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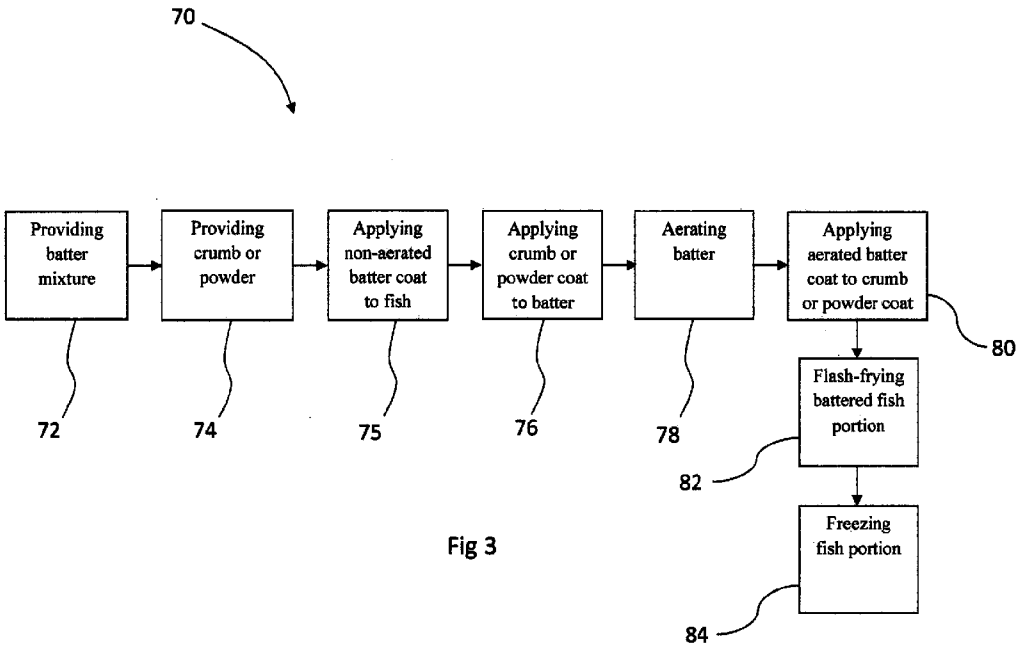


Fig 3

(57) Abstract: The invention relates to improvements in or relating to the coating of food with batter. A method includes: applying the composite batter coating to the portion of food (e.g. fish, seafood or meat portion), the composite batter coating comprising at least a primary batter coat, and a crumb coat or a powder coat; and part-cooking (e.g. frying) the portion of food to at least partially cook the composite batter coating. The method includes providing the primary batter coat comprising at least flour, water and an emulsifier (e.g. palm oil fat or similar) and aerating the primary batter coat with a food-safe gas (e.g. CO2 or N2) prior to applying the primary batter coat. The primary (aerated) batter coat may be applied as an initial coating, followed by a crumb coating (such as with fish fingers), or may be a final coat (after an initial, non-aerated batter coat and a crumb coat) of the food portion. The method may include controlling the amount of the food-safe gas in the primary batter coat so as to maintain the level of aeration thereof within a predetermined range.

WO 2017/207954 A1

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The emulsifier may form 2-10%, more preferably 5-10%, and more preferably 7-8% by weight of the primary batter coat A portion of food coated with batter and obtained by the method, and an apparatus for applying a composite batter coating to a portion of food, is also disclosed.

Improvements in or Relating to the Coating of Food with Batter

Technical Field

The invention relates to improvements in or relating to the coating of food with batter, and in particular a method of applying a batter coating, and an apparatus for the coating of food with batter.

Background

It is known to provide a way of battering food such as fish comprising three steps. In a first stage a pre-wash of batter is applied to fish, which may be frozen or fresh, on a belt using a curtain enrober. In a second stage a crumb is applied using a mechanical breader with a crumb curtain and base bed of crumb. In a third stage a further coat of batter is applied to the fish using a submerge system whereby the fish passes through and is submerged in a trough of batter. In this prior art system, batter is mixed in a vessel with a high speed whisk or shear blade in the base and an outer jacket to keep the batter cool. Batter viscosity is measured at each stage using a flow cup (i.e. a cup with a hole in its base is filled with a known amount of batter, and the time taken for the batter to flow out of the hole is recorded). Importantly, in the third stage the batter is mixed using chilled water at 5 °C, and is maintained within a target viscosity and kept at a chilled temperature of around 10 °C +/- 2 °C. The amount of intermediate crumb pick up is measured by weighing. The batter contains various raising agents which react under the correct cooking conditions to deliver a level of crispness. Once the seafood product (i.e. fish) has passed through the three stages it enters a fryer for 50-60 seconds with rapeseed oil at 195-205 °C. The product is not fully cooked (i.e. seafood remains frozen but the outer

coating is cooked). The final stage before packing is to re-freeze the product so the product can be stored before sale. The product may be sold to the consumer in the frozen state, or it may be defrosted at the point of sale for purchase by the consumer.

Whereas the known way of coating food may keep fresh, for example up to seven days once thawed, a problem may be encountered towards the end of this shelf life because water and juices may be lost from the food resulting in soggy batter. The water may contribute to reducing the shelf life and appearance of the food, or at least contribute to a reduction in the colour, flavour or integrity of the food after two or three days. In addition, the soggy batter looks unsightly and may break away prior to cooking which is unappealing to the consumer.

A further problem is that an optimal (i.e. Organoleptic) process result for the correct texture after cooking (i.e. crispness, light eating, and no thick under layer) is difficult to achieve. Chilled (i.e. non-frozen) batter products have a seven day shelf life, and often after two or three days the texture attributes reduce creating a much softer and heavier tasting product. Frozen batter products are cooked by the consumer from frozen, so entail fewer problems over the life of the product.

A further problem is that, although the product is part fried within the process, the final cooking by the consumer is by baking in an oven. This oven baking does not replicate the traditional cooking method of deep frying, so creating the correct texture which replicates deep frying is a further challenge.

It is broadly an object of the present invention to address one or more of the above mentioned disadvantages of the previously known ways of battering food.

In particular, it is an object of the present invention to provide a method and apparatus that afford one, some or all of the following product attributes:

- Texture with crispness, light eating and no thick under layer;
- Uniformity of eating experience regardless of the point within the chilled life of up to seven days at which home cooking is performed;
- Correct/intended texture achieved after consumer oven baking;
- Consistent product quality for every production run; and
- A robust and measurable process.

Summary

What is required is a way of battering food 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 applying a composite batter coating to a portion of food, the method including: applying the composite batter coating to the portion of food, the composite batter coating comprising at least a primary batter coat, and a crumb coat or a powder coat; and part-cooking the portion of food to at least partially cook the composite batter coating; wherein applying the composite batter coating comprises providing the primary batter coat comprising at least flour, water and an emulsifier; and aerating the primary batter coat with a food-safe gas prior to applying the primary batter coat.

Such a method has the advantage that the portion of battered food may be fresher for a longer period of time, which may increase the shelf life, or at least contributes to an improved colour, flavour or integrity of the food over a given period of time. It will be appreciated that the emulsifier is a food safe emulsifier.

In addition, an advantage is that there are no intermediate layers of batter after oven-cooking and there is only one homogenous layer. In other words the base batter coat, crumb coat, and primary batter coat appear as one after oven cooking. The batter also makes the fish look bigger i.e. has a volumising effect, which is appealing to the consumer because it is light and crispy.

Also, the batter process provides the advantage of an improved quality of the batter (e.g. a better quality colour of batter and a less mushy batter) at or near to the end of the shelf life of the product. The problem of a "soggy bottom" for the finished product is avoided.

In one embodiment, applying the composite batter coating comprises: applying a base batter coat to the portion of food; applying the crumb coat to the base batter coat; and applying the primary batter coat to the crumb coat.

The method may further include de-glazing the portion of food prior to applying the base batter coat or the powder coat.

In one embodiment, applying the composite batter coating comprises: applying the primary batter coat to the portion of food; and applying the crumb coat to the primary batter coat.

The method may further include de-glazing the portion of food prior to applying the primary batter coat, or applying a base batter coat to the portion of food prior to applying the primary batter coat.

The method may further include applying a powder coat to the portion of food prior to applying the primary batter coat.

Preferably, the method further includes applying the primary batter coat using a fantail nozzle. Using a nozzle in this form can reduce wastage of batter. In addition, using a nozzle in this form can reduce handling of the batter and reduce "knock out" of the CO_2 from the mixture, i.e. as the use of a full "curtain" of batter is avoided.

Preferably, aerating the primary batter coat comprises controlling the amount of the food-safe gas in the primary batter coat so as to maintain the level of aeration thereof within a predetermined range. Advantageously, the level of aeration is not fixed and may be readily controlled to the appropriate value, depending on the type of batter.

Preferably, aerating the primary batter coat comprises using an aeration device connected to a source of the food-safe gas. Preferably, aerating the primary batter coat comprises periodically or continuously: measuring the level of aeration of the primary batter coat,

and if level of aeration is not within a predetermined range, adjusting the input pressure of the food-safe gas into the aeration device so as to maintain the level of aeration within the predetermined range. Preferably, measuring the level of aeration of the primary batter coat comprises measuring the ratio of the weight of a fixed volume of (i) batter for the primary batter coat to (ii) non-aerated batter that has not entered the aeration device.

Preferably, the predetermined range corresponds to a ratio of the weight of a fixed volume of (i) aerated batter for the primary batter coat to (ii) non-aerated batter having the range 43.75% to 50%. The combination of the correct ingredients, accurate levels of aeration and accurate depositing/enrobing produces a product with the desired attributes. In particular, when finally cooked, the batter exhibits crispiness with blade/like or spike-like projections or other so-called "flares" and "highlights" of batter, thereby giving the finished (cooked) product a hand-made look.

In one embodiment, the aeration device is configured to receive a first input of non-aerated batter at 6 bar and a second input of food-safe gas at 8 bar.

In embodiments, the emulsifier forms 2-10%, more preferably 5-10%, and more preferably 7-8% by weight of the primary batter coat.

Preferably, the emulsifier is a fat or oil. Preferably, the emulsifier is palm oil fat. Such a fat or oil is a food-safe fat or oil. It is understood by the inventors that the fat or oil releases or "sweats out" of the batter when the food product is oven-cooked by the consumer, thereby creating the crispy flares. It is believed that the gas bubbles remain in the batter

due to the fat/emulsifier (e.g. palm oil fat) and in effect the gas locks onto the fat, creating a better aeration of the batter when mixed.

The method preferably further comprises, prior to the step of aerating the primary batter coat, controlling the temperature of the batter for the primary batter coat so as to be within a predetermined temperature range. Preferably, the predetermined temperature range is 8-12 °C, more preferably 8-11 °C, and more preferably 10 °C.

The aeration device preferably comprises a rotor and stator, the rotor and stator having intermeshing pins.

The method may further comprise: collecting a portion of the primary batter coat that does not adhere to the portion of food during the applying the composite batter coating; remixing the portion of the primary batter coat in a secondary mixer so as produce a remixed portion of batter from which the food-safe gas has been substantially removed; and incorporating the remixed portion of batter into the primary batter coat prior to aerating the primary batter coat with the food-safe gas. Thus, excess batter is collected in a secondary mixer which re-mixes the batter, thereby reducing the levels of gas before it is returned to the aeration device. Re-mixing the batter ensures an accurate and continuous level of aeration.

Preferably said applying the composite batter coating to the portion of food comprises applying the primary batter coating to the portion of food from above. Such a way of applying the aerated batter from above helps to retain the bubbles within the aerated batter

when applying it to the portion of food so that the gas is less likely to be knocked out of the batter during the application stage.

Preferably the method further comprises collecting a portion of the primary batter coat in a batter bath, and coating an underside and sides of the portion of food in the batter bath using the portion of primary batter coat. Preferably the method further comprises coating the underside and sides of the portion of food in the batter bath before applying the primary batter coating to the portion of food from above. Such a way of coating the portion of food means that the next step of part-cooking the portion of food is performed immediately after the top of the portion of food has been coated with the primary batter.

Preferably the method further comprises using a belt above the batter bath to draw the portion of food through the batter bath.

Preferably, part-cooking the portion of food comprises frying the composite batter coating. Preferably said frying comprises submerging the portion of food in an oil bath.

Preferably the method further includes using one or more belts at least partially or wholly within the oil bath to draw the portion of food through the oil bath. Preferably the method further includes using the one or more belt to submerge the portion of food in the oil bath.

Preferably the method further includes adjusting a horizontal position of the one or more belts to set a position at which the portion of food is engaged in order to set a point at which the portion of food is submerged in the oil bath. Such an arrangement provides the

advantage of a degree of control when a belt contacts the portion of food in order to reduce or minimise marking of the portion of food by the belt.

Preferably the method further including frying the portion of food within 1 to 5 seconds after application of the primary batter coat. Preferably the method further including frying the portion of food within 2 to 4 seconds after application of the primary batter coat.

Preferably, the food-safe gas is one or more of carbon dioxide, nitrogen, air, and nitrous gas.

According to a second aspect of the invention there is provided a portion of food coated with batter using the method according to any of the method claims 1 - 32.

According to a third aspect of the invention there is provided an apparatus for applying a composite batter coating to a portion of food, the composite batter coating comprising at least a primary batter coat, and a crumb coat or a powder coat, the apparatus including: a source of a primary batter coat, the primary batter coat comprising at least flour, water and an emulsifier; an aeration device, coupled to the source of the primary batter coat, for aerating the primary batter coat with a food-safe gas prior to applying the primary batter coat; a plurality of coating application stages for applying the composite batter coating to the portion of food, the plurality of coating application stages including at least a primary batter coat application stage and a crumb coat application stage; and a cooking device for part-cooking the portion of food to at least partially cook the composite batter coating.

In one embodiment, the plurality of coating application stages comprise: a base batter coat application stage, for applying a base batter coat to the portion of food; the crumb coat application stage, for applying the crumb coat to the base batter coat; and the primary batter coat application stage, for applying the primary batter coat to the crumb coat.

The apparatus may further include a de-glazing device, for de-glazing the portion of food prior to applying the base batter coat or the powder coat.

In another embodiment, the plurality of coating application stages comprise: the primary batter coat application stage, for applying the primary batter coat to the portion of food; and the crumb coat application stage, for applying the crumb coat to the primary batter coat.

The apparatus may further including;

a de-glazing device, for de-glazing the portion of food prior to applying the primary batter coat; or

a base batter coat application stage, for applying a base batter coat to the portion of food prior to applying the primary batter coat.

The apparatus may further include a powder application stage, for applying a powder coat to the portion of food prior to applying the primary batter coat.

Preferably, the primary batter coat application stage includes a fantail nozzle for applying the primary batter coat.

The apparatus preferably further comprises a controller for controlling the amount of the food-safe gas in the primary batter coat so as to maintain the level of aeration thereof within a predetermined range.

Preferably, the aeration device is connected to a source of the food-safe gas. The apparatus preferably further comprises a controller configured for periodically or continuously: measuring the level of aeration of the primary batter coat, and if the level of aeration is not within a predetermined range, adjusting the input pressure of the food-safe gas into the aeration device so as to maintain the level of aeration within the predetermined range. Preferably, measuring the level of aeration of the primary batter coat comprises measuring the ratio of the weight of a fixed volume of (i) batter for the primary batter coat to (ii) non-aerated batter that has not entered the aeration device.

Preferably, the predetermined range corresponds to a ratio of the weight of a fixed volume of (i) aerated batter for the primary batter coat to (ii) non-aerated batter having the range 43.75% to 50%.

Preferably, the aeration device is configured to receive a first input on non-aerated batter at 6 bar and a second input of food-safe gas at 8 bar.

Preferably, the emulsifier forms 2-10%, more preferably 5-10%, and more preferably 7-8% by weight of the primary batter coat.

Preferably, the emulsifier is a fat or oil. Preferably, the emulsifier is palm oil fat.

The apparatus preferably further comprises a controller for, prior to the step of aerating the primary batter coat, controlling the temperature of the batter for the primary batter coat so as to be within a predetermined temperature range.

Preferably, the predetermined temperature range is 8-12 °C, more preferably 8-11 °C, and more preferably 10 °C.

Preferably, the aeration device comprises a rotor and stator, the rotor and stator having intermeshing pins.

The apparatus may further comprise: a collection device for collecting a portion of the primary batter coat that does not adhere to the portion of food during the applying the composite batter coating; a secondary mixer for remixing the portion of the primary batter coat so as produce a remixed portion of batter from which the food-safe gas has been substantially removed; and at least one conduit for incorporating the remixed portion of batter into the primary batter coat prior to aerating the primary batter coat with a food-safe gas.

Preferably the primary batter coating stage comprises an outlet to apply the primary batter coating to the portion of food from above. Such a way of applying the aerated batter from above helps to retain the bubbles within the aerated batter when applying it to the portion

of food so that the gas is less likely to be knocked out of the batter during the application stage.

Preferably the apparatus comprises a batter bath to collect a portion of the primary batter coat, wherein the primary batter coating stage comprises coating an underside and sides of the portion of food with the portion of primary batter coat in the batter bath. Preferably the apparatus comprises coating the underside and sides of the portion of food in the batter bath before applying the primary batter coating to the portion of food from above. Such a way of coating the portion of food means that the next step of part-cooking the portion of food is performed immediately after the top of the portion has been coated with the primary batter.

Preferably the apparatus comprises a belt above the batter bath to draw the portion of food through the batter bath.

Preferably, the cooking device comprises a fryer configured for frying composite batter coating. Preferably said fryer comprises an oil bath for submerging the portion of food.

Preferably one or more belt are provided at least partially within the oil bath to draw the portion of food through the oil bath. Preferably the one or more belts are operable to submerge the portion of food in the oil bath.

Preferably the apparatus comprising an adjustment device for adjusting a horizontal position of the one or more belts to set a position at which the portion of food is engaged

in order to set a point at which the portion of food is submerged in the oil bath. Such an arrangement provides the advantage of a degree of control when a belt contacts the portion of food in order to reduce or minimise marking of the portion of food by the belt.

Preferably one or more belts have a non-stick coating to reduce sticking of the portion of food thereto.

Preferably, the food-safe gas is one or more of carbon dioxide, nitrogen, air, and nitrous gas.

According to a fourth aspect of the invention there is provided an apparatus for performing the method according to the first aspect of the invention.

According to an alternative characterisation of the invention there is provided a method of applying a batter coat to a portion of food, the method including:

providing the batter coat comprising at least flour, water and an emulsifier;

aerating the batter coat with a food-safe gas;

transporting the portion of food on a conveyor device past a batter application stage;

applying the batter coat to the portion of food at the batter application stage;

and part-cooking the portion of food to at least partially cook the batter coat.

According to a further alternative characterisation of the invention there is provided an apparatus for applying a batter coat to a portion of food, the apparatus including:

a source of a batter coat, the batter coat comprising at least flour, water and an emulsifier;

an aeration device, coupled to the source of the batter coat, for aerating the batter coat with a food-safe gas;

a batter application stage;

a conveyor device for transporting thereon the portion of food past the batter application stage;

a cooking device for part-cooking the portion of food to at least partially cook the composite batter coating;

wherein, in use, the batter coat is applied to the portion of food as the portion of food passes the batter application stage.

According to a further alternative characterisation of the invention there is provided a method of applying a batter coat to a portion of food, the method including;

providing a first batter coat comprising at least flour and water;

applying the first batter coat to the portion of food;

applying a crumb coat or a powder coat to the first batter coat;

providing a second batter coat comprising at least flour, water and an emulsifier;

aerating the second batter coat with a food-safe gas;

applying the second batter coat to the portion of food over the first coat and the crumb coat; and

part-frying the portion of food to at least partially cook the first coat, the crumb coat, and second batter coats.

According to a further alternative characterisation of the invention there is provided an apparatus for applying a batter coat to a portion of food, the apparatus including;

a source of a first batter coat, the first batter coat comprising at least flour and water;

a source of a second batter coat, the second batter coat comprising at least flour, water and an emulsifier;

an aeration device, coupled to the source of the second batter coat, for aerating the second batter coat with a food-safe gas;

a source of crumb or a powder;

a first batter application stage to apply the first batter coat to the portion of food;

a crumb application stage to apply a crumb coat to the first batter coat, or a powder application stage to apply a powder coat to the first batter coat;

a second batter application stage to apply the second batter coat to the portion of food over the first batter coat and the crumb coat or the powder coat; and

a cooking device for part-cooking the portion of food to at least partially cook the first batter coat, the crumb coat or the powder coat, and second batter coat.

According to a further alternative characterisation of the invention there is provided a method of applying a batter coat to a portion of food, the method including;

providing a batter coat comprising at least flour, water and an emulsifier;

aerating the batter coat with a food-safe gas;

applying the batter coat to the portion of food;

applying a crumb coat or a powder coat to the batter coat;

part-frying the portion of food to at least partially cook the batter coat and the crumb coat.

According to a further alternative characterisation of the invention there is provided an apparatus for applying a batter coat to a portion of food, the apparatus including;

a source of a batter coat, the batter coat comprising at least flour, water and an emulsifier;

an aeration device, coupled to the source of the batter coat, for aerating the batter coat with a food-safe gas;

a source of crumb or powder;

a batter application stage to apply the batter coat to the portion of food;

a crumb application stage to apply a crumb coat to the batter coat, or a powder application stage to apply a powder coat to the batter coat; and

a cooking device for part-cooking the portion of food to at least partially cook the batter coat and the crumb coat or powder coat.

Particular embodiments of the alternative characterisations of the invention may be as set forth above with respect to the first to fourth aspects of the invention.

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 a schematic side view of an apparatus for applying a composite batter coating to a portion of food according to an embodiment of the invention;

Figure 2 shows a cross section of a portion of food with a batter coating, produced by the apparatus of Fig. 1;

Figure 3 shows steps of a method according to an embodiment of the invention;

Figure 4 shows a schematic side view of an apparatus for applying a composite batter coating to a portion of food according to another embodiment of the invention;

Figure 5 shows a cross section of a portion of food with a batter and bread coating, produced by the apparatus of Fig. 4;

Figure 6 shows steps of a method according to another embodiment of the invention;

Figure 7 shows a schematic side view of an apparatus for applying a composite batter coating to a portion of food according to another embodiment of the invention; and

Figure 8 shows a schematic side view of a flash frying apparatus for use with the apparatus of Figures 1, 4 and 7 according to another embodiment of the invention.

Detailed Description

Figure 1 shows a schematic side view of an apparatus for applying a composite batter coating to a portion of food according to an embodiment of the invention, generally designated 10. The apparatus 10 has a wire belt 12 which moves in a direction indicated at arrow 14 so that a portion of food 16 passes the various coating stages of the apparatus. The portion of food 16 is frozen. The first stage is to apply a wash-coat of batter shown at 18, for example using a known curtain enrober apparatus. The wash-coat may be termed an adhesive coat or a base coat. The second stage is to apply a crumb coating from above and below as shown at 20, 22. The crumb is applied using a mechanical breader with a crumb curtain and base bed of crumb. The crumb coating 20, 22 may include, or may be, flour and/or rice particles. The crumb coating 20, 22 may be termed a breaded coating, or an intermediate coating, and is a dry granular coating or a powder coating. One effect of the wash-coat 18 is to remove or soften a glaze that is present on the surface of the frozen food 16. The glaze is the frozen surface (i.e. frozen water) of the food 16 that might otherwise prevent or reduce the crumb coating 20, 22 from adhering to the portion of food 16. Alternatively, a steam device (not shown) may be used to remove the glaze on the frozen food as shown at 15. The third stage is to apply a second batter coat 24 to the portion of food from above as shown at 24. The second batter coat 24 may be termed a primary batter coat. The crumb coating 20, 22 and the second batter coating 24 may be termed a composite batter coating. A mixing head 28 mixes a batter mixture 30 from a hopper 32 with carbon dioxide gas 34 to aerate the batter. The batter 30 is mixed in the hopper 32 with a high speed whisk or shear blade in the base and an outer jacket to keep the batter cool. Batter viscosity is measured at each stage using a flow cup (i.e. a cup with a hole in its base is filled with a known amount of batter, and the time taken for

the batter to flow out of the hole is recorded). Importantly, the batter 30 is mixed in the hopper 32 using chilled water at 5 °C, and is maintained within a target viscosity and kept at a chilled temperature of around 10 °C +/- 2 °C. A fantail nozzle 36 then applies the second batter coat 24 from above. Any drips of batter from the food shown by arrow 38 are collected in a tray 40 and form a bath 41 to coat the underside of the food as shown at 42. Excess batter is then passed to a secondary mixer 44 which re-mixes the batter to reduce the levels of carbon dioxide before it is returned to the hopper 32. Re-mixing of the batter ensures an accurate and continuous level of aeration. The second batter coat 24 comprises batter made from ingredients 25 that are put into the hopper 32. The ingredients 25 are shown in the following table (the 2 – 10 % Palm fat is a key emulsifier ingredient so that the batter and gas mix form an emulsion):

Primary Ingredients	**Secondary Ingredients**	**Derived From**	**Status (Nat, NI, Art MSC)**	**ENo.**	**% Composition**	**Rank**
Wheat Flour	Statutory wheat flour additive (Calcium, Carbonate, Iron, Niacin, Thiamin)	Wheat	N/A	N/A	60-90%	1
Palm Fat	N/A	Palm		N/A	2-10%	2
Raising Agents (E450, E500)	N/A	Chemical	N/A	N/A	0-5%	3
Maize Flour	N/A	Maize	N/A	N/A	0-5%	4

Skimmed Milk Powder	N/A	Milk (Cow)	N/A	N/A	0-5%	5
Wheat Starch	N/A	Wheat	N/A	N/A	0-5%	6
Wheat Gluten	N/A	Wheat	N/A	N/A	0-5%	7

The portion of food shown at 46 is then flash fried (not shown) using a known process whereby it enters a fryer for 50-60 seconds with rapeseed oil at 195-205 °C. The product is not fully cooked (i.e. the food may remain frozen but the outer coating is cooked). The final stage before packing is to re-freeze the product so that it can be stored before sale. The product may be de-frosted at the point of sale to the consumer or may be sold in a frozen condition to the consumer.

In one arrangement a pre-dust step 17 is performed on the portion of food 16 prior to applying the wash-coat of batter shown at 18 in Figure 1. The pre-dust step 17 comprises coating the portion of food 16 with flour or a powdered flavoured coating. Such a pre-dust step 17 may be termed coating the portion of food with a powder coat. One effect of this is to create an adhesion coat between the portion of food 16 and the wash-coat of batter 18. The steam device (not shown) may be used to remove the glaze on the frozen food as shown at 15 prior to the pre-dust step 17.

In one arrangement the wash-coat of batter 18 and the crumb coat 20 are omitted, and the de-glazing step 15 and the pre-dust step 17 are performed prior to applying the batter coat 24 to the portion of food. With such an arrangement the steam device may be used to remove the glaze on the frozen food as shown at 15 prior to the pre-dust step 17.

Figure 2 shows a cross section of a portion of food with a batter coating, generally designated 50. In Figure 2 like features to the arrangements of Figure 1 are shown with like reference numerals. In Figure 2 the portion of food 50 is shown after the flash fried step described above, and prior to the final oven-baking step by the consumer. At this stage the batter coating is relatively malleable which means that it is less likely to crack away from the fish (e.g. due to handling and stacking at the supermarket) prior to the consumer oven-cooking the food. The food is shown at 52, the first batter coating is shown at 54, the crumb coating is shown at 56, and the second batter coating is shown at 58. Air bubbles 60 are shown in the second batter coating. The powder coat 53 may be between the food 52 and the batter coating 54.

Figure 3 shows steps of a method according to an embodiment of the invention, generally designated 70, for coating a portion of food, e.g. a portion of fish. Initially (step 72) the batter mixture is provided (such as batter mixture 30 in a hopper 32 in Fig. 1, and optionally also in a separate container/supply). In addition the crumb or powder for applying a crumb coat or powder coat is provided (step 74). Thereafter, a first, non-aerated batter coat (e.g. from hopper 32 in Fig. 1, or from a separate supply) is applied to the fish (step 75), i.e. as a wash coat, as shown at 18 in Fig. 1, for example using a known curtain enrober apparatus. A powder coat may be applied to the portion of food 16 prior to applying the wash coat 18, as shown at 17 in Fig. 1. The powder coat may be applied to the portion of food 16 instead of the wash coat 18 and the crumb coat 20.

Next, at step 76, the crumb or powder is applied to the first batter coat on the fish, i.e. such as by applying a crumb coating or powder coating from above and below as shown

at 20, 22 in Fig. 1. The crumb may be applied using a mechanical breader with a crumb curtain and base bed of crumb. At least a portion of the batter mixture (30 in a hopper 32 in Fig. 1) is aerated (step 78), e.g. a mixing head 28 mixes a batter mixture 30 from a hopper 32 with carbon dioxide gas 34 to aerate the batter, as shown in Fig. 1. Then, at step 80, a second batter coat 24 is applied to the (crumb/powder coating on the) fish, i.e. such as by a fantail nozzle 36, as shown in Fig. 1.

Thereafter, the steps of flash-frying (82) the battered fish portion and freezing (84) the battered fish portion are performed, i.e. to finally prepare the fish for packing and transport to a point of sale.

Whereas the above embodiments relate to applying batter to a portion of food to provide a battered product, the apparatus 10 may also be used to provide a breaded product (e.g. fish fingers). When using the apparatus 10 for breading a portion of food, the stages are switched round as mentioned below.

Figure 4 shows a schematic side view of an apparatus for applying a composite batter coating to a portion of food according to another embodiment of the invention, generally designated 80. In Figure 4 like features to the arrangements of Figure 1 are shown with like reference numerals. In Figure 4 the portion of food 16 is frozen. The first stage is to apply the aerated batter which is an adhesive coat as shown at 24. The adhesive coat may be termed a primary batter coat. The crumb coating 20, 22 and the batter coating 24 may be termed a composite batter coating. The crumb coating 20, 22 may include, or may be, flour and/or rice particles. The crumb coating 20, 22 may be termed a breaded coating, or

an intermediate coating, and is a dry granular coating or a powder coating. As previously described the mixing head 28 mixes the batter mixture 30 from the hopper 32 with carbon dioxide gas 34 to aerate the batter. The batter 30 is mixed in the hopper 32 as described above with the high speed whisk or shear blade in the base and the outer jacket to keep the batter cool. Batter viscosity is measured at each stage using the flow cup. Importantly, the batter 30 is mixed in the hopper 32 using chilled water at 5 °C, and is maintained within the target viscosity and kept at a chilled temperature of around 10 °C +/- 2 °C. The fantail nozzle 36 then applies the batter coat 24 from above. Any drips of batter from the food shown by arrow 38 are collected in the tray 40 and form the bath 41 to coat the underside of the product as shown at 42. Excess batter is then passed to the secondary mixer 44 which re-mixes the batter to reduce the levels of carbon dioxide before it is returned to the hopper 32. Re-mixing of the batter ensures an accurate and continuous level of aeration. The second batter coat 24 comprises batter made from ingredients 25 that are put into the hopper 32. The second stage is to apply a crumb coating from above and below as shown at 20, 22. The crumb is applied using a mechanical breader with a crumb curtain and base bed of crumb. The crumb coating may alternatively be a breaded coating. The portion of food shown at 46 is then flash fried (not shown) using a known process described above whereby it enters a fryer for 50-60 seconds with rapeseed oil at 195-205 °C. The product is not fully cooked (i.e. the food may remain frozen but the outer coating is cooked). The final stage before packing is to re-freeze the product so that it can be stored before sale. The product may be de-frosted at the point of sale to the consumer or may be sold in a frozen condition to the consumer.

In another arrangement the de-glazing step 15 is performed on the portion of food 16 prior to applying the aerated batter coat 24 to the portion of food 16 shown in Figure 4. The de-glazing step 15 may comprises coating the portion of food 16 with a mixture of flour and water. The de-glazing step may comprise the wash-coat of batter shown at 18 above (i.e. a first coat of batter). Alternatively, a steam device (not shown) may be used to remove the glaze on the frozen food. One effect of the de-glazing step is to remove or soften a glaze that is present on the surface of the frozen food 16. The glaze is the frozen surface of the food 16 that might otherwise prevent or reduce the aerated batter coat 24 from adhering to the portion of food 16.

In another arrangement a pre-dust step 17 is performed on the portion of food 16 prior to applying the aerated batter coat 24 to the portion of food 16 shown in Figure 4. The pre-dust step 17 may be performed just after the de-glazing step 15 (i.e. applying the wash coat 18 instead of steam). The pre-dust step comprises coating the portion of food 16 with flour or a powdered flavoured coating. Such a pre-dust step 17 may be termed coating the portion of food with a powder coat. One effect of this is to create an adhesion coat between the portion of food 16 and the aerated batter coat 24. In this arrangement the aerated batter 24 and the pre-dust layer become homogenous such that the pre-dust layer is not visible to the consumer after oven cooking of the portion of food.

Figure 5 shows a cross section of a portion of food with a batter and bread coating, generally designated 90. In Figure 5 like features to the arrangements of Figure 2 are shown with like reference numerals. In Figure 5 the portion of food 90 is shown after the flash fried step described above, and prior to the final oven-baking step by the consumer.

At this stage the batter coating is relatively malleable which means that it is less likely to crack away from the fish (e.g. due to handling and stacking at the supermarket) prior to the consumer oven-cooking the food. The food is shown at 52, the batter coating is shown at 54, and the crumb coating is shown at 56. Air bubbles 60 are shown in the batter coating. The powder coat 53 may be between the food 52 and the batter coating 54.

Figure 6 shows steps of a method according to another embodiment of the invention, generally designated 70, for coating a portion of food, e.g. a portion of fish. Initially (step 72) the batter mixture is provided (such as batter mixture 30 in a hopper 32 in Fig. 4, and optionally also in a separate container/supply). In addition the crumb or powder for applying a crumb coat or powder coat is provided (step 74).

At least a portion of the batter mixture (30 in a hopper 32 in Fig. 1) is aerated (step 78), e.g. a mixing head 28 mixes a batter mixture 30 from a hopper 32 with carbon dioxide gas 34 to aerate the batter, as shown in Fig. 1. Then, at step 80, an aerated batter coat 24 is applied to the fish from above, i.e. such as by a fantail nozzle 36, as shown in Fig. 4. A base batter coat (i.e. a wash-coat) or a de-glazing step may be applied to the portion of food prior to applying the aerated batter coat 24, as shown at 15 in Fig. 4. A powder coat may be applied to the portion of food prior to applying the aerated batter coat 24, as shown at 17 in Fig. 4.

Next, at step 76, the crumb or powder is applied to the aerated batter coat on the fish, i.e. such as by applying a crumb coating or powder coating from above and below as shown

at 20, 22 in Fig. 4. The crumb may be applied using a mechanical breader with a crumb curtain and base bed of crumb.

Thereafter, the steps of flash-frying (82) the battered fish portion and freezing (84) the battered fish portion are performed, i.e. to finally prepare the fish for packing and transport to a point of sale.

Figure 7 shows a schematic side view of an apparatus for applying a composite batter coating to a portion of food according to another embodiment of the invention, generally designated 90. In Figure 7 like features to the arrangements of Figure 1 and 4 are shown with like reference numerals. Figure 7 shows that the stages of applying the second batter coat 58 to the portion of food from above as shown at 24, and coating the underside of the food as shown at 42 in the bath 41 are switched round when compared to Figure 1. The arrangements of Figure 7 provide the advantage that the air bubbles 60 within the batter coat 58 are more likely to remain therein prior to flash frying the portion of food shown at 46 as described above. It will be appreciated that the effect of coating the underside of the portion of food first in the bath 41 followed by applying the second batter coat 58 to the portion of food from above as shown at 24 means that flash frying of the top coat occurs more quickly after the top coat has been applied. The resulting fried batter coat has a greatly improved appearance and crispiness. The tray 40 may be termed a trough.

Figure 7 also shows a wire belt 92 above the bath 41 of batter. The wire belt 92 moves in a direction indicated by the arrows so that the portion of food passes through the bath 41

of batter to coat the underside of the food as shown at 42. The batter in the bath 41 is a relatively high viscosity and the wire belt 92 provides the advantage of helping to move (i.e. draw) the portion of food through the batter. Whereas the bath 41 is primarily intended to coat the underside of the food it will be appreciated that the sides of the portion of food may also be coated. Optionally the top of the portion of may be partially coated in the bath 41.

It will be appreciated that the various aspects described above in relation to Figure 1 also apply to Figure 7. These aspects may include using a deglazing step on the frozen food as shown at 15, applying the wash-coat of batter shown at 18, optionally using the pre-dust step 17 on the portion of food 16 prior to applying the wash-coat of batter shown at 18, apply a crumb coating from above and below as shown at 20, 22, and aerating the batter coat 24 using the apparatus, ingredients and steps 25, 28, 30, 32, 34, 36, 38, 40, 41, 44.

The various aspects of Figure 7, in particular the switching round of the stages of applying the second batter coat 58 to the portion of food from above as shown at 24, and coating the underside of the food as shown at 42 in the bath 41, may also be used with the embodiment of Figure 4.

Figure 8 shows a schematic side view of a flash frying apparatus for use with the apparatus and methods of Figures 1, 3, 4, 6 and 7 according to another embodiment of the invention, generally designated 100. In Figure 8 like features to the arrangements of previous embodiments are shown with like reference numerals. In Figure 8 the portion of

food 46 is shown to be at the end of the wire belt 12 as shown at the right side of Figures 1, 4 and 7. In Figure 8 the portion of food 46 then moves off the wire belt 12 as shown by arrow 102 so that it drops into a bath 106 containing hot oil so that it is submerged below a surface 108 of the hot oil, as shown at 110. The hot oil is within a tray or trough 104. A non-stick belt 111 is provided to guide the portion of food 110 through the hot oil. The non-stick belt has a non-stick coating such as TEFLON to reduce sticking of the portion of food 110 to the wire belt 111. As the portion of food 110 is flash fried it begins to float more readily and another wire belt 112 guides the portion of food through the hot oil as shown at 114. The wire belts 111, 112 draw the portion of food through the bath 106, and move in a direction indicated by the arrows. The non-stick belt 111 is provided along approximately the first 25% of the bath 106, and the wire belt 112 is provided along approximately the remaining 75% of the bath 106. Also shown is another wire belt 116 above the portion of food 114, which moves in a direction indicated by the arrows and operates to keep the portion of food 114 below the surface 108 and to move the portion of food 114 through the bath 106 as shown at 118.

The wire belt 116 above the portion of food 114 is adjustable, as shown by a double headed arrow 120, so that a horizontally position of the wire belt 116 can be set. Such adjustability may be provided by any convenient adjustment device or means, such as a screw device, or providing the wire belt 116 on a movable carriage. The Applicant has discovered that the horizontal position at which the wire belt 116 is set has an important effect on the top coating (i.e. the aerated batter coating 58) of the portion of food 114. If the wire belt 116 engages the portion of food 114 too soon (i.e. if the wire belt 116 is too far to the left as shown in Figure 8) then the wire belt 116 may be imprint marks onto the

top coating, which is undesirable. If the wire belt 116 engages the portion of food 114 too late (i.e. if the wire belt 116 is too far to the right as shown in Figure 8) then the portion of food 114 may start to drift in the bath 106 and not progress through the hot oil, which is also undesirable. A balance has to be struck between these two factors, and the provision of horizontal adjustability to the wire belt 116, as shown by a double headed arrow 120, greatly improves the operability of the apparatus 100 and the quality of the portion of food 118. It will be appreciated that the wire belt 116 having an adjustable position sets the point at which the portion of food 114 is submerged in the bath 106.

Figure 8 also shows a final wire belt 119 to lift the portion of food out of the hot oil as shown at 122. The finished portion of food is shown at 124 which can then be re-frozen before final packing and storage before sale. It will be appreciated that the frying apparatus 100 of Figure 8 may be used after any of the coating apparatus 10, 80, 90 shown in Figures 1, 4 and 7, or described with reference to the methods of Figures 3 and 6. It will be appreciated that the wire belts 12, 92, 112, 116, 119 may be alternatively termed conveyor devices.

In the above embodiments the coating of fish is discussed, and it will be appreciated that other types of food or product may be coated using the apparatus or methods of Figure 1 - 8, such as other meat or products (goujons, nuggets, etc) or seafood (e.g. calamari, prawns, etc), or other products (e.g. chocolate bars).

In the above embodiments the batter 24 applied to the food has a level of food-safe fat or oil content to ensure a correct level of aeration using carbon dioxide gas and provides

stability of the carbon dioxide bubbles within the batter 24. It is believed that the emulsifier agent within the batter (e.g. typically 5-10% palm oil fat) makes the aerated batter more stable. Whereas as the palm oil fat is disclosed above, it will be appreciated that any other food-safe oil or fat may be used with the proviso that the gas combines with the oil or fat to provide the required aeration to the batter 24. Whereas as the use of carbon dioxide gas is disclosed above, it will be appreciated that any other food-safe gas may be used such as nitrogen, air, nitrous gas etc, with the proviso that the gas combines with the fat to provide the required aeration to the batter 24.

In the above embodiments the use of the fantail nozzle 36 reduces wastage of the batter 24 because a full "curtain" of batter is avoided. Such a fantail nozzle 36 also reduces handling or processing of the batter. Such processing might otherwise reduce the amount of gas in the batter mixture. Alternatively a relatively large diameter pipe (e.g. with an internal bore of between 2 to 3cm) may be used in place of the fantail nozzle 36. Using a fantail nozzle 36, or a relatively large diameter pipe, may help to maintain the low pressure of the aerated batter to retain the bubbles therein when applying it to the portion of food. The pressure of the aerated batter exiting the fantail nozzle 36, or large diameter pipe is relatively low and may be around 5 to 6.5 bar. The fantail nozzle 36 or the large diameter pipe may be termed an outlet.

The mixing head 28 described above is an emulsifier apparatus or an aeration apparatus. Such an apparatus may be a MONDOMIX apparatus available from Haas. Such an apparatus can provide a continuous flow of aerated batter 24. The mixing head 28 has a rotor and stator both fitted with intermeshing pins, which provide a constant shear to the

batter resulting in better temperature control and better control of the bubble size distribution in the batter 24. Within the mixing head 28 the liquid batter and the gas 34 merge and are homogenized with accurate flow control under a controlled pressure to provide the batter 24 with a consistent quality. It is believed that the gas bubbles stay in the batter due to the fat/emulsifier (i.e. palm oil fat) and in effect the gas (e.g. carbon dioxide) locks onto the fat creating a better aeration of the batter when mixed. In effect the fat binds the batter mixture with the gas. When using the MONDOMIX apparatus with carbon dioxide, the first input to the mixing head 28 of non-aerated batter has a pressure of about 6 bar, and a second input of carbon dioxide has a pressure of about 8 bar, which provides a flow rate for the carbon dioxide of about 425 ln/hr, where the unit "ln" is a normal litre at standard conditions and 20°C. The first input of non-aerated batter may have a pressure in the range 4 - 8 bar, and a second input of carbon dioxide has a pressure of about 6 - 10 bar. Whereas the "normal litre" unit has been used it will be appreciated that the flow rate for the gas is measure in millimetres of mercury, which is converted to the "normal litre" unit with a conversion graph.

Using the above described calibrated flow cup, the batter 30 within the hopper 32 weighs 240g. After aerating the same volume of batter (i.e. the batter 24) weighs between 105 – 120g. In other words a ratio of the weight of a fixed volume of (i) aerated batter 24 to (ii) non-aerated batter 30 has the range 43.75% to 50%.

Using the above embodiments, the combination of the ingredients, accurate levels of aeration and accurate depositing of the batter 24 produces a product with the desired attributes which has a hand-made look with crispy "flares" and "highlights" of batter, as

may be produced when battered fish is deep fried in a fish and chip shop. It is believed that the palm fat oil releases or "sweats out" of the batter when the food product is oven-cooked by the consumer which creates the crispy flares. After oven-cooking by the consumer the food product has no intermediate layers of batter so that there is only one homogeous layer (i.e. the first batter coat, the crumb coat, and second batter coat appear as one after oven cooking). A further advantage is that the oven cooked batter makes the food look bigger because the batter has a volumising effect, which is appealing to the consumer because it is light and crispy.

The Applicant has realised that an important aspect of the embodiments described herein is to apply the aerated batter to the portion of food from above as shown at 24, and to flash fry the portion of food as soon as possible thereafter. In effect the aerated batter is allowed to slowly fall onto the portion of food under the action of gravity. Such a way of applying the aerated batter from above helps to retain the bubbles within the aerated batter when applying it to the portion of food so that the gas is less likely to be knocked out of the batter during the application stage. The step of flash frying the portion of food as soon as possible after applying the aerated batter from above also helps to produce batter with the above-described crispy "flares" and "highlights" of batter. This is because the bubbles within the aerated batter have less time to escape from the batter before being frying begins. In one embodiment the step of flash frying (i.e. the moment when the portion of food enters the hot oil 106) begins within 1 to 5 seconds after application of the aerated batter, and more preferably within 2 to 4 seconds after application of the aerated batter.

Overall the batter process describe above also provides the advantage of an improved quality of the batter (e.g. a better quality colour of batter and a less soggy batter) at or near to the end of the shelf life of the product. The problem of a "soggy bottom" for the finished product is avoided.

In the above embodiments the use of a crumb coating 20, 22 (or a powder coating) is disclosed. Such a crumb coating 20, 22 may comprise intermediate layers of flour and/or rice particles or bread particles. Furthermore the use of a wash-coat 18 is disclosed. Such a wash-coat 18 is a low viscosity batter coat used as an adhesive coat for the crumb coating 20, 22 (or a powder coating). The wash-coat 18 may also be considered as a de-glazing step.

The above embodiments mention re-freezing the portion of food shown after 46 in Figures 1, 3, and 7, or after 124 in Figure 8. Such re-freezing may be performed using a nitrogen tunnel to re-freeze the surface (i.e. the crust) of the portion of food 46. Such a nitrogen tunnel is chamber of cold nitrogen gas that is be just above the boiling point of liquid nitrogen. The wire belt 12 passes through the chamber of nitrogen gas to flash freeze the portion of food 46. Such an arrangement is intended to remove heat from the portion of food 46 that has been introduced by the flash frying step.

In the above embodiments the portion of food 16 at the start of the process shown in Figures 1, 4 and 7 is mentioned as being frozen. In another embodiment the portion of food 16 may not be frozen, in which case the de-glazing step 15 may not be required. With such an arrangement the step of freezing the portion of food shown 46 at may not

be required, but instead the portion of food 46 may be chilled to remove any unwanted heat from the portion of food 46 after the frying step.

While embodiments have been described by reference to embodiments having various components in their respective implementations, it will be appreciated that other embodiments make use of other combinations and permutations of these and other components.

CLAIMS

1. A method of applying a composite batter coating to a portion of food, the method including;

applying the composite batter coating to the portion of food, the composite batter coating comprising at least a primary batter coat, and a crumb coat or a powder coat; and

part-cooking the portion of food to at least partially cook the composite batter coating;

wherein applying the composite batter coating comprises:

providing the primary batter coat comprising at least flour, water and an emulsifier; and

aerating the primary batter coat with a food-safe gas prior to applying the primary batter coat.

2. A method according to claim 1, wherein applying the composite batter coating comprises:

applying a base batter coat to the portion of food;

applying the crumb coat to the base batter coat; and

applying the primary batter coat to the crumb coat.

3. A method according to claim 1 or 2, and further including de-glazing the portion of food prior to applying the base batter coat or the powder coat.

4. A method according to claim 1, wherein applying the composite batter coating comprises:

applying the primary batter coat to the portion of food; and

applying the crumb coat to the primary batter coat.

5. A method according to claim 4, and further including de-glazing the portion of food prior to applying the primary batter coat, or applying a base batter coat to the portion of food prior to applying the primary batter coat.

6. A method according to claim 4 or 5, and further including applying a powder coat to the portion of food prior to applying the primary batter coat.

7. A method according to any of the preceding claims, and further including applying the primary batter coat using a fantail nozzle.

8. A method according to any of the preceding claims, wherein aerating the primary batter coat comprises controlling the amount of the food-safe gas in the primary batter coat so as to maintain the level of aeration thereof within a predetermined range.

9. A method according to any of the preceding claims, wherein aerating the primary batter coat comprises using an aeration device connected to a source of the food-safe gas.

10. A method according to claim 9, wherein aerating the primary batter coat comprises periodically or continuously:

measuring the level of aeration of the primary batter coat, and

if level of aeration is not within a predetermined range, adjusting the input pressure of the food-safe gas into the aeration device so as to maintain the level of aeration within the predetermined range.

11. A method according to claim 10, wherein measuring the level of aeration of the primary batter coat comprises measuring the ratio of the weight of a fixed volume of (i) batter for the primary batter coat to (ii) non-aerated batter that has not entered the aeration device.

12. A method according to any of claims 8 to 11, wherein the predetermined range corresponds to a ratio of the weight of a fixed volume of (i) aerated batter for the primary batter coat to (ii) non-aerated batter having the range 43.75% to 50%.

13. A method according to claim 9, or any claim dependent thereon, wherein the aeration device is configured to receive a first input of non-aerated batter at 6 bar and a second input of food-safe gas at 8 bar.

14. A method according to any of the preceding claims, wherein the emulsifier forms 2-10%, more preferably 5-10%, and more preferably 7-8% by weight of the primary batter coat.

15. A method according to any of the preceding claims, wherein the emulsifier is a fat or oil.

16. A method according to claim 15, wherein the emulsifier is palm oil fat.

17. A method according to any of the preceding claims, further comprising, prior to the step of aerating the primary batter coat, controlling the temperature of the batter for the primary batter coat so as to be within a predetermined temperature range.

18. A method according to claim 17, wherein the predetermined temperature range is 8-12 °C, more preferably 8-11 °C, and more preferably 10 °C.

19. A method according to claim 9, or any claim dependent thereon, wherein the aeration device comprises a rotor and stator, the rotor and stator having intermeshing pins.

20. A method according to any of the preceding claims, further comprising:

collecting a portion of the primary batter coat that does not adhere to the portion of food during the applying the composite batter coating;

remixing the portion of the primary batter coat in a secondary mixer so as to produce a remixed portion of batter from which the food-safe gas has been substantially removed; and

incorporating the remixed portion of batter into the primary batter coat prior to aerating the primary batter coat with the food-safe gas.

21. A method according to any of the preceding claims, wherein said applying the composite batter coating to the portion of food comprises applying the primary batter coating to the portion of food from above.

22. A method according to claim 21, and further comprising:

collecting a portion of the primary batter coat in a batter bath; and

coating an underside and sides of the portion of food in the batter bath using the portion of primary batter coat.

23. A method according to claim 22, and further comprising:

coating the underside and sides of the portion of food in the batter bath before applying the primary batter coating to the portion of food from above.

24. A method according to claim 22 or 23, and further comprising:

using a belt above the batter bath to draw the portion of food through the batter bath.

25. A method according to any of the preceding claims, wherein part-cooking the portion of food comprises frying the composite batter coating.

26. A method according to claim 25, wherein said frying comprises submerging the portion of food in an oil bath.

27. A method according to claim 26, and further including:

using one or more belts at least partially or wholly within the oil bath to draw the portion of food through the oil bath.

28. A method according to claim 27, and further including using the one or more belts to submerge the portion of food in the oil bath.

29. A method according to claim 27 or 28, and further including adjusting a horizontal position of the one or more belts to set a position at which the portion of food is engaged in order to set a point at which the portion of food is submerged in the oil bath.

30. A method according to any of claims 25 to 29, and further including frying the portion of food within 1 to 5 seconds after application of the primary batter coat.

31. A method according to claim 30, and further including frying the portion of food within 2 to 4 seconds after application of the primary batter coat.

32. A method according to any of the preceding claims, wherein the food-safe gas is one or more of carbon dioxide, nitrogen, air, and nitrous gas.

33. A portion of food coated with batter using the method according to any of the method claims 1 - 32.

34. An apparatus for applying a composite batter coating to a portion of food, the composite batter coating comprising at least a primary batter coat, and a crumb coat or a powder coat, the apparatus including:

a source of a primary batter coat, the primary batter coat comprising at least flour, water and an emulsifier;

an aeration device, coupled to the source of the primary batter coat, for aerating the primary batter coat with a food-safe gas prior to applying the primary batter coat;

a plurality of coating application stages for applying the composite batter coating to the portion of food, the plurality of coating application stages including at least a primary batter coat application stage and a crumb coat application stage; and

a cooking device for part-cooking the portion of food to at least partially cook the composite batter coating.

35. An apparatus according to claim 34, wherein the plurality of coating application stages comprise:

a base batter coat application stage, for applying a base batter coat to the portion of food;

the crumb coat application stage, for applying the crumb coat to the base batter coat; and

the primary batter coat application stage, for applying the primary batter coat to the crumb coat.

36. An apparatus according to claim 34 or 35, and further including:

a de-glazing device, for de-glazing the portion of food prior to applying the base batter coat or the powder coat.

37. An apparatus according to claim 34, wherein the plurality of coating application stages comprise:

the primary batter coat application stage, for applying the primary batter coat to the portion of food; and

the crumb coat application stage, for applying the crumb coat to the primary batter coat.

38. An apparatus according to claim 37, and further including:

a de-glazing device, for de-glazing the portion of food prior to applying the primary batter coat; or

a base batter coat application stage, for applying a base batter coat to the portion of food prior to applying the primary batter coat.

39. An apparatus according to claim 37 or 38, and further including a powder application stage, for applying a powder coat to the portion of food prior to applying the primary batter coat.

40. An apparatus according to any of claims 34 to 39, wherein the primary batter coat application stage includes a fantail nozzle for applying the primary batter coat.

41. An apparatus according to any of claims 34 to 40, further comprising a controller for controlling the amount of the food-safe gas in the primary batter coat so as to maintain the level of aeration thereof within a predetermined range.

42. An apparatus according to any of claims 34 to 41, wherein the aeration device is connected to a source of the food-safe gas.

43. An apparatus according to claim 42, further comprising a controller configured for periodically or continuously:

measuring the level of aeration of the primary batter coat, and

if the level of aeration is not within a predetermined range, adjusting the input pressure of the food-safe gas into the aeration device so as to maintain the level of aeration within the predetermined range.

44. An apparatus according to claim 43, wherein measuring the level of aeration of the primary batter coat comprises measuring the ratio of the weight of a fixed volume of (i) batter for the primary batter coat to (ii) non-aerated batter that has not entered the aeration device.

45. An apparatus according to any of claims 41 to 44, wherein the predetermined range corresponds to a ratio of the weight of a fixed volume of (i) aerated batter for the primary batter coat to (ii) non-aerated batter having the range 43.75% to 50%.

46. An apparatus according to claim 42, or any claim dependent thereon, wherein the aeration device is configured to receive a first input of non-aerated batter at 6 bar and a primary input of food-safe gas at 8 bar.

47. An apparatus according to any of claims 34 to 46, wherein the emulsifier forms 2-10%, more preferably 5-10%, and more preferably 7-8% by weight of the primary batter coat.

48. An apparatus according to any of claims 34 to 47, wherein the emulsifier is a fat or oil.

49. An apparatus according to claims 48, wherein the emulsifier is palm oil fat.

50. An apparatus according to any of claims 34 to 49, further comprising a controller for, prior to the step of aerating the primary batter coat, controlling the temperature of the batter for the primary batter coat so as to be within a predetermined temperature range.

51. An apparatus according to claim 50, wherein the predetermined temperature range is 8-12 °C, more preferably 8-11 °C, and more preferably 10 °C.

52. An apparatus according to claim 42, or any claim dependent thereon, wherein the aeration device comprises a rotor and stator, the rotor and stator having intermeshing pins.

53. An apparatus according to any of claims 34 to 52, further comprising:

a collection device for collecting a portion of the primary batter coat that does not adhere to the portion of food during the applying the composite batter coating;

a secondary mixer for remixing the portion of the primary batter coat so as to produce a remixed portion of batter from which the food-safe gas has been substantially removed; and

at least one conduit for incorporating the remixed portion of batter into the primary batter coat prior to aerating the primary batter coat with a food-safe gas.

54. An apparatus according to any of claims 34 to 53, wherein the primary batter coating stage comprises an outlet to apply the primary batter coating to the portion of food from above.

55. An apparatus according to claim 54, comprising a batter bath to collect a portion of the primary batter coat, wherein the primary batter coating stage comprises coating an underside and sides of the portion of food with the portion of primary batter coat in the batter bath.

56. An apparatus according to claim 55, comprising coating the underside and sides of the portion of food in the batter bath before applying the primary batter coating to the portion of food from above.

57. An apparatus according to claim 55 or 56, comprising a belt above the batter bath to draw the portion of food through the batter bath.

58. An apparatus according to any of claims 34 to 57, wherein the cooking device comprises a fryer configured for frying the composite batter coating.

59. An apparatus according to claim 58, wherein said fryer comprises an oil bath for submerging the portion of food.

60. An apparatus according to claim 59, wherein one or more belts are provided at least partially or wholly within the oil bath to draw the portion of food through the oil bath.

61. An apparatus according to claim 60, wherein the one or more belts are operable to submerge the portion of food in the oil bath.

62. An apparatus according to claim 60 or 61, comprising an adjustment device for adjusting a horizontal position of the one or more belts to set a position at which the portion of food is engaged in order to set a point at which the portion of food is submerged in the oil bath.

63. An apparatus according to claim 60, 61 or 62, wherein one or more belts have a non-stick coating to reduce sticking of the portion of food thereto.

64. An apparatus according to any of claims 34 to 63, wherein the food-safe gas is one or more of carbon dioxide, nitrogen, air, and nitrous gas.

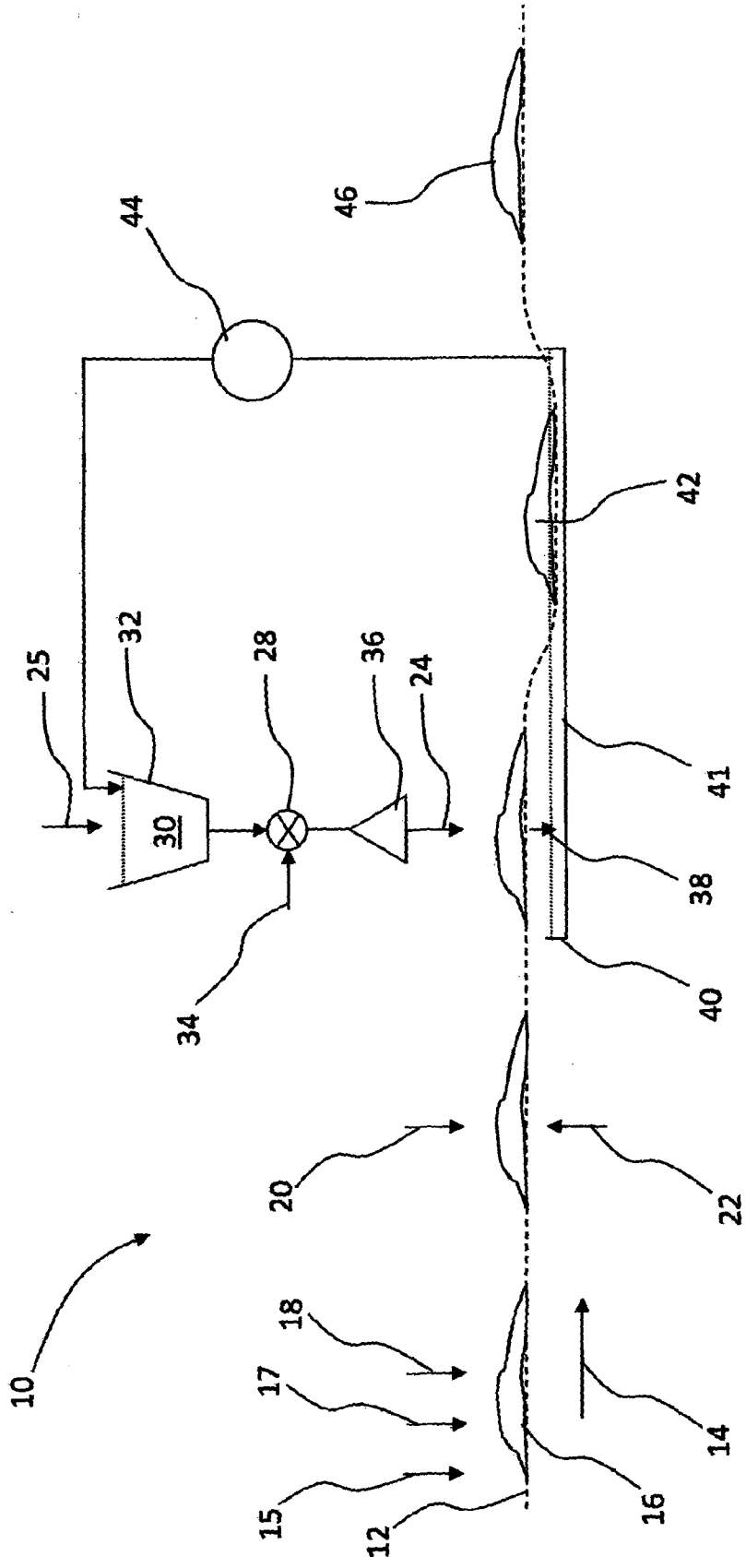


Fig 1

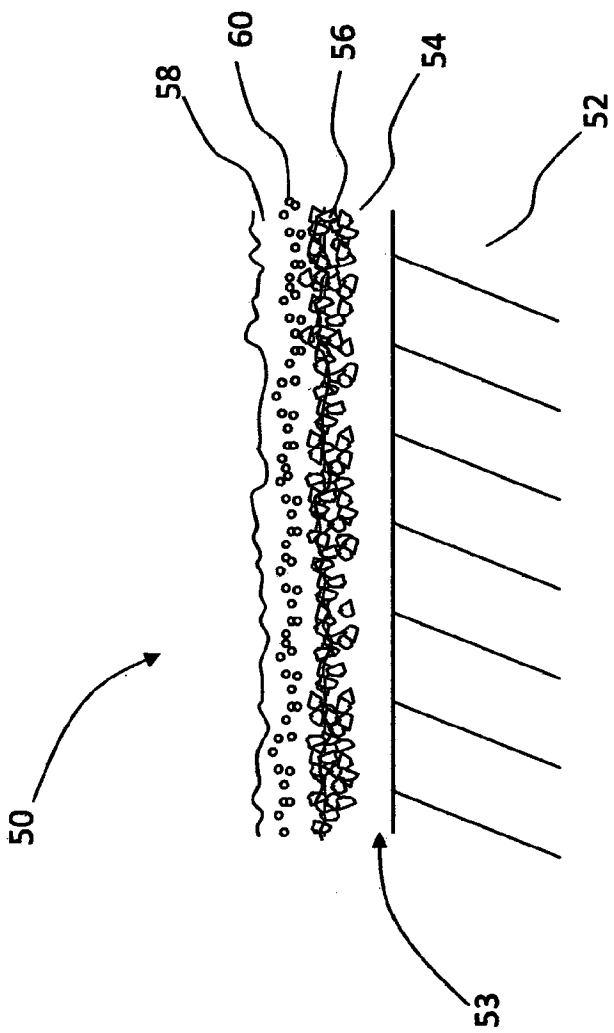


Fig 2

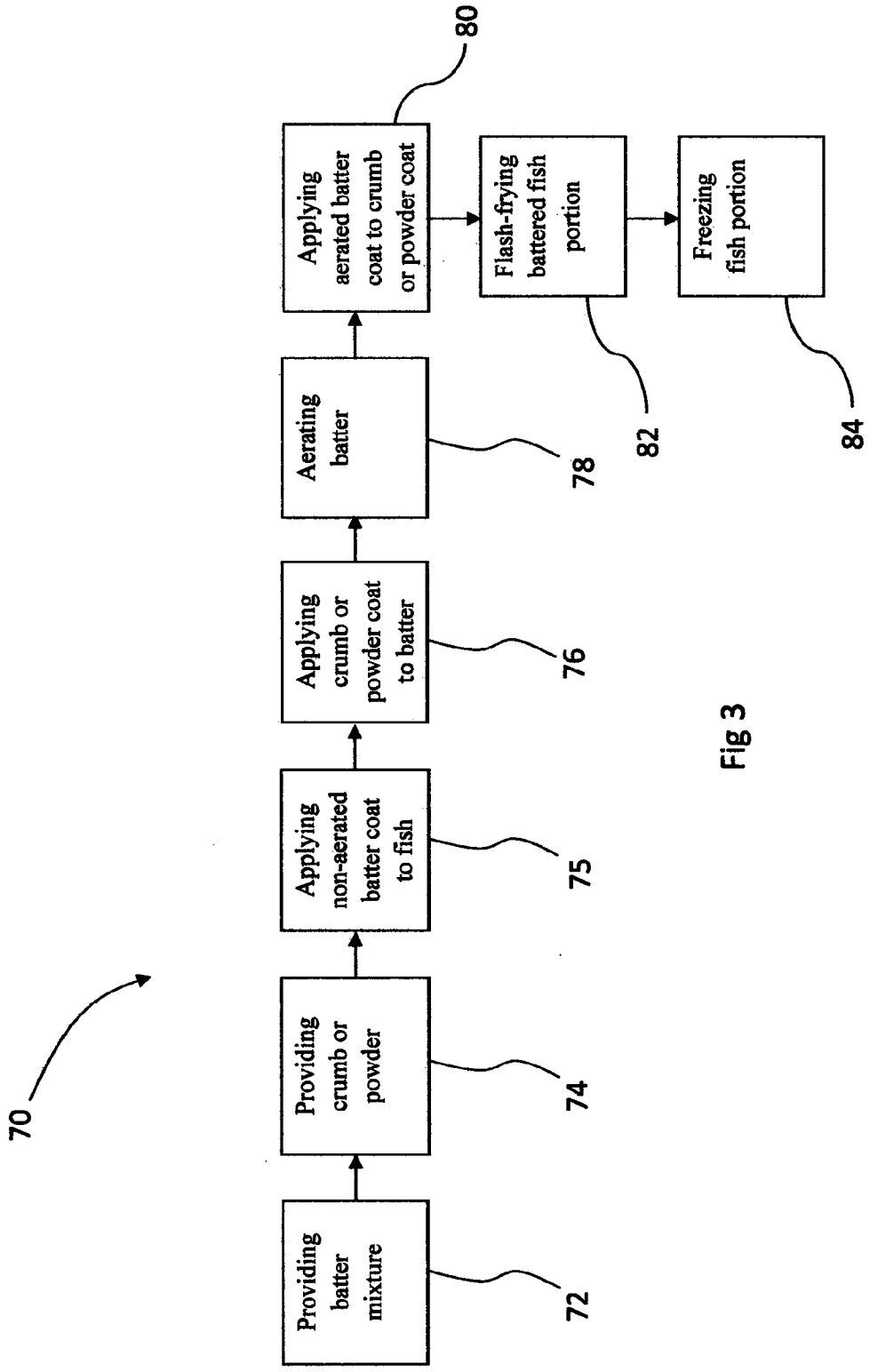

70
Providing batter mixture
72
Providing crumb or powder
74
Applying non-aerated batter coat to fish
75
Applying crumb or powder coat to batter
76
Aerating batter
78
Applying aerated batter coat to crumb or powder coat
80
Flash-frying battered fish portion
82
Freezing fish portion
84

Fig 3

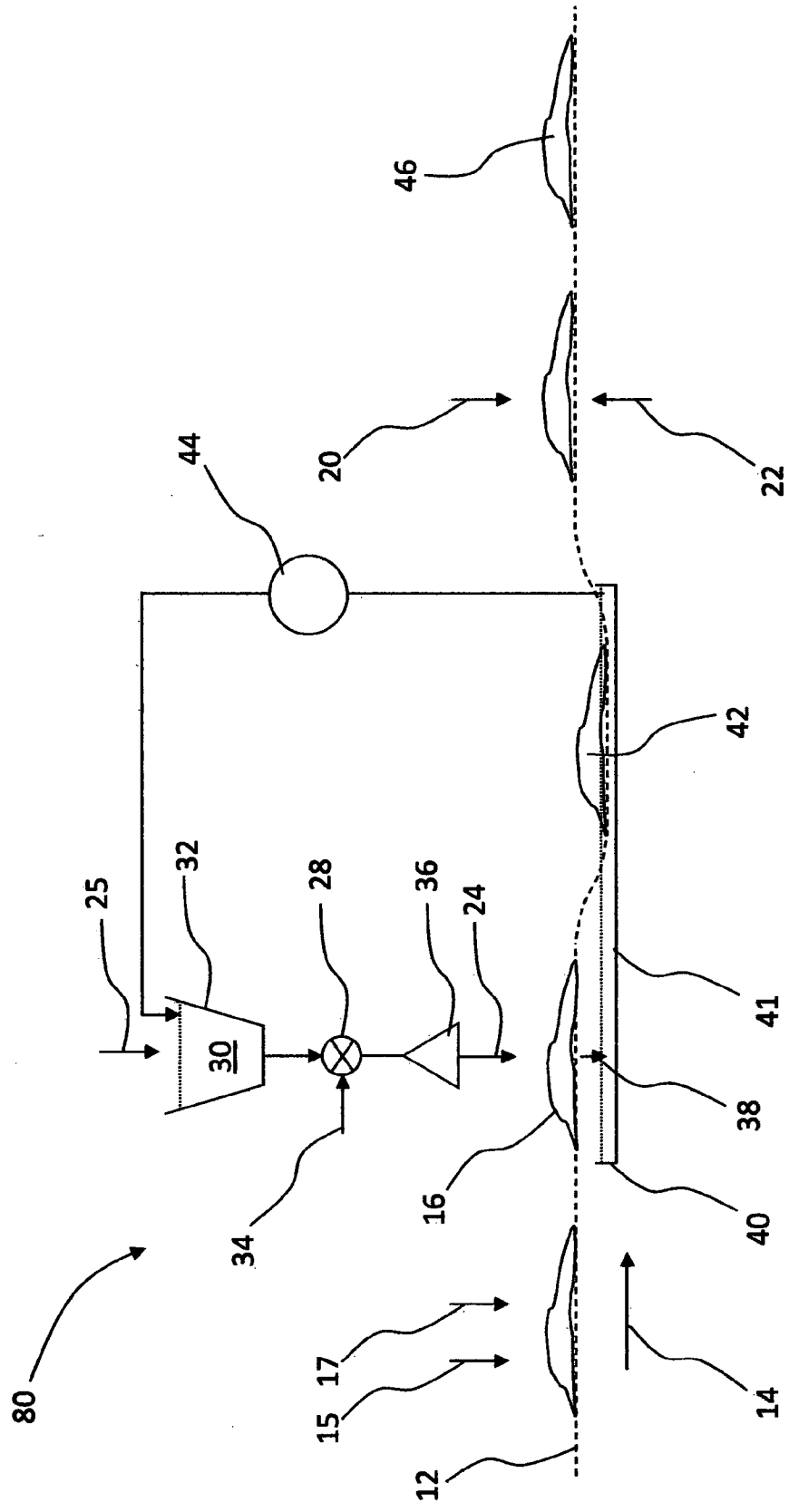


Fig 4

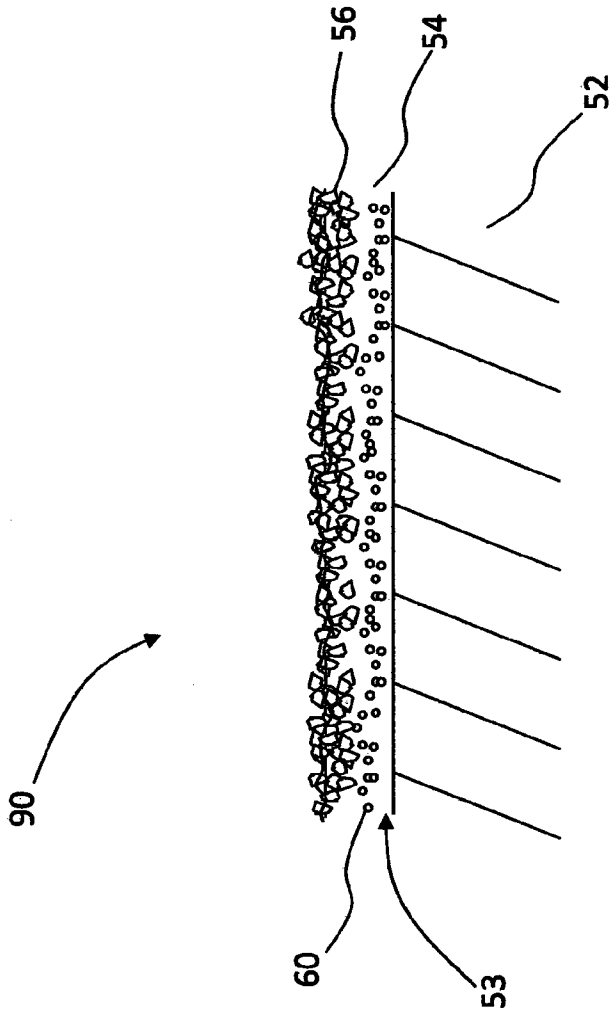


Fig 5

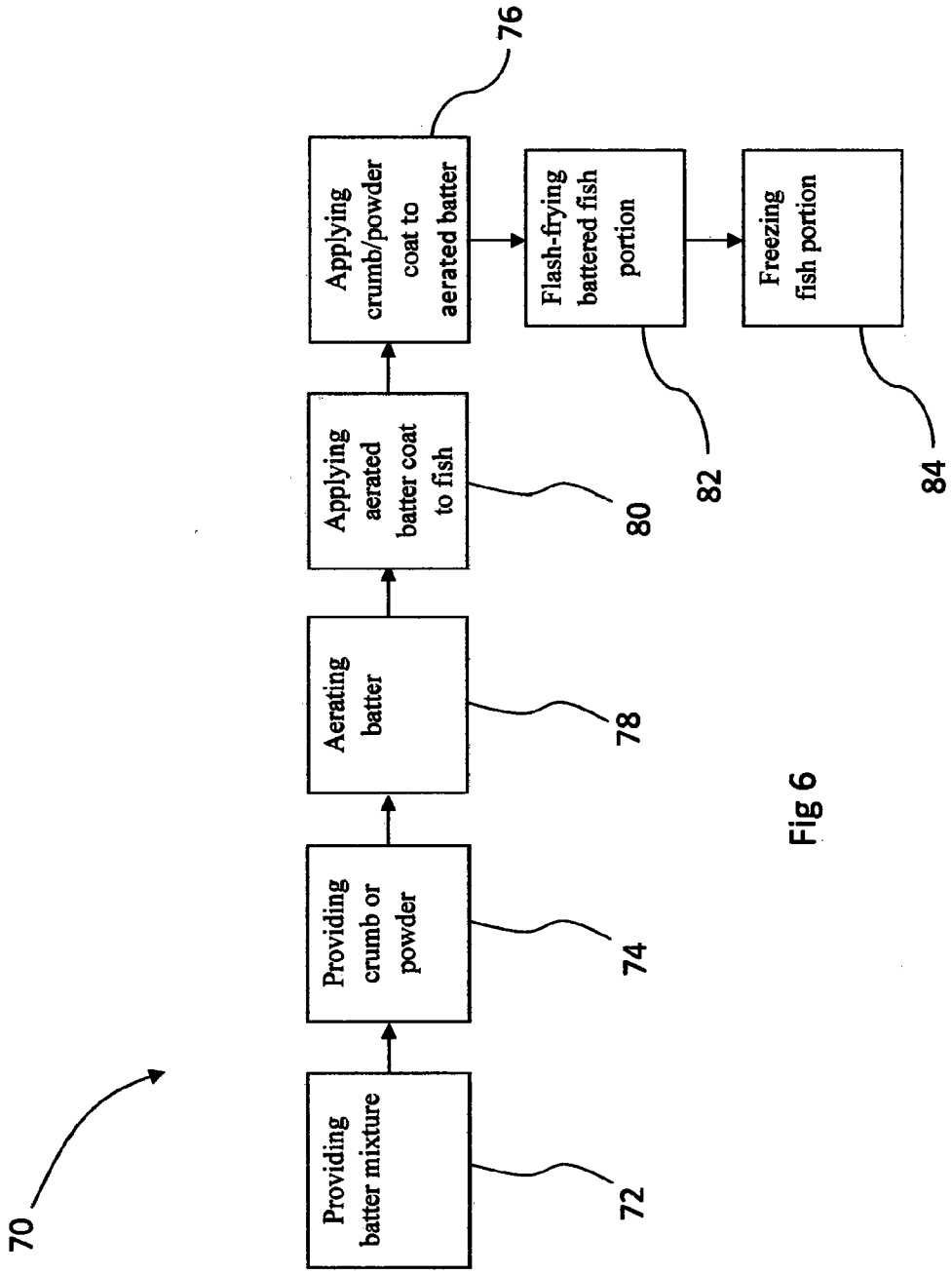

70
Providing batter mixture
72
Providing crumb or powder
74
Aerating batter
78
Applying aerated batter coat to fish
80
Applying crumb/powder coat to aerated batter
76
Flash-frying battered fish portion
82
Freezing fish portion
84

Fig 6

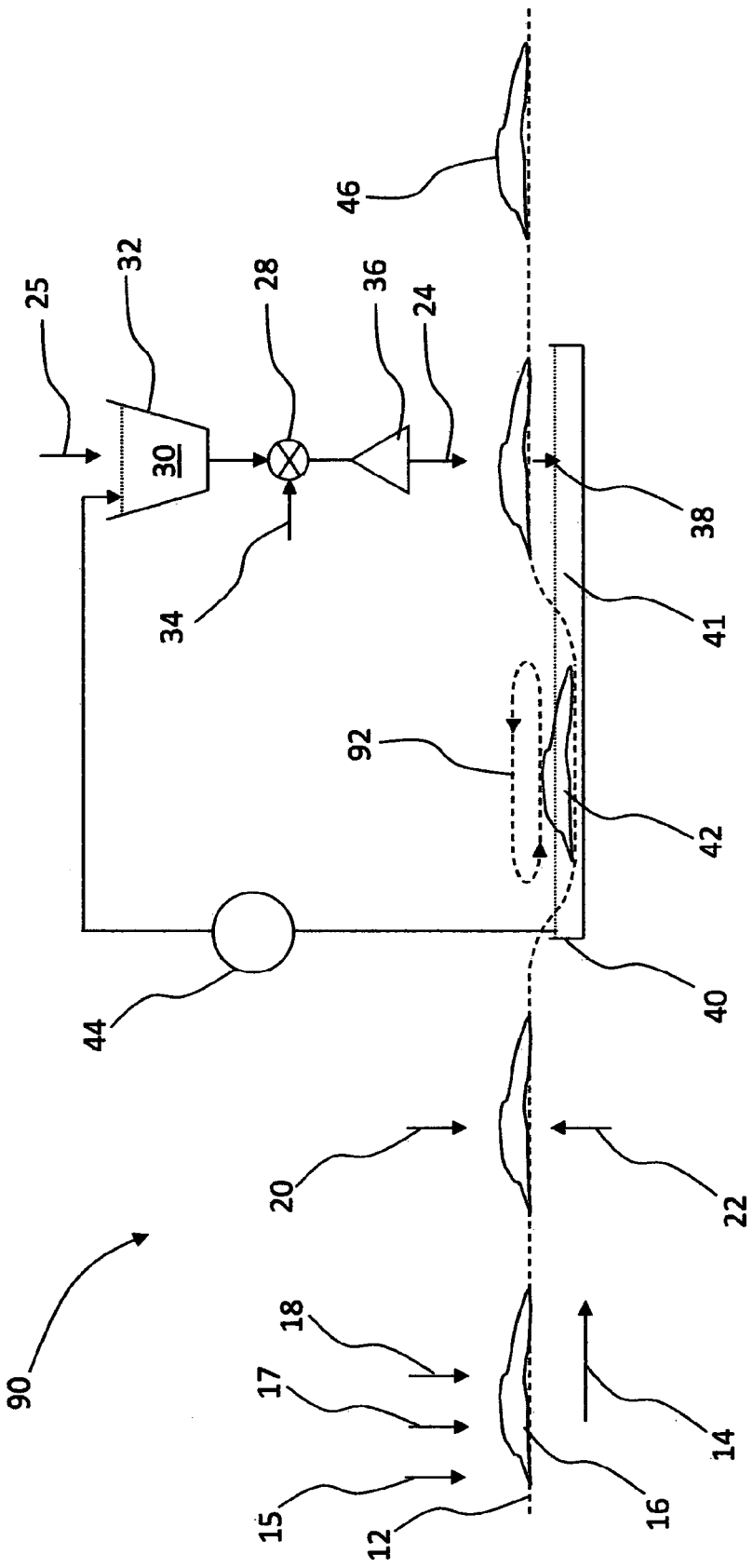


Fig 7

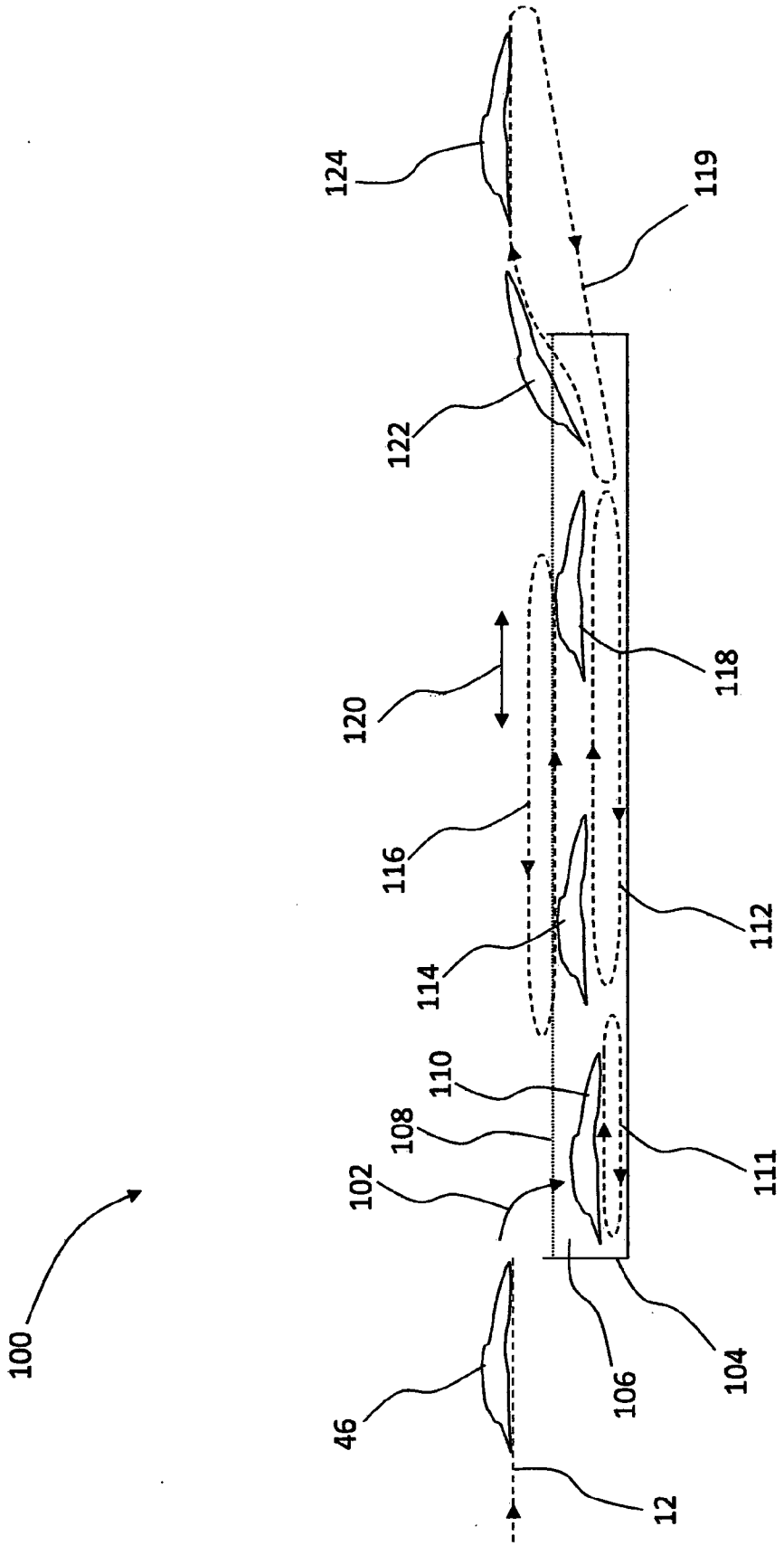


Fig 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2017/000084

A. CLASSIFICATION OF SUBJECT MATTER
INV. A23P20/12 A23P20/25
ADD.

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)
A23P

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 practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 091 532 A (MODERN MAID FOOD PRODUCTS INC) 4 August 1982 (1982-08-04)	1-19, 21-52, 54-64
A	page 3, line 68 - page 5, line 68	20,53
A	US 2012/196005 A1 (PICKFORD KEITH GRAHAM [GB]) 2 August 2012 (2012-08-02) paragraph [0100] - paragraph [0143]; figures 1-5	1-64
A	US 4 375 484 A (LEE CHARLESTON R ET AL) 1 March 1983 (1983-03-01) column 2, line 43 - column 8, line 30	1-64
A	US 4 386 559 A (EL-HAG NABIL A ET AL) 7 June 1983 (1983-06-07) column 3, line 45 - column 7, line 59; figures 1-4	1-64

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
2 August 2017	14/08/2017

Name and mailing address of the ISA/	Authorized officer
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1

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2017/000084

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2004/011223 A1 (ODOM WILLIAM J [US]) 22 January 2004 (2004-01-22) paragraph [0015] - paragraph [0027] -----	1-64

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/GB2017/000084

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