METHOD AND APPARATUS FOR PREPARING A PASTRY INGREDIENT COMPRISING FLOUR AND FAT

The invention relates to methods and apparatus for the preparation of a pastry crumb product (32) comprising flour and fat. The method and apparatus include preparing of the pastry crumb product (32) using a food processing apparatus (18). The method and apparatus include providing a temperature controlled environment (16) for the ingredients having a predetermined temperature. The method and apparatus include providing the ingredients in the temperature controlled environment (16) so that they are substantially at the predetermined temperature. The method and apparatus include mixing the ingredients in the temperature controlled environment (16) comprising cutting the fat and flour together using the food processing apparatus (18) to prepare the pastry crumb product (32).
METHOD AND APPARATUS FOR PREPARING A PASTRY INGREDIENT COMPRISING FLOUR AND FAT

Technical Field
The invention refers to methods and apparatus relating to the preparation of pastry, and in particular, although not exclusively, the preparation of a pastry crumb product.

Background
It is known to prepare relatively small quantities of pastry by hand using a technique of rubbing fats and flour together. The flour is initially sieved into a mixing bowl, which assists with incorporating air into it. Salt and/or sugar may be added to the flour if required. The fats, comprising butter and/or lard, may be cut into small lumps using a knife and then added to the flour. Prior to rubbing the fats and flour together the fats should be at room temperature, for example 18 - 30°C, so that they are soft. This is important because the fats are required to be incorporated into the flour as quickly as possible, and if the fats are too cold they are too hard and the rubbing will take too long. If rubbing the fats and flour together takes too long the fats become oily due to the warmth of the hands and the heat produced by friction, and the finished pastry may be difficult to roll out. Furthermore the finished pastry may have an inferior texture.

The rubbing technique comprises lightly rubbing the fats into the flour using the finger tips. As this is done the mixture may be lifted and allowed to fall back into the mixing bowl, which assists with incorporating air into the mixture. The rubbing technique should be performed relatively quickly and just long enough to produce a crumb mixture. A final ingredient of water, eggs and/or milk is then added to the crumb
mixture and worked into it by hand to produce the finished pastry. If the fats become oily during rubbing they coat more flour grains than required. If this happens the crumb mixture is unable to absorb a sufficient amount of the final ingredient, and the finished pastry may crumble and be difficult to roll out. Prior to being rolled out the finished pastry is required to be rested, for example, by placing it in a fridge for 30 minutes. This allows gluten within the flour and the final ingredient to react together, and cools the finished pastry down. Such resting produces a more elastic finished pastry so that it is easier to roll out. Without resting it may be difficult to roll out the finished pastry.

A problem associated with the above way of preparing pastry is that it is a manual technique that is relatively slow. In particular the rubbing together of the fats and flour is only suitable for preparing relatively small amounts of pastry in the home or commercial kitchen such as a restaurant kitchen. Accordingly such a rubbing technique is not readily scalable to produce larger quantities of pastry. Furthermore the rubbing technique requires practice and skill to get right in order to produce the finished pastry with a consistent quality. The requirement to rest the finished pastry also takes time.

It is also known to freeze the finished pastry after the final ingredient has been added to the crumb mixture. When this is done in the home or commercial kitchen the finished pastry is simply placed into a freezer, and allowed to freeze naturally. A problem associated with such freezing is that ice crystals form in the finished pastry due to the presence of water. The water is typically incorporated into the mixture due to the final ingredient of water, eggs and/or milk. Due to the formation of ice crystals the frozen pastry may undergo an accelerated decay due to a breakdown of the finished pastry into
water, gluten, fat etc. Typically after a few days of being frozen the finished pastry may lose its fresh quality.

When using an industrial freezing technique for preserving a food product it is known to use blast freezing which aims to freeze the food product quickly to around -18°C. Blast freezing reduces the possibility for ice crystals to form within the food product, which keeps the frozen food fresher for longer. A problem associated with blast freezing is the increased cost of installing and operating an apparatus to perform the blast freezing, which has a consequential increase in cost for the food product.

It is also known to produce pastry on a larger scale by using an industrial process of spraying liquid fats onto flour, and mixing the ingredients together using a large food mixing apparatus. Water is then sprayed onto the ingredients and mixture into them to make the finished pastry, which is then squeezed out of the food mixing apparatus through a nozzle to provide a continuous production method. The finished pastry may then be frozen using blast freezing. A problem associated with such a technique is that the finished pastry may be relatively difficult to roll out compared to the manual technique of rubbing ingredients together. Furthermore, due to the addition of the final ingredient prior to freezing, the pastry may have a relatively shorter shelf life due to the formation of ice crystals. Overall the finished pastry produced by spraying fats onto flour may be of a lower quality compared to the manual technique of rubbing ingredients together.
It is broadly an object of the present invention to address one or more of the above-mentioned disadvantages.

**Summary**

What is required are method and apparatus for preparing a pastry crumb product, and for making a pastry dough, which may reduce or minimise at least some of the above-mentioned problems.

According to a first aspect of the invention, there is provided a method of preparing a pastry crumb product using a food processing apparatus, the method comprising:

- providing ingredients for the pastry crumb product comprising flour and fat;
- providing a temperature controlled environment for the ingredients, the temperature controlled environment having a predetermined temperature;
- preparing a predetermined quantity by weight of the ingredients;
- providing the ingredients in the temperature controlled environment so that they are substantially at the predetermined temperature; and
- mixing the ingredients in the temperature controlled environment comprising cutting the fat and flour together using the food processing apparatus to prepare the pastry crumb product.

Such a method provides the advantage of being able to incorporate the fat and flour together quickly. Furthermore the possibility for the ingredients to heat up may be reduced. Such advantages are provided by using the temperature controlled environment for the ingredients and using the food processing apparatus to cut and mix the fat and
flour together. It will be appreciated that cutting may alternatively be termed shearing. A further advantage is that the method can be used to produce relatively larger batches of pastry crumb product having a consistent quality. The pastry crumb product can then be used to make a finished pastry with a consistent quality. Using the temperature controlled environment and the food processing apparatus also means that the prior art technique of rubbing the fats and flour together can be omitted. Omitting the rubbing technique is advantageous because it removes a skilled task in the making of a finished pastry. Such a rubbing technique is a relatively slow manual technique, and the method according to the invention may be used to produce the pastry crumb product more quickly. Furthermore using the food processing apparatus according to the invention, and using solid fats instead of liquid fats, may incorporate more air into the pastry crumb product, which may produce an improved finished pastry.

Preferably the food processing apparatus has a mixing blade, wherein said cutting is provided using the mixing blade. The mixing blade provides the advantage of being able to cut the fat and mix the ingredients together at the same time.

Preferably the method further includes using a temperature range of -10 to 10°C for the predetermined temperature. Preferably the method further includes using a temperature range of 4 to 14°C for the predetermined temperature, and more preferably using a temperature range of 8 to 12°C, or 4 to 10°C for the predetermined temperature. Such temperature ranges are sufficiently low enough for the fats to be cut and mixed together with the flour.
In one embodiment the method further includes providing the predetermined temperature for the fat at a lower temperature than the flour within the temperature controlled environment. Such a method may further assist with producing the pastry crumb product whereby the fat and the flour are mixed within the temperature controlled environment when the fat is at a lower temperature than the flour.

Preferably the method further includes providing the fat in the temperature range -10 to 10°C, and more preferably in the temperature range 2 to 8°C, and more preferably in the temperature range 4 to 6°C. Preferably the method further includes providing the predetermined temperature for the flour in the temperature range 4 to 14°C within the temperature controlled environment, and more preferably in the temperature range 4 to 10°C, or 8 to 12°C. In one arrangement the method includes providing the flour in the temperature range the 5 to 7°C. Such temperatures are advantageous temperature ranges for the ingredients to produce the pastry crumb product.

Preferably the method further includes mixing the ingredients for an increased length of time when the fats are below 4°C. Preferably the method further includes mixing the ingredients for a reduced length of time when the fats are above 4°C.

Preferably said preparing comprises cutting or dicing the fat into lumps prior to mixing it with the flour. Preferably the method further includes cutting or dicing the fat so that the lumps have a maximum dimension of between 0.2 - 10 cm, and preferably between 2 - 4 cm.
In one embodiment the method further includes freezing the pastry crumb product. Preferably said freezing includes freezing the pastry crumb product using ambient freezing. With such freezing the production of ice crystals is largely avoided due to the absence of a final ingredient is required to produce a pastry dough.

In one embodiment the method further includes controlling a humidity of the temperature controlled environment. Such a method may have the advantage of being able to provide an improved pastry crumb product.

Preferably the method further includes providing ingredients for the pastry crumb product comprising at least one of a raising agent, a flavouring, sugar and salt.

According to a second aspect of the invention there is provide a method of making a pastry dough using a pastry crumb product prepared using a method according to the first aspect of the invention, the method of making the pastry dough including:

adding a further ingredient to the pastry crumb product comprising at least one of water, egg, milk; and

mixing the further ingredient with the pastry crumb product to produce the pastry dough.

Such a method has the advantage that when the pastry dough is required to be made in the home or the commercial kitchen a person need only measure out a sufficient quantity of the pastry crumb product so that the final ingredient can be mixed into it. Such a method may involve less waste when producing the finished pastry. Furthermore
the person preparing the finished pastry does not need to perform the time consuming and skilled task of preparing the pastry crumb product. The addition of the final ingredient to prepare the finished pastry is a simple step requiring a lower level of skill, which means that the finished pastry is more likely to be of a consistently good quality, and typically of a quality which is comparable with the prior art technique of rubbing the ingredients together. Furthermore, it has been discovered that the pastry dough produced using the pastry crumb product is not required to be rested as per the prior art pastry dough. According to the invention, since the pastry crumb product is already cooled such resting may be omitted, which saves time.

According to a third aspect of the invention there is provided an apparatus for preparing a pastry crumb product with ingredients comprising flour and fat, the apparatus comprising a chamber having a food processing apparatus within it, the chamber having an air conditioning device operable to maintain an air temperature within the chamber at a predetermined temperature, the apparatus being operable to provide the ingredients so that they are substantially at the predetermined temperature, wherein the apparatus is operable to mix and cut the fat and flour together at the predetermined temperature to prepare the pastry crumb product with the food processing apparatus.

Such an apparatus provides the advantage of being able to incorporate the fat and flour together quickly. Furthermore, the possibility for the ingredients to heat up may be reduced. Such advantages are provide by using a chamber with the temperature controlled environment for the ingredients and using the food processing apparatus to cut and mix the fat and flour together. It will be appreciated that cutting may
alternatively be termed shearing. A further advantage is that the apparatus can be used to produce relatively larger batches of pastry crumb product having a consistent quality. The pastry crumb product can be used to make a finished pastry with a consistent quality. Using the temperature controlled environment and the food processing apparatus also means that the prior art technique of rubbing the fats and flour together can be omitted. Omitting the rubbing technique is advantageous because it removes a skilled task in the making of a finished pastry. Such a rubbing technique is a relatively slow manual technique, and the apparatus according to the invention may be used to produce the pastry crumb product more quickly. Furthermore using the food processing apparatus according to the invention, and using solid fats instead of liquid fats, may incorporate more air into the pastry crumb product, which may produce an improved finished pastry.

Preferably the food processing apparatus has a mixing blade to mix and cut the fat and flour together. Preferably the mixing blade is mounted on a substantially vertical shaft of the food processing apparatus. The mixing blade provides the advantage of being able to cut the fat and mix the ingredients together at the same time.

Preferably the predetermined temperature is in the range -10 to 10°C. Preferably the predetermined temperature is in the range 4 to 14°C, and more preferably in the range 4 to 10°C, or 8 to 12°C. Such temperature ranges are sufficiently low enough for the fats to be cut and mixed together with the flour.
Preferably the apparatus further includes a first cooler device operable to provide the fat at a lower temperature than the flour within the temperature controlled environment. Such an apparatus may further assist with producing the pastry crumb product.

Preferably the first cooler device is operable to provide the fat in the temperature range -10 to 10°C, and more preferably in the temperature range 2 to 8°C, and more preferably in the temperature range 4 to 6°C. Such temperatures are advantageous temperature ranges for the ingredients to produce the pastry crumb product.

Preferably the apparatus further includes a second cooler device operable to provide the flour in the temperature range 4 to 14°C within the temperature controlled environment, and more preferably in the temperature range 4 to 10°C, or 8 to 12°C. In one arrangement the second cooler device is operable to provide the flour in the temperature range 5 to 7°C. Such temperatures are advantageous temperature ranges for the ingredients to produce the pastry crumb product.

In one embodiment the apparatus further includes a freezer device operable to freeze the pastry crumb product using ambient freezing.

In one embodiment the air conditioning device is operable to control an air humidity of the air within the chamber. Such an apparatus may have the advantage of being able to provide an improved pastry crumb product.
According to a fourth aspect of the invention there is provide a method of making a pastry crumb product using an apparatus according to the third aspect of the invention.

According to an alternative characterisation of the invention there is provided a method of preparing a pastry crumb product using a food processing apparatus, the method comprising:

- providing ingredients for the pastry crumb product comprising flour and fat;
- providing a temperature controlled environment for the ingredients, the temperature controlled environment having a first predetermined temperature;
- preparing a predetermined quantity by weight of the ingredients;
- providing the fat at a second predetermined temperature within the temperature controlled environment;
- providing the flour at a third predetermined temperature within the temperature controlled environment; and
- mixing the ingredients in the temperature controlled environment comprising cutting the fat and flour together using the food processing apparatus to prepare the pastry crumb product.

According to another characterisation of the invention there is provided an apparatus for preparing a pastry crumb product with ingredients comprising flour and fat, the apparatus comprising a chamber having a food processing apparatus within it, the chamber having an air conditioning device operable to maintain an air temperature within the chamber at a first predetermined temperature, a fat storage device to provide the fat at a second predetermined temperature, a flour storage device to provide the
flour at a third predetermined temperature, wherein the food processing apparatus is operable to mix and cut the fat and flour together to prepare the pastry crumb product.

Any preferred or optional features of one aspect or characterisation of the invention may be a preferred or optional feature of other aspects or characterisations of the invention.

**Brief Description of the Drawings**

Other features of the invention will be apparent from the following description of preferred embodiments shown by way of example only with reference to the accompanying drawings, in which;

- **Figure 1** shows an apparatus for making a pastry crumb product according to an embodiment of the invention;
- **Figure 2** is a process flow diagram for using the apparatus of Figure 1; and
- **Figure 3** is a diagram of a method according to an embodiment of the invention.

**Detailed Description**

Figure 1 shows an apparatus for making a pastry crumb product according to an embodiment of the invention, generally designated 10. The apparatus 10 comprises a chamber or room 12 which has an air conditioning device 14. The air conditioning device 14 is a device which operates to control an air temperature of air 16 within the room 12 so that it is within the temperature range 8 - 12°C. Optionally the air conditioning device 14 operates to control an air humidity of the air 16. In such a mode of operation the air conditioning device 14 operates as an air humidity device. The air
conditioning device 14 operates to exchange the air 16 with air external to the room 12 as shown by the arrow 15. A food processing apparatus 18 is provided inside the room 12. The food processing apparatus 18 has a mixing bowl 20, a motor 22, a drive shaft 24 and mixing blades 26. A suitable food processing apparatus 18 is a ROBOT COUPE™ vertical cutter-mixer model R30, although an alternative food processing apparatus 18 may be used. The food processing apparatus 18 is a food mixing apparatus.

The room 12 is, for example, a walk-in refrigerator which is sufficiently large enough to store a sufficient quantity of the required ingredients for making a pastry crumb product, and for an operator to prepare the ingredients, and to use the food processing apparatus 18. The ingredients comprise fats and flour. The fats may include butter and/or lard, and may comprise vegetable and/or animal fats. The flour may be wheat flour. Optionally the ingredients may also include a raising agent, a flavouring, salt and/or sugar. The fats are stored in a fats storage container 27, and the flour is stored in a flour storage container 29. The storage containers 27, 29 are, for example, cooler devices such as refrigerators and are within the room 12. The fats storage container 27 stores the fats at a first temperature within the temperature range 4 - 6°C. The flour storage container 29 stores the flour at a second temperature of about 12°C. Prior to operating the apparatus 10 the food processing apparatus 18 it is left within the room 12 for a sufficiently long period of time so that it is within the ambient temperature of the room i.e. within the temperature range 8 - 12°C. Prior to starting the mixing of the ingredients using the food processing apparatus 18 the ingredients are left within the storage containers 27, 29 for a sufficiently long period of time so that they are substantially at the required temperature i.e. the fats at a temperature within the
temperature range 4 - 6°C, and the flour at a temperature of about 12°C. It will be appreciated that a core temperature of a given mass of the ingredients should be within these temperature ranges.

The operator selects and prepares the fats 28 and flour 30 from the storage containers 27, 29. The fats are roughly diced by the operator as shown at 28. The fats 28 and flour 30 are then put into the mixing bowl 20. Optionally a raising agent, a flavouring, salt and/or sugar may also be added to the mixing bowl 20 depending on the recipe required. It will be appreciated that prior to mixing the ingredients, the fats are introduced into the mixing bowl 20 whilst they are at the temperature 4 - 6°C, the flour 30 is introduced into the mixing bowl 20 whilst at a temperature of 12°C, and the room 12 is within the temperature range 8 - 12°C.

The food processing apparatus 18 has a substantially vertical drive shaft 24 with the mixing blades 26 mounted thereon. Such mixing blades 26 of the food processing apparatus 18 cut or shear the fats 28 and mix them with the flour 30 at the same time to produce a pastry crumb product 32 within the mixing bowl 20. The mixing bowl 20 may have a lid (not shown). The vertical drive shaft 24 and mixing blades 26 also assist with introducing air into the mixture by lifting the ingredients as the cutting and mixing is performed. The food processing apparatus 18 may be pivotally mounted so that the pastry crumb product 32 can be tipped out of the mixing bowl 32 after preparation.

After preparation the pastry crumb product 32 is frozen, i.e. chilled, in a freezer 34 which is within the room 12. The freezer 34 cools the pastry crumb product 12 down to
a suitable temperature, for example at or below -18°C, so that a core temperature of a
mass of the pastry crumb product 32 is substantially at or below -18°C. The freezer 34
uses a slow freezing process i.e. the pastry crumb product 32 is introduced into the
freezer 34 and allowed to reach the ambient temperature within the freezer 34. Such a
technique may be termed ambient freezing, which may alternatively be termed ambient
chilling. Such a slow freezing or chilling process may be used because there is little or
no water in the pastry crumb product 32. Accordingly a known technique within the
food industry of blast freezing is not required, which is advantageous. According to the
embodiment of the invention the pastry crumb product 32 may be stored for relatively
long periods due to the absence of water. It will be appreciated that whereas no water is
added to the pastry crumb product 32, trace amounts of water may already be present in
the fats and flour. It will be appreciated that the freezer 34 is a cooler device, and
whereas the pastry crumb product 32 is already frozen, i.e. solid, at temperatures of 4 -
12°C, the freezer 34 further cools the pastry crumb product 32 down to the required
temperature e.g. -18°C or below, for the purposes of preserving the food. Such a
temperature of -18°C or below, is typically required to meet the requirements of food
safety standards.

To make a finished pastry, i.e. a pastry dough, using the pastry crumb product 32 a final
ingredient is required to be added and worked into it. The final ingredient is one or more
of water, eggs, milk of the required quantity to make the finished pastry. If the pastry
crumb product 32 is frozen, i.e. chilled to -18°C or below, the addition of the final
ingredient defrosts or warms the pastry crumb product 32 so that the finished pastry can
be made. It will be appreciated that when finished pastry is required to be made in the
home or the commercial kitchen a person need only measure out a sufficient quantity of the pastry crumb product 32 so that the final ingredient can be mixed into it. Preparing the finished pastry may involve less waste. Furthermore the person preparing the finished pastry does not need to perform the time consuming and skilled task of preparing the pastry crumb product 32. The addition of the final ingredient to prepare the finished pastry is a simple step requiring a lower level of skill, which means that the finished pastry is more likely to be of a consistently good quality, and typically of a quality which is comparable with the prior art technique of rubbing the ingredients together. According to the embodiments of the invention, the pastry crumb product 32 is a useful and versatile ingredient in making the finished pastry. It will be appreciated that different types of pastry crumb product 32 may be made using the apparatus 10 to make different types of finished pastry, for example, butter short crust pastry, sweet pastry, suet pastry, butter scone pastry etc.

It has been discovered that the pastry dough produced using the pastry crumb product is not required to be rested as per the prior art pastry dough. According to the embodiments herein, since the pastry crumb product is already cooled or frozen prior to adding the final ingredient, such resting may be omitted, which saves time. Whereas the inventors do not have a full scientific explanation, it is also thought that since the fats are cut into small pieces, i.e. crumbs, during mixing this may further contribute to avoiding the need for resting. Without such resting the finished pastry produced using the crumb pastry product has good elastic properties which are required for rolling out the pastry dough.
The required time to create a particular type of pastry crumb product 32 varies depending on the recipe and the type of food mixing apparatus used. Using the ROBOT COUPE™ vertical cutter-mixer model R30, the time taken to make a batch of pastry crumb product 32 is within the range of 25 to 40 seconds. For each recipe the mixing time is of the order of tens of seconds, and is carefully controlled to be within a particular time range. An example of how to make the pastry crumb product 32 of a short crust pastry now follows using the ROBOT COUPE™ vertical cutter-mixer model R30 food processing apparatus 18.

The ROBOT COUPE™ vertical cutter-mixer model R30 has a triple blade arrangement which is vertically above one another. The blades are set up so that they are equally spaced around the shaft 24 so that there is an angle of 120° between each blade when looking vertically downwards along the shaft 24. A lower blade is set at 0°, a middle blade is set at 120°, and an upper blade is set at 240°. The flour is added to the mixing bowl 20 at the ambient temperature of the room 12, e.g. between 8 - 12°C. The air conditioning device 14 operates to control the air temperature of air 16 within the room 12 so that it is within the temperature range 8 - 12°C, which is advantageous because it assists with ensuring that the ingredients are at the required temperature range whilst they are cut and mixed together. Whereas the air conditioning device 14 operating to exchange the air 16 with air external to the room 12, as shown by the arrow 15, the velocity of the air flow into the room 12 should be sufficiently slow and uniform so that the flour 30 is not disturbed. The air conditioning device may have a baffle arrangement 17 to deflect the movement of air away from the flour 30 and the mixing area in general, and to produce a sufficiently slow and even air movement within the room 12.
The fat, comprising butter and lard, is diced and added to the mixing bowl 20 at a temperature of 4°C. Salt is then added to the mixing bowl 20. The ingredients are added to the mixing bowl 20 in the required quantity by weight up to a maximum of 40% of the litre capacity of the food processing apparatus 18. In the case of the ROBOT COUPE™ vertical cutter-mixer model R30, the mixing bowl 20 has a maximum capacity of 30 litres, so that the maximum quantity of the ingredients for making the pastry crumb product 32 has a volume of 12 litres. The food processing apparatus 18 is then operated to pulse-mix for a first three second period at 1500 rpm. The ingredients are allowed to rest for a short period, and then the food processing apparatus 18 is operated to pulse-mix for a second three second period at 1500 rpm. The ingredients are allowed to rest for a short period, and then the food processing apparatus 18 is operated to mix continuously for fifteen seconds at 1500 rpm. The ingredients are allowed to rest for a short period, and then the food processing apparatus 18 is operated to pulse-mix for a third three second period at 1500 rpm. The pastry crumb product 32 is now prepared and ready to be frozen. The periods of rest between the mixing and pulse-mixing permit the ingredients to be in contact with each other to assist with coating of the fats with the flour, and to produce an even distribution of the fats 28 and flour 30 within the mixture. It will be appreciated that the mixing times and modes of operation to product the pastry crumb product 32 will depend on the type of food mixing apparatus used.
Figure 2 is a process flow diagram, generally designated 40, for using the apparatus 10 of Figure 1. In Figure 2 the ambient ingredient storage i.e. the ambient temperature of the room 12, is shown at 42. The ambient ingredient storage 42 is provided by the flour storage container 29. The chilled ingredient storage is shown at 44. The chilled ingredient storage 44 is provided by the fats storage container 27. The ambient ingredients are then selected by the operator as shown at 46. The chilled ingredients are then selected by the operator as shown at 48. The ingredients are then prepared and weighed by the operator as shown at 50. This may include preparing the flour and dicing the fats as shown at 28 and 30 in Figure 1. Referring back to Figure 2 the ingredients are then mixed as shown at 52 to product the pastry crumb product 32. The pastry crumb product is then frozen as shown at 54, for example using the freezer 34 shown in Figure 1.

Figure 3 is a diagram of a method according to an embodiment of the invention, generally designated 60. It will be appreciated that the steps may be performed in a different order, and may not necessarily be performed in the order shown in Figure 3. In Figure 3 the method is a method of preparing a pastry crumb product 32 using a food processing apparatus 18. The method comprises providing ingredients for the pastry crumb product 32 comprising flour and fat, as shown at 62. The method includes providing a temperature controlled environment for the ingredients, the temperature controlled environment having a predetermined temperature, as shown at 64. The method includes preparing a predetermined quantity by weight of the ingredients, as shown at 66. The method includes providing the ingredients in the temperature controlled environment so that they are substantially at the predetermined temperature,
as shown at 68. The method includes mixing the ingredients in the temperature controlled environment comprising cutting the fat and flour together using the food processing apparatus 18 to prepare the pastry crumb product 32, as shown at 70.

The food processing apparatus 18 has a mixing blade 26, the method includes said cutting being provided using the mixing blade 26, as shown at 72. The method further includes using a preferred temperature range for the predetermined temperature for example 4 to 14°C, or 8 to 12°C, or 4 to 10°C, as shown at 74. The method further includes providing the fat at a lower temperature than the flour within the temperature controlled environment, as shown at 76. The method further includes using a preferred temperature range for the ingredients, for example -10 to 10°C, or 2 to 8°C, or 4 to 6°C for the fat, and 4 to 14°C, or 8 to 12°C, or 4 to 10°C, or 5 to 7°C for the flour, as shown at 78. The method further includes mixing the ingredients for an increased length of time when the fats are below the 4°C, as shown at 79. The method further includes mixing the ingredients for a reduced length of time when the fats are above 4°C, as shown at 79. Said preparing comprises cutting or dicing the fat into lumps prior to mixing it with the flour, as shown at 81. The method further including cutting or dicing the fat so that the lumps have a maximum dimension of between 0.2 - 10 cm, as shown at 81. Using a lumps of fat with a size at the lower end of this range, i.e. in the range 0.2 - 0.5cm, provides the ability to use grated fats, which has been found to be another successful way of preparing the fats prior to mixing to produce the crumb pastry product.
The method further includes freezing the pastry crumb product 32, as shown at 80. Said freezing 80 includes freezing the pastry crumb product 32 using ambient freezing, also known as ambient chilling. The method further includes controlling a humidity of the temperature controlled environment, as shown at 82. The method further includes providing ingredients for the pastry crumb product 32 comprising at least one of a raising agent, a flavouring, sugar and salt.

The method includes making a pastry dough using the pastry crumb product 32, as shown at 84, comprising adding a further ingredient to the pastry crumb product 32 comprising at least one of water, egg, milk, and mixing the further ingredient with the pastry crumb product 32 to produce the pastry dough.

It will be understood from the above embodiments that the food processing apparatus 18 is operated in a manner required to produce the pastry crumb product 32. In the production of the pastry crumb product 32 the fats are cut or sheared by the food processing apparatus 18 in the mixing process. The pastry crumb product 32 comprises a fine and relatively homogenous crumb. The crumb is relatively uniform and non-lumpy, having granules that may be about 1 or 2mm in diameter. The mixing process reduces the ingredients to the pastry crumb product 32 which comprises fine grains of fat and flour. The production of the pastry crumb product 32 is made possible due to a combination of maintaining the ingredients at a predetermined temperature prior to mixing, and performing the mixing in a temperature controlled environment. The predetermined temperature and the temperature controlled environment are sufficiently low temperatures so that the fats do not become unduly soft or melt. Such temperatures
are 8 to 12°C for the temperature controlled environment, between 4 to 6°C for the fats, and 12°C for the flour. Providing the flour at a higher temperature of 12°C compared to the lower temperature of 4 to 6°C for the fats is beneficial for the mixing of the ingredients. It will be appreciated that cutting of the fats may not be possible if the ingredients are at an elevated temperature such that the fats are too soft. Furthermore the ingredients are mixed for a relatively short period of time so that the pastry crumb product 12 is not overworked and to preserve the fat temperature and the crumb structure of the pastry crumb product 32.

The production of the pastry crumb product 32 having the required properties is a significant part of producing pastry dough that is relatively non-elastic. Such non-elastic pastry dough produces finished pastry goods with a higher quality texture and with a crispy quality. When producing the pastry crumb product 32 according to the above embodiments it is necessary not to overwork the ingredients so that gluten strands of the flour remain intact. Furthermore if the fats are overworked the oil within them may start to separate out as the temperature rises. The pastry crumb product 32 has a structure of fat, flour and gluten where the gluten has not been overworked and the crumb is light. The ingredients are mixed and cut up to a point when small crumbs have been reached to give a light texture.

It will be appreciated that the arrangement of the above embodiments may be configured as an apparatus or method which is at least partially automated so that the requirement for an operator to manually select and prepare the fats 28 and the flour 30, and to operate the food processing apparatus 18 is reduced.
In the above embodiments various temperature ranges are used for the air 16, the fats, and the flour. It will be understood that the upper and lower limits of these temperature ranges may be reduced or increased by a few degrees, for example ±2°C, without significantly changing the ability of the apparatus 10 to produce the pastry crumb product 32.

In one arrangement the fats are diced, i.e. cut, prior to mixing with the flour so that they are lumps or approximately the shape of cubes or cuboids having a maximum dimension of between 2 - 12 cm, and preferably between 2 - 4 cm.

It has been discovered by the Applicant that an optimum temperature for the fat 28 prior to mixing in the food processing apparatus 18 may be 4°C. However, this may be reduced to -10°C or increased to 8°C or 10°C by storing the fats 28 in the storage container 27 prior to mixing them. When the fat 28 is at -10°C the step of mixing the ingredients as shown at 52 is possible because the fats do not freeze at such a temperature. Furthermore, the step of mixing the ingredients 52 to produce a fine crumb pastry product 32 is not possible when the fat 28 is above about 8°C or 10°C because the fats become too soft and the mixture starts to clump and/or over-mixes without full incorporation of fat.

It has been discovered by the Applicant that an optimum temperature for the air 16 and/or the 30 flour provided by the flour storage container 29, and prior to mixing in the food processing apparatus 18 may be 6°C. However, this may be reduced to 4°C or
increased to 10°C or 12°C. It has also been discovered by the Applicant that the
temperature of the environment, i.e. the temperature of the air 16 within the room 12,
has greater effect on performance and the quality of the pastry crumb product 32 than
the temperature of the ingredients 28, 30. This is because the temperature of the air 16
within the room 12 influences the equipment temperature, i.e. the temperature of the
surfaces of the food processing apparatus 18, as well as the temperature of the
ingredients 28, 30 being prepared within the room 12 as shown at 50 prior to mixing as
shown at 52.

In a more simple arrangement of the apparatus 10 and the method 40, 60, the fats 28 and
the flour 30 are merely provided within the room 12 without the refrigerators 27, 29,
whereby the predetermined temperature of the of the room 12 is in the range -10 to
10°C. In such an arrangement, since the predetermined temperature is low sufficiently
low enough, and if the fats 28, and flour 30 were left in the room 12 for sufficiently
long enough, then the ingredients would reduce in temperature naturally to permit the
crumb pastry product to be produced.

The Applicant has also discovered that an improved mixing is achieved and an
improved crumb pastry product 32 is achieved by increasing the mixing time by 10
seconds for every degree that the fats 28 are below 4°C. It will be appreciated that the
increased time is per batch of pastry crumb product 32 produced by the food processing
apparatus 18. Furthermore, an improved mixing is achieved and an improved crumb
pastry product 32 is achieved by reducing the mixing time by 10 seconds for every
degree that the fats 28 are above the temperature of the air 16. Such a reduced mixing
time reduces the chance of clumping of the crumb pastry product 32. The mixing time to produce the crumb pastry product 32 influences the quality of the final pastry that is produced when the final ingredient is introduced. For example, the mixing time ranges from 12 seconds to 130 seconds.
1. A method of preparing a pastry crumb product using a food processing apparatus, the method comprising:

   providing ingredients for the pastry crumb product comprising flour and fat;
   providing a temperature controlled environment for the ingredients, the temperature controlled environment having a predetermined temperature;
   preparing a predetermined quantity by weight of the ingredients;
   providing the ingredients in the temperature controlled environment so that they are substantially at the predetermined temperature; and
   mixing the ingredients in the temperature controlled environment comprising cutting the fat and flour together using the food processing apparatus to prepare the pastry crumb product.

2. A method according to claim 1, the food processing apparatus having a mixing blade, wherein said cutting is provided using the mixing blade.

3. A method according to claim 1 or 2, and further including using a temperature range of -10 to 10°C for the predetermined temperature.

4. A method according to claim 1 or 2, and further including using a temperature range of 4 to 14°C for the predetermined temperature.
5. A method according to claim 4, and further including using a temperature range of 8 to 12°C for the predetermined temperature.

6. A method according to claim 3 or 5, and further including using a temperature range of 4 to 10°C for the predetermined temperature.

7. A method according to any preceding claim, and further including providing the predetermined temperature for the fat at a lower temperature than the flour within the temperature controlled environment.

8. A method according to claim 7, and further including providing the fat in the temperature range -10 to 10°C.

9. A method according to claim 8, and further including providing the fat in the temperature range 2 to 8°C.

10. A method according to claim 9, and further including providing the fat in the temperature range 4 to 6°C.

11. A method according to any of claims 8 - 10, and further including mixing the ingredients for an increased length of time when the fats are below 4°C.

12. A method according to any of claims 8 - 10, and further including mixing the ingredients for a reduced length of time when the fats are above 4°C.
13. A method according to any of claims 7 - 12, and further including providing the predetermined temperature for the flour in the temperature range 4 to 14°C within the temperature controlled environment.

14. A method according to claim 13, and further including providing the flour in the temperature range 8 to 12°C.

15. A method according to claim 13, and further including providing the flour in the temperature range 4 to 10°C.

16. A method according to claim 13 or 15, and further including providing the flour in the temperature range 5 to 7°C.

17. A method according to any preceding claim, wherein said preparing comprises cutting or dicing the fat into lumps prior to mixing it with the flour.

18. A method according to claim 17, and further including cutting or dicing the fat so that the lumps have a maximum dimension of between 0.2 - 10 cm.

19. A method according to any preceding claim, and further including freezing the pastry crumb product.
20. A method according to claim 19, wherein said freezing includes freezing the pastry crumb product using ambient freezing.

21. A method according to any preceding claim, and further including controlling a humidity of the temperature controlled environment.

22. A method according to any preceding claim, and further including providing ingredients for the pastry crumb product comprising at least one of a raising agent, a flavouring, sugar and salt.

23. A method of making a pastry dough using a pastry crumb product prepared using a method according to any preceding claim, the method of making the pastry dough including:

   adding a further ingredient to the pastry crumb product comprising at least one of water, egg, milk; and

   mixing the further ingredient with the pastry crumb product to produce the pastry dough.


25. An apparatus for preparing a pastry crumb product with ingredients comprising flour and fat, the apparatus comprising a chamber having a food processing apparatus within it, the chamber having an air conditioning device operable to maintain an air temperature within the chamber at a predetermined temperature, the apparatus being
operable to provide the ingredients so that they are substantially at the predetermined
temperature, wherein the apparatus is operable to mix and cut the fat and flour together
at the predetermined temperature to prepare the pastry crumb product with the food
processing apparatus.

26. An apparatus according to claim 25, wherein the food processing apparatus has a
mixing blade to mix and cut the fat and flour together.

27. An apparatus according to claim 25 or 26, wherein the mixing blade is mounted
on a substantially vertical shaft of the food processing apparatus.

28. An apparatus according to claim 25, 26 or 27, wherein the predetermined
temperature is in the range -10 to 10°C.

29. An apparatus according to claim 25, 26 or 27, wherein the predetermined
temperature is in the range 4 to 14°C.

30. An apparatus according to claim 29, wherein the predetermined temperature is in
the range 8 to 12°C.

31. An apparatus according to claim 28 or 30, wherein the predetermined
temperature is in the range 4 to 10°C.
32. An apparatus according to any of claims 25 - 31, and further including a first cooler device operable to provide the fat at a lower temperature than the flour within the temperature controlled environment.

33. An apparatus according to claim 32, wherein the first cooler device is operable to provide the fat in the temperature range -10 to 10°C.

34. An apparatus according to claim 33, wherein the first cooler device is operable to provide the fat in the temperature range 2 to 8°C.

35. An apparatus according to claim 34, wherein the first cooler device is operable to provide the fat in the temperature range 4 to 6°C.

36. An apparatus according to any of claims 32 - 35, and further including a second cooler device operable to provide the flour in the temperature range 4 to 14°C within the temperature controlled environment.

37. An apparatus according to claim 36, wherein the second cooler device is operable to provide the flour in the temperature range 8 to 12°C.

38. An apparatus according to claim 36, wherein the second cooler device is operable to provide the flour in the temperature range 4 to 10°C.
39. An apparatus according to claim 38, wherein the second cooler device is operable to provide the flour in the temperature range 5 to 7°C.

40. An apparatus according to any of claim 25 - 39, and further including a freezer device operable to freeze the pastry crumb product using ambient freezing.

41. An apparatus according to any of claim 25 - 40, wherein the air conditioning device is operable to control an air humidity of the air within the chamber.

42. An apparatus for preparing a pastry crumb product as substantially described herein with reference to Figure 1 of the accompanying drawings.

43. A method of making a pastry crumb product using an apparatus according to any of claims 25 - 42.
Fig 2

1. Ambient Ingredient Storage
2. Chilled Ingredient Storage
3. Select Ambient Ingredients
4. Select Chilled Ingredients
5. Prepare and Weigh Ingredients
6. Mixing Ingredients
7. Freezing Crumb Pastry Product
Using a preferred temperature range for the predetermined temperature.

Providing ingredients for the pastry crumb product.

Providing a temperature controlled environment for the ingredients.

Cutting or dicing the fats

Preparing a predetermined quantity by weight of the ingredients.

Providing the ingredients in the temperature controlled environment.

Mixing the ingredients in the temperature controlled environment comprising cutting the fat and flour together.

Said cutting being provided using the mixing blade.

Freezing the crumb pastry product.

Making a pastry dough using the crumb pastry product.

Fig 3
INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2013/00436

A. CLASSIFICATION OF SUBJECT MATTER
INV. A21D6/00 A21D10/00 A21C1/00

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)
A21D A21C F25D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database consulted during the international search (name of database and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X: Further documents are listed in the continuation of Box C.  
X: See patent family annex.  

* Special categories of cited documents:
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Date of the actual completion of the international search: 10 February 2014
Date of mailing of the international search report: 17/02/2014

Name and mailing address of the ISA:
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016

Authorized officer: Piret-Viprey, E
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