Nov. 13, 1951 R. B. WAITE 2,574,991

PRESSURE PROOF DISPENSER CLOSURE

Original Filed Oct. 27, 1948

Fig. 1.

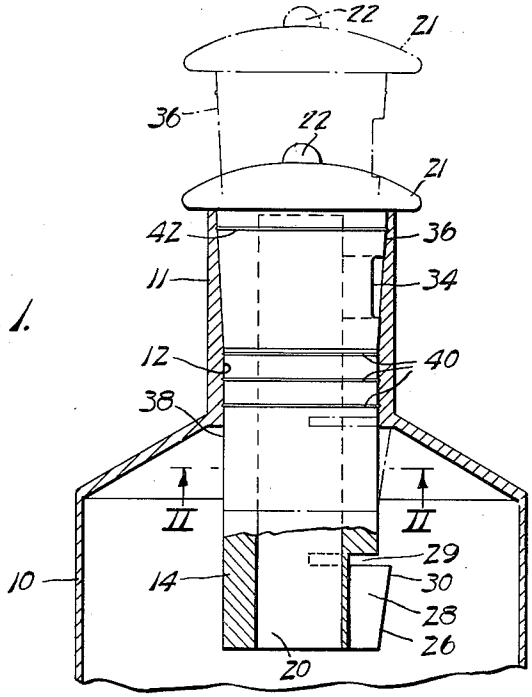
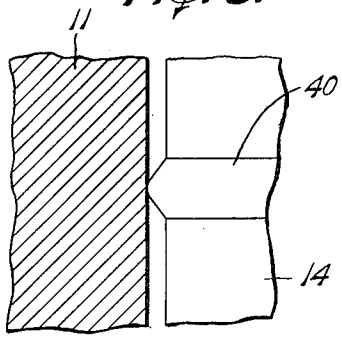


Fig. 3.



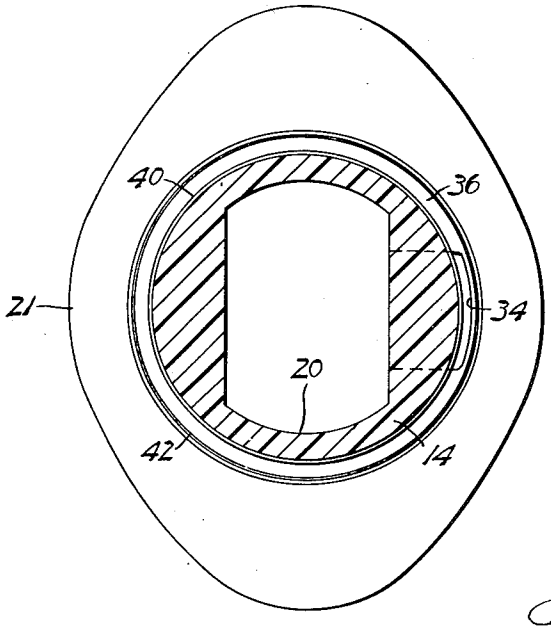


Fig. 2.

INVENTOR
Ralph B. Waite
BY
Bean, Brooks, Buckley & Bean.
ATTORNEYS

Patented Nov. 13, 1951 2,574,991

UNITED STATES PATENT OFFICE

2,574,991

PRESSUREPROOF DISPENSER CLOSURE

Ralph B. Waite, Springville, N. Y.

Continuation of application Serial No. 56,693, October 27, 1948. This application August 10, 1951, Serial No. 241,257

11 Claims. (Cl. 222—92)

1

This invention relates to improvements in dispensing closures for containers in the industrial, chemical and pharmaceutical arts, such as in connection with dental cream or like products, and has particular reference to an improved pressure-proof dispenser closure for use in connection with collapsible or deformable tubes, bottles, etc., containing dental cream, shaving cream, cosmetics and the like. This application is a continuation of my copending application Serial Number 56,693, filed October 27, 1948, and since abandoned.

An important object of the invention is to provide a container and closure plug therefor which embodies improved means for fixing the closure plug in non-leaking position relative to the container, even though the container is placed under substantial pressure, for example when it is packed in a suitcase or the like.

A further object is to provide a dispensing control closure for containers which shall effectively and in fact hermetically seal the contents of the container between dispensing operation, thus preventing the drying and hardening of the material in the container.

A further object is to provide an improved sealing arrangement for a container of the type referred to wherein multiple sealing means cooperate with each other for the effective sealing of the container.

A further object is to provide in a device of this character a closure plug slidable in the neck of a container and of such nature as to be deformable under internal pressures, and to utilize such inherent deformability in the plug to seal it within the neck of the container to prevent opening movement of the plug, after the latter has been pushed to closed position, when the container is subjected to external forces which generate internal pressures therein.

A further object is to provide a novel device of the character referred to wherein a particularly effective cooperation is established between the closure plug and the container body, thus making it possible to provide a closure plug which is slidable outwardly from the neck of the container for the dispensing of material therefrom and wherein the return movement of the plug into the neck of the tube will not displace material upwardly through the passage in the tube to leave a daub at the discharge port, thus permitting the device to dispense material from the container, whereupon the plug can be pushed cleanly back to its normal closed position without leaving a messy daub of material around the head of the plug and the neck of the container.

2

A further object is to provide a device of this character employing a slidable closure plug having a passage therethrough communicating at its outer end with a lateral discharge port through which material such as shaving cream, dental cream, etc. may be dispensed when the plug is pulled to open position and pressure is applied to the container, and to so form the dispensing port as to provide for the extrusion from the discharge port of a ribbon of the material in flat form to facilitate the use of the material.

Other objects and advantages of the invention will become apparent during the course of the following description.

In the drawing I have shown one embodiment of the invention. In this showing

Figure 1 is an enlarged fragmentary sectional view taken through a portion of the upper end of the dispensing tube of the collapsible type, the closure plug being shown in elevation with parts broken away,

Figure 2 is a section, on an enlarged scale through the closure member, taken substantially along line II—II of Figure 1 and

Figure 3 is a substantially exaggerated fragmentary detail view of the closure sealing ridge means associated with the plug.

The invention has been illustrated in conjunction with a container of the collapsible tube type. The container is formed of deformable metal of the usual type, and has the usual body part 10 provided with an upstanding reduced cylindrical neck 11 formed with a bore 12 the lower end of which is cylindrical and the upper end of which tapers upwardly to increase in diameter as further referred to below.

The dispensing control device is indicated as a whole by the numeral 14 and comprises a generally cylindrical body formed of plastic material, such as a suitable synthetic plastic or rubber or the like and is provided with a central longitudinal bore or passage 20 closed at its upper end by means of a head 21 formed on the control device 14. This head is preferably oval or oblong in plan shape as shown in Figure 2, so as to enable the operator to securely grasp the head with his fingers and to rotate the plug 14 to facilitate seating and locking or unseating and unlocking of the plug relative to the container, much after the fashion of rotating a bottle cork to remove it.

The inner end of the plug or closure 14 is provided with a barb shaped formation 26, vertically bisected by means of a vertical groove 28 extending from the lower end of the closure and running into and communicating with a transverse groove 29. This provides a pair of normal-

ly outstanding ends 30 adapted to act as detents to prevent the dispensing control member 14 from becoming detached from the neck of the container subsequent to assembly thereof within the tube. The material of the plug or closure 14 being deformable and flexible, the detents 30—30 extend outwardly beyond the contour of the body 14, thereby forming detents for engagement under the lower end of the neck of the container. The downward and inward taper of the face 26 is such that the detents 30 are guided and compressed inwardly into the bore of the neck when inserting the dispensing plug in the neck of the container. The resilient wall sections are easily compressed within the neck as the member 14 passes downwardly, and the detents 30 spring outwardly so that upon reversal of axial movement, they will engage the lower end of the neck of the container to limit upward movement of the plug 14.

Adjacent its upper end, the passage or bore 20 opens into communication with a laterally directed discharge or dispensing port 34, extending through a side wall portion of the plug 14 at such position that when the plug is pulled upwardly to the broken line position shown in Figure 1, the port 34 clears the upper end of the neck 11. When the plug 14 is pushed inwardly to the solid line position shown in Figure 1, the discharge port 34 is closed by the neck of the container. In this connection it will be noted that the cap 21 is provided with an axial substantially hemispherical boss 22 for facilitating the closing of the plug in a manner to be described.

The upper portion of the bore 12 of the neck tapers to increase in diameter upwardly, and the upper portion of the closure plug 14 is similarly tapered as at 36. Whenever the closure is pressed back to sealing position as shown in solid lines in Figure 1, therefore, the tapered portions of the neck and plug will snugly fit each other.

In practice it has been found that the tapered bore portion of the neck 11 and the correspondingly tapered portion 36 of the plug 14 very snugly engage each other and tend very strongly to prevent upward movement of the plug from its closed position under the influence of internal pressures within the tube 10, as further referred to below. However, means is provided for even more effectively preventing undesirable opening movement of the plug, and for improving the sealing of the plug within the neck of the container to the point where a substantially perfect hermetic seal is provided. The body of the plug 14 is provided preferably with a plurality of outstanding rings 40 formed integral with the plug 14. These rings are shown as being four in number in Figure 1 and the cross-sectional shape of the rings has been greatly exaggerated in Figure 3. Actually, these rings project only slightly beyond the adjacent surfaces of the plugs. One such ring may be employed, or a plurality of them as shown for example in Figure 1. One of the rings, the ring 42 as shown in Figure 1, is preferably arranged at a position on the plug above the dispensing port 34.

Operation

The operation of the device, in general, will be apparent from the foregoing description. The parts normally occupy the positions shown in Figure 1, the closure plug 14 being pushed inwardly, the cylindrical and tapered portions of the plug snugly fitting the correspondingly shaped inner surfaces of the neck, the ridges 40 (and 42) snugly binding within the neck of the container, and the cap 21 preferably seating on the upper end of the neck 11. When the contents of the tube are to be dispensed, the user will grasp the cap 21, which is out of round as shown in Figure 2, and by imparting a slight twisting action to the head 21 while at the same time pulling upwardly thereon, the plug 14 will be released from the neck 11 for free upward movement to the operative broken line position in Figure 1. The material within the tube 10 readily may be dispensed by squeezing the tube to displace the contents of the tube upwardly through the passage 20 and outwardly through the discharge port 34. The cream or other contents of the tube will be wiped or otherwise removed from the vicinity of the discharge port 34, whereupon the plug 14 may be pushed back to the inoperative closed position shown in solid lines in Figure 1.

The cylindrical portion of the plug 14 has a sliding fit with the cylindrical portion of the bore 12 of the neck 11, such portion of the neck bore thus acting as a sliding bearing for the plug in its movement between opened and closed positions. The plug 14, as previously stated, is made of a deformable material such as a deformable plastic, and the passage or bore 20 may be made circular in cross-section, concentric to or eccentric with respect to the axis of the plug 14, or it may be out-of-round as shown in Figure 2 with opposite sides of the bore relatively flat and parallel to each other, and with the intermediate walls of the bore, 90° from the flat faces thereof, formed relatively thin. This arrangement provides a closure plug in which the radial deformability of the material of the plug is uneven through the circumference thereof, thus permitting radial deformation to take place readily. In practice, however, it has been found that the cross-sectional shape of the bore 20 is not critical in any sense, and as stated above, this bore may be circular and concentric with the axis of the plug 14, if desired.

The radial deformability of the plug is extremely important. Materials sold in tubes of this character frequently contain materials which are volatile under elevated temperatures, even if such temperatures are not particularly high. For example, many toilet materials such as shaving cream, toothpaste and the like, in a tube of this character placed on display in a drug store window and subject to the action of the sun's rays, will expand materially within the tube, due in part to the volatile constituents of the material and due in part to the expansion of the solid materials at the higher temperatures. Such expansion of the material in the tube creates a pressure on the lower end of the plug 14 which will tend to move this plug endwise away from closed position, and if this action takes place, the material within the tube will be forced from the upper end thereof.

In this connection it will be noted that the dispensing port 34 normally snugly fits within the neck 11 when the plug is in the fully closed position. However, if the plug is forced upwardly even to a slight extent under the influence of internal pressures within the tube 10 due to expansion or volatility of the materials in the tube, the port 34 will not be snugly closed and material within the tube will be extruded therefrom. However, the radial deformability of the plug prevents this undesirable action from taking place. The binding of the plug within the tube

provides a substantial degree of resistance to movement of the plug out of closed position unless the cap 21 is grasped by the hand and opened in the manner described. This binding action is such that upon the generation of internal pressures, the plug body around the bore 20 will expand into even tighter engagement with the inner walls of the neck 11, the greater the internal pressures the greater the binding action due to the radial deformation of the plug. Thus whenever there is excessive internal pressure present within the tube, due to expansion under the influence of elevated temperatures or due to externally applied pressures, for example, when a tube 10 is packed in a suitcase and subjected to the pressure of surrounding articles, the plug 14 will not be dislodged from its fully closed position. Accordingly the present device may be packed in a suitcase with no wrapping therearound to protect articles of clothing arranged next to the tube.

Another important feature of the invention lies in the fact that when the plug is pushed from opened to closed position after material has been dispensed from the tube, there will be no messy daub of material projecting from the discharge port 34. It normally would be expected that after the tube 10 has been squeezed to extrude a ribbon from the discharge opening 44 and the plug is then pushed inwardly to closed position, the material within the tube would be displaced by the lower end of the plug and such material would flow upwardly through the passage 20 and some would be discharged through the port 34 to leave a daub of material projecting outwardly from such port. This operation however, together with its obvious disadvantage, does not take place. The material of the tube 10 is highly flexible and deformable but is self-form retaining in accordance with the conventional practice in making collapsible tubes of this character. The cross-sectional area of the passage 20 is so related to the deformability of the material from which the tube body 10 is made that the resistance to passage of material through the bore 20 is greater than the resistance of the tube body 10 to outward deformation. To accomplish this there is no definite size or cross-sectional shape for the passage 20 since this will depend upon the nature and consistency of the material within the tube 10. A larger passage 20 will be used for thick creams; a relatively smaller passage 20 for creams and the like of medium thickness, and a relatively smaller passage 20 will be used for relatively thin creams.

The cross-sectional area of the passage 20 need not be uniform from end to end thereof, so long as the shape of the passage does not appreciably reduce the degree of radial deformability of the plug body and so long as the passage 20 provides the proper degree of resistance to movement of the material therethrough in proportion of the degree of deformation of the tube body 10. It is preferred, however, that the minimum diameter or cross-sectional area of the passage be at the lower end of the plug and that such minimum cross-sectional area of the passage be not over seventy-five percent. of the cross-sectional area of the cylindrical portion of the plug body.

It has been found that where a discharge port such as the port 34 is provided through a relatively thin wall portion of the plug, there is a tendency for the extruded ribbon of material to curl as it leaves the discharge port. It has been found that if this discharge port is formed through a relatively thick wall portion of the

plug, as shown in Figure 1, there is no tendency for the ribbon of material to curl. The ribbon is extruded perfectly straight and this is important, particularly in the case of dental cream, since it provides a flat ribbon of cream to lie flat on a toothbrush.

In the use of the device it is frequently the practice to hold the tube in one hand and to hold something else in the other hand, for example when extruding a ribbon of dental cream onto a toothbrush. The boss 22 greatly facilitates the easy closing of the plug 14 with the use of the one hand holding the tube 10. Assuming that the user has extruded a ribbon of cream onto a toothbrush, the ribbon will be wiped off at the port 34, whereupon the user may engage the boss 22 against a convenient wall or mirror surface and push inwardly on the plug. If the boss 22 were not present, it would be necessary for the user to fairly accurately exert force against a wall surface axially of the cap 21, otherwise there might possibly be a tendency for the plug 14 to bind in the bore 12. The hemispherical boss 22 permits the closing operation to take place accurately with less care since it assures the application of an axial closing force to the plug 14.

In connection with the operation of closing the plug, attention is again invited to the fact that the engagement between the cylindrical plug and neck surfaces provides for a free sliding movement of the plug. This is important from a practical standpoint since it eliminates the necessity for having to grasp the tube 10 under substantial pressure when closing the plug. The relation between the deformability of the container body and the frictional resistance to movement of the cream or paste through the plug body would not provide the desired results if it were necessary tightly to grasp the tube body when pushing the plug to closed position.

The ribs 40 (and 42) in actual practice are quite thin and these ribs or ridges do not engage the bore of the neck until the plug 14 is approximately completely closed. The last increment of closing movement of the plug causes the ridges to bind tightly within the neck 11 of the container. This binding action together with the snug fitting of the plug within the neck is such, as indicated above, that strong resistance is provided against movement of the plug out of closed position under the influence of internal pressures. The plug will not move and internal pressures will be built up in the plug bore 20 to cause the plug radially to expand into engagement with the bore surfaces of the neck 11, thus preventing any accidental or unwanted movement of the plug from closed position. At the same time, this resistance to opening movement of the plug is not such as to materially interfere with the opening of the plug by twisting and pulling on the cap 21. This operation is easily performed.

As stated above, it is preferred that one of the sealing rings or ridges, namely the ridge 42, be arranged at a position above the dispensing opening 34. Thus if any contents of the tube find their way externally of the plug around the portion thereof adjacent the dispensing opening 34, for example, if extruded cream is not wiped clean from the plug, the ring 42 provides a positive seal against the escape of such material from the top of the container neck.

I claim:

1. A dispensing container for dental cream or the like, comprising a container member having a neck, and a closure member therefor compris-

ing a generally cylindrically shaped plug member slidably fitting in said neck and formed of deformable plastic material and having a cap portion and a longitudinal bore extending therethrough from the opposite end thereof and terminating under said cap portion, a laterally directed port extending through a side wall portion of said plug member into communication with the longitudinal bore and so positioned as to be covered by said container neck whenever the closure member is pressed inwardly thereof, said bore being out-of-round to provide the material of said plug member surrounding said bore with unequal resistances to radial deformation in response to internal pressures in said bore, said closure member having a ridge portion extending therearound adapted to bind into fluid sealing relation with said container neck when said closure member is deformed radially in response to pressure therein, whereby said closure member may be automatically locked relative to the container member to prevent accidental expulsion of said closure member from said container neck.

2. A dispensing container comprising a container member having a cylindrical neck and a closure member therefor comprising a generally cylindrically shaped plug member having a cap portion and a longitudinal bore extending therethrough from the opposite end thereof and terminating under said cap portion, said plug member being formed of deformable material and said bore being out-of-round to provide the material of said plug member surrounding said bore with unequal resistances to radial deformation whereby the greater the pressure interiorly of the container member the more said plug member tends to expand and more firmly lock itself within said neck.

3. A dispensing container comprising a container member having a cylindrical neck, and a closure member therefor comprising a generally cylindrically shaped plug member formed of deformable plastic material and having a cap portion and a longitudinal bore extending therethrough from the opposite end thereof and terminating under said cap portion, a laterally directed port extending through a side wall portion of said plug member into communication with the longitudinal bore and so positioned as to be covered by said neck whenever the closure member is pressed inwardly thereof, said bore being out-of-round to provide the material of said plug member surrounding said bore with unequal resistances to radial deformation whereby internal pressures in said bore will expand certain portions of said plug member outwardly, said closure member having ridge portions extending therearound both above and below said laterally directed port and adapted to press into binding relation with said neck when said closure member is expanded radially in response to pressure therein, whereby said closure member may be automatically locked relative to the container member at both sides of said port to prevent accidental expulsion of contents from said container member.

4. A dispensing container comprising a container member having a cylindrical neck and a closure member therefor comprising a generally cylindrically shaped plug member having a cap portion and a longitudinal bore extending therethrough from the opposite end thereof and terminating under said cap portion, a laterally directed port extending through a side wall portion of said plug member into communication with the longitudinal bore and so positioned as to be covered by said container neck whenever the closure member is pressed inwardly thereof, said container neck being cylindrically bored at the inner end portion thereof and taper-bored at the outer end portion thereof to increase in diameter toward said cap, said closure member being of tapered form at the upper portion thereof corresponding to the taper-bored portion of said container neck so that whenever the closure member is pressed inwardly of said container said tapered portion presses into snug sealing relation with the tapered portion of said container neck, said plug member being formed of unequal thickness around said bore to be radially deformable by pressures in said bore to bind within said neck, said plug member having integral annular ridge means extending therearound for engaging the bore of said neck to seal said plug member relative thereto upon radial deformation of said plug in response to pressure forces interiorly thereof.

5. A dispensing container for cream, paste or the like comprising a container member having a neck, and a closure member therefor projecting through said neck and having a cap portion and a longitudinal passage opening through the bottom of said closure member, said passage being non-circular in cross sectional area to provide diametrically opposite relatively thick closure member walls, the closure member walls between such thickened walls being relatively thin to provide said closure member with a substantial degree of radial deformability under the influence of pressures in said container member to cause said closure member to bind in said neck, one of the thickened walls of said closure member having a discharge port therethrough positioned to be exposed above said neck when said closure member is pulled upwardly to discharge material therethrough, said opening being of a length corresponding to the thickness of said last-named thickened wall to project material through said opening in relatively straight form.

6. A dispensing container comprising a deformable container body having a neck provided with a cylindrical bore portion and an upwardly diverging tapered bore portion of substantial length thereabove, and a closure member therefor comprising a plug member having a cap portion and a longitudinal bore extending therethrough from the opposite end thereof and terminating under said cap portion, said plug portion having a cylindrical surface portion slidably fitting said cylindrical bore portion and being of tapered form at the upper portion thereof to correspond to the tapered bore portion of said neck so that whenever the closure member is pressed inwardly of said container body said tapered portion of said plug member presses into snug fitting relation with the tapered bore portion of said neck, said closure member having an integral peripheral ridge therearound adapted to press into binding relation with said neck for locking the plug member in pressure-sealing relation within said neck, said plug portion being formed of deformable material of such nature as to be radially outwardly deformable under the influence of internal pressures occurring incident to the generation of pressures in said container body when said plug portion is in closed position.

7. A dispensing container comprising a deformable container body provided with a neck having a bore therethrough, the lower end por-

tion of which is cylindrical and the upper end portion of which is relatively long and tapered to diverge upwardly, and a closure member arranged in said neck and having a cap portion and a longitudinal passage extending from the lower end of such member to a point spaced from said cap portion, said plug member having a cylindrical outer surface portion fitting the cylindrical bore portion of said neck and having an upper tapered portion corresponding to the tapered bore portion of said neck and adapted to fit snugly thereinto when said plug member is in its lowermost position, said plug member being slidable upwardly to an operative position with said cap portion spaced above said neck and said plug member having a relatively thick wall portion provided with a transverse discharge port exposed above said neck portion when said plug member is in operative position, said cylindrical bore portion of said neck being of substantial length to guide said plug member for linear movement between its said two positions, said plug member being formed of deformable material of such nature as to be radially outwardly deformable under the influence of internal pressures occurring incident to the generation of pressures in said container body when said plug member is in closed position.

8. A dispensing container comprising a deformable container body having a cylindrical neck and a closure member therefor comprising a generally cylindrically shaped plug member having a cap portion and a longitudinal bore extending therethrough from the opposite end thereof and terminating under said cap portion, a laterally directed port extending through a side wall portion of said plug member into communication with the longitudinal bore and so positioned as to be covered by said container neck whenever the closure member is pressed inwardly thereof, said container neck being cylindrically bored at the inner end portion thereof and taper-bored at the outer end portion thereof to increase in diameter toward said cap, said closure member being of tapered form at the upper portion thereof corresponding to the taper-bored portion of said container neck so that whenever the closure member is pressed inwardly of said body said tapered portion presses into snug sealing relation with the tapered portion of said container neck, said plug member being formed of deformable material and of such nature as to be radially outwardly deformable under the influence of internal pressures occurring incident to the exertion of pressures on said container body when said plug member is in closed position, said plug member having integral annular ridge means therearound for engaging the taper-bored portion of said neck in wedging relation thereto to seal said plug member in said neck.

9. A dispensing container comprising a deformable container body having a neck provided with a cylindrical bore portion and an upwardly diverging tapered bore portion thereabove, and a closure member therefor comprising a plug member having a cap portion and a longitudinal bore extending therethrough from the opposite end thereof and terminating under said cap portion, said plug portion having a cylindrical surface portion slidably fitting said cylindrical bore portion and being of tapered form at the upper portion thereof to correspond to the tapered bore portion of said neck so that whenever the closure member is pressed inwardly of said container member said tapered portion of said plug member presses into snug fitting relation with the tapered bore portion of said neck, said cylindrical plug surface portion and said cylindrical bore portion of said neck being relatively long to guide said plug member for linear movement axially thereof, said plug portion being formed of deformable material of such nature as to be radially outwardly deformable under the influence of internal pressures occurring incident to the generation of pressures in said container body when said plug portion is in closed position.

10. A dispensing container comprising a container body having a neck provided with a cylindrical bore portion, and a closure member therefor comprising a plug member having a cap portion and being provided with a cylindrical surface portion freely slidably fitting said cylindrical bore portion for movement between an inner closed position and an outer open position, said plug member being of closed section transversely thereof and having a longitudinal passage extending therethrough and communicating at its inner end with the interior of said body, and having a lateral discharge port communicating with the upper end of said longitudinal passage, said discharge port being arranged above said neck when said plug member is in its open position, said container body being formed of normally self form-retaining material and being readily deformable for the displacement through said longitudinal passage and said discharge port of a paste material in said container member, the area of said longitudinal passage being substantially less than the cross sectional area of said plug to frictionally resist passage of the paste material therethrough to an extent greater than the resistance of said container body to outward deformation whereby, when said plug member is pushed to its closed position, the pressure generated within said container body by said plug member will deform said container body outwardly without appreciable movement of the paste material through said longitudinal passage, thus minimizing the formation of a daub of the paste material at said discharge port.

11. A dispensing container comprising a container body having a neck provided with a cylindrical bore portion, and a closure member therefor comprising a plug member having a cap portion and being provided with a cylindrical surface portion slidably fitting said cylindrical bore portion for movement between an inner closed position and an outer open position, said plug member having a longitudinal passage extending therethrough and communicating at its inner end with the interior of said body, and having a lateral discharge port communicating with the upper end of said longitudinal passage, said discharge port being arranged above said neck when said plug member is in its open position, said container body being formed of readily deformable material for the displacement through said longitudinal passage and said discharge port of a paste material in said container member, said longitudinal passage being of a cross sectional area substantially less than the cross sectional area of said plug and being substantially narrowed in one transverse direction to provide opposite relatively closely spaced parallel walls, to frictionally resist passage of the paste material through said passage whereby displacement of paste material in said container body when said plug member is pushed to its closed position

will deform said container body outwardly without appreciable movement of the paste material through said longitudinal passage, thus minimizing the formation of a daub of the paste material at said discharge port.

RALPH B. WAITE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
706,710	Allen	Aug. 12, 1902
1,451,461	King	Apr. 10, 1923
1,567,084	Rose	Dec. 29, 1925
2,418,348	Hermann	Apr. 1, 1947

FOREIGN PATENTS

Number	Country	Date
8,074	Great Britain	Apr. 4, 1910
150,640	Great Britain	Sept. 9, 1920