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(71) Applicant: **JEMPAK CORPORATION** [CA/CA]; 80 Doney Crescent, Concord, Ontario L4K 3P1 (CA).

(72) Inventors: **TARNOWSKY, Emil**; 80 Doney Crescent, Concord, Ontario L4K 3P1 (CA). **ELBI, Nat**; 80 Doney Crescent, Concord, Ontario L4K 3P1 (CA). **HILDEBRANSKI, Mariusz**; 80 Doney Crescent, Concord, Ontario L4K 3P1 (CA).

(74) Agent: **GILBERT'S LLP**; 77 King Street West, Suite 2010, Toronto, Ontario M5K 1K2 (CA).

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(54) Title: MULTI-CHAMBER UNIT DOSE DETERGENT PRODUCTS, AND MACHINES AND METHODS FOR MANUFACTURING SAME

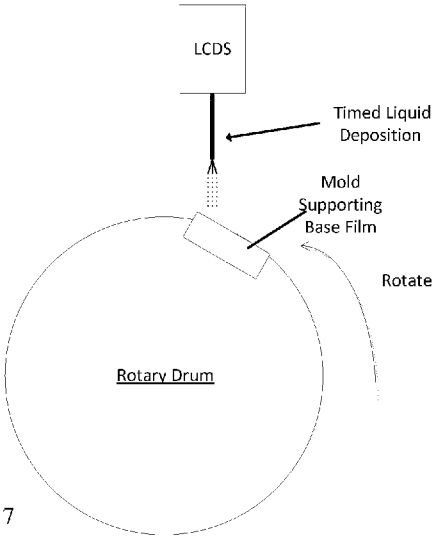

FIG 7

(57) Abstract: Disclosed herein is a method of manufacturing a unit dose detergent product comprising: using a rotary pouch packaging machine, forming at least first and second separate chambers with a water-soluble film; depositing at least a liquid-phase component in the first chamber; depositing powder-phase detergent component in the first and second chambers; and sealing the first and second chambers with a water-soluble film thereby to contain the components in respective chambers. A unit dose detergent product is also disclosed, as is an improvement in a rotary drum type pouch packaging machine, the improvement comprising a liquid-deposition station arranged to deposit liquid-phase component in a first chamber of each a plurality of multi-chamber pouches being formed; and a powder-deposition station arranged to subsequently deposit powder-phase component in the first chamber and at least one other chamber of each of the plurality of multi-chamber pouches being formed.

WO 2019/144244 A1

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MULTI-CHAMBER UNIT DOSE DETERGENT PRODUCTS, AND MACHINES AND METHODS FOR MANUFACTURING SAME

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to United States Provisional Patent Application Serial No. 62/623,537 filed on January 29, 2018.

FIELD OF THE INVENTION

[0002] This application relates generally to cleaning compositions and more particularly to unit dose detergent products, rinse-aid compositions, and related methods.

BACKGROUND

[0003] Unit dose detergent products are appreciated by consumers for their convenience and ease of use in dishwashing and clothes washing applications.

[0004] Various unit dose detergent products for dishwashing applications are known. For example, United States Patent No. 8,551,929 to Graham et al. (Sun Products Corporation) discloses a multi-phase unit dose detergent composition with a cleaning system comprising at least two different phases contained within a single-chamber container. In embodiments incorporating a solid gel phase, the gel incorporates a substantial amount of water, and the at least two different phases each occupy a respective different layer within the container.

[0005] Speed of manufacturing is an important factor in the production of unit dose detergent products. Rotary pouch-forming machines tend to enable faster production of unit dose detergent products than other kinds of machines such as horizontal pouch forming machines. An example of a rotary pouch forming machine is the Hydroforma 660 produced by Cloud Packaging Solutions Inc. of Des Plaines, Illinois, U.S.A.

[0006] The speed with which unit dose detergent products can be manufactured tends to be decreased when a particular unit dose product is to incorporate liquid and some other phase, such as a powder phase and/or a gel phase. For example, flowability of the material is slowed when liquid and powder are to be delivered together in combination by a machine for unit dose products.

[0007] Some manufacturers appear to deal with flowability constraints by dealing with the phases as separately as possible, such as by forming unit dose detergent products in multiple "passes". In particular, machines are apparently configured to encapsulate one of the phases in a first chamber during a first pass and then, during a second pass, physically "stack" a second chamber encapsulating the other phase atop the first chamber. For example, Cascade Platinum unit dose detergent components each include a large chamber containing powder-phase detergent component supporting one or more smaller chambers containing just liquid phase components stacked atop the large powder-filled chamber. As

would be understood, multiple passes per product can be time-consuming and the resultant products, being stacks of chambers, can be thick.

[0008] Some manufacturers appear to deal with flowability constraints when it is desirable to include rinse aid along with detergent by using granules of rinse aid (rather than liquid rinse aid) such as Dehypon® GRA available from BASF Corporation, which is more flowability-compatible with the powdered detergent, at least in respect of it being delivered for inclusion in a unit dose detergent product along with the powder-phase detergent component. However, reduction in the overall size of the resultant products for a given performance level is limited because generally a higher volume of granule rinse aid than liquid rinse aid is required for a comparable level of rinse aid performance.

[0009] For example, unit dose dish detergent products having multiple chambers for including both a powder-phase detergent and a rinse aid have heretofore been limited to having masses of about 18 grams or more in order to meet or exceed standards set by benchmark-setting products such as Cascade Platinum or Cascade Complete.

[0010] In this regard, conventions have been established for testing detergent products for both their cleaning performance during mechanical dishwashing, and their performance in reducing or eliminating deposition on glassware during mechanical dishwashing. See for example the publications entitled "Methods for ascertaining the cleaning performance of dishwasher detergents (Part A)" (SOFW-Journal, 125, Jahrgang 11/99) and "Methods for Ascertaining the Cleaning Performance of Dishwasher Detergents (Part B, updated 2005)" (SOFW-Journal, 132, 9-2006) published by IKW (Association of German Detergent Manufactures e.V. / Industrieverband Korperpflege und Waschmuttel e.V.), and also "Standard Guide for Deposition on Glassware During Mechanical Dishwashing" (ASTM Designation D3556-14) published by ASTM International, the contents of each of which are incorporated herein by reference in their entireties.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] Embodiments of the invention will now be described with reference to the appended drawings in which:

[0012] Figure 1 is a top plan view of a unit dose detergent product, according to an embodiment;

[0013] Figure 2 is a cross-sectional side view of a unit dose detergent product, showing base film and top film separate just prior to sealing base and top together and then a cross-sectional side view after the sealing, according to an alternative embodiment;

[0014] Figure 3 is a cross-sectional end view of the unit dose detergent product of Figure 2;

[0015] Figure 4 is a top plan view of a drawing of the unit dose detergent product of Figure 1 and relative dimensions;

[0016] Figure 5 is a top perspective view of an example mold for unit dose detergent product of Figure 1;

[0017] Figure 6 is a simplified front elevation view of components of a rotary pouch forming machine including a liquid component deposition station depositing liquid in a first chamber of a unit dose detergent product being formed atop a base film supported within a mold that is, in turn, supported on a rotary drum;

[0018] Figure 7 is a simplified side elevation view of the rotary pouch forming machine of Figure 6 during the liquid deposition;

[0019] Figure 8 is a simplified front elevation view of components of the rotary pouch forming machine including a powder component deposition station depositing powder, after liquid has been deposited in the first chamber, in both the first and second chambers of the unit dose detergent product being formed atop the base film supported within the mold, and also showing liquid being deposited at the same time from nozzles (not shown in Figure 8) into each mold in a subsequent row of molds; and

[0020] Figure 9 is a simplified side elevation view of the rotary pouch forming machine showing timed powder deposition and timed liquid deposition operating simultaneously on different rows of unit dose detergent products being formed.

DETAILED DESCRIPTION

[0021] Figure 1 is a top plan view of a unit dose detergent product 10, according to an embodiment. In this embodiment, unit dose detergent product 10 includes a water-soluble container 12 defining first and second chambers 14 and 16. The unit dose detergent product 10 comprises a cleaning system including a liquid-phase rinse-aid component 14A and a powder-phase detergent component 16A in chamber 14, and a powder-phase detergent component 16A in chamber 16.

[0022] In this embodiment, the unit dose detergent product 10 has a total mass of about 13 grams, and has a performance profile that is within 2 standard deviations of the performance profile of Cascade Complete™, Cascade Platinum™, or equivalent product, as defined in the IKW 2005 standards for ascertaining cleaning performance during mechanical dishwashing.

[0023] Furthermore, in this embodiment, the unit dose detergent product has a performance profile meeting or exceeding a score of 2.0 when tested with about 300ppm calcium carbonate water hardness as defined in the ASTM D3556 – 14 standard for ascertaining deposition on glassware during mechanical dishwashing.

[0024] In this embodiment, the unit dose detergent product 10 has the dimensions shown in Fig 4. In this embodiment, the water-soluble container 12 is transparent. As such, the contents of the water-soluble container 12 adjacent to the inner walls of each of the chambers 14 and 16 are visible from the outside of the water-soluble container 12. In this embodiment, the water-soluble container 12 is formed from polyvinyl alcohol (PVA) film. Other water-soluble polymers or other appropriate water-soluble materials that can contain the cleaning system while dry but that can fully release the cleaning system

upon being sufficiently dissolved in water – such as when brought into contact with a sufficient volume of water within a dishwasher - are contemplated.

[0025] In this embodiment, chamber 14 containing both liquid-phase rinse-aid component 14A and powder-phase detergent component 16A is formed as a generally L-shaped body having an axial thickness (into the page) that is less than the axial thickness of chamber 16 containing just the powder-phase component 16A. As such, as chamber 14 is smaller, in this embodiment there is a relatively low volume of the overall powder-phase detergent in unit dose detergent product 10 that is in contact with a liquid-phase component. As such, a sufficient volume of detergent is provided within the unit dose detergent product 10, but a high proportion of the powder-phase detergent component is not wet, and thus has high relative flowability. The differences in axial thickness of chambers 14 and 16 may be seen more readily by observing the relative axial depths of the corresponding cavities 140, 160 of a sample mold 100 (see Fig. 5) used, in this embodiment, to form supported chambers in a first layer of the PVA film for receiving components 14A and 16A therein prior to sealing with a second layer of the PVA film.

[0026] Figure 2 is a cross-sectional side view of a unit dose detergent product according to an alternative embodiment. Figure 2 includes a diagram showing base film B and top film T separate just prior to sealing base Band top T together, and a diagram showing a cross-sectional side view after the sealing. Figure 3 is a cross-sectional end view of the unit dose detergent product of Figure 2.

[0027] Like the embodiment of the unit dose detergent product shown in Figure 1, the embodiment shown in Figures 2 and 3 includes a base B formed from water-soluble film, with the base B defining the first and second separate chambers 14, 16 each extending axially (seen as "vertically" in Figures 2 and 3) all the way from the base B to each respectively terminate at a top T formed from water-soluble film. Like the embodiment shown in Figure 1, the first and second chambers 14, 16 are transversely (seen as into the page and laterally i.e. from left to right in Figures 2 and 3) separate from each other, with at least the liquid-phase component being in the first chamber 14 and the powder-phase detergent component in the second chamber. More particularly, when taken in the axial direction, chamber 14 is not beneath or above chamber 16 – the chambers are not stacked upon each other. This configuration relates to speed of manufacturing, where the unit dose detergent product having both powder and liquid components can be formed in a single rotation of a rotary pouch forming machine, rather than requiring a first rotation for containing liquid within a chamber and a second rotation for containing powder in a different chamber "stacked" atop the liquid-containing chamber, or vice versa. Or, rather than requiring manufacturing using the typically lower-throughput horizontal pouch forming machines.

[0028] According to the invention, an improved rotary drum type pouch packaging machine is provided and includes a liquid-deposition station arranged to deposit liquid-phase component in a first chamber of each a plurality of multi-chamber unit dose detergent products being formed; and a powder-deposition station arranged to subsequently deposit powder-phase component in the first chamber and

at least one other chamber of each of the plurality of multi-chamber unit dose detergent products being formed.

[0029] It is useful for a substantial part of the liquid and powder components be visible, and preferably visible to a substantial degree through the transparent water-soluble container 12. This is so that a person using the unit dose detergent product 10 is able to observe that it includes a satisfying amount of rinse-aid component 16A. However, alternative embodiments may be provided having a water-soluble container that is not transparent.

[0030] Figure 6 is a simplified front elevation view of components of a rotary pouch forming machine including a liquid component deposition station depositing liquid in a first chamber of a unit dose detergent product being formed atop a base film supported within a mold that is, in turn, supported on a rotary drum. As would be understood, prior to deposition of any liquid or powder, the base film (in this embodiment, a water-soluble film such as PVA) is fed over the mold cavities being supported on the rotary drum, and vacuumed into the cavities thereby to cause the base film to conform to the shape of the mold thereby to form the first and second chambers so that the chambers can receive and contain the liquid and powder before the top film is applied.

[0031] In this embodiment, the liquid component deposition station employs an array of high-accuracy nozzles in fluid communication with the liquid component and positioned to be aligned with respective first chambers in the rows of molds as the first chambers are continuously rotated beneath the nozzles to deliver a quantum of liquid into the first chamber of each. Nozzles and a corresponding dispensing pump or pumps such as those available from Hibar Systems Inc. of Richmond Hill, Canada are suitable for delivering quantums of liquid as little as 0.1 cc of liquid in this application into the first chamber at the times the nozzles are aligned with respective first chambers being formed (thereby to be positioned to receive and hold the liquid). Such nozzles can then to be closed with little or no leakage of liquid as the molds continue to rotate with the rotary drum to align the first and second chambers with subsequent stages in the product forming process. Figure 7 is a simplified side elevation view of the rotary pouch forming machine of Figure 6 during the liquid deposition.

[0032] Figure 8 is a simplified front elevation view of components of the rotary pouch forming machine including a powder component deposition station depositing powder, after liquid has been deposited in the first chamber, in both the first and second chambers of the unit dose detergent product being formed atop the base film supported within the mold. Also shown for ease of understanding is liquid being deposited at the same time from nozzles (not shown in Figure 9 for simplification) into each mold in a *subsequent* row of molds. Figure 10 is a simplified side elevation view of the rotary pouch forming machine showing timed powder deposition and timed liquid deposition operating simultaneously on different rows of unit dose detergent products on the rotary drum as they are being formed. It will be understood that some of the powder being deposited in this way will enter into and stay within the first chamber (there will be remaining volume in the first component as the amount of

liquid previously deposited there will typically not be enough to fill the first chamber) thereby coming into contact with the previously-deposited liquid component. However, more of the powder being deposited by the powder component deposition station will enter into and stay within the second chamber thereby remaining dry. The powder entering into the first chamber may change colour upon coming into contact with the liquid component, depending on the constituents of the liquid component and the powder component.

[0033] After the liquid and powder components have been deposited as described above, a top film (in this embodiment, also a water-soluble film such as PVA) is fed over the filled chambers and is sealed to the base film at a sealing station or equivalent thereby to fully contain the liquid and powder components that have been deposited. Subsequent to this, the unit dose detergent products are separated from each other and conveyed to subsequent stages, such as for quality assurance review and packing.

[0034] Since all or most of the liquid components can be separated the powder flow can be significantly improved, which accordingly enables improvements to the weight control on the pouch forming machine and increase and/or better control the concentrations/amounts of active ingredients thereby enabling further control over unit dose detergent product sizes.

[0035] In embodiments, the liquid components may include rinse aid non-ionic surfactant or in combination with solid rinse aid (such as Dehypon^{TM} GRA) to delay its dissolution rate. Corrosion inhibitors (such as benzotriazole) may be incorporated.

[0036] Ingredients containing water are permitted, even with the container being water-soluble, provided the water content is kept below 8%. Using some ingredients in solution form can be more cost effective since it will obviate the need for spray drying and/or granulation processes.

[0037] In embodiments, some of the key liquid ingredients include polymers (Acusol 445N, Acusol 588N, etc.) and/or chelating ingredients (Trilon M, carboxy methyl inulin, Baypure CX - iminodisuccinate-, Itaconix, etc.).

[0038] While particular embodiments have been disclosed herein, alternatives are contemplated.

[0039] For example, embodiments are contemplated in which the liquid-phase component is a liquid or liquids other than or instead of liquid rinse-aids.

[0040] Furthermore, embodiments are contemplated in which the chamber containing the liquid-phase component does not also contain powder-phase detergent component.

[0041] Furthermore, while embodiments are contemplated in which a rotary pouch forming machine is employed to form the unit dose detergent products described herein, alternatives are contemplated. For example, a horizontal pouch forming machine may alternatively be employed to form the unit dose detergent products described herein.

[0042] Furthermore, embodiments of the unit dose detergent product described herein have two chambers. However, alternatives are contemplated in which a unit dose detergent product is provided

with more than two chambers, and all or a subset of the chambers (such as just two) contain powder-phase detergent component whereas not all chambers contain the liquid-phase component.

[0043] Furthermore, while a unit dose detergent product has been described herein having a mass of 13 grams, it is expected that the configurations and manufacturing techniques disclosed herein can provide unit dose detergent products of less than 18 grams, such as from about 10 grams to 17 grams, and particularly 12 grams. Furthermore, the configurations and manufacturing techniques disclosed herein can also be employed to produce unit dose detergent products of more than 18 grams where useful and/or desirable for certain applications.

What is claimed is:

1. A unit dose detergent product, comprising:
a water-soluble container defining at least first and second separate chambers; and
a cleaning system comprising:
at least a liquid-phase component in the first chamber; and
a powder-phase detergent component in the second chamber,
wherein the unit dose detergent product has a mass of less than 18 grams,
wherein the unit dose detergent product has a performance profile within 2 standard deviations of the performance profile of Cascade Complete, Cascade Platinum, or equivalent product, as defined in the IKW 2005 standards for ascertaining cleaning performance during mechanical dishwashing.

2. The unit dose detergent product of claim 1, wherein the liquid-phase component in the first chamber comprises liquid-phase rinse-aid.

3. The unit dose detergent product of claim 1 or 2, wherein the unit dose detergent product has a performance profile meeting or exceeding a score of 2.0 when tested with about 300ppm calcium carbonate water hardness as defined in the ASTM D3556 – 14 standard for ascertaining deposition on glassware during mechanical dishwashing

4. The unit dose detergent product of claim 1, further comprising a non-liquid-phase rinse aid in the first chamber.

5. The unit dose detergent product of claim 4, wherein the solid-phase rinse aid comprises Dehypon™ GRA.

6. The unit dose detergent product of one of claims 1 to 5, further comprising at least one corrosion inhibitor in the first chamber.

7. The unit dose detergent product of claim 6, wherein the at least one corrosion inhibitor comprises benzotriazole.

8. The unit dose detergent product of claim 1, wherein the water-soluble container is transparent.

9. The unit dose detergent product of one of claims 1 to 8, wherein the mass is about 13 grams.

10. The unit dose detergent product of one of claims 1 to 8, wherein the mass is from about 10 grams to about 17 grams.

11. The unit dose detergent product of claim 10, wherein the mass is about 12 grams.

12. The unit dose detergent product of claim 1, further comprising powder-phase detergent in the first chamber.

13. A method of manufacturing a unit dose detergent product:

using a rotary pouch packaging machine, forming at least first and second separate chambers with a water-soluble film;

depositing at least a liquid-phase component in the first chamber;

depositing powder-phase detergent component in the first and second chambers; and

sealing the first and second chambers with a water-soluble film thereby to contain the components in respective chambers.

14. The method of claim 13, wherein forming comprises:

forming the second chamber to have a larger volume than the first chamber.

15. The method of claim 13, wherein the liquid-phase component comprises liquid-phase rinse aid.

16. A rotary drum type pouch packaging machine, the improvement comprising:

a liquid-deposition station arranged to deposit liquid-phase component in a first chamber of each a plurality of multi-chamber pouches being formed; and

a powder-deposition station arranged to subsequently deposit powder-phase component in the first chamber and at least one other chamber of each of the plurality of multi-chamber pouches being formed.

17. The rotary drum type pouch packaging machine of claim 16, wherein the liquid-deposition station is configured to deposit as little as 0.1 cc of liquid-phase component into each first chamber.

18. The rotary drum type pouch packaging machine of claim 16, wherein the liquid-deposition station comprises a plurality of Hibar^{TM} high precision nozzles each positioned with respect to the rotary drum to deposit a respective quantum of the liquid-phase component in a respective first chamber when aligned therewith.

19. A unit dose detergent product, comprising:

a base formed from water-soluble film, the base defining first and second separate chambers each extending axially from the base to each terminate at a top formed from water-soluble film and sealed to the base, the first and second chambers being transversely separate from each other;

at least a liquid-phase component in the first chamber; and

a powder-phase detergent component in the second chamber.

20. The unit dose detergent product of claim 19, wherein the liquid phase component comprises liquid rinse-aid component.

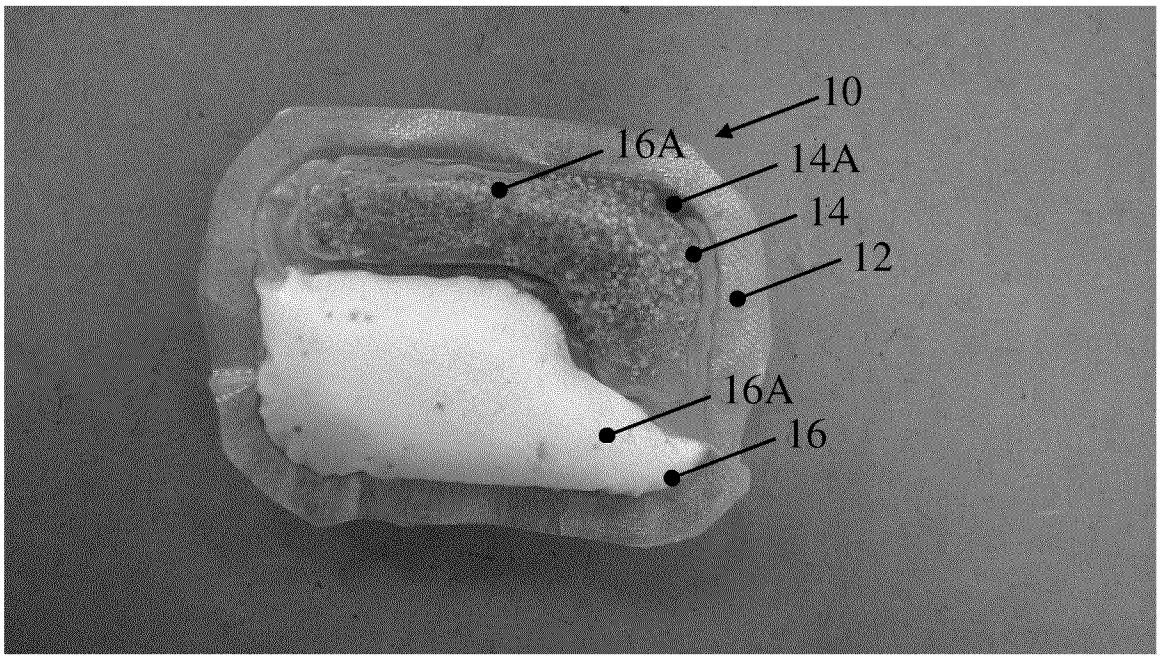


FIG. 1

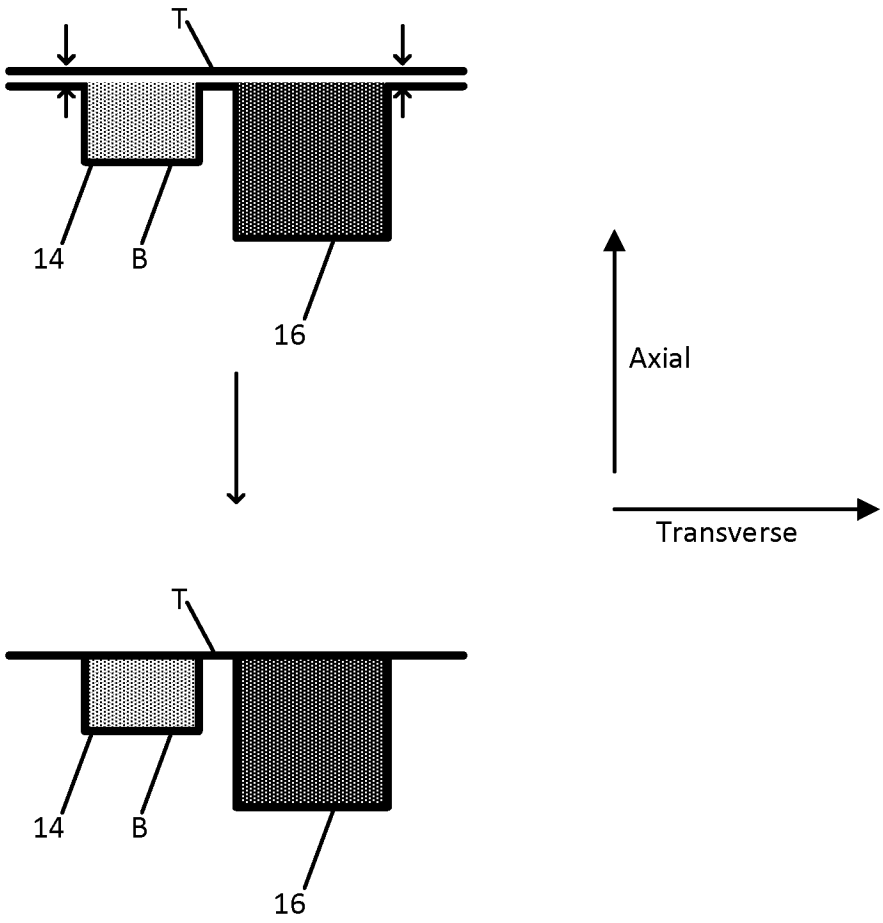


FIG 2

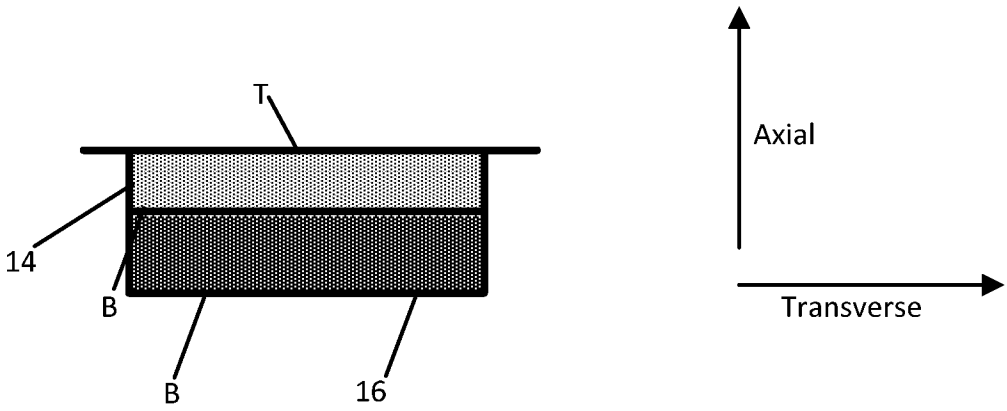


FIG. 3

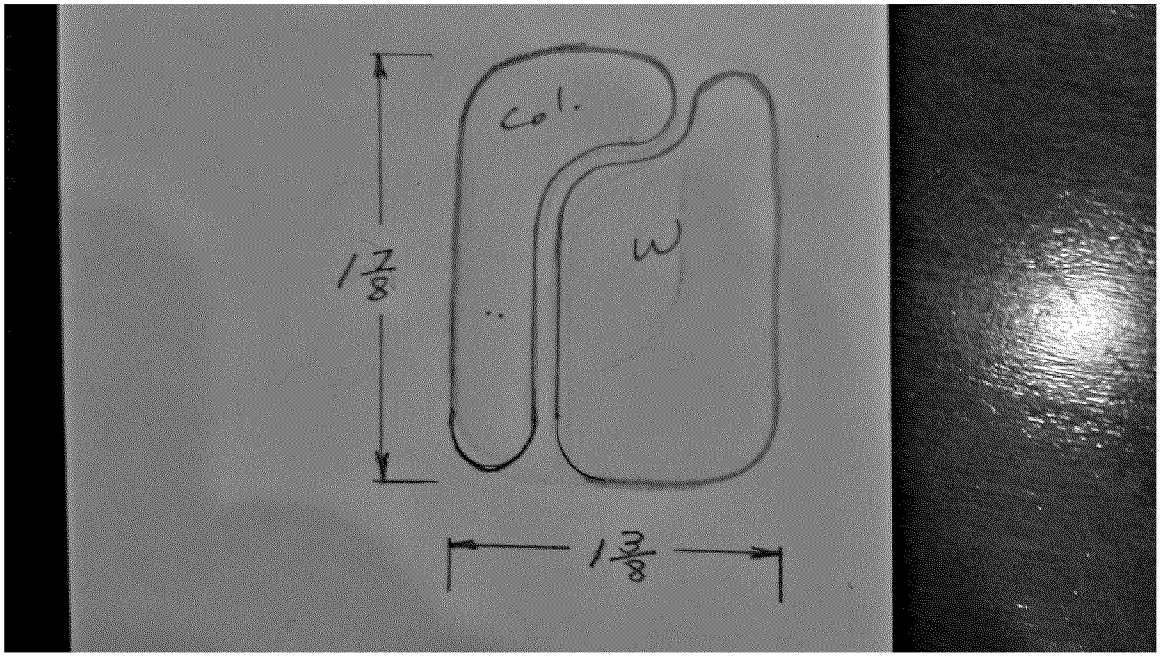


FIG. 4

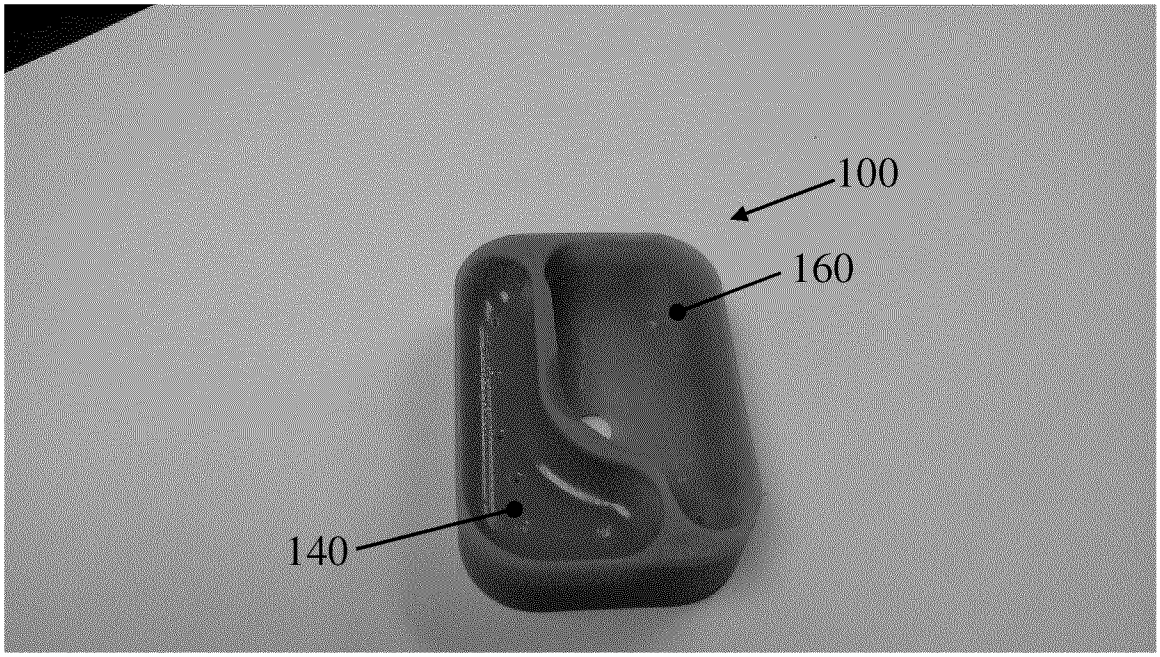
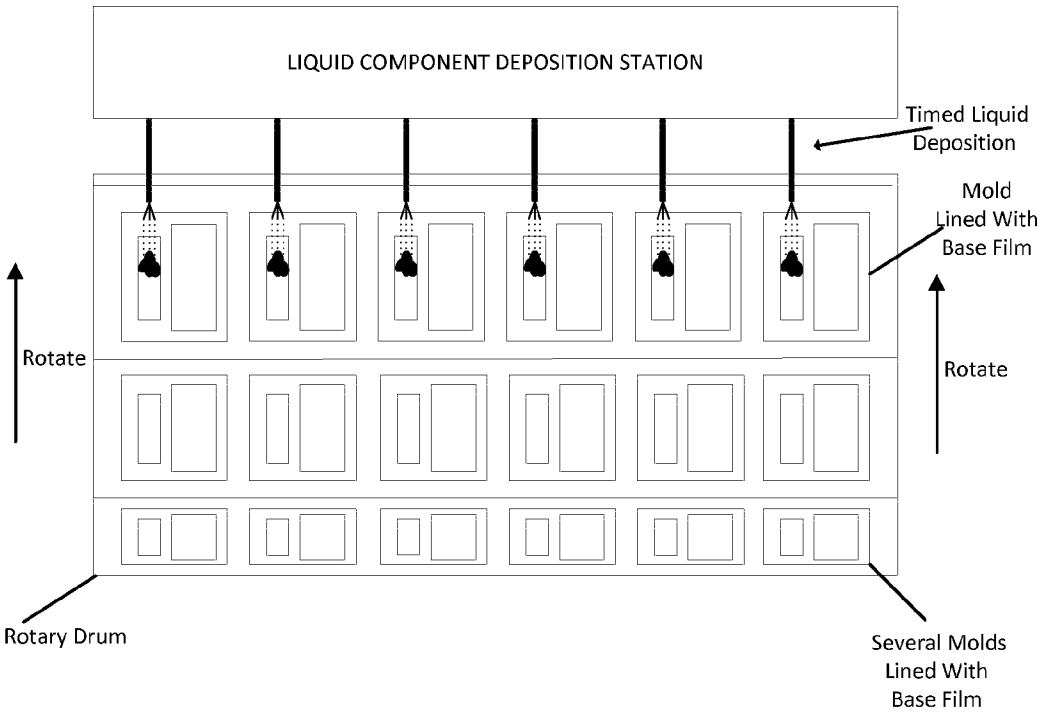
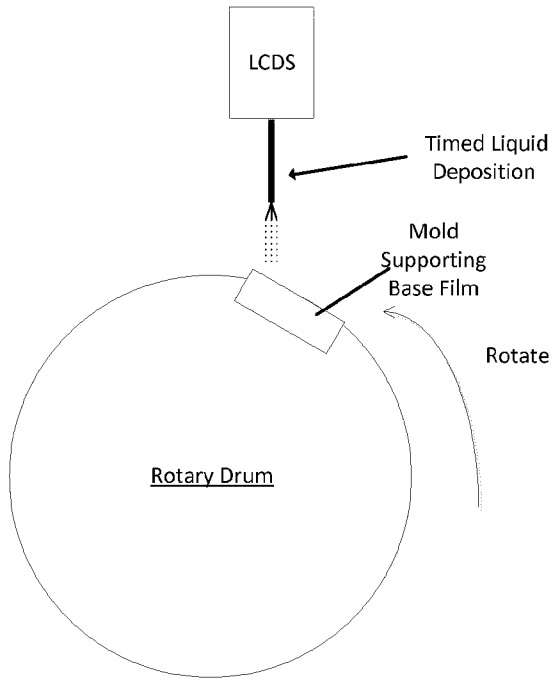
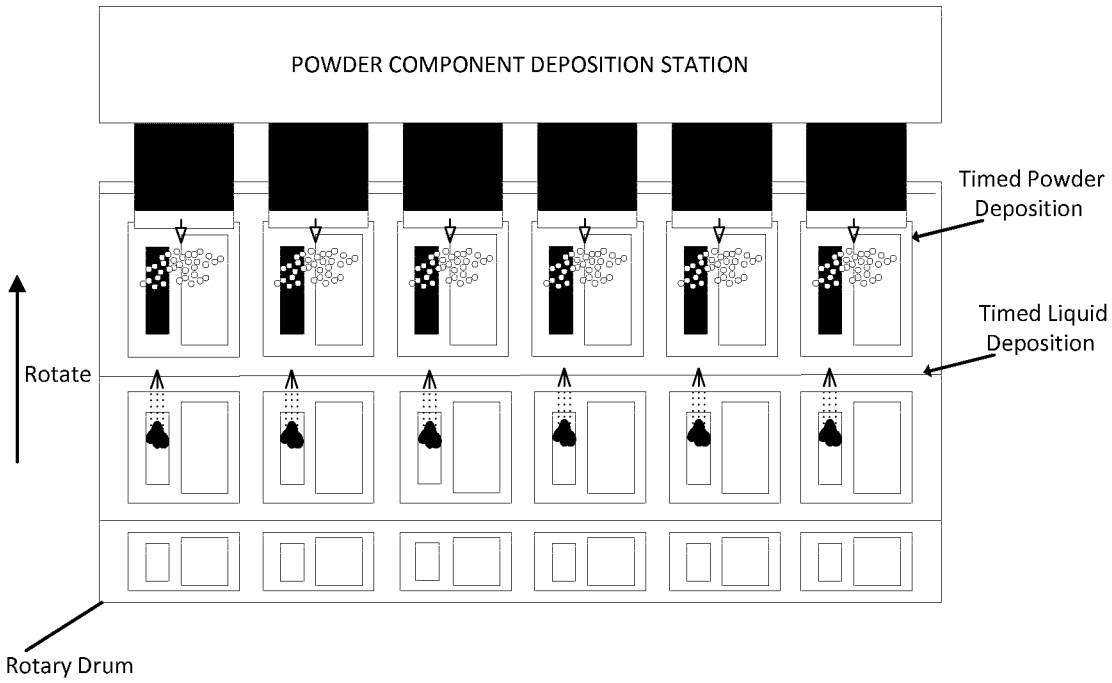


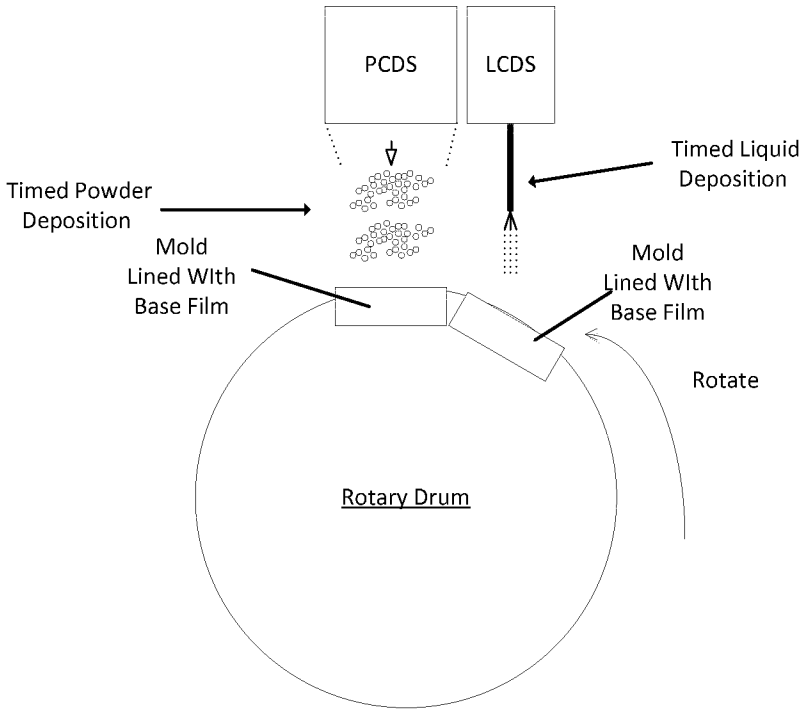
FIG. 5





FIGS. 6 (TOP) and 7 (BOTTOM)





FIGS. 8 (TOP) and 9 (BOTTOM)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2019/050104

A. CLASSIFICATION OF SUBJECT MATTER
IPC: ***C11D 17/08*** (2006.01) , ***B65D 65/46*** (2006.01)

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)
IPC: ***C11D*** and ***B65D***

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

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)
Intellect (Canadian Patent database) and Questel Orbit

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 8,008,241 B2 (The Procter & Gamble Company) 30 August 2011 (30-08-2011) (abstract; col.1, lines 6-9; col.3, lines 37-43 and lines 62-63; col.4, lines 1-5, 17-24, 29-39; col.19,	1-3 and 9-12
Y	lines 54-66 and claim 7)	4, 5 and 8
X	US 7,125,828 B2 (The Procter & Gamble Company) 24 October 2006 (24-10-2006) (abstract; claim 1; col.2, line 61 – col.3, line 2; col.3, lines 55-57; col.5, lines 27-30; col.18, line 61	1-3, 6-7, 12-13 and 16-19
Y	– col.19, line 9; col.19, lines 22-23; col.23, lines 47-66 and col.27, line 63 – col.28, line 8)	4, 5, 8, 14, 15 and 20
Y	CA 2,859,297 A1 (UNILEVER PLC) 27 June 2013 (27-06-2013) (page 10, lines 23-25)	4, 5, 15 and 20
Y	US 7,521,411 B2 (The Procter & Gamble Company) 21 April 2009 (21-04-2009) (abstract, col. 6, lines 33-41 and claim 5)	8 and 14

☐ Further documents are listed in the continuation of Box C.

☑ See patent family annex.

*	Special categories of cited documents:	"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
"A"	document defining the general state of the art which is not considered to be of particular relevance	"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
"E"	earlier application or patent but published on or after the international filing date	"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
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"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		

Date of the actual completion of the international search 2 May 2019 (02-05-2019)	Date of mailing of the international search report 13 May 2019 (13-05-2019)
Name and mailing address of the ISA/CA Canadian Intellectual Property Office Place du Portage I, C114 - 1st Floor, Box PCT 50 Victoria Street Gatineau, Quebec K1A 0C9 Facsimile No.: 819-953-2476	Authorized officer Irina Kargina (819) 576-2768

Box No. II **Observations where certain claims were found unsearchable (Continuation of item 2 of the first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claim Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claim Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claim Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III **Observations where unity of invention is lacking (Continuation of item 3 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

The features that link the subject matters defined in independent claims 1, 13, 16 and 19 are:

a unit dose detergent product comprising:

(i) Two chambers, formed from and separated by a water-soluble film;

(ii) At least a liquid-phase component in the first chamber; and

(iii) A powder-phase component in the second chamber.

However, all these features are known from D1 and D2. Therefore, there is *a posteriori* lack of unity of invention. The features (i), (ii) and (iii) are not technical features that define a contribution over the prior art.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☑ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claim Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

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Continued on "Extra Sheet" on page 18

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