(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
13 June 2013 (13.06.2013)

WIPO | PCT

(10) International Publication Number
WO 2013/085629 A1

(51) International Patent Classification:
A23G 3/48 (2006.01) *A23G 3/54* (2006.01)

(21) International Application Number:
PCT/US20 12/060941

(22) International Filing Date:
19 October 2012 (19.10.2012)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
13/3 14,124 7 December 201 1 (07. 12.201 1) US

(71) Applicant: **APPTEC, INC.** [US/US]; 4 Washington Drive, Cranbury, NJ 08512 (US).

(72) Inventors: **REDDY, Vilambi, Nrk;** 4 Washington Drive, Cranbury, NJ 085 12 (US). **TORGALKAR, Anil;** 4 Washington Drive, Cranbury, NJ 085 12 (US). **XAVIER, Lionel;** Vinyy Garden, Devadhanam, Trichy, Taminadu 620002 (IN).

(74) Agent: **KREMEN, Stanley, H.;** 4 Lenape Lane, East Brunswick, NJ 08816 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available):* AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI,

[Continued on nextpage]

(54) Title: PROCESS FOR PREPARING LOW-CALORIE, LOW-FAT SNACK NUTS

(57) Abstract: The Present Invention relies upon a physical process for preparing reduced fat, high fiber, high protein, low calorie roasted snack nuts. The process of the Present Invention exhibits significantly lower process times and higher yields than the prior art processes. The process comprises expelling the oil from nutmeat kernels (defatting) using a novel pressing process that takes less than a minute. The defatting process deforms the nuts. The nuts are reformed to their original shape using water. Then the reformed nuts are annealed using cold water to produce hardened nuts. The nuts are then dried and post-processed with coatings and roasting using state-of-the-art technology. The yield of snack nuts produced by this process is generally greater than eighty percent.

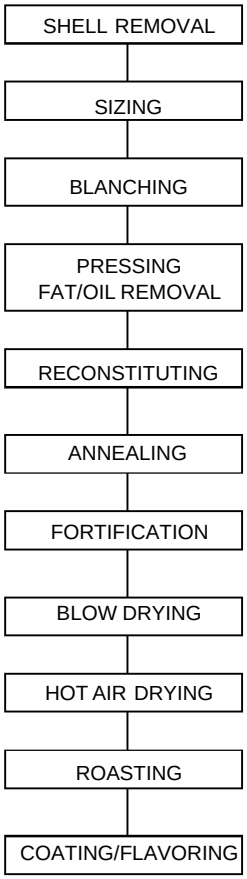


FIG. 1

WO 2013/085629 A1

NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available):* ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

— *with amended claims and statement (Art. 19(1))*

TITLE OF INVENTION

PROCESS FOR PREPARING LOW-CALORIE, LOW-FAT SNACK NUTS

CROSS REFERENCE TO RELATED APPLICATIONS

This Present Application is the PCT International Counterpart of currently pending US Patent Application Serial No. 13/314,124 filed on December 7, 201 1, which is incorporated herein by reference in its entirety. The Present Application claims the benefit of and international priority to said Application No. 13/314,1 24.

FIELD OF THE INVENTION

The Present Invention relates to an improved process for preparing snack nutmeats (including *inter alia* peanuts, cashews, pistachios, pecans, walnuts, macadamia nuts, brazil nuts, hickory nuts, beechnuts, acorns, and almonds, *etc.)* that are lower in fat and calories and higher in protein and fiber than the original natural nuts. In particular, the Present Invention relates to a high speed process for preparing the partially defatted, low calorie snack nuts, the method of which is suitable for commercial manufacturing with high yields. The process of the Present Invention relates to snack nuts, which are defined as whole or split nuts. The snack nuts formed by this process have a pleasing flavor, color, and texture that enable them to be used whole as a snack food.

BACKGROUND OF THE INVENTION

Nuts constitute a very popular high-protein snack food. Unfortunately, they have a high fat and calorie content. This is due to the presence of nut oil. This oil inherently permeates the nut. Peanuts have high oil content. Peanut oil represents 50 percent of the weight of the peanut, and approximately 80 percent of the calorie content. Prior art processes exist that partially remove the oil from peanuts, thereby reducing the fat and calorie content. However, there are no current commercially available snack nuts. This is due to inherent limitations present in the prior art manufacturing processes.

Peanuts are primarily used to produce peanut butter, a most popular snack food. Nearly half of the peanuts produced in the United States are consumed as peanut butter. Peanut butter is produced from a paste of ground peanuts as a fine powder along with several other paste-forming agents. Low-fat peanut butter products are available commercially, but they do not use low fat snack nuts as a starting point.

The Present Invention does not deal with reduced fat peanut butter. Rather, it involves a process to produce low fat, low calorie snack nuts. For a nut to become a snack nut, it must first be shelled. Shelling is the process that removes the outer shell covering from the nut kernel. The nut kernels may then be used as snack nuts - either whole or split. Many snack nuts then go through a blanching process where a skin covering is removed from the kernel. However, this is not always the case. Nonetheless, snack nuts either are whole nut kernels or split kernels. They never consist of ground nut kernel powders or granules.

There are two commercially feasible methods for removing oil from nuts. In the first type of process, chemical solvents may be used to absorb the oil, and the solvent with the dissolved oil is thereafter separated from the nuts. Hexane is a typical solvent used for this purpose. However, the use of organic solvents in the food industry is somewhat undesirable.

The second type of process removes nut oil by applying pressure to the nuts. The high pressure expels the oil from the nuts. Following application of pressure, the nuts are deformed. When commercial expellers designed to remove the maximum amount of oil from the nut are used, the deformed nuts are ejected as a cake. These nuts cannot be reformed to look like the natural nuts. However, oil may also be partially removed from the nuts. This process results in production of partially deformed nuts. The nuts are flattened. Therefore, the deformed nuts are reconstituted to their original familiar shape to make them commercially appealable. This is done using water. The reconstituted wet nuts are then dried and roasted.

This second type of process, which partially expels the oil from nuts by application of high pressure, has limitations that have prevented commercial viability. The key limitations include:

- Pressure is usually applied by placing the nuts into a hydraulic press. The time required for applying pressure is inordinately long, ranging from 30 minutes to two hours. This renders the process not commercially viable. Unfortunately, this factor forces the unit operation to be a batch process.
- Reforming the nuts into their original shape by reconstituting in an aqueous medium produces a low yield of nuts.

· After the reforming step, the nuts have too low hardness characteristics for post processing, thereby further decreasing the yield of snack nuts.

While low fat, low-calorie nuts are produced using prior art processes, the time necessary for completion of the processes and the yield of snack nuts mitigate against cost-effective commercialization.

Over the past quarter-century, American consumers have become very weight conscious. There is a need for a low calorie nut, especially a peanut that is low in fat. The processes that are in use today to form low calorie nuts are too slow to be viable for commercial manufacturing. In addition, the low calorie nuts formed by state of the art processes are unappealing in texture and taste, and although they may be commercially suitable for nut products, such as peanut butter or peanut oil used in cooking, they are not suitable for eating reconstituted snack nuts. The market has a compelling need for an economical process to rapidly prepare low calorie, low fat snack nuts that appeal to consumers.

SUMMARY OF THE INVENTION

The Present Invention relies upon a physical process for preparing reduced fat, high fiber, high protein, low calorie roasted nuts. The process of the Present Invention exhibits lower process times and higher yields than the prior art processes. As a starting point, the nuts are shelled. This produces nut kernels. The next step is blanching, in which the skin or dried coat is removed. The blanching step is optional. Then a close-packed monolayer of nut kernels are placed in a press, and the oil is extracted by multiple pressing and releasing cycles during an interval of less than one minute. This releases between 20 to 50 percent of the oil from the nut in a controlled manner. The expelled oil is simultaneously removed and collected using a vacuum pump. Pressing in this manner leaves the nuts in a controlled deformed flattened state. The nuts are then reconstituted to their original shape by placing them in contact with water heated to a temperature between 176° to 212° F. Typically, this process takes less than one minute. Then, the nuts are immediately annealed (hardened) by subjecting them to cold water at a temperature ranging from 32° to 68° F for a period of time typically less than one minute. The nuts are then dried and post-processed with coatings and roasting using state-of-the-art technology.

The yield of snack nuts produced by the process of the Present Invention is generally greater than eighty percent. The processing time is significantly lower than that of the prior art processes, and the yields are significantly higher.

DISCUSSION OF THE PRIOR ART

This section compares much of the prior art processes found in the patent literature with that of the Present Invention. The prior art processes are discussed *infra,* and for each reference, the Present Invention is compared "by contrast." A person having ordinary skill in the art will comprehend these differences.

The prior art processes have not proved commercially viable. While they have been successful in producing low fat, low calorie nuts, the batch process times are too long (and therefore too costly), and in many instances, the nuts lack commercially pleasing flavor and texture. By contrast, the process of the Present Invention has proven to be commercially successful. Snack peanuts made using this process are currently being sold throughout the United States. The taste and texture of the low fat, low calorie peanuts thus produced are virtually indistinguishable from regular peanuts. The process of the Present Invention fulfills a long-felt need for a less expensive method for producing reduced fat, low calorie, high protein, and healthy diet snack nuts.

A comparative discussion of the prior art follows:

(1) US Patent No. 2,003,41 5 issued to Ammann on June 4, 1935 teaches a process of extracting oil from peanuts by heating them to between 176° and 194° F and applying a pressure of almost 9,000 psi for 45 minutes to one hour to remove 60 to 70% of the oil. The kernels are deformed into a cake, but are reconstituted by exposure to steam for approximately 20 to 30 minutes. According to Baxley *(infra)* the nuts produced by this process lack flavor. This process takes too long to be practical commercially. In addition, it is costly to sustain a pressure of 9,000 psi for such a long time. By contrast, the process of the Present Invention does not use steam for reconstitution. The pressure applied is less than 1,000 psi, the pressing time is less than one minute, and the reforming time is less than one minute.

(2) US Patent No. 3,294,549 issued to Vix, *et.al.* on December 27, 1966 teaches a process to partially defat nutmeats. The process teaches removing the oil from nutmeats by mechanical pressing and, thereafter, reconstituting the distorted kernels to their general original physical size and appearance by expanding them in an aqueous vehicle. The process may use hot pressing or cold pressing. Cold pressing requires a pressure of about 2,000 psi over a period ranging from 30 minutes to 2 hours at ambient room temperature. Hot pressing uses steam to heat the kernels to a temperature ranging from 180° to 220° F and applying a pressure of about 2,000 psi for approximately one hour. Complete reconstitution of the nut kernels to their original shape occurs between 3 and 8 minutes in an aqueous medium.

By contrast, the process of the Present Invention uses pressing times that are less than one minute. The applied pressure is less than 1,000 psi. A vacuum pump is used to remove the oil rapidly during pressing to reduce cycle time. The reconstitution time for the Present Invention is very short (less than one minute), and the process uses a cold-water step before drying to freeze the nuts and to improve processability.

(3) US Patent No.3,645,752 issued to Baxley on February 29, 1972 also teaches a process to defat peanuts. He comments on the above-mentioned US Patent Nos. 2,003,41 5 and 3,294,549 stating that, while the nuts are low calorie, they lack flavor and have a very short shelf life. Baxley proposes to correct these problems by drying and roasting the nuts after they are pressed and reconstituted. The succeeding two-step process includes the steps of subjecting the pressed, partially defatted nuts to an oil bath at a temperature sufficient to roast the nuts, typically in the range of 300^0 to 350^0 F, wherein the nuts return to their original shape. The nuts are then drained for a short period, such as 1 minute, and while still hot then subjected to a second oil bath in the temperature range from 130 ° to 140 ° F. During the reconstitution process, the cells that formerly contained oil are empty and subjected to vacuum. During reconstitution, the oil may contain any desired flavoring, which can then fill the voids. Baxley does not specify the pressure applied to the nuts or the time for applying pressure. By contrast, the process of the Present Invention does not include oil roasting to reconstitute the nuts.

(4) US Patent No. 4,049,833 issued to Gannis, *et.al.* on September 20, 1977, and assigned to Nabisco, discloses a process whereby partially defatted nuts are subjected to a glycerol-containing solution until at least a portion of the solution is absorbed by the nuts during reconstitution. Gannis points out that defatted nuts have not been widely accepted by the public because they do not have a desirable texture and they do not have the flavor and storage stability of original nuts. Gannis states that, "when chewed, such products feel gritty or chalky in the mouth and produce an unsatisfactory mouth feel." By contrast, the process of the Present Invention does not use glycerol to reconstitute the nuts.

(5) US Patent No. 4,329,375 issued to Holloway on May 11, 1982, and assigned to Nabisco, discloses a somewhat different process to prepare low fat, low calorie nuts having a desirable flavor and texture. Prior to pressing, he initially roasts the nuts and then re-hydrates them in water. Here, the nuts develop a roasted flavor and color prior to pressing them. Once re-hydrated, the roasted nuts are pressed using pressures greater than 1,000 psi from about 15 minutes to 2 hours. By contrast, the process of the Present Invention does not initially roast or re-hydrate the nuts prior to pressing. In addition, the pressing time is less than one minute for the Present Invention.

(6) US Patent No. 4,466,987 issued to Wilkins, *et.al.* on August 21, 1984, and assigned to Nabisco, similarly discloses a process where the nuts are pre-roasted prior to pressing. Gannis is a co-inventor. Pressures ranging from 1,000 psi to 1,500 psi are applied for a time ranging from 15 minutes to 2 hours. This is done to impart a pleasant flavor and color to the low fat nuts. Wilkins differs from Holloway in that the step of pre-hydration prior to pressing is absent. Hydration takes place after pressing. By contrast, as with Holloway, the process of the Present Invention does not pre-roast the nuts prior to pressing, and pressing takes place in less than one minute. The applied pressure is less than 1,000 psi.

(7) US Patent No. 4,938,987 issued to Gannis, *et.al.* on July 3, 1990, and assigned to Nabisco, discloses a process where the nuts are roasted after pressing. However, the nuts are not blanched prior to pressing. Wilkins is a co-inventor. Once again, pressures ranging from 1,000 psi to 1,500 psi are applied for a time ranging from 15 minutes to 2 hours. By contrast, the

process of the Present Invention uses pressing times of less than one minute. The applied pressure is less then 1,000 psi.

(8) Another US Patent No. 5,002,802 issued to Gannis, *et.al.* (with Wilkins as a co-inventor) on March 26, 1991 , and also assigned to Nabisco, discloses a process in which the nuts are initially pressed, and then dry-roasted. Then, while still hot, the nuts are infused with an edible oil to improve the flavor while retaining the low fat content. Once again the pressing time is between 15 minutes and two hours at pressures ranging from 1,000 psi to 1,500 psi. By contrast, the process of the Present Invention does not infuse the dry hot roasted nuts with oil, and the pressing time is less than one minute. The applied pressure is less then 1,000 psi. Furthermore, reconstitution is not done while roasting the pressed nuts.

(9) US Patent No. 5,094874 issued to Zook on March 10, 1992, and also assigned to Nabisco, also discloses a process which infuses the nuts with an edible oil after pressing, reconstituting, and roasting. The pressing times and pressures are the same as for the other Nabisco patents *(supra).* By contrast, the process of the Present Invention does not infuse the dry hot roasted nuts with oil, and the pressing time is less than one minute. In addition, reconstitution is not done while roasting the pressed nuts.

(10) US Patent No. 5,164,217 issued to Wong, *et.al.* on November 17, 1992, and assigned to Procter & Gamble, discloses a process whereby food compatible particulate matter less than 1,000 microns in size is added to the nuts during pressing at pressures ranging from 1500 to 7,500 psi. The particulate matter is removed in a subsequent step. Pressing time ranges from 5 to 30 minutes. In the preferred process, the peanuts are mixed with a peanut oil slurry of salt with a particle size less than 40 microns. The nuts are then pressed at a pressure of 5,200 psi for 10 minutes. By contrast, the process of the Present Invention does not add any particulate material while pressing. In addition, the pressing time is less than one minute. The applied pressure is less then 1,000 psi.

(11) Another patent issued to Zook, *et.al.* and assigned to Nabisco, *viz.,* US Patent No. 5,240,726 issued on August 31, 1993, discloses a process wherein the natural fatty nut oil is replaced with a low calorie fat-like material. This material comprises a triglyceride bearing one long chain fatty acid residue and two short chain fatty acid residues. The nuts are first de-fatted

using any process such as those disclosed any of the Nabisco patents *(supra).* By contrast, the process of the Present Invention does not add such low calorie, fat-like or triglyceride materials to the defatted nuts.

(12) US Patent No. 5,290,578 issued to Passey, *et.al.* on March 1, 1994 discloses a process that extracts the oil from peanuts using supercritical carbon dioxide. There is a pre-treatment step that comprises humidification and microwaving. Dry ice is used to supply the carbon dioxide to the system. The supercritical carbon dioxide is in a fluid state. This process has the advantage of being a continuous process rather than a batch process. However, the process comprises a 2-hour extraction hold step. Extraction of the oil takes place in several stages. Implementation of this process is complex and costly, and has so far not proven to be commercially viable. Clearly, this is a different process than that of the Present Invention.

(13) Yet another patent was issued to Zook and assigned to Nabisco - US Patent Serial No. 5,595,780 issued on January 21, 1997. Here, Zook discloses a process whose starting point is a nut that has been defatted using one of the processes previously discussed. Zook then places the nuts under vacuum of at least about 30 inches of Mercury, and infuses the nuts with an edible oil. The process can use the same oil that was previously used to roast the nuts. Reconstitution of the nuts takes place with steam. By contrast, the process of the Present Invention does not infuse the nuts with oil, and no steam is used in the reconstitution step.

(14) US Patent Application No. 09/731,296 filed by Hathi on December 6, 2000 and published as Patent Application Publication US 2002/0068122 A1 on June 6, 2002 discloses a process for removing oil from nuts by first grinding the nut into a powder, then extracting the oil from the milled nuts, and finally remolding the nut powder into the shape of a nut using a mold. Clearly, the Hathi process is completely different from that of the Present Invention, which does not grind or mill the nuts to extract the fats and oils and then remold the powder into the final shape.

(15) International Patent Application Serial No. PCT/US91/00163 filed by Holloway, *et.al.* on January 8, 1991, assigned to Nabisco, and published as International Publication No. WO 91/10372 on July 25, 1991, discloses a process whereby partially defatted nuts are roasted, and then contacted with a non-digestible or only partially digestible fat-like substance. This low calorie

fat-like material can replace fully digestible triglyceride fats or oils in the human diet. The nuts have the characteristics of full-fat nuts without the calories. The partially defatted nuts are first pressed to extract 40-52% of their initial triglyceride fat content at pressures ranging from 1,100 to 1,300 psi, for times of 15 minutes to 2 hours. Reconstitution takes place after the roasting process by contacting the nuts with water. By contrast, the process of the Present Invention does not infuse the nuts with a non-digestible or partially digestible fat-like material, and the press time is less than one-minute. The applied pressure is less then 1,000 psi.

(16) International Patent Application Serial No. PCT/GB93/00371 filed by Zumbe on February 22, 1993, and published as International Publication No. WO 93/16609 on September 3, 1993, discloses a process for producing reduced fat (oil depleted) nuts by use of microwave heating. Zumbe performs this process on raw hazelnuts. First, they are pre-dried and optionally blanched. The nuts are then pressed for an undisclosed period of time. Then, the nuts are reconstituted into their original shape using water almost at the boiling point. A vacuum chamber is used during reconstitution. Next, the nuts are partially dried and then subjected to microwave drying and roasting. By contrast, the process of the Present Invention does not using microwave heating in the defatting step.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of the process of the Present Invention.

FIG. 2 is a schematic of the defatting step of the process of the Present Invention.

FIG. 3 is a schematic showing the reconstituting step of the process of the Present Invention.

DETAILED DESCRIPTION OF THE INVENTION

The Present Invention consists of a process for manufacturing low fat, low calorie snack nuts as well as the snack nut produced by said process. The steps in the process are blocked out in FIG. 1. The sequence of steps generally runs from the top of the drawing to the bottom. However, the order of some of the steps is not critical, and some of the steps are optional.

The process of the Present Invention is useful for manufacturing, *inter alia,* low fat, low calorie snack peanuts, almonds, cashew nuts, pecans,

hazelnuts, Brazil nuts, pine nuts, macadamia nuts, hickory nuts, beechnuts, pistachio nuts, acorns, *etc.*

Peanut snack nuts manufactured using the process of the Present Invention are presently being marketed under the trade name, Nachalur Natural Nut™. Almonds and cashews made by this process are also being sold. The table below is a nutritional value comparison based upon 100 gm (3.5 oz) of peanuts produced using the process of the Present Invention.

Nutritional Component	Regular Peanut	Nachalur Natural Nuts™
Energy, kcal	567	373
Fat & Oil, gm	44.6	29.3
Protein, gm	25.3	30.19
Dietary Fiber, gm	3.1	3.7
Carbohydrates, gm	26.1	31.15
Sugar, gm	0	0

Referring to FIG. 1, the process steps are as follows:

(1) Shelling

Most nuts, especially peanuts, are harvested with their shells. The first step in the process is to remove the shells. What is extracted from the shell is the nut kernel. This forms the snack nut. A snack nut refers to either an entire kernel or a kernel that is split into two halves.

(2) Sizing

The nut kernels are sized to separate and remove those that are too small or those that are too big.

(3) Blanching

Most nuts have a skin that surrounds the kernel. Blanching is the process whereby the skin is removed. Most consumers prefer peanuts that are blanched. However, many consumers prefer almonds with their dark skin. Therefore, this is an optional step.

(4) Defatting

This is a physical process that extracts the oil from the nut under pressure. Pressing is one method to remove the oil. This is done in a hydraulic press. The nuts may be pressed between two flat plates, or in a rotary press, or in a disk press, *etc.* Extraction of oil from nuts in a hydraulic press with two flat plates is shown in FIG. 2.

This step is novel in several respects. Instead of dumping a large number of nuts into a press chamber, the Present Invention uses a monolayer of nuts. Referring to FIG. 2, the monolayer of nuts **2** is positioned on the lower plate of hydraulic press **1.** A vacuum pump creates a vacuum on the lower plate. This serves two purposes. First, it causes the nuts to remain as a close-packed monolayer on the lower plate. Second, it serves to collect the expelled oil. As the two plates come together, the nuts are squeezed, and the oil is expelled from the nut. The oil is collected along air/oil path **3** into a receptacle **4.** Once collected, the nut oil has its own uses, and it can be harvested. For example, peanut oil is often sold for cooking.

It is important to note that pressing is not a grinding or milling process. The product is not powdered nuts. Instead, as a result of the pressing (or defatting) stage, the nut remains as a kernel, but it is deformed or flattened. The yield of snack nuts produced by this process is greater than eighty percent.

Another novel feature of this step is the pressing process itself. Pressing comprises of a plurality of cycles that consist of pressing and releasing. For example, there could be three such cycles during an interval of less than one minute, thereby extracting between 20% and 50% of the oil from the nut. The number of cycles of the plurality is determined by the desired extraction amount. However, there must be at least one cycle. Nonetheless, they all complete in less than one minute. Once the pressing cycles have extracted the desired amount of oil, the vacuum is released, the plates are withdrawn, and the nuts are driven from the press to the next step in the process. Before the plates close again, a new monolayer of nuts enters the press, and the process is repeated. Thus, the press never stops. It runs continuously, thereby increasing the throughput and making the process very economical.

One skilled in the art will recognize that a flat plate hydraulic press can have a plurality of plates, said plurality being more than two. The plurality of plates would be stacked in layers. Each plate could press its own monolayer of nuts, thereby greatly increasing the yield.

FIG. 2 shows a flat plate hydraulic press for illustration purposes only. One skilled in the art will recognize that a flat plate hydraulic press can be replaced with a rotary press or other mechanical means to continuously feed the nuts in a monolayer configuration and apply pressure to expel the oil.

(5) Reconstituting

Because of the pressing step, the nut kernel is compressed and deformed into a flattened shape. In this step, the kernel is reformed into its approximate original shape. This is illustrated in FIG. 3. FIG. 3A represents the original nut kernel; FIG. 3B represents the flattened kernel that was deformed by pressing; and FIG. 3C represents the reformed or reconstituted nut kernel.

A nut kernel resembles a sponge. It is not uniformly solid. Instead, it comprises cells that contain mostly fatty oil and some water, said cells being interspersed within the nutmeat. When a nut is squeezed, the oil and water are expelled from the cells, and the nut deforms. However, a nut kernel is different from a sponge in that it lacks the resilience possessed by a sponge. Therefore, when compressed, a nut kernel remains in its deformed state unless it is reconstituted.

Reconstitution is done by filling the empty cells with water. After the deformed kernels leave the press, they are contacted with hot water bath at a temperature between 176°F and 212°F for less than one minute. Water is absorbed in the range of 15 to 45 lbs per hundred pounds of wet weight defatted peanuts after reconstitution, and the shape returns approximately to the original shape of snack peanuts. The hot water contacting medium is presented for illustration purposes only, and one skilled in the art will recognize that the hot water in the reconstitution step can be replaced with an aqueous medium that predominantly contains hot water along with other dissolved edible water soluble ingredients.

(6) Annealing

Reconstituted nuts are soft and fragile, and they tend to break in handling. A novel step in the process is annealing, which tempers or hardens the nuts. After the reconstitution step, the nuts are contacted

with cold water. The temperature of the cold-water bath is between 32°F and 69 °F. This cold hardens the nut kernels in a similar way that metals are annealed after hot working. Hardening the nuts helps to prevent breakage during post-processing, and helps to ease handling, and increases the yield of snack nuts. Prior to annealing, the mean hardness of a typical peanut kernel is measured as 2.48 (+10.9 SD) Shore A with an ASTM D2240 Type A device. After annealing, the mean hardness of a typical peanut kernel is measured as 48 (+9.7 SD) Shore A with an ASTM D2240 Type A device.

Annealing may also be accomplished by contacting the nut kernels with cold air or liquid nitrogen, or by any other chilling method.

(7) Fortification

Fortification comprises two steps - one optional, and the other strongly recommended.

The first step involves contacting the nut with a water-soluble material, such as Vitamin C. The fortifying agent is absorbed into the nut cells that are filled with water, and it dissolves therein, thereby becoming a component of the nut. Clearly, impregnating with a fortifying agent is optional. The fortifying agent may also be added to the water as an aqueous solution during the steps of reconstitution or annealing.

The second step consists of placing a coating around the exterior of the nut kernel after annealing. The coating would be either a natural or synthetic, edible material. It would consist of a water-soluble film-forming polymer. Examples include starch, hydroxyl-propyl-methyl cellulose (commonly used in drug tablets), carboxy-methyl cellulose (CMC), improved gelatin, *etc.* The coating may be applied by dipping or spraying. The coating helps to prevent additional damage to the nuts during post-processing, packing, handling, storage, and distribution. It also minimizes oil absorption during oil roasting.

(8) Blow Drying

This step involves blowing air at room temperature over the nut kernels in order to remove excess water.

(9) Hot Air Drying

The nut kernels are placed into a hot air convection oven maintained at a temperature between 250°F and 400°F. This step serves to extract the water from the nut and to bring it to its final shape.

Any other heating means, such as a heat tunnel, may be used to dry the nuts. Drying is performed until the moisture content of the nuts is reduced to approximately 10% of the nut weight.

(10) Roasting

Roasting of the nut kernels is performed by the state-of-the-art process to produce roasted nuts. Roasting is done to produce a pleasing color and flavor.

(12) Coating/Flavoring

This is the final step in the process, and it is optional. Here, the nut kernel can be coated with various edible flavors. Examples include honey, cinnamon, chocolate, *etc.* This coating step is a state-of-the-art process.

The process of the Present Invention, disclosed *supra,* is able to produce a defatted snack peanut comprising a whole or split nut kernel, wherein the snack peanut comprises (on a 100 gm basis):

a) between 20 gm and 40gm of fat and oil;

b) between 27.5gm and 35 gm of protein; and

c) between 3.5 gm and 4.0 gm of dietary fiber; and having a hardness (Shore Hardness Type A) between 30 HA and 60HA, as measured after reconstitution prior to drying using a Durometer measurement.

The above disclosure teaches a process that produces reduced fat, low calorie, high fiber, and high protein roasted nuts. The nuts have texture, taste, aroma, and a physical appearance closely approximating that of natural nuts. The shelf life is improved relative to the prior art processes. The prior art, especially the Nabisco patents, attempted to manufacture nuts of this type by various processes with some measure of technological success, but with no commercial success. The reason for the commercial failure of these processes is that they are batch processes having critical steps taking an

inordinate amount of time. The process of the Present Invention is unique in that the critical steps take so little time as to make the process quasi-continuous. The nuts produced using this process have sold very well. Manufacturing facilities are currently expanding to meet the increased demand.

CLAIMS

We claim:

1. A process for manufacturing defatted snack nuts comprising whole or split nut kernels, wherein the nut kernels contain nut oil, said process comprising:
   a) placing the nut kernels into a pressing device that further comprises pressing elements, a vacuum pump, and a path through which the nut oil can flow;
   b) arranging the nut kernels into a close-packed monolayer within the pressing device;
   c) pressing the nut kernels in a plurality of pressing cycles at varying pressures and for a total duration of less than one minute, thereby expelling a desired quantity of nut oil from the nut kernels;
   d) applying a vacuum to the nut kernels and oil, thereby allowing the expelled nut oil to flow through the path;
   e) collecting the expelled nut oil; and
   f) reconstituting the nut kernels by contacting them with water.
2. The process of claim 1 wherein the pressing device is a flat plate hydraulic press.
3. The process of claim 1 wherein the pressing device is a rotary press.
4. The process of claim 1 wherein the plurality of pressing cycles is at least two in number.
5. The process of claim 4 wherein the plurality of pressing cycles is two in number.
6. The process of claim 4 wherein the plurality of pressing cycles is three in number.
7. The process of claim 1 wherein reconstituting is accomplished by contacting the nut kernels with hot water at a temperature between 176°F and 212°F for less than one minute.
8. The process of claim 1 further comprising annealing the reconstituted nut kernels by contacting them with a chilling cold medium, thereby producing hardened nut kernels.
9. The process of claim 8 wherein the chilling cold medium is cold water.

10. The process of claim 9 wherein the cold water is at a temperature ranging between 32 °F and 69 °F.

11. The process of claim 1 further comprising blanching the nut kernels by removing their outer skins.

12. The process of claim 1 further comprising fortifying the nut kernels by causing an edible fortifying agent to become dissolved within the nut kernels.

13. The process of claim 1 further comprising coating the nut kernels with an edible, water-soluble, film-forming polymer.

14. The process of claim 1 further comprising blowing air at room temperature over the nut kernels for a time required to remove a desired amount of excess water.

15. The process of claim 1 further comprising hot air drying of the nut kernels.

16. The process of claim 15 wherein hot air drying is accomplished in a convection oven or a heat tunnel.

17. The process of claim 15 wherein hot air is at a temperature between 250 °F and 400 °F.

18. The process of claim 1 further comprising roasting the nut kernels.

19. The process of claim 1 further comprising coating the nut kernels with an edible flavoring.

20. The process of claim 1 wherein the nut kernels are peanuts.

21. The process of claim 1 wherein the nut kernels are selected from the group consisting of almonds, cashew nuts, pecans, hazelnuts, Brazil nuts, pine nuts, macadamia nuts, hickory nuts, beechnuts, pistachio nuts, and acorns.

22. Reduced fat, low calorie, high fiber, high protein snack nuts comprising whole or split nut kernels by a process comprising:

a) placing the nut kernels into a pressing device that further comprises pressing elements, a vacuum pump, and a path through which the nut oil can flow;

b) arranging the nut kernels into a close-packed monolayer within the pressing device;

c) pressing the nut kernels in a plurality of pressing cycles at varying pressures and for a total duration of less than one minute, thereby expelling a desired quantity of nut oil from the nut kernels;

d) applying a vacuum to the nut kernels and oil, thereby allowing the expelled nut oil to flow through the path;

e) collecting the expelled nut oil; and

f) reconstituting the nut kernels by contacting them with water.

23. The snack nuts of claim 22 wherein they are peanuts.

24. The snack nuts of claim 22 wherein they are selected from the group consisting of almonds, cashew nuts, pecans, hazelnuts, Brazil nuts, pine nuts, macadamia nuts, hickory nuts, beechnuts, pistachio nuts, and acorns.

25. The snack nuts of claim 22 wherein the plurality of pressing cycles is at least two in number.

26. The snack nuts of claim 25 wherein the plurality of pressing cycles is two in number.

27. The snack nuts of claim 25 wherein the plurality of pressing cycles is three in number.

28. The snack nuts of claim 22 wherein reconstituting is accomplished by contacting the nut kernels with hot water at a temperature between 176°F and 212°F for less than one minute.

29. The snack nuts of claim 22 wherein the process further comprises annealing the reconstituted nut kernels by contacting them with cold water, thereby producing hardened nut kernels.

30. The snack nuts of claim 29 wherein annealing is accomplished by contacting the nut kernels with water at a temperature between 32°F and 69°F.

31. A defatted snack peanut comprising a whole or split nut kernel, said snack peanut comprising:

a) between 20 gm and 40gm of fat and oil on a 100 gm basis; and

b) having a hardness (Shore Hardness Type A) between 30 HA and 60HA, as measured after reconstitution prior to drying using a Durometer measurement.

32. The defatted snack peanut of claim 31 further comprising between 27.5gm and 35 gm of protein on a 100 gm basis.

33. The defatted snack peanut of claim 32 further comprising between 3.5 gm and 4.0 gm of dietary fiber on a 100 gm basis.

34. The defatted snack peanut of claim 31 further comprising:

c) comprising between 27.5gm and 35 gm of protein on a 100 gm basis; and

d) between 3.5 gm and 4.0 gm of dietary fiber on a 100 gm basis.

AMENDED CLAIMS
received by the International Bureau on
29 April 2013 (29.04.13)

1. A process for manufacturing defatted snack nuts comprising whole or split nut kernels, wherein the nut kernels contain nut oil, said process comprising:
   a) placing the nut kernels into a pressing device that further comprises pressing elements, a vacuum pump, and a path through which the nut oil can flow;
   b) arranging the nut kernels into a close-packed monolayer within the pressing device;
   c) pressing the nut kernels in a plurality of pressing cycles at varying pressures and for a total duration of less than one minute, thereby expelling a desired quantity of nut oil from the nut kernels;
   d) applying a vacuum to the nut kernels and oil, thereby allowing the expelled nut oil to flow through the path;
   e) collecting the expelled nut oil; and
   f) reconstituting the nut kernels by contacting them with hot water at a temperature between 176°F and 212 °F for less than one minute, and afterwards[fj];
   g) annealing the reconstituted nut kernels by contacting them with a chilling cold medium, thereby producing hardened nut kernels.
2. The process of claim 1 wherein the pressing device is a flat plate hydraulic press.
3. The process of claim 1 wherein the pressing device is a rotary press.
4. The process of claim 1 wherein the plurality of pressing cycles is at least two in number.
5. The process of claim 4 wherein the plurality of pressing cycles is two in number.
6. The process of claim 4 wherein the plurality of pressing cycles is three in number.
7-8 **(canceled)**
9. The process of claim 1 wherein the chilling cold medium is cold water.

10. The process of claim 9 wherein the cold water is at a temperature ranging between 32 °F and 69 °F.

11. The process of claim 1 further comprising blanching the nut kernels by removing their outer skins.

12. The process of claim 1 further comprising fortifying the nut kernels by causing an edible fortifying agent to become dissolved within the nut kernels.

13. The process of claim 1 further comprising coating the nut kernels with an edible, water-soluble, film-forming polymer.

14. The process of claim 1 further comprising blowing air at room temperature over the nut kernels for a time required to remove excess water.

15. The process of claim 1 further comprising hot air drying of the nut kernels.

16. The process of claim 15 wherein hot air drying is accomplished in a convection oven or a heat tunnel.

17. The process of claim 15 wherein hot air is at a temperature between 250 °F and 400 °F.

18. The process of claim 1 further comprising roasting the nut kernels.

19. The process of claim 1 further comprising coating the nut kernels with an edible flavoring.

20. The process of claim 1 wherein the nut kernels are peanuts.

21. The process of claim 1 wherein the nut kernels are selected from the group consisting of almonds, cashew nuts, pecans, hazelnuts, Brazil nuts, pine nuts, macadamia nuts, hickory nuts, beechnuts, pistachio nuts, and acorns.

22. Reduced fat, low calorie, high fiber, high protein snack nuts comprising whole or split nut kernels obtained by the process of any one of cleims 1, 4, 5, 6, or 9.

23. The snack nuts of claim 22 wherein they are peanuts.

24. The snack nuts of claim 22 wherein they are selected from the group consisting of almonds, cashew nuts, pecans, hazelnuts, Brazil nuts, pine nuts, macadamia nuts, hickory nuts, beechnuts, pistachio nuts, and acorns.

25. The snack nuts of claim 22 wherein the plurality of pressing cycles is at least two in number.
26. The snack nuts of claim 25 wherein the plurality of pressing cycles is two in number.
27. The snack nuts of claim 25 wherein the plurality of pressing cycles is three in number.
28. The snack nuts of claim 22 wherein reconstituting is accomplished by contacting the nut kernels with hot water at a temperature between 176°F and 212 °F for less than one minute.
29. The snack nuts of claim 22 wherein the process further comprises annealing the reconstituted nut kernels by contacting them with cold water, thereby producing hardened nut kernels.
30. The snack nuts of claim 29 wherein annealing is accomplished by contacting the nut kernels with water at a temperature between 32 °F and 69°F.
31. A defatted snack peanut comprising a whole or split nut kernel, said snack peanut comprising:
    a) between 20 gm and 40gm of fat and oil on a 100 gm basis; and
    b) having a hardness (Shore Hardness Type A) between 30 HA and 60HA, as measured after reconstitution prior to drying using a Durometer measurement.
32. The defatted snack peanut of claim 31 further comprising between 27.5gm and 35 gm of protein on a 100 gm basis.
33. The defatted snack peanut of claim 32 further comprising between 3.5 gm and 4.0 gm of dietary fiber on a 100 gm basis.
34. The defatted snack peanut of claim 31 further comprising:
    c) comprising between 27.5gm and 35 gm of protein on a 100 gm basis; and
    d) between 3.5 gm and 4.0 gm of dietary fiber on a 100 gm basis.

STATEMENT ACCOMPANYING AMENDMENT TO THE CLAIMS

In the Reasoned Statement of the Written Opinion, the Examiner stated that claims 1 and 7 (as originally submitted) lacked novelty as being obvious over EP 0168210 A2 (hereinafter D1) and that both claims lacked inventive step under PCT Article 33(3). Claim 1 is independent and claim 7 depends from claim 1.

However, the Examiner determined that claim 8 meets the requirements of PCT Article 33(2) and (3) with respect to novelty and inventive step. Claim 8 is a dependent claim, depending directly from claim 1, which incorporates all of the limitations of claim 1 therein. Therefore, to overcome the determination of lack of novelty and inventive step in claim 1, the Applicants submit an amendment to claim 1 herewith whereby claims 7 and 8 have been incorporated into claim 1 as steps (f) and (g), respectively. Because amended claim 1 now contains the limitations of claim 8 therein, the Applicant respectfully requests a determination that claim 1 now fulfills the requirements of PCT Articles 33(2) and (3) with respect to novelty and inventive step.

Because claims 7 and 8 have been incorporated into amended claim 1, original claims 7 and 8 have been canceled.

Based upon a determination that claim 1 now fulfills the PCT requirements with respect to novelty and inventive step, the Applicants respectfully request a determination by the Examiner that dependent claims 2-6 and 9-21 also meets the requirements of PCT Articles 33(2) and (3) with respect to novelty and inventive step, as they all incorporate the limitations of amended claim 1 therein.

In the Reasoned Statement of the Written Opinion, the Examiner stated that independent claim 22 lacks novelty and inventive step as being obvious over D1 in view of WO 93-16609 A1 (hereinafter D3). Consequently, claim 1 has been amended to be a multiple dependent claim, depending from any of claim 1, 4, 5, 6, or 9. Please note that claims 4, 5, 6, and 9 are now directly or indirectly dependent upon claim 1. Claim 22 now incorporates all of the limitations of claim 1 therein. Therefore, the Applicant respectfully requests a determination that claim 22 now fulfills the requirements of PCT Articles 33(2) and (3) with respect to novelty and inventive step.

Please note that dependent claims 23-30 depend from claim 22. Based upon a determination that claim 22 now fulfills the PCT requirements with respect to novelty and inventive step, the Applicants respectfully request a determination by the Examiner that dependent claims 23-30 also meet the requirements of PCT Articles 33(2) and (3) with respect to novelty and inventive step, as they now all incorporate the limitations of claims 1 and 22 therein.

In the Reasoned Statement of the Written Opinion, the Examiner determined that independent claim 31 and claims 32-34 depending from claim 31

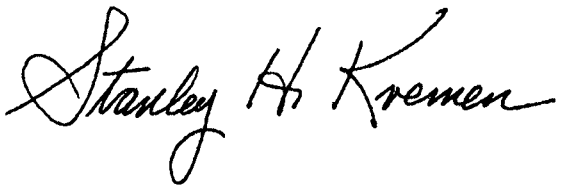
meet the requirements for novelty and inventive step under PCT Articlex 33(2) and (3).

Furthermore, all claims 1-34 were determined to be industrially applicable under PCT Article 33(4).

REQUEST FOR RECONSIDERATION IN LIGHT OF AMENDMENTS

Based upon the claim amendments submitted herewith as well as the above arguments, the Applicant respectfully requests that the Examiner reconsider the claims in the Present Application and issue a determination that all claims in the Present Application meet the requirements PCT Articles 33(2), (3), and (4) with regard to novelty, inventive step, and industrial applicability.

Respectfully submitted,



Stanley H. Kremen,
Registered Patent Agent
United States Patent and Trademark Office
Registration No. 51900

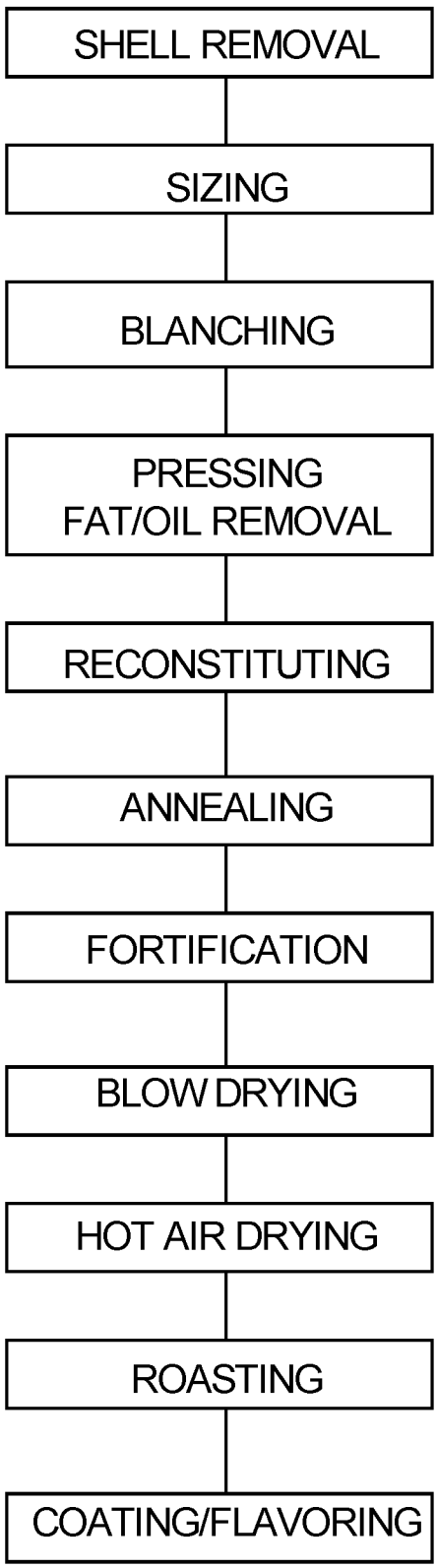

SHELL REMOVAL
SIZING
BLANCHING
PRESSING
FAT/OIL REMOVAL
RECONSTITUTING
ANNEALING
FORTIFICATION
BLOW DRYING
HOT AIR DRYING
ROASTING
COATING/FLAVORING

FIG. 1

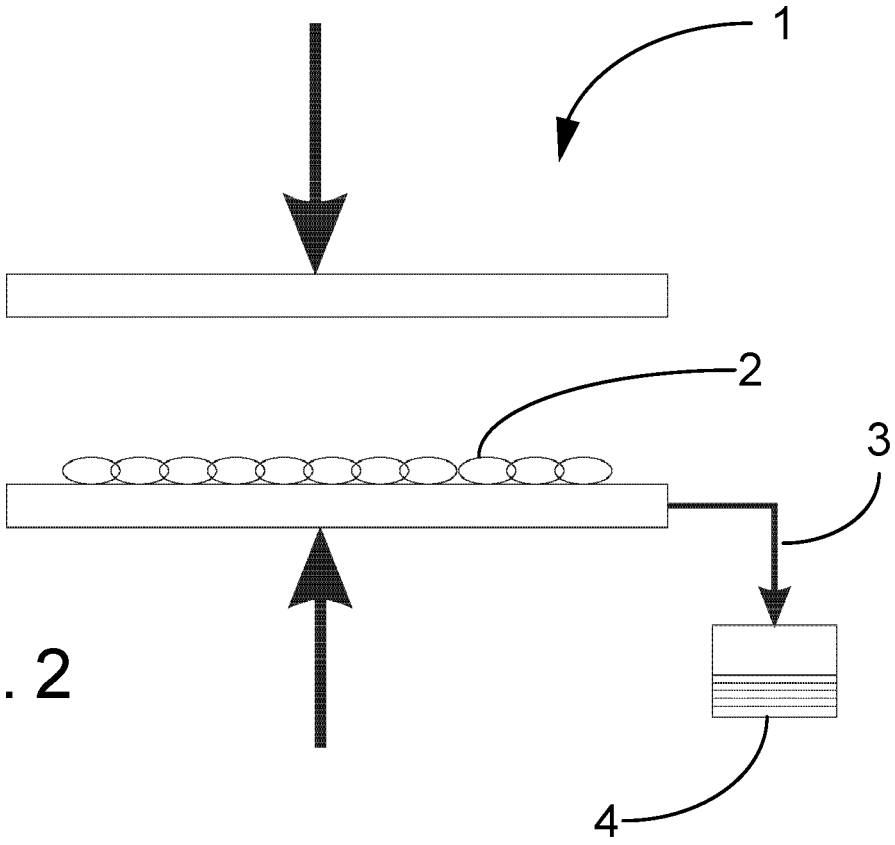


FIG. 2

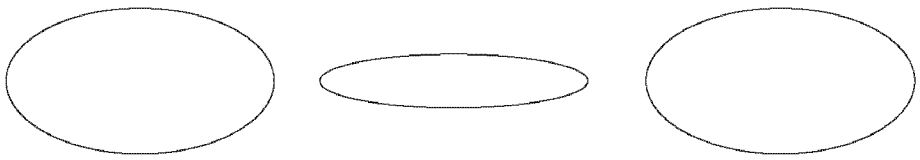


FIG. 3A FIG. 3B FIG. 3C

FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/060941

A. CLASSIFICATION OF SUBJECT MATTER

A23G 3/48(2006.01)i, A23G 3/54(2006.01)1

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)

A23G 3/48; A23L 1/36; A23P 1/00; A23L 1/38

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: defatted, low calories, peanut, kernel, oil, pressing device, reconstituting, hardness, protein, dietary fiber

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0168210 A2 (NABISCO BRANDS INC.) 15 January 1986 See page 1, lines 4-6; page 6, line 22-26; page 11, lines 1-11; page 12, lines 7-28; page 14, lines 1-10, line 28 - page 15, line 5, line 17 - page 16, line 2; page 17, lines 3-11; page 18, lines 2-9; claims 1, 11, 14;	1-7,11-13,18-21
Y	and figurs 1-2.	14-17,22-28
A		8-10,29-34
Y	US 4938987 A (GANNIS, PETER et al.) 3 July 1990	14-17
A	See column 4, line 55 - column 5, line 7; and claims 1-5, 13-16, 20.	1-13,18-34
Y	W0 93-16609 Al (JACOBS SUCHARD AG) 2 September 1993 See page 1, lines 6-7; page 3, lines 9-21; page 4, lines 15-18; page 6, Table	22-28
A	1; page 7, line 21 - page 8, line 11; and claim 1, 12, 14-18.	1-21,29-34
A	US 5595780 A (ZOOK, DENISE E.) 21 January 1997 See column 9, lines 30-53; and claims 1-3, 5-6, 8-9, 12, 15.	1-34

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)

"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

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29 March 2013 (29.03.2013)	**29 March 2013 (29.03.2013)**

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
189 Cheongsa-ro, Seo-gu, Daejeon Metropolitan City, 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

AHN, Jeong Hwan

Telephone No. 82-42-481-5741

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/060941

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0139459 A1 (NABISCO BRANDS, INC.) 2 May 1985 See page 5, lines 19-24; page 10, lines 22-26; page 12, lines 13-22; and claims 1, 6.	1-34
A	US 4504513 A (BLACK, DAVID J.) 12 March 1985 See column 1, lines 48-57; and claim 1.	1-34

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2012/060941

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0 1682 10 A2	15 .0 1. 1986	AU 4462785 A	16 .0 1. 1986
		AU 574202 B2	30 .06 . 1988
		CA 12622 13 A1	10 . 10 . 1989
		EP 0 1682 10 A3	07 .09 . 1988
		JP 1472684 C	27 . 12 . 1988
		JP 6 1-03577 1 A	20 .02 . 1986
		JP 63-02 1465 B	07 .05 . 1988
US 4938987 A	03 .07 . 1990	CA 20 16955 A1	28 .02 . 199 1
W0 93- 16609 A1	02 .09 . 1993	AT 16 1 150 T	15 .0 1. 1998
		AU 3570693 A	13 .09 . 1993
		DE 693 15822 D1	29 .0 1. 1998
		DE 693 15822 T2	14 .05 . 1998
		DK06268 1 1T3	09 .02 . 1998
		EP 06268 11 B1	17 . 12 . 1997
		ES 2 1 12416 T3	0 1. 04 . 1998
		GB 9204001 DO	08 .04 . 1992
		GR 3025852 T3	30 .04 . 1998
US 5595780 A	2 1 .0 1. 1997	None	
EP 0 139459 A1	02 .05 . 1985	AU 3263584 A	28 .03 . 1985
		AU 573756 B2	23 .06 . 1988
		CA 12 18560 A1	03 .03 . 1987
		DE 3462989 D1	14 .05 . 1987
		EP 0 139459 B1	29 . 12 . 1999
		JP 1426083 C	25 .02 . 1988
		JP 60-094074 A	27 .05 . 1985
		JP 62-033858 B	23 .07 . 1987
		US 4466987 A	2 1. 08 . 1984
US 45045 13 A	12 .03 . 1985	US 4364967 A	2 1. 12 . 1982