

**APPARATUS AND METHOD FOR REUSABLE, NO-WASTE COLLAPSIBLE
TUBE DISPENSERS WITH CONTROL RIBS AND/OR DETENT, AND CAP
CLOSURE**

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TECHNICAL FIELD

The invention relates to controlled flow and cap closure mechanisms with particular application to forming collapsible tube dispensers.

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BACKGROUND OF THE INVENTION

The earliest collapsible tube dispensers in the US patent database date from the early nineteenth century. Since that time, there has been continued innovation, leading to the various collapsible tube dispensers used for pharmaceuticals, personal care products, toothpaste, foods, paints, glues, hazardous chemicals, grease products, and viscous
15 plastics, to name some of the more common uses of these tubes. As used herein, personal care products include but are not limited to, cosmetics, facial care products, skin care products, over-the-counter health products, and/or hair products.

There are problems with the collapsible tube technologies of the prior art. They do not lend themselves both to being reusable and supporting the complete, controlled
20 dispensing of their contents. As the term is used herein, reusable will refer to the capability to dispense small, or controlled, portions of the contents multiple times, perhaps on different occasions. Reusable will also refer to the capability to secure the closure to the same degree repeatedly, each time it is engaged. Reusable may further refer to the capability to refill the contents multiple times. And reusable may further refer to a
25 container, which can be cleaned, and refilled with differing contents.

Four prior art collapsible tubes dispense all the tube's contents and are reusable. One is not a tube but a pouch that has a mechanism of closing the throat requiring no conventional screw cap, but is an "airless" suction closure. Another is a tube shape that also uses an airless closure. Both these tubes are unfamiliar designs which consumers
30 may or may not trust or prefer because of the absence of a cap and thus the suggestion, true or untrue, that the contents will not remain completely sealed if subjected to outside pressures (as in air travel), or that the contents may not be completely safe from

contaminants from the outside environment. Such tubes may be undesirable for personal care and other products demanding a high degree of aesthetic features, such as oversized caps allowing the tube to stand vertically.

Third, there are some one-time use containers made essentially of a squeeze tube with a narrow end, which is cut to open the tube. All of the contents are then squeezed out, and the tube is discarded. Thus these one-time use containers are not reusable.

Fourth, a collapsible tube with flexible shoulder and screw threads allows compression of the shoulder and threaded throat of the tube that is usually rigid, however it has two structural problems that undermine its intended effects. The first problem stems from over tightening the cap, which in certain instances can apply an excess pressure to the flexible throat, causing it to deform and thereby break the seal formed with the cap, allowing contents to escape or environmental contaminants to enter. The second problem comes from the flexibility of the flexible shoulder, which can buckle or fold when squeezed, causing the contained product to be dispensed erratically.

With the exception of the four examples above, prior art collapsible tube dispensers typically possess a rigid shoulder and a rigid throat. The rigid throat provides an exterior, rigid screw. This exterior rigid screw mates with a cap providing a matching interior screw pattern. When the cap is screwed onto the exterior screw of the throat, a seal is formed, which seals in the contents of the collapsible tube and protects the contents from environmental contamination.

For the last century or two, screws have been built with either threads that taper away from the body, or remain of constant thickness. These screw threads will be referred to herein as open threads. Up until now, using these open thread screws required that the throat and the threads of a collapsible tube be essentially rigid. An essentially rigid throat on a collapsible tube dispenser virtually guarantees that some of the tube contents will not readily leave the tube, causing the tube to waste some of its contents. The rigid shoulder further guarantees this waste.

The use of tubes for carrying food in sports and wilderness exploration environments is well known. None on the market, however, are both reusable and

completely collapsible. Thus, they do not dispense all their contents. A refillable tube that does dispense all its contents is especially desirable when food is otherwise scarce.

Figure 1A shows a prior art exterior screw 20 with a prior art external flexible thread form 22. The prior art external flexible thread form 22 is shown in an expanded view through the following examples shown in Figures 1B and C with a matching internal thread form 24.

There is a local coordinate system in Figure 1A, which will be used throughout this document. The z axis 10 extends through the center of the cylinder of the prior art exterior screw 20, and is the central axis of the cylinder. The r axis 12 is the radial direction of the thread at a point, which, for the sake of discussion, is referred to as thread point 22 in Figure 1A. The n axis 14 is normal to the thread point 22. When the screw is turned in the n direction, it engages more of the threads.

The engagement of an exterior screw thread and matching interior screw is shown in the expanded view of the prior art open screw thread 22 in Figure 1A. The expanded view is a cross-section of the threads taken in the plane of the z axis 10 and the r axis 12.

Figure 1B shows an example of Figure 1A using a standard acme thread for the external flexible thread form 22 and the matching internal thread form 24. A first external acme thread 22-1 matches the first internal acme thread 24-1. A second external acme thread 22-2 with the second internal acme thread 24-2.

Figure 1C shows an example of Figure 1A using a standard buttress thread for the external flexible thread form 22 and the matching internal thread form 24. A first external buttress thread 22-3 matches the first internal buttress thread 24-3. A second external buttress thread 22-4 with the second internal buttress thread 24-4.

Figure 1D shows an example of Figure 1A using a box thread for the external flexible thread form 22 and the matching internal thread form 24. A first external box thread 22-5 matches the first internal box thread 24-5. A second external box thread 22-6 with the second internal box thread 24-6. One skilled in the art will recognize that Figures 1B to 1D show some of the many variations in open threads in use today. Other commonly used threads include various "V" shaped threads, as well as variations in angles of the walls, variations in the shape of the peaks and troughs of the threads.

To summarize what is needed are reusable collapsible tubes able to dispense in a completely controlled manner essentially all of its contents with closure mechanism able repeatedly to create a complete seal of its contents.

SUMMARY OF THE INVENTION

Certain embodiments of the invention include a collapsible tube for containing at least one product, comprising a flexible throat coupled to a flexible shoulder. The flexible throat and the flexible shoulder flatten to dispense essentially all the contained product.

5 The flexible throat is engaged with a mating closure of variable shapes, including but not limited to a screw and cap mechanism, or a mechanism of interlocking protrusions that engage flexible protrusions on the flexible throat with mating essentially rigid protrusions included in the cap. The screw and cap closure is comprised of at least one external flexible thread form that mates with an internal thread form, included in the cap, urging
10 the flexible throat to seal against the cap when the cap is twisted onto the flexible throat.

The flexible shoulder may comprise a raised detent near the widest circumference of the flexible shoulder that stops a cap when twisted onto the flexible throat at a final position.

Alternatively, the flexible shoulder may comprise at least two raised flexible ribs
15 to control the flattening of the flexible shoulder in a single direction.

Or the flexible shoulder may comprise both the raised detent for stopping the cap and the raised flexible ribs to control the flattening, which may be preferred in certain situations.

The raised detent may include a raised rim near the widest circumference of the
20 flexible shoulder sufficient to create a barrier to the cap turning beyond when the cap is in the final position.

The raised detent may include at least one gap for engaging with a bump on the cap to create a cue indicating to a user that the final position has been reached.

In embodiments where the flexible shoulder includes raised ribs, the flexible
25 shoulder may include at least two external raised ribs and/or at least two internal raised ribs. The number of external or internal raised ribs may be even or odd.

Aspects of the invention include manufacturing the collapsible tube with the flexible shoulder including the raised detent by molding a first injected material to create the collapsible tube with the raised detent included in the flexible shoulder. Certain

embodiments of the invention include the collapsible tube with the raised detent as a product of this manufacturing process.

Aspects of the invention include manufacturing the collapsible tube with the raised flexible ribs by molding a first injected material to create the collapsible tube with the raised flexible ribs included in the flexible shoulder. Certain embodiments of the invention include the collapsible tube with the flexible ribs as a product of this manufacturing process.

Certain embodiments include a flexible thread form on the flexible throat that is interrupted in two or more places and may result in said thread form appearing as a series of protrusions that mate to protrusions included in a cap. The cap's internal protrusions engage with the flexible throat's flexible protrusions to create a seal and may include a bump or post to provide a tactile or auditory cue that the final and fully engaged position of the closure has been reached. One skilled in the art appreciates there are many variations possible in the dimensions of such protrusions, including their slope and profile, bumps or ridges on the protrusions that snap together or those in the shape embodied in childproof or tamper proof closures that until now have been essentially rigid.

Certain embodiments include a cap for the collapsible tube, including an interior bulge to act upon the flexible throat to urge the flexible throat to engage the internal thread form and the external flexible thread form or an interior rim to act upon the flexible throat to urge the flexible throat to engage the internal thread and the external flexible thread form.

The cap for the collapsible tube with the flexible shoulder including the raised detent may include a lower surface to engage with the raised detent to stop the cap from twisting past the final position.

The cap for the collapsible tube with the flexible shoulder including raised flexible ribs may include an internal rib that snaps over the raised flexible ribs to indicate the cap turning to the final position or an internal post with sufficient length to snap over the raised flexible ribs of the flexible throat as the cap is turned into the final position, producing a cue indicating to the user that the final position has been reached.

Aspects of the invention include manufacturing the cap for collapsible tube with the raised detent on the flexible shoulder by molding a second injected material to create the cap including the lower surface for engaging the raised detent on the flexible shoulder of the collapsible tube. Certain embodiments include the cap with the lower surface as a
5 product of this process.

Other aspects of the invention include manufacturing the cap for the collapsible tube with a flexible shoulder including raised ribs by either molding the second material to create the cap with the internal rib for snapping over the raised flexible ribs or to create the cap with the internal post for snapping over the raised flexible ribs, or to create the
10 cap with internal protrusions to mate with external flexible protrusions on the flexible throat. Any of these caps are products of this process.

Using the collapsible tube permits dispensing essentially all the contained product, which is advantageous in a variety of fields where today everyone is forced to waste the last part of the contained product. This is valuable in such diverse areas of
15 application as pharmaceuticals, personal care products, over the counter health products, paints, toothpaste, foods, glues, hazardous chemicals, viscous plastics or pastes and grease products.

BRIEF DESCRIPTION OF THE FIGURES

Figure 1A shows a prior art exterior screw with a prior art external flexible thread form;

Figure 1B shows a prior art example of Figure 1A using a standard acme thread
5 for the external flexible thread form and the matching internal thread form;

Figure 1C shows a prior art example of Figure 1A using a standard buttress thread for the external flexible thread form and the matching internal thread form;

Figure 1D shows a prior art example of Figure 1A using a box thread for the external flexible thread form and the matching internal thread form;

10 Figure 2A shows a side view of a collapsible tube in accord with the invention including a raised detent near the widest circumference of its flexible shoulder;

Figure 2B shows a top view of the collapsible tube of Figure 2A including the raised detent and its raised rim;

Figure 2C shows a top view of an alternative collapsible tube where the raised
15 detent includes a first and second gap separating a first and second raised rim;

Figure 2D shows an alternative flexible throat for the collapsible tube of Figures 2A through 2C;

Figure 3A shows a side view of a collapsible tube including at least one external raised rib on the flexible shoulder, in accord with the invention;

20 Figure 3B shows a top view of a collapsible tube including two external raised ribs in accord with the invention;

Figure 3C shows a top view of a collapsible tube including two internal raised ribs in accord with the invention;

25 Figure 3D shows a top view of a collapsible tube including two external raised ribs and two internal raised ribs in accord with the invention;

Figure 4A shows a side view of a collapsible tube with two external raised ribs included on its flexible shoulder;

Figure 4B shows a top view of a collapsible tube with six external raised ribs included on its flexible shoulder;

Figure 4C shows a top view of a collapsible tube with five external raised ribs included on its flexible shoulder;

Figure 5A shows a side view of a collapsible tube including at least one external raised rib and a raised detent on the flexible shoulder, in accord with the invention;

5 Figure 5B shows a top view of a collapsible tube including two external raised ribs and a raised detent in accord with the invention;

Figure 5C shows a top view of a collapsible tube including two internal raised ribs and a raised detent in accord with the invention;

10 Figure 5D shows a top view of a collapsible tube including two external raised ribs, two internal raised ribs and a raised detent in accord with the invention;

Figures 6A to 6D show the side view of the squeezing of the collapsible tube in accord with the invention, with the contained product being dispensed;

Figure 7A shows a side view of a cap engaged through a lower surface to the raised detent of the collapsible tube in accord with the invention;

15 Figure 7B shows a cross section of the cap of Figure 7A with an interior rim engaging the flexible throat of the collapsible tube;

Figure 7C shows a cross section of an alternative cap including an internal bulge for engaging the flexible throat, and the lower surface engaging the raised detent of the collapsible tube;

20 Figures 8A and 8B show an internal post in the cap engaging with a raised rib on the flexible shoulder of the collapsible tube;

Figures 9A and 9B show the cap with an internal post and a bump, where the internal post engages a raised rib and the bump engages a gap in the raised detent of the collapsible tube; and

25 Figures 9C and 9D show a cap including the bump engaging a gap in the raised detent included in the collapsible tube.

DETAILED DESCRIPTION OF THE INVENTION

The invention relates to controlled flow and closure mechanisms with threaded screw and cap or mating protrusion cap with particular application to forming collapsible tube dispensers.

5 Certain embodiments of the invention include a collapsible tube 500 for containing at least one contained product 900, comprising a flexible throat coupled to a flexible shoulder with detent as shown in Figure 2A 512 and/or control ribs 505 as shown in Figure 4A. The flexible throat may include an external flexible thread form 502 as shown in Figures 2A to 5D. The flexible thread form may be interrupted as shown in
10 Figure 2B in at least two places or in more places to create, in effect, a series of protrusions. The flexible throat and the flexible shoulder flatten to dispense essentially all the contained product 900, as shown in Figures 6A to 6D. The external flexible thread form or flexible protrusion mates with an internal thread form or protrusion, included in the cap 800, urging the flexible throat to seal against the cap when the cap is twisted onto
15 the flexible throat.

The flexible shoulder 504 may include a raised detent 512 near the widest circumference of the flexible shoulder 504 as shown in Figures 2A to 2C, and 5A to 5D. The raised detent stops a cap 800 when twisted onto the flexible throat 502 at a final position as shown in Figures 7A to 7C.

20 Alternatively, the flexible shoulder 504 may comprise at least two raised flexible ribs 505 as shown in Figures 3A to 4C. These raised ribs serve to control the flattening of the flexible shoulder 504 in a single direction.

Or the flexible shoulder 504 may comprise both the raised detent 512 for stopping the cap 800 and the raised flexible ribs 505 to control the flattening, which may be
25 preferred in certain situations and is shown in Figures 5A to 5D.

The raised detent 512 may include a raised rim 516 near the widest circumference of the flexible shoulder 504 as shown in Figures 2A to 2C, 5A to 5D, and 7A to 7C. The raised detent is sufficient to create a barrier to the cap 800 turning beyond when the cap is in the final position. Figures 5A and 7A to 7C show the raised detent and its raised rim as

creating the widest circumference of the flexible shoulder. Figures 2A to 2C and 5B to 5D show the raised rim as part or near the widest circumference.

The raised detent 512 may include at least one gap 514 for engaging with a bump 824 of the cap 800 to create a cue indicating to a user that the final position has been reached as shown in Figures 9B to 9D. Figure 2C shows an example with the raised detent including a first gap 514-1 and a second gap 514-2, separating the first raised rim 516-1 from the second raised rim 516-2.

In embodiments where the flexible shoulder 504 includes raised ribs, the flexible throat may include at least two external raised ribs and/or at least two of an internal raised ribs, as seen in the following examples:

Figure 3A shows one side of the flexible shoulder 504 including a first external raised rib 505-1.

Figures 3B and 5B show the flexible shoulder including a first external raised rib 505-1 and a second external raised rib 505-2.

Figures 3C and 5C show the flexible shoulder including a first internal raised rib 507-1 and a second internal raised rib 507-2.

Figures 3D and 5D show the flexible shoulder including both a first external raised rib 505-1 and a second external raised rib 505-2, as well as a first internal raised rib 507-1 and a second internal raised rib 507-2.

Figures 4A and 5A show one side of the flexible shoulder including a first external raised rib 505-1 and a second external raised rib 505-2, which when the flexible shoulder is symmetric with its other side, would thus include four external raised ribs. In certain embodiments, this may be a preferred configuration.

Figure 4B shows the flexible shoulder including more than four external raised ribs, in fact including a first external raised rib 505-1, a second external raised rib 505-2, a third external raised rib 505-3, a fourth external raised rib 505-4, a fifth external raised rib 505-5 and a sixth external raised rib 505-6.

Figure 4C shows the flexible shoulder including an odd number of external raised ribs, in fact including a first external raised rib 505-1, a second external raised rib 505-2,

a third external raised rib 505-3, a fourth external raised rib 505-4, and a fifth external raised rib 505-5.

Various embodiments of the flexible shoulder may have an even or odd number of external or internal raised ribs. The number these internal and/or external raised ribs may
5 further be any number that maximizes flow control according to the viscosity of the contents and/or the dimensions of the throat, which, as understood by one skilled in the art, may vary on any of its dimensions including length, width, size of aperture, angle of taper, and wall thickness.

Using the collapsible tube 500 permits dispensing essentially all of the contained
10 product 900 as shown in Figure 6A to 6D, which is advantageous in a variety of fields where today everyone is forced to waste the last part of the contained product. The contained product may be any of the following: a pharmaceutical, a personal care product, a toothpaste, a food, an artist's paint, a glue, a hazardous chemical, a grease product, a viscous plastic, a decorative paste, and/or a casting product.

15 A contained product 900 will be referred to herein as a viscous plastic product when it is viscous enough to be pressed out of a collapsible squeeze tube to form a blob or a line for various purposes, such as caulk or other sealants, a compound used to create a Braille letter, or other identifying mark on items for the blind, or a decorative substance that is not simply paint but creates texture and mass when applied, or at least one
20 compound that dries when exposed to air forming durable shapes, marks, seals, decorations, and the like.

The collapsible tube 500 may preferably be made of at least one flexible thermoset elastomeric and/or flexible thermoplastic elastomer. Elastomeric plastics include, but are not limited to, urethane, polyvinyl chloride, ThermoPlastic elastomer
25 Olefin (TPO), Thermal PolyVinyl chloride (TPV), ThermoPlasRubber (TPR) and/or Silicone based compounds. The cap 800 to which the flexible threads mate may also be manufactured using existing collapsible tube manufacturing technology and materials.

Aspects of the invention include manufacturing the collapsible tube 500 with the flexible shoulder 504 including the raised detent 512 by molding a first injected material
30 to create the collapsible tube with the raised detent included in the flexible shoulder.

Certain embodiments of the invention include the collapsible tube with the raised detent as a product of this manufacturing process.

Another aspect of the invention includes manufacturing the collapsible tube 500 with the raised flexible ribs 505 by molding the first injected material to create the collapsible tube with the raised flexible ribs included in the flexible shoulder 504. Certain
5 embodiments of the invention include the collapsible tube with the flexible ribs as a product of this manufacturing process.

As used herein, the first injected material may be but is not limited to, at least one thermoset elastomeric and/or thermoplastic elastomer. Elastomeric plastics include, but
10 not limited to, urethane, polyvinyl chloride, ThermoPlastic elastomer Olefin (TPO), Thermal PolyVinyl chloride (TPV), ThermoPlasRubber (TPR) and/or Silicone based compounds.

Other manufacturing processes may be used to make embodiments of the collapsible tube 500. The threads on the flexible throat 502, the flexible shoulder 504, and
15 when applicable, the collapsible tube body 506, are preferably made of flexible materials including, but are not limited to, at least one thermoset elastomeric and/or thermoplastic elastomer. Elastomeric plastics include, but not limited to, urethane, polyvinyl chloride, ThermoPlastic elastomer Olefin (TPO), Thermal PolyVinyl chloride (TPV), ThermoPlasRubber (TPR) and/or Silicone based compounds.

20 An elastomeric plastic is typically a polymer blend or compound, which above its melting temperature, exhibits a thermoplastic behavior enabling it to be shaped into a fabricated article, such as a collapsible tube or cap. When the article is within its design temperature range, it exhibits elastomeric behavior without cross-linking during fabrication. The fabrication process is reversible. The article can be reprocessed and
25 remolded. The method of making these collapsible tubes 500 may include, but is not limited to, using a mold, into which the material(s) are injected and/or blown. The material may be injected one or more times. When material is injected more than one time, the process is often known as a multi-shot molding.

Certain embodiments include a cap 800 for the collapsible tube 500 as shown in
30 Figures 7A to 9D, including an interior bulge 802 to act upon the flexible throat 502 as

shown in Figure 7C or an interior rim 822 to act upon the flexible throat as shown in Figure 7B. Both the interior bulge 802 and interior rim 822 act upon the flexible throat 502 to urge the flexible throat to engage the internal thread form 804-1 to 804-N, where in these two examples N is four.

5 Further, the cap 800, for the collapsible tube 500 with the flexible shoulder 504 including the raised detent 512, may include a lower surface 830 to engage with the raised detent to stop the cap from twisting past the final position as shown in Figures 7A to 7C.

The cap 800, for the collapsible tube 500 with the flexible shoulder 504 including raised flexible ribs 505, may include an internal post 823 that snaps over a raised flexible
10 rib 505-1 to indicate the cap turning is in the final position as shown in Figures 8A and 8B.

The cap 800 may include a bump 824 engaging the gap 514 in the raised detent 512 as the cap is turned into the final position, producing a cue indicating to the user that the final position has been reached, as shown in Figures 9A through 9D. The may include
15 the internal post 823 as shown in Figures 9A and 9B, or may not include the internal post as shown in Figures 9C and 9D.

In further detail, Figure 7C shows a cross section of Figure 7A of the collapsible shoulder 504, flexible throat 502 engaging the internal thread form and the external flexible thread form. The internal thread form includes internal buttress threads 804-1 to
20 804-4. The external flexible thread form includes external buttress threads 702-1 to 702-4. The internal thread form and the external flexible thread form collectively urge the cap 800 and the flexible throat 502 to seal the contained product into the collapsible tube. The cap 800 further, preferably includes an interior bulge 802 which acts upon the flexible throat 502 to urge the flexible throat 502 to engage the internal thread form and the
25 external flexible thread form.

In Figures 7B and 7C, the internal thread form of the cap 800 slides along the external flexible thread form of the collapsible tube, and the external flexible thread form slides along the internal thread form to slide along each other, when the internal thread form and the external flexible thread form engage. After they engage, continued sliding
30 causes the internal thread form and the external flexible thread form to seal the contained

product 900 into the collapsible tube 500 until the surface of the cap 830 meets the rim surface of the detent 512 which stops the cap turning.

In Figure 7B, the interior rim 822 included in the cap 800 may preferably extend to below at least the first external thread 804-1 to aid in urging the reforming of the flexible throat 502. It may further preferred that the interior rim 822 extend below the
5 second external thread 804-2, and so on. One skilled in the art will recognize that many variations in the cap 800 are preferred in different situations, causing variation in at least their size, shape, number of threads, and whether or not they are hollow.

The cap 800 shown in the preceding Figures may preferably be made from the
10 second injected material containing at least one rigid thermoset elastomeric and/or rigid thermoplastic elastomer. Elastomeric plastics include, but not limited to, urethane, polyvinyl chloride, ThermoPlastic elastomer Olefin (TPO), Thermal PolyVinyl chloride (TPV), ThermoPlasRubber (TPR) and/or Silicone based compounds. The cap to which the flexible threads mate may also be manufactured using existing cap molding
15 technology and materials. The interior bulge 802 on the cap that inserts into the flexible throat 502 may also be a standard cap design. The interior rim 822 on the cap that inserts into the flexible throat 502 may also be a standard cap design. These caps may also be made from conventional cap materials.

Aspects of the invention include manufacturing the cap 800 for collapsible tube
20 500 with the raised detent 512 on the flexible shoulder 504 by molding a second injected material to create the cap including the lower surface for engaging the raised detent on the flexible shoulder 504 of the collapsible tube. Certain embodiments include the cap with the lower surface as a product of this process.

Other aspects of the invention include manufacturing the cap 800 for the
25 collapsible tube 500 with a flexible shoulder 504 including raised ribs by either molding the second material to create the cap with the internal rib for snapping over the raised flexible ribs 505 or to create the cap with the internal post for snapping over the raised flexible ribs. Either of these caps are products of this process.

In further detail, Figures 2B and 2C show a top view of the collapsible tube 500
30 including a first break 600 and a second break 602. Figures 3A shows a side view of the

collapsible tube 500 with the first break 600 forming rectangular column on the flexible throat.

Figures 3A shows the flexible throat 502 with an external flexible thread form including at least one and in this case four open threads. These threads could, be by way
5 of example, external acme threads, external buttress threads, external V threads, external box threads, or combinations or modifications of these well known open threads. The first break 600 in Figure 2A forms a canted column on the flexible throat 502. The first break 600 is rectangular on the flexible throat in Figure 2D.

The collapsible tube 500 may have a tube closure, repeatedly opened and sealed
10 shut by using a mechanical device (sometimes known as a key). Versions of key typically include a plastic cylinder with a slit in its center that slides over the open end of the tube, rolls toward the flexible throat 504 of the collapsible tube 500 to seal the tube closure, and locks itself in the closed position.

The preceding embodiments have been provided by way of example and are not
15 meant to constrain the scope of the following claims.

CLAIMS

What is claimed is:

1. A collapsible tube for containing at least one product, comprising an external flexible thread form on a flexible throat coupled to a flexible shoulder; wherein said
5 flexible shoulder comprises a raised detent near the widest circumference of said flexible shoulder that stops a cap when twisted onto said flexible throat at a final position;

wherein said external flexible thread form mates with an internal thread form, included in said cap, urging said flexible throat to seal against said cap when said cap is twisted onto said flexible throat; and

10 wherein said flexible throat and said flexible shoulder flatten to dispense essentially all of said product;

2. The collapsible tube of Claim 1, further comprising said flexible shoulder mating to a collapsible tube body; wherein said flexible throat and said flexible shoulder flatten
15 with said collapsible tube body to dispense essentially all of said product.

3. The collapsible tube of Claim 1, wherein said raised detent comprises a raised rim near said widest circumference sufficient to create a barrier to said cap turning beyond when said cap is in said final position.

20 4. The collapsible tube of Claim 1, wherein said raised detent comprises at least one gap for engaging with a bump on said cap to create a cue indicating to a user that said final position has been reached.

25 5. The collapsible tube of Claim 1, wherein said contained product is a member of the group consisting of a pharmaceutical product, a personal care product, a paint product, a toothpaste, a food product, a glue product, a hazardous chemical, a grease product, a decorative paste or casting product, and a viscous plastic product.

6. The collapsible tube of Claim 1, wherein said flexible shoulder comprises at least two raised flexible ribs to control the flattening of said flexible shoulder in a single direction.

5 7. The collapsible tube of Claim 6, wherein said raised flexible ribs are external to said flexible shoulder.

8. The collapsible tube of Claim 6, wherein said raised flexible ribs are internal to said flexible shoulder.

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9. The cap for use with said collapsible tube of Claim 1, comprising a lower surface to engage with said raised detent to stop said cap from twisting past said final position; and

15 further comprising a member selected from the group consisting of
an interior bulge to act upon said flexible throat to urge said flexible throat to engage said internal thread form and said external flexible thread form; and
an interior rim to act upon said flexible throat to urge said flexible throat to engage said internal thread and said external flexible thread form.

20 10. A method of manufacturing for at least one of the members of a group consisting of said collapsible tube and said cap of Claim 9, wherein said method comprises at least one member selected from the the group consisting of the steps of:

molding a first injected material to create said collapsible tube with said raised detent included in said flexible shoulder;

25 molding a second injected material to create said cap including said lower surface for engaging said raised detent.

11. A collapsible tube for containing at least one product, comprising an external flexible thread form on a flexible throat coupled to a flexible shoulder; wherein said
30 flexible shoulder comprises at least two raised flexible ribs, either internal or external to

said flexible shoulder, to control the flattening of said flexible shoulder in a single direction;

wherein said flexible throat and said flexible shoulder flatten to dispense essentially all of said product;

5 wherein said flexible throat comprises at least one external flexible thread form that mates with an internal thread form, included in a cap, urging said flexible throat to seal against said cap when said cap is twisted onto said flexible throat.

12. The collapsible tube of Claim 11, further comprising
10 said flexible shoulder mating to a collapsible tube body;
wherein said flexible throat and said flexible shoulder flatten with said collapsible tube body to dispense essentially all of said product.

13. The collapsible tube of Claim 11, comprising at least four raised flexible ribs
15 external to said flexible shoulder.

14. The collapsible tube of Claim 11, comprising at least four raised flexible ribs internal to said flexible shoulder.

20 15. The collapsible tube of Claim 11, wherein said contained product is a member of the group consisting of a pharmaceutical product, an over the counter health product, a personal care product, a paint product, a toothpaste, a food product, a glue product, a hazardous chemical, a grease product, and a viscous plastic or paste product.

25 16. The collapsible tube of Claim 11, wherein said flexible shoulder further comprises a raised detent near the widest circumference of said flexible shoulder that stops said cap when twisted onto said flexible throat at a final position.

17. The collapsible tube of Claim 16, wherein said raised detent comprises a raised rim of flexible material near said widest circumference sufficient to create a barrier to
30 said cap turning beyond when said cap is in said final position.

18. A cap for use with said collapsible tube of Claim 11, comprising

an internal post with sufficient length to snap over said raised flexible ribs of said flexible shoulder as said cap is turned into said final position, producing a cue indicating to the user that said final position has been reached; wherein said cue includes at least one member selected from the group consisting of an auditory cue and a tactile cue; and

wherein said cap, further comprises a member selected from the group consisting of

an interior bulge to act upon said flexible throat to urge said flexible throat to engage said internal thread form and said external flexible thread form; and

an interior rim to act upon said flexible throat to urge said flexible throat to engage said internal thread and said external flexible thread form.

19. A method of manufacturing at least one member selected from the group of said collapsible tube and said cap of Claim 18, comprising at least one member selected from the group consisting of the steps of:

molding a first injected material to create said collapsible tube with said raised flexible ribs included in said flexible throat; and

molding said second injected material to create said cap with said internal post for snapping over said raised flexible ribs.