March 19, 1973 L. PETERS 3,798,335

METHOD FOR EMBOSSMENT PACKAGING OF WARM BUTTER

Filed Nov. 26, 1971 3 Sheets-Sheet 1

FIG. 1

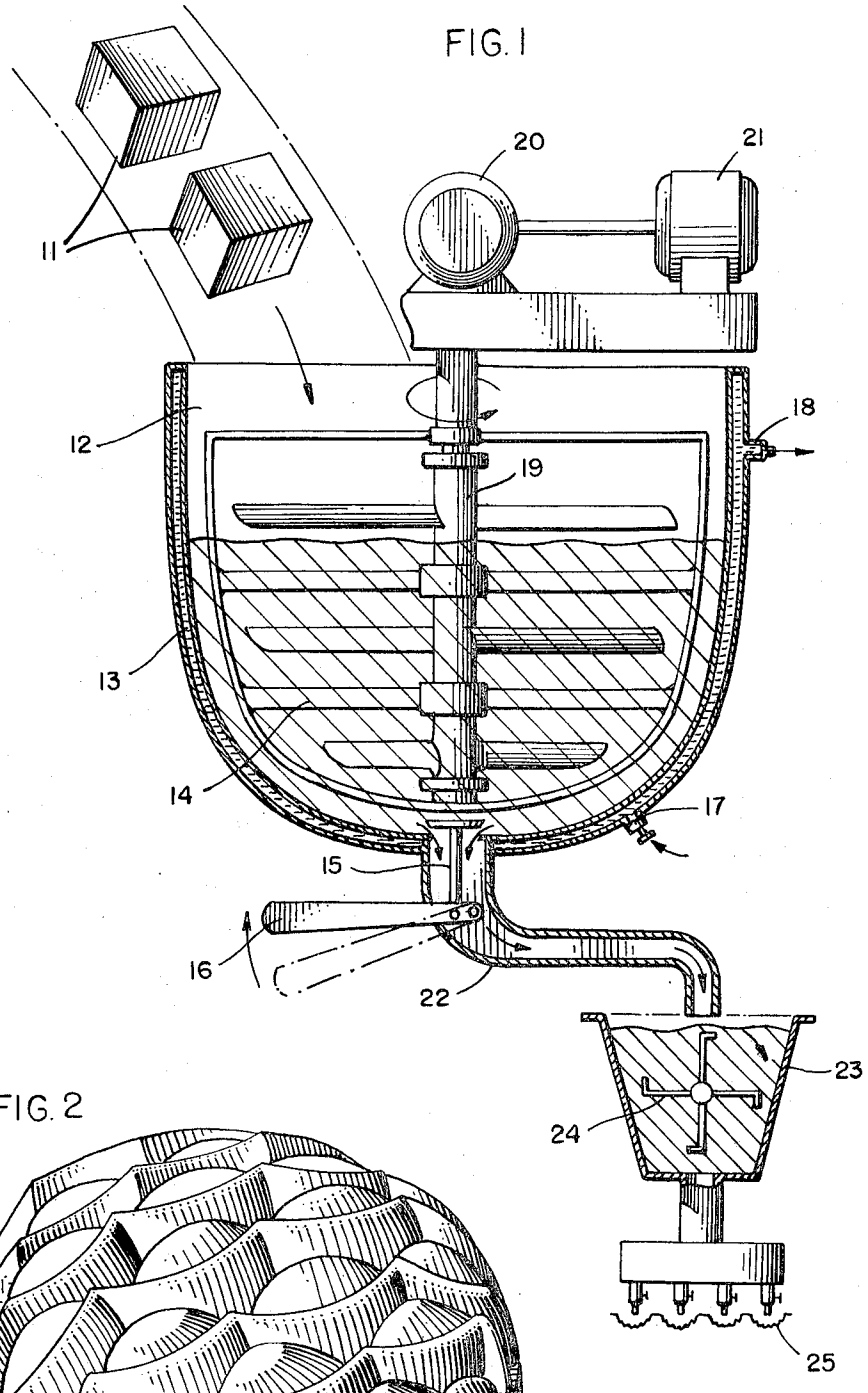


FIG. 2

METHOD FOR EMBOSSMENT PACKAGING OF WARM BUTTER

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FIG. 3

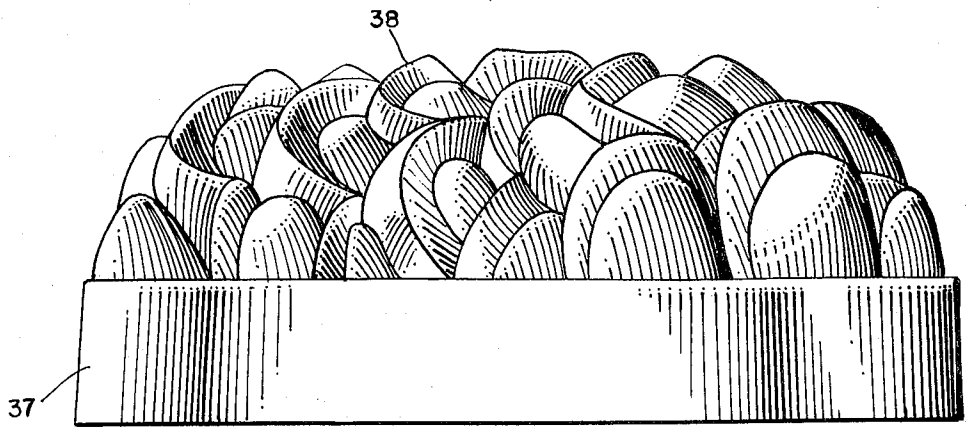
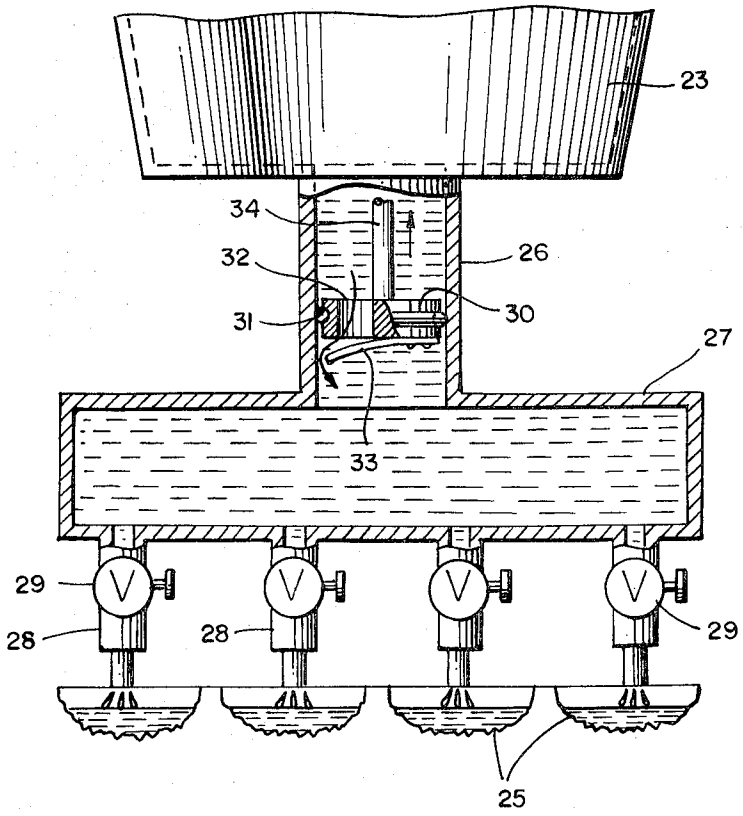


FIG. 4



METHOD FOR EMBOSSMENT PACKAGING OF WARM BUTTER

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FIG. 5

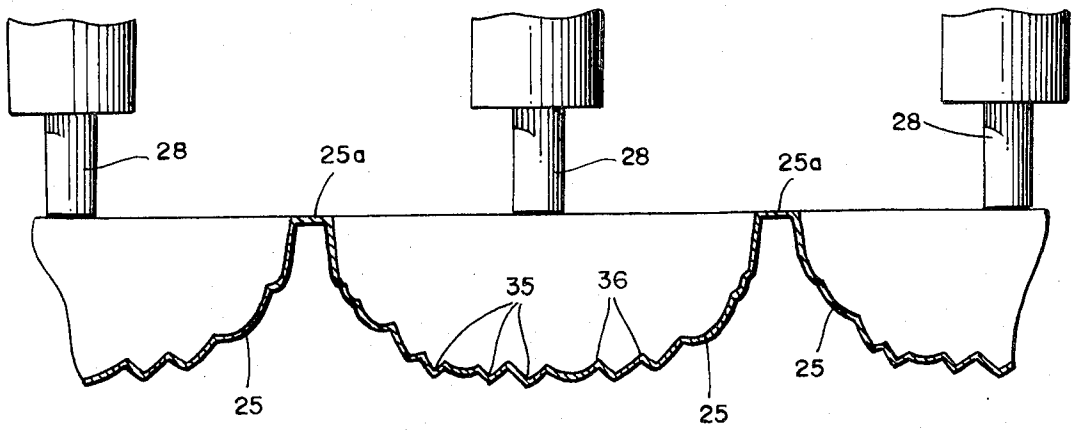


FIG. 6

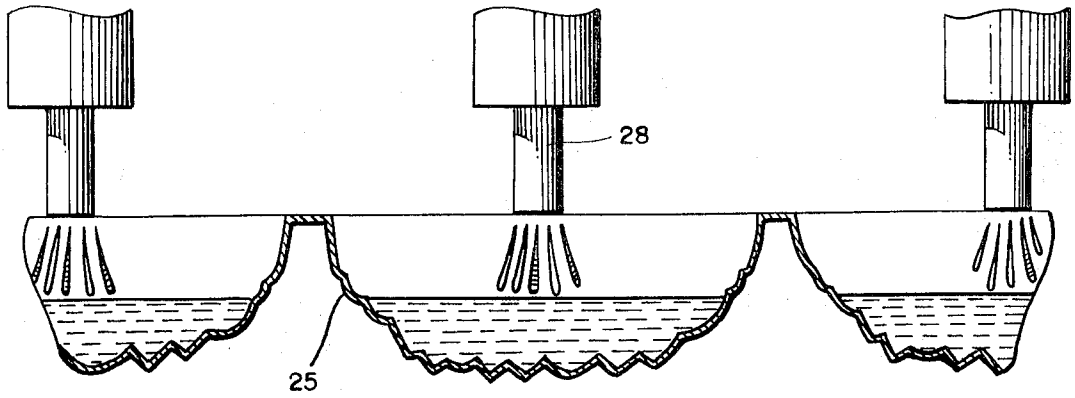
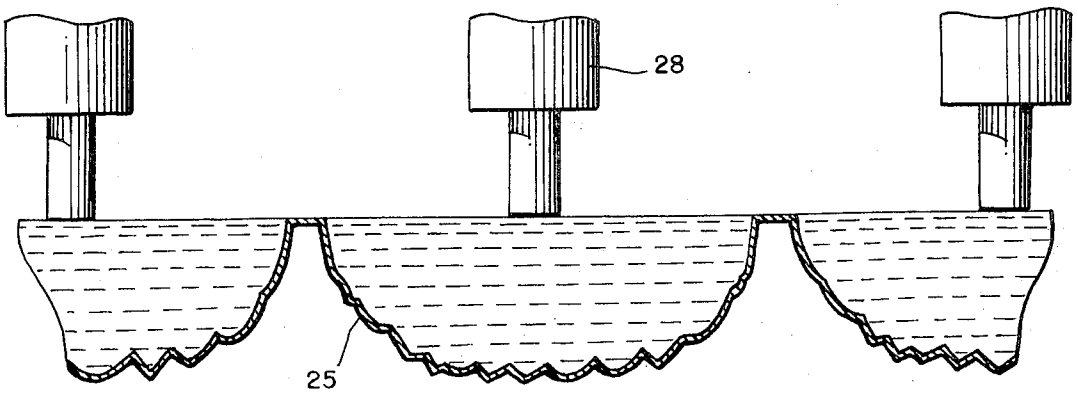


FIG. 7



United States Patent Office 3,798,335
Patented Mar. 19, 1974

3,798,335

METHOD FOR EMBOSSMENT PACKAGING OF WARM BUTTER

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Filed Nov. 26, 1971, Ser. No. 202,168
Int. Cl. A33c *15/00;* B65b *25/00*
U.S. Cl. 426—130 12 Claims

ABSTRACT OF THE DISCLOSURE

Nonwhipped butter or margarine is packaged, after it has been churned, by elevating its temperature until it is flowable under its own weight, and then, while under agitation, flow-filling it into embossing dies or packages.

BACKGROUND OF INVENTION

The commercial embossment of multicubic-dimensioned butter surfaces is a relatively new art. As this art developed, new and varied discoveries to overcome the inherent problems of production and packaging made their appearance. The present invention is a major discovery in the development of this art. It discloses a solution to perhaps the most vexing and stubborn problem in the entire field of the butter-embossment-packaging art. It centers on the three-phased problem of (1) embossing a cube of regular (nonwhipped) butter without reducing and/or impairing its spreadability, and /or destroying the market acceptability of its body; (2) producing on its upper surfaces and delivering to the final consumer intact and unmarred embossments of the "multicubic-dimensioned—finely delineated" kind described and defined in my Pat. No. 3,410,699; and (3) doing this via dies and/or embossing-walled packages that cooperate as the female members in a die-casting process in which the butter is the male member.

The word "multi" in the term "multicubic-dimensioned" needs emphasizing because it is the multiplicity of the cubic dimensions that make these embossed designs intricate and involved which, in turn, give them a natural tendency to lock in air and block out butter during the embossment forming of butter surfaces in the dies or packages used for producing embossed surfaces on butter. Such embossment may have not only cubic dimensions in relation to the surface on which they rest, but also within the cubic lines that form the larger outlines of a given embossment there may be additional, more delicate and more detailed, cubic-dimensional lines that again branch off in a multiplicity of cubic directions. There may be embossments on butter that run in single parallel directions longitudinally from the top to bottom of a cube's shape (from the bottom to the top of its embossing cavity). Such simple embossments are not included under my definition of the term "multicubic." Such embossments do not represent major forming, filling and/or dispensing problems. But when the butter cubes also have latitudinal and/or diagonal (i.e., *around,* rather than *over*) lines of embossment, then the problems of filling, forming, and/or dispensing are present in a high degree, and such designs are then encompassed by my "multicubic" definition. It is these latter inter- and intrarelated, and criss-crossing lines within my cubic designs that create the butter-embossment-forming problems that lay at the heart of the solution-giving discovery of this invention.

It is these cubic designs too, that on the surface of butter, will not easily accommodate themselves to butter-forming procedures and techniques hitherto used in the art; that require special packaging methods and means that suit their particular needs. And the special manufacturing ingredient on which the present discovery is based, and

which is the overall objective of this invention, is the hitherto never-before commercially-used use of "warm" butter (i.e., nonwhipped butter at temperatures over 70° F.) in the form-filling and packaging of embossed butter surfaces. (All temperatures used in this application will be on the Fahrenheit scale.)

The stubborness and intractability of the problem is evidenced by: (1) my Pat. No. 3,410,699 which provided a solution while remaining within the confines of conventional processing "cold"-temperature requirements; and (2) by the relative lateness, compared with other art in the field, of this discovery.

In contrast to the packaging of "cold" (temperatures under 70°) butter, which is not fluid, and therefore not flowable at gravity, this invention packages butter at the hitherto "forbidden" flowing temperature of 70° to 90°; temperatures considered by the butter industry to be "warm," and therefore damaging to butter's commercially-acceptable body.

While this invention has peculiar applicability to butter, its particular and specific methods and means as they are required for filling and forming embossed surfaces also apply to margarine. This invention will use butter as the exemplary product for its description, with the understanding that it also applies to the other popular table fat: margarine.

HISTORY OF THE PRIOR-ART PRACTICES

The nonobviousness, and the surprising nature, of the present discovery may best be appreciated from an understanding of the industry background as it relates to butter body.

Production of butter from cow's milk is one of the world's major food industries. Its annual world production is around 10½ billion pounds. Huge investments have been made in research and equipment for its production and packaging.

Its importance to the economies of the major producing nations may be attested to by the legal safeguards with which these nations endeavor to protect its quality standards. For example, in the United States butter is one of only two foods whose quality standards are defined by Federal statute; standards which cannot be changed or modified except by an act of Congress. Thus, by statute law, many of the factors that influence butter body are rigidly fixed. And so too, its spreadability, which is one of the important functions of its body, is to a large extent circumscribed by law.

Margarine, butter's big competitor, can change its formulations at will under permission from the Federal Food & Drug Administration; butter cannot. Margarine has several different oils of uniform consistencies from which to choose for its body formulatins; butter does not. In fact, the milk and cream from which butter is separated and churned has significant variations in its chemical and physical composition; variations which the buttermaker is helpless to alter or change. Butterfat from which butter is made is comprised of eleven dissimilar fatty acids whose ratios within the butterfat varies from batch to batch. Yet, by law, this varied composition may not be basically modified or "adulterated." If even the tiniest percentage of an oil or fat used in making margarine is added to butter, the whole amount, by law, must be labeled as "margarine."

There are many factors ad combinations of factors that influence the body and spreadability of butter, Some of these have to do with the composition of the butterfat, the physical structure of the milk fat globules and their ensuing churned butter fat granules; the rate at which the butterfat will crystallize (i.e., change from a liquid cream phase to a fat phase; from a milk fat globule to a crystallized fat granule); the amount of liquid fat and size

of the fat globules and crystals; the quantity of milk solids (which form a "shell" around the globules) retained in the finished churned butterfat; all of which are influenced by the uncontrollable vagaries of season, weather, climate, and cow's feed and breed; and all of which, in turn and in various degrees, also influence such manufacturing procedures as the intensity of cream cooling, temperature of butter wash water, manner and intensity of working, and the temperature at which butter is held immediately after manufacture and before packaging. The relationship between some of these factors as they affect body and texture is known but much of it still is unknown to the butter industry.

The major possible and practical source for modifying butter's body and influencing its spreadability is in the manufacturing process and method. In this area a vast amount of research has taken place, with results that were not always in agreement with and/or contributory to body and/or spreadability improvement.

Among the various well known methods and means used in attempts to improve butter spreadability are the following:

Subjecting the cream to a prechilling or preheating treatment, depending on the butter maker's judgment of its requirements.

Using different procedures for summer and winter butter; it being a known "fact" that winter butter is harder-bodied than summer butter.

Greater control over that phase of butter churning known as "washing" of the butter granules, whereby the granules are tempered by various wash water temperatures so that a greater quantity of milk solids are retained in the finished product, and retained along with them the emulsifying (body spreadability) benefits of the lecithin within the solids.

Using a post churning preprinting treatment to slice 41° butter into paper-thin layers before processing it thru a printing (forming) machine.

Using special types of printing machines to "rechurn," mash, or "work" cold butter before it enters a printer (forming-shaping) extruding orifice or die.

Special procedures used by the newer continuous churns (in distinction to batch churns) whereby, after the butter has been churned and made, it is "worked" at various speeds for various lengths of time, before it has a chance to "set" or harden (this being a well-known phenomena of butter making, whereby the fat arrives at a phase of crystallized equilibrium).

All of these, and other, methods, means, and procedures known to and/or used by the prior art to improve butter's spreadability, have indeed produced some improvements; the most notable of which have come from some of the new type (i.e., manufactured and marketed during the past ten years) continuous churning machines which incorporate some of the procedures mentioned above.

However, overriding and confirming the circumscribed manufacturing alternatives mentioned above, are certain processing standards to which all present buttermaking and packaging methods rigidly adhere.

One of these universally-used standards is the temperature limitation under which butter is packaged. Regular (nonwhipped) butter made today is packaged at temperaturs in the 45° to 60° range. At these temperatures butter is nonflowable at gravity and is considered to be "cold." It is accepted as fact by the world's butter industry that when butter is processed and/or packaged at only 10° above the present 60° limit (i.e., at 70°, which is normal room temperature, and considered "warm") its fine crystalline structure is irreparably damaged, its body permanently degraded, and it becomes commercially undesirable and unacceptable.

The ideal body for butter, recognized by both industry and the U.S. Department of Agriculture, is one that is firm and compact, free from visible moisture, and has a waxy, plastic, spreadable texture.

The literature on the art is replete with "expert," "scientific" observations that when nonwhipped butter is held and/or "worked" above 70° its body loses these ideal characteristics, so that when rechilled, it will be hard, brittle, have poor spreadability, and will not meet U.S.D.A. grading specifications for its highest score grades. So, to be safe, all nonwhipped butter is processed and packaged well under 70°; as a matter of fact, under 60°.

In considering the applicability of prior processing methods and means to the present invention, one must draw a sharp distinction between "whipped" and "nonwhipped" butter because bodywise and usewise they are radically different products; to wit:

1. Whipped is frequently warm packaged; nonwhipped is not.

2. Whipped has from 25% to 50% air within its body; nonwhipped should have none.

3. Whipped relies on the air within its body for most of its spreadability; nonwhipped cannot do this.

4. Whipped is so different in body that the U.S.D.A. has refused to give it a grading-score; nonwhipped only is allowed a butter-grading score.

5. Because of air cell tension whipped will remain in a visible fat phase even at temperatures far above butter's 92° emulsion break point; nonwhipped will change into oil-phase at this temperature. Therefore whipped is used by preference on such hot foods as pancakes where soak-in of butter is not desired.

6. Because of the air within its body, whipped does not have the concentration of fat-flavor within a given cubic area that nonwhipped does; therefore nonwhipped is used by preference on most foods where fat-flavor is the paramount consideration.

7. These differences between "whipped" and "nonwhipped" have resulted in about 3% of the U.S. butter market preferring whipped and 97% preferring nonwhipped.

These differences between whipped and nonwhipped butter are mentioned here to emphasize that the warm-processing-packaging of some whipped butter does not suggest that such processing packaging would be applicable to nonwhipped butter. If any suggestion had been present it would have pointed away, rather than toward, using the processing procedures of whipped butter to process and package nonwhipped butter.

As a result of these prior art experiences, "scientific" judgments, and market preferences practically the entire world butter industry has been equipped to process and package only in the 45° to 60° nonflowable-at-gravity temperatures. The machines that package butter for final consumer use are practically all designed for wrapping a paper or foil wrapper around a relatively firm bodied stick or cube of butter that has been extruded with heavy positive ram action (practically unlimited) pressures from a shaping die or orifice at a temperature under 60°. Even under my Pat. No. 3,410,699 for embosed butter I try to stay well under the 70° limit to pressure form into its die cavities. In summary, no regular (nonwhipped) butter is commercially packaged in the U.S. (and to my knowledge, in the world) today by pouring it under its own weight at gravity into cup-like consumer size packages. If it ever has been flow filled into such packages, it has been done under flowing pressures greater than those supplied by its own weight at gravity, and at temperatures below 70°. Margarine today is flow filled into some cup-like packages; but only that which is commercially known as "soft" margarine, i.e., margarine containing a sufficiently high percentage of liquid (nonhydrogenated; nonhardened) oils that makes some of it flowable even under 70°. None of this margarine is packaged in cups that would provide embossed surfaces on it.

Thus the standard prior art practices for packaging non-whipped butter give clear positive evidence of the

industry's conviction that for butter's body to be officially and commercially acceptable it must be packaged under 60°. Thus anyone considering the packaging of butter above 60° is confronted with a massive amount of prior "knowledge" and practice which, with complete finality, has concluded it cannot be done without reducing butter's spreadability and/or destroying butter's commercial acceptability. So, in addition to statute law, prior-art processing and packaging, and market preferences, butter also has been circumscribed (especially as it applies to embosed butter) by a hardened mental attitude toward "warm" butter processing by those people who prescribe the industry's manufacturing standards.

This mental attitude has some legitimate warrant for its existence. In addition to the historical, there is also very recent empirical evidence to support it. For example, as disclosed in my Pat. No. 3,410,699, when butter is packaged at temperatures which render it nonflowable at gravity it is difficult to prevent the entrapment of air within the mass and between the mass and its embossing die. Such entrapped air frequently shows itself as holes on the surfaces of present day plain (nonembossed) surfaced wrapped butter. While these surface pockets are not commercially objectionable because consumers have learned to accept them; and while the particular smoothness, or lack of it, on the surface of today's plain surfaced butter cubes is not detrimental to present-day sales or acceptance of such butter; nevertheless these surfaces remain as mute evidence to industry people of the difficulties in producing smooth surfaces on just plain surfaced butter; let alone doing it for the more difficult embossed surface butter. Furthermore, industry people know that pressure formed cold butter, whether plain surfaced or embossed surfaced, even if it does not have visible air pockets on its surfaces, also lacks the smoothness over its entire surfaces that would be characteristic of a fluid formed warm butter; that the surface appearance of cold formed butter is visibly different from the surfaces of warm formed butter; that the former has more of a rough, pockmarked, grainy, dull appearance; while the latter has more of a smooth, satiny, even glistening appearance. But then, industry people have reasoned and rested, in the assumed "knowledge" that (1) the rough, dull, appearance of present-day pressure-formed butter has become an "acceptable" visible mark of quality versus the smoother, shiner, surfaces of a warm formed butter, and (2) they have been afraid of what warm forming would do to their "fine" spreadable body.

While air pockets and surface roughness, even of a gross condition, and consumer acceptance of it, is commercially tolerable with plain surfaced butter; it is intolerable with embossed (upraised) surfaces of the kind used in this invention. Here consumers buy butter for its fine appearance, and will refuse to repurchase it if the surface designs are blemished.

In my Pat. No. 3,410,699 I described the problems and offered some solutions for the production and packaging of embossed butter. At the time that invention was developed, the art did not accept the possibility of being able to maintain acceptable butter body and spreadability by packaging it above 70°. Yet it was, and is, a known fact that the production of commercially acceptable embossed surfaces on butter is much easier, more accurate, the surfaces smoother, and the designs more acceptable and free of air pockets with flowable than with nonflowable butter.

When butter is actually fluid and is flow-filled into female embossing dies it literally "wets" itself onto the embossing surfaces and so picks up the detail of such dies with greater fidelity, a glossier surface smoothness (if the walls of the die cavity are of a glossy or glassy finish), and with less danger of air-entrapment, than when cold filled. Flowing butter can start filling such die cavities from the center of the bottom, out and up, slowly pushing air ahead of itself as it moves and creeps along the embossed bottom and up and into the embossed sides of such embossing dies. Then it can be leveled at the top of the fill by gentle shaking or vibrating without the need of heavy back-up dies to withstand the pressures needed to compress and level cold (nonflowable) butter into embossing die packages.

Thus it is an objective of this invention to flowfill at the pressure supplied by its own weight at gravity unwhipped butter into dies and/or packages that will emboss its surfaces with multicubic-dimensioned embossments.

DETAILED DESCRIPTION OF THE INVENTION

Butter (and margarine too, whose oils have been wholly or partially hydrogenated) is an emulsion in a fat phase; i.e., a suspension of solids in a liquid with sufficient quantity of the emulsion in a crystalline (nonliquid) state to give it a firm, nonflowable body at room (serving) temperatures. Butter produced in the U.S. has a standard content made up of about 80% butterfat, 16% water, and 4% solids. The butterfat crystallizes in the normal churning temperature range between 48° and 58°. The water, of course, remains in a liquid (noncrystallized) state above 32°; but if butter is stored or transported below 32° then this water will be crystallized into ice. If this water content has been thoroughly incorporated into the butter emulsion, its expansion into ice will not noticeably affect the butter body; it will not break up the body, nor render it leaky or hard.

It is well known that the manner in which water from cream is retained and incorporated into, and dispersed within, the butter emulsion has an important bearing on butter's spreadability. Water that is finely dispersed and thoroughly, minutely, incorporated into butter's body, will normally improve the spreadability of butter, provided the normal crystalline fat-phase character of the butterfat granules is not disturbed. It has been accepted as fact that butter processed and packaged at temperatures above 70° does indeed disturb the finely emulsified and crystallized character of butterfat; the butter oil, solids, and water will separate out of emulsion to the point that when a partly broken emulsion is rechilled it will result in a butter body that is harder, leakier, and less spreadable at home refrigerator temperatures.

I have discovered, however, that butter processed in accordance with the following steps is retentive of the best commercial spreadability to be found in butter commercially manufactured and sold in the U.S. today.

1. Selection of properly-churned butter.—The butter is advantageously churned in such modern continuous churns as the Westfalia "Buttermatic" (manufactured in West Germany) and the Paasch & Silkeborg (manufactured in Denmark). Both of these machines do a better job of performing the functions and producing the results needed to improve spreadability and emulsification of butter's ingredients than do the older batch churns or other types of continuous churns. Butter from these newer foreign made continuous churns has spreadability and other body characteristics superior to any other butter commercially produced. These newer machines perform functions such as pre-churning to break the lecithin (solids) "shell" that surrounds butterfat globules. This frees the butterfat that is within the globules, retains more of the solids (and therefore lecithin too) while removing most of the buttermilk; and then texturizing and working the butter for a fine textured body with an extremely even and extremely fine distribution of water within the water-fat-solids emulsion; all of which contribute importantly to the spredability of butter and (now in this invention) retaining this spreadability despite the "forbidden" processing for packaging of it at temperatures over 70°.

2. Chilling and "setting".—After procuring such butter, my next step is to chill it to temperatures within the 40° to 60° range before preparing it for my new kind of packaging. The length of time for chilling is optional but I prefer 12 hours. The important consideration is to

give the process of "setting" time to run its course. The 12-hour chill is preferred because it can be done overnight and this is more than adequate time for butter to acquire a firm and complete commercial "set". "Set" is usually understood to be a physical process whereby the granular crystals have reached their maximum commercial growth and have become firmly interattached to each other to form relatively rigid homogeneous formations.

The "setting" proceeds rapidly at first and then more slowly, and may continue for several hours. Some butter makers believe butter should not be allowed to "set" for any length of time before it is packaged, in order to avoid a later break-up of the butter for packaging. They prefer to package it shortly (within an hour) after it has been churned, under the theory that this is the best way to preserve the body and texture qualities worked into the butter in the churning process. This is optional and permissible under my methods, but I consider it preferable and advantageous to allow the progressive growth of granular crystalline formations of the emulsified fat to substantially complete itself so that the fat crystals themselves have reached their maximum commercial growth and maturity; that the attachments and interlacings of the formations are as well bonded together as they can be before taking my next step. It is well known that large crystals and a tight granular body structure are contributive to good spreadability.

3. Warming and Agitating.—This third step has, to my knowledge, never before been used in the commercial processing for packaging of nonwhipped butter. It is therefore a unique contribution to the art of this industry; and of crucial importance to the successful practice of this invention. This new step does subject the butter to a very radical and "forbidden" conditioning process, but it is important to know that it does not involve a physical "break-up" of the crystallized mass in the way that this is done with cold butter that is conventionally packaged.

In this step I elevate the temperature of the butter gradually, and without disturbing its "set," in a tempering room or vessel and then, as soon as it can be rechurned, stirred, or mixed smoothly, without having it break apart into chunks, usually at about 65°, stirring the butter, within a 75° to 85° water-jacketed vessel, with a double rotary action agitation or churn-blade-type movement, fast enough to prevent the low temperature-melting fatty acids in butter from separating out of the emulsion, but slow enough so as not to whip air into it and/or break up the basic formations and interattachments of the "set" granules; and do this while its temperature is elevated into the 70° to 85° range (but under no circumstances above 90°), and continue this until it is lump free. The lump free condition is visible evidence that the agitating mass has reached a level of uniform temperature and consistency.

Within the 70° to 90° permissible temperature range of this invention, the most advantageous temperature range is the 10° range between 75° and 85°. Within this narrow range the methods and means of this invention find their most successful results.

At these elevated temperatures buttermakers of the past have, to my knowledge, unanimously agreed that the finished body of butter would be commercially ruined; that the spreadable crystalline character of well made butter would be disturbed to an extent that its body would be considerably less spreadable and commercially nonacceptable. But with the present invention this is no longer true.

With my butter under slow agitation from spaced apart agitator blades rotating in opposite directions at about 40 to 50 r.p.m. within the 75° to 85° temperature range, it is sufficiently soft and fluid to flow and pour under its own weight. The reason for agitation and movement is to keep low-melting fatty acids which are present in butter (such as the butyric, caproic, caprylic, oleic, and linoleic, all of which have melting points below the 85° preferred temperature limit of my process) from separating from my elevated temperature emulsion.

It is old art for some whipped butter to be processed at high temperatures, even above its emulsion break point of 92° so that there is a complete break-up of the emulsion. But the whipping process will then restore a purely physical type emulsion (in contrast to the physical plus crystalline granular emulsion of nonwhipped butter), and then the air cell tension of the whipped product will maintain it, even at temperatures above 92°; so that for certain special commercial uses the market will accept it. However, nonwhipped butter cannot be either movement or temperature abused (i.e., have either its granular formations or its emulsion broken) and then still be able to restore the original body to anywhere near its original self. With my invention such break-ups are avoided by keeping the butter under gentle agitation and movement from the time it reaches 70° until it is deposited at a higher temperature in its embossing package. It is permissible under my procedures to approach the 90° mark, but since the complete emulsion-break point is 92° I prefer to stay at least 7° below this point; i.e., keep my butter no higher than 85°.

It is therefore a further object of this invention to elevate the temperature of my butter, agitate its body, and keep it under movement so that it will flow by its own weight at gravity in a manner that will not harm its original crystallized, finely emulsified, and spreadable body.

4. Packaging.—While in the state of agitation and movement, slowly flow-fill the butter into my cup-like embossed-surfaced dies and/or packages, permitting the butter to fill such embossing cavities under pressure only from its own weight; and then vibrate the cup-like receptacle to level its contents. Thereafter, (1) if the embossing vehicle is a die used only for embossing purposes, the die with its flow filled butter is chilled down to temperatures at which the butter will be hard enough to fall out of the die when the latter is inverted, and do so cleanly and with embossed surfaces intact. It is then packaged bare-surfaced in a package such as described in my copending application, Ser. No. 121,010, filed Mar. 4, 1971, (2) if the embossing vehicle is to function as a package, such as a plastic or metal cup with embossed walls and/or bottom, then a lid is placed over its mouth to complete the package.

This fourth step is also, to my knowledge, a uniquely new in the art of processing packaging nonwhipped butter and of critical importance to the successful practice of this invention.

By flow fill packaging and/or die forming at the slight pressures of the weight of butter at gravity I eliminate the need for costly thick walled dies and/or packages to withstand the heavy pressure needed to form cold butter. Cold butter, depending on its temperature, requires forming pressures far in excess of one pound p.s.i., while flow filling and forming pressures are always under this. For example, for a one pound cube of butter at any given square inch of surface on an embossing walled package the pressure would always be considerably less than one pound because the one pound weight would be spread over the entire inside surface of my embossing cavity. In the case of a ¼ lb. cube (which is the most popular size for home consumption) the per square inch pressure (weight) would always be considerably less than ¼ lb.

The butter conditioning methods and means of his invention are, of course, usable for flow filling butter into any kind of cup-like packages. There are many such packages in the prior art used for packaging relatively cold (under 60°) whipped and nonwhipped butter, but all of them are smooth walled, and none of them are intended to produce embossed-surfaced butter cubes. Most of them are simply waxed paperboard, metal, or plastic cups intended as packages from which a consumer may dip or scoop out servings.

These prior art plain and smooth walled (nonembossed suraced) cup-like packages are normally filled with relatively firm cold (nonflowable at gravity) bodied butter without commercially harming its surface appearance and acceptability. Such butter may have air and air formed pockets entrapped along its surfaces, and its top surface, which normally has a standing peak after filling, is leveled by jamming a cover down on it with heavy machine-rammed pressures, and normally entrapping air in the process; and all this is done without diminishing its appearance value for the customer mainly because its surface appearance is changed anyway by the normal removal from its package, which is done by the consumer digging or scooping it out. Its surface appearance, both inside and outside its package, is of no commercial importance.

However, with embossed-surfaced butter (and especially multicubic-dimensioned embossments) surface appearance is of critical importance because consumers purchase it for its appearance value, and so it must be removed from its embossing package or die with its embossed surfaces intact; surfaces which are true and conformed replicas of the cavity surfaces by and/or from which they were embossed. Because of this flow filling has significant merit, provides an essential need, and performs a necessary advantageous function for filling and forming butter into, and only into, embossed surfaced cup-like dies or packages of any shape or configuration, round, rectangular, or polyangular cross-section and/or base either lined or unlined; either with or without lids over their open mouths. The necessity of flow filling butter into multicubic-dimensioned embossed package surfaces may be illustrated by the following comparison of filling movements:

Into smooth (nonembossed) walled cup-like packages: nonwhipped butter is normally filled at temperatures well under 70° and at the fast speeds of 40 to 80 cycles per minute because there is no need to be careful about surface apperance and/or entrapping air along the wall's surfaces. As a result the butter enters and fills such packages with movements that may best be described as swift, smooth, and uninterrupted, free to plunge, push, slip and slide in single directioned lines of travel along the package walls.

Into embossed-walled cup-like packages (especially those having multicubic dimensioned embossments on their walls): butter can only be filled, formed, and surface embossed with surface design integrity and smoothness at temperatures above 70° and at the relatively slow speeds of about 20 to 40 cycles per minute because the butter must fill the embossed wall crevices without entrapping air along the wall surfaces. As a result, the movements of butter as it enters and fills such packages may best be described as slow, bumpy and interrupted, proceeding in tortuous, crooked, up and down, side to side, in and out, twist and turn, wriggle and weave, lines of travel along the package walls. Only such flow filling temperatures, slow filling rates of fill, and high fluidity, combined with slow movement of the butter within the embossment producing walls themselves, will produce embossment designs on butter surfaces that are visibily intact, visibly smooth-surfaced, and therefore visibly free of roughness and of pockets that could otherwise have been formed by air entrapped between the butter and the embossing package walls. Such flow filled, slow filled, embossed butter surfaces have a surface smoothness and design-intactness, especially noticeable in the tiny crevices, sharp edges and corners of the intricate and/or delicate designs, that visibly distinguish such flow formed surfaces from surfaces produced on nonwhipped embossed butter by any other method or means.

It is evident therefore that my discovery of commercially acceptable packaging of warm free flowing nonwhipped butter provides a significant, peculiar and particular function and advantage, along with visible distinguishing features, for filling and forming such butter into embossed-walled packages and dies. These functional and visibily-observable advantages, therefore, are further objectives of this invention, namely: to flow fill, slow fill, nonwhipped butter into open-mouthed cup-like embossing dies or packages so that the butter will cooperate with the embossing walls to completely fill and "wet" into and on to, without a design mutilating amount of surface entrapped air, all of the multi-cubic-dimensioned designs on any of the embossing walls used by this invention in a manner that visibly distinguishes the method.

5. Cooling.—Thee continuing agitation and movement of my warm free flowing butter from the time it reaches 70° until it is deposited in my embossing dies or packages produces a state of static movement-tension that keeps the butter emulsion intact long enough (for about an hour) to finally set and solidify the emulsion under refrigeration. So, after filling my package, leveling its contents, and placing a lid over its open mouth, it is a further object of this invention to chill it before its emulsion starts separating, and store it for shipment, down under the 40° level in order to permanently "reset" both its emulsified body and its embossed surfaces.

6. Removal from package.—After cooling, the nonwhipped flow filled butter may be removed from its embossing die or package by removing any lid and inverting it so its flat side (mouth side of cavity) is down and tapping it to energize its movement and break any wall-vacuum. Its embossments will be intact and smooth surfaced, and its spreadability commercially unimpaired.

Butter (and margarine) produced by the foregoing process can be removed from a rigid walled die and/or package with embossments intact, and without requiring (as is the case with whipped butter) that the embossing vehicle be lined with a reversible liner, provided the butter is sufficiently cold (and therefore sufficiently hard). With a whipped product, the embossed surfaces in contact with an embossing package's walls are so frangible, because of its air-cells, that a reversible liner is usually required for good commercial operation in removing the cube intact from its package. The important consideration for clean removal is that the butter should cohere to itself more firmly than it will adhere to its embossing package's walls. Its ability to cohere to itself, for ejection purposes, is a result of the presence of three factors: (1) its inherent cohesiveness, plus (2) a low temperature (for hardness), plus (3) the completeness with which it "wetted" onto the embossing walls. It is the last (No. 3) factor that appears odd to one skilled in the art. It has always appeared reasonable that the more firmly and extensively a food has spread itself in an adhering manner across the surface of a package the more difficult it would be to cleanly separate the two. But I have found that the more complete the contact (the "wetting") has been between the butter and my embossing surface the better the cohesion of the body to itself, and the less adhesion to the embossing walls at the time of removal. This was unexpected because it would appear natural that the more complete the contact, the more resistance to release. But apparently the more complete the contact, the more complete also is the cohesiveness of the butter body at point of embossing wall contact.

In summary, I have discovered that with the six processing and packaging steps outlined above that the inter-attached granules of unwhipped butter will hold together; will apparently stretch and elongate, and will remain in emulsion without breaking apart into an oil phase or leak water, so that the original spreadability is left substantially undisturbed, and will have the same commercially acceptable spreadability as if packaged cold with its original "set." In any event, my second, and high temperature, working, a fluid fill into an embossing package, and a second "setting" produces an unwhipped but-

ter body that is as spreadable as the original butter from which it started. This new ability to fluid fill unwhipped butter also opened a whole new technology for the forming, packaging and then, surprisingly, the unpackaging of embossed butter surfaces.

DESCRIPTION OF THE DRAWING

The invention will be further explained in conjunction with the drawing in which:

FIG. 1 is a diagrammatic illustration of a specific example of the method;

FIG. 2 is a perspective view of embossed butter produced according to my invention;

FIG. 3 is an enlarged side elevational view of FIG. 2;

FIG. 4 is an enlarged fragmentary sectional view of a portion of the apparatus shown in FIG. 1; and

FIGS. 5 through 7 are sequential views illustrating the flow-filling of the embossing dies.

DESCRIPTION OF SPECIFIC EXAMPLE

Since many creameries in which butter is churned are too small to support an efficient low cost consumer size packaging operation, the butter trade in the U.S. normally does such packaging in "print rooms" located at considerable distances from the creameries. Butter comes to these print rooms in 68 lb. blocks from the producing creameries. It is then "printed" into consumer size ¼ lb. and 1 lb. sizes for sale in retail stores. It is at such print room locations that I practice a preferred embodiment of my invention by following the specific values, procedures, times, speeds, and temperature parameters outlined below.

1. Select butter made in the modern continuous churns of the kind described hereinbefore.

2. Slowly temper the butter (elevate its temperature) in the original creamery packed bulk containers (thus confining the block to keep the butter emulsion from breaking open) by elevating its temperature in 70° (with optional ranges of 65° to 75°) temperature rooms, until the butter itself reaches the 70° level stubstantially throughout its entire 68 lb. block. The time needed to accomplish this will, of course, depend on the starting temperature of the butter; varying from a few hours for butter direct from a churn, to 3 days for butter that enters the tempering room at 10°.

3. Deposit 2400 lbs. of the 70° butter blocks **11** in a 300-gallon kettle **12** equipped with (a) water jacketed sides **13** for controlled temperature water heat, and (b) six (2"-wide) double action rotatable blades **14** geared for slow agitation and sweep around the entire inside perimeter of the kettle, and (c) having an outlet valve **15** at the bottom to permit fluid butter to flow out under its own weight at gravity. The valve may be opened and closed by lever **16**. Suitable kettles are available from Hamilton Copper and Brass Works of Cincinnati, Ohio.

4. Stirring the kettle-deposited butter by rotating the kettle's blades at about 40 r.p.m. (with optional range of 30 to 50 r.p.m.) while the water in the jacket **13** is maintained within the 75° to 85° range until the butter itself in its entire 2400 lb. mass reaches the 75° temperature, at which time the temperature of the water in the jacket is immediately lowered to at least 75° (to maintain the temperature of the butter at a level no higher than necessary for its flowability at gravity). This step in the processing procedure usually requires no more than about one hour for the 2400 lbs. of 70° butter to be raised to 75°. At about this temperature butter is flowable at gravity. The temperature of the water in the jacket can be controlled by circulating water at the desired temperature through the jacket by means of the water inlet **17** and outlet **18**. The rotable blades are rotated by means of shaft **19**, gear box **20**, and motor **21**.

5. With butter at a flowable consistency it is released at the bottom of the kettle and permitted to flow by gravity (or optionally via a slow 40 to 60 r.p.m. pump, if it must be flowed uphill) through conduit **22** into a package filling machine hopper **23** equipped with single action rotating blades **24** to maintain the fluid butter emulsion under movement while waiting to be filled into packages. Filling such moving fluid butter via filling valves and nozzles to be described in detail hereinafter, which permit butter to flow into embossed walled dies or packages **25** which are cycled into filling position under the filling machine's nozzles.

6. Because the cup-like die or package into which the flowing butter is filled has walls that are embossed with multicubic-dimensioned embossments over most of its inside wall surfaces the rate of fill must be scaled down considerably under the cycling rates used for filling conventional smooth walled cup-like packages. I have found that with comparable sizes and quantities per cup the rate of fill for embossed packages should not be much more than about half the rate of fill for smooth walled packages. For example, if the normal rate for a smooth walled package is 50 to 60 cycles per minute, the rate for a comparable size embossed walled package should be about 25 to 30 cycles per minute; and if the embossments are intricate and of delicate detail the rate of fill should be about 20 cycles per minute or less. This graphically illustrates the effect that embossments have on the mechanics of packaging with the two different type packages and end products.

7. Immediately after filling, the butter in its embossing cavity is leveled by vibration. The open mouth (flat side of the butter) of the embossing cavity is then covered or lidded and carried into refrigerated storage, or conveyed through a freezing tunnel, to lower the butter's temperature as quickly as practical from its flowable phase to a solid phase and "set" its emulsion for the second time.

When processing butter at the temperatures required by this invention, there is a continuing tendency for the butter emulsion to separate. A separation, of course, of the water, butter oils, and solids from out of emulsion is ruinous for the commercial acceptance of its body. I have found, however, that by keeping my warm butter in constant movement until the moment it is deposited in an embossing cavity, and then immediately chilling it, I can control and eliminate any break-up of the emulsion; at least to the extent that such a break-up would be commercially noticeable and/or objectionable.

8. As soon as the packaged mass of embossed surfaced butter has solidified below the 32° freezing point of water it will remove clean and easily (especially if its temperature is lowered to about 0°) from its embossing cavity walls (whether such walls are lined or unlined with an embossment conforming reversible liner) by inverting it so its open (nonembossed) side is down; or by not inverting it, and pulling it from its embossing cavity with a suction cup.

9. For quality control on the spreadability of my embossed butter, to measure body softness (or hardness) and thus spreadability, I use a simple portable instrument: the Pelouze Mfg. Co.'s Model 5–T Tension scale. This is a spring-loaded rod having a ½" diameter head, and a needle-indicator positioned to travel over a calibrated distance of a cylinder which encloses the spring loaded rod. The calibration on the cylinder measures spring resistance in terms of ounces and pounds of pressure exerted on the spring by the rod. The head of the rod is placed on a cold butter surface and pressure exerted on the rod holding cylinder until the butter contacting head penetrates the surface of the butter.

I find that pressure of 5 lbs., as measured on the Pelouze scale, exerted by the head on the surface of 45° butter (the temperature at which butter is usually stored in a home refrigerator) will produce a penetration of the head into the butter of about 1/32"; and this penetration should measure approximately the same with both a control sample of butter before processing under my method, and

a sample of identical butter processed and packaged under my method; indicating that both the control and the processed samples have bodies of comparable softness and therefore spreadability.

One suitable filling machine for flow filling the embossed walled dies **25** is shown in FIGS. 1 and 4. A conduit **26** connects the bottom of the hopper **23** with a multiple nozzled manifold **27**. Embossed walled dies or packages are positioned below the manifold **27**; and under each filling nozzle **28**, and each nozzle is provided with a metering valve **29**.

The butter is flowed through the nozzles into the dies at the desired rate by means of a piston **30** which reciprocates in the conduit **26**. The piston **30** is equipped with a gasket **31** which sealingly engages the inside surface of the conduit **26** and is provided with an axially extending opening **32**. The opening **32** is closed and opened by a flap **33** which is secured to the lower surface of the piston. The piston is reciprocated by a rod **34** which can be connected to a suitable source of reciprocatory motion, and as the piston moves downwardly the flap **33** closes the opening **32** and forces butter to flow into and through the manifold **27** and nozzles **28**. As the piston is raised, butter from the hopper will flow through the opening **32** and past the flap **33** under the influence of gravity as illustrated in FIG. 4 to keep the manifold **27** filled.

Referring to FIGS. 5–6, each embossed walled die or package **25** can be conveniently formed by cold forming or the like a sheet of suitable material such as metal or plastic so that the remaining unformed planar portions *25a* of the sheet provide support for and connection between the individual dies. The multicubic-dimensioned inner surfaces of the dies is shown in FIG. 5, these surfaces including many finely delineated crevices or valleys **35** and peaks **36**.

As shown in FIG. 6, the rate of fill is such that the butter wets and flows completely into all of the embossment-forming crevices without entrapping any air bubbles until the butter reaches the desired level as shown in FIG. 7. At this time the plurality of dies can be simultaneously removed from under the nozzles while the piston **30** is being retracted upwardly, and another set of dies can be moved into place below the nozzles.

A unit **37** of butter formed by the dies **25** is shown in FIGS. 2 and 3. The butter is seen to be provided with finely delineated multicubic-dimensioned embossments which include sharp peaks **38** formed by the crevices **35** of the dies. The surface of the butter is relatively glossy and is characterized by few, if any, marks which would be caused by air bubbles entrapped between the butter and the die.

While in the foregoing specification a detailed description of a specific embodiment of the invention was set forth for the purpose of illustration, it is to be understood that many of the details herein given may be varied considerably by those skilled in the art without departing from the spirit and scope of the invention.

I claim:

1. A method for embossing the surfaces of packaged non-whipped butter while maintaining its original spreadability, by

selecting for said embossment, butter that has been made in continuous-type churns, that produce butter of superior spreadability;

chilling said continuous churned butter to a temperature within the 40° to 60° range for a long enough time to let the process of crystalline growth of fat granules reach the state at which the butter-maker wishes to "set" its best spreadability characteristics;

warming the chilled butter slowly, in order to prevent disturbing its crystalline "set" until it reaches about 70°, then

stirring said warmed body with a rotary agitation so as to (a) prevent the low-temperature-melting fats in butter from separating from the butter emulsion, (b) prevent whipping air into it, and/or (c) prevent breaking up its basic crystalline "set," while its temperature is elevated into the 70° to 90° range until it becomes flowable at gravity; then, while under said agitation,

filling said warmed and stirring butter into multicubic-dimensioned embossed-walled packages at a cycling rate of no more than 50 r.p.m. so that it will enter into the embossments of said walls without entrapping embossment-destroying air in the process;

cooling said packaged-filled butter rapidly down under 40° in order to permanently "set" both its emulsified body and its embossed surfaces; by

conveying it into and/or through a freezing tunnel, and thereafter

removing said embossed-surface butter from its die or package by inverting it so its flat side is down.

2. A process of forming embossed-surfaced nonwhipped continuous-churned butter comprising the steps of:

(a) warming the butter without agitation to about 70° F.;

(b) stirring the 70° F. temperatured butter with mixing means rotating at no more than 50 r.p.m. while elevating the temperature of the butter to no more than 90° F. and thus rendering it flowable under its own weight at gravity and keeping its emulsion intact below its emulsion break point;

(c) while maintaining the butter within said 70° F. to 90° F. temperature range and continuing said stirring, flow filling the butter into multicubic-dimensioned embossing-walled cup-like dies or packages at filling speeds not in excess of 40 cycles per minute; and

(d) chilling the contents of said flow-filled dies or packages within 60 minutes from the time of filling by conveying the dies or packages through a freezing tunnel to solidify the contents at temperatures below 40° F. and to maintain the original prewarmed spreadability of the butter in its post-formed later-chilled nonfluid body.

3. A process of forming and surface embossing nonwhipped continuous-churned butter by

(a) flow-filling the butter into multicubic-dimensioned-walled cup-like dies at a rate not to exceed about 40 cycles per minute while the butter is within the 70° F. to 90° F. temperature range and while the butter is being kept in a rotating-mixing movement at speeds of no more than 50 r.p.m. to prevent both emulsion separation and air incorporation, and then

(b) chilling said die-filled butter within 60 minutes from the time of filling down into its nonfluid crystalline fat phase below 40° F. to permanently set both its emulsion and its embossed surfaces and thereby retain in said set and embossed butter the spreadability it had before said processing.

4. A process for manufacturing and packaging embossed-surfaced nonwhipped butter, comprising:

selecting a fine textured, thoroughly water-emulsified-bodied butter,

chilling the butter to a temperature between 40° to 60° while the butter is in its creamery-packed bulk containers,

holding the butter at this temperature and in this container until its "setting" or crystallizing cycle has been subsantially completed, after which

elevating its temperature, while in said container, gradually and without physical movement of its "set" mass until it reaches about 70°,

placing the butter in a water-jacketed vessel,

elevating its temperature further and rapidly into the 70° to 90° range while agitating it slowly at the same time until the mass is in lump-free flowing movement,

flow-filling it into open-mouthed cup-like dies or packages having multicubic-dimensioned embossments on

their inner side and/or bottom walls; and

chilling it in said dies or packages to firmly form its surfaces in conformation to the embossed surfaces of said dies or packages.

5. The process of claim 4 including the step of removing said chilled embossed-surfaced butter from its forming die or package either by inverting said die or package so its open-mouthed (nonembossed) side is down and so permitting said chilled butter to fall free from said die, or by lifting said chilled butter out of said die with a suction cup.

6. A process for maintaining the spreadability of continuous-churned nonwhipped, warm-packaged butter comprising:

maintaining said butter at finished-churn or lower temperatures for a long enough time for the butter to "set" and crystallize the physical spreadability characteristics worked into it by the butter-maker; thereafter

elevating its temperature without physical movement of the mass until said mass has reached 70°, so as not to break up the crystallized attachments and linkages of the "set" butter granules, and thus not disturb said spreadability;

moving said 70° mass under slow agitation, while elevating it into the 70° to 90° range, in order to hold the granular interattachments and linkages together without pulling them apart, and to maintain the original fine, minute, dispersion of the water within the butter emulsion;

maintaining said temperature-elevated and moving mass in said moving and temperatured states while it is flow-filled and slow-filled into cup-like embossing packages, and thereafter

chilling said packaged butter rapidly to temperatures below 40° in order to permanently "set" both its emulsified body and its embossed surfaces.

7. The process of claim 6 in which the temperature of the butter is elevated to the 75° to 85° range while the mass is moved under slow agitation.

8. A process of forming nonwhipped continuous-churned butter comprising the steps of:

(a) warming the butter to about 70° F.;

(b) stirring the 70° F. temperatured butter while elevating its temperature to no more than 90° F. and thus rendering it flowable under its own weight at gravity and keeping its emulsion intact below its emulsion-break point;

(c) while maintaining it within said 70° F. to 90° F. temperature range and continuing said stirring, flow-filling the butter into multicubic-dimensioned embossing-walled cup-like dies or packages; and

(d) chilling the contents of said flow-filled dies or packages to solidify the contents in conformity with said embossing-walled dies and to maintain the original prewarmed spreadability of the butter in its post-formed later-chilled nonfluid body.

9. The process of claim 8 in which the stirring is performed by mixing means rotating at no more than 50 r.p.m.

10. The process of claim 8 in which the rate of the flow-filling of the dies or packages is less than 40 cycles per minute.

11. The process of claim 8 in which the contents of the flow-filled dies or packages are chilled to below 40° F. within 60 minutes from the time of filling.

12. The product produced by the process of claim 8.

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U.S. Cl. X.R.

426—185, 336, 414, 515