June 17, 1952 J. G. LIVINGSTONE 2,601,040

FITTING AND SEALING MEANS THEREFOR

Filed July 5, 1950

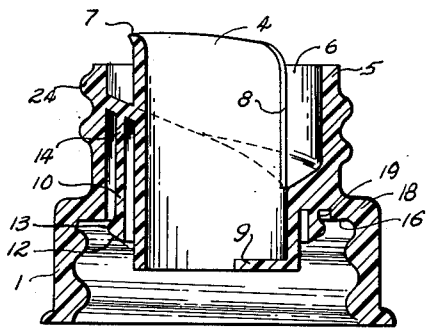


fig.-1

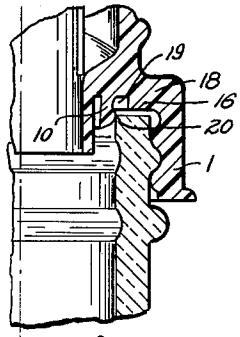


fig.-2

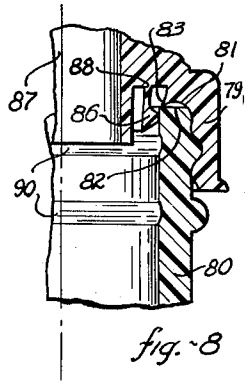


fig.-8

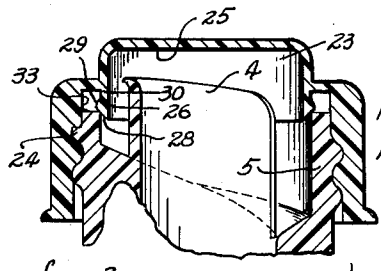


fig.-3

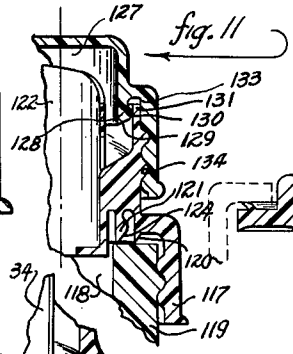


fig.-11

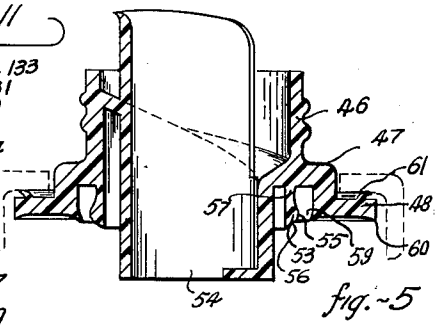


fig.-5

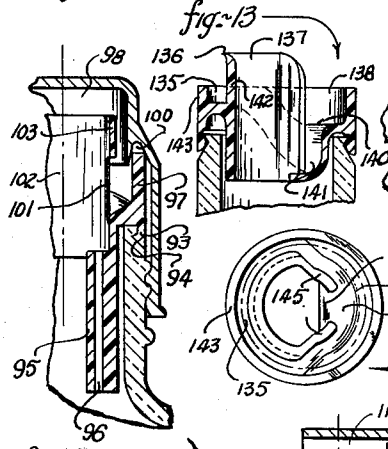


fig.-9

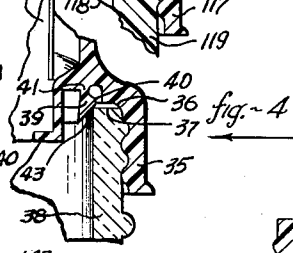


fig.-4

fig.-12

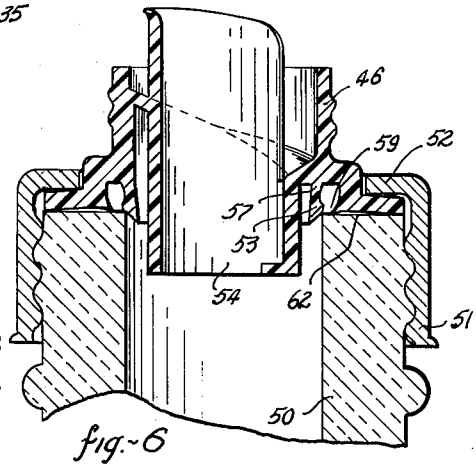


fig.-6

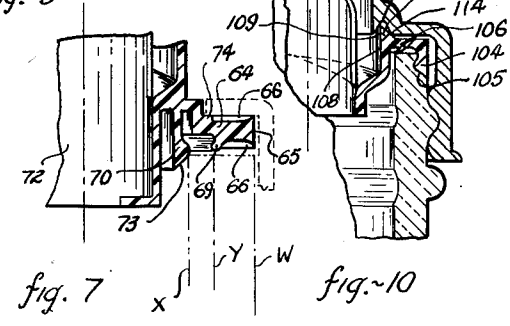


fig. 7

fig.-10

INVENTOR.
JAY G. LIVINGSTONE
BY

Gardner Mack
ATTORNEY

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FITTING AND SEALING MEANS THEREFOR

Jay Gould Livingstone, Akron, Ohio

Application July 5, 1950, Serial No. 172,167

16 Claims. (Cl. 222—109)

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This invention relates to fittings to be secured to an opening of a vessel which contains fluid. The fittings are usually fastened to an opening such as the neck of a vessel through which liquid is poured. The invention relates more particularly to novel means for forming a liquid-tight seal between the fitting and the opening in the vessel. It includes the vessel and attached fitting.

The term "fitting" is used herein to describe that class of objects which include various types of adapters through which liquid is poured from the vessel, other types of dispensers such as atomizers or the like which are fastened to the necks of bottles, and closure caps of all types which are either to be fastened directly over the opening of the vessel or to be used for covering various types of outlets employed at the opening of a vessel. The novel sealing means may be provided in any such fitting. The fittings disclosed in this application are preferably molded from plastic material. They may be formed of a relatively soft, flexible plastic, or in part of such a plastic and in part of a harder plastic. The sealing means will be formed of a flexible plastic material regardless of the composition of the remainder of the fitting.

The difficulties of adequately sealing the neck of a bottle to which, for example, a fitting such as an adapter or closure cap is threaded have long been appreciated by the bottling industry. The wall thickness of the neck of a glass bottle may vary considerably from one bottle to the next. The upper surface against which the fitting should seat may contain ridges or other irregularities which prevent a fitting from seating itself flat against it to form a seal. If the neck of the bottle is slightly out-of-round the various portions of the fitting will be distorted when they are applied to the neck of a bottle and it will be difficult to maintain a proper seal. The use of gaskets in combination with certain fittings is effective to prevent leakage but there are disadvantages to the use of them, such as the added cost of the gasket and its assembly with the particular fitting before the fitting is applied to the bottle or other vessel.

The use of bottles molded from plastics such as polyethylene, for example, is becoming quite popular in industry for a variety of purposes. Such bottles, for example, make excellent shipping containers for certain acids, solvents, etc., to which the plastic is inert. The bottles may be shipped without the danger of being broken. In the cosmetic industry cologne, perfume, deodorant, etc. are being bottled in flexible plastic bottles each equipped with an atomizer. To dispense the liquid the bottle is simply squeezed. This eliminates the need for transferring the cosmetic from the bottle to an atomizer.

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The problem of sealing a flexible bottle is probably more formidable than that of sealing bottles of more rigid materials. If the neck of a flexible bottle is relatively thin, the neck has a tendency to collapse and separate from the fitting fastened to it, and usually leakage develops around the base of the fitting. Certain of the fittings described herein are provided with sealing means which are particularly effective for preventing leakage when the fitting is used with a flexible bottle.

The fittings of this invention are adapted to be fastened over openings such as the opening in the neck of a bottle or over the opening in an atomizer or other adapter fastened to a bottle. Generally, the neck or other projection to which the fitting is attached will be cylindrical, although the fittings may be designed for tubular openings which are non-cylindrical.

The improved sealing means is formed integrally with the fitting. It includes a tubular tongue which is usually adapted to contact the inner surface of the neck of the vessel either at the inner rim, or below this. In certain of the fittings the tongue is designed to contact the top surface of the neck of the bottle. The tongue is flexible and its wall length will be reduced as it is pressed into sealing contact with the neck of the bottle or other tubular member. The contacting surface of the tongue is yielding so that it will conform to irregularities in the surface it contacts and form a liquid-tight seal. One or more tubular projections may be provided in concentric relation to the tongue for contact with the top surface of the neck of the bottle.

Plastic bottles of the type referred to above are often made so that the wall forming the neck is two or three times as thick as the sides of the bottle. This is to prevent the neck from flexing when the bottle is squeezed. The fittings used with these thick-neck bottles will usually be provided with a tongue which seals against the upper surface of the neck. When these plastic bottles are to be used for certain purposes the diameter of the opening through the neck is reamed out so that the wall thickness of the neck becomes relatively thin—about equal to the thickness of the sides of the bottle. For such a thin-neck bottle the tongue preferably extends down into the neck of the bottle or contacts the

inner rim at the neck and serves to reinforce the neck to prevent it from collapsing when the bottle is squeezed. A liquid-tight seal is maintained at all times. A preferred fitting disclosed herein is designed to fit and form an effective seal on either the thin-neck or the thick-neck bottles of the same outside neck diameter. One advantage of the sealing means of this invention is that it may eventually eliminate the need for thick-neck bottles for many purposes thereby bringing about appreciable economies in this art.

The drawings are illustrative of several preferred designs of adapters and closure caps provided with the novel sealing means of this invention. In certain of the drawings only fragmentary portions of the adapter and the sealing means are illustrated. The invention is not limited to the adaptations shown. In the drawings:

Fig. 1 is a cross-sectional view through a preferred adapter;

Fig. 2 is a fragmentary view of a portion of this adapter fastened to the neck of a bottle;

Fig. 3 shows a fragmentary portion of the upper end of the adapter shown in Fig. 1 with a closure cap applied thereto;

Fig. 4 is a fragmentary view of an adapter of the type shown in Fig. 1 with modified sealing means;

Fig. 5 is a cross-sectional view of an adapter with different sealing means;

Fig. 6 is a cross-sectional view of the adapter shown in Fig. 5 fastened on the neck of a bottle;

Fig. 7 is a fragmentary view showing an adapter with a modified form of sealing means;

Fig. 8 is a fragmentary view of an adapter with other sealing means;

Fig. 9 is a fragmentary view of an adapter which snaps onto the neck of a bottle and a closure cap for this adapter;

Fig. 10 is a fragmentary view of an adapter on the neck of a bottle and covered by a closure cap;

Fig. 11 is a fragmentary view of another type of adapter on a bottle and provided with a preferred closure cap;

Fig. 12 is a plan view of an adapter having a special type of pouring tube; and

Fig. 13 is a side view in cross section showing the adapter of Fig. 12 fastened to a bottle.

The drawings illustrate different applications of the sealing means. It is understood that a particular sealing means is not limited to use with the particular fitting with which it is described. The various sealing means shown may be applied to any type of fitting, such as adapters, dispensers, closure caps, etc. Unless otherwise stated, the plastic parts indicated in the drawings are flexible yielding polyethylene.

The adapter shown in Fig. 1 is a run-back adapter more particularly described in my copending application Serial No. 130,432, filed December 1, 1949. The adapter is provided with an internally threaded skirt 1 which is adapted to be threaded onto the exterior threads around the neck of a bottle. The outlet or pouring tube 4 is surrounded by wall 5 which is spaced radially outward from the pouring tube. The space between the outside of the tube 4 and the wall 5 forms a channel 6. Liquid poured through the tube 4 is adapted to flow over the pouring lip 7 at the upper edge of the tube. The portion of the channel immediately under the pouring lip 7 is relatively shallow. The bottom of the channel slopes downward from the shallow portion on each side of the tube 4, becoming gradually deeper and terminating at each edge of the slot 8 which extends down the back wall of the pouring tube. Liquid which drips from the pouring lip 7 is collected in the channel immediately under the lip and drains through the channel, and back into the vessel through the slot 8. While pouring from the vessel, baffle 9 limits the amount of liquid which can be poured through the pouring tube and prevents the liquid from overflowing through slot 8.

The seal for this adapter is designed so that the adapter may be used with either a glass bottle or a flexible plastic bottle. The seal is formed by the annular tongue 10 which is formed integrally with the adapter when the adapter is molded. The tongue 10 is located between the pouring tube and the skirt 1 and is formed concentrically with respect to each of these elements. The outer surface 12 of the bead 13 around the bottom of the tongue is inclined downwardly and inwardly toward the pouring tube. The bead is appreciably thicker than the upper portion 14 of the tongue which is joined to the bottom of the portion which forms the base of the run-back channel 6. The bead 13 extends around the tongue near its bottom and projects outwardly toward the threaded skirt 1. The outside diameter of the bead is greater than the inner diameter of the neck of the bottle for which the adapter is designed.

Extending inwardly from the top of the threads in the skirt is a shoulder 16. The tongue is connected to the adapter above this shoulder 16. If the tongue 10 were joined to the adapter at a point in the same plane as shoulder 16, on tightening the sides of the skirt would tend to pivot about the point where the tongue is joined to the adapter, and this would cause the thickened portion 18 of the skirt to swing outwardly and upwardly, which, in turn, would pull the sides of the skirt away from the threads on the bottle. By providing the annular void 19 between the tongue and the shoulder 16 the flexing point is located above shoulder 16 and the tongue may be flexed without distortion of the skirt, thereby preventing the skirt from being lifted from the neck of the bottle when it is tightened.

When the skirt is threaded onto a bottle the tongue 10 is flexed inwardly as shown in Fig. 2. The bottom of the outer surface of the thick portion of the tongue tapers inwardly, and this guides the tongue into the opening in the neck of the bottle as the opening squeezes it inwardly. If the diameter of the neck of the bottle is appreciably smaller than the outside diameter of the bead on the tongue the surface 12 does not pass entirely into the bottle but becomes seated against the inner edge 20 of the rim of the neck of the bottle to form a seal. Ordinarily the inward flexing of the tongue caused by the formation of such a seal is very slight. The top surface of the bottle need not bottom against the shoulder 16.

Fig. 3 shows the upper portion of the adapter shown in Fig. 1 with a closure cap 23 threaded onto the threads 24 which are formed on the outside surface of the wall 5. The upper portion of the pouring tube 4 extends upwardly into the dome 25 formed in the roof of the cap. To form a liquid-tight seal the closure cap is provided with an annular tongue 26 which projects downwardly from the circumference of the dome inside the cap. The surface 28 of bead 29 on this tongue is beveled downwardly and inwardly toward the bottom of the cap. When not under

any strain the lower portion of the tongue flares outwardly somewhat toward the threads in the cap. The upper portion of the tongue is thinner than at the bead 29, and it is joined to the cap at 30, which is a considerable distance above the threads inside the cap.

When the cap is placed over the pouring tube the beveled surface 28 contacts the inner rim of the annular wall 5. As the cap is tightened the tongue is squeezed inwardly on all sides so that the beveled surface 28 wedges itself tightly against the inside rim of the annular wall 5. As the tongue is compressed it flexes inwardly about the point 30. The tongue will resist this compression and, due to the tightening action, the upper portion of the wall 5 will be expanded somewhat in diameter and will be pinched between the bead 29 and the flat, smooth wall 33 which is formed above the threads inside the cap. Preferably the threads inside the cap terminate below the tongue and the wall 33 opposite the tongue is smooth and vertical with no obstructions or irregularities which might jam against the upper rim of the wall 5 and prevent the cap from being screwed tightly in place. This sealing action is very effective in preventing leakage of liquid around the top of the adapter.

The closure cap 23 may be applied directly to the top of a bottle having the same size threads instead of being applied to an adapter, as shown in Fig. 3. A cap to be used directly on the neck of a bottle need not be domed, and ordinarily will have a flat top. A tongue similar to tongue 26 will project downwardly from the inner surface of the roof of such a cap and will be located radially inwardly from the threaded sides.

Fig. 4 shows a portion of an adapter 34 of the type shown in Fig. 1 but with a seal somewhat similar to the seal formed in the closure cap 23 of Fig. 3. It is to be understood that the skirt and sealing means shown in Fig. 4 are substantially symmetrical about the centerline indicated. The adapter is provided with a threaded skirt 35 and above the threads on the interior of it there is a fillet-shaped surface 36 which is adapted to press against the outer rim of the top surface 37 of a bottle neck 38 when the skirt is tightened. The tongue 39 is annular and is spaced radially inwardly from the threads. A thick bead 40 is formed at about the middle of the tongue and projects toward the thread. The tongue is joined to the adapter at 41 and flexes at point 41, which is above the fillet 36. The lower surface 43 of the bead slants downwardly and inwardly toward the pouring tube. As the skirt is threaded onto the bottle the surface 43 slides downwardly across the inner rim of the upper surface 37 causing the tongue to flex inwardly about the point 41. Both the inner and outer rims at the top of the bottle neck are pinched tightly. The surface 43 yields sufficiently to conform to irregularities in the rim of the bottle.

The adapter in Fig. 5 is a run-back adapter of the type described in Fig. 1, but it is provided with different sealing means. At the base of the wall 46 which forms the run-back channel there is a stepped shoulder portion 47 and below this there is an annular wafer section 48. The wafer portion is designed to rest on the upper edge of neck 50 of a bottle, as is shown in Fig. 6. The adapter is fastened to the bottle by an auxiliary cap 51 which is a conventional type cap (made of hard rubber, hard phenolic resin, metal or the like) with a large opening in its roof through which the shoulder 47 fits when the cap is in place. The roof portion 52 of the cap 51 bears on the top of the wafer 48 and clamps it firmly to the top of the bottle neck.

The wafer 48 is designed to cooperate with the annular flexible tongue 53 which projects from the lower portion of the adapter and is spaced concentrically around the pouring tube 54. This tongue is formed with a thick bead portion 55 having a beveled lower surface 56. The tongue flexes from the point 57, which is above the wafer portion 48. A relatively thin, flexible, annular web 59 with sides which converge to a point, projects inwardly and downwardly from the bottom inner edge of the wafer portion. A similar flexible web 60 projects outwardly and downwardly from the bottom lower edge of the wafer. On the upper surface of the wafer and preferably spaced inwardly from its edge there is an annular projection 61 which protrudes somewhat above the top surface of the wafer and is flexible.

When the adapter is placed on the top of a bottle neck, the beveled surface 55 of the tongue will contact the inner rim of the top surface 62 of the bottle neck. Ordinarily the wafer 48 will not touch the neck of the bottle. The projecting webs 59 and 60 may contact the surface before pressure is applied but the tongue 53 may prevent such contact. The cap 51 is then placed over the wafer and is threaded onto the neck. The roof of the cap will first contact the projection 61 and fold this projection downwardly tight against the top of the wafer to form a tight seal between the top of the wafer and the roof and then the roof will force the wafer down toward the bottle. The web 60 will be flexed upwardly and outwardly and contact the outer rim of the neck of the bottle. The inner web 59 will be flexed upwardly and inwardly and will press against the upper surface of the bottle. As the cap is tightened the tongue 54 will be flexed inwardly as it is wedged into the neck of the bottle. Its beveled surface 55 will form a seal with the inner rim of the bottle neck. Several tight seals are formed at different locations. One purpose of the projection 61 on the top of the wafer 48 is to apply pressure to the middle of the top of the wafer to flex it downwardly and thus maintain the webs 59 and 60 in proper contact with the bottle neck. No gasket is necessary with this type of sealing means although a gasket may be employed if desired.

The adapter shown in Fig. 7 is designed to be attached to a bottle by means of an auxiliary cap, such as cap 51 of Fig. 6. Such a cap is indicated in the dotted lines. Only a fragmentary section of the sealing portion of this adapter is shown in Fig. 7 and it is understood that the sealing portion is substantially symmetrical about the centerline indicated. This sealing means is designed particularly for adapters to be used with bottles having the same outside diameter but different wall thickness. The wafer portion 64 extends over the top surface of a bottle's neck, and the outer edge 65 will be approximately the same diameter as the outer diameter of the bottle's neck (indicated by the line W). Both the upper and lower edges around the outside of the wafer 65 are provided with a flexible web 66. When the cap is tightened the lower web is adapted to flex upwardly and press against the outer rim of the neck. The upper web will be deformed against the interior of the cap's roof to insure the application of pressure on the bottom web 66.

Spaced inwardly from the web 66 on the bottom of the wafer is a somewhat thicker, annular web 69. This latter web projects downwardly and inwardly. The adapter is also provided with the annular, flexible tongue 70 which is located concentrically around the pouring tube 72. This tongue is similar in design to the other tongues shown.

If the adapter is tightened on a thick-walled neck the inner surface of which is indicated by dotted line x, the lower, beveled surface 73 of tongue 70 presses against the inner rim of the neck and is flexed inwardly in the manner described for the previous adapters. The roof portion of the auxiliary cap such as cap 51 rests on the small ledge 74 and on the top of web 66 and bridges across the center of the wafer as indicated in the dotted lines before the cap is tightened. After it is tightened the web 69 will press against the top surface of the bottle's neck in a manner similar to that in which web 59 in Fig. 6 fits against the bottle 50. This pressure will usually cause the center of the wafer to bow upwardly so that it is pressed against the roof of the cap.

If the neck is thin-walled, the tongue 70 will have no effect as a seal. The web 69 will contact the inner rim of the inner wall indicated by the dotted line Y to form a tight seal.

A single mold for such an adapter will produce a product that may be used on bottles of different wall thicknesses. Regardless of the thickness of the neck of the bottle, some portion of the webs formed on the wafer will make tight contact with the bottle and form a liquid-tight seal.

The sealing means on the adapter shown in Fig. 8 is designed more like that on the adapter of Fig. 1. It is provided with a threaded skirt 79 which, as shown, is threaded onto the neck of a plastic bottle 80. A fillet portion 81 is formed above the threads inside the skirt and this forms a tight seal against the outer rim of the bottle's upper surface 82 when the skirt is tightened in place. Around the inner portion of the fillet 81 a downwardly and inwardly directed flexible web 83 is formed. When the skirt is screwed onto a bottle, the web presses at or near the inner rim of the neck's upper surface.

Spaced radially inwardly from the web 83 is a tongue 86 which is formed concentrically around the pouring tube 87. This tongue is similar to the tongues described above but is adapted to be flexed inwardly and forced inside the neck in the manner shown. The tongue is joined to the adapter at the point 88 which is above the web 83 so that the threads in the skirt grip the neck threads tightly. The tongue presses outwardly against the inside surface of the bottle just below the inside rim. Usually there is a slight irregularity in the inner surface of the neck just opposite the threads as is indicated at 90. The tongue may be formed so that it projects a considerable distance into the neck, but preferably it does not extend to the irregularity opposite the starting point of the threads in the bottle. The yielding surface of the tongue will accommodate itself to irregularities in the surface of the bottle when under pressure, but such an irregularity as that indicated at 90 is objectionable because it reduces or entirely relieves the pressure of the bead against the bottle surface. For best results the tongue will press against an area of the inside surface between the top of the thread and the top of the bottle.

This adapter is particularly adapted for use on flexible plastic bottles since the pressure of the tongue 86 against the inner wall of the bottle's neck reinforces the neck of the bottle and prevents its collapsing when the bottle is squeezed or pressure is otherwise applied on the bottle. The pressure of the tongue is also effective in keeping the threads of the skirt tightly engaged with the bottle so that there is no danger of the cap being inadvertently pulled off the neck.

Fig. 9 shows a run-back adapter which is provided with a short skirt 93 designed to be snapped into a groove 94 around the top of the bottle to fasten the adapter to the bottle. The run back portion of the adapter is located above the rim of the bottle's neck. This adapter is provided with a baffle 95 which extends down into the neck of the bottle. In cross section the baffle has the shape of a circular segment and a vent hole 96 extends longitudinally through the baffle. The hole 96 admits air into the bottle to replace the volume of liquid being poured out through the adapter. The liquid poured from the bottle flows along the flat side of the baffle. The baffle and the vent hole 96 cooperate so that a smooth stream of liquid issues from the adapter. This long baffle and vent are advantageously employed with small adapters used with narrow neck medicine or prescription bottles containing very fluid liquids.

This adapter is formed with a run-back channel and the top edge of the wall 97 which surrounds the run-back channel is substantially flat. A dome-shaped closure cap 98 is threaded onto the neck of the bottle over the skirt 93, as shown. This cap 98 is preferably of hard material although it may be a soft flexible material. On the underside of the cap, between the threads and the dome, there is an annular groove 100 shaped like an inverted V. The tapering sides of the groove press down on the inner and outer rim of the top of wall 97 when the cap is tightened. This arrangement forms a very effective double seal at the top of wall 97.

It may be noted that the slot 101 in pouring tube 102 of the adapter of Fig. 9 is of slightly different design than in the other run-back adapters shown in the drawings. The slot 101 or opening 102 does not extend to the upper edge of the pouring tube and this variation in the design is for manufacturing purposes. When molding a run-back adapted such as shown in Fig. 1 two cores are used. A number 1 core which is substantially cylindrical forms the interior surface of the pouring tube. The run back channel, the outside surface of the pouring tube, and the inside surface of the wall surrounding the run-back channel is formed with a number 2 core which is tubular and is located concentrically around a number 1 core. The clearance between the two cores is equal to the material thickness of the walls of the pouring tube. To form the slot in the back of the pouring tube a key is usually formed integrally with the number 1 core and projects therefrom to contact the number 2 core. With this arrangement flash is formed along the edges of the slot next to the outside surface of the pouring tube. When molding certain adapters, particularly those for small bottles, the amount of flash may be sufficient to obstruct the run back channel. To overcome this difficulty the key may be formed integrally with the number 2 core so that the flash, if any, is formed along the edge of the slot at the inside wall of the pouring tube. To avoid forming any flash around the top portion of the pouring tube

when using this latter arrangement, a short key is used which forms only a short slot as indicated. The upper portion of the pouring tube is a continuous wall with an annular cross-sectional shape. The wall of the pouring tube above the slot is indicated by the section lines 103 in Fig. 9.

The adapted in Fig. 10 is formed with a skirt 104 which is adapted to snap onto a groove 105 in the neck of a bottle in the same manner that the adapter in Fig. 9 is attached, except that the inner side of the skirt 104 is formed with a flexible bead 106 which is spaced radially inward from the edge of the skirt. This bead is deformed against the top of the neck when the adapter is snapped into place, and it forms a very tight liquid seal between the bottle and the adapter. The rim around the top of the wall 108 which surrounds the run-back channel is provided with a projection 109. The outside surface 110 of the projection slants upwardly and inwardly away from the skirt 104 and it converges with the inside surface of the wall 108 to form a sharp edge. The closure cap 112 is preferably made of a hard material, although it may be formed of a flexible material and it is dome-shaped. Located inside of the cap around the base of the dome there is an inverted V-shaped groove 113. The corner side of the groove presses tightly against the sharp edge of the projection 109. The sharp edge 114 on the cap where the outer side of the groove 113 joins with the skirt, presses tightly against the surface 110. Thus, there are two sealing points: one where the sharp edge of the projection 109 meets the inner side of the groove 113 and the second where the outer side of groove 113 presses against the inclined surface 110 of the projection 109.

If the cap is of a hard material and the adapter soft, the cap will deform the portions against which it presses sufficiently to form an adequate seal. A seal is also formed if both the adapter and the closure cap are of soft, flexible material.

The adapter shown in Fig. 11 is designed particularly for plastic bottles and may be used for either thick-neck or thin-neck bottles having the same outside diameter. The adapter is formed with a skirt 117 which is threaded onto the bottle 118 having a thick-neck 119. An effective seal is obtained by the annular, sharp-pointed bead 120 and the annular tongue 121, each of which surrounds the pouring tube 122 and is located radially inwardly from the skirt. The bottom of both the tongue and the bead press on the top surface of the bottle's neck when the skirt is tightened.

The same adapter may be used with thin-neck bottles. On such a bottle only the pointed bead 120 will press against the top surface of the neck and the beveled surface 124 of the tongue will press against the inner rim of the neck so that the tongue is flexed inwardly. With a thin-neck bottle the sealing means of this adapter will seal against the neck in about the same manner as the sealing means of the adapter shown in Fig. 6.

The closure cap 127 is dome-shaped. It is provided with an annular tongue 128 located immediately below the edges of the dome portion. The tongue is shaped with a beveled surface 129 and a thickened bead portion 130. When the cap is threaded onto the wall 131 the tongue projects into the run-back channel and the bead portion 130 presses on the inner surface of wall 131 below its rim. It is to be noted carefully that opposite the bead portion 130 of the tongue the inside surface of the skirt portion of the cap is a smooth vertical wall 133. The internal threads 134 formed inside the skirt of the cap terminate a substantial distance below the tongue. Wall 131 is relatively thin as shown in the drawing. As the cap is tightened the wall will have a tendency to expand in diameter due to the pressure of the tongue on the inside surface. (The tongue will also flex inwardly somewhat.) If the threads in the skirt extend up as far as the bead portion 130, the upper rim of the wall will be pressed into threaded portions when the wall is expanded and it will be very difficult or impossible to tighten the cap properly. By making the surface of the skirt of the cap opposite the thick portion of the tongue a smooth vertical wall, the cap is tightened easily. When the tongue first comes into contact with the wall the outer rim of the top is pressed against the smooth vertical surface and there is nothing on this surface to obstruct or jam against the rim.

In order to select an adapter best suited for a particular bottling operation consideration is given to the style and type of bottle (glass, plastic, etc.), the size of the bottle, the fluidity or viscosity of the liquid to be contained in the bottle, the bottling equipment in the plant where the bottles are filled, etc. If a bottle is a snap-on type, for example, and the opening through the neck is relatively wide (greater than about $\frac{5}{8}$ inch diameter) an adapter of the design shown in Fig. 10 might be selected. The run-back channel of this adapter is located inside the neck of the bottle so that the adapter projects only a very short distance above the neck. The pouring tube, although considerably smaller than the opening through the neck, is still sufficiently large that a good stream of liquid may be poured through the pouring tube.

If, however, the opening in the neck is relatively small—for example, less than about $\frac{5}{8}$ inch diameter—the design shown in Fig. 10 is not practical, since the diameter of the pouring tube would be so small that it would be difficult to pour a good stream. The smallest opening permissible with one liquid will not be satisfactory with liquid having different physical properties, such as viscosity, etc. For example, it has been found that it is difficult to pour water through a pouring tube of about $\frac{3}{16}$ inches in diameter. The adapter shown in Fig. 9 is designed particularly to provide a pouring tube of the largest possible diameter in a small opening. All of the run-back channel on this adapter is located above the neck of the bottle so that the pouring tube may be formed nearly as large as the opening through the neck.

For certain bottling operations it has been found that an adapter of the design shown in Fig. 9 projects too far above the neck of the bottle. The adapters may be knocked off the bottles during shipment. Under these conditions an adapter of the design shown in Figs. 12 and 13 is recommended. This adapter projects no farther above the neck than the adapter of Fig. 10, and it is provided with a sufficiently large pouring tube to permit a good stream to be poured through it even for small-neck bottles. It is designed so that the front portion 135 of the run-back channel, immediately below the pouring lip 136 of the pouring tube 137, is located above the neck of the bottle (see Fig. 13). The portion 138 of the run-back channel which is in back of the pouring tube is considerably wider than the portion

135 of the channel. It is stepped down at 140 and the deeper portion 141 of the channel is inside the neck of the bottle below its upper rim.

The cross-sectional shape of the pouring tube 137 is not annular as in the adapters described in the foregoing. Its cross-sectional shape is shown in the plan view of Fig. 12. The front wall 142 of the pouring tube is concentric with the outer wall 143 around the run-back channel. The back of the pouring tube is formed by the sides 145 which converge sharply toward one another from both sides of the front wall 143. The resulting shape of the pouring tube is such that an adequate stream of liquid may be poured through it even though the baffle 147 and the deep portion 141 of the run-back channel immediately above the baffle are located inside the neck of the bottle.

This adapter is designed to be snapped on to the bottle in the same manner that the adapter in Fig. 9 is fastened. It may be covered with a closure cap similar to the type shown in Fig. 9. This adapter advantageously projects only a very slight distance above the rim of the bottle yet a large size pouring tube may be employed. It requires less material than an adapter which is higher, such as the adapter of Fig. 9, for example, and this results in a lower unit cost for both the adapter and closure cap. This adapter of Figs. 12 and 13 is so constructed as to permit it to be applied to the bottle automatically and at high speeds. It is adaptable to such operations as are performed on movable conveyors using automatic screw-down closure-cap applicators. The machine for applying this spout to the bottle should be installed ahead of the cap applicator thereby becoming another station in the sequence of operations.

The adapters shown in the preceding figures, for example Fig. 1, Fig. 5, etc., may be formed with a pouring tube of this design so that the front of the channel is above the neck of the bottle and the rear portion of the channel is inside the neck of the bottle.

Although generally the fittings shown herein will be used without gaskets, a gasket may be used with each of the fittings. Ordinarily there will be no advantage gained by using a gasket with fittings having wafer-like projections such as is illustrated in Figs. 5, 6 and 7, or the fittings shown in Figs. 9 and 10. The invention is defined in the appended claims.

Constructions disclosed and not claimed herein, are claimed in my copending application Serial No. 130,432 filed December 1, 1949.

What I claim is:

1. In combination, a fitting of resilient material having a body portion secured to the end of a generally cylindrical, tubular object similar to the neck of a bottle or the like, a flexible annular tongue which is a part of the fitting, the tongue being relatively thin where it is joined to the body of the fitting, the tongue having a relatively thicker portion away from the body which is diametrically wider than the diameter of the opening through the tubular object to which the fitting is secured, but which portion is diametrically narrower than the outside diameter of the tubular object, the outer surface of the wider portion of the tongue being deformed against the tubular object, the tongue being flexed inwardly about the thin portion to permit the deformation of the wider portion of the tongue.

2. In combination, a fitting of resilient material secured to the end of a generally cylindrical tubular object similar to the neck of a bottle or the like, a downwardly projecting, flexible annular member which is substantially concentric with the end of the object on which the fitting is secured, the member having one portion above its bottom diametrically wider than the bottom portion of the member, and the outer surface of the member tapering from the portion of wider diameter downwardly toward the portion of narrower diameter, which tapered portion is wedged against the inner rim of the end of the tubular opening through the object, forming a continuous seal between the fitting and the object.

3. In combination, a fitting of resilient material, having a body portion secured to the end of a generally cylindrical tubular object similar to the neck of a bottle or the like, a flexible annular tongue which is relatively thin where it is joined to the body portion and projecting downwardly therefrom and having a section away from the body portion which is diametrically wider than the diameter of the opening through the object to which the fitting is secured, but which section is diametrically narrower than the outside diameter of the tubular object, the bottom surface of the tongue tapering inwardly and downwardly from the wider portion to a portion diametrically narrower than the diameter of the opening through the tubular object, the tapering surface being in contact with the inner rim of the end of the object and squeezing the tongue inwardly and flexing it through its thin upper portion and thereby deforming the tongue to provide a continuous seal between the tongue and the object.

4. In combination, a fitting of resilient material, having a body portion secured to the end of a generally cylindrical tubular object similar to the neck of a bottle or the like, a flexible annular tongue which is relatively thin where it is joined to the body portion and projecting downwardly therefrom and having a section away from the body portion which is diametrically wider than the diameter of the opening through the object to which the fitting is secured, but which section is diametrically narrower than the outside diameter of the tubular object, the bottom surface of the tongue tapering inwardly and downwardly from the wider portion to a portion diametrically narrower than the diameter of the opening through the tubular object, the tapering surface being in contact with the object and squeezing the tongue inwardly and flexing it through its thin upper portion.

5. In combination, a fitting of resilient material secured to the end of a generally tubular object similar to the neck of a bottle or the like, an annular flexible tongue spaced inward on the fitting from the outer rim of the end of the object to which the fitting is secured and disposed substantially concentrically with respect thereto, the tongue being deformed against the object inwardly from the object's outer rim to effect a continuous seal around the object's end, the tongue being joined to a portion of the fitting which is spaced from the end of the object and the tongue being relatively thick at the portion thereof adjacent the object and being relatively thin at the portion thereof where it is joined to the fitting, the thick portion of the tongue being deformed to form a seal and the thin portion being flexed whereby there is no appreciable distortion of any other portion of the fitting.

6. In combination, a fitting of resilient material having a body adapted to be secured to the end of a generally tubular cylindrical object similar to the neck of a bottle or the like, an annular flexible tongue which is relatively thin where it is joined to the body of the fitting and relatively thick farther from the fitting, and the outer surface of the tongue farthest from the body tapering inwardly from the thick portion toward the center axis of the fitting, the thick portion of the tongue being diametrically wider than the diameter of the opening through the tubular object to which the fitting is adapted to be secured but narrower than the outside diameter of the tubular object, and the tapering surface of the tongue terminating in a portion narrower than the opening through the tubular object, whereby the thick portion of the tongue is pressed against the object and deformed and the tongue is squeezed inwardly to form a continuous seal with the object, the tongue being flexed through the thin upper portion thereby preventing distortion of any other portion of the fitting.

7. An adapter-and-cap assembly of resilient material for a shipping container for liquid, the adapter portion of the assembly including an outer tubular portion with a threaded skirt attached thereto which skirt is adapted to be threaded onto the neck of the container, and inside the skirt and substantially concentric therewith an annular tongue which projects downwardly from the tubular portion, the tongue being relatively thin where it is joined to the tubular member and being relatively thick near its bottom portion, the tongue being adapted to be deformed against a portion of the neck of the container when the skirt is threaded thereon, the upper edge of the tubular portion of the adapter being covered by the closure cap which has a roof portion and a skirt portion threaded onto the tubular portion of the adapter, and which further includes an annular tongue projecting downwardly from the roof and located concentrically of the skirt, this closure cap tongue being thin where it is joined to the roof and being thicker near the bottom, and being flexed inwardly with the thick portion in pressure contact with the interior surface of the tubular portion of the adapter below the inner rim thereof and forming a continuous seal therewith.

8. An adapter of resilient material for a shipping container for liquid, which adapter includes an outlet passage through which liquid may be poured from the container along one side thereof, the opposite side of the passage having an opening near the bottom thereof, a wall surrounding the outlet passage, a channel between the wall and the outlet passage leading to the opening, the bottom of the channel at the opening being lower than any other portion of the channel's bottom whereby liquid spilling into the channel is conducted to the opening where it empties into the outlet passage, the top of the passage projecting above the wall, extending outwardly from the base of the wall means to releasably secure the adapter to the container, and within the securing means an annular tongue which surrounds the outlet passage concentrically, this tongue being relatively thin at the portion joined to the adapter and being relatively thick at the lower end thereof, the tongue being adapted to be flexed inwardly at the thinner portion and the thicker portion being adapted to be deformed against a portion of the neck of the container when the adapter is positioned on the neck.

9. A fitting of resilient material having a body portion, a flexible annular tongue extending away from the body portion and located radially inwardly from the outer edge thereof and concentric therewith, said tongue being relatively thin where it is joined to the body portion and including a thicker section of larger diameter than the thin portion, the bottom of the tongue tapering from said section of larger diameter to a section of smaller diameter.

10. An adapter of resilient material for the neck of a container for liquids which includes a pouring tube through which liquid is adapted to flow and a portion extending outwardly therefrom for releasably engaging the neck, and located radially inwardly from the outer edge of said portion and concentrically about the tube an annular tongue which has a relatively thin upper portion where it is joined to the adapter and a relatively thick portion near its bottom, the tongue being adapted to be squeezed inwardly and deformed against the neck when the adapter is secured thereto.

11. A closure cap for a generally cylindrical tubular object similar to the neck of a bottle or the like, which cap comprises a roof portion with means extending therefrom to releasably secure the cap to the object and projecting downwardly from the roof an annular flexible tongue the outer surface of which is adapted to contact the object inwardly from where said means is adapted to contact it, a lower portion of the tongue being relatively thick and the upper portion being relatively thin where it is connected to the roof of the cap, the tongue being adapted to be squeezed inwardly by flexure of the thin portion.

12. A cap of resilient material adapted as a closure for a generally cylindrical tubular object similar to the neck of a bottle or the like, which cap comprises a roof portion with means at the edge thereof for releasably engaging an object of said type, and projecting downwardly from the roof within said means an annular flexible tongue which is adapted to contact the object inwardly from where said means is adapted to contact it, the upper portion being joined to the roof by a relatively thin portion, and a lower portion of the tongue being relatively thick, the outside surface of the tongue being tapered inwardly from the thicker portion toward the bottom edge, the tongue being adapted to be flexed through the thin portion whereby the tongue may be deformed inwardly without distortion of any portion of the cap other than the tongue.

13. A cap of resilient material adapted as a closure for a generally cylindrical tubular, flexible object similar to the neck of a bottle or the like, which cap comprises a roof portion, a skirt projecting downwardly from the roof with threads therein adapted to be engaged with complementary threads on the exterior of the object, an annular tongue which projects downwardly from the roof and is spaced inwardly and concentrically from the skirt, the tongue being relatively thin where it is joined to the roof portion and having a lower thick portion protruding toward the skirt, the bottom portion of the tongue tapering inwardly and downwardly from the thick portion, the threads in the skirt terminating below the thick portion of the tongue and the wall of the skirt opposite the thick portion being substantially smooth and vertical, the thick portion of the tongue being adapted to fit against the

object and to press the wall of the object against said smooth wall of the skirt when the cap is fastened thereon.

14. In combination, a fitting of resilient material having a body portion with internal threads in threaded engagement with external threads on a generally cylindrical, tubular object, between the end of the object and the external threads a smooth cylindrical outer surface, a tongue projecting from the fitting into the object and pressing outwardly against it, the fitting including between the base of the tongue and the internal threads a smooth cylindrical inner surface with which the smooth cylindrical outer surface of the object is thereby brought into contact.

15. An adapter-and-cap assembly of resilient material for a shipping container for liquid, the container being provided with an outlet which includes a neck, the adapter portion of the assembly including an outer tubular portion with a threaded skirt attached thereto which skirt is adapted to be threaded onto the neck of the container, and inside the skirt and substantially concentric therewith an annular tongue which projects downwardly from the tubular portion, the tongue being relatively thin where it is joined to the tubular portion and being relatively thick near its bottom portion, the outer surface of the tongue being adapted to be deformed against said outlet when the skirt is threaded on the neck, the upper edge of the tubular portion of the adapter being covered by the closure cap which has a roof portion and a skirt portion threaded onto the tubular portion of the adapter, and which further includes an annular tongue projecting downwardly from the roof and located concentrically of the skirt, this closure cap tongue being thin where it is joined to the roof and being thicker than the bottom, and being flexed inwardly with the outer surface of the thick portion in contact with the tubular portion of the adapter and forming a continuous seal therewith.

16. A fitting of resilient material an outer portion of which is adapted to be secured at the end of a generally cylindrical tubular object similar to the neck of a bottle or the like, a flexible annular tongue concentric with said outer portion and extending away from a portion located radially inwardly from said outer portion and adapted to contact the object, said tongue being relatively thin where it is joined to the fitting and including a thicker section of larger diameter than the thin portion, the outer surface of which thicker section is adapted to form a seal with the object.

JAY GOULD LIVINGSTONE.

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