Claims

1.

An anti-refill product 10, 110, 210, 410, 610 that includes:

a container 12 including a neck 24 with an interior passage 32 and a corresponding interior surface 33;

an anti-refill dispensing fitment 14, 114, 214, 414, 614 positioned at least partially in the interior passage of the neck of the container, and including at least one ceramic or glass component 34, 134, 234, 434, 534, 136, 436, 636; and

a bonding material disposed between the interior surface of the neck of the container and a radially outer surface of the fitment,

wherein, the bonding material non-removably secures the fitment to the interior passage of the neck of the container and thereby renders the product tamper-evident.

2.

The product set forth in claim 1, wherein the anti-refill dispensing fitment includes a check valve including:

a valve retainer 34, 134, 234, 434, 534 positioned at least partially in the interior passage of the neck of the container and having a radially inner surface 42, 142, 242, 342, 442, 542 and a radially outer surface 44, 144, 244, 344, 444, 544 radially inward of the interior surface of the neck;

a plug 36, 136, 236, 436, 636 positioned at least partially in the interior passage of the neck of the container and having a through passage 66, 266, 466, 666 and a radially outer surface 62, 162, 262, 462 axially inward of the inner surface of the retainer, and

a valve ball 38, 138, 238, 338, 438, 538 positioned in the interior passage of the neck of the container between the valve retainer and the plug;

wherein at least a portion of the radially outer surface of the valve retainer is in indirect contact with the interior surface of the neck of the container by way of the bonding material.

3.

The product set forth in claim 2, wherein the container is a bottle having a body 16 and the neck having the interior surface, an exterior surface 31, and an axial end surface 29 between the interior and exterior surfaces, and wherein the valve retainer includes a radially inboard wall 40, 140, 240, 340, 440, 540 having the radially inner and outer surfaces, a radially outboard wall 46, 246 having a second radially inner surface 48, 248 radially outward of the exterior surface of the neck of the container, and a transverse wall 50, 150, 250, 350 between the radially inboard and outboard walls that has an axially outward surface 52, 252, 352 and an axially inward surface 54, 154, 254, 354 axially outward of the axial end surface of the neck of the container.

4.

The product set forth in claim 3, wherein the plug includes an axially extending inboard wall 60, 160, 260, 460, 660 having the radially outer surface, and a transverse flange 68, 168, 268, 468 extending from the axially extending inboard wall, the transverse flange of the plug having an axially inward surface 70, 170, 270, 470 axially outward of the axially outward surface of the valve retainer.

5.

The product set forth in claim 2, wherein the container is a bottle having a body 16 and the neck having the interior surface, an exterior surface 31, and an axial end surface 29 between the interior and exterior surfaces, and wherein the valve retainer includes a radially inboard wall 40, 140, 240, 340, 440, 540 having the radially inner and outer surfaces, and wherein the plug includes an axially extending inboard wall 60, 160, 260, 460, 660 having the radially outer surface, a radially outboard wall 163 having a radially inner surface 165 radially outward of the exterior surface of the neck of the container, and a transverse flange 68, 168, 268, 468 between the inboard and outboard walls of the plug that has an axially inward surface 70, 170, 270, 470 axially outward of the axial end surface of the neck of the container.

6.

The product set forth in claim 2, wherein the valve retainer includes a valve ball seat 56, 256, 356, 456, 556, the plug includes an axially inwardly facing end 64, 264, 464, 664, the valve ball is loosely trapped between the valve ball seat and the axially inwardly facing end of the plug, and wherein the through passage of the plug allows liquid to pass between the valve ball and the end of the plug when the valve ball contacts the end of the plug.

7.

The product set forth in claim 1, wherein the anti-refill dispensing fitment includes a stacked and nested check valve arrangement including:

a first valve retainer 234 positioned at least partially in the interior passage of the neck of the container and having a first radially inner surface, and a first radially outer surface radially inward of the interior surface of the neck,

a first valve ball 238 positioned in the interior passage of the neck of the container within the first valve retainer,

a second valve retainer 334 positioned at least partially in the interior passage of the neck of the container and having a second radially inner surface, and a second radially outer surface radially inward of the first radially inner surface of the first valve retainer,

a second valve ball 338 positioned in the interior passage of the neck of the container within the second valve retainer, and

a plug 236 positioned at least partially in the interior passage of the neck of the container and having a through passage 266, and a radially outer surface 262 radially inward of the second radially inner surface of the second valve retainer,

wherein the bonding material is disposed between the interior surface of the neck of the container and the first radially outer surface of the first valve retainer.

8.

The product set forth in claim 1, wherein the anti-refill dispensing fitment includes a stacked check valve arrangement including:

a first valve retainer 434 positioned at least partially in the interior passage of the neck of the container and having a first radially inner surface, and a first radially outer surface radially inward of the interior surface of the neck,

a first valve ball 438 positioned in the interior passage of the neck of the container within the valve retainer,

a second valve retainer 534 positioned at least partially in the interior passage of the neck of the container and having a second radially inner surface, and a second radially outer surface radially inward of the interior surface of the neck,

a second valve ball 538 positioned in the interior passage of the neck of the container within the second valve retainer, and

a plug 436 positioned at least partially in the interior passage of the neck of the container and having a through passage 466,

wherein the bonding material is disposed between the interior surface of the neck of the container and at least one of the first or second radially outer surfaces of the first and second valve retainers.

9.

The product set forth in claim 1, wherein the bonding material includes a ceramic or glass bonding compound.

10.

A method of producing a product that includes:

(a) providing a container 12 having a neck 24 that includes an interior passage 32 and a corresponding interior surface 33;

(b) flowing liquid into the container through the interior passage of the neck;

(c) assembling an anti-refill fitment 14, 114, 214, 414, 614 into the interior passage of the neck of the container such that a bonding material is disposed between the interior surface of the neck of the container and the fitment; and

(d) heating the bonding material to non-removably secure the fitment to the container and thereby render the product tamper-evident.

11.

The method of claim 10, wherein the bonding material of said step (c) is positioned between the interior surface of the neck of the container and the fitment by being carried thereto by the fitment.

12.

The method of claim 10, wherein the bonding material of said step (c) is positioned between the interior surface of the neck of the container and the fitment by being carried thereto by the container.

13.

The method of claim 10, wherein the bonding material is heated in said step (d) by directing focused beam energy at the product.

14.

The method of claim 10, wherein the anti-refill fitment is assembled into the interior passage of the neck in said step (c) such that an axial end of the fitment extends axially out of the container.

15.

The method of claim 10, wherein the anti-refill fitment is assembled into the interior passage of the neck in said step (c) such that an axial end of the fitment is flush with or recessed below an axial end surface 29 of the neck of the container.

16.

A product produced by the method of claim 10.

The invention claimed is:

1. A method of producing a product that includes:

(a) providing a container having a neck that includes an interior passage and a corresponding interior surface;

(b) flowing liquid into the container through the interior passage of the neck;

(c) assembling an anti-refill fitment into the interior passage of the neck of the container with a bonding material disposed between the interior surface of the neck of the container and the fitment; and

(d) heating the bonding material to non-removably secure the fitment to the container and thereby render the product tamper-evident,

wherein the anti-refill fitment includes a check valve including a valve retainer and a plug, and said step (c) includes positioning at least a portion of the valve retainer in the interior passage of the neck of the container such that at least a portion of a radially outer surface of the valve retainer is in indirect contact with the interior surface of the neck by way of bonding material,

wherein said step (c) also includes positioning at least a portion of the plug in the interior passage of the neck of the container and in the valve retainer such that at least a portion of a radially inner surface of the valve retainer is in indirect contact with a radially outer surface of the plug by way of bonding material,

wherein the check valve further includes a valve ball, and said step (c) further includes positioning the valve ball between the valve retainer and the plug,

wherein the container and the anti-refill fitment are made of glass, the bonding material includes a glass component, and said step (d) includes melting the glass component of the bonding material,

wherein the bonding material of said step (c) is positioned between the interior surface of the neck of the container and the fitment by being carried thereto by the fitment.

2. The method of claim **1**, wherein the bonding material of said step (c) is positioned between the interior surface of the neck of the container and the fitment by being carried thereto by the container.

3. The method of claim **1**, wherein the bonding material is heated in said step (d) by directing focused beam energy at the product.

4. The method of claim **1**, wherein the bonding material is heated in said step (d) by directing a laser beam at the product.

5. The method of claim 1, wherein the bonding material includes a heat-activated ceramic or glass bonding compound, a solder glass, a ring of soda lime glass, an adhesive, an epoxy, or a sol-gel adhesive.

6. A product produced by the method of claim 1.

7. The method of claim 1, wherein the anti-refill fitment is assembled into the interior passage of the neck in said step (c) such that an axial end of the fitment extends axially out of the container.

8. A method of producing a product that includes:

(a) providing a container having a neck that includes an interior passage and a corresponding interior surface;

(b) positioning at least a portion of an anti-refill fitment within the interior passage of the neck of the container such that at least a portion of a radially outer surface of the fitment is in indirect contact with the interior surface of the neck by way of bonding material; and then

(c) heating the bonding material to non-removably secure the fitment to the container,

wherein the anti-refill fitment includes a check valve including a valve retainer and a plug, and said step (b) includes positioning at least a portion of the valve retainer in the interior passage of the neck of the container such that at least a portion of a radially outer surface of the valve retainer is in indirect contact with the interior surface of the neck by way of bonding material,

wherein said step (b) also includes positioning at least a portion of the plug in the interior passage of the neck of the container and in the valve retainer such that at least a portion of a radially inner surface of the valve retainer is in indirect contact with a radially outer surface of the plug by way of bonding material,

wherein the check valve further includes a valve ball, and said step (b) further includes positioning the valve ball between the valve retainer and the plug,

wherein the container and the anti-refill fitment are made of glass, the bonding material includes a glass component, and said step (c) includes melting the glass component of the bonding material,

wherein the bonding material of said step (b) is positioned between the interior surface of the neck of the container and the fitment by being carried thereto by the fitment.

9. The method of claim 8, wherein the check valve further includes a valve ball seat including an aperture, and said step (b) includes positioning the valve ball between the valve retainer and the plug such that the valve ball covers the aperture of the valve ball seat.

10. The method of claim 8, wherein the anti-refill fitment includes first and second check valves including first and second valve retainers having radially outer surfaces and a plug having a through passage, and said step (b) includes positioning the first valve retainer and at least a portion of the second valve retainer in the interior passage of the neck of the container such that the first and second check valves are axially stacked on top on one another and at least a portion of the radially outer surface of the first valve retainer is in indirect contact with the interior surface of the neck by way of bonding material.

11. The method of claim 10, wherein said step (b) includes positioning at least a portion of the plug in the interior passage of the neck of the container and in axial abutment against the second valve retainer.

12. The method of claim 8, wherein the anti-refill fitment includes a radially inboard wall and a radially outboard wall spaced radially outwardly from the inboard wall, and said step (b) includes positioning the radially inboard wall in the interior passage of the neck of the container such that at least a portion of a radially inner surface of the radially outboard wall is in indirect contact with an exterior surface of the neck of the container by way of bonding material.

13. The method of claim 12, wherein the anti-refill fitment further includes a transverse wall extending between the radially inboard and outboard walls, and said step (b) includes positioning the radially inboard wall in the interior passage of the neck of the container such that at least a portion of an axially inward surface of the transverse wall is in indirect contact with an axially end surface of the neck of the container by way of bonding material.

14. The method of claim 12, wherein the anti-refill fitment further includes a plug having an axially extending wall and a through passage, and said step (b) further includes positioning at least a portion of the axially extending inboard wall of the plug in the interior passage of the neck of the container such that at least a portion of a radially outer surface of the inboard wall of the plug is in indirect contact with a radially inner surface of the radially inboard wall of the fitment by way of bonding material.

15. The method of claim **8**, wherein said step (b) includes positioning a portion of the anti-refill fitment within the interior passage of the neck of the container such that an axial end of the fitment extends axially out of the container.

16. The method of claim **8**, wherein said step (b) includes positioning the anti-refill fitment within the interior passage of the neck of the container such that an axial end of the fitment is flush with or recessed below an axially end surface of the neck of the container.

17. The method of claim **8** also including, before said step (b), applying bonding material to the fitment.

18. The method of claim **8**, wherein the bonding material is a heat activated glass or ceramic bonding compound, a solder glass, a ring of soda lime glass, a bead of glass material, an adhesive, an epoxy, or a sol-gel adhesive, and said step (c) includes heating the bonding material to its bonding temperature.

19. The method of claim **8**, wherein said step (c) includes heating the bonding material to a temperature of about 625° C.

20. The method of claim **8**, wherein, when an attempt is made to breach the fitment by force, one or more components of the fitment are damaged.