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(54) Title: METHODS OF USING ABRASIVE ARTICLES

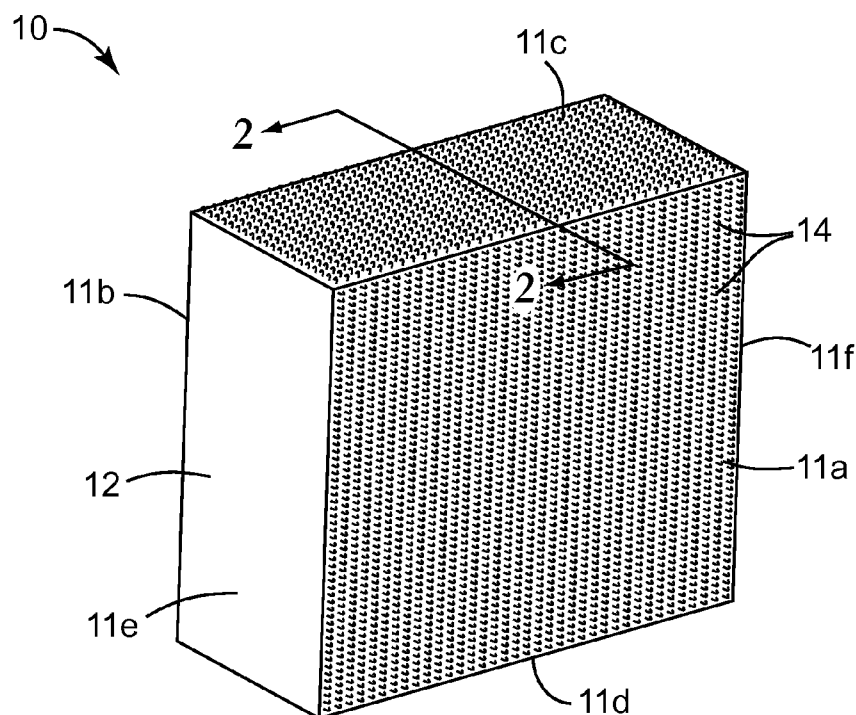


FIG. 1

(57) Abstract: Methods and kits are described for removing pills in fabric, particularly clothing, using a compressible abrasive article.



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- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

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METHODS OF USING ABRASIVE ARTICLES

Background

Pilling is a surface defect of certain textiles caused by repeated use. It may occur when the washing and wearing of fabrics causes loose fibers to emerge from the surface of the textile. Eventually, surface abrasion can result in the fibers developing into small spherical bundles, anchored to the surface of the fabric by protruding fibers that have not yet broken. Fibers such as wool, cotton, polyester, nylon and acrylic have a greater tendency to pill, though wool pilling diminishes over time as non-tenacious wool fibers work themselves free of the fabric and break away. Pilling of certain synthetic textiles is a more serious problem, as the stronger fibers securely hold onto the pills and do not allow pills to naturally escape.

Though aesthetically unseemly, pills do not initially interfere with the functionality of the textile. However, the continued existence of one or more pills may result in a hole in the fabric. Without wishing to be bound by theory, the emergence of pill causes areas of weakness, since the formation of the pill removes filaments or fibers from the fabric, causing the fabric to thin. Once the fabric decreases in thickness a sufficient amount, there is an increased likelihood that a hole will form in the weakened area.

Pilling can compromise a textile's desirability, and is the focus of appreciable industry research. Attempts have been made to allow consumers to remove pills from clothing. Exemplary products include handheld electric fabric shavers consisting of rotating blades behind a large-holed screen, which remove pills by forcing the pills through the screen and slicing them off with the blades; pumice stones that remove pills by cutting the filaments holding the pills using the sharp edges of the stone; and fabric combs that remove pills either by catching the pills in the teeth of the comb and pulling the pills off of the clothing or by cutting the filaments using an abrasive edge.

Summary

These three categories of pill removal products suffer from several disadvantages. Electric shavers can damage clothing and require clothing to be placed on a flat surface before using the device. Pumice stones can also be damaging to clothing and tend to leave pumice particles behind on the fabric. Fabric combs are conveniently small for portability and can be used while wearing the garment but remove pills from only a small area at a time.

The present disclosure provides an abrasive article for fabric pill removal. The conformable abrasive article includes a substrate having at least one surface with abrasive particles attached thereto. The substrate typically includes a foam. Advantages of the present disclosure include ergonomic comfort, ease of use, conformability to clothing on the wearer, low degree of fabric damage in use, ease of reuse, and the ability to treat a large area of fabric quickly.

In one aspect the methods includes providing a conformable, abrasive article, wherein the abrasive article has at least one abrasive surface with abrasive particles attached thereto; contacting the

surface of a fabric with the abrasive surface of the abrasive article; wherein pills on the surface of the fabric are abraded by the abrasive particles attached to the abrasive surface of the abrasive article while the abrasive surface of the abrasive article is moved relative to the surface.

In another aspect, the present disclosure provides a method for removing pills from clothing, the method including: providing an abrasive article including at least one abrasive surface, the abrasive surface including a plurality of abrasive particles; providing a fabric having a pill formed on a surface thereof; contacting the abrasive surface of the article on the fabric surface proximate to or in contact with the pill; and moving the abrasive article relative to the fabric surface, wherein the movement of the article relative to the surface is sufficient to abrade the pill.

In certain embodiments, the pills are removed from the fabric surface. In another aspect, the methods provide a kit for removing pills from fabric, the kit including; an abrasive article comprising at least one abrasive surface; instructions for abrading a pill, the instructions describing the steps of: contacting the abrasive surface of the article on a fabric surface proximate to or in contact with the pill; and moving the abrasive article relative to the fabric surface.

In certain embodiments of the kits and the methods of the present disclosure, the abrasive article is a sanding sponge.

As used herein, a “pill” means a fibrous bundle on the surface of a textile fabric.

As used herein, an “abrasive surface” means a surface of an article having abrasive particles coupled thereto. In certain preferred embodiments, the abrasive surface includes an abrasive layer.

The terms “comprises” and variations thereof do not have a limiting meaning where these terms appear in the description and claims.

The words “preferred” and “preferably” refer to embodiments of the invention that may afford certain benefits, under certain circumstances. However, other embodiments may also be preferred, under the same or other circumstances. Furthermore, the recitation of one or more preferred embodiments does not imply that other embodiments are not useful, and is not intended to exclude other embodiments from the scope of the invention.

As recited herein, all numbers should be considered modified by the term “about”.

As used herein, “a,” “an,” “the,” “at least one,” and “one or more” are used interchangeably. Thus, for example, a fabric comprising “a” pill can be interpreted to comprise “one or more” pills.

Also herein, the recitations of numerical ranges by endpoints include all numbers subsumed within that range (e.g., 1 to 5 includes 1, 1.5, 2, 2.75, 3, 3.80, 4, 5, etc.).

The above summary of the present invention is not intended to describe each disclosed embodiment or every implementation of the present invention. The description that follows more particularly exemplifies illustrative embodiments. In several places throughout the application, guidance is provided through lists of examples, which examples can be used in various combinations. In each instance, the recited list serves only as a representative group and should not be interpreted as an exhaustive list.

Brief Description of the Drawings

The invention will be further described with reference to the drawings, wherein corresponding reference characters indicate corresponding parts throughout the several views, and wherein:

Figure 1 is a perspective view of an abrasive article for use in the methods of the present disclosure;

Figure 2 is a cross-sectional view of an abrasive surface of Fig. 1;

Figure 3 is a side view of an abrasive article attached to a handle according to an embodiment of the present disclosure; and

Figure 4 is an illustration of an abrasive article being use to remove a pill from a fabric, while the fabric is being worn.

Figure 5 is a top view of another embodiment of an abrasive article for use in the methods of the present disclosure;

Layers in certain depicted embodiments are for illustrative purposes only and are not intended to absolutely define the thickness, relative or otherwise, or the location of any component. While the above-identified figures set forth several embodiments of the invention, other embodiments are also contemplated, as noted in the discussion. In all cases, this disclosure presents the invention by way of representation and not limitation. It should be understood that numerous other modifications and embodiments can be devised by those skilled in the art, which fall within the scope and spirit of the principles of the invention.

Detailed Description of Illustrative Embodiments

The methods of the present disclosure allow for improved, simplified removal of pills from fabric substrates. The methods include contacting a fabric surface with an abrasive article at a location proximate to a pill. Simultaneous with or following the surface contact, the abrasive article can be moved relative to fabric surface to abrade the pill. This movement may take the form of rotational movement, lateral movement, sweeping movement in the direction of the pill, and combinations thereof. It should be appreciated that the type of movement relative to the surface does not limit the scope of the present disclosure and that any movement sufficient to abrade the pill is within the scope of the inventive methods. In preferred embodiments, the abrasion of the pill caused by the movement of the abrasive article is sufficient to remove the pill from the fabric surface.

Referring to Figure 1, an abrasive article 10 suitable for use in the methods of the present disclosure includes a substrate 12 and a plurality of abrasive particles 14 at least partially attached to one or more surfaces of the substrate 12. The abrasive article 10 features three pairs of opposing major surfaces: 11a and 11b; 11c and 11d; and 11e and 11f. While the abrasive article 10 is shown as having

two major surfaces 11a and 11c coated with abrasive particles, any or all surfaces of the substrate 12 can be coated. In a particular useful implementation, four major surfaces 11a, 11b, 11c and 11d are coated, leaving side surfaces 11e and 11f without deliberately attached abrasive particles. In other suitable implementations (e.g., Figure 5), only one major surface is coated within abrasive particles. This implementation can be more comfortable for gripping or other manipulation by a user. Though depicted as having a generally rectangular cross-section, it should be appreciated that the abrasive article may have any shape (e.g., hexagonal, conical, frustoconical, etc.) that provides at least one exterior surface to bond abrasive particles.

One particularly suitable abrasive article is a sanding sponge. Sanding sponges generally include a layer of abrasive particles adhered to a foam backing by a flexible adhesive. One such sanding sponge is commercially available from 3M Company, St Paul, Minn. under the trade designation "SandBlaster Bare Surfaces Sponge". The flexible adhesive layer and the foam backing permit the layer of abrasive to conform to the surface being abraded. Exemplary suitable abrasive articles, including sanding sponges, may be found in: US Patent Nos. 6,059,850, 6,406,504, and 6,419,573 all to Lise et al.; US Patent No. 6,733,876 to Beardsley et al; and US Patent Publication Nos. 2004/0038634 to McCarthy and 2006/0288647 to Thurber et al.

Referring now to FIG. 2, there is shown a cross sectional view of abrasive article 10, depicting an abrasive layer 16. The abrasive layer includes at least a flexible adhesive 13 and a plurality of abrasive particles 14 at least partially embedded within the adhesive 8.

The flexible adhesive 13, commonly known as a make coat or make layer, bonds the layer of abrasive particles 14 to the substrate 12 and can adhere the at least some of abrasive particles 14 together, so that the substrate 12 can remain sufficiently flexible to the contour of surfaces to be abraded without substantial loss of abrasive particles. Make coat formulations are known and methods of applying them are described, for example, in U.S. Pat. Nos. 6,059,850 and 6,733,876. Typically, a make coat precursor is first applied to the substrate. Abrasive particles are then at least partially embedded in the make layer (e.g., by electrostatic coating), and the make coat precursor is cured (e.g., crosslinked) to secure the particles to the make layer. The make coat precursor suitable for use in the invention is a coatable, hardenable adhesive binder and may comprise one or more thermoplastic or thermosetting resinous adhesives. Resinous adhesives suitable for use in the present invention include phenolic resins, aminoplast resins having pendant (α,β)-unsaturated carbonyl groups, epoxy resins, ethylenically unsaturated resins, acrylated isocyanurate resins, urea-formaldehyde resins, isocyanurate resins, acrylated urethane resins, acrylated epoxy resins, bismaleimide resins, fluorene-modified epoxy resins, polyurethane resins and combinations thereof.

A layer of hard, anti-loading size coating 15 can optionally extend over the flexible adhesive 13 and the abrasive particles 14 opposite the substrate 12. Size coat formulations are known and methods of applying them are described, for example, in U.S. Pat. Nos. 6,059,850 and 6,733,876. Typically, a size layer comprising a size coat precursor is applied over the make layer and abrasive particles, followed by

curing of the size precursor. Alternatively, both the size and make precursors may be cured at the same time.

The abrasive particle 14 can be any known abrasive particle, including the abrasive particles described in U.S. Pat. Nos. 6,059,850 or 6,733,876, particularly including particles of aluminum oxide including ceramic aluminum oxide, heat-treated aluminum oxide and white-fused aluminum oxide; as well as silicon carbide, alumina zirconia, diamond, ceria, cubic boron nitride, garnet, ground glass, quartz, and combinations of the foregoing in the range of about 36 to 400 grit. Other softer abrasive particles, such as certain thermoset polymers or crushed natural materials (e.g., nutshells) may be useful in certain implementations.

Useful abrasive particles include all known fine and larger abrasive particles having a median particle diameter of from 1 micron to about 600 microns (2000 to 30 grit). In certain embodiments, the abrasive particles include at least 50 grit, in some embodiments at least 75 grit, and in some embodiments at least 80 grit. In certain aspects, the abrasive particles include a grit of no greater than 200, in certain embodiments, no greater than 170, in other embodiments no greater than 150, and in yet other embodiments no greater than 125.

The abrasive particles can be uniformly or non-uniformly distributed on the abrasive surface. In some embodiments, only a portion of the abrasive surface includes abrasive particles bound thereto. In other suitable embodiments, the abrasive particles are distributed across and along the entire surface.

In general, any resilient substrate 12 with coatable surfaces on at least one surface of the substrate may be used in the abrasive articles of the present disclosure. These include open-cell foams, closed-cell foams, reticulated foams, and combinations thereof, any of which can further include an outer skin layer. Suitable foam substrates can be made from synthetic polymer materials, such as, polyurethanes, foam rubbers, and silicones, and natural sponge materials. One particularly useful substrate is a urethane, open-cell foam. Another suitable substrate comprises a first layer of open-cell foam and a second layer of foam rubber. In some embodiments, the compression ratio of the foams is at least 1.5 to 10 (i.e., the compression ratio of the foam is the ratio of the thickness of the foam before it is compressed to the thickness of the foam after it is compressed).

Typically the substrate 12 has a thickness that ranges from 1 mm to 100 mm, such that the substrate can be easily manipulated by a user, though greater to lesser substrate thickness may conceivably be used. Other dimensions may be selected without deviating from the scope of the present disclosure. One particularly suitable abrasive article is a 6.7cm X 4.8cm sanding sponge. In certain embodiments, it may be preferable to have a sponge sized and shaped to be manipulated by hand without any other implements attached thereto.

Turning now to FIG. 3, an abrasive article 20 can include a handle 30 coupled to at least a portion of at least one surface thereof. The handle 30 includes a least one graspable portion 32, which can be in the form of an elongated body or other known handle structure. An abrasive surface 22 is typically opposite the attached surface 24, such that the abrasive surface 22 will be oriented towards a fabric

surface to be abraded when the graspable portion 32 is held by the user. Though depicted as having only one abrasive surface, any and all surfaces of the article 20 may include an abrasive layer (even the attachment surface). The handle 30 may be coupled to the attachment surface 24 of abrasive article 20 by any known permanent or temporary attachment mechanism 34, including but not limited to adhesives, pressure sensitive adhesives, recloseable (e.g., hook and loop) fasteners, mating structures (e.g., posts & apertures), magnetized substrates, or microreplicated features (e.g., microstructures) that engage with the abrasive material.

The abrasive articles described above are particularly suitable for removing pills from fabric surfaces, typically clothing. In one embodiment, an abrasive surface of an abrasive article is brought proximate to or into contact with at least a portion of a fabric surface proximate a pill. The abrasive surface may alternatively be placed directly upon at least a portion of the pill. Subsequently, the abrasive article is moved relative to the fabric surface to allow abrasive particles on the abrasive surface to abrade the pill. This movement preferably keeps at least a portion of the abrasive surface in contact with the fabric. The abrading movement may take the form of, for example, rotational movement, lateral movement, sweeping movement, back-and-forth movement, and combinations thereof. For certain fabrics, this abrading movement may need to occur repeatedly to sufficiently abrade or remove the pill. For other fabrics, including but not limited to certain wool clothing products, the abrading movement can potentially be performed once.

The methods of removing a fabric pill do not necessarily require a hard substrate beneath the fabric surface to work. Accordingly, the methods may advantageously be performed while the fabric is being worn, as depicted in FIG. 4. In certain embodiments, the fabric may be held taught while the pill is abraded. In other embodiments, the abrasive article may be fixed while the fabric surface is moved relative to the abrasive surface. In preferred embodiments, the user may grip at least one side of the abrasive article directly while abrading the pill.

The methods for removing a pill may be performed on a variety of pill-producing fabrics, including but not limited to knits and wovens made from wools and wool blends, synthetics such as polyester, nylon and acrylic, and other natural fibers like cotton.

The pill removing abrasive articles described above may further be provided in a kit. The kit may include one or more abrasive articles. The kit may further include a blade or other cutting implement to allow a user to determine the desired size of the abrasive article. The kit may further include a handle, which may be provided attached to abrasive article or may be provided separately with an attachment mechanism. In certain preferred embodiments, the kit includes instructions for carrying out a method of removing a pill from a fabric surface.

Embodiments

1. A method for removing pills from clothing, the method comprising:
providing a compressible abrasive article including at least one abrasive surface, the abrasive surface including a plurality of abrasive particles;

providing a fabric having a pill formed on a surface thereof;
contacting the abrasive surface of the article on the fabric surface proximate to or in contact with the pill; and

moving the abrasive article relative to the fabric surface, wherein the movement of the article relative to the surface is sufficient to abrade the pill.

2. The method of embodiment 1, wherein the movement of the article relative to the substrate is sufficient to remove the pill.

3. The method of embodiments 1 or 2, wherein moving the abrasive article relative to the fabric surface includes maintaining contact between the abrasive surface and at least a portion of pill during at least a portion of the movement.

4. The method of any of the previous embodiments, wherein the abrasive article is a sanding sponge.

5. The method of any of the previous embodiments, wherein the abrasive surface includes a substrate and an abrasive layer disposed on the substrate.

6. The method according to embodiment 5, wherein the abrasive layer comprises a make layer comprising a make coat, wherein the abrasive particles are at least partially embedded in the make layer, and a size layer comprising a size coat, secured to the make layer and the abrasive particles.

7. The method according to embodiment 6, wherein said make coat is selected from the group consisting of nitrile rubber, acrylate, epoxy, urethane, polyvinyl chloride, and butadiene rubber.

8. The method of embodiments 6 or 7, wherein said size coat is a coatable, hardenable resinous adhesive binder.

9. A method according to any one of embodiments 6-8, wherein the size coat is selected from the group consisting of phenolic resins, aminoplast resins having pendant (α,β)-unsaturated carbonyl groups, urethane resins, epoxy resins, ethylenically unsaturated resins, acrylated isocyanurate resins, urea-formaldehyde resins, isocyanurate resins, acrylated urethane resins, acrylated epoxy resins, bismaleimide resins, fluorene-modified epoxy resins, and combinations thereof.

10. The method of any of the previous embodiments, wherein the abrasive surface includes abrasive particles of no greater than 200 grit and at least 50 grit.

11. The method of embodiment 10, wherein the abrasive surface includes abrasive particles of at least 75 grit and no greater than 150 grit.

12. The method of any of the previous embodiments, wherein said abrasive particles comprise material selected from the group consisting of aluminum oxide, silicon carbide, alumina zirconia, diamond, ceria, cubic boron nitride, garnet, ground glass, quartz, and combinations thereof.

13. The method of any of the previous embodiments, wherein the substrate comprises a foam formed of a material selected from the group consisting of polyurethane, foam rubber, silicone, and natural sponge.

14. The method of any of the previous embodiments, wherein providing an abrasive article comprising providing an abrasive article including a handle attached to a surface thereof.

15. The method of any of the previous embodiments, wherein the abrasive article includes a plurality of abrasive surfaces.

5 16. A kit for removing pills from fabric, the kit comprising:
a compressible abrasive article comprising at least one abrasive surface;
instructions for abrading a pill, the instructions describing the steps of: contacting the abrasive surface of the article on a fabric surface proximate to or in contact with the pill; and moving the abrasive article relative to the fabric surface.

10 17. The kit of embodiment 16, wherein the instructions further describe the step of maintaining contact with between the abrasive surface and the pill for at least a portion of the movement.

18. The kit of embodiments 16 or 17, wherein the abrasive surface includes a substrate and an abrasive layer disposed on the substrate, wherein the abrasive layer comprises a make layer comprising a make coat, wherein the abrasive particles are at least partially embedded in the make layer, and a size layer comprising a size coat, secured to the make layer and the abrasive particles.

15 19. The kit of embodiment 18, wherein the abrasive surface includes abrasive particles of at least 75 grit and no greater than 150 grit.

20. The kit of any of the previous embodiments and further including a handle attachable to surface of the abrasive article.

20 21. The kit of any of the previous embodiments and further comprising a cutting implement.

The complete disclosures of the patents, patent documents, and publications cited herein are incorporated by reference in their entirety as if each were individually incorporated. Various modifications and alterations to this invention will become apparent to those skilled in the art without departing from the scope and spirit of this invention. It should be understood that this invention is not intended to be unduly limited by the illustrative embodiments and examples set forth herein and that such examples and embodiments are presented by way of example only with the scope of the invention intended to be limited only by the claims set forth herein as follows.

We Claim

1. A method for removing pills from clothing, the method comprising:
providing a compressible abrasive article including at least one abrasive surface, the abrasive
5 surface including a plurality of abrasive particles;
providing a fabric having a pill formed on a surface thereof;
contacting the abrasive surface of the article on the fabric surface proximate to or in contact with
the pill; and
moving the abrasive article relative to the fabric surface, wherein the movement of the article
10 relative to the surface is sufficient to abrade the pill.
2. The method of claim 1, wherein the movement of the article relative to the substrate is sufficient
to remove the pill.
- 15 3. The method of claims 1 or 2, wherein moving the abrasive article relative to the fabric surface
includes maintaining contact between the abrasive surface and at least a portion of pill during at least a
portion of the movement.
4. The method of claims 1 or 2, wherein the abrasive article is a sanding sponge.
- 20 5. The method of claims 1 or 2, wherein the abrasive surface includes a substrate and an abrasive
layer disposed on the substrate.
6. The method according to claim 5, wherein the abrasive layer comprises a make layer comprising
25 a make coat, wherein the abrasive particles are at least partially embedded in the make layer, and a size
layer comprising a size coat, secured to the make layer and the abrasive particles.
7. The method according to claim 6, wherein said make coat is selected from the group consisting of
nitrile rubber, acrylate, epoxy, urethane, polyvinyl chloride, and butadiene rubber.
- 30 8. The method of claim 6, wherein said size coat is a coatable, hardenable resinous adhesive binder.
9. A method according to claim 9, wherein the size coat is selected from the group consisting of
phenolic resins, aminoplast resins having pendant (α,β)-unsaturated carbonyl groups, urethane resins,
35 epoxy resins, ethylenically unsaturated resins, acrylated isocyanurate resins, urea-formaldehyde resins,
isocyanurate resins, acrylated urethane resins, acrylated epoxy resins, bismaleimide resins, fluorene-
modified epoxy resins, and combinations thereof.

10. The method of claims 1 or 2, wherein the abrasive surface includes abrasive particles of no greater than 200 grit and at least 50 grit.

11. The method of claim 10, wherein the abrasive surface includes abrasive particles of at least 75 grit and no greater than 150 grit.

12. The method of claims 1 or 2, wherein said abrasive particles comprise material selected from the group consisting of aluminum oxide, silicon carbide, alumina zirconia, diamond, ceria, cubic boron nitride, garnet, ground glass, quartz, and combinations thereof.

13. The method of claims 1 or 2, wherein the substrate comprises a foam formed of a material selected from the group consisting of polyurethane, foam rubber, silicone, and natural sponge.

14. The method of claims 1 or 2, wherein providing an abrasive article comprising providing an abrasive article including a handle attached to a surface thereof.

15. The method of claims 1 or 2, wherein the abrasive article includes a plurality of abrasive surfaces.

16. A kit for removing pills from fabric, the kit comprising:
a compressible abrasive article comprising at least one abrasive surface;
instructions for abrading a pill, the instructions describing the steps of: contacting the abrasive surface of the article on a fabric surface proximate to or in contact with the pill; and moving the abrasive article relative to the fabric surface.

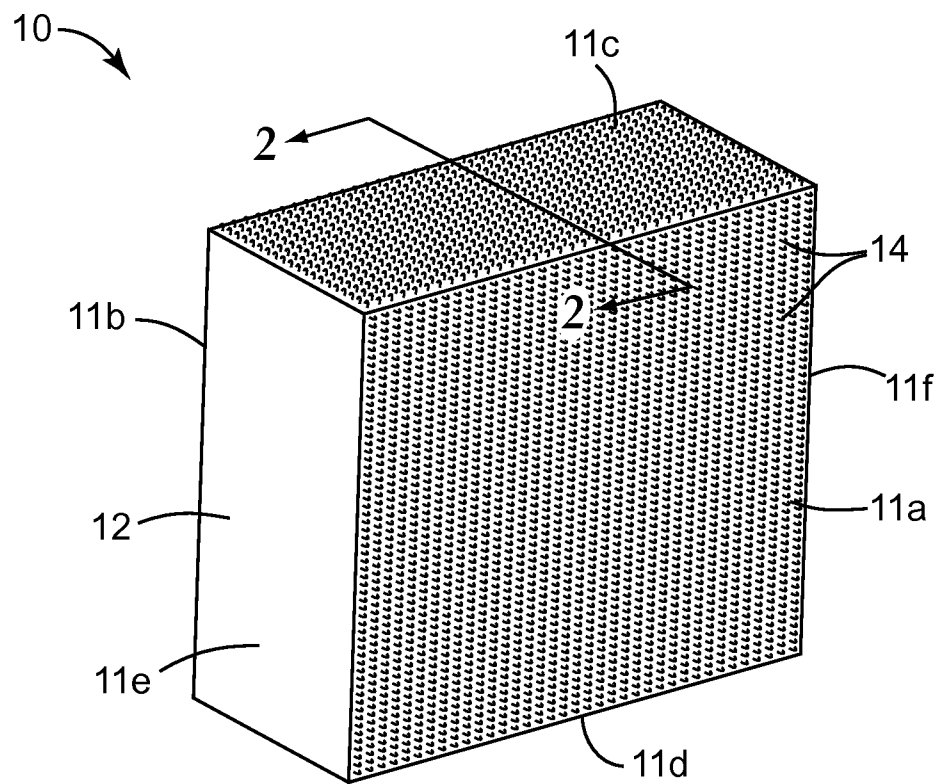
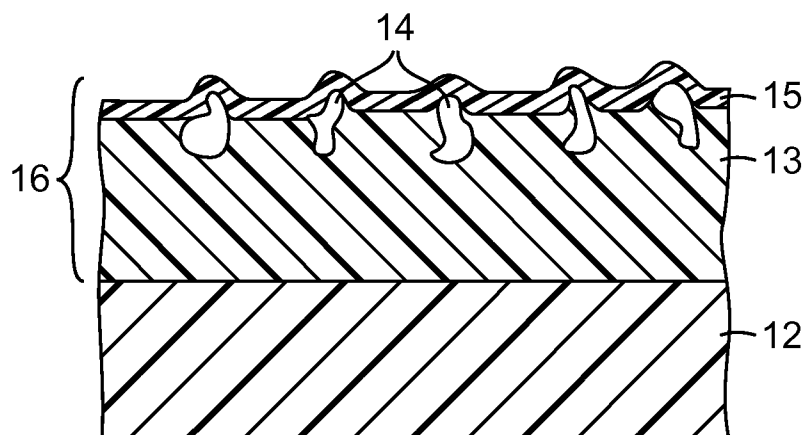
17. The kit of claim 16, wherein the instructions further describe the step of maintaining contact with between the abrasive surface and the pill for at least a portion of the movement.

18. The kit of claims 16 or 17, wherein the abrasive surface includes a substrate and an abrasive layer disposed on the substrate, wherein the abrasive layer comprises a make layer comprising a make coat, wherein the abrasive particles are at least partially embedded in the make layer, and a size layer comprising a size coat, secured to the make layer and the abrasive particles.

19. The kit of claim 18, wherein the abrasive surface includes abrasive particles of at least 75 grit and no greater than 150 grit.

20. The kit of claims 16 or 17, and further including a handle attachable to surface of the abrasive article.

21. The kit of claim 16 and further comprising a cutting implement.

**FIG. 1****FIG. 2**

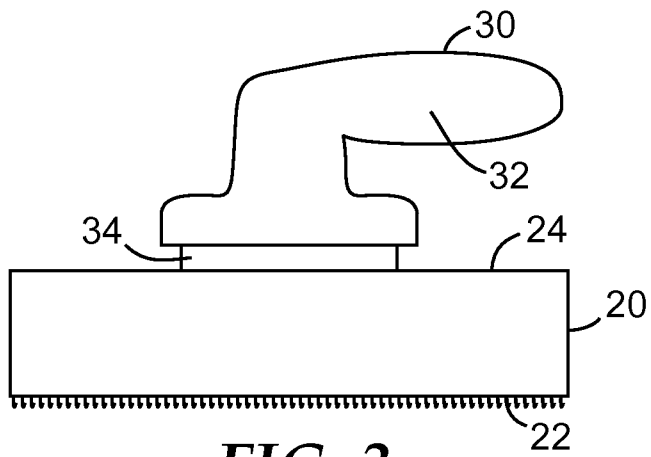


FIG. 3

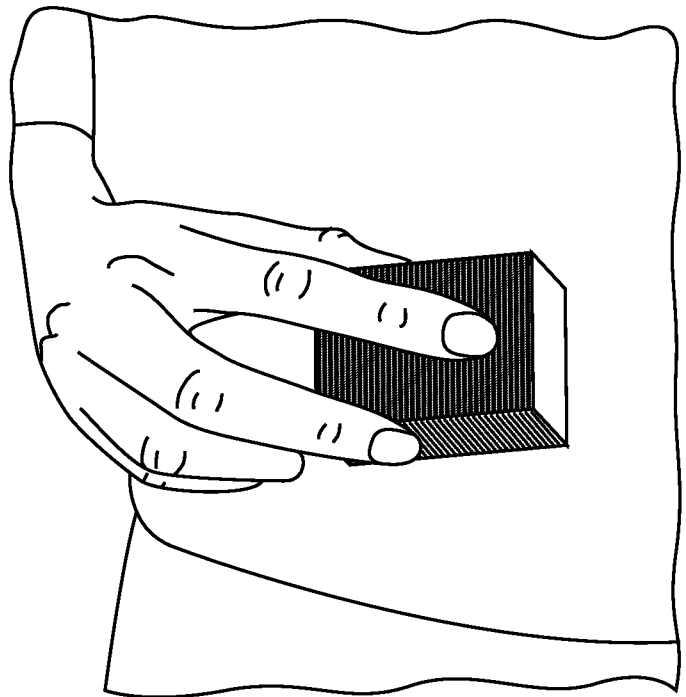


FIG. 4

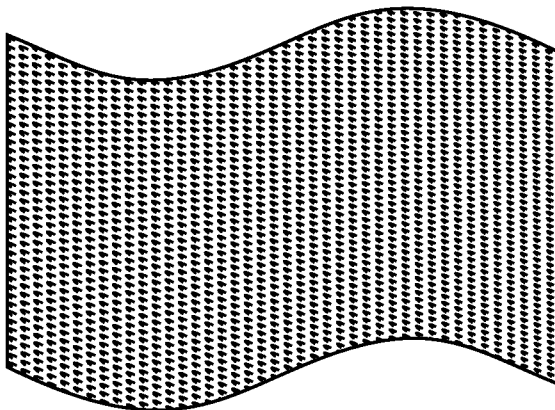


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 13/26643

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - C09K 3/14 (2013.01)

USPC - 51/298

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)

USPC -- 51/298

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
51/298,307,309

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PubWEST (USPT,PGPB,JPAB,EPAB); Google

Search Terms:

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X -- Y	US 5,036,561 A (Calafut) 06 August 1991 (06.08.1991), entire document especially Abstract, col 1, ln 45-50 and col 2, ln 35-62, col 3, ln 1-11 and col 4, ln 10-20	1-3, 5, 10-12, 14-17 and 20-21 ----- 4, 6-9, 13 and 18-19
Y	US 7,618,306 B2 (Felipe Sr. et al.) 17 November 2009 (17.11.2009), entire document especially Abstract, col 7, ln 30-45, col 17, ln 40-45, col 12, ln 14-20 and col 13, ln 1-5	4, 6-9, 13 and 18-19
A	US 2010/0112920 A1 (Usui et al.) 06 May 2010 (06.05.2010)	1-21

☐ 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

"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)

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