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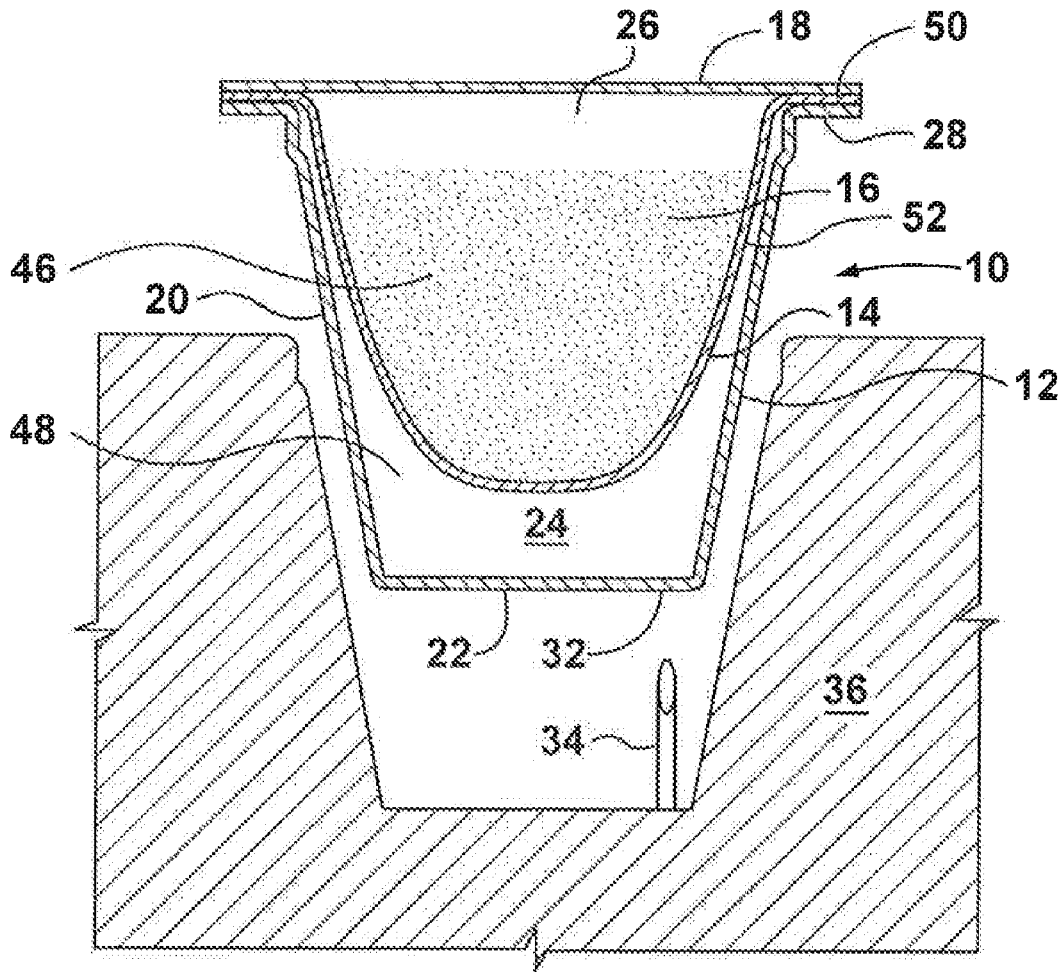
(19) **United States**(12) **Patent Application Publication****Fu et al.**(10) **Pub. No.: US 2017/0297811 A1**(43) **Pub. Date: Oct. 19, 2017**(54) **BEVERAGE CAPSULE WITH MOLDABLE FILTER**(71) Applicant: **2266170 Ontario Inc.**, Mississauga (CA)(72) Inventors: **YuCheng Fu**, Mississauga (CA);  
**Liberatore A. Trombetta**, Ancaster (CA)(21) Appl. No.: **15/636,731**(22) Filed: **Jun. 29, 2017****Related U.S. Application Data**

(62) Division of application No. 14/074,024, filed on Nov. 7, 2013.

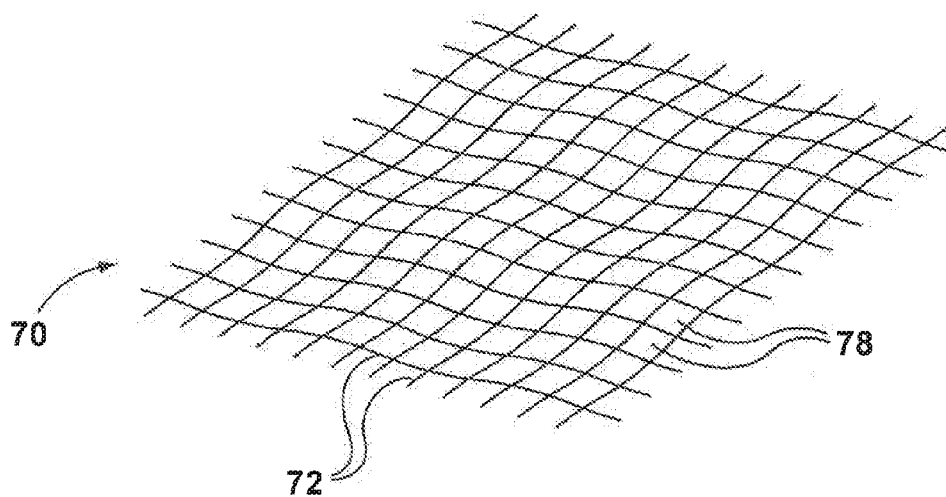
(60) Provisional application No. 61/723,644, filed on Nov. 7, 2012.

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CPC ..... **B65D 85/8043** (2013.01)(57) **ABSTRACT**

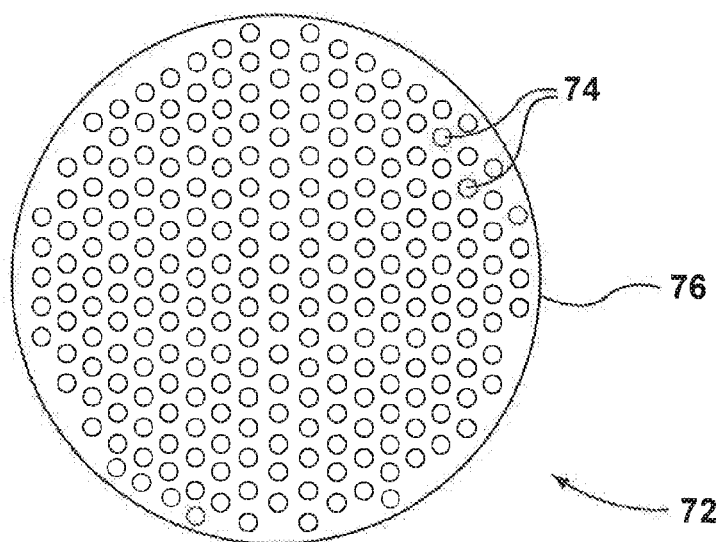
A method for making a beverage capsule for use in a beverage preparing machine disposes a moldable non-woven fabric over an opening defined by a body having an interior space. The fabric includes multi-component fibers that are constructed and arranged to be drawn to a desired depth. A portion of the fabric is sealed to a sealing layer disposed on the body. A portion of the fabric disposed over the opening is molded to the desired depth in the interior space to form a filter defining an ingredients chamber. Ingredients are disposed in the ingredients chamber for preparing a desired beverage. A cover disposed over the opening. The cover is sealed to the body.



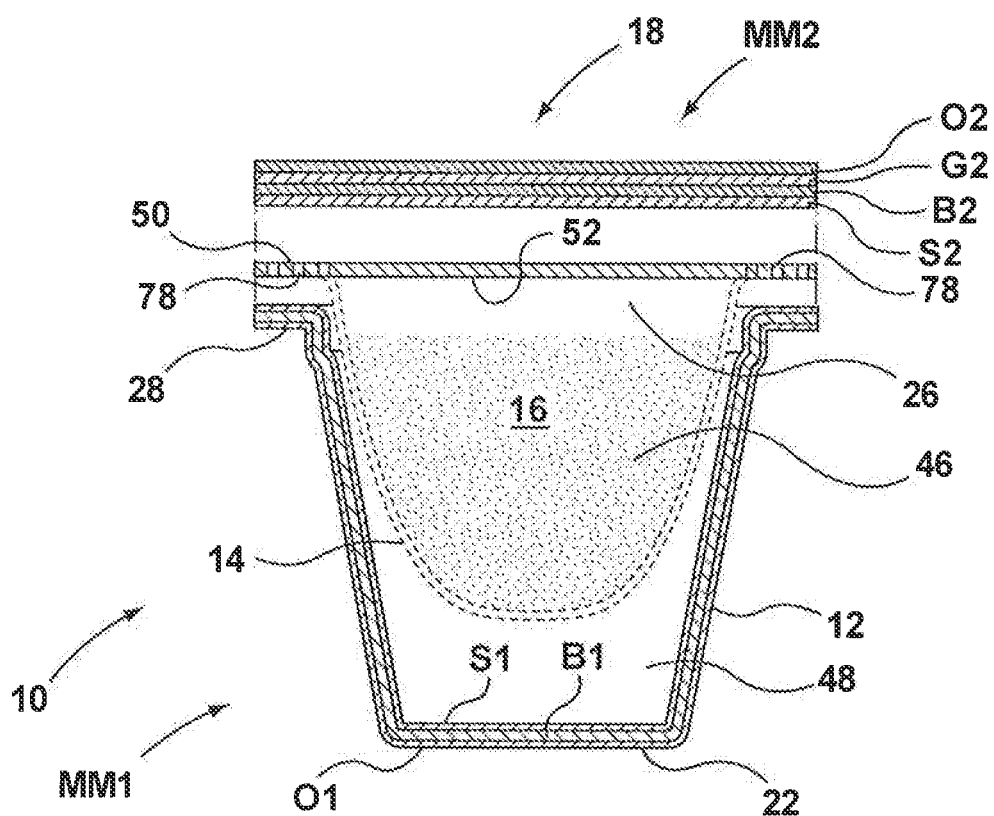




**FIG. 2**



**FIG. 3**



**FIG. 4**

## BEVERAGE CAPSULE WITH MOLDABLE FILTER

[0001] This application is a division of U.S. application Ser. No. 14/074,024 filed on Nov. 7, 2013 which claims the benefit of U.S. Provisional Application No. 61/723,644 filed on Nov. 7, 2012.

### FIELD

[0002] This specification relates to beverage capsules used in beverage preparing machines and in particular to beverage capsules having improved filter materials and methods for making same.

### BACKGROUND

[0003] The following background discussion is not an admission that anything discussed below is citable as prior art or common general knowledge. The documents listed below are incorporated herein in their entirety by this reference to them.

[0004] Single serve beverage capsules for use in beverage preparing machines are becoming increasingly popular. Such beverage capsules come in a variety of formats for producing beverages such as espresso coffee, drip coffee, tea or hot chocolate.

[0005] One example of a single serve beverage capsule is the Keurig K-Cup™ capsule. This beverage capsule includes a paper filter having a side wall that is sealed to an inside peripheral edge of a thermoformed body. The side wall of the filter is pleated or fluted to define channels extending between the top and bottom of the filter.

[0006] It is desirable to use moldable thermoplastic filter materials in place of paper filters for a variety of reasons including an improved taste profile, potential health benefits, barrier preservation, sedimentation control and manufacturing efficiencies.

[0007] There are a number of challenges to finding a suitable moldable polymer filter material however. In addition to meeting food grade requirements, it is desirable that the filter material be capable of being sealed in a sandwich between a flange and a cover for the beverage capsule. It is also desirable that the filter material be capable of being molded at high speed to a desired shape without tearing or otherwise compromising its filtering capabilities. It is also desirable that the filter material be stable at the operating temperatures for beverage preparing machines.

[0008] There is a need for a beverage capsule having an improved filter material that addresses the above challenges.

### SUMMARY

[0009] In one aspect the invention provides a beverage capsule for use in a beverage preparing machine, the beverage capsule comprising:

[0010] a body defining an opening;

[0011] a filter disposed in said opening and secured to said body, said filter being molded to define an ingredients chamber, said filter being formed of a moldable nonwoven fabric comprising fibers that are undrawn or partially drawn prior to molding;

[0012] ingredients disposed in said ingredients chamber for preparing a desired beverage; and

[0013] a cover disposed over said opening.

[0014] In another aspect the invention provides a beverage capsule for use in a beverage preparing machine, the beverage capsule comprising:

[0015] a body defining an opening;

[0016] a filter disposed in said opening and secured to said body, said filter being molded to define an ingredients chamber, said filter being formed of a moldable nonwoven fabric comprising multi-component fibers that are undrawn or partially drawn prior to molding, wherein said multi-component fibers are formed of materials including polyester;

[0017] ingredients disposed in said ingredients chamber for preparing a desired beverage; and

[0018] a cover disposed over said opening.

[0019] Other aspects and features of the teachings disclosed herein will become apparent, to those ordinarily skilled in the art, upon review of the following description of the specific examples of the specification.

### DRAWINGS

[0020] The drawings included herewith are for illustrating various examples of articles, methods, and apparatuses of the present specification and are not intended to limit the scope of what is taught in any way. For simplicity and clarity of illustration, where considered appropriate, reference numerals may be repeated among the drawings to indicate corresponding or analogous elements.

[0021] FIG. 1 is a sectional view of a beverage capsule in accordance with the present invention disposed in a schematic representation of a brew chamber for a beverage preparing machine;

[0022] FIG. 2 is enlarged schematic view of a filtration fabric for a beverage capsule in accordance with the present invention;

[0023] FIG. 3 is an enlarged schematic sectional view of a multi-component fiber for the filtration fabric shown in FIG. 2;

[0024] FIG. 4 is a sectional view of a beverage capsule in accordance with the present invention showing the process for sealing and forming the filter.

### DESCRIPTION OF VARIOUS EMBODIMENTS

[0025] Various apparatuses or methods will be described below to provide examples of the claimed invention. The claimed invention is not limited to apparatuses or methods having all of the features of any one apparatus or method described below or to features common to multiple or all of the apparatuses described below. The claimed invention may reside in a combination or sub-combination of the apparatus elements or method steps described below. It is possible that an apparatus or method described below is not an example of the claimed invention. The applicant(s), inventor(s) and/or owner(s) reserve all rights in any invention disclosed in an apparatus or method described below that is not claimed in this document and do not abandon, disclaim or dedicate to the public any such invention by its disclosure in this document.

[0026] A beverage capsule in accordance with the present invention is shown generally at 10 in the Figures. Beverage capsule 10 includes a body 12, filter 14, ingredients 16 and cover 18. Body 12, filter 14 and cover 18 are all formed of food grade materials (meaning materials that are considered to be safe for preparation of food products). Body and cover

are each formed of multilayered materials that include one or more barrier layers providing barriers against one or more environmental factors such as light, oxygen, and moisture.

[0027] Body 12 includes a side wall 20 and an end wall 22 together defining an interior space 24. An opening 26 is defined at one end of body 12. A flange 28 extends around the perimeter of opening 26. End wall 22 includes an extraction region 32 adapted for being pierced by an extraction needle 34 of a beverage preparing machine 36.

[0028] Filter 14 is adapted to be disposed within body 12 to define at least one ingredients chamber 46 in an upper region of the interior space 24 for receiving one or more ingredients 16 and at least one extraction chamber 48 exterior to the ingredients chamber 46 in the interior space 24 for receiving beverage from the at least one ingredients chamber 46 prior to extraction using the extraction needle 34.

[0029] Filter 14 includes a gasket portion 50 that is adapted to be disposed between flange 28 and cover 18. Filter 14 also includes a filter portion 52 located inwardly from gasket portion 50 that is adapted to be molded to a desired shape for filtering a beverage from ingredients 16.

[0030] In an alternative embodiment (not shown), body 12 does not include a side wall 20 and end wall 22 that define interior space 24. Body 12 instead comprises a structure that is adapted to support filter 14 and also support capsule 10 in beverage preparing machine 36 without fully enclosing filter 14. The structure may comprise flange 28 either on its own or in combination with a partial side wall 20. Filter 14 may be secured to either the top of flange 28 (preferable) or to side wall 20. Flange 28 may be sized to support capsule in beverage preparing machine 36. Cover 18 may be secured to flange 28, directly or over filter 14, as described herein.

[0031] Referring to FIGS. 2 and 3, filter 14 is formed of a moldable non-woven fabric 70 having a basis weight in the range of 40 to 150 grams per square meter (gsm) and more preferably between 60 to 120 gsm.

[0032] Fabric 70 is comprised of filaments or fibers 72 (referred to as fibers 72 hereafter) having a single component (homo-component) or multiple components (multi-component). Multi-component fibers 72 may have components arranged in configurations such as islands-in-the-sea, sheath-core or segmented pie. Preferably, fibers 72 comprise two components (bi-component) formed of a first material 74 and a second material 76. The bi-component fiber 72 may be arranged in an islands-in-the-sea configuration with first material 74 forming islands and second material 76 forming a sea as shown in FIG. 3. It will be seen that multiple strands of first material 74 form islands within the sea formed by second material 76.

[0033] First material 74, preferably has a higher tensile strength than second material 76 to provide sufficient integrity and strength to fabric 70. First material 74 also preferably has a higher melt temperature than the melt temperature of second material 76. First material 74 also preferably has a higher melt temperature than the melt temperature of the sealing layer of body 12 and the sealing layer of cover 18.

[0034] This allows gasket portion 50 of filter to be secured to flange 28 and cover 18 by way of a heat seal that melts second material 76 and the sealing layer of flange 28 while maintaining a web of first material 74 defining channels 78. Channels 78 are adapted to receive molten material from sealing layers for flange 28 and cover 18 during heat sealing to sandwich and seal gasket portion 50 of filter 14 between

flange 28 and cover 18. More details of filter 14 and the manner for securing filter 14 and cover 18 to flange 28 of body 12 are provided in co-pending patent application Ser. No. 13/600,582 which is incorporated in its entirety herein by reference.

[0035] First material 74 is preferably selected from polyamide (PA) such as nylon, polyethylene terephthalate (PET) and polyester such as polybutylene terephthalate (PBT) or polylactic acid (PLA). More preferably first material 74 is formed from PBT. Second material 76 is preferably selected from polyethylene (PE), polypropylene (PP) and PA. More preferably second material is formed from PE. It is preferable that first material 74 comprises at least 50% of the fibers 72 and more preferable that first material 74 comprises at least 70% of the fibers 72.

[0036] Fabric 70 preferably comprises undrawn or partially drawn fibers 72 in order that fibers 72 have the capability to be drawn sufficiently during the filter molding process to form a desired depth of filter 14. Fibers 72 may for instance be formed by melting and spinning selected polymers at low air drawing and/or low spinning speeds. It is preferred that a lower spinning speed is selected to optimize the amount of undrawn or partially drawn fibers.

[0037] Fibers 72 may be bonded together mechanically, thermally or chemically. Preferably, fibers 72 are mechanically bonded through hydroentanglement or needle punching. More preferably, fibers 72 are mechanically bonded through hydroentanglement.

[0038] Some examples of manufacturing processes, configurations and materials for forming fabric 70 are provided below:

Process	Cross section	First material	Second material	Bonding method
Spun-bond	Homo-component, round		PP	Thru-air bonding/calendaring/hydro-entangling/ultrasonic
Spun-bond	Round, Islands in the sea, 7 islands or higher	Island material-polyester, PA (50-90%)	Sea material-PE, PP, PA (10-50%)	Thru-air bonding/calendaring/hydro-entangling/ultrasonic
Spun-bond	Round, sheath-core	Core material-polyester, PA (50-90%)	Sheath material-PE, PP, PA (10-50%)	Thru-air bonding/calendaring/hydro-entangling/ultrasonic
Spun-bond	Round, segmented pie	Polyester, PA (50-90%)	PE, PP, PA (10-50%)	Thru-air bonding/calendaring/hydro-entangling/ultrasonic
Melt-blown	Homo-component, round		PP, PE, PA	None, calendaring, or ultrasonic bonding
Melt-blown	Round, sheath-core	Core material-polyester, PA (50-90%)	Sheath material-PE, PP, PA (10-50%)	None, calendaring, or ultrasonic bonding

[0039] Referring to FIG. 4, an exploded sectional view of a beverage capsule 10 in accordance with the present invention is shown.

[0040] Beverage capsule 10 includes body 12 formed of a conventional multilayered material MM1 that includes a barrier layer B1 preferably formed of ethylene vinyl alcohol

(EVOH) and a sealing layer S1 preferably formed of polyethylene (PE). As well, body 12 may include outer base layer O1 preferably formed of polyolefin or polyester or other materials adapted to cover and protect barrier layer B1.

[0041] Beverage capsule 10 further includes cover 18 formed of a conventional multilayered material MM2 that includes a barrier layer B2 preferably formed of aluminum foil or metalized polyester or EVOH and a sealing layer S2 preferably formed of polyolefin. As well, cover 18 may include an outer base layer O2 preferably formed of polyolefin or polyester and a graphics layer G2 preferably formed of ink.

[0042] Filter 14 is formed by disposing fabric 70 over opening 26 of body 12. Gasket portion 50 of filter 14 engages sealing layer S1 disposed on the top surface of flange 28 and filter portion 52 extends across opening 26. Gasket portion 50 is then sealed with a heat sealer (not shown) to sealing layer S1 disposed on the top surface of flange 28. A portion of the sealing layer S1 on top surface of flange 28 and a portion of second material 76 of fabric 70 is melted by heat sealer and flows into channels 78 within gasket portion 50 of fabric 70. Once the melted material sufficiently cools to support gasket portion 50 on flange 28, then filter 14 may be molded for instance by engaging filter portion 52 using a heated mandrel (not shown) to mold filter portion 52 to a desired shape within interior space of body 12 to form the ingredients chamber 46. Then ingredients 16 are disposed within ingredients chamber 46 of filter 14 and cover 18 is positioned over gasket portion 50 to cover opening 26.

[0043] Cover 18 may then be partially sealed to gasket portion 50 using a heat sealer. A portion of the sealing layer S2 on bottom surface of cover 18 and a portion of second material 76 of fabric 70 is melted by heat sealer (not shown) and flows into channels 78 of gasket portion 50. The air within interior space 24 of capsule 10 may then be evacuated and replaced with an inert gas such as nitrogen. Cover 18

may then be fully sealed to body 12 over gasket portion 50 to seal the interior space 24 of capsule 10. In particular, cover 18 may be heated to the melt temperature of sealing layer S2 so that the material of sealing layer S2 and second material 76 of fabric 70 at least partially flows into channels 78 of gasket portion 50 to form a seal upon cooling.

[0044] While the above description provides examples of one or more processes or apparatuses, it will be appreciated that other processes or apparatuses may be within the scope of the accompanying claims.

I/We claim:

1. A method for making a beverage capsule for use in a beverage preparing machine, said method comprising the steps of:

disposing a moldable non-woven fabric over an opening defined by a body having an interior space, said fabric comprising multi-component fibers that are constructed and arranged to be drawn to a desired depth;  
sealing a portion of said fabric to a sealing layer disposed on said body;  
molding a portion of said fabric disposed over said opening to said desired depth in said interior space to form a filter defining an ingredients chamber;  
disposing ingredients in said ingredients chamber for preparing a desired beverage;  
disposing a cover over said opening; and  
sealing said cover to said body.

2. The method of claim 1 further comprising the step of evacuating air from said interior space and replacing with an inert gas.

3. The method of claim 1, wherein said body includes a flange that extends around the perimeter of said opening, said fabric being sealed to said sealing layer disposed on said flange.

4. The method of claim 3, wherein said cover is sealed to said fabric on said flange.

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