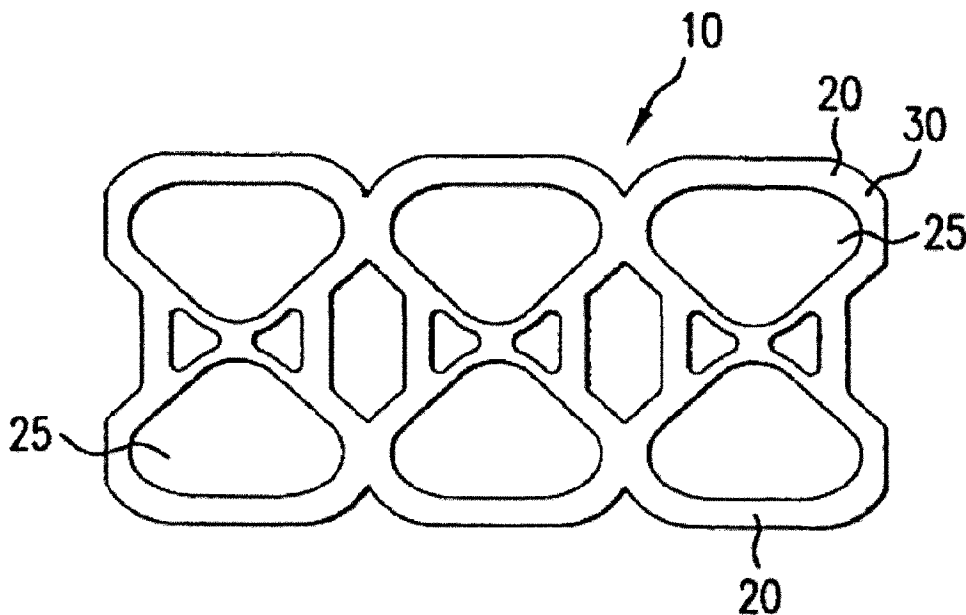




(86) Date de dépôt PCT/PCT Filing Date: 2020/01/14
(87) Date publication PCT/PCT Publication Date: 2020/07/23
(45) Date de délivrance/Issue Date: 2023/12/19
(85) Entrée phase nationale/National Entry: 2021/06/01
(86) N° demande PCT/PCT Application No.: US 2020/013489
(87) N° publication PCT/PCT Publication No.: 2020/150219
(30) Priorités/Priorities: 2019/01/14 (US62/792,264);
2020/01/13 (US16/741,149)

(51) Cl.Int./Int.Cl. *B65D 71/50* (2006.01),
C08L 23/06 (2006.01), *C08L 23/08* (2006.01)
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(54) Titre : PORTE-RECIPIENTS
(54) Title: CONTAINER CARRIER



(57) Abrégé/Abstract:

A flexible carrier for carrying a plurality of containers, such as soft drink and other beverage containers, is formed from a polymer composition which provides the carrier with improved recovery, tensile strength and tear resistance. The polymer composition includes about 40-60% by weight of a low density ethylene polymer having a density of about 0.910-0.950 grams/cm³ and about 40-60% by weight of a post-consumer recycled product blend of low density polyethylene polymer and linear low density polyethylene polymer.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property

Organization

International Bureau

(43) International Publication Date

23 July 2020 (23.07.2020)



(10) International Publication Number

WO 2020/150219 A1

(51) International Patent Classification:

B65D 71/50 (2006.01)

C08L 23/08 (2006.01)

C08L 23/06 (2006.01)

(21) International Application Number:

PCT/US2020/013489

(22) International Filing Date:

14 January 2020 (14.01.2020)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

62/792,264

14 January 2019 (14.01.2019)

US

16/741,149

13 January 2020 (13.01.2020)

US

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(81) Designated States (unless otherwise indicated, for every kind of national protection available):

AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available):

ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

(54) Title: CONTAINER CARRIER

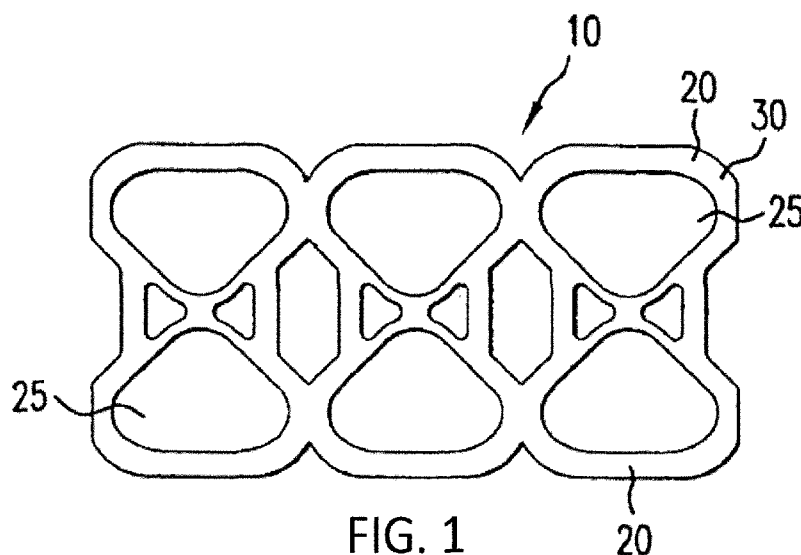


FIG. 1

(57) **Abstract:** A flexible carrier for carrying a plurality of containers, such as soft drink and other beverage containers, is formed from a polymer composition which provides the carrier with improved recovery, tensile strength and tear resistance. The polymer composition includes about 40-60% by weight of a low density ethylene polymer having a density of about 0.910-0.950 grams/cm³ and about 40-60% by weight of a post-consumer recycled product blend of low density polyethylene polymer and linear low density polyethylene polymer.

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Declarations under Rule 4.17:

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:

- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

CONTAINER CARRIER

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

This invention relates to a container carrier having container receiving apertures
5 for unitizing a plurality of containers.

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.

10 Flexible plastic ring carriers having a plurality of container receiving apertures,
typically of a generally oval, round or rectangular configuration, 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.

There is interest in increasing use of post-consumer recycled ("PCR") content
15 to manufacture a carrier. However, a carrier that includes such post-consumer recycled content
must still create a sturdy and aesthetically pleasing package that meets performance parameters
without breakage, sag at the ends or danger of container loss. Such a carrier must also
withstand the rigors of high speed application to containers. Further, such a carrier must meet
rigorous photodegradability standards. As such, a need arises for a carrier that includes post-
20 consumer recycled content and is capable of carrying a large number of containers that permits
high speed application and results in an aesthetically pleasing package for the consumer to
handle.

SUMMARY OF THE INVENTION

The present invention is directed to a flexible carrier for packaging containers
25 that includes an arrangement of container receiving apertures that are configured to permit
placement over containers and permit carrying a unitized package of containers.

The carrier is suitably configured with a combination of webs and container
receiving apertures that permit opening up and generally even, distributed stretching for
application to the containers. Traditional carriers typically include generally oval, round,
30 rectangular or triangular shaped container receiving apertures.

The subject invention is directed to a container carrier that includes an
arrangement of container receiving apertures and intermediate cutouts. The resulting carrier is
configured to enable placement over corresponding containers to result in a tight, unitized
bricklike package.

The present invention is directed to a flexible carrier for containers, which incorporates post consumer recycled material with convention material and still maintains desired recovery after stretch, suitable elongation at break, and desirable photodegradability properties. The flexible carrier is formed using a polymer blend which preferably includes the following components:

- a) about 30-80% by weight of a low density polyethylene polymer including about 80 to 100% by weight ethylene;
- b) about 20-70% by weight of a post-consumer recycled product blend of low density polyethylene polymer and linear low density polyethylene polymer; and
- c) one or more other additives for improving manufacture and/or post-consumer characteristics such as degradation.

Additives may include slip agents and other processing aids for enhancing extrusion and/or die-cutting. Additives may include compounds for improving or aiding degradation including photodegradation such as 0 to about 20% by weight of a carbon monoxide comonomer for enhancing photodegradation.

The flexible carrier includes a plastic sheet formed using the polymer blend, and including a plurality of openings for surrounding and holding the containers. Each opening is surrounded by a portion of the flexible carrier defined as a container engaging portion.

An aspect of the present invention provides for a flexible carrier for carrying a plurality of containers, including a flexible sheet and a plurality of primary apertures having only convex edges formed in the sheet for receiving portions of the containers by stretching and recovering the flexible carrier surrounding the primary apertures around the containers, the flexible sheet having a polymer composition which includes: about 30-80% by weight of a branched low density polyethylene polymer including about 80 to 100% by weight ethylene and zero to about 20% by weight of a carbon monoxide comonomer, the branched low density polyethylene polymer having a density of about 0.910 to 0.935 grams/cm³ and prepared using a high pressure polymerization process; and about 20-70% by weight of a post-consumer recycled product blend of low density polyethylene polymer and linear low density polyethylene polymer and having a density of about 0.920 to about 0.935 grams/cm³ and a melt flow rate of about 0.5 to about 1.5 grams/10 min.

Another aspect of the present invention provides for a flexible carrier for carrying a plurality of containers, including a flexible sheet and a plurality of primary apertures having only convex edges formed in the sheet for receiving portions of the containers by stretching and recovering the flexible carrier surrounding the primary apertures around the containers, the flexible sheet comprising a polymer composition which

includes: about 40-60% by weight of an ethylene-carbon monoxide copolymer having a density of about 0.910 to 0.935 grams/cm³ which includes a branched low density polyethylene polymer formed using a high pressure polymerization process and greater than zero to about 20% by weight of a carbon monoxide comonomer; and about 40-60% by weight of a post-consumer recycled product blend of low density polyethylene polymer and linear low density polyethylene polymer, the post-consumer recycled polymer having a density of about 0.920 to about 0.935 grams/cm³.

A further aspect of the present invention provides for a flexible carrier for carrying a plurality of containers, having a flexible sheet and a plurality of primary apertures having only convex edges formed in the sheet for receiving portions of the containers by stretching and recovering the flexible carrier surrounding the primary apertures around the containers, the flexible sheet including a polymer composition which includes: about 40-60% of an ethylene-carbon monoxide copolymer having a density of about 0.910 to about 0.935 grams/cm³ and including branched low density polyethylene and a carbon monoxide comonomer; and about 40-60% by weight of a post-consumer recycled product blend of low density polyethylene polymer and linear low density polyethylene polymer, the post-consumer recycled product blend having a density of about 0.920 to about 0.935 grams/cm³.

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 elevational view of a container carrier according to one preferred embodiment of this invention; and

Fig. 2 is a chart showing modulus change and strain change across five different compositions of a container carrier material.

DESCRIPTION OF PREFERRED EMBODIMENTS

Fig. 1 shows a flexible carrier 10 for unitizing multiple containers into a resulting unitized package. Although Fig. 1 illustrates a carrier having six container receiving apertures 25, the illustration is exemplary, and the invention is not limited to the flexible carrier shown for six containers. For example, the flexible carrier 10 may be alternatively configured and used to unitize four, eight, ten, twelve, or any other desired number of containers.

Containers are preferably cans or bottles, however any other commonly unitized container may be used with flexible carrier 10 according to this invention. The containers are

preferably, though not necessarily, like-sized within a single flexible carrier.

Each flexible carrier 10 preferably includes a single layer of flexible sheet 20 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 are preferably arranged
5 in two longitudinal rows and multiple longitudinal ranks so as to form an array of container receiving apertures, such as two rows by three ranks for a six container multipackage as shown in Fig. 1. Container receiving apertures 25 are preferably generally slightly elongated in a longitudinal direction of flexible carrier.

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

Preferably, the flexible carriers 10, such as shown in Fig. 1, are manufactured in a generally continuous string of carriers wherein carriers are punched or otherwise formed
15 longitudinally adjacent to other carriers. In this manner, a generally continuous string of carriers is formed that may be rolled onto reels or folded into boxes for later unwinding and application to containers. The carriers are then cut into individual carriers and packages.

Container receiving apertures and intermediate apertures are preferably formed in a geometry that results in a uniform application of the carrier to containers to produce a tight
20 unitization of containers within flexible carrier. Such a result is difficult when material within the flexible carrier is minimized as shown and described herein.

The containers to be inserted in the container receiving apertures 25 may be bottles or cans having varying shapes and diameters. Referring to Fig. 1, for instance, each flexible carrier 10 is installed on containers by stretching the carrier receiving portions 30 in
25 the cross direction, in opposing fashion. The carrier receiving portions 30 are installed around the containers while stretched, and are allowed to retract (recover) to provide a snug fit around the rib, chime or outside surface of the containers. The strength of that snug fit will be impacted, in part, by the modulus of the flexible sheet 20 used to construct the flexible carrier 10. The plan view dimensions of the flexible carrier 10, and its components, vary according to
30 the end use. Particular end uses include without limitation soft drink and beverage cans and bottles of various sizes and shapes.

The flexible sheet 20 used to form the flexible carrier 10 is desirably a plastic film, which can be formed by an extrusion process and then cut to form the flexible carrier. The flexible sheet 20 has a thickness which provides sufficient structural integrity to carry a

desired number of containers. For instance, each flexible carrier 10 may be designed to carry multiple containers of a desired product having a specific weight, volume, shape and size. For most applications, the flexible sheet 20 may have a thickness of about 3-50 mils, suitably about 5-30 mils, commonly about 10-20 mils.

5 The flexible sheet 20 used to form the flexible carrier 10 is formed using a polymer composition which includes a high pressure low density polyethylene polymer and a post-consumer recycled product blend of low density polyethylene polymer and linear low density polyethylene polymer. The composition provides the carrier 10 with a desirable recovery after stretch, suitable elongation and strength at break, compared to an otherwise
10 similar carrier made using the high pressure low density polyethylene polymer alone. Elongation at break and strength at break are measured using the stress-strain test described in ASTM D882-91, which procedure is incorporated by reference. Recovery after stretch can be measured using various standard and specialized procedures.

 The polymer blend used to form the flexible carrier includes about 30-80% by
15 weight of a low density polyethylene polymer including about 80 to 100% by weight ethylene and 0 to about 20% by weight of a carbon monoxide comonomer. Desirably, this polymer is branched, and is prepared using a conventional high pressure polymerization process. The low density polyethylene polymer may be prepared using a Ziegler-Natta catalyst or a single-site catalyst system. The low density polyethylene polymer may be a homopolymer, or a
20 copolymer of ethylene with one or more C3 to C12 alpha-olefin comonomers and/or carbon monoxide. Desirably, the low density polyethylene polymer includes a carbon monoxide comonomer, which makes the carrier more prone to degradation in the presence of ultraviolet light. Suitably, the polymer blend includes about 70-97% by weight of the low density polyethylene polymer, desirably about 80-95% by weight of the low density polyethylene
25 polymer.

 The desired amount of carbon monoxide comonomer in the low density polyethylene polymer varies depending on the percentage of the low density polyethylene polymer in the polymer blend composition. When present, the carbon monoxide comonomer may constitute about 0.1-20% by weight of the low density polyethylene polymer. When
30 considered as a percentage of the polymer blend composition, the carbon monoxide comonomer may constitute about 0.1-10% by weight.

 The low density polyethylene polymer should have a density of about 0.910-0.950, grams/cm³, suitably about 0.920-0.940 grams/cm³, desirably about 0.920-0.935 grams/cm³. In other words, the term "low density polyethylene polymer" includes

polyethylene polymers commonly considered as having medium density, as well as polyethylene polymers commonly considered as having low density. The low density polyethylene polymer should have a melt index of about 0.2-3.0 grams/10 min., suitably about 0.3-1.5 grams/10 min., desirably about 0.4-0.7 grams/10 min., measured at 190°C using ASTM D1238.

The polymer blend used to form the flexible carrier also includes about 20-70% by weight of a low density polyethylene polymer post-consumer recycled product. More preferably, the polymer blend includes 40-60% by weight of a post-consumer recycled product blend of low density polyethylene polymer and linear low density polyethylene polymer. The following table lists exemplary combinations of low density polyethylene polymer post-consumer recycled material useful to form the flexible carrier composition of the invention.

Flexible Carrier Compositions

- I. 40-60% by weight ethylene-carbon monoxide copolymer, having a density of 0.925-0.931 grams/cm³, a melt index (190°C) of 0.42-0.62 grams/10 min.,
- II. 40-60% by weight of a post-consumer recycled product blend of low density polyethylene polymer and linear low density polyethylene polymer having the following qualities:

Property	Unit	Nominal Value	ASTM Test Method
Relative Density	g/cm ³	0.920-0.935	D792
Melt Flow Rate (AVG)	g/10 min.	0.5-1.5	D1238
Ash Content	%	=<2.5	D4218
Moisture Content	%	=<0.05	D6980
Pellet Size	Mm	4.5-5.5	

; and

- III. 0-10% additives.

As shown in Fig. 2, the combination of the ethylene-carbon monoxide copolymer and the post-consumer recycled material may result in desirable property characteristics up to about 65% by weight of the post-consumer recycled content. As shown, photodegradability improves at 25% PCR content where it begins to decrease through 50% PCR content and become worse at about 65% by weight PCR. Likewise, recovery and modulus remain fairly consistent between 0 and 25% PCR content where recovery begins to decrease as PCR percent increases. The PCR material is preferably generally clear/translucent and not

opaque/dark.

The polymer blend composition used in the flexible carrier includes two primary polymer components as described above in the stated percentage ranges, with or without other polymer components, provided that the important physical properties of the flexible carrier described above are substantially maintained. For instance, the ethylene-carbon monoxide copolymer which destabilizes the carrier against ultraviolet radiation may be provided separately, in the form of a masterbatch or concentrate having a higher carbon monoxide content, or some or all of the carbon monoxide may be copolymerized with the single-site catalyzed ethylene alpha olefin plastomer. Other polymers may also be added in amounts which substantially maintain or enhance the recovery, elongation, modulus, tensile strength, and tear resistance of the flexible carrier, and/or which provide the carrier with cold temperature resistance, stress crack resistance, enhanced clarity and other desirable properties. The polymer components may be dry blended and/or melt blended together. Typically, they are fed separately to the extruder which forms the flexible carrier sheet, and are melt blended in the extruder.

According to one preferred embodiment of the invention, the 40-60% by weight of a post-consumer recycled product blend of low density polyethylene polymer and linear low density polyethylene polymer may comprise quantifiable amounts of propylene, Butene, LDPE, Hexene, Styrene and LLDPE (linear low-density polyethylene). Examples of specific batches of material are listed in the following table.

Sample #	wt% PP (as propylene)	wt% Butene	wt% Hexene (includes some LDPE)	Approximate wt% LDPE	wt% Styrene	Approximate wt% LLDPE
1	1.8	2.2	4.4	50	0.05	45
2	2.3	2.0	4.4	45	0.15	45
3	1.7	2.6	3.8	53	0.29	38

In one embodiment of the invention, the composition preferably includes an additive for assisting in the degradability of the subject carrier. In one embodiment, such degradability is photodegradable and may include the introduction of carbon monoxide such that the the polymer blend should have a carbon monoxide content of about 0.1-10% by weight.

According to one preferred embodiment, a single-site catalyzed ethylene-alpha

olefin copolymer plastomer may be further included to enhance recovery and modulus characteristics of the flexible carrier 10. The plastomer preferably includes a density of about 0.850-0.905 grams/cm³. Suitable single-site catalyzed ethylene-alpha olefin copolymer plastomers may include metallocene and may also include plastomers available from Exxon-
5 Mobil Chemical Co. under the trade name EXACT, and from Dow Chemical Co. under the trade names AFFINITY and ENGAGE.

Other additives that may comprise 0-10% of the composition of the container carrier may include slip agents and other processing aids for enhancing extrusion and/or die-cutting. One such additive may comprise a fluorinated processing aid, such as KYNAR FLEX
10 5300 manufactured by Arkema, that comprises approximately .25% of the composition. Other additives may include an antiblock, antioxidant, and slip to adjust the composition to accommodate the stretch and recovery characteristics required in the finished container carrier.

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
15 purpose of illustration, it will be apparent to those skilled in the art that flexible carrier 10 is 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

What is claimed is:

1. A flexible carrier for carrying a plurality of containers, comprising a flexible sheet and a plurality of primary apertures having only convex edges formed in the sheet for receiving portions of the containers by stretching and recovering the flexible carrier surrounding the primary apertures around the containers, the flexible sheet comprising a polymer composition which includes:

about 30-80% by weight of a branched low density polyethylene polymer including about 80 to 100% by weight ethylene and zero to about 20% by weight of a carbon monoxide comonomer, the branched low density polyethylene polymer having a density of about 0.910 to 0.935 grams/cm³ and prepared using a high pressure polymerization process; and

about 20-70% by weight of a post-consumer recycled product blend of low density polyethylene polymer and linear low density polyethylene polymer and having a density of about 0.920 to about 0.935 grams/cm³ and a melt flow rate of about 0.5 to about 1.5 grams/10 min.

2. The flexible carrier of Claim 1, wherein the branched low density polyethylene polymer comprises a polyethylene homopolymer.

3. The flexible carrier of Claim 1, wherein the branched low density polyethylene polymer comprises ethylene and another alpha-olefin comonomer.

4. The flexible carrier of Claim 1, further comprising an additive that results in photodegradability.

5. The flexible carrier of Claim 1, comprising not less than two and not more than fifteen of the primary apertures.

6. The flexible carrier of Claim 1, wherein the branched low density polyethylene polymer has a density of about 0.920-0.935 grams/cm³.

7. The flexible carrier of Claim 1, further comprising about 1-10% by weight of a single-site catalyzed ethylene-alpha olefin copolymer plastomer having a density of about 0.850-0.905 grams/cm³.

8. The flexible carrier of Claim 7, wherein the single-site catalyzed ethylene-alpha olefin copolymer plastomer comprises an alpha-olefin comonomer having 3-12 carbon atoms.

9. The flexible carrier of Claim 8, wherein the alpha-olefin comonomer has 4-8 carbon atoms.

10. The flexible carrier of Claim 1, wherein the polymer composition comprises about 40-60% by weight of the branched low density polyethylene polymer and about 40-60% by weight of the post-consumer recycled product blend, without substantial loss of mechanical properties from a flexible carrier without post-consumer recycled product.

11. The flexible carrier of Claim 1, wherein the branched low density polyethylene polymer comprises about 0.5% to about 10% by weight of the carbon monoxide comonomer.

12. The flexible carrier of claim 3, wherein the alpha-olefin comonomer comprises at least one of propylene, Butene, Hexene and Styrene.

13. A flexible carrier for carrying a plurality of containers, comprising a flexible sheet and a plurality of primary apertures having only convex edges formed in the sheet for receiving portions of the containers by stretching and recovering the flexible carrier surrounding the primary apertures around the containers, the flexible sheet comprising a polymer composition which includes:

about 40-60% by weight of an ethylene-carbon monoxide copolymer having a density of about 0.910 to 0.935 grams/cm³ which includes a branched low density polyethylene polymer formed using a high pressure polymerization process and greater than zero to about 20% by weight of a carbon monoxide comonomer; and

about 40-60% by weight of a post-consumer recycled product blend of low density polyethylene polymer and linear low density polyethylene polymer, the post-consumer recycled polymer having a density of about 0.920 to about 0.935 grams/cm³.

14. The flexible carrier of Claim 13, wherein the ethylene-carbon monoxide copolymer comprises about 0.5-10% by weight carbon monoxide.

15. A flexible carrier for carrying a plurality of containers, comprising a flexible sheet and a plurality of primary apertures having only convex edges formed in the sheet for receiving portions of the containers by stretching and recovering the flexible carrier surrounding the primary apertures around the containers, the flexible sheet comprising a polymer composition which includes:

about 40-60% of an ethylene-carbon monoxide copolymer having a density of about 0.910 to about 0.935 grams/cm³ and including branched low density polyethylene and a carbon monoxide comonomer; and

about 40-60% by weight of a post-consumer recycled product blend of low density polyethylene polymer and linear low density polyethylene polymer, the post-consumer recycled product blend having a density of about 0.920 to about 0.935 grams/cm³.

16. The flexible carrier of Claim 15, wherein the ethylene-carbon monoxide copolymer has a density of about 0.925-0.931 grams/cm³.

17. The flexible carrier of Claim 15, wherein the ethylene-carbon monoxide copolymer has a melt index of about 0.42-0.62 grams/10 min.

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