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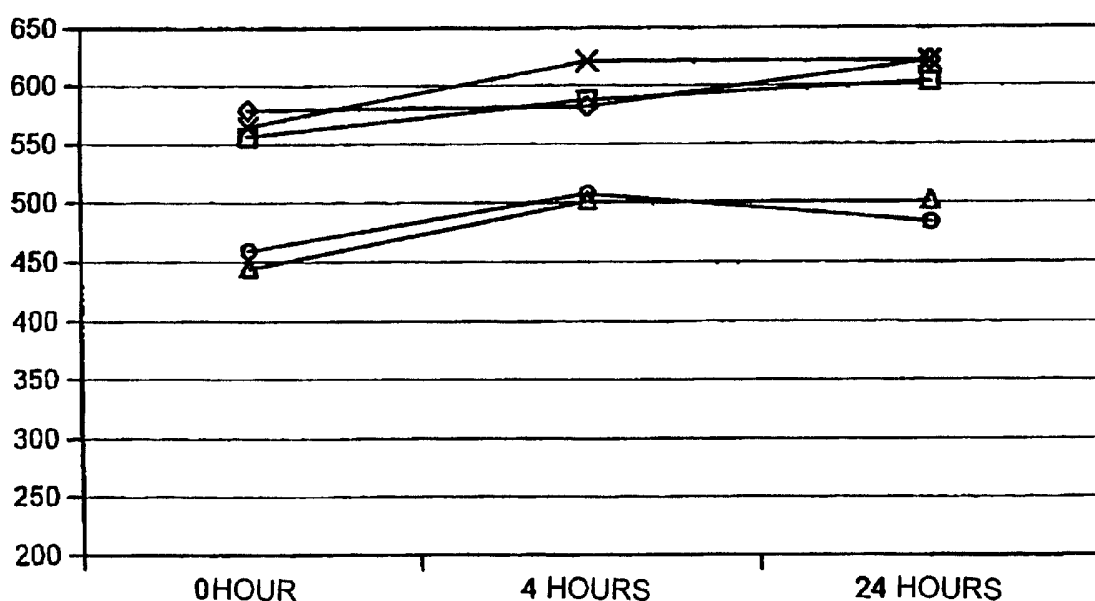
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(54) Title: FROZEN CONFECTIONERY



(57) Abstract: Frozen confectionery preserving its unctuousness and exhibiting reduced crystalline growth during a heat shock followed by refreezing, and comprising fat, sweetener, milk solids-not-fat and water, characterized in that the sum of the quantities of starch and milk solids-not-fat is between 2.5 and 18 % and in that the starch/milk solids-not-fat weight ratio is between 0.03 and 1.5. Process for manufacturing such a frozen confectionery.



WO 03/015530 A1

FROZEN CONFECTIONERY

The present invention relates to the field of frozen confectioneries and in particular to ice-cream.

5

Ice-creams are traditionally made using ingredients such as: fat, milk solids-not-fat, sweeteners, emulsifiers and water. The various ingredients are homogenized, the mixture is then pasteurized, cooled
10 and optionally allowed to mature at about 2 to 4°C and deep-frozen with stirring with injection of air to provide a degree of overrun of the order of 75 to 120%.

In general, starch, by virtue of its physicochemical
15 characteristics and its rheological properties, is often used in the food industry as a thickener and/or as a binder. Thus, numerous documents describe the use of native or gelatinized starch, physically or chemically modified or not, in frozen confectioneries,
20 as fat substitute or texturing agent.

Frozen confectioneries are particularly appreciated for their creamy and unctuous characteristics. However, these products, in order to preserve their optimum
25 organoleptic characteristics of unctuousness, have to be stored and handled with care. Thus, temperature variations, even small, can be observed during storage, distribution or handling. This is particularly the case when the consumer buys a frozen confectionery, when
30 they do not consume it straight away and when there is a gap between the time the product is taken from the deep-frozen section and when it is placed in the domestic freezer. In such circumstances, substantial or partial defrosting of the product occurs before it is
35 refrozen. Such cycles of temperature variation are responsible for crystalline growth of ice crystals in the product. A crystallized texture thus results therefrom. This texture and this crystallized mouth feel accompanied by an impaired appearance of the

product compromises or at the very least reduces its overall quality as perceived by the consumer.

Various gums and/or emulsifiers have been used as additives with the aim of improving the stability, the creaminess and the resistance of frozen confectioneries to heat shocks. These may include guar gum, carob or guar seed flour, alginate, carboxymethyl cellulose, xanthan, carrageenan, synthetic or natural emulsifiers such as egg yolk. The milk proteins contained in the milk dry extract participate in this stabilization by virtue of their water-binding property.

However, the use of gums has the disadvantage of conferring on the product a texture which is sometimes firm or gummy. Moreover, the addition of such stabilizing compounds is often poorly viewed by the consumer and their use is regulated. Furthermore, additives of the type including milk solids-not-fat and/or proteins or milk protein derivatives are particularly expensive.

The problem which the invention proposes to solve consists in providing an inexpensive formulation for frozen confectioneries which makes it possible to increase their stability during heat shocks without compromising their organoleptic qualities.

To this end, the present invention consists in a frozen confectionery, in particular an ice-cream, comprising fat, sweeteners, milk solids-not-fat, water and starch, characterized in that the sum of the quantities of starch and milk solids-not-fat is between 2.5 and 18% and in that the starch/milk solids-not-fat weight ratio is between 0.03 and 1.5.

A frozen confectionery according to the present invention may comprise 2 to 12% of fat, 10 to 25% of

sweeteners, 2 to 15% of milk solids-not-fat, 0.5 to 3% of starch and 45 to 85% of water.

5 The percentages indicated in the description relate to the percentages by weight except in the case of the overrun values which are defined in % by volume.

10 Thus, according to the invention, the partial replacement of the milk solids-not-fat traditionally used by starch allows substantial savings while improving the resistance to heat shocks. Furthermore, the product thus obtained has a creamy and unctuous mouth feel close to or even superior to that of the traditional product. Thus, apart from the mere economic
15 advantage, the invention makes it possible to simultaneously improve the pleasantness of use and the textural and organoleptic qualities of frozen confectioneries.

20 The starch used in the present invention may be a native starch or a chemically or physically modified starch. It may thus include native starches from maize, rice, potato or tapioca, for example, which are used alone or in the form of a mixture or alternatively
25 chemically modified starches of these same origins, such as hydroxypropylated starches, for example. Such starches have a gelatinization temperature of between approximately 50 and 85°C, and a granule diameter of between approximately 3 and 100 µm.

30

The ingredients used for making a frozen confectionery according to the invention are, apart from the starch, milk solids-not-fat such as powdered or concentrated skimmed milk, for example. This may also include
35 powdered or concentrated defatted sweet whey, for example. These milk solids-not-fat may also be derived from a commercial mixture of milk powder and whey proteins whose functionality is controlled by specific

denaturation treatments. These may include for example Nollibel®.

The frozen compositions according to the invention may optionally comprise one or more emulsifiers in an amount of 0.2 to 0.3% which facilitate the emulsification of the various ingredients during manufacture. These may thus include, for example, mono- or diglycerides or polysorbates or a mixture thereof, for example.

The frozen confectioneries according to the present invention may comprise stabilizing agents; these may include carob flour, guar flour, alginates, carboxymethyl cellulose, xanthan, carrageenan, used alone or in the form of a mixture at a dose of 0.1 to 0.5%, preferably 0.25%.

The fat used may be a vegetable or animal fat, hydrogenated or otherwise, for example. It may be a mixture of fat of plant origin, such as palm, coconut or palm kernel oil, hydrogenated or not.

The sweetener used may be sucrose, glucose, fructose or glucose syrup with variable DE varying from 20 to 40, or a mixture thereof, for example. The formulation of the product according to the invention may in addition comprise colourings such as beta-carotene, for example, and/or any type of flavourings or perfumes customarily used to flavour frozen confectioneries, such as vanilla or chocolate for example.

The frozen confectioneries according to the invention may be composed of milk solids-not-fat, sweeteners, fat and water. The proportions of ingredients such as starch and milk solids-not-fat make it possible to obtain increased stability of the products as well a substantial reduction in the cost price of these products. These savings are made through the partial

replacement of the milk solids-not-fat traditionally used by starch. Furthermore, the organoleptic qualities of the frozen compositions according to the invention are not reduced compared with the traditional products.

5 Thus, the characteristics of unctuousness and creaminess are increased and in particular better preserved during the period of storage. In the frozen compositions according to the invention, it is the addition of starch in place of a portion of the milk

10 solids-not-fat which makes it possible to slow down the rate of melting of the products obtained and thus confers greater stability to heat shocks on the product.

15 The frozen compositions according to the invention may have a dry extract of the order of 25 to 45%, preferably 30 to 40% and more preferably still from 33 to 36%. The compositions according to the invention may in addition optionally comprise additions such as fruit

20 or fruit pieces, for example, or nuts, or hazelnuts, whole or in pieces, for example.

The invention also relates to a process for making frozen confectioneries comprising the following steps:

25 - dispersion, heating and homogenization of the ingredients entering into the composition of a frozen confectionery according to the present invention at a temperature, a pressure and for a period sufficient to hydrate and gelatinize the starch and pasteurize the

30 mixture,

- cooling of the mixture to a temperature of between 2 and 8°C,
- ripening of the mixture at a temperature of between 2 and 6°C, without stirring,
- 35 - freezing to a temperature of between -3°C and -7°C, providing a degree of overrun of between 70 and 130%,
- hardening of the mixture by deep-freezing to a temperature of between -20°C and -40°C.

Optionally, the step of ripening of the mixture may be carried out with stirring.

5 The ingredients entering into the composition of a frozen confectionery according to the present invention may be dispersed at around approximately 60 to 70°C for approximately 15 to 30 minutes, for example. The whole may be heated and homogenized at around 70 to 75°C, for
10 example, at a pressure of the order of 140 to 220 bar, for example. These steps of dispersion, heating and homogenization make it possible to bring about hydration and swelling of the starch.

15 The mixture may then be pasteurized according to methods known to persons skilled in the art, for example at around 80 to 90°C for 10 to 30 seconds. The homogenization-heating step may be carried out at a pasteurization temperature which brings about, on its
20 own, pasteurization of the mixture. The mixture may then be cooled to around 2 to 8°C by known means. This mixture may then be ripened or otherwise for 4 to 48 hours at around 2 to 6°C, for example, with or without stirring. After this ripening step, the mixture may be
25 frozen at around -3 to -7°C with stirring with injection of gas so as to produce a degree of overrun of the order of 70 to 130%, for example. The mixture obtained may then be hardened by freezing at around -20 to -40°C, for example.

30 After the ripening step, the frozen compositions may, for example, be extruded in the form of quenelles having a greater or lesser degree of overrun, with the aid of an ice-cream industry refrigerated extruder,
35 with or without injection of gas, for example.

To evaluate the influence of the partial replacement of milk solids-not-fat by starch, various textural, microscopic and macroscopic tests may be carried out.

Measurement of the melting of ice-creams:

5 The melting tests are carried out both on samples stored at -30°C and on samples which have been subjected to a heat shock.

10 Standard heat shock: the samples initially stored at -30°C are subjected, for 7 days, to a temperature cycle of $-10^{\circ}\text{C}/20^{\circ}\text{C}$. After the 7 days, the melting parameters are evaluated for these samples which were subjected to a heat shock.

15 The temperature for the melting test is set at 20°C , in a chamber saturated with moisture. Before the test, the samples are tempered overnight at -20°C . Each ice-cream sample is unmoulded and deposited on a grid on top of a scale. The duration of the test is between 30 and 240 minutes approximately. The mass of unmelted product is thus recorded over time. The parameters measured are the following:

M: percentage by weight of product which has flowed through the grid at the end of the test.

25 S: time taken for 1% of the initial mass to have flowed.

Measurement of the viscosity of the mixtures for frozen confectionery:

30 The measurement of the viscosity is carried out on the mixture during the ripening step at around 4°C , for example. A measuring probe is inserted into the mixture and connected to a motor which brings about its rotation at a predefined constant speed.

35 The viscosity can thus be measured at around 4°C with the aid of a Brookfield LVT-DV2 viscometer, for example. The speed of rotation of the probe may be established at 30 revolutions per minute, for example.

The viscosity may then be read on the display of the viscometer. This viscosity may be expressed in Pa.s or a multiple.

5 Size and distribution of the ice crystals in an ice-cream

An aliquot of ice-cream is mixed with an equivalent quantity of glycerol and observed under a microscope at
10 a temperature of -10°C. The measurement may be carried out in a chamber at -10°C equipped with microscope and a camera. It is thus possible to measure the mean diameter of the crystals (in μm) in the finished products and in the products which have been subjected
15 to a heat shock. Knowing the mean diameter of the crystals, the crystalline growth which has taken place in the product can be easily evaluated.

Embodiments of the invention include, for example,
20 frozen bars, ice-creams, frozen yoghurts and any frozen confectionery or dessert with a greater or lesser degree of overrun.

It can thus be observed that the samples containing for
25 example 1.5% starch and 6% milk solids-not-fat have a homogeneous viscosity compared with a control sample traditionally containing 10% milk solids-not-fat and no starch. Thus, the mixture, after the ripening stage, exhibits no phase separation, remains pumpable and
30 shows no signs of developing a gelled structure.

As regards the heat shock resistance properties, the parameters measured demonstrate retardation as regards the rate of melting of the samples containing starch
35 compared with the traditional product.

The frozen confectioneries according to the present invention exhibit improved stability and organoleptic characteristics similar to traditional products. Such

products according to the invention preserve their organoleptic properties of creaminess and unctuousness throughout their preservation, storage, handling, distribution and more especially with respect to heat shocks which are harmful to these characteristics. These products indeed exhibit reduced crystalline growth compared with traditional products. This contributes to their unctuous consistency and to the preservation of this characteristic despite unfavourable storage conditions responsible for the development of ice crystals which may be responsible for a crystallized and sandy structure. Such functionalities make it possible to envisage production, storage and distribution of the products according to the invention extending over time, volume and space.

A frozen confectionery according to the present invention is therefore characterized in that it preserves its unctuousness and exhibits reduced crystalline growth during a heat shock followed by refreezing.

The expression "reduced crystalline growth" is understood to mean an increase in the mean diameter of the ice crystals of less than 50% after heat shock (see Table 4).

The invention is described below with reference to various precise examples of preferred embodiments and modes of formulation. However, various adaptations and/or modifications may be made while remaining within the scope of the present invention.

35 MANUFACTURE OF THE VARIOUS SAMPLES

Various examples of manufacture of frozen confectionery according to the present invention are produced

according to the formulations indicated in Table 1 below.

The various ingredients are dispersed at 65°C and then
 5 undergo a hydration step at 60°C for 20 minutes. The
 mixture is preheated to 72°C, which brings about
 gelatinization of the starch present, where
 appropriate. The mixture is then homogenized at 180 bar
 with the aid of an ice-cream industry homogenizer and
 10 then pasteurized at 86°C for 20 seconds. After cooling
 to 5°C, the mixture is ripened for 24 hours at 4°C,
 without stirring. Finally, the mixture is frozen at
 about -5°C with a degree of overrun of 100%. The ice-
 cream obtained is hardened at -30°C by conventional
 15 means.

Table 1

	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5
Nollibel®	10	6	6	6	0
Skimmed milk powder	0	0	0	0	10
Hydroxypropylated potato starch	0	1.5	0	0	0
Hydroxypropylated tapioca starch	0	0	0	1.5	0
Native maize starch	0	0	1.5	0	0
Cremodan®	0.5	0.5	0.5	0.5	0.5
Vegetable fat Polawar®	8	8	8	8	8
Sugar	14	15	15	15	14
Glucose syrup DE 38-42	4	5	5	5	4
Water	63.5	64.5	64.5	64.5	63.5

20 Nollibel®: mixture of milk powder and functional whey proteins.

Cremodan®: mixture of emulsifiers and stabilizers.

Polawar®: mixture of fractionated and partially hydrogenated vegetable fat from palm kernel.

Variation of the viscosity of the mixtures

Figure 1 shows the viscosities of the mixtures and the variation of these viscosities during the ripening step at 4°C.

All the mixtures are homogeneous after 24 hours of ripening, that is to say that no phase separation is observed in spite of the absence of stirring. The mixtures remain pumpable and are not gelled. A slight increase in viscosity may be noted over the period of time measured. Furthermore, the viscosity ranges are fairly narrow and are within the values of the reference examples (Examples 1 and 5).

Melting tests:

Table 2

<i>Samples stored at -30°C</i>					
	Dry extract (%)	S (min)	variation	M (%)	variation
Example 1	36.5	31		30	
Example 2	35.6	31	0.00%	24	-20.00%
Example 3	35.9	49	58.06%	21	-30.00%
Example 4	35.9	48	54.84%	19	-36.67%
Example 5	36.5	50	61.29%	40	33.33%

Table 3

<i>Samples after heat shock</i>					
	Dry extract (%)	S (min)	variation	M (%)	variation
Example 1	36.5	26.5		51	
Example 2	35.6	44	66.04%	40	-21.57%
Example 3	35.9	52	96.23%	34	-33.33%
Example 4	35.9	43	62.26%	25	-50.98%
Example 5	36.5	40	50.94%	53	3.92%

Tables 2 and 3 show that all the samples containing starch begin to melt later than (S value always higher, up to 100% increase, or equal) and their percentage of molten product at the end of the test is always less than for the references. These conclusions are valid for the products stored at -30°C but also, which is more important, for the products which were subjected to a heat shock.

10 Size of the crystals and crystalline growth:

Table 4

	Mean diameter of the ice crystals (µm)		Growth after heat shock		
	Storage at -30°C	After heat shock		µm	%
Example 1	32	49		16	53
Example 2	30	45		15	49
Example 3	32	42		10	31
Example 4	31	44		13.5	43
Example 5	30	50		19.5	67

Table 4 shows the mean diameter of the ice crystals in various frozen products. It may be observed that the products containing starch have, on the one hand, a mean crystal diameter smaller than the references, this being so particularly after heat shock. The samples with starch exhibit increases in crystal size which are significantly less than for the references. Analysis of the size and of the distribution of the ice crystals makes it possible to show that the partial replacement of the milk solids-not-fat by starch improves the stability of the samples during heat shock.

Sensory analysis:

The five samples were evaluated by a panel of people trained in the evaluation of texture and flavour.

The questionnaire distributed contains the descriptive attributes for:

- texture
- 5 - sweet taste
- flavour

10 All the texture descriptions show significant product effects, reflecting the differences between the products. The products do not appear to be significantly different for the flavour descriptions. Furthermore, surprisingly, the samples with starch have a higher score as regards the description relating to the cream flavour.

15 The samples with starch (compared with the control samples) have a greater mouthfill, are slightly harder, smoother, melt less rapidly, are less cold and are slightly more gummy, which appears to correspond to the
20 presence of crystals in the control sample. It is thus confirmed that these samples with starch would therefore withstand heat shock better.

CLAIMS

1. Frozen confectionery, comprising fat, sweetener, milk solids-not-fat, water and starch, characterized in
5 that the sum of the quantities of starch and milk solids-not-fat is between 2.5 and 18% by weight and in that the starch/milk solids-not-fat weight ratio is between 0.03 and 1.5.
- 10 2. Frozen confectionery comprising, by weight, 2 to 12% of fat, 10 to 25% of sweeteners, 2 to 15% of milk solids-not-fat, 0.5 to 3% of starch and 45 to 85% of water.
- 15 3. Frozen confectionery according to Claims 1 and 2, characterized in that the starch is chosen from the group consisting of native starches from potato, maize, tapioca or rice or a mixture thereof.
- 20 4. Frozen confectionery according to Claims 1 to 3, characterized in that the starch is a chemically or physically modified starch.
5. Frozen confectionery according to Claims 1 and 2,
25 comprising one or more emulsifiers.
6. Frozen confectionery according to Claims 1 and 2, comprising at least one stabilizer chosen from the following group: carob or guar seed flour, alginates,
30 cellulose, xanthan, carrageenans.
7. Frozen confectionery according to Claims 1 and 2, characterized in that the milk solids-not-fat are chosen from the group composed of powdered or
35 concentrated skimmed milk, powdered or concentrated defatted sweet whey, a commercial mixture of milk powder and of whey proteins.

8. Frozen confectionery according to Claims 1 and 2, characterized in that the sweeteners are chosen from the group comprising sucrose, glucose, fructose or glucose syrups or a mixture of these agents.
- 5 9. Frozen confectionery according to Claim 8, characterized in that the glucose syrups have a DE of between 20 and 40.
- 10 10. Frozen confectionery, characterized in that it preserves its unctuousness and exhibits reduced crystalline growth during a heat shock followed by refreezing.
- 15 11. Process for making frozen confectioneries comprising the following steps:
- dispersion, heating and homogenization of the ingredients entering into the composition of a frozen confectionery according to one of Claims 1 to 9 at a
 - 20 temperature, a pressure and for a period sufficient to hydrate and gelatinize the starch and pasteurize the mixture,
 - cooling of the mixture to a temperature of between 2 and 8°C,
 - 25 - ripening of the mixture at a temperature of between 2 and 6°C, without stirring,
 - freezing to a temperature of between -3°C and -7°C, providing a degree of overrun of between 70 and 130%,
 - 30 - hardening of the mixture by deep-freezing to a temperature of between -20°C and -40°C.
12. Process according to Claim 11, characterized in that the step of ripening of the mixture is
- 35 carried out with stirring.

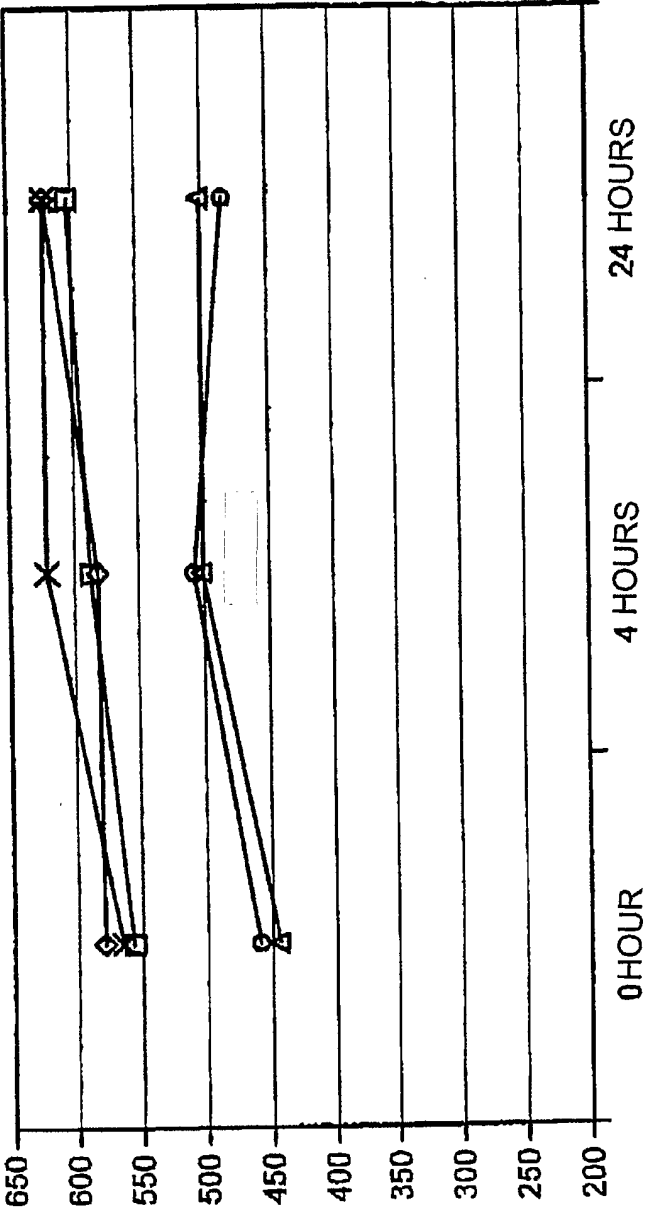


FIG. 1

INTERNATIONAL SEARCH REPORT

Interr I Application No
PCT/EP 01/09473

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A23G9/02

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 A23G

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, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	US 4 725 445 A (FERRERO PIETRO) 16 February 1988 (1988-02-16) the whole document ----	1
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☒ 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
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Date of the actual completion of the international search

18 January 2002

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INTERNATIONAL SEARCH REPORT

Inte Application No
PCT/EP 01/09473

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

Intern — Application No

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