(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
23 December 2009 (23.12.2009)

PCT

(10) International Publication Number
WO 2009/153753 A1

(51) International Patent Classification:
A45D 40/26 (2006.01) *A46B 9/02* (2006.01)
A45D 34/04 (2006.01)

(21) International Application Number:
PCT/IB2009/052612

(22) International Filing Date:
18 June 2009 (18.06.2009)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
08/54011 18 June 2008 (18.06.2008) FR
61/091,973 26 August 2008 (26.08.2008) US

(71) Applicant *(for all designated States except US)*: **L'OREAL** [FR/FR]; 14 rue Royale, F-75008 Paris (FR).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **GUERET, Jean-Louis** [FR/FR]; 27 avenue Raymond Poincaré, F-75016 Paris (FR).

(74) Agent: **TANTY, François**; Nony & Partners, 3 rue de Penthièvre, F-75008 Paris (FR).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH,

[Continued on next page]

(54) Title: A PACKAGING AND APPLICATOR DEVICE, IN PARTICULAR FOR MASCARA

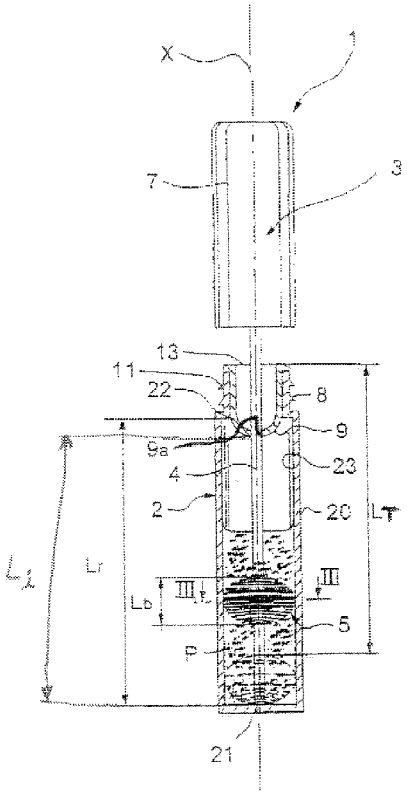

Fig.1

(57) Abstract: The present invention relates to a packaging and applicator device (1) comprising: - an applicator (3) comprising an applicator element (5) having a length and defining an envelope surface of cross-section that varies, passing through at least one maximum; and - a container (2) containing a composition (P) for application to human keratinous materials, the container defining an internal space containing the composition, the space being of height that is at least twice the length of the applicator element; the maximum cross-section of the envelope surface of the applicator element occupying at least 70% "of the inside section of the internal space of the container containing the composition, at least along a portion of the path over which the applicator element travels while it is being removed from the container, the portion being of height that is at least equal to twice the length of the applicator element, the composition being able to flow relative to the applicator element from a zone located below the application element to a zone located above the applicator element, and vice versa.

WO 2009/153753 A1

GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

A PACKAGING AND APPLICATOR DEVICE, IN PARTICULAR FOR MASCARA

FIELD OF THE INVENTION

The present invention relates to packaging and applicator devices for applying a composition to human keratinous materials, more particularly, but not exclusively, to the eyelashes or to the eyebrows. The applicator of the invention can be used for applying product to keratinous fibers and to skin or lips. The product may be mascara, eyeshadow, liquid lipstick, lipgloss, this list not being limiting.

BACKGROUND

Numerous mascara applicators comprise a container provided with a wiper member fitted in the neck of the container, and an applicator comprising an applicator element such as a twisted-core brush disposed at one end of a stem, the other end of which is secured to a handle that also constitutes a closure cap for closing the container.

The wiper member includes a lip defining a wiper orifice having a diameter that substantially corresponds to the diameter of the stem, so as to avoid the presence of excess composition on the stem once the stem has been removed from the container.

The container is made with an internal volume that is suitable for multiple applications, and the free ends of the bristles of the applicator element are situated at a distance from the inside surface of the container.

In use, a chimney forms in the composition as a result of the movement of the applicator element, and in some circumstances that may lead to an extraction rate for the container that is unsatisfactory, e.g. less than or equal to 60%, with a certain quantity of composition remaining unused since it is stuck to the inside surface of the side wall of the container.

In addition, the composition is stirred relatively little inside the container each time the applicator is removed and put back, and its characteristics may deteriorate.

In order to homogenize the composition, it is known to dispose a piston inside the container, which piston is moved by the stem carrying the applicator element while the applicator is being removed or put back. The piston complicates manufacture of the container and leads to the applicator element being wiped in a way that is relatively difficult to master, and that may be detrimental to the consistency of the performance of the applicator. The piston may also reduce the capacity available for the composition, and it does not enable the composition to be homogenized right down to the bottom of the container.

In order to stir more effectively the composition contained in the container, US patent No. 5 226 744 teaches making the side wall of said container with indentations forming ribs on its inside surface that come into contact with the applicator element while said applicator element is being inserted into the container or removed therefrom. The applicator element remains spaced apart from the inside wall of the container except at the indentations. The drawback of such a device is that it complicates manufacture of the container, and the indentations impart to the container a shape that departs from the conventional appearance of most widely known devices, which may lead to the consumer believing that the container contains less composition.

Another solution for reducing the loss of composition consists in giving the core of the brush a non-rectilinear shape, so as to bring it into contact with the inside surface of the side wall of the container, as proposed in US patent No. 6 508 603. That solution presents the drawback of complicating the manufacture of the brush and of making the application of

makeup more difficult for a user who is used to conventional applicators.

US patent No. 6 158 912 teaches making the container with a flexible portion enabling the user, by pressing thereon, to cause the composition to move towards the brush. Such a solution complicates manufacture of the container when the flexible portion is limited to a fraction of the container. When the entire container is flexible, a consumer who is used to rigid containers may have the impression that the device is of poor quality.

In addition, in conventional devices, the volume of composition situated in the bottom of the container is generally difficult to extract. Certain publications, such as US 2 245 906 and US 6 572 296, disclose containers having a bottom that matches the shape of the brush, at least in part. In US 2 245 906, the composition does not flow in the container, relative to the applicator element, from below to above but remains below.

Furthermore, mascara sample devices are known that include a container of volume that is practically equal to the volume of the brush that they receive. US 4 982 838, EP 1 690 466, and US 2001/0052348 disclose such sample devices. The drawback of such sample devices is their small capacity, and the short length of the stem on which the brush is mounted.

Application FR 2 840 166 describes an applicator in which the supply of composition is contained in the handle.

Finally, US patent No. 2 135 112 describes a device in which the composition is situated outside a central housing for receiving the applicator when said applicator is not in use.

SUMMARY

There exists a need to improve still further packaging and applicator device comprising a container

defining an internal space containing the composition for application, and an applicator including an applicator element for loading with composition from the container.

The invention relates more particularly to packaging and applicator devices that are not sample devices, i.e. for which the container presents a capacity that is relatively large compared to the volume occupied by the applicator element.

In one of its aspects, the invention provides a packaging and applicator device comprising:

· an applicator including an applicator element having a length and defining an envelope surface of cross-section that varies, passing through at least one maximum; and

· a container containing a composition for application to human keratinous fibers, the container defining an internal space containing the composition, the space being of height that is at least twice the length of the applicator element;

the maximum cross-section of the envelope surface of the applicator element occupying at least 70% of the inside section of the container, i.e. the inside section of the inside space containing the composition, at least along a portion of the path over which the applicator element travels while it is being removed from the container, the height of the portion being at least equal to twice the length of the applicator element, e.g. lying in the range two to ten times the length of the applicator element.

The length of the applicator element is defined by the length of the portion carrying the bristles for applying the composition to the eyelashes, as measured along the longitudinal axis of the core of the applicator element carrying the bristles.

The height of the internal space of the container corresponds to the distance measured between the bottom of the container and the outlet orifice, and for containers comprising a neck and/or a wiper member, from

the bottom of the container to a wiping orifice of the wiper member or a shoulder defined by the neck in the absence of a wiper member. The said portion of the path may be along the part of the container in contact with the composition at first use. For example, the part of the container extending from the bottom to the top surface of the composition at first use may have at at least one point along the longitudinal axis of the container a cross section that is not more 1.43 times the maximum cross section of the envelope surface of the applicator element.

Some composition may flow relative to the applicator element from a zone located below the applicator element to a zone situated above, and vice versa, for example during introduction of the applicator element in the container or withdrawal thereof. Some composition may flow through the applicator element.

The term "portion of the container path over which the applicator element travels" should be understood to mean a portion of the container that comes to face the applicator element while it is being moved from its storage position to a position outside the container.

By means of the invention, the applicator element may behave somewhat like a piston inside the container, over at least a fraction of the stroke of inserting the applicator into the container or of removing it therefrom, so as to stir the composition contained in the container.

For given capacity, the invention thus makes it possible to increase the number of applications, or for an identical number of applications, it makes it possible to reduce the quantity of composition initially present in the container. This result may be obtained without the container being expensive to manufacture, and enables said container to preserve the appearance of conventional containers, if so desired. For example, for a container having a capacity of 6 milliliters (mL), 3.5 mL to 4 mL

of composition may be placed therein. The quantity of composition present in the container may be greater than the volume defined by the envelope surface of the applicator element.

The extraction rate may be increased compared to known devices, e.g. being greater than or equal to 60%, better greater than or equal to 70%, or even greater than or equal to 80% or 90% or 98%.

The invention makes it possible to achieve an extraction rate that is greater than 90%, instead of 47% for a conventional mascara. For a container that will be used as long, it is possible to put in less composition, thereby generating containers that are shorter than conventional containers, e.g. devices the size of a sample or of a lipstick.

The quantity of composition on the applicator element each time it is removed from the container may be relatively constant because of wiping and because of the fact that the applicator element stirs the composition in the container. The texture of the composition may also be relatively constant as a result of said composition being homogenized.

The invention also makes it possible to reduce the dead volume of composition present in the bottom of the container, thereby also reducing the quantity of unused composition. The bottom of the container may advantageously present a shape that substantially matches the shape of the applicator element, in particular depending on the residual volume that is acceptable at the end of use of the device.

The composition may surround the applicator element completely, at least before first use.

At least some composition may be present above the applicator element at first use, i.e. between the applicator element and an outlet of the container.

The applicator element is carried by a stem. The stem is preferably rectilinear, so as to enable the

applicator element to be centered properly in the container.

The applicator element may be connected to the stem by means of a flexible portion that may possibly deform while the applicator element is being inserted into the container, thereby making it possible, for example, to avoid excessive stress being generated on the applicator element by bearing against the container, in the event that the stem is not completely straight and not in alignment with the longitudinal axis of the container.

In exemplary embodiments, the diameter of the orifice of the wiper member (also known as a wiper) may be equal to the greatest diameter of the stem so as to squeeze and wipe the stem.

The stem may be fitted on the closure member of the container, e.g. heat-sealed, bonded, force-fitted, screwed, crimped, stapled, snap-fastened, or fastened in some other way on the closure member of the container containing the composition.

The stem may also be molded directly on the closure member of the container, thereby enabling it to be perfectly straight relative to the closure member and thus relative to the axis of the container.

The stem and the closure member may be secured, by molding or by fitting the stem, with angular indexing between the applicator element and the closure member.

The stem may also be made out of metal.

The container may include a central body and a covering part that extends around the central body, at least in part, the covering part being made, at least in part, out of metal or of plastics material, and it may be of any shape. The central body of the container may be cylindrical, in particular circularly cylindrical, over at least half of its height, for example, or even over two-thirds of its height, or more.

The central body may be made with a neck that is molded integrally therewith, or the neck may belong to a part that is fitted in the central body.

The container may be made of plastics material. It may be injected-molded or injection blow molded.

In other exemplary embodiments, at least some, or even all, of the container may be made out of glass, out of pressed metal, or out of extruded metal. For a container made out of metal, the inside surface in contact with the composition may be protected by a surface treatment, e.g. an anodizing treatment.

When the container is made by injection blow molding, it may be deformed only very slightly compared to the preform, thereby making it possible to have a constant inside diameter and a straight wall.

In other exemplary embodiments, the container is blow molded only at the neck, so as to have better control over its inside diameter and have a wider neck for receiving the wiper member and for using applicator elements of greater transverse size.

In its storage position inside the container, the applicator element may remain at a non-zero distance from the bottom of the container, so as to accommodate the expansion and/or swelling or lengthening of the stem, the wiper member, and the applicator element.

The invention can make new formulations possible, making it possible to introduce into the composition compounds that require homogenizing immediately prior to being taken and applied. When fibers are present in the composition, said fibers may be distributed inside and on top of the applicator element after said applicator element has been wiped.

The composition may have any consistency, e.g. it may be a gel, or it may have a consistency that is creamy to pasty. The composition may contain waxes, pigments, magnetic particles, amongst other ingredients. The composition may be a liquid.

The invention makes it possible to disperse ingredients that are incompatible and that must be mixed at the last moment, e.g. flakes, fibers, pigments, or active ingredients, in order to obtain a composition that is more homogenous.

The composition may be a substance that is stable or non-stable. It may contain ingredients that react to a source of heat.

The rheology of the composition may be modified. For example, the composition may become more viscous or less viscous than at rest. Where appropriate, the applicator may be used to mix two substances or ingredients before first use, e.g. two substances having different colors. A fatty substance may be mixed with water to obtain a smoother, glossier, or better makeup effect.

The invention may also improve the ability of the composition to impregnate the applicator element the first time it is inserted into the container, by enabling the composition to pass more easily through the applicator element. The invention may enable the applicator element to be saturated in composition before it is wiped. Thus, the applicator element may be fully ready to use the first time it is removed from the container.

In spite of the small amount of space, or even the direct contact, between the applicator element and the inside surface of the container along the portion of the container path over which the applicator element travels, the applicator element can nevertheless move in the container without the composition posing too great a resistance to the movement of the applicator element, because of the non-constant shape in cross-section of the envelope surface of the applicator element. In particular, the peripheral region of the applicator element closest to the inside surface of the container

may be relatively short, and the composition may thus pass through it easily.

The region of the applicator element that is situated at a short distance from the inside surface of the side wall of the container path over which the applicator element travels, e.g. at a distance of less than 1.5 millimeters (mm) therefrom, better less than 1 mm or less than 0.5 mm, may be of length that is less than or equal to 5 mm, measured along the axis of the applicator element.

The container may present an inside section that is non-circular. In this event, the "inside diameter" of the container corresponds to the diameter of the greatest circle inscribed in the inside section of the inside space of the container containing the composition. By way of example, the greatest transverse dimension of the envelope surface of the applicator element may be at least 0.85 times the inside diameter of the container in the portion over which the applicator element travels (ignoring the neck), better at least 0.90 times, or even at least 0.95 times.

The applicator element may have an envelope surface of cross-section that is polygonal, over at least a fraction of its length, in particular in the shape of an optionally-regular polygon, e.g. triangular, square, rectangular, pentagonal, or hexagonal, or a cross-section that is non-circular and non-polygonal, e.g. substantially elliptical.

The applicator element may have an envelope surface of cross-section, in particular non-circular cross-section, that turns about a longitudinal axis of the applicator element on moving along the applicator element.

The greatest transverse dimension of the applicator element may be equal to, or greater than, the inside diameter of the container in the portion over which the applicator element travels (ignoring the neck), the

greatest transverse dimension being greater by a factor lying in the range 1 to 1.15 times the greatest inside diameter of the container.

The inside diameter of the container may be at its maximum at the portion of the container path over which the applicator element travels.

Outside the region of the applicator element that is close to the inside surface of the side wall of the container, the applicator element has its envelope surface at a distance of more than 0.075 times the greatest inside diameter of the side wall of the container, for example, the distance corresponding to a distance of more than 1.5 mm, for example.

The portion of the container, other than the neck, in which the applicator element may be moved at little or no distance from the inside surface of the container, where the distance $|D_r - D_b| \leq 3$ mm, better ≤ 2 mm, still better ≤ 1.5 mm or ≤ 0.5 mm, for example, preferably extends over the major portion of the height of the inside space of the container, and preferably in the bottom half of the container, at least in part. D_r designates the greatest inside diameter of the container in its portion over which the applicator element travels, below the neck if any, and D_b designates the greatest transverse dimension of the applicator element. It is possible to have $D_b < D_r$ or $D_b > D_r$, i.e. the applicator element rubs against the inside surface of the container.

The applicator element may travel at least three times its length while being removed from the container.

The dead volume of composition, defined by the volume beyond the applicator element but inside the container, over the segment of the container extending axially between the proximal end of the applicator element when the applicator is in its storage position in the container, and the bottom of the container, may be less than or equal to the volume of the applicator element, e.g. less than or equal to ¾ of the volume, or

even less than or equal to ½ of the volume. The term "volume of the applicator element" means the volume defined by its envelope surface.

The length of the applicator element may be less than or equal to 25 mm, better less than or equal to 20 mm, still better less than or equal to 15 mm or 12 mm, a relatively short applicator element enabling makeup to be applied either with the side surface of the applicator element or with the tip of the applicator element. By way of example, this makes it possible to apply makeup in different directions to a set of eyelashes, so as to achieve new makeup effects. The length of the applicator element may lie in the range 4 mm to 20 mm, better in the range 7 mm to 13 mm, and the greatest transverse dimension D_b may lie in the range 6 mm to 20 mm, better in the range 7 mm to 16 mm. The greatest transverse dimension of the applicator element corresponds to the greatest diameter of said applicator element when the envelope surface is circularly symmetrical.

The applicator element may have a twisted core or it may be an injection-molded applicator element or it may be hybrid, having a twisted core and a portion made by molding material that carries the core and that may include projecting elements that are used for application purposes. The applicator element may include flocking.

The applicator element may include bristles or teeth or other projecting elements extending all around the core. The bristles, teeth, or other projecting elements may be fitted on an optionally-twisted core or molded integrally with the core.

The core may also be molded onto the bristles, teeth, or other projecting elements.

The applicator element may include any type of projecting elements extending from the core that may optionally be central. The projecting elements may be bristles or teeth. The term "bristle" should be understood to mean any individual projecting element

carried by the core. The terms "bristle" or "tooth" are interchangeable, even if the term "bristle" is normally used to designate projecting elements fitted on a core, e.g. as for a twisted-core brush, and the term "tooth" is often used to designate applicator elements of an applicator element made by molding.

When the applicator element includes teeth or bristles that are molded integrally with the core, said teeth or bristles may be of any shape and have any disposition, e.g. a staggered configuration, or with their bases in alignment.

Any molding technique may be used to make the applicator element, in particular injection molding using one or two materials, molding onto or through the core.

The applicator element may include projecting elements formed by blades or disks, in particular flexible blades or disks made of an elastically-deformable material and suitable for flexing while passing through the wiper member and/or while the applicator element is being moved within the container.

Each of the projecting elements in the form of blades or disks may include at least one notch. The notches may be in alignment or angularly offset around the longitudinal axis of the core.

The blades or disks may be made by molding, cutting, or machining an optionally-thermoplastic material. The blades or disks may be molded out of thermoplastic material separately from the core, then fitted on said core. The blades or disks may carry flocking, or they may be made with portions in relief such as molded bristles or teeth. The blades or disks may be molded with a portion of the core by injection molding, or injection-molding onto or through the core. The thickness of the blades or disks may lie in the range 0.1 mm to 10 mm, better 0.1 mm to 1 mm.

The core receiving the disks or blades may be molded integrally with the stem of the applicator. The blades

or disks may be made out of metal, where appropriate. The number of disks or blades lies in the range 5 to 30, for example. The greatest transverse dimension of a disk or blade lies in the range 7 mm to 16 mm. By way of example, the width of the gap between two consecutive disks or blades is greater than 0.1 mm, e.g. in the range 1 mm to 5 mm.

The projecting elements may be off-centered in alternation relative to the core, in particular when they comprise disks or blades as described above.

The applicator element may also include a spring, e.g. a helical spring.

The applicator element may be hybrid and include both teeth molded integrally with the core and bristles that are fitted, e.g. stapled or held on the applicator element by embedding or by being molded thereon. In another exemplary embodiment, the hybrid applicator element may include a spring and bristles carried by a core.

The envelope surface of the applicator element is defined as being the surface that bears on the free ends of the projecting elements.

The applicator element may present an envelope surface that is optionally axially symmetrical having an axis of symmetry that coincides with the longitudinal axis of the core of the applicator element. The envelope surface of the applicator element may optionally be circularly symmetrical about its longitudinal axis. Thus, the maximum cross-section of the envelope surface of the applicator element may be circular.

The applicator element need not have a notch extending longitudinally, parallel to the core of the applicator element. The applicator element may include projecting elements, e.g. bristles extending all around the core.

The applicator element may have a zone without projecting elements, in particular without bristles.

The applicator element may have a core that is rectilinear, situated in the axis of the stem carrying the applicator element.

The core may be centered or off-center, rectilinear or non-rectilinear. The longitudinal axis of the core may coincide with the longitudinal axis of the stem. Alternatively, the longitudinal axis of the core need not be in alignment with the longitudinal axis of the stem. The core may be curved.

By way of example, the applicator element may be a twisted-core brush, but, in a variant, it may be an injection-molded brush preferably with bristles having a length that is greater than the diameter of the core. The term "diameter of the core" means the diameter of the circle that circumscribes the greatest cross-section of the core. For an injection-molded brush, the bristles may have a length that lies in the range 2.5 mm to 3.5 mm, for example. The diameter of the core may lie in the range 1.5 mm to 3 mm, e.g. 1.5 mm to 2.5 mm. By way of example, the applicator element may be a molded brush of maximum diameter 8 mm, with a central core of 2 mm in diameter.

The cross-section of the envelope surface of the applicator element may pass through a maximum remote from the proximal and distal ends of the applicator element, e.g. about mid-way along the applicator element.

The envelope surface of the applicator element may be generally spherical, oval, frustoconical, or biconical, or it may comprise successive sections of different shapes, e.g. shapes selected from spherical, hemispherical, oval, frustoconical, or biconical.

The container may be provided with a wiper member that is fitted, molded onto the container, or molded integrally with the container.

The container may be made in two portions, one portion containing the composition and a fitted portion including the wiper member. The fitted portion may

include the neck of the container. The fitted portion may include anti-rotation ridges or other portions in relief that co-operate with corresponding portions in relief of the reservoir-forming portion of the container, e.g. also ridges. By way of example, the two portions of the container are assembled together by snap-fastening.

The container may be provided with a closure member that closes it in leaktight manner. The closure member may also constitute a handle for holding the applicator. An axial position of the applicator element may not vary relative to the handle or the bottom of the container between the first use and last use. The stem may have a constant length. In storage configuration, the applicator element may not exert any axial force on the composition.

The container may be at atmospheric pressure before being closed.

The applicator of the container may be removed with the atmospheric pressure in the container being re-established before the applicator element has passed right through the wiper member, e.g. by means of a flow of air between the stem and the wiper member and/or between the applicator element and the wiper member, because of a difference in their sections.

By way of example, the capacity of the container may be greater than or equal to 3 mL, better greater than or equal to 5 mL, e.g. in the range 3 mL to 10 mL. The container preferably presents an internal cross-section that is circular, and a diameter that is substantially constant over a length that is at least twice, e.g. two to ten times, the diameter of the applicator element, e.g. a length lying in the range 20 mm to 100 mm. That enables the applicator element to move at a short distance from, or in contact with, the container, over a distance that is relatively long, so as to enable the composition to be stirred thoroughly inside the container.

The extent to which the container is filled relative to its maximum capacity is preferably greater than or equal to 50%, e.g. lying in the range 50% to 75%, e.g. 5 grams (g) of composition for a container that is suitable for holding 8 g.

The container may be rigid, visibly not being deformed while the user is taking the composition. The inside surface of the container may be non-varying. The term "non-varying inside surface" should be understood to mean that the inside shape of the container does not change in the region facing, or around, the applicator element, in particular it does not have a movable partition, unlike that which is described in US 2005/0232681, nor does it have a wall that is deformable in use. The container may be made with a rigid wall defining its inside surface.

Where appropriate, the inside surface of the container may have at least one groove, e.g. a groove that is straight and parallel to the axis of the container.

When the applicator element is a twisted-core brush, the core is made with a wire of diameter lying in the range 0.35 mm to 0.95 mm, for example. The number of bristles per turn lies in the range 5 to 60, for example, better in the range 10 to 50. For a twisted-core brush, the bristles extend from the core along two helical layers. The number of turns of the brush corresponds to the sum of the turns about the core of the two layers. The bristles may be made of a natural or synthetic material, e.g. selected from polypropylene (PP), polyamide (PA), polyethylene terephthalate (PET), polystyrene (PS), polyethylene (PE), or polyvinyl chloride (PVC). The core may have a left-hand twist or a right-hand twist.

The bristles may include a magnetic particules or that seeks to improve sliding, e.g. graphite, polytetrafluoroethylene (PTFE), or molybdenum disulfide.

The bristles may include preservatives, e.g. benzalkonium chloride, stearalkonium chloride, or a selected paraben.

The diameter of the stem supporting the applicator element may lie in the range 2.5 mm to 6 mm.

The applicator may be a vibratory applicator, a rotary applicator, in particular one that is driven in rotation by a motor or that is free to move in rotation, a vibratory and rotary applicator, a heater and vibratory applicator, or a heater and rotary applicator.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention can be better understood on reading the following detailed description of non-limiting embodiments thereof, and on examining the accompanying drawings, in which:

- Figure 1 is a diagrammatic and fragmentary longitudinal section in elevation showing an embodiment of a packaging and applicator device made in accordance with the invention;
- Figure 2 is a fragmentary longitudinal section showing the bottom portion of the device while the container is closed;
- Figure 3 is a cross-section on III-III of Figure 1;
- Figure 4 is a diagrammatic cross-section showing the outline of the envelope surface of the applicator element and the side wall of the facing container;
- Figures 5A to 5L show variant embodiments of the applicator element;
- Figure 6 shows the envelope surface of an example of an applicator element;
- Figures 7A to 7B show diagrams of variant embodiments of the applicator element;
- Figures 8A to 8G show other variant embodiments of the applicator element;

· Figures 9A to 9H are cross-sections showing variant embodiments of the applicator element;

· Figure 10 shows is a cross-section view showing another variant embodiment of the applicator element;

· Figures 11A to 11E show variant applicators;

· Figures 12A and 12B show the possibility of making the stem with a constriction;

· Figure 13 shows a variant embodiment of the applicator element;

· Figure 14 shows a variant of an applicator;

· Figure 15 shows a detail of the Figure 14 applicator;

· Figures 16 and 17 are fragmentary longitudinal sections showing embodiments of applicators;

· Figure 18 is a fragmentary longitudinal section showing the bottom portion of a container provided with an applicator constituting a variant embodiment of the invention;

· Figures 19 to 24 are plan views showing variant embodiments of wiper members;

· Figures 25 to 31 are fragmentary longitudinal sections showing variant embodiments of the wiper member;

· Figures 32 to 38 show other variant embodiments of wiper members and their corresponding containers;

· Figures 39 to 41 show variant embodiments of the bottom portion of the container;

· Figure 42 to 45 show variant embodiments of the container;

· Figures 46A to 46C are cross-sections showing variants of devices made in accordance with the invention;

· Figure 47 shows a detail of Figure 46A;

· Figure 48 shows a variant embodiment of the applicator;

· Figure 49 shows a variant embodiment of packaging and applicator device;

· Figure 50 is a longitudinal section of the Figure 49 device; and

· Figures 51 to 66 are cross-sections showing variant embodiments of bristles.

A packaging and applicator device 1 made in accordance with the invention comprises a container 2 that contains the composition P for application, e.g. mascara, and an applicator 3 that makes it possible to apply the composition P to human keratinous materials, e.g. the eyelashes or the eyebrows.

The container 2 may be made by injection molding thermoplastic material, blow molding, injection blow molding, or co-extrusion, for example.

The applicator 3 comprises a stem 4 at the end of which an applicator element 5 is mounted.

In the embodiment shown, on the side remote from the applicator element 5, the stem 4 includes a handle 7 that also constitutes a closure cap for closing the container 2. The container includes a threaded neck 11 on which the handle 7 may be screwed, the neck 11 defining an outlet orifice 13.

A wiper member 8 may be mounted in the neck 11 of the container 2, as shown, the wiper member 8 including a wiper lip 9 defining a wiper orifice 9a having a diameter that corresponds substantially to the diameter of the stem 4, for example, so that said stem does not present excess composition after being removed from the container 2.

The applicator element 5 may be a brush comprising bristles 16 that may be carried by a core 15 that may be made of metal. For example, the core 15 is twisted, comprising two branches of a wire, said branches being twisted together with a right-hand twist or with a left-hand twist, trapping bristles there between. The branches may be formed by folding a wire in the shape of a U. In a variant not shown, the core of the applicator

element is formed by twisting together two cores that are themselves twisted and carrying bristles.

The core 15 of the applicator element 5 may be fastened on the stem 4 in various ways. For example, a portion of the core 15 that does not have bristles 16 is force-fitted into a corresponding housing provided at the distal end of the stem 4.

The length L_b of the applicator element 5 is defined as being the length of the portion carrying the bristles 16 that are useful for application purposes. The length L_b may substantially correspond to the visible length of the applicator element 5. The length L_b lies in the range 4 mm to 20 mm, for example. The length L_b is measured along the longitudinal axis of the core.

During manufacture of the applicator element 5, the bristles 16 may be cut in such a manner as to impart the desired shape to the envelope surface E of the applicator element 5

The envelope surface E is defined as being the geometric envelope surface that, on moving along the core 15, lies against the free ends of the bristles 16 that are the furthest from the core 15.

The envelope surface E may be circular about the longitudinal axis Z of the core 15. The cross-section of the envelope surface E may thus be circular over at least a fraction of the applicator element 5, in particular where its diameter is greatest.

In exemplary embodiments of the invention, the cross-section of the envelope surface E varies, i.e. it is not constant over at least a fraction of the length of the core 15 from the visible proximal end 15a of the core 15 to the distal end 15b of the core 15.

The cross-section of the envelope surface E may pass through a maximum M at at least one point, e.g. situated in the range ¼ to ¾ of the length of the core measured from its distal end 15b, e.g. in the range $^1/_3$ to $^2/_3$ from the distal end 15b, e.g. substantially in the middle of

the visible portion of the core extending between the proximal and distal ends 15a and 15b.

The envelope surface E may be substantially ball shaped or spherical, as shown, but other shapes are possible, as described below.

The envelope surface E may optionally be symmetrical about a mid-plane, where the section is at its maximum.

The container 2 includes a side wall 20 that, as shown, may be of circular cross-section about a longitudinal axis X that may coincide with the longitudinal axis Z of the applicator when said applicator is in place on the container.

By way of example, the side wall 20 has an inside surface 23 that is substantially circularly cylindrical about the axis X. By way of example, the inside diameter D_r of the side wall 20 of the container is substantially constant over a length L_r that goes from the bottom 21 of the container 2 to a shoulder 22 via which the neck 11 is connected to the side wall 20, as shown in Figure 1. The length L_r lies in the range 3 centimeters (cm) to 12 cm, for example. The inside space of the container has a height L_i, measured from the bottom 21 to the wiping orifice 9a of the wiper member 9. The height of composition P in the inside space and above the applicator element may exceed at first use more than twice or three times the length L_b.

In the embodiment under consideration, the dead volume V_m of composition, cross-hatched in Figure 2, is less than the volume of the applicator element, defined by its envelope surface E. The dead volume V_m is the volume that extends around the applicator element in its storage position.

In exemplary embodiments of the invention, the inside surface 23 of the side wall 20 of the container is situated at a relatively short, or even zero, distance j from the envelope surface E for at least a certain portion of the path over which the applicator element 5

travels while said applicator element is being removed from the container 2 starting from its storage position.

The distance j that is short or zero, at least at the maximum section M of the applicator element, makes it possible to stir the composition P to a certain extent while the applicator element 5 is being removed from the container and returned thereto, the applicator element 5 behaving somewhat like a piston that moves the composition P in the container.

The composition may flow relative to the applicator element 5 from a zone located above the applicator element 5 in the container to a zone below the applicator element 5 when the latter is moved upwards in the container. When the applicator element 5 is moved downwards, the composition may flow relative to the applicator element from a zone below the applicator element to a zone above the applicator element.

By way of example, the envelope surface E may be at a distance that is less than j_{max} from the inside surface 23 of the side wall 20 of the container over a length L_p, measured along the axis X, for at least one position of the applicator element 5 on its outlet path from the container, and better for at least a certain length of said path. The total length L_T of the path of the applicator element is measured between the end of the applicator element adjacent to the stem in its storage position and the outlet orifice. By way of example, the length L_T is at least twice, better at least three times, still better at least five times, e.g. in the range 5 to 15 times, the length L_b of the applicator element 5.

In view of the fact that the cross-section of the applicator element varies, L_p/L_b may lie in the range $^1/_{100}$ to ½, better in the range $^1/_{10}$ to ½, for a value j_{max} equal to 0.075 D_r, for example. It is possible to have the same ranges of the ratios L_p/L_b for an absolute value j_{max} equal to 1.5 mm, 1 mm, 0.5 mm, or 0.2 mm, in different embodiments.

For example, when j_{max} = 1 mm and L_p/L_b = ¼, that means that for ¼ of the length of the applicator element, the distance to the side wall 20 of the container is less that 1 mm, and over the remaining ¾ of the length of the applicator element, the distance to the side wall of the container is greater than 1 mm.

By way of example, the inside diameter D_r of the container lies in the range 7 mm to 16 mm, e.g. 10 mm, and the maximum diameter D_b of the applicator element for a container in which D_r is 10 mm, may be equal to 9.5 mm, for example.

When a single cross-section of the applicator element 5 is under consideration, it may present bristles 16 of a length such that some of them come into contact with the inside surface 23 of the side wall 20 of the container and others do not.

In other words, the envelope surface E in the plane of its greatest cross-section need not be situated at a constant distance j from the inside surface 23 of the container, but at a distance j that may vary, e.g. being zero over at least an angular sector about the longitudinal axis of the container, the angular sector extending over more than 30° for example, or even over more than 60°, 90°, 120°, 180°, 210°, 240°, or 270°.

The maximum cross-section S_M of the envelope surface E of the applicator element 5, shown by stippling in Figure 3, is for example equal to the inside section of the side wall 20 of the container or at the very least equal to at least 70% of said inside section, better at least 75%, still better at least 80%, 85%, 90%, or 95%, so that the movement of the applicator element 5 while being removed from the container moves a relatively large volume of composition P inside the container.

The envelope surface E of the applicator element 5 may have numerous shapes satisfying the definition of an envelope surface E of varying cross-section.

By way of example, the envelope surface E may be non-spherical, e.g. substantially biconical as shown in Figure 5A, the envelope surface of the applicator element 5 being of shape that is substantially symmetrical or asymmetrical about a mid-plane defining the maximum section S_M. The angle α at the intersection of the conical portions lies in the range 5° to 160°, for example.

The applicator element 5 may present an envelope surface E of shape that is substantially hemispherical, as shown in Figure 5B, the maximum section of the envelope surface E being situated substantially at its proximal end, for example.

As shown in Figure 5C, the applicator element 5 may also present a frustoconical shape that converges towards the distal end of the applicator element 5, the maximum cross-section M of the envelope surface E being situated substantially at its proximal end, for example.

In the example shown in Figure 5D, the applicator element 5 presents a cross-section that remains at a maximum over a distance L_m before decreasing, e.g. along a conical surface, towards the distal end of the applicator element 5.

The distance L_m is less than 10 mm, better less than 7.5 mm, or even less than 5 mm, and in relative terms $L_m/L_b \leq ½$, better $L_m/L_b \leq {}^1/_3$, still better $L_m/L_b \leq ¼$, for example.

In the embodiment in Figure 5E, the envelope surface presents a general shape that flares towards the distal end of the envelope surface E, said envelope surface having a substantially frustoconical shape that diverges away from the stem 4.

The envelope surface E may present a shape that is oval, e.g. elliptical, e.g. of diameter D_b that is greater than its length L_b, as shown in Figure 5F, or vice versa, as shown in Figure 5G.

The applicator element may have an envelope surface having the shape of two balls as shown in Figure 5H, comprising two successive spherical or substantially spherical portions. The applicator element may thus have a cross-section that passes through a minimum that is situated between two maxima. The applicator element may present two adjacent biconical portions, as shown in Figure 5I.

The applicator element may include an annular groove 279 that extends all around the core, as shown in Figures 5H and 5I.

For a succession of portions having a cross-section that varies, as shown in Figures 5H and 5I, each portion may come into contact with, or come up to a short distance from, the inside surface of the container, in particular may present the same diameter D_b satisfying the above-indicated relationships.

Figure 5J shows a variant embodiment of a brush in which said brush includes a portion 200 that is bulbous, and a portion 201 that is of diameter that is less than the maximum diameter of the bulbous portion 200. By way of example, the portion 201 may be cylindrical, of optionally circular section, e.g. of polygonal cross-section. By way of example, the bulbous portion 200 may be of spherical or substantially spherical shape, e.g. being less than twice as long as it is wide. The length L_b of the portion carrying the bristles is less than or equal to 25 mm, for example, and the length of the bulbous portion 200 is less than or equal to 12 mm.

The applicator element 5 may include a spring 16_k having turns that define as many projecting elements 90, as shown in Figure 5K.

The applicator element may be a hybrid brush.

Figure 5L shows the possibility of making the applicator element with a spring 16_k mounted around a twisted-core brush. The spring 16_k and/or the bristles 16 of the brush may come into the proximity of the inside

surface of the container. The spring may be made with turns of varying section, as shown. The turns of greatest section may have an axial position that substantially coincides with the axial position of the bristles of greatest length.

In other embodiments, the applicator element may include a portion that is bulbous, for example spherical, joined to a portion that is flat.

Figure 6 shows an example of the envelope surface of such an applicator element. The greatest transverse dimension of the flat portion may be equal to the diameter of the envelope surface of the spherical portion, as shown in Figure 7A, or it may be less than that, as shown in Figure 7B.

The bulbous portion is preferably proximal, as shown in Figure 8A that shows such an applicator element in profile.

Figure 8B shows an embodiment in which the bulbous portion presents a biconical shape, and Figure 8C shows an applicator element formed by a flat portion joined to two successive bulbous portions, e.g. each of biconical shape.

The applicator elements shown in Figures 8A to 8C are twisted-core brushes, but the envelope-surface shape in Figure 6 is not limited to twisted brushes and may also correspond to injection-molded brushes or to applicator elements made in some other way. Figures 8D and 8E show applicator elements of elongate shape having a conical distal portion that converges towards the distal end of the applicator element and that is joined to a portion of sphere. The portion of sphere may be hemispherical at least.

The brush in Figure 8D is a twisted-core brush, whereas Figure 8E shows an injection-molded brush. In

these embodiments, the length of the applicator element lies in the range 15 mm to 25 mm, e.g. being 20 mm, but other lengths are possible.

The portion of sphere may be configured to scrape the inside wall of the container or to come up to a short distance therefrom. The portion of sphere may define the greatest diameter of the applicator element 5. In the case of hemispherical and conical portions, the junction between the portions may define to the greatest diameter of the applicator element 5. The applicator element 5 can, as shown in Figure 8F, include a succession of projecting elements 90 formed by blades or disks extending transversally to the longitudinal axis of the core, preferably perpendicularly thereto. The projecting elements 90 may be molded integrally with the core out of the same material or out of a different material, or, in a variant, they may be fitted on the core 15, e.g. being formed by disks or blades stacked on the core and held thereon, e.g. by mechanical fastening or in some other way. The core may be molded integrally with the stem.

At least some or even all of the projecting elements 90 may be off-center relative to the longitudinal axis X of the core, as shown in Figure 8G.

The projecting elements 90 may be made with various shapes making it possible in particular, for at least some of them, to come, over at least a portion of their periphery, into the proximity of the inside surface 23 of the container, in particular to come within less than 1.5 mm therefrom.

The projecting elements 90, in particular the disks or blades, may have a thickness that varies, e.g. that increases towards the core. A plurality of disks or blades of different kinds may follow one another on the core, e.g. being made of different materials and/or with different shapes or dimensions, e.g. selected from those described below.

In a variant not shown, the projecting elements are formed by disks including at least one hole that does not open out onto the external outline of the projecting element.

In a variant not shown, it is possible to make the projecting elements 90 with an outline that is not circular, e.g. flat. It is also possible, as shown in Figure 9A, to make the projecting elements 90 with a shape that defines one or more extensions 93 that come into the proximity of the inside surface 23 of the container. For example, as shown in Figure 9A, it is possible to have extensions each having an edge 95 that extends a side 94 of the projecting element, the extensions 93 being oriented in the same circumferential direction about the longitudinal axis of the core, for example.

The radially outermost ends of the extensions the closest to the inside surface of the container may be situated at a short distance from the inside surface 23, e.g. less than 1.5 mm, better less than 1 mm, or even less than 0.5 mm, or in contact with the inside surface 23.

Figure 9B shows the possibility of at least one projecting element 90 presenting a portion of its outline that is circular for example, of diameter that is slightly smaller than the diameter of the inside surface of the container, and elsewhere one or more extensions 93. In the embodiment in Figure 9B, the projecting element 90 includes an extension 93 that separates two notches that have bottoms that substantially define right angles. The radially outermost end of the branch 93 extends to a short distance j from the inside surface 23.

It is possible to make at least one projecting element 90 with at least one notch 80, as shown in Figure 9C.

The outline of the projecting element 90, apart from the notch 80, may be circular, of diameter close to the inside diameter of the container.

When the projecting elements 90 include notches 80, the outline of the projecting element, not including the notch, need not be circular, but could be circular and truncated on the side remote from the notch, for example, as shown in Figure 9C.

In all of the embodiments in Figures 9A to 9C, the projecting elements may optionally be offset angularly.

The container 2 may present an inside cross-section that has a shape other than circular, as shown in Figures 9D and 9E in particular.

These figures show a container having an inside cross-section of shape that is substantially polygonal, e.g. square or triangular.

When the inside section of the container is not circular, in particular when it is polygonal, the applicator element may be extracted from the container with or without movement in turning about the longitudinal axis of the container. For example, the applicator element may be removed without relative movement in turning relative to the container, the applicator being fastened on the container by snap-fastening, for example. In a variant, the applicator element is extracted with turning of the applicator element relative to the inside surface of the container. In this event, the dimensions of the applicator element and the flexibility of the projecting elements are selected in such a manner as to allow turning to be performed.

In particular, when the container presents an inside cross-section that is not circular, the applicator may be fastened on the container with its angular position relative to the container being indexed, so that in its storage configuration, the projecting elements are not stressed by the inside surface of the container. For

this purpose, it is possible to provide complementary portions in relief formed on the container and on the applicator, respectively, in particular on a mounting skirt thereof, serving to fasten the applicator on the container, and on which skirt the stem of the applicator may be connected.

The envelope surface of the applicator element, when observed in cross-section, may present a similar shape. For example, the cross-section of the envelope surface of the applicator element may have a shape that is polygonal over at least a fraction of the length of the applicator element, as shown in Figures 9D and 9E, e.g. square as shown in Figure 9D, or triangular as shown in Figure 9E.

The cross-section of the envelope surface of the applicator element may also have a shape that is non-circular, e.g. substantially polygonal, e.g. substantially hexagonal, over at least a fraction of the length of the applicator element, whereas the container is cylindrical at least in part, as shown in Figure 9F.

In the plane of the largest section of the applicator element, the vertices of the polygon extend to a short distance from the inside surface 23 of the container, e.g. to less than 1.5 mm, or even to a shorter distance, in particular to less than 1 mm, or even to less than 0.5 mm. The applicator element 5 may touch the inside surface 23 of the container, in particular at the vertices of the polygon.

Other star-shaped sections are shown in Figures 9G and 9H. In the embodiment in Figure 9G, the section defines three branches, in the embodiment in Figure 9H, the section defines four branches.

In these embodiments in particular, the applicator element may have a section that optionally turns about the longitudinal axis of the core. The applicator element 5 may be hybrid, as shown in Figure 10, i.e. made with both a twisted-core brush and with a support 129 made of thermoplastic material or of metal, that is

secured to the brush and serves to hold the brush on the applicator, for example.

The support 129 may carry projecting elements 131 that are molded integrally therewith. For example, the support may comprise branches 130 that are connected together at their proximal and distal ends, and carrying teeth, and the core of the brush may extend between the branches. Hybrid applicator elements of this type are described in publication FR 2 916 328. The envelope surface presents a cross-section that varies, so as to pass through at least one maximum where the elements are at a short distance from, or in contact with, the inside surface of the container.

Figures 11A and 11B show applicators of the invention provided with a twisted-core applicator element, whereas Figures 11C to 11E show molded applicator elements.

The applicators in Figures 11B and 11C are provided with a stem including a flexible distal portion 50 that further includes a constriction 209 at the base of the applicator element so as to give it more flexibility, in particular at the moment of application or of wiping. Furthermore, in the storage position, the flexible portion may preserve the applicator element from poor alignment of the stem, and avoid it pressing heavily against the wall of the container, in particular during storage.

The stem 4 of an applicator of the invention may be made with at least one annular constriction 208, as shown in Figures 11A, 11D, 11E, 12A, and 12B. At least one annular constriction 208 may be positioned on the stem in such a manner as to come to face the lip of the wiper member in its storage position.

Such a constriction may avoid stressing the wiper member during storage and may ensure that the container returns to atmospheric pressure before it is hermetically closed, in the event that the wiper member increases the

pressure inside the container by hindering the escape of air while the stem is being put into the container.

The applicator element in Figure 11D includes a portion 45 without projecting elements.

The portion 45 may be made out of the same material as the portion of the applicator element that carries the projecting elements, the portion 45 being connected to the stem.

The portion 45 may have been molded ab initio without projecting elements, or, in a variant, it may have been molded with projecting elements and said projecting elements may have been eliminated by subsequently treating the applicator element, e.g. by grinding.

The core 15 may extend along a longitudinal axis Z that is rectilinear and that coincides with the longitudinal axis X of the stem, for example, said stem possibly also being rectilinear, and the longitudinal axis of the core 15 may coincide with the longitudinal axis X of the container, for example, while the applicator is in place on said container.

In the examples shown in Figures 11A to 12C, the longitudinal axes of the brush and of the stem are rectilinear and coincide. In other embodiments not shown, the axis of the applicator element may slope a little relative to the axis of the stem. It is not beyond the ambit of the present invention for the core 15 to be non-rectilinear, e.g. having a shape that is curved, as shown in Figure 13. The distal end 15b of the core 15 may optionally be situated on the longitudinal axis X of the stem 4.

The applicator element 5 may be stationary relative to the stem 4, e.g. such as when the applicator element 5 includes a twisted core 15 that is fastened in a housing provided at the distal end of the stem 4.

The applicator element 5 may also be made in such as manner as to be able to turn relative to the handle 7

and/or to the stem 4, e.g. while the applicator element 5 is being removed from the container and/or while the applicator element 5 comes into contact with the eyelashes.

In the embodiment in Figures 14 and 15, the applicator element 5 is mounted in such as manner as to be able to turn freely about a support pin 30. By way of example, the applicator element 5 is made by molding thermoplastic material, and comprises bristles 16 that extend all around a core 32. By way of example, the core is molded in the same material as the bristles 16, or it is molded in a different material, the bristles 16 being injection molded onto the core 32, for example.

In the embodiment in Figures 14 and 15, but also in other embodiments in which the core does not turn about the stem but is molded, the greatest transverse dimension D_b of the applicator element 5 is at least 1.5 times the greatest transverse dimension D_a of the core 32, for example, and that may impart a certain flexibility to the bristles 16.

By way of example, the pin 30 is inserted at one end into a housing in the stem 4, and the other end may include a retaining head 33 for retaining the applicator element 5. By way of example, the head 33 is formed by heat-sealing performed before or after the pin 30 is put into place on the stem 4. The pin 30 may be made of metal or of thermoplastic material. The pin 30 may also be molded integrally with the stem 4 rather than being fitted thereto.

In a variant not shown, the stem 4 is turned relative to the handle 7, e.g. by an electric motor. A generally spherical shape for the applicator element may make it possible to apply makeup to both eyes without changing hand, with the applicator turning in one direction only, thereby simplifying the appliance compared to other rotary applicators.

The applicator may include a vibration source 40 that is fitted on the handle 7 for example, as shown in Figure 14. By way of example, the vibration source 40 includes a contactor 42 that makes it possible to trigger the operation of the vibration source so that vibration is transmitted to the applicator element 5.

In the embodiment in Figure 14, the vibration source 40 is described in association with an applicator element 5 that turns about the longitudinal axis X of the stem, but in a variant not shown, the vibration source 40 is mounted on an applicator such as the applicator shown in Figure 1 for example, in which the applicator element 5 is stationary relative to the stem 4.

The applicator element 5 may be connected to the stem 4 via an intermediate element 50 that makes it possible for the applicator element 5 to move a certain amount relative to the stem 4, the intermediate element 50 being an elastomer member, for example, including a distal portion 51 in which there is fastened the core 15 of the applicator element 5, and a proximal portion 53 for fastening in the stem 4, the portions 51 and 53 being connected via a thin portion 54 that acts somewhat like a hinge about all axes. Figure 16 shows such a possibility.

Other means may be used to enable the applicator element 5 to move a certain amount relative to the stem 4, during application and/or while it is being removed from the container.

For example, as shown in Figure 17, the applicator may include a helical spring 60 connecting the stem 4 to the applicator element 5. The stem 4 may include an endpiece 61 on which there is fastened a proximal end 60a of the spring 60, and the core 15 of the applicator element 5 may be fastened in a support element 63 on which there is fastened the distal end 60b of the spring 60.

The longitudinal axis Z of the core 15 may coincide with the longitudinal axis of the container 2, and the longitudinal axis of the stem 4 may extend, over the major fraction of the length of the stem, parallel to the longitudinal axis of the container, but at a certain distance therefrom, as shown in Figure 18.

The wiper member 8 may have various shapes, without going beyond the ambit of the present invention. In particular, the wiper orifice 9a may have a circular-shape, as shown in Figure 19, without a slot opening out into the wiper orifice 9a.

In a variant, as shown in Figure 20, the wiper member 8 may be made with slots 9b that are radial, and that open out into the wiper orifice 9a, making it possible to impart greater deformability to the lip of the wiper member.

The wiper member 8 may also be made with slots 9b that are not radial, but that open out tangentially into the wiper orifice 9a, as shown in Figure 21.

The wiper member 8 need not include a circular wiper orifice, but merely one or more slots, as shown in Figures 22 to 24.

In Figure 22, the wiper member includes a single slot 9c, in Figure 23 two slots 9c that cross each other, and in Figure 24 a plurality of slots 9c that are disposed in a star shape.

The wiper lip 9 may be formed at the end of the wiper member 8, as shown in Figure 25, e.g. by a rib projecting radially inwards from a substantially cylindrical wall 8a of the wiper member.

The wiper orifice 9a may also be formed at the end of a wall 9b of the substantially cone-shaped wiper member 8.

In the example in Figure 27, the wiper orifice 9a is formed at a distance from the distal end 8f of the wiper member.

In the example in Figure 28, the wiper orifice 9a is formed through an undulating wall 8j that is suitable for spreading out when the applicator element 5 passes therethrough.

In the example in Figure 29, the wiper orifice 9a is defined by a wall 8k that is generally convex towards the inside of the container.

In the example in Figure 30, the wiper orifice 9a is formed through a wall 8ℓ that is generally concave towards the inside of the container.

In the example in Figure 31, the wiper member 8 is formed by a block of foam that has at least one slot 9j passing therethrough, for example.

The wiper member 8 may be made as shown in Figure 32 with a lip 9 that comes into contact with the stem 4 over a length L_C that is relatively long, so as to provide a certain amount of guidance to the applicator. By way of example, the lip 9 is of shape that is substantially cylindrical, or that is slightly conical diverging towards the outside of the container, having the same axis as the longitudinal axis of the container. The length L_C lies in the range 2 mm to 5 mm, for example.

The wiper member 8 may also be fitted on the body of the container 2 in such a manner as to form the neck 11 thereof, as shown in Figure 33.

Figure 34 shows the possibility of making the wiper member 8 with two lips 204 and 205 that come to bear against the stem 4 at different heights. The presence of the two lips 204 and 205 may provide the stem with a certain amount of guidance, as described with reference to Figure 32.

Figures 35 and 36 show the possibility of making the neck of the container with a separate part fitted in the body 2a of the container. The part 333 may carry the wiper member 8, as shown. The part 333 may include any means that prevent it from turning relative to the body 2a of the container, e.g. ridges 340 as shown. The

ridges may co-operate with ridges formed on the body 2a of the container. By way of example, the part 333 may be fastened by snap-fastening in the body of the container. The wiper member 8 may also be fastened by snap-fastening on the part 333. The wiper member 8 may include a skirt 343 that bears in leaktight manner against the inside surface of the body 2a of the container. In this embodiment, the body 2a may be made with an inside section that is substantially constant starting from its opening receiving the part 333 up to the proximity of its bottom.

The container 2 may present a neck 11 of section that is wide compared to the body of the container, as shown in Figure 37, so that the wiper member 8 presents an inside surface 83 that is situated substantially at the same distance from the longitudinal axis of the container as the inside surface 23 of its side wall 20, as shown in Figure 37.

It can be seen in Figure 37 that the bottom 21 of the container may present a shape that is concave towards the outlet orifice 13, so as to match as well as possible the shape of the applicator element 5, as shown also in Figure 39.

In the embodiment in Figure 38, it may be seen that the container 2 may include a wiper member 8 that is molded onto the container 2, for example.

The bottom portion of the container may include a bulbous portion 85 that substantially matches the bulbous portion of the applicator element 5 when said applicator element is in place on the container, as shown in Figure 40.

In the embodiment in Figure 38, the bulbous portion 85 presents a shape that is substantially spherical.

The container may have a cylindrical body having an inside diameter that is smaller than the greatest transverse dimension of the applicator element, and the cylindrical body may be connected to a bottom portion

having dimensions that are such that the bristles of the applicator element are not constrained by the container in its storage position, as in Figure 38, for example.

The container 2 may include a fitted bottom 21, as shown in Figure 41.

The container may, as shown in Figure 42, be made with a body 2a defining the inside space containing the composition, and a covering part 2b defining the outside shape of the container.

The covering part may be made out of metal or plastics material and have any desired appearance. The closure cap may also be include a covering part that matches the covering part of the container.

The use of the reservoir-forming body disposed inside a covering part makes it possible to have an inside section of the container that is relatively small compared to the outside dimensions of the container, and to use an applicator element that does not have a diameter that is greater than the diameter of conventional applicator elements, while having a small amount of clearance, or even zero clearance, between the applicator element and the inside surface of the container.

The body 2a may be made by being molded integrally with a neck 11, in particular a threaded neck, that may support the wiper member 8.

As shown, the body 2a may be made with a collar 119 that is used to fasten it in the covering part 2b, e.g. by snap-fastening.

The body 2a may have a constant inside section over the major fraction of its length, e.g. a circular section. The bottom of the body 2a may have a spherical cup shape.

Figure 43 shows the possibility of using the covering part 2b as a bottom for the reservoir-forming body.

By way of example, the covering part 2b may include a bottom portion 301 that is provided with an annular sealing lip 302 that may bear against the inside surface of the bottom portion 303 of the body 2a. The bottom portion 301 may be of any shape, flat or rounded, as shown in Figure 43.

The body 2a may be molded integrally with the wiper member 8 that is in the form of an annular lip projecting from the inside surface of the body 2a in the proximity of its top opening, for example.

In a variant, the wiper member 8 is a separate part that is fastened on the body 2a or on the body 2b, for example. The covering part 2b may be fastened on the body 2a by any means, e.g. by snap-fastening, snap-fastening possibly taking place, for example, in the bottom part of the body 2a or in the top portion as shown. Where appropriate, the body 2a may be made as shown in Figure 43 with a collar 119 against which the covering part 2b may axially come into abutment.

The inside surface of the container is preferably smooth, but it may also present portions in relief.

Figure 44 shows an embodiment in which the body 2a may be made with a bulbous portion 320 adjacent to the opening of the container, which bulbous portion makes it possible, for example, to use a wiper member having an inside section that is greater than when there is no bulbous portion 320, so as to make it easier for the applicator element to pass. The wiper member may be held in place inside the container using various means, and may be snap-fastened on the body 2a, for example. In particular, the bulbous portion 320 may be obtained by injection blow molding.

Figure 45 shows the possibility of making the body with a main portion 323 that may be obtained by injection blow molding with an inside section that is larger than the section of the body 2a in the portion 325 receiving the wiper member 8. In the embodiments in Figures 44 and

45, the covering part is fastened on the body 2a in various ways, and, for example, by means of ribs 328 made with the covering part 2b coming to clamp the body 2a.

The inside surface of the container may, as shown in Figures 46A and 47, include a plurality of grooves 23a that are longitudinal and that are, for example, parallel to the longitudinal axis of the container, separated by portions 23b of smaller diameter that are situated at a shorter distance from the envelope surface E of the applicator element 5 when said applicator element is in the container, and in particular at a distance m that is less than or equal to 1.5 mm, whereas the distance n between the envelope surface E and the bottom of a groove 23a is greater for example, and in particular may be greater than or equal to 2 mm, or even greater than or equal to 2.5 mm or 3 mm.

Each portion (or sector) 23b may extend over a corresponding angular area α_i about the longitudinal axis of the container, and the sum of all of the angles α_i may be greater than 90°, better greater than 120°, or even greater than 180° or 210°, so that the applicator element stirs the composition contained in the container in spite of the presence of the grooves 23a.

Figure 46B shows a container having grooves that are more pronounced than in the embodiment in Figure 46A, and Figure 46C shows an embodiment with three grooves 23a that are separated by sectors 23b that are also three in number, the sum of the angles $\alpha_1 + \alpha_2 + \alpha_3$ corresponding to a total angular extent of about 270°.

Figure 48 shows the possibility of having a stem fitting in a housing of the closure cap 3. By way of example, the mounting portion of the stem is force-fitted, snap-fastened, or fastened in some other way on the closure cap.

The device 1 may be made in such a manner that the applicator element 5 is movable relative to the container 2 between a retracted position, shown in Figure 49, and

an extended position, shown in Figure 50, without the applicator element 5 being separated from the container 2.

The device 1 may include an applicator 3 having, at one end, a movable portion 90 that is suitable for being moved by the user relative to the container 2 against the action of a resilient return member 100.

A locking system 105 makes it possible to block the applicator in the extended position until an unlocking action is exerted by the user.

By way of example, the locking system 105 includes a tab that becomes snap-fastened in a corresponding recess 106 of the container 2.

A chamber 110 is defined inside the container 2 for containing the composition P.

By way of example, the container 2 may include a wiper member 115 that is molded integrally with the container 2 or that is formed by a member fitted on the container.

A partition 117 separates the chamber 110 from the compartment containing the resilient return member 100, the partition 117 being passed through in leaktight manner by the stem 4.

A closure cap 120 may close the outlet orifice 13 when the applicator element is in its retracted position inside the container 2.

When the applicator element is a brush, it is possible to use, for the brush, bristles 16 having different shapes in cross-section, without going beyond the ambit of the present invention. All of the bristles of the brush may have the same section, or the brush may include a number of bristles having different characteristics, in particular different sections.

Figures 51 to 66 show examples, amongst others, of possible sections for the bristles 16 of the brush.

The bristles may present a solid circular section as shown in Figure 51, a hollow circular section as shown in

Figure 52, a hollow polygonal section as shown in Figure 53, e.g. a hollow triangular section. The bristles 16 may also present a hollow star-shaped section as shown in Figure 54, a multi-lobed section that may be solid as shown in Figure 55, a flat section as shown in Figure 56, an oval section as shown in Figure 57, an angle section as shown in Figure 58, an H-shaped section as shown in Figure 59, a dumbbell-shaped section as shown in Figure 60, a solid triangular-shaped polygonal section as shown in Figure 61, a square section as shown in Figure 62, a pentagonal section as shown in Figure 63, a semi-circular section as shown in Figure 64, a trapezoidal section as shown in Figure 65, or even a U-shaped section as shown in Figure 66.

The invention is not limited to the embodiments described above.

For example, all of the above-mentioned twisted-core brushes may be replaced by injection-molded brushes.

The bristles or other projecting elements may be flocked.

For bristles fitted on a core, said core may be other than a twisted core, and by way of example, the bristles may be stapled, injection-molded, or heat-sealed on the core, or they may be held by stamping the core.

When the applicator element is a twisted-core brush, the diameter of the bristles may lie in the range 0.08 mm to 0.36 mm, better in the range 0.13 mm to 0.35 mm.

When the applicator element is an injection-molded brush, the bristles, also known as teeth, may present various cross-sections, e.g. as shown in Figures 51, 56, 57, or 61 to 66. By way of example, the injection-molded brush is made of elastomer of any of the following type: nitrile rubber; silicone rubber; ethylene-propylene-diene terpolymer (EPDM); butyl rubber; styrene-ethylene-butylene-styrene (SEBS); Hytral®; polyvinyl chloride (PVC); Pebax®; ethyl vinyl acetate (EVA); amongst others.

The bristles may have bases that are optionally aligned, and they may form between them V shapes when the brush is observed along its longitudinal axis, or in a variant, when viewed perpendicularly to its longitudinal axis. The greatest transverse dimension of the bristles at their base lies in the range 0.25 mm to 0.6 mm.

The applicator element may include a twisted portion. The twisted portion may present an angular offset between its distal and proximal ends that may be relatively small. The term "angular offset" means the angle through which the major axis of the cross-section turns between said ends. The twisted portion may be twisted in the clockwise or counterclockwise direction, or both over two respective consecutive portions.

The expression "comprising a" should be understood as being synonymous with "comprising at least one".

CLAIMS

1. A packaging and applicator device (1) comprising:

· an applicator comprising an applicator element having a length and defining an envelope surface (E) of cross-section that varies, passing through at least one maximum; and

· a container containing a composition for application to human keratinous materials, the container defining an internal space containing the composition, the space being of height that is at least twice the length of the applicator element; the maximum cross-section of the envelope surface of the applicator element occupying at least 70% of the inside section of the internal space of the container containing the composition, at least along a portion of the path over which the applicator element travels while it is being removed from the container, the portion being of height that is at least equal to twice the length of the applicator element, the composition being able to flow relative to the applicator element from a zone located below the applicator element to a zone located above the applicator element, and *vice versa*.

2. A device according to claim 1, the applicator element traveling at least three times its length while being removed from the container.

3. A device according to claim 1 or 2, the quantity of composition contained in the container being greater than the volume defined by the envelope surface of the applicator element.

4. A device according to any one of claims 1 to 3, the length (L_b) of the applicator element being less than or equal to 25 mm.

5. A device according to any one of claims 1 to 4, the length of the applicator element being less than or equal to 15 mm.

6. A device according to any one of claims 1 to 5, the length of the applicator element being less than or equal to 12 mm.

7. A device according to any one of claims 1 to 6, the applicator element having an envelope surface that is axially symmetrical.

8. A device according to any one of claims 1 to 7, the applicator element having an envelope surface that is circularly symmetrical.

9. A device according to any one of claims 1 to 8, the applicator element having a core that is rectilinear.

10. A device according to any one of claims 1 to 9, the envelope surface of the applicator element being spherical, oval, frustoconical, or biconical.

11. A device according to any one of claims 1 to 10, the applicator element being movable at a distance from the inside surface of the container that is zero or for which $|D_r - D_b| \leq 3$ mm over the major portion of the height of the inside space of the container, where D_r designates the greatest inside diameter of the container in its portion over which the applicator element travels, and D_b designates the greatest transverse dimension of the applicator element.

12. A device according to any one of claims 1 to 11, the length (L_p) of the region of the applicator element that is situated at less than 1.5 mm from the inside

surface of a side wall of the container, being less than or equal to 5 mm.

13. A device according to any one of claims 1 to 12, the greatest transverse dimension of the envelope surface of the applicator element being at least 0.85 times the inside diameter of the side wall of the container.

14. A device according to any one of claims 1 to 13, the applicator element being a twisted-core brush.

15. A device according to any one of claims 1 to 13, the applicator element being an injection-molded brush.

16. A device according to any one of claims 1 to 15, the cross-section of the envelope surface of the applicator element passing through a maximum remote from the proximal and distal ends of the applicator element.

17. A device according to any one of claims 1 to 16, the applicator element being turnable relative to a pin that carries it.

18. A device according to any one of claims 1 to 17, the container comprising a bulbous bottom portion and a side wall above the bulbous portion, the side wall being of smaller inside section, the bristles of the applicator element not being constrained by the bulbous portion.

19. A device according to any one of claims 1 to 18, the length of the region of the applicator element extending at a distance from a side wall of the container that is less than or equal to 0.075 times the greatest inside diameter of the side wall, being

less than or equal to half the length of the applicator element.

20. A device according to any one of claims 1 to 19, comprising a wiper member.

21. A device according to claim 1, the composition being a liquid.

22. A device according to any one of claims 1 to 21, the applicator element being at a same distance from a bottom of the container between first use and last use of the container, in storage configuration.

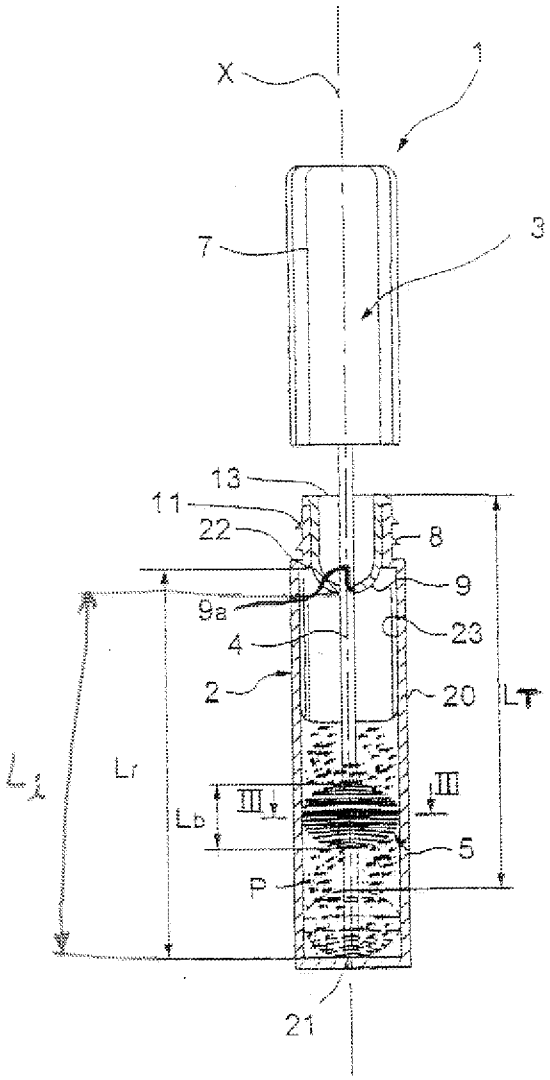

Fig.1

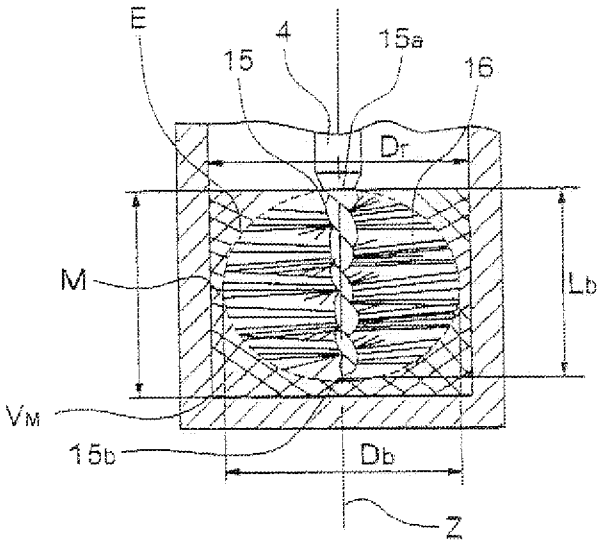

Fig.2

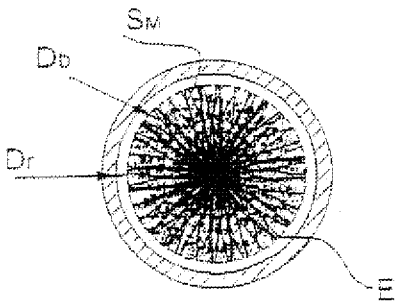

Fig.3

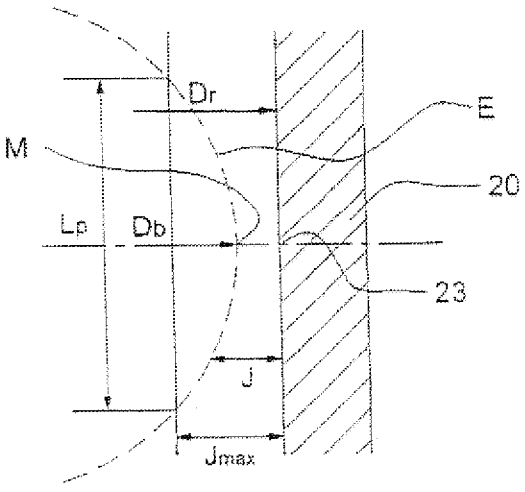

Fig.4

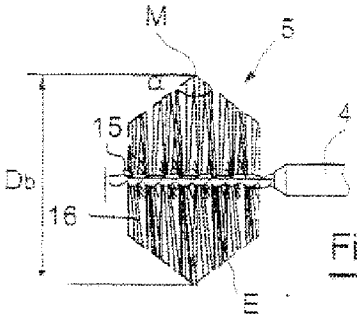

Fig.5 A

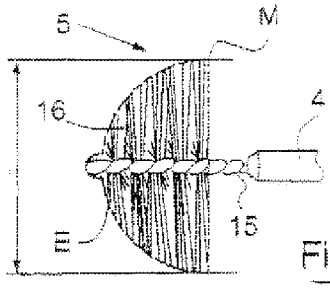

Fig.5 B

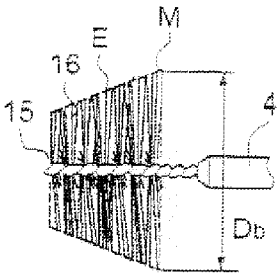

Fig. 5C

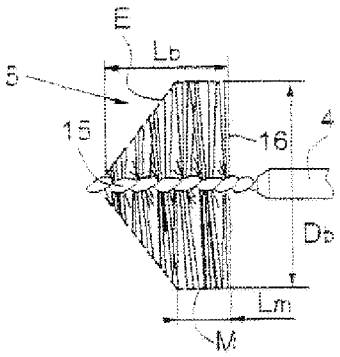

Fig.5 D

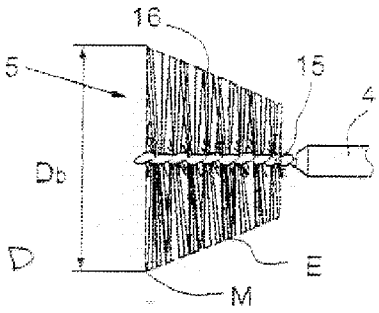

Fig.5 E

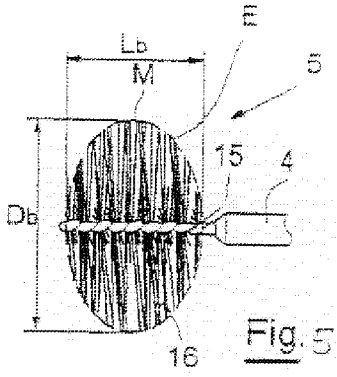

Fig. 5F

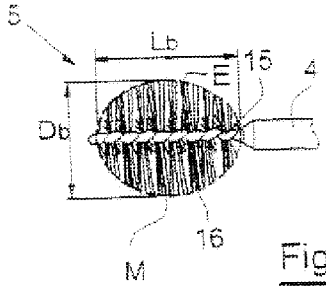

Fig. 5G

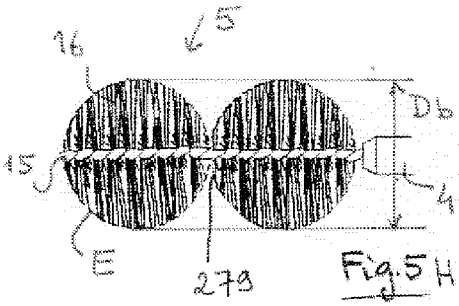

Fig.5 H

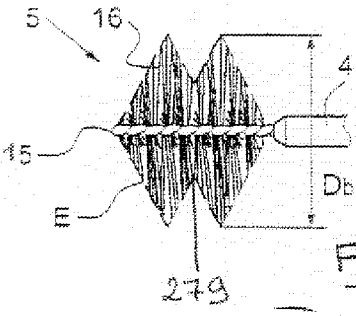

Fig 5I

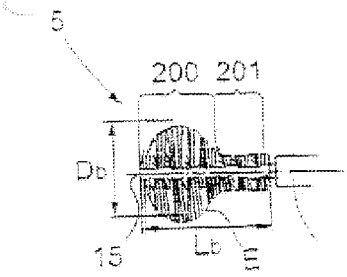

Fig. 5 J

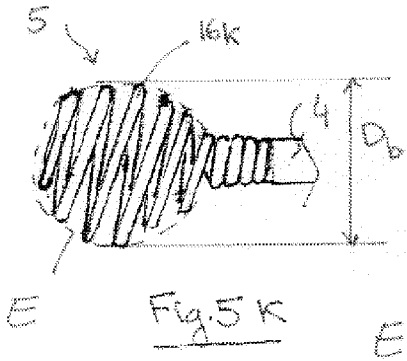

Fig.5 K

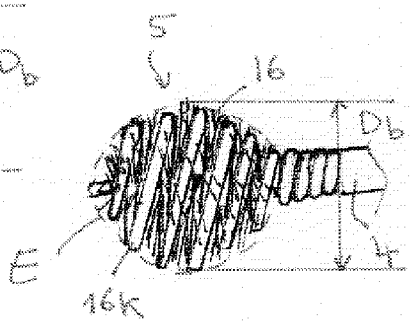

Fig.5 L

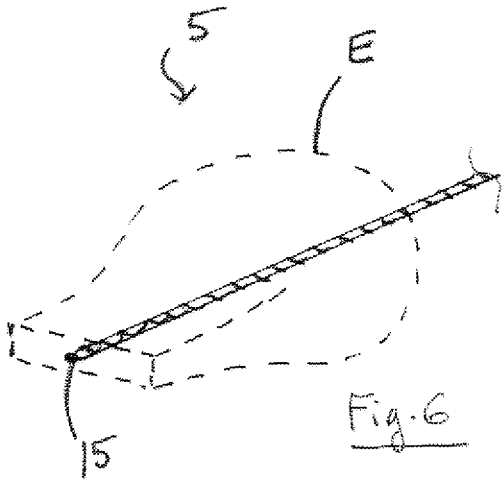

Fig.6

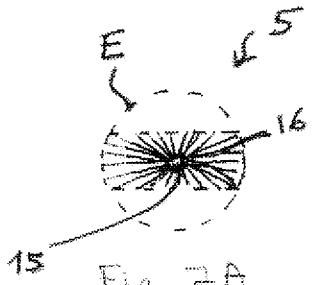

Fig.7A

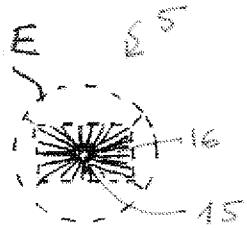

Fig.7B

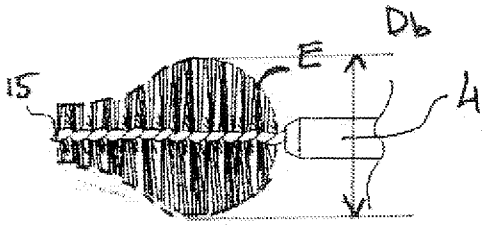

Fig.8A

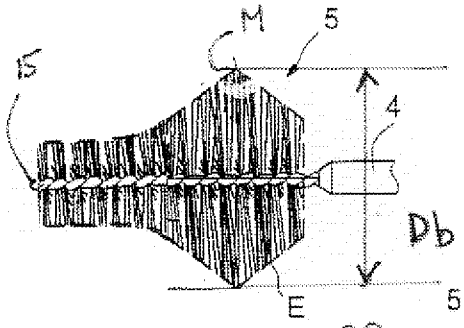

Fig.8B

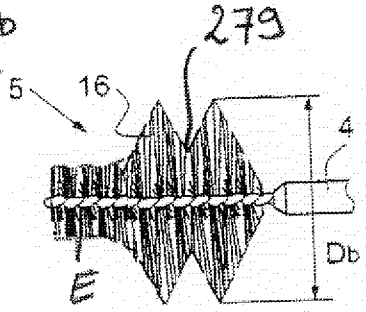

Fig8C

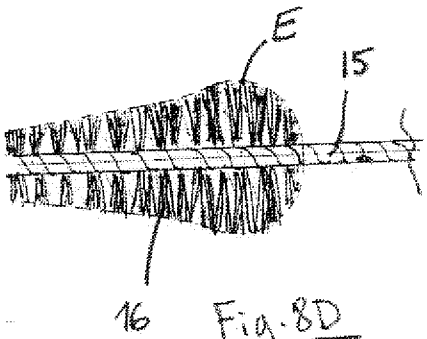

Fig.8D

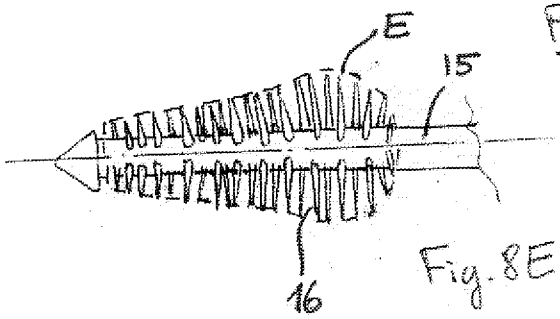

Fig.8E

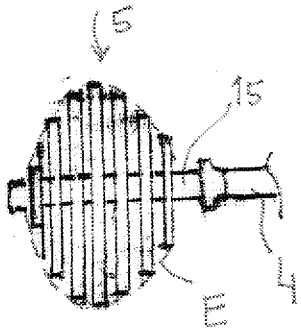

Fig.8F

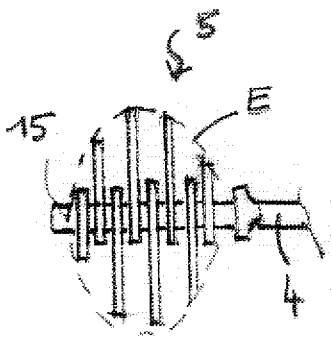

Fig.8G

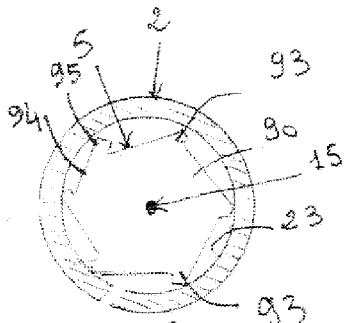

Fig. 9A

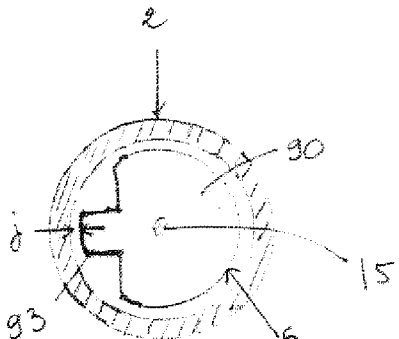

Fig. 9B

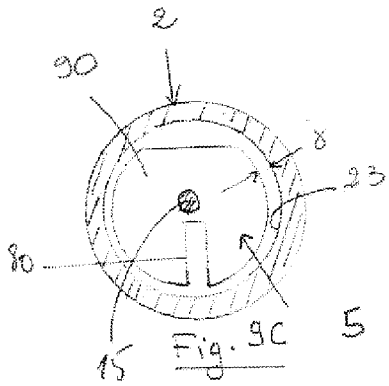

Fig. 9C

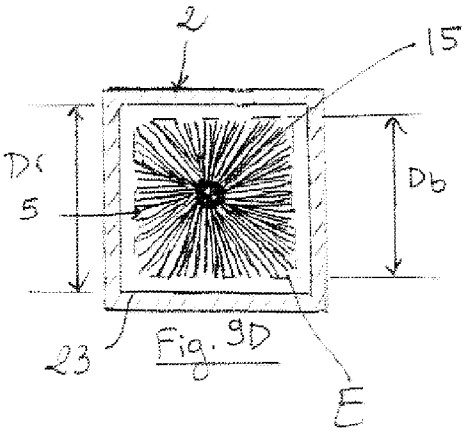

Fig. 9D

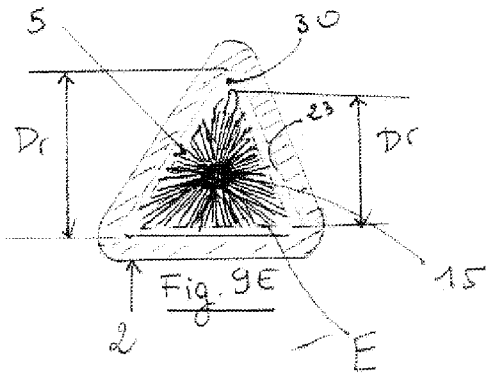

Fig. 9E

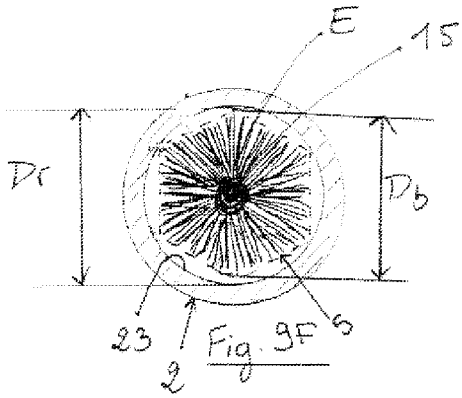

Fig. 9F

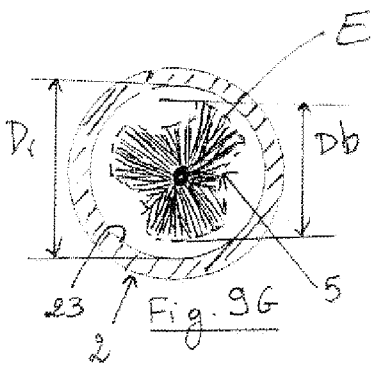

Fig. 9G

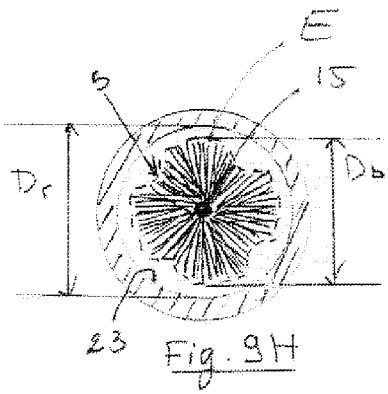

Fig. 9H

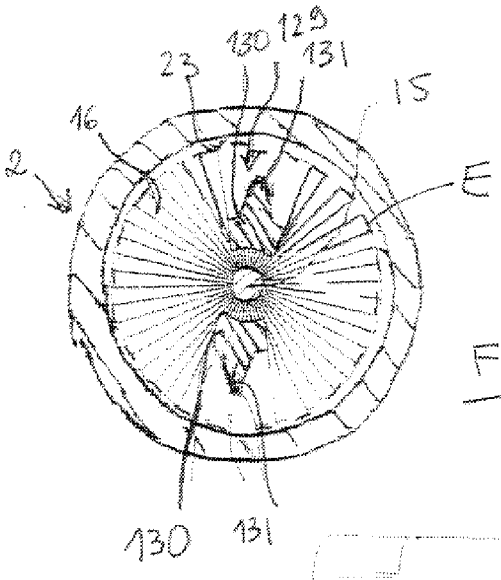

Fig.10

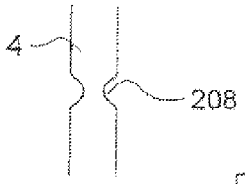

Fig.12A

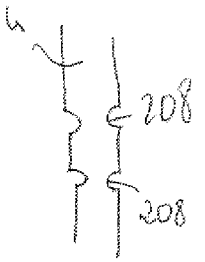

Fig.12B

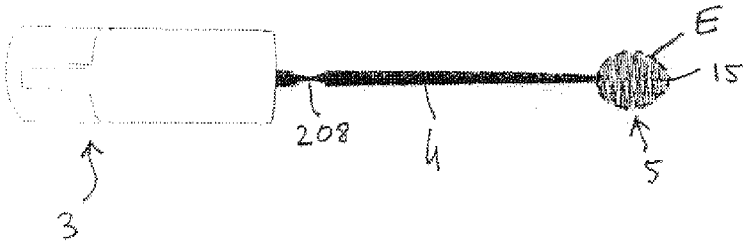

Fig. 11A

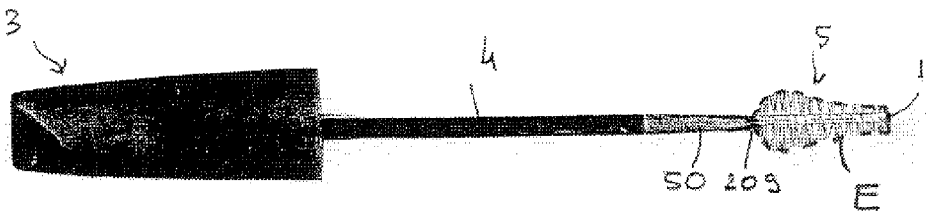

Fig. 11B

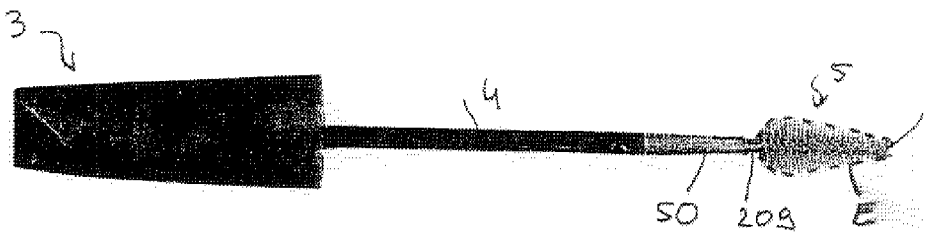

Fig 11C

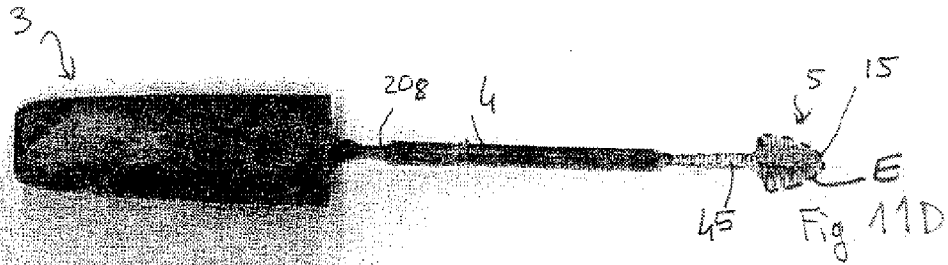

Fig 11D

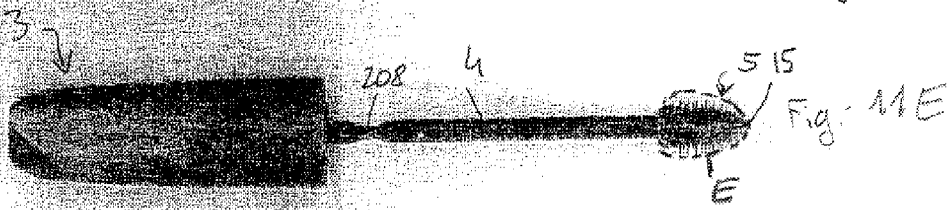

Fig. 11E

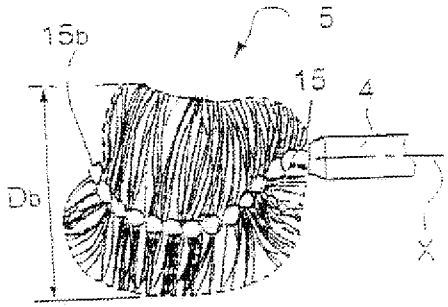

Fig.13

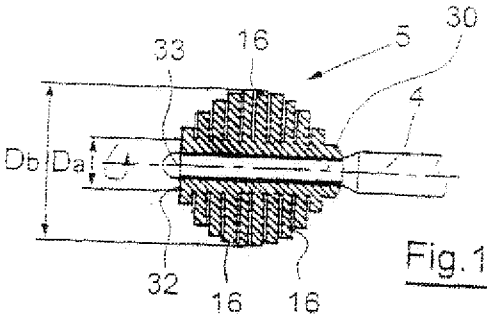

Fig.15

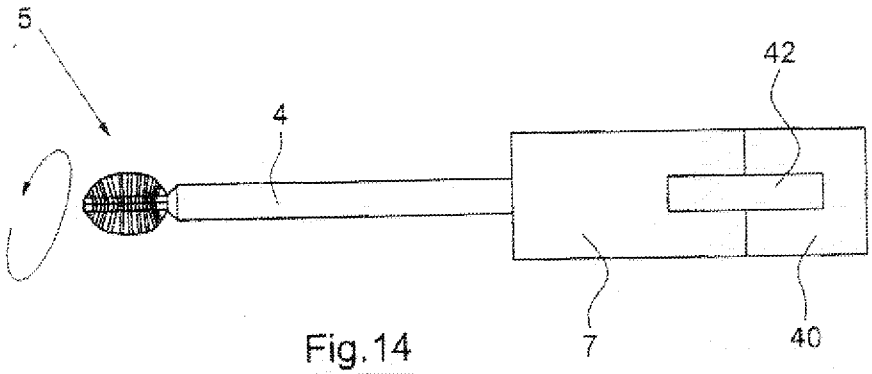

Fig.14

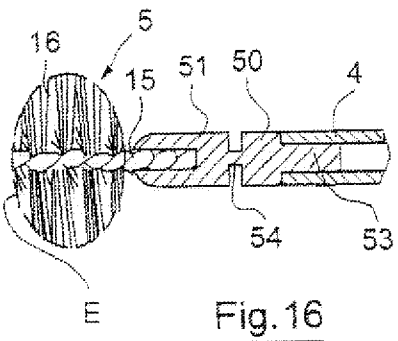

Fig.16

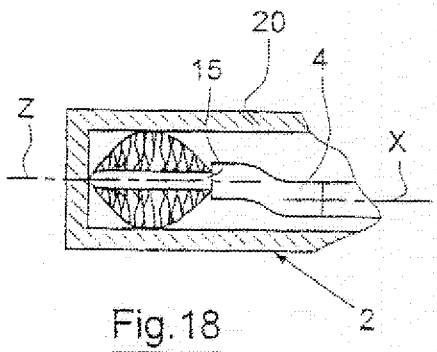

Fig.18

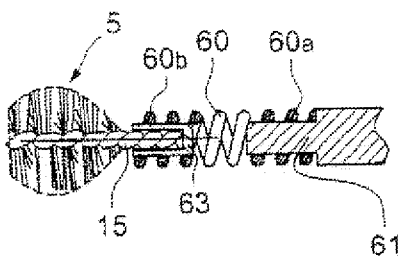

Fig.17

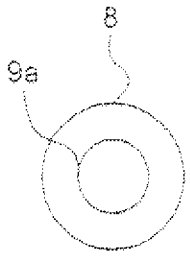

Fig.19

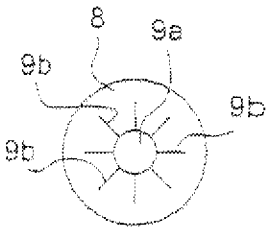

Fig.20

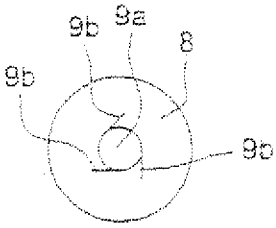

Fig.21

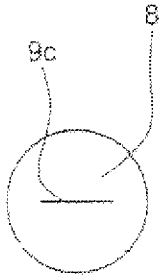

Fig.22

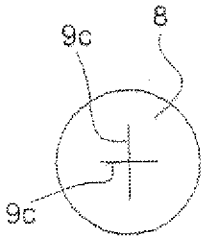

Fig.23

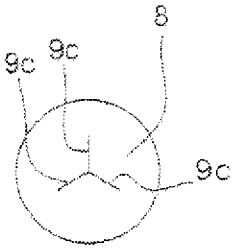

Fig.24

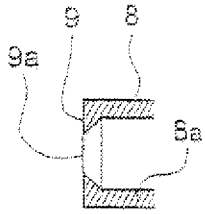

Fig.25

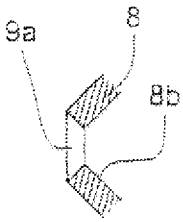

Fig.26

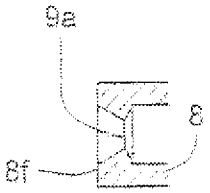

Fig.27

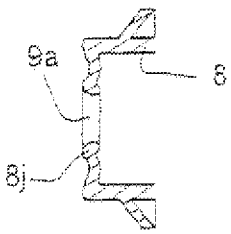

Fig.28

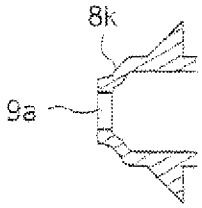

Fig.29

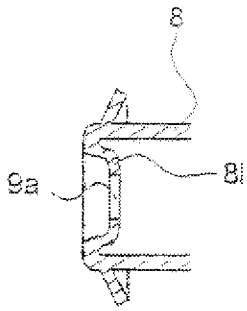

Fig.30

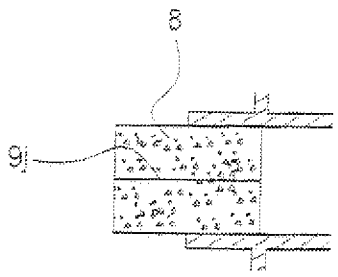

Fig.31

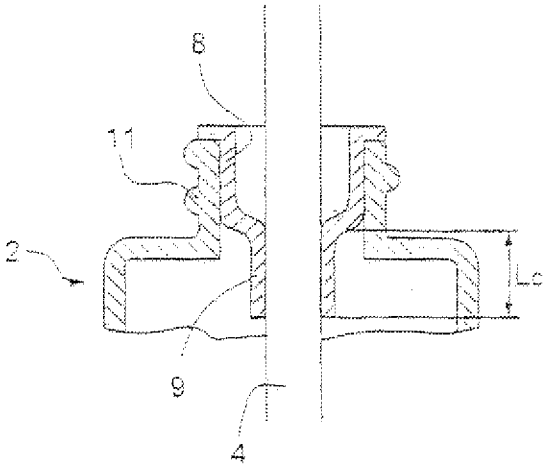

Fig.32

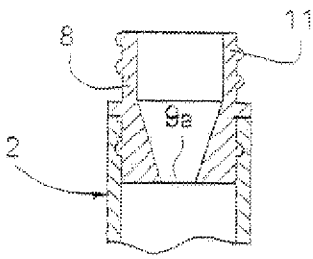

Fig.33

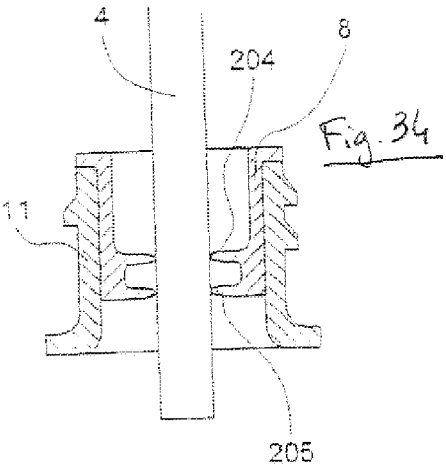

Fig. 34

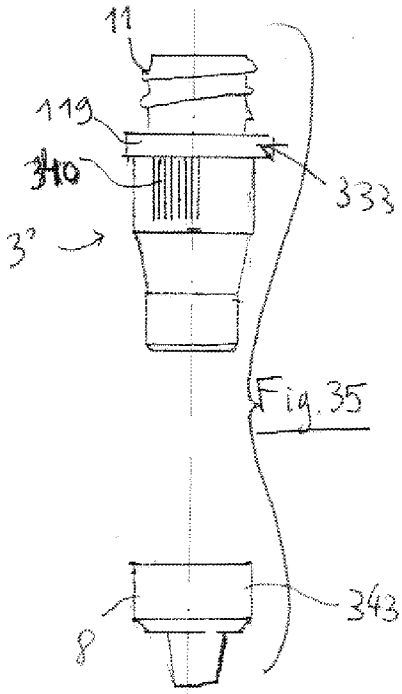

Fig. 35

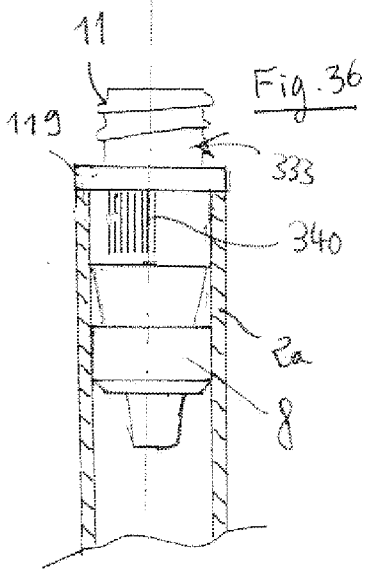

Fig. 36

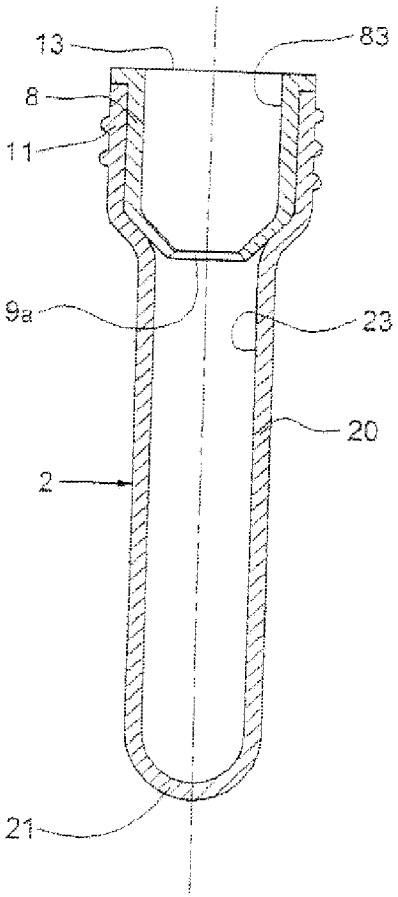

Fig. 37

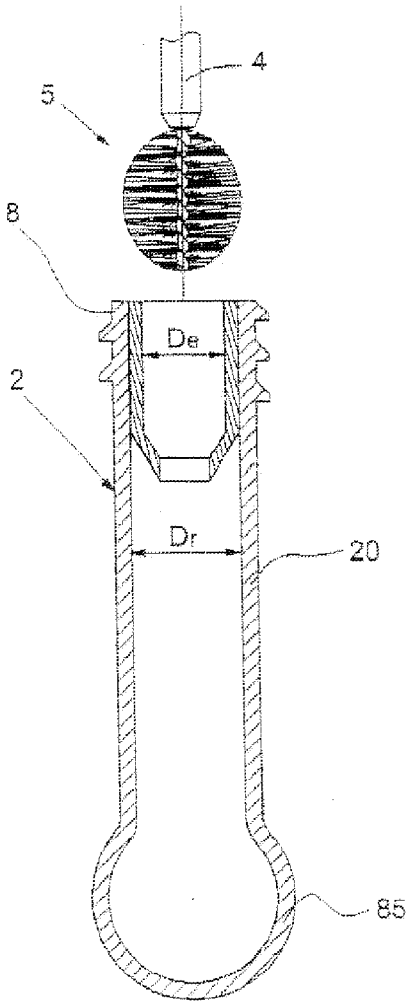

Fig. 38

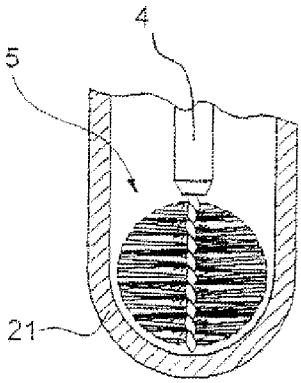

Fig. 39

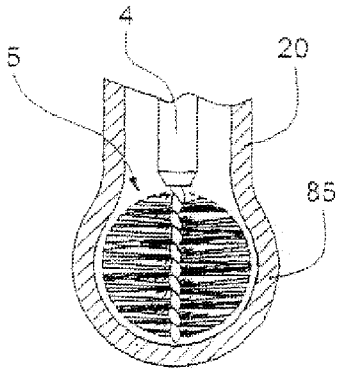

Fig. 40

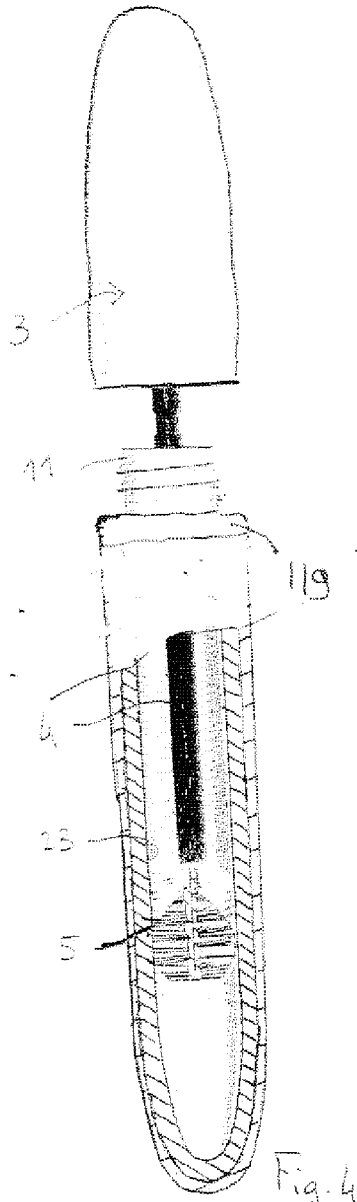

Fig. 42

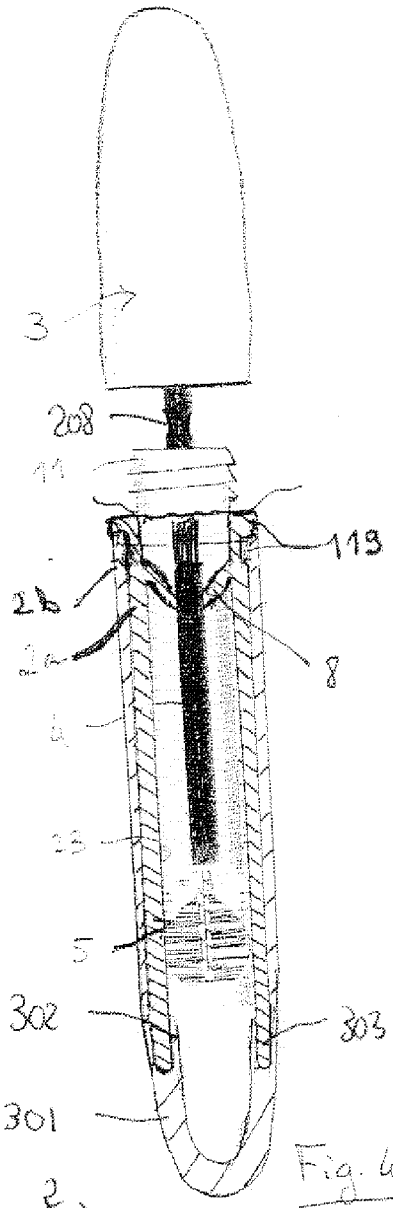

Fig. 43

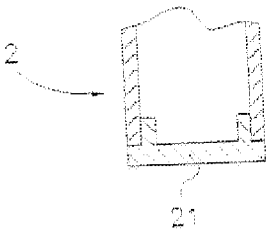

Fig. 41

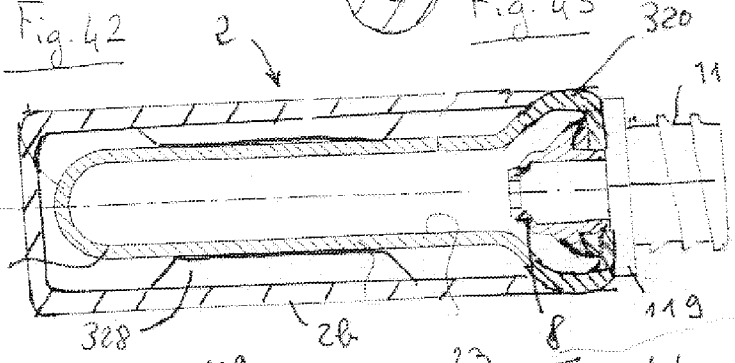

Fig. 44

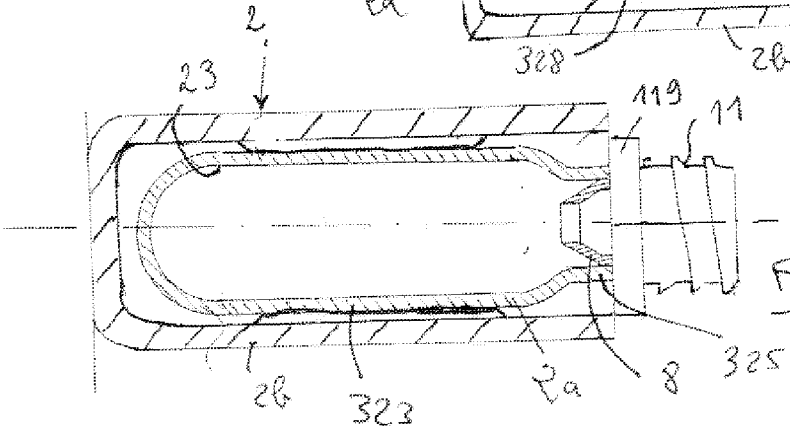

Fig. 45

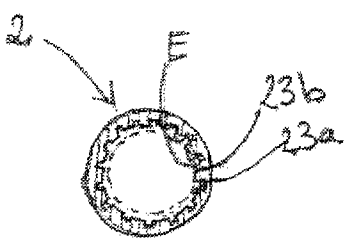

Fig. 46 A

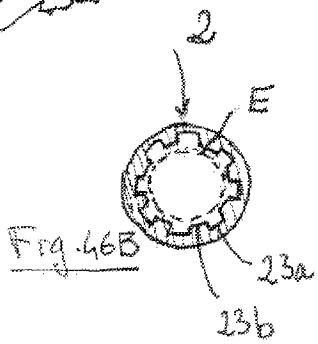

Fig. 46B

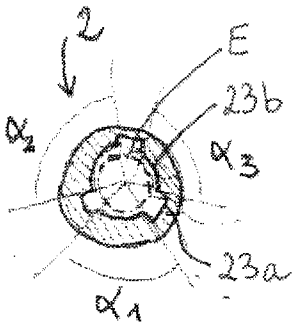

Fig. 46C

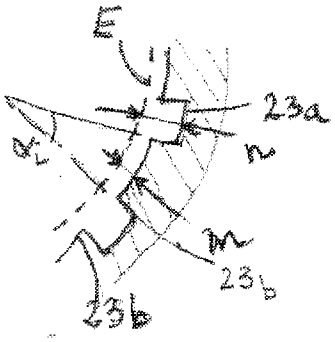

Fig. 47

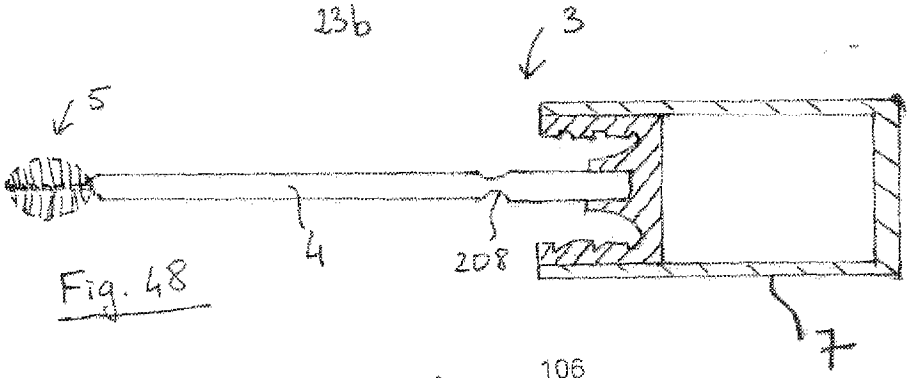

Fig. 48

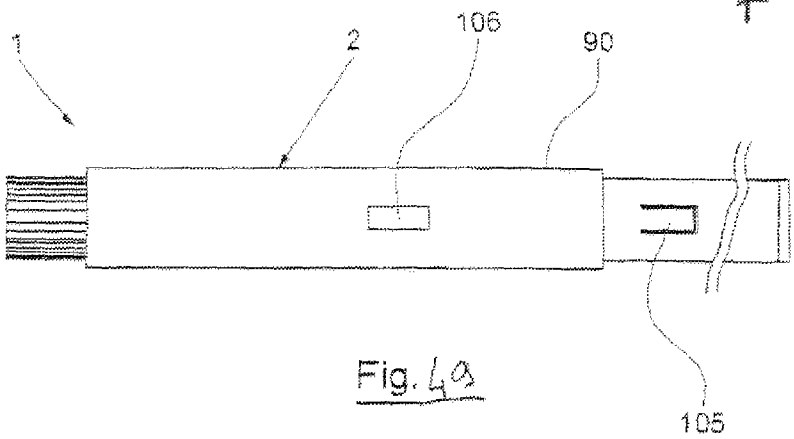

Fig. 49

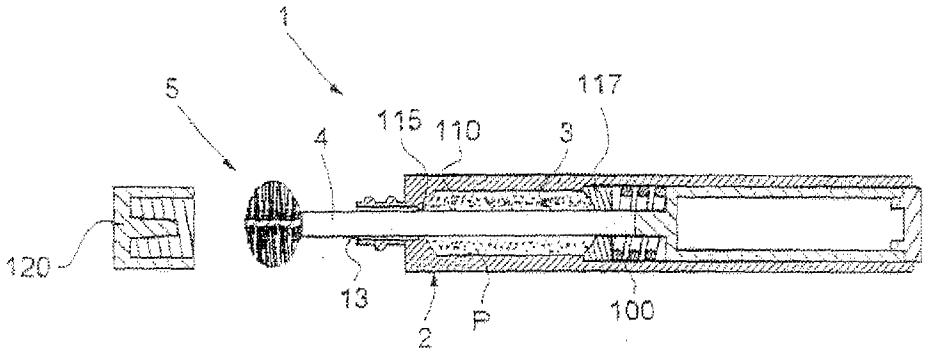

Fig. 50

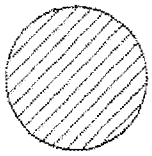

Fig. 51

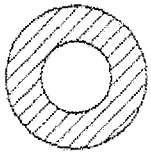

Fig. 52

Fig. 53

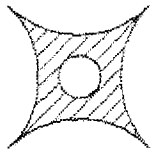

Fig. 54

Fig. 55

Fig. 56

Fig. 57

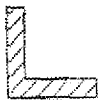

Fig. 58

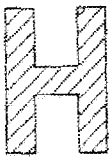

Fig. 59

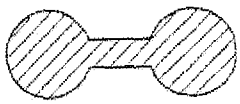

Fig. 60

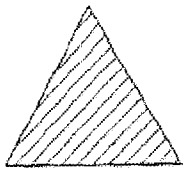

Fig. 61

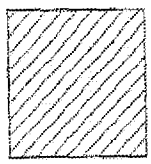

Fig. 62

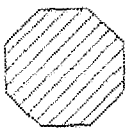

Fig. 63

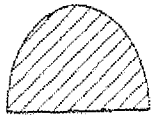

Fig. 64

Fig. 65

Fig. 66

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2009/052612

A. CLASSIFICATION OF SUBJECT MATTER
INV. A45D40/26 A45D34/04 A46B9/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A45D A46B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	WO 2009/125345 A2 (OREAL [FR]; GUERET JEAN-LOUIS [FR]) 15 October 2009 (2009-10-15) page 1, lines 3-5; figures 1,61 page 14, lines 6-16 page 29, line 31 - page 30, line 30	1,4-11, 14,16, 20-21
X	GB 2 432 513 A (LANE MELINDA SUE [GB]) 30 May 2007 (2007-05-30) page 1, lines 3-5; figure 7 page 7, line 28 - page 8, line 4 page 9, lines 26-28	1-22
A	FR 2 840 166 A (TECHPACK INT [FR]) 5 December 2003 (2003-12-05) page 1, lines 7-10; figures 2,6a,6b,7 page 5, line 27 - page 6, line 27 page 10, lines 1,2	1-13, 16-17, 19-22

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 October 2009	05/11/2009

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Escudero, Raquel

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2009/052612

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2009125345 A2	15-10-2009	FR 2929495 A1	09-10-2009
GB 2432513 A	30-05-2007	EP 1951083 A2	06-08-2008
		WO 2007060438 A2	31-05-2007
		US 2009226238 A1	10-09-2009
FR 2840166 A	05-12-2003	US 2004028455 A1	12-02-2004