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(54) **Title**: SKIN-ADHESIVE DECALS

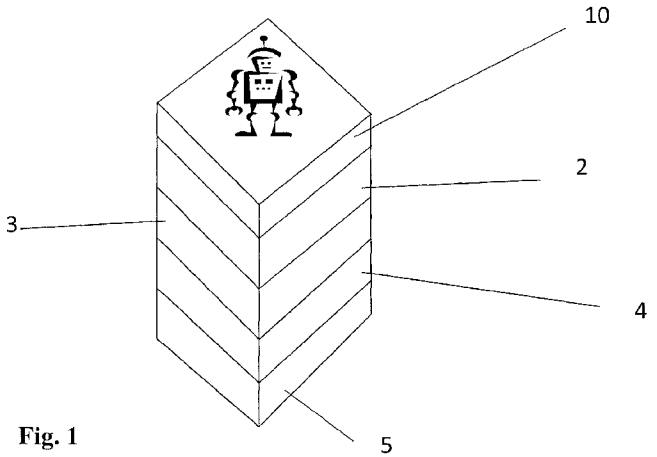

Fig. 1

(57) **Abstract**: Skin-adhesive decals for body decorative and cosmetic applications, from flexible elastic polymeric water-resistant body-conformable membranes printed with color process and spot layer inks. Non-migrating or low-migrating inks, including glow-in-the-dark, ultraviolet, photochromatic, hydro-chromatic, and thermo-chromatic inks may be utilized, and the decals include a barrier varnish layer which carries fragrance, metallic or glitter or other special effects elements, and may include an additional barrier varnish layers which may protect and further impede migration of ink toward the skin or skin exudates toward the ink, preserving the quality of the printed image. Processes for making the skin-adhesive decals are also provided. The skin-adhesive decals are easily applied and removed and provide a realistic image and a variety of special visual and sensory effects, may be applied to the skin for an extended period of time, and are able to substantially conform to movement of the skin.

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SKIN-ADHESIVE DECALS

TECHNICAL FIELD

The present invention relates to decorative and cosmetic body arts, in particular to decals possessing properties rendering them particularly suitable for application to skin and for long-term adherence to the skin.

BACKGROUND

In the context of artistic and political expression through the use of the human body as a canvas, non-permanent alternatives to tattoo technology have been developed. Aside from simple body-painting and ink printing directly on skin, known alternatives include application of transferable ink images and decal images. In transfer images, typically a water-soluble ink is printed on a substrate in a desired design or image and transferred by wetting the design or image (or the skin) and then pressing the wetted inks against the skin, transferring them to the skin. Although advances in printing technologies have provided more realistic and artistic design capability, the transfer method is seriously limited by the human element involved in effectuating the transfer which tends to produce streaked, smeared and partial images. Sealer films of varnish may be applied covering the ink when the tattoo is in place on the skin, which generally gives an undesirable sheen to the underlying ink that spoils some of the effect of the decal appearing to be a real tattoo. Further, the ink itself is in direct contact with the skin, which places serious allergenic and health limitations on allowable inks and reduces the ability to employ special-effects inks such as glow-in-the-dark and ultraviolet inks.

Decal alternatives comprise a printed image on a substrate with an adhesive material on the other side of the substrate, generally protected by and peelable from a release backer/liner. However, the decals known in the art have generally been highly artificial in appearance due to undesirable characteristics of the substrate, which is generally thick, rigid and reflective. When thinner flexible substrates are employed, inks tend to migrate through the substrate and come in contact with the skin, and skin exudates migrate through the substrate into the ink, resulting in defective images and potential safety concerns.

For example, U.S. Patent No. 4594276 provides a decal-type alternative which employs a flexible, porous, non-woven, compacted tissue substrate which is translucent

and which has an image printed on one side and a pressure sensitive adhesive on the opposite side. Although the substrate is flexible and provides translucence and a texture similar to human skin, the examples include latexes as components to the substrate and all are disclosed as highly porous to air and moisture with limited elasticity, making them subject to premature release and generally undesirable for extended wear and conformation to human movement. The porous surface leads to admitted print precision problems and the applied decals suffer from migration of inks through the substrate over a very short period of time, which may be hastened in humid conditions. Since inks will migrate readily through the substrate toward the skin, printing is limited to inks approved for direct and sustained contact with skin. The lack of elasticity, as measured by elongation properties, limits the ability of the substrate to conform to natural movement by the wearer, placing strain on the decal and resulting in detachment from the skin.

There remains a need in the body cosmetic arts for skin-adhesive decals which provide a realistic simulation to an actual tattoo and/or which provide a wider range of rendering modes for body art in general, and which further are amenable to simple inexpensive processes for making the decal including flexographic printing steps in which difficulties caused by water soluble material from the release layer of the decal papers are avoided. There is further a need for decal technologies which provide the capability for greater artistic expression by permitting use of more exotic specialty inks which do not substantially migrate through porous substrates, or which can be inhibited from migration, for decals which may be safely worn by the user for extended periods of time, which are elastic enough to conform to skin movement during use, and which mimic the texture and flexibility of skin without cracking of the ink layer or causing premature peeling from the skin surface.

SUMMARY

Accordingly, embodiments of the instant invention provide novel skin-adhesive decal technologies for artistic, political and/or cosmetic renderings on the skin. The inventive skin-adhesive decals employ a suitably elastic, flexible, thin substrate which may be printed with inks by known processes. The substrate is particularly suitable for application of substantially non-migrating or low-migrating inks. Where low-migrating inks may be employed, additional barrier layers may be interposed to prevent migration.

Adhesives are selected to be substantially impermeable to water so that migration of sweat and water-based exudates toward the ink is inhibited. Additional barrier varnish may be precisely applied to prevent oil-based skin exudates from migrating into the ink layer as well. Hence, the inventive decals may be printed with a wider variety of specialty inks providing a superior range of artistic expression or cosmetic need. The applied decals are both realistic and safe for application to skin and remain in place without premature peeling over one or several days, and in some cases up to a week.

Certain embodiments of the invention are directed to skin-adhesive decals comprising (a) a membrane layer comprising a flexible elastic polymeric water-resistant film; (b) an adhesive layer disposed on one side of the membrane layer; (c) a release backer layer releasably adhered to one side of the adhesive layer; (d) an ink layer disposed across at least a portion of the membrane layer, and (e) optionally, one or more barrier varnish layers. Generally a substantially non-migrating or low-migrating ink may be used. In some embodiments a barrier varnish layer may be disposed over the ink layer and/or a barrier varnish layer may be interposed between the ink and membrane layers, or both. The ink layer may comprise several layers of ink including one or more layers of color process ink and one or more layers of spot process ink. The layers of applied ink may be configured in ways to provide special visual effects when applied to the skin and may be configured such that the visual effects are altered according to changes in one or more of temperature, humidity or lighting of the environment in which the decal is worn.

The membrane layer is relatively thin and flexible. The membrane layer, the adhesive layer and the release backer layer combined are no more than about .007 inches in thickness. The membrane has desirable elongation properties such that it can conform to ordinary human movement without premature detachment from the skin, yet the degree of elongation permitted is tolerant to avoid deformation of the printed image.

According to other embodiments, the skin-adhesive decal comprises: (a) a membrane layer comprising a flexible elastic water-resistant low density polyethylene film; (b) a hypoallergenic substantially water-insoluble acrylic adhesive layer disposed on one side of the membrane layer; (c) a release backer layer comprising a silicone release coating and releasably adhered to the adhesive layer; (d) an ink layer adjacent at least a portion of a surface of the membrane layer opposite the adhesive layer, wherein

the ink comprises a substantially non-migrating or low migrating ink, (e) optionally a barrier varnish layer disposed over the ink layer; and (f) optionally a barrier varnish layer interposed between the ink layer and the membrane layer; wherein a combined thickness of the membrane layer and adhesive layer is less than .0030 inches and the membrane layer possesses a percent elongation property of between about 300 and about 450 according to ASTM-D882.

Further embodiments are directed to methods for manufacturing the inventive skin-adhesive decals. The methods generally comprise the steps of (a) providing a porous breathable water-resistant low density polyethylene membrane having a hypo-allergenic acrylic adhesive on one surface of the membrane and a release backer applied to the adhesive opposite the membrane; (b) applying an ink adjacent a surface of the membrane opposite the adhesive; and

(c) optionally applying one or more barrier varnish layers.

These and other embodiments and aspects of the invention will become clearer by reference to the accompanying figures and detailed description. Specific embodiments described herein should not be construed as limiting the scope of the invention as defined by the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1. A schematic cross-sectional illustration depicting layers in exaggerated vertical dimensions of a skin-adhesive decal according to a specific embodiment of the invention.

Figure 2. A schematic cross-sectional illustration of a specific embodiment according to the invention depicting a barrier varnish layer interposed between the ink layer and the membrane layer.

Figure 3. A schematic cross-sectional illustration of specific embodiment of the skin-adhesive decals depicting a barrier varnish layer interposed between the ink layer and the membrane layer and a barrier varnish layer comprising fragrance elements applied over the ink layer.

Figure 4. A schematic cross-sectional illustration of a specific embodiment of the skin-adhesive decals depicting a barrier varnish layer interposed between the ink layer and the membrane layer and a barrier varnish layer

comprising glitter and/or metallic and/or texture elements applied over the ink layer.

Figure 5. A schematic cross-sectional illustration of a specific embodiment of the skin adhesive decals depicting an ink layer comprising substantially non-migrating or low-migrating ink is depicted.

DETAILED DESCRIPTION

A number of embodiments of the present invention are described in detail herein. Preferred and specific embodiments should be considered exemplary rather than limiting and it is understood that various modifications may be made without departing from the spirit and scope of the invention. Accordingly, it is understood that the invention is not to be limited by the specific illustrated embodiments, but only by the scope of the appended claims.

With reference to Figure 1, a schematic cross-sectional view of an embodiment of a decal according to the disclosure is depicted. The dimensions are not set forth to-scale, but are vertically skewed for clarity. An ink layer **2** comprising a substantially non-migrating or low-migrating ink is printed in one or more process steps onto a membrane layer **3**, which comprises a porous breathable substrate. As used herein, the phrase "substantially non-migrating or low-migrating ink" includes a range of non-migrating to low migrating inks, such that the ink will not contact the skin by penetration / migration through the breathable membrane **3** while the decal is adhered to the skin. The ink layer **2** may comprise one or more discrete non-contiguous applications/deposits of ink atop the membrane layer **3** and the ink layer **2** is not necessarily commensurate in area with the membrane layer **3**. An ink layer **2** according to the disclosure may comprise more than one layer of ink.

Special effects agents such as fragrance elements **10** may be applied to the ink layer **2**. Fragrance elements which are suitably applied are well-known in the art and may include free, encapsulated or carrier-bound fragrance elements. Generally carrier-bound special effects agents such as carrier-bound fragrance elements including, for example, well known cyclodextrin or zeolite carrier-bound organic perfume agents, are not applied directly to the ink layer **2**; rather they are first admixed with a varnish and applied as part of a barrier varnish layer over the ink layer. Free organic and inorganic

fragrance/perfume agents may be applied directly to the ink layer **2**. Free fragrance agents or carrier agents may also be mixed with an ink and applied as part of the ink layer **2**. An adhesive layer **4** comprising a direct skin contact hypoallergenic adhesive is on one surface of the membrane layer **3**, opposite the ink layer **2**, such that the adhesive layer **4** is between the membrane layer **3** and a release backer layer **5**. The adhesive layer **4** is releasably adhered to the release backer layer **5** and may be readily detached from the release backer layer **5** by the user and thereafter applied to the skin.

Figure 2 depicts a schematic cross-sectional view of another illustrative embodiment of the skin-adhesive decal according to the invention. A barrier varnish layer **6** is interposed between the ink layer **2** and the membrane layer **3**. Where low-migrating inks are employed, the barrier varnish layer **6** further ensures that inks applied in the ink layer **2** will not penetrate or migrate enough to come in contact with skin, and further that perspiration or oily exudates of the skin do not migrate into and degrade the quality of the ink layer **2**. An adhesive layer **4** is disposed between and adjacent the membrane layer **3** a release backer layer. The adhesive layer **4** is releasably adhered to the release backer layer **5**.

According to Figure 3 another specific embodiment of the inventive skin-adhesive decals is depicted. In some embodiments, the decal comprises at least two layers of barrier varnish, including a barrier varnish layer **6** interposed between and adjacent the membrane layer **3** and the ink layer **2**, and a barrier varnish layer **7** applied over the ink layer **2** and comprising one or more special effects agents. The barrier varnish layer **7** may also protect inks applied in the ink layer **2** or provide additional textural effects, for example by being subject to frothing techniques. Special effects agents may include, as non-limiting examples, fragrance elements which may be organic, oily or water-based and be present as free molecules within the barrier varnish matrix or encapsulated or bound to carrier molecules by methods well-known in the art. Special effects agents may also include any agent which can be admixed with the barrier varnish, or deposited on the barrier varnish, which create or impart a special sensory effect. Non-limiting examples include metallics, glitter, texture agents, for example to provide a three-dimensional effect, and flocking agents, for example to create a furry texture, and other textural elements applied to create holographic or perceptual effects. Such elements, processes and methods are well-known in the specialty ink process arts in the

context of printing on fabrics/woven/paper materials and may be employed herein in association with particular embodiments, for example by admixing with varnish where carriers are necessary, and by including a barrier varnish layer beneath the ink layer to inhibit migration of low-migrating inks and prevent direct contact with skin.

As is understood in the art, many inks comprising special effects agents are generally not approved for direct contact with skin. Further, many inks comprising special effects agents suffer from unacceptable thickness or rigidity upon drying on conventional decal substrates. The present inventors surprisingly discovered that linear low density polyethylene membranes provide a substrate ideal for utilization of special-effects agents and inks when applied in combination with the disclosed barrier varnish layers, because (1) migration to skin is avoided, (2) migration of skin exudates toward the ink layer is avoided, and (3) inks may be applied thinly enough to avoid cracking during elongation tolerances expected with ordinary skin movement and permitted by the elastic properties of the low density polyethylene membranes.

It may be readily discerned and understood that in embodiments where the ink layer **2** comprises discrete non-contiguous areas applied over a portion of the membrane layer 3, the barrier varnish layer **1** may be in direct contact with portions of the membrane layer **3**. Hence, the figures, while depicting totally contiguous surfaces, should not be construed to exclude such embodiments.

Figure 4 depicts another specific embodiment of the skin-adhesive decals of the invention, comprising two barrier varnish layers and special effects agents. A barrier varnish layer **6** is disposed between a membrane layer **3** and an ink layer **2**. A barrier varnish layer **7**, which is admixed with one or more special effects agents, is applied over the ink layer.

Referring to Figure 5, an embodiment wherein the ink layer **2** comprises an ultraviolet (UV) ink is depicted. A UV ink is known in the art as a substantially non-migrating ink and therefore in some embodiments may be employed without a barrier varnish layer. In particular a UV ink is substantially non-migrating with respect to the low density polyethylene membrane embodiment of the instant disclosure. UV ink is typically substantially invisible in wavelengths of the visible spectrum, but becomes visible under UV (black) light. UV inks are typically not used in applications requiring contact with skin, but are well known in woven and fabric substrate applications.

Non-limiting examples of inks suitable for specific embodiments of the invention include glow-in-the-dark, thermo-chromic, photo-chromic, hydro-chromic, glitter, metallic, cold-cast, and cure inks. The ink may be ultraviolet or water-based. A ink layer may comprise more than one layer of ink depending on effect or design desired. According to some embodiments, an ink layer may be formed by application of a color process ink, such as by application of a layer of CMYK, followed by application of a spot layer comprising a special-effects ink such as glow-in-the-dark ink. The special effects inks contemplated by the disclosure are well-known in the art. CMYK is a well-known type of process color printing and refers to the four inks used therein: cyan, magenta, yellow, and key (black). Ink is generally although not necessarily applied in the order of the abbreviation. Process color printing is a subtractive coloring process, contrasted for example with spot color printing, in which specific colored inks are used to produce the colors appearing on a substrate.

Application of the ink layer may be by printing with both four-color process inks and additional spot color inks. Generally high-quality materials such as photographic images require process color printing while other special effects inks such as metallic inks and glow inks, require spot color printing. As used herein "CMYK layer" is understood to include as many CMYK layers as necessary to achieve a desired color or image.

A thermo-chromatic ink changes color as the ink temperature changes. Generally, below an activation temperature the ink is one color and above an activation temperature the ink lightens or become clear. As the ink cools, the original color returns. For example, a purple ink may become pink at a skin-surface temperature below activation temperature and then return to purple when cooled. Preferred inks for specific embodiments herein are engineered with an activation temperature close to skin surface temperature such that ordinary changes in skin temperature trigger a temperature and therefore color change in the ink. In other specific embodiments a first CMYK layer is applied to the membrane layer and a thermo-chromatic ink is spot applied to the CMYK layer. In other specific embodiments, above activation temperature the thermo-chromatic ink may become transparent, revealing an image formed from the CMYK layer beneath.

In some embodiments the activation temperature is slightly below ordinary ambient skin temperature. Skin temperature fluctuates according to factors such as air temperature and time spent in that environment, as well as emotional state and health of the person. Skin becomes warmer as blood is diverted to capillaries close to the skin surface, for example, during excited arousal states and fear. In other cases, blood may be diverted from the skin to the inner core of the body, such as during periods of meditation or relaxation. A normal temperature of skin in an ambient, wind-sheltered environment is generally considered to be between about 88 and 94°F. In very specific embodiments, the activation temperature of the thermo-chromatic ink is just below or just above normal skin temperature so that changes in mood or arousal of the person to whom the decal is applied triggers a change in skin temperature and activates the ink on the applied decal to provide a general indication of a change in "mood." In very specific embodiments the activation temperature of the thermo-chromatic ink is about 33°C, equivalent to about 91°F. Such inks are well known by a person of ordinary skill in the decorative printing arts.

A photo-chromatic ink is typically invisible until brought into contact with light of a particular wavelength. In very specific examples the photo-chromatic ink comprises an ultraviolet (UV) ink, which is only visible in "black" light, or light outside the visible spectrum. Hydro-chromatic inks are generally applied as a white ink over a pre-existing image. The ink is activated by water such that when water is applied, the white ink disappears and the image behind the ink appears. When the water dries, the image goes back to white. A person of ordinary skill in the art will readily recognize the wide variety of visual effects which may be achieved by mixtures and superimpositions/layering configurations of the various reveal-type image inks activated by one or more of temperature, wavelength of light, and water. Generally a color process ink may be applied to create an image which is then obscured by a spot layer of a special effects ink, and then revealed or distorted upon occurrence of a triggering environmental condition. Creative reveal effects of an infinite variety are contemplated.

The inventors surprisingly found that by utilizing membrane substrates comprising very specific features as disclosed herein, it is possible to employ a wider variety of specialty inks in a skin-adhesive decal while avoiding safety concerns

associated with very thin breathable substrates known in the art, and while avoiding resort to thick unrealistic substrates to prevent such contact.

According to one embodiment, the membrane layer comprises a polyethylene film. In a particularly preferred embodiment, the polyethylene film is a latex-free low density polyethylene film, and in a very specific embodiment the membrane layer comprises a linear low density polyethylene film. According to some specific embodiments, a membrane layer comprises a linear low-density polyethylene (LLDPE), which is a substantially linear polymer (polyethylene), with significant numbers of short branches. LLDPEs are known for comparatively high tensile strength and have higher impact and puncture resistance than conventional substrates including polyethylene in general and other LDPEs. LLDPE is highly flexible and can be used to make thinner films, with better environmental stress cracking resistance. Further, LLDPE exhibits superior chemical resistance. In contrast to substrates known in the body decal arts, LLDPEs are water-resistant rather than water-permeable and therefore skin-adhesive decals according to the invention maybe be manufactured with a wider variety of specialty inks including inks which have not been approved for contact or for prolonged contact with skin. Films suitable for membranes according to the disclosure are medical grade films available, for example, from Mactac North America. A product designated TM1015 is an exemplary film and further comprises an acrylic medical grade adhesive coating protected by a release liner. Various release liners are available depending on specific needs. A preferred release backer layer according to the invention comprises a silicone release. The film is designed to be highly conformable in skin applications and transparent, with low light reflectance. The present inventors surprisingly discovered that in combination with certain other inventive layering configurations, low density polyethylene films provide superior physical tolerances for print process and body decal needs.

In specific embodiments the thickness of the membrane layer, adhesive layer and release backer layer combined is between about .005 and .007 inches. In a very specific embodiment the combined thickness is about .006 inches. In other specific embodiments a combined thickness of the membrane layer and adhesive layer is about .0025 inches and a thickness of the release backer is about .0035 inches. In other specific embodiments the membrane layer is elastic and capable of elongation such that it

substantially conforms to body movement without triggering premature peeling of the applied skin-adhesive decal. In very specific embodiments the membrane layer possesses a percentage elongation property of between about 300 and 450 as measured according to ASTM – D882 test protocol.

Other embodiments of the invention are directed to methods of manufacturing a skin-adhesive decal. According to one embodiment, a method comprises (a) providing a porous breathable water-resistant low density polyethylene membrane having a hypo-allergenic acrylic adhesive on one surface of the membrane and a release backer applied to the adhesive opposite the membrane; (b) applying an ink adjacent a surface of the membrane opposite the adhesive; and (c) optionally applying one or more barrier varnish layers. According to specific embodiments, a barrier varnish layer may be applied over the ink layer, and/or a barrier varnish layer may be interposed between the ink layer and the membrane layer. Application of a barrier varnish layer between the ink and membrane level further inhibits migration/penetration of ink toward the skin, and is particularly important where inks not approved for direct contact with human skin are contemplated. The interposed barrier varnish layer further inhibits migration of skin exudates into the ink layer, substantially preventing degradation of the image by perspiration and oil, resulting in a longer lasting pleasing effect to the decal as applied.

The ink may be applied to the membrane or to the varnish coating over the membrane, in more than one application process, each of which may comprise one or more steps. For example, one or more color process inks may be applied followed by application of at least one spot process ink over at least a portion of the color process ink. Various application configurations may provide numerous special effects. Spot process inks capable of providing desirable artistic and reveal visual effects include, without limit, glow-in-the-dark, ultraviolet, photo-chromatic, hydro-chromatic, and thermo-chromatic ink. Special agents which confer additional sensory effects may be applied directly to the ink layer, or admixed with a varnish applied over the ink layer. Such agents include but are not limited to fragrance, metallic, texture, flocking or glitter elements. Printing may be effectuated by any conventional process known for printing images on flexible substrates including but not limited to flexographic, off-set, sheet-fed offset, digital, and gravure printing processes.

The decals may be provided in various forms. The printed image may be partially precut so that the edge of the decal is the perimeter of the image, or any shape may be cut (e.g. circular, square, irregular), or so that the perimeter comprises a transparent portion allowing the image to stand out against skin viewed through the transparent portion. The decals may be provided as individual decals or in sheets with decals able to be peeled in pre-cut shapes from the release backer layer, or the consumer may be provided uncut decals on sheets which are then cut to desired shapes by the consumer.

It is noted that terms like "generally," "ordinary," and "typically," when utilized herein, are not intended to limit the scope of the claimed embodiments or to imply that certain features are critical, essential, or even important to the structure or function of the claimed embodiments. Rather, these terms are merely intended to identify particular aspects of an embodiment or to emphasize alternative or additional features that may or may not be utilized in a particular embodiment.

For the purposes of describing and defining embodiments herein it is noted that the terms "substantially," "significantly," and "approximately" are utilized to represent the inherent degree of uncertainty that may be attributed to any quantitative comparison, value, measurement, or other representation. The terms "substantially," "significantly," and "approximately" are also utilized herein to represent the degree by which a quantitative representation may vary from a stated reference without resulting in a change in the basic function of the subject matter at issue.

Having described embodiments of the present invention in detail, and by reference to specific embodiments thereof, it will be apparent that modifications and variations are possible without departing from the scope of the embodiments defined in the appended claims. More specifically, although some aspects of embodiments of the present invention are identified herein as preferred or particularly advantageous, it is contemplated that the embodiments of the present invention are not necessarily limited to these expressed aspects.

CLAIMS

1. A skin-adhesive decal comprising:

(a) a membrane layer comprising a flexible elastic polymeric water-resistant film;

(b) an adhesive layer disposed on one side of the membrane layer;

(c) a release backer layer releasably adhered to one side of the adhesive layer;

(d) an ink layer disposed across at least a portion of the membrane layer, wherein the ink layer comprises a substantially non-migrating or low-migrating ink, and

(e) optionally, one or more barrier varnish layers.

2. A skin-adhesive decal according to claim 1, comprising a barrier varnish layer interposed between the ink layer and the membrane layer.

3. A skin adhesive decal according to claim 1, wherein the membrane layer comprises a breathable latex-free film

4. A skin adhesive decal according to claim 3 wherein the membrane layer comprises a low density polyethylene film.

5. A skin adhesive decal according to claim 4, wherein the membrane comprises a linear low density polyethylene film.

6. A skin-adhesive decal according to claim 1 further comprising a fragrance element applied to a surface of the ink layer.

7. A skin adhesive decal according to claim 1 comprising a barrier varnish layer disposed across a surface of the ink layer.

8. A skin-adhesive decal according to claim 7, wherein the barrier varnish layer comprises one or more special effects agents admixed within the barrier varnish.

9. A skin-adhesive decal according to claim 8, wherein the special effects agents are selected from a fragrance element, a metallic element, a texture element, a flocking element and a glitter element.

10. A skin-adhesive decal according to claim 1, wherein the ink layer comprises a layer of process color ink and a spot layer applied over at least a portion of the process color ink, wherein the spot layer comprises one or more of a glow-in-the-dark ink, an ultraviolet ink, a photo-chromatic ink, a hydro-chromatic ink, and a thermo-chromatic ink.

11. A skin-adhesive decal according to claim 10, wherein the spot layer comprises a thermo-chromatic ink having an activation temperature just above or just below normal ambient human skin surface temperature such that a change in an arousal state of a person on whom the decal is applied triggers a change in a color of the ink layer.

12. A skin-adhesive decal according to claim 10, wherein the spot layer comprises a photo-chromatic ink such that exposure to a triggering wavelength of light results in a change in a visual image on the decal.

13. A skin-adhesive decal according to claim 1, wherein the adhesive layer comprises a hypo-allergenic acrylic substantially water-insoluble adhesive.

14. A skin-adhesive decal according to claim 1, wherein the membrane layer, the adhesive layer and the release backer layer combined are no more than about .007 inches in thickness.

15. A skin-adhesive decal according to claim 1, wherein the membrane layer possesses a percent elongation property of between about 300 and about 450 according to ASTM-D882.

16. A skin-adhesive decal according to claim 1, wherein the release backer lining comprises a silicone release coating.

17. A skin-adhesive decal comprising:

(a) a membrane layer comprising a flexible elastic water-resistant low density polyethylene film;

(b) a hypoallergenic substantially water-insoluble acrylic adhesive layer disposed on one side of the membrane layer;

(c) a release backer layer comprising a silicone release coating and releasably adhered to the adhesive layer;

(d) an ink layer adjacent at least a portion of a surface of the membrane layer opposite the adhesive layer, wherein the ink comprises a substantially non-migrating or low-migrating ink,

(e) optionally a barrier varnish layer disposed over the ink layer; and

(f) optionally a barrier varnish layer interposed between the ink layer and the membrane layer;

wherein a combined thickness of the membrane layer and adhesive layer is less than .0030 inches and the membrane layer possesses a percent elongation property of between about 300 and about 450 according to ASTM-D882.

18. A method of manufacturing a skin-adhesive decal comprising the steps of:

(a) providing a porous breathable water-resistant low density polyethylene membrane having a hypo-allergenic acrylic adhesive on one surface of the membrane and a release backer applied to the adhesive opposite the membrane;

(b) applying an ink adjacent a surface of the membrane opposite the adhesive; and

(c) optionally applying one or more barrier varnish layers.

19. The method according to claim 18, comprising applying a barrier varnish over the ink.

20. The method according to claim 19, comprising applying a barrier varnish to the membrane opposite the adhesive and prior to application of the ink such that the barrier varnish is interposed between the membrane and the ink.

21. The method according to claim 18 wherein application of the ink comprises one or more applications of one or more color process inks followed by application of at least one spot process ink over a color process ink, the spot process ink selected from one or more of glow-in-the-dark, ultraviolet, photo-chromatic, hydro-chromatic, and thermo-chromatic ink.

22. The method according to claim 19, wherein the barrier varnish layer comprises fragrance, metallic, texture or glitter elements.

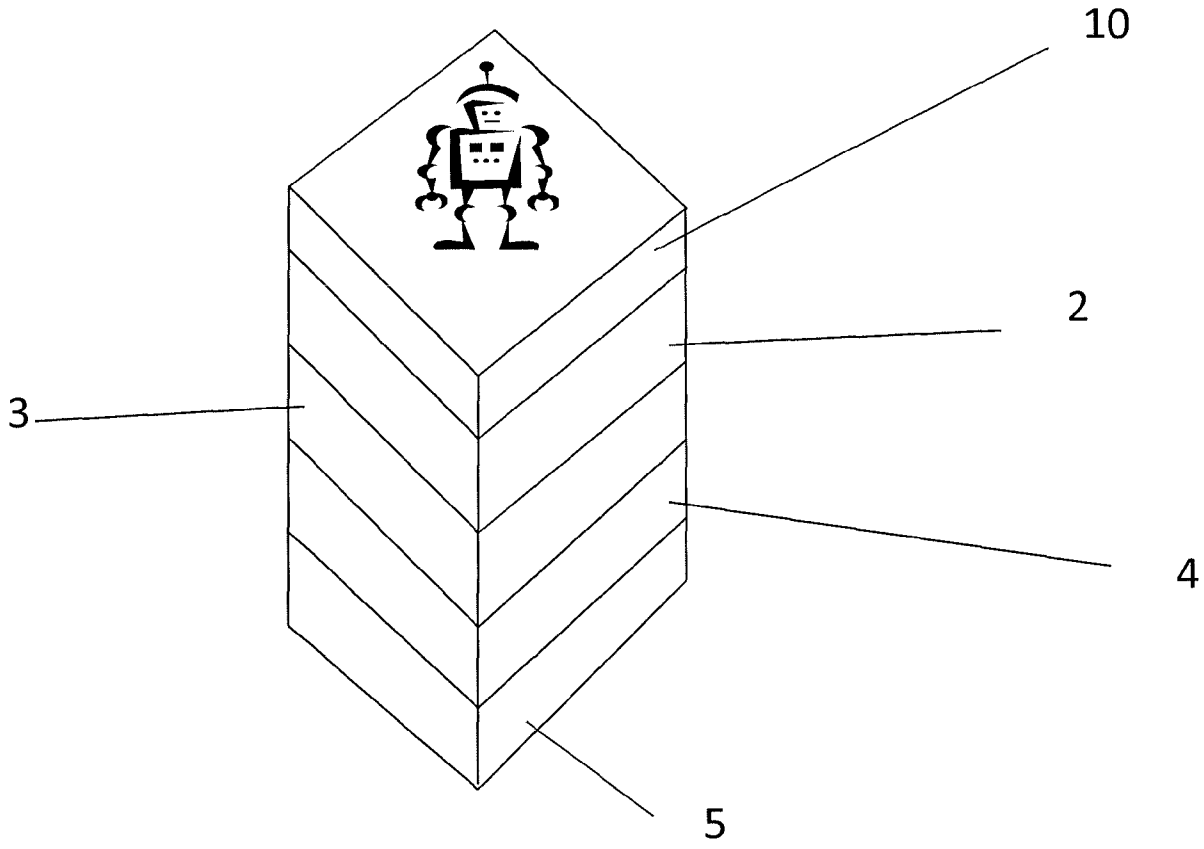

Fig. 1

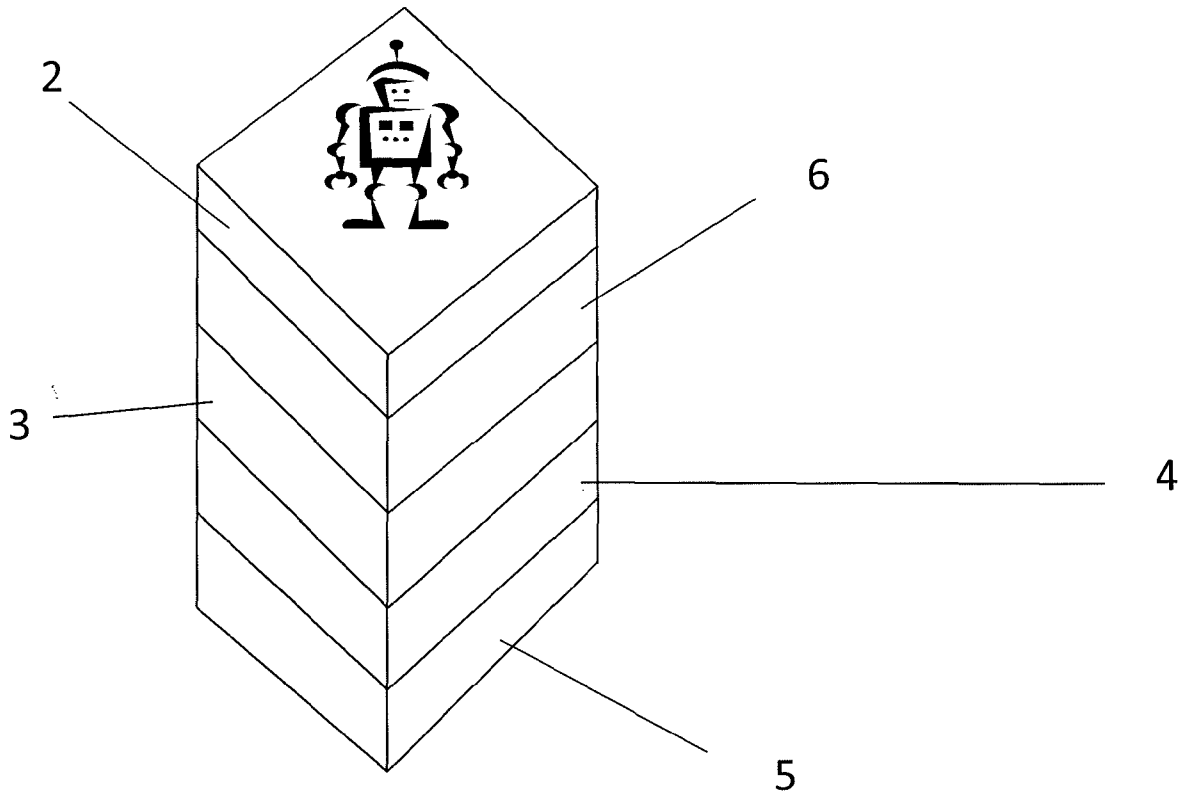

Fig. 2

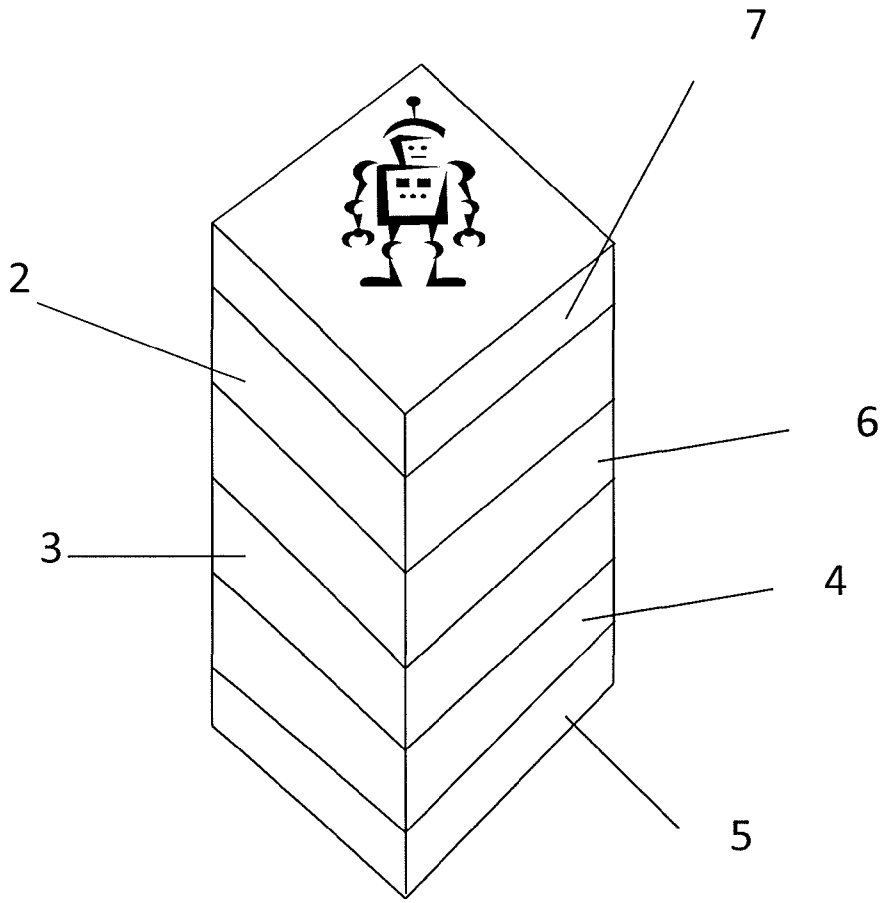

Fig. 3

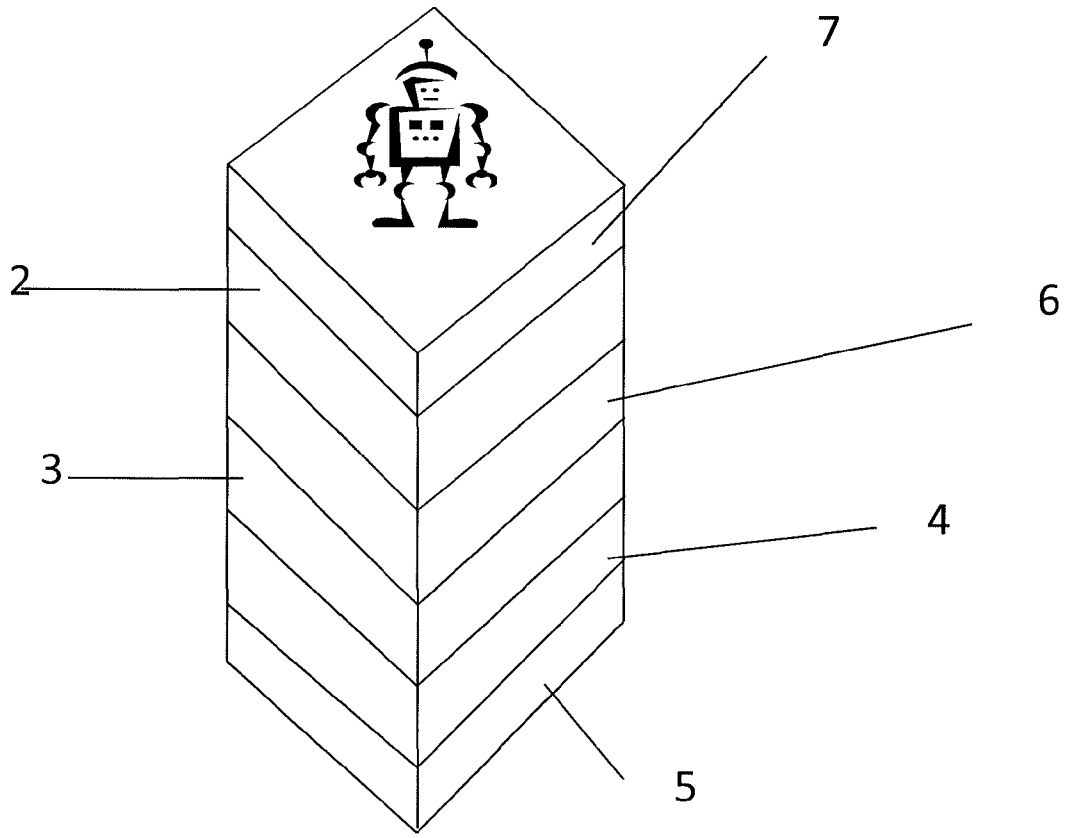

Fig. 4

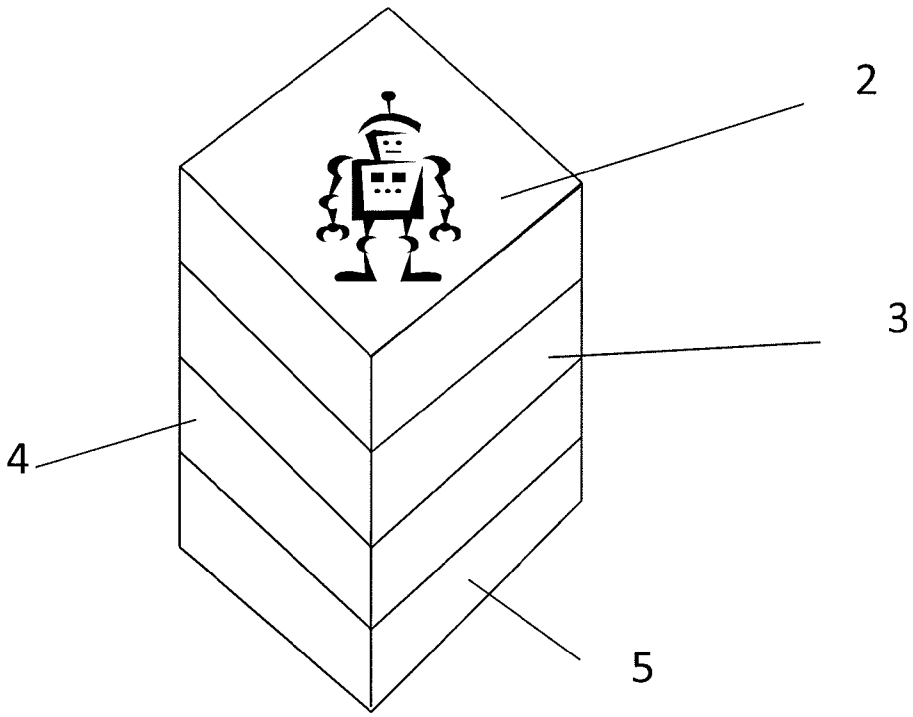

Fig. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 13/27040

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - B32B 9/00, B41M 3/12, C09D 5/16 (2013.01)
USPC - 428/40.1, 428/41.6, 428/41.7, 428/41.8, 428/42.1
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)
IPC(8)- B32B 9/00, B41M 3/12, C09D 5/16 (2013.01);
USPC- 428/40.1, 428/41.6, 428/41.7, 428/41.8, 428/42.1

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Patents and NPL (classification, keyword; search terms below)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PubWest, PatBase (USPTO, EPO, JPO, WIPO, PCT), GoogleScholar (PL, NPL), FreePatentsOnline (USPTO, EPO, JPO, WIPO, NPL); search terms: decal, tattoo, patch, layer, sheet, film, multilayer, membrane, elastic, elastomer, rubber, water, resistant, repel, release, non-migrate, low-migrate, varnish, acrylic, LDPE, LLDPE, linear, low, density, polyethyle

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2008/0233324 A1 (LEE et al.) 25 September 2008 (25.09.2008), Figs. 2, 3; para [0017], [0020], [0036], [0055]-[0059], [0103]	1-22
Y	US 2003/0152733 A1 (WITTMEYER) 14 August 2003 (14.08.2003), Fig. 1; para [0009], [0012], [0013], [0017], [0025], [0029]-[0035]	1-22
Y	US 2006/0232059 A1 (FORTUNE et al.) 19 October 2006 (19.10.2006), para [0010], [0020], [0022], [0023]	10, 11, 21
Y	US 2006/0251843 A1 (GIVENS et al.) 09 November 2006 (09.11.2006), para [0027], [0030]	13, 17-22
Y	US 5,817,385 A (STANISLAV) 06 October 1998 (06.10.1998); abstract	6
Y	US 2007/0259029 A1 (MCENTIRE et al.) 08 November 2007 (08.11.2007), para [0021]-[0215]	1-22
Y	WO 02/076379 A2 (LIPPER et al.) 03 October 2002 (03.10.2002), pg 2-18	1-22
Y	US 6,042,881 A (EWAN) 28 March 2000 (28.03.2000), col 2-5	1-22
Y	WO 99/39167 A1 (RIBI et al.) 05 August 1999 (05.08.1999), pg 2-15	1-22
Y	US 5,942,065 A (BIGGS et al.) 24 August 1999 (24.08.1999), col 2-5	1-22

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 April 2013 (14.04.2013)	08 MAY 2013

Name and mailing address of the ISA/US	Authorized officer:
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

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