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A THERMOCHROMIC CAP

Field of Invention

The present invention relates generally to cap for use with a container. Specifically, the invention relates to a thermochromic cap for use in bottles, for example, nursing bottles.

Background

Bottles for containing fluids, for example a beverage container, usually further function to conceal any indication of temperature of the fluids contained therein. Tell-tale elevated temperature indicators, for example steam, are further concealed when the opening of the bottle is covered with a cap. Touching the bottle will provide a person with a rough idea of whether the temperature of the bottle's contents is too hot, or too cold. However, the touching of the bottle for determining temperature of its contents becomes unacceptable when it is performed not by the person who is to consume the contents. For example, solely touching a nursing bottle containing freshly-prepared instant formula milk prior for provision to an infant is unacceptable as the instant formula milk in the bottle could be hotter than how the bottle felt. An often used approach would be the dripping of a few dribbles of milk onto back of the caregiver's hand to get a feel of the temperature of the milk. However, such an approach will require the use of two hands, one hand for manipulating the nursing bottle and the other for catching the milk drips, and make it difficult for a caregiver who has to carry the infant at the same time. A disclosed approach integrates visual temperature indicators, for example a thermometer or thermochromic paint, with the container portion of the bottle. However, the container portion of the bottle is usually covered when the bottle is held, which in turn, covers the visual temperature indicators and prevent them from being easily observable. Additionally, the temperature indicating feature of the bottle having the visual temperature indicators cannot be shared with other ordinary bottles without such a feature. This renders the ordinary bottles useless and requires multiple bottles with the visual temperature indicator to be purchased which adds to the expense of caring for an infant should the convenience of the temperature indicator feature be required. Therefore, there exists a need for an improved temperature indication means.

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Summary

In accordance with a first aspect of the invention, there is disclosed a cap comprising a body having at least one thermochromic portion. The at least one thermochromic portion has an activation temperature. The body comprises a cover structure and an engagement structure. The cover structure is positionable over at least a portion of a container with the container having at least one opening. The engagement structure is engageable with the container for coupling the cover structure to the container to thereby position the cover structure over the at least one opening of the container. The at least one thermochromic portion changes one of towards and away from an activation colour in response to temperature of the at least one thermochromic portion being at least at the activation temperature.

In accordance with a second aspect of the invention, there is disclosed a bottle comprising a containment portion, a first cap and a second cap. The containment portion is for receiving fluids therewithin. The containment portion has a first opening and a second opening. The first cap is couplable to the containment portion and shaped and dimensioned for substantially impeding fluid communication through the first opening of the containment portion. The second cap is couplable to the containment portion and shaped and dimensioned for substantially impeding fluid communication through the second opening of the containment portion. At least one of the first cap and the second cap has at least one thermochromic portion with the at least one thermochromic portion having an activation temperature. The at least one thermochromic portion changes one of towards and away from an activation colour in response to temperature of the at least one thermochromic portion being at least at the activation temperature.

Brief Description of the Drawings

FIG. 1 shows a partial front sectional elevation of a cap being coupled to a container according to a first exemplary embodiment of the invention;

FIG. 2 shows a partial front sectional view of a thermochromic portion of the cap of FIG. 1;

FIG. 3 shows a partial front sectional elevation of the cap of FIG. 1 with a cover structure being shaped as a teat structure;

FIG. 4 shows a partial front sectional elevation of the cap of FIG. 1 with a nursing teat being coupled thereto;

FIG. 5 shows a partial front sectional elevation of a bottle having a first cap, a second cap and a container according to a second exemplary embodiment of the invention; and

FIG. 5 shows a partial front sectional elevation of the bottle of FIG. 5 with the first cap having a nursing teat coupled thereto and the second cap having a valve integrated therewith.

Detailed Description

A first exemplary embodiment of the present invention, a cap 20 and a bottle 100 comprising the cap 20, is described hereinafter with reference to FIGS. 1 to 4.

For purposes of brevity and clarity, the description of the present invention is limited hereinafter to applications relating to caps for use with containers. This however does not preclude various embodiments of the present invention from other applications where fundamental principles prevalent among the various embodiments of the invention such as operational, functional or performance characteristics are required.

The cap 20 is preferably for use with a container 22 for containing fluids, for example, instant formula and beverages. The container 22 is preferably light permeable. The cap 20 comprises a body 24 having at least one thermochromic portion 25 (hereinafter referred to as the thermochromic portion 25 or the at least one thermochromic portion 25). The thermochromic portion 25 has an activation temperature and is reactive to temperature changes at the activation temperature. Preferably, the thermochromic portion 25 has a first colour at room temperature. When the temperature of the body 24, and consequently the thermochromic portion 25, reaches or exceeds the activation temperature, the first colour of the thermochromic portion 25 fades to white. Alternatively, the thermochromic portion 25 has no colour at room temperature but changes towards the first colour when the temperature thereof reaches or exceeds the activation temperature. Further alternatively, the thermochromic portion 25 is of the first colour at room temperature and will change into a second colour when the activation temperature is reached or exceeded. Nonetheless, the colour change reaction of the thermochromic portion 25 is substantially reversible. It is apparent to a person skilled in the art in light of the above description that the thermochromic portion 25 can extend throughout the entire body 24 of the cap 20.

The body 24 comprises a cover structure 26 and an engagement structure 28 extending from the cover structure 26. Preferably, the cover structure 26 and the engagement structure 28 are shaped and dimensioned for use with the container 22. The container 28 preferably comprises a neck 30 defining an opening 32. The neck 30 is adapted to cooperate with the engagement structure 28 for coupling the body 24 to the container 22. Preferably, each of the neck 30 and the engagement structure 28 comprises screw threads (not shown) for enabling coupling of the neck 30 with the engagement structure 28. Each of the neck 30 and the engagement structure 28 is preferably ring-shaped for enabling concentric disposable of one around the other thereof. The screw threads of the neck 30 and the engagement structure 28 comprise internal screw threads and external screw threads that are either continuous or discontinuous. Alternatively, the engagement structure 28 couples with the neck 30 by one or a combination of snap fitting and interference fit. The cover structure 26 and the engagement structure 28 are inter-configured for positioning the cover structure 26 over at least a portion

of the opening 32 when the engagement structure 28 couples with the neck 30 of the container 22.

The thermochromic portion 25 is formable from a material comprising a polymer-thermochromic ink mixture or theremochromic ink spheroids suspended in a polymer matrix. The polymer utilised preferably comprises polyethylene naphthalate (PEN) and polyethylene terephthalate (PET). The ratio of PEN to PET is preferably between 10%:90% to 20%:80%. Alternatively, the theremochromic portion 26 is formed from forming a thermochromic ink layer 36 over a polymeric substrate 38. To reduce wear of the thermochromic ink layer 36 when in use, a protective layer 40 is formable over the thermochromic ink layer 36 for disposing the thermochromic ink layer 36 between the protective layer 40 and the polymeric substrate 38.

When in use, the cap 20 couples with the container 22 for forming the bottle 100 and for substantially covering the opening 32 of the container 22 when fluid, for example liquid beverage, has been introduced into the container 22. Heat from the fluid contained in the container 22 is communicated via one or a combination of conductive and convective thermal exchange. This, in turn, changes the temperature of the thermochromic portion 25 and consequently the colour thereof when the temperature of the thermochromic portion 25 is at least the activation temperature. The change in colour of the thermochromic portion 25 therefore visually indicates that the content of the container 22 may be too hot for consumption or use. When the thermochromic portion 25 does not form the whole of the body 24, it can be shaped for presenting a graphical or textual layout when the activation temperature is exceeded.

The at least one thermochromic portion 25 can comprise multiple thermochromic portions with multiple activation temperatures (not shown). For example, the at least one thermochromic portion 25 comprises a first thermochromic portion with a first activation temperature and a second thermochromic portion with a second activation temperature (all

unreferenced). This enables the first thermochromic portion and the second thermochromic portion to be indicative of temperature falling outside a temperature range delimited by the first activation temperature and the second activation temperature. The first thermochromic portion is indicative of temperatures beyond the first activation temperature, while the second thermochromic portion is indicative of temperatures below the second temperature. Consequently, this enables visual indication that content of the container, whereto the cap 20 is coupled, is neither too hot nor too cold. This is especially useful when the bottle 100 is used for nursing infants.

Preferably, the cap 20 further comprises one or more tongues (not shown) extending from the body 24. The tongues are positionable within the container 22 when the cap 20 is coupled thereto. The tongues enable thermal communication between the content of the container 22 with the body 24 of the cap 20 and consequently with the thermochromic portion 25. Alternatively, the tongues extend from an annular ring (not shown) receivable within for abutting with the body 24 of the cap 20. The cap 20, annular ring and the container 22 are inter-configurable for disposing the tongues within the container 22.

The cover structure 26 is preferably planar. Alternatively, at least a portion of the cover structure 26 is shaped as a spout wherefrom the content of the container 22 is dischargable. Alternatively, at least a portion of the cover structure 26 is shaped as a teat structure 44 with the bottle 100 functioning as a feeding bottle. Further alternatively, the cover structure 26 has an annular shape for defining a cap opening 46. The cap 20 further comprises a nursing teat 48 with a portion thereof being disposable through the cap opening 46. The nursing teat 48 is preferably resiliently biased and is made from one of silicone and latex. The nursing teat 48 is configurable with the body 24 for aligning the nursing teat 48 with the opening 32 of container 22 when the body 24 is coupled with the neck 30 of the container 22. This enables the content of the container 22 to be dispensable from the nursing teat 48.

Preferably, the nursing teat 48 comprises a flange 47 disposable between the cover structure 26 and the neck 30 for forming substantially a fluid seal therebetween. Alternatively, the flange 47 is replaceable with a ring seal (not shown) disposable between the cover structure 26 and the neck 30.

The container 22 is formable in any shape as determined by intended use thereof. The container 22 is preferably elongated with the neck 30 being formed at one extremity and a teat structure being formed adjacent the other extremity thereof. When the teat structure is formed at one extremity of the container 22, a valve (not shown) is one of formed and coupled integral with the body 24 of the cap 20 to enable passage of air into the container 22 therethrough and to impede escape of fluids from the container 22 therefrom.

A first cap 60 and a second cap 62 for use with a container 64 for constituting a bottle 66 therefrom according to a second exemplary embodiment of the invention is described with reference to FIG. 5 and FIG. 6. The container is also referable to as a containment portion. The first cap 60 comprises a first body 68 comprising a first cover structure 70 and a first engagement structure 72. The second cap 62 comprises a second body 74 which comprises a second cover structure 76 and a second engagement structure 78. Functionally and structurally, the first cover structure 70 and the second cover structure 76 corresponds with the cover structure 26 of the cap 20 while the first engagement structure 72 and the second engagement structure 78 corresponds with the engagement structure 28 of the cap 20.

Preferably, the container 64 comprises a first neck 80 defining a first opening 82 and a second neck 84 defining a second opening 86. Preferably, the container 64 is elongated and defines a longitudinal axis (not shown). A person having ordinary skill in the art with knowledge of the above description will understand that the longitudinal axis can be either straight or curved. Alternatively, the container 64 can take on other shapes especially shapes for enabling ergonomic use and handling of the bottle 66. The first cap 60 is for coupling with the first neck 80 while the second cap 62 is for coupling with the second neck 84 of the

container 64. The container 64 couples with each of the first cap 60 and the second cap 62 by at least one of screw-threads, interference fitting, latching and snap fitting. Ring seals (not shown) are preferably use for fluid sealing at least one of the first cap 60 to the first neck and the second cap 62 to the second neck 84.

Preferably, at least one thermochromic portion 88 is formed integral with each or one of the first body 68 of the first cap 60 and the second body 74 of the second cap 62. Functionally, the thermochromic portion 88 of the second exemplary embodiment shares the same characteristics and purpose of the thermochromic portion 25 of the first exemplary embodiment. The approach and material used for forming the thermochromic portion 25 in the first exemplary embodiment is adoptable for forming the thermochromic portion 88 of the second exemplary embodiment.

Preferably, the first cap 60 further comprises a nursing teat 88. The first body 68 defines a cap opening 90 wherethrough at least a portion of the nursing teat 88 is disposable. The nursing teat 88 is preferably elastic to enable engagement thereof with the cap opening 90 to thereby couple the nursing teat 88 with the first body 68. Alternatively, a portion of the first body 68 is preferably shaped as one of a spout and a nursing teat structure (not shown).

The first neck 80 and the second neck 84 are preferably formed adjacent opposing extremities of the container 64. Preferably, the second cap 62 comprises a valve 92 being one of formed and coupled integral with the second body 74 of the second cap 62 to enable passage of air into the container 64 therethrough and to impede escape of fluids from the container 64 therefrom. When the bottle 66 is used for nursing an infant, the ability for air intake thereto through the valve 92 mitigates colic from developing in the infant.

In the foregoing manner, a thermochromic cap for use with a container is described according to two exemplary embodiments of the present invention. Although only two exemplary

embodiments of the present invention are disclosed, it will be apparent to a person skilled in the art in view of this disclosure that numerous changes and/or modifications can be made without departing from the scope and spirit of the present invention.

Claims

1. A cap comprising:

a body having at least one thermochromic portion, the at least one thermochromic portion having an activation temperature, the body comprising:

a cover structure positionable over at least a portion of a container, the container having at least one opening; and

an engagement structure engageable with the container for coupling the cover structure to the container to thereby position the cover structure over the at least one opening of the container,

wherein the at least one thermochromic portion changes one of towards and away from an activation colour in response to temperature of the at least one thermochromic portion being at least at the activation temperature.

2 The cap as in claim 1, further comprising:

at least one tongue extending from the body, the at least one tongue and the body being inter-configured for disposing the at least one tongue substantially within the container when the engagement structure of the body is coupled with the container.

3. The cap as in claim 1, further comprising:

an annular ring shaped and dimensioned for being received by and abutting with the body; and

at least one tongue extending from the annular ring, the annular ring and the body being inter-configured for disposing the at least one tongue substantially within the contained when the engagement structure of the body is coupled with the container

4. The cap as in claim 1, the at least one thermochromic portion comprising:

a substrate; and

a thermochromic layer extending over the substrate.

5. The cap as in claim 1, the at least one thermochromic portion further comprising:

a protective layer extending over the thermochromic layer for disposing the thermochromic layer between the substrate and the protective layer.

6. The cap as in claim 1, the at least one thermochromic portion comprising:

thermochromic spheroids suspended in a polymeric matrix.

7. The cap as in claim 1, the body being made from a material comprising at least one of polyethylene naphthalate (PEN) and polyethylene terephthalate (PET).

8. The cap as in claim 1, at least a portion of the cover structure being shaped as one of a nursing teat and a spout for the discharge of fluid from the container therethrough.

9. The cap as in claim 1, the cover structure being substantially annular for defining an aperture, the aperture being shaped and dimensioned for enabling passage of at least a portion of a nursing teat therethrough, the cover structure for aligning the nursing teat with the at least one opening of the container when the engagement structure is coupled with the container to thereby enable discharge of fluid from the container through the nursing teat.

10. The cap as in claim 1, the container having a neck whereby the at least one opening is defined, the cover structure for engaging the neck of the container for forming a seal with the container.

11. The cap as in claim 10, the engagement structure of the body comprising one of and the neck of the container comprising the other of internal screw-threads and external screw-threads inter-operable for coupling the engagement structure to the container.

12. The cap as in claim 10, further comprising a seal configurable with the body for substantially fluid sealing the cover structure with the neck of the container.

13. The cap as in claim 1, the engagement structure of the body couples with the container by at least one of screw threads, interference fitting and latching.

14. The cap as in claim 1, further comprising a valve coupled with the body for enabling passage of air into the container and substantially impeding exhaust of fluids from the container.

15. The cap as in claim 14, the container comprising a teat portion, the container being elongated, the teat portion and the at least one opening being at two extremities of the container.

16. The cap as in claim 1, the body being dome-shaped and being further shaped and dimensioned for substantially accommodating the container therewithin.

17. The cap as in claim 1, the body being light-permeable.

18. A bottle comprising:

a containment portion for receiving fluids therewithin, the containment portion having a first opening and a second opening;

a first cap couplable to the containment portion and shaped and dimensioned for substantially impeding fluid communication through the first opening of the containment portion; and

a second cap couplable to the containment portion and shaped and dimensioned for substantially impeding fluid communication through the second opening of the containment portion, at least one of the first cap and the second cap having at least one thermochromic portion, the at least one thermochromic portion having an activation temperature, and the at least one thermochromic portion changes one of towards and away from an activation colour in response to temperature of the at least one thermochromic portion being at least at the activation temperature.

19. The bottle as in claim 18, further comprising:

an annular ring shaped and dimensioned for being received by and abutting with the first cap; and

at least one tongue extending from the annular ring, the annular ring and the first cap being inter-configured for disposing the at least one tongue substantially within the containment portion when the first cap couples therewith.

20. The bottle as in claim 18, the at least one thermochromic portion comprising:

a substrate; and

a thermochromic layer extending over the substrate.

21. The bottle as in claim 18, the at least one thermochromic portion further comprising:

a protective layer extending over the thermochromic layer for disposing the thermochromic layer between the substrate and the protective layer.

22. The bottle as in claim 18, at least one of the first cap and the second cap being made from a material comprising at least one of polyethylene naphthalate (PEN) and polyethylene terephthalate (PET).

23. The bottle as in claim 18, at least a portion of the first cap being shaped as one of a nursing teat and a spout for the discharge of fluid from the bottle therethrough.

24. The bottle as in claim 18, the first cap being substantially annular for defining an aperture, the aperture being shaped and dimensioned for enabling passage of at least a portion of a nursing teat therethrough, the first cap for aligning the nursing teat with the first opening of the containment portion when the first cap is coupled with the containment portion to thereby enable discharge of fluid from the containment portion through the nursing teat.

25. The bottle as in claim 24, further comprising a valve coupled with the second cap for enabling passage of air into the containment portion and substantially impeding exhaust of fluids from the containment portion.

26. The bottle as in claim 18, further comprising a seal configurable with the first cap for substantially fluid sealing the first cap to the first opening of the containment portion.

27. The bottle as in claim 18, each of the first cap and the second cap with the containment portion by at least one of screw threads, interference fitting and latching.