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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/230,691	09/03/2008	Akio Ozasa	12480-000055/US/DVA	3456

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HARNESS, DICKEY & PIERCE, P.L.C.
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RESTON, VA 20195

EXAMINER	
KHARE, ATUL P	

ART UNIT	PAPER NUMBER
1742	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte AKIO OZASA, AKIHISA HASHIMOTO, and
SHINJI TANAKA

Appeal 2010-010024
Application 12/230,691
Technology Center 1700

Before BRADLEY R. GARRIS, TERRY J. OWENS, and
KAREN M. HASTINGS, *Administrative Patent Judges*.

OWENS, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

The Appellants appeal under 35 U.S.C. § 134(a) from the Examiner's rejection of claims 13-34, which are all of the pending claims. We have jurisdiction under 35 U.S.C. § 6(b).

The Invention

The Appellants claim a method for making a biodegradable molded article. Claim 13 is illustrative:

13. A method for producing a biodegradable molded article, comprising the steps of:

directly heating a molding material by dielectric heating to form a biodegradable expanded molded article, the biodegradable expanded molded article being molded in a specified shape with an irregular surface by steam expansion molding of the molding material, and

simultaneously thermally softening a coating film and attaching the thermally softened coating film to the irregular surface of the biodegradable expanded molded article so as to maintain the irregular surface of the biodegradable expanded molded article,

wherein the coating film is mainly made of a biodegradable plastic and having at least hydrophobicity, the molding material is a slurry or dough molding material mainly made of a starch or a starch derivative and prepared by adding water to the starch or the starch derivative, and the starch or the starch derivative contains high-amylose starch or high-amylose starch derivative.

The References

Altieri	5,153,037	Oct. 6, 1992
Ando	5,639,518	Jun. 17, 1997
Doane	5,861,216	Jan. 19, 1999
Bradt	5,888,599	Mar. 30, 1999
Shogren	6,146,573	Nov. 14, 2000
Lörcks	CA 2,143,432	Nov. 28, 2000

The Rejections

The claims stand rejected under 35 U.S.C. § 103 as follows: claims 13, 16, 18-24, 27, and 29-34 over Lörcks in view of Doane and Ando, claims 14 and 15 over Lörcks in view of Doane, Ando, and Altieri, claims 17 and 28 over Lörcks in view of Doane, Ando, and Bradt, and claims 25 and 26 over Lörcks in view of Doane, Ando, and Shogren.

OPINION

We reverse the rejections. We need to address only the independent claims, i.e., claims 13 and 24.[1] Those claims require heating a molding material to form a biodegradable expanded molded article having an irregular surface, and simultaneously thermally softening a coating film and attaching it to the irregular surface so as to maintain the irregular surface. For that claim requirement the Examiner relies upon Lörcks (Ans. 4).

Lörcks foams and cures starch to form a layer and simultaneously combines it with an additional layer of a further laminate material in an expansion molding apparatus at 180-270ºC to obtain a laminated composite material (pp. 2, 5-6, 10). The further laminate material can be a synthetic or biopolymeric film (pp. 3, 7).

The Examiner argues that "although Lorcks does not explicitly disclose thermal softening of the laminate composite material, the Lorcks molding temperature of 220ºC is sufficient to cause softening of many or all of the laminate composite materials of Lorcks, including synthetic films" (Ans. 13).

Lörcks does not disclose any particular synthetic film materials. Thus, Lörcks does not appear to provide a basis for the Examiner's argument that a molding temperature of 220ºC is sufficient to soften many or all of Lörcks' synthetic film materials, and the Examiner has not established such a basis.

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[1] The Examiner does not rely upon any disclosure in Altieri, Bradt or Shogren which remedies the deficiency in the references applied to the independent claims (Ans. 8-10).

The Examiner argues that the Appellants' Specification states that "the softening point of the coating film 12 is preferably not less than 130ºC, and more preferably not less than 150ºC" (Spec. 56:1-3), and that Lörcks' "laminate material can be made from a synthetic film, and is included in the mold during the foaming process, which would inherently thermally soften the film as required by the claim (page 3)" (Ans. 4)

An inherent characteristic must be inevitable, and not merely a possibility or probability. *See In re Oelrich*, 666 F.2d 578, 581 (CCPA 1981). The Examiner has not established that Lörcks discloses the coating film in the relied-upon portion of the Appellants' Specification or that Lörcks' synthetic coating film inevitably thermally softens instead of remaining unsoftened at the molding temperature.

Hence, the Examiner has not established a prima facie case of obviousness of the Appellants' claimed method.

DECISION/ORDER

The rejections under 35 U.S.C. § 103 of claims 13, 16, 18-24, 27, and 29-34 over Lörcks in view of Doane and Ando, claims 14 and 15 over Lörcks in view of Doane, Ando, and Altieri, claims 17 and 28 over Lörcks in view of Doane, Ando, and Bradt, and claims 25 and 26 over Lörcks in view of Doane, Ando, and Shogren are reversed.

It is ordered that the Examiner's decision is reversed.

REVERSED

sld

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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.:	12/230,691
Filing Date:	September 3, 2008
Applicant:	Akio OZASA et al.
Group Art Unit:	1791
Examiner:	Atul P. Khare
Title:	BIODEGRADABLE MOLDED ARTICLE
Attorney Docket:	12480-000055//US/DVA

Customer Service Window
Randolph Building
401 Dulany Street
Alexandria, VA 22314
Mail Stop Amendment

November 8, 2011

INFORMATION DISCLOSURE STATEMENT

Sir:

Pursuant to 37 C.F.R. §§ 1.56, 1.97 and 1.98, Applicant hereby submits an Information Disclosure Statement for consideration by the Examiner.

I. LIST OF PATENTS, PUBLICATIONS, AND OTHER INFORMATION

The patents, publications and other information submitted for consideration by the Office (except unpublished U.S. patent applications) are listed on Form PTO-1449 attached hereto.

II. COPIES

A. ☒ Submitted herewith is a legible copy of (i) each foreign patent; (ii) each publication or that portion which caused it to be listed, other than U.S. patents and U.S. patent application publications unless required by the Office; (iii) for each cited pending unpublished U.S. application listed below in Section IV, the application specification including the claims, and any drawing of the application, or that portion of the application which caused it to be listed including any claims directed to that portion; and (iv) all other information or that portion which caused it to be listed.

B. ☐ Any patents, publications or other information which are listed on Form PTO-1449 or on the copies of Form PTO-892, but which are not enclosed herewith, were previously cited by or submitted to the PTO in one of the following applications which has been relied upon for an earlier filing date under 35 U.S.C. § 120:

U.S. Serial Number	U.S. Filing Date

C. ☒ Because the present application was/is being filed after June 30, 2003, no copies of the U.S. patents or U.S. patent application publications which are listed on the attached Form PTO-1449 are enclosed pursuant to the waiver of 37 C.F.R. § 1.98(a)(2)(i). Any foreign patent documents or non-patent literature listed on the attached Form PTO-1449 are enclosed herewith.

D.☐ This is a PCT application in the entry of the National Phase in the United States. A copy of the International Search Report is attached for the Examiner's information. The documents listed on the International Search Report are listed on the attached Form PTO-1449 for consideration by the Examiner and for listing on any patent resulting from this application. Since the International Search Report was from the US, EPO, or JPO search authorities, copies of these references should have been supplied to the USPTO under the trilateral agreement and are believed to be in the file of the above-identified application. (MPEP 1893.03(g))

III. CONCISE EXPLANATION OF THE RELEVANCE (check at least one box)

A. ☒ Except as may be indicated below in (B), all of the patents, publications or other information are in the English language (concise explanation not required).

B. ☒ A concise explanation of the relevance of each patent, publication or other information listed that is not in the English language is as follows (see 37 C.F.R. § 1.98(a)(3)):

1. ☒ See the attached foreign patent office communication from a counterpart foreign application: ***Translation of Japanese Office Action mailed September 13, 2011 in corresponding Japanese Application No. 2008-297336***
2. ☐ English abstract is provided for:
3. ☐ Other:

C. ☒ The following additional information is provided for the Examiner's consideration. ***JP5-278738, JP8-500547, JP2001-114912, JP2000-169611 and JP7-10148 listed in the Japanese Office Action were cited in an Information Disclosure Statement on September 3, 2008 in this application.***

IV. CROSS REFERENCE TO RELATED APPLICATION(S)

A. ☐ The Examiner is advised that the following co-pending application(s) contain(s) subject matter that may be related to the present application. By bringing this (these) application(s) to the Examiner's attention, Applicant(s) does(do) not waive the confidentiality provisions of 35 U.S.C. § 122.

Serial No.	Filing Date	Art Unit

V. THIS IDS IS BEING FILED UNDER

A. ☐ 37 C.F.R. § 1.97(b): (check only one box)

1.☐ within three months of the filing date of a national application other than a continued prosecution application under 37 C.F.R. § 1.53(d) (37 C.F.R. § 1.97(b)(1)). No fee or certification is required.

2. ☐ within three months of the date of entry of the national stage as set forth in 37 C.F.R. §1.491 in an international application (37 C.F.R. § 1.97(b)(2)). No fee or certification is required.

3.☐ before the mailing of a first Office Action on the merits (37 C.F.R. § 1.97(b)(3)). No fee or certification is required. In the event that a first Office Action on the merits has been issued, please consider this IDS under 37 C.F.R. § 1.97(c) and see the certification under 37 C.F.R. § 1.97(e) below; or, if no certification has been made, charge our deposit account a fee in the amount of $180.00 as required by 37 C.F.R. § 1.17(p).

4. ☐ before the mailing of a first Office Action after the filing of a request for continued examination under 37 C.F.R. § 1.114. No fee or certification is required.

B.☐ 37 C.F.R. § 1.97(c): (check only one box)

☐ before the mailing date of either any Final Office Action under 37 C.F.R. § 1.113, a Notice of Allowance under 37 C.F.R. § 1.311, or an action that otherwise closes prosecution.

1. ☐ No certification; therefore, a fee in the amount of $180.00 is required by 37 C.F.R. § 1.17(p).

2. ☐ See the certification below. No fee is required.

C. ☒ 37 C.F.R. § 1.97(d):

☒ after the mailing date of either a Final Office Action under 37 C.F.R. § 1.113 or a Notice of Allowance under 37 C.F.R. § 1.311, yet on or before payment of the issue fee.

1. ☒ See the certification below. A fee in the amount of $180.00 is required by 37 C.F.R. § 1.17(p).

VI. <u>CERTIFICATION UNDER 37 C.F.R. § 1.97(e):</u> (check <u>only</u> one box)

The undersigned hereby certifies that:

A. ☒ each item of information contained in this IDS was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this IDS (See 37 C.F.R. § 1.97(e)(1)). <u>See further statement under 37 C.F.R. § 1.704(d) below in section VII, if applicable</u>; <u>or</u>

B. ☐ no item of information contained in this IDS was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the undersigned after making reasonable inquiry, no item of information contained in this IDS was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of this IDS (See 37 C.F.R. § 1.97(e)(2)).

C. ☐ Some of the items of information were first cited in a communication from a foreign patent office. As to this information, the undersigned hereby certifies that each item of information contained in this IDS was cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this IDS. As to the remaining information, the undersigned hereby certifies that no item of this remaining information contained in this IDS was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the undersigned after making reasonable inquiry, no item of information contained in this IDS was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of this IDS.

VII. <u>STATEMENT UNDER 37 C.F.R. § 1.704(d)</u>

The undersigned hereby states that:

☐ each item of information contained in this IDS was cited in a communication from a foreign patent office in a counterpart application and this communication was not received by any individual designated in 37 C.F.R. § 1.56(c) more than <u>thirty days</u> prior to the filing of this IDS.

VIII. <u>PAYMENT OF FEES</u> (check <u>only</u> one box)

A. ☐ No fee is believed to be due in light of the above-noted status or above-provided certification.

B. ☒ A check in the amount of $180.00 is enclosed for the above-identified fee.

C. ☐ Please charge Deposit Account No. 08-0750 in the amount of $180.00 for the above-indicated fee. A duplicate copy of this paper is attached.

The above references are being cited only in the interest of candor and without any admission that they constitute statutory prior art, contain matter which anticipates the invention, or which would render the same obvious, either singly or in combination, to a person of ordinary skill in the art. Furthermore, this Information Disclosure Statement shall not be construed as a representation that a search has been made.

If it is determined that this IDS has been filed under the wrong rule, the PTO is requested to consider this IDS under the proper rule (with a petition if necessary) and charge the appropriate fee to Deposit Account No. 08-0750.

Please charge any additional fees or credit any overpayment pursuant to 37 C.F.R. §§ 1.16 or 1.17 to Deposit Account No. 08-0750.

Respectfully submitted,

HARNESS, DICKEY, & PIERCE, P.L.C.

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DJD/EGH:cfc

Enclosures:
☒ Form PTO-1449(s) (1 sheet(s))
☒ Document(s)
☒ Fee
☒ Other: Translation of Japanese Office Action mailed September 13, 2011 for Japanese Application No. 2008-297336

FORM HDP-1449 (Based on Form PTO-1449) **PATENT AND TRADEMARK OFFICE** **INFORMATION DISCLOSURE CITATION** (Use several sheets if necessary) Sheet 1 of 1	ATTORNEY DOCKET NO. 12480-000055/US/DVA	SERIAL NO. **12/230,691**
	APPLICANT Akio OZASA et al.	
	FILING DATE September 3, 2008	GROUP 1791

OPAP IAP3
NOV 08 2011
PATENT & TRADEMARK OFFICE

U.S. PATENT DOCUMENTS

Ref. Desig.	Examiner's Initials	Document Number	Date	Name	Class/ Subclass	(If appropriate) Filing Date

FOREIGN PATENT DOCUMENTS

Ref. Desig.	Examiner's Initials	Document Number	Date	Country	Class/ Subclass	Translation Yes	No
		WO/01/60898 A1	08/23/2001	PCT			

OTHER DOCUMENTS (including Author, Title, Date, Pertinent Pages, etc.)

Ref. Desig.	Examiner's Initials	
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1307956

Examiner:	Date Considered:

EXAMINER: Please initial if citation considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 01/60898 A1

(54) Title: A SHEET AND PRODUCT BASED ON FOAMED SHAPED STARCH

(57) Abstract: Materials in the form of foam sheet comprising destructured or complexed starch expanded as a continuous phase, having a density lying between 20 and 150 kg/m^3, cell dimensions in the range lying between 25 and 700 μm and with a cell distribution such that 80 % of them have a dimension lying between 20 and 400 μm in the absence of stretching.

A sheet and product based on foamed shaped starch

Background of the invention

The present invention relates to partly-finished products such as sheets of different thicknesses and profile based on destructured and/or complexed starch, expanded by means of an extrusion process, which can be used as such, variously treated, as biodegradable products and which can be formed at the output of the extrusion head or in a subsequent stage, and to products formed there from.

Starch-based products according to the invention are particularly suitable for use in the packaging sector.

The use of plastics materials such as polystyrene, polyurethane, polyethylene and polypropylene has until now dominated in the packaging sector; however, the problems of disposal associated with these products is opening new prospects for starch-based material in that they are biodegradable and from renewable sources, in particular in the foam materials sector.

The state of the art shows various approaches to the formation of foamed starch-based products. However, because of the nature and characteristics of starch it appears at present problematical to succeed in obtaining starch-based foamed products with optimum properties in terms of dimensions and cell distribution, and density of the partly-finished product such as to permit the conversion of the partly-finished product in a regular manner at an industrial rate into a competitive product as far as weight and performance is concerned, in particular as far as the aspect of fragility of the product at hinge points is concerned. This is particularly true for the preparation of starch-based foams utilised for the formation of sheets and associated moulded items.

In particular, no starch-based partly-finished product is yet available on the market with starch in continuous phase, which is able to be shaped using an industrial process, with optimum properties in terms of dimensions, cell distribution and density such as to render the resultant product resilient, in particular in the hinge regions even after successive bending.

In effect, whilst much attention has until now been directed to research and making available various starch-based compositions comprising combinations with various synthetic polymers and additives, the problem of making available extrusion and foaming processes which make it possible to arrive at the production of foamed products having well determined properties such as homogeneity of the foamed structure, surface smoothness, and low fragility of the foamed workpieces has received limited attention.

Starting composition

The products according to the invention are obtained from starting compositions supplied to the extruder containing starchy material, water in percentages lying between 4 and 30 percent wt. of the total composition, possibly a thermoplastic polymer and possibly further additives such as plasticizers, lubricants, surfactants, weak acids etc. As far as the components of the starting composition are concerned, the contents of the European Patent Application

EP/0 696 611 are incorporated into the present application by reference.

In particular, the present invention relates to foamed, partly-finished products such as sheets of various thickness and profile which can be used themselves as products, and associated shaped on formed products comprising destructured and/or complexed starch as continuous phase in the partly-finished product and the finished product itself.

As far as the starch material is concerned, this can be both crude and modified starch or a mixture of these. The use of potato, wheat, maize and tapioca starch is preferred. As far as modified starches are concerned, these can be physically and chemically modified, for example ethoxylated starches, acetate starches, butyrate starches, propionate starches, hydroxypropylated starches, cationic starches, oxidated starches, cross-linked starches, gelatinised starches, starches complexed with molecules and/or polymers able to give "V" type complexes, dextrinated starches and starches grafted with chains such as polyesters, polyurethanes, polyesters-urethanes, polyureas, polyesters-ureas, polysiloxanes, silanes, titanates, fat chains and so on. The preferred chemically or physically modified starches are those with any kind of modification, which have an intrinsic viscosity, measured in DMSO at 30° C, lying between 2 dl/g and 0.6 dl/g, preferably between 1.5 dl/g and 0.8 dl/g, and more preferably between 1.3 dl/g and 1 dl/g.

It is intended that flours and meals resulting from the discharge from mill workings lie within the invention.

The term destructured starch is intended to mean a starch which has been treated thermally above the glass transition temperature and fusion temperature of its components to obtain the consequent disordering of the molecular structure of the starch grains and to render it thermoplastic. Reference is made in this respect to patens EP 118240 and EP 327505.

Complexed starches on the other hand mean a starch where the amylose component is partially or entirely engaged in the formation of "V" type complexes (single helix structures) which have second derivative X-ray spectral and FTIR characteristics.

With reference to the thermoplastic polymer, polymers having a melting point or glass transition point lying between 60 and 175 ° C are particularly relevant for the products according to the present invention, and in particular those having such points lying between 70 and 110 ° C.

In particular usable polymers are selected from:

- polymers of natural origin, which can be both modified and non-modified, in particular those derived from cellulose such as cellulose acetate, cellulose propionate, cellulose butyrate and their co-polymers, with a degree of substitution lying between 1 and 2.5; polymers of the alkyl cellulose type, hydroxyalkyl cellulose, carboxyalkyl cellulose, in particular carboxymethyl cellulose, nitrocellulose and chitosane, pullulan or casein and caseinate, zein, soya protein, alginic acid and alginates, natural rubbers, polyaspartates, gluten;

- biodegradable polymers of synthetic or fermentative origin, in particular polyesters, such as polymers or co-polymers, of C_2-C_{24} aliphatic hydroxyacids, or their corresponding lactones or lactides, in particular polymers of lactic acid having various D/L lactic acid ratios, and preferably with a D-lactic content comprised between 4 - 25% mole, co-polymers of polylactic acid with aliphatic polyesters and aromatic-aliphatic polyesters, polycaprolactone, polyvalerolactone, their co-polymers and polyesters derived from difunctional acids and aliphatic diols, aliphatic-aromatic polyesters, in particular co-polymers of the alkylene-terephthalate adipate type whether treated or not with chain extenders, preferably with quantities of terephthalic acid less than 40 mole percent, preferably less than 30% mole, epoxy resins in general and bisphenolic resins in particular;
- polymers able to interact the starch to form complexes, that is to say polymers which contain hydrophilic groups intercalated with hydrophobic sequences, for example, ethylenevinyl alcohol co-polymers, ethylenevinyl acetate co-polymers, acrylic esters, ethylene acrylic ester co-polymers, co-polymers of ethylene with unsaturated acids such as acrylic acid, methacrylic acid, crotonic acid, itaconic acid; co-polymers having alcoholic and carboxylic functional groups aliphatic polyesters and/or aliphatic-aromatic polyesters, epoxy resins including those containing bisphenol resins;
- polymers forming hydrogen bonds with starch, in particular, polyvinyl alcohols of varying degrees of hydrolysis, possibly modified as acrylates or methacrylates and polyvinyl alcohols preliminarily plasticised or modified for the purpose of lowering the melting point.

Preferred thermoplastic polymers are the polyvinyl alcohols, co-polymers of an olefinic monomer, preferably ethylene, with a monomer chosen from vinyl alcohol, vinyl acetate, acrylic acid and methacrylic acid, aliphatic polyesters derived from caprolactone, polyalkylenesuccinates, polymers of azelaic acid, sebacic acid, brassilic acid and their co-polymers, aliphatic polyamides, polyalkylenesebacates, polyalkylene-azelates, polyalkylenebrassilates, in particular with diols comprised between C_2-C_{13}, polyesters containing dimeric acids, aromatic-aliphatic polymers of the polyalkylene terephthalate adipate type and the epoxy resins, particularly with bisphenolic groups.

The extruded foamed partly-finished product according to the invention further preferably contains a nucleating agent. The use of a suitable nucleating agent in fact makes it possible to increase the homogeneity of the cells of the sheet. The quantity of nucleating agent utilised in the course of the process depends on the process conditions and the desired morphology for the extruded, partly-finished product. Preferably, the quantity of nucleating agent with respect to the starting composition lies in the range between 0.05 and 10 % by weight, preferably between 0.5 and 7 % and more preferably between 1 and 5 %.

Usable nucleating agents are, for example, inorganic compounds such as talc (magnesium silicate), calcium carbonate, sulphates such as sodium and barium, titanium dioxide etc, possibly surface treated with adhesion promotors such as silanes, titanates, etc. Organic fillers and fibres such as wood powder, cellulose powder, grape residue, bran, maize husks, other natural fibres in concentrations between 0.5 and 20% may also be utilised. Further, substances able to be dispersed and/or to be reduced in lamellas with submicronic dimensions, preferably less than 500 µm, more preferably less than 300 µm, and even more preferably less than 50 µm may be utilised in order to improve stiffness, water and gas permeability, dimensional stability. Particularly preferred are zeolites and silicates of various kind such as wollastonites, montmorillonites, hydrotalcytes functionalised with molecules able to interact with starch. Particularly preferred are submicronic particles of complexed starch also with specific functional groups introduced by virtue of silanes, titanates and other.

The starting compositions can moreover contain suitable additives such as lubricating agents and/or dispersants, flame retardants, colorants, plasticising agents, fillers etc. In particular, food oils such as palm, maize, soya, sunflower oil are particularly good, as are fatty acids from C_{12} to C_{22} and their glycerides with various degrees of substitution and in particular synthetic hydrogenated fats or fats of animal origin which are solid at least at ambient temperatures and, preferably, above ambient temperature to improve the moisture resistance and reduce wetability. It is also possible to use weak acids such as lactic, tartaric, citric acid etc to regulate the viscosity of the starch during the extrusion, and plasticizers such as glycerine, sorbitol, mannitol, pentaerithritol, and derivatives thereof, esters of citric acid and their derivatives.

The starting composition can be supplied directly to the extruder or can be supplied in the form of preliminarily extruded or pelletised granules.

Process for the production of the sheet

The foamed, partly-finished product according to the invention is prepared by means of a process of extrusion of the basic starch composition effected by means of particular extruders such as slow twin screw extruders or two single screw tandem extruders in cascade or their combination, in such a way as to guarantee significantly long dwell times for the purpose of optimising the viscosity of the starchy material and the homogenisation of the nucleating agents and mixing of the foaming agents in the molten mass. In particular the use of a slow twin screw extruder is preferred.

In the performance of the extrusion process the extrusion temperature can vary as a function of the particular formulation and the desired properties of the partly-finished product and the finished product. The temperature control of the molten mass is therefore significant for obtaining products with specific characteristics.

The temperature of the molten mass in the course of the extrusion process can generally vary along the profile of the screw from 50 to 230° C, preferably between 60 and 210° C and more preferably between 70 and 200° C.

The foaming of the thermoplastic products according to the invention is achieved by the use of a suitable mixture of physical foaming agents which can also contain chemical foaming agents. In particular the use of CO_2 in gaseous form is preferred, in combination with water or CO_2 in gaseous form in combination with water and other physical and chemical foaming agents. Among the chemical foaming agents can be taken into consideration, among others, citric acid, bicarbonate and their combinations.

The foaming agent is preferably supplied to a region of the extruder in which the starting composition supplied to the extruder is present in the molten state. In particular the foaming agent is supplied to an advanced region of the extruder in such a way that the extrusion process is not altered by the phenomenon of regurgitation of the molten mass towards the extruder feed zone.

The CO_2 is supplied in concentrations greater than 0,4%, preferably greater than 0,8%, with respect to the total composition fed to the hopper, to a region where the melt is at a temperature lying between 100° C and 200° C, preferably between 130° C and 190° C. The mixture of CO_2 and H_2O and the specific concentrations are determining factors for the low density and the cell structure.

The quantity of CO_2 can vary in a range lying between 0,4% and 10% by weight, preferably between 0,8% and 7% and more preferably between 1% and 4% by weight. The CO_2 is added to the melt. The total water content of the composition fed to the hopper of the extruder for the expansion is lying between 4% and 30% by weight, preferably between 8% and 20% and more preferably between 10% and 18% by weight.

The extruder can be completed by extruder heads of the flat or tubular type; tubular heads are particularly preferred.

Preferably the configuration of the head of the extruder is such as to guarantee a homogeneous supply to the nozzle. With the starting compositions of the foam sheet according to the invention this problem is relevant since small variations of shear rate can generate significant variations in the local viscosity, with consequent alterations in the foaming process and therefore manifest irregularities in the sheet in terms of thickness thereof, cell dimensions, presence of preferential flow etc.

The head of the extruder is therefore preferably configured in such a way as to cancel the elastic memory of the material and, at the same time, not create any foam before the entry of the material into the nozzle. The preferred extrusion shear rate ranges for the sheet are between 500 and 50,000 sec^{-1}, preferably between 800 and 40,000 sec^{-1}, and more preferably between 900 and 35,000 sec^{-1}.

At the output from the extrusion head, and before the forming process, the foamed sheet according to the invention can be laminated with layers of non-woven fabric, textile, paper, biodegradable and non-biodegradable films, or aluminium. As far as the non-woven or textile fabrics are concerned these can be made of natural fibres, such as, for example, fibres of jute, cotton, wool, fibres based on polysaccharides such as, for example, cellulose acetate, starch acetate, viscose etc, or fibres produced from biodegradable polymers and in particular aliphatic polyesters such as polylactic acid, polycaprolactone, polyalkylene carboxylate with dialcohols and diacids selected from the linear range C_2-C_{13} and/or cycloaliphatic, aliphatic-aromatic polyesters, in particular of the family of terephthalate polyalkylene adipates and their co-polymers, particularly with a terephthalic acid content less than 55% with respect to the amount of terephtalic acid + adipic acid, polyamides in particular based on caprolactam, aliphatic amines etc, aliphatic polyurethanes, polyester-urethanes, polyurea, and epoxy resins. The above biodegradable polymers can be utilised also in the form of films for lamination or coating.

The films are generally coupled to the sheet through temperature and/or the application of suitable biodegradable adhesives based on polymers, lactic acid, polyurethanes, polyvinyl acetates and polyvinyl alcohol, proteins such as casein and glutens, starches and other polysaccharides, hot melts particularly based on aliphatic polyesters.

The films can be obtained by casting or bubble film-forming and can be co-extruded with an adhesive surface for the foam support. Films with a melting point greater than 60° C, preferably greater than 80° C, and more preferably greater than 100° C, are preferred.

The partly-finished product coupled to film can be used unformed, as the sheet as such, or in a foaming or shaping process to form finished products.

For the coating it is possible to utilise emulsions, solutions or dispersions of the type described in European patent EP 696612 for the treatment of expanded particles, considered included within the present invention. Natural and synthetic waxes can also be utilised, with melting points up to 120° C depending on the application. In this case the treatment can be before or after the forming or shaping stage.

The foam sheet may also be co-extruded with expanded layers of other starch based materials so to have differentiated properties between the inside and the outside of a multiplayer or it may be co-extruded with layers of materials having lower hydrophilicity such as the polyesters above mentioned for the laminated films.

The foam sheet according to the invention must be obtained starting from a homogeneous molten mass in which the nucleating agents and the gas and/or vapours are homogeneously dispersed throughout the molten mass. For this the dwell times in the extruder must lie between 5 and 40 minutes, preferably between 10 and 35 minutes, and more preferably between 15 and 25 minutes.

The foam sheet can be controlled in thickness by the extrusion conditions and calendering.

In the case of tubular sheet the head can be provided with air or steam blowing systems from within, as in the case of bubble film-forming, or orientation by air or steam blowing to distend the sheet and give it a biaxial stretch, avoiding or regulating the formation of waves. The sheet can have a thickness lying between 0.5 mm and 15 mm, preferably between 1,0 mm and 10 mm. The thickness of the partly-finished product can be achieved by stretching and calendering the sheet.

The foam sheet may be corrugated and the corrugations may be exploited in order to increase the cushion properties of the foam. The corrugations may have different width and height. The height, which corresponds to the thickness of the resulting panel, may be about the double of the foam sheet thickness. The frequency of the corrugations may reach 350 per linear metre.

Sheets of this type can be combined together in multi layers, forming different geometries for different products in the packaging sector such as sheets and expanded blocks of high resilience, corners or protection containers. Specific examples of the sectors suitable for application are those of electrical domestic equipment, electronic products, the food sector, pharmaceuticals, design and furniture, mail order, and envelopes for couriers. The sheets can be utilised also in combination with other supports to form multi layers mixed with wood, paper, cardboard, textiles of natural and synthetic fibres, aluminium and other metals. In particular, the products of this type can be directly anchored to the piece to be packaged, exploiting their characteristic adhesiveness upon moistening or, preferably, with hot melts or melts to be sprayed.

Products obtained from coupling sheets or formed products can be protected by an external film to increase performance.

Products can also be rolls and tubes obtained by winding and gluing sheets, or by directly extruding tubes. Rolls and tubes can be utilised as supports for toilet paper, kitchen paper or other types or may be used as protection for cylindrical things such as bottles and others.

Process for forming the sheet

Forming can be achieved by a continuous process or by a batch process.

The production of expanded products according to the invention by means of continuous processes provides for the extrusion/calendering phase, a possible conditioning phase and the forming phase to be consecutive. The production of foamed products according to the invention by means of batch processes provides for the extrusion/calendering phase with winding of the sheet into coils or collection in sheets; the partly-finished products can them be conditioned and formed in a second phase.

In a continuous foaming process it is envisaged that the partly-finished product in the form of sheet from the extruder would be maintained at a temperature not less than 40° C, and preferably not less than 80 ° C and having a water content lying between 6 and 30% by weight, preferably between 10 and 25% by weight and more preferably between 15 and 20% by weight. The temperature of the sheet must not exceed 150° C and preferably 100° C.

In particular, if synthetic components are present, the forming temperature must be close to the glass transition temperature or the melting point of the thermoplastic polymer.

It is also possible to form the partly-finished product by a batch process by subjecting it to a preliminary conditioning process for the water content and temperature range referred to above for continuous processes.

The conditioning stage can immediately precede or be coincident with the forming station.

Products even of complex form, provided with particular, even aesthetic, characteristics such as, for example, the clam shell illustrated in Figure 1, can be obtained with a forming process at ambient temperature, and in any event at temperatures not greater than 100° C, between abutting male and female mould to define the maximum level of compression and the final minimum thickness of the product.

A die for the forming of the clam shell of Figure 1 with the foam sheet according to the present invention is illustrated, as a way of example, in Fig. 2. Male (10) and female (11) may be designed in such a way that they do not get in touch just next to the lateral walls of the clam shell. Such room between male and female allows the slipping of the foam sheet without tears during the forming.

The process forming the subject of the invention, together with the characteristics of the partly-finished product generally allow forming cycles less than 20 seconds, preferably less than 10 seconds and more preferably less than 7 seconds. With reference to the forming process, the parameters relating to the water content and temperature are critical for the achievement of a good formability of the partly-finished product. The loss of water vapour from the partly-finished product at the outlet from the extruder nozzle in fact makes it necessary to exercise a strict control on the level of removal of water for the purpose of avoiding both phenomena of collapse and phenomena of excessive drying.

Forming can take place in moulds or dies at ambient temperature on expanded but unopened tubular sheets. This system makes it possible simultaneously to mould two layers of sheet per mould, limiting the problems of drying of the sheets. If the tubular sheets are conveniently offset from one another it is possible to obtain a surface of the product having an aspect similar to the surface weave of a fabric.

Forming is normally conducted on an opened tube. In this case the water content is regulated by utilising a conditioning station which uses steam.

Characteristics of the sheet

The material which constitutes the partly-finished product or foamed sheet forming the subject of the present invention has an intrinsic viscosity in DMSO at 30° C lying between 1.5 and 0.3 dl/g, preferably lying between 1.2 and 0.4 dl/g and more preferably between 1 and 0.6 dl/g.

In expanded partly-finished products according to the invention the cell dimension can vary in a range lying between 25 and 700 μm and preferably between 40 and 600 μm (as determined by microscopic inspection).

The expanded partly-finished product has closed cell morphology in which the cells are substantially non communicating with one another, which is different from the open cell morphology in which the cells are largely interconnected with one another.

The partly-finished product can have a density lying between 20 and 150 kg/m^3, preferably lying between 25 and 100 kg/m^3, more preferably between 30 and 70 kg/m^3.

The foam structure of the sheet is characterised by a cell distribution in which 80% of the cells present, in the absence of stretching, have a dimension lying between 20 and 400 μm, preferably between 25 and 300 μm and more preferably between 30 and 200 μm.

When a stretch is applied to the sheet the cells can, however, be subjected to an orientation with thinning of the wall.

Also within the scope of the present invention is a sheet with optimised resilience properties, a density characteristic lying between 30 and 70 kg/m^{3}' and with an average cell dimension between 80 and 120μm.

Products forming the subject of the present invention are principally used in the food packaging sector and in particular as trays for food with a lifetime of the order of 30 days, for the packaging of meat, milk products, vegetables, eggs and fruit; holders for packages of glass, plastics or metal of very small dimensions, containers for fast food such as containers for hamburgers, potato chips and similar products; multi compartment containers for foods, known also as lunch boxes, cups for coffee and other hot or cold drinks for fast food and meals.

The formed products of the present invention are also used as containers for objects of small weight such as multi-compartment trays for portable telephones and small electrical domestic appliances in particular, with mechanical properties such as to avoid phenomena of abrasion encountered with containers of pressed paper etc.

In the case of food applications where liquids at high or low temperatures are to be expected, the containers can be co-extruded or coupled to another layer of foam or polyester film and/or cellulose acetate and/or starch or other polymer resistant to liquids at the temperature which will be experienced in use. In particular films of aromatic-aliphatic polyester type can be utilised and, specifically, polyalkylene terephthalate adipates, alkylene butyrates, polyalkylene succinates, polyalkylene sebacates, polyalkylene azelates, polycyclic alkylene dicarboxylates, in particular polyhexyldimethyldicarboxylates, olycyclohexyldicarboxylates. If it is necessary to absorb liquids as in the case of packaging for meat it is possible to consider the use of superabsorbent material which can inserted directly into the sheet, applied to the surface or in intermediate layers between two shells welded together or under the film which makes the tray impermeable.

Also to be considered the subject of the present invention are products formed for ovens and microwaves, possibly characterised by treatments with water-repellent coatings to avoid drying of the container during the cooking phase.

Characteristics of the formed products

Formed products according to the invention have a closed cell structure with a relatively low density lying between 40 and 400 kg/m^3, preferably between 45 and 200 kg/m^3 and more preferably between 50 and 150 kg/m^3.

Products formed according to the invention further have good properties of flexibility, in particular in the hinge region, thanks to the fine and homogeneous morphology of the cells. Such products also have a very good uniform surface.

Hinges, such as for examples the one numbered as 12 in Figure 2, can be produced in products obtained in the forming phase, by forming ribs of the type used for cardboard hinges, are resistant to at least ten (preferably > 20) consecutive opening at 180°/closing cycles at 35% RH and 23°C without breakage, using about 2-4 seconds for each opening at 180°/closing operation, and preferably at least 100 consecutive opening and closing cycles at 40% RH and 23°C without breaking, using about 2-4 seconds for each opening/closing cycles.

The good properties of flexibility can be tested also with a dynamometer with a climatic cell adapted to adjust the temperature and relative humidity at the above values. Samples of 25 x 10 cm with an hinge at the middle of their length can be submitted to opening/closing cycles from 0 to 180° with a velocity of in the range of 3000 - 10,000 mm/min of the mobile bar of the dynamometer.

Examples

The invention is further illustrated by means of the following examples provided by way of illustrative and non-limitative example of the invention itself.

Example 1

A mixture was prepared having the following composition:

- 88.9% of destructured potato starch with an intrinsic viscosity in DMSO at 30°C of 1.1 dl/g and the water content of 14%.

- 8.9% by weight of polyvinylalcohol
- 1.8% by weight of talc
- 0.35% by weight of glycerol
- 0.36% by weight of loxial G10
- 2% by weight of water.

The composition was supplied to a slow twin screw extruder with co-rotating screws having a diameter (d) = 113.8 mm and

L/D ratio = 19:1. At the end of the extruder was mounted an extrusion head for a tubular sheet with a diameter of 100 mm and lip opening of 0.5 mm. The dwell time of the melt in the extruder was about 20 minutes.

In addition to the water contained in the feed mixture, a further 1% by weight of CO_2 was also added to the molten mass as a further expansion agent, at a feed pressure equal to 37 bar. The CO_2 was introduced at the level of the eleventh diameter of the screw.

The operating conditions were as follows:

- RPM : 16
- Temperature profile (°C) : 95/120/120/150/180/180/185/190/197
- Feed rate : 54 kg/h
- Lip shear rate : 912 sec^{-1}

The foamed sheet obtained had a density of 56 kg/m^3 and a cell dimension lying between 40 and 170 μm, the average value of the cell dimension was 81 μm.

The intrinsic viscosity of the material constituting the sheet, taken in DMSO at 30°C, is 0.68dl/g.
The sheet was wound in a coil.

Example 2

A mixture was prepared having the following composition:

- wheat starch	34.4% (12% H_2O)
- potato starch	34.4% (16% H_2O)
- polyvinylalcohol	13.5%
- H_2O	17.4%

- Monoglyceride oleic acid 0.3%

This mixture was supplied to a twin screw APV 2080 extruder having a diameter (d) = 80mm and L/D ratio = 40. It was operated in the following conditions:

- RPM : 285
- Temperature profile:
  50/75/75/180/180/170/170/175/175/165/165/155/155/145/120

Degassing was regulated in such a way as to maintain in the granules a total water content of about 14.5%. The intrinsic viscosity of the pellets was 1.98 dl/g.

The granules thus obtained were mixed with 2.5% of talc having an average particle diameter of about 1.5 μm and supplied to a slow twin screw extruder with co-rotating screws having a diameter (d) = 113.8 mm and L/D ratio = 19:1 with an extrusion head for tubular sheet of 100 mm in diameter and 0.4 mm of lip separation, operating in the following conditions:

- RPM :14
- Temperature profile (°C):
  90/120/120/140/165/165/170/186/186
- Feed rate : 50 kg/h
- Shear rate : 1360 sec^{-1}

To the molten mass was added, as a further expanding agent, CO_2 in quantities equal to 1.5% by weight at a feed pressure equal to 40 bar.

The tubular sheet obtained had a thickness equal to about 3 mm a density of 70 kg per m^3 and an average cell dimension equal to 90 μm (minimum/maximum cell dimension = 10/290 μm). The water content of the sheet was equal to about 1.8% by weight and the intrinsic viscosity of the material constituting the sheet was m = 1.1 dl/g.

Example 3

The tubular sheet obtained by the example 2 was opened by subjecting it to a calendering and steam conditioning process until it had a water content in the sheet equal to 15 %. The forming was achieved by means of a suitable mould, such that illustrated in figure 2, of the male-female type for hinged trays of the clam shell type suitable for fast food products.

Forming was conducted with dies at ambient temperature on the sheet maintained at a temperature about 80°C by applying a pressure of 6 kg/cm^2. The moulding cycle was about 6 seconds and the product thus obtained had a thickness equal to about 1.6 mm and a density in the bottom wall of 165 kg/m^3.

In particular, the product obtained was constituted by two asymmetrical valves having a length of 12.5 cm connected by a hinge 10 cm wide. This hinge zone had particular properties of mechanical strength. After 20 successive bendings for a time of 3 seconds (corresponding to about 5000 mm/min) for opening/closure cycles at 35% RH and 23° C it continued to perform its function.

The product obtained also had a very smooth surface constituted by super-imposed flattened ribs which confer on the product a pleasing aesthetic aspect.

Example 4

The coiled sheet obtained according to example 1 was maintained at a water content of 14%. To the sheet was applied a film of 14 μm of polybutyleneterephthalate-adipate containing 33% by mole of terephthalate with an intrinsic viscosity in THF of 1.1 dl/g. The sheet with the applied film was brought to 80°C and formed in the mould described in example 3. The container obtained was resistant to water at 80°C for an hour, the time necessary for the temperature to fall from 80°C to 20°C without any collapse or soaking of the foamed starch container.

Example 5

As for example 4, with the single difference of having applied a film of polyethylene sebacate. The tray was perfectly resistant to water without becoming saturated and/or collapse of the starchy product.

Example 6

As for example 4, with the exception of the application of a non-woven fabric of viscose of 30 g/m^2, in place of the polyester film.

Example 7

As for example 4, with the exception that the polyester film was replaced by a foamed sheet of polyethylene sebacate of a density of 80 kg/m^3 and a thickness of 300 μm.

Example 8

As for example 4, with the exception that the film was applied to both sides. The resultant tray was utilised for packaging trials of beef. The results related to the mechanical properties and to the preservation of the meat were comparable to the ones observed for trays made with expanded polystyrene.

Example 9

The tubular sheet obtained according to process of example 1 was formed directly in the conditions of example 3 with a male/female mould in the form of a tray 2.5 cm deep and 15 x 12 cm, to form a double container with a thickness of about 3 mm. The double container was positioned between two films of the type described in example 4, of 10 μm which were welded together forming a bag within which the tray was contained. The film was heat shrunk to form a compact and impermeable product for meat.

Example 10

A mixture was prepared having the following composition:

- 74.3% by weight of potato starch (H_2O 16%)
- 10.0% by weight of Ecoflex EBX 7000 (BASF)
- 0.3% by weight of Loxiol G 10 F
- 15.4 by weight of water.

The composition was supplied to a twin screw extruder APV 2030 with (d) = 30.0 mm and L/D = 40. The operating conditions were as follows:

- RPM :170
- Temperature profile (°C) : 30/100/100/150/160/150/140/130/110 x 8

The degassing step was adjusted so as to have in the pellets a water content of about 13.5-14.5% .

The pellets were then mixed with 2.5% of talc, with particles having mean diameter of 1.5 µm, and subsequently fed to a slow twin screw extruder with co-rotating screws having a diameter (d) = 113.8 mm and L/D ratio = 19:1. At the end of the extruder was mounted an extrusion head for a tubular sheet with a diameter of 100 mm and lip opening of 0.1 mm. The operating conditions were as follows:

- RPM :14
- Temperature profile (°C) : 90/120/140/180/210/210/210/195/196
- Feed rate : 75 kg/h
- shear rate : 31531 sec^{-1}

A further 0.8% by weight, with reference to the fed composition, of CO_2 was also added to the molten mass as a further expansion agent, at a feed pressure equal to 40 bar. The obtained foamed sheet had a thickness of about 5 mm, a density of 81 kg/m^3 (calendered) and a average value of the cell dimension of 86 µm (cell dimension lying between 35 and 188 µm).

CLAIMS

1. A partly-finished product, in particular in the form of a foam sheet material, comprising destructured or complexed starch foamed as a continuous phase, having a density lying between 20 and 150 kg/m^3, cell dimensions in a range lying between 25 and 700 µm with a cell distribution such that 80% of them have, in the absence of stretching, a dimension lying between 20 and 400 µm.

2. A partly-finished product, in particular in the form of a foam sheet material, according to claim 1 having a density lying between 25 and 100 kg/m^3 and cell dimensions in a range lying between 40 and 600 µm and with a cell distribution such that 80% of them have, in the absence of stretching, a dimension lying between 25 and 300 µm.

3. A partly-finished product, in particular in the form of a foam sheet material, according to claim 2 having a density lying between 30 and 70 kg/m^3 and with a cell distribution such that 80% of them have, in the absence of stretching, a dimension lying between 30 and 200 µm.

4. A partly-finished product, in particular in the form of foam sheet, according to claim 3 having a density lying between 30 and 70 kg/m^3 and average cell dimensions lying between 80 and 120 µm.

5. A partly-finished product according to any of claims 1 to 4, in which the starch is natural or modified starch or a mixture of these.

6. A partly-finished product according to claim 5 in which the natural or modified starch is derived from potato, wheat, maize and tapioca.

7. A partly-finished product according to claim 5 wherein the modified starch is physically or chemically modified, particularly ethoxylated starches, acetate starches, butyrate starches, propionate starches, hydroxypropylated starches, cationic starches, oxidated starches, cross-linked starches, gelatinised starches, starches complexed with molecules and/or polymers able to give "V" type complexes, dextrinated starches and starches grafted with chains such as polyesters, polyurethanes, polyesters-urethanes, polyureas, polyesters-ureas, polysi-loxanes, silanes, titanates, fat chains.

8. A partly-finished product according to any of claims 1 to 7, able to form products with hinges obtained in a forming phase capable of resisting at least ten consecutive opening/closing cycles at 35% RH and 23°C without breaking, by using 2 - 4 seconds for each opening and closing operation.

9. A partly-finished product according to any of claims 1 to 8, in which the material from which the foam sheet is made has an intrinsic viscosity in DMSO at 30°C lying between 1.5 and 0.3 dl/g.

10. A partly-finished product according claims 9 in which the intrinsic viscosity in DMSO at 30°C is lying between 1.2 and 0.4 dl/g.

11. A partly-finished product according to claim 10, in which the intrinsic viscosity in DMSO at 30°C is lying between 1.1 and 0.6 dl/g.

12. A partly-finished product according to any of claims from 1 to 11, containing one or more thermoplastic polymers with a melting point lying between 60 and 175°C.

13. A partly-finished product according to claim 12 in which the thermoplastic polymer is a polymer of natural origin which can be modified or non modified, in particular derived from cellulose as cellulose acetate, cellulose propionate, cellulose butyrate and their co-polymers, with a degree of substitution lying between 1 and 2.5; polymers of the alkyl cellulose, hydroxy alkyl cellulose, carboxy alkyl cellulose type, in particular carboxy methyl cellulose, nitrocellulose and chitosan pullulan or casein and casinate, zein, soya protein, alginic acid and alginates, natural rubbers, polyaspartates; glutens, dextrens.

14. A partly-finished product according to claim 12 in which the thermoplastic polymer is a biodegradable polymers of synthetic or fermentative origin, in particular polyesters of the type including polymers or co-polymers of C_2-C_{24} aliphatic hydroxy acids, or their corresponding lactones or lactides, in particular polymers of lactic acid having various D/L lactic acid ratios, co-polymers of polylactic acid with aliphatic and aliphatic-aromatic polyesters, polycaprolactone, polyvalerolactone, their co-polymers and also polyesters derived from difunctional acids and aliphatic diols, aliphatic-aromatic polyesters, in particular co-polymers of the type including alkaline-terephthalate adipate treated or not with chain extenders, preferably with

quantities of tereftalic acid less than forty mole percent, epoxy resin in general and bisphenolic resin in particular.

15. A partly-finished product according to claim 12 in which the thermoplastic polymer is a polymer containing hydrophilic groups intercalated in hydrophobic sequences such as, for example, ethylene-vinylalcohol co-polymers, ethylene vinylacetate co-polymers, acrylic esters, acrylic ethylene-ester co-polymers, co-polymers of ethylene with unsaturated acids such as acrylic acid, methacrylic acid, crotonic acid, itaconic acid, co-polymers with hydrophilic units with a functional alcoholic a carboxylic group in aliphatic polyesters and/or aromatic-aliphatic polyesters, epoxy resins including resins containing bisphenols.

16. A partly-finished product according to claim 12 in which the thermoplastic polymer is a polymer able to form hydrogen bonds with the starch, in particular polyvinyl alcohol with various degrees of hydrolysis, possibly modified with acrylates or methacrylates, polyvinyl alcohol preliminarily plastisized or modified for the purpose of lowering its melting point.

17. A partly-finished product according to Claim 12 containing polymers such as polyvinylalcohol, copolymers of an olefin polymer, preferably ethylene, with a monomer chosen from vinyl alcohol, vinyl acetate, acrylic acid and methacrylic acid, aliphatic polyesters such as caprolactone, the polyalkylene succinates, the polymers of azelaic acid, sebacic acid brassilic acid and their co-polymers, aliphatic polyamides, polyalkylenesebacates, polyalkylene-azelates, polyalkylenebrassilates, in particular with diols comprised between C_2-C_{13}, polyesters containing dimeric acids, aromatic-

aliphatic polymers of the polyalkylene terepthalate adipate type and the epoxy resins, particularly with bisphenolic groups.

18. Partly-finished products according to any of Claims from 1 to 17, containing nucleating agents for the starting composition in concentrations lying in the range from 0.05 to 10% by weight, preferably between 0.5 and 7% and more preferably between 1 and 5%.

19. A partly-finished product according to Claim 18, in which the nucleating agent is constituted by inorganic compositions such as talc (magnesium silicate), calcium carbonate, sulphates of sodium and barium, titanium dioxide, possibly surface treated with adhesion promoters such as silanes, titanates.

20. A partly-finished product according to any of Claims from 1 to 19 containing organic fillers and fibres such as wood powder, cellulose, grape residue powder, bran, maize husks or other natural fibres in concentrations between 0.5 and 20%.

21. A partly-finished product according to any of Claims from 1 to 20, containing nucleating agents, lubricants and/or dispersants and plasticisers.

22. A partly-finished product according to any of Claims from 1 to 21 containing alimentary oils such as palm oil, maize oil, soya oil, sunflower oil, C_{12} to C_{22} fatty acids, their glycerides with various degrees of substitution, and in particular hydrogenated fats of animal or synthetic origin which are solid at least at ambient temperatures, and

preferably above ambient temperatures, to improve the moisture resistance and reduce the wetability by water.

23. A partly-finished product according to any of Claims from 1 to 22 containing weak acids such as lactic acid, tartaric acid, citric acid to regulate the viscosity of the starch during the extrusion process.

24. Products and partly-finished products obtained from the partly-finished products of Claims 1 to 23, obtained by lamination with layers of non-woven fabric, woven fabric, paper, biodegradable and non-biodegradable films or aluminium.

25. Products and partly-finished products according to claim 24 produced by lamination with non-woven fabric or woven fabric of natural fibres, such as for example fibres of jute, cotton, wool, fibre based on polysaccharides such as, for example, cellulose acetate, starch acetate, viscose etc, or fibres produced starting from biodegradable polymers and in particular aliphatic polyesters such as polylactic acid, polycaprolactone, polyalkaline carboxylates with die alcohols and die acids selected from the linear range C_2-C_{13} and/or cycloalophatic, aliphatic-aromatic polyesters, in particular from the family of adipated terraphelate polyalkalines and their co-polymers, polyamides, in particular based on caprolactane, aliphatic amine etc, aliphatic polyurethanes, polyester-urethanes, polyurea, and epoxy resins.

26. Products and partly-finished products according to claim 24 coupled with films constituted by biodegradable polymers and in particular aliphatic polyesters such as polylactic acid, polycaprolactone and/or cycloalyphatics, polyalkaline

carboxylates with dialcohols and diacids selected from the linear range C_2, C_{13}, aliphatic-aromatic polyesters, in particular from the family of adipated terephthalate polyalkylenes and their co-polymers, polyamides, in particular based on caprolactam, aliphatic amines etc, aliphatic polyurethanes, polyester-urethanes, polyureas, epoxy resins obtained by blown extrusion, co-extrusion and/or casting.

27. Products and partly-finished products obtained from the partly-finished products of Claims from 1 to 23, by way of coating with emulsions, dispersions, solutions, hot melts of biodegradable polymers and in particular aliphatic polyesters such as polylactic acid, polycaprolactone, polyalkylene carboxylates with dialcohols and diacids selected from the linear and/or cycloalophatics range C_2-C_{13}, aliphatic-aromatic polyesters, in particular from the family of adipated polyalbylene terephthalates and their co-polymers, polyamides, in particular based on caprolactane, aliphatic amines etc, aliphatic polyurethanes, polyester-urethanes, polyureas, epoxy resins.

28. Products and partly-finished products according to Claim 26, in which the films are coupled to the partly-finished products by temperature and/or the application of suitable biodegradable adhesives based on polymers of lactic acid, polyurethanes, polyvinylactates and polyvinylalcohols, proteins such as casein and gluten, starches, dextrins and other polysaccharides.

29. Products and partly-finished products according to Claims 26 and 28, in which the films can be obtained from

cast and bubble film-forming and can be co-extruded with an adhesive surface for the foamed support.

30. Products and partly-finished products according to Claim 29, in which the films have a melting point greater than 60° C, preferably greater than 80°C and more preferably greater than 100°C.

31. A sheet according to Claim 26 or Claim 28 form able as a non-laminated sheet.

32. Products and partly-finished products obtained from the materials of Claims 1 to 23, treated with natural and synthetic waxes with melting points up to 120°C in depending on their various applications.

33. A process for the production of foam sheet by extruder comprising the steps of:

- supplying to an extruder starch with an intrinsic viscosity lying between 2 and 0.6 dl/g in the presence of water in proportions from 6 to 30% by weight of the total composition, in quantities such as to permit the starchy component constitute the continuous phase of the material, possibly a natural or synthetic thermoplastic polymer and further additives such as plasticisers, lubricants, nucleating agents, surfactants, weak acids and fillers.
- complete melting of the starchy mass
- introduction of CO_2 in quantities lying between 0.4 and 10%, preferably between 0.8 and 7% and more preferably between 1.0 and 4% by weight into the melt at a temperature lying between 100 and 180°C, preferably between 120 and 160°C; and

- working the melt for between 5 and 40 minutes to homogenise the distribution of the mixture of expanding agents, water and CO_2 and, possibly, chemical expanding agents such as citric acid and bicarbonate, and to adjust the viscosity of the composition to between 1.5 and 0.3 dl/g.

34. A process according to Claim 33 in which the extrusion of the melt takes place through a flat or tubular head able to impart to the melt shear rates comprised between 500 and 50,000 sec^{-1} preferably between 800 and 40,000 sec^{-1} and more preferably between 900 and 35,000 sec^{-1}.

35. A process according to Claim 34 in which the extruded tubular sheet is blown with air or steam to impart by biaxial stretch, confer smooth surfaces and hold the sheet at the desired moisture point, opened, calendered, possibly further conditioned and wound on a coil.

36. A process according to Claim 34 in which the tubular sheet is blown with air or steam to distend the sheet itself and hold it at the desired moisture point, opened calendered and cut into flat sheets.

37. A process according Claim 34, in which there is produced a partly-finished product in the form of a tube which is calibrated, conditioned and then collected.

38. A process for forming partly-finished products according to any of Claims from 1 to 32 which comprises:

- conditioning the product or partly-finished product to a water content between 6% and 30% preferably between 10% and 25% and more preferably between 15% and 20% and at a temperature between 40 and 120 °C and preferably between 40 and 100° C,

- forming in a male-female impact mould between ambient temperature and 80° C
- possible creasing to provide a product formed with a density between 40 and 400 kg/m^3 preferably between 45 and 200 kg/m^3 and more preferably between 50 and 150 kg/m^3 possibly having a hinge resistant to repeated closure/opening cycles.

39. Combinations of partly finished product according to any of the Claims 1-32 in multilayer structures to form products of various geometry such as rolls, blocks and foam sheet of significant resilience, corner pieces, protective containers for use in the electrical domestic appliance sectors, or for electronic products, in the food sector, for pharmaceuticals, for design and furniture, for mail order or envelopes for couriers.

40. Combinations of materials according to Claims 1 to 32, with other supports to provide multilayers mixed with wood, paper, cardboard, non-woven fabric, woven fabric of natural or synthetic fibres, aluminium or other metals for use in the packaging sector.

41. Products formed according to Claim 38, used principally in the food packaging sector and in particular as trays for foods with a lifetime of the order of 30 days for packaging meat, dairy products, vegetables, eggs, fruit; display containers for glass, plastic or metal packages of small dimensions, containers for fast food such as containers for hamburgers, potato chips and similar products; multi compartment containers for fast food and meals.

42. Products formed according to Claim 38, used for hot and cold liquids as cups for coffee and drinks, containers for soup of the type used in Asiatic countries and for other products having a high liquid content for fast food and meals.

43. Products formed according to Claim 38, used as containers for objects of small weight such as multi-compartment trays for portable telephones and small electrical domestic appliances, in particular, with mechanical properties such as to avoid phenomena of abrasion encountered with containers of pressed paper etc.

44. Products according to Claim 38, in the form of trays for wrapping meat in supermarkets which provide for the use of absorbent or super absorbent materials for eliminating the presence of blood, fitted directly into the sheet, applied to the surface or in intermediate layers between two shells welded together or under the film which renders the tray impermeable.

45. Products formed according to Claim 38, in the form of containers for oven and microwave use possibly surface treated to avoid excessive weakening of the container by the effect of the removal of the water.

Fig.1

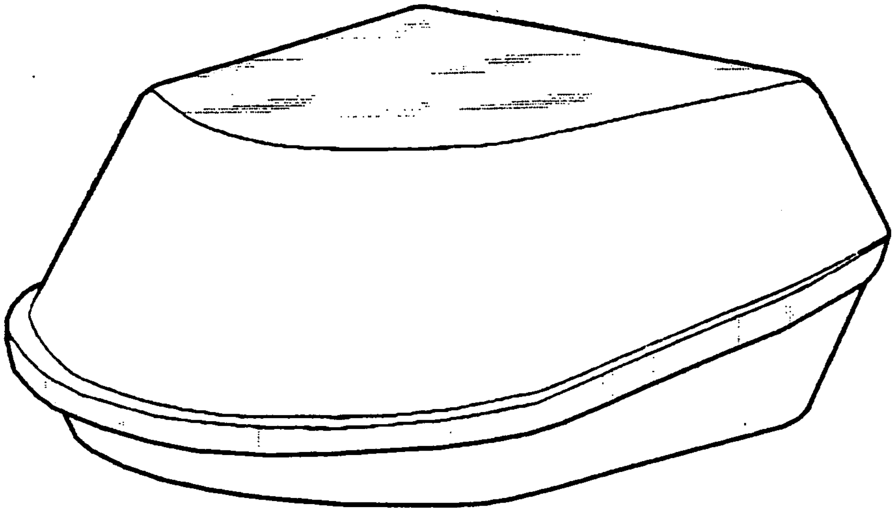
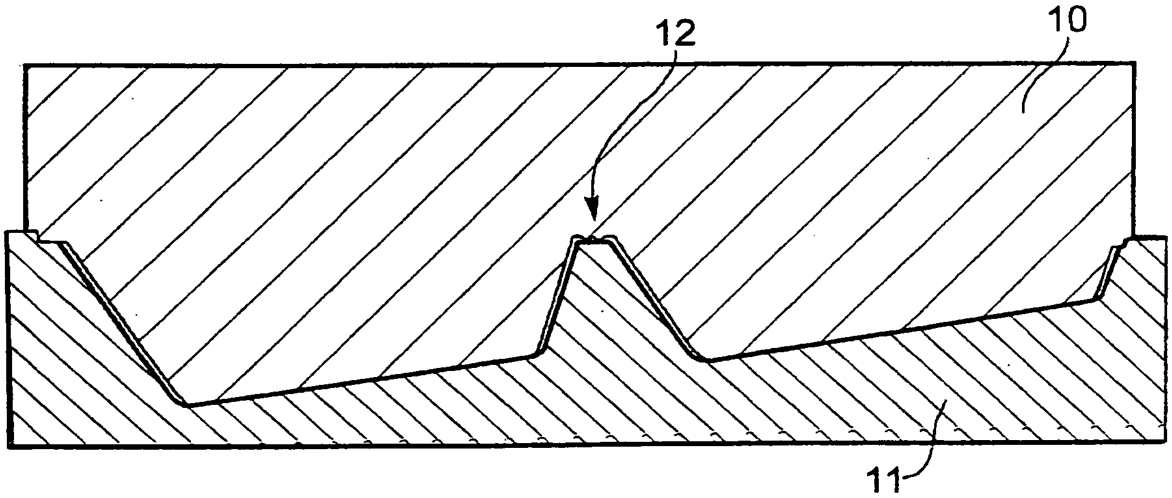


Fig.2



INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 01/01601

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C08J9/12 //C08L3/00

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)
IPC 7 C08J

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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 153 037 A (ALTIERI PAUL A) 6 October 1992 (1992-10-06) column 7, line 9-38 column 4, line 4-44	1-7
A	column 6, line 42-45 claims ---	24
X	US 5 437 924 A (DECKER III WILLIAM C ET AL) 1 August 1995 (1995-08-01) column 2, line 33-60 claims -----	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in 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 document 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 27 July 2001	Date of mailing of the international search report 07/08/2001
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer Oudot, R

INTERNATIONAL SEARCH REPORT

Information on patent family members

In' tional Application No
PCT/EP 01/01601

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5153037 A	06-10-1992	US 4863655 A	05-09-1989
		US 5043196 A	27-08-1991
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/230,691	09/03/2008	Akio Ozasa	12480-000055/US/DVA	3456

30593 7590 07/21/2010
HARNESS, DICKEY & PIERCE, P.L.C.
P.O. BOX 8910
RESTON, VA 20195

EXAMINER	
KHARE, ATUL P	

ART UNIT	PAPER NUMBER
1791	

MAIL DATE	DELIVERY MODE
07/21/2010	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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HARNESS, DICKEY & PIERCE, P.L.C.
P.O. BOX 8910
RESTON, VA 20195

Appeal No: 2010-010024
Application: 12/230,691
Appellant: Akio Ozasa et al.

Board of Patent Appeals and Interferences
Docketing Notice

Application 12/230,691 was received from the Technology Center at the Board on July 19, 2010 and has been assigned Appeal No: 2010-010024.

In all future communications regarding this appeal, please include both the application number and the appeal number.

The mailing address for the Board is:

BOARD OF PATENT APPEALS AND INTERFERENCES
UNITED STATES PATENT AND TRADEMARK OFFICE
P.O. BOX 1450
ALEXANDRIA, VIRGINIA 22313-1450

The facsimile number of the Board is 571-273-0052. Because of the heightened security in the Washington D.C. area, facsimile communications are recommended. Telephone inquiries can be made by calling 571-272-9797 and referencing the appeal number listed above.

By order of the Board of Patent Appeals and Interferences.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/230,691	09/03/2008	Akio Ozasa	12480-000055/US/DVA	3456

30593 7590 07/14/2010
HARNESS, DICKEY & PIERCE, P.L.C.
P.O. BOX 8910
RESTON, VA 20195

EXAMINER	
KHARE, ATUL P	

ART UNIT	PAPER NUMBER
1791	

MAIL DATE	DELIVERY MODE
07/14/2010	PAPER

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APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
12230691	9/3/2008	OZASA ET AL.	12480-000055/US/DVA

HARNESS, DICKEY & PIERCE, P.L.C.
P.O. BOX 8910
RESTON, VA 20195

EXAMINER	
ATUL KHARE	
ART UNIT	**PAPER**
1791	20100713

DATE MAILED:

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Commissioner for Patents

Acknowledgement of Reply Brief
The reply brief filed 29 June 2010 has been entered and considered. The application has been forwarded to the Board of Patent Appeals and Interferences for decision on the appeal.

Conclusion
Any inquiry concerning this communication or earlier communications from the examiner should be directed to ATUL KHARE whose telephone number is (571)270-7608. The examiner can normally be reached on Monday-Thursday 7:30 a.m. - 5:00 p.m. EST. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Christina Johnson can be reached on (571)272-1176. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Christina Johnson/
Supervisory Patent Examiner, Art Unit 1791

/ATUL KHARE/
Examiner, Art Unit 1791

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BIB DATA SHEET

CONFIRMATION NO. 3456

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
12/230,691	09/03/2008 **RULE**	428	1791	12480-000055/US/DVA

APPLICANTS
Akio Ozasa, Inukami-gun, JAPAN;
Akihisa Hashimoto, Inukami-gun, JAPAN;
Shinji Tanaka, Inukami-gun, JAPAN;

** **CONTINUING DATA** *************************
This application is a DIV of 10/505,157 04/28/2005 ABN
which is a 371 of PCT/JP03/01858 02/20/2003

** **FOREIGN APPLICATIONS** *************************
JAPAN 2002-045059 02/21/2002

** **IF REQUIRED, FOREIGN FILING LICENSE GRANTED** **
09/29/2008

		STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
Foreign Priority claimed ☑ Yes ☐ No 35 USC 119(a-d) conditions met ☑ Yes ☐ No Verified and Acknowledged /ATUL P KHARE/ Examiner's Signature	☐ Met after Allowance Initials	JAPAN	23	22	2

ADDRESS
HARNESS, DICKEY & PIERCE, P.L.C.
P.O. BOX 8910
RESTON, VA 20195
UNITED STATES

TITLE
Biodegradable molded article

FILING FEE RECEIVED 1390	FEES: Authority has been given in Paper No.____________ to charge/credit DEPOSIT ACCOUNT No.____________ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other ________________ ☐ Credit

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PATENT AF/Dn

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.: 12/230,691
Filing Date: September 3, 2008
Appellants: Akio OZASA et al.
Group Art Unit: 1791
Examiner: Atul P. Khare
Title: BIODEGRADABLE MOLDED ARTICLE
Attorney Docket: 12480-000055/US/DVA

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Randolph Building
401 Dulany Street
Alexandria, VA 22314
Mail Stop Appeal Brief

June 29, 2010

APPELLANTS' REPLY BRIEF UNDER 37 C.F.R. § 41.41

Sir:

In response to the Examiner's Answer mailed May 3, 2010, Appellants request the appeal be maintained and supply the following arguments in reply under 37 C.F.R. § 41.41(a)(1).

I. STATUS OF CLAIMS

Claims 13-34 are pending, and remain finally rejected, in the current application. Claims 1-12 have been cancelled. Claims 13 and 24 are in independent form. No claim amendments are being filed in conjunction with this request. The claims are rejected as follows:

1. Claims 13, 16, 18-24, 27 and 29-34 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Canadian Patent No. 2,143,432 to Lorcks et al. (hereinafter "Lorcks") in view of U.S. Patent No. 5,861,216 to Doane et al. (hereinafter "Doane") and further in view of U.S. Patent No. 5,639,518 to Ando et al. (hereinafter "Ando");
2. Claims 14 and 15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lorcks in view of Doane and Ando and further in view of U.S. Patent No. 5,153,037 to Altieri;
3. Claims 17 and 28 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lorcks in view of Doane and Ando and further in view of U.S. Patent No. 5,888,599 to Bradt; and
4. Claims 25 and 26 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lorcks in view of Doane and Ando and further in view of U.S. Patent No. 5,888,599 to Shogren.

See, e.g., Final Office Action dated November 17, 2009 ("Final OA").

Claims 13-34 are being appealed. Claims 1-12 have been cancelled.

II. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Review is requested for the rejections of (i) claims 13, 16, 18-24, 27 and 29-34 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Canadian Patent No. 2,143,432 to Lorcks et al. (hereinafter "Lorcks") in view of U.S. Patent No. 5,861,216 to Doane et al. (hereinafter "Doane") and further in view of U.S. Patent No. 5,639,518 to Ando et al. (hereinafter "Ando"), (ii) claims 14 and 15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lorcks in view of Doane and Ando and further in view of U.S. Patent No. 5,153,037 to Altieri, (iii) claims 17 and 28 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lorcks in view of Doane and Ando and further in view of U.S. Patent No. 5,888,599 to Bradt, and (iv) claims 25 and 26 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lorcks in view of Doane and Ando and further in view of U.S. Patent No. 5,888,599 to Shogren. Appellants direct the Board's attention to the Response filed on September 4, 2009, which addresses the above rejections.

Claims 13-34 are being appealed and claims 13-23 and 24-34 rise and fall together, respectively.

III. ARGUMENT

A. CLAIMS 13, 16 AND 18-23 STAND REJECTED UNDER 35 U.S.C. § 103(A) AS BEING UNPATENTABLE OVER CANADIAN PATENT NO. 2,143,432 TO LORCKS ET AL. (HEREINAFTER "LORCKS") IN VIEW OF U.S. PATENT NO. 5,861,216 TO DOANE ET AL. (HEREINAFTER "DOANE") AND FURTHER IN VIEW OF U.S. PATENT NO. 5,639,518 TO ANDO ET AL. (HEREINAFTER "ANDO"); AND

B. CLAIMS 24, 27 AND 29-34 STAND REJECTED UNDER 35 U.S.C. §103(A) AS BEING UNPATENTABLE OVER CANADIAN PATENT NO. 2,143,432 TO LORCKS ET AL. (HEREINAFTER "LORCKS") IN VIEW OF U.S. PATENT NO. 5,861,216 TO DOANE ET AL. (HEREINAFTER "DOANE") AND FURTHER IN VIEW OF U.S. PATENT NO. 5,639,518 TO ANDO ET AL. (HEREINAFTER "ANDO").

For at least the reasons given below, Appellants maintain the position that Lörcks, Doane, Ando and the combination thereof fail to explicitly teach, or otherwise suggest, all the features recited in claims 13 and 24.

The Examiner's Answer (hereinafter "Answer") states that the step of Lorcks where a plurality of ribbed laminate material layers, including a ribbed synthetic film, is introduced in a mold heated to 220°C with a foaming aqueous starch suspension anticipates the step of "simultaneously thermally softening a coating film and attaching the thermally softened coating film to the irregular surface of the biodegradable expanded molded article so as to maintain the irregular surface of the biodegradable expanded molded article" as recited in claims 13 and 24[1].

However, Appellants respectfully submit that Lorcks merely teaches that "by proper design of the die, structures can be molded into the laminated composite material, such as, e.g, openings, cavities, webs or ribs. This might make sense for packaging and strength reasons".[2] Therefore, Lorcks merely

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[1] *See* Answer, lines 5-3 of page 14 and line 15 on page 17 – line 2 on page 18.

[2] *See* Lorcks, page 4, fourth paragraph.

teaches that by introducing a further laminate material into a rib-forming die with the foaming aqueous starch suspension, a ribbed laminated composite material can be formed, e.g., a finished product obtained in such a manner that the cured starch is combined with the further laminate material[3]. Lorcks neither teaches nor suggests that the further laminate material before molding serves as a ribbed laminate material. Therefore, Appellants respectfully submit that the Examiner is inaccurate in their assertion that Lorcks teaches introducing a plurality of ribbed laminate material layers, including a ribbed synthetic film, in a mold heated to 220 °C with a foaming aqueous starch suspension.

Further, the Examiner asserts that due to the physical properties of solid materials, the molding temperature of 220 °C, described in the sixth paragraph on page 5 of Lorcks, is sufficient to cause softening of many or all of the laminate composite materials of Lorcks including synthetic films[4].

However, Appellants submit that one of skill in the art would know that polymers are classified into thermosetting and thermoplastic polymers, that thermosetting polymers are not softened even if they are heated, and there are many types of thermosetting polymers that have melting points lower than 220 °C such that they would be melted instead of softened at 220 °C. Therefore, Appellants respectfully submit that the Examiner is inaccurate in their assertion that the laminate composite materials of Lorcks including synthetic films are softened at 220 °C. For example, Doane teaches that films are prepared by molding the powder of hydroxyl-functional polyester at 100 °C to 180 °C, which suggests that the powder of hydroxyl-functional polyester is melted at 100 °C to 180 °C to a fluid, rather than softened.[5] Therefore, Appellants respectfully submit that the Examiner is inaccurate in their

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[3] *See* Id., page 3, lines 5-8 of the last paragraph.
[4] *See* Answer, page 13, line 15 and page 17, lines 3-12.
[5] *See* Doane, column 12, line 66 – column 13, line 5.

assertion that many or all of the laminate composite materials of Lorcks including synthetic films are softened at 220 °C.

Moreover, the Examiner asserts that page 4 of Lorcks does not teach away from the invention as recited in claims 13 and 24 because the statement "the relatively high molding temperature does not affect the further laminate material" does not preclude thermal softening.[6] However, Appellants respectfully submit that Lorcks is referring to the relatively high molding temperature not causing a change in shape and/or state of the further laminate material, and as such, Lorcks does preclude the thermal softening of the further laminate material. As such, Appellants maintain the position that Lörcks teaches away from the features of claims 13 and 24.

Finally, the Examiner comes to conclusions based on the description in the specification as filed, which was not published at the time of filing the subject application. Therefore, Appellants respectfully submit that the Examiner is using impermissible hindsight reconstruction to reject the claims. Without access to the present invention, Appellants submit that there would neither be any motivation nor any inclination of one skilled in the art to combine the aforementioned references in order to render obvious claims 13 and 24.

For at least the reasons given above, Appellants submit that Lörcks, Doane, Ando and the combination thereof fail to explicitly teach, or otherwise suggest, all the features recited in claims 13 and 24.

Claims 14-23 and 25-24 are allowable at least for depending from an allowable base claim. Therefore, withdrawal of the rejection of claims 13-34 under 35 U.S.C. § 103(a) is respectfully requested.

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[6] *See* Answer, page 14, lines 2-5 and page 17, lines 12-15.

VIII. CONCLUSION

Appellants respectfully maintain their request that the Board reverse the Examiner's rejection of the pending claims 13-34.

If the USPTO believes that personal communication will further the prosecution of this application, the Office is invited to contact Erin Hoffman, Reg. No. 57,752, at the telephone number below.

The Commissioner is authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 08-0750 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

HARNESS, DICKEY, & PIERCE, P.L.C.

By: Erin G Hoff Reg. No. 57752
for Donald J. Daley, Reg. No. 34,313
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DJD/EGH:ljs

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/230,691	09/03/2008	Akio Ozasa	12480-000055/US/DVA	3456

30593 7590 05/05/2010
HARNESS, DICKEY & PIERCE, P.L.C.
P.O. BOX 8910
RESTON, VA 20195

EXAMINER	
KHARE, ATUL P	
ART UNIT	**PAPER NUMBER**
1791	
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05/05/2010	PAPER

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12230691	9/3/2008	OZASA ET AL.	12480-000055/US/DVA

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EXAMINER	
ATUL KHARE	
ART UNIT	**PAPER**
1791	20100504

DATE MAILED:

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner for Patents

The IDS document submitted 12 November 2009 has been fully considered with no further Action required by the Office. The signed document is attached with this Communication.

/Christina Johnson/
Supervisory Patent Examiner, Art Unit 1791

/ATUL KHARE/
Examiner, Art Unit 1791

PTO-90C (Rev.04-03)

REPLACEMENT FORM HDP-1449 (Based on Form PTO-1449) **PATENT AND TRADEMARK OFFICE** **INFORMATION DISCLOSURE CITATION** (Use several sheets if necessary) Sheet 1 of 1	ATTORNEY DOCKET NO. 12480-000055/US/DVA	SERIAL NO. **12/230,691**
	APPLICANT Akio OZASA et al.	
	FILING DATE September 3, 2008	GROUP 1794

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U.S. PATENT DOCUMENTS

Ref. Desig.	Examiner's Initials	Document Number	Date	Name	Class/ Subclass	(If appropriate) Filing Date
	/A.K./	US 4,863,655	09/05/1989	LACOURSE et al.		
	↓	US 6,106,753	08/22/2000	REDD et al.		
		US 6,231,970	05/15/2001	ANDERSEN et al.		

FOREIGN PATENT DOCUMENTS

Ref. Desig.	Examiner's Initials	Document Number	Date	Country	Class/ Subclass	Translation Yes	No
	/A.K./	JP 08-143710	06/04/1996	JAPAN		~~Abstract~~ **YES**	

OTHER DOCUMENTS (including Author, Title, Date, Pertinent Pages, etc.)

Ref. Desig.	Examiner's Initials	
	/A.K./	European Search Report dated August 19, 2009 in corresponding European Application No. 03705349.3

Examiner: /Atul Khare/	Date Considered: 05/04/2010

EXAMINER: Please initial if citation considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/230,691	09/03/2008	Akio Ozasa	12480-000055/US/DVA	3456

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KHARE, ATUL P	

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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 12/230,691
Filing Date: September 03, 2008
Appellant(s): OZASA ET AL.

Donald J. Daley
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 25 February 2010 appealing from the Office action mailed 17 November 2009.

(1) Real Party in Interest

The examiner has no comment on the statement, or lack of statement, identifying by name the real party in interest in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The following is a list of claims that are rejected and pending in the application:

Claims 13-34

(4) Status of Amendments After Final

The examiner has no comment on the appellant's statement of the status of amendments after final rejection contained in the brief.

(5) Summary of Claimed Subject Matter

The examiner has no comment on the summary of claimed subject matter contained in the brief.

(6) Grounds of Rejection to be Reviewed on Appeal

The examiner has no comment on the appellant's statement of the grounds of rejection to be reviewed on appeal. Every ground of rejection set forth in the Office action from which the appeal is taken (as modified by any advisory actions) is being maintained by the examiner except for the grounds of rejection (if any) listed under the subheading “WITHDRAWN REJECTIONS.” New grounds of rejection (if any) are provided under the subheading “NEW GROUNDS OF REJECTION.”

(7) Claims Appendix

The examiner has no comment on the copy of the appealed claims contained in the Appendix to the appellant’s brief.

(8) Evidence Relied Upon

CA 2,143,432 C "Biodegradable Laminated Composite Material Based On Cured Starch Foam And Method For Preparing It." Lorcks et al. 11/28/2000.

5,861,216	Doane et al.	1-1999
5,639,518	Ando et al.	6-1997
5,153,037	Altieri	10-1992
5,888,599	Bradt	3-1999
6,146,573	Shogren et al.	11-2000

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

Claims 13, 16, 18-24, 27, and 29-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over LORCKS ET AL. (CA 2,143,432) in view of DOANE ET AL. (US 5,861,216) and further in view of ANDO ET AL. (US 5,639,518).

As to claims 13 and 24, LORCKS teaches in a method for preparing a biodegradable laminated composite material that a starch foam is prepared and simultaneously combined with an additional layer of a further material (abstract). The starch suspension is preferably an aqueous starch suspension that may contain native and/or modified starch (page 3). The native starch may be high in amylose content, and the modified starch is a physically and/or chemically produced starch derivative (page 3). The starch suspension is introduced into a heated mold and foams following evaporation to fill the mold cavities, combining the starch foam with a further laminate material to form a unit that is subsequently released as a laminated composite material (page 3). A person having ordinary skill in the art would appreciate that the process of LORCKS constitutes steam expansion molding as required by the claim. A person having ordinary skill in the art would appreciate that the process of LORCKS is capable of molding a biodegradable expanded molded article in a specified shape with irregular surface, and that the step of binding the foam with the laminate material causes the laminate material to maintain the irregular surface of the expanded molded article as required by the claim. The laminate material can be made from a synthetic film, and is included in the mold during the foaming process, which would inherently thermally soften the film as required by the claim (page 3). LORCKS does not appear to explicitly disclose the use of dielectric heating, that the coating film is made of a biodegradable plastic having hydrophobicity, or that the slurry is made by adding polyvinyl alcohol to the starch or starch derivative. However, DOANE teaches a biodegradable article having a self-supporting structure made from starch and polyvinyl alcohol that has a self-adherent, moisture resistant polyester film laminated on the structure surface (abstract). Additionally, ANDO teaches in a method for manufacturing biodegradable molded articles that dielectric heating is used to heat a biodegradable material (column 2 lines 12-17).

At the time of the invention, it would have been *prima facie* obvious to a person having ordinary skill in the art to use a moisture resistant lamination layer as disclose by DOANE along with dielectric heating for the biodegradable material as disclosed by ANDO in the method of LORCKS because of the need in the art to provide water resistance to the final product, because of the need in the art to include a polyol such as polyvinyl alcohol in the starch structure to optimize the physical properties of the final product, and because of the advantages provided by dielectric heating to the biodegradable material (see column 3 lines 26-35 or DOANE, column 10 lines 1-8 of DOANE, and column 2 lines 37-68 of ANDO).

As to claims 16 and 27, LORCKS teaches that the film can be made from synthetic, biopolymeric, and metallic materials (page 3). LORCKS does not appear to explicitly disclose making the film from a modified polyester. However, DOANE teaches a biodegradable article having a self-supporting structure made from starch and polyvinyl alcohol that has a self-adherent, moisture resistant hydroxyl-functional (modified) polyester film laminated on the structure surface as discussed in the rejection of claims 13 and 24 above (abstract).

At the time of the invention, it would have been *prima facie* obvious to a person having ordinary skill in the art to use the modified polyester film of DOANE in the method of modified LORCKS because of the need in the art for the final product to have moisture resistance (abstract of DOANE).

As to claims 18 and 29, LORCKS does not appear to explicitly disclose that the molding material contains a water-insoluble fiber. However, ANDO teaches including in the biodegradable material inorganic substances such as glass, metal, carbon and ceramics, fibers thereof, structural materials thereof, and mixtures thereof (see column 8 lines 60-64 and column 10 lines 11-13).

At the time of the invention, it would have been *prima facie* obvious to a person having ordinary skill in the art to include the water-insoluble fibers of ANDO in the biodegradable material of modified LORCKS because of the need in the art to include a strength adjusting agent in the biodegradable material (column 9 lines 47-49 of ANDO).

As to claims 19 and 30, LORCKS does not appear to explicitly disclose the weight percent of the expanded molded article in the biodegradable molded article. However, LORCKS teaches that the laminate material can be provided in one or more sheets, and that it has low specific weight. At the time of the invention, a person having ordinary skill in the art would appreciate that since the lamination material has low specific weight and can be provided in only one sheet, as desired, that the final product could have a weight percent of the expanded molded article that meets the claim.

As to claims 20 and 31, LORCKS does not appear to explicitly disclose the weight percent of water in the molding material. However, ANDO teaches in one example using water at 38.7 weight percent, which meets the claim (see column 13 table 1).

At the time of the invention, it would have been *prima facie* obvious to a person having ordinary skill in the art to have a weight percent of water in a range that meets the claim because of the need in the art to vary the weight percent of the biodegradable material in order influence the properties of the final product (see tables 1, 2, 5, and 9, for example).

As to claims 21 and 32, modified LORCKS does not appear to explicitly disclose the weight percent of water in the expanded molded article. However, ANDO teaches that it is possible to alter the moisture content in the final product as desired (see tables 18-23, for example). ANDO suggests that having low moisture content in the final product increases the moldability of that product (see tables 18-22).

At the time of the invention, it would have been *prima facie* obvious to a person having ordinary skill in the art to adjust the moisture content in the final product as taught and suggested by ANDO in combination with the method of modified LORCKS to meet the claim because of the effect that this has on the final product and because of the need in the art to enhance moldability of the final product.

As to claims 22 and 33, LORCKS teaches that the mold is made of iron (page 5). LORCKS does not appear to explicitly disclose that the mold is heated by an electrical means while the molding material is heated by dielectric means. However, ANDO teaches providing electroconductive heating to the molding material at the same time as dielectric heating (column 2 lines 37-48). A person having ordinary skill in the art would appreciate that the electrical heating of the biodegradable molding material would transfer heat to the mold as required by the claim.

At the time of the invention, it would have been *prima facie* obvious to use the combination of heating methods as disclosed by ANDO in the method of modified LORCKS because of the need in the art to provide adequate heating to create a final product having desired physical properties (see column 2 lines 37-68 of ANDO).

As to claims 23 and 34, please see the rejection of claims 13 and 24 above. A person having ordinary skill in the art would appreciate that the process of LORCKS is capable of molding a biodegradable expanded molded article in a specified shape with irregular surface, and that the step of binding the foam with the laminate material causes the laminate material to maintain the irregular surface of the expanded molded article as required by the claim. A person having ordinary skill in the art would appreciate that since the method of modified LORCKS is substantially identical to that of applicant's that the final product could be produced which has bumps and dips as required by the claim.

Claims 14 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over LORCKS ET AL. (CA 2,143,432) in view of DOANE ET AL. (US 5,861,216) and further in view of ANDO ET AL. (US 5,639,518) as applied to claims 13, 16, 18-24, 27, and 29-34 above, and further in view of ALTIERI (US 5,153,037).

As to claims 14 and 15, modified LORCKS does not appear to explicitly disclose the weight percent of high amylose starch in the starch molding material or starch derivative molding material. However, ALTIERI teaches in a method of preparing biodegradable molded articles that the amylose content is at least 45 percent by weight, and even 65 percent by weight, which meets the claim (see column 2 line 68 and column 4 line 29).

At the time of the invention, it would have been *prima facie* obvious to a person having ordinary skill in the art to use the high amylose starch material as disclosed by ALTIERI in the method of modified LORCKS because of the need in the art to enhance the physical properties of the final product (column 2 lines 60-68 to column 3 lines 1-2 of ALTIERI).

Claims 17 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over LORCKS ET AL. (CA 2,143,432) in view of DOANE ET AL. (US 5,861,216) and further in view of ANDO ET AL. (US 5,639,518) as applied to claims 13, 16, 18-24, 27, and 29-34 above, and further in view of BRADT (US 5,888,599).

As to claims 17 and 28, modified LORCKS does not appear to explicitly disclose that the film is biaxially stretched. However, BRADT teaches a multilayer lidding film and a package with the lidding film heat sealed thereto as a cover (abstract). The film is a biaxially oriented polyester film (column 3 lines 19-21).

At the time of the invention, it would have been *prima facie* obvious to a person having ordinary skill in the art to include the biaxially stretched film of BRADT in the method of modified LORCKS because of the need in the art to enhance the strength of such films and of the final product (see column 1 lines 61-67 to column 2 lines 1-4 for example).

Claims 25 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over LORCKS ET AL. (CA 2,143,432) in view of DOANE ET AL. (US 5,861,216) and further in view of ANDO ET AL. (US 5,639,518) as applied to claims 13, 16, 18-24, 27, and 29-34 above, and further in view of SHOGREN (US 6,146,573).

As to claim 25, modified LORCKS does not appear to explicitly disclose the polymerization degree of the polyvinyl alcohol. However, SHOGREN teaches in a method for producing disposable molded articles having polyvinyl alcohol with a degree of polymerization over 1600, which meets the claim (abstract).

At the time of the invention, it would have been *prima facie* obvious to a person having ordinary skill in the art to include polyvinyl alcohol with a degree of polymerization as disclosed by SHOGREN in the method of modified LORCKS because of the need in the art to create a final product having improved flexibility and increased water resistance (column 3 lines 18-25 of SHOGREN).

As to claim 26, modified LORCKS does not appear to explicitly disclose the saponification degree of the polyvinyl alcohol. However, SHOGREN teaches that the saponification degree is less than or equal to 95.5 percent, which meets the claim (column 4 lines 29-35).

At the time of the invention, it would have been *prima facie* obvious to a person having ordinary skill in the art to include the saponification degree of SHOGREN in the method of modified LORCKS because of the need in the art to create a final product having improved flexibility and increased water resistance (column 3 lines 18-25 of SHOGREN).

(10) Response to Argument

Appellants' Argument Group I:

Appellants argue that the combination fails to teach “simultaneously thermally softening a coating film and attaching the thermally softened coating film to the irregular surface of the biodegradable expanded molded article so as to maintain the irregular surface of the biodegradable expanded molded article" as recited in claim 13 (Br. 10). Appellants further argue that the Examiner has failed to meet the Examiner’s burden of establishing a proper *prima facie* case of obviousness regarding claim 13, and that Lorcks teaches away from simultaneously thermally softening a coating film and attaching the thermally softened coating film to the irregular surface of the biodegradable expanded molded article as recited in claim 13 (Br. 11-12). Appellants further argue that at page 3, first paragraph, Lorcks specifically states that the laminated composite material is a flat material covered with starch foam (Br. 12). Appellants further argue that nothing in Lorcks suggests that any of the disclosed materials would soften at the temperatures used in the process (Br. 12). Appellants further argue that Lorcks states that "the relatively high molding temperature does not affect the further laminate material when the method is conducted properly” (Br. 12). Appellants further argue that Lorcks explains that the lack of effect of high temperature on the laminate material is a benefit to his process because printed matter on the laminate material remains intact through the molding process, and that the lack of effect of the temperature also applies for any printing done to the further laminate material, especially paper, paperboard, or cardboard, prior to introduction into the die and subsequent deformation (Br. 12). Appellants further argue that neither Doane nor Ando cures the above described deficiencies of Lorcks regarding claim 13 (Br. 12). Appellants further argue that Altieri and/or Bradt do not remedy the deficiencies of Lorcks, Doane, and Ando with respect to claim 13 (Br. 13).

Examiner's Response Group I:

As a preliminary matter, the Examiner notes that Appellants do not appear to dispute that the modified Lorcks method constitutes steam expansion molding as required by claim 13. However, for clarification purposes, the Examiner submits that the steam expansion molding method required by claim 13 is met by the foaming method taught by Lorcks. Lorcks teaches preparing an aqueous starch suspension and introducing the suspension into a die in measured amounts (p. 3 paragraphs 2 and 4). In the heated mold, the suspension foams following evaporation (of water) (p. 3, paragraph 4). Lorcks describes this molding method as "expansion molding" (p. 5, paragraph 6). Since the boiling point of water is 100°C, and since the Lorcks expansion molding method is performed at 220°C in order to foam an aqueous starch suspension by evaporation, the Lorcks expansion molding method constitutes steam expansion molding as required by claim 13. Appellant describes conducting steam expansion molding using a similar type of evaporative expansion of water from an aqueous starch solution at p. 13 lines 11-20 of the specification.

The Lorcks method includes the steps of preparing an aqueous starch suspension and combining it in a heated mold with a laminate composite material. In addition to paper, paperboard, and cardboard, other materials such as leather, synthetic films, and biopolymeric materials may be used as the laminate material (p. 3, paragraph 3). When introduced into the mold, the laminate material can be in a preformed state (p. 3, paragraph 3). The laminate material can optionally consist of a plurality of layers (p. 4 paragraph 3). By proper design of the die, structures can be molded into the laminate composite material such as openings, cavities, webs, or ribs for packaging and strength reasons (p. 4, paragraph 4). During the expansion molding process, the mold is heated to 220°C (p. 5, paragraph 6).

The Examiner submits that a preformed synthetic film laminate material having structures such as ribs molded therein meets the required irregular surface of the biodegradable molded article. The Examiner further submits that although Lorcks does not explicitly disclose thermal softening of the laminate composite material, the Lorcks molding temperature of 220°C is sufficient to cause softening of many or all of the laminate composite materials of Lorcks, including synthetic films. Appellants' specification at p. 56 lines 1-3 provides further evidence to this point, wherein the thermal softening point of a coating film is preferably not less than 130°C, and more preferably not less than 150°C. The Examiner further submits that due to the physical properties of solid materials, the Lorcks molding temperature of 220°C is sufficient to cause thermal softening of the laminate composite materials of Lorcks, including synthetic films. The Examiner further submits that the teaching that "the relatively high molding temperature does not affect the further laminate material when the method is conducted properly" at p.4 paragraph 2 of Lorcks does not constitute a teaching away because it does not preclude thermal softening of the laminate material. The Examiner further submits that when a plurality of ribbed laminate material layers, including at least one ribbed synthetic film, is included in a mold heated to 220°C with a foaming aqueous starch suspension that becomes a biodegradable expanded molded article, the required step of "simultaneously thermally softening a coating film and attaching the thermally softened coating film to the irregular surface of the biodegradable expanded molded article so as to maintain the irregular surface of the biodegradable expanded molded article" of claim 13 occurs in a similar manner as described in Appellants' specification at p. 72 line 18 to p. 73 line 18 and figure 12(b).

Appellants' Argument Group II:

Appellants argue that the combination fails to teach "simultaneously thermally softening a coating film and attaching the thermally softened coating film to the irregular surface of the biodegradable expanded molded article so as to maintain the irregular surface of the biodegradable expanded molded article" as recited in claim 24 (Br. 13-14). Appellants further argue that the Examiner has failed to meet the Examiner's burden of establishing a proper *prima facie* case of obviousness regarding claim 24, and that Lorcks teaches away from simultaneously thermally softening a coating film and attaching the thermally softened coating film to the irregular surface of the biodegradable expanded molded article as recited in claim 24 (Br. 14). Appellants further argue that at page 3, first paragraph, Lorcks specifically states that the laminated composite material is a flat material covered with starch foam (Br. 15). Appellants further argue that nothing in Lorcks suggests that any of the disclosed materials would soften at the temperatures used in the process (Br. 15). Appellants further argue that Lorcks states that "the relatively high molding temperature does not affect the further laminate material when the method is conducted properly" (Br. 15). Appellants further argue that Lorcks explains that the lack of effect of high temperature on the laminate material is a benefit to his process because printed matter on the laminate material remains intact through the molding process, and that the lack of effect of the temperature also applies for any printing done to the further laminate material, especially paper, paperboard, or cardboard, prior to introduction into the die and subsequent deformation (Br. 15). Appellants further argue that neither Doane nor Ando cures the above described deficiencies of Lorcks regarding claim 24 (Br. 15-16). Appellants further argue that Bradt and/or Shogren do not remedy the deficiencies of Lorcks, Doane, and Ando with respect to claim 24 (Br. 16).

Examiner's Response Group II:

As a preliminary matter, the Examiner notes that Appellants do not appear to dispute that the modified Lorcks method constitutes steam expansion molding as required by claim 24. However, for clarification purposes, the Examiner submits that the steam expansion molding method required by claim 24 is met by the foaming method taught by Lorcks. Lorcks teaches preparing an aqueous starch suspension and introducing the suspension into a die in measured amounts (p. 3 paragraphs 2 and 4). In the heated mold, the suspension foams following evaporation (of water) (p. 3, paragraph 4). Lorcks describes this molding method as "expansion molding" (p. 5, paragraph 6). Since the boiling point of water is 100°C, and since the Lorcks expansion molding method is performed at 220°C in order to foam an aqueous starch suspension by evaporation, the Lorcks expansion molding method constitutes steam expansion molding as required by claim 24. Appellant describes conducting steam expansion molding using a similar type of evaporative expansion of water from an aqueous starch solution at p. 13 lines 11-20 of the specification.

The Lorcks method includes the steps of preparing an aqueous starch suspension and combining it in a heated mold with a laminate composite material. In addition to paper, paperboard, and cardboard, other materials such as leather, synthetic films, and biopolymeric materials may be used as the laminate material (p. 3, paragraph 3). When introduced into the mold, the laminate material can be in a preformed state (p. 3, paragraph 3). The laminate material can optionally consist of a plurality of layers (p. 4 paragraph 3). By proper design of the die, structures can be molded into the laminate composite material such as openings, cavities, webs, or ribs for packaging and strength reasons (p. 4, paragraph 4). During the expansion molding process, the mold is heated to 220°C (p. 5, paragraph 6).

The Examiner submits that a preformed synthetic film laminate material having structures such as ribs molded therein meets the required irregular surface of the biodegradable molded article. The Examiner further submits that although Lorcks does not explicitly disclose thermal softening of the laminate composite material, the Lorcks molding temperature of 220°C is sufficient to cause softening of many or all of the laminate composite materials of Lorcks, including synthetic films. Appellants' specification at p. 56 lines 1-3 provides further evidence to this point, wherein the thermal softening point of a coating film is preferably not less than 130°C, and more preferably not less than 150°C. The Examiner further submits that due to the physical properties of solid materials, the Lorcks molding temperature of 220°C is sufficient to cause thermal softening of the laminate composite materials of Lorcks, including synthetic films. The Examiner further submits that the teaching that “the relatively high molding temperature does not affect the further laminate material when the method is conducted properly” at p.4 paragraph 2 of Lorcks does not constitute a teaching away because it does not preclude thermal softening of the laminate material. The Examiner further submits that when a plurality of ribbed laminate material layers, including at least one ribbed synthetic film, is included in a mold heated to 220°C with a foaming aqueous starch suspension that becomes a biodegradable expanded molded article, the required step of “simultaneously thermally softening a coating film and attaching the thermally softened coating film to the irregular surface of the biodegradable expanded molded article so as to maintain the irregular surface of the biodegradable expanded molded article" of claim 24 occurs in a similar manner as described in Appellants' specification at p. 72 line 18 to p. 73 line 18 and figure 12(b).

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/ATUL KHARE/

Examiner, Art Unit 1791

/Christina Johnson/

Supervisory Patent Examiner, Art Unit 1791

/Benjamin L. Utech/

Primary Examiner