A composition comprising keratinous fibres, and the length of the fibres (F) being between 3 and 40 mm.

**Title**: ELEMENT FOR APPLYING FIBRES TO HUMAN KERATINOUS FIBRES

**Abstract**: The present invention relates to an element (20) for the application of fibres (F) to human keratinous fibres, comprising fibres (F) held together in a predefined way by first joining means (F1) and second joining means (F2), spaced apart from one another, along a given fibre (F), said first joining means comprising an adhesive composition in liquefiable solid form, the liquefying of said composition on application making it possible for at least a part of the fibres (F) to come into adherent contact with said keratinous fibres, and the length of the fibres (F) being between 3 and 40 mm.
Element for applying fibres to human keratinous fibres

The present invention relates to cosmetic treatments which make it possible to modify the appearance of human keratinous fibres, more particularly but not exclusively the eyelashes. The invention is targeted in particular at physically lengthening the eyelashes.

**Background**

Generally, users of mascara wish to render their eyelashes more visible by lengthening and/or thickening.

The principle of the majority of existing products consists in forming a thick and coloured deposit layer and also in shaping the eyelashes. The made-up eyelashes are thus thicker, more coloured and more curved.

Mascaras have been proposed which include, in the composition, fibres of a few millimeters. The fixing of the fibres at the end of the eyelashes is random and the result is not sufficiently effective as it is often scarcely visible.

Another approach consists in adhesively bonding "false eyelashes" to the eyelid or in adhesively bonding small tufts of a few fibres. This introduces a true transformation of the eyelashes and of the fringe in its entirety but requires a highly professional touch which limits its use on a daily basis. Furthermore, the result is often perceived as being too artificial to be worn every day.

The proposal has also been made to form extensions by hot spinning a material. This route provides a very great physical lengthening which is judged to be more natural.

However, this approach is not entirely satisfactory for producing long extensions.

Application WO 2006/037904 A1 describes the use of a composition comprising a magnetic filler and the formation of extensions by exposing the composition to a magnetic field at the end of the eyelash.

Application US 2007/0286831 discloses a mascara applicator which comprises a heating part and in which the product is provided in the form of bars or beads deposited on the heating part when the latter is in a housing. Feed means comprising a piston, a
cylinder or an endless screw are provided in order to bring the product onto the heating part.

Application EP 1 621 101 describes an applicator comprising mascara which is provided in the form of a wound band which a user can bring into contact with a heating means of the applicator.

Application EP 1 955 610 discloses an applicator tip comprising a composition for making up the eyelashes, fitted by push-fitting onto a heating support exhibiting a finger shape, the product extending over the entire circumference of the applicator tip.

Application WO 2006/043544 reveals a device for application of a cosmetic product, comprising a unit fitted to a region for receiving a base facing a heating means and receiving the product to be applied once in place on the base.

The problem of the lengthening of the eyelashes is longstanding and, to date, the solutions provided are not suitable for the achievement of significant lengthening, in a simple and rapid way, without requiring a hand movement which is difficult to reproduce.

Furthermore, another problem is that the outcome of lengthening using straight fibres added to the eyelashes may be unattractive if the user herself has stiff eyelashes.

Another aim of the invention is therefore to allow attractive attachment of fibres to the eyelashes, and more particularly of curved fibres, in an appropriate orientation relative to the eyelashes on which these fibres are to be sited.

**Summary**

The invention is targeted at meeting this need and it manages this by virtue of an element for the application of fibres, preferably curved fibres, for addition to keratinous fibres, more particularly human keratinous fibres, such as the eyelashes, comprising fibres [F] held together in a predefined way by first joining means and second joining means, spaced apart from one another, along a given fibre (F), said first joining means comprising a liquefiable adhesive composition in solid form, the liquefying of the adhesive composition on application making it possible for at least a part of the fibres to come into adherent contact with said keratinous fibres.

By "liquefiable" is meant a composition which is in the solid state at ambient temperature (25°C) and atmospheric pressure, but is capable of being fluidified, and more particularly liquefied, in response to a change in condition, and in particular to a specific
stimulus, for example a physical stimulus, such as a thermal stimulus, or a chemical
stimulus.

By "come into adherent contact" is meant that the added fibres can be sited
fixedly on part of the length of the keratinous fibres (overlapping) or that the added fibres
can have a respective free end which is sited fixedly end to end in contact with one
another, or else that the adhesive composition may form a join between the added fibres
and the keratinous fibres, positioned end to end, with a space between these fibres filled by
said liquefied or resolidified adhesive composition.

These first and second joining means thus form a respective link connecting a
plurality of fibres to one another over a first respective length and a second respective
length of the fibres. These first joining means integrally connect at least two separate fibres
to one another, preferably all of the fibres. These second joining means integrally connect
at least two separate fibres to one another, preferably all of the fibres. Preferably, with
regard to the length of the fibres, the first joining means extend over a first half of the
fibres constituting the element, and the second joining means extend over a second half of
the fibres constituting the element. Preferably, the first joining means extend at the height
of or close to a first end, referred to as the proximal end, of said fibres, and the second
joining means extend at the height of or close to a second end, referred to as the distal end.

By "proximal end" is meant the end intended to be closest to the keratinous
fibres when said element is in mounted position on said keratinous fibres. In other words, it
is the end intended to be sited in contact, or in alignment, with said keratinous fibres.

By "distal end" is meant the end furthest from the keratinous fibres when said
element is in position mounted on said keratinous fibres. In other words, it is the free end
of said fibres constituting said element when said element is in position mounted on the
keratinous fibres.

The first and second joining means connect at least two fibres, or two strands
of fibres, to one another.

The first and second joining means are preferably present in the form of a band
or a thread, each extending, preferably with interruption (or continuously), through the
fibres. The first and second joining means extend substantially parallel to one another.

The first and second joining means are advantageously carried by said fibres.
These first and second joining means delimit a through-orifice between two subsequent fibres. The first and second joining means are at a distance from one another. With a configuration of this kind it is possible on the one hand to facilitate the siting of fibres, both straight and curved, and on the other hand, in the presence of curved fibres to be sited, to limit, or even prevent, any possibility of pivoting of one fibre relative to another during application of these fibres to said keratinous fibres.

The reason is that the first joining means form means of adhering the fibres to the human keratinous fibres, while the second joining means allow the movements of fibres to be locked when they are sited on the keratinous fibres. This technical feature is particularly advantageous since the liquefying of the first joining means by heating means may tend, in the course of their softening, to cause the fibres to pivot relative to one another and also relative to the human keratinous fibres; these second joining means, however, guarantee a unitary structure which on the one hand will prevent any displacement of one fibre relative to another and on the other hand will limit, or even prevent, any movement of the fringe of fibres relative to the human keratinous fibres.

By liquefying the adhesive composition prior to or subsequent to application, the invention allows the fibres to be detached from the support and to be adhesively bonded to said human keratinous fibres by means of a simple hand operation, in order to achieve a result which is both very effective in terms of lengthening and/or curving, and also very attractive.

Said second joining means may be different in nature and/or composition from said first joining means. The second joining means may take the form of a liquefiable solid composition, more particularly a solid composition which is hot-meltable or dissolvable by solvent. Such a composition may be identical to, but preferably is different from, the adhesive composition employed to form the first joining means.

According to one particular embodiment, said second joining means may be realized by pressing or immersing said fibres onto a fluid substance which is capable of solidifying at ambient temperature, or by attaching a band of such a substance to said fibres. The first joining means may advantageously be sited on the fibres in the same way.

These second joining means may comprise a thread made, for example, of metallic, synthetic or natural material, optionally held by means of an adhesive, preferably a reversible adhesive, on said fibres to be added.
This metallic thread may be made, for example, of stainless steel.

This synthetic thread may be made, for example, of plastics material, and more particularly thermoplastics material, such as a nylon thread.

This natural thread may be made, for example, of flax.

Second joining means of these kinds are preferably sited on the fibres by means of an adhesive, as for example by means of a vegetable-based or synthetic adhesive, and advantageously a pressure-sensitive adhesive or PSA.

According to a first siting embodiment, this thread may be sited on the fibres by an adhesive for both the thread and the thread-adhesive combination that is added to the fibres, or, preferably, by an adhesive provided on the fibres, with the thread being subsequently added to the fibres provided with this adhesive.

According to a second siting embodiment, this thread may be sited on fibres coated beforehand with an adhesive band or with glue dots.

This thread may be adapted to be withdrawn in one piece by the exertion of a pulling, advantageously after siting which adheres the first joining means to the keratinous fibres, by liquefying, for example by heating or dissolution, or else by breaking.

The element can be used to lengthen the eyelashes and/or to introduce fibres between the eyelashes and thereby to thicken the fringe for people with "gaps" in the fringe of eyelashes.

When it is desired to produce extensions, it is preferable to use fibres of a material and thickness in accordance with those of natural eyelashes. In the case of a thickening effect, it is possible to use eyelashes of a thickness and material equivalent to natural eyelashes or different, such as thicker fibres, fibres as tufts, fibres as zigzags, etc.

The first joining means may comprise or be composed of a hot-melt adhesive.

The fibres are positioned in a predefined way within the element by being, for example, individually positioned separated from one another, preferably substantially parallel to one another, or, in an alternative form, by being grouped together in bundles.

If appropriate, the user is provided with a cutting tool in order to cut the fibres to the desired length, before or after application.

In one embodiment, the fibres are orientated transversely, in particular substantially perpendicularly, to a longitudinal axis of the element.
In an alternative form, the fibres are orientated in a manner substantially parallel to a longitudinal axis of the element.

During application, the fibres are orientated substantially perpendicularly to the fringe.

The fibres can be coloured and/or made-up beforehand.

The length of the fibres is preferably greater than or equal to 3 mm, being, for example, between 3 and 40 mm, preferably between 4 and 30 mm, and more preferably between 5 and 15 mm. The fibres advantageously exhibit at least one apparent free end, that is to say projecting with respect to the element, for example emerging outside the adhesive formed by the first joining means.

The fibres can have substantially the same length. In an alternative form, the fibres can have different lengths.

The fibres can have substantially the same spacing. In other words, the fibres are positioned with a certain pitch over the element when they are bonded to the liquefiable adhesive in solid form formed by the first joining means. In an alternative form, the fibres can have a variable spacing within the element.

The number of fibres of an element is, for example, between 2 and 300, for example 10 to 200, for example 20 to 100, when the element is short in length. However, in the case of an element as a band, of greater length, the number of fibres can be higher.

The first joining means comprise an adhesive comprising a fatty substance chosen from hydrocarbon oils or silicone oils. The liquefiable adhesive composition formed by the first joining means may comprise or be composed of an adhesive chosen from hot-melt adhesives, preferably based on E/VA (ethylene/vinyl acetate) copolymer. The adhesive may comprise a fatty hydrocarbon substance, for example a paraffin, or a fatty silicone substance, for example a PDMS oil. The first joining means comprise a colouring agent. Very preferably, the liquefiable adhesive comprises a colouring agent advantageously chosen from iron oxides or carbon black.

In one alternative form, the adhesive composition may comprise or be composed of an adhesive which is dissoluble, more particularly in a water-soluble solvent.

The first joining means may exhibit one or more embossments which may help in the siting of the element on an application device and/or in the distinguishing of the elements from one another.
In one embodiment, the first joining means form a self-supporting sheet. In other words, the fibres are rendered integral with one another by these first joining means.

When the first joining means form a self-supporting sheet, the fibres may be present over a length of the element of less than or equal to 10 cm, in particular of less than or equal to 6 cm and, for example, of between 0.2 and 3 cm.

The element can further comprise a support on which the adhesive composition is present. This support can be covered on one face only with the adhesive composition or, in an alternative form, be completely embedded in the adhesive composition and then act as an internal frame.

Independently of or in combination with the above, the invention thus relates, according to another of its aspects, to a device for the application of fibres to human keratinous fibres, comprising:

- a support, and
- an element as defined above comprising fibres positioned in a predefined way and connected to the support by the above-defined liquefiable adhesive composition.

The support can be a rigid or flexible support, in particular a support as a band. At least a portion of the support can be embedded in the liquefiable adhesive composition and constitute a frame giving added strength.

The support can be porous or openwork.

The fibres can be positioned in a predefined way on the support, for example be positioned individually on the support, preferably substantially parallel to one another, or, in an alternative form, be grouped together in bundles on the support. The support can be delivered to the user with the fibres prepositioned on the support.

Preferably, the support comprises embossments which make it possible to keep the orientation of the fibres substantially constant with respect to the support once the adhesive composition has liquefied, during contact with the eyelashes. These embossments comprise, for example, ribs orientated parallel to the fibres.

The support can be ribbed, as mentioned above, and the fibres are then preferably positioned between the ribs, which can facilitate the application of the fibres to the eyelashes. The presence of ribs can also contribute to retaining the adhesive composition on the support.
The fibres may be positioned individually on the support. In an alternative form, the fibres are assembled in bunches on the support.

The fibres are preferably orientated transversely to a longitudinal axis of the support at a distance from its ends but, in an alternative form, the fibres are positioned at an end of the support, for example with an orientation parallel to its longitudinal axis.

The number of fibres positioned on the support is, for example, between 2 and 300, better still 10 to 200 and even better still 20 to 100.

The support can be coated with Hquefiable adhesive composition between the fibres. The length of the support coated with hquefiable adhesive composition can, for example, be between 1 and 40 mm, better still 2 to 30 mm, even better still 5 to 20 mm.

The device may comprise a heating tip, on which the support can be fixed detachably.

The element can be designed to come specifically into contact with the eyelashes of a right eye and/or of a left eye. Thus, the user can be provided with different elements for making up respectively the left eye and the right eye.

The element, comprising or not comprising a support, can comprise one or more markers indicating if it is intended to be brought into contact with the eyelashes of a right eye, or the eyelashes of a left eye.

A marker can, for example, be the colour of the support, in the case of an element comprising a support. In this case, an element designed for a right eye comprises a support colour which is different from that of an element designed for a left eye.

A marker can also comprise a design and/or one or more characters indicating, to the user, if the element is intended for the eyelashes of a right eye or of a left eye.

Two elements intended for left and right eyes can differ in the orientation of the fibres relative to the support and/or their positioning relative to the support.

A further subject of the invention, according to another of its aspects, is a combination comprising:

- an element as defined above, with or without support, and
- an application device comprising a liquefying region on which all or part of the element can be fitted.
The application device can comprise, when the adhesive composition is a hot-melt adhesive, a heating part, in particular a heating tip, on which the liquefying region is present.

The device and the element can be present initially in the same packaging. If appropriate, the packaging can comprise several elements, for example elements specific to the left or right eye and/or intended to provide different results.

The fibres can be positioned in an identical fashion on the different elements. In an alternative form, the packaging can comprise elements for which the fibres and/or their positioning differ.

For example, the elements can comprise shorter or longer fibres and the user can choose an element according to the makeup which she wishes to produce.

In one embodiment, the application device comprises, within it, a first storage region in which at least one element as defined above is stored.

This application device can additionally comprise a transfer mechanism which makes it possible to bring, to the liquefying region, all or part of an element present in the first storage region.

The element can, for example, be present in the storage region in a wound band form.

When the element is in the band form, the transfer mechanism can make possible a displacement of at least a portion of the element towards the liquefying region. This transfer mechanism can comprise an actuation means which transforms an action of the user into an incremental displacement of the element.

The application device can comprise a return circuit which makes it possible to bring, to a second storage region, all or part of an element present beforehand in the liquefying region. For example, in the case of an element as a band, the band can unwind in the first storage region and then be wound up in the second storage region, after passing through the liquefying region, where the fibres can leave the element in order to be applied to the eyelashes. In this case, the adhesive composition is carried by a support as a band.

The first storage region can be separate from the second storage region. In an alternative form, first and second storage regions are coincident, for example when the support is a band going round in a closed loop.
In another embodiment, a storage region comprising the element or elements may not be present within the application device but belong to a recharging device.

When it is necessary to place all or part of an element on the liquefying region, the recharging device may be integrally attached in temporary fashion to the application device.

The invention also relates to a cosmetic treatment method wherein:
- fibres of an element as defined above, with or without support, are brought into contact with eyelashes or other human keratinous fibres, preferably by performance of a slight rotation,
- the first joining means are liquefied,
- a part at least of the fibres is caused to adhere to the eyelashes or other human keratinous fibres, and
- the second joining means are eliminated.

This method can, in addition, comprise a stage which consists in modifying the appearance of the fibres by exposing them to a luminous, thermal or mechanical stimulus or by bringing them into contact with a third compound. This stage of modifying the appearance of the fibres can take place before, during or after the stage of adhesive bonding of the fibres to the keratinous fibres. It is possible in particular to modify the curvature, the length and the colour of the fibres, as will be described in detail below.

Such a method is very particularly suitable for the application of the fibres to the eyelashes.

The length of overlap between the eyelashes and the fibres is, for example, between 1 to 20 mm, better still 1.5 to 15 mm, even better still 2 to 10 mm.

The adhesive composition of the first joining means is preferably a hot-melt adhesive. The liquefying of the composition may in that case take place by heating the composition, by means, for example, of an application device comprising a heating means.

The second joining means are themselves advantageously adapted to be eliminated by withdrawal in one piece, liquefying or breaking.

The second joining means are advantageously liquefiable, and more particularly dissoluble or hot-meltable. The liquefying of the corresponding composition may then take place, as for the first joining means, by heating the composition, by means, for example, of an application device comprising a heating means.
When they are dissoluble, these second joining means may be dissolved using an organic solvent or a water-soluble solvent.

In an alternative form, these means may be made of a metallic or synthetic material, more particularly a plastic material.

When the element comprises a support, the latter can be separated from the heating means after application of the fibres to the keratinous fibres. The support may or may not be separated from the application device after the application of the fibres, according to the presence or absence of a second storage region, as mentioned above.

The invention also relates to a process for the preparation of an element as defined above, comprising the stages consisting in:

- choosing the fibres from one or more type(s) of fibres, preferably curved fibres,
- bringing the chosen fibres into contact with first joining means forming a liquefiable adhesive composition, preferably a hot-melt adhesive, in liquid form,
- allowing this adhesive composition to solidify, in order to obtain an element as defined above, with or without support, and
- connecting the fibres with the second joining means.

In this process, the installation of the second joining means could equally be done before the installation of the first joining means.

This allows the user to personalize an element with fibres of her choice, for example produced from her hair.

Another subject of the invention is a combination for preparing an element as defined above, comprising:

- one or more type(s) of fibres, and
- first joining means, forming a liquefiable adhesive composition, preferably a hot-melt adhesive,
- second joining means, optionally liquefiable, which are situated at a distance from the first joining means,

the fibres being intended to be brought into contact with the first and second joining means in order to form an element as defined above. The combination may comprise a means for positioning and keeping the fibres in a predefined orientation until the first and, where
appropriate, second joining means have solidified. The combination may comprise a
heating means for liquefying the first and, where appropriate, second joining means.

The invention also relates to a cosmetic treatment method, comprising the
stages consisting in:

- making available an element as defined above, with or without support,
- applying a mechanical and/or thermal stimulus to this element, in order to
  modify the shape thereof and to confer a persistent deformation on the
  fibres present within this element,
- positioning the element with the fibres thus deformed on a liquefying
  region of an application device, it being possible for the positioning to take
  place before or after the application of the mechanical stimulus,
- liquefying the adhesive composition and bringing the fibres into contact
  with the region to be treated, in particular the eyelashes, and
- eliminating the second joining means.

The application of the mechanical and/or thermal stimulus makes it
possible, for example, for an element having a given shape to conform to liquefying
regions of different geometry(ies).

The persistent deformation of the fibres can confer a bending effect on the
eyelashes and can thus further improve the attractiveness of the makeup.

The mechanical stimulus can be a curving of the element, resulting in a
curving of the fibres.

In an alternative form, it is possible to cut naturally curved or wavy
keratinous fibres to be attached to the human keratinous fibres.

**Description of the figures**

- Figure 1 represents an example of an application device,
- Figures 2, 2A and 2B diagrammatically represent implementational
  examples of elements according to the invention,
- Figures 3 and 3A to 3D diagrammatically represent combinations of
  elements according to the invention and of heating means,
- Figures 4 and 5 diagrammatically represent other alternative embodiments
  of elements according to the invention,
- Figure 6 diagrammatically represents a kit according to the invention,
- Figure 7 diagrammatically represents a method for adhesively bonding the fibres to the eyelashes,
- Figures 7A to 7D are photographs of examples of the adhesive bonding of fibres to a test specimen of false eyelashes,
- Figures 8A and 8B are series of photographs of an example of makeup according to the invention, with Figure 8A showing the second joining means still present and Figure 8B showing the definitive placement outcome,
- Figure 9 diagrammatically and partly represents a transfer mechanism present within an application device according to the invention, and
- Figure 10 diagrammatically illustrates a method for the persistent deformation of the fibres.

**Treatment device**

The treatment device can comprise an application device arranged so as to receive the element comprising the fibres connected on the one hand by first joining means $P_1$ comprising a liquefiable adhesive composition in solid form, and on the other hand by second joining means $P_2$.

The description of the application device in the implementational example where the element comprises fibres connected by first and second joining means without a support applies equally to the implementational example where the element comprises a support and also fibres connected to this support by means of a liquefiable adhesive composition formed by the first and second joining means.

The application device can in particular be arranged so as to make possible detachable fixing of the element during its use in applying the fibres to the eyelashes.

In a preferred implementational example of the invention, the first joining means comprise a liquefiable adhesive composition which is a hot-melt adhesive. In this case, the application device which receives the fibres comprises a heating means, in particular a heating tip, which makes it possible to raise the temperature of the adhesive to a value sufficient to bring about the melting thereof.

The application device exhibits, for example, an elongated general shape, comprising a grasping part which can house an electrical source, for example one or more
batteries or a storage battery, and a heating means which makes it possible to produce heat present at the end of the device, on which the element can be fitted.

Figure 1 represents an example of an application device 10, in top view. The grasping part 11 has been represented only partially in this figure.

The application device 10 can comprise an indicator light 12 which indicates that it is operating and/or that the temperature necessary for the application has been reached, and also an on/off switch 13.

The application device 10 can house a circuit for controlling the heating means, this control circuit comprising, for example, one or more electronic components which make(s) it possible to regulate the temperature of the heating means, in particular a microcontroller.

The application device 10 can also comprise a temperature sensor, preferably positioned in the heating means and connected to the control circuit.

The grasping part 11 can extend around the energy source. An access hatch can be provided for the removal or the replacement of the energy source.

The heating means can be produced in various ways and can comprise a resistive electrical conductor, coiled or in track form. The heating means is, for example, flexible, for example comprising a polyimide substrate carrying a resistive track.

The heating means can exhibit a substantially flat shape or a shape at least partially curved in transverse cross section. The heating means can also exhibit, in transverse cross section, a dome shape.

The heating means can exhibit, in longitudinal cross section, a substantially flat shape or at least a curved part.

In an implementational example, the heating means exhibits a part crenellated in longitudinal and/or transverse cross section.

The heating means can comprise a metal covering, for example made of stainless steel or of anodized aluminium.

The heating means can define at least partially the region for receiving the element.

The heating means can face, via the metal covering, at least a part of the element.
Generally, the heating means exhibits, for example, a nominal power of between 0.5 and 2 W, for example of between 0.75 and 1 W, for example of the order of 0.8 W, and makes it possible to achieve a temperature of greater than 50°C, indeed even 60°C, in less than 30 seconds, for example a temperature of greater than 50°C, indeed even 60°C, in less than 2 minutes, better still less than 1 minute, for an ambient temperature of 20°C. The heating means can be arranged so as to exhibit, when operating, a power density of between 0.8 W/cm² and 1.2 W/cm².

Preferably, the temperature of the heating means is regulated so as to be between values compatible with application. The temperature to which the element is heated is preferably between 50 and 75°C, for example being of the order of 65°C.

The application device 10 can comprise a vibrating source, if appropriate.

An example of an element 20 comprising first joining means comprising an adhesive composition in the form of at least one self-supporting sheet supporting fibres F has been represented in isolation in Figure 2.

The element 20 comprises a plurality of fibres F oriented side by side. At least two of these fibres, and preferably the entirety, are connected to one another by first joining means Pi formed by this liquefiable adhesive composition, and by second joining means P₂, which are situated at a distance from these first joining means. These first and second joining means thus extend at two distinct lengths of said fibres. These first and second joining means may thus define a through-going open space between two consecutive fibres.

In other words, with regard to the total length of a fibre, the first joining means may be provided at a first length of this fibre, whereas the second joining means may extend to a second length of said fibre.

According to the example illustrated in Figure 2, element 20 comprises fibres F, comprising a first respective part embedded at least partly in a liquefiable composition Pi formed by said first joining means, which in this specific case is adhesive, and a second respective part held by second joining means P₂, formed for example of a synthetic, natural or metallic thread, which is fixed by adhesive bonding.

The fibres F are, for example, each embedded in the adhesive composition Pi over a length of greater than 1 mm, this length preferably being less than 4 mm.

The fibres F can extend individually within the element, as illustrated.
In an alternative form not illustrated, the fibres F are grouped in a plurality of tufts within the element 20. The number of fibres per tuft is then, for example, between 2 and 40, for example between 3 and 15. Within a tuft, the fibres can be substantially parallel, can exhibit a fan-shaped arrangement or can cut across one another.

The length of the element 20 on which the fibres F are present is, for example, between 0.2 and 3 cm, when the element is unitary, as illustrated in Figure 2 in particular.

The fibres F may have a total length 1 of from 2 mm to 50 mm.

The fibres F, as illustrated in Figure 2 and elsewhere, may exhibit a first free end 41 protruding beyond first joining means Pi and an opposing second free end 42 protruding beyond said second joining means P2. The protruding lengths l2 and l4 may be identical or different. These lengths, both of which are preferably non-zero, are advantageously each less than or equal to 25 mm, to 10 mm or even to 5 mm. More particularly these lengths l2 and l4 may be between 0.1 mm and 8 mm inclusive.

The length l3 extending between said first and second joining means may be between 2 and 30 mm, for example between 3 and 20 mm, for example between 4 and 10 mm.

The number of fibres F per element 20 is for example between 2 and 300.

The length l6 over which the fibres F are held by the first joining means Pi is for example between 1 and 4 mm. The length l5 over which the fibres F are held by the second joining means P2 is for example between 0.1 and 2 mm.

The ratio of the total length of the fibres F of the element 20 to the sum of the lengths l3 and l6 overlapping said fibres is for example between 0.5 and 40 inclusive, better still between 1 and 10 inclusive, even better still between 2 and 6 inclusive.

The ratio of the total length of the fibres F of the element 20 to the length l4 extending between said first and second joining means may advantageously be from 1 to 15, better still from 2 to 10.

Figure 2A shows in isolation an alternative embodiment of element 20, in which the fibres F are placed on the surface of the adhesive composition Pi. The fibres may therefore be integral with the adhesive composition Pi only by way of a portion of their circumference, where they cover this adhesive material.
In this variant illustrated in Figure 2A, the element 20 differs from that shown in Figure 2 in that the fibres F have their respective ends 42 held by the second joining means P₂.

The alternative form illustrated in Figure 2B differs from the alternative form represented in Figure 2 in that the first and second joining means both comprise a solid composition P₁ and P₂, respectively, this composition being liquefiable by exposure to heat or to a solvent. Apart from the same physical nature of these compositions P₁ and P₂, they may also be identical or different in their chemical composition.

The longitudinal axis Y of the element 20 can be transversal or substantially parallel to the longitudinal axis of the application device, when the element 20 is in place on the latter.

Various shapes can be given to the adhesive composition P₁.

The adhesive composition P₁ is preferably present in the form of a sheet elongated along the Y axis, of flattened shape.

The element 20 is intended to be brought into contact with or close to a liquefying region, in order for the adhesive to change into the liquid state and for the fibres to be able to be detached from the element.

When the adhesive composition P₁ is a hot-melt adhesive, the liquefying region is defined by a heating means.

Figure 3 shows an implementational example in which the liquefying region 100 and the adhesive composition P₁ both exhibit, in transverse cross section, a substantially flat shape.

There is preferably contact between the heating means and the element 20 in order to facilitate the liquefying of the adhesive.

As shown in Figure 3, the element may comprise a visual indicator 300 which indicates to the user the face of the element to be positioned on the heating means.

The visual indicator 300 may, as illustrated, be in the form of a geometrical pattern. It is also possible to employ characters, designs or colours, this list not being limitative.

Figures 3A and 3B exhibit implementational examples in which the liquefying region and the adhesive composition P₁ exhibit complementary shapes, for example substantially curved shapes, which are convex for the liquefying region 100 and concave
for the opposing face of the element 20, for the example of Figure 3A, and conversely for the example of Figure 3B.

It is also possible for the adhesive composition Pi and the liquefying region to exhibit a plurality of interacting embossments 200 and 210, either in the transverse direction, as illustrated in Figure 3C, or in the longitudinal direction, as illustrated in Figure 3D.

The shape of the element 20 can be modified under the action of a thermal or mechanical stimulus.

It is possible, for example, to modify the shape of the application element 20 by exerting a mechanical stress with the hand, using a tool or using the application device itself.

Figure 10 shows an element 20 which can deform under the action of a stress exerted with the hand. The user takes the element 20 between two of her fingers D, for example the index finger and the thumb, and imposes a curvature on it, for example about its longitudinal axis. Following this stress, the fibres F and the adhesive composition of the element 20 take on a persistent curvature. The element 20 is then placed on a liquefying region of appropriate shape, and the adhesive composition Pi is liquefied by heating. Eyelashes C are contacted with the adhesive composition Pi thus liquefied, and with the fibres, and, following removal of the eyelashes C, the fibres F remain fixed to the eyelashes C and exhibit a persistent curvature, which produces a particularly attractive bending effect on the part of the eyelashes. In an alternative form, these curved fibres may be obtained by cutting naturally curved keratinous fibres in order to form the element 20 to be attached subsequently to the human keratinous fibres.

Figure 9 shows an example of a transfer mechanism within an alternative form of the application device. In this implementational example, the element 20 is in the form of a band and comprises a support in the form of a band. The element 20, which has not yet been introduced into the liquefying region 100, is initially present in a storage region in the form of a first roller 62.

A user rotates the first roller 62 so as to bring an as yet unused portion of the element 20, carrying fibres F, from the storage region to the liquefying region 100, in order to allow the adhesive bonding of the fibres F to the eyelashes C.
Following liquefying of the adhesive composition and adhesion of the fibres F to the eyelashes C, the portion thus used of the application element 20 follows a return circuit to a second roller 63 within a second storage region. As illustrated, fibres may remain on the portion of the application element 20 reaching the return circuit.

It is also possible to use transfer means such as a piston or a cylinder, as described in US 2007/028681.

Figure 4 shows, in isolation, an example of an element 20 comprising a support 21.

The fixing of the support 21 to the heating tip can be carried out in a variety of ways, as for example by push-fitting, magnetic attraction and/or snap-fastening.

Where appropriate, a device for ejecting the support 21 is provided on the application device 10, this ejection device being actuated by the user to act on the support 21 in order to eject it or at the very least to facilitate its removal by the user.

In the example illustrated in Figure 4, the support 21 has a shape elongated along the longitudinal axis X of the application device 10.

In alternative forms not illustrated, the orientation of the longitudinal axis of the support 21 is not coaxial with that of the tool which carries it, being, for example, perpendicular to the longitudinal axis of the application device.

In Figure 4, it is seen that the support 21 can comprise a body elongated along a longitudinal axis, having a shape suited to the fitting thereof to the heating tip. The support 21 can exhibit a portion of transverse cross section having a concave shape towards the heating tip. The support 21 can comprise a distal end part 23 in the form of a dome, arranged in order to engage with the heating tip so as to keep the support 21 in place on the tip. The support 21 can comprise any coupling means, arranged for example in order to allow fixing by clamping or snap-fastening in a housing or on a corresponding embossment of the application device 10, so as to retain the support 21 on the heating tip.

In the example illustrated, the support 21 carries ribs 25 which are parallel and generally perpendicular to the longitudinal axis X, these ribs 25 being, for example, evenly spaced along the axis X. A hot-melt adhesive composition Pi is present between the ribs 25.

Each rib 25 exhibits, for example, a rounded upper edge 26 which is convex towards the outside.
The support 21 is, for example, molded from a single part made of a thermoplastic optionally comprising, as filler, inorganic particles or fibres, for example of metal oxides, or carbon black or glass fibre or powder, for example a polyolefin such as polyethylene or polypropylene, or, in an alternative form, made of nonpolyolefinic materials, such as acrylonitrile-butadiene-styrene (ABS) or polyoxymethylene (POM).

Fibres F are carried by the support 21, being partially embedded in the adhesive composition Pi.

In the example of Figure 4, the fibres F are grouped in tufts 40 each positioned in a respective gap between two consecutive ribs 25. Each gap preferably comprises adhesive composition Pi holding a plurality of fibres at their first end 41 (which cannot be seen in this figure). As shown in Figure 4, these first ends may be completely embedded in the mass of said composition Pi extending between two ribs 25, or, as illustrated in Figure 1, may slightly project therefrom.

The opposite second ends 42 of these fibres are wholly or partly connected by the second joining means P2.

The fibres F are preferably positioned relative to the support 21, whether or not they are grouped in tufts, such that they project more on one side than on the other. Accordingly, the length by which the fibres F protrude on one side of the support, projecting outside the mass of composition Pi, may be between 2 and 40 mm, better still 3 to 30 mm and even better still 4 to 10 mm, whereas, on the opposite side, the length of the projecting fibres is either zero or less than or equal to 25 mm, 10 mm, even better still 5 mm.

The number of fibres per tuft 40 is, for example, between 1 to 40, better still 2 and 15. Within a tuft 40, the fibres F may be substantially parallel, exhibit a fan-shaped arrangement, or cut across one another.

The fibres F may extend out of the adhesive composition Pi substantially all in the same plane, which may facilitate their application, this plane being, for example, parallel to the X axis and, for example, parallel to a plane S defined by the lower longitudinal edges of the support 21. This plane containing the fibres may also form an angle with the plane S. Nevertheless, according to one preferred embodiment of the invention, the fibres are curved.
Figure 5 shows an alternative embodiment in which the fibres F are not grouped in tufts but extend individually within the element 20, being parallel with one another. In this case, the number of fibres F immersed in the adhesive composition Pi between two consecutive ribs 25 is, for example, between 1 and 50, better still 2 and 40.

The support 21 may have any shape which allows the fibres to be held with the desired orientation when the adhesive composition Pi is in the melted state.

The support thus advantageously comprises, as described above, ribs between which the fibres are positioned.

The invention is of course not limited to any specific embodiment of the support, and the fibres can be maintained with the desired orientation on the support in various ways and, for example, without the use of ribs, the support comprising, for example, protrusions for holding the fibres in place when the adhesive composition is in the melted state.

Where appropriate, the fibres may be maintained with the desired orientation on the support independently of any embossment present on the support, by virtue, for example, of an appropriate viscosity on the part of the composition Pi.

In the example of Figure 4, the support 21 exhibits a shape elongated along a rectilinear longitudinal axis. It would not be departing from the scope of the present invention to give other shapes to the support 21, with a curvilinear longitudinal axis, for example. In one alternative form, the fibres extend generally parallel to the longitudinal axis of the support, at the end of the latter, or are positioned at the end of the heating tip, in a plane which is generally perpendicular to the longitudinal axis of the application tool.

The elements can be sold with the application device in a common pack 40, for example a blister pack, as illustrated in Figure 6, comprising a plurality of elements 20 and the application device 10, on which, where appropriate, an element 20 is already fixed. The elements may contain identical or different fibres.

**Fibres**

Use may be made of various types of fibres F, without departing from the scope of the present invention.

The fibres are, for example, of natural or synthetic origin.
Use may be made, for example, of head hair, body hairs of animals or synthetic fibres made, for example, of thermoplastic.

For example, use may be made of fibres made of one of the thermoplastics chosen from polyolefins and polyamides.

The fibres F can, when they are synthetic, be made of one or several materials. Use may in particular be made of fibres comprising a sheath made of a first material covering a core made of a second material.

The fibres may or may not be coloured. For example, the fibres can be black or can have a colour other than black, for example being made of a material coloured throughout its body or coated with a coloured sheath. The fibres can be chosen so as to have the natural colour of the eyelashes of the user.

The fibres F can comprise pigments or dyes, generating a colour by absorption and/or by luminescence.

The fibres F can have various shapes in transverse cross section, for example can be of circular or noncircular cross section, for example polygonal cross section, in the shape of a tile, and may or may not be hollow, the external diameter of the fibres being, for example, between 0.1 and 3 mm, better still 0.2 to 2 mm, even better still 0.5 to 1.5 mm.

The fibres can be produced with a uniform transverse cross section over their entire length or, in an alternative form, with a decreasing transverse cross section, for example decreasing in the direction of at least one free end.

The fibres F can have a smooth or rough surface state, it being possible for a degree of roughness to facilitate the attachment of mascara.

The fibres may or may not be rectilinear, for example wavy. In one particular embodiment the fibres are curved. Advantageously they have a radius of curvature of between 0.5 and 4 cm.

The length of each fibre is preferably between 1 and 50 mm, better still 2 to 25 mm, even better still 4 to 15 mm, in the case of use for lengthening the eyelashes.

At least one characteristic of the fibres can vary in response to a luminous, thermal or mechanical stimulus or by being brought into contact with a third compound.

This characteristic which can vary under the action of a stimulus can, for example, be chosen from: the shape, the length or the optical properties, in particular the colour, the reflectance and the opacity of the fibres.
In one embodiment, the fibre can change in curvature along its longitudinal axis, in particular can curve up, or can have an apparent length which varies following the action of at least one of the abovementioned stimuli.

It is, for example, possible for the fibres to change in curvature, in particular to curve up, under the action of heating.

The fibres F carried by one and the same application unit 20 can all be identical or, in an alternative form, can be different.

For example, one and the same element 20 can comprise a mixture of fibres of different colours and/or with different properties, for example with different lengths, with different cross sections and/or with different surface states.

Once in place on at least one of said first and second joining means Pi and P2 of the element 20, the fibres F can be subjected to a treatment targeted, for example, at modifying their length, the shape of their end and/or their surface state and/or their appearance.

It is possible, for example, to cut the fibres so that all the ends 42 are aligned along an axis parallel to the axis X. It is also possible to cut the fibres so as to render their lengths slightly different and to give a more natural appearance to the makeup.

When the fibres are in place on the element or before this deployment on at least one of said first and second joining means Pi and P2 or the support 21, the fibres can be coated with a makeup product.

The fibres F can be coated over a first part of their length by first liquefiable joining means or by any compound intended, for example, to improve the attachment of these first joining means to the fibres F. This coating can take place, when the application unit comprises a support, before the fixing of the fibres to the support. The fibres comprise portions which are not coated by the adhesive composition, at least before the element is heated on the application device. The fibres also comprise a second covered part of the second joining means, by coating with liquefiable material or adhesive bonding of an attached element such as a thread made of synthetic, natural or metallic material.

In particular when the element comprises a support, the installation of the fibres on the support 21 may take place while the fibres are integrally attached to one or more reels. The support 21 may be covered or immersed in the first, liquid joining means, under hot conditions, and the fibres are then held between guides of the support. After
cooling of said adhesive composition, the fibres are attached by the second joining means, and then optionally cut.

It is also possible to arrange the fibres, already cut, against the support or, in the absence of a support, against a mold by holding them by means of one or more gripping jaws, after which the first joining means are cast in the liquid state over the support. The gripping jaw or jaws releases the fibres after they have set. The second joining means may themselves be installed before, during or after the positioning of the first joining means.

It is also possible to bring the fibres as a reel against at least two sheets of unwound or extruded liquefiable solid composition, and to press the fibres, under hot conditions, against said sheets in order to render them integral with the sheet.

**First joining means P₁**

The first joining means comprise a liquefiable adhesive composition which has a solid state at ambient temperature (25°C) and atmospheric pressure. This composition may comprise or may even be composed entirely of a liquefiable adhesive. This adhesive may be a hot-melt adhesive, for example.

The adhesive can comprise, indeed can even be composed of, a compound chosen from the following:

AJ Polymers and copolymers comprising at least one alkene monomer, in particular ethylene-based copolymers.

Such compounds can be chosen from:

- copolymers of alkene and of vinyl acetate, in particular copolymers of ethylene and of vinyl acetate.

Use may in particular be made of the copolymers of ethylene and of vinyl acetate preferably comprising more than 25% by weight of vinyl acetate, with respect to the total weight of the polymer.

Mention may be made, as examples of ethylene/vinyl acetate copolymers, of those which are sold under the Elvax name by Du Pont de Nemours and in particular the compounds Elvax 40W, Elvax HOW, Elvax 200W, Elvax 205W, Elvax 210W and Elvax 310.
Mention may also be made of the products sold under the Evatane name by Arkema, such as Evatane 28-800. Mention may also be made of Melthene-H Grade H-6410M, provided by Tosoh Polymer.

- copolymers of ethylene and of octene, such as, for example, the products sold under the "Affinity" reference by Dow Plastics, for example Affinity GA 1900 and GA 1950.

These polymers and copolymers can be used alone or as a mixture with at least one compound chosen from so-called tackifying resins, as described in the Handbook of Pressure Sensitive Adhesives, edited by Donatas Satas, 3rd ed., 1989, pp. 609-619, waxes, and their combinations. The tackifying resins can in particular be chosen from rosin, rosin derivatives, hydrocarbon resins and their mixtures.

Mention may be made, as mixtures based on ethylene/vinyl acetate copolymer, for example of the products sold under the Coolbind name by National Starch.

Use may also be made of mixtures of ethylene/vinyl acetate copolymer and of paraffin. For example, it is possible to use a mixture comprising 55.5% by mass of ethylene/vinyl acetate copolymer, 44% by mass of paraffin and 0.5% by mass of preservative.

These polymers can be provided in their pure form or can be conveyed in an aqueous phase or an organic solvent phase.

B/ Polyvinyl acetate homopolymers, preferably exhibiting a molecular weight of less than 20,000, for example Raviflex BL1S from Vinavil.

C/ Silicone resins

These resins are crosslinked organosiloxane polymers.

The nomenclature of silicone resins is known under the "MDTQ" name, the resin being described according to the various monomeric siloxane units which it comprises, each of the "MDTQ" letters characterizing one type of unit.

The letter M represents the monofunctional unit of formula \((\text{CH}_3)_3\text{SiO}_2/2\), the silicon atom being connected to a single oxygen atom in the polymer comprising this unit.

The letter D means a difunctional unit \((\text{CH}_3)_2\text{SiO}_2/2\) in which the silicon atom is connected to two oxygen atoms.

The letter T represents a trifunctional unit of formula \((\text{CH}_3)\text{SiC}^3/2\).
In the M, D and T units defined above, at least one of the methyl groups can be replaced by a group R which is different from the methyl group, such as a hydrocarbon (in particular alkyl) radical having from 2 to 10 carbon atoms or a phenyl group or alternatively a hydroxyl group.

Finally, the letter Q means a tetrafunctional unit $\text{SiO}_4^2-$ in which the silicon atom is bonded to four oxygen atoms, themselves bonded to the remainder of the polymer.

Mention may in particular be made of T resins, especially functionalized T silicone resins, such as polyphenylsiloxanes, especially functionalized by silanol (Si-OH) groups, such as that sold under the reference Dow Corning (R) Z-1806.

D/ Film-forming block ethylenic polymers

These polymers preferably comprise at least one first block and at least one second block having different glass transition temperatures ($T_g$), said first and second blocks being connected to one another via an intermediate block comprising at least one constituent monomer of the first block and at least one constituent monomer of the second block.

Advantageously, the first and second blocks of the block polymer are incompatible with one another.

Such polymers are described, for example, in the documents EP 1 411 069 or WO 04/028488 or WO 04/028493.

The term "block" polymer is understood to mean a polymer comprising at least 2 distinct blocks, for example at least 3 distinct blocks.

The first and second blocks of the polymer differ from one another in their degree of deformability. Thus, the first block can be rigid and the second block can be flexible.

The glass transition temperatures of the flexible and rigid blocks can be theoretical $T_g$ values determined from the theoretical $T_g$ values of the constituent monomers of each of the blocks, which can be found in a reference handbook, such as the Polymer Handbook, 3rd ed., 1989, John Wiley, according to the following relationship, referred to as the Fox Law:
\[ \frac{1}{Tg} = \sum (\omega_i \div Tgi), \]

\( \omega_i \) being the mass fraction of the monomer \( i \) in the block under consideration and \( Tgi \) being the glass transition temperature of the homopolymer of the monomer \( i \).

Unless otherwise indicated, the \( Tg \) values indicated for the first and second blocks in the present patent application are theoretical \( Tg \) values.

The rigid block can have a \( Tg \) of greater than 20°C.

The flexible block can have a \( Tg \) of less than or equal to 20°C.

According to one embodiment, the copolymer comprises a first rigid block and a second flexible block.

Preferably, the proportion of the rigid block ranges from 20 to 90% by weight of the copolymer, better still from 30 to 90% by weight and even better still from 50 to 90% by weight.

Preferably, the proportion of the flexible block ranges from 5 to 75% by weight of the copolymer, preferably from 10 to 50% by weight and better still from 15 to 45% by weight.

**Rigid block**

In the context of the present invention, the rigid block or blocks are more particularly formed from the following monomers:

- methacrylates of formula \( CH_2=C(CH_3)-COOR_i \)
  in which \( R_i \) represents an unsubstituted linear or branched \( C_4 \) alkyl group, such as a methyl, ethyl, propyl or isobutyl group, or \( R_i \) represents a \( C_4 \) to \( C_{12} \) cycloalkyl group, such as an isobornyl group,
- acrylates of formula \( CH_2=C-H-COOR_2 \)
  in which \( R_2 \) represents a tert-butyl group or a \( C_4 \) to \( C_{12} \) cycloalkyl group, such as an isobornyl group,
- (meth)acrylamides of formula:

\[
\begin{array}{c}
\text{CH}_2=\text{C} \quad \text{CO} \quad \text{N} \\
\text{R} \quad \text{R}_7 \\
\text{R}_8
\end{array}
\]
where \( R_7 \) and \( R_8 \) are identical or different and each represent a hydrogen atom or a linear or branched \( C_i \) to \( C_{12} \) alkyl group, such as an n-butyl, t-butyl, isopropyl, isoheptyl, isooctyl or isononyl group, or \( R_7 \) represents H and \( R_8 \) represents a 1,1-dimethyl-3-oxobutyl group, and \( R' \) denotes H or methyl.

5 Mention may be made, as example of monomers of this type, of N-butylacrylamide, N-[(t-butyl)acrylamide, N-isopropylacrylamide, N,N-dimethylacrylamide and N,N-dibutylacrylamide,

- and their mixtures.

 Particularly preferred monomers of the rigid block are isobornyl methacrylate, isobornyl acrylate and their mixtures.

Flexible block

In the context of the present invention, the flexible block or blocks are more particularly formed from the following monomers:

- acrylates of formula \( CH_2=CHCOOR \), with

5 \( R_3 \) representing an unsubstituted linear or branched \( C_i \) to \( C_{12} \) alkyl group, such as an isobutyl group (with the exception of a tert-butyl group), in which one or more heteroatoms chosen from O, N and S is/are optionally intercalated,

- methacrylates of formula \( CH_2=C(CH_3)-COOR \), with

5 \( R_4 \) representing an unsubstituted linear or branched \( C_6 \) to \( C_{12} \) alkyl group in which one or more heteroatoms chosen from O, N and S is/are optionally intercalated;

- vinyl esters of formula \( R_5-CO-0-CH=CH_2 \) where \( R_5 \) represents a linear or branched \( C_4 \) to \( C_{12} \) alkyl group;

- \( C_4 \) to \( C_{12} \) alkyl vinyl ethers;

- and their mixtures.

25 Particularly preferred monomers of the flexible block are isobutyl acrylate.

Each of the blocks can comprise a minor proportion of at least one constituent monomer of the other block.

Thus, the first block can comprise at least one constituent monomer of the second block, and vice versa.
Each of the first and/or second blocks can comprise, in addition to the monomers indicated above, one or more other monomers, known as additional monomers, which are different from the main monomers mentioned above.

This additional monomer is chosen, for example, from:

a) hydrophilic monomers, such as:
- monomers possessing ethylenic unsaturation(s), other than acrylic acid, comprising at least one carboxylic or sulphonic acid functional group, such as, for example, methacrylic acid, crotonic acid, maleic anhydride, itaconic acid, fumaric acid, maleic acid, acrylamidopropanesulphonic acid, vinylbenzoic acid or vinylphosphonic acid, and the salts of these,
- monomers possessing ethylenic unsaturation(s) comprising at least one tertiary amine functional group, such as 2-vinylpyridine, 4-vinylpyridine, dimethylaminoethyl methacrylate, diethylaminoethyl methacrylate, dimethylaminopropylmethacrylamide and the salts of these,
- methacrylates of formula CH$_2$=C(CH$_3$)-COOR$_8$,
  in which $\frac{3}{4}$ represents a linear or branched alkyl group comprising from 1 to 4 carbon atoms, such as a methyl, ethyl, propyl or isobutyl group, said alkyl group being substituted by one or more substituents chosen from hydroxyl groups (such as 2-hydroxypropyl methacrylate or 2-hydroxyethyl methacrylate) and halogen atoms (Cl, Br, I, F), such as trifluoroethyl methacrylate,
- methacrylates of formula CH$_2$=C(CH$_3$)-COOR$_9$,
  $R_9$ representing a linear or branched $C_6$ to $C_{12}$ alkyl group in which one or more heteroatoms chosen from O, N and S is/are optionally intercalated, said alkyl group being substituted by one or more substituents chosen from hydroxyl groups and halogen atoms (Cl, Br, I, F);
- acrylates of formula CH$_2$=CHCOOR$_{10}$,
  $R_{10}$ representing a linear or branched $C_{10}$ to $C_{12}$ alkyl group substituted by one or more substituents chosen from hydroxyl groups and halogen atoms (Cl, Br, I and F), such as 2-hydroxypropyl acrylate and 2-hydroxyethyl acrylate, or $R_1$ representing a (Cl-C$_2$)$_{10}$ alkyl-0-POE (polyoxyethylene) with repetition of the oxyethylene unit from 5 to 30 times, for example methoxy-POE, or $R_2$ representing a polyoxyethylene group comprising from 5 to 30 ethylene oxide units,
b) monomers possessing ethylenic unsaturation(s) comprising one or more silicon atoms, such as methacryloyloxypropyltrimethoxysilane or methacryloyloxypropyltrimethoxysilane(3 trimethylsiloxy)silane, and their mixtures.

This or these additional monomers generally represent(s) an amount of less than or equal to 30% by weight, for example from 1 to 30% by weight, preferably from 5 to 20% by weight and more preferably from 7 to 15% by weight, of the total weight of the first and/or second blocks.

According to one embodiment, the copolymer can comprise at least one first block and at least one second block connected to one another via an intermediate segment comprising at least one constituent monomer of the first block and at least one constituent monomer of the second block.

Preferably, the intermediate block results essentially from constituent monomers of the first block and of the second block.

Advantageously, the intermediate segment comprising at least one constituent monomer of the first block and at least one constituent monomer of the second block of the copolymer is a random polymer.

Advantageously, the copolymer results essentially from monomers chosen from alkyl methacrylates, alkyl acrylates and their mixtures.

The term "essentially" is understood to mean, in that which precedes and in that which follows, comprising at least 85%, preferably at least 90%, better still at least 95% and even better still 100%.

As regards the acrylate and methacrylate esters, they can derive from the esterification of linear or branched, cyclic or aromatic C_{4-12} alcohols, in particular C_{4-10} alcohols.

Mention may in particular be made, by way of illustration and without implied limitation of these alcohols, of isoborneol.

According to one embodiment, said copolymer comprises at least acrylate and methacrylate monomers deriving from the esterification of the same alcohol and in particular isoborneol.
Preferably, the film-forming linear block polymer comprises at least isobornyl acrylate monomers, at least isobornyl methacrylate monomers and at least isobutyl acrylate monomers.

According to an alternative embodiment, the block polymer can comprise at least:

- a rigid block, which is an isobornyl methacrylate/isobornyl acrylate copolymer, and
- a flexible block, which is an isobutyl acrylate copolymer.

More specifically, the copolymer can comprise 50 to 80% by weight of isobornyl methacrylate/acrylate and from 10 to 20% by weight of isobutyl acrylate.

The weight-average molecular mass (Mw) of the copolymer preferably ranges from 80 000 to 300 000, indeed even from 100 000 to 150 000.

The number-average molecular mass (Mn) of the copolymer preferably ranges from 20 000 to 90 000, for example from 25 000 to 45 000.

E/ Copolymers of dienes and of styrene, in particular copolymers of butadiene and of styrene.

Mention may in particular be made of the styrene butadiene copolymers sold under the Pliolite S5E reference by Eliokem.

F/ Polyesters comprising at least one monomer carrying at least one \(-\text{SO}_3\text{M}\) group (M representing a hydrogen atom, an ammonium ion \(\text{NH}_4^+\) or a metal ion), also known as sulphopolyesters.

These polyesters advantageously have a glass transition temperature (Tg) of greater than 38°C.

They can exhibit a weight-average molecular mass advantageously of less than 200 000, for example ranging from 10 000 to 50 000.

These polyesters can be obtained in a known way by polycondensation of at least one dicarboxylic acid with at least one polyol, in particular diols.

The dicarboxylic acid can be aliphatic, alicyclic or aromatic. Mention may be made, as examples of such acids, of: oxalic acid, malonic acid, dimethylmalonic acid, succinic acid, glutaric acid, adipic acid, pimelic acid, 2,2-dimethylglutaric acid, azelaic acid, suberic acid, sebastic acid, fumaric acid, maleic acid, itaconic acid, phthalic acid, dodecanedioic acid, 1,3-cyclohexanedicarboxylic acid, 1,4-cyclohexanedicarboxylic acid,
isophthalic acid, terephthalic acid, 2,5-norbornedimdicarboxylic acid, diglycolic acid, thiodipropionic acid, 2,5-naphthalenedimedimdicarboxylic acid or 2,6-naphthalenedimdicarboxylic acid. These dicarboxylic acid monomers can be used alone or as a combination of at least two dicarboxylic acid monomers. The choice is preferably made, among these monomers, of phthalic acid, isophthalic acid or terephthalic acid.

The diol can be chosen from aliphatic, alicyclic or aromatic diols. Use is preferably made of a diol chosen from: ethylene glycol, diethylene glycol, triethylene glycol, 1,3-propanediol, cyclohexanediethanol or 1,4-butanediol.

Use may be made, as other polyols, of glycerol, pentaerythritol, sorbitol or trimethylolpropane.

Polyesteramides can be obtained analogously to the polyesters by polycondensation of diacids with diamines or aminoalcohols. Use may be made, as diamines, of ethylenediamine, hexamethylenediamine, meta-phenylenediamine or para-phenylenediamine. Use may be made, as aminoalcohol, of monoethanolamine.

The polyester comprises at least one monomer carrying at least one -SO₃M group, with M representing a hydrogen atom, an ammonium ion NH₄⁺ or a metal ion, such as, for example, an Na⁺, Li⁺, K⁺, Mg²⁺, Ca²⁺, Cu²⁺, Fe²⁺ or Fe³⁺ ion. Use may in particular be made of a bifunctional aromatic monomer comprising such an -SO₃M group.

The aromatic ring system of the bifunctional aromatic monomer additionally carrying an -SO₃M group as described above can be chosen, for example, from the benzene, naphthalene, anthracene, biphenyl, oxydiphenyl, sulphonyldiphenyl or methylenediphenyl ring systems. Mention may be made, as example of bifunctional aromatic monomer additionally carrying an -SO₃M group, of: sulphoisophthalic acid, sulphoterephthalic acid, sulphophthalic acid or 4-sulphonaphthalene-2,7-dicarboxylic acid.

It is preferable to use copolymers based on isophthalate/sulphoisophthalate and more particularly copolymers obtained by condensation of diethylene glycol, cyclohexanediethanol, isophthalic acid and sulphoisophthalic acid.

Such polymers are sold, for example, under the Eastman AQ® trade name by Noveon, for example Eastman AQ 38S.

G/ Waxes

The wax under consideration in the context of the present invention is generally a lipophilic compound which is solid at ambient temperature (25°C), which is or
is not deformable, which exhibits a reversible solid/liquid change in state and which has a melting point of greater than or equal to 30°C which can range up to 100°C and in particular up to 90°C.

On bringing the wax to the liquid state (melting), it is possible to render it miscible with oils and to form a microscopically homogeneous mixture but, on bringing the temperature of the mixture back to ambient temperature, recrystallization of the wax in the oils of the mixture is obtained.

In particular, the waxes suitable for the invention can exhibit a melting point of greater than or equal to 45°C and in particular of greater than or equal to 55°C.

Within the meaning of the invention, the melting temperature corresponds to the temperature of the most endothermic peak observed by thermal analysis (DSC) as described in the standard ISO 11357-3; 1999. The melting point of the wax can be measured using a differential scanning calorimeter (DSC), for example the calorimeter sold under the name "MDSC 2920" by TA Instruments.

The measurement protocol is as follows:

A 5 mg sample of wax placed in a crucible is subjected to a first rise in temperature ranging from -20°C to 100°C at a heating rate of 10°C/minute, is then cooled from 100°C to -20°C at a cooling rate of 10°C/minute and, finally, is subjected to a second rise in temperature ranging from -20°C to 100°C at a heating rate of 5°C/minute. During the second rise in temperature, the variation in the difference in power absorbed by the empty crucible and by the crucible comprising the sample of wax is measured as a function of the temperature. The melting point of the compound is the value of the temperature corresponding to the tip of the peak of the curve representing the variation in the difference in power absorbed as a function of the temperature.

The waxes capable of being used in the compositions according to the invention are chosen from waxes of animal, vegetable, mineral or synthetic origin, and their mixtures, which are solid at ambient temperature.

The waxes which can be used in the compositions according to the invention generally exhibit a hardness ranging from 0.01 MPa to 15 MPa, in particular of greater than 0.05 MPa and especially of greater than 0.1 MPa.

The hardness is determined by the measurement of the compressive force measured at 20°C using a texture analyzer sold under the name TA-XT2 by Rheo,
equipped with a stainless steel cylinder with a diameter of 2 mm which is displaced at the measuring rate of 0.1 mm/s and which penetrates the wax to a penetration depth of 0.3 mm.

The measurement protocol is as follows:

The wax is melted at a temperature equal to the melting point of the wax + 10°C. The molten wax is cast in a receptacle with a diameter of 25 mm and a depth of 20 mm. The wax is recrystallized at ambient temperature (25°C) for 24 hours, so that the surface of the wax is flat and smooth, and then the wax is stored at 20°C for at least one hour before measuring the hardness or the tack.

The spindle of the texture analyzer is displaced at a rate of 0.1 mm/s and then penetrates the wax to a penetration depth of 0.3 mm. When the spindle has penetrated the wax to the depth of 0.3 mm, the spindle is held stationary for 1 second (corresponding to the relaxation time) and is then withdrawn at the rate of 0.5 mm/s.

The value of the hardness is the maximum compressive force measured divided by the surface area of the cylinder of the texture analyzer in contact with the wax.

Mention may in particular be made, by way of illustration of the waxes suitable for the invention, of hydrocarbon waxes, such as beeswax, lanolin wax and Chinese insect waxes; rice bran wax, carnauba wax, candelilla wax, ouricury wax, esparto wax, berry wax, shellac wax, Japan wax and sumac wax; montan wax, orange and lemon waxes, microcrystalline waxes, paraffin waxes and ozokerite; polyethylene waxes, the waxes obtained by the Fischer-Tropsch synthesis and waxy copolymers, and their esters, waxes obtained by catalytic hydrogenation of animal or vegetable oils having linear or branched fatty chains, such as isomerized jojoba oil, hydrogenated sunflower oil, hydrogenated castor oil, hydrogenated coconut oil, hydrogenated lanolin oil and di(l,l,l-trimethylopropane) tetrastearate, sold under the name of Hest 2T-4S® by Heterene.

Mention may also be made of silicone waxes and fluorinated waxes.

Use may also be made of the waxes obtained by hydrogenation of castor oil esterified with cetyl alcohol which are sold under the names of Phytowax Castor 16L64® and 22L73® by Sophim. Such waxes are described in the application FR-A-2 792 190.

Use may be made of a wax referred to as a "tacky wax", that is to say having a tack of greater than or equal to 0.1 N.s and a hardness of less than or equal to 3.5 MPa.

Use may be made, as tacky wax, of a C₂₀-C₄₀ alkyl (hydroxystearylxylo)stearate (the alkyl group comprising from 20 to 40 carbon atoms), alone or as a mixture.
Such a wax is sold in particular under the names "Kester Wax K 82 P®", "Hydroxypolyester K 82 P®" and "Kester Wax K 80 P®" by Koster Keunen.

The adhesive can comprise, can indeed even be composed of, a mixture of the compounds A// to G/ described above.

The liquefiable adhesive is preferably chosen from ethylene/vinyl acetate copolymers, optionally with the addition of paraffin or of a PDMS oil.

The total mass of composition Pi within the application units according to the invention is, for example, between 5 and 300 mg, better still 10 mg and 100 mg. The composition Pi is preferably solid at 20°C, that is to say that it does not flow under the effect of gravity at this temperature.

The composition Pi, when it is not composed solely of the liquefiable adhesive, can comprise an active principle, a wax, an oil, a surfactant, for example a silicone surfactant, or one or more pigments and/or dyes intended, for example, to opacify the composition and/or to give it the desired colour, for example a black iron oxide. The liquefiable adhesive preferably exhibits a threading (d_max) of greater than or equal to 5 mm, for example obtained at a temperature of greater than 40°C. The d_max threading nature is defined in the French patent application filed under No. 06 53468.

The content by mass of liquefiable adhesive in the composition Pi is, for example, between 1 and 100%, preferably greater than 50%, better still approximately 80%.

The content of colouring agents, in particular of pigment(s), for example black iron oxide, in the composition P is, for example, between 1 and 10%.

The adhesive used is preferably reversible, that is to say that, on being heated again or brought into contact with a suitable solvent, it liquefies. In an alternative form, the composition P comprises ingredients which make possible a permanent adhesive bonding.

It is possible in particular to choose the additional compounds from those appearing in the passages "waxes", "emulsifying system", "water-soluble gelling agent", "oils", "film-forming polymer", "colorant", "fillers" and "cosmetic active principles" of the French patent application filed under No. 06 53468, these passages being incorporated by reference.

Second joining means P_2.
The second joining means P2 may be in a solid state at ambient temperature (25°C) and atmospheric pressure.

These means may nevertheless be liquefiable under certain conditions, particularly by exposure to heat or solvent. The second joining means may optionally be identical to the first joining means described above. They may comprise a composition comprising or even composed of one of the adhesive compounds A to G described above, or a mixture of these compounds.

In an alternative form, these second means for liquefiable joining may be selected from at least one thread which is dissoluble in a water-soluble solvent.

According to another embodiment, these second joining means may be attached and on said keratinous fibres precoated with a glue. Such joining means may in that case in particular be selected from a metallic or synthetic thread. In such a case, such second joining means may be fixed to said fibres by adhesive bonding, for example by means of a pressure-sensitive adhesive or PSA.

Advantageously and preferably, the adhesive used is reversible.

Use

In order to use the device according to the invention, the user, once the melting temperature of the liquefiable adhesive composition Pi has been reached, brings the element into contact with the eyelashes C to be lengthened, with the free end 42 of the fibres F directed outwards, as illustrated in Figure 7.

The user brings the eyelashes into contact with the composition Pi and moves the heating tip upwards and outwards. Surprisingly, the fibres F stick easily and rapidly to the eyelashes and, in addition, in a very attractive way, as illustrated in Figures 8A and 8B.

Prior to the application of the fibres, the eyelashes or other keratinous fibres intended to receive them can be coated with a composition targeted at facilitating the removal of makeup or, on the other hand, at improving the attachment of the fibres.

When the fibres have been positioned, the device can then be withdrawn, preferably by rotation of said device. Such a rotation may take place manually. In an alternative form, it may be automated, in particular by any appropriate return means. This rotation may for example involve 1/3 of a turn.
In an alternative form, withdrawal may be accomplished by a translation movement. More particularly, this movement may result in a separation of at least two gripping jaws clamping the curved fibres.

According to a further alternative form, the withdrawal movement may be the result both of a rotation and of a separation, by means for example of a device equipped with a connecting-rod system.

The second joining means may be withdrawn before or simultaneously with the application of the curved fibres, but are preferably withdrawn after the application of said curved fibres. This withdrawal may be carried out in a single piece, by breaking or by liquefying of said second joining means, and more particularly, in the latter case, by thermal melting or dissolution in an appropriate solvent.

The process of installing the element on the keratinous fibres, and more particularly on the eyelashes, preferably comprises a stage wherein the first joining means are opposite said keratinous fibres, while the second joining means are at an offset, or at a slant, relative to these keratinous fibres.

Figure 8A shows the positioning of the curved fibres on the keratinous fibres following liquefying of the adhesive composition \( P_1 \) but before withdrawal of the second joining means \( P_2 \). Figure 8B shows the final result of the curved fibres, after withdrawal, or elimination, of the second joining means \( P_2 \).

**Examples**

**Example 1**

The liquefiable adhesive composition \( P_1 \) and optionally \( P_2 \) described below is used in combination with fibres composed of head hair, with a length of the order of 15 mm, carried by a ribbed thermoplastic support, such as that represented in Figure 3.

<table>
<thead>
<tr>
<th></th>
<th>% by mass</th>
<th>Supplier</th>
<th>Trade name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black iron oxide</td>
<td>4</td>
<td>Sun</td>
<td>Sunpuro Black Iron Oxide</td>
</tr>
<tr>
<td>Ethylene/VA copolymer</td>
<td>81</td>
<td>National Starch</td>
<td>Cool Bind 34-1300®</td>
</tr>
</tbody>
</table>
Polydimethylsiloxane carrying triglycerol groups and C_{12} alkyl groups

| 15 | Shin-Etsu    | KF-6105 |

Use is made of the application device 10 described above with reference to Figure 1.

Application to the eyelashes takes place under hot conditions, when the composition P_1, and optionally P_2, is molten, at approximately 65°C, by combing the eyelashes with the element 20 charged with adhesive and fibres F.

The makeup result obtained after application to the external eyelashes of the eye is that represented in Figure 8.

**Example 2**

The following adhesives were tested, the application protocol of Example 1 being reproduced, on a test specimen of false eyelashes:

a) C_{18-38} fatty alcohol hydroxystearoyl stearate (Kester Wax K 82 P)
b) Vinyl acetate / allyl stearate (65/35) copolymer (Mexomere PQ)
c) Poly(isobornyl methacrylate-co-isobornyl acrylate-co-isobutyl acrylate-co-acrylic acid) (Mexomere PAS)
d) Adhesive composition of Example 1

From these tests, an E/VA copolymer adhesive provides the best results by making it possible to position the fibres at the free end of the eyelashes (end-to-end/in alignment).

Figure 7A corresponds to the result obtained with the adhesive a), 7B to the adhesive b) and 7C to the adhesive c) with, in the three cases, as a result, the fibres adhesively bonded to the test specimen at the base.

With the adhesive d) corresponding to Figure 7D, the fibres are adhesively bonded to the tips of the eyelashes of the test specimen.

**Other alternative forms**

Although an adhesive composition which can liquefy under hot conditions has more particularly been described, an adhesive composition which can liquefy by introduction of solvent, for example water or alcohol, can be used, for the first joining means, and even for the second joining means.
For example, use may be made of a polymer which is soluble in ethanol. For example, use is made of a formulation of Ultrahold Strong (BASF) at 20% in ethanol, which is deposited on the support, care being taken to hold the fibres thereon and that the amount applied is sufficient to create a thickness of polymer amply covering the fibres.

After drying, the fibres are released. They are adhesively bonded to the support.

At the moment of use, a small amount of ethanol is applied, which will soften the polymer. The support is then drawn close to the eyelashes and, by an outwards movement, the fibres are adhesively bonded to the eyelashes.

The eyelashes or other keratinous fibres can be coated with a first compound and the element can comprise a second liquefiable compound capable of reacting with the first to form an adhesive capable of holding the fibres on the eyelashes. For example, the example with use of ethanol above is taken up again and ethanol is applied to the eyelashes.

The invention is very particularly suitable for the eyelashes but also applies to the treatment of the hair, for corrective purposes, for example for correcting a haircut with areas cut too short, or for the purposes of embellishment, either for lengthening the hair or for thickening it or for obtaining novel colour effects. The invention is also suitable for the treatment of the eyebrows.

The expression "comprising a" is synonymous with "comprising at least one", unless otherwise specified.

The expression "between" is understood as with limits included.
CLAIMS

1. Element (20) for the application of fibres (F) to human keratinous fibres, comprising fibres (F) held together in a predefined way by first joining means (Pi) and second joining means (P₂), spaced apart from one another, along a given fibre (F), said first joining means comprising an adhesive composition in liquefiable solid form, the liquefying of said composition on application making it possible for at least a part of the fibres (F) to come into adherent contact with said keratinous fibres, and the length of the fibres (F) being between 3 and 40 mm.

2. Element according to Claim 1, wherein with regard to the length of the fibres (F), the first joining means (Pi) extend over a first half of the fibres constituting the element, and the second joining means (P₂) extend over a second half of the fibres constituting the element.

3. Element according to Claim 1 or 2, wherein the first joining means (Pi) extend at the height of or close to a first end (41) of said fibres (F), and the second joining means (P₂) extend at the height of or close to a second end (42) of said fibres (F).

4. Element according to Claim 1, 2 or 3, wherein the first (Pi) and second (P₂) joining means are each present in the form of a band or a thread, each extending across the fibres (F).

5. Element according to any of the preceding claims, wherein the liquefiable adhesive composition is a hot-melt adhesive composition.

6. Element according to any of the preceding claims, wherein said second joining means (P₂) are different in nature and/or composition from said first joining means.

7. Element according to any of the preceding claims, wherein said second joining means (P₂) are chosen from a solid composition which is liquefiable by exposure to temperature or by a solvent, and a thread which is optionally held by means of an adhesive.

8. Element according to any of the preceding claims, wherein the fibres (F) are coloured and/or made-up beforehand.

9. Element according to any of the preceding claims, wherein the first joining means comprise an adhesive chosen from:

- polymers and copolymers comprising at least one alkene monomer, in particular ethylene-based copolymers,
- polyvinyl acetate homopolymers,
- silicone resins,
- film-forming block ethylenic polymers, which preferably comprise at least
one first block and at least one second block having different glass transition temperatures
(Tg), said first and second blocks being connected to one another via an intermediate block
comprising at least one constituent monomer of the first block and at least one constituent
monomer of the second block,
- copolymers of dienes and styrene,
- sulphopolyesters,
and their mixtures.

10. Element according to any of the preceding claims, wherein the first joining
means comprise an adhesive chosen from:
- copolymers of alkene and of vinyl acetate, in particular copolymers of
ethylene and of vinyl acetate,
- copolymers of ethylene and of octene,
- polyvinyl acetate homopolymers,
- T silicone resins, such as polyphenylsiloxanes,
- film-forming block ethylenic copolymers resulting essentially from
monomers chosen from alkyl methacrylates, alkyl acrylates and their mixtures,
- copolymers of butadiene and of styrene,
- copolymers obtained by condensation of diethylene glycol,
cyclohexanediol, isophthalic acid and sulphoisophthalic acid,
and their mixtures.

11. Element according to any of the preceding claims, wherein the first joining
means comprise an adhesive comprising a copolymer of ethylene and of vinyl acetate.

12. Element according to any of Claims 1 to 10, wherein the first joining
means comprise an adhesive comprising a surfactant, in particular a silicone surfactant.

13. Element according to any of the preceding claims, wherein the first joining
means comprise an adhesive comprising a fatty substance chosen from hydrocarbon oils or
silicone oils.

14. Element according to any of the preceding claims, wherein the number of
fibres (F) is between 2 and 300.
15. Element according to any of the preceding claims, wherein the first joining means comprise a colouring agent.

16. Element according to any of Claims 1 to 15, wherein the first joining means form a self-supporting sheet.

17. Element according to any of Claims 1 to 15, wherein the first joining means are carried by a support, in particular a flexible support, it being possible for the support optionally to be as a band.

18. Device for the application of fibres (F) to human keratinous fibres, comprising:

- a support (21),
- an element (20) according to any of the preceding claims, comprising fibres (F) arranged in a predefined way and joined to the support (21) by said liquefiable adhesive composition.

19. Combination comprising:

- an element (20) as defined in any of Claims 1 to 17, and
- an application device comprising a liquefying region on which the element or a part of the latter can be fitted.

20. Cosmetic treatment method wherein:

- fibres (F) of an element as defined in any of Claims 1 to 17 are brought into contact with eyelashes or other human keratinous fibres,
- the first joining means (P₁) are liquefied,
- a part at least of the fibres (F) is caused to adhere to the eyelashes or other human keratinous fibres and
- the second joining means (P₂) are eliminated.
**INTERNATIONAL SEARCH REPORT**

**PCT/EP2011/071278**

### A. CLASSIFICATION OF SUBJECT MATTER

INV. A45D2/48  A41G5/02  A41G5/00  A45D44/00

ADD.

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  A41G

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**

### C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>US 6 510 856 BI (AHN CHANG H [US]) 28 January 2003 (2003-01-28) col umns 2-4; figures ------</td>
<td>1,3-20</td>
</tr>
<tr>
<td>X</td>
<td>US 2003/005941 AI (10SI LEVICH I RINA [US]) 9 January 2003 (2003-01-09) page 3; figures ------</td>
<td>1,3,4, 8-18</td>
</tr>
<tr>
<td>X</td>
<td>Wo 2009/052359 A2 (PROCTER &amp; GAMBLE [US]; RABE THOMAS ELLIOT [US]; WYATT PETER JONATHAN) 23 April 2009 (2009-04-23) pages 4-10 ------</td>
<td>1,3,19</td>
</tr>
<tr>
<td>X</td>
<td>US 2005/061341 AI (CH0E YE0NG-JIN [KR]) 24 March 2005 (2005-03-24) ------</td>
<td>1,3,4, 8-15, 17, 18</td>
</tr>
</tbody>
</table>

* Special categories of cited documents:

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

* “I” 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

- **S** document member of the same patent family

Date of the actual completion of the international search: 21 February 2012

Date of mailing of the international search report: 29/02/2012

Name and mailing address of the ISA:

European Patent Office, P.B. 5818 Patentlaan 2
NL-2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax. (+31-70) 340-3016

Authorized officer: Dinescu, Daniel

Form PCT/ISA/210 (second sheet) (April 2005)
<table>
<thead>
<tr>
<th>Patent document cited in search report</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
<th>Publication date</th>
</tr>
</thead>
<tbody>
<tr>
<td>US 6510856 B1</td>
<td>28-01-2003</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td>US 2003005941 A1</td>
<td>09-01-2003</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP 2011500979 A</td>
<td>06-01-2011</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 2009217939 A1</td>
<td>03-09-2009</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 2011290271 A1</td>
<td>01-12-2011</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WO 2009052359 A2</td>
<td>23-04-2009</td>
</tr>
<tr>
<td>US 2005061341 A1</td>
<td>24-03-2005</td>
<td>JP 2005146500 A</td>
<td>09-06-2005</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 2005061341 A1</td>
<td>24-03-2005</td>
</tr>
</tbody>
</table>