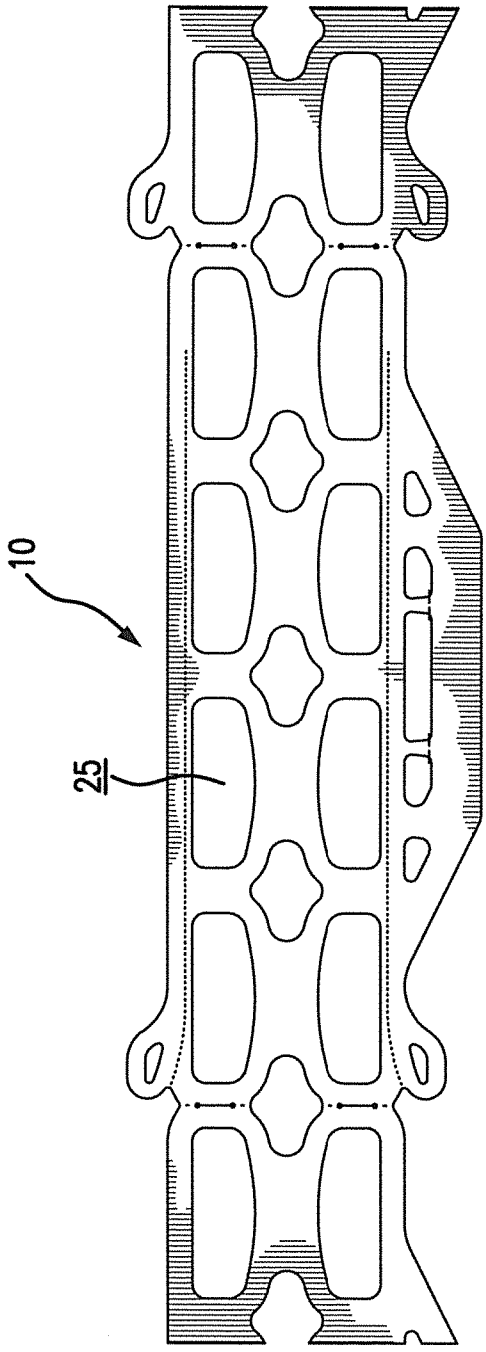

FIG. 2

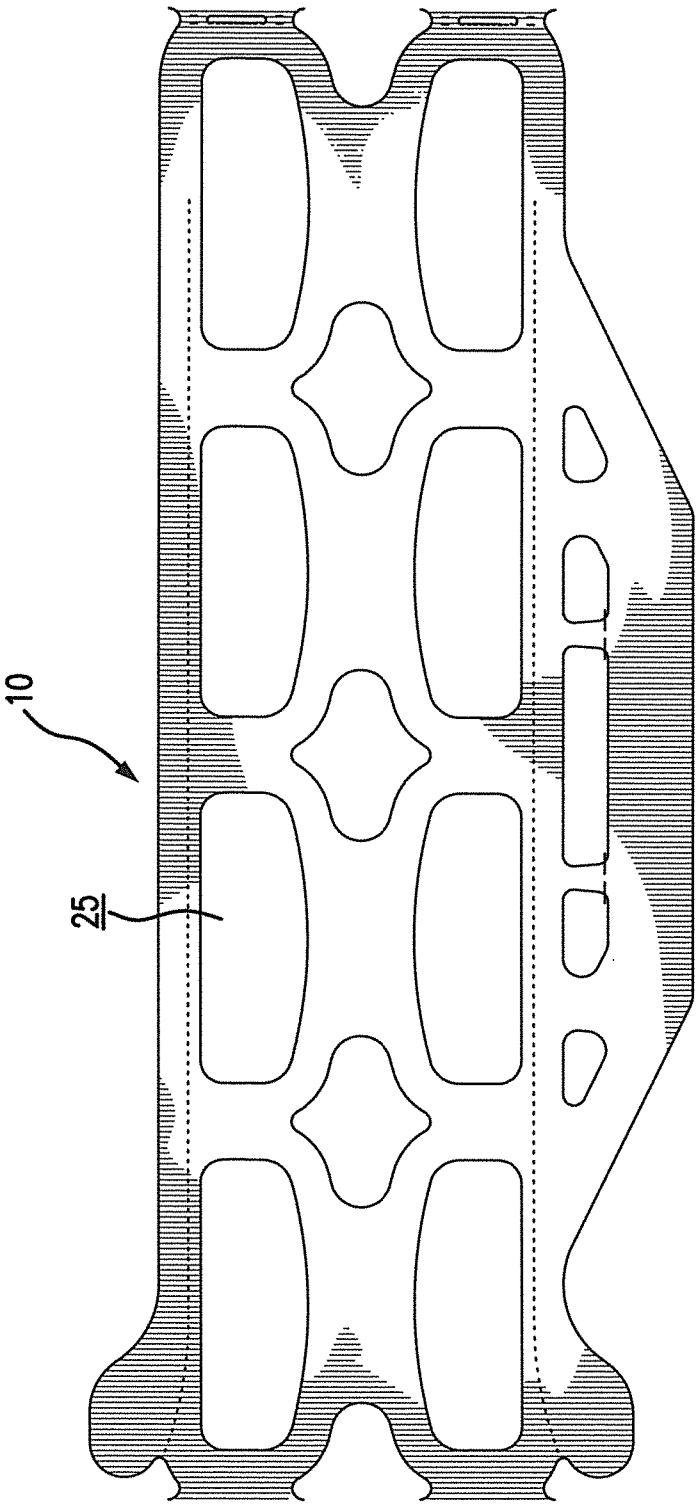

FIG. 3

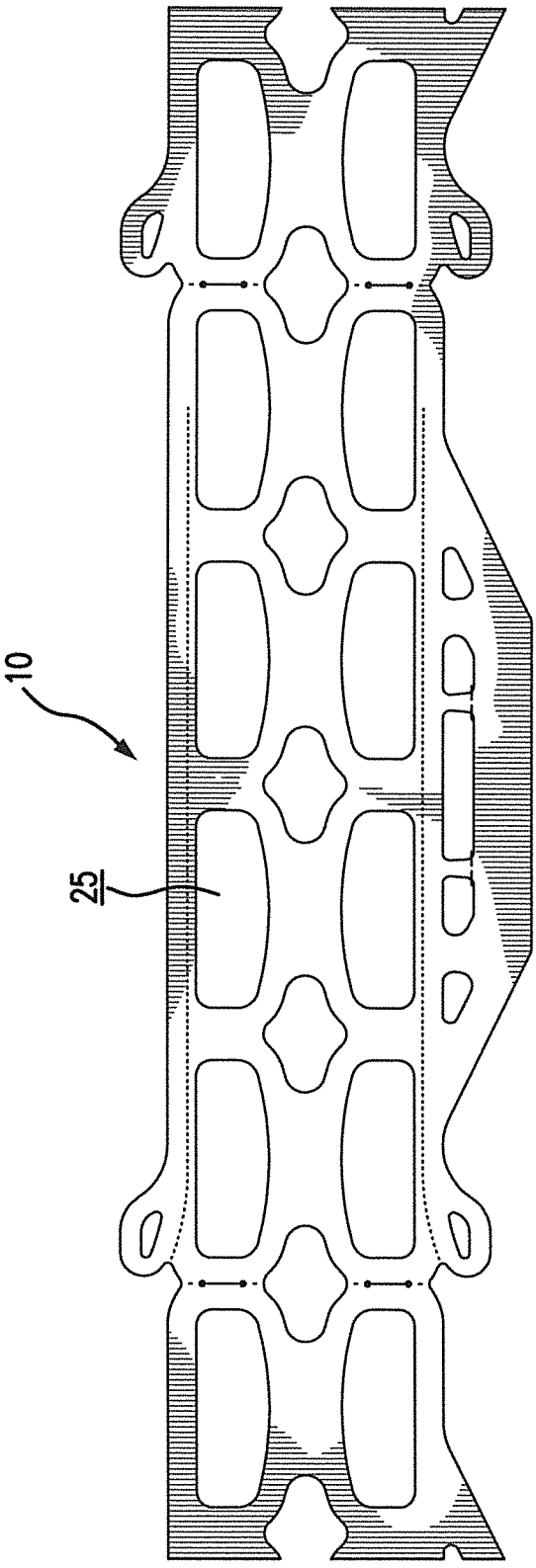

FIG. 4

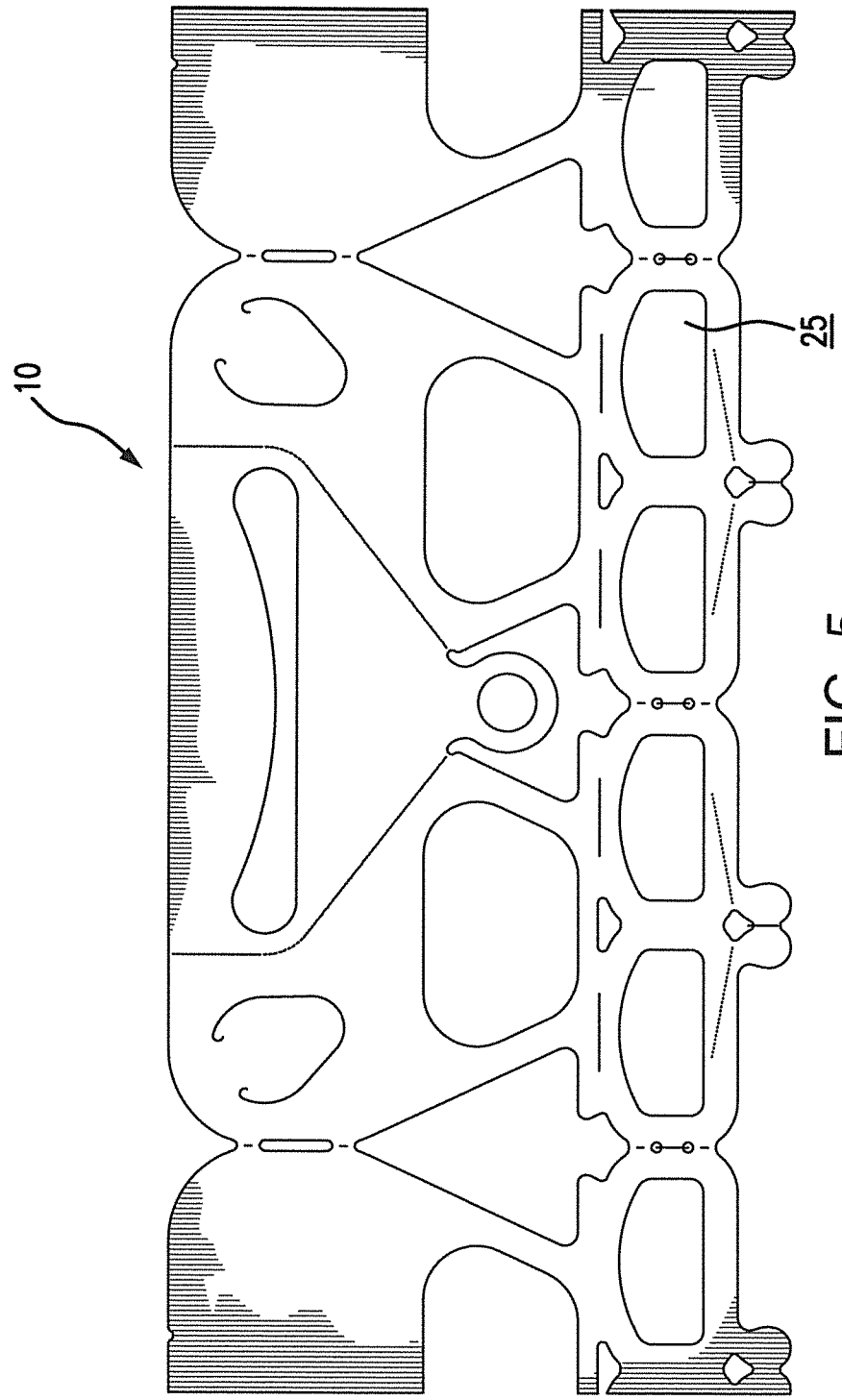

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2015/040664

A. CLASSIFICATION OF SUBJECT MATTER
INV. B26F1/38 B26D7/18 B65H75/00 B26D7/14
ADD. B26F1/44

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)
B26F B26D B65H B65B B65D

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 1 231 848 A (ILLINOIS TOOL WORKS, INC.) 12 May 1971 (1971-05-12)	1,2, 4-10, 12-16
A	page 1, line 31 - page 3, line 113; figures 1-5	3,11

X	US 3 528 330 A (EHLERT DAVID) 15 September 1970 (1970-09-15) column 1, line 53 - column 4, line 9; figures 1-6	1-16

A	US 2007/051218 A1 (DUPUIS LOUIS [CA] ET AL) 8 March 2007 (2007-03-08) paragraph [0022] - paragraph [0056]; figures 1-6	1,8,15

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[X] Further documents are listed in the continuation of Box C.

[X] 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

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"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	Date of mailing of the international search report
16 September 2015	28/09/2015

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Maier, Michael

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2015/040664

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2014/109914 A1 (ILLINOIS TOOL WORKS [US]) 17 July 2014 (2014-07-17) page 2 - page 6; figures 1-5	1,8,15
A	EP 0 456 359 A2 (ILLINOIS TOOL WORKS [US]) 13 November 1991 (1991-11-13) column 3, line 33 - column 9, line 8; figures 1-4	1,8,15

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2015/040664

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 1231848 A	12-05-1971	AT 300325 B	25-07-1972
		BE 725033 A	16-05-1969
		CH 476555 A	15-08-1969
		DE 1778670 A1	12-08-1971
		DK 119847 B	01-03-1971
		ES 354484 A1	01-11-1969
		FR 1563522 A	11-04-1969
		GB 1231848 A	12-05-1971
		JP S526516 B1	22-02-1977
		NL 6817484 A	10-06-1969
		SE 355750 B	07-05-1973
		US 3508458 A	28-04-1970
US 3528330 A	15-09-1970	BE 740215 A	16-03-1970
		DE 1952899 A1	27-05-1970
		DE 6940871 U	23-11-1972
		ES 372721 A1	01-11-1971
		FI 49118 B	31-12-1974
		FR 2021350 A1	24-07-1970
		GB 1234140 A	03-06-1971
		NL 6915089 A	27-04-1970
		SE 352016 B	18-12-1972
		US 3528330 A	15-09-1970
US 2007051218 A1	08-03-2007	NONE	
WO 2014109914 A1	17-07-2014	CN 104903211 A	09-09-2015
		US 2014197051 A1	17-07-2014
		WO 2014109914 A1	17-07-2014
EP 0456359 A2	13-11-1991	AT 114593 T	15-12-1994
		AU 643005 B2	04-11-1993
		AU 7606091 A	07-11-1991
		BR 9101753 A	10-12-1991
		CA 2040175 A1	08-11-1991
		CN 1056285 A	20-11-1991
		DE 69105346 D1	12-01-1995
		EP 0456359 A2	13-11-1991
		ES 2064906 T3	01-02-1995
		FI 912197 A	08-11-1991
		HK 211396 A	06-12-1996
		IE 911524 A1	20-11-1991
		JP 3103613 B2	30-10-2000
		JP H05132074 A	28-05-1993
		MX 166052 B	16-12-1992
		NO 911769 A	08-11-1991
		NZ 237803 A	27-09-1993
		PT 8712 T	31-08-1993
		US 5018620 A	28-05-1991