

QUESTION 2

THE EXAMINATION PAPERS FOR QUESTION 2 CONSIST OF:

PAPER 1 – Text of Question (7 sheets)

PAPER 2 – Schematic drawings (2 sheets)

PAPER 3 – Patent A (5 sheets)

PAPER 4 – Article B (2 sheets)

QUESTION 2

PAPER 1

PAGE 1 OF 7

TEXT OF QUESTION 2

You act for Chopped Cheese Pty Ltd, an Australian manufacturer of processed cheese products. The main products produced by Chopped Cheese P/L include shredded mozzarella cheese, shredded cheddar cheese, grated parmesan cheese, and frozen forms of these products.

You receive a telephone call from Mr Bill Jones, the head of Research and Development of Chopped Cheese P/L. Mr Jones invites you to their factory to view a new process he has developed. You attend and take detailed notes. In your meeting Mr Jones expresses an interest in obtaining patent protection for what he regards as a critical development.

Your notes set out that the biggest market of Chopped Cheese P/L is shredded mozzarella cheese. The pizza industry is the principal user of shredded mozzarella cheese. The shredded mozzarella cheese is applied to the tops of pizzas and baked in high temperature convection ovens. These ovens are rapid throughput ovens where pizzas on a conveyor belt traverse the oven at temperatures between about 270°C to about 350°C, usually around 320°C.

The shredded mozzarella cheese produced by Chopped Cheese P/L needs to be shipped all round Australia and it needs to be frozen to prevent deterioration. The frozen cheese must then be thawed to enable its use as a pizza topping.

Your notes explain that mozzarella cheese is associated with a number of problems. First, mozzarella cheese, whether frozen and thawed, or unfrozen, sporadically shows excessive burning and blistering when subject to high temperature cooking in the high throughput ovens used in the pizza industry. The resultant pizzas have unattractive dark black burned mozzarella cheese on their surface. Large blistered scabs may appear, again on the surface of the pizza. Further, the traditional stretch of the mozzarella cheese on each pizza may be missing. This sporadic problem seems to effect mozzarella cheese produced from Australian milk, but not that from New Zealand shredded mozzarella cheese products. Mr Jones refers to these problems as "functionality problems". Mr Jones explains that Chopped Cheese P/L has 8,000 kg of mozzarella cheese to be grated, frozen and shipped around

QUESTION 2

PAPER 1

PAGE 2 OF 7

Australia. The pizza industry does not want it because of the functionality problems. Your notes indicate that Chopped Cheese P/L was faced with financial ruin if it could not find a market for its mozzarella cheese in the pizza industry.

A second problem which arises with frozen mozzarella cheese, is that it must be slow thawed over a period of 2 to 3 days or more at about 4°C to lessen functionality problems. This is time consuming and creates processing problems for the user. Mr Jones explains this as a "handling problem".

Your file note explains that in the standard process for producing frozen grated mozzarella cheese, the mozzarella cheese in 10 to 30 kg blocks is applied to a mechanical grater which shreds it into small shredded cheese particles. The grated cheese is placed on a conveyor belt or any other conveyor means, and passed into a freezing chamber, where it is snap frozen. Your file note explains that freezing is known as an IQF process, which stands for an individually quick frozen process. A number of standard freezing chambers are used in the IQF standard processes including fluidised beds, and cylindrical tumblers in which the grated cheese is frozen by means of a cryogenic fluid, such as liquefied air, gas, carbon dioxide or liquid nitrogen. The cryogenic fluid passes into the freezing chamber through a plurality of nozzles, slots, or by other means. Freezing chambers are conventionally chilled to about –30°C by surrounding refrigeration. Cryogenic fluid flow in the chamber provides a freezing zone at a temperature typically between about –130°C and –200°C.

Your file note explains that mozzarella cheese invariably has a water content between 49-50% w/w. Mr Jones has a hunch, for no particular reason, that if he can raise the water content of the grated mozzarella by 2-3% w/w he might be able to solve both the functionality and handling problems.

Your notes explain that Mr Jones tried to raise the moisture content of the mozzarella cheese after it was grated, and before it was snap frozen by the IQF process. This was first tried by spraying water onto the grated mozzarella cheese shreds as they passed along a conveyor belt before being fed into the freezing chamber. Mr Jones said that these experiments were a dramatic failure. The result was not individual free flowing shreds of cheese coated in a jacket of ice, as had been hoped, but rather large sheets and aggregates

QUESTION 2

PAPER 1

PAGE 3 OF 7

of ice with lumps of cheese shreds dispersed in pockets throughout. Mr Jones told you that the product was unusable and was not commercially acceptable.

On thinking about the matter further Mr Jones tried spraying water directly into the freezing chamber. Your notes show that this test was again a failure as the jet of water sprayed was directed at the freezing chamber walls and frozen in large sheets containing little or no cheese.

Mr Jones told you that he found that when the grated cheese was supplied to a freezing chamber where moisture was sprayed into the freezing chamber so that it formed a shower of ice particles, these ice particles coated the grated cheese as it passaged through the freezing chamber to give a free flowing frozen product. Mr Jones said he achieved this by spraying water into the cryogenic gas stream in the chamber. Mr Jones' results showed that under these circumstances a shower of fine ice particles are produced which coat the grated cheese as it is snap frozen, giving a hydrated product. The "hydrated" grated mozzarella cheese was found by Mr Jones to overcome both the functionality and handling problems which plagued mozzarella.

Your notes show that Mr Jones carried out his tests in a freezing chamber in the form of a cylindrical rotatable tumbler into which was sprayed a cryogenic fluid in the form of liquid nitrogen. Grated cheese falls off the conveyor into the freezing chamber past an array of nozzles or slots squirting the coolant at a substantially controlled rate in a downwards direction. The freezing chamber contains means (a lance with a water spray at its end) to spray water substantially transversely across the cryogenic gas stream. However Mr Jones stressed that a fluidized bed or other type of conventional freezing chamber which used a cryogenic gas stream could be used.

Mr Jones shows you schematic drawings of an example of his process and these form **Paper 2**. Mr Jones apologises that the drawings are schematic; and stresses that the apparatus is not important to his process. Figure 1 is said by Mr Jones to illustrate a tubular freezing chamber in side view, and Figure 2 an illustration of the mixing and freezing section of the chamber in cross-sectional view.

QUESTION 2

PAPER 1

PAGE 4 OF 7

Referring to Figure 1, grated cheese is placed in hopper 101 and caused to drop at an even rate to conveyor 102 which transmits the cheese to the freezing chamber 107. Roller bearings 105 and 106 allow the freezing chamber 107 to gently rotate.

Liquid nitrogen is introduced into the freezing chamber 107 through pipe 103, and water is sprayed into the chamber 107 through pipe 104. The frozen grated cheese 108 is free flowing and ready for packaging.

The process of Figure 1 is carried out in a temperature controlled room at a temperature between about -15°C and -40°C .

In Figure 2, grated cheese 203 passes along conveyor 204 and falls through a freezing zone 207 defined by a stream of liquid nitrogen (cryogen) which emits from nozzles 205. A spray of water is introduced into the freezing chamber through spray 206 into the liquid nitrogen gas stream. A shower of ice particles is formed which contact the grated cheese forming a coating of ice particles on their exterior 209. The grated IQF mozzarella cheese 209 falls onto the lower surface 208 of the freezing chamber. Under gravity the frozen hydrated cheese transmits out of the freezing chamber onto a conveyor of bagging and low temperature storage. The water content of the hydrated IQF mozzarella is 52-53% w/w.

Mr Jones explains that the feed rates of the grated cheese, and flow rates of the liquid nitrogen and water are controllable to introduce 2-3% moisture on a w/w basis to the cheese in the form of frozen ice particles on the frozen grated cheese surface. Mr Jones believes that a water increase of 1% to 4% w/w should provide the same benefits of functionality and handling. Above 4% w/w Mr Jones thinks other functionality problems could arise.

Your notes show that Mr Jones again stresses that other commercially available freezing chambers can be used in his process. He gives examples of the kind of equipment used for IQF freezing of other food products, particularly vegetables. These processes use a fluidised bed-type IQF equipment. Mr Jones says that in this situation the cryogen is introduced as the fluidising agent into the base of the fluidised bed. Water is introduced into the fluidised bed by means which spray a stream of water across or into the flow of the cryogenic fluidising gas.

QUESTION 2

PAPER 1

PAGE 5 OF 7

The frozen grated cheese is free flowing, does not aggregate or otherwise stick together and can be readily bagged or otherwise packaged for distribution in a frozen state which Mr Jones indicates is a great advantage of his process. About 1%-4% w/w of water is added. This is why Mr Jones sometimes refers to his frozen grated cheese being hydrated.

Mr Jones goes on to tell you that the frozen free flowing hydrated cheese shreds produced by his process can be applied to a pizza and baked in a frozen form without any detriment to functionality of the cooked pizza. Mr Jones says the water is free of additives and the cheese has a perfect mozzarella taste.

Mr Jones tells you that he wants to file a patent application for his process and new cheese product. Mr Jones tells you that he wants to protect frozen mozzarella cheese as he thinks this can be sold overseas and he is sure people will try and copy what the company is doing. Mr Jones says that to his knowledge this has never been done before.

Mr Jones asks you to conduct appropriate patent searches, preparatory to filing a complete patent application.

You carry out a search and reveal Patent A and Article B which form **Paper 3** and **Paper 4** respectively.

You show Patent A to Mr Jones and he responds with words to the effect *"Yes I know all about the Leprino patent. It has been touted by Leprino to be a major innovation in producing mozzarella cheese but we found it did not address the functionality problems which I solved and produces a funny tasting product."* Mr Jones goes on to tell you that he thinks that the Leprino patent only optionally adds an aqueous carrier containing a flavour additive or a cheese emulsifier to the already frozen cheese granules, and that this process is carried out in a separate reactor after the cheese is frozen. Mr Jones says he believes that in Leprino the coating freezes a film over each cheese shred which does not work like his development. With reference to Article B Mr Jones asks you to form your own view on its relevance or otherwise.

QUESTION 2

PAPER 1

PAGE 6 OF 7

Your notes show you asked Mr Jones if his process can be used on other cheeses apart from mozzarella cheese. His answer was yes. Indeed, Mr Jones enthused about using a blend of cheddar cheese and mozzarella cheese (30:50 parts to 70:50 parts respectively) which gives a beautifully rich and satisfying mouthfeel. Mr Jones has never seen this before.

QUESTION 2

PAPER 1

PAGE 7 OF 7

PLEASE READ THE FOLLOWING STANDARD INSTRUCTIONS CAREFULLY

Candidates are required to draft a complete specification for an Australian Standard patent. Candidates should accept as correct the information given in the question relating to technical aspects of the prior art and the client's development, but candidates should exercise their own judgement in relation to non-technical statements made by the client.

Candidates should judge the novelty of the client's development against the prior art supplied and should not have regard to any personal knowledge they may have concerning similar subject matter.

The specification should comply with Sub-Sections (2) and (3) of Section 40 of the Patents Act 1990, and should address the prior art and advances made.

All claims must be novel over the prior art and should exhibit at least a scintilla of invention. Marks will not be awarded for claims directed to features which are not material to the invention under consideration and the inclusion of such claims may affect the Examiners' assessment of the candidate's answer paper.

Care should be taken with expression in all aspects of the paper and legible writing in ink will greatly assist the Examiners to assess candidate's answer papers.

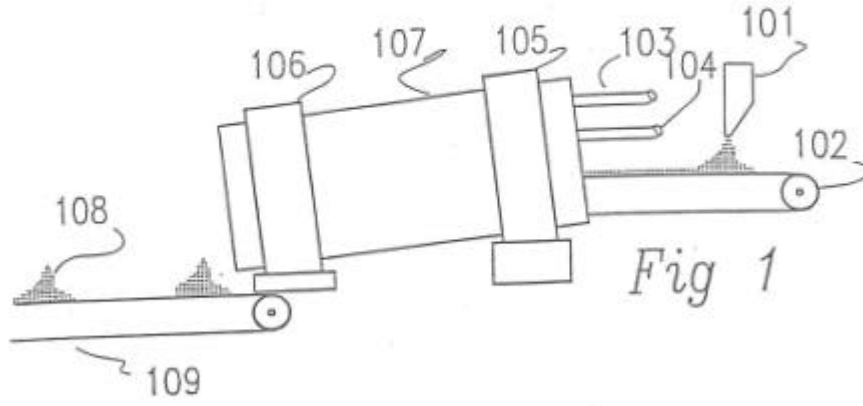
(100 marks)

END OF QUESTION 1

QUESTION 2

QUESTION 2

PAPER 2
PAGE 1 of 2



QUESTION 2

QUESTION 2

PAPER 2
PAGE 2 of 2

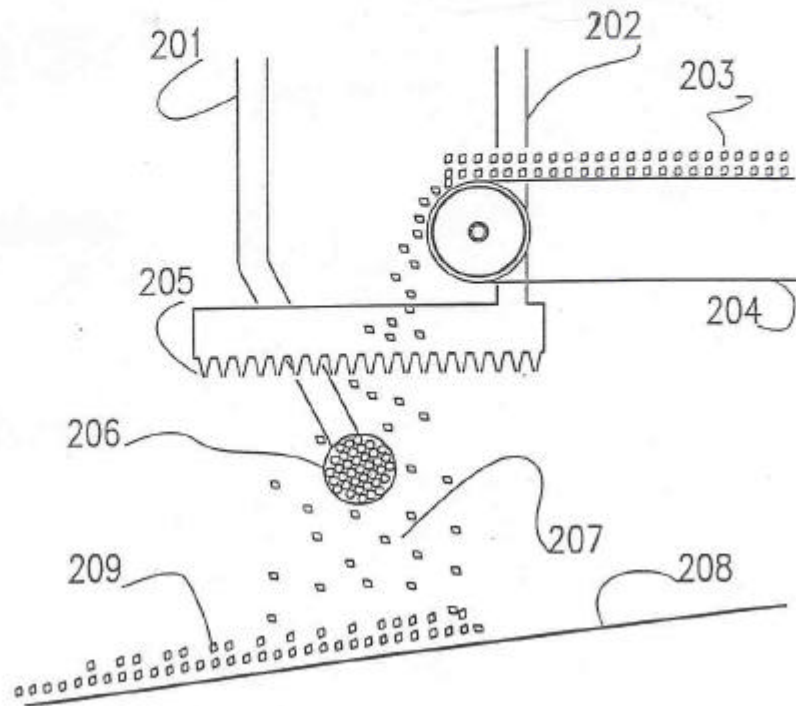


Fig 2

QUESTION 2

PAPER 3

PAGE 1 OF 5

PATENT A

FROZEN GRANULAR CHEESE PRODUCTS FOR BAKED PIZZAS

Applicant: Leprino Inc

Publication Date: 3 March 1997

Field of Invention

The field of this invention is the use of comminuted cheese on baked pizza.

Background of the Invention

In the United States, many retail operations engaged in preparation and baking of pizzas desire to use cheese in a comminuted form. Consequently, producers of mozzarella and other cheese used on pizzas shred or dice block cheese for delivery to the pizza restaurants. To provide improved storage and keeping qualities, comminuted cheese for use on pizzas can be frozen and delivered in frozen or semi-frozen condition. However, the cheese must at least be thawed to the extent that the shreds or granules can be separated. Moreover, further thawing is needed to improve functionality.

The use of comminuted cheese in frozen or partially frozen condition on pizzas frequently results in baked products showing excessive browning and blistering. Not only is this appearance unattractive to the consumer, but the flavour and eating quality can also be adversely affected.

The recommended practice involves slow thawing of the frozen cheese at around 4°C (normal refrigeration temperature). Where thawing is carried out a minimum of two to three days of thawing-holding is usually required. Moreover, the best practice involves holding of the granular cheese for four to five days, until thawing is completed.

Because of the problems associated with the use of frozen comminuted cheese for preparing pizza, certain franchised cheese restaurants require that the comminuted cheese be packaged non-frozen in specially designed packages. This adds considerably to packaging and distribution expenses.

QUESTION 2

PAPER 3

PAGE 2 OF 5

As far as is known, no one heretofore has produced frozen comminuted cheese which can be applied to pizzas in frozen or partially frozen condition and baked to produce a pizza product as of good quality as with fully thawed cheese. The high standards of appearance, quality and taste for large scale pizza preparation have not been satisfied by the use of comminuted cheese which has not been completely thawed.

Summary of Invention

According to a first embodiment of the invention there is provided a method of manufacturing modified cheese granules.

Granules of cheese are frozen by individual quick freezing at a temperature below -10°F whereby said individual granules retain substantially the same moisture content and distribution as before freezing. The resulting frozen granules are in a free-flowing condition. Optionally an aqueous carrier containing a flavour additive, or a cheese emulsifier additive, or both additives are subsequently applied to the frozen granules to form a frozen surface coating.

The development of this invention has required a better understanding of the problems associated with the use of comminuted cheese on pizzas. It was observed that the frozen granules of comminuted cheese usually had an ice film on their outer surfaces. Examination disclosed that this ice is formed as the granules are frozen-moisture being exuded and freezing around the granules. Consequently, when thawing was commenced the outer surfaces became wet, but by holding of the granules for several days, the free moisture was reabsorbed. With holding periods of four to five days, substantial equilibration of moisture distribution was obtained, although this had not been previously recognized. In effect, the interior moisture of the cheese particles redistributed substantially as it was before freezing. Without such holding and equilibration, the ice film melted and the water flashed off as the pizzas were baked. This invention involves a recognition that such water loss can aggravate undesirable browning and blistering.

It was found that to produce pizza of the most pleasing appearance and taste, it is important to fully maintain the moisture content of the applied cheese. As the moisture flashes off, the

QUESTION 2

PAPER 3

PAGE 3 OF 5

resulting steam can raise blisters. In blistering, the protein layers are lifted from the surface of the baking pizzas. Such blisters tend to burn and discolour.

This invention provides for the first time frozen comminuted cheese which can be used on pizza without any pre-thawing. The resulting baked pizzas has good or better appearance and quality as when prepared from fully thawed and equilibrated cheese. To achieve this result it is necessary to freeze the granules very rapidly, so that the frozen granules have essentially the same moisture content and distribution as before freezing. Rapid freezing prevents moisture migration to the surface of the cheese particles. The frozen particles are free from visible ice coatings, and the moisture within the particles in the form of very fine crystalline ice.

When the frozen cheese of this invention is thawed during baking, it immediately has the optimum moisture distribution for baking. No holding time is needed for moisture equilibration. Moreover, during baking the contacting surfaces of the cheese particles thaw first, becoming softened with particle-to-particle fusing. In fact, the particular cheese can begin to fuse into smoothly melted layers while the interiors of the individual particles are still partially frozen. Using frozen cheese of the kind prepared by the method of this invention does not interfere with normal melting of the cheese on pizzas baked very rapidly. In the practice of using convection ovens through which the pizzas pass on conveyor belts, baking times are usually less than ten minutes for both "thick" and "thin" crust type pizzas. Nevertheless, by using the method of this invention, the baked cheese appears smooth and non-lumpy. The melted cheese exhibits an appearance comparable to that obtained with fully thawed cheese.

Since the frozen cheese produced in accordance with this invention is in a particular free-flowing condition, modification of taste and functional properties of the cheese can be obtained by applying coatings to the outsides of the cheese particles. The coatings are applied so as to encapsulate the individual granules. More specifically, it has been found that a new kind of frozen granular cheese product can be prepared by coating frozen free-flowing cheese granules with an aqueous carrier containing one or more cheese additives, such as flavour modifiers, emulsifiers, etc. The additive can be distributed in an aqueous carrier in the form of a solution, dispersion, or emulsion. The carrier containing the additive

QUESTION 2

PAPER 3

PAGE 4 OF 5

is applied as a thin coating to the granules. On contact with the granules, the coating freezes, thereby fixing the additive in distributed form around the outer surfaces of the granules.

The coated frozen granules have a variety of uses in addition to application to pizzas. They can be used as toppings or ingredients in other food products. By application in frozen or semi-frozen condition, the coatings remain distributed on the granules. When the food product is baked, the coatings will liquefy and the additive will be spread over and into the cheese granules or into and through the food product. In other words, the desired modification occurs during baking use of the coated frozen granules. A method and product are thereby provided which achieve efficient and uniform modification of granular cheese for use in baked food products.

To accomplish rapid freezing of the comminuted cheese, a bed of the granules can be directly contacted by freezing air. For example, the cheese granules may be contacted in a fluidized bed, or in an agitated bed for rapidly exposing all exterior surfaces of the granules to the freezing air. By passing the freezing air upwardly through beds in which the cheese particles are agitated, or preferably fluidized, the air flow can contact all of the exterior surfaces of the particles. With air at a sufficiently low temperature, surface crusts will rapidly form on the granules, thereby locking in the moisture.

Commercially available equipment can be used for the freezing of the comminuted cheese. This equipment is of the kind sold for individual quick freezing (IQF) of granular food products. Heretofore, "IQF" equipment has been employed primarily for freezing vegetables, and the freezing step has usually been accompanied by partial drying of the product. In preparing the frozen cheese, for the purpose of this invention, as explained above, it is desirable to avoid moisture loss from the cheese as it is being frozen.

In one preferred method of freezing the comminuted cheese, fluidized bed-type IQF equipment is employed. Such fluidized bed equipment is described in United States Patents 3,169,381, 4,265,096 and 4,478,141. Commercially suitable IQF fluidized bed equipment is available from Frigoscandia (Frigoscandia Contracting, Inc., Bellevue, WA). Expanded bed-type freezing equipment is available from several suppliers, including Cloud & Britton, Inc., Mountlake Terrace, Washington.

QUESTION 2

PAPER 3

PAGE 5 OF 5

After the cheese is frozen as described, the shreds or granules will be in an individual free-flowing form. The particulate cheese is then further processed in accordance with this invention. For example, a conveyor belt, or rotating drum, or other equipment may be used. In one embodiment, the cheese particles may be sprayed with an aqueous carrier containing one or more cheese additives, such as flavour modifiers, emulsifiers, surfactants, defoamers, preservatives, etc. Any GRAS-approved food additive can be used. The additive may be in an aqueous solution, dispersion, or emulsion, and a plurality of additives may be applied in a single layer or a plurality of layers. The carrier should contain sufficient water so that it will freeze on the already frozen cheese particles. Granules of different kinds of cheese may be mixed in frozen condition, either before or after coating.

It is desirable to mix or agitate the frozen cheese while the coatings are being applied at about -4°C to -10°C . When properly applied, the individual granules become encapsulated by the frozen coating. This can be done using a conveyor belt can be equipped with devices for mixing the cheese particles as they are coated. Spray application of the coatings will usually be most convenient. As the aqueous carrier is distributed over the outer surfaces of the cheese granules, the carrier can be rapidly converted to frozen layers. At the same time, the coated granules can remain free-flowing. In a preferred embodiment, the coatings are in the form of thin continuous layers and comprise from 0.5 to 4.0% by weight based on the uncoated cheese granules, that is, from 0.5 to 4 parts of the aqueous coating are used per 100 parts by weight of the cheese. Thorough distribution of the coatings is enhanced because the aqueous carrier is not absorbed by the frozen granules. A series of coatings, such as a two-layer coating may be applied, each layer containing one or more different additives. The use of such frozen coatings can be in addition to application of a preservative or other agent to the granules before freezing, when immediate granule penetration is desired. For example, an aqueous solution of sodium citrate may be sprayed on the granules prior to freezing.

QUESTION 2

PAPER 4

PAGE 1 OF 2

ARTICLE B

IQF freezer boosts capacity, quality for pizza-topping producer

Replacing mechanical freezers with an IQF rotating-tumbler type CO₂ system erased a production bottleneck, boosted capacity by 40 percent, contained labor costs, improved product quality and opened new markets for Flavored Meats Co., a producer of custom-blended pizza toppings in Lafayette, IN.

Flavored Meats makes about 55 different pre-cooked toppings based on beef, pork, vegetable, cheese and spice blends, in accordance with closely-guarded customer recipes for frozen pizza producers and restaurants throughout a nine-state area centred in Indiana.

"We had the cooking capacity to grow substantially," says Michael Cassidy, president and son of founder Joseph Cassidy. "We also wanted to get into value-added products for distributors who want more than just plain pizza toppings."

Pizza producers and restaurants want added convenience, more accurate portion control, better taste and appearance, he adds. *"But we couldn't freeze the batches fast enough to run at full cooking capacity, and the mechanical freezers offered no possibility for product improvement."*

One freezer replaces five

To solve the problem, the company installed a 25 ft Kwikfreeze tumble freezer supplied by Airco Industrial Gases. The system uses carbon dioxide to individually quick-freeze topping particles at -190°F at a capacity of 2,500 lb per hour – three times the capacity of the five mechanical freezers it replaced.

Freezing a 300 lb batch of dense product (such as a pork based topping) now takes only 6-7 minutes as compared to 45 minutes with the earlier system. Installed in what was formerly one of two freezing rooms, the Kwikfreeze unit further occupies less floor space and minimizes labor costs.

QUESTION 2

PAPER 4

PAGE 2 OF 2

"To get the same freezing capacity, we could have expanded the building and added room for more mechanical freezers," says Cassidy. "Capital investment for the two options was similar. But we would have had to add more people for the mechanical freezing operation. With the CO₂ system, we could triple capacity with the existing number of people. And the IQF process would give us a better product."

The IQF process

Topping particles are individually frozen almost instantly without bruising, crushing or clumping in the tumbler. Liquid CO₂ at 280 psi and at -120°C is injected into the cylinder through two horns. As CO₂ reaches atmospheric pressure at the horn nozzles, it flashes into snow at a rate of 40 lbs per minute.

Snow and product are gently mixed as they travel the length of the cylinder on a slight incline. By the time product discharges, the snow has sublimed to gas and the product temperature has been reduced to between -30 and -20°F.

Tumbler throughput is adjusted by varying rotation speed and the amount of CO₂ injected. Both variables are adjusted via the control panel for products with different freezing requirements.