

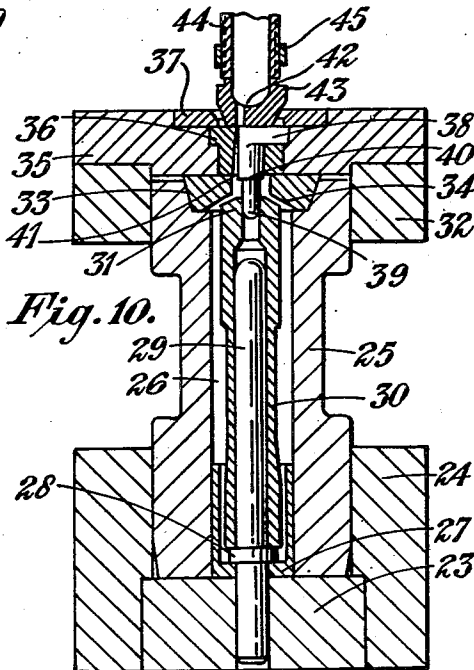
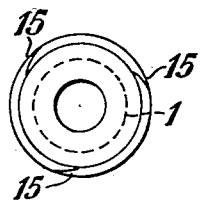
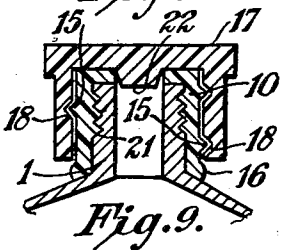
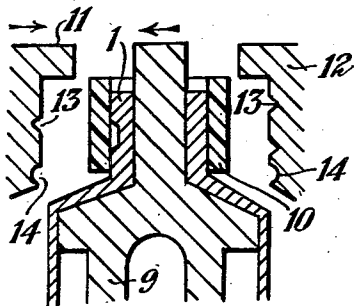
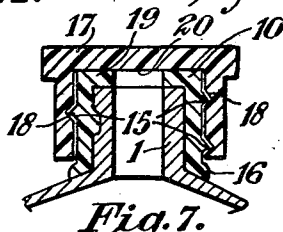
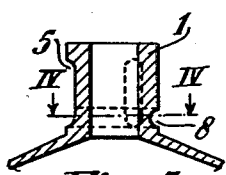
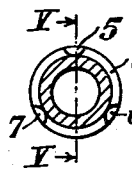
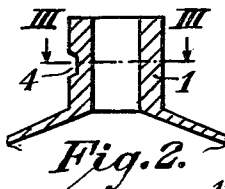
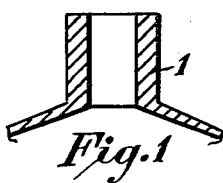
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2,794,574

COLLAPSIBLE TUBES

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COLLAPSIBLE TUBES

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5 Claims. (Cl. 222—92)

This invention relates to collapsible tubes such as those used for packaging toothpaste and like products and is more particularly concerned with tubes of the type having a collapsible metal body of some ductile metal such as tin, lead or aluminium, and provided with a nozzle of some inert non-metallic substance such as a plastic material for co-operation with a removable cap of inert material, the purpose of such cap and nozzle of inert material being the avoidance of undesirable soiling or injurious contamination of the product by metal abraded from the body of the tube as may occur if the surface of the nozzle which cooperates with the cap is formed from tube body metal.

Hitherto it has been usual to provide the body of a collapsible metal tube with a separate nozzle of hard moulded plastic material which has been secured to the end or shoulder wall of the tube as by forcing such nozzle into an orifice in the shoulder wall or by flanging metal of the shoulder wall over a flange or rim of the plastic nozzle. These known closure devices for collapsible tubes have usually been subject to disadvantages either in respect of manufacturing methods, the security of the seal provided for the tube contents, or the efficiency of the cap or like member employed to cover the tube nozzle.

The object of the present invention is to provide an improved and simplified construction in which certain sealing difficulties of the prior art are reduced or avoided and in which a simplified and cheapened method of manufacture is made possible.

A further object of the invention is to provide an efficient collapsible tube closure device depending for its effectiveness on the different physical properties in respect of resilience and hardness possessed by a collar moulded round the tube nozzle and a removable cap co-operating therewith.

According to the invention the tube nozzle, comprising a tubular neck-like projection of metal integral with the tube body, is surrounded by a closely fitting collar or covering of suitable thermo-plastic material, the nozzle being shaped to form a key for the thermoplastic. Preferably, the metal nozzle is provided with a "key" surface for the thermoplastic by means of threads, ribs, indentations or the like, and the thermo-plastic collar is moulded to the tube nozzle so as to conform to the said threads, ribs, indentations or the like. The expression suitable thermo-plastic material means a material having physical and chemical properties suitable for the purpose of the present invention and will be defined more particularly hereinafter. The class of thermoplastics known under the generic name polythene, or substances having equivalent properties, are suitable for the practice of the invention.

According to a further aspect of the invention, a closure device for a metal collapsible tube comprises a collar of thermo-plastic material moulded round the metal tube nozzle, and a removable co-operating cap differing from the moulded collar in properties of resilience and hardness whereby an effective seal is provided therebetween,

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The external surface of such collar or equivalent covering is shaped for rapid engagement and disengagement with a cap. Most conveniently a screw fastening is provided, preferably a multiple start fast-pitch thread, on the collar and the cap. The latter may be and preferably is formed of a plastic material appreciably harder and more rigid, i. e. less resilient in character than the collar material. A collar of slightly resilient thermo-plastic material, for example polythene, by reason of its inherent resilience and chemical inertness, serves to provide an adequate seal both between itself and the metal of the tube neck and, additionally, between itself and a screw cap of harder material without the need for providing any separate packing washers or like seal-providing inserts. Moreover, mouldable thermoplastics such as polythene lend themselves to the formation of accurate fast-pitch threads, allowing rapid and easy removal and replacement of a threaded cap.

Various methods may be employed according to the invention for moulding the collar to the tube nozzle. For example, a pre-formed cylindrical collar may be conformed by heat and pressure in a die. Alternatively the collar may be formed by extrusion from a bulk supply into a heated extrusion head and die surrounding the tube nozzle.

Examples of the tube structure according to the invention and methods of making it will now be described in more detail with reference to the accompanying drawings in which:

Fig. 1 is an axial section through the shoulders and nozzle of a tube blank;

Fig. 2 is an axial section through the tube after a forming operation;

Fig. 3 is a section on the line III—III of Fig. 2, and showing the section line II—II on which Fig. 2 is taken;

Fig. 4 is an axial section of a tube blank after a forming operation alternative to that in Figs. 2 and 3;

Fig. 5 is a cross-section on the line V—V of Fig. 4;

Fig. 6 is a diagrammatic cross section illustrating one method of moulding a plastic collar on the tube nozzle;

Fig. 7 is an axial section through the tube nozzle after application of a plastic collar and showing also a tube cap in position;

Fig. 8 is a top plan view of a nozzle with a collar moulded thereto having quick threads;

Fig. 9 is an axial section through a tube nozzle with an external thread with a plastic collar moulded thereto, and an alternative form of cap;

Fig. 10 is a cross-section through part of an extrusion moulding apparatus.

Referring now to the drawings, more particularly Figs. 1 to 3, 6 and 7, a tube blank of known ductile metal having a plain cylindrical nozzle 1 is subjected to a forming operation in a die under heat and pressure, whereby notches 2, 3, 4 spaced at 120° are impressed therein to form a key for a thermo-plastic collar to be molded thereon. The tube is placed over a hollow mandrel 9 (Fig. 6) projecting through the nozzle 1, and a plain cylindrical collar 10 of suitable thermo-plastic material, for example polythene, is placed over the nozzle. A die having radially adjustable jaws 11, 12, surrounds the said nozzle and has two or three high pitch threads 13 formed in its cylindrical surface. The die also has a bottom annular groove 14 of rounded cross-section formed in the same surface. The jaws are closed radially on to the tube nozzle and heat and pressure applied to mould the collar 10 into the notches 2, 3, 4, and over the end of the tube, and at the same time to form quick threads 15 (Fig. 7) in the external surface of the collar and a base ridge 16 where the moulded collar joins the tube shoulder.

In Fig. 7, which shows a tube nozzle with a collar moulded thereto as above described, a removable cap 17

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of substantially harder and more rigid material, such as a phenol-formaldehyde condensation product, having a corresponding quick thread 18, is applied to the protected nozzle, whereby an effective substantially air-tight seal is obtained between the moulded end surface 19 of the collar 10 and the under side 20 of the cap. At the same time the cap is firmly yet resiliently held on the tube nozzle by the high pitch threads 18 in the cap 17 and collar 10. An efficient sealing of the tube orifice, without the aid of washers or pads, may be obtained when the collar 10 is made of a thermo-plastic material, for example polythene, having slight resilience, this allowing it to deform slightly under the pressure of the harder cap 15 to obtain air-excluding contact therebetween. The same property, and the ability of polythene and other thermo-plastics to receive an accurately moulded high-pitch thread or threads, results in a rapidly removable and effective form of tube closure for preserving the contents of the tube. It is preferred to have three quick threads as shown in Fig. 8, but other numbers of threads are possible.

Fig. 9 shows a tube of which the metal nozzle 1 carries an ordinary slow thread 21 such as is found in tubes normally manufactured for toothpaste and similar products. The thread 21 forms an effective key, in the same way as the notches 2, 3, 4, of Fig. 3; for retaining the subsequently moulded collar 10 on the nozzle. A cap of similar form to that in Fig. 7 may be fitted to the nozzle. Alternatively the cap may have a slightly tapered plug 22 projecting into the circular orifice presented by the end of the moulded collar 10.

Figs. 4 and 5 illustrate an alternative preliminary shaping of the plain metal nozzle 1 to provide a key for the collar to be subsequently moulded thereon. By means of an appropriately shaped die applied to the plain metal nozzle of Fig. 1, a shallow channel 8 is formed surrounding the base of the nozzle and in addition three narrow notches 5, 6, 7, spaced at 120° are formed in the surface of the nozzle. The circular channel 8 will effectively prevent axial displacement of the subsequently moulded collar, whilst the notches 5, 6 and 7 will prevent rotation thereof. The thermo-plastic collar may be moulded onto the tube nozzle shown in Figs. 4 and 5 by the method described with reference to Fig. 6.

Fig. 10 is a diagrammatic representation of an axial section through part of an extrusion moulding apparatus whereby polythene or other thermo-plastic material from a bulk supply may be used to form a collar about a suitably preformed tube nozzle, for example the nozzle formed with a keyway as in Figs. 2 to 5, or with a thread 21 as in Fig. 9.

The assembly of parts shown comprises a backing block 23 supporting a surrounding locating bush 24, within which is disposed an inner split bush 25 and other parts for locating and holding the collapsible tube blank (not shown) in the required position, preferably the vertical position, during the moulding operation. The axial bore 26 of the inner bush contains a locating sleeve 27 upon which rests the flange 28 of a mandrel 29, whose lower part is accurately located in a bore in the sleeve 27 and in a further bore in the block 23. Surrounding and projecting above the top of the mandrel is a sleeve 30 whose top portion 31 is shaped to the contour of the tube shoulders which are to rest thereon when the tube blank is placed over the said sleeve.

The top of the inner bush 25 is surrounded by a locating ring 32, and has a frusto-conical rebate which receives a split threaded ring 33, the top of whose internally directed surface 34 forms the die for the collar to be moulded round the tube nozzle. The die surface 34 of ring 33 is formed with high pitch threads (not shown), such as the threads 13 shown in Fig. 6, and preferably with an annular channel (not shown), such as the channel 14 shown in Fig. 6.

Accurately fitted to the top of the split ring 33, and to

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the locating ring 32, is a back plate 35, within which are coaxially fitted a sprue bush 36 and a retaining ring 37, the latter being secured to the back plate by set screws. The sprue bush is bored to take a plug 38, whose end 39 projects through the tube nozzle and into a corresponding bore in the sleeve 30. The sprue bush 36 has at one side a sprue or channel 41, between itself and the plug 38, leading to the moulding cavity between the split ring 33 and the tube nozzle. The sprue 41 is opposite an orifice 42 in the head 43 of a nozzle 44 held therein by a locking nut 45. The nozzle 44 is part of a piston type extrusion head which has adjusting motion vertically with respect to the mould assembly above described.

In operation, the tube (not shown) with the metal nozzle threaded or keyed as already described, is positioned in the mould, which is provided with suitable heating means, for example a heating coil (not shown). A charge of thermo-plastic material, of volume just sufficient to form the collar on the tube nozzle, is extruded from the nozzle 44 and enters the moulding cavity through the sprue or channel 41 to form the collar of the shape shown in Figs. 7 and 9. After cooling, the tube with the moulded collar is removed. The plug is enlarged at 40, where it is spaced away from the tube nozzle, and is so dimensioned that the moulded material forms an end covering, such as 19 in Fig. 7, to protect the end of the metal nozzle.

The method above described may be adapted to a multi-position turret head in which the operation is performed in stages. Either the extrusion head and nozzle 44, or the moulding assembly 23-40, is vertically adjustable to bring the parts into the aligned position with the orifice 42 adjacent the sprue or channel 41.

After the thermo-plastic collar has been completely formed, as above described, the heating current is interrupted and the mandrel and the moulding assembly are removed to a second position and are cooled by spraying with water or any other appropriate cooling liquid, until the moulded polythene is in such a condition that the die jaws may be radially removed without the risk of the moulded plastic adhering thereto. At the next operating stage the tube with the moulded collar in position is removed from the mandrel, which is then returned to the first stage, where a further tube, threaded, ribbed or impressed as above described or in any other suitable manner, is placed over the mandrel, and the operations of moulding, cooling and separation are repeated as described above.

The class of thermo-plastics known under the generic name polythene are suitable for the practice of the invention since, in addition to providing the requisite inert character resisting chemical action with the contents of the tube and avoiding soiling or contamination by grinding action between the collar and the cap during replacement and unscrewing of the latter, they have the advantage of tending to shrink with age with consequent increase rather than decrease of the tightness with which the collar grips the metal tube neck. They have an inherent slightly resilient characteristic permitting the formation of an adequate seal at all times to preserve the tube contents. They also have the property of lending themselves to the accurate moulding of threads, so that the combination of a collar of such material with a hard plastic cap prevents any undue binding between the two interengaging plastic surfaces.

While polythene is known to be a suitable thermo-plastic material for the practice of the invention, the use of other substantially equivalent materials that are or may become available is not excluded from the scope of the invention. Such materials must essentially be capable of injection and/or extrusion and/or compression moulding, be resistant to cold flow or creep within the temperature range 0° C.-60° C. and under moderate stresses of up to 200 lbs./sq. in. and must be resistant to chemical attack by organic solvents, mineral, and essential oils,

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weak acids, alkalis and salts. They should have a good tensile strength of several hundred lbs./sq. in. at 60° C., be sufficiently resilient to ensure a seal with a cap of substantially harder plastic material, have a coefficient of expansion of similar order to or greater than those of the common tube-forming metals and should not be brittle within the temperature range 0° C.-60° C.

We claim:

1. A collapsible tube comprising a metal body, a metal nozzle formed integrally therewith, said nozzle having a non-uniform cross-section between the open end thereof and the junction with the tube shoulders by virtue of indentations formed substantially lengthwise in the outer surface of said nozzle, and a collar of resilient inert thermoplastic material moulded round said nozzle, said indentations forming a key to receive a portion of the moulded thermoplastic material and preventing displacement of the thermoplastic collar in the axial direction.

2. A collapsible tube comprising a metal body, a metal nozzle formed integrally therewith, said nozzle having a non-uniform cross-section between the open end thereof and the junction with the tube shoulders by virtue of keyways formed in the outer surface of said nozzle extending substantially lengthwise but not the entire length thereof and terminating at one end in an annular groove formed in said nozzle, and a collar of resilient inert thermoplastic material moulded round said nozzle and into the said keyways, said material preventing displacement of the thermoplastic collar in the axial direction of the tube nozzle.

3. A collapsible tube comprising a metal body, a metal nozzle formed integrally therewith, a series of grooves formed in the outer surface of said nozzle presenting a non-uniform cross-section between the open end of the nozzle and the junction with the tube shoulders, and a collar of polythene extending between the discharge orifice of the metal nozzle and the junction of the nozzle with the tube shoulders, said collar being moulded round said nozzle and into the said grooves, said grooves extending in a direction generally lengthwise of the nozzle but not the entire length thereof and terminating at one end in an annular groove, said grooves forming a key receiving a portion of the moulded polythene to secure the collar in position and to prevent removal or displacement of said moulded collar in the axial and circumferential directions of the nozzle.

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ment of said moulded collar in the axial and circumferential directions of the nozzle.

4. A collapsible tube comprising a metal body, a metal nozzle formed integrally therewith, said nozzle having a non-uniform cross-section between the open end thereof and the junction with the tube shoulders by virtue of keyways formed in the outer surface of said nozzle extending substantially lengthwise but not the entire length thereof and terminating at one end in an annular groove formed in said nozzle, and a collar of resilient inert thermoplastic material moulded around said nozzle and into the said keyways, said collar covering the outside surface and the outer end portion of the nozzle, said keyways preventing displacement of the thermoplastic collar in the axial and circumferential directions of the tube nozzle.

5. A collapsible tube comprising a metal body, a metal nozzle formed integrally therewith, said nozzle having a non-uniform cross section between the open end thereof and the junction with the tube shoulders by virtue of keyways formed in the outer surface of said nozzle, said keyways being spaced along the circumference of the nozzle and each keyway extending along the nozzle and running in a direction from one end to the other end of the nozzle but stopping short of both ends of said nozzle, and a collar of resilient inert thermoplastic material moulded around said nozzle and into the said keyways, said material preventing displacement of the collar in the axial direction of the nozzle.

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