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(54) GLOVES WITH REINFORCING ELEMENTS AND METHODS FOR MAKING SAME

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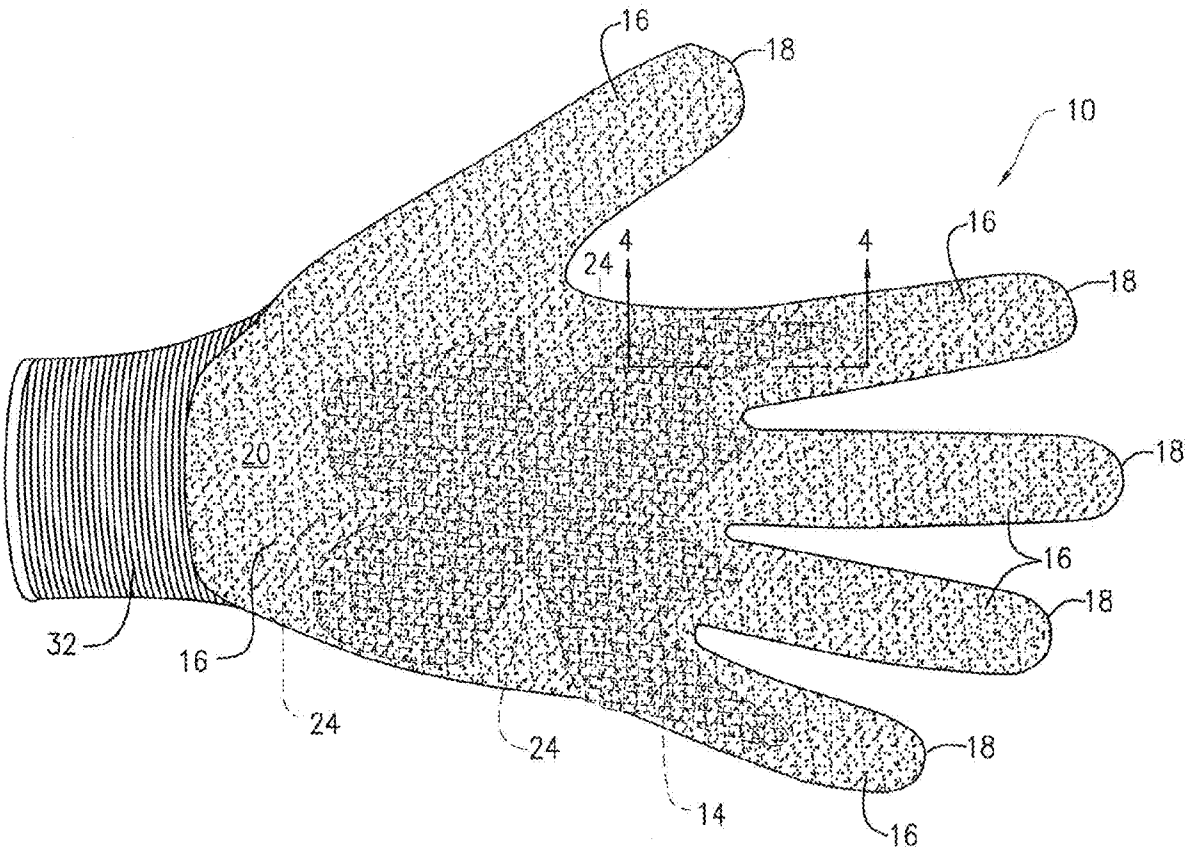
(57) **ABSTRACT**

A reinforced glove includes a substrate, typically in the form of a shell having the shape of a human hand, and a protective coating disposed on the substrate to form a composite therewith. The shell and any integral or non-integral reinforcing elements are at least partially covered by the protective coating, which penetrates such reinforcing elements to thereby improve the bond between the shell and reinforcing elements, whereby the durability, strength and grippability of the glove are enhanced.



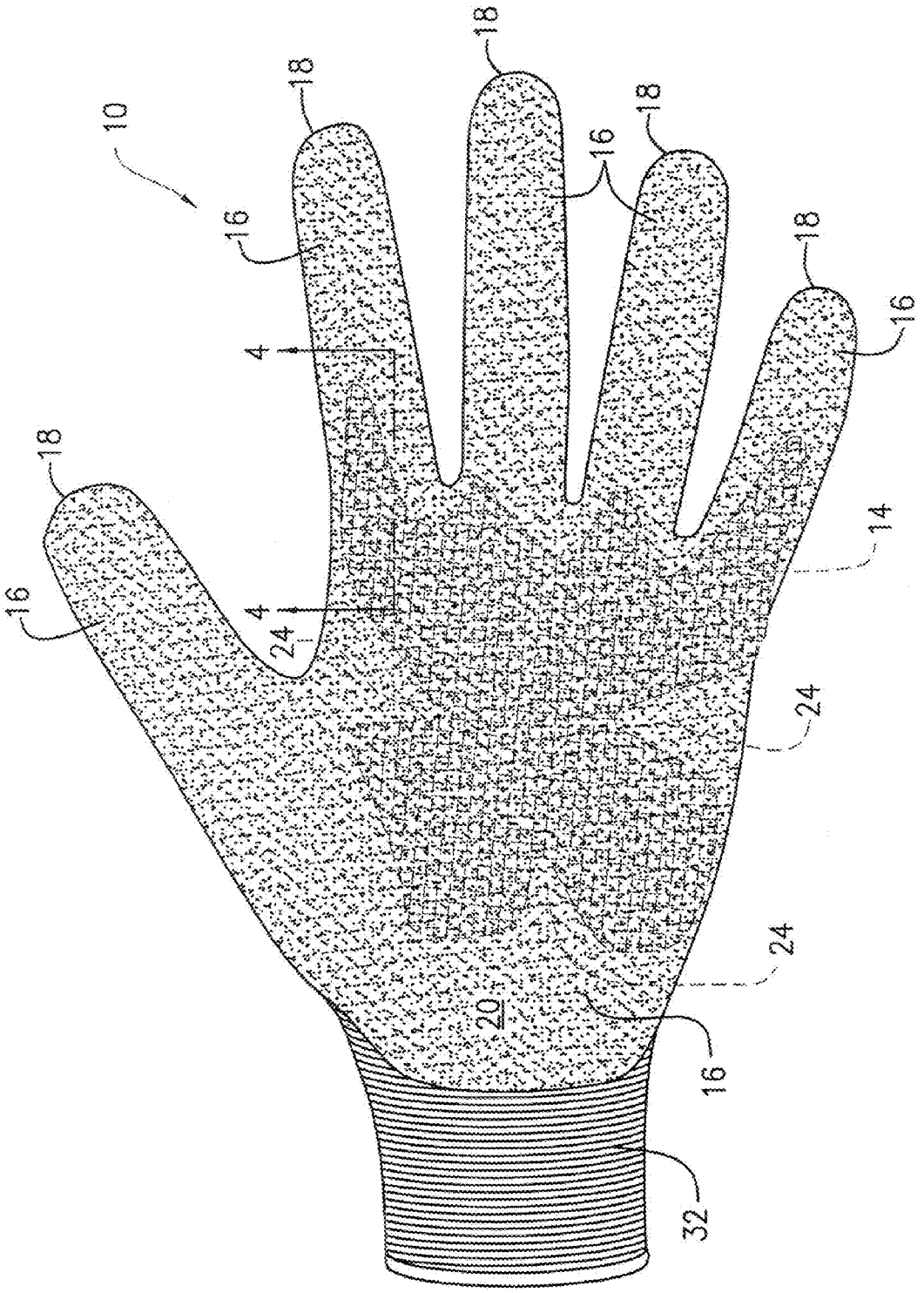


FIG. 1

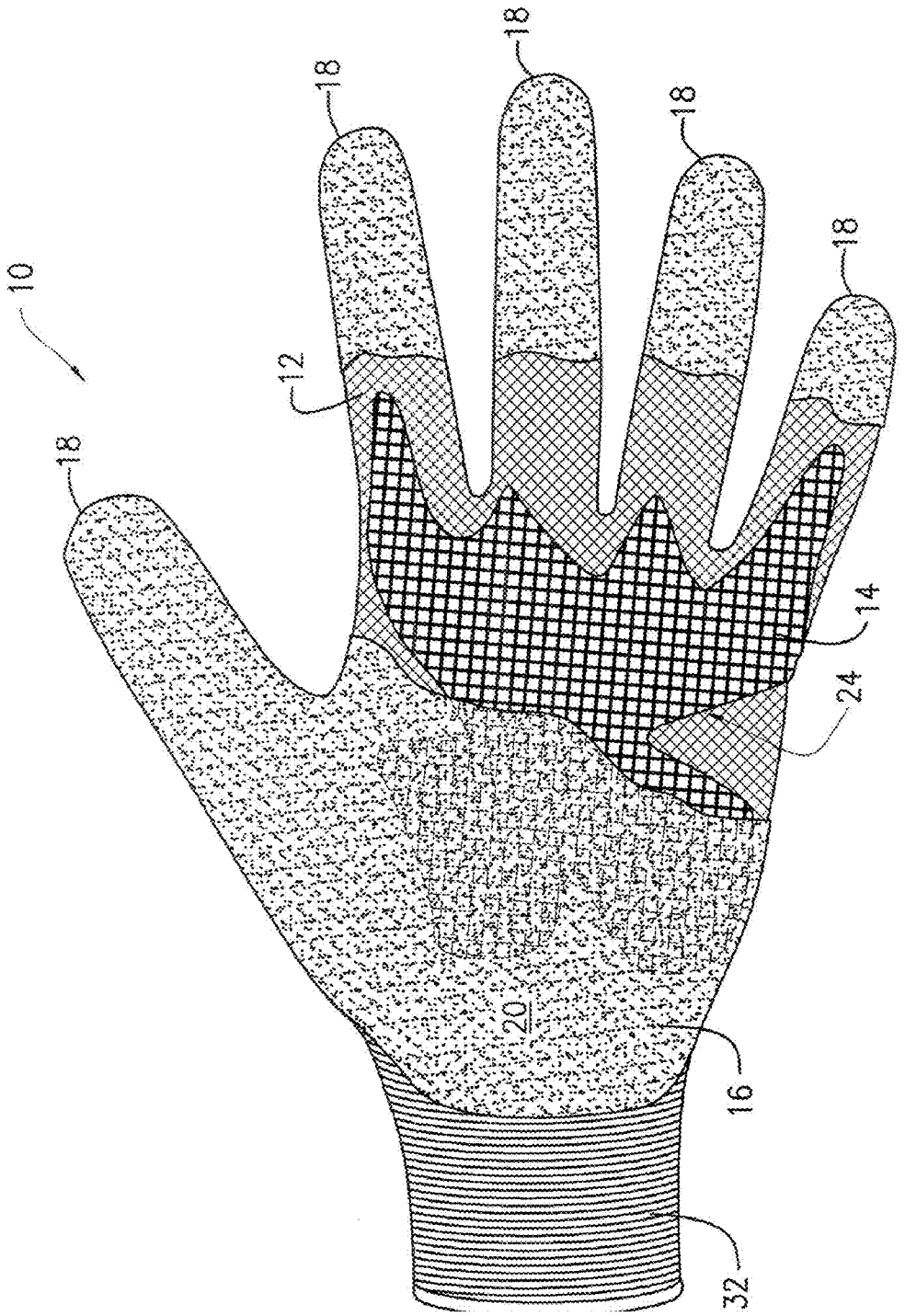


FIG. 2

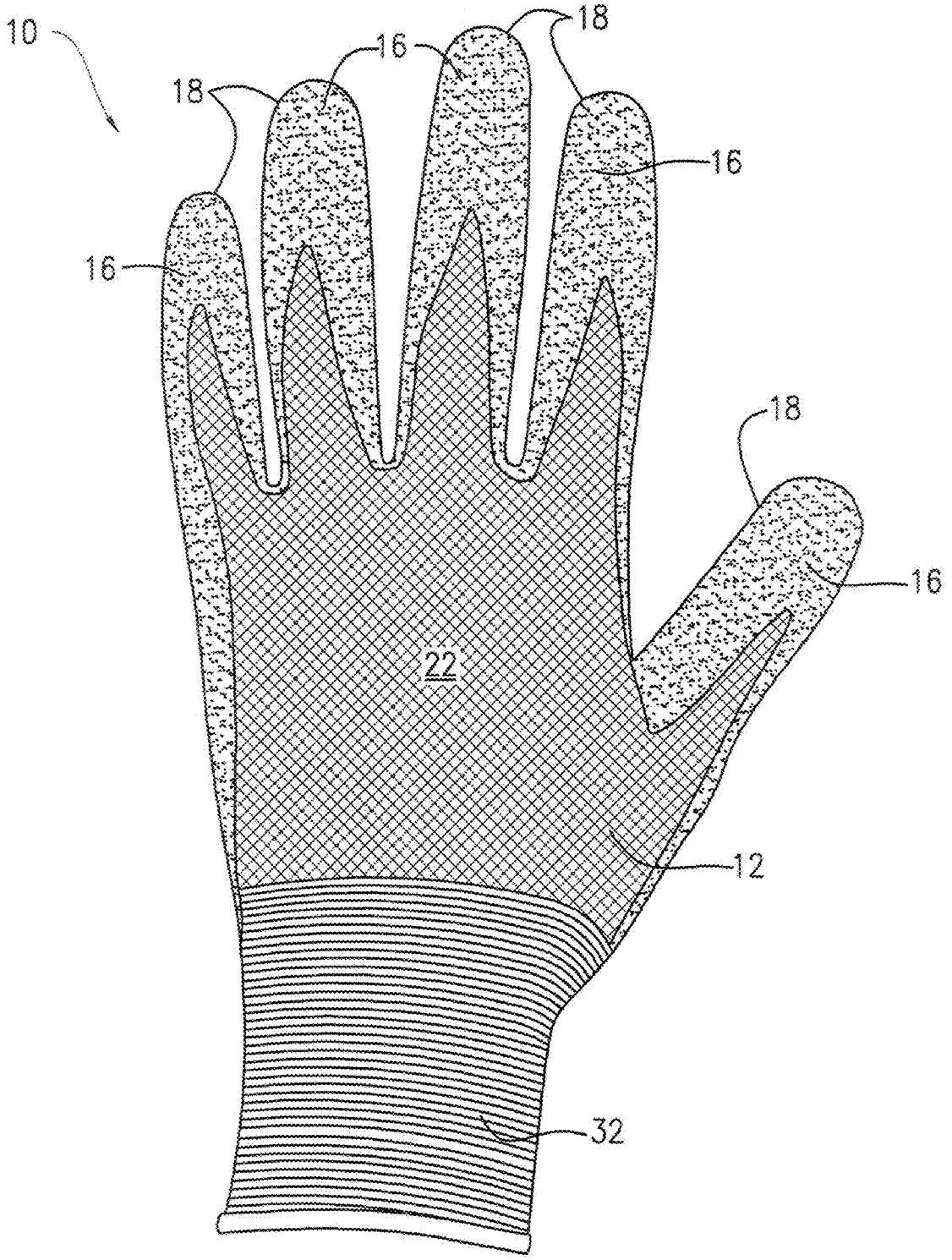


FIG. 3

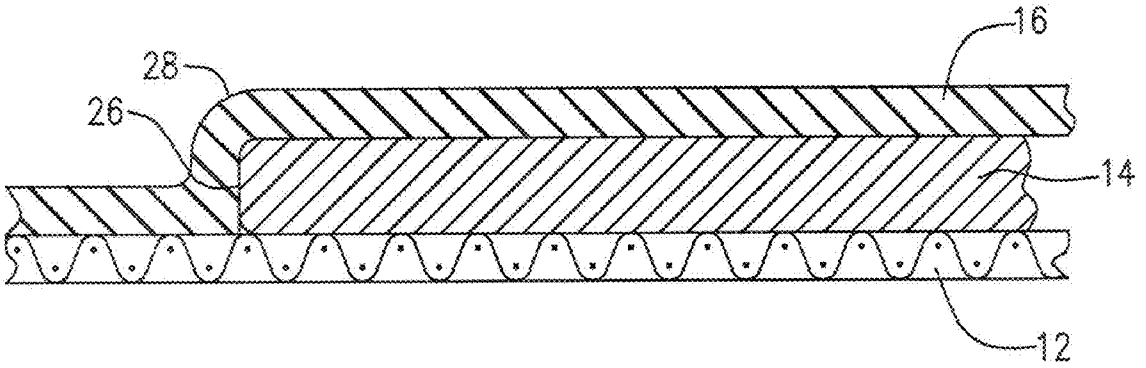


FIG. 4

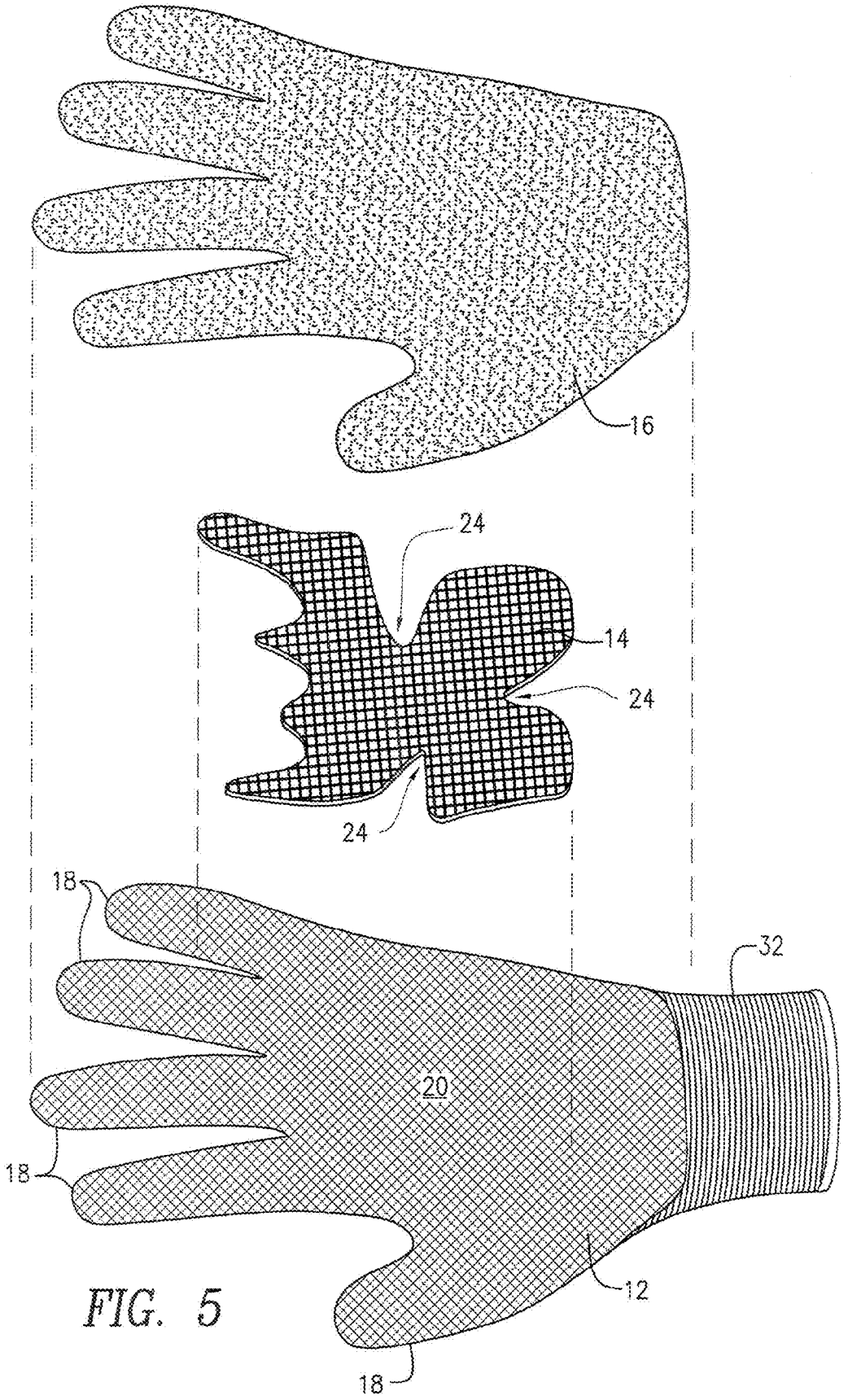


FIG. 5

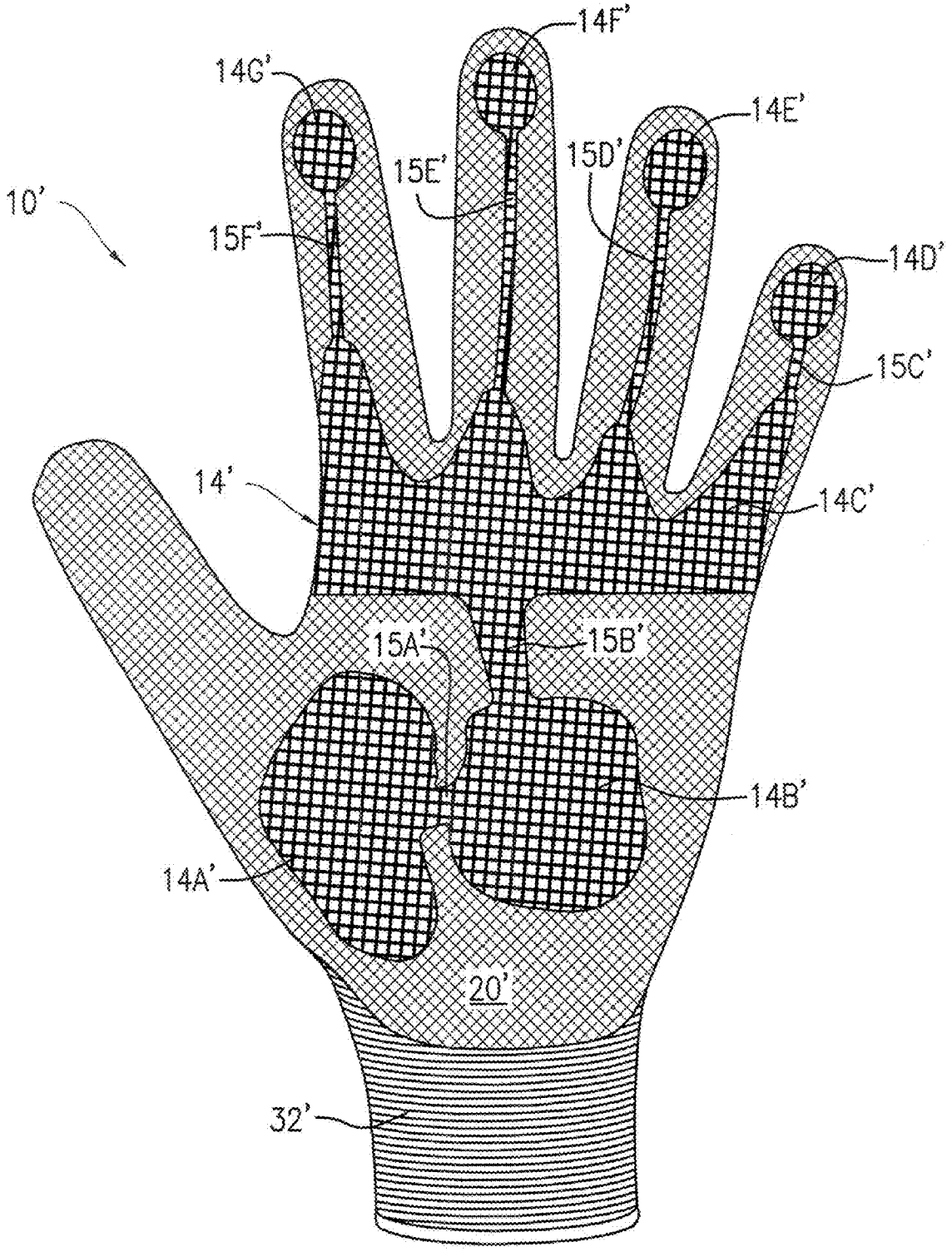


FIG. 6

GLOVES WITH REINFORCING ELEMENTS AND METHODS FOR MAKING SAME

CROSS-REFERENCE TO RELATED APPLICATION

[0001] The present application claims the priority of the U.S. Patent Application Ser. No. 60/856,558 filed Nov. 3, 2006, the entire disclosure of which is incorporated herein by reference in its entirety.

FIELD OF THE INVENTION

[0002] The present invention relates to multilayer, reinforced gloves and methods for manufacturing such gloves.

BACKGROUND OF THE INVENTION

[0003] Gloves of the prior art are constructed of various materials and are used for various purposes. For example, the prior art includes workman gloves, surgical gloves, driving gloves, household gloves, skiing gloves, and gloves for providing warmth. Gloves of the prior art have typically been formed from leather, polyvinyl-chloride, rubber, and fabric. It is also known in the art to provide composites, such as fabric gloves dip-coated with a natural or nitrile rubber.

[0004] The prior art also includes gloves having fabric and leather reinforcing elements that are mechanically fastened to a glove. For example, the prior art includes fabric and leather strips sewn onto the outer surface of the glove. The fabric and leather reinforcing elements are positioned on sections of the glove corresponding to the fingertips, the knuckles, the wrist, the palm, and/or the back side of the hand. Although fabric and leather reinforcing elements increase a glove's grip and wear resistance, they are expensive materials and must be mechanically fastened to the glove. This increases the total manufacturing cost of the glove, as well as the final retail price paid by consumers.

[0005] It is also known in the art to provide a glove having polyvinylchloride patches bonded to an underlying fabric. For example, U.S. Pat. No. 6,185,747 discloses polyvinylchloride patches that are metal-screened to the fibers of the underlying fabric. Unfortunately, the bond between the screened polyvinylchloride and the fibers causes the fibers to stiffen, which in turn causes discomfort and potential irritation to the hands of a person wearing the glove. Furthermore, the fabric of the glove is exposed in multiple locations, such as in the areas between the polyvinylchloride patches. This forms vulnerable areas that have low wear resistance and that are easily susceptible to puncture and/or chemical penetration.

[0006] What is needed in the art is a glove that provides good grippability at a low cost and does so without unnecessarily compromising the wear resistance or comfort of the glove.

SUMMARY OF THE INVENTION

[0007] In accordance with the present invention, a glove, which includes a shell in the shape of a human hand, is reinforced over at least a portion of the shell and then coated so as to at least partially cover the shell, including its reinforced portion. The shell can be reinforced integrally by, for instance, making a portion of it thicker than the rest of the shell. If the shell has a knit construction, the reinforced portion can be formed by knitting thicker (i.e., lower gauge) threads into the shell at desired locations on the palm side and/or the back side of the shell. Once the shell is coated, the result is a composite glove having a plurality of reinforced portions that enhance the durability, grippability and/or comfortability of the glove. It is also possible to reinforce the shell using independent reinforcing elements that are attached to the palm side and/or the back side of the shell by the coating. The result, in this instance, is a reinforced, multi-layered glove having enhanced durability, grippability and/or comfortability.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] For a more complete understanding of the present invention, reference is made to the following description of various exemplary embodiments thereof taken in conjunction with the accompanying drawings, in which:

[0009] FIG. **1** is a top plan view of a palm side of a glove constructed in accordance with one exemplary embodiment of the present invention;

[0010] FIG. **2** is a view similar to FIG. **1**, except that a portion of a coating layer of the glove has been removed to show an underlying shell and reinforcing element;

[0011] FIG. **3** is a top plan view of a back side of the glove shown in FIG. **1**;

[0012] FIG. **4** is sectional view, taken along section line **4-4** of FIG. **1** and looking in the direction of the arrows, of the glove shown in FIG. **1**;

[0013] FIG. **5** is an exploded perspective view of the glove shown in FIG. **1**; and

[0014] FIG. **6** is a top plan view of a palm side of a glove constructed in accordance with another exemplary embodiment of the present invention, an outer coating layer of the glove having been removed so that an underlying shell and reinforcing elements are visible.

DETAILED DESCRIPTION OF THE INVENTION

[0015] Referring to FIGS. **1-3** and **5**, there is shown a glove **10** which includes a shell or substrate **12** (see FIG. **2**), a reinforcing element **14** and a coating layer **16**. The shell **12** is in the form of a conventional fabric glove and includes a plurality of finger portions **18**, a palm side **20** and a back side **22**. More particularly, the shell **12** can have a string-knit construction which provides a seamless shell, or a sewn-knit construction which provides a shell having seams. Alternatively, the shell **12** can be woven, knitted, or non-woven, including but not limited to bonded fiber, stitched bonded, needle punched, spun bonded and spun lace are examples of textile types which can be used.

[0016] The shell **12**, especially if it has a knit construction, may also include areas or portions (not shown) that have a gauge (i.e., number of courses of threads per inch) or strength or size different from the rest of the shell **12**, thereby providing integrally formed reinforcing portions with different texture, weight and/or integrity. For instance, such integrally formed reinforcing portions can result in raised areas having a cushioning effect if the size or gauge (i.e., diameter) of the threads in the reinforced portion is larger than the size of the threads used to make the remainder (i.e., the unreinforced portion) of the shell **12**. Rather than modifying thread size, the type of material used to make the reinforced portion could be different than the type used to make the unreinforced portion of the shell **12**, thereby providing an opportunity to enhance the durability, grippability and/or comfortability of the glove **10**. The use of a stronger (i.e., more wear-resistant) material

for the reinforced portion would, by way of example, enhance durability which would, in turn, increase the useful life of the glove **10**.

[0017] If the shell **12** is made from one of the foregoing constructions, suitable materials include polyester, nylon, acrylic, Kevlar®, Dyneema®, rayon, polypropylene, lyocell, glass lyocell, glass and metallic fibers, acetate, aramide, modacrylic. melamine, urethane etc., or blends thereof. The other suitable materials include all natural fibers such as vegetable fibers (i.e., cotton, flax, jute, and sisal, also including animal fibers such as wool, horsehair and silk), and synthetic fibers including regenerated cellulose, polylactic acid, polyurethane, vinyl and polyolefins. High performance specialty fibers such as aramide, polybenzimidazole, polyimide, phenolaldehyde and polysulfone are also suitable for construction of the shell **12**. The shell **12** could be made from non-fabric materials. For instance, heat-sealed plastic or rubber (natural or synthetic), as well as other elastomeric materials, might be used to form the shell **12**.

[0018] Referring now to FIGS. **1**, **2** and **5**, the reinforcing element **14** can be any sheet-like material that has some degree of flexibility and some affinity for liquid agents used to form the coating layer **16**. The term "affinity" is used herein to define a material that can absorb or adsorb suitable liquid agents or that does not repel such agents. One suitable material for the reinforcing element **14** is a urethane foam, preferably one with a reticulated construction, having cells in the range of from about 20 per inch to about 100 per inch. Such a foam material can be provided with a thickness preferably ranging from about 0.04 inch to about 0.25 inch, and, more preferably, ranging from about 0.06 inch to about 0.12 inch.

[0019] Other suitable materials for the reinforcing element **14** include knit or woven fabrics. The knit or woven fabrics have a mesh-like or somewhat open construction and are typically made from cotton, polyester, nylon, acrylic, Kevlar®, Dyneema®, rayon, polypropylene, lyocell, etc., or blends thereof.

[0020] The reinforcing element **14** can also be made from non-woven fabrics constructed by any known process, such as airlaid, spun bound, spunlace (e.g., Ahlstrom Green Bay, Inc. Grades SX-392, SX-252 and SX-600), melt blown, carded/bonded and needle punched processes. Like the knit and woven fabrics, the non-woven fabrics can be constructed from cotton, polyester, nylon, acrylic, Kevlar®. Dyneema®, rayon, polypropylene, lyocell, etc., or blends thereof. Other materials suitable for the reinforcing element **14** are perforated plastic films, plastic foams, reticulated foams, plastic netting and molded plastic. Rubber sheeting, rubber foams, molded rubber, and soft metal (e.g., bronze and aluminum) mesh and screening are also suitable. Leather, reconstituted leather (e.g., perforated leather) and low quality leather are suitable as well. Preferably, all of these materials should have an open construction. The term "open construction" is used herein to define a characteristic or property which allows liquid agents used to form the coating layer **16** to more readily penetrate or permeate the reinforcing element **14**.

[0021] When a fabric material (e.g., knit, woven or non-woven fabric) is used to make the reinforcing element **14**, the preferred weight of the fabric material can range from about 1.0 oz per square yard to about 8 oz per square yard. Of course, the fabric material could have a weight outside this range, depending upon the type of fiber used and the degree of reinforcement desired.

[0022] In certain cases, it may be preferable to perforate or die cut openings in the reinforcing element **14** to achieve satisfactory penetration/permeation of the coating agent (to be described in greater detail hereinafter) into the reinforcing element **14**. If desired, an anti-vibration effect can be achieved by selecting an appropriate material for the reinforcing element **14**. For instance, a reticulated urethane foam or a bonded non-woven fabric (e.g., 6 denier polyester bonded fiber) having a thickness of about 0.12 inch can be used as the reinforcing element **14** to achieve such an effect.

[0023] It may be desirable to provide one or more pressure relief areas **24** in the reinforcing element **14** for enhanced flexibility or conformity of the glove **10** to the hand of a user. In addition, the reinforcing element **14** could be replaced with a plurality of reinforcing elements, the size, shape and/or location thereof being variable. For instance, while the reinforcing element **14** shown in FIGS. **1** and **2** is applied to the palm side **20** of the shell **12** with portions thereof extending onto the finger portions **18**, the back side **22** of the shell **12** could be reinforced in a similar manner using multiple reinforcing elements (not shown). For instance, a reinforcement element can be positioned in the knuckle-area (not shown) on the back side **22** of the shell **12** in order to provide additional protection to the knuckles of the wearer of the glove **10**.

[0024] The reinforcing element **14** provides enhanced cushioning to the hand of a user. The reinforcing element **14** also increases the tensile strength of the glove **10**, while functioning as an abrasion-resistant and cut-resistant element. Accordingly, the shell **12** can be made from a comfortable material (e.g., fabric) and then reinforced with the reinforcing element **14**.

[0025] The reinforcing element **14** could be dispensed with, if the shell **12** is provided with an integrally formed reinforcing portion as described above. Alternatively, the reinforcing element **14** could be used, as a supplement, in combination with any such integrally formed reinforcing portion.

[0026] The coating layer **16**, which permanently adheres the reinforcing element **14** to the shell **12**, can be made from any suitable liquid coating agent adapted for absorption or adsorption by the reinforcing element **14** or from such an agent that is not repelled by the reinforcing element **14**. Suitable coating agents include any elastomeric compound known in the art, such as natural rubber latex, synthetic rubber latices (e.g., neoprene, nitrile (Rheichold/Dow TYLAC 68074-06) or urethane). Other suitable materials for the coating layer **16** include silicone, polyurethane, polyvinylchloride or other 100% solid plastic resins, and solvent solutions of similar resins. All of the foregoing materials could be expanded or foamed. In certain instances, the coating layer **16** might be formed from neoprene and/or styrene butadiene rubbers.

[0027] The coating layer **16** bonds to the shell **12**, while permeating and penetrating the reinforcing element **14** to thereby securely attach it to the shell **12**. More particularly, the coating layer **16** permeates or penetrates the reinforcing element **14** through its intersticies or openings. The bonds formed within the intersticies (not shown) of the reinforcing element **14** prevent the reinforcing element **14** and the coating layer **16** from bunching-up or folding onto themselves as the glove **10** is flexed by a user's hand, thereby providing greater comfort to the user and excellent durability for the glove **10**. Preferably, the reinforcing element **14**, including its peripheral edges **26**, is encapsulated or enveloped by the coating

layer **16**. As a result, the coating layer **16** forms a fillet-like border **28** (see FIG. **4**) along the peripheral edges **26** of the reinforcing element **14**, thereby providing added protection to such edges. Depending upon the construction of the reinforcing element **14**, the coating layer **16** could be absorbed directly into the material forming the reinforcing element **14**.

[0028] The glove **10** can be made using the following process or method. First, the shell **12** is applied to a three-dimensional mold or two-dimensional form (not shown) which is in the shape of a human hand. Next, the reinforcing element **14** is applied to the shell **12** on the palm side **20** thereof. More particularly, the reinforcing element **14** can be applied loosely to the shell **12**; or it can be temporarily affixed thereto using any conventional mechanism, such as a light spray adhesive. After such affixation of the reinforcing element **14**, the shell **12** is dipped into a liquid bath of a suitable coating agent at an angle such that an area **30** (see FIG. **3**) on the back side **22** of the shell **12** is free of the coating agent. This free area **30** is provided so as to improve the breathability of the glove **10**. If breathability is not a concern, then the entire shell **12** can be dipped into the coating bath, thereby eliminating the free area **30**. After the shell **12** is removed from the bath, the coating agent applied to the shell **12** is cured in a conventional manner to form the coating layer **16**. For instance, the shell **12** can be oven-dried in accordance with methods known in the glove manufacturing industry. After curing, the shell **12** is removed from the mold, resulting in the formation of a unique reinforced, multi-layer glove. It should be noted that alternate methods of applying the coating can be used. Screen printing and spray coating are among some alternate methods to the dipping process. An elastic strap **32** is then attached to a wrist portion of the shell **12**. A loop and fastener (not shown) may be attached to the elastic strap **32**. Alternate wrist treatments include an overcast hem or gauntlet cuff.

[0029] Depending upon the thickness and construction of the reinforcing element **14**, the reinforcing element **14** can be readily observed on the glove **10**. However, in some instances, it may be desirable to further highlight the appearance of the reinforcing element **14** from the rest of the glove **10**. By selecting the reinforcing element **14** from the variety of the materials available, varying the thickness of the reinforcement or the degree of openness of the reinforcing element **14**, the reinforced areas, after coating, can be visually and tactilely highlighted so that the glove **10** can be readily determined to be reinforced. Additionally, this can be accomplished by providing the reinforcing element **14** in a contrasting color (e.g., the reinforcing element **14** can be highlighted in black, while the shell **12** can be provided in white). The coating layer **14** could then be formulated with varying degrees of translucency to enhance the desired highlighting effect. Such a highlighting effect can be achieved by screen printing the contrasting color (e.g., black) over the portion of the coating layer **16** overlying the reinforcing element **14**.

[0030] Referring to FIG. **6**, a glove **10'** includes a reinforcing element **14'** having pads **14**A'-**14**G' positioned on a palm side **20'** of the glove **10'**, including finger portions **18'** thereof. For ease of manufacturing and handling, the pads **14**A'-**14**G' are attached together by connecting strips **15**A'-**15**F' (i.e., small segments made from the same material as the pads **14**A'-**14**G' themselves).

[0031] The preferred embodiments disclosed herein provide for a reinforced, multilayer glove that achieves many desirable objectives (e.g., grippability, durability, comfortability, etc.) at a relative low manufacturing cost. Various reinforcement elements enhance the properties of the gloves depending on the materials, and the form of the materials (e.g., knit, nonwoven, molded part, etc.), that are utilized in the construction of same. The invention also improves glove performance characteristics such as abrasion resistance, vibration isolation, thermal insulation, and protection against hand injuries. Nevertheless, it should be understood that the embodiments described herein are merely exemplary and that a person skilled in the art may make many variations and modifications without departing from the spirit and scope of the present invention. Accordingly, all such variations and modifications, including those discussed above, are intended to be included within the scope of the invention.

What is claimed is:

1. A reinforced glove, comprising a shell in the shape of a hand, said shell having a first side and a second side opposite said first side, at least one of said sides being reinforced over at least a portion thereof to thereby form a reinforced portion of said shell, and a coating applied to said shell so as to at least partially cover said shell and said reinforced portion thereof.

2. The glove of claim **1**, wherein said shell has an unreinforced portion which is at least partially covered by said coating, said coated reinforced portion having a characteristic which distinguishes said coated reinforced portion from said coated unreinforced portion.

3. The glove of claim **2**, wherein said characteristic is visually perceptible.

4. The glove of claim **2**, wherein said characteristic tactilely perceptible.

5. The glove of claim **1**, wherein said reinforced portion of said shell is formed integrally with said shell.

6. The glove of claim **5**, wherein said shell is formed by a plurality of elements made from a first material and said reinforced portion of said shell is at least partially formed by reinforcing elements made from a second material that is more durable than said first material.

7. The glove of claim **6**, wherein said shell has a knit construction and said reinforcing elements are knitted into said shell.

8. The glove of claim **1**, wherein said reinforced portion of said shell is formed by an independent reinforcing element attached to said shell by said coating.

9. A reinforced, multi-layered glove, comprising a shell in the shape of a hand, said shell defining a first layer and having a palm side and a back side; a second layer applied to said first layer so as to reinforce at least a portion thereof; and a third layer applied as a coating so as to at least partially cover said first and second layers.

10. The glove of claim **9**, wherein said second layer is applied to only a portion of said first layer, whereby said shell has a reinforced portion and an unreinforced portion, said reinforced portion of said shell being completely covered by said third layer and said unreinforced portion of said shell being partially covered by said third layer, said coated reinforced portion having a characteristic which distinguishes said coated reinforced portion from said coated unreinforced portion.

11. The glove of claim **10**, wherein said third layer penetrates said second layer and contacts said first layer over at least a portion of said reinforced portion of said shell, whereby said third layer is bonded to both said first layer and said second layer.

12. The glove of claim **10**, wherein said second layer has a first surface, which is positioned adjacent to said first layer, a second surface, which is opposite said first surface and which is positioned remote from said first layer, and a peripheral edge between said first and second surfaces.

13. The glove of claim **12**, wherein said peripheral edge of said second layer is enveloped by said third layer.

14. The glove of claim **9**, wherein said second layer has an open construction.

15. The glove of claim **14**, wherein said second layer is made from a fabric.

16. The glove of claim **14**, wherein said second layer has a plurality of openings extending from said first surface thereof to said second surface thereof, said plurality of openings permitting said liquid coating agent to flow therethrough.

17. The glove of claim **16**, wherein said third layer forms bonds within said openings of said second layer, whereby said second and third layers are inhibited from folding onto themselves when the glove is in use.

18. The glove of claim **9**, wherein said second layer. includes a plurality of reinforcing elements, whereby said shell has a plurality of reinforced portions.

19. The glove of claim **18**, wherein at least one of said reinforcing elements is positioned on said palm side of said shell and wherein at least one of said reinforcing elements is positioned on said back side of said shell.

20. The glove of claim **18**, wherein at least some of said reinforcing elements are positioned on said palm side of said shell at spaced-apart locations thereon, said at least some of said reinforcing elements being attached together by connecting strips.

21. The glove of claim **9**, wherein said first and second layers are made from flexible material, said second layer having at least one pressure relief area formed therein so as to enhance the flexibility of said second layer.

22. The glove of claim **21**, wherein said third layer is formed by a liquid coating agent having elastic properties when cured, whereby said first and second layers remain flexible after they are at least partially covered by said third layer.

23. A reinforced glove, comprising a shell in the shape of a hand, said shell having a first side and a second side opposite said first side, at least one of said sides being reinforced over a portion thereof to thereby form a reinforced portion and an unreinforced portion, and a coating applied to said shell so as to at least partially cover said reinforced and unreinforced portions thereof, said coated reinforced portion having a characteristic which distinguishes said coated reinforced portion from said coated unreinforced portion.

24. The glove of claim **23**, wherein said characteristic is visually perceptible.

25. The glove of claim **23**, wherein said characteristic tactilely perceptible.

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