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[54] **CAPTIVE DISPENSING AND METERING CAP**
7 Claims, 9 Drawing Figs.

[52] U.S. Cl. 222/48,
222/521

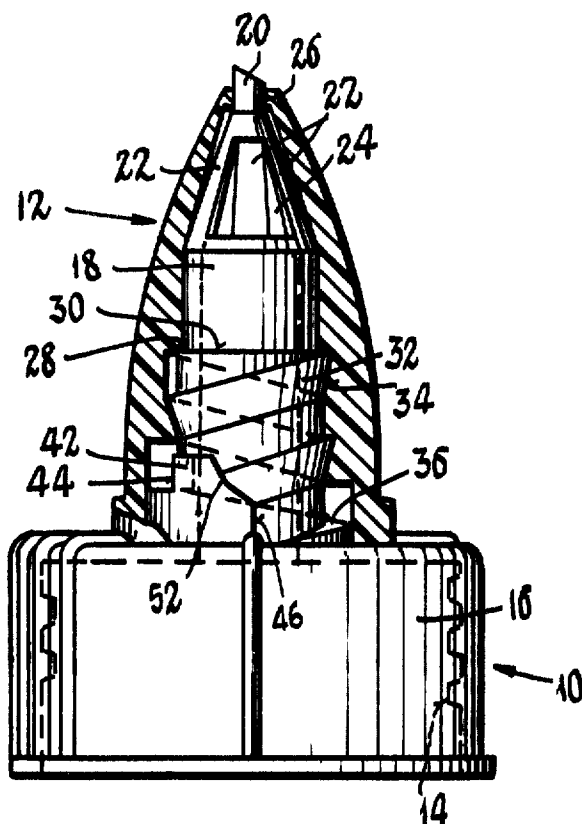
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568, 572, 528, 529, 530, 521, 509, 545, 41, 44,
46—48; 215/40; 151/22

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2,582,026	1/1952	Friedman	222/48 X
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ABSTRACT: A dispensing and metering cap construction comprising a threaded tubular spoutlike cap body and an orifice-type screw cap both of molded plastic composition. In addition to the screw threads on the cap and cap body, the cap has a stop lug which is especially arranged to constitute a cam follower whereby it also serves somewhat like a thread element adapted to engage a cam track at the base of the cap body. Both the screw threads and the cam track and follower lug serve to raise the cap on the cap body in response to unscrewing movement. The extent of unscrewing determines the size of the opening of the discharge orifice in the cap. The cam track constitutes a positive or nonyielding lead means for the cap, whereas the screw threads are yieldable and impositive. Thus the cam track is the dominating one of the two lead means. By providing a hump or depression in the cam track, an accurate raised axial position of the cap can be readily effected for a given rotative position, without requiring an accurate corresponding relative positioning of the screw threads, since the latter can be made to yield a lesser or a greater amount under the influence of the cam track. The provision of the hump or depression thus can be used to attain an accurate metering position of the cap, and is easier to accomplish than accurate reorientation of the screw threads.



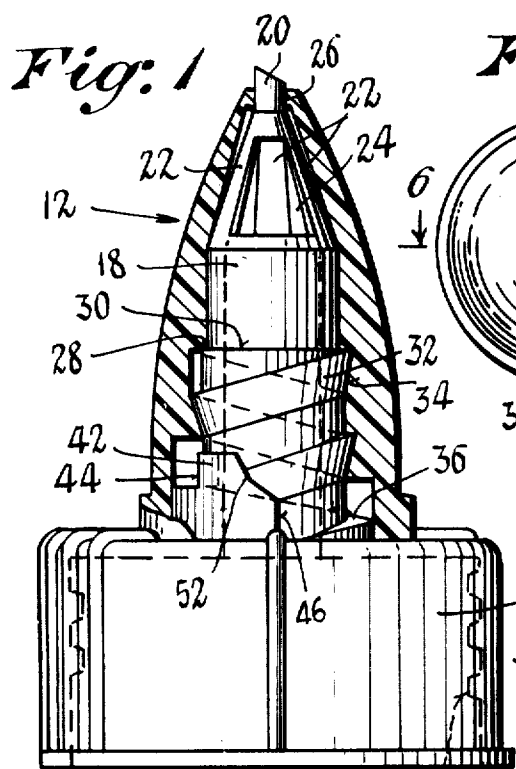


Fig. 5

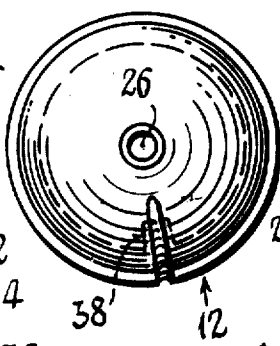


Fig. 7

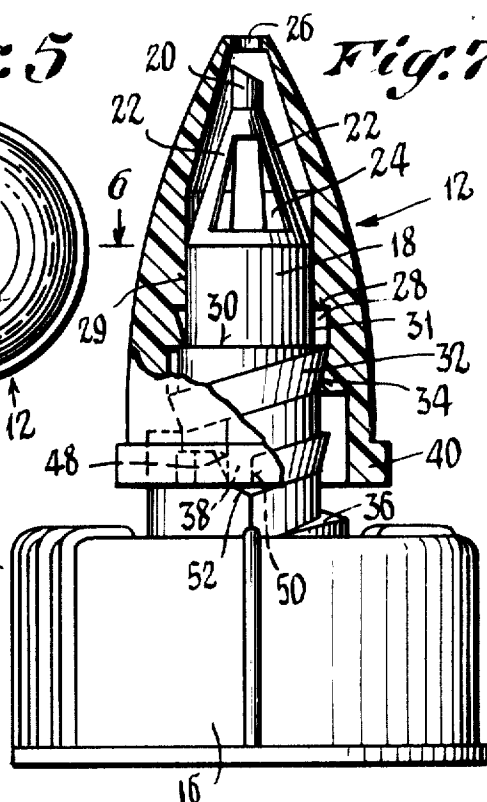


Fig. 2

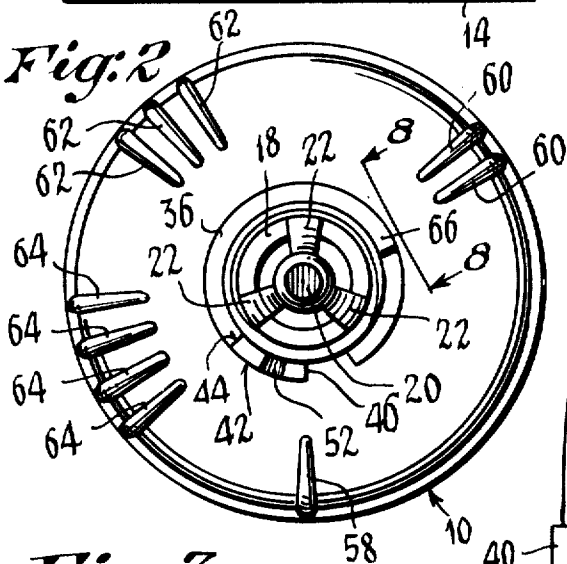


Fig. 4

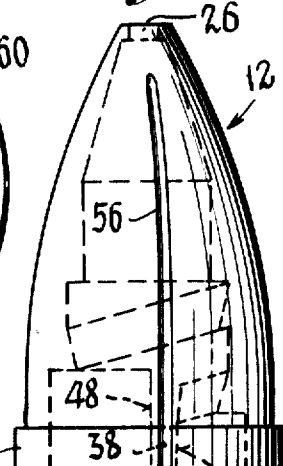


Fig. 6

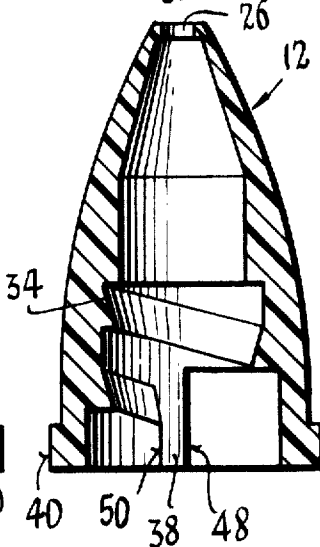


Fig. 3

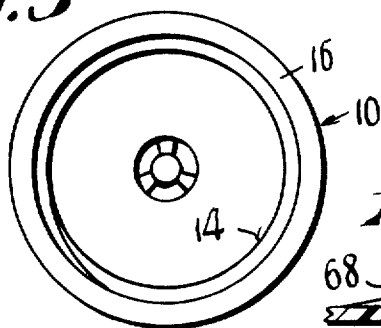


Fig. 8



Fig. 9



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CAPTIVE DISPENSING AND METERING CAP

CROSS-REFERENCES TO RELATED APPLICATIONS AND PATENTS

U.S. Pats. No. 3,216,630, No. 3,319,843, No. 3,339,773, No. 3,351,249 No. 3,407,967, No. 3,406,880, No. 3,370,764; Copending application of Morton B. Stull, Ser. No. 855,971, filed Sept. 8, 1969 entitled "Captive Dispensing Cap Construction," and having common ownership with the present application; and copending application of Morton B. Stull, Ser. No. 867,199, filed Oct. 17, 1969, entitled "Captive Cap for Dispensers," and having common ownership with the present application.

BACKGROUND

This invention relates to dispensing type screw caps, and more particularly to captive caps of this kind wherein the rotational cap position determines the orifice size and consequently the flow rate.

Heretofore, flow measuring or metering screw caps wherein there is an orifice and a stopper plug movable in the orifice required a very accurate orientation of the screw threads with respect to the indicator means, in order to obtain any kind of meaningful reading of the flow rate for a given cap setting. Where liquids of different viscosity were involved, the necessary shifting or alteration of this relative orientation, involving mold changes and cut-and-try procedures, was time consuming and costly.

SUMMARY

The above drawbacks of the prior dispensing closures of the metering type are obviated by the present invention, one subject of which is to provide an improved dispensing and metering cap construction wherein the orientation of the screw threads with respect to the indicator means need not be altered or changed from a given basic position in order to effect the desired flow rate for a certain setting, or in order to make adjustment for different liquid viscosities. This is accomplished by making the screw threads resilient and yieldable, and preferably of the buttress type, and by providing an easily altered cam means or track operating concurrently with the screw threads to raise or position the cap and normally dominating the threads due to the yielding nature of the latter. The cam track can be made to have a hump or a depression at the place corresponding to the cap setting which indicates the required flow rate, this being much more easily effected than changing the screw thread orientation. Thus a considerable saving in time and money is possible, as well as a more accurate indication of the flow rate.

Other objects and features of the invention reside in the provision of an improved captive screw cap as above set forth, which is especially effective and reliable in its operation, simple in construction, involves few parts, and is inexpensive to produce.

Still another features and advantages will hereinafter appear. In the drawings:

FIG. 1 is a side elevational view of the cap body part of the construction, with the screw cap part shown in axial section.

FIG. 2 is a top plan view of the body part.

FIG. 3 is a bottom plan view of the body part.

FIG. 4 is a side elevational view of the screw cap part of the construction.

FIG. 5 is a top plan view of the screw cap part.

FIG. 6 is an axial section of the screw cap part, taken on line 6-6 of FIG. 5.

FIG. 7 is a side elevational view of the cap construction with a portion of the cap part broken away. This view illustrates the interference and camming action between the stop lugs during assembly of the cap part to the body part.

FIG. 8 is a fragmentary sectional view taken on the line 8-8 of FIG. 2.

FIG. 9 is a view like that of FIG. 8 but showing a modification of the invention.

Considering first FIGS. 1 and 7, the improved dispensing cap construction of the invention is seen to comprise a cap body part designated generally by the numeral 10, and a screw cap part designated generally by the numeral 12. The cap body part is of tubular configuration, being adapted for attachment to a container (not shown) as by means of internal screw threads 14 disposed in a lower portion 16. It will be understood that the portion 16 of the body part may be screwed onto the threaded neck of the container.

The body part 10 has a discharge spout portion 18 terminating at its upper or outer end in a stopper pin 20 which is supported by three webs 22 defining triangular openings 24 through which the product from the container can pass after traversing the spout portion. The screw cap part 12 has a central opening 26 in its tip to accommodate the stopper pin 20 when the cap is screwed down to its full-on position as shown in FIG. 1. A seal is thus effected by the pin 20, preventing leakage of the product from the cap construction. The screw cap part 12 also has annular sealing surfaces 28, 29 arranged for tight engagement with a shoulder portion 30, 31 of the spout 18 to effect a seal below the triangular openings 24 of the spout.

The body part 10 and screw cap part 12 have a pair of mutually engageable portions comprising cooperable screw thread means 32, 34 respectively on said parts for moving the cap part axially as it is turned. The screw thread means comprises a helical thread element 32 which are preferably of the buttress type, said thread element having working surfaces characterized by a relatively small slope or angle with respect to the axis of the cap construction. The arrangement is such that, as in the present case where there is a certain degree of yieldability of the parts, the thread elements may be stripped past each other by applying an excessive axial force to the cap part 12 in a direction tending to remove the same. However, the nonsloping shoulders of the buttress thread element prevent an opposite stripping, that is, prevent the cap part from being forcibly applied to the body part by purely axial movement.

In accordance with the present invention at least one of the parts of the cap construction, and preferably both said parts are constituted of resilient, yieldable plastic substance such as polyethylene or other suitable well-known formulation whereby advantage is taken of the yieldability to facilitate the obtaining of the proper flow rate for a given dispensing setting of the cap part 12. As in my referred to copending applications, the cap part is normally held captive on the body part after it has been screwed on the latter to the full-on position or at least past an intermediate position representing the full-open or unstopped condition of the cap.

The helical thread elements 32, 34 function to effect upward and downward (as viewed in FIGS. 1 and 7) axial movement of the cap part 12 as the latter is turned in counter-clockwise and clockwise directions (as viewed from the top). If, when the cap part 12 is first applied to the body part 10 and screwed down, it should encountered some momentary obstruction to its axial movement as later described, one or both of the thread elements 32, 34 can yield as the cap part is momentarily halted axially. One thread element will tend to ride up on the other, and when the obstruction to axial movement of the cap part ceases, the thread elements will tend to spring the cap part 12 downward or toward its full-on position as the elements restore to their initial, normal or nonyielding non-deformed condition.

In accordance with the present invention the body part 10 has a specially constituted second or additional thread element which dominates the threads 32, 34, said second element comprising a helically faced cam track 36 provided around the base of the spout portion 18, which cooperates with an interior lug 38 provided within the bottom rim 40 of the cap part 12. The lug 38 rides on the cam track 36 and imparts a positive or nonyielding outward axial movement to the cap part as

the latter is turned in unscrewing direction. The metering function of the lug 38 as it is involved with the present invention, is described further below.

As in my copending applications, the cap and body parts have a second pair of mutually engageable portions, comprising cooperable stop lugs one of which is constituted as the lug 38. The second lug, disposed on the spout portion 18 of the body part, is designated 42 and is disposed at the high end of the cam track 36. The stop lug 42 has opposite surfaces 44, 46 which are respectively engageable with opposite surfaces 48, 50 of the stop lug 38. Also, the surface 46 the lug 42 has a camming portion 52 constituting a face which slopes with respect to the direction of movement of the lug 38 of the cap part 12. The cam surface 52 is adapted to be engaged by the stop lug 38 of the cap part 12 as the latter is screwed onto the body part 10, such engagement being illustrated in FIG. 7. The engagement with the sloping face 52 constitutes a momentary obstruction or impediment, as above mentioned, to the downward axial movement of the cap part 12 and in fact causes an opposite or slightly raising movement of the cap part as the turning of the latter is continued. During such reverse movement, the thread elements 32, 34 will yield, one element riding up an extent on the other as permitted by the slightly sloping engaged faces of the elements. Referring again to FIG. 7, as the clockwise turning movement of the cap part 12 is continued, the stop lug 38 thereof will be forced past the top of the lug 42 of the body part 10 and upon reaching the surface 44 of the lug 42 it will snap downward so as to engage the high portion of the cam track 36. This snapping downward of the lug 38 and cap part 12 is due in part to the tendency for the deformed thread element to resume the nonyielding or unsprung condition. Also, the equipment (not shown) which applies the screw cap 12 may have a spring action by which the cap part is yieldably urged downward as it is being screwed onto the body part 10.

Upon the lug 38 of the cap part being cammed past the lug 42 of the body part, the screwing-on movement of the cap part can be continued until it reaches the full-on position of FIG. 1.

Thus, as the consumer unscrews the cap part 12 to avail himself of the product, the lug 38 can be brought into engagement with the stop surface 44 of the lug 42, whereby further unscrewing of the cap part 12 will be prevented. For the full-on position of the cap part, the surface 48 of the lug 38 is engaged with the surface 46 of the lug 42, whereupon there exists positive stops defining not only the full-on position of the screw cap but also the full-open position of the same.

For different intermediate positions of the cap part 12, the extent of closing of the discharge opening 26 by the sealing pin 20 is varied, thus providing a degree of control of flow of the liquid product from the container. This variation of the size of the opening 26 is determined not only by the screw threads 32, 34 but also by the cam track 36 and the cam follower lug 38. As already mentioned, the cam track and follower lug dominate the raising movement of the cap part 12, since the screw threads 32, 34 are yieldable. Preferably the relative orientation of the screw threads and cam track is such that the screw threads are always slightly distorted or compressed whereby they cause the cap part 12 to continuously exert a downward pressure on the track through the medium of the follower lug 38. In consequence, the configuration of the cam track will be the main factor in determining the axial position of the cap part 12 and the extent of opening of the orifice 26 for any rotative position of the cap part.

The cap construction includes an indicator means, comprising an index groove 56 in the outside surface of the cap part 12, and cooperable raised portions or ribs provided in the top shoulder portion of the body part 10. As seen in FIG. 2, there is shown a single raised portion or rib 58 for indicating the closed position of the screw cap, a pair of ribs 60 for indicating a partially open or slow dispensing position of the screw cap, a set of three ribs 62 for indicating a more fully open position of the screw cap part, and a set of four ribs 64 to indicate the fully opened position of the screw cap. That is, when the

groove 56 of the cap part 12 is opposite the ribs 64, the cap will be fully opened, whereas when the groove 56 is opposite the two ribs 60, the screw cap will be only partially opened.

In accordance with the present invention, the cam track 36 is so modified that, for a given dispensing position of the screw cap part 12 the rate of flow or extent of opening of the orifice 26 may be accurately correlated to the rotative setting of the cap part. Referring to FIGS. 2 and 8, for the dispensing setting where the groove 56 is opposite the ribs 60, the cam track 36 is provided with a hump 66 which normally causes the cap part 12 to be raised more than it would be if the track had no hump. The additional raising of the cap part is made possible since the screw threads 32, 34 can yield the extent necessary to permit the follower lug 38 to ride up on the hump 66. In reworking the molds for the body part 10, the alteration of the mold part necessary to provide various sizes of humps 66 can be easily effected, much more so than if the adjustment of orifice size were to be attempted by changing the orientation of one of the screw threads 32, 34. In like manner, the cam track 36a illustrated in FIG. 9 may be provided with a slight depression 68 instead of the hump 66. In either circumstance, the alteration of the cam track, which dominates the raising movement of the cap part 12 as against the action of the screw threads 32, 34 can be more easily effected and with greater certainty of arriving at the required flow for a given rotative setting of the cap part at the ribs 60, than if the adjustment had to be effected by a change in the orientation of the screw threads 32, 34.

The adjusting of the size of the orifice 26 and rate of flow to a given setting of the cap part involves a somewhat cut-and-try procedure wherein trials are made with the liquid product, which has a certain viscosity. Accordingly, several alterations of the mold part to provide different configurations of the cam track may be necessary. The cut-and-try procedures can be greatly shortened, however, by experimentally placing wedges between the bottom rim 40 of the cap part 12 and the top shoulder surface of the body part 10. By adjusting the height of the cap part 12 in this experimental manner while measuring rates of flow, the desired axial position of the cap part can be readily determined. It is then merely a simple matter to either add to or detract from the height of the cam track 36 at the location of the lug 38, by an amount equal to that experimentally found necessary to obtain the desired rate of flow. Thus, it is seen that the alteration of the cam track can be effected much more quickly and accurately than a reorientation of the spiral thread elements 32, 34 wherein there is involved a rotative positioning of the elements one with respect to the other.

It will now be understood from the foregoing that I have provided a novel and improved captive dispensing cap construction wherein the cap part is held from complete removal by a positive stop and has an intermediate dispensing position determined by an alteration in the cam track 36 to enable the orifice size to be accurately related to the flow indicator means. The hump or the depression in the cam track is easily effected by simple mold changes, making the more costly and time-consuming reorientation of the screw threads unnecessary. The unscrewed or dispensing position of the cap part 12 and also the full-on or sealing position of the part are determined by positive action stop lugs, and the cap part is held captive on the body part once it has been applied thereto and screwed past the full-open dispensing position.

Variations of the structure shown are possible without departing from the spirit of the invention.

I claim:

1. A captive dispensing cap construction comprising, in combination:

- a. a tubular body part adapted to be carried by a container and having a discharge spout,
- b. a screw cap part carried by said body part and surrounding said discharge spout,
- c. said cap and body parts having two pairs of mutually engageable portions,

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- d. one pair of mutually engageable portions comprising cooperable resilient and yieldable screw thread means on said parts, for moving the cap part axially on the body part as the cap part is turned,
- e. the other pair of mutually engageable portions comprising a helical cam track and a follower lug respectively on the body and cap parts for moving the cap part axially as it is turned, substantially in a like manner to the unscrewing action of said screw thread means,
- f. said cam track having a helical face on which the lug rides, and having an interruption in said face at one point thereof whereby the cap part departs from its uniform axial movement as the follower lug traverses said point during turning of the cap part, and
- g. indicator means on the body and cap parts, for indicating different rotative positions of the latter.
2. A cap construction as in claim 1, wherein:
- a. the interruption in the cam track face comprises a hump

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- thereon.
3. A cap construction as in claim 1, wherein:
- a. The interruption in the cam track face comprise a depression therein.
4. A cap construction as in claim 1, wherein:
- a. the cam track is on the cap body part.
5. A cap construction as in claim 1, wherein:
- a. the screw thread means comprises buttress thread elements arranged to permit the cap part to be stripped off the body part under the influence of excessive axial force.
6. A cap construction as in claim 1, wherein:
- a. the screw thread means comprises a helical thread element having a relatively small slope with respect to the axis of the cap construction.
7. A cap construction as in claim 1, wherein:
- a. The resilient screw thread means continuously tends to shift the cap part axially toward its full-on position.