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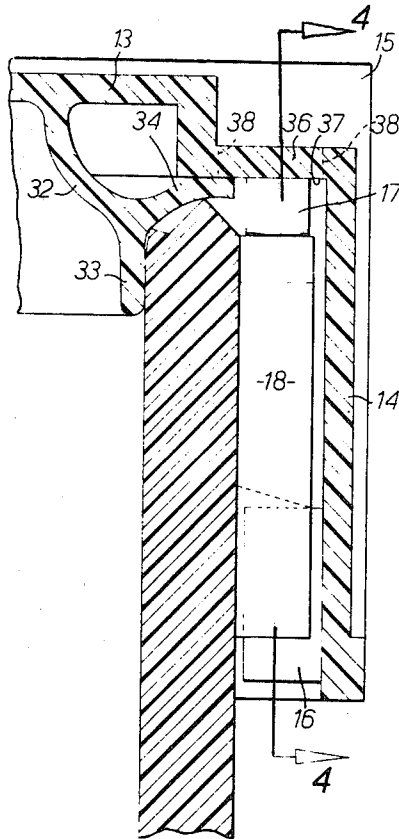
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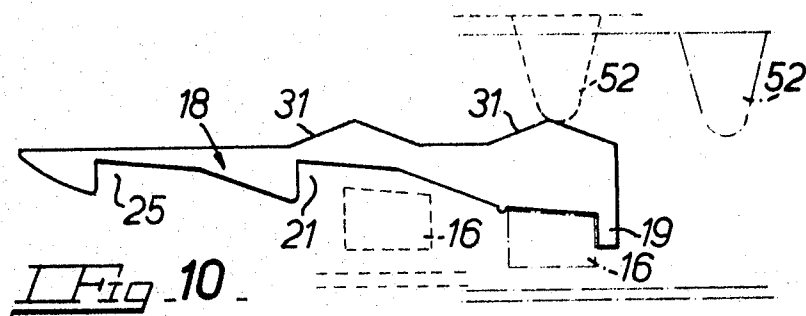
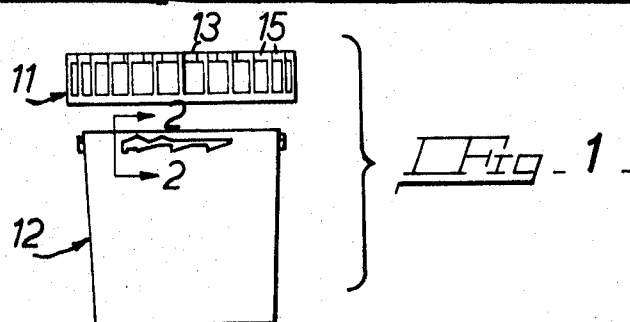
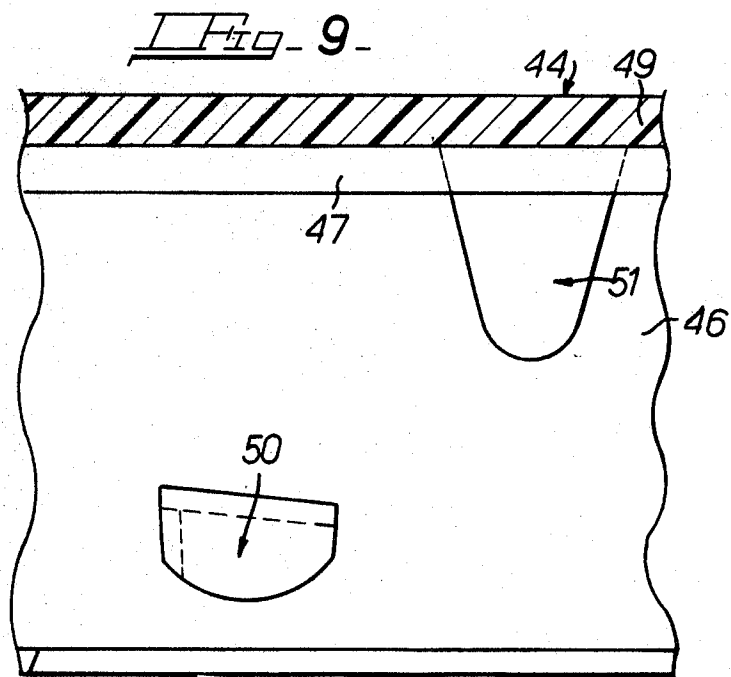
[54] **SAFETY CLOSURE WITH SEAL**
11 Claims, 10 Drawing Figs.

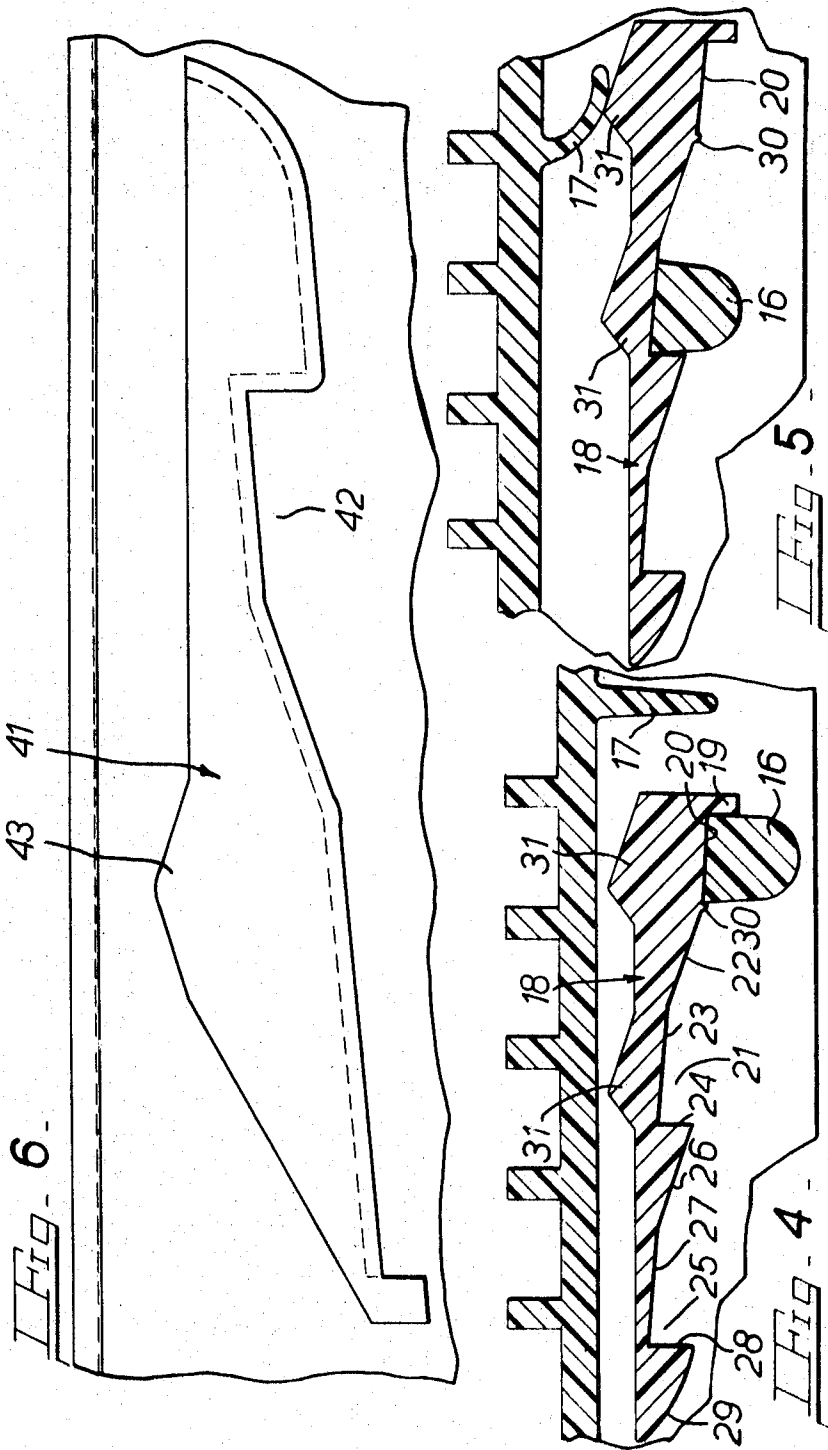
[52] U.S. Cl..... 215/9,
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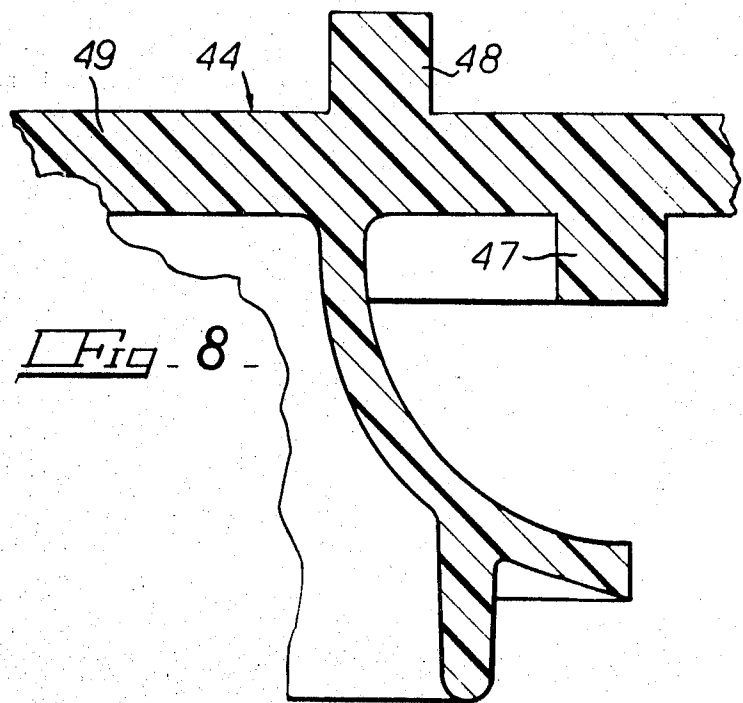
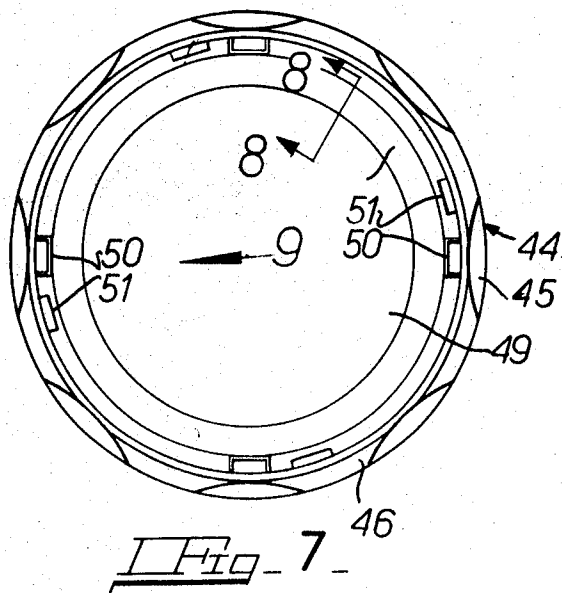
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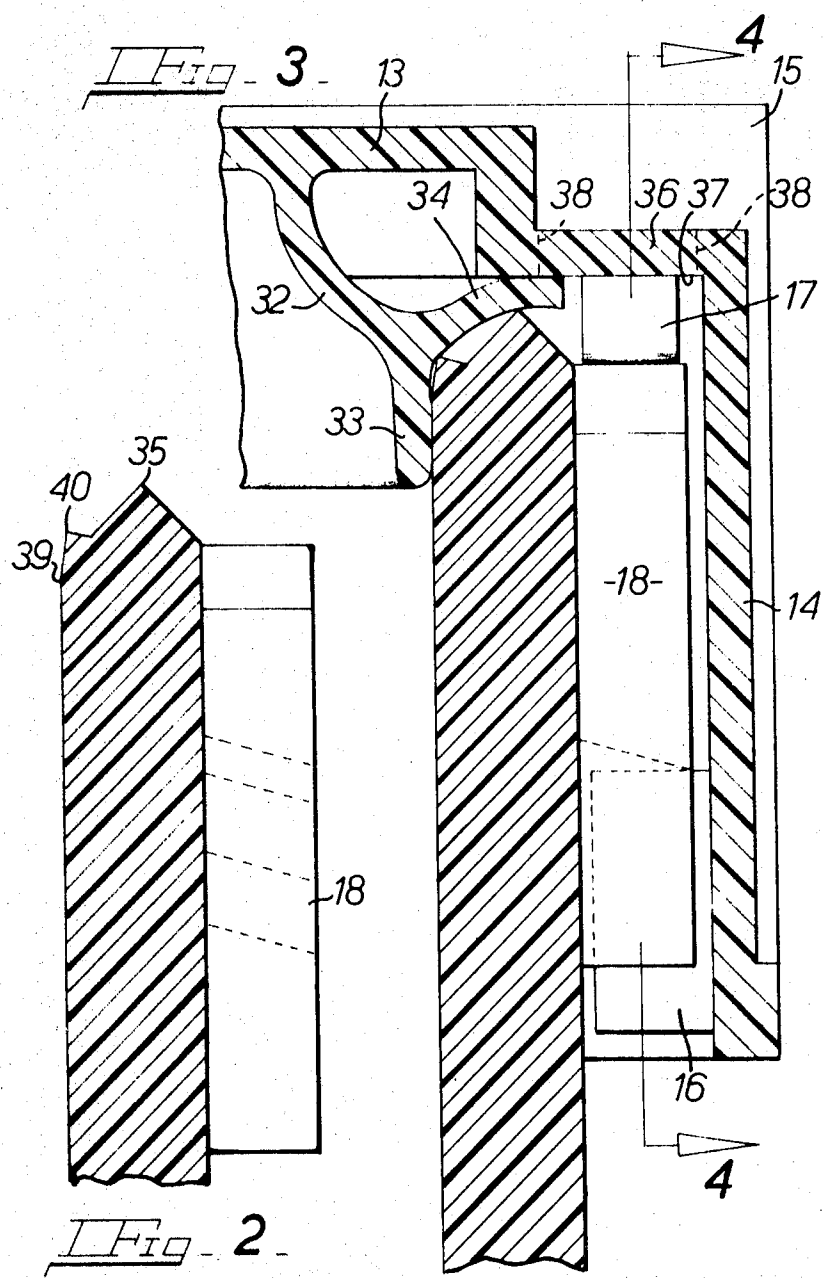
ABSTRACT: A childproof closure for a container including a top and complementary neck which cooperate together to provide a leak proof seal. The closure is characterized by having two locking positions with it being necessary to press the closure in twice while twisting in order to unlock the closure for removal.











SAFETY CLOSURE WITH SEAL

This invention relates to closures for bottles and other containers.

The aim of the invention is to provide a closure, together with the complementary neck of a container, which can cooperate together to provide a leakproof seal, the closure being formed as a unitary whole. The arrangement may also be such that the closure is childproof, that is the closure is difficult for a child to remove while being possible for an adult to remove.

According to the present invention there is provided a closure and the neck of a container, the closure comprising a top, a flange depending from the periphery of the top, and securing formations on the inside of the flange, and the neck being of tubular shape and having complementary securing formations on the outside thereof, the formations being such as to enable the closure to be releasably mounted in a closed position on the neck so as to close the neck, the closure and neck being characterized in that the closure has a flexible and resilient skirt integral with the top and depending from it inside the flange, at least the lower part of the skirt being divided to form an inner layer and an outer layer, the neck entering between the layers of the skirt when the closure is placed on the neck, and the outer layer being trapped between the neck and the top of the closure when the closure is in its closed position so as to form a positive liquidtight seal, and the inner layer entering the neck when the closure is placed on the neck, and forming a second seal when the closure is in its closed position.

The neck of the container may be formed integrally with the container or may comprise a separately formed component secured or adapted to be secured to the container.

The invention will be more particularly described with reference to the accompanying drawings, in which:

FIG. 1 is a side view of a closure and a container embodying the invention, the closure having been removed from the container;

FIG. 2 is a section, to a much larger scale, along the line 2—2 of FIG. 1;

FIG. 3 is similar to FIG. 2 but includes the adjacent part of the closure in its closed position;

FIG. 4 is a somewhat diagrammatic section, to a rather smaller scale, along a curved plane including the line 4—4 of FIG. 3;

FIG. 5 is similar to FIG. 4 but shows the parts in different relative positions;

FIG. 6 is a side view of the neck of a modified form of container;

FIG. 7 is a view from below of the closure for use with the modified form of container shown in FIG. 6;

FIG. 8 is a section, to a larger scale, along the line 8—8 of FIG. 7;

FIG. 9 is a view, to a larger scale, in the direction of the arrow 9 in FIG. 7; and

FIG. 10 is a diagrammatic view, similar to FIGS. 4 and 5, but illustrating a further modification.

FIG. 1 shows a closure 11 and a container 12. The closure 11 is formed as a unitary moulding from a plastics material such as polypropylene which is adequately stiff in thick section but which is flexible and resilient in thin section. The container 12 is also formed as a unitary moulding from a plastics material, but as there is no need for flexibility or resilience the container is preferably made from a more rigid material such as polystyrene. The container 12 may conveniently be transparent or translucent. The container 12 is intended for housing solids, powders or liquids such as medicines which it is desired to keep from children. As will become apparent from the following description there are complementary formations on the closure 11 and container 12 which cooperate in such a manner that the closure can be placed on the container and rotated in one direction to a closed position in which the container is sealed. In order to remove the closure it is necessary to rotate the closure 11 in the reverse direction; but the application of torque above is insufficient to enable the closure to

be removed as the closure 11 reaches a first locking position such that it cannot be further rotated in the direction necessary for its removal. It is then necessary to push the closure 11 downwards, that is towards the bottom of the container 12, against the action of resilient means, before the closure 11 can be further rotated towards its released position. On further rotation of the closure a second locking position is reached, and again it is necessary to push the closure downwards against the action of the resilient means before the closure can be rotated again. This last rotation of the closure 11 brings the closure to its released position, in which it can be lifted from the container. The arrangement is also such that if the closure is in its first locking position and is rotated in the direction necessary for closing the container the closure then moves to its closed position. Similarly if the closure is in its second locking position and it is rotated in this direction it moves through the first locking position to the closed position. It has been found that a child has considerable difficulty in opening a container of this kind but that an adult can quite readily remove the closure. The reason appears to be that it is difficult for a child to press the closure and rotate it at the same time, an action necessary to release the closure.

The closure 11 has a circular top 13 with a depending peripheral flange 14. Radial fins 15 are provided for decorative purposes, also strengthen the closure and to enable the user's fingers to grip the closure and rotate it. The closure has four sets of formations integrally formed with it and spaced at uniform intervals around it. Each set is similar to the others and one set is shown in FIGS. 3, 4 and 5. This comprises a lug 16 which constitutes a locking formation, and a flexible and resilient blade 17. As can be seen from FIG. 3 the lug 16 projects inwards from the flange 14, while the blade 17 depends from the top 13 closely adjacent to the flange 14 but separated from it.

The formations 16 and 17 cooperate with complementary undercut formations 18 on the outside of the neck of the container 12, the neck being that part of the container around the open mouth of the container. There are four formations 18, one for each set of formations 16 and 17. The shape of each formation 18 can be seen in FIGS. 4 and 5.

Each formation 18 has a lower surface for cooperation with the associated lug 16. This surface presents a stop 19; a portion 20 shaped like a partial screw thread and at the same inclination as the top of the lug 16; a first socket 21 bounded by an inclined portion 22, a top 23 and a vertical wall 24; a second socket 25 similar to the first socket 21 and bounded by an inclined portion 26, a top 27 and a vertical wall 28; and an inclined lead-in portion 29. Between the portions 20 and 22 is a small pip 30 which the lug can ride over when the closure is rotated by the user, but which prevent the lug inadvertently leaving the portion 20 which it engages when the closure is in its closed position as shown in FIG. 4. Without the pip 30 there might be a risk of the closure starting to leave its closed position if the container and closure were subjected to vibration.

The upper surface of the formation is largely flat but is provided with two triangular humps 31. The upper surface cooperates with the blade 17.

When the closure is in its closed position (FIG. 4) the lug 16 is against the stop 19, and due to its engagement with the partial screw thread 20 is in its lowermost position. The closure is therefore pulled down as far as it will ever go on the container 12. On rotation of the closure 11 in the direction required to release the closure the lug 16 passes over the pip 30 and enters the first locking socket 21 as shown in FIG. 4. The blade 17, which was unstressed when the closure was in its closed position (FIG. 4) is now highly stressed by its engagement with the first of the humps 31. It therefore urges the closure upwards and thus urges the lug 16 into the socket 21. On the application of torque along to the closure, the lug 16 abuts the vertical wall 24 and further rotation of the closure in that direction is prevented. It is then necessary to push the closure downwards, so that the blade 17 is further flexed and the lug is

removed from the socket 21. Further rotation of the closure is then possible. The lug 16 enters the second locking socket 25 unless the downward force on the closure is maintained. If the lug 16 does enter the socket 25 it is again necessary to apply a downward force to remove it. While the lug 16 is in, or close to the socket 25 the blade 17 is stressed by its engagement with the second of the humps 31. Finally the lug passes beneath the portion 29 so that the closure can be removed.

When the closure is placed on the container and rotated in the other direction, to close the container, the lug slides down the inclined lead-in portion 29, enters the second locking socket 25, leaves this readily due to the inclination of the portion 26, passes through the first locking socket 21, and again leaves it readily due to the inclination of the portion 22, passes over the pip 30 and continues until it reaches the stop 19.

It will be appreciated that modifications are possible. For example the humps 31 may be omitted, the flat upper surface of the formation 18 being sufficiently high to stress the blade 17 adequately. There may be only a single locking socket on the formation, so that the formation would appear like that shown in FIG. 6. This, however, would reduce the childproof properties of the device. Yet again, if it were not desired to provide a childproof container and closure the locking sockets could be entirely omitted, and the whole of the lower surfaces of the formations 18 could be shaped as parts of screw threads, that is they could be gradually inclined like the portion 20. A pip like the pip 30 would however preferably be provided. The blade 17 might be replaced by fingers of circular cross section, and there might be a ring of blades or fingers around the whole of the lid of the closure so that there are always blades or fingers engaging the top of the formations 18, and a continuous upward force would be applied to the closure. Nevertheless, as there is a tendency for plastics material to acquire a permanent set if they have been retained in stressed positions for long periods, it is particularly desirable to ensure that at least some of the blades or fingers are only stressed, or are additionally stressed, when the closure is moved from its closed position. In the arrangement illustrated it will be noted that the blade 17 in FIG. 4 is entirely unstressed so that even if the closure remains closed for a long period the blade is fully operative as soon as an attempt is made to remove the closure.

The closure 11 is also formed with means which afford a seal. This comprises an annular skirt 32 integral with the top 13 of the closure and depending from it inside the flange 14. The lower part of the skirt 32 is divided to form an inner layer 33 and an outer layer 34. In its unstressed position the skirt is the same shape as that shown in FIG. 8. When the closure 11 is placed on the container 12 the inner layer 33 enters the mouth of the container, and to this end it extends vertically downwards and is of slightly smaller external diameter than the internal diameter of the neck of the container.

The outer layer 34 initially extends outwards and slightly downwards. When the closure is placed on the container the neck enters between the layers 33 and 34, and, as shown in FIG. 3, traps the outer layer 34 against the top 13 of the closure so as to form a positive liquidtight seal. The uppermost part of the neck presents a sealing edge 35 (FIG. 2) which is very much narrower than the remainder of the neck. In order to avoid the need to stress the skirt 32 excessively the outer part of the top 13 is stepped downwards, as clearly shown at 36 in FIG. 3, to provide an abutment surface 37 which is lower than the undersurface of the remainder of the top 13. It may be mentioned here that four holes are formed in the port 36 of the top 13, one hole being above each of the lugs 16 so as to enable a moulding tool to enter the closure and define the upper surface of the lug 16. The edges of one such hole are indicated by the broken lines 38. Each hole extends between two of the fins 15, and the presence of the fins renders the holes less noticeable.

The extent to which the outer layer 34 is trapped by the edge 35 is determined by the position of the stop 19. If the stop is not present, and the portion 20 of the lower surface of

the formation 18 is extended there may be difficulty in controlling the extent to which the container is sealed. This may be satisfactory in some circumstances, but in most circumstances it is desirable to provide the stop 19 or its equivalent.

As the outer layer 34 of the skirt 32 is pushed upwards the inner layer 33 is pulled outwards and seals against an edge 39 on the inside of the neck of the container. At the same time an edge 40, between the edges 35 and 39 engages that part of the skirt between the inner and outer layers 33 and 34 so as to form a third seal.

The skirt 32 may be shaped somewhat differently in that the division between the layers may extend substantially to the top 13 of the closure.

In use the outer layer 34 exerts a downward force on the container, and this assists the blades 17 in urging the lugs 16 into the sockets 21 or 25. It also continues to bear on the neck of the container when the lugs are in either of the sets of sockets, and thus continues to provide a seal, although this is considerably less tight than that formed when the closure is in its closed position.

Nevertheless, as explained above, there is a tendency for the plastic material to acquire a permanent set, so that after prolonged closure the skirt may not return to its original shape for some time after the closure is removed. The blade 17 or their equivalent then have to act as the sole spring means. If desired the skirt may be shaped initially to conform more closely to the shape shown in FIG. 3 so that it never acts as spring means to urge the lugs 16 into the locking sockets 21 and 25.

The container and closure shown in FIGS. 6 to 10 is generally similar to that shown in FIGS. 1 to 5, and only the differences between the two types will be described in detail. The container differs from the container 12 only in that the formations 18 are replaced by formations 41 each of which has only a single locking socket 42 and no pip 30. It also has a single hump 43 at the top.

The closure 44, shown in FIG. 7, differs from the closure 11 in that the fins 15 are omitted and are replaced by recesses 45 in the depending flange 46. Further, the step 36 is omitted and is replaced by an annular rib 47. There is also a strengthening rib 48 on the upperside of the top 49 of the closure. The formations on the closure 44 comprise lugs 50, like the lugs 16, and cams 51 which replace the blades 17. The cams are rigid and stem from the flange 46. Each cam 51 is shaped as shown in FIG. 9 and cooperates with the upper surface of the associated formation 41 in a manner similar to that described above with reference to FIGS. 4 and 5, except that the cam 51 does not yield so that when it engages the hump 43 it causes the lug 50 to enter the socket 42. The childproof action is therefore more positive than that in the version shown in FIGS. 1 to 5 but suffers from the disadvantage that if the skirt acquires a permanent set the lugs 50 may drop out of the sockets 42. To avoid this difficulty it would be possible to use blades similar to blades 17, or other similar resilient means, in addition to the cams 51.

The version shown in FIGS. 1 to 5 may also be modified by substituting cams for the blades 17. The operation of such a modification is shown in FIG. 10. Here, a cam 52 and the associated lug 16 are shown in two positions: the chain-dotted lines showing their positions when the closure is in its closed position, and the broken lines showing their position when the lug 16 is entering the first locking socket 16. Here again the cams may be used in conjunction with resilient means like the blades 17 or the like.

The present invention is related to the invention which is the subject of my British Pat. No. 1,104,001 and some of the containers and closures described above make use of that invention.

I claim:

1. A closure and the neck of a container, the closure comprising a top, a flange depending from the periphery of the top, and securing formations on the inside of the flange, and the neck being of tubular shape and having complementary securing formations on the outside thereof, the formations

being such as to enable the closure to be releasably mounted in a closed position on the neck so as to close the neck, the closure and neck being characterized in that the closure has a flexible and resilient skirt integral with the top and depending from it inside the flange, at least the lower part of the skirt being divided to form an inner layer and an outer layer, the neck entering between the layers of the skirt when the closure is placed on the neck, and the outer layer being trapped between the neck and the top of the closure when the closure is in its closed position so as to form a positive liquidtight seal, and the inner layer entering the neck when the closure is placed on the neck, and forming a second seal when the closure is in its closed position.

2. A closure and the neck of a container according to claim 1 in which the uppermost part of the neck presents a sealing edge which is narrower than the remainder of the neck and engages the outer layer of the skirt.

3. A closure and the neck of a container according to claim 2 in which the neck presents a subsidiary edge which engages that part of the skirt between the inner and outer layers thereof when the closure is in its closed position so as to form a third seal.

4. A closure and the neck of a container according to claim 1 in which the complementary formations on the closure and the neck cooperate in the manner of a nut and screw.

5. A closure and the neck of a container according to claim 1 in which the complementary formations on the closure and the neck afford lugs and sockets which cooperate in the manner of a bayonet fitting, there being resilient means acting between the closure and the neck to urge the lugs into the sockets, but capable of yielding to allow the lugs to be removed from the sockets so that the closure can then be rotated and removed from the neck, the arrangement being such that when the lugs are in the sockets the closure cannot be rotated by the application of torque alone to a position in which it can be removed from the neck.

6. A closure and the neck of a container according to claim 5 in which the resilient means is at least partially constituted by the flexible and resilient skirt.

7. A closure and the neck of a container according to claim 5 in which the resilient means is at least partially constituted by flexible and resilient elements integral with the closure and disposed between the skirt and the peripheral flange, the elements engaging formations on the outside of the neck at least when the lugs are in the sockets, the elements being deformed and exerting when the lugs are at the mouths of the sockets, a force which is greater than any force which they exert when the closure is in its closed position.

8. A closure and the neck of a container according to claim 5 in which the formations which afford the sockets also afford partial screw threads which are engaged by the lugs when the closure is in its closed position, the lugs having to pass the sockets before the closure can be removed from the neck.

9. A closure and the neck of a container according to claim 8 in which there are stops beyond the partial screw threads which stops are engaged by the lugs when the closure is in its closed position and which prevent additional rotation of the closure relative to the neck.

10. A closure and the neck of a container according to claim 8 in which there are pips between the sockets and the partial screw threads to engage the lugs and prevent the lugs inadvertently leaving their engagement with the partial screw threads.

11. A closure and the neck of a container according to claim 5 in which there are cooperating cam formations on the closure and on the neck such that when the closure is rotated from its closed position the cam formations cooperate to cause the lugs positively to enter the sockets, so that further rotation of the closure preparatory to release of the closure can be effected only after axial movement of the closure against the action of the resilient means.

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