This invention relates to an improvement in the construction of flexible or collapsible containers, such as a bottle, tube or the like, having a dispensing plug disposed within an opening defined by the reduced neck portion of the container.

More particularly, this invention relates to an improved closure or seal between such a plug and the resilient neck of such bottles. Collapsible or flexible bottles, that is, bottles formed of a flexible and resilient material, for example, a plastic such as polyethylene, have become increasingly popular as packaging units for medicines, cosmetics, insecticides and sundry items. Such containers are well known and have been widely used as a non-breakable replacement for the conventional glass bottles. However, their utility does not end there, as the flexible walls make them inherently adaptable for use as a dispensing device similar in function to a nebulizer, that is, they may be arranged to extrude the confined material in a spray or jet backed by a considerable quantity of pressure by providing the neck opening with a suitable dispensing plug or nozzle. Such plugs or nozzles usually have a rather long axial conduit having a bore of rather relatively small diameter, so that the path of the stream extruded is well defined.

While such an arrangement is widely used, it has not been entirely satisfactory. As the production of such containers is a low margin and highly competitive industry, it has not been economically feasible to seal these plugs in place by such apparent techniques as adhesive sealing or by thermally induced methods of self-sealing. Rather, it has been customary to form cylindrical plugs having a diameter slightly greater than that of the opening in the neck of the bottle, and to force-fit these plugs into the smooth bore of these openings. As the axial length of the portion of the plug inserted within the neck is usually substantially equal to the entire length of the neck portion, and in any event is of a substantial length, the unit pressure between the plug and the resilient bore of the neck is rather low. This becomes evident when the flexible walls of the container are manipulated to induce a flow of the confined material through the dispensing nozzle, as it has been found that such manipulation frequently creates a fluid pressure greater than the unit pressure between the plug and the bore of the neck and causes a leakage between them. This condition is, of course, highly undesirable, as the material leaking around the plug will run down the walls of the container and wet the fingers of the user. Furthermore, this is not only an disagreeable effect, as frequently the confined material is of such a nature that a sticky or otherwise undesirable residue is left on the container. It will be readily seen that many people have had unfortunate experiences with flexible containers having such a plug sealing arrangement, and that it is highly desirable to provide an effective and dependable seal for the dispensing plug which will not leak or run under any normal handling conditions.

Thus far, the only practical manner in which this problem has been to provide plugs considerably larger than the bore of the resilient neck portion when it is in a relaxed condition. It will be readily seen that if the plug is large enough, a very high unit-pressure seal can be accomplished between the plug and the neck, and that the danger of leakage may be thus effectively obviated. However, this approach has not been altogether satisfactory, as the conventional methods of manufacturing such flexible bottles results in relatively large variations in the various internal dimensions of the bottles produced. Therefore, it sometimes happens that if a bottle has a relatively small bore, the complete insertion of a large plug will distort the exterior of the neck to a degree making an adequate closure with the protective screw cap impossible. In other words, the variance between the sizes of the plug and the neck opening will be so great that the force plug will warp the exterior threads. As the conventional protective screw cap is rigid, its interiorly disposed threads will not mesh properly with those on the neck and the cap will either break or jam. Thus, reliance upon exceedingly large plugs to achieve a high unit-pressure seal is not entirely feasible, especially when one considers that such dispensing bottles are produced and assembled by automatic machinery which provides no practical method of individual selection of suitably fitting plugs and bottles. Bearing in mind the problems presented above, it is an object of this invention to provide a dispensing plug sealing arrangement which economically and yet effectively seals the plug with the resilient neck of a flexible container.

It is a further object of this invention to provide a dispensing plug which may be tightly sealed to a resilient bottle by a force-fit between their respective elements, the seal being attained without distorting the screw threads which are exteriorly disposed to receive a conventional rigid cap.

These and other objects of the invention will be fully understood from the following detailed description of a typical preferred form and application of the invention, and the appended claims.

The invention may be best understood with reference to the accompanying drawings, in which:

Figure 1 is an elevational view with portions broken away to illustrate the invention;

Figure 2 is an enlarged fragmentary view, taken in section, of the bottle shown in Figure 1; and

Figure 3 is a section taken along 3—3 of Figure 2.

In Figure 1, there is illustrated a suitable container, such as a bottle or tube 10 for fluent or powdered material, and which may be formed of a flexible and resilient plastic material, for example, of polyethylene. Such bottles may be extruded in one piece or may be formed with their various elements molded separately and then joined by heat sealing the component parts or by joining them adhesively in any of a number of known and accepted methods. The bottle 10 carries an integral reduced centrally disposed cylindrical neck portion 12.

The exterior surface of the neck has threads 16 which are adapted to receive the interior threads 40 of a protective or safety screw cap 18. As will be discussed hereinafter, the threads 16 may be formed in the neck portion of the bottle when it is molded, or the threads may be cut into the wall portion in the conventional manner if the neck is originally formed as a smooth-sided cylinder. In any event, the threads extend along the exterior of the neck for a substantial distance, that is, through several turns of the thread itself, but they do not reach the free or open end of the neck. Rather, the end of the threaded portion is spaced from the free end 20 of the neck by a smooth annular portion 22. It will be seen that the portion 22 of the exterior wall of the neck 12, between the
threads 16 and the free end 20 is formed with a diameter which is substantially equal to or less than the minor or root diameter of the threads. That is to say, the external diameter of the portion 22 of the neck 12 immediately adjacent the free end 20 is formed with a diameter which is equal to or less than the minor diameter of the internal threads 40 of the cap.

The free end of the neck is further provided with an integrally disposed circumferential flange or flexible shoulder 24 which extends inwardly for a substantial distance, and has a central opening 26 which is substantially smaller than the bore 28 of the neck portion 12.

A hollow dispensing plug, generally indicated at 30, is force-fitted within the opening 26, as shown in Figures 1 and 2. The plug consists of a nipple or outer portion 32 which has a reduced dispensing outlet 33 which communicates with the axial bore 34 to conduct a stream of the fluid or powdered material confined within the bottle 10 outwardly therefrom.

The nipple portion 32 is formed as a paraboloid or of mushroom shape and has a peripheral reduced annular shoulder 31 resting upon the outer planar surface of the flange 24. Depending from the nipple portion 32 is an inner portion 36 arranged to be inserted into the neck of the container or bottle 10 indicated generally. The outer surface of the inner end portion 36 is tapered and diverges upwardly from the lower end 37 (Fig. 2). The free end of the plug has a diameter smaller than the diameter of opening 26 when the flange 24 is in a relaxed or unstrained condition. An intermediate portion 38 of the plug 30, has its outer surface tapered and diverging downwardly towards the lower end 37 so as to provide an enlarged or bulged portion. All sections of the intermediate portion 38 have a diameter sufficiently greater than the relaxed diameter of opening 26, as discussed above, to produce an effective high unit pressure seal when the plug is fitted within the opening 26.

As the plug 30 is formed of rigid or semi-rigid or yieldable material, the forced insertion of the body portion 34 into the opening 26 will deform the resilient neck wall surrounding the circumferential flange 24. However, as this portion 22 of the neck is reduced to a diameter equal to or less than the minor diameter of the thread 16, it will be seen that there can be no resulting interference with thread 23 of safety cap 18, when the later is being threaded on the bottle. The restricted opening 26, in the circular flange 24, is of slightly smaller diameter than the inner portion 36 of the plug 30 which extends into the neck of the bottle, and provides means in the form of a narrow wall or band against which the outer tapered surface of the plug 32 exerts a high unit pressure so as to insure an effective seal and also prevents the dislodging of the plug 30 upon the squeezing of the resilient container 10. Moreover, the smooth external upper end portion 22 of the neck is offset or spaced laterally relative to the internal threads 40 on the cap, so that when the flange 24 is displaced radially and outwardly by the plug 30, the outer smooth surface 22 of the neck will not abut or interfere with the threaded engagement of the cap with the neck. In other words, the unthreaded portion 22 of the neck is located above the threads on the neck of the bottle, to provide means so that the engaging pressure of the plug and the shoulder 24 cannot distort the external threads of the neck, so that the cap 18 will at all times be readily attached to or removed from the bottle without interference resulting from the locking engagement of the plug 30 with the wall of the opening 26 in the flange 24.

While we have described the plug as carrying a paraboloid nipple 32, it will be understood that this exterior portion of the plug may be formed of any material, size, shape or color which will suit the particular user of the dispensing container or which may enhance the appearance or appeal of the package.

Having described only a typical preferred form and application of the invention, it will be understood that the invention is not to be limited or restricted to specific details herein set forth, but we wish to reserve to ourselves any variations or modifications that may appear to those skilled in the art and falling within the scope of the following claim.

What is claimed is:

In combination, a flexible container having a reduced neck provided with a transverse resilient flange at the top thereof, said flange having a central opening of smaller diameter than the interior diameter of the neck, the outer surface of the neck adjacent the top having a smooth annular portion and a threaded portion below the smooth portion, a dispensing plug insertable in said flange, opening said plug having an outer end portion and an inner end portion, the outer end portion being enlarged and having a central reduced opening, said enlarged outer end being connected to the inner end by a reduced shoulder portion that engages the flange when the inner portion is inserted through the flange opening into the container, the inner end portion of said plug having an outer diameter slightly larger than the diameter of the central opening in the said flange, and a cap having an internally threaded portion connected to the external threads of said neck, the smooth portion of the neck being spaced from the adjacent inner wall of the cap, so that the plug when inserted into the container exerts a high pressure adjacent the flexible flange to provide a tight seat at a point above the threaded portion of the neck without the tight-engaging pressure displacing the external threads on the neck in order that the cap may be attached to or removed from the container without interference resulting from the locking engagement of the plug with the flexible flange.

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