

BEVERAGE FILTER CARTRIDGE

CROSS REFERENCE TO RELATED APPLICATIONS

5 This application claims priority from U.S. Provisional Patent Application Serial No. 60/183,708 filed 02/18/2000 and U.S. Utility Patent Application filed on February 13, 2001 (serial no. unknown), both of which are incorporated herein by reference in their entirety.

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FIELD OF THE INVENTION

 This invention relates to disposable single serve beverage filter cartridges.

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DESCRIPTION OF THE PRIOR ART

 A known disposable single serve beverage filter cartridge is disclosed in U.S. Patent Nos. 5,325,765 and 5,840,189 (Sylvan et al.), dated respectively July 5, 1994
20 and November 24, 1998, the disclosures of which are herein incorporated by reference.

 This beverage filter cartridge is comprised basically of an impermeable yieldably-piercable cup-shaped outer container internally subdivided by a permeable cone-shaped filter into first and second chambers. A granular or powdered dry beverage medium, e.g., roasted ground coffee, is stored in the first chamber, and the
25 container is closed by an impermeable yieldably piercable lid.

 During a processing cycle, the lid and container bottom are pierced, respectively, by tubular inlet and outlet probes. The inlet probe admits heated liquid under pressure into the first chamber for infusion with the beverage medium, and the resulting brewed beverage passes through the filter into the second chamber from
30 which it exits via the outlet probe for delivery to an underlying cup.

 This known beverage filter cartridge has gained rapid and increasingly widespread acceptance, notwithstanding several problems that have persisted since its initial introduction. One such problem stems from a tendency of the container side

wall to buckle under the force exerted by the outlet probe as it pierces the container bottom. This sometimes results in a failure of the outlet probe to achieve bottom penetration, thus aborting the brewing process because the brewed beverage cannot be delivered to the underlying cup. Buckling of the container side wall also can distort the
5 punctured orifice in the container bottom, thus compromising sealing and resulting in leakage of the brewed beverage.

Problems have also been encountered in reliably sealing the rim of the filter component to the interior side wall of the container, as well as in centrally securing the bottom of the filter component to the container bottom. Failure to achieve a proper rim
10 seal can cause the unsealed portion of the filter to collapse under brew pressure, resulting in the brewed beverage being contaminated by beverage medium residue escaping from the collapsed filter. By the same token, contamination of the brewed beverage also can occur if the filter bottom is not centrally secured, resulting in the filter being punctured by the outlet probe as it projects upwardly through the container
15 bottom. Contamination of the brewed beverage also occurs occasionally when a filter element bursts under the pressure exerted by the heated liquid being infused with the beverage medium.

Still another problem stems from heat sealing the upper rim of the filter at or closely adjacent to the upper rim of the container side wall. This increases the
20 unoccupied so called "head space" between the outside of the filter and the surrounding container wall, and also limits the maximum amount of beverage medium that can be stored in the cartridge to that which can be contained within the filter. In some cases, this can compromise the strength of the resulting brewed beverage. Beverage strength can be optimized by filling the filter to its maximum capacity, but this can result in
25 errant granules of the beverage medium spilling onto the container rim. This in turn can disrupt the integrity of the seal between the cover and the container rim.

Among the objectives of the present invention is a strengthening of the container side wall to thereby resist buckling when the container bottom is punctured by the outlet probe of the brewer.

30 Companion objectives include a beneficial increase in beverage medium storage capacity, improvements in the manner in which the filter component is sealed to and radially supported by the container side wall, as well as improvements in the manner in which the lower end of the filter is positioned and anchored to the cartridge bottom.

SUMMARY OF THE INVENTION

In accordance with the present invention, the container side wall is provided with circumferentially spaced flutes which are strategically positioned to enhance resistance to buckling without interfering with or compromising the integrity of the seal between the side wall and the filter component. The location at which the filter component is joined to the interior side wall of the container is lowered to achieve a beneficial increase in beverage medium storage capacity. This location is defined by a tapered circular ledge against which the tapered filter component is reliably sealed.

10 The channels formed between the circumferentially spaced flutes serve to efficiently direct the brewed beverage downwardly towards the pierced container bottom, with an accompanying beneficial increase in turbulence in the head space defined between the filter element and container side wall.

In a second embodiment of the invention, the container bottom is configured to provide a downwardly protruding centrally disposed boss defining a reduced diameter interior sump surrounded by an annular planar bottom area. The annular bottom area is available for piercing by the outlet probe. The filter projects downwardly into and is secured within the sump at a location safely out of harms way with respect to the piercing action of the outlet probe. A beneficial decrease in head space is also realized by locating the lower end of the filter in the reduced diameter sump.

In a third embodiment of the present invention, the circumferentially spaced flutes protrude sufficiently inwardly into the container interior to radially contact the filter element at circumferentially spaced locations. This radial contact beneficially guides the filter element into its centrally located position during assembly of the cartridge components, and, during the processing cycle, provides radial support which resists distortion and possible bursting of the filter element.

These and other features, objectives and advantages of the present invention will now be described in greater detail with reference to the accompanying drawings, wherein:

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BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of a disposable beverage filter cartridge in

accordance with one embodiment of the present invention;

Figure 2 is an exploded perspective view of the basic components of the beverage filter cartridge shown in Figure 1;

Figure 3 is a side elevational view of the beverage filter cartridge shown in
5 Figure 1;

Figures 4 and 5 are vertical and horizontal sectional views taken, respectively, on lines 4-4 and 5-5 of Figure 3;

Figure 6 is an enlarged sectional view of a rim portion of the filter cartridge as shown in Figure 4;

10 Figure 7 is an enlarged view of a portion of the side wall of the beverage cartridge;

Figure 8 is a sectional view taken along line 8-8 of Figure 7;

Figure 9 is a bottom perspective view of a disposable filter cartridge in accordance with a second embodiment of the present invention;

15 Figure 10 is a side elevational view of the filter cartridge shown in Figure 9;

Figure 11 is a bottom view of the filter cartridge shown in Figures 9 and 10;

Figure 12 is an enlarged cross sectional view taken along line 12-12 of Figure
10;

Figure 13 is a perspective view of a disposable beverage filter cartridge in
20 accordance with a third embodiment of the present invention;

Figure 14 is an exploded perspective view of the components of the beverage filter cartridge shown in Figure 13;

Figure 15 is a side elevational view looking in the direction depicted by the arrow "x" in Figure 13;

25 Figure 16 is another side elevational view looking in the direction depicted by the arrow "Y" in Figure 13;

Figure 17 is an enlarged bottom view of the beverage filter cartridge shown in Figures 13-16;

Figure 18 is an enlarged vertical sectional view taken along line 18-18 of Figure
30 16;

Figure 19 is a vertical sectional view taken along line 19-19 of Figure 18;

Figure 20 is a horizontal sectional view taken along line 20-20 of Figure 19;

and

Figure 21 is an enlarged sectional view of a rim portion of the cartridge as shown in Figures 18 and 19.

5 DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

With reference initially to Figures 1-5, a beverage filter cartridge in accordance with a first embodiment of the invention is generally depicted at 10. As shown in Figure 2, the basic components of the beverage filter cartridge include an outer cup-shaped container 12, a generally cone-shaped filter element 14, and a planar circular lid 16.

The cup-shaped container 12 has a bottom 18, and a side wall 20 extending upwardly from the bottom to a circular rim 22 surrounding an upper opening 24. With reference additionally to Figures 6-8, it will be seen that the side wall 20 has an upper section 20a extending downwardly from the rim 22 to an intermediate section defined by an inwardly tapered ledge 20b, and a lower tapered section 20c extending downwardly from ledge 20b to the bottom 18.

The upper wall section 20a is preferably subdivided into upper and lower segments 20a' and 20a''. Moving down the cup, segment 20a' is flared outwardly, and segment 20a'' tapers inwardly, with the juncture therebetween defining a stacking shoulder 20d. The bottom 18 is optionally and preferably provided with an upwardly protruding central boss 18a.

The lower tapered wall section 20c is configured to provide a plurality of circumferentially spaced flutes 20e, the upper ends of which terminate beneath the intermediate section defined by ledge 20b, and the lower ends of which terminate as indentations in the bottom wall 18.

It will be seen from Figure 8 that the depths "d" of the flutes 20e gradually increase from a minimum at their upper ends to a maximum at their lower ends. Likewise, as can be seen from Figure 7, the widths "w" of the flutes also gradually increase from a minimum at their upper ends to a maximum at their lower ends.

The cup-shaped container is preferably thermo-formed vacuum molded from an impermeable yieldably piercable heat sealable material having a nominal thickness of 0.031" and comprising, for example, polyethylene/EVOH/polystyrene supplied by

Curwood Packaging of Oshkosh, Wisconsin, U.S.A.

The filter element 14 is formed of a pliable and permeable heat sealable material such as for example cellulose polypropylene supplied by J. R. Crompton, Ltd of Bury, Lancashire, England. The bottom of the filter element is supported on and
5 secured as by heat sealing to the central boss 18a.

The lid may be cut or blanked from any suitable impermeable heat sealable and yieldably pierceable material, such as for example, a metallic/polymer laminate supplied by Winpak Heat Seal Packaging, Inc. of Montreal, Canada.

As can best be seen in Figure 6, the filter element is heat sealed as at 26 to the
10 intermediate wall section defined by tapered ledge 20b. The taper angle of the ledge 20b closely approximates the taper angle of the filter element 14, thereby facilitating the task of securely and reliably heat sealing the two together. The filter element serves to subdivide the interior of the container 12 into first and second chambers A, B. A dry granular or powdered beverage medium "M", typically ground roasted
15 coffee, is stored in chamber A, and the container opening 24 is closed by heat sealing the lid 16 to the rim 22.

At the onset of a processing cycle, the lid 16 and container bottom 18 are pierced, respectively, by tubular inlet and outlet probes 28, 30 (see Figure 3). The inlet probe 28 admits a heated liquid, typically hot water, into chamber A where it
20 infuses and combines with the beverage medium M to produce a beverage. The beverage passes through the filter element 14 into chamber B, from which it exits via outlet probe 30.

The second embodiment illustrated in Figures 9-11 is similar in many respects to the above-described first embodiment. Similar features of the second embodiment
25 have been identified with similar reference numerals in a two hundred series. Thus, for example, reference numeral 10 identifies the filter cartridge of the first embodiment, and reference numeral 210 identifies the filter cartridge of the second embodiment.

In the second embodiment, the container bottom 218 is configured to provide a
30 downwardly protruding centrally disposed reduced diameter boss 218a defining an interior sump 218b surrounded by an annular substantially planar bottom area. The bottom of the conical filter element is received in and secured to the bottom of the sump as at 218c.

The third embodiment illustrated in Figures 13-21 is also similar in many respects to the first embodiment. Again, similar features have been identified with similar reference numerals, but in a three hundred series.

The major difference between the first and third embodiments is that the latter
5 has fewer and much deeper flutes 320e. As can be best seen in Figure 19, the deeper flutes 320e contact and provide radial support for the filter element 314.

In light of the foregoing, it will now be appreciated by those skilled in the art that the present invention offers significant advantages over the known beverage filter cartridge described in the previously referenced patents. For example, the
10 circumferentially spaced flutes 20e, 220e and 320e strengthen the container side wall against buckling when the bottom is pierced by the outlet probe 30. The deeper flutes 320e of the third embodiment offer the added advantage of radially supporting the filter element, which can be particularly beneficial during the processing cycle, when the filter element is being stressed by the infusion of pressurized heated liquid into the
15 beverage medium.

In all embodiments, the downwardly diverging and gradually deepening of the flutes serves to promote downward flow of the brewed beverage in chamber B while beneficially encouraging turbulence. The upwardly protruding bosses 18a, 318a on the container bottoms of the first and third embodiments provide readily accessible support
20 platforms for the bottoms of the filter elements. Securing the bottoms of the filter elements to the bosses 18a, 218a insures that the filter elements will not be punctured by the outlet probe 30.

The small diameter sump 218b defined by the downwardly protruding boss 218a of the second embodiment receives the lower end of the filter component in a
25 confined space which beneficially decreases head space and further assists in positively locating and safeguarding the filter from damaging contact with the outlet probe.

The tapered ledges 20b, 220b, 320b of all embodiments provide distinct and readily accessible lands to which the filter elements may be reliably joined by heat sealing. The upper ends of the flutes 20e, 220e, 320e terminate below the ledges 20b,
30 220b, 320b, thereby insuring that the ledges are not interrupted by discontinuities that would be detrimental to the critical seal of the filter elements to the container side walls.

The upper container sections 20a, 220a, 320a above the filters provide

beneficial increases in available storage capacity for the beverage medium. This increased storage capacity makes it unnecessary to fill the interior chamber A to its maximum capacity, thereby safeguarding the container rim from contamination by errant granules of the beverage medium.

5 Although the outer container and cover have been described as being formed from impermeable materials, it will be understood by those skilled in the art that, alternatively, permeable materials may be employed for one or both of these components. Where permeable materials are employed, the completed cartridges will preferably be subsequently enclosed, either individually or in batches, with
10 impermeable wrappings. Materials for such wrappings are well known, and include for example EVOH films, aluminum foil, etc.

 Although the present invention has been described with reference to several embodiments, various changes, modifications and additions may be made without departing from the spirit and scope of the appended claims.

15 We claim:

1 1. A beverage filter cartridge comprising:

2 a cup-shaped outer container having a bottom and a side wall extending from
3 said bottom wall to a circular rim surrounding an upper opening, said side wall having
4 an upper section extending downwardly from said rim to an intermediate section, and
5 having a tapered lower section extending downwardly from said intermediate section to
6 said bottom wall, said tapered lower section being configured to provide a plurality of
7 circumferentially spaced flutes;

8 a filter element received in said container, said filter element being joined to
9 said side wall and being configured and positioned to subdivide the interior of said
10 container into first and second chambers;

11 a beverage medium stored in said first chamber; and

12 a cover joined to said side wall at said rim and closing said upper opening, said
13 cover being yieldably piercable to accommodate an injection of liquid into said first
14 chamber for combination with said beverage medium to produce a beverage, said filter
15 element being permeable to accommodate a flow of said beverage from said first
16 chamber into said second chamber, and said bottom wall being yieldably piercable to
17 accommodate an outflow of said beverage from said second chamber to the exterior of
18 said cartridge.

1 2. The beverage filter cartridge of claim 1 wherein said flutes extend
2 downwardly from upper ends terminating beneath said intermediate section to lower
3 ends at said bottom wall.

1 3. The beverage filter cartridge of claim 2 wherein the lower ends of said
2 flutes define indentations in said bottom wall.

1 4. The beverage filter cartridge of claims 2 or 3 wherein the depths of said
2 flutes gradually increase from a minimum at said upper ends to a maximum at said
3 lower ends.

1 5. The beverage filter cartridge of claims 2 or 3 wherein the widths of said
2 flutes gradually increase from a minimum at said upper ends to a maximum at said
3 lower ends.

1 6. The beverage filter cartridge of claim 1 wherein said filter element is
2 joined to said side wall at said intermediate section.

1 7. The beverage filter cartridge of claim 1 wherein said intermediate
2 section is defined by a ledge joining said upper section to said lower section, and
3 wherein said filter element is joined to said side wall at said ledge.

1 8. The beverage filter cartridge of claim 7 wherein said ledge tapers
2 inwardly from said upper section to said lower section, and wherein the taper angle of
3 said intermediate section is greater than the taper angle of said lower section.

1 9. The beverage filter cartridge of claim 1 wherein said upper section has
2 an upper segment extending downwardly from said circular rim and a lower segment
3 extending upwardly from said intermediate section, said upper segment being flared
4 outwardly and said lower segment being tapered inwardly, with the juncture of said
5 upper and lower segments defining an exterior stacking shoulder.

1 10. The beverage filter cartridge of claim 1 wherein said bottom wall is
2 provided with an upwardly protruding centrally disposed boss, a lower end of said
3 filter element being supported on said boss.

1 11. The beverage filter cartridge of claim 10 wherein the lower end of said
2 filter is secured to said boss.

1 12. The beverage filter cartridge of claim 1 wherein said filter element is in
2 contact with and radially supported by said flutes.

1 13. The beverage filter cartridge of claim 1 wherein said bottom is provided
2 with a downwardly protruding centrally disposed boss defining an interior sump, and
3 wherein the lower end of said filter element is received in said sump.

1 14. The beverage filter cartridge of claim 13 wherein said filter element is
2 secured to the bottom of said sump.

1 15. The beverage filter cartridge of claim 1 wherein said outer container is
2 impermeable.

1 16. The beverage filter cartridge of claims 1 or 15 wherein said cover is
2 impermeable.

1 17. A beverage filter cartridge comprising:

2 a cup-shaped outer container having a bottom and a side wall extending from
3 said bottom wall to a circular rim surrounding an upper opening, said side wall having
4 an upper section extending downwardly from said rim to an intermediate section, and
5 having a tapered lower section extending downwardly from said intermediate section to
6 said bottom wall, said tapered section being configured to provide a plurality of
7 circumferentially spaced flutes;

8 a filter element received in said container, said filter element being in contact
9 with and radially supported by said flutes and being joined to said side wall at a
10 location subdividing the interior of said container into first and second chambers;

11 a beverage medium stored in said first chamber; and

12 a cover joined to said side wall at said rim and closing said upper opening, said
13 cover being yieldably piercable to accommodate an injection of liquid into said first
14 chamber for combination with said beverage medium to produce a beverage, said filter
15 being permeable to accommodate a flow of said beverage from said first chamber into
16 said second chamber, and said bottom wall being yieldably piercable to accommodate
17 an outflow of said beverage from said second chamber to the exterior of said cartridge.

1 18. A beverage filter cartridge comprising:

2 a cup-shaped container having a bottom and a side wall extending from said
3 bottom wall to a circular rim surrounding an upper opening, said side wall having an
4 upper section extending downwardly from said rim to an intermediate section, and
5 having a tapered lower section extending downwardly from said intermediate section to
6 said bottom wall, said tapered section being configured to provide a plurality of
7 circumferentially spaced flutes, said bottom being provided with a downwardly
8 protruding centrally disposed boss defining an interior sump;

9 a conical filter element received in said container, the bottom of said filter
10 element protruding downwardly into and being secured within said sump, said filter
11 element being joined to said side wall and being configured and positioned to subdivide
12 the interior of said container into first and second chambers;

13 a beverage medium stored in said first chamber; and

14 a cover joined to said side wall at said rim and closing said upper opening, said
15 cover being yieldably piercable to accommodate an injection of liquid into said first
16 chamber for combination with said beverage medium to produce a beverage, said filter
17 being permeable to accommodate a flow of said beverage from said first chamber into

18 said second chamber, and said bottom wall being yieldably piercable to accommodate
19 an outflow of said beverage from said second chamber to the exterior of said cartridge.