

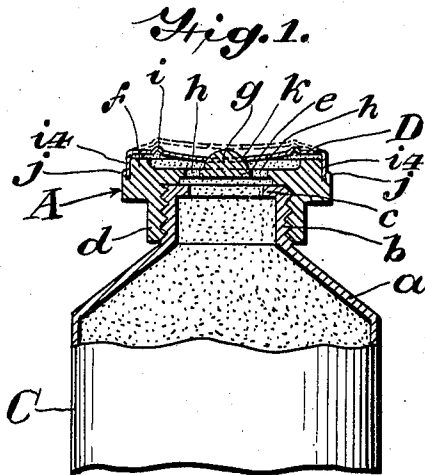
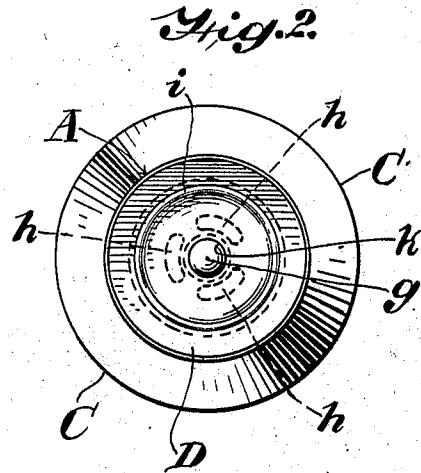
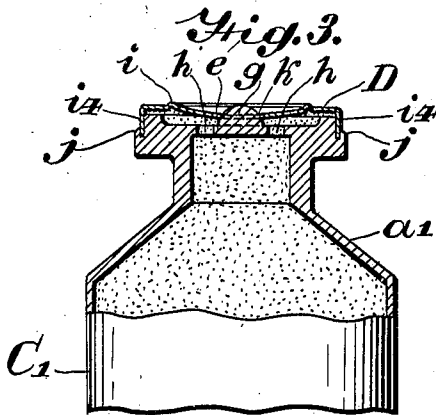
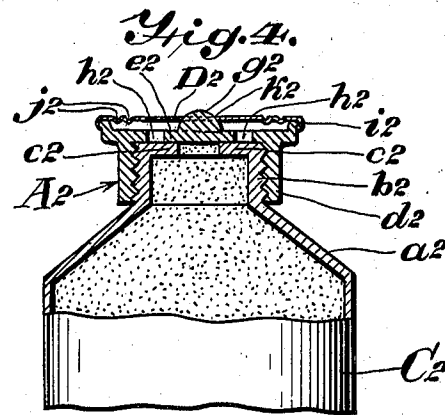
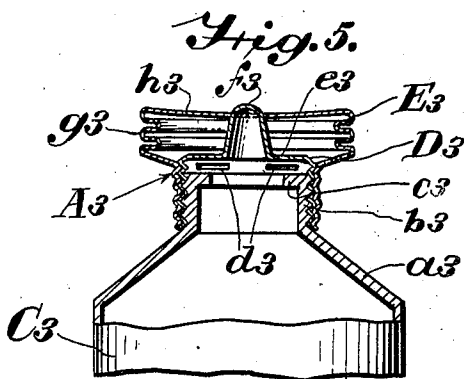
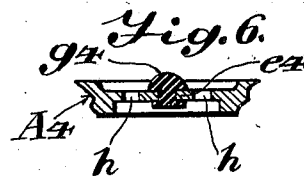
April 23, 1929.

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1,709,948

CLOSURE STRUCTURE

Filed April 19, 1926



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CLOSURE STRUCTURE.

Application filed April 19, 1926. Serial No. 102,832.

My invention relates to closure structure for a container, collapsible tube, or the like within which is stored and from which is dispensed a desired material, either liquid, semi-solid or solid, as tooth paste, soap paste, shaving cream, cold cream, or the like.

In accordance with my invention, the discharge nozzle or orifice of a suitable container is automatically closed or sealed by a member which, upon increase of pressure within the container, is displaced or moved from its normal position for opening a path through said nozzle or orifice.

Further in accordance with my invention, in the outlet of a container nozzle or orifice there is positioned a suitable member forming a seat with which a diaphragm normally engages for closing or sealing the container to prevent egress of the contents thereof, and more particularly, the diaphragm aforesaid comprises a partially flexed or unbalanced resilient member.

My invention resides in closure structure and features of construction of the character hereinafter described and claimed.

For an illustration of some of the various forms my invention may take, reference is to be had to the accompanying drawing in which:

Fig. 1 is a vertical sectional view of a container and cap structure constructed in accordance with my invention.

Fig. 2 is a plan view of the structure shown in Fig. 1.

Fig. 3 is a vertical sectional view of a tube showing the closure structure of Fig. 1 formed integrally with the container.

Fig. 4 is a vertical sectional view of a modified form of cap structure.

Fig. 5 is a vertical sectional view of another modified form of cap structure.

Fig. 6 is a vertical sectional view showing a modified form of seating member.

Referring to Fig. 1, there is illustrated a container structure or collapsible tube C herein shown as comprising the tapered end portion *a*, terminating in an exteriorly threaded neck, nozzle or orifice *b* which may be provided with the inwardly directed flanged section *c*.

For closing the end of tube C, there is utilized cap structure A comprising the mem-

ber or sleeve *d* threaded onto nozzle *b*, a plate-like section *e* bridging the open end of said nozzle, and a circumferential wall section *f*. Rising from section *e* substantially centrally thereof is the semi-spherical seating member *g*. In the example shown, member *g* is formed as an integral part of plate section *e*, although it shall be understood that said member may be formed separately and secured to the plate-section in any suitable manner. Plate section *e*, outwardly of member *g*, is provided with any suitable number of passages or elongated slots through which material may pass from within the container structure C.

For preventing egress of the contents of tube C, there is utilized a closure plate or diaphragm D secured to the cap structure A in any suitable manner. In the example shown, diaphragm D comprises a circumferential rib *i* and terminates in a circumferential flange *j*, received in a groove formed in the periphery of cap structure A, the outer wall *k* of said groove clamping the flange *j* against the inner groove wall and folding the diaphragm securely in position on said cap.

In the form of my invention illustrated in Figs. 1 and 2, diaphragm D, prior to assembly with cap A, is unbalanced or partially flexed whereby, when fixed in position thereon, the wall of a centrally disposed opening or perforation *h* in said diaphragm is biased into engagement with member *g* of plate section *e*, as indicated by the full line position of the parts in Fig. 1.

Upon compression of tube C, as when grasped or squeezed by the hand of the user, pressure beneath the interior surface of diaphragm D is increased with resultant movement thereof away from the seating member *g*, for example, into the position indicated by the broken lines in Fig. 1, the diaphragm at this time being in an abnormal position, that is, it has, due to its unbalanced condition, a decided tendency to return toward its seat *g*. The cap structure A being thus opened, the contents of tube C is expelled through nozzle *b* and openings *h* until the pressure within the tube has decreased an amount sufficient to permit automatic return of diaphragm D into engagement with seat

g. Ordinarily, by such an action, but a relatively small amount of the tube contents are removed.

Obviously, the degree of flexing or unbalancing imparted to the diaphragm should be such that, in conjunction with seat *g*, it will positively prevent leakage of the tube contents. At the same time, the diaphragm should be so constructed as to yield readily when compression is applied to the tube in the manner indicated above.

In Fig. 3, I have illustrated cap and diaphragm structure of the character shown in Fig. 1, the sole point of difference residing in the fact that the cap structure is not threaded to a nozzle of the container structure *C*₁, but is formed as an integral part of the tapered end portion *a*₁ of said container. Otherwise, the construction is substantially the same in both examples of my invention and the contents of container *C*₁ may be expelled in the same manner as described above with respect to container *C* of Fig. 1.

Referring to Fig. 4, there is illustrated a modified form of my invention comprising a collapsible tube *C*₂ having a tapered end portion *a*₂ terminating in the exteriorly threaded nozzle *b*₂ provided with the inwardly directed flanged section *c*₂, preferably extending nearer to the center of nozzle *b*₂ than does the flange *c* toward the center of nozzle *b*, Fig. 1.

The cap structure *A*₂ comprises the sleeve *d*₂ threaded onto nozzle *b*₂, a plate-like section *e*₂ and the feeding member *g*₂. Section *e*₂ outwardly of member *g*₂ is provided with a plurality of slots or passages *h*₂ preferably circumferentially arranged and all overlying the nozzle flange *c*₂. Suitably secured to the ledge or wall portion *i*₂ of cap *A*₂ is the closure member or diaphragm *D*₂ having a centrally disposed opening or recess receiving seat *g*₂, and preferably provided with one or more circumferential ribs or corrugations *j*₂. Diaphragm *D*₂ differs from the diaphragm *D* of Fig. 1 in that it is not flexed or unbalanced prior to assembly with cap structure *A*₂.

To effect withdrawal of material from container structure *C*₂, it is first necessary that cap *A*₂ be slightly unscrewed to raise plate section *e*₂ from engagement with flange *c*₂ thereby opening circuitous paths for the tube contents through the passages *h*₂. Thereafter, compression of tube *C*₂ increases the pressure on the interior face of diaphragm *D*₂, and, due primarily to the corrugations *j*₂, the central portion of said diaphragm bends or bows outwardly from seat *g*₂ permitting escape of the tube contents. Upon substantial equalization of pressure on the inner and outer diaphragm faces, it will return to the position indicated in Fig. 4, to prevent further passage of material from within the tube. The form of my invention described in Fig. 4 possesses marked advantages in that

with the cap *A*₂ entirely threaded onto nozzle *b*₂, accidental withdrawal of the tube contents cannot be effected, thereby rendering the device particularly desirable for purposes of shipment or when traveling. However, by the simple operation described above, the device may be rendered entirely automatic in operation and may be maintained in this condition as long as desired.

From the foregoing, it will be observed that the diaphragms of Figs. 1 and 4 differ in at least one important respect. Due to the fact that diaphragm *D* is partially flexed, it will inherently assume a curved contour as indicated by the full lines in Fig. 1, any substantial increase of pressure within the container tending to cause said diaphragm to assume a plane position, for example, as indicated by the broken lines in Fig. 1. However, diaphragm *D*₂ of Fig. 4, which has not been previously flexed or unbalanced, will assume a substantially plane position while sealing or closing the container *C*₂ and, therefore, upon increase of pressure therewithin, said diaphragm will necessarily move into a bowed position to permit egress of the container contents.

In Fig. 5, I have illustrated a container structure *C*₃ comprising a tapered portion *a*₃, an orifice or nozzle *b*₃ and a flanged portion *c*₃ generally the same as the corresponding structure of Fig. 1. Secured to container *C*₃ is the cap *A*₃ comprising the two sections or members *D*₃ and *E*₃, the former comprising a sleeve threaded onto nozzle *b*₃, said sleeve being provided with perforations or passages *d*₃ and the horizontal portion *e*₃ from which rises the core-shaped section *f*₃. Member *E*₃ comprises a sleeve threaded to the sleeve of member *D*₃ from which rises the corrugated wall *g*₃ terminating in the substantially plane diaphragm *h*₃ having an opening receiving core *f*₃.

Upon initial compression of tube *C*₃, the contents thereof pass through the openings *d*₃ until the space interiorly of wall *g*₃ and diaphragm *h*₃ has been filled. Thereafter, upon compression of container *C*₃, diaphragm *h*₃, primarily due to the corrugated wall portion *g*₃, will rise and permit escape of material from within the tube through the passage thus opened. Thereafter, the diaphragm automatically returns to the position indicated in Fig. 5 to close the tube.

Ordinarily it is desirable that the seating members *g* and *g*₂ be constructed of metal. It shall be understood, however, that other non-metallic materials may be utilized as a phenol condensation product, hard rubber, or the like. As an example of such modified construction, I have illustrated in Fig. 6 a closure cap *A*₄ of any suitable type, as those illustrated in Figs. 1-4, which has a perforated plate *e*₄, corresponding with either plate *e* or *e*₂. Suitably secured in a

centrally disposed perforation in plate c_4 is a seating member or button g_4 comprising a spherical surface of hard rubber for coaction with a closure plate or diaphragm of any suitable type.

The various diaphragms D, D_2 may be constructed of any suitable material, either metallic or non-metallic. However, with the type of construction illustrated in Figs. 1-3, it is particularly desirable to utilize resilient metal which may be readily "set" so as to thereafter inherently possess the quality of snapping on to its seating member to close the discharge orifice from the tube.

Although I have illustrated only the cap structure of Fig. 3 as formed integrally with the tube, it shall be understood that any other form of cap structure constructed in accordance with my invention may be either detachably or integrally formed with their associated containers, as found desirable.

In the construction illustrated in Fig. 1, it will be observed that cap structure A immediately below member g and perforations h , is provided with a recess terminating in a flanged wall within which may be placed a disk of suitable material having the function of positively sealing or closing container C. Such a feature is important, for example, when the container is shipped. Obviously, the ultimate purchaser may readily unscrew cap A, remove the disk, and upon replacement of the cap, the device is in condition for automatic operation.

The type of diaphragm illustrated in Fig. 1 is particularly effective due to the fact that only a decreasing pressure is required to move the same from the full line to the broken line position. This is true despite the fact that the inherent tension thereof due to the flexing or unbalancing operation is sufficient to maintain it in positive engagement with its seat.

Closure structure constructed in accordance with my invention constitutes a measuring device in effect, for the amount of

material expelled at any one operation is roughly proportional to the size of the diaphragm aperture receiving the coacting seat, as the members g, g_2, f_3 and g_4 . Obviously, the size of the diaphragm apertures may be chosen as desired.

It shall be understood that the sealing arrangement comprising the flange c_2 , Fig. 4, for preventing undesired removal of the tube contents may be readily utilized in connection with a cap structure of the character illustrated in Figs. 1 and 2.

What I claim is:

1. The combination with a container comprising collapsible wall structure and having a discharge end of a valve element, and an unbalanced resilient diaphragm, attached and disposed exteriorly of said container and having an orifice, biased into engagement with the valve element under the influence of energy stored in said diaphragm.

2. The combination with a container comprising collapsible wall structure and having a discharge passage, of a valve element interposed in the path of the container contents emerging through said passage, and a diaphragm biased into engagement with the valve element under the influence of energy stored in said diaphragm.

3. A collapsible container having a discharge nozzle, a plate bridging said nozzle and having a passage, a seat on said plate interposed in the path through said nozzle, an unbalanced resilient diaphragm having a substantially centrally disposed opening in which said seat is received, and means for restraining movement of the diaphragm periphery only.

4. A collapsible container having a discharge passage, a valve element located in said passage, and an exteriorly disposed spring member carried by the tube and having an orifice which normally seats on said valve element.

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