A coated glove and method of making the same is provided. The invention proposes a knitted liner glove which is dyed after the knitted portion is dipped into a rubber polymer. Further, the method for making the glove includes knitting a liner of the glove, dipping the knitted liner into a rubber polymer to cover a portion thereof, and then dyeing the knitted polymer coated liner.
KNIT A GLOVE LINER

COAT THE GLOVE LINER WITH A RUBBER POLYMER

CURE THE RUBBER POLYMER

DYE THE KNITTED POLYMER COATED GLOVE

START

STOP

METHOD 500

FIG. 5
DYED, COATED GLOVE AND METHOD OF MAKING SAME

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority under 35 U.S.C. 119(e) to U.S. Provisional Application Ser. No. 61/465,571, filed Mar. 21, 2011, which is hereby incorporated by reference in its entirety.

BACKGROUND

1. Field of the Invention
2. Description of the Related Art
3. Embodiments of the present invention generally relate to gloves and, more particularly, to a dyed, coated glove and a method of making same.
4. Description of the Related Art
5. Presently, a variety of gloves are utilized in many fields for protecting workers, such as medical, industrial, household and many more. The gloves are subjected to extensive wear and movement in certain applications which, in turn, creates a need for durability, stretch-ability, and flexibility.
6. In one conventional technique, a glove having a knitted liner is dipped into a rubber polymer (e.g., natural rubber latex, synthetic rubber latex, and the like) to form a coating that covers at least a portion of the glove. To create a glove having color, a knotted portion of the gloves is dyed before dipping the product into the rubber polymer, while some other techniques merely utilize a colored yarn for forming the glove. The use of colored yarns or adding a dyeing step prior to the glove fabrication process adds expense and complexity to glove manufacturing.
7. Therefore, there exists a need for an improved colored glove as well as a commensurate method of making such a glove.

SUMMARY OF THE INVENTION

Embodiments of the present disclosure generally include a dyed, coated glove and a method of making such a glove. One embodiment of the invention provides a knitted liner having a rubber coating, where the liner and coating have been simultaneously dyed after the rubber has been cured.

In another embodiment, a method for making a coated glove is provided. The method includes knitting a liner of the glove, dipping the knitted liner into a rubber polymer, curing the rubber polymer to form a rubber coated glove, and then dyeing the rubber glove.

BRIEF DESCRIPTION OF THE DRAWINGS

So that the manner in which the above recited features of the present invention can be understood in detail, a more particular description of the invention, briefly summarized above, may be had by reference to embodiments, some of which are illustrated in the appended drawings. It is to be noted, however, that the appended drawings illustrate only typical embodiments of this invention and are therefore not to be considered limiting of its scope, for the invention may admit to other equally effective embodiments.

FIG. 1 shows a schematic representation of a knitted liner used as a portion of an embodiment of the present invention;

FIG. 2 shows a schematic representation of a knitted liner created using a variable knit technique that forms a portion of another embodiment of the invention;

FIG. 3 illustrates an exemplary coated glove showing the palm-side according to an embodiment of the present invention;

FIG. 4 illustrates an exemplary coated glove showing the knuckle-side according to an embodiment of the present invention;

FIG. 5 is flow diagram of a method for making a glove according to an embodiment of the present invention; and

FIG. 6 is a close up, sectional view of a portion of a glove in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION

Embodiments of the present invention comprise a dyed, coated glove and method of making such a glove. The glove comprises a knitted liner, a cured rubber polymer coating over at least a portion of the knitted liner, and a dye staining the coating and dyeing the liner. Further embodiments of the invention comprise a method for making the dyed, coated glove. The method includes knitting a liner of the glove, dipping the knitted glove liner into a rubber polymer to cover at least a portion of the liner, curing the rubber polymer, and then dyeing the polymer coated knitted glove.

FIG. 1 shows a schematic representation of a knitted liner 100 used as a portion of an embodiment of the present invention. The liner 100 has seven major glove components. These components include a pinky finger component 102, a ring finger component 104, a middle finger component 106, a forefinger component 108, a palm component 112, a thumb component 110, and a wrist component 114. The shapes of the liner fingers do not taper, nor does the wrist component 114 taper to promote a tight fit at the wrist. In other liner forms, the fingers and wrist components may taper for an improved fit.

Existing flat knitting machines can be programmed to accommodate a large number of changes in stitch dimensions using stitch setup and to alter the physical dimensions used in a seven component liner 100. Stitch setup can be used to “customize” gloves and liners manufactured in various sizes, such as 6, 7, 8, 9, and 10. They also can be used to develop specifications for finger length and width, palm length and width, and overall glove or liner length and width.

FIG. 2 shows a liner 200 forming a portion of another embodiment of the present invention. This liner 200 includes nineteen total sections of the glove, including three sections for each of the five fingers 210, 212, 214, 216 and 218, and three palm sections 204, 206, and 208 and one wrist section 202. Each of the fingers 210, 212, 214, 216, and 218 is knit according to three separate instructions for the knitting machine to create these three distinct areas designed to conform to the shape of fingers. These three sections are shown in FIG. 2 as sections 250, 252, and 254 for the pinky finger 210; sections 244, 246, and 248 for the ring finger 212; sections 238, 240, and 242 for the middle finger 214; sections 232, 234, and 235 for the forefinger 216; and sections 220, 222, and 224 for the thumb 218.

The liner 200 of this embodiment can be knit on a knitting machine and requires programming of the machine for each of the nineteen sections. For example, the liner 200 can be made according to the specifications provided in Table
1. Each of the components is indicated, and the sections that match FIG. 2 are shown. Note that the courses begin with 1 for each component and continue through the sections. The stitch setup here shows a number, which indicates how deep the knitting needle penetrates. A lower number indicates less needle penetration, while a larger number indicates that the needle penetrates deeper. For example, in component 1, which is the pinky finger, the first course has a knitting needle penetration depth of 37 in course 1 and increases gradually in a linear fashion to a knitting needle penetration depth of 39 at course 22. This means that course 1 is tighter to stretch than course 22, and the pinky finger is draped by the glove with the finger edge tight against the glove. The second section of component 1 continues seamlessly with the same stitch setup of 39, maintaining the depth of penetration of the knitting needle.

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>STITCH SETUP</th>
<th>COURSES</th>
<th>SECTION IN FIG. 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>37-39</td>
<td>1-22</td>
<td>250</td>
</tr>
<tr>
<td></td>
<td>37</td>
<td>23-25</td>
<td>254</td>
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<td></td>
<td>39-37</td>
<td>59-88</td>
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<td>2</td>
<td>37-39</td>
<td>1-32</td>
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<td>33-37</td>
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<tr>
<td></td>
<td>39-37</td>
<td>73-116</td>
<td>248</td>
</tr>
<tr>
<td>3</td>
<td>37-39</td>
<td>1-32</td>
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<tr>
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<td>39</td>
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</tr>
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<td></td>
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</tr>
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</tr>
<tr>
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<td>1-32</td>
<td>220</td>
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</tr>
<tr>
<td></td>
<td>37</td>
<td>1-72</td>
<td>202</td>
</tr>
</tbody>
</table>

The specification in Table 1 can be used on a SFG knitting machine available from Shima Seiki Mfg., Ltd. based in Wakayama, Japan to create a size 9 glove. The information for the stitch setup and the number of courses is entered into the knitting machine’s operating system using a keypad and LED display. Adjustments can be made to the specifications in Table 1 to create gloves of different sizes. The liners can be knitted from different compositions of yarn, including cotton, nylon fibers, water-soluble fibers, such as polyvinyl alcohol, or other fibers that can be used on a knitting machine, such as polyester or high-strength synthetic fibers, such as aramid, polyethylene, and liquid crystal polymer. The yarns used to knit the gloves can be spun yarns, textured filament yarns, or multi-component composite yarns. Once the liner 100 or 200 is complete, it is coated at least in part with a polymer.

[0022] The manufacturing process for a flexible polymer coated glove involves several steps. In a detailed embodiment, an 18-gauge knitted liner with nominally 140 denier nylon 66 yarn is dressed on a hand shaped ceramic or metallic former and is immersed in a 2-5 wt % calcium nitrate aqueous solution. The calcium nitrate coagulant solution penetrates the entire thickness of the knitted liner. When this coagulant coated liner contacts aqueous polymeric latex emulsion, it destabilizes the emulsion and gels the latex. The coagulant coated knitted liner dressed on the former is next dipped in the aqueous polymeric latex emulsion. The polymeric aqueous latex has a viscosity in the range of 250-5000 centipoise and has commonly used stabilizers including but not limited to potassium hydroxide, ammonia, sulfonates, and other. The latex may contain other commonly used ingredients such as surfactants, anti-microbial agents, fillers/additives and the like. Due to the smaller diameter of the yarn, the distance between the fibers decrease rapidly forming a pinch region in the knitted liner and when the polymeric latex emulsion enters this region, the gelling action essentially chokes the ingress of the polymeric latex emulsion, thereby substantially preventing the entire penetration of the polymeric latex emulsion into the thickness of the knitted liner. This penetration and gelling action is sensitive to the viscosity of the polymeric latex emulsion and the depth to which the former with the coagulant coated liner is depressed into the polymeric latex emulsion tank. The higher the hydrostatic pressure, the polymeric latex emulsion penetrates more into the knitted liner. When the immersion depth is small and the viscosity of the polymeric latex emulsion is high the polymeric latex coating minimally penetrates the knitted liner resulting in poor adhesion of the coating. Therefore two controllable process variables are available for precisely and reliably controlling the penetration of the polymeric latex coating into the knitted liner, even when the knitted liner is relatively thin. These process variables are 1) the control of polymeric latex emulsion viscosity and 2) depth of immersion of the knitted liner dressed former. Typical depth of immersion needed to achieve this aqueous polymeric latex emulsion to a depth greater than half the thickness of the knitted liner to a penetration that is less than the entire thickness, e.g., 0.2 to 5 cm, based on the viscosity of the latex emulsion. Since a latex coating of the glove is generally only provided on the palm and finger areas of the glove, the former is articulated using a complex mechanism that moves the form in and out of the latex emulsion, immersing various portions of the knitted liner dressed on the former to progressively varying depths. As a result, some portions of the glove may have some degree of latex penetration, however, more than 75% of the knitted liner is penetrated at least half way or more than halfway without showing latex stain on the skin-contacting surface of the glove. The first embodiment of the process produces a thin continuous latex gel layer on a thin knitted liner is washed first and is subsequently heated to vulcanize the latex composition and is washed to remove coagulant salts and other processing chemicals used to stabilize and control viscosity and wetting characteristics of the latex emulsion. The glove thus produced is better than 30% less in weight and thickness compared to a 15-gauge glove, and has better than three times the flexibility.

[0024] In a second embodiment of the invention, the polymeric latex emulsion used is foamed. The air content is typically in the 5 to 50% range on a volume basis. The polymeric latex emulsion may contain additional surfactants such as Tween 20 to stabilize the latex foam. Once the latex is foamed with the right air content and the viscosity is adjusted, refinement of the foam is undertaken by using the right whipping impeller stirrer driven at an optimal speed first and the air bubble size is refined using a different impeller run at a reduced speed. This foamed polymeric latex emulsion generally has a higher viscosity and therefore is more difficult to penetrate the interstices between the yarns in the knitted liner and may require a higher depth of immersion of the former with dressed knitted liner. The penetrated foamed latex emulsion instantly gels due to the action of the coagulant resident of the surfaces of the yarns forming choking regions
between the fibers preventing further entry of the foamed latex emulsion into the thickness of the knitted liner. The air cells reduce the modulus of elasticity of the polymeric latex coating increasing the flexibility of the glove. The air content in the range of 5-15 volumetric percentile results in foams that have closed cells and the polymeric latex coating is liquid impervious. This coating has a spongy soft feel. Some of the air cells adjacent to the external surface open out providing increased toughness and have the ability to remove boundary layer of oil and water from a gripping surface, providing increased grip. When the volumetric air content is in the range of 15-50%, the air cells are adjacent to each other and during vulcanization heating step, they expand, touch each other creating an open celled foam. The polymeric latex coating of the glove is breathable and the glove does not become clammy. If a drop of liquid is placed on a glove in the palm portion, the liquid may penetrate the polymeric latex coating especially when the glove is worn due to the stretching of the open air cells. This liquid penetration can be minimized or prevented depending on the size of the openings in the air cell by applying an aqueous fluorochromosiloxane dispersion coating. The dispersion generally consists of fluorochromosiloxane composition dispersed in an aqueous solvent medium to form a coating that is typically 0.5 to 2 micron in thickness. The aqueous fluorochromosiloxane dispersion coating may also be applied to portions of the knitted liner that is not covered by the polymeric latex coating. The fluorochromosiloxane coating may be applied to the gelled latex prior to vulcanization and the coating cures together with the latex polymer. The fluorochromosiloxane coating may be equally well applied to unfoamed latex coating to prevent oil or water penetration through occasional imperfections in the latex coating of the glove.

According to some embodiments, the liners 100 or 200 can comprise a woven textile fabric or a knitted textile fabric. The liners 100 or 200 can comprise cotton, nylon, or a form of spandex (elastane), or any combination of two or more of the foregoing. In other embodiments for various glove applications, the cotton, nylon, or spandex may be combined with rayon, polyester, polypropylene, Kevalr® (DuPont, Wilmington, Del.), Spectra™ (Honeywell, Morris- town, N.J.), or steel wire. The liners 100 or 200 comprising cotton and/or rayon, for example, can be placed on the skin-contacting surface, thereby providing a comfortable feel and moisture-absorption. The liners 100 or 200 comprising steel wire, Kevalr®, and/or Spectra™, can be placed on the exterior surface, thereby providing cut-resistance.

FIG. 3 illustrates an exemplary dipped, knitted glove 300 showing the palm-side and FIG. 4 illustrates an exemplary dipped, knitted glove 300 showing the back of the hand side having been coated by a cured elastomeric coating according to an embodiment of the present invention.

As illustrated in FIG. 3, a palm side of the glove 300 with a knitted liner 302 (for example, liners 100 or 200 of FIG. 1 or 2 respectively) is coated by an elastomeric coating 304. In this exemplary embodiment, the glove 300 is made by knitting the liner 302 using an 18-gauge needed bed from a stretchable body yarn that was 160 denier having an elastic (spandex) core and 2 wraps of nylon to form four finger components, such as 102, 104, 106, and 108, the thumb component 110, the palm component 112, and a wrist component 114 (FIG. 1). A plaited yarn of 140 denier nylon (2 ply) is simultaneously knitted with the stretchable body yarn in every other course in the tips and base of each finger and the thumb and in selected parts of the palm components. A second section of the wrist component was formed from a 140 denier nylon yarn (elastic-free), folded over, and secured to form a cuff.

Further, the knitted liner is then dipped into a rubber polymer and partially coated as described above.

Furthermore, a dyeing process is performed on the resultant knitted, elastomeric coated glove produced from above steps. In one embodiment, the gloves are pre-cured in a dryer, then acid dyed for 30 minutes at 140°F, then washed with detergent, followed by a cold water wash, and finally dried. The pre-curing step insures that the urethane coating is not "tacky." If it is tacky, the gloves may stick to each other during the dyeing or drying process. The result of dyeing the glove in this manner is a dyed liner and a stained coating.

Fig. 5 is flow diagram of a method 500 for making the glove 300 according to at least one embodiment of the present invention.

The method 500 starts at step 502 and proceeds to step 504. At step 504, a glove liner is knitted as described above with respect to FIG. 1 or 2.

At step 506, the knitted glove liner is coated with a rubber polymer. In some embodiments, the knitted glove liner is dipped into a rubber polymer to cover at least a portion of the liner. The glove liner is dipped into a coagulant composition, then into at least one aqueous emulsion composition comprising rubber latex, a tackifier, or both. Those skilled in the art may utilize other chemical compositions for the rubber polymer and utilize various other coating techniques, without limiting and departing from the scope of the invention.

At step 508, in one embodiment, the gloves are cured (e.g., tumble dried) in a gas powered dryer at 170°F for 20 minutes. The curing process reduces the toughness of the rubber coating and ensures that the gloves will not stick to one another during the drying process.

At step 510, the knitted polymer coated glove is dyed using an acid dye for 30 minutes at 140°F, then washed with detergent, followed by a cold water wash, and finally dried. For gloves with nylon liners, the dye bath temperature is about 140°F, to reduce shrinking of the liner. In other embodiments, using other glove materials, the dye bath temperature may be higher than 140°F, e.g., 180°F or 200°F. Those skilled in the art may utilize various dyeing techniques for making the final coated gloves. The method 500 proceeds to step 510, where the method 500 ends.

The dye provides color to the inner and stains the elastomeric coating. FIG. 6 represents a close-up, sectional view of a portion 600 of a glove 300. The portion 600 comprises a liner 302 and the coating 304. The liner 302 comprises yarns 602 and 604. The yarns 602 and 604 comprise a plurality of threads that produce fibers 608 and 606. The fibers extend from the yarns. When the liner 302 is coated, some of the threads project through the coating 304. When dyed, the threads are dyed as well as the liner yarns 602 and 604. Also, due to the dyeing process, the coating is stained by a slight penetration of dye into the coating surface (dyed surface 610). The entire area is determined by the claims that follow.

1. A glove comprising:
   a knitted liner;
   a polymer coating adhered to at least one portion of the knitted liner; and
   a dye for coloring the knitted liner and staining a surface of the polymer coating.
2. The glove of claim 1 wherein the dye completely penetrates the knitted liner and penetrates a portion of the surface of the polymer coating.
3. The glove of claim 1 wherein fibers of the knitted liner penetrate the polymer coating and the dye colors the fibers.

4. The glove of claim 1 wherein the knitted liner comprises at least one of natural fiber, synthetic fiber, water-soluble fiber, high-strength synthetic fiber, steel wire, or liquid crystal polymer yarn.

5. The glove of claim 4 wherein the yarn comprises at least one of cotton, nylon, polyester, polypropylene, m-aramid, p-aramid, ultra-high molecular weight polyethylene, SPANDEX®, KEVLAR®, rayon, Spectra™, liquid crystal polymer, or blends thereof.

6. The glove of claim 4 wherein the yarn is a spun yarn, textured filament yarn, or multi-component composite yarn.

7. The glove of claim 1 wherein the knitted liner comprises an elastic, stretchable body yarn having a 180 denier and two nylon warps, and a plaited yarn having a denier of 140 or less.

8. The glove of claim 1 wherein the liner is partially coated with a polymeric latex.

9. The glove of claim 8 wherein the polymeric latex is foamed.

10. The glove of claim 9 wherein the foam has a volumetric air-content between 5% to about 15%.

11. The glove of claim 9 wherein the foam is a closed-cell foam.

12. The glove of claim 9 wherein the foam has a volumetric air-content between 15% to about 50%.

13. The glove of claim 9 wherein the foam is an open-celled foam.

14. A method of making a glove comprising: knitting a liner; coating at least a portion of the knitted liner with a polymer; dyeing the coated liner, where the dye colors the knitted liner and stains a surface of the polymer coating.

15. The method of claim 14 further comprising: after coating the knitted liner, curing the coating.

16. The method of claim 15 further comprising drying the gloves.

17. The method of claim 16 wherein dyeing further comprises acid dyeing the coated liner for about 30 minutes at about 140 degrees F.

18. The method of claim 14 further comprising washing the gloves after dyeing.

19. The method of claim 14 wherein the liner is knitted with an 18-gauge needle.

20. The method of claim 14 wherein the liner is knitted with a main body yarn and a plaited yarn.