



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) **EP 1 033 324 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
06.09.2000 Bulletin 2000/36

(51) Int Cl.7: **B65D 81/34**

(21) Application number: **99104223.5**

(22) Date of filing: **03.03.1999**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**
Designated Extension States:
AL LT LV MK RO SI

(71) Applicant: **Cryovac, Inc.**
Duncan, South Carolina 29334 (US)

(72) Inventors:
• **Deighton, Jeffrey Paul**
Chinnor, Oxford OX9 4PL (GB)

• **Haslam, Colin John Pelissier**
Bishop's Stortford, Herts CM23 4DU (GB)

(74) Representative: **De Carli, Elda**
Sealed Air S.p.A.
Packaging Technical Center
Via Trento 7
20017 Passirana di Rho (MI) (IT)

(54) **Method for baking bread in a package and thermoplastic perforated film used therefore**

(57) A method for producing a baked bread product directly into the final package, which method comprises packaging a partially baked bread product into a perforated film of a heat-resistant thermoplastic material, such as nylon 66, nylon 46 or nylon 6/66, and baking off

said partially baked bread product while it is retained within said film. The perforated film and a packaged bread product comprising a baked or partially baked bread product surrounded by the perforated film are also described and claimed.

EP 1 033 324 A1

Description

[0001] The present invention relates to a method for producing a bread product directly into the final package, to the packaged bread product, and to the perforated film of heat-resistant thermoplastic material that is used in said method.

[0002] Baking of dough to make bread can be done in one single step or in two separate steps. This latter method is widely used mainly in the supermarkets or retail stores, where partially baked bread products are acquired from an outside plant bakery, e.g. once or twice a week, and subjected to the final baking phase when needed. The baked off bread products thus obtained have the appearance, consistence and taste of fresh, just baked, bread. Furthermore the thus obtained product complies with the present UK legislation on weight. This same method finds also extensive use in hospitals, nursing homes, prisons, schools, in the armed services, employee's cafeterias and in many commercial or institutional kitchens.

[0003] A partially baked bread product is obtained by submitting a traditional leavened dough to a baking process and stopping said process after the bread product has essentially reached its final structure and the action of the leavening is completed and arrested but before leading to coloration and formation of the crusty surface.

[0004] A partially baked bread product can be maintained for some time, typically up to seven days, depending on temperature and humidity, and for a longer period if maintained in the frozen state or under the modified atmosphere of a preservative gas. A partially baked bread product is then subjected to the final baking phase, just prior to consumption or sale, to provide a bread product that has all the characteristics of fresh bread including the golden crust.

[0005] More particularly, in the actual two step process the dough is prepared, typically from a flour or a mixture of different flours, water, salt, yeast, optionally fats, sugars, minerals, preservative agents, and spices, and worked by any conventional and known method; it is then divided into pieces of the desired weight and shape that are allowed to undergo the normal fermentation cycle; after the fermentation phase, said pieces are partially baked in an oven.

[0006] The oven can be electric, oil fired or gas fired hot air baking oven. This first step of partial baking generally requires at least 10 minutes, typically from 12 to 45 minutes, depending on the type of bread (e.g. the type of flour and the amount of water), the weight and volume of the single dough pieces, the baking method (wherein tinned products require a longer time and oven bottom products a shorter one) and the temperature of the oven.

[0007] Generally the temperature required for this first partial baking step is comprised between about 90 °C and about 240 °C, and preferably between about 100

°C and about 230 °C. Typically, in the plant bakeries, the temperature is high at the beginning of the baking process and is then gradually reduced during baking time.

[0008] In this first baking step, the interior of the bread should be almost completely structured, and the starch gelatinized to a large extent but the caramelized crust should not yet be formed.

[0009] Once partially baked, a number of bread products are then packaged in a moisture-barrier thermoplastic film aimed at controlling loss of moisture and undesired drying up. Typically an irradiatively cross-linked polyolefin film for food contact applications, is employed and the naked, partially baked, bread products are packaged therein under ambient atmosphere.

[0010] The packages containing the naked partially baked, bread products are then sent to the retail in-store bakeries. Here, the bags are kept ambient until the partially baked bread products are subjected to the final baking phase.

[0011] For this second baking phase a temperature higher than that employed for the first step and a shorter baking time are typically required.

[0012] While for some types of bread products, such as garlic bread, pies, croissants, etc., temperatures of from about 160 °C to about 200 °C, are preferably employed, for conventional types of bread temperatures over 200 °C are generally required.

[0013] Bake-off typically takes 5-15 minutes.

[0014] In some cases, after 3-5 minutes at a very high temperature (e.g. about 240-250 °C), baking is continued for additional 5-10 minutes at a temperature of from about 200 to about 220 °C. In other cases a fixed temperature of about 220-240 °C is maintained for the whole final baking stage. In some cases steam is introduced into the oven for the first 1 to 3 minutes to help glaze the crust.

[0015] Upon completion of the bake-off step, the fresh, crusty and tasty bread thus obtained would then be ready for sale.

[0016] However, to prolong the shelf life of the finally baked off bread and for hygienic reasons, before putting the bread products onto the shelves, these are generally packaged in a thermoplastic perforated film. The frequency of the perforations and the size thereof are suitably selected to control the gradual loss of moisture by evaporation. The optimum frequency and size of said perforations would depend therefore on the type of bread and the moisture content therein.

[0017] The above overall process requires however that a suitable packaging line be present at the retail in-store bakery and presents obvious hygienic problems as the finally baked bread is exposed to the environment and it is manually handled until it is packaged.

[0018] The present invention allows solving these problems by providing a method for producing a baked bread product directly into the final package, which method comprises packaging a partially baked bread

product into a perforated film of a heat-resistant thermoplastic material and baking off said partially baked bread product while it is retained within said perforated film.

[0019] A first object of the present invention is therefore a method for producing a baked bread product directly in the final package, which method comprises packaging a partially baked bread product in a perforated film of a heat-resistant thermoplastic material and baking off said partially baked bread product while it is retained within said film.

[0020] A second object of the present invention is a packaged bread product comprising a perforated film of a heat-resistant thermoplastic material and a bread product, baked or partially baked, surrounded by said perforated film.

[0021] A third object of the present invention is a perforated film of a heat-resistant thermoplastic material suitable for use in the above method.

[0022] According to the method of the present invention, the partially baked bread products are packaged, typically at the main bakery plant, with a perforated film of a heat-resistant thermoplastic material.

[0023] As used herein "heat-resistant" thermoplastic material means a thermoplastic material that can withstand the heating conditions of the bake-off step without melting or being degraded. Typically, for the scope of the present invention, a heat-resistant thermoplastic material has a melting point that is higher than 210 °C, preferably higher than 220 °C, more preferably higher than 230 °C, even more preferably higher than 240 °C and yet even more preferably higher than 250 °C. The minimum melting temperature required will depend on the temperature at which the bake-off step is carried out.

[0024] Heat-resistant thermoplastic materials are e.g. certain polyesters, and certain polyamides.

[0025] Preferred heat-resistant polymers are in particular polyethylene terephthalate, polycyclohexylenedimethylene terephthalate, polycaprolactam (nylon 6), polyamide homopolycondensate of hexamethylenediamine and adipic acid (nylon 66), homopolycondensate of tetramethylenediamine and adipic acid (nylon 46) and polyamide copolymers based on ϵ -caprolactam and hexamethylenediamine and adipic acid (nylon 6/66).

[0026] Nylon 66, nylon 46 and certain grades of the copolyamide nylon 6/66 are particularly preferred as they withstand very high temperatures (e.g. 240-255 °C and in some instances even more) without melting or being degraded.

[0027] As indicated above the frequency and size of the perforations will be suitably selected to prolong the shelf life of the baked off bread products. The presence of perforations in the packaging film during the bake-off process is however necessary to permit evaporation of the moisture contained in the partially baked bread product (typically about 30 %) during this latter heat treatment. It is however an additional advantage of the method of the present invention that the loss of weight (i.e. loss of moisture) for the bread products individually

packaged in the perforated film is much less than that obtained when the bread products are baked off without being packaged. This results in a longer shelf life of the end, totally baked, bread product.

[0028] A suitable frequency of the perforations in the packaging film to be used in the method of the present invention is comprised between 1 and about 300 perforations per in² (corresponding to between 1 and about 300 perforations per 6.45 cm²), preferably from 3 to about 250 perforations per in², more preferably from 5 to about 200 perforations per in², still even more preferably from 8 to about 150 perforations per in².

[0029] Typically the perforations are substantially uniformly distributed on the film surface.

[0030] The size (diameter) of the perforations of the perforated film according to the present invention is typically comprised between about 50 μ m and about 2,000 μ m. Generally it is from about 100 μ m up to about 1,500 μ m, preferably from about 150 μ m up to about 1,200 μ m, more preferably from about 200 μ m up to about 1,000 μ m, still more preferably up to about 750 μ m, and still yet more preferably up to 500 μ m. The presence of perforations with a small diameter will in fact prevent that granules of dust or powders enter into the bread package.

[0031] The film to be used in the method of the present invention can be a mono- or multi-layer film and can be obtained by any known method.

[0032] Typically it is obtained by cast extrusion or co-extrusion through a round or a flat extrusion die. The cast film thus obtained can also be oriented, mono-axially or biaxially, by the trapped bubble process or by the tenter frame process, and maintain some shrink properties or be heat-set.

[0033] Alternatively it can also be obtained by the hot blown process.

[0034] When a multi-layer film is employed it can also be obtained by lamination of pre-formed films.

[0035] Preferably the thermoplastic film to be used in the method according to the present invention is however a monolayer film and, more preferably, it is a monolayer cast film or oriented and heat-set film.

[0036] The film may be from about 8 to about 150 μ m thick, preferably from about 9 to about 100 μ m thick, more preferably from about 10 to about 50 μ m, and yet more preferably from about 11 to about 40 μ m thick.

[0037] Said film can contain additives, in particular stabilizers, anti-oxidant agents, pigments, etc. It is however necessary that said additives be heat-resistant and suitable for food-contact applications. The film may also be printed, if desired, using a heat resistant ink. When a laminate of two preformed films is employed, the print is preferably a trapped print.

[0038] Perforation of the thermoplastic film can be achieved by any suitable method depending on the desired diameter of the perforations.

[0039] Flame perforation and hot or cold needle perforation are typically employed when larger perforations

are acceptable, while electric discharge or laser are generally employed when very small perforations are desired.

[0040] One method and device that can be employed for perforating the film is described in US-A-3,038,198 and employs a cooled grid over which the film is passed while it is exposed to a jet of hot gas which will melt the film in the uncooled areas. Another suitable method and device widely employed in industry to make perforated films provides for the use of a rotating shaft with heated needles that perforate the film. Alternatively cold needle perforation, laser perforation and electric discharge perforation can be employed.

[0041] Some film manufacturers provide perforated film rolls where the perforations are created in the film during a post production process. Alternatively it is also possible to start from a plain roll and perforate the film in a first step of the packaging process (as described for instance in US-A-5,386,752).

[0042] In a preferred embodiment the perforation method employed is a high temperature perforation process as in his way the edge of the roughly round perforations will be strengthened.

[0043] Packaging of the partially baked bread products is typically achieved by means of a horizontal form-fill-seal (HFFS) or a vertical form-fill-seal (VFFS) machine, using a roll-stock of the suitable perforated film as a flat sheet. Alternatively, the partially baked bread products can be packaged in a seamless tubing of the suitable diameter, where the single packages are then closed and separated by transverse seals and cuts of the tubing. Still alternatively the partially baked bread products can be packaged in end-sealed or transverse-sealed pre-formed bags or pouches of the convenient size, still obtained from the suitable perforated thermoplastic film, and the bag mouth closed, typically by sealing.

[0044] Sealing can be obtained e.g. by hot-wire impulse sealing, ultra-sonic sealing, or RF sealing. The above listed polymers in fact contain polar molecules that oscillate, when a high frequency electric current is passed through the film by the sealing bars, under the influence of said current. The molecular agitation that is then produced is converted to heat sufficient to melt the film in the seal area.

[0045] When the film is RF-sealed, the seal is obtained by applying a pressure to the two film webs that have to be lap-sealed or fin-sealed together, e.g. by means of a couple of bars, and welding the two webs together by RF typically at a frequency of about 27 MHz, which is the usual frequency provided in RF welding apparatuses. The temperature of the bars can be varied from about room temperature to as high as possible as long as the film does not stick thereto. In line of principle, considering also that the polymer used for the perforated film need to have a high melting temperature, it would be preferable to have heated bars, as this will shorten the welding time. The welding time is function of the tem-

perature of the sealing bars, of the pressure applied, of the thickness of the film as well as of the RF susceptibility. Any skilled operator can easily set up the optimum parameters, i.e. welding time and sealing bar temperature.

[0046] If the film is oriented and heat-shrinkable, it will be necessary to take into account the reduction in size of the bag or pouch that will occur during the final baking step at the selected high temperature. It should therefore be necessary in such a case to allow for an extra space within the package to avoid that shrinkage of the thermoplastic film might deform the bread product or break the seal. When an oriented and heat-shrinkable film is employed, it might also be possible to avoid sealing of the package, as the packaging material, upon shrinking, will automatically conform to the product itself.

[0047] A plurality of the partially baked bread products, individually packaged in the perforated film according to the present invention, are then wrapped up in a moisture impermeable thermoplastic film or packaged in a bag or pouch made therefrom. The number of individually packaged bread products wrapped up together may vary depending on the customers' needs. For the sake of clarity, whether the groups of individually packaged bread products are wrapped up in a film or loaded into a preformed bag, said outer flexible container will be anyway called a "master pack".

[0048] If no oxygen barrier properties are desired for this outer master pack, then an irradiatively cross-linked polyolefin film may typically be employed. These polymers in fact have good moisture barrier and mechanical properties, can be easily sealed and have a low cost. No barrier properties are necessary when air is contained in the outer master pack. On the contrary if a suitable preserving gas is employed in the packaging of the partially baked bread products into the outer master pack, in order to increase the shelf-life thereof, then a gas barrier material will preferably be employed for the outer master pack. Barrier thermoplastic films suitable for this use will then comprise a gas barrier layer, such as a PVDC, EVOH and/or polyamide gas-barrier layer.

[0049] The outer master pack can bear, printed, labeled or coded thereon, all the necessary or desired information, such as type of product, ingredients, weight, date of production, directions for the preservation and the baking off step, etc.

[0050] Said packages are then kept ambient and the outer master pack is then opened up when the partially baked bread products, individually packaged in the perforated film of heat-resistant thermoplastic material need to be baked off.

[0051] The conditions for this second baking step, as indicated above, may vary depending on the type of bread, the weight thereof, the amount of moisture still contained therein, the level of partial baking, and the type of oven. Typically however the temperature reached in this second baking step is over 160 °C and

generally over 200 °C.

[0052] The invention is illustrated by the following example, which is provided for the purpose of representation, and is not to be construed as limiting the scope of the invention.

Example

[0053] Four loaves, about 470 g each, of partially baked brown bread (Harvest Brown) were individually packaged on a Bluebird L-sealer using a 700 mm wide roll of a cast film, 30 µm thick, of Filmon CSS (polyamide 6/66 - m.p. 260 °C) by Caffaro, flame perforated with a frequency of perforations of about 56 perforations/in² and an average diameter of the perforations of about 1,100 µm.

[0054] The four individually wrapped up loaves were then packaged in a 15 µm thick polyolefin film and the package kept at room temperature for one day. The master pack was then opened and the individually packaged loaves were baked off in a Bakermat Mastermind 2005 oven (Leventi). Baking off was carried out with steam for 1 minute, followed by 9 minutes at about 204 °C.

[0055] Two loaves were positioned on the oven top shelf and two on the bottom shelf. After bake-off, the following observations were made on the obtained end products :

- a good crust, both in quality and appearance, was formed;
- the internal texture was very good;
- the products did not stick to the shelves; and
- there was no misting up.

[0056] The average weight loss (after bake-off weight - pre-bake-off weight) for the above four loaves was 12.4 g.

[0057] In a comparative example, four loaves of the same partially baked bread were packaged in the same standard polyolefin film without being individually wrapped in the perforated polyamide film. After one day at room temperature baking-off was carried out as indicated above for the packaged loaves. The average weight loss was about 27 g.

Claims

1. A method for producing a baked bread product directly in the final package, which method comprises packaging a partially baked bread product in a perforated film of a heat-resistant thermoplastic material and baking off said partially baked bread product while it is retained within said film, characterised in that the perforated film comprises from 1 to about 300 perforations per in², preferably from 3 to about 250 perforations per in², more preferably from 5 to

about 200 perforations per in², still even more preferably from 8 to about 150 perforations per in².

2. A packaged bread product comprising a perforated film of a heat-resistant thermoplastic material comprising from 1 to about 300 perforations per in², preferably from 3 to about 250 perforations per in², more preferably from 5 to about 200 perforations per in², still even more preferably from 8 to about 150 perforations per in²; and a bread product surrounded by the perforated film.
3. The package of claim 2 wherein the bread product is partially baked.
4. A perforated film of a heat-resistant material comprising from 1 to about 300 perforations per in², preferably from 3 to about 250 perforations per in², more preferably from 5 to about 200 perforations per in², still even more preferably from 8 to about 150 perforations per in².
5. The perforated film of claim 4 wherein the perforations are substantially uniformly distributed on the film surface.
6. The perforated film of claim 4 wherein the size (diameter) of the perforations is from about 50 µm up to about 2,000 µm, preferably from about 100 µm up to about 1,500 µm, more preferably from about 150 µm up to about 1,200 µm, even more preferably from about 200 µm up to about 1,000 µm, yet more preferably up to about 750 µm, and yet even more preferably up to 500 µm.
7. The perforated film of claim 4 wherein the heat-resistant thermoplastic material has a melting point that is higher than 210 °C, preferably higher than 220 °C, more preferably higher than 230 °C, even more preferably higher than 240 °C and yet even more preferably higher than 250 °C.
8. The perforated film of claim 7 wherein the heat-resistant thermoplastic material is selected from the group consisting of polyesters and polyamides.
9. The perforated film of claim 8 wherein the heat-resistant thermoplastic material is selected from the group consisting of polyethylene terephthalate, polycyclohexylenedimethylene terephthalate, polycaprolactam (nylon 6), polyamide homopolycondensate of hexamethylenediamine and adipic acid (nylon 66), homopolycondensate of tetramethylenediamine and adipic acid (nylon 46), and polyamide copolymers based on ε-caprolactam and hexamethylenediamine and adipic acid (nylon 6/66).
10. The perforated film of claim 9 wherein the heat-re-

sistant thermoplastic material is selected from the group consisting of polyamide homopolycondensate of hexamethylenediamine and adipic acid (nylon 66), homopolycondensate of tetramethylenediamine and adipic acid (nylon 46), and polyamide copolymers based on ϵ -caprolactam and hexamethylenediamine and adipic acid (nylon 6/66). 5

11. The method of claim 1 wherein the perforated film is as defined in any of preceding claims 5 to 10. 10
12. The package of claim 2 or 3 wherein the perforated film is as defined in any of preceding claims 5 to 10.
13. The method of claim 1 wherein the bake-off of the partially baked packaged bread product is carried out at a temperature higher than 200 °C and for at least 3 minutes. 15
14. A flexible container of a moisture-barrier thermoplastic film containing a plurality of partially baked bread products individually packaged in a perforated film of a heat-resistant thermoplastic material comprising from 1 to about 300 perforations per in², preferably from 3 to about 250 perforations per in², more preferably from 5 to about 200 perforations per in², still even more preferably from 8 to about 150 perforations per in². 20 25

30

35

40

45

50

55



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 10 4223

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION
Y	US 4 426 401 A (OTTOW ALEXANDER B ET AL) 17 January 1984 (1984-01-17)	1,2,7-14	B65D81/34
X	* the whole document *	3	

Y	GB 2 132 974 A (BUXTER POULTRY LIMITED) 18 July 1984 (1984-07-18)	1,2,7-14	
X	* page 2, line 25 - line 33; claims 8,9 *	4-6	

Y	EP 0 720 910 A (GRACE W R & CO) 10 July 1996 (1996-07-10)	8-10	
	* claims 1,4 *		

A	FR 2 205 042 A (CELLOPHANE SA) 24 May 1974 (1974-05-24)	1-14	
	* the whole document *		

A	US 4 866 786 A (NAGLER PETER M) 12 September 1989 (1989-09-12)	1-14	
	* the whole document *		

A	EP 0 334 291 A (VISKASE CORP) 27 September 1989 (1989-09-27)	4-13	TECHNICAL FIELDS SEARCHED
	* the whole document *		B65D

The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 9 August 1999	Examiner Pernice, C
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.02 (P04/C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 99 10 4223

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

09-08-1999

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4426401 A	17-01-1984	LU 72277 A	03-02-1977
		AT 358505 B	10-09-1980
		AT 45879 A	15-02-1980
		AT 354930 B	11-02-1979
		AT 269276 A	15-06-1979
		AU 503615 B	13-09-1979
		AU 1290276 A	20-10-1977
		BE 840703 A	13-10-1976
		CA 1134668 A	02-11-1982
		CH 610272 A	12-04-1979
		DE 2615956 A	28-10-1976
		DK 171876 A, B,	15-10-1976
		FR 2307723 A	12-11-1976
		GB 1550000 A	08-08-1979
		IE 44147 B	26-08-1981
		JP 51125590 A	02-11-1976
		NL 7603888 A	18-10-1976
		SE 430680 B	05-12-1983
		SE 7604447 A	15-10-1976
		ZA 7602216 A	30-11-1977
GB 2132974 A	18-07-1984	NONE	
EP 0720910 A	10-07-1996	US 5534277 A	09-07-1996
		AU 698879 B	12-11-1998
		AU 3911095 A	20-06-1996
		BR 9505720 A	23-12-1997
		CA 2164057 A	10-06-1996
		NZ 280532 A	20-12-1996
		ZA 9510202 A	12-06-1996
FR 2205042 A	24-05-1974	NONE	
US 4866786 A	12-09-1989	NONE	
EP 0334291 A	27-09-1989	US 4857408 A	15-08-1989
		CA 1337287 A	10-10-1995
		DK 149689 A	26-09-1989
		FI 891482 A, B,	26-09-1989
		JP 1932385 C	26-05-1995
		JP 3087253 A	12-04-1991
		JP 6061914 B	17-08-1994

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82