March 24, 1959 A. HERTZ 2,878,973

SELF SEALING COLLAPSIBLE TUBES

Filed Aug. 3, 1954

FIG. 1

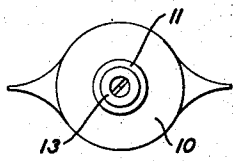


FIG. 2

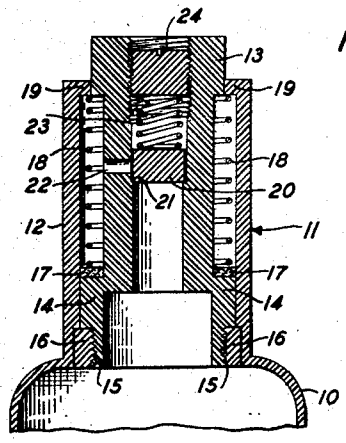


FIG. 3

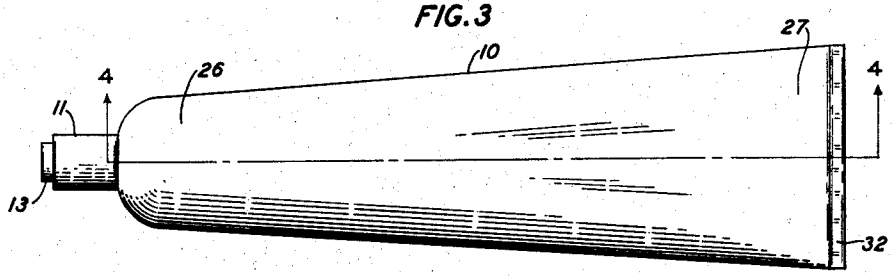


FIG. 4

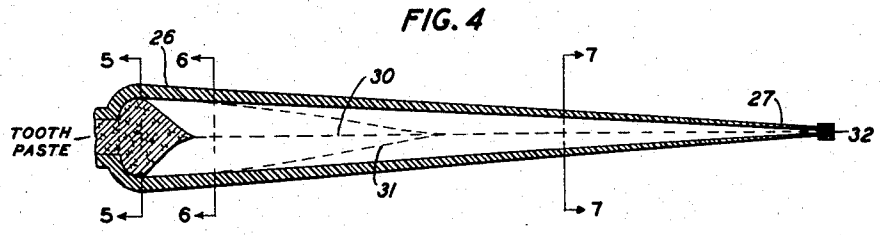


FIG. 5

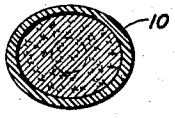


FIG. 6



FIG. 7



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SELF SEALING COLLAPSIBLE TUBES

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6 Claims. (Cl. 222—212)

This application relates to collapsible tubes and to dispensing caps or valves which are particularly designed to be used in conjunction with collapsible tubes.

Heretofore collapsible soft metal tubes, such as toothpaste tubes, utilized threaded caps which were removed when usage of the contents of the tubes was required. Due to the customarily repeated usage of the tubes, the threads become worn allowing air passageways into the tubes and the hardening of the tube contents. Moreover the caps, as utilized in the prior art, provide a greater supply of material than is required, or can be used, since the flow of the tube contents cannot be controlled or rapidly shut off. Conventional caps are also frequently lost or misplaced, allowing the tube contents to harden.

The present invention overcomes these difficulties and accomplishes the following objects by providing, in the specific embodiments incorporated herein, for a cap that may be integral with or threaded upon the neck of a collapsible tube. The cap is resiliently movable when pressure is exerted upon the sides of the collapsible tube to present an aperture through the cap to the interior of the tube. Removing the pressure from the sides of the tube allows the resilient member to restore the positioning of the cap and shut off the aperture.

It is therefore an object of the present invention to provide for a novel collapsible tube having a self-sealing cap integral therewith.

Another object of the present invention is the provision of a novel, sturdy and durable collapsible container and cap which is relatively simple and inexpensive to manufacture, assemble and utilize.

Still another object of the present invention is the provision of a novel collapsible container having a dispensing aperture which is automatically covered when the container is not in use.

A feature of the present invention resides in the provision of means for locking the cap so that it cannot operate when the container is inadvertently squeezed. The cap is unlocked when the container is to be utilized.

When the viscosity of the contents of the container is high, the restoring force of the resilient members in the cap must also be large. In order to aid the resilient members restore the cap to its normal or closed position, the present invention includes as a feature the utilization of a resilient collapsible container which restores to its normal configuration when pressure is removed from the sides of the container. When pressure is removed from the sides of the container or tube, it restores to its normal shape and creates a vacuum which aids the resilient members restore the cap to its closed position.

It is still another object therefore of the present invention to provide a self-sealing collapsible container having means for creating a vacuum in the container which aids in restoring the cap to its closed position.

Still another feature of the present invention resides in the provision of means operable responsive to the application of pressure at only one position for causing substantially all the material in the flexible container to be emitted. Heretofore in the prior flexible container art, to empty the container it is necessary to squeeze the container first at the bottom and then as the container is emptied to squeeze it further from the bottom while rolling up the bottom of the container as it is emptied. Such a procedure is unsatisfactory because the tendency is to apply pressure to the container sides somewhere near the neck and not first at the bottom. When pressure is so supplied, the material in the container adjacent the neck thereof is first dispensed. Thereafter in order to dispense additional material it is necessary to apply pressure towards the bottom of the container and gradually work the material up towards the neck of the container. Such a dispensing procedure is not accomplished with facility and causes creases, folds and even cracks in the container.

The present invention also overcomes this difficulty and accomplishes the foregoing objects by providing a flexible container which restores to its original shape as described above, and which has sides, the thickness of which diminishes from the neck to the bottom of the container. The portion of the sides adjacent the bottom of the container are therefore more flexible than the portion of the sides adjacent the neck of the container. When pressure is applied to the portion of the sides adjacent the neck the portion of the sides adjacent the bottom flex inwardly to cause the material near the bottom of the container to be displaced. It is as if the container is squeezed first near the bottom and then gradually further and further towards the neck although pressure is applied only to the portion of the sides adjacent the neck.

It is therefore still another object of the present invention to provide a flexible container that can be substantially emptied by first displacing material furthest from the dispensing aperture when pressure is applied only at one position adjacent the aperture.

Still another object of the present invention is the provision of a flexible container having tapered walls with the thinnest part of the walls being furtherest from the dispensing aperture of the container.

Still another object of the present invention is the provision of a flexible container being tapered in shape and having walls of a thickness which varies linearly.

Further objects and advantages will become apparent to those skilled in the art upon consideration of the following description taken in conjunction with the drawing wherein:

Fig. 1 is the top view of the novel collapsible container of the present invention;

Fig. 2 is an enlarged sectional view of the dispensing cap of the present invention;

Fig. 3 is a side view of the novel self-sealing collapsible container of the present invention;

Fig. 4 is a partial sectional view taken along line 4—4 in Fig. 3;

Fig. 5 is a sectional view taken along line 5—5 in Fig. 4;

Fig. 6 is a sectional view taken along line 6—6 in Fig. 4; and

Fig. 7 is a sectional view taken along line 7—7 in Fig. 4.

Referring to Figs. 1 through 3 the flexible container or tube 10 has a self-sealing cap 11 which is of the type described in my copending application Serial No. 377,522 filed on August 31, 1953, now Patent 2,788,160. The cap 11 may be integral with the tube 10 or may be connected thereto by any suitable means such as threads. In the specific embodiment disclosed herein the cap 11 is integral with the tube 10 as shown in Fig. 2.

The cap 11 has a neck 12 which is integral with the

tube 10 and a hollow dispensing plunger 13 which is slidable in the neck 12. The plunger 13 has an abutment 14 which slidably mates with the inner circumference of the neck 12. The abutment 14 can be locked to the neck 12 by means of the threads 15 thereon and the threads on collar 16. The maximum diameter of the threads 15 is the same or less than the diameter of the abutment 14. In the position shown in Fig. 2 the plunger 13 is in its locked position so that when pressure is applied to the sides of tube 10 as is hereinafter described the cap 11 is not operated to dispense the contents of tube 10. The plunger 13 therefore has three positions; a locked position with the threads 15 on the abutment 14 and the threads on collar 16 engaged; a normal position with the threads 15 and 16 not engaged, and with no pressure applied to the tube 10; and a dispensing position with the threads 15 on the abutment 14 and the threads on collar 16 not engaged and with pressure applied to the tube 10. The retaining collar 16 may be friction fitted or otherwise attached to the neck 12.

The abutment 14 supports a gasket seal 17 and a coiled spring 18 which is enclosed between the neck 12 and the plunger 13. The top of the spring 18 is retained by a retaining lip 19 of the neck 12. The plunger 13 encloses a slidable aperture block 20 which is supported in its lowest or normal position as shown in Fig. 2 by abutment 21. In its normal position the block 20 shuts off or blocks the inner opening of a radial dispensing aperture 22 in the plunger 13. The block 20 supports a coiled spring 23 which is restrained by an adjusting screw 24. By rotating the screw 24 the restoring force upon block 20 may be varied.

When pressure is applied to the flexible walls of tube 10 it is transmitted to the abutment 14 of plunger 13 and to the aperture block 20. The restoring force of spring 23 is adjusted by screw 24 to be greater than that of spring 18 so that the applied pressure first causes the compression of spring 18 when the threads 15 and on collar 16 are not engaged. The plunger 13 is in this manner moved up until the aperture 22 clears the top of the retaining lip 19 of neck 12. Further pressure applied to the walls of tube 10 compresses the spring 23 and causes the block 20 to move up and unseal the inner opening of the aperture 22. When the block 20 clears the inner opening of the aperture 22 some of the tube contents exit therethrough. When pressure upon the walls of tube 10 is relaxed the block 20 is returned to its normal position shutting off the emission of the tube contents and the spring 18 restores plunger 13 to its normal position. The plunger 13 returns to its normal position where it is supported by the top of the collar 16 of neck 12. Thereafter the plunger 13 can be locked in place by rotating the plunger 13 and thereby engaging the threads 15 and on collar 16.

The aperture 22 may be larger or smaller or may be located higher or lower in the plunger 13 to decrease or increase the time until the emission of the tube contents commences. The present invention is not restricted to the specific dimensions shown.

In order to aid in restoring the block 20 and the plunger 13 to the normal positions described above, the tube 10 is made of resilient plastic or rubber or other similar material which restores to its original shape when pressure is removed therefrom. When the pressure is removed the tube 10 therefore tends to create a vacuum which assists the springs 18 and 23 to restore the plunger 13 and block 20, respectively, to their normal positions. When the tube contents are highly viscous such a tube construction is highly desirable in order to avoid the utilization of springs having relatively large spring constants. The restoration of the tube 10 to its original shape when the application of pressure is removed therefrom together with the restoring effect of the springs 18 and 23 in this manner restores the tube 10 and cap 11 to its normal position ready for further use. In another embodiment not shown herein of the present invention springs are not utilized and the restoration of the tube to its original shape in itself restores the cap to its normal position.

In order to substantially empty the contents of tube 10 it is necessary to apply pressure thereto only at the portion of the tube 10 adjacent its neck 12 which is designated by the numeral 26. The walls of tube 10 as shown in Figs. 4 through 7 are linearly tapered from a relatively large thickness at portion 26 to a relatively small thickness at portion 27 where they are restrained by the seal 32. When pressure is applied at portion 26 the portion 27 of tube 10 flexes inwardly due to its greater flexibility than portion 26. The end of tube 10 in the vicinity of the portion 27 is in this manner the first to be emptied. As further pressure is applied to the portion 26, the walls flex nearer to portion 26 until finally, as shown by the dotted line 30 in Fig. 4, substantially the entire walls of tube 10 have been flexed and substantially the entire tube contents dispensed. It is as if tube 10 is squeezed first at portion 27 and then gradually further and further towards portion 26 although pressure is only applied at portion 26. The dotted lines 31 illustrate the position of the inside of the walls of tube 10 when pressure is applied and the tube 10 is approximately half empty.

Various other modifications may be provided without departing from the spirit of the invention. For example, the walls of tube 10 need not vary linearly but may decrease from neck to bottom by some other function, or the neck portion of the tube may be rectangular instead of arcuate as shown. The tube 10 may be modified by having two rigid plates which are pivoted at one end to each other and which are connected to each other by resilient material. The application of pressure on the tube near the neck or unpivoted end of the plates will cause the plates to function as a bellows and substantially all the material in the tube to be discharged. The above-described arrangements are, therefore, only illustrative of the application of the principles of the invention.

What is claimed is:

1. A collapsible tube comprising a tube neck, an axial movable plunger supported in said tube neck having a radial dispensing aperture normally covered by said neck, resilient means urging said plunger to a position whereby said aperture is blocked, and body walls having a thickness which varies linearly from a thick portion adjacent said neck to a thinner portion furtherest from said neck.

2. In a self-sealing collapsible tube comprising a neck; a resilient plunger supported in said neck, having an aperture and a blocking member for said aperture; means whereby the application of pressure to said tube moves said aperture out of said neck and thereafter moves said blocking member to unseal said aperture; and means for adjusting the movement of said blocking member relative to the movement of said plunger.

3. A collapsible tube having a tube neck, and body walls of varying stiffness, said tube having an open end at said tube neck and a closed end, said varying stiffness of said walls being linear with the stiffest portion thereof being adjacent said open end.

4. A collapsible tube having a substantially conical unrestrained shaped body, and a restraining seal which seals one end of said body and thereby modifies the shape of said body; said body having walls which vary in stiffness being progressively stiffer from the sealed end to the unsealed end of said tube.

5. A collapsible tube which can be emptied by the application of pressure to a small portion of the tube comprising a tube neck, a substantially conical unrestrained shaped body integral to said tube neck, and a restraining seal which seals one end of said body and thereby modifies the shape of said body, said body having a thickness which varies gradually from a larger thickness

adjacent said neck to a smaller thickness adjacent said seal.

6. A collapsible tube comprising a tube neck, an axial movable plunger supported in said tube neck having a radial dispensing aperture normally covered by said neck, said aperture having an inner and an outer end, resilient means urging said plunger to a position whereby said aperture is blocked, the body walls of said tube having a thickness which varies linearly from a thick portion adjacent said neck to a thinner portion furtherest from said neck, a blocking member, resilient means normally urging said blocking member to a position whereby said inner end of said radial dispensing aperture is blocked, and means for adjusting the restoring force of said second-mentioned resilient means.

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