Oct. 29, 1968 M. B. STULL 3,407,967

DISPENSING CLOSURE CAP

Filed Jan. 24, 1967 2 Sheets-Sheet 1

Fig. 1

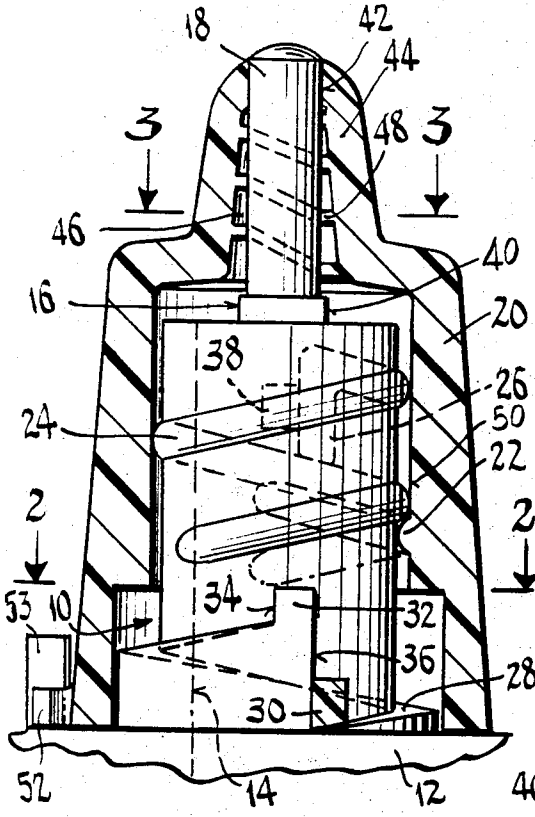


Fig. 4

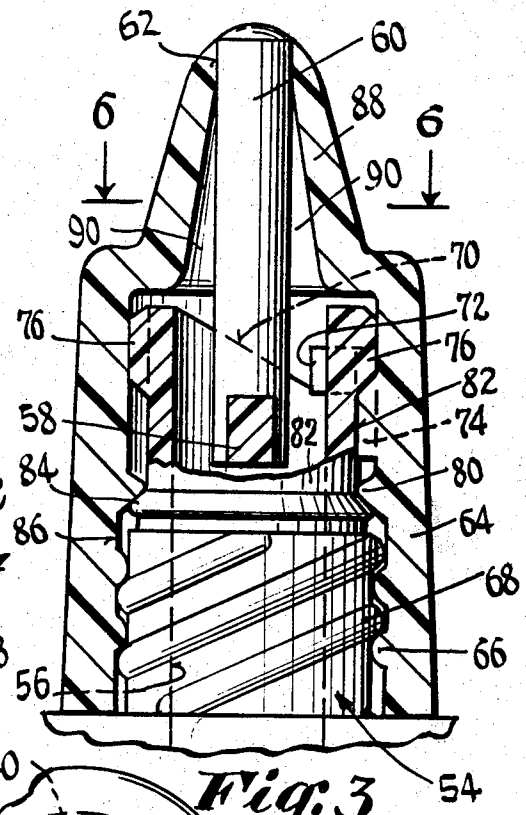


Fig. 2

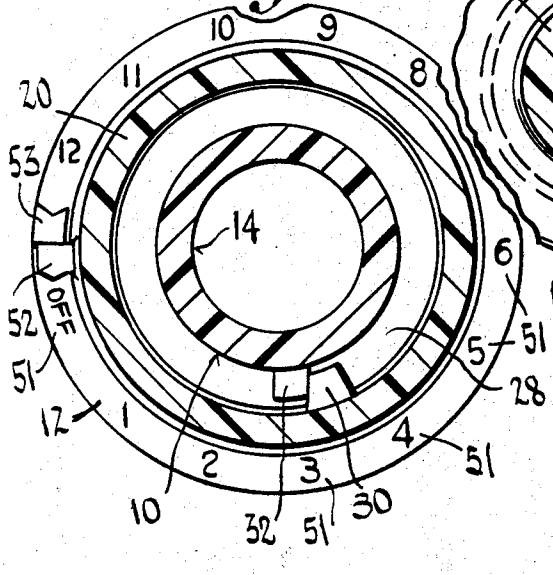


Fig. 3

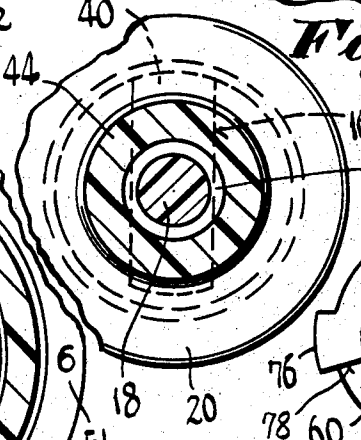
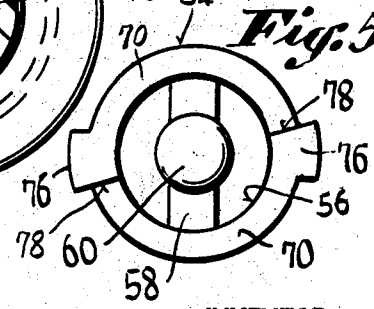


Fig. 5



INVENTOR.
Morton B. Stull
BY
H. Gibson Lehmann
AGENT

Oct. 29, 1968 M. B. STULL 3,407,967

DISPENSING CLOSURE CAP

Filed Jan. 24, 1967 2 Sheets-Sheet 2

Fig. 6

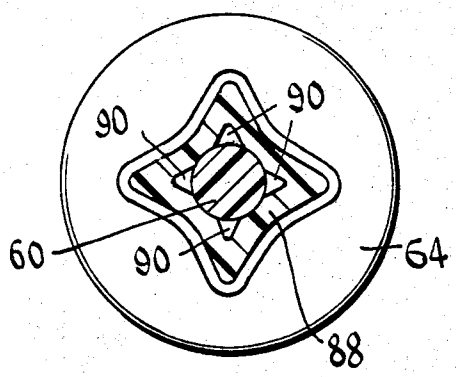


Fig. 8

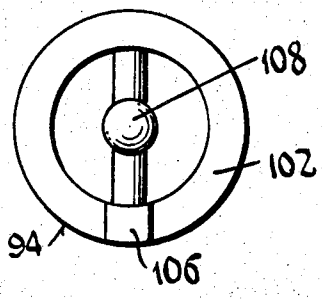


Fig. 7

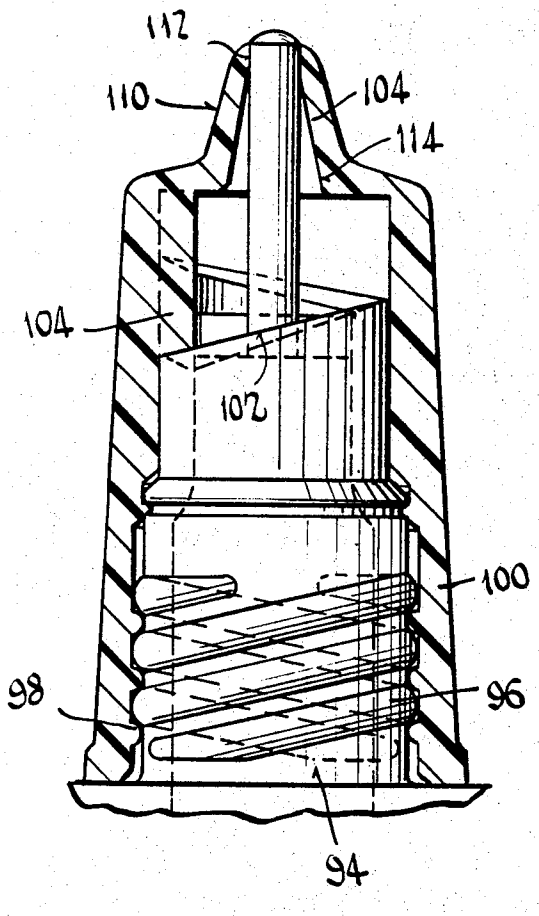
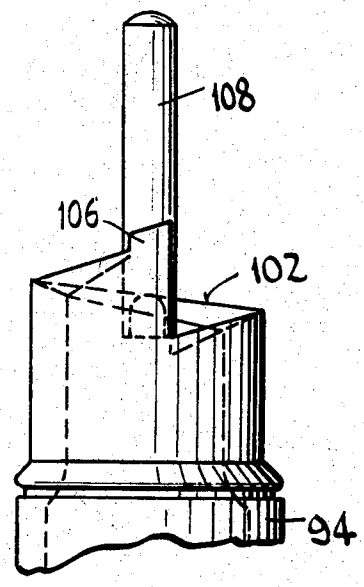


Fig. 9



INVENTOR.
Morton B. Stull
BY
H. Gibson Lehmann
AGENT

United States Patent Office

3,407,967

Patented Oct. 29, 1968

3,407,967

DISPENSING CLOSURE CAP

Morton B. Stull, Boonton, N.J. (% Stull Engraving Company, 221–223 Banta Ave., Garfield, N.J. 07026)

Filed Jan. 24, 1967, Ser. No. 611,325

11 Claims. (Cl. 222—48)

ABSTRACT OF THE DISCLOSURE

A dispensing closure cap structure having a tubular molded plastic body through which the product passes, and having a screw cap on the body, provided with a raised, central orifice which is closed by a closure pin on the body when the cap is screwed down. Screw means is especially arranged to prevent backlash, and a duct is provided on the cap between the orifice and the cap interior, said duct having means which coacts with the closure pin to accurately progressively restrict the passage for the product as the cap is unscrewed.

Cross references

(1) U.S. application Ser. No. 511,593 filed Dec. 6, 1965, by Morton B. Stull, and entitled "Captive Closure Cap Construction."

(2) U.S. Patent No. 3,216,630.

(3) Copending application of Morton B. Stull, Ser. No. 602,004 filed Dec. 15, 1966, and entitled "Dispensing Closure Cap."

(4) Copending application of Morton B. Stull, Ser. No. 605,654 filed Dec. 29, 1966, and entitled "Dispensing Screw-Type Closure Cap" now Patent No. 3,370,764 dated Feb. 27, 1968.

(5) Copending application of Morton B. Stull, Ser. No. 605,805 filed Dec. 29, 1966, and entitled "Dispensing Closure Cap."

Background

This invention relates to molded plastic dispensing closure caps wherein a stationary body portion holds captive a movable screw cap portion which has the discharge orifice.

In some prior captive dispensing cap constructions where an adjustable flow is had by screwing in or unscrewing the cap member the play or lost motion normally present in the thread means of the cap impairs considerably the accuracy of the flow adjustment. Also, the range of opening of the discharge passage is not ideally suited to the range of turning of the cap member, and in addition the hardening of product in the cap and contamination of threads by the product often results in malfunctioning of the dispensing closure.

Summary

The present invention obviates disadvantages of prior adjustable-flow cap constructions, and one object of the invention is to provide a novel and improved captive screw-cap type adjustable flow dispensing closure wherein considerable accuracy is had in the adjustment or setting of the flow control means. This is accomplished by the provision of novel thread systems between the cap member and the body member on which the cap member is mounted, whereby backlash and lost motion are prevented for the various adjusted cap positions, with the result that the size of the discharge passage is a true function of the rotative position of the cap member. The cap member can have a range of turning of from 180° to substantially 360°, thereby to adapt the turning movement to the different sizes of discharge passage in the most advantageous manner. A wiper action of one of the thread

systems tends to dislodge product from the cap interior and to return it to the container.

Other objects and advantages are to provide an improved cap construction as above, wherein a compact arrangement is had and small sizes are possible, wherein the adjustable discharge passage and thread and wiper systems are arranged in a simple manner and can be readily adapted to liquid products of various characteristics, wherein the action is reliable and foolproof, and wherein the parts can be economically molded and assembled.

Other features and advantages will hereinafter appear.

In the drawings:

Fig. 1 is an axial sectional view of an adjustable flow cap construction as provided by the invention.

FIG. 2 is a horizontal section taken on the line 2—2 of FIG. 1.

FIG. 3 is a horizontal section taken on the line 3—3 of FIG. 1.

FIG. 4 is an axial sectional view of an adjustable flow cap construction constituting another embodiment of the invention.

FIG. 5 is a top plan view of the cap body member of the construction of FIG. 4.

FIG. 6 is a horizontal sectional view taken on the line 6—6 of FIG. 4.

FIG. 7 is an axial sectional view of a cap construction illustrating yet another embodiment of the invention.

FIG. 8 is a top plan view of the cap body member of FIG .7.

FIG. 9 is a side elevational view of the cap body member of FIG. 7.

Referring first to FIGS. 1–3, the improved adjustable dispensing cap construction shown therein comprises an upright tubular molded plastic body **10** which is adapted to be carried on a container such as a plastic squeeze bottle or the like. The body **10** has a base portion **12** which is arranged to be either screwed onto the neck of the container or else to be press-fitted thereon in accordance with well-known procedures. For example, the base portion **12** may comprise an internally threaded screw cap part. Or, it may comprise the actual upper wall of the container, as may be readily understood. The tubular body **10** has a central bore **14** constituting a dicharge passage for product which is to be discharged or dispensed from the container.

In the body **10** there is a diametric bridge **16** which carries a closure pin **18**, locating the latter at the upper end of the discharge passage or bore **14** so as to extend upward from the center of the upper end of the body **10**. Axially movable on the body **10** and surrounding the same is a molded plastic screw cap **20** having an internal thread formation **22** which is cooperable with an external helical thread **24** disposed on the outer side of the body **10**. The helical thread formation **24** includes an axially extending bead **26** which joins adjacent upper portions of the thread **24** to form therewith a continuous ridge by which product is prevented from flowing between the threads and contaminating the same.

In addition to the thread system comprising the threads **22**, **24** there is additionally provided a second thread system by which backlash of the cap **20** on the body **10** is prevented, thereby to cause the axial position of the cap to be a true function of its rotative position. Use is made of this to insure an accurate control of the size of the discharge passage leading to the exterior orifice of the cap, as will be hereinafter disclosed.

The second thread system comprises a helical track **28** disposed at the base of the tubular body **10**, and a follower or stop lug **30** on the interior of the cap **20** at the bottom edge thereof. The follower lug **30** is adapted to ride on or

traverse the track **28** and to remain in engagement therewith under the action of the helical threads **22, 24** as the cap is turned.

The helical track **28** includes a stop projection **32** having a shoulder surface or side face **34** engageable with a cooperable shoulder surface of the stop lug **30** of the cap to limit the unscrewing movement thereof to a maximum of slightly less than 360° from the fully screwed down position of FIG. 1. In FIG. 1 an opposite shoulder surface of the follower or stop lug **30** is shown as engaged with an end face or shoulder surface **36** of the track **28** (which surface is circumferentially spaced from the shoulder surface **34**) thereby limiting the fully screwed down position of the cap **20**. For the position of FIG. 1, the axial bead **26** of the body **10** is also engaged by a second internal stop lug **38** in the cap **20**, this constituting a second stop for limiting the screwing in of the cap. The stop lug **38** is also engageable with a shoulder **40** provided at one end of the bridge **16**, such engagement occurring when the cap **20** is unscrewed slightly less than 360°.

The above structure is essentially similar to that already described in my copending application, Ser. No. 605,805, filed Dec. 29, 1966, and entitled "Dispensing Closure Cap."

The cap member **20** has a discharge opening or orifice **42** disposed at the top of a central tubular upward extension **44** constituting an upright duct disposed between and connecting the orifice **42** and the interior of the cap **20**. The duct **44** surrounds the closure pin **18** and coacts therewith to control the flow of liquid product past the pin. The duct **44** has means at its inside, coacting with the pin to control the flow of product. The said flow-control means provides for a progressively less restricted passage for the product through the duct **44** and past the pin **18** as the cap **20** is unscrewed more and more from the fully seated, sealing or closing position of FIG. 1. In the embodiments of the invention the flow control means of the ducts comprise a generally tapered bore thereof. As shown in FIG. 1, the bore has an internal groove **46** providing a generally helical thread **48** engageable with the pin **18**. The groove **46** varies in width and depth, being wider and deeper at the bottom of the duct **44** and narrower and shallower at the top of the duct. Accordingly, as the cap **20** is unscrewed, more and more of the upper portions of the groove **46** will be removed from the pin **18**, resulting in a larger and still larger discharge passage leading from the upper interior of the cap **20** to the orifice **42** thereof. When the cap **20** is fully unscrewed, only the wider and deeper portions of the groove **46** will coact with the pin **18** to define the flow control passage, the remainder of the groove being disposed beyond the top of the closure pin. Thus, the largest discharge passage is provided for this condition. As the cap **20** is screwed down little by little, more and more of the shallower, narrower portions of the discharge groove **46** will surround the pin **18**, resulting in a lesser rate of flow of the product.

It will be noted that the internal thread **22** is disposed below the external thread **24**, and that the follower lug **30** is disposed above the helical track **28**. In consequence, looseness and backlash of the cap **20** is prevented, and instead the axial position of the cap will clearly be a function of its rotative position and accordingly the relationship of the groove **46** with the pin **18** will also be a function of the rotative position of the cap **20**. There is thus the advantage that an accurate adjustability of the size of the discharge passage is had, by virtue of the elimination of backlash in the turning movement (screwing and unscrewing) of the cap **20**.

Further, positive stops are provided for the raised and lowered positions of the cap **20**, and contamination of the thread systems comprising the threads **22, 24** and the track **28** and lug **30** is prevented by virtue of the sealing engagement between the closed-end helical thread **24** and the cylindrical inner sealing wall **50** of the cap. The viscous product is thus kept from the track **28** and lug **30**, as well as from the spaces between the screw threads **22, 24**.

Also, the base portion **12** can be made like a dial and provided with indicia **51**, such as the numbers from 1 to 12 and the word "off," disposed in a circle around the outside of the base of the cap **20**, and the latter can have a reference pointer **52** adapted to travel past the numbers to indicate numerically the extent of opening of the cap, or the closed position thereof. The pointer can cooperate also with a stop lug **53** on the base portion **12**, thereby providing additional positive stop means. The adjusted size of the discharge passage **46** can have an exact specific relationship with the numbers **51**, due to the elimination of backlash in the screw means of the closure device.

Another embodiment of the invention, wherein a smaller diameter is possible and wherein there is had a total turning movement of slightly less than 180°, is illustrated in FIGS. 4, 5 and 6. In these figures there is shown a tubular body **54** having an internal bore **56** through which the product is discharged. A diametric bridge **58** mounts a closure pin **60** which is disposed in an orifice **62** of a screw cap **64**. The cap **64** has internal threads **66** which are cooperable with external threads **68** on the body **54** to effect axial movement of the cap in response to its being turned.

In addition to the thread system **66, 68** there is a second thread system comprising helical tracks **70** disposed at the upper end of the body **54**, on which internal lugs **72** of the screw cap ride. Also, the screw cap **64** has additional internal lugs **74** which are engageable with axially extending lugs **76** provided on the outer peripheral upper portions of the body **54**. The lugs **74, 76** constitute stops which limit the unscrewing movement of the cap **64**, and the lugs **72** are engageable with end surfaces **78** of the tracks **70** to limit the downward or closing movement of the cap **64**.

A sealing bead **80** in the cap **64** engages a cylindrical surface **82** of the tubular body **54**, providing a seal which prevents the product from coming in contact with the cooperable threads **66, 68**. A second annular sealing bead **84** on the outer periphery of the tubular body **54** engages an internal cylindrical surface **86** of the cap **64**.

The screw threads **66, 68** in conjunction with the tracks **70** and follower lugs **72** prevent lost motion or backlash as the cap **64** is being screwed down or unscrewed to raise it. A structure as above set forth is essentially disclosed and described in my copending application Ser. No. 605,805, filed Dec. 29, 1966, and entitled "Dispensing Closure Cap."

By the present invention, the screw cap **64** has an upstanding duct portion **88** provided with a tapered bore comprising tapered V-grooves **90** which are of lesser depth near the top of the duct **88** and of greater depth near the bottom of the duct. As seen in FIG. 6, the cross sectional shape of the duct **88** may be somewhat in the form of a star, and said cross sectional shape may have a greater or a lesser number of points than that shown. For example, the star shape may have three points instead of four, or may have five points or six points, or it may have two points or there may be provided but a single groove in place of the four grooves **90** which are illustrated.

As the screw cap **64** is unscrewed from the closed, sealing position of FIG. 4, more and more of the grooves **90** will be removed from around the closure pin **60**, resulting in a correspondingly greater size of discharge passage through the duct **88**. The size of the discharge passage may be a true function of the rotative position of the cap **64** by virtue of the elimination of backlash in the thread systems provided between the cap and the tubular body. By the provision of the tracks **70** at the upper end of the tubular body **54** there is achieved a reduction in the overall diameter of the cap construction, as will be understood.

Whereas in FIGS. 4, 5 and 6 the screw cap has a total turning movement of slightly less than 180° with a small diameter characteristic, in FIGS. 7, 8 and 9 there is illus-

trated a screw cap of small diameter, which has a total range of turning of slightly less than 360°. In these figures, the tubular body **94** has external screw threads **96** which are cooperable with internal threads **98** of a screw cap **100**. A second thread system is provided, comprising a helical track **102** at the upper end of the tubular body **94**, said track being engageable by an internal lug **104** at the inside of the screw cap **100**. The lug **104** is engageable with side edges of a stop lug **106** disposed on the upper edge of the body **94**, thereby to limit the turning movement of the cap **100** to less than 360°.

The tubular body **94** has a closure pin **108** which is received in a discharge duct **110** terminating in an orifice **112** at the top of the screw cap **100**. The duct **110** has a smooth conical or tapered bore comprising a frusto-conical inner wall **114**. As the screw cap **100** is unscrewed or turned in the opening direction, more and more of the inner wall **114** of the duct **110** will be removed from the closure pin **108**, thereby enlarging the size of the discharge passage defined by the duct. An accurate adjustment of the flow is thus possible, since looseness or lost motion in the screwing or unscrewing movement of the cap **100** is eliminated by virtue of the two screw thread systems provided.

In the form of the invention illustrated in FIGS. 1–3, the interior lug **38** and the helical thread **48** tend to break up and dislodge the product which is disposed in the upper portion of the screw cap **20**. In the forms of the invention illustrated in FIG. 4–9, the follower lugs **72, 74** tend to break up and dislodge product which is disposed in the upper portion of the screw cap.

Further details of the essential structures and functioning of the cap construction of FIGS. 7–9 are disclosed and described in my copending application Ser. No. 605,805, filed Dec. 29, 1966, and entitled "Dispensing Closure Cap."

In all of the forms of the invention an accurate control of the size of the discharge passage disposed within the duct of the cap is had, by merely turning the cap in one direction or the other from the fully closed position or positions intermediate the fully closed and fully opened positions. The cap construction is seen to be simple, and the parts thereof may be readily molded in simple mold cavities and equipment. Accordingly, the manufacturing cost is held to a low figure. The cap constructions have various advantages in addition to enabling an accurate adjustment of the size of the discharge passage to be had. Contamination of the screw threads is prevented, a positive unscrewing action is had, and the structures are seen to be compact and of relatively small size.

Variations and modifications may be made within the scope of the claims, and portions of the improvement may be used without others.

I claim:

1. A dispensing closure cap comprising, in combination:

(a) an upright tubular molded plastic, yieldable body adapted to be carried on a container, the bore of said body constituting a discharge passage for product to be dispensed from the container,

(b) said body having a closure pin disposed at the end of said discharge passage and extending upward from the center of the upper end of the body,

(c) a molded plastic screw cap axially movable on said body and surrounding the same,

(d) cooperable thread means on the tubular body and screw cap for effecting axial movement of the latter in response to its being turned,

(e) said cap having an orifice in its top, adapted to be closed by the closure pin when the cap is screwed down on the tubular body, wherein the improvement comprises:

(f) said screw cap including an upright duct disposed between and connecting the orifice thereof and the interior of the cap,

(g) said duct surrounding the closure pin and having means at its inside, coacting with said pin to control the flow of liquid product past the pin,

(h) said pin and flow-control means providing for a progressively less restricted passage for product through the duct as the cap is unscrewed more and more,

(i) said cooperable thread means comprising two separate thread systems acting in conjunction with each other to eliminate backlash of the cap whereby the axial position thereof is a true function of its rotary position, said rotary position thereby constituting an accurate determiner of the degree of restriction of the passage in the duct, for the product.

2. A cap as in claim **1**, wherein:

(a) one thread system comprises helical interior and exterior cooperable threads respectively on the cap and tubular body,

(b) the other thread system comprising a helical track on the tubular body and a follower lug in the cap, said lug being adapted to traverse the track in engagement therewith under the action of the helical threads as the cap is turned.

3. A cap as in claim **2**, wherein:

(a) the helical track is at the upper end of the tubular body.

4. A cap as in claim **2**, wherein:

(a) the helical track is at the base of the tubular body.

5. A cap as in claim **2** wherein:

(a) the helical track extends for approximately half a perigon.

6. A cap as in claim **2**, wherein:

(a) the helical track extends for approximately a perigon.

7. A cap as in claim **1**, wherein:

(a) an indicating means is provided, for giving specific statistical indications of different unscrewed positions of the cap which has its blacklash eliminated.

8. A dispensing closure cap comprising, in combination:

(a) an upright tubular molded plastic, yieldable body adapted to be carried on a container, the bore of said body constituting a discharge passage for product to be dispensed from the container,

(b) said body having a closure pin disposed at the end of said discharge passage and extending upward from the center of the upper end of the body,

(c) a molded plastic screw cap axially movable on said body and surrounding the same,

(d) cooperable thread means on the tubular body and screw cap for effecting axial movement of the latter in response to its being turned,

(e) said cap having an orifice in its top, adapted to be closed by the closure pin when the cap is screwed down on the tubular body, wherein the improvement comprises:

(f) said screw cap including an upright duct disposed between and connecting the orifice thereof and the interior of the cap,

(g) said duct surrounding the closure pin and having means at its inside, coacting with said pin to control the flow of liquid product past the pin,

(h) said pin and flow-control means providing for a progressively less restricted passage for product through the duct as the cap is unscrewed more and more,

(i) said flow control means of the duct comprising a generally tapered bore thereof,

(j) said tapered bore having its smaller end adjacent the said orifice,

(k) said tapered bore of the duct being threaded.

9. A dispensing closure cap comprising, in combination:

(a) an upright tubular molded plastic, yieldable body adapted to be carried on a container, the bore of said body constituting a discharge passage for product to be dispensed from the container,

(b) said body having a closure pin disposed at the end of said discharge passage and extending upward from the center of the upper end of the body,
(c) a molded plastic screw cap axially movable on said body and surrounding the same,
(d) cooperable thread means on the tubular body and screw cap for effecting axial movement of the latter in response to its being turned,
(e) said cap having an orifice in its top, adapted to be closed by the closure pin when the cap is screwed down on the tubular body, wherein the improvement comprises:
(f) said screw cap including an upright duct disposed between and connecting the orifice thereof and the interior of the cap,
(g) said duct surrounding the closure pin and having means at its inside, coacting with said pin to control the flow of liquid product past the pin,
(h) said pin and flow-control means providing for a progressively less restricted passage for product through the duct as the cap is unscrewed more and more,
(i) said flow control means of the duct comprising a generally tapered bore thereof,
(j) said tapered bore having its smaller end adjacent the said orifice,
(k) said tapered bore of the duct having internal longitudinal grooves of tapered depth.

10. A dispensing closure cap comprising, in combination:
(a) an upright tubular molded plastic, yieldable body adapted to be carried on a container, the bore of said body constituting a discharge passage for product to be dispensed from the container,
(b) said body having a closure pin disposed at the end of said discharge passage and extending upward from the center of the upper end of the body,
(c) a molded plastic screw cap axially movable on said body and surrounding the same,

(d) cooperable thread means on the tubular body and screw cap for effecting axial movement of the latter in response to its being turned,
(e) said cap having an orifice in its top, adapted to be closed by the closure pin when the cap is screwed down on the tubular body, wherein the improvement comprises:
(f) said screw cap including an upright duct disposed between and connecting the orifice thereof and the interior of the cap,
(g) said duct surrounding the closure pin and having means at its inside, coacting with said pin to control the flow of liquid product past the pin,
(h) said pin and flow-control means providing for a progressively less restricted passage for product through the duct as the cap is unscrewed more and more,
(i) two circumferentially-acting positive stop means are provided, limiting respectively the fully screwed and fully unscrewed positions of the cap, said stop means comprising cooperable shoulder surfaces on the yieldable body and screw cap, said body having two said shoulder surfaces circumferentially-spaced apart.

11. A cap as in claim **10**, wherein:
(a) the stop means comprises two separate stop devices,
(b) each such stop device positively limiting both the fully screwed and fully unscrewed positions of the cap.

References Cited

UNITED STATES PATENTS

2,017,140	10/1935	Worth	222—521
2,582,026	1/1952	Friedman	222—48 X
3,131,836	5/1964	Van Baarn	222—521

ROBERT B. REEVES, *Primary Examiner.*
HADD S. LANE, *Assistant Examiner.*