Sept. 15, 1964 D. F. CORSETTE ETAL 3,148,805

LIQUID DISPENSER

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FIG. 2

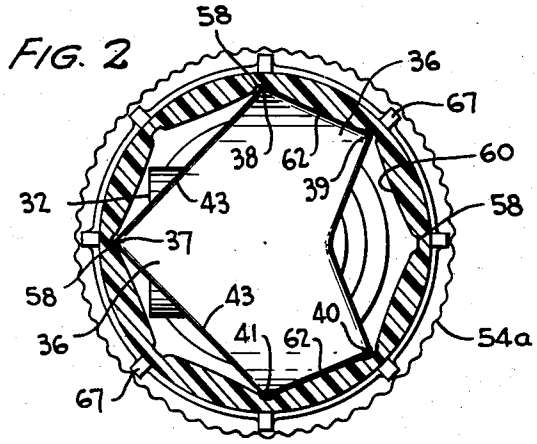


FIG. 3

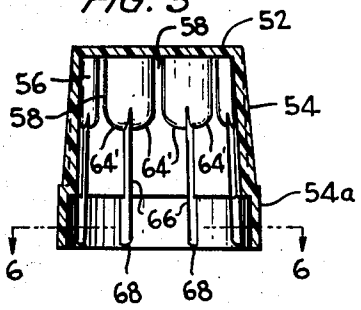


FIG. 1

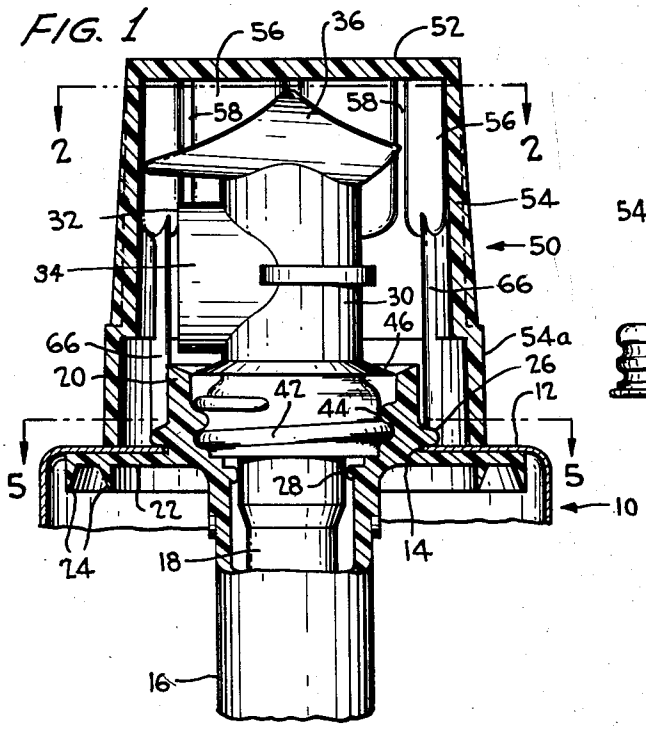
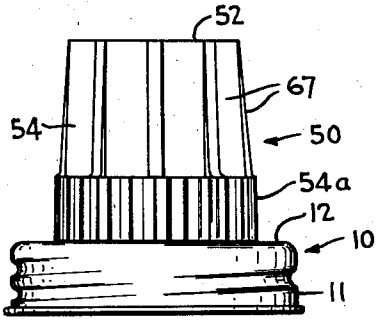


FIG. 4



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FIG. 5

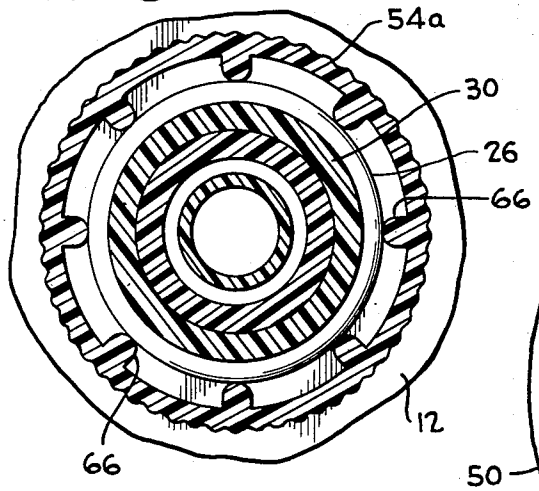


FIG. 6

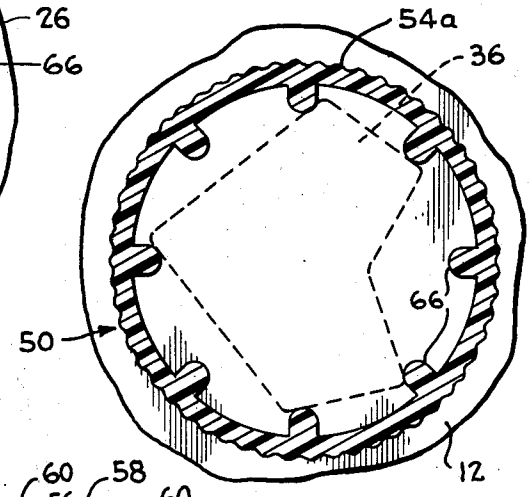
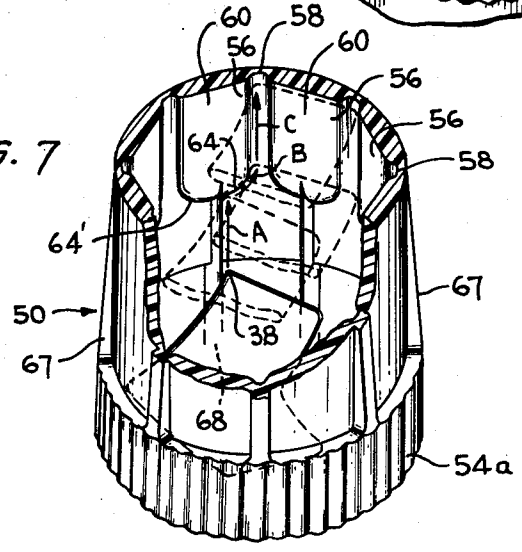


FIG. 7



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LIQUID DISPENSER

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Filed July 31, 1962, Ser. No. 213,752
12 Claims. (Cl. 222—384)

This invention relates to a liquid dispenser and more particularly to improvemtnts in the protective overcap for the plunger of such a dispenser as well as to the combination of the improved overcap with the dispenser structure.

More specifically the invention relates to a reciprocating pump type liquid dispenser and protective cap such as is disclosed in our co-pending application, Serial No. 170,543, filed February 2, 1962, now abandoned, of which this application is a continuation in part. In such a dispenser, the pump cylinder is normally supported through an opening in the container while the hollow plunger which reciprocates within the cylinder has an exterior dispensing head projecting upwardly therefrom and adapted for actuation by finger pressure on its upper end.

The plunger and cylinder are provided with a threaded connection for securing the plunger in a depressed and immobilized condition during shipment and storage, and the protective cap is frictionally secured on the plunger head in such a manner as both to protect it and to function as a wrench for transmitting rotational force to the plunger head.

In accordance with prevailing practice and as required as a matter of practice for the purpose of economy, the overcap and pump both are normally formed of a suitable moulded plastic material. The strength and the rigidity of such material normally are such as will tend to limit the maximum amount of torque capable of being transmiitted between the overcap and the plunger without relative distortion and movement of their inter-engaged parts with resultant burring or disfiguring unless an unusually heavy and uneconomical construction is employed.

Moreover, it has been found that the overcap disclosed in our prior application may be undesirably axially tilted or cocked with respect to the plunger in the event the endwise load or thrust exerted on it (as by an over-lying container or package) is unequally distributed. This may result in damage to the plunger.

Further, in applying the overcap to the plunger there arises the problem of rotationally orienting the overcap and plunger with respect to each other for proper reception of one within the other.

With these considerations in mind, the primary objects of the instant invention are:

To provide an improved form of overcap and combination thereof with the plunger, for reciprocation and cooperation with the plunger in such manner as to provide a non-rotatable coupling or connection between the two having substantially improved torque transmitting ability; to provide for improved rotational orientation of the parts by a camming action as an incident to their relative axial movement; to provide a construction of overcap which is adapted for moulding as a unit from a minimum amount of material while yet having adequate strength for its protective and load supporting functions; and to provide such an overcap in which a novel disposition of axial ribs or projections contributes to the attaining of both of the

objects of properly orienting and strengthening the overcap, while also engaging a portion of the pump cylinder and cooperating therewith to concentrically position the lower end of the cap with respect to the cylinder. Further objects and features of the invention will be apparent from the following description, taken in connection with the accompanying drawings, in which:

FIGURE 1 is a fragmentary view of a dispensing pump as applied to a container cap, the pump plunger being secured in its fully depressed inoperative shipping position, with a protective overcap applied thereto in accordance with the invention, certain of the parts being broken away for clarity of illustration.

FIGURE 2 is a cross-section on the line 2—2 of FIGURE 1.

FIGURE 3 is a cross-section of the overcap on a reduced scale, this section being taken in an axial plane.

FIGURE 4 is a similarly reduced side elevation of the overcap as applied over a container closure.

FIGURE 5 is an enlarged section on the line 5—5 of FIGURE 1, showing the centering action of the internal ribs of the overcap in conjunction with the flange on the pump barrel.

FIGURE 6 is a section through the overcap skirt, on the line 6—6 of FIGURE 3, showing in broken lines the manner in which the finger piece cooperates with the internal ribs of the overcap; and

FIGURE 7 is a perspective view of the overcap, partly broken away, showing a portion of the plunger head finger piece in full lines at the start of its reception within the overcap, and showing the intermediate and final operation position of these parts in broken lines respectively.

To promote an understanding of the invention, reference will now be made to the preferred embodiment thereof illustrated in the accompanying drawings, and specific language will be used to describe the same. It will nevertheless be appreciated that no limitation of the scope of the invention is thereby intended, such further modifications and alterations being contemplated as would normally occur to one skilled in the art to which the invention relates.

Referring now in detail to the accompanying drawings, and first considering the structure of FIGURE 1, the dispensing pump will normally be supported in a container (not shown) through an opening in the container closure or cap 10, which may be of the usual type having a threaded skirt 11 for application to the threaded neck of the container, and a flat top wall or web 12 having a central aperture 14 therein.

The pump barrel or cylinder 16 in which the hollow plunger 18 reciprocates, and from which it is normally spring projected upwardly is formed with an enlarged portion or collar 20 at its upper end. In assembling the parts this enlarged collar 20 is inserted upwardly through the central opening 14 within the cap until its movement is arrested by engagement with the cap of an outwardly projecting annular flange 22 preferably constituting an integral part of the cylinder structure and extending radially outwardly to be interposed between the upper end of the container neck and the top wall 12 of the cap 10. For providing sealing engagement with the container neck, the flange 22 is shown as being provided with downwardly directed feather edged annular ribs 24 arranged

concentrically to the flange and to each other respectively.

After the cylinder and cap are thus assembled, the enlarged collar **20** may be acted upon in a suitable forming or swaging operation to form above the cap an outwardly projecting radial rib or flange **26** which abuts against the upper surface of the cap and by virtue of its overlying relationship with respect to the cap prevents downward movement of the cylinder.

The plunger **18** which reciprocates within the cylinder **16** has its upward stroke limited by means of an inwardly directed annular flange **28** within the pump barrel at its upper end, it being apparent that this will overlie the conventional piston (not shown) at the lower end of the plunger and will limit the upward movement of the piston under the spring pressure which urges it upwardly.

At its upper end the plunger **18** terminates in an upwardly directed external plunger head **30** which is formed to eject the pump fluid laterally through a suitable opening or openings in the laterally directed face **32** of the fluid discharge portion or element **34**. It will be understood that the fluid or liquid within the container to which the cap **10** is applied is caused, by the reciprocating motion of the plunger **30**, to flow upwardly through the hollow plunger and outwardly through the discharge portion **34** thereof, this action being under the control of usual pump check valves which may be disposed within the plunger in generally conventional manner.

For reciprocating the plunger **18**, the plunger head or dispensing head **30** is formed at its upper extremity with an upwardly presented push button or finger piece **36**, preferably having its upper surface concavely curved for reception of the user's finger. As seen in plan, in FIGURE 2, the finger piece **36** is formed to have a plurality of radial points or projections, designated **37** through **41**, respectively. All of these projections lie on a common cylinder or surface of revolution concentric with the axis of both the plunger **18** and the pump cylinder **16**. It will be noted also that these several projections **37** to **41** are relatively angularly spaced and disposed so that each coincides with one of the corners of a given regular polygon which in the present instance, is an octagon. Preferably the included angle defined by the edges **43** of the forward point or projection **37** is substantially 90 degrees.

In addition to being reciprocable in the pump cylinder **16** along the cylindrical axis of the latter, the plunger **18** is freely rotatable within said cylinder about its said axis whereby to permit coupling and uncoupling as desired of the threaded interconnection between the plunger and cylinder defined by the threads **42** and **44**. The external threads **42** are formed around and integral with the head of plunger **18**, while the threads **44** are conveniently formed within the collar **20** of the pump barrel. Both the threads **42** and **44** (and therefore the threaded interconnection defined by them) are concentric to the rotational axis of the plunger so that rotation of the plunger head **30** in a clockwise direction with the plunger in depressed condition will engage the threads **42** and **44** to thus retain the plunger in its fully depressed condition. Obviously in such condition the plunger will be immobilized so that it may be shipped or roughly handled without danger of its being actuated to eject the container contents. In order to prevent seepage of the contents upwardly between the plunger and its cylinder **16**, it is desirable to provide the plunger with an external feather edged flange **46** disposed for edgewise sealing engagement within the collar **20**, as shown in FIGURE 1, in the fully depressed condition of the plunger **18**. The plunger may be released for operation by rotating it in an opposite direction to disengage the threads **42–44**, whereby it will be free to reciprocate. It will normally be projected upwardly by spring pressure, and may then be reciprocated by intermittently applied and released finger pressure on its finger piece **36**. The structure as thus far described has been heretofore known and is discolsed in our copending application Serial No. 170,543, filed February 2, 1962.

It has been found that where the containers are packed for shipping they will normally be arranged in layers superimposed on top of each other with the result that the upwardly directed plunger heads **30** of the lowermost containers are required to support the weight of the layers of containers above them. Thus there is a possibility of damaging the plungers in event of rough handling of the packages. Further, it is found that difficulty is sometimes encountered in rotating the plunger head **30** in a counter-clockwise direction in order to release the threaded interconnection **42, 44** to permit upward projection of the plunger.

Therefore in order to attain the two-fold objectives of providing for protection of the plunger during shipping and storage and also to provide means for facilitating the application of torque to the plunger, there is provided a protective overcap or cover designated **50** in its entirety. This overcap is specifically designed, not only to carry out its primary functions as above mentioned, but in addition to particularly adapt it for proper orientation with the plunger **36** incident simply to axial reception of the plunger head within the socket defined by the cap.

To this end it will be seen that the overcap **50** is of generally inverted cup-like shape closed by a web **52** at its upper end, from which web there depends an integral generally cylindrical skirt **54** which is open at its lower end for reception of the plunger head.

Adjacent its upper end, the overcap is formed interiorly with a plurality of axially extending lands, each designated **56**, which project radially toward the cylindrical axis of the skirt **54** for reception between relatively adjoining radial projections **37** to **41**, respectively, of the finger piece **36**. To provide for better gripping engagement with these projections **37–41**, the lands **56** are relatively uniformly spaced in a circumferential direction to define relatively parallel grooves **58** which all extend in an axial direction and are positioned to coincide with a regular polygon having the same number of sides as that with which the radial projections **37** to **41** of the finger piece **36** coincide. In order to insure positive gripping reception of the projections **37–41** within the grooves **58**, it is desirable that the surface of revolution on which the projections lie be of slightly greater diameter than a surface of revolution circumscribed about the imaginary intersections of the inner surfaces of the lands **56**. In the present embodiment, the several lands **56** are provided with flat inwardly presented surfaces **60** and the notches or grooves **58** defined between such lands at their relatively adjoining edges preferably have their relatively circumferentially opposed side walls disposed at a relative angle of no greater than 90° to each other. This angular relationship of the opposed side walls of the grooves has been found to be the optimum one for producing a strong gripping engagement of the projections **37** to **41** within the several notches without slipping or failure of the parts, particularly when the side edges of the finger piece are at a relative angle of 90° on either side of the projection **37**, as in the preferred embodiment.

It will be noted that the finger piece **36** of the preferred embodiment is provided with a pair of marginal edge portions or sections each designated **62** which coincide with sides of the imaginary regular polygon above mentioned and which therefore will engage and lie flush against the corresponding inner surfaces **60** of certain of the lands **56** to strengthen the gripping and torque transmitting action already provided by inter-engagement between the projections **37** through **41** and the grooves **58**.

At its lower end, each land **56** terminates in substantially spaced relation from the open end of the overcap **50** and is provided with an axially directed cam surface,

preferably including the oppositely axially inclined edge portions 64, 64' adapted to function as cams or cam surfaces for operative engagement with the projections 37 to 41 in a manner to relatively rotate these projections and the plunger itself so as to guide the projections into the respective grooves 58 as the plunger is received within the socket defined by the overcap 50. Because the cam surfaces 64 and 64' of each land 56 in the preferred embodiment slope axially in opposite directions from a diametrical plane bisecting each such land, the relative rotation between the plunger and the overcap will be in one direction or the other depending on the initial position of rotary engagement of these parts. In other words, these cam surfaces are inclined to a radial plane through the overcap.

Extending downwardly to the open end of the overcap, along the projected axial center line of each land or flat 56, is a relatively narrower extension or rib 66 having its lower end circumferentially rounded as shown in FIGURES 3 and 7 to provide a further cam surface 68. The said ribs with their cam surfaces 68 function as pilots so that, when the finger piece 36 is initially received within the open end of the overcap, any of the projections 37 through 41 contacted by the rounded lower ends or cam surfaces 68 will circumferentially deflect the overcap in one direction or the other. This will urge ribs 66 partially toward the nearest projections 37–41 to an initial position of rough orientation, so that their final orientation may then be completed by engagement with each of the projections of one or the other of the cam surfaces 64 or 64' of the respective flats 56.

It will be noted that the lower end portion 54*a* of the skirt 54 is of comparatively larger internal diameter than the rest of the skirt whereby to facilitate the initial insertion and rotary orientation movement of the finger piece 36. Also, as shown best in FIGURE 5, the inner extremities of the several ribs 66 are all disposed to lie on a commond circle concentric to the axis of the skirt and of a diameter similar to the external diameter of the flange 26. The arrangement is such that when the overcap 50 is fully seated over the plunger 30, the inner extremities of the ribs 66 will engage the outer periphery of the flange 26 to prevent any cocking or axial tilting of the overcap such as might tend to misalign its axis with that of the plunger, as might occur otherwise due to uneven application of pressure on the top of the overcap or to a side wise thrust exerted thereon. The length of the skirt is so proportioned with respect to the height of projection of the plunger in its fully depressed condition that the lower edge of the skirt will normally abut against and rest on the upper surface of the wall 12 of the container to transmit any thrust imposed on the cap directly to the container closure 10 and thus safeguard the plunger 18.

The ribs 66 in addition to their above mentioned piloting function and their function in resisting tilting of the cap by cooperation with the flange 26, perform the still further function of strengthening the comparatively thin lower wall portion of the skirt 54 to enable it better to resist axial compressive forces exerted on the overcap. In other words, these ribs are of importance as contributing substantially to the axial compressive strength of the cap while permitting its formation from a minimum amount of material.

The overcap as thus described is adapted for mass production by usual plastic molding methods from usual materials which may, if desired, be either comparatively rigid or may, if desired, by somewhat flexible. It is thus contemplated that the overcap in accordance with the invention may be produced by conventional molding methods from various conventional plastics having sufficient rigidity and strength for the intended functions. For instance, overcaps in accordance with the preferred embodiment of the invention herein disclosed have been successfully made from styrene, polypropylene and other conventional materials, and could also be made from various of the known thermosetting plastics, as well as other materials such as metal.

It should be observed that all portions of the socket below the wrenching lands 56 and between adjoining ribs 66, are preferably circular in cross-section and are of sufficient diameter to freely rotatably receive the finger piece 36, whereby to permit its rotational orientation for proper reception of its projections 37–41 within the grooves 58.

Preferably the lower skirt portion 54*a* is externally knurled or fluted as shown in FIGURES 2 and 14 to facilitate the gripping and rotating thereof. The external ribs 67, also shown in these figures, may function toward this same end, while also contributing axial compressive strength to the overcap construction.

In the use of the invention, overcap is supported in a random position of rotational orientation about its axis, but in such manner as to permit it at least a limited amount of angular movemen around such axis. Such support may be either manual or through usual mechanical means. While thus supported, it is urged axially onto the plunger head 30 of a dispensing pump. At the time the finger piece 36 of the plunger head is initially received in the open end or mouth of the socket defined by the overcap, if any of its projections 37–41 are aligned with the ribs 66, the diametrically opposed uppermost projections 38 and 41 will encounter the rounded lower ends 68 of certain ribs as shown in FIGURE 6. The resulting camming action will angularly deflect the overcap so that the projections will pass upwardly between the ribs, and, in so doing, will be partially oriented with respect to the grooves 68.

If, upon reaching the level of the lower ends of the wrenching flats 56, the projections are disaligned with the grooves 58, the uppermost or leading projections 38 and 41 will engage pairs of camming surfaces 64—64 or 64'—64'. On continued axial movement of the plunger and socket, the interaction of these surfaces with the projections will fully orient the overcap so that each of the projections 37–41 will be received in a groove 58 as the cap is fully applied onto the plunger.

In FIGURE 7 there is illustrated by the successive arrows, one path which the projection 38 might follow during assembly of the parts. Thus the projection may move axially toward the shoulder, to one side of a rib 66, as indicated by the arrow A. The arrow B indicates the relative rotary movement which occurs due to the camming engagement of the projection 38 with inclined shoulder or camming surface 64, and the arrow C shows the final axial movement after the projection and a groove 58 are fully aligned or oriented by the camming action.

If, when the overcap is applied, the plunger is raised to its operative position, it may be depressed by axial pressure on the overcap and secured in depressed condition, as in FIGURE 1, by clockwise rotation of the overcap to interengage the threads 42 and 44. At this time, the lower edge of the skirt 54 will rest on the upper web 12 of the container closure, while the upper end wall 52 of the overcap will be spaced somewhat above the finger piece 36. Therefore, any crushing loads resulting from the piling of containers or boxes thereof one on another, will be borne by the overcaps alone and transmitted to the closure caps 10 in a manner to by-pass and protect the plungers 18.

The ribs 66 within each overcap, in addition to having served the initial piloting or partial orienting function above mentioned, will, in the fully seated position of the overcap, snugly surround and engage the flange 26 to center the lower end of the overcap with respect to the plunger, and thereby to prevent any cocking or tilting of the overcap. In addition, these ribs 66 substantially reinforce the skirt 54 of the overcap to strongly resist crushing loads, without adding to the overall wall thickness of the cap. Thereby a saving of material is achieved.

When it is desired to use one of the pumps having the

protective cap thus applied, the threaded interconnection 42, 44 is released by rotation of the overcap in the appropriate direction. This overcap is then lifted from the plunger, which in the meantime is normally projected upwardly to operative position by its conventional return spring.

Obviously, the gripping action of the overcap on the plunger is such as to permit the transmission of a substantial torque from one to the other, and in a manner to avoid injuring or marring the finger piece 36. In the fully applied condition of the overcap on the plunger, each of the finger piece projections 37–41 will be received in a groove 58, so that interengagement between the groove side walls and these projections will strongly interlock the finger piece and overcap for rotation together. This interlocking action is strongly supplemented in the preferred embodiment by the abutting engagement of the side edges 62 of the finger piece with the opposed surfaces of the lands 56.

Moreover, it will be noted that the forward projection or point 37 of the finger piece, having its converging side edges 68—68 at substantially ninety degrees to each other, is snugly received and confined within a groove 58 also having its side walls also at substantially ninety degrees to each other, to transmit an exceptional degree of torque between the overcap and finger piece. While the angles above mentioned may be somewhat less than 90°, without adversely affecting the operation, it is not desirable to have them greater than 90° for the reason that the projections then tend to ride out of the grooves. In oher words, the wrenching efficiency is then impaired.

Having thus described our invention, we claim:

1. In a fluid dispenser which includes a pump of the class in which a spring projected plunger, disposed in a pump cylinder for rotation about and reciprocation along the cylinder axis, is selectively maintained in a fully depressed inoperative position by a threaded connection between the cylinder and plunger concentric to the cylinder axis, said plunger including a finger piece at its upper end having a plurality of radial projections disposed substantially on a common surface of revolution coaxial with said cylinder, each said projection being positioned to coincide with a corner of a given regular polygon; the combination with said pump of a protective overcap defining a socket open at one end for reception of said plunger, and formed with a plurality of axially extending inwardly projecting lands within said socket for reception between adjoining radial projections of said plunger, to interconnect said overcap and plunger for angular movement together, said lands being relatively uniformly spaced to define relatively parallel grooves extending in an axial direction and positioned to coincide with the corners of said regular polygon, said lands having ends directed toward said open end, said ends defining cam surfaces inclined with respect to a radial plane through the overcap and being arranged to operatively engage at least one of said projections of the finger piece, and to angularly orient said plunger and overcap for reception of said projections within the respective grooves as the overcap is applied to the plunger.

2. The combination as defined in claim 1 in which the said lands terminate in spaced relation from the open end of said socket, including a rib extending axially from the terminal end of each said land to the open end of the socket, said ribs being narrower and relatively more widely spaced than said lands, said ribs terminating adjacent said open end in rounded cam surfaces for angular deflection by any said projections encountered thereby during movement of the overcap onto the plunger.

3. The combination as defined in claim 1 including an external annular flange on said cylinder concentric to its axis, and a plurality of axially parallel inwardly projecting ribs extending upwardly into the socket from the mouth of the socket, the inner extremities of said ribs lying on a surface of revolution of substantially equal diameter to said flange for snug engagement with the periphery of said flange, and functioning with said finger piece to maintain the overcap and plunger in axial alignment.

4. The combination as defined in claim 1, in which the upper end portion of said socket is defined by a series of axially parallel and relatively angularly spaced wrenching lands having surfaces coincident with the respective sides of a regular polygon of smaller size than but otherwise similar to the first mentioned polygon, said finger piece also having side edges coincident with certain of the sides of said last mentioned regular polygon for operative engagement with certain of said lands, said grooves being located between and defined by adjoining wrenching lands.

5. In a fluid dispenser which includes a pump of the class in which a spring projected plunger, disposed in a pump cylinder for rotation about and reciprocation along the cylinder axis, is selectively maintained in a fully depressed inoperative position by a threaded connection between the cylinder and plunger concentric to the cylinder axis, said plunger including a portion adjacent its upper end having a plurality of radial projections disposed substantially on a common surface of revolution coaxial with said cylinder, each said projection being positioned to coincide with a corner of a given regular polygon; the combination with said pump of a protective overcap defining a socket open at one end for reception of said plunger, and means within said socket defining a plurality of axially parallel grooves spaced from its open end, and disposed to coincide with the corners of said regular polygon, means defining a plurality of cam surfaces within said socket between said grooves and its open end, said cam surfaces being inclined with respect to a radial plane through the overcap and arranged to operatively engage at least one of said projections to relatively orient said plunger and overcap for reception of said projections within the respective grooves as the overcap is applied axially to the plunger.

6. The combination as defined in claim 5 in which said axially inclined ends are axially spaced from the open end of said socket, said overcap comprising between its open end and said lands a skirt portion of circular cross section of a diameter to rotatably receive said finger piece.

7. The combination as defined in claim 5 in which said axially inclined ends of the lands are convexly curved, and including a piloting and reinforcing rib extending downwardly from the circumferential midpoint of each said lower end to the open end of the socket, said ribs being disposed with their inner extremities on a circle of lesser radius than that defined by the said radial and having circumferentially rounded lower ends disposed for camming engagement with said projections of the finger piece, whereby to cause relative rotary movement between the overcap and plunger to permit reception of the projections between adjoining ribs during initial axial movement of the overcap onto the plunger.

8. The combination as defined in claim 5, in which said grooves are each defined in part by circumferentially opposed walls disposed substantially normally to each other and at least one of said projections is defined by converging side edges substantially normal to each other.

9. A protective overcap for a dispensing pump plunger, said overcap being of inverted cup shape defining a socket closed at its upper end and open at its lower end for reception of the plunger, axially extending radially inwardly projecting lands within said socket, said lands being relatively uniformly angularly spaced and defining a plurality of axially extending grooves between adjoining lands, the bottom and side walls of said grooves being disposed at the corners of a first regular polygon on a common surface of revolution, said lands having inwardly directed flat surfaces substantially coinciding with the respective sides of a second regular polygon, the angle between the flat surfaces of adjoining said lands being

equal to a multiple of angle between said sidewalls of each said groove, said surface of revolution being of greater diameter than a circle circumscribed about said second regular polygon.

10. A protective overcap as defined in claim 9, including a convex cam surface formed at the lower end of each said land, and an inwardly projecting rib extending from the circumferential midpoint of each cam surface toward the open end of said socket.

11. A protective overcap as defined in claim 10, in which the lower ends of said ribs are convexly curved.

12. A protective overcap as defined in claim 10, in which said grooves are substantially of right angular cross section.

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