US 20150099042A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2015/0099042 A1**

(43) **Pub. Date: Apr. 9, 2015**

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(54) **COFFEE CAPSULE WITH DIFFUSER FOR SINGLE SERVE BREWER**

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(21) Appl. No.: **14/046,236**

(22) Filed: **Oct. 4, 2013**

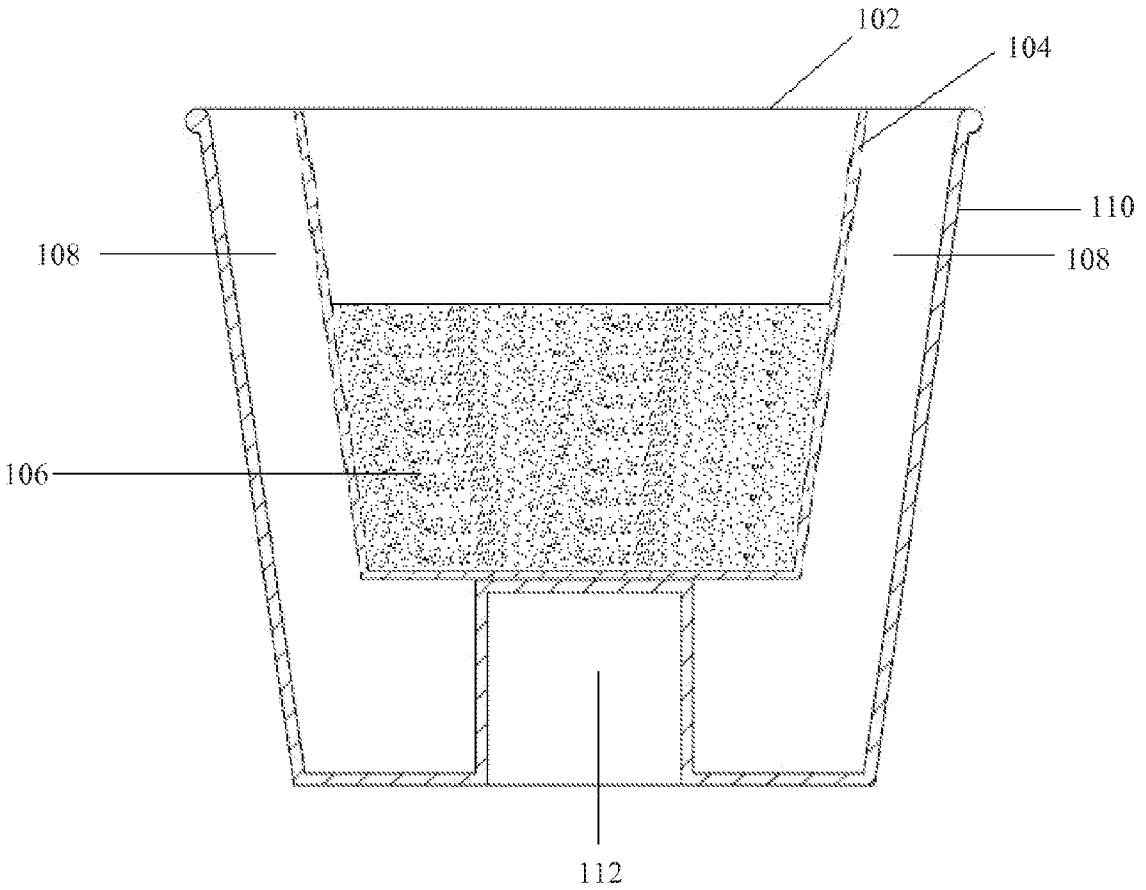
Publication Classification

(51) **Int. Cl.**
B65D 85/804 (2006.01)

(52) **U.S. Cl.**
CPC ***B65D 85/8043*** (2013.01)

(57) **ABSTRACT**

The invention is directed toward a capsule for use in a single serve beverage brewing machine. The capsule forms a chamber with a film cover sealing the chamber for the brewing of a beverage. At the base of the capsule the external wall of the capsule protrudes into the body of the capsule chamber to form a diffuser. The base of the paper filter cup rests on the diffuser. The top rim of the paper filter cup is attached to the film cover. Between the walls of the paper filter cup and the external capsule wall is a vertical flow channel. During the brewing process water initially flows through the extractable ingredient in the paper filter, circulates upward within the vertical flow channel, back through the paper filter, and recirculates through the extractable ingredient.



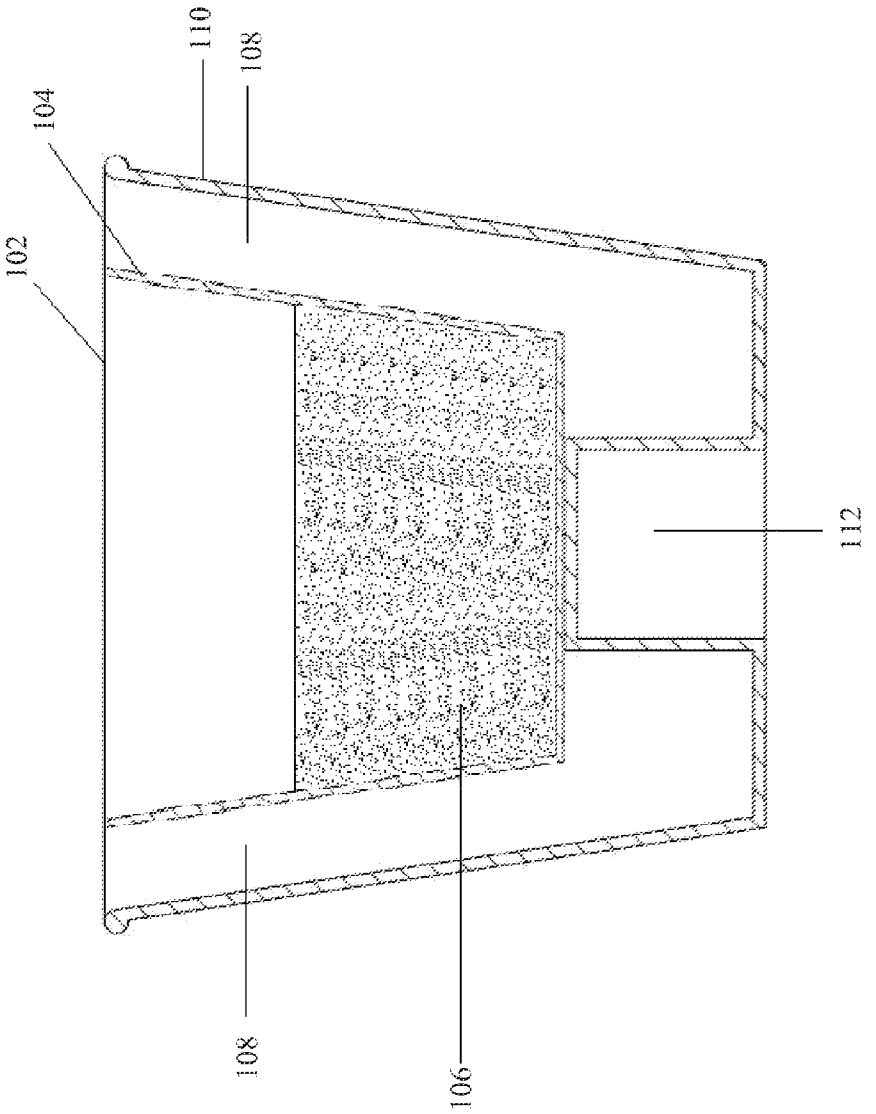


Fig. 1

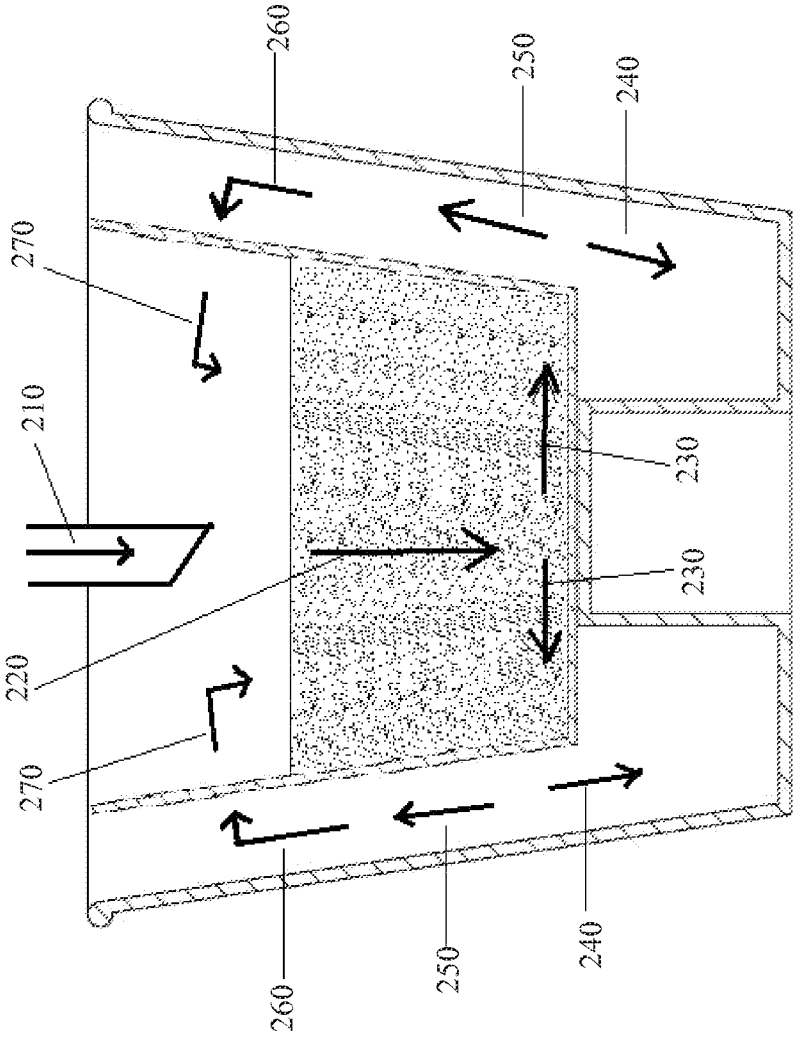


Fig. 2

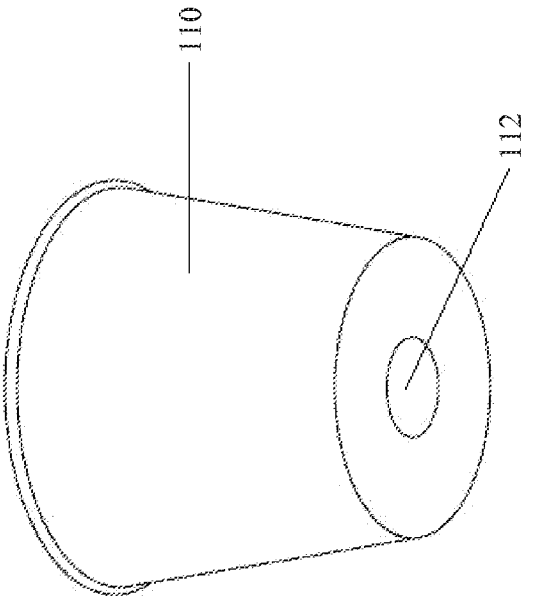


Fig. 3

COFFEE CAPSULE WITH DIFFUSER FOR SINGLE SERVE BREWER

FIELD OF THE INVENTION

[0001] The present invention relates to the brewing of single serve beverages and more particularly to a capsule for preparing a beverage containing extractable beverage ingredients such as coffee in a beverage production machine.

BACKGROUND OF THE INVENTION

[0002] Single serve beverage brewing capsules are popular and well known. They provide a convenient and easy means for individuals to brew coffee or tea in a limited amount. In the standard embodiment of the prior art, the beverage capsule is formed from a small cup of thermoplastic material. The cup has a flat circular base and cylindrical side walls. The top of the cup is sealed with a film of aluminum or plastic. This creates an airtight chamber within the cup. The walls may be tapered such that the diameter at the top of the cup is larger than the diameter at the bottom of the cup. The bottom of the cup may have a small circular indentation in the center of the base. The small circular indentation may be about half of the diameter of the base and has negligible depth.

[0003] Inside this cup is placed a paper filter. The substance which is intended to brewed, such as coffee or tea, is ground into a powder and placed into the paper filter. The paper filter is welded to the top of the cup and narrows in diameter toward the bottom, creating an empty space between the wall of the cup and the paper filter toward the bottom of the cup. When placed in a machine for brewing, the machine punctures a hole in through the film with a water pipe. The water pipe pumps hot pressurized water into the cup. The hot pressurized water passes through the grounds and extracts soluables from the grounds to create the beverage. Shortly after the hot pressurized water is pumped into the cup, a hole is punctured into the base of the cup to allow the brewed beverage to drain out of capsule and into a cup.

[0004] Standard single serve beverage cups are limited in construction. Beverages such as coffee or tea brew by a specific extraction process. This extraction process depends on a series of factors, including the size of the ground particulate material, the temperature of the water, and the length of time that the water and the particulate material interact. As the length of time of the interaction between the water and the particulate material increases, more extraction of the particulate material occurs. More extraction creates a more flavorful and desireable beverage. Machines designed to utilize single serve capsules have a set period of time programmed for the interaction of the water and the particulate material before the hole in the bottom of the capsule is punctured and the water is released from the capsule. The moment the water leaves the capsule, the extraction process ceases. Because users cannot change the length of time the machine leaves the water in the capsule, there is no means for a user to create a more robust and flavorful beverage based on varying the machine settings.

[0005] Another limitation of the standard single serve capsule is that the flow of the water within the capsule does not occur in a manner which enhances the interaction between the water and the grounds. Pressurized hot water is pumped in through the top water pipe. As the hot water reaches the capsule, the liquid expands out to fill all available space within the capsule. This causes the water to flow immediately through the grounds and filter and into the void area under the filter. Because pressurized hot water is continuously pumped in, water that has already passed through the filter does not move upward to interact with the grounds a second time.

[0006] Additional prior art is known which attempts to solve this problem. U.S. Pat. No. 8,263,148, Yoakim, et al. attempts to solve this problem by restricting the outward flow of the water from the capsule and maintain the internal pressure of the capsule to present a longer period of time for the interaction of the water and the particulate material. This is performed by means of two layers of paper filters that restrict the flow of water away from the particulate material. This solution is limited in that it requires additional material to be utilized in the construction of the capsule which increases the cost of production. Furthermore, it presents risk of loss of effectiveness if the layers of the paper filters become separated during the manufacturing process and is not perceived during the quality control process. Furthermore, it does not change the flow of the water in the capsule. The hot water still passes over the particulate material once.

[0007] Standard coffee brewing methods teach that hot water is passed over the coffee grounds once for extraction. Standard capsules are designed to reproduce this method of brewing. Once hot water passes through the coffee grounds in a capsule the pressure of the continuous water input prevents the resulting brew from reinteracting with the coffee grounds. Besides the standard method of brewing coffee, the Turkish brewing method teaches that the water and the coffee grounds interact multiple times to increase the amount of extraction. In the Turkish method, the water and coffee grounds are boiled in a pot. The mixture is brought to a boil three times. This boiling method results in a turbulent mixture between the water and coffee grounds and increases the extraction of the coffee which produces a robust and flavorful coffee. What is needed is a single serve capsule that recreates the turbulent interaction between the water and coffee that occurs in the Turkish coffee brewing method and causes the hot water to pass over the coffee grounds multiple times.

SUMMARY OF THE INVENTION

[0008] The invention is directed toward a single serve capsule for use in a coffee brewing machine. The cup base contains a diffuser which protrudes into the body of the capsule. When the hot pressurized water is pumped into the capsule the water passes through the particulate material and the paper filter, creating an extract. As the resulting extract encounters the diffuser, the extract is forced laterally. This resulting turbulence causes the extract to recircle back through the paper filter along the outer wall of the capsule. The extract has a second chance to interact with the particulate material, increasing the amount of extract.

[0009] The invention displays improved extraction results when compared over the prior art. Tests on conventional single serve capsules display test results showing that the resulting brewed beverage results in 15.27% extraction with 0.771% of brewed solids. The identical tests performed on the invention display test results showing that the resulting brewed beverage results in in 17.56% extraction with 0.883% of brewed solids.

[0010] The invention is directed toward a capsule for producing a beverage in a beverage production machine comprising an external capsule wall forming a chamber for the brewing of an instant beverage, a film cover, a paper filter cup, and an extractable beverage ingredient. In this embodiment of the invention the external capsule wall has an upper edge, the

film cover is sealed to the upper edge of the external capsule wall, the paper filter cup is within the chamber of the external capsule wall, the extractable beverage ingredient is within the paper filter cup, and the external capsule wall includes a diffuser protruding into the capsule chamber from the base of the capsule.

[0011] In another embodiment of the invention the top rim of the paper filter cup may be attached to the film cover. Furthermore, the paper filter cup may be cylindrical in shape. The top diameter of the paper filter cup is between 1.5 inches and 1.75 inches and the bottom diameter of the base of the paper filter cup is between 1.25 inches and 1.5 inches. The vertical length of the paper filter cup is 1.25 inches. Furthermore, the base of the paper filter cup rests on the diffuser. In addition, this embodiment may further comprise a vertical flow channel between the wall of the paper filter cup and the external capsule wall wherein the vertical flow channel extends the entire vertical length of the wall of the paper filter cup. Furthermore the vertical flow channel surrounds the entire circumference of the paper filter cup. The diffuser may be cylindrical in shape. The diffuser may be between 0.5 inches and 0.75 inches in diameter. In one specific embodiment the diffuser has a diameter of 0.5 inches. In one specific version of this embodiment the top diameter of the paper filter cup is 1.5 inches and the bottom diameter of the base of the paper filter cup is 1.25 inches. In another specific version of this embodiment the top diameter of the paper filter cup is 1.75 inches and the bottom diameter of the base of the paper filter cup is 1.5 inches.

[0012] In another embodiment of the invention the invention is directed toward a capsule for producing a beverage in a beverage production machine comprising an external capsule wall forming a chamber for the brewing of an instant beverage, a film cover, a paper filter cup, an extractable beverage ingredient wherein the external capsule wall has an upper edge, and a vertical flow channel between the wall of the paper filter cup and the external capsule wall. In this embodiment the film cover is sealed to the upper edge of the external capsule wall, the paper filter cup is within the chamber of the external capsule wall, the extractable beverage ingredient is within the paper filter cup, the external capsule wall includes a diffuser protruding into the capsule chamber from the base of the capsule, and the vertical flow channel extends the entire vertical length of the wall of the paper filter cup. Furthermore, the vertical flow channel surrounds the entire circumference of the paper filter cup.

[0013] In another embodiment of the invention the invention is directed toward a capsule for producing a beverage in a beverage production machine comprising an external capsule wall forming a chamber for the brewing of an instant beverage, a film cover, a paper filter cup, an extractable beverage ingredient wherein the external capsule wall has an upper edge, and a vertical flow channel between the wall of the paper filter cup and the external capsule wall. In this embodiment the film cover is sealed to the upper edge of the external capsule wall, the paper filter cup is within the chamber of the external capsule wall, the extractable beverage ingredient is within the paper filter cup, the external capsule wall includes a diffuser protruding into the capsule chamber from the base of the capsule, the top rim of said paper filter cup is attached to said film cover, the paper filter cup is cylindrical in shape, the top diameter of the paper filter cup is between 1.5 inches and 1.75 inches, the bottom diameter of the base of the paper filter cup is between 1.25 inches and 1.5 inches, the vertical length of the paper filter cup is 1.25 inches, and the vertical flow channel extends the entire vertical length of the wall of the paper filter cup. Furthermore, the vertical flow channel may surround the entire circumference of the paper filter cup.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] FIG. **1** is a perspective view of the capsule

[0015] FIG. **2** is a view of the internal water flow of the capsule

[0016] FIG. **3** is an oblique view of the capsule

DETAILED DESCRIPTION OF THE DRAWINGS

[0017] Although the present invention will be described with reference to the exemplary embodiments shown in the drawings, it should be understood that the present invention can be embodied in many alternate forms or embodiments.

[0018] Referring to FIG. **1**, a cut away perspective view of the capsule is displayed. The capsule is comprised of an external capsule wall **110**, a paper filter **104**, a film cover **102**, and an extractable ingredient **106**. Located at the bottom base of the capsule is a diffuser **112** which protrudes into the inner chamber of the capsule. In the preferred embodiment the diffuser **112** is a round protrusion of the external capsule wall **110**. As seen in FIG. **3**, the diffuser **112** is approximately one half of the diameter of the base diameter of the capsule. The diffuser **112** may be of any size or shape to effectuate its purpose. The diffuser **112** forms a platform in inner chamber of the capsule. The lower base of the paper filter **104** rests on the platform of the diffuser **112**.

[0019] The upper rim of the paper filter **104** is attached to the film cover **102**. Between the wall of the paper filter **104** and the external wall of the capsule **110** is a vertical flow channel **108**. The vertical flow channel **108** extends around the entire circumference of the paper filter **104**. Contained within the paper filter **104** is the extractable material **106**. The extractable material **106** may be coffee or tea. The extractable material **106** may comprise a mixture of ingredients for the purpose of creating a flavored beverage.

[0020] The capsule is designed to properly effectuate the flow of hot pressurized water within the inner chamber of the capsule as shown in FIG. **2**. The hot pressurized water flows from the water pipe **210** of a single serve beverage brewing machine. The first flow step **220** the water flows downward through the extractable ingredient **106**. The down flow of the water in the first flow step **220** causes the water to impact the diffuser **112**. The impact of the water on the diffuser causes the water to move laterally through the extractable ingredient in the second flow step **230**. The water passes through the paper filter **104** and impacts the external capsule wall **110**. The impact of the water on the external cellular wall **110** causes the water to split into two flow paths. Part of the water flows downward along the external capsule wall **110** through the third flow step **240**. The pressure of the water causes part of the water to flow upward along the external capsule wall **110** through the fourth flow step **250**. The upward flowing water then encounters the film cover **102**. When the upward flowing water encounters the film cover, the water is pushed inward and back through the paper filter **104** in the fifth flow step **260**. After the water passes back through the paper filter **104** the water encounters the initial stream of hot pressurized water emitting from the water pipe **210**. The flow of the water then flows through the sixth flow step **270** and flows back

down through the extractable ingredient **106**. In this manner the water recirculates through the extractable ingredient **106**. This method causes greater extraction and a more flavorful product. When the brewing process is complete the water passes out of holes punched in the base of the capsule by the single serve beverage brewing machine.

1. A capsule for producing a beverage in a beverage production machine comprising

An external capsule wall forming a chamber for the brewing of an instant beverage

Wherein said external capsule wall has an upper edge

A film cover

Wherein said film cover is sealed to said upper edge of said external capsule wall

A paper filter cup

Wherein said paper filter cup is within said chamber of said external capsule wall

An extractable beverage ingredient

Wherein said extractable beverage ingredient is within said paper filter cup

Wherein said external capsule wall includes a diffuser protruding into the capsule chamber from the base of the capsule.

2. The capsule as in claim **1**

Wherein the top rim of said paper filter cup is attached to said film cover

3. The capsule as in claim **2**

Wherein said paper filter cup is cylindrical in shape

Wherein the top diameter of said paper filter cup is between 1.5 inches and 1.75 inches

Wherein the bottom diameter of the base of said paper filter cup is between 1.25 inches and 1.5 inches

Wherein the vertical length of said paper filter cup is 1.25 inches

4. The capsule as in claim **3**

Wherein the base of said paper filter cup rests on said diffuser

5. The capsule as in claim **4**

Further comprising a vertical flow channel between the wall of said paper filter cup and said external capsule wall

Wherein said vertical flow channel extends the entire vertical length of the wall of said paper filter cup

6. The capsule as in claim **5**

Wherein said vertical flow channel surrounds the entire circumference of said paper filter cup

7. The capsule as in claim **6**

Wherein said diffuser is cylindrical in shape

8. The capsule as in claim **7**

Wherein said diffuser is between 0.5 inches and 0.75 inches in diameter

9. The capsule as in claim **8**

Wherein said diffuser has a diameter of 0.5 inches

10. The capsule as in claim **9**

Wherein the top diameter of the paper filter cup is 1.5 inches

Wherein the bottom diameter of the base of the paper filter cup is 1.25 inches

11. The capsule as in claim **9**

Wherein the top diameter of the paper filter cup is 1.75 inches

Wherein the bottom diameter of the base of the paper filter cup is 1.5 inches

12. The capsule as in claim **1**

Further comprising a vertical flow channel between the wall of said paper filter cup and said external capsule wall

Wherein said vertical flow channel extends the entire vertical length of the wall of said paper filter cup

13. The capsule as in claim **12**

Wherein said vertical flow channel surrounds the entire circumference of said paper filter cup

14. The capsule as in claim **3**

Further comprising a vertical flow channel between the wall of said paper filter cup and said external capsule wall

Wherein said vertical flow channel extends the entire vertical length of the wall of said paper filter cup

15. The capsule as in claim **14**

Wherein said vertical flow channel surrounds the entire circumference of said paper filter cup

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