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FORCE PLUG FOR MOLDED ARTICLES

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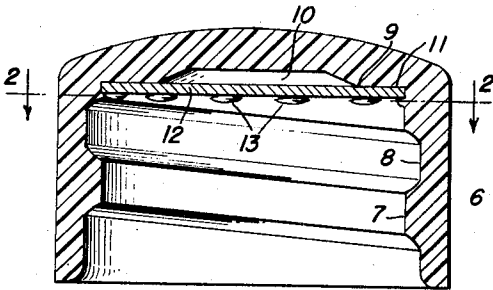


FIG. 1

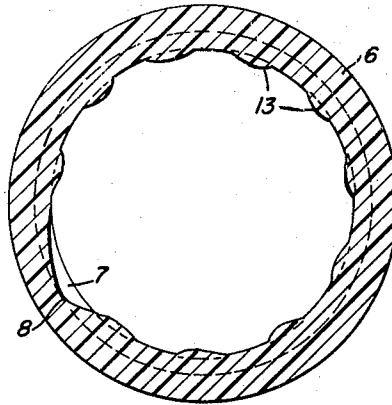


FIG. 2

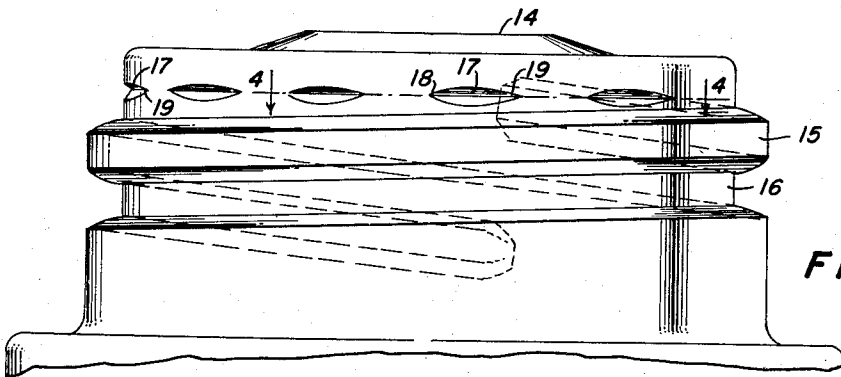


FIG. 3

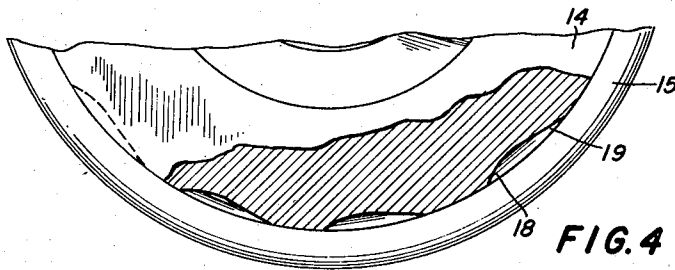


FIG. 4

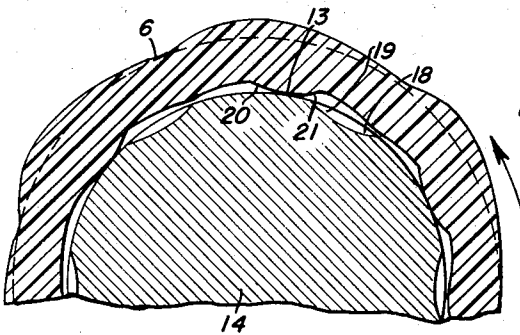


FIG. 5

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FORCE PLUG FOR MOLDED ARTICLES

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1 Claim. (Cl. 18—45)

This specification relates to a novel force plug used in the formation of molded articles such as bottle caps.

Molded bottle caps for screw-threaded attachment to bottles or similar containers are generally provided with sealing liners which fit against the mouth of the bottle. Retaining the liner in position for sealing purposes involves a particular formation of the cap. Primarily the liner must be inserted within the inner diameter of the screw-thread. Attachment of the liner to the cap can be made by means of adhesive. This, however, imposes a limitation on speed of assembly. Moreover, the adhesive may not be fully effective, but will deteriorate by standing and later fail to hold at the time when it is desired to remove the seal with the bottle cap. Under such conditions the attachment of the seal to the cap may be broken and the seal remain on the bottle mouth from which it may have to be forcibly pried off by a separate operation.

It is of course well known to provide inwardly extending projections which engage the edge of the liner and force it is not only to grip the inner surface of the cap, but also to rotate with the latter.

In respect to the method of forming the improved bottle cap, one purpose of the invention is to utilize the inherent elasticity and resilience possessed by the thermosetting or the thermoplastic material of which the cap is molded. These properties are temporary and last only while the cap is in the formative stage and in heated condition. The invention therefore takes advantage of the fact that while still heated, the molded cap can be stretched out of normal shape to facilitate the removal of the retaining lugs without damaging them. Subsequently the cap returns to its normal shape. Finally the cooling operation makes the cap rigid. At the same time there is a definite shrinkage of the material resulting in reduction of the diameter of the cap.

A material incident in the novel method of forming the improved cap is the provision of a force plug. This is used to form the inner surface of the cap during molding. The lugs for retaining the liner are formed by appropriate recesses in the side wall of the force plug.

Removal of the still plastic cap from the force plug by unscrewing imposes a strain upon the lugs which may cause damage to them. In order to prevent this happening, the force plug is given a novel shape in that the recesses forming the lugs are extended on the leading side with respect to the unscrewing operation, so that a gradual incline or slope is provided. In this way the individual lugs are caused to move out of the recesses gradually, transferring the strain to the still plastic side wall of the cap without imposing damaging strain to the lugs themselves.

An important feature of the force plug is that the lug-forming recesses are in a plane spaced from and parallel to the upper surfaces. In this way partial rotation of the still plastic cap not only causes each lug to ride up out of the forming recess, but also by reason of the pitch of the screw-thread, the lug is moved axially of the plug so

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that it passes laterally of the next adjoining recess. After the movement of dislodgment has started, the lugs ride over the cylindrical surface until they pass above the top of the plug. The resilience of the material at that point restores the normal circular contour.

The objects of the invention as above briefly pointed out and other incidental desirable features are shown by the following description and the accompanying drawings of the preferred form of the invention in which:

Fig. 1 is a longitudinal cross-section of the improved molded cap with its liner;

Fig. 2 is a transverse cross-section of the cap taken on the line 2—2 of Fig. 1;

Fig. 3 is a side elevation of the force plug used in molding the cap;

Fig. 4 is a transverse cross-section on the line 4—4 of Fig. 3 and

Fig. 5 is a similar fragmentary cross-section of the plug and cap in the separating operation.

Briefly described the invention utilizes the characteristic features of the thermosetting or thermoplastic molding materials to form a row of lenticular lugs in a plane which will coincide with the inner surface of the seal. The seal may thus be snapped into position and held against inadvertent removal. At the same time the seal is reasonably free to be held by the mouth of the bottle in sealing relation while the cap is unscrewed up to the point where the upward pressure of the lugs is sufficient to break the seal and thus lift the liner away from the mouth of the bottle.

To successfully form such a molded cap with retaining lugs it is necessary, however, to provide a gradually sloping edge for the lugs so that they may ride up out of the forming recesses. In this operation the elastic material will cause temporarily the deformation of the cap.

After removal of the cap from the force plug, the resilient plastic cap resumes its normal shape. As the cap cools, it undergoes a definite shrinkage into its final cross-sectional dimension.

As illustrated, the bottle cap 6 is made of thermoplastic molding material. This cap is formed by molding the hot material under pressure into the desired form over a force plug. As pointed out above, the thermosetting or thermoplastic material is capable of limited stretching while still hot, enabling its removal from the force plug. It has inherent resilience, however, that brings it back to the normal molded shape. Ultimate cooling of the article results in rigidity. At the same time there is a characteristic shrinkage which necessitates removal of the cap from the force plug before cooling has progressed too far.

The bottle cap has an internal screw-thread 7. The valley 8 of the screw-thread forms the channel which will receive the screw-thread on the neck of the bottle or like article.

There is an inner top surface 9 for the cap. This may have a central recess 10 which limits the operating surface to a marginal flange 11. A liner 12 is adapted to be held in place against the flange 11. The liner is customarily made of paper pulp, cork or the like, having a lower sealing surface.

The liner is held in place by means of lugs 13 integrally formed on the inner side wall of the cap. These are in a plane parallel to the flange 11 and spaced far enough to receive the liner 12 as shown in Fig. 1.

The lugs 13 permit the liner to be snapped past and into place. In position the liner is retained but capable of relative rotation with respect to the cap. It is thus possible for it to form a sealing engagement with the mouth of the bottle subject, however, to being pulled away by the pressure of the lugs on the inner face of the liner.

The lugs 13 are formed integrally with the bottle cap 6 during the molding operation by the use of a special force plug 14. This force plug is made of steel or other similar material and is generally cylindrical in form. It has a special screw-thread 15, the valleys 16 of which conform to the ribs of the screw-thread 7 in the cap 6. The screw-thread 15 extends to the point near the top surface of the force plug as shown in dotted lines in Fig. 3.

A row of recesses 17 is cut into the side wall of the force plug 14 in a plane parallel to the top wall of the latter. Each recess is lenticular in that it has slightly convex sides. The center line which forms the edge of the lugs slopes down toward each end. The rear end 18 is substantially the same radius as the cutting tool. The front edge 19 is given a more gradual slope than edge 18. This is accomplished by moving the cutter or grinder circumferentially of the plug and at the same time withdrawing it.

This results in giving the same general contour to the individual lugs during the molding operation. Thus each lug 13 will have a front edge 20 of gradual slope and a rear edge 21 more abrupt in slope. This is indicated particularly in Figs. 2 and 5, while the gradual slope of the front edge of the recess 17 is clearly shown in Figs. 3 and 4.

During the molding operation the force plug 14 operates upon a mass of heated thermosetting or thermoplastic material in the mold to form the cap 6 with its screw-thread 7 and the lugs 13.

While the material is still hot and plastic, the cap is unscrewed by rotation counterclockwise, as shown in Fig. 5. This is made possible by the fact that the material is still capable of being stretched.

In this movement each individual lug 13 rides up the more gradual slope of the edge 19 of the recess 17. The lug is therefore brought out onto the cylindrical side surface of the plug without deformation or damage, such as stripping.

It will be readily recognized that due to the pitch of the screw-thread 15, each lug 13 will rise out of the plane of the recesses 17 so that the lug will pass above or lat-

erally of the next successive recess 17. Slight continued rotation of the cap will lift it up of the force plug without damaging the lugs.

After separation from the force plug, the cap by reason of its resilient material will resume the normal cross-sectional form as shown in Fig. 2. The cap as it cools will also shrink into the ultimate, desired cross-sectional dimension.

The particular form of the lugs is thus most advantageous in permitting their formation integral with the cap without likelihood of deformation or damage. The inner wall of the cap which carries the lugs also has a diameter not greater than the root of the screw-thread 15 (rib of the screw-thread 7). As a consequence, the liner 12 will readily pass the screw-threaded portion of the cap and be easily moved into position above the series of lugs. It is thus held against separation, but permitted relative rotary motion, so that the seal on the bottle or the like remains until the series of lugs forcibly lift the liner off the mouth of the bottle.

While the preferred form of the invention has been described above in detail, numerous variations in form, material and proportions are possible without departing from the scope of the following claim.

What I claim is:

A force plug for molding a thermosetting or thermoplastic bottle top having a generally cylindrical form, a screw-thread on the side wall and a transverse series of lenticular recesses on the said side wall above the end of the screw-thread, each of said recesses having its edge nearer the screw-thread with a slope less than that of the opposite edge.

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