AUSTRALIA

PATENTS ACT 1990 661760

PATENT REQUEST: STANDARD PATENT

We, OWENS-ILLINOIS PLASTIC PRODUCTS INC., being the person identified below as the Applicant, request the grant of a patent to the person identified below as the Nominated Person, for an invention described in the accompanying standard complete specification.

Full application details follow.

Applicant: OWENS-ILLINOIS PLASTIC PRODUCTS INC.

Address: One SeaGate, Toledo, Ohio 43666, United States of America

Nominated Person: As above

Address: As above

Invention Title: "PLASTIC CONTAINER MADE FROM A FUSION BLEND OF POST CONSUMER PLASTIC AND ETHYLENE POLYMERS"

Names of actual inventors: James N. Herman and James M. Fargher

BASIC CONVENTION APPLICATION DETAILS:

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Country: United States of America
Country Code: US
Date of Application: 27th February 1992

Address for service is: SHELSTON WATERS
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DATED this 23rd Day of February 1993
OWENS-ILLINOIS PLASTIC PRODUCTS INC.

by

Fellow Institute of Patent Attorneys of Australia
of SHELSTON WATERS

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To: The Commissioner of Patents
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(54) Title
PLASTIC CONTAINER MADE FROM A FUSION BLEND OF POST CONSUMER PLASTIC AND ETHYLENE POLYMERS

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(57) Claim

1. A plastic container made from a fusion blend comprising post consumer resin of homopolymer high density polyethylene resin and a high density polyethylene copolymer resin,

such that the physical properties of the container including stress cracks resistance are maintained as contrasted to the loss of such physical properties that have been heretofore resulted from the use of post consumer resins.

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COMPLETE SPECIFICATION

FOR A STANDARD PATENT

ORIGINAL

Name of Applicant: OWENS-ILLINOIS PLASTIC PRODUCTS INC.

Actual Inventors: James N. Herman and James M. Fargher

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Invention Title: "PLASTIC CONTAINER MADE FROM A FUSION BLEND OF POST CONSUMER PLASTIC AND ETHYLENE POLYMERS"

The following statement is a full description of this invention, including the best method of performing it known to us:-

This invention relates to plastic containers and particularly to plastic containers made of post consumer resin.

Background and Summary of the Invention

In the use of plastic materials for containers such as bottles, it has been found desirable to attempt to recycle and reuse the plastic which is commonly known as post consumer plastic (PCP) or post consumer resin (PCR). In attempts to make containers from such materials, it has been found that the properties have been adversely affected.

Specifically when containers are made from post consumer high density polyethylene homopolymers (HDPE) container scrap, it has been found that the containers have diminished physical properties and particularly diminished resistance to stress cracking. Such containers made of high density polyethylene homopolymers also have been used for packaging of certain types of liquid detergent products. The use of such containers to package liquid detergent products has been somewhat restricted, however, by reason of the fact that many types of liquid detergent products accelerate the tendency of the container to exhibit stress cracking. Stress cracking is evidenced by the appearance of hazy cracks in the container which are aesthetically unpleasing to the ultimate consumer. In extreme cases, stress cracking can lead to leakage of the contents from the container. Stress cracking can occur when the containers are for liquid products including liquid detergents and liquid hypochlorite bleaches.

It has been suggested that such post consumer resin be utilized because large quantities of high density polyethylene post consumer resin are available due to the extensive use of high density polyethylene in large containers for milk and water. Post consumer resin from such containers contains contaminants of paper and other plastic resins, for example, from closures such that it has been generally thought that it can not be used to make satisfactory plastic containers.

Accordingly among objectives of the present invention are to provide a blend of post consumer resin from high density polyethylene containers and the like which will have substantial resistance to stress cracking and which will have minimal diminution in other physical properties permitting its use for various kinds of containers, that is for containing various products.

In accordance with the invention, a plastic container is made from a fusion blend of a post consumer resin and ethylene polymers comprising post consumer resin of homopolymer high density polyethylene plastic and virgin high density polyethylene copolymer resin. The physical properties of the container including stress crack resistance are maintained as contrasted to the loss of such physical properties that have been heretofore resulted from the use of post consumer resins.

In accordance with the invention, pellets of a homopolymer high density polyethylene resin from post consumer resin (PCR) and pellets of a virgin high density polyethylene copolymer were mixed and fusion blended. Containers were blow

molded and subjected to testing for stress cracking, top load and drop impact.

The blends of the present invention contain about 15-50% by weight of post consumer resin and about 50-85% by weight of virgin high density polyethylene copolymer resin.

Post consumer resin contains primarily the plastic from high density polyethylene homopolymer containers used for packaging milk and small amounts of colored plastic containers and possible polypropylene resin from syrup bottles, multi-layer ketchup bottles and caps. Such post consumer resin has the properties set forth in the following Table I.

Table I

PROPERTY	SPECIFIED VALUE
Material Density	.961 ± .002 natural
Melt Flow - Melt Index	0.75 ± 0.2 dgm
Polypropylene (Includes Multi-layer Bottles)	Not to exceed 3%
Fines	<0.01%
Moisture	<0.05%
Contamination	
Paper	<0.01%
Plastic-Dens. >1.0 gm/cc	<0.1%
Metal fragments	None
Other (glass, stone)	None

The virgin high density copolymer resin contains linear high-density ethylene polymer. The linear high-density ethylene copolymer included in the blends will have a density of at least about 0.94 gm/ml, a melt index of less than about 0.5 gm/10 min. and will have polymerized therein at least about 98 mol % ethylene with any comonomer polymerized therein being an alpha-monoolefin containing about 3 to 12 carbon atoms. Such linear high-density ethylene polymers are known and reported in the art and are commercially available from numerous commercial producers. Such linear high-density ethylene polymers are prepared by polymerizing ethylene, optionally in the presence of an alpha-monoolefin comonomer containing 4 to 12 carbon atoms in the presence of certain metallic catalysts such as chromium catalysts, e.g. CrO_3 supported on silica-alumina supports, and the Ziegler-Natta catalysts, e.g. $TiCl_3$ employed in conjunction with certain aluminum alkyl cocatalysts. The requisite density and melt index desired in the polymer are obtained by proper control of polymerization conditions including temperature, pressure, comonomer concentration, and the concentration of telegenating agents such as hydrogen. The preferred linear high-density ethylene polymers will have a density of at least about 0.94 gm/ml. The especially preferred polymers will have a density of at least about 0.95 gm/ml. Stress crack resistance is conventionally conducted with test methods as established by Technical Bulletin PBI 11-1978 of the Plastic Bottle Institute, Rev.1-1991 or ASTM D2561-70 (Reapproved 1989).

The following Table II summarizes one set of tests that have been conducted.

32 OZ. PINCH WAIST OVAL

RUN#	1	2	3	4	5	6	7
% PCR		25	40	50	60	75	100
% Virgin Copolymer	100	75	60	50	40	26	
Gram Weights (20 Bottles)							
Mean	46.54	46.80	46.45	46.45	46.61	47.17	46.53
STD. Dev.	.338	.263	.244	.169	.270	.229	.228
TOP Load (10 Bottles)							
Pounds	37.2#	41.8#	43.2#	43.7#	47.9#	44.4#	45.8#
Drop Impact Test (25 Bottles) Bruceton Staircase							
EMFH	7.36'	8.44'	8.96'	8.18'	7.40'	9.25'	8.13'
Stress Crack Test 140 Degrees (10 Bottles) Days to							
1st Fail/50% Fail	42/**	4/27	3/8	8/12	1/2	1/1	1/1
120 Degrees (10 Bottles) Days to							
1st Fail/50% Fail	6/16	4/6	3/3	3/4	1/2	1/1	1/1

**Variable #1 Bottles had been in 140 Deg. Stress Crack for 51 Days as of 1/31/92, 50% Failure had yet to occur.

Additional tests are summarized in the following Table:

Table III

Data Summary

16oz. Oval
Control Virgin Copolymer
15% Milk Bottle PCS Material
30% Milk Bottle PCS
45% Milk Bottle PCS Material

	Averages			
	Control	15%	30%	45%
gram weights (50 bottles)				
mean	34.83	34.77	34.95	35.22
std. dev.	.1870	.3058	.1992	.1918
top load test (10 bottles)				
pounds	66.6	73.2	68.6	60
drop impact test (25 bottles)				
Bruceton Staircase	9.5+	9.25	9.5+	9.5+
stress crack test (140°F)				
# of failures	0	0	0	0

The post consumer resin in pellet form was dry mixed with virgin 0.954 density copolymer HDPE resin pellets and the blend was fed to the machine hopper. Melt temperature was approximately 400°F. No processing or machine changes were made in order to produce good quality bottles.

It can thus be seen that there has been provided a plastic container is made from a fusion blend of a post consumer resin and ethylene polymers comprising post consumer resin of homopolymer high density polyethylene plastic and virgin high density polyethylene copolymer resin. The physical properties of the container including stress crack resistance are maintained as contrasted to the loss of such physical properties that have been heretofore resulted from the use of post consumer resins.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. A plastic container made from a fusion blend comprising post consumer resin of homopolymer high density polyethylene resin and a high density polyethylene copolymer resin,

such that the physical properties of the container including stress cracks resistance are maintained as contrasted to the loss of such physical properties that have been heretofore resulted from the use of post consumer resins.

2. The plastic container set forth in claim 1, wherein said blend comprises a fusion blend of homopolymer high density polyethylene post consumer resin and virgin high density polyethylene copolymer resin wherein said virgin high density polyethylene copolymer resin forms the major constituent of the blends.

3. The plastic container set forth in claim 2, wherein said post consumer resin ranges between about 15% to 50% and said virgin high density copolymer ranges between about 50% to 85%, by weight.

4. A plastic container, substantially as herein described with reference to Table II and any one of Runs 2 to 6 and Table III but excluding the control.

DATED this 10th day of May, 1995
OWENS-ILLINOIS PLASTIC PRODUCTS INC
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AUSTRALIAN PATENT OFFICE

PLASTIC CONTAINER MADE FROM A FUSION BLEND OF POST CONSUMER PLASTIC AND ETHYLENE POLYMERS

Abstract of the Disclosure

A plastic container made from a fusion blend of a post consumer resin and ethylene polymers comprising post consumer resin of homopolymer high density polyethylene resin and a high density polyethylene copolymer resin. The physical properties of the container including stress crack resistance are maintained as contrasted to the loss of such physical properties that have been heretofore resulted from the use of post consumer resins.

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