A closure apparatus for a bottle neck and cap increases the torque necessary to remove the cap from the bottle neck. Projections are provided on one of the bottle neck exterior and cap interior, and indentations are provided on the other of the bottle neck exterior and cap interior. When the cap is secured on the bottle neck, the projections engage in the indentations. The engagement of the projections in the indentations requires an increased torque to remove the cap from the bottle neck.
Figure 3

Figure 4
BOTTLE AND CAP CLOSURE APPARATUS WITH TORQUE FEATURE

BACKGROUND OF THE INVENTION

[0001] (1) Field of the Invention

[0002] The present invention pertains to a closure apparatus for a bottle neck and cap that increases the torque necessary to remove the cap from the bottle neck. More specifically, projections are provided on one of the bottle neck and cap interior, and indentations are provided on the other of the bottle neck and cap interior. When the cap is secured on the bottle neck, the projections engage in the indentations. The engagement of the projections in the indentations requires an increased torque to remove the cap from the bottle neck.

[0003] (2) Description of the Related Art

[0004] A typical bottle and cap closure apparatus comprises a bottle neck having one or more exterior screw threads that engage with interior screw threads of the cap. The cap is positioned on top of the bottle neck and turned in the clockwise direction relative to the bottle to screw the interior threads of the bottle cap onto the exterior threads of the bottle neck. To remove the cap from the bottle neck, the cap is rotated in the opposite, counterclockwise direction. In both attaching the cap to the bottle neck and removing the cap from the bottle neck, it is the sliding engagement between the exterior screw threads of the bottle neck and the interior screw threads of the cap that attach the cap to the bottle neck and remove the cap from the bottle neck.

[0005] When the cap is secured tightly on the bottle neck, it is the friction engagement between the bottle neck exterior screw threads and the cap interior screw threads that securely holds the cap to the bottle neck. This friction engagement between the screw threads of the bottle neck and the cap also affects the quality of the liquid seal between the cap and bottle. Typically, when the cap is screwed tightly down on the bottle neck, an annular surface at the top of the bottle neck will engage in sealing engagement with an interior surface of the cap, thereby providing a liquid seal between the cap and bottle neck. If the cap is loose on the bottle neck due to the cap not being screwed down entirely on the bottle neck liquid contained in the bottle could potentially leak through the connection.

[0006] A disadvantage often encountered in the constructions of bottle and cap closures of the type described above is the tendency of the cap to become loose from the bottle neck. When the cap is screwed down tightly onto the bottle neck providing a seal between the bottle neck and the cap, often only the friction engagement between the external screw threads of the bottle neck and the internal screw threads of the cap holds the cap in its sealed position against the top of the bottle neck. When the cap and bottle neck are subjected to certain conditions, for example when the cap and bottle neck are vibrated when being transported, the cap can have a tendency to move in a counterclockwise rotation on the bottle neck due to the spiraling configurations of the exterior screw threads of the bottle neck and the interior screw threads of the cap. This counterclockwise rotation of the cap is called "backing off", and can cause leakage of a liquid contained in the bottle.

SUMMARY OF THE INVENTION

[0007] The present invention provides a bottle and cap closure apparatus that overcomes disadvantages associated with the constructions of prior art bottle and cap closure apparatus by providing an enhanced torque feature. The enhanced torque feature of the bottle and cap closure apparatus of the invention securely holds the cap on the bottle neck and requires an increased counterclockwise torque on the bottle cap to remove the cap from the bottle neck, thereby preventing the backing off of the cap from the bottle neck. The bottle and cap closure apparatus of the invention is provided in several different embodiments, with each embodiment employing a basic concept of the invention.

[0008] A first embodiment of the bottle and cap closure apparatus of the invention improves the conventional construction of a bottle and cap closure. The apparatus is employed on a bottle neck having an exterior screw thread that spirals around the bottle neck, and a bottle cap having an interior screw thread that spirals around the interior of the cap. The bottle neck screw thread and the cap screw thread are mated and screwed together in attaching the cap to the bottle neck in the conventional manner. However, the bottle and cap closure apparatus of the invention differs from the constructions of prior art bottle and cap closure apparatus by providing a number of projections that extend axially outwardly from a flank surface of the bottle neck screw thread. The same number of indentations extend axially into a flank surface of the cap screw thread.

[0009] In attaching the cap to the bottle neck, the axial projections on the bottle neck screw thread extend into the axial indentations in the cap screw thread and thereby securely hold the cap on the bottle neck and prevent backing off of the cap. To remove the cap from the bottle neck a sufficient torque force must be exerted on the cap to cause the disengagement of the bottle neck screw thread projections from the cap screw thread indentations.

[0010] A second embodiment of the bottle and cap closure apparatus is similar in construction to the first embodiment, except that the axial indentations are provided in the bottle neck screw thread, and the axial projections are provided on the bottle cap screw thread. The bottle cap projections are received in the bottle neck indentations to securely hold the cap to the bottle neck and to prevent backing off of the cap. Like the previously described embodiment, to remove the cap from the bottle neck a sufficient torque force must be exerted on the bottle cap to cause the disengagement of the bottle cap screw thread projections from the bottle neck screw thread indentations.

[0011] A third embodiment of the bottle and cap closure apparatus is similar to the previously described embodiments, except that it comprises a number of projections that project radially outwardly from the bottle neck adjacent the bottle neck screw threads. The screw thread of the cap is provided with an equal number of indentations that extend radially into the screw thread of the cap. In attaching the cap to the bottle neck, the radial projections on the bottle neck extend into the radial indentations on the cap to securely hold the cap to the bottle neck and to prevent backing off of the cap. In order to remove the cap from the bottle neck, a sufficient torque force must be exerted to cause the bottle neck projections to disengage from the bottle cap indentations.
In each of the embodiments of the bottle and cap closure apparatus described above, the engagement of projections on one of the bottle neck and cap into indentations of the other of the bottle neck and cap securely holds the cap to the bottle neck and prevents the unintended backing off of the bottle cap.

BRIEF DESCRIPTION OF THE DRAWINGS

Further features of the invention are set forth in the following detailed descriptions of the preferred embodiments of invention, and in the drawing figures wherein:

FIG. 1 is a partial view of a bottle employing a first embodiment of the bottle and cap closure apparatus of the invention;

FIG. 2 is a cross-section of a bottle cap employing the bottle and cap closure apparatus of FIG. 1;

FIG. 3 is a partial view of a bottle employing a second embodiment of the bottle and cap closure apparatus of the invention;

FIG. 4 is a cross-section of a bottle cap employing the bottle and cap closure apparatus of FIG. 3;

FIG. 5 is a partial view of a bottle employing a third embodiment of the bottle and cap closure apparatus of the invention; and,

FIG. 6 is a cross-section of a bottle cap employing the bottle and cap closure apparatus of FIG. 5.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Each of the embodiments of the bottle neck closure apparatus to be described could simply be used to close the opening of a bottle, or could be used as an attachment for another component to the bottle, for example a hand operated trigger sprayer. In each of the embodiments to be described the component parts of the embodiments are constructed of materials typically used in the construction of bottle and cap closures, for example plastic material. A first embodiment of the bottle and cap closure apparatus of the invention is shown in FIGS. 1 and 2.

FIG. 1 shows an upper portion of a bottle 12 having a cylindrical bottle neck 14. The bottle neck 14 surrounds an opening to an interior volume of the bottle. The bottle neck and bottle opening have a center axis 16 that defines mutually perpendicular axial and radial directions relative to the bottle 12 and the bottle neck 14. The bottle neck 14 has a cylindrical exterior surface 18 that extends upwardly from the bottle 12 to an annular end surface 22 of the neck that surrounds the bottle opening. The features of the bottle described above are typical in the construction of most bottles.

The novel features of the invention are provided in the construction of a bottle screw thread 24 on the bottle neck exterior surface 18. The bottle screw thread 24 has a length that extends from a first end 26 of the thread to a second end 28 of the thread. The thread first end 26 is positioned adjacent the annular end surface 22 of the bottle neck. From the first end 26, the screw thread spirals around the bottle neck exterior surface 18 to the thread second end 28 positioned adjacent the bottle 12. The screw thread 24 is formed with opposite flank surfaces 32, 34 that extend the length of the thread. The thread is also formed with a crest surface 36 that separates the opposite flank surfaces 32, 34 of the thread. The crest surface 36 also extends the length of the thread.

The construction of the bottle screw thread 24 differs from that of conventional screw threads in that it is provided with a plurality of projections 38 that project axially from one of the thread flank surfaces 34. In the embodiment of the bottle shown in FIG. 1, the projections 38 project axially downwardly from the lower flank surface 34 positioned on the underside of the screw thread 24. Although four projections 38 are shown in FIG. 1, a greater number of projections or a lesser number of projections could also be employed. The projections 38 have a general triangular configuration and are separated from each other by portions of the screw thread flank surface 34. Constructing the bottle 12 of a plastic material gives the projections 38 a resilience that allows the projections 38 to compress and deflect slightly when attaching the cap 42 to the bottle neck 14. In the preferred embodiment of the invention, the projections 38 are positioned adjacent the second end 28 of the screw thread. Although only one screw thread 24 is shown on the bottle neck in FIG. 1, the one screw thread could be replaced by a pair of screw threads of shorter length.

FIG. 2 shows the construction of a cap 42 that is employed with the bottle 12 of FIG. 1. The cap 42 shown is adapted for use in attaching a trigger sprayer to the bottle 12, and therefore has an opening through the top of the cap. The cap is shown in cross section to provide a better view of the novel construction of the interior of the cap. In variant embodiments of the cap 42, the top of the cap could be closed to provide a sealing closure for the bottle 12.

The cap 42 has a cylindrical side wall 44 with a cylindrical interior surface 46. The interior surface 46 extends axially downwardly from the top of the cap 42 to a bottom annular end surface 48 of the cap. The cap end surface 48 and interior surface 46 surround an interior volume of the cap that is dimensioned to receive the bottle neck 14 in securing the cap 42 on the bottle 12. The construction of the cap described to this point is typical among many caps.

The novel construction of the cap 42 is provided in the particular construction of an internal screw thread 52 that spirals around the cap interior surface 46. The cap screw thread 52 has a length with a first end 54 adjacent the top of the cap sidewall 44, and an opposite second end 56 adjacent the annular end surface 48 of the cap. The screw thread is formed with opposite flank surfaces 62, 64 that extend the length of the screw thread between the first 54 and second 56 ends. A crest surface 66 of the thread separates the two flank surfaces 62, 64 and also extends the length of the thread from the first end 54 to the second end 56.

A plurality of indentations 68 extend into the cap screw thread 52. The number of indentations 68 corresponds to the number of projections 38 on the bottle screw thread 24. The indentations 68 extend axially downwardly into the top flank surface 62 of the screw thread as shown in FIG. 2. The spatial arrangement of the indentations 68 in the flank surface 62 corresponds to the spatial arrangement of the projections 38 on the bottle screw thread 24. The indentations 68 are also provided adjacent the second end 56 of the cap screw thread 52.
In attaching the cap 42 to the bottle 12, the cap 42 is screwed onto the bottle neck 14 in the conventional manner. However, as the cap 42 is screwed down on the bottle neck 14, the cap screw thread indentations 68 approach the bottle screw thread projections 38. As the cap 42 is tightened down on the bottle neck 14, the bottle neck screw thread projections 38 will align with and extend into the cap screw thread indentations 68. This securely holds the cap 42 on the bottle neck 14 and prevents backing off of the cap from the bottle neck. To remove the cap 42 from the bottle neck 14, a sufficient torque must be exerted on the cap to cause the disengagement of the bottle neck screw thread projections 38 from the cap screw thread indentations 68.

A second embodiment of the bottle and cap closure apparatus of the invention is shown in FIGS. 3 and 4. This second embodiment is similar in construction to that of the previously described embodiment shown in FIGS. 1 and 2, and common structural features of the second embodiment to those of the first embodiment are labeled with the same reference numbers followed by a double prime ("), Because the second embodiment has common structural features to the first embodiment that have already been described with reference to FIGS. 1 and 2, these common structural features will not again be described.

Referring to FIG. 3 of the drawings, the bottle neck screw thread 24" of the second embodiment of the apparatus differs in construction from that of the first embodiment in that the projections 38 of the first embodiment are replaced by a plurality of triangular indentations 72. As shown in FIG. 3, the plurality of indentations 72 have a general triangular configuration and extend axially upwardly into the bottom flank surface 34" of the bottle screw thread 24". In a similar manner to the previously described embodiment, the bottle thread indentations 72 are positioned adjacent the second end 28" of the bottle screw thread 24".

The cap 42" of the second embodiment of the invention shown in FIG. 4 differs in construction from that of the first embodiment in that the screw thread indentations 68 of the first embodiment of the cap are replaced by screw thread projections 74 on the second embodiment of the cap. As shown in FIG. 4, the shape and number of cap screw thread projections 74 correspond to the shape and number of bottle screw thread indentations 72. The spatial positioning of the cap projections 74 also corresponds to that of the bottle thread indentations 72.

In attaching the cap 42" to the bottle neck 14", the cap is first initially screwed threaded onto the bottle neck. As the cap 42" is tightened down on the bottle neck 14", the cap projections 74 approach the bottle thread indentations 72. The projections 74 engage in the indentations 72 as the cap is tightened down on the bottle neck, thereby securely holding the cap 42" on the bottle neck 14" and preventing the backing off of the cap. To remove the cap 42" from the bottle neck 14" a sufficient torque must be exerted on the cap to cause the disengagement of the cap projections 74 from the bottle indentations 72.

A third embodiment of the bottle and cap closure apparatus is shown in FIGS. 5 and 6. This third embodiment is similar in construction to that of the first described embodiment of the invention shown in FIGS. 1 and 2, and common structural features of the third embodiment to those of the first embodiment are labeled with the same reference numbers followed by a double prime ("), Because the third embodiment has common structural features to the first embodiment that have already been described with reference to FIGS. 1 and 2, these common structural features will not again be described.

Referring to FIG. 5 of the drawings, the bottle neck screw thread 24" of the third embodiment of the apparatus differs in construction from that of the first embodiment in that the projections 38 of the first embodiment are replaced by a plurality of projections 82 that extend axially downwardly from the lower flank surface 34" across the exterior surface 18" of the bottle neck 14". As seen in FIG. 5, each of the projections 82 extends downwardly from the thread flank surface 34" to the bottle 12" where the bottle neck 14" extends outwardly from the bottle. Thus, the projections 82 are formed as three adjacent columns that have general trapezoidal cross sections that project radially outwardly from the bottle neck 14". In a similar manner to the previously described embodiments, the bottle thread projections 82 are positioned adjacent the second end 28" of the bottle screw thread 24".

The cap 42" of the second embodiment of the invention shown in FIG. 6 differs in construction from that of the first embodiment in that the screw thread indentations 68 of the first embodiment of the cap are replaced by screw thread indentations 84 on the third embodiment of the cap. As shown in FIG. 6, the cap screw thread indentations 84 correspond in shape and in number to the bottle screw thread projections 82. The spatial positioning of the cap indentations 84 also corresponds to that of the bottle thread projections 82. However, the cap thread indentations 84 extend radially into the crest surface 66" of the cap screw thread. Thus, the cap indentations 84 form grooves that extend completely across the cap screw thread 52" between the screw thread flank surfaces 62", 64".

In attaching the cap 42" to the bottle neck 14", the cap is first initially screwed threaded on the bottle neck. As the cap 42" is tightened down on the bottle neck 14", the cap indentations 84 approach the bottle neck projections 82. The bottle neck projections 82 engage in the cap indentations 84 as the cap is tightened down on the bottle neck, thereby securely holding the cap 42" on the bottle neck 14" and preventing the backing off of the cap. To remove the cap 42" from the bottle neck 14" a sufficient torque must be exerted on the cap to cause the disengagement of the bottle neck projections 82 from the cap indentations 84.

While the present invention has been described above by reference to specific embodiments of the invention, it should be understood that modifications and variations could be made to the bottle and cap closure apparatus without departing from the intended scope of the following claims.

1. A bottle and cap closure apparatus comprising:
   a bottle having an interior volume and an opening in the bottle to the bottle interior volume;
   a cylindrical bottle neck on the bottle opening, the bottle neck having a center axis that defines mutually perpendicular axial and radial directions relative to the bottle, and the bottle neck having a cylindrical exterior surface and an annular end at an axially opposite end of the bottle neck from the bottle;
a bottle screw thread on the bottle neck exterior surface, the bottle screw thread having opposite first and second ends and a length between the opposite first and second ends, the bottle screw thread length extending around the bottle neck exterior surface as the bottle screw thread extends from the first end of the bottle screw thread positioned adjacent the bottle neck annular end, to the second end of the bottle screw thread positioned adjacent the bottle;

a projection on the bottle screw thread, the projection extending outwardly from the bottle screw thread;

a cap having an interior volume and an opening in the cap to the cap interior volume, the cap opening and the cap interior volume being dimensioned to receive the bottle neck through the cap opening and inside the cap interior volume;

cylindrical sidewall on the cap surrounding the cap opening and the cap interior volume, the sidewall having a center axis that defines mutually perpendicular axial and radial directions relative to the cap, the sidewall having a cylindrical interior surface and an annular end that surround the cap opening and the cap interior volume;

cap screw thread on the sidewall interior surface, the cap screw thread having opposite first and second ends and a length between the opposite first and second ends, the cap screw thread length extending around the cap interior surface as the cap screw thread extends from the first end to the second end; and,

an indentation on the cap screw thread, the indentation extending inwardly into the cap screw thread, and the indentation being sized to receive the projection on the bottle screw thread when the cap is screw threaded on the bottle neck.

2. The apparatus of claim 1, further comprising:

the projection being adjacent the second end of the bottle screw thread.

3. The apparatus of claim 1, further comprising:

the projection being one of a plurality of projections on the bottle screw thread; and,

the indentation being one of a plurality of indentations on the cap screw thread.

4. The apparatus of claim 1, further comprising:

the plurality of projections on the bottle screw thread all being adjacent the second end of the bottle screw thread.

5. The apparatus of claim 1, further comprising:

the projection extending axially outwardly from the bottle screw thread; and,

the indentation extending axially inwardly into the cap screw thread.

6. A bottle and cap closure apparatus comprising:

a bottle having an interior volume and an opening in the bottle to the bottle interior volume;

cylindrical bottle neck on the bottle surrounding the bottle opening, the bottle neck having a center axis that defines mutually perpendicular axial and radial directions relative to the bottle, and the bottle neck having a cylindrical exterior surface and an annular end at an axially opposite end of the bottle neck from the bottle;

a bottle screw thread on the bottle neck exterior surface, the bottle screw thread having opposite first and second ends and a length between the opposite first and second ends, the bottle screw thread length extending around the bottle neck exterior surface as the bottle screw thread extends from the first end of the bottle screw thread positioned adjacent the bottle neck annular end, to the second end of the bottle screw thread positioned adjacent the bottle;

an indentation on the bottle screw thread, the indentation extending inwardly into the bottle screw thread;

a cap having an interior volume and an opening in the cap to the cap interior volume, the cap opening and the cap interior volume being dimensioned to receive the bottle neck through the cap opening and inside the cap interior volume;

cylindrical sidewall on the cap surrounding the cap opening and the cap interior volume, the sidewall having a center axis that defines mutually perpendicular axial and radial directions relative to the cap, the sidewall having a cylindrical interior surface and an annular end that surround the cap opening and the cap interior volume;

cap screw thread on the sidewall interior surface, the cap screw thread having opposite first and second ends and a length between the opposite first and second ends, the cap screw thread length extending around the cap interior surface as the cap screw thread extends from the first end to the second end; and,

an indentation on the cap screw thread, the projection on the cap screw thread, the projection extending outwardly from the cap screw thread, and the projection being sized to extend into the indentation on the bottle screw thread when the cap is screw threaded on the bottle neck.

7. The apparatus of claim 6, further comprising:

the indentation being adjacent the second end of the bottle screw thread.

8. The apparatus of claim 6, further comprising:

the indentation being one of a plurality of indentations in the bottle screw thread; and,

the projection being one of a plurality of projections on the cap screw thread.

9. The apparatus of claim 8, further comprising:

the plurality of indentations in the bottle screw thread all being adjacent the second end of the bottle screw thread.

10. The apparatus of claim 6, further comprising:

the indentation extending axially inwardly into the bottle screw thread; and,

the projection extending axially outwardly from the cap screw thread.

11. A bottle and cap closure apparatus comprising:

a bottle having an interior volume and an opening in the bottle to the bottle interior volume;
a cylindrical bottle neck on the bottle surrounding the bottle opening, the bottle neck having a center axis that defines mutually perpendicular axial and radial directions relative to the bottle, and the bottle neck having a cylindrical exterior surface and an annular end at an axially opposite end of the bottle neck from the bottle;

a bottle screw thread on the bottle neck exterior surface, the bottle screw thread having opposite first and second ends and a length between the opposite first and second ends, the bottle screw thread length extending around the bottle neck exterior surface as the bottle screw thread extends from the first end of the bottle screw thread positioned adjacent the bottle neck annular end, to the second end of the bottle screw thread positioned adjacent the bottle;

a projection on the bottle neck exterior surface adjacent the bottle screw thread, the projection extending radially outwardly from the bottle neck exterior surface;

a cap having an interior volume and an opening in the cap to the cap interior volume, the cap opening and the cap interior volume being dimensioned to receive the bottle neck through the cap opening and inside the cap interior volume;

cylindrical sidewall on the cap surrounding the cap opening and the cap interior volume, the sidewall having a center axis that defines mutually perpendicular axial and radial directions relative to the cap, the sidewall having a cylindrical interior surface and an annular end that surround the cap opening and the cap interior volume;

cap screw thread on the sidewall interior surface, the cap screw thread having opposite first and second ends and a length between the opposite first and second ends, the cap screw thread length extending around the cap interior surface as the cap screw thread extends from the first end to the second end; and,

an indentation on the cap screw thread, the indentation extending radially inwardly into the cap screw thread, and the indentation being sized to receive the projection on the bottle neck exterior surface when the cap is screw threaded on the bottle neck.

12. The apparatus of claim 11, further comprising:
the projection being adjacent the second end of the bottle screw thread.

13. The apparatus of claim 11, further comprising:
the projection being one of a plurality of projections on the bottle neck exterior surface; and,

the indentation being one of a plurality of indentations on the cap screw thread.

14. The apparatus of claim 13, further comprising:
the plurality of projections on the bottle neck exterior surface all being adjacent the second end of the bottle screw thread.

15. The apparatus of claim 11, further comprising:
the cap screw thread having opposite flank surfaces that extend the length of the cap screw thread between the cap screw thread first and second ends; and, the indentation extending radially inwardly into the cap screw thread crest surface.

16. A bottle and cap closure apparatus comprising:

a bottle having an interior volume and an opening in the bottle to the bottle interior volume;

cylindrical bottle neck on the bottle surrounding the bottle opening, the bottle neck having a center axis that defines mutually perpendicular axial and radial directions relative to the bottle, and the bottle neck having a cylindrical exterior surface and an annular end surface at an axially opposite end of the bottle neck exterior surface from the bottle;

bottle screw thread on the bottle neck exterior surface, the bottle screw thread having opposite first and second ends and a length between the opposite first and second ends, the bottle screw thread length spiraling around the bottle neck exterior surface as the bottle screw thread extends from the first end of the bottle screw thread positioned adjacent the bottle neck annular end surface to the second end of the bottle screw thread positioned adjacent the bottle, the bottle screw thread having opposite flank surfaces that extend between the bottle screw thread first and second ends;

a projection on one of the bottle screw thread flank surfaces, the projection extending axially outwardly from the one bottle screw thread flank surface;

cap having an interior volume and an opening in the cap to the cap interior volume, the cap opening and the cap interior volume being dimensioned to receive the bottle neck through the cap opening and inside the cap interior volume;

cylindrical sidewall on the cap surrounding the cap opening and the cap interior volume, the sidewall having a center axis that defines mutually perpendicular axial and radial directions relative to the cap, the sidewall having a cylindrical interior surface and an annular end surface that surround the cap opening and the cap interior volume;

cap screw thread on the sidewall interior surface, the cap screw thread having opposite first and second ends and a length between the opposite first and second ends, the cap screw thread length extending around the cap interior surface as the cap screw thread extends from the first end to the second end; and,

an indentation on the cap screw thread, the indentation extending axially inwardly into the cap screw thread, and the indentation being sized to receive the projection on the bottle neck exterior surface when the cap is screw threaded on the bottle neck.

17. The apparatus of claim 16, further comprising:
the projection being adjacent the second end of the bottle screw thread.

18. The apparatus of claim 16, further comprising:
the projection being one of a plurality of projections on the one of the bottle screw thread flank surfaces; and,
19. The apparatus of claim 18, further comprising:

the plurality of projections on the one of the bottle screw thread flank surfaces all being adjacent the second end of the bottle screw thread.

20. The apparatus of claim 16, further comprising:

the bottle screw thread flank surface opposite the one of the bottle screw thread flank surfaces having no projections.

21. The apparatus of claim 16, further comprising:

the bottle screw thread having a crest surface between the opposite flank surfaces, the crest surface extending the length of the bottle screw thread between the bottle screw thread first and second ends.

22. A bottle and cap closure apparatus comprising:

a bottle having an interior volume and an opening in the bottle to the bottle interior volume;

a cylindrical bottle neck on the bottle surrounding the bottle opening, the bottle neck having a center axis that defines mutually perpendicular axial and radial directions relative to the bottle, and the bottle neck having a cylindrical exterior surface and an annular end surface at an axially opposite end of the bottle neck exterior surface from the bottle;

an indentation on one of the bottle screw thread flank surfaces, the indentation extending axially inwardly into the one bottle screw thread flank surface;

a cap having an interior volume and an opening in the cap to the cap interior volume, the cap opening and the cap interior volume being dimensioned to receive the bottle neck through the cap opening and inside the cap interior volume;

a cylindrical sidewall on the cap surrounding the cap opening and the cap interior volume, the sidewall having a center axis that defines mutually perpendicular axial and radial directions relative to the cap, the sidewall having a cylindrical interior surface and an annular end surface that surrounds the cap opening and the cap interior volume;

a cap screw thread on the sidewall interior surface, the cap screw thread having opposite first and second ends and a length between the opposite first and second ends, the cap screw thread length spiraling around the cap interior surface as the cap screw thread extends from the first end to the second end, the cap screw thread having opposite flank surfaces that extend between the cap screw thread first and second ends; and,

a projection on one of the cap screw thread flank surfaces, the projection extending axially outwardly from the one cap screw thread flank surface, and the projection being sized to be received in the indentation in the one bottle screw thread flank surface when the cap is screw threaded on the bottle neck.

23. The apparatus of claim 22, further comprising:

the indentation being adjacent the second end of the bottle screw thread.

24. The apparatus of claim 22, further comprising:

the indentation being one of a plurality of indentations in the one bottle screw thread flank surface; and,

the projection being one of a plurality of projections on the one cap screw thread flank surface.

25. The apparatus of claim 24, further comprising:

the plurality of indentations in the one bottle screw thread flank surface all being adjacent the second end of the bottle screw thread.

26. The apparatus of claim 22, further comprising:

the bottle screw thread flank surface opposite the one bottle screw thread flank surface having no indentations.

27. The apparatus of claim 22, further comprising:

the bottle screw thread having a crest surface between the opposite flank surfaces, the crest surface extending the length of the bottle screw thread between the bottle screw thread first and second ends.

28. A bottle and cap closure apparatus comprising:

a bottle having an interior volume and an opening in the bottle to the bottle interior volume;

a cylindrical bottle neck on the bottle surrounding the bottle opening, the bottle neck having a center axis that defines mutually perpendicular axial and radial directions relative to the bottle, and the bottle neck having a cylindrical exterior surface and an annular end surface at an axially opposite end of the bottle neck exterior surface from the bottle;

a cap screw thread on the bottle neck exterior surface, the bottle screw thread having opposite first and second ends and a length between the opposite first and second ends, the bottle screw thread length spiraling around the bottle neck exterior surface as the bottle screw thread extends from the first end of the bottle screw thread positioned adjacent the bottle neck annular end surface, to the second end of the bottle screw thread positioned adjacent the bottle, the bottle screw thread having opposite flank surfaces that extend between the bottle screw thread first and second ends; and,

a projection on the bottle neck exterior surface adjacent one of the bottle screw thread flank surfaces, the projection extending radially outwardly from the bottle neck exterior surface;
a cylindrical sidewall on the cap surrounding the cap opening and the cap interior volume, the sidewall having a center axis that defines mutually perpendicular axial and radial directions relative to the cap, the sidewall having a cylindrical interior surface and an annular end surface that surrounds the cap opening and the cap interior volume;

a cap screw thread on the sidewall interior surface, the cap screw thread having opposite first and second ends and a length between the opposite first and second ends, the cap screw thread length spiraling around the cap interior surface as the cap screw thread extends from the first end to the second end, the cap screw thread having opposite flank surfaces that extend between the cap screw thread first and second ends, the cap screw thread having a crest surface between the opposite flank surfaces, the crest surface extending the length of the cap screw thread between the cap screw thread first and second ends; and,

an indentation on the cap screw thread crest surface, the indentation extending radially inwardly into the cap screw thread crest surface, and the indentation being sized to receive the projection on the bottle neck exterior surface when the cap is screw threaded on the bottle neck.

29. The apparatus of claim 28, further comprising: the projection being adjacent the second end of the bottle screw thread.

30. The apparatus of claim 28, further comprising: the projection being one of a plurality of projections on the bottle neck exterior surface; and, the indentation being one of a plurality of indentations on the cap screw thread crest surface.

31. The apparatus of claim 30, further comprising: the plurality of projections on the bottle neck exterior surface all being adjacent the second end of the bottle screw thread.

32. The apparatus of claim 28, further comprising: the bottle screw thread having a crest surface between the opposite flank surfaces, the crest surface extending the length of the bottle screw thread between the bottle screw thread first and second ends.