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(54) Title: COMPOSITE SURFACE CLEANING ARTICLE



Fig. 1

(57) Abstract: Composite surface cleaning articles are disclosed which include a base member which may be a glove or mitten and includes an array of hooks on a portion of an outer surface, and a three zone pad which includes an assembly zone of a low density, open non-woven fibrous structure suitable for joining with the hooks of the base member, a supporting zone adjacent to the assembly zone of an intermediate density, open non-woven fibrous structure, and a cleaning zone adjacent to the supporting zone of a high density, open non-woven fibrous structure and abrasive, wherein the pad is removably attached to the base member.



COMPOSITE SURFACE CLEANING ARTICLE

Field of the Disclosure

5 The present disclosure relates to a composite surface cleaning article, useful for cleaning a variety of different surfaces.

Background

10 A wide variety of cleaning implements are known to aid in the cleaning of a variety of surfaces. Such implements include brushes, scrubbing pads, scrubbing cloths and the like. Many of such implements are designed to be disposable, washable or replaceable. An example of a replaceable cleaning implement is a mop which contains a re-usable handle and a detachable mop head which can be removed and either washed or replaced by a new detachable mop head.

15 There are also a variety of cleaning implements which have a handle assembly which is designed to hold scrubbing pads or scrubbing cloths. The handle assembly is re-usable and the pad or cloth can be removed and either washed or replaced. A variety of mechanical fasteners have been used to attach the pad or cloth to the handle assembly.

20 Summary

Composite cleaning articles, methods of preparing composite cleaning articles and methods of using composite cleaning articles to clean surfaces are disclosed.

25 Pads containing 3 zones are disclosed. The pads comprise an assembly zone comprising a low density, open non-woven fibrous structure, a supporting zone adjacent to the assembly zone comprising an intermediate density, open non-woven fibrous structure, and a cleaning zone adjacent to the supporting zone comprising a high density, open non-woven fibrous structure and abrasive.

30 Also disclosed are methods for preparing a pad comprising assembling a non-woven fiber web with a thickness and a first side and a second side, roll coating the fiber web in a 2 roll coater with a first thermosetting adhesive liquid, spray coating the first side of the fiber web with a second thermosetting adhesive liquid which has a lower viscosity than the first thermosetting adhesive liquid, such that the adhesive penetrates no more than

66% of the non-woven fiber web thickness, spray coating the first side of the fiber web with abrasive particles, such that the abrasive particles penetrate no more than 33% of the non-woven fiber web thickness, and curing and/or drying the fiber web.

5 Surface cleaning articles are also disclosed which comprise a composite assembly comprising a base member comprising a glove or mitten comprising an array of hooks on a portion of an outer surface, and a three zone pad comprising an assembly zone comprising a low density, open non-woven fibrous structure suitable for joining with the hooks of the base member, a supporting zone adjacent to the assembly zone comprising an intermediate density, open non-woven fibrous structure, and a cleaning zone adjacent to the supporting zone comprising a high density, open non-woven fibrous structure and
10 abrasive, wherein the pad is removably attached to the base member.

Methods for cleaning a surface are also disclosed, the methods comprise assembling a surface cleaning article, comprising providing a base member comprising a glove or mitten comprising an array of hooks on a portion of an outer surface, and
15 providing a three zone pad comprising an assembly zone comprising a low density, open non-woven fibrous structure suitable for joining with the hooks of the base member, a supporting zone adjacent to the assembly zone comprising an intermediate density, open non-woven fibrous structure, and a cleaning zone adjacent to the supporting zone comprising a high density, open non-woven fibrous structure and abrasive, wherein the
20 pad is removably attached to the base member, attaching the assembly zone of the pad to the hooks of the base member, and wiping a surface with the surface cleaning article.

Brief Description of the Drawings

Figure 1 shows a cross sectional view of a pad of the present disclosure.
25 Figure 2 shows a base member of the present disclosure.
Figure 3 shows a base member of the present disclosure.
Figure 4 shows a composite cleaning article of the present disclosure.

Detailed Description

30 A wide variety of cleaning implements are known to aid in the cleaning of a variety of surfaces. Such implements include brushes, scrubbing pads, scrubbing cloths and the like. Such implements are designed to be grasped or held by the user when used.

However, grasping or holding a cleaning implement can become difficult, especially if done for long periods of time. Additionally, for a variety of cleaning tasks it is desirable to have a glove or mitten cover the hand to protect the hand from exposure to dirt and grime, cleaning solutions, biohazards, rough textured surfaces, and the like. However, the wearing of a glove can make it more difficult to grasp cleaning implements such as brushes, scrubbing pads, and the like. Therefore it is desirable to have a cleaning implement which includes a glove or mitten for protection and has a built in, but replaceable, cleaning implement which can be used without having to be grasped or held by the user.

A composite surface cleaning article is disclosed which comprises a base member that is a glove or mitten which has an array of hooks on a portion of the outer surface and a multilayer cleaning pad which is removably attachable to the glove. The pad may be removed from the base member, washed and reattached or discarded and replaced by a different pad.

As used herein, the term “base member” refers to a glove or mitten. A glove is a fitted covering for the hand with a separate sheath for at least one finger and the thumb, typically a glove has a separate sheath for each finger and the thumb. A mitten is a covering for the hand that encases the thumb separately and the four fingers together.

As used herein, the term “pad” refers a multilayer fibrous construction useful for cleaning a surface.

As used herein, the term “removably attached” when dealing with composite cleaning articles means that the pad can be attached to the base member, removed from the base member and reattached to the base member repeatedly.

As used herein, the term “non-woven” refers to a web or batt of random or directional fibers held together through mechanical, chemical, or physical methods, or any combination of these; but does not include weaving, knitting, stitching traditional felting as well as conventionally formed paper.

As used herein, the term “low density” when dealing with a non-woven web refers to an extremely open structure having an extremely high void volume. The terms “intermediate density” and “high density” are relative to the above defined low density.

As used herein, the term “open” when dealing with a non-woven web refers to a web structure that has interspersed spaces. One method for characterizing an open web is

that, for a web thickness of about 6 millimeters (one quarter inch), when held up to a light the web is highly translucent or even transparent to a viewer's eyes, i.e. substantially all of the light registering on the viewer's eyes passes through the web structure.

5 The pad which attaches to the base member described below comprises three zones. The three zone pad comprises an assembly zone comprising a low density, open non-woven fibrous structure suitable for joining with the hooks of the base member, a supporting zone adjacent to the assembly zone comprising an intermediate density, open non-woven fibrous structure, and a cleaning zone adjacent to the supporting zone comprising a high density, open non-woven fibrous structure and abrasive.

10 The three zone pad may be prepared in a continuous process. The process for forming the three zone pad involves preparing a non-woven web. The web has a thickness and a first side and a second side. The web thickness is typically 5 to 50 millimeters, more typically 5 to 20 millimeters.

15 The non-woven web is, typically, an open non-woven web made of fibers that generally are joined one to the other in their mutual contact points by a prebonding cured resin. The non-woven web can be made from an air-supported construction, cloth, piquet, twisted, wet woven and fusion. A particularly suitable non-woven web is the non-woven web made of a non-woven, air-supported, three-dimensional, lifted, open substrate, such as the one described in US Patent No. 2,958,593 (Hoover et al.).

20 The non-woven web is generally made of an appropriate synthetic fiber capable of standing the temperatures in which the resins and adhesives cure without deteriorating. The appropriate fibers include natural and synthetic fibers, and blends of both. Examples of suitable synthetic fibers include those fibers made of polyester (for example, polyethylene-terephthalate), high or low resilience nylon (for example, hexamethylene-adipamide, polycaprolactame), polypropylene, acrylic (formed from acrylonitrile
25 polymer), rayon, cellulose acetate, chloride copolymers of vinyl-acrylonitrile, and the like. Examples of suitable natural fibers include those coming from cotton, wool, jute, and hemp.

30 The non-woven web may be formed in a "Rando-Webber Machine" (from Rando, Macedon, New York) or by other conventional methods.

The formed non-woven web may then be passed through a roll coater where a first thermosetting adhesive liquid may be applied to the non-woven web. The roll coater may

be any suitable roll coater suitable for applying a thermosetting adhesive liquid. The thermosetting adhesive liquid may be any suitable solution or dispersion of thermosetting adhesive resin. In some embodiments the first thermosetting adhesive liquid is a water-based adhesive liquid. Examples of suitable thermosetting adhesive resins include

5 phenolic resins, epoxy resins, melamine resins, and isocyanate and isocyanurate resins. In some embodiments the first thermosetting adhesive resin is a water-based phenolic resin adhesive. Typically, the first thermosetting adhesive is cured and/or dried by passing the coated web through an oven. The temperature of the oven, length of the oven and line speed at which the web passed through the oven can be controlled to give the desired

10 curing of the thermosetting adhesive liquid. Typically the oven temperature is in the range of 150-200°C, more typically 165-185°C, the oven length is 5 to 30 meters, more typically 10-20 meters, and the line speed is 1-20 meters/minute, more typically 5-15 meters/minute.

After passing through the roll coater and oven, the non-woven web is spray coated

15 on one side of the web, referred herein as the “first side”, with a second thermosetting adhesive liquid. Generally, for ease of application, the first side is the top side of the web. Any conventional spray coating methods may be used to apply the second thermosetting adhesive liquid. The second thermosetting adhesive liquid, like the first thermosetting adhesive liquid may be any suitable solution or dispersion of thermosetting adhesive resin

20 as long as the thermosetting adhesive liquid is capable of being spray coated. Typically, spray coating requires lower viscosity liquids than roll coating. In some embodiments the second thermosetting adhesive liquid is a water-based adhesive liquid. Examples of suitable thermosetting adhesive resins include phenolic resins, epoxy resins, melamine resins, and isocyanate and isocyanurate resins. In some embodiments the second

25 thermosetting adhesive resin is a water-based phenolic resin adhesive. In some embodiments the second thermosetting adhesive resin is the same water-based phenolic resin adhesive as the first thermosetting adhesive resin, suitably diluted to reduce the viscosity to permit spray coating.

The spray-applied second thermosetting adhesive liquid does not penetrate the

30 entire thickness of the non-woven web thickness. Typically the second thermosetting adhesive liquid penetrates the non-woven web to a thickness of no more than 66% of the total non-woven fiber web thickness. This penetration of the web thickness aids in the

formation of the central or supporting zone of the formed pad, as will be explained below. As described above for the first thermosetting adhesive, the second thermosetting adhesive liquid may be cured and/or dried by passing the coated web through an oven. The temperature of the oven, length of the oven and line speed at which the web passed
5 through the oven can be controlled to give the desired curing of the thermosetting adhesive liquid. Typically the oven temperature is in the range of 150-200°C, more typically 165-185°C, the oven length is 5 to 30 meters, more typically 10-20 meters, and the line speed is 1-20 meters/minute, more typically 5-15 meters/minute.

After passing through the adhesive spray coating equipment and oven, the non-
10 woven web is spray coated on the first side with abrasive particles. The spray coating with abrasive particles may be carried out using any suitable abrasive granule coating equipment.

Abrasive materials useful to prepare the pads may be a soft abrasive, a hard abrasive or a mixture thereof. Soft abrasives, having a Mohs hardness in the range of
15 about 1 to 7, provide the pad with a mildly abrasive surface. Examples of soft abrasives include such inorganic materials as garnet, flint, silica, pumice and calcium carbonate; and such organic polymeric materials as polyester, polyvinylchloride, methacrylate, methylmethacrylate, polycarbonate, and polystyrene. Hard abrasives, those having a Mohs hardness greater than about 8, provide the pad with an aggressive abrasive surface.
20 Examples of hard abrasives include such materials as silicon carbide, aluminum oxide, topaz, fused alumina-zirconia, boron nitride, tungsten carbide, and silicon nitride. The particle size of the abrasive particles can range from about 80 grade (average diameter of about 200 micrometers) to about 280 grade (average diameter of about 45 micrometers) or finer.

Typically the abrasive particles liquids do not penetrate the entire thickness of the non-woven web thickness. Typically the abrasive particles penetrate the non-woven web to a thickness of no more than 33% of the total non-woven fiber web thickness. This concentration of the abrasive particles in a narrow portion of the web thickness aids in the formation of the cleaning zone of the formed pad, as will be explained below.
25

In addition to the application of abrasive particles, colorant may also be added to
30 the non-woven web. Generally the colorant is added in the form of pigment particles

which are applied at the same time as the abrasive particles or after the application of the abrasive particles. The pigment is generally a water-based colorant dispersion which provides the required color to the material. Addition of the pigment can be used, for example, to identify the abrasive level of the surface of the pad by using different colors for the different abrasive levels or content.

After application of the abrasive particles and optional application of colorant, the non-woven web the thermosetting adhesive or adhesives are generally cured or set by the application of heat. The curing of the thermosetting adhesive reinforces the 3 dimensional matrix of the web by bonding the fibers of the web at their points of intersection as well as bonding the abrasive particles to the fibers. Typically the application of heat is carried out by the use of conventional forced air ovens or similar equipment as described above.

After curing of the adhesive resin, the non-woven web can be cut and processed to form individual pads. The pads may take any of a variety of shapes and sizes. For example, the pad may be circular, elliptical, or quadrangular. Generally the pad is rectangular and is of a size and bulk to be easily attached to the base member to form the composite cleaning article. Typically, the pad is from about 10 to 30 centimeters in length, from about 5 to 25 centimeters in width, and from about 5 to 20 millimeters in thickness.

The pad formed from the above described process contains three zones which are called herein the assembly zone, the supporting zone, and the cleaning zone. The assembly zone is formed from the second side of the non-woven web. The second side of the non-woven web does not have the second adhesive or abrasive particles applied to it and therefore the assembly zone comprises a low density, open non-woven fibrous structure suitable for joining with the hooks of the base member.

The cleaning zone is on the opposite face of the pad and is formed from the first side of the non-woven web. The cleaning zone has both adhesive and abrasive particles applied thereto and consequently, the cleaning zone comprises a high density, open non-woven fibrous structure containing abrasive.

The supporting zone is between the assembly zone and the cleaning zone. In the above process for preparing the pad, the applied thermosetting adhesive liquids are not uniformly dispersed throughout the thickness of the non-woven web. As described above, the second adhesive is applied to the first side of the non-woven web and penetrates no

more than about 66% of the thickness of the non-woven web. The abrasive particles are also applied to the first side of the non-woven web and penetrate no more than about 33% of the thickness of the non-woven web. Therefore the supporting zone comprises an intermediate density, open non-woven fibrous structure which is essentially free of
5 abrasive particles.

The above description of the zone structure of pads suitable for use in the practice of this disclosure is not meant to limiting as the relative thicknesses of each zone. For example, the pads need not have the assembly zone be 33% of the total thickness of the pad, the supporting zone be 33% of the total thickness of the pad and cleaning zone be
10 33% of the total thickness of the pad. Similarly, the zones may overlap and not be distinctly divided.

An exemplary embodiment of a pad of this disclosure is shown in cross sectional Figure 1. The pad **100** comprises assembly zone **10**, support zone **20** and cleaning zone **30**. The zones are not necessarily to scale, and as stated previously the zones may overlap
15 and not be distinctly divided.

The base member comprises a glove or a mitten. The glove or mitten may be made out of variety of different materials with a variety of different thicknesses depending upon the intended use for the composite surface cleaning article. For example, if only light duty cleaning is to be done the glove or mitten may be thinner and more flexible whereas for
20 more heavy duty cleaning and especially for dealing with more hazardous cleaning fluids, thicker and more impervious gloves or mittens may be used. In some embodiments the base member is a glove made of latex rubber, nitrile rubber or similar material with a thickness typically of from 0.33 millimeter (13 mils) to 1.0 millimeter (39 mils).

The base member comprises a means for reversibly attaching the pad to form the composite surface cleaning article. Typically the attachment means comprises hooks
25 which can engage with the assembly zone of the cleaning pad. Only a portion of the outer surface of the base member comprises hooks. Generally, the hooks will be located in palm section of the glove or mitten of the base member for ease of use of the composite surface cleaning article. However the hooks may be located at other locations on the base
30 member as well, either in addition to, or instead of, hooks in the palm area.

In some embodiments, the fastening means comprises hooks located on the surface of the palm area of a glove or mitten. The entire palm area may be covered with the

fastening hooks. More typically the surface of the palm area is covered with the fastening hooks in a discontinuous manner. Examples of discontinuous arrays of hooks include strips, squares, circles, triangles, and the like, or the hooks may be arrayed in a non-regular pattern. In general it is desirable that the total area of fastening hooks should be large enough to fasten the cleaning pad firmly to the base member. In some embodiments the surface area of the base member which is covered by hooks may be the same or nearly the same as the surface area of the pad. Typically, the surface area of the base member covered by fastening hooks is up to about 50% of the surface area of the pad. In some embodiments the area of the base member covered by fastening hooks is up to about 30% of the surface area of the pad.

The shape of the fastening hooks may be any suitable mechanical fastening form known in the art, e.g. hook-shaped, mushroom-shaped or notched-pyramid. Typically, the fastening hooks are shaped as hooks, either single or double (i.e. inverted T-shaped) hooks. Generally, such hook-shaped fastening hooks are substantially parallel to the side edge of the cleaning pad. The fastening hooks generally have a height of at least 0.5 millimeter, more typically at least 0.6 millimeter, or even 0.7 millimeter or greater.

Suitable fastening hooks include plastic, such as nylon, hooks on a backing, referred to in the following as hook meshes. In such hook meshes, the plastic hooks may be stitched through a fabric backing, or alternatively the hooks may be profile extruded or molded types of hooks where the plastic hooks have a plastic backing. Examples of hook meshes include nylon hook strips commercially available under the brand 3M SCOTCHMATE Reclosable Fastener, such as the types SJ-3526 hook and SJ-3419 and hook meshes commercially available under the trade name VELCRO. Hook meshes are generally attached to the base member by an adhesive, which firmly affixes the backing of hook meshes to the material from which the base member is made. Hook meshes typically have at least 30 hooks per square centimeter, more typically at least 40 hooks per square centimeter.

Representative exemplary embodiments of base members are shown in Figure 2 and Figure 3. In Figure 2, the base member **200** comprises a mitten **210** with strips of hook meshes **220**. In Figure 3, the base member **300** comprises a glove **310** with a rectangular patch of hooks **320** in the palm section of glove **310**.

The base member and the pad described above can be assembled to form a composite cleaning article. The article can be assembled by removably attaching the assembly zone of the pad to the hooks on the surface of the base member. Attachment may be achieved by pressing the pad to the hooks or by bending the pad the applying the assembly zone to the hooks with a rolling motion.

It is desirable that the assembly zone of the pad and the hooks on the surface of the base member stay together during the use of the composite cleaning article. A variety of testing procedures could be used and/or adapted from standard testing procedures to mimic the conditions of use of the assembled composite cleaning article.

Among the standard testing procedures used to characterize mechanical fasteners are, for example, ASTM D-5169-98 "Standard Test Method for Shear Strength (Dynamic Method) of Hook and Loop Touch Fasteners" which is a method to measure the resistance to separation when forces are applied parallel to the plane of the fastener, and ASTM D5170-98 "Standard Test Method for Peel Strength ("T" Method) of Hook and Loop Touch Fasteners" which is a method to measure the resistance to separation when forces are applied normal to the line of separation of the fastener.

Another method for testing the ability of the composite cleaning article to stay assembled under working conditions would be to suspend a free weight from the pad of the assembled composite article without the peeling away of the pad from the base member. Various weights and times of testing could be used to characterize the composite cleaning article.

Since the pads are washable and reusable, a test has been developed to mimic this use of the composite cleaning article. In this test, called the "Repetitive Pad Washing Test", the pad is removed from the base member, soaked in water and washed and then reattached to the base member. The composite article is then shaken to determine if the pad remains attached to the base member. Details of this test are presented in the Examples section below. Pads of this disclosure are able to be reattached greater than 50 times when tested according to the Repetitive Pad Washing Test.

Because the assembly zone is designed to provide attachment to hooks on the base member, the pads of this disclosure provide enhanced attachment properties compared to a similar pad prepared without the assembly zone.

An exemplary embodiment of a composite cleaning article of this disclosure is shown in Figure 4. The composite cleaning article **400** comprises base member **200** and pad **100** joined via hooks on base member **200** attached to assembly zone **10** of pad **100** (hooks and assembly zone not shown).

5 A variety of commercial and residential surfaces can be cleaned with the composite surface cleaning article of the present disclosure. The surfaces for which the composite surface cleaning article is particularly useful are often referred to as “hard surfaces”. Such surfaces can include wood, metal, ceramics, stone, porcelain, plastics, glass and the like. Such surfaces are present in homes, hospitals, office buildings,
10 lavatories, and the like.

The composite surface cleaning article may be used alone or it may be used in conjunction with a cleaning fluid. The cleaning fluid may be water or an aqueous solution. Typically cleaning fluids contain soaps or detergents and may contain a variety of components ranging from acidic (such as mineral or organic acids) to basic (such as
15 ammonium hydroxide) components. Since it is undesirable or even dangerous for many of these cleaning fluids to contact the skin, the composite surface cleaning article of the present disclosure provides the base member to protect the skin from contacting the cleaning fluid.

To clean a surface, the user may take a preassembled composite surface cleaning
20 article and place it on his or her hand. Or the user may place the base member glove or mitten on his or her hand and then attach the pad. The pad may pre-loaded with a cleaning fluid prior to attachment to the base member.

The user may use the composite surface cleaning article to clean the desired surface directly or may apply a cleaning fluid to the pad to clean the surface. Since the
25 pad is attached to the base member, the user need not grasp the pad during the cleaning.

After a period of cleaning the user may wish to replace the cleaning pad. The pad may become dirty or worn down or the user may wish to use a different type of pad. To remove the pad, the user need only grasp the pad and peel the pad away from the hooks on the base member. The user can either clean the pad and reattach it, or attach a different
30 pad and continue cleaning.

Examples

These examples are merely for illustrative purposes only and are not meant to be limiting on the scope of the appended claims. All parts, percentages, ratios, etc. in the examples and the rest of the specification are by weight, unless noted otherwise. Solvents and other reagents used were obtained from Sigma-Aldrich Chemical Company; Milwaukee, Wisconsin unless otherwise noted.

Table of Abbreviations

<u>Abbreviation or Trade Designation</u>	<u>Description</u>
Rubber Glove	Rubber gloves commercially available from Dipped Products Limited, Sri Lanka.
Adhesive-1	A waterborne phenolic resin adhesive of 75 centipoise viscosity commercially available as “BB077 Phenolic Resin” from Neste Resins Corporation, Mississauga, Ontario, Canada.
Adhesive-2	A waterborne phenolic resin adhesive of 55 centipoise viscosity commercially available as “BB077” from Neste Resins Corporation, Mississauga, Ontario, Canada diluted with water to give the desired viscosity.
Abrasive Particles Mixture	A waterborne mixture of 130-140 centipoise viscosity containing phenolic resin adhesive commercially available as “BB077” from Neste Resins Corporation, Mississauga, Ontario, Canada with added CaCO ₃ and Abrasive Particles.
Abrasive Particles	Particles of aluminum oxide (Al ₂ O ₃), “280#”, commercially available from China Baiyun Corp., Guizhou Province, China.
Commercial Pad	SCOTCH-BRITE General Purpose Scouring Pad 96, commercially available from 3M Company, St. Paul, MN.
Hook Material	Strips of adhesive coated nylon strips with hooks protruding approximately 0.7 millimeters from the base, commercially available as

	“VELCRO STICKY BACK” from Velcro Fastening Systems Company, Zhangjiagang, China.
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Test Methods

Repetitive Pad Washing Test

This test mimics the washability and reusability of the pads. The pad to be tested
5 was attached to the glove, removed from the glove, soaked in room temperature water for
10 minutes and washed for 30 minutes and was then reattached to the glove to reform the
composite cleaning article. The composite article was then shaken to determine if the pad
remained attached to the glove. If the pad remained attached, the pad was removed and
put through the soaking, washing and reattaching cycle. The testing was continued until
10 either the pad detached from the glove when shaken (which was recorded as “FAIL” and
the number of cycles done was recorded) or the pad passed 50 cycles (which was reported
as “PASS” and the number of cycles was recorded as “50”).

Example 1:

Preparation of base member:

A Rubber Glove was modified by placing 3 strips of Hook Material on the palm
portion of the glove.

Preparation of pad:

20 A web of non-woven fibers was formed on a Rando-Webber machine
(commercially available from Rando Corp., Macedon, NY) from nylon fiber with 15-50
denier and approximately 50 millimeter length. This web was passed through a
conventional 2-roll coater and coated with Adhesive-1. The coated web was passed
through a 15 meter long oven with a temperature of 175°C at a line speed of 10
25 meters/minute. The web was passed beneath a spray coater and spray coated on the top
side of the web with Adhesive-2. The spray-coated web was passed through a 15 meter
long oven with a temperature of 175°C at a line speed of 10 meters/minute. The web was
then passed beneath a spray coater and Abrasive Particle Material was sprayed onto the
top side of the web. The web was then passed through a 15 meter long oven with a
30 temperature of 175°C at a line speed of 10 meters/minute, allowed to cool to room

temperature and cut into pads of 15 centimeter (6 inches) width and 23 centimeter (9 inches) length. A three zone pad was formed with an assembly zone on the untreated side of the web, a cleaning zone on the treated side of the web and a supporting zone between these zones.

5

Assembly and testing of composite article:

The pad was attached to the hooks on the glove using the assembly zone of the pad. The composite cleaning article was then tested by the Repetitive Pad Washing Test Method shown above. The results are presented in Table 1.

10

Comparative Example 1:

The same base member described above was used. The pad was a Commercial Pad. A composite cleaning article was assembled and tested as described above for Example 1. The results are presented in Table 1.

15

Table 1

Example	Pass/Fail	Number of Washes
1	Pass	50
C1	Fail	3

What is claimed is:

1. A pad comprising:

an assembly zone comprising a low density, open non-woven fibrous structure;
a supporting zone adjacent to the assembly zone comprising an intermediate
density, open non-woven fibrous structure; and
a cleaning zone adjacent to the supporting zone comprising a high density, open
non-woven fibrous structure and abrasive.

2. The pad of claim 1 wherein the pad has a thickness of from 5 to 20 millimeters.

3. The pad of claim 1 wherein the assembly zone is essentially free of abrasive particles.

4. The pad of claim 1 wherein the supporting zone comprises cured adhesive and is
essentially free of abrasive particles.

5. The pad of claim 4 wherein the cured adhesive comprises a cured phenolic resin
adhesive, a cured urea-formaldehyde adhesive, a cured melamine-formaldehyde adhesive,
a cured poly-acrylic adhesive, a cured epoxy resin adhesive or combinations thereof.

6. The pad of claim 1 wherein the cleaning zone comprises cured adhesive and abrasive
particles.

7. A method of preparing a pad comprising:

assembling a non-woven fiber web with a thickness and a first side and a second
side;

roll coating the fiber web in a 2 roll coater with a first thermosetting adhesive
liquid;

spray coating the first side of the fiber web with a second thermosetting adhesive
liquid which has a lower viscosity than the first thermosetting adhesive liquid,
such that the adhesive penetrates no more than 66% of the non-woven fiber web
thickness;

spray coating the first side of the fiber web with abrasive particles, such that the

abrasive particles penetrate no more than 33% of the non-woven fiber web thickness; and
curing and/or drying the fiber web.

- 5 8. The method of claim 7 wherein the non-woven fiber web comprises a low density, open non-woven fibrous web.
9. The method of claim 7 further comprising additional curing and/or drying steps.
- 10 10. The method of claim 7 wherein the first and the second adhesive liquids comprise water-based thermosetting adhesives.
11. The method of claim 10 wherein the second adhesive liquid comprise the same adhesive as the first adhesive liquid with additional water added.
- 15 12. The method of claim 10 wherein the water-based adhesives comprise a phenolic resin adhesive.
13. The method of claim 7 wherein the non-woven fiber web has a thickness of 5 -20
20 millimeters.
14. The method of claim 7 wherein the formed pad comprises a three zone pad, the three zone pad comprising:
an assembly zone comprising a low density, open non-woven fibrous structure
25 suitable for joining with the hooks of the base member;
a supporting zone adjacent to the assembly zone comprising an intermediate density, open non-woven fibrous structure; and
a cleaning zone adjacent to the supporting zone comprising a high density, open non-woven fibrous structure and abrasive.
- 30 15. A surface cleaning article comprising a composite assembly comprising:
a base member comprising a glove or mitten comprising an array of hooks on a

portion of an outer surface; and

a three zone pad comprising:

an assembly zone comprising a low density, open non-woven fibrous structure suitable for joining with the hooks of the base member;

a supporting zone adjacent to the assembly zone comprising an intermediate density, open non-woven fibrous structure; and

a cleaning zone adjacent to the supporting zone comprising a high density, open non-woven fibrous structure and abrasive, wherein the pad is

removably

attached to the base member.

16. The surface cleaning article of claim 15 wherein the array of hooks on a portion of an outer surface of the base member comprises strips of hooks covering the palm portion of the base member.

17. A method of cleaning surface comprising:

assembling a surface cleaning article, comprising:

providing a base member comprising a glove or mitten comprising an array of hooks on a portion of an outer surface; and

providing a three zone pad comprising:

an assembly zone comprising a low density, open non-woven fibrous structure suitable for joining with the hooks of the base member;

a supporting zone adjacent to the assembly zone comprising an intermediate density, open non-woven fibrous structure; and

a cleaning zone adjacent to the supporting zone comprising a high density, open non-woven fibrous structure and abrasive, wherein the pad is removably attached to the base member;

attaching the assembly zone of the pad to the hooks of the base member;

and

wiping a surface with the surface cleaning article.

18. The method of claim 17 further comprising applying a cleaning solution to the cleaning layer of the pad.

5 19. The method of claim 18 wherein applying a cleaning solution to the cleaning layer of the pad occurs after assembly of the surface cleaning article.

20. The method of claim 18 wherein applying a cleaning solution to the cleaning layer of the pad occurs before assembly of the surface cleaning article.

10 21. The method of claim 17 further comprising removing the pad from the base member and attaching a different pad to the base member.

22. The method of claim 17 further comprising removing the pad from the base member and reattaching the pad to the base member.

15 23. The method of claim 17 further comprising attaching the surface cleaning article to a users hand prior to wiping the surface with the surface cleaning article.

20 24. The method of claim 17 further comprising attaching the base member to a user's hand prior to assembly of the surface cleaning article.

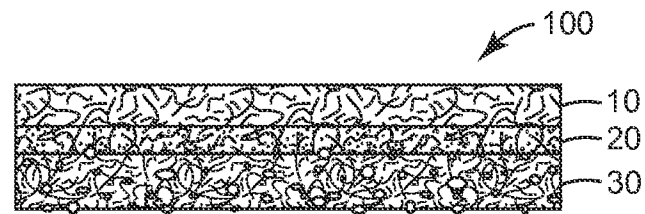


Fig. 1

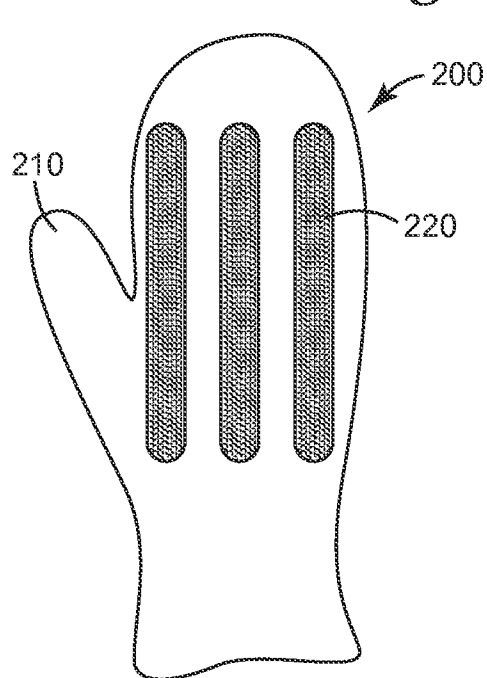


Fig. 2

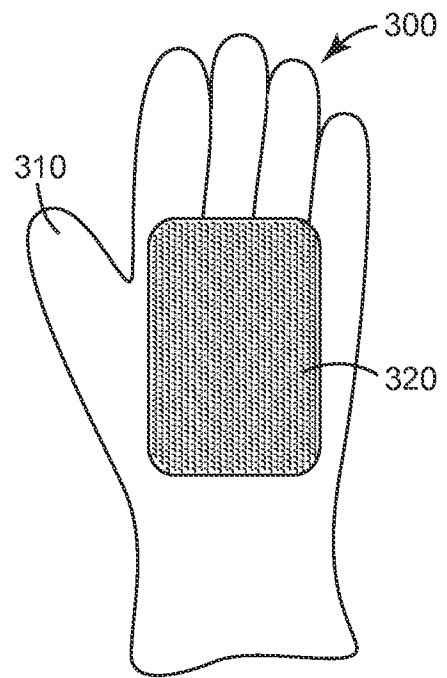


Fig. 3

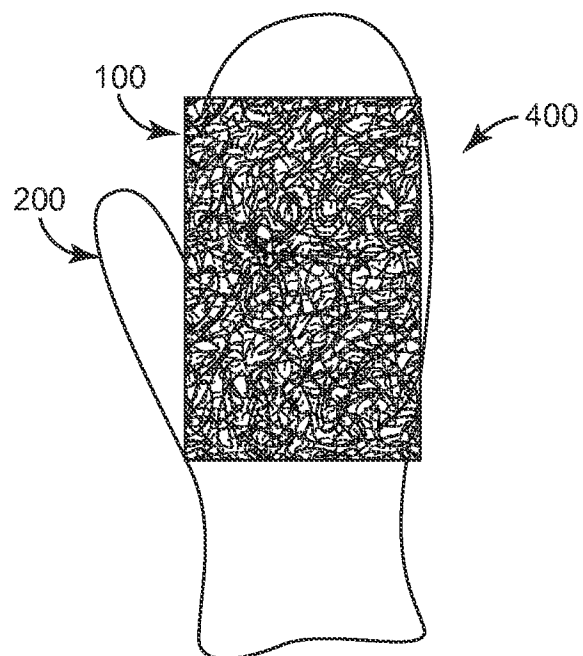


Fig. 4