

(19)



(11)

EP 3 031 734 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

15.06.2016 Bulletin 2016/24

(51) Int Cl.:

B65B 7/14 (2006.01)

B65B 7/28 (2006.01)

(21) Application number: **15199539.6**

(22) Date of filing: **11.12.2015**

(84) Designated Contracting States:

**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

Designated Extension States:

BA ME

Designated Validation States:

MA MD

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Patentanwälte

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(30) Priority: **12.12.2014 US 201462091231 P**

(54) **SEALABLE PACKAGING DEVICE AND RELATED METHOD**

(57) A packaging device includes an expandable and collapsible tube, for receiving a product therein. The tube has a sidewall, a closed end and an open end. A closed-cell foam plug is compressible and insertable in

the compressed state at least partially into the open end of the tube. Upon expanding, the foam plug closes and seals the open end of the tube.

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Description

BACKGROUND OF THE INVENTION

[0001] The present invention is generally directed to a packaging device, and more particularly to a packaging device comprising a tube for receiving a product therein, sealable by a foam plug.

[0002] Packaging products in some form of a collapsible tube or pouch is common practice. For example, topical formulations, e.g., gel, ointment, cream, shampoo and lotion, pharmaceutical products, cosmetic products and the like, are often packaged and sealed in a form of collapsible tube or pouch. Typically, the tube is filled with the product via an open end thereof, the open end being thereafter heat sealed with the product contained inside the tube.

[0003] One drawback of heat sealing the open end of the tube is that the temperature at which the opposing layers of the thermoplastic tube material, e.g., polyethylene and/or polypropylene, are sealed together is often too high for a heat sensitive product within the tube. Thus, heating sealing the tube may damage or degrade the product contained therein. One approach to addressing this drawback has been to form the tube of a material which can be heat sealed at lower temperatures, e.g., Surlyn® Ionomer Resin, sold by E. I. du Pont de Nemours and Company of Wilmington, Delaware, in order to mitigate damage or degradation of the product. However, such materials are often not chemically compatible with the product contained in the tube, or are not recognized and/or approved by the appropriate regulatory agency.

[0004] Therefore, it would be advantageous to manufacture an easily sealable packaging device, sealable in a manner that avoids damage or degradation to a product contained within the package, while also not running afoul of associated regulatory requirements.

BRIEF SUMMARY OF THE INVENTION

[0005] Briefly stated, one aspect of the present invention is directed to a packaging device. The packaging device comprises an expandable and collapsible tube and a closed-cell foam plug. The tube includes a sidewall, a closed end and an open end, and is for receiving product therein. The foam plug is insertable in a compressed state at least partially into the open end of the tube and is then permitted to expand to close and seal the open end of the tube.

[0006] Another aspect of the invention is directed a packaging method comprising the steps of:

- (1) filling an expandable and collapsible tube with a product via an open end of the tube, (2) compressing a closed-cell foam plug, (3) inserting the compressed foam plug at least partially into the open end of the tube, and (4) sealing the open end of the tube by permitting the foam plug to expand to close and seal

the open end of the tube.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The foregoing summary, as well as the following detailed description of a preferred embodiment of the invention, will be better understood when read in conjunction with the appended drawings. For the purpose of illustrating the invention, there is shown in the drawings an embodiment which is presently preferred. It should be understood, however, that the invention is not limited to the precise arrangements and instrumentalities shown. In the drawings:

Fig. 1A is an elevational view of a tube of a packaging device of the present invention, depicting the step of filling the tube with a product;

Fig. 1B is an elevational view of the tube of the packaging device of Fig. 1A, and a foam plug of the packaging device of the present invention in an original expanded state, depicting the step of compressing the foam plug into a temporary compressed state for insertion into an open end of the tube;

Fig. 1C is an elevational view of the foam plug of Fig. 1B in the temporary compressed state, depicting the step of inserting the plug into the tube; and

Fig. 1D is an elevational view of the foam plug after insertion into open end of the tube, depicting the step of the foam plug expanding and sealing the open end of the tube.

DESCRIPTION OF THE DISCLOSURE

[0008] Certain terminology is used in the following description for convenience only and is not limiting. The words "lower," "bottom," "upper" and "top" designate directions in the drawings to which reference is made. The words "inwardly," "outwardly," "upwardly" and "downwardly" refer to directions toward and away from, respectively, the geometric center of the packaging device, and designated parts thereof, in accordance with the present disclosure. Unless specifically set forth herein, the terms "a," "an" and "the" are not limited to one element, but instead should be read as meaning "at least one." The terminology includes the words noted above, derivatives thereof and words of similar import.

[0009] It should also be understood that the terms "about," "approximately," "generally," "substantially" and like terms, used herein when referring to a dimension or characteristic of a component of the invention, indicate that the described dimension/characteristic is not a strict boundary or parameter and does not exclude minor variations therefrom that are functionally similar. At a minimum, such references that include a numerical parameter would include variations that, using mathematical and industrial principles accepted in the art (e.g., rounding, measurement or other systematic errors, manufacturing tolerances, etc.), would not vary the least signifi-

cant digit.

[0010] Referring to the drawings in detail, wherein like numerals indicate like elements throughout, there is shown in Figs. 1A-1D a packaging device, generally designated 10, according to the present invention. The packaging device 10 is adapted for sealingly packaging any of a numerous variety of products, such as, for example, without limitation, topical formulations, e.g., gel, oil, cream, shampoo, and lotion, pharmaceutical products, cosmetic products and the like.

[0011] As shown in Figs. 1A-1D, the packaging device 10 comprises a pouch or tube 12, sealable by a foam plug 14. In the illustrated embodiment, the tube 12 is generally cylindrical in shape, for, example, without limitation, in the shape of a toothpaste tube, having a sidewall 12a, a closed end 12b connecting to the sidewall 12a at one end, and an opposing open end 12c (prior to sealing). However, as should be understood by those of ordinary skill in the art, the tube 12 may take the form of any of numerous different shapes, while having an opening sufficient for inserting a product into the tube 12.

[0012] In the illustrated embodiment, the tube 12 is a flexible tube that is expandable and collapsible, defining an initial diameter D_1 in the collapsed state. The tube 12 is preferably formed of a polymeric material that is substantially impermeable to direct light and oxygen, in order to minimize degradation or damage to a product packaged within the tube 12. For example, the tube 12 may be formed of a thermoplastic material such as, for example, without limitation, polyethylene ("PE") or polypropylene ("PP"). However, as should be understood by those of ordinary skill in the art, the tube 12 may be formed of any of numerous different materials, currently known or that later become known, providing generally the same properties for the tube 12 as described herein. Additionally, the tube 12 may be formed of a single layer of material, or multiple laminated, or otherwise bound layers, e.g., via intermediate copolymer layers. As also should be understood, the tube 12 may be appropriately sized for receiving the desired volume of product, such as, for example, without limitation, within the range of about 5 ml to about 200 ml.

[0013] Referring to the foam plug 14, the plug 14 is formed of a closed-cell foam, such that the plug 14 is substantially fluid, i.e., gas and liquid, impermeable as should be understood by those of ordinary skill in the art, and conformable, i.e., squeezable, from a naturally expanded state (Fig. 1B) to a temporarily compressed state (Fig. 1C). In the illustrated embodiment, the foam plug 14 is cylindrical in shape, to correspond with the shape of the open end 12c of the tube 12, as described further below. However, as should be understood, the foam plug 14 may take the form of any of numerous different shapes, complimentary to the opening 12c of the tube 12. In the expanded state, as shown in Fig. 1B, the foam plug 14 defines a diameter D_2 which is greater than the inside diameter D_1 of the open end 12c of the tube 12. The foam plug 14 is compressible into the temporary

compressed state (Fig. 1C) to define a diameter D_3 which is smaller than the diameter D_1 of the open end 12c of the tube 12, in order to insert the foam plug 14 into the open end 12c of the tube 12, as described further below.

[0014] The foam plug 14 is generally formed of the same or substantially the same material as the inner surface of the tube 12, thereby avoiding undesirable interaction between the tube 12 and the foam plug 14 when the plug 14 is inserted into the open end 12c of the tube 12. For example, if the inner surface of the tube 12 is formed of PE, then the foam plug 14 is formed of PE, and if the inner surface of the tube 12 is formed of PP, then the foam plug 14 is formed of PP. Accordingly, the tube 12 and the foam plug 14 have substantially the same melting point.

[0015] In use, the foam plug 14 is initially unattached from the tube 12, and the tube 12 is filled with a product via the open end 12c thereof, as shown in Fig. 1A. Thereafter, as shown in Figs. 1B and 1C, the foam plug 14 is compressed into a compressed state, such that the diameter D_3 of the plug 14 is at least slightly smaller than the diameter D_1 of the open end 12c of the tube 12, and the foam plug 14 is inserted at least partially into the open end 12c. Preferably, the foam plug 14 is inserted to a depth into the tube 12 at least equivalent to the diameter (or width) D_1 of the open end 12c to ensure an appropriate fluid-tight seal sufficiently resistant to inadvertent opening. Once inserted into the open end 12c of the tube 12, as shown in Fig. 1D, the foam plug 14 naturally returns to substantially the original expanded state thereof, thereby elastically stretching the open end 12c of the flexible tube 12 to define a diameter D_4 of the open end 12c substantially equivalent to (but preferably at least slightly less than) the diameter D_2 of the foam plug 14 in the expanded state. Thus, the plug 14 exerts a circumferential, radially outwardly directed force onto the tube 12, and the tube 12 exerts a circumferential, radially inwardly directed force onto the plug 14, forming a substantially fluid-tight compression seal between the open end 12c of the tube 12 and foam plug 14.

[0016] For removing the product from the sealed packaging device 10, the foam plug 14 must be pulled out from the tube 12 with sufficient force to overcome the compressive force between the tube 12 and plug 14. Thereafter, the foam plug 14 maybe compressed and re-inserted into the tube 12 in the same manner as described above to re-seal the tube 12. Alternatively, the foam plug 14 may be permanently sealed in the open end 12c of the tube 12 and the closed end 12b of the tube 12 may contain, for example, a removable and resealable cap, to allow access to the product.

[0017] In some embodiments, adhesive, or some other such material, may be applied around the exterior of the foam plug 14 prior to insertion into the tube 12, such that a substantially fluid-tight seal therebetween is formed both by the adhesive attachment of the plug 14 to the tube 12 and the compression seal. In some embodiments, the top portion 14a of the foam plug 14 that re-

mains external to the tube 12 after insertion of the plug 14 may also be heated to sealingly join with the top edge 12d of the open end 12c of the tube 12, thereby minimizing heat delivery to the product contained within the tube 12 and avoiding damage thereto.

[0018] It will be appreciated by those skilled in the art that changes could be made to the embodiment described above without departing from the broad inventive concept thereof. It is understood, therefore, that this disclosure is not limited to the particular embodiment disclosed, but it is intended to cover modifications within the spirit and scope of the present disclosure as defined by the appended claims.

Claims

1. A packaging device comprising:

an expandable and collapsible tube, for receiving a product therein, the tube having a sidewall, a closed end and an open end; and a closed-cell foam plug, insertable in a compressed state at least partially into the open end of the tube and thereafter permitted to expand to engage, close and seal the open end of the tube.

2. The packaging device of claim 1, wherein the plug forms substantially fluid-tight compression seal.

3. The packaging device of claim 1, wherein the tube and the foam plug define substantially the same melting point.

4. The packaging device of claim 1, wherein the tube and the foam plug are both constructed of polyethylene.

5. The packaging device of claim 1, wherein the tube and the foam plug are both constructed of polypropylene.

6. The packaging device of claim 1, wherein the tube and foam plug are generally cylindrical, and wherein a diameter of the foam plug in the expanded state is at least slightly greater than a diameter of the open end of the tube.

7. A packaging method comprising:

filling an expandable and collapsible tube with a product via an open end thereof; compressing a closed-cell foam plug; inserting the compressed foam plug at least partially into the open end of the tube; and closing and sealing the open end of the tube upon expansion of the foam plug.

8. The packaging method of claim 7, wherein the tube and the foam plug are generally cylindrical.

9. The packaging method of claim 8, wherein the compressing step comprises compressing the closed-cell foam plug to a diameter smaller than a diameter of the open end of the tube and wherein the sealing step comprises permitting the foam plug to expand and engage the tube, forming a substantially fluid-tight compression seal.

10. The packaging method of claim 7, wherein the inserting step comprises inserting the compressed foam plug a depth at least equal to a width of the open end of the tube.

11. The packaging method of claim 7, wherein the sealing step comprises heating the foam plug and the open end of the tube to sealingly join together the foam plug and the tube.

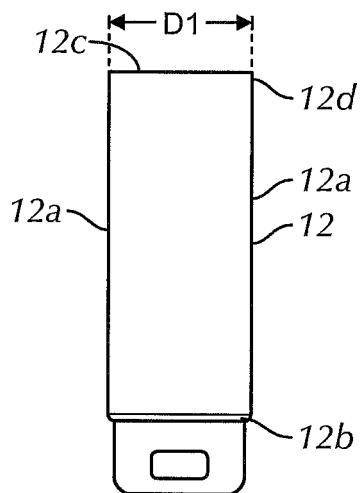


FIG. 1A

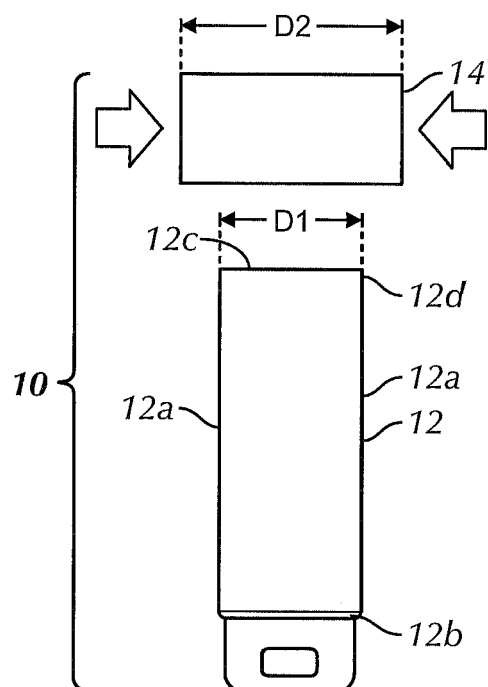


FIG. 1B

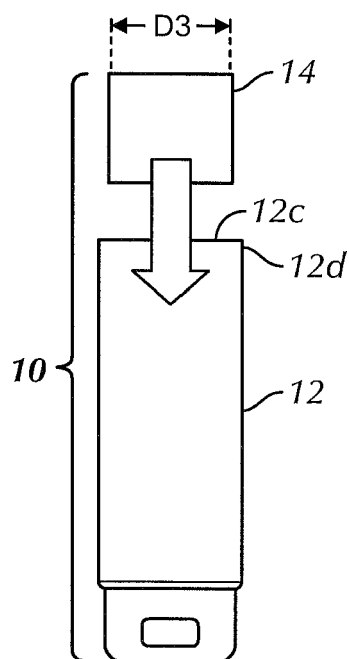


FIG. 1C

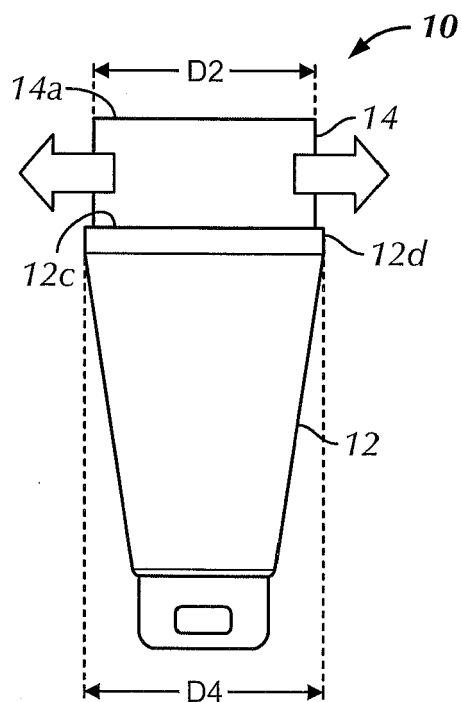


FIG. 1D



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Place of search Munich		Date of completion of the search 24 February 2016	Examiner Yazici, Baris
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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