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(54) Title: PLACEMENT OF EJECTOR PIN MARKS ON A CONVEYOR BELT MODULE TO IMPROVE CONTACT WITH A NOSEBAR

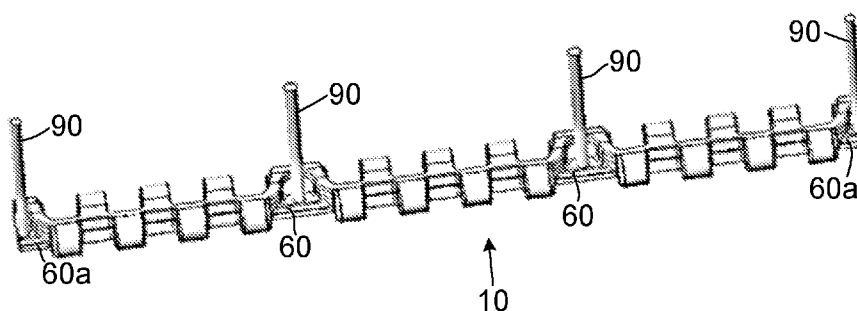


FIG. 8

(57) Abstract: A conveyor belt module and method of making a conveyor belt module through injection molding provide a smooth, uniform nosebar-contacting surface on an underside of the module that is free from ejector pin marks created during the injection molding process. The conveyor belt module includes ejector pin marks only on surfaces that are recessed from the nosebar-contacting surfaces.



**Placement of Ejector Pin Marks on a Conveyor Belt
Module to Improve Contact with a Nosebar**

Related Applications

5 The present application claims priority to US Provisional Patent Application Serial Number 63/523,435, filed June 27, 2023 and entitled "Placement of Ejector Pin Marks on a Conveyor Belt Module to Improve Contact with a Nosebar", the contents of which are herein incorporated by reference.

10 Field of the Invention

 The present invention relates to modular plastic conveying technology. More specifically, the present invention relates to injection-molded conveyor belt modules and the placement of ejector pin marks on the modules to facilitate operation of the conveyor belt.

15 Background

 Modular plastic conveyor belts are widely used in various industries to convey products. Modular plastic conveyor belts are constructed of a series of rows of side-by-side belt modules. Hinge elements along opposite ends of each row interleave with hinge elements of consecutive rows. A hinge rod inserted in the interleaved hinge elements
20 connects the rows together at hinge joints into an endless conveyor belt loop.

 Modular plastic conveyor belts are generally formed by an injection molding process. Injection molding of conveyor belt modules often involves the use of ejector pins to push the molded module from the mold. Ejector pins leave a mark on the module, and may be undesirable, because they create a nonuniform surface. In particular, the existence of ejection
25 pin marks on the bottom surface of a module creates difficulty when the module goes around a nosebar, as the uneven surface created by the ejector pin marks creates vibrations, uneven wear and other undesirable effects.

Summary

30 An injection-molded conveyor belt module locates ejector pin marks on surfaces that do not contact a nosebar. Ejector pins push against a surface in drive pockets on the module

during ejection from a mold to form the ejector pin marks in a recessed area. A nosebar-contacting bottom surface of the module is smooth and free of ejector pin marks.

According to one aspect, a conveyor belt module comprises a laterally-extending body having a top conveying surface and an opposite body bottom surface, a first set of hinge elements and a second set of hinge elements. The first set of hinge elements extend longitudinally from a first end of the body and include a first hinge bottom surface between the body and a point longitudinally inwards of a center of the hinge elements. The second set of hinge elements includes a second hinge bottom surface between the body and a point longitudinally inwards of a center of the hinge elements. The body bottom surface, first hinge bottom surface and second hinge bottom surface define a nosebar-contacting surface. A plurality of ejector pin marks are formed on surfaces that are recessed from the nosebar-contacting surface, such that the nosebar-contacting surface is devoid of ejector pin marks.

According to another aspect, a conveyor belt module comprises a laterally-extending body having a top conveying surface and an opposite bottom surface, a first set of hinge elements extending longitudinally from a first end of the body and a second set of hinge elements extending longitudinally from a second end of the body. The first set of hinge elements includes a first central hinge element forming a drive pocket open to a bottom of the module and a first edge hinge element forming a half drive pocket open to both the bottom of the module and a first side edge. A plurality of ejector pin marks are formed only on surfaces within a drive pocket and a half drive pocket.

According to another aspect, a method of making a conveyor belt module comprises the steps of providing a mold defining the module, injecting molten plastic into the mold to form the module, cooling the molten plastic to harden the module and ejecting the module from the mold using ejector pins. The mold defines a module having a body having a top conveying surface and an opposite bottom surface, a first set of hinge elements extending longitudinally from a first end of the body and a second set of hinge elements extending longitudinally from a second end of the body. The body bottom surface and portions of bottom surfaces formed by the first and second sets of hinge elements define a nosebar-contacting surface. The ejector pins only push against recessed surfaces of the module that are recessed from the nosebar-contacting surface.

Brief Description of the Drawings

FIG. 1 is an isometric top view of a conveyor belt module according to an embodiment of the invention;

FIG. 2 is an isometric bottom view of the conveyor belt module of FIG. 1;

5 FIG. 3 is a cross-sectional view of the conveyor belt module of FIG. 1 through line 3—3;

FIG. 4 is a side view of a portion of a conveyor belt composed of conveyor belt modules of FIG. 1 going over a nosebar in a conveyor system;

10 FIG. 5 is a bottom view of a portion of the conveyor belt module of FIG. 1 highlighting a nosebar-contacting surface;

FIG. 6 is a cross-sectional view of the conveyor belt module of FIG. 1 through line 6-6;

FIG. 7 is a bottom view of a drive pocket of the conveyor belt module of FIG. 1;

15 FIG. 8 is a bottom view of the conveyor belt module of FIG. 1 during ejection from a mold using ejector pins;

FIG. 9 is a bottom view of the conveyor belt module of FIG. 1, showing the ejector pin marks on a non-contacting bottom surface of the module.

Detailed Description

20 An injection-molded conveyor belt module places ejector pin marks on surfaces that do not contact an associated nosebar. The invention will be described relative to certain illustrative embodiments, but the invention is not limited to those embodiments.

Referring to FIGS. 1—2, a conveyor belt module 10 useable to construct a modular conveyor belt comprises a central body, shown as a laterally-extending spine 20. A first set of hinge elements 40 extends longitudinally from a first end of the spine and a second set of
25 hinge elements 50 extends longitudinally from a second end of the spine 20. The hinge elements 40 on one end of the spine are laterally offset from the hinge elements 50 at the other end.

Gaps separate the hinge elements along each end so that the hinge elements of
30 consecutive modules can be interleaved—the first set of hinge elements 40 of one module residing in the gaps in the second set of hinge elements 50 of a consecutive module.

Lateral openings through the interleaved hinge elements 40, 50 of consecutive modules are aligned to form a lateral passageway for a hinge rod (not shown). The hinge rods define hinge axes about which consecutive rows of belt modules 10 can articulate.

Selected hinge elements 52 in the second set of hinge elements 50 are drive hinge elements and form drive pockets 60 in an underside for receiving drive teeth on a sprocket to drive the conveyor belt. These illustrative drive hinge elements 52 are wider than the other, standard hinge elements and the gap opposite each drive hinge elements is wider than the other gaps separating the hinge elements 40 to accommodate the drive hinge elements 52.

The illustrative interior module 10 includes two interior drive pockets 60 and two half drive pockets 60a formed at each side of the module 10. Each half drive pocket 60a has an open side edge and cooperates with a half drive pocket of an adjacent module in the row to form a full drive pocket 60 when the conveyor belt is assembled. The drive pockets 60 and half drive pockets 60a include a top wall that is recessed from the shaped bottom surface of the module 10.

As shown in FIG. 3, the illustrative spine 20 extends in height from a top conveying surface 22 to an opposite bottom surface 24. The illustrative top conveying surface 22 is flat, but can be shaped depending on the product conveyed by the conveyor belt. The opposite bottom surface 24 is concave and has a curve configured to match the curve of an associated nosebar 120 over which the conveyor belt traverses at the end of a carryway, as shown in FIG. 4. First end and second ends 26, 28 are shaped to form a curve to accommodate the hinge elements of a connected module. The illustrative spine 20 tapers in the longitudinal direction from the top conveying surface 22 to the concave bottom surface 24. The spine 20 extends from a first side of the module to a second side of the module. In one embodiment, the module 10 is an interior module of a conveyor belt. In such an embodiment, a full row of the conveyor belt will comprise two edge modules and one or more interior modules 10, with adjacent modules cooperating to form a full drive pocket at the seam formed between the modules.

The standard hinge elements 40, 50 (i.e., those without a drive pocket) are formed by curved outer surfaces that extend from the top conveying surface 22 to the concave bottom surface 24. As shown in FIGS. 3, 4 and 5, a nosebar-contacting surface 70 is formed on the

bottom of the module between boundaries 72 and 74. The boundaries 72, 74 are located on bottom surfaces of the hinge elements 40, 50, slightly inwards from the center of the hinge elements and the bottom-most point of the module. The nosebar-contacting surface 70 includes the bottom surface 24 of the spine 20 and a selected portion of the bottoms of the hinge elements. Only the nosebar-contacting surface 70 contacts the nosebar, and other surfaces of the module 10 remain out of contact with the nosebar 120 in transition regions.

Referring to FIGS. 6 and 7, the illustrative drive pockets 60 are recessed into the underside of the module 10 and receive a sprocket tooth to drive the conveyor belt. The drive pocket 60 intersects the hinge passageway formed by a lateral opening 51 in the drive hinge element 52. The drive pocket 60 includes a rear wall formed by a hinge rod inserted in the lateral opening 51, angled side walls 62, 64 that expand the drive pocket width and a top wall 66 opposite the conveying surface 22. The top wall 66 is recessed from the bottom surfaces 24, 70 of the module 10. A drive wall 68 is formed by the outer surface of the drive hinge element 52, so that adjacent modules join to close the perimeter of the drive pocket 60 when the conveyor belt is assembled.

The conveyor belt module 10 is injection-molded out of a thermoplastic polymer or other suitable injection moldable material. The injection molding process involves providing a mold defining the module, as described above. Then, molten plastic is injected into the mold and cooled to form a hardened module. Then, ejector pins are activated to push against the module and eject it from the mold.

To enhance the contact between the conveyor belt formed of a plurality of the modules 10 and the noseroller 140, the conveyor belt module 10 is molded such that the ejector pin marks used to eject the module from the mold do not contact the nosebar-contacting surface 70. Rather, as shown in FIGS. 8 and 9, the ejector pins 90 contact and leave ejector pin marks 92 only on surfaces that do not contact the nosebar during normal operation. In an illustrative embodiment, the ejector pins 90 contact the top wall 66 forming the drive pockets 60 and half pockets 60a. The top wall is recessed from the bottom surfaces 70 that contact the nosebar. In this manner, the nosebar-contacting surface 70 remains smooth and even. The illustrative ejector pin locations are evenly spaced across the width of the module, but the invention is not so limited.

In another embodiment, ejector pin pads are added in ejector pin locations to remove sharp corners from the module where the ejector pins contact the module. The size and location of the pads can be optimized to reduce wear effects on the nosebar.

The scope of the claims is not meant to be limited to the details of the described
5 exemplary embodiments.

What is claimed is:

1. A conveyor belt module, comprising:

a laterally-extending body having a top conveying surface and an opposite body

5 bottom surface;

a first set of hinge elements extending longitudinally from a first end of the body, the first set of hinge elements including a first hinge bottom surface between the body and a point longitudinally inwards of a center of the hinge elements;

10 a second set of hinge elements extending longitudinally from a second end of the body, the second set of hinge elements including a second hinge bottom surface between the body and a point longitudinally inwards of a center of the hinge elements, wherein the body bottom surface, first hinge bottom surface and second hinge bottom surface define a nosebar-contacting surface; and

15 a plurality of ejector pin marks formed on surfaces that are recessed from the nosebar-contacting surface, such that the nosebar-contacting surface is devoid of ejector pin marks.

2. The conveyor belt module of claim 1, wherein the first set of hinge elements includes at least one drive hinge element including a drive pocket and a first ejector pin mark is

20 formed on a top wall of the drive pocket.

3. The conveyor belt module of claim 2, wherein a second ejector pin mark is formed in a top wall of a half drive pocket formed at a first side of the module.

25 4. The conveyor belt module of claim 3, wherein a third ejector pin mark is formed in a top wall of a half drive pocket formed at a second side of the module.

5. The conveyor belt module of claim 1, wherein the body tapers longitudinally from the top conveying surface to the opposite bottom surface.

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6. The conveyor belt module of claim 5, wherein the opposite bottom surface is a concave curve.

7. The conveyor belt module of claim 5, wherein the body has a shaped front edge and a shaped rear edge.

8. A conveyor belt module, comprising:

a laterally-extending body having a top conveying surface and an opposite bottom surface;

a first set of hinge elements extending longitudinally from a first end of the body, the first set of hinge elements including

a first central hinge element forming a drive pocket open to a bottom of the module; and

a first edge hinge element forming a half drive pocket open to both the bottom of the module and a first side edge;

a second set of hinge elements extending longitudinally from a second end of the body, and

a plurality of ejector pin marks formed only on surfaces within a drive pocket and a half drive pocket.

9. The conveyor belt module of claim 8, wherein a first ejector pin mark is formed on a top wall of the drive pocket on the first central hinge element.

10. The conveyor belt module of claim 8, wherein a second ejector pin mark is formed on a top wall of the half drive pocket.

11. The conveyor belt module of claim 10, wherein the first set of hinge elements further comprises a second edge hinge element forming a half drive pocket open to the bottom of the module and a second side edge, wherein a third ejector pin mark is formed on a top wall in the second edge hinge element.

12. The conveyor belt module of claim 8, wherein the conveyor belt module has a nosebar-contacting surface that is devoid of ejector pin marks.

13. A method of making a conveyor belt module, comprising the steps of:

5 providing a mold defining the module, including a body having a top conveying surface and an opposite bottom surface, a first set of hinge elements extending longitudinally from a first end of the body and a second set of hinge elements extending longitudinally from a second end of the body, the body bottom surface and portions of bottom surfaces formed by the first and second sets of hinge elements defining a nosebar-
10 contacting surface;

injecting molten plastic into the mold to form the module;

cooling the molten plastic to harden the module; and

ejecting the module from the mold using ejector pins, such that the ejector pins only push against recessed surfaces of the module that are recessed from the nosebar-contacting
15 surface.

14. The method of claim 13, wherein the recessed surfaces are formed in top walls of drive pockets formed in the first set of hinge elements.

20 15. The method of claim 14, wherein a first recessed surface is formed in a central drive pocket and a second recessed surface is formed in a half drive pocket at a first side edge of the module.

16. The method of claim 15, wherein a third recessed surface is formed in a half drive
25 pocket at a second side edge of the module.

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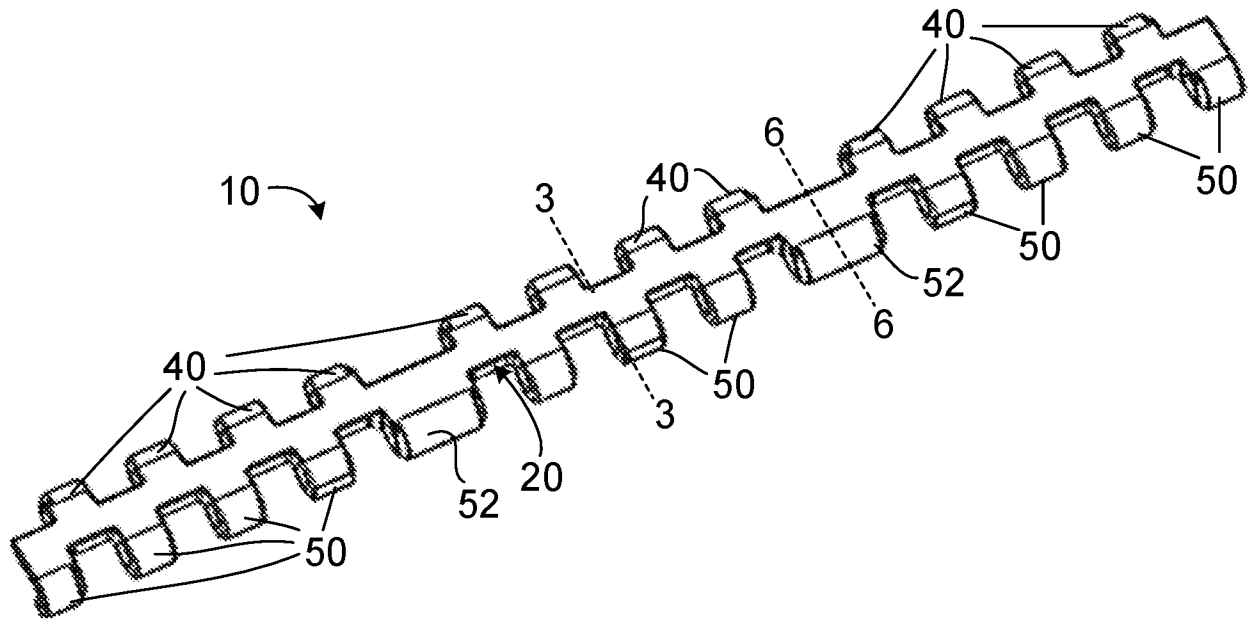


FIG. 1

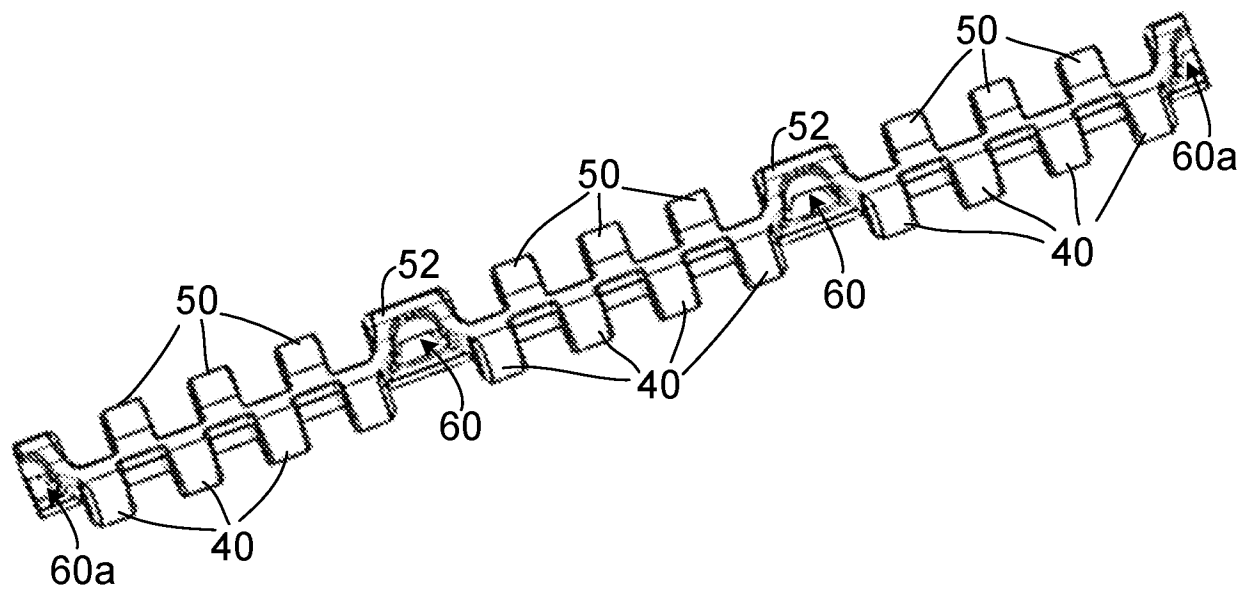
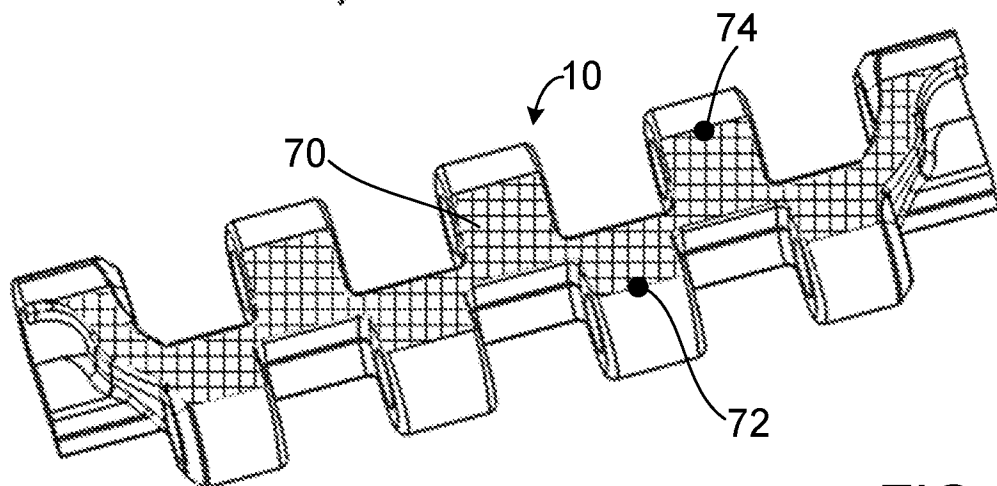
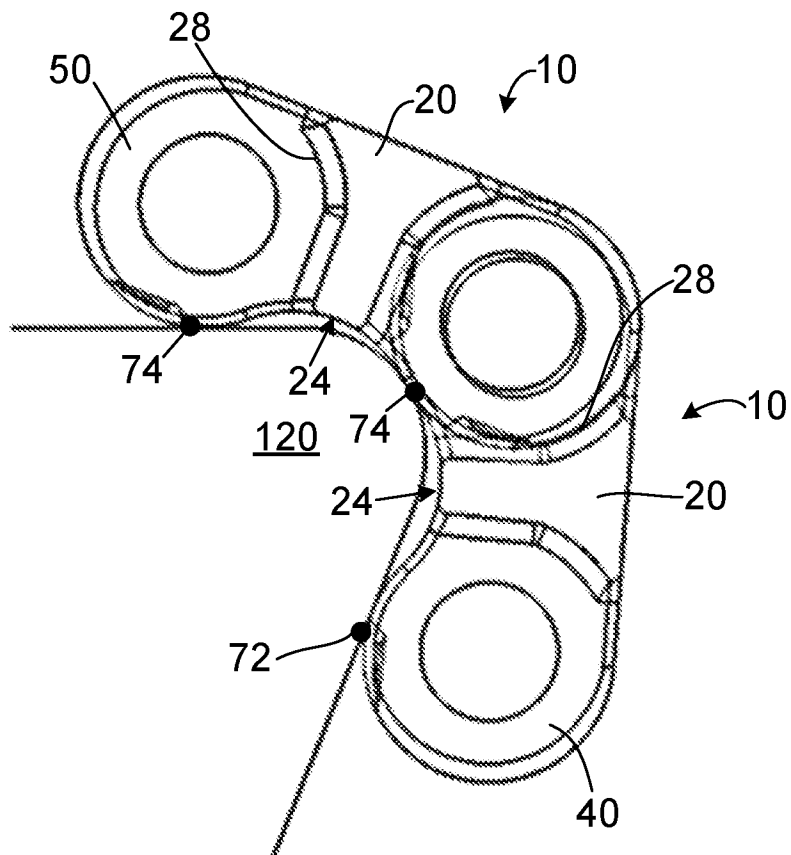
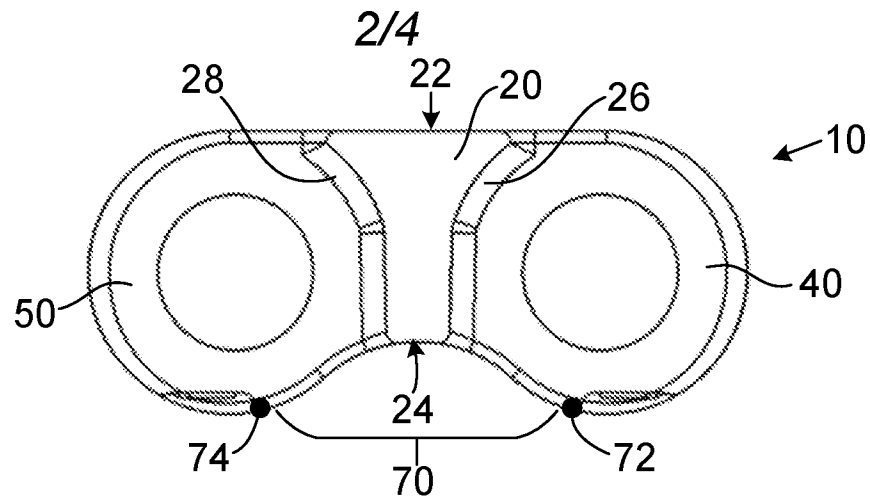


FIG. 2



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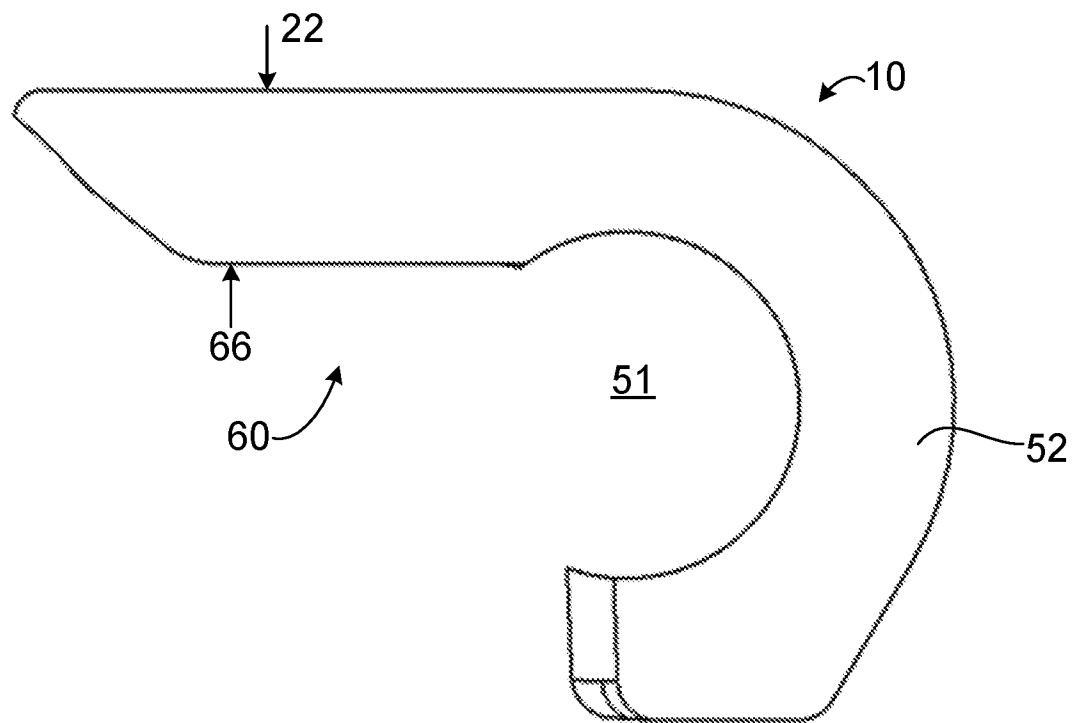


FIG. 6

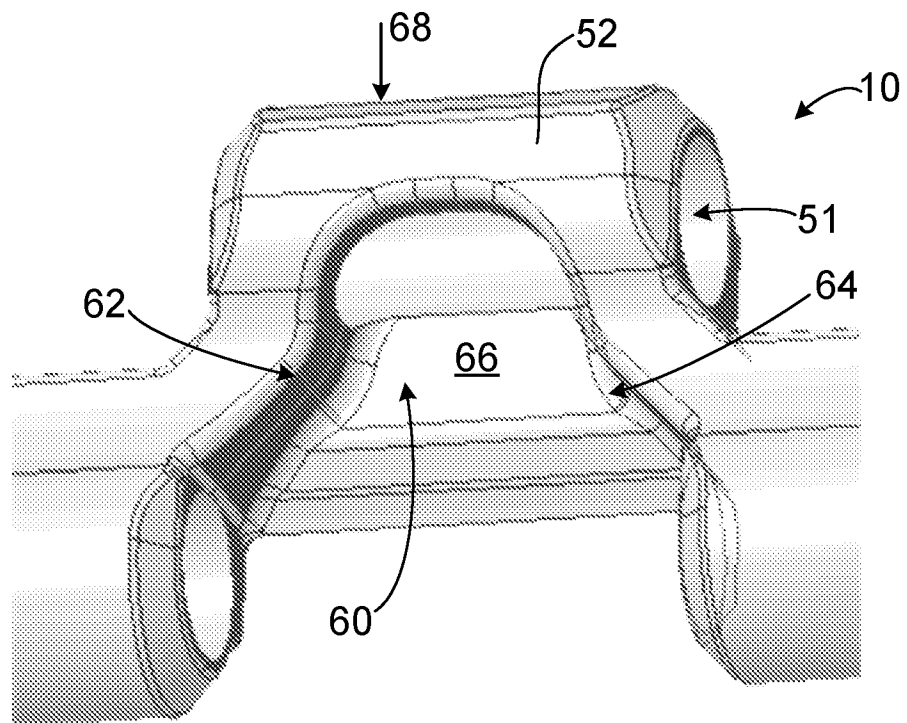


FIG. 7

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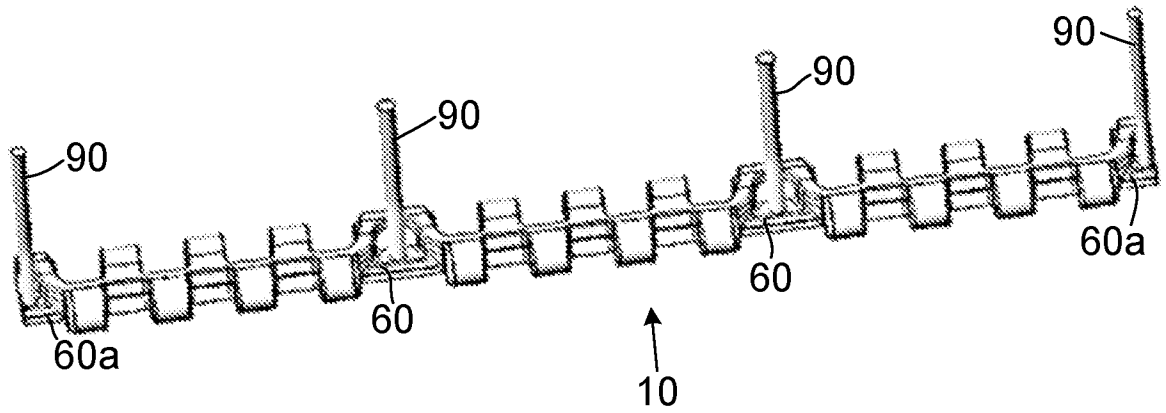


FIG. 8

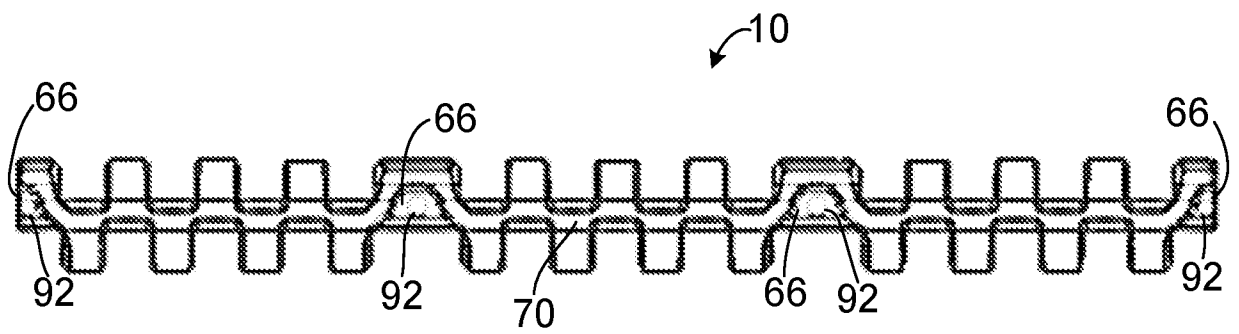


FIG. 9

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2024/034296

A. CLASSIFICATION OF SUBJECT MATTER B65G 17/40(2006.01)i; B65G 17/08(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) B65G 17/40(2006.01); B29C 45/37(2006.01); B64F 1/36(2006.01); B65D 1/34(2006.01); B65G 15/30(2006.01); B65G 15/32(2006.01); B65G 17/06(2006.01); B65G 17/08(2006.01); B65G 23/06(2006.01); G08B 13/14(2006.01) 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) & Keywords: conveyor belt module, hinge, ejector pin, mold, pocket, mark		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2009-525934 A (HABASIT AG.) 16 July 2009 (2009-07-16) paragraphs [0001], [0013]-[0016] and figures 1-3	1-16
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A	US 2019-0055088 A1 (LAITRAM, L.L.C.) 21 February 2019 (2019-02-21) paragraphs [0014]-[0022] and figures 1-6	1-16
☐ 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 “D” document cited by the applicant in the international application “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 “&” document member of the same patent family		
Date of the actual completion of the international search 30 September 2024		Date of mailing of the international search report 14 October 2024
Name and mailing address of the ISA/KR Korean Intellectual Property Office 189 Cheongsa-ro, Seo-gu, Daejeon 35208, Republic of Korea Facsimile No. +82-42-481-8578		Authorized officer LEE, Eon Su Telephone No. +82-42-481-8539

INTERNATIONAL SEARCH REPORT
Information on patent family members

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