Zero Waste Packaging System
Flow Bottle Twist Dispensing Design

Pack Flow Concepts LLC

Gene Eckert
23 Briar Ct.
Hamburg, NJ 07419
201 317 5777
eck327@aol.com

Dr. Stephen Derby
172 Lockrow Rd
Troy, NY 12180
518-279-3419 (office)
518-441-6101 (cell)
sderby1@gmail.com

David Brown
9 Surrey Lane
Pittsford, NY 14534
585-267-7829

Dr. John McFadden
35 Creek Rd
Wynantskill, NY 12198
518-429-5746

Patent Pending

March 4, 2014

Executive Summary

This is the first consumer product packaging system that dispenses 100% of its product while being completely compostable and reduces overall production and shipping costs by 30-40%. Standard consumer bottles and tubes leave product in the container creating waste (Figure 1). 15% product is left using hand pumps and 5-10% for tubes. With the Zero-Waste packaging system your customers will be able to use 100% of the product it contains. This gives you a marketing advantage on the shelf because you can rightfully claim that you provide more value and no wasted product or money. And because it's completely compostable, there is no wasted packaging. It is a true zero-waste system.

This patent pending concept consists of novel reusable outer containers with refill pouches of product that allow for a reduction of overall costs and landfill use. Features within the design allow for easy consumer dispensing by actuating components of the outer container to dispense the contents of the refill container. The twist dispensing with the ratchet indicator produces a repeatable amount of liquid for consumer use so as to minimize waste. Liquids can be as thin as water or as thick as laundry detergent or shampoo or lotions. The basic Flow Bottle design and manufacturing is the subject of an earlier provisional patent application.

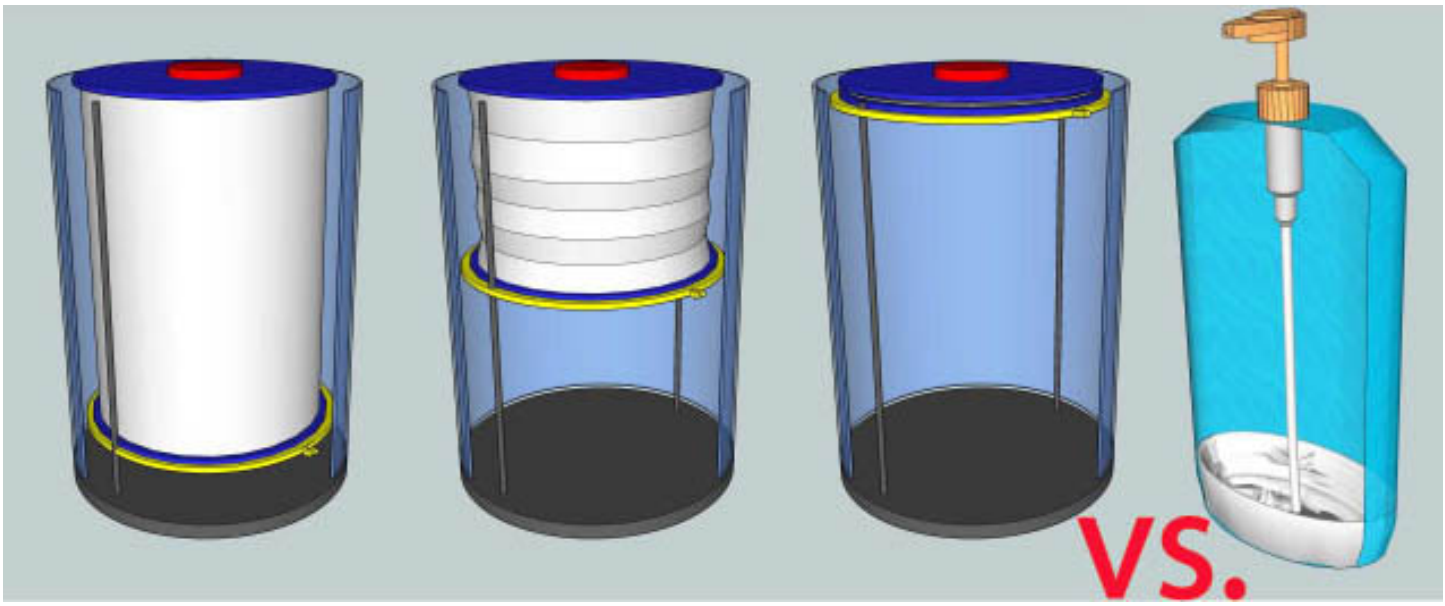
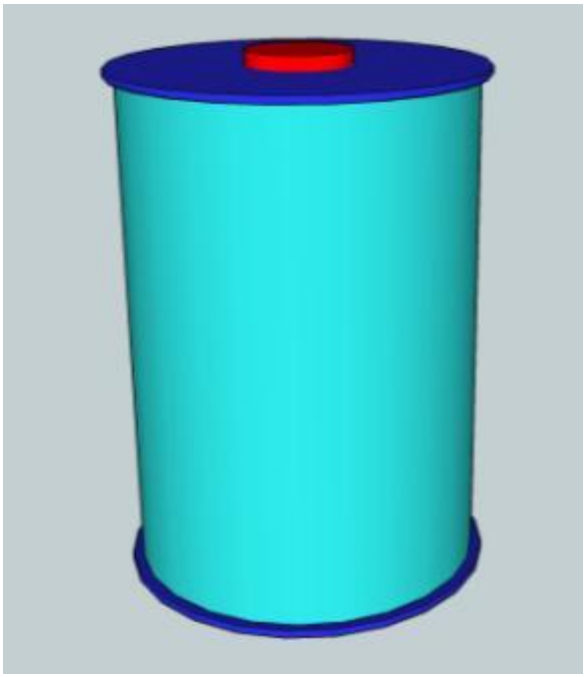


Figure 1 Zero Waste Packaging System vs. Traditional Pump Dispenser

Basic Flow Bottle Concept

The Flow Bottle was described in detail in an earlier white paper. In summary, a biodegradable bottle refill is manufactured and sold for users to place into a reusable outer container. This gave several options for many uses. Figure 2 shows a generic Flow Bottle refill container as the starting point for the Twist Dispenser design.



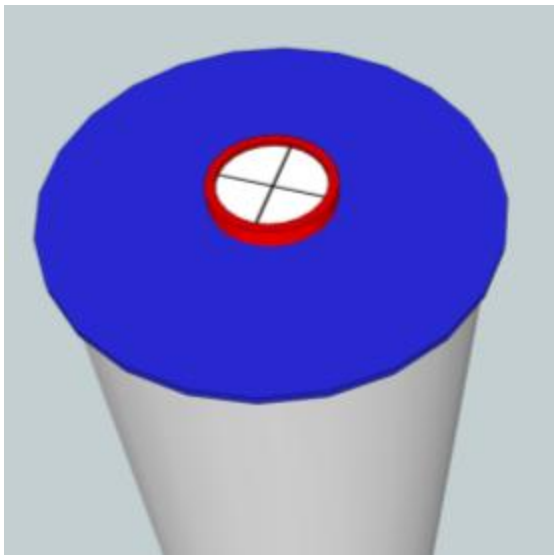


Figure 2 Flow Bottle Refill Container **Refill with Optional Valve**

Flow Bottle Twist Dispenser Design

The Flow Bottle Twist Dispenser goes beyond the original designs and uses of the original Flow Bottle. The Twist Dispenser has the following features:

- Minimizes product contact with air
- Uses a Flow Bottle refill
- Has a actuating top or bottom to dispense liquid
- Actuating motion can drive a viscous liquid through a nozzle port
- Actuating motion has a ratchet so that the twisting motion cannot go backwards
- The motion device has an indicator to allow user to dispense a known amount
- No need to turn backwards to load in next refill
- Can dispense viscous liquid into one's hand or fill a "spoon" with thin liquids like oils

The basic twisting action to raise a lipstick or lip balm has been around for years. But the user must twist the device backwards to lower the remaining product. For the dispensing tasks, lowering the product and allowing air to contact the product is not a desirable trait.

Figure 3 shows how a lipstick is raised. The base is twisted and the platform and pin raises and lowers the lipstick. Depending on the lipstick container construction, the lipstick can simply rise or it can rise while it twists similar to the user's twisting motion. The device shown has an overall rising motion, but using a pair of detents, allows the lipstick to firmly lock into place at both the upper and lower position.

For the Flow Bottle Twist Dispenser, the single groove (technically called either a barrel cam or a helical thread as per a nut and bolt) is insufficient. It is desirable to have a single direction twist slowly raise the product and then when the product is used up, an additional smaller twist resets the platform holding the product rapidly to the starting lowest position. To do this a standard reversing helical thread could be used (Figure 4), but this requires significant twisting to reset the platform and users would grow weary. A rapid return reversing helical thread would be more appropriate.

The rapid return reversing helical thread barrel cam was used for several years on certain models of copiers to slowly traverse the scanning head to make a quality copy but to return the head quickly for the next operation. Currently no images or drawings of this design have been found. And since the platform to be lifted will be exerting more force than simply raising a lipstick, a single pin will likely create a jamming situation.

Using Multiple Helical Thread Cam Tracks

For exerting significant force to move the liquid out of the container, multiple helical thread cam tracks and multiple pins are needed to keep the platform from jamming. It is likely that 3 cam tracks and pins are the best option, but for clarity the Twist Dispenser concept will be explained using 2 cam tracks and pins.

So a pair of pins in a double helical rapid return barrel cam (Figure 5) is used. It is unknown if any such cams have been built in the past. The green curve cam track lowest point starts out at the lower left side of the cylinder, while the red curve cam track starts out at the lower right side. The green curve makes approximately 4.5 revolutions before reaching the top where it levels off. Then in less than a half revolution it drops back to the starting level like the finale of a good rollercoaster. The red curve does exactly the same motion but offset a half revolution. In practice the number of revolutions for lifting the platform can be more or less.

The relationship between the green and red curves can be seen in Figure 6 where the yellow platform with 2 pins would turn and raise up to the top until the rapid return. The platform would always be parallel to the bottom of the cylinder.

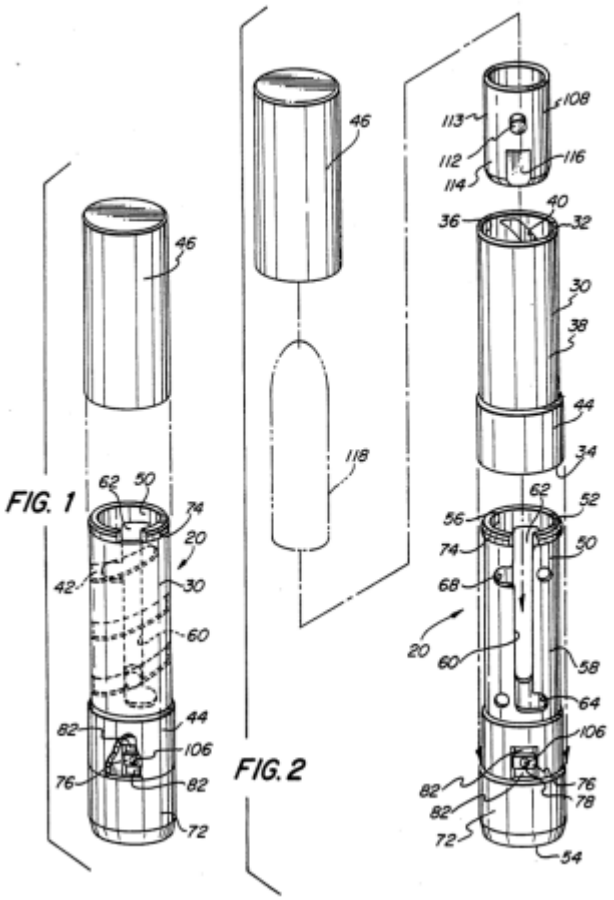


Figure 3 Lipstick Raising Operation from US Patent 5186561

Figure 4 Reversing Helical Thread on a Barrel Cam

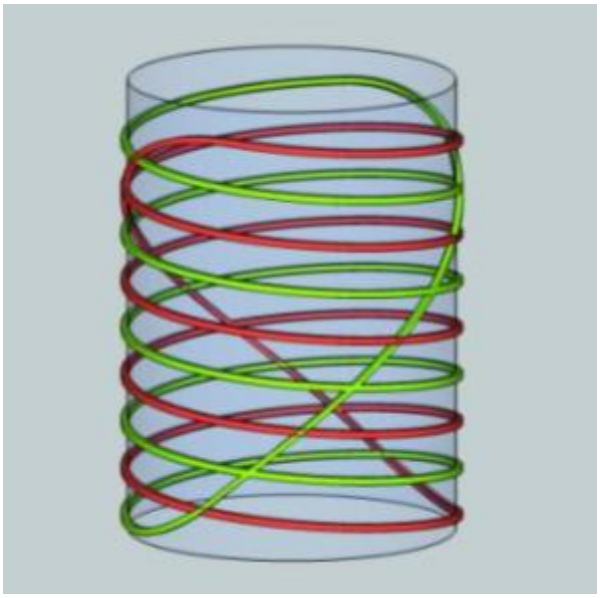


Figure 5 Double Helical Rapid Return Barrel Cam – Direction of Motion

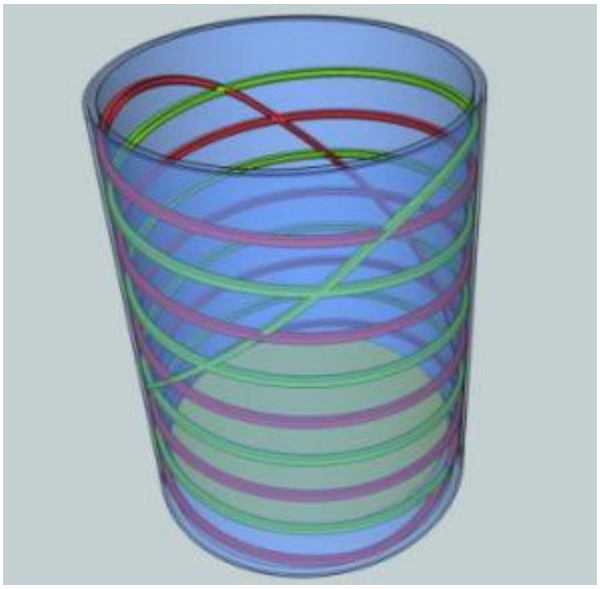


Figure 6 Yellow Platform Attached to Both the Red and Green Curves

A common question at this point it how to guarantee that the pin (cam follower) keeps going in the proper direction and does not change direction when the curve cross over itself or another pin's curve. As shown in Figure 7, a black pin holds a cam follower (yellow rectangle with rounded edges). The cam follower rectangle is sized to be long enough to stay in its track.

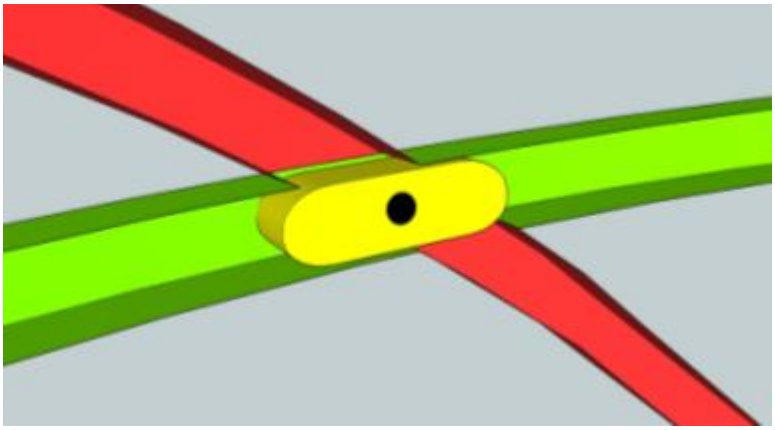


Figure 7 Cam Track with Black Pin and Yellow Cam Follower

Figure 8 shows the yellow platform with the yellow cam followers in the red and green cam tracks that lifts the product. Note how the product twists along with the platform and this may or may not be desirable.

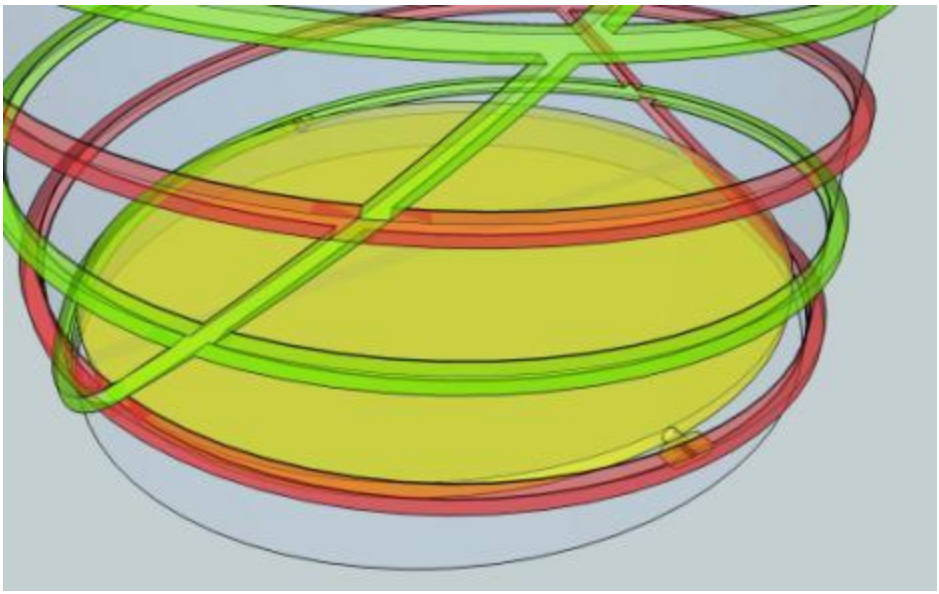


Figure 8 Platform Twists as Pins move up Red and Green Cam Track Curves

To Twist or Not To Twist

In the case of the lipstick example shown, the twisting motion turns the single groove and the platform can simply move up without twisting, or alternate designs can allow it to twist if marketing desires. For the red and green curve cam track system, to prevent the product from twisting, the cylinder also needs to twist and then the platform would simply rise. To do this, 2 black rods are added in Figure 9 to restrict the twisting motion.

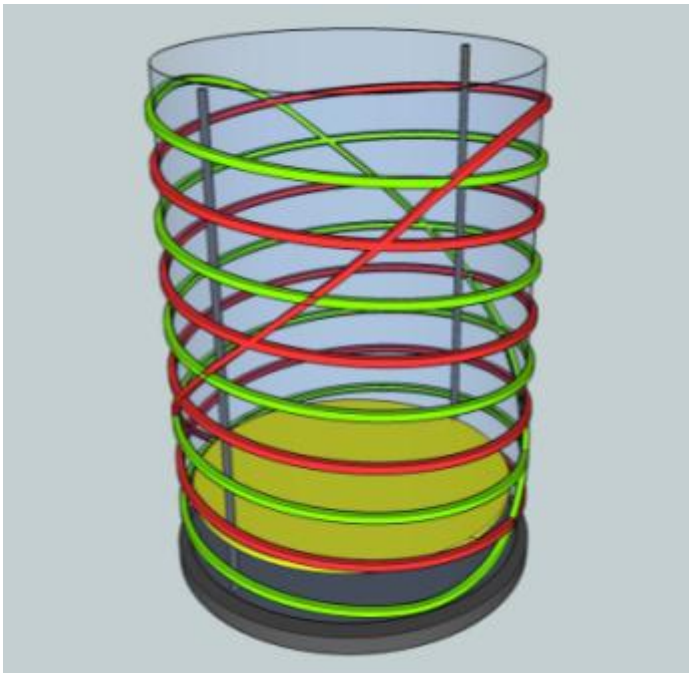


Figure 9 Black Rods Restrict Platform to Rise While Cylinder with Red and Green Curves Twist

For dispensing, Figure 10 shows the Flow Bottle refill inside the cylinder with the cylinder walls hidden for clarity. The upward motion compresses the refill and the contents are extruded from the top.

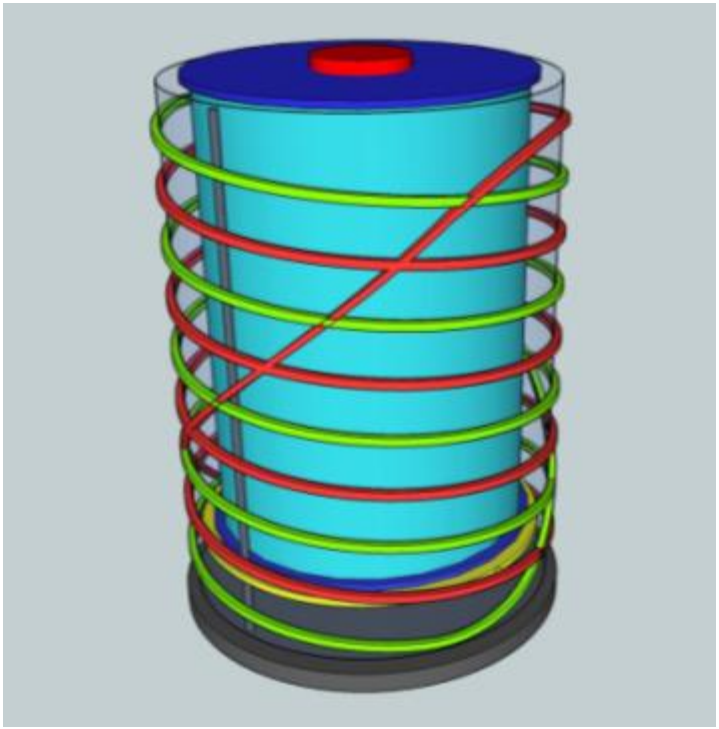


Figure 10 Flow Bottle Refill Compressed to Extrude Contents

Compressing the Product for Some Dispensing Options

Another option is to add a compression layer (shown in green in Figure 11) where the twisting motion compresses the springy material or diaphragm located under the Flow Bottle refill. The twisting motion creates a pressure on the contents until product is released and the compression layer expands, reducing the pressure. This could be used to generate pressure to dispense similar to a hand pump or aerosol spray bottle.

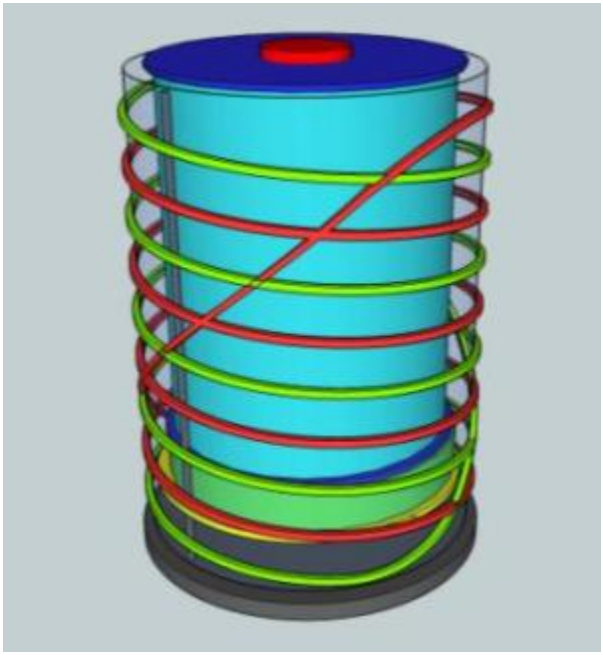


Figure 11 Flow Bottle with Compression Layer

Manufacturing Concerns

The cylinder outside container would have the red and green cam tracks molded into the internal walls (Figure 12). Another question is how one makes the cylinder outside container and gets the 2 pins into the red and green tracks. The most logical method would be to attach the cylinder's 2 halves on the side seams. Then the platform, pins and bottom portion of the red and green curves cam track are configured as a subassembly, and then the subassembly is raised into the cylinder.

Twist Dispenser Benefits

Potential benefits include:

- Replacing Hand Pumps with a Green alternative
- Replacing Aerosol Container with a Green alternative
- Dispensing liquid product and eliminating air contact
- Dispensing liquid product and eliminating waste from over dispensing
- Replacing Aerosol Container with an Airline Friendly alternative that has no compressed gasses

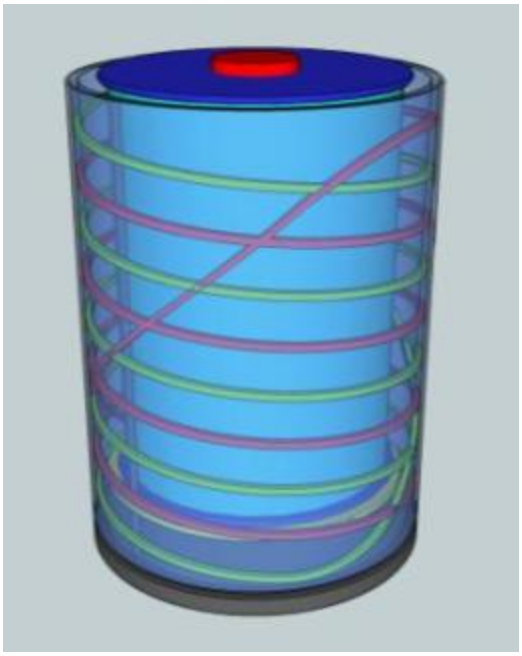


Figure 12 Outer Cylinder with Cam Track Curves Molded on Inside Walls – Including Refill Container

Potential Dispensing Tops and Bottoms

There are several methods for dispensing (Figure 13):

1] Use the over-cap as a measuring cup/spoon to take the dispensed product and pour into bowl/washer
2] Have a nozzle and on/off valve to allow spray after twisting for compression
3] Have a reservoir that is filled when twisted and then user pours from. This could include an overflow tube that would prevent overflow or allow another method of metering doses (not illustrated)
4] Have a sponge/paint pad on bottom that is filled from the twisting dispensing (implies inverted container)

Twist Dispenser Additional Features and Options

1] An indicator (possibly a hole in outer container to see inside platform height) to show that the contents are under compression or the refill is empty.
2] An indicator (possibly a hole in outer container to see inside platform height) to show that the outer container is ready to accept a new refill.
3] A ratchet indicator that shows how many twisting clicks will result from dispensing lever.
4] Optional electric motor drive to index the twist a repeatable amount.

The dispending lever can be on an optional bottle handle to facilitate 1 hand operation. The dispensing lever can be similar to a traditional spray bottle, with its squeezing grip action (Figure 14). Or it could be a thumb actuated rotating lever that is connected to the twisting mechanism.

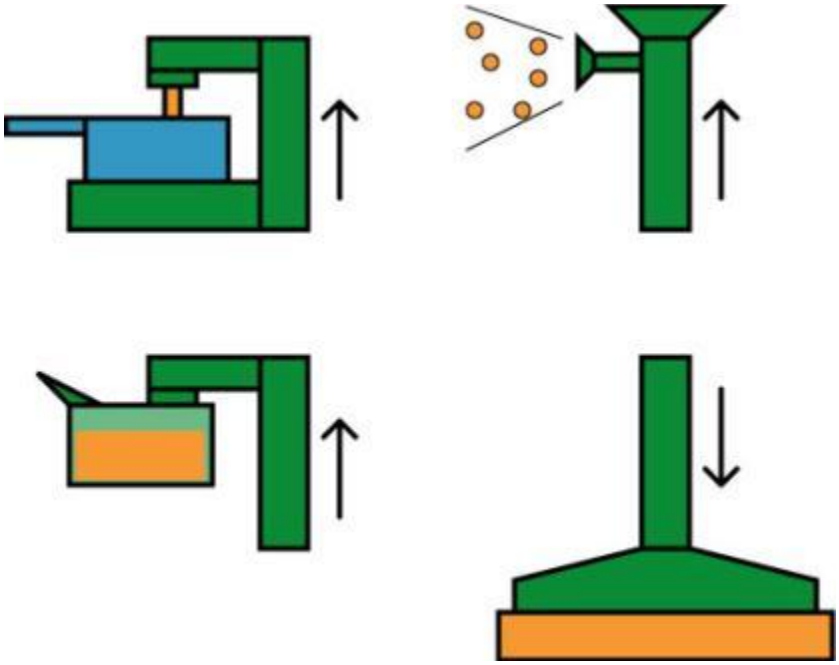


Figure 13 Potential Dispensing Tops and Bottoms

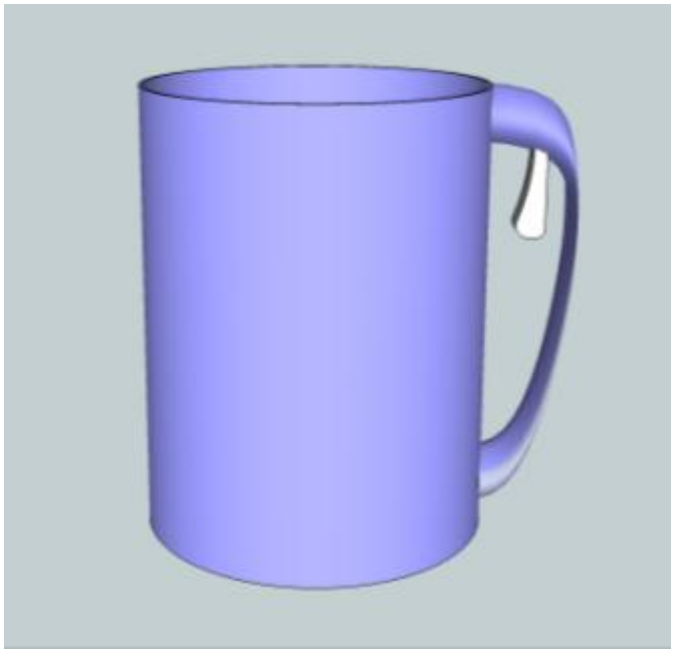


Figure 14 Optional Trigger Type Bottle to Actuate Ratchet Twisting Dispensing

The Flow Bottle Twist Dispenser has been Rapid Prototype modeled recently. Figure 15 shows the results.

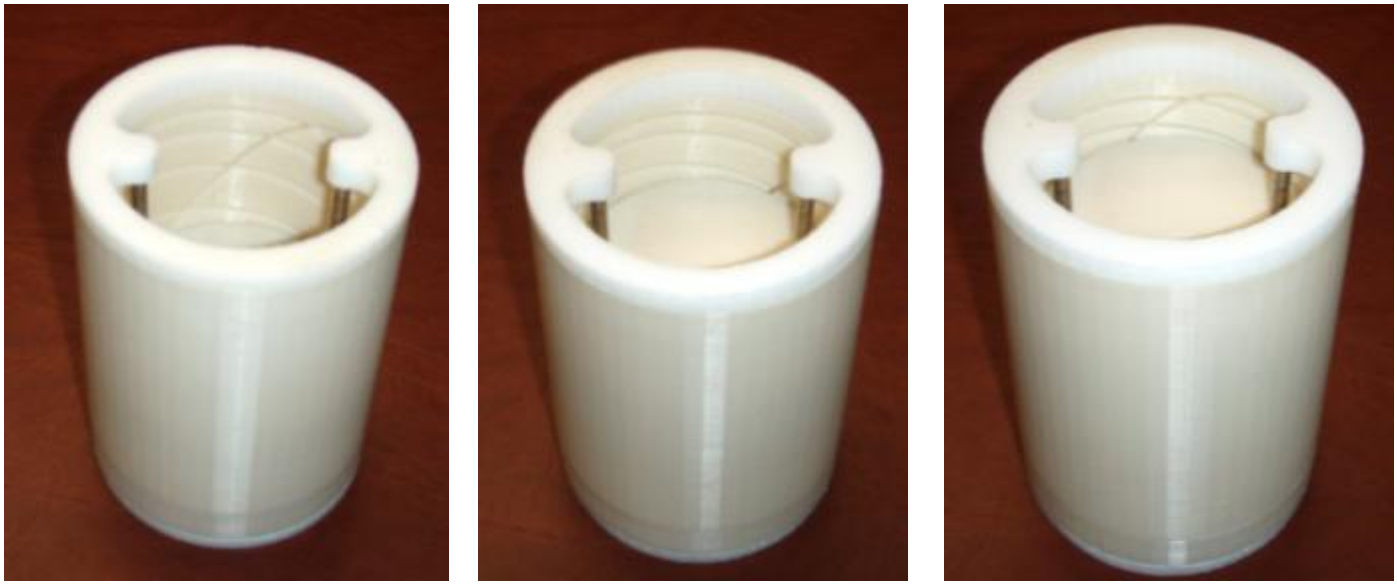


Figure 15 Internal Platform at Low, Middle and High Levels

How do you translate the trigger motion to the rotation/ compressing of the pack?

The upper twist ring can be attached to the trigger via a linkage by using a ratchet and pawl mechanism, shown generically in Figure 16. There are several variations on this device that have been around for many years. The ratchets will provide audible clicks that will aid the user to know how much product has been dispensed and can be coordinated with a setting indicator on the container body showing how much will be dispensed per click.

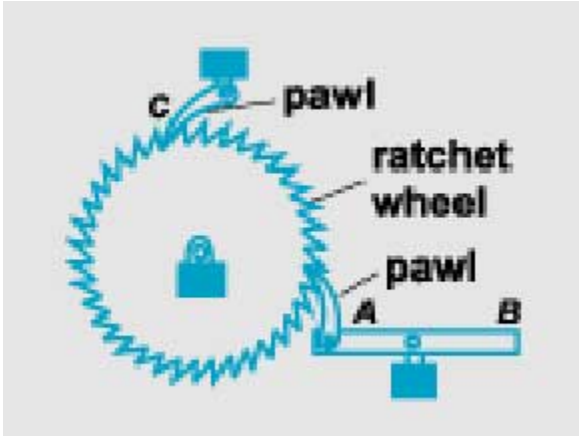
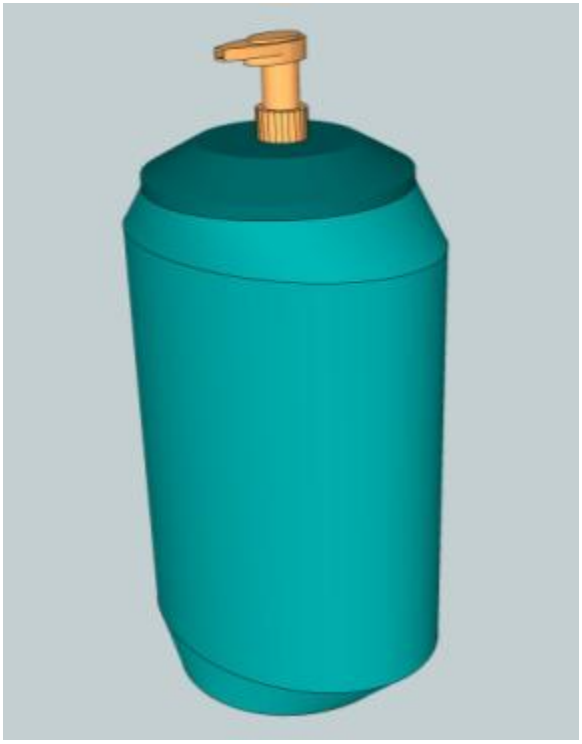


Figure 16 Generic Ratchet and Pawl Mechanism

The trigger system converts the pulling motion to a rotary motion similar to an old fashion flour sifter (the handle pull version not the hand crank version).

Conclusions

The Zero Waste Flow Bottle Twisting Dispenser (Figures 17 and 18) concept addresses many of the needs of today's consumers and today's manufacturers. From Green Packaging concerns to reduced shipping costs, there are many benefits to this new design. After initial machine development to manufacture and fill the refill bottles, there are cost savings and other benefits to be achieved.



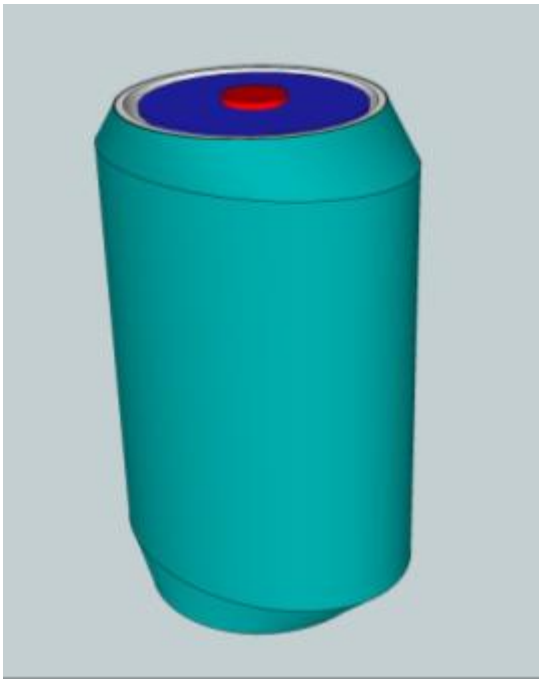
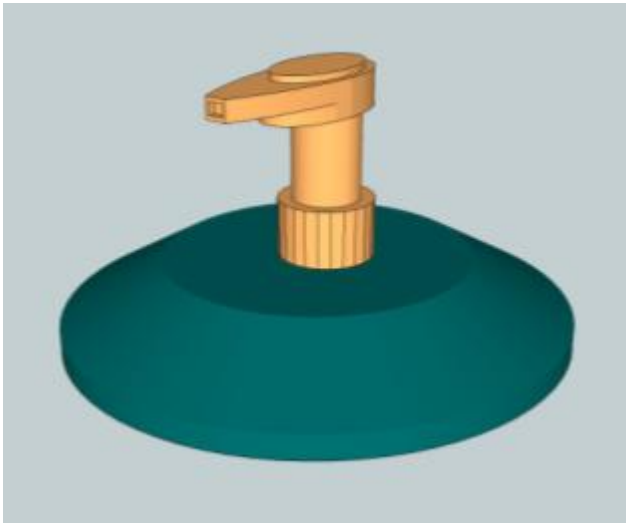


Figure 17 Zero Waste Twist Dispensing Flow Bottle Concept **Bottle with Lid Removed**



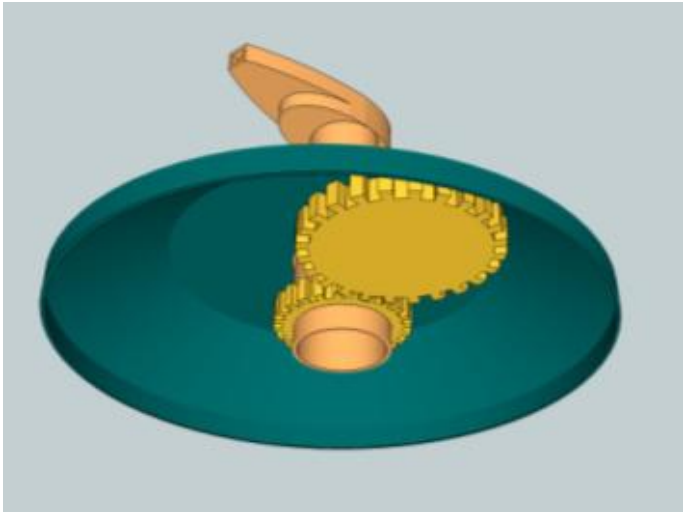


Figure 18 Hand Pump Lid **Hand Pump Turns Gears to Turn Ratchet (not shown)**