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(54) **MULTIFUNCTIONAL KNITTED GLOVE**

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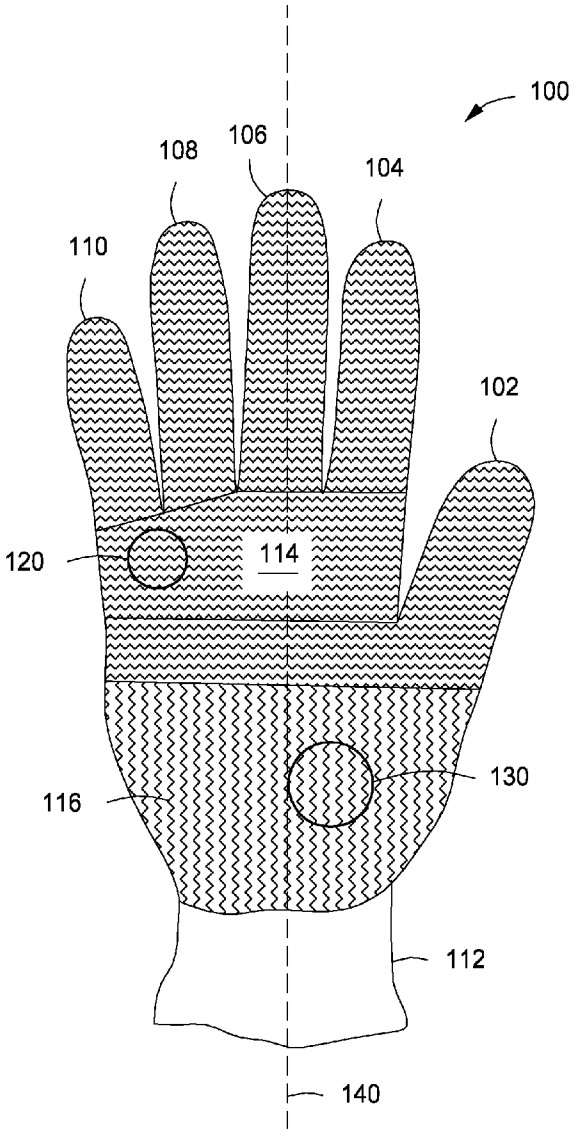
USPC **66/174**; 66/45; 66/65

(57) **ABSTRACT**

A knitted glove that includes a knitted liner, the knitted liner including at least a first yarn and a second yarn, the first and second yarns forming knitted courses, wherein the knitted courses are disposed along a longitudinal axis of the liner, forming a knitted glove.



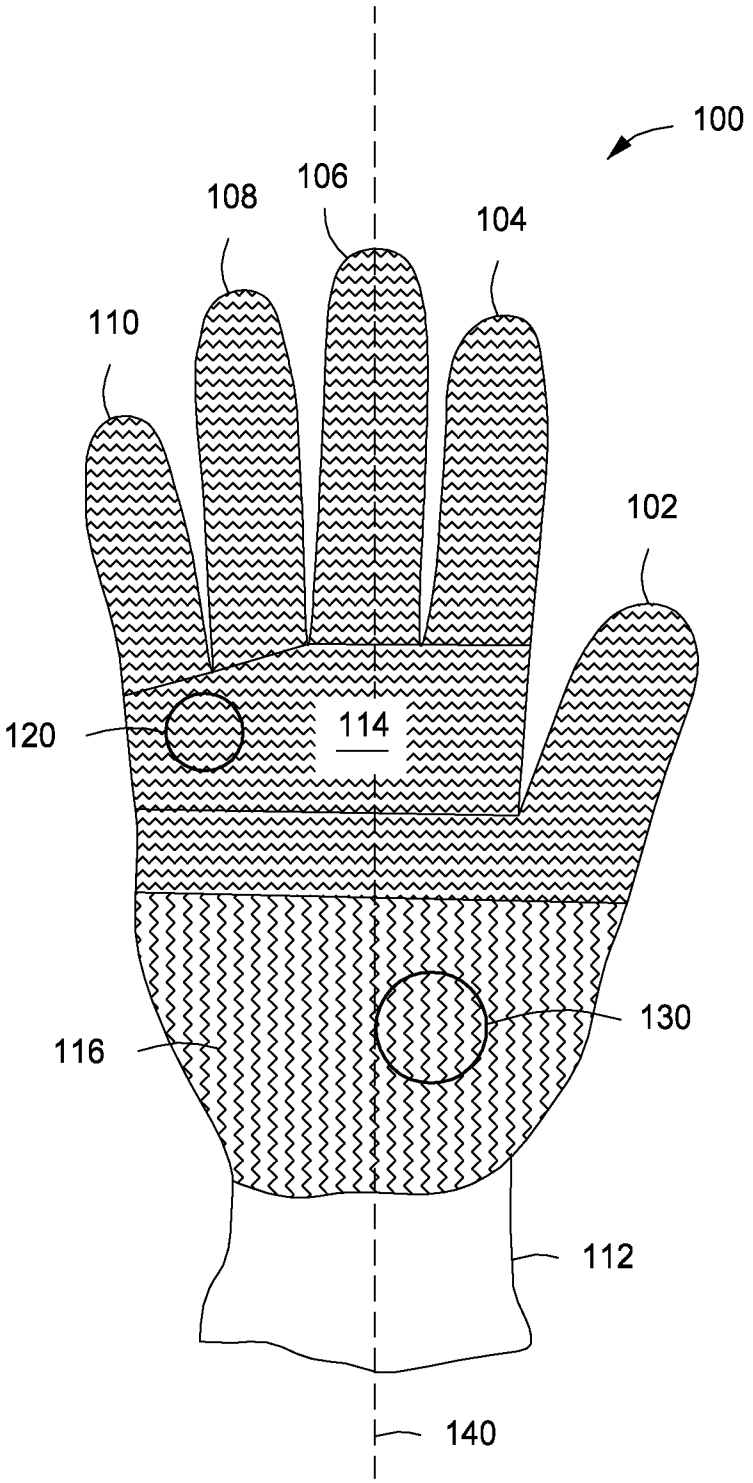


FIG. 1

FIG. 2

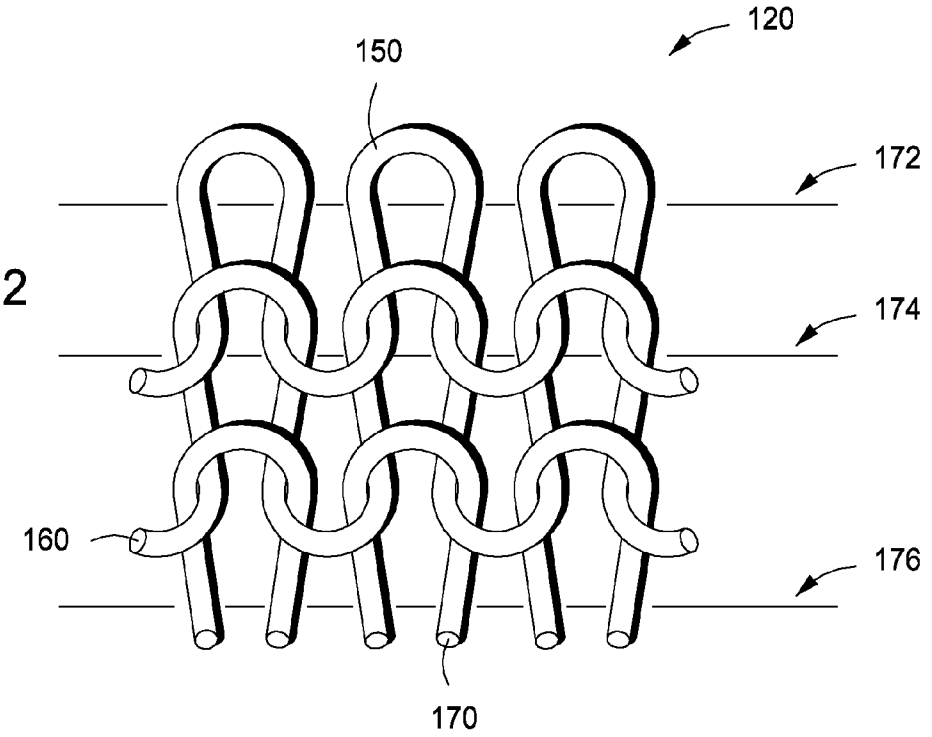


FIG. 3

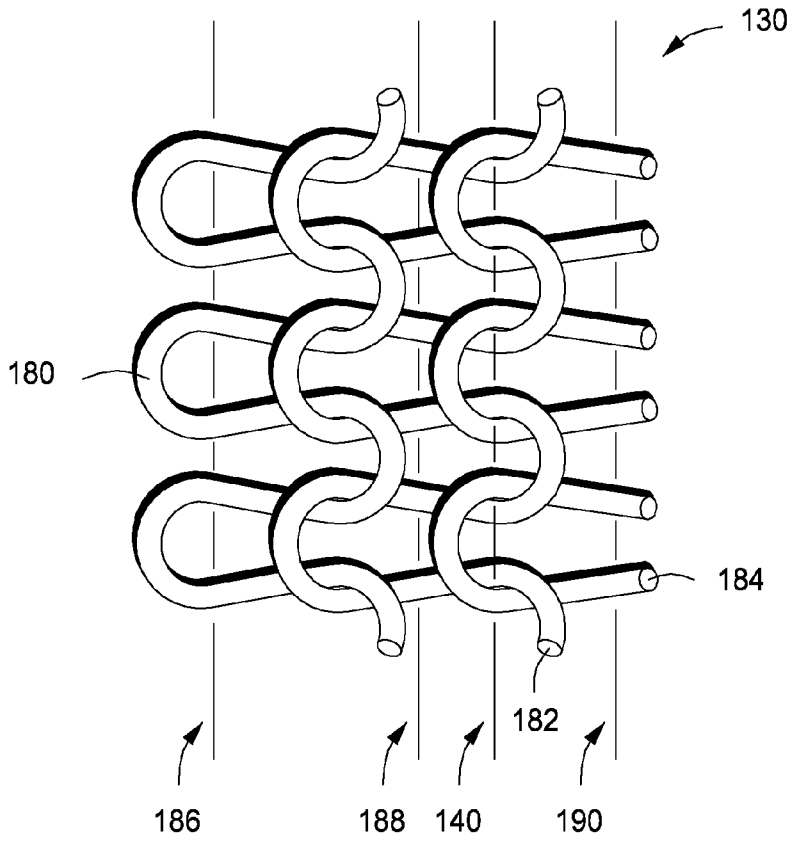
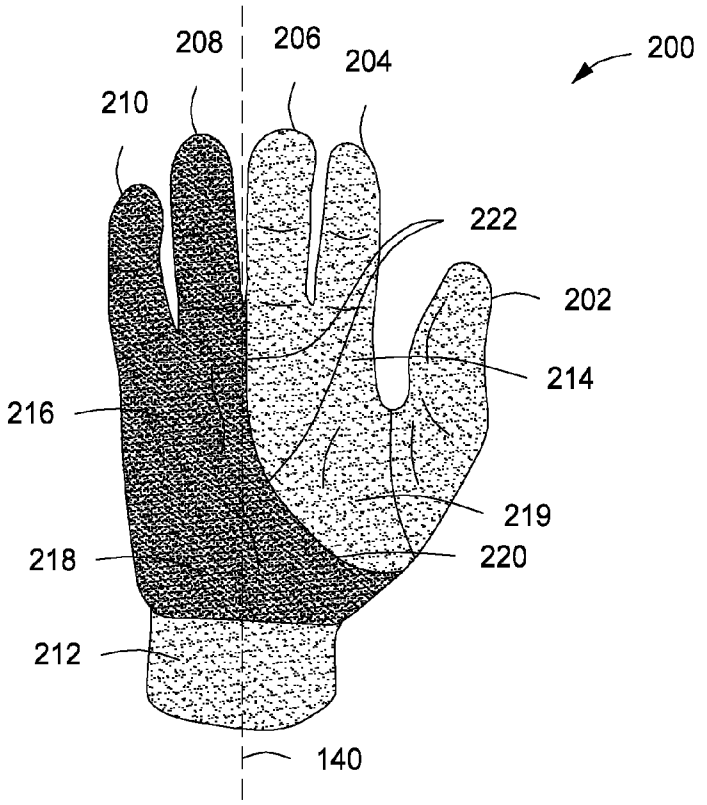


FIG. 4


208
206
204
200
210
222
202
214
216
219
218
220
212
140

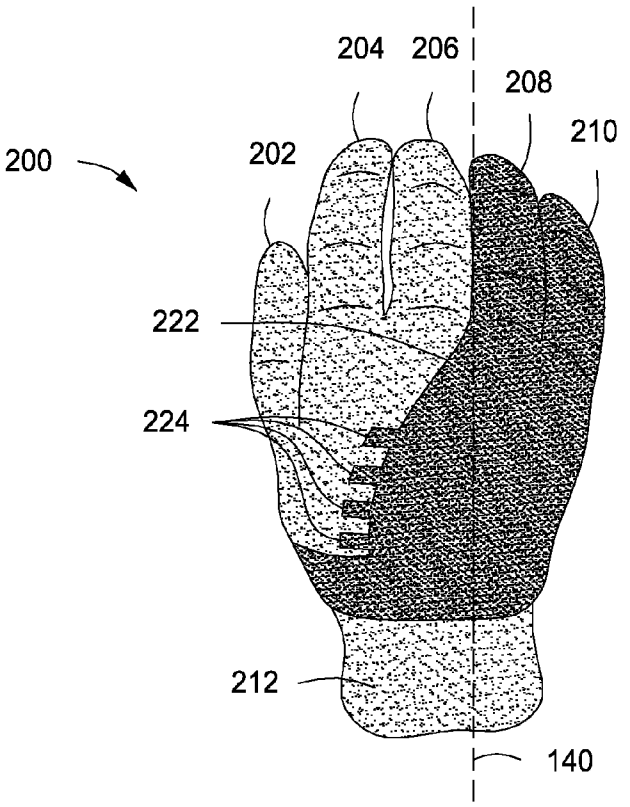

204
206
208
210
200
202
222
224
212
140

FIG. 5

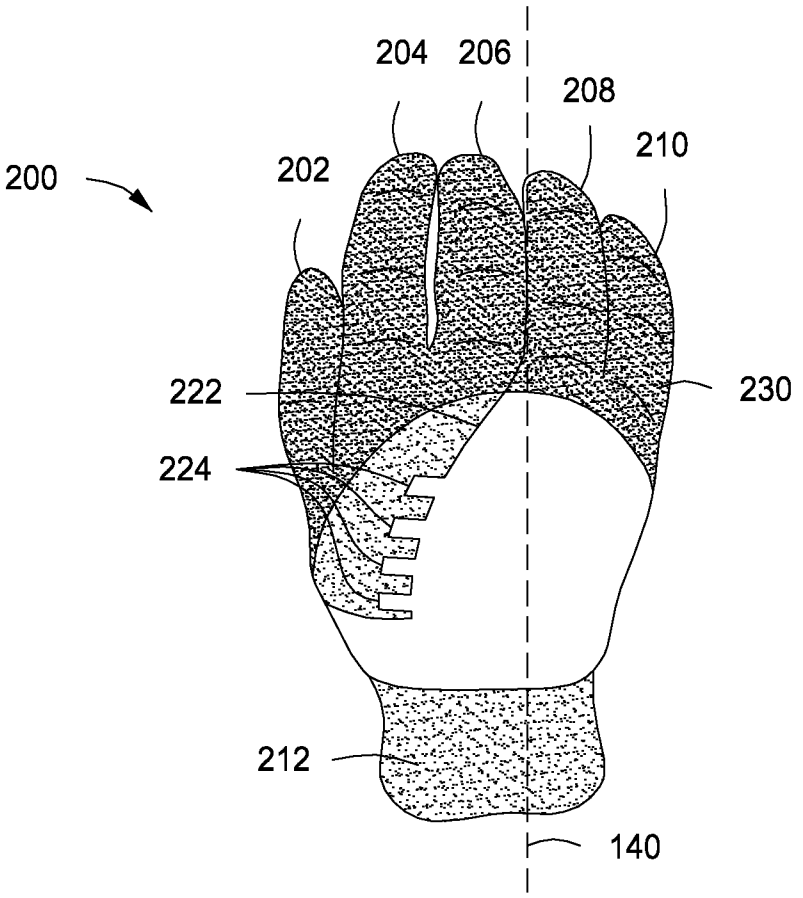


FIG. 6

MULTIFUNCTIONAL KNITTED GLOVE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application No. 61/735,881, filed on Dec. 11, 2012, which is incorporated herein in its entirety.

BACKGROUND

[0002] 1. Field of the invention

[0003] Embodiments of the present invention generally relate to gloves and, more particularly, to gloves comprising a plurality of yarns in selected regions of the gloves.

[0004] 2. Description of the Related Art

[0005] Gloves are used in many industrial and household settings to protect the hands of users. Many gloves are designed to embody specific properties for specific applications, for example, cut resistant yarns in gloves for use by those who uses knives, saws, and the like. Many users have multiple needs. For example, a metalworker, such as a welder, may need gloves that provide heat-resistance as well as cut-resistance. Designing gloves for such applications can prove to be challenging with the balance of properties in mind. For example, glove designers have designed gloves that are cut-resistant and heat-resistant at the expense of thinness, dexterity, and flexibility. Moreover, over-engineering a glove, for example, by having additional yarns where not needed, wastes manufacturing time and capital resources.

[0006] Therefore, providing gloves having an enhanced balance of desirable properties in various regions of the gloves would represent an advance in the art.

SUMMARY OF THE INVENTION

[0007] Embodiments of the invention include vertically knitted, multifunctional gloves comprising at least two yarns in accordance with the present invention, substantially as shown in and/or described in connection with at least one of the figures, as set forth more completely in the claims, are disclosed. Various advantages, aspects, and novel features of the present disclosure, as well as details of an exemplary embodiment thereof, will be more fully understood from the following description and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] 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. It is to be understood that elements and features of one embodiment may be in other embodiments without further recitation and that, where possible, identical reference numerals have been used to indicate comparable elements that are common to the figures.

[0009] FIG. **1** depicts a glove in accordance with embodiments of the invention;

[0010] FIG. **2** depicts a close up view of element **120** of glove **100** of FIG. **1**, in accordance with embodiments of the invention;

[0011] FIG. **3** depicts a close up view of element **130** of glove **100** from FIG. **1**, in accordance with embodiments of the invention;

[0012] FIG. **4** depicts a plan view of the palm side of glove **200**, in accordance with embodiments of the invention;

[0013] FIG. **5** depicts a plan view of the backhand side of glove **200**, in accordance with embodiments of the invention; and

[0014] FIG. **6** depicts a plan view of FIG. **5** having a polymeric coating disposed thereon, in accordance with embodiments of the invention.

DETAILED DESCRIPTION

[0015] Embodiments of the present invention comprise vertically knitted gloves having at least two different yarns. In this context, vertically knitted means that the courses of the gloves are disposed parallel to a longitudinal axis of the glove. A glove in accordance with embodiments of the invention comprises different regions, for example, finger stalls, a palm region, a backhand region, a cuff region, and the like. Any region may comprise vertically knitted parts. Additionally, a region may comprise knitted courses that include both vertically and horizontally knitted courses.

[0016] FIG. **1** depicts a glove according to some embodiments of the invention. A glove **100** comprises a thumb **102**, an index finger **104**, a middle finger **106**, a ring finger **108**, a pinky finger **110**, an upper palm **114**, a lower palm **116**, and, optionally, a cuff **116**. In the fingers and upper palm **114**, the courses of the knitted glove run laterally or, in other words, perpendicular to a longitudinal axis **140** of the glove **100**. In the lower palm **116**, the courses of the knitted glove run along, i.e., parallel to, the longitudinal axis **140** of the glove **100**. Close up views of the knitted structure, as shown in elements **120** (horizontal structure) and **130** (vertical structure) are described in greater detail in FIGS. **2** and **3** respectively.

[0017] A first yarn exhibits a desired property, such as cut-resistance, and a second yarn exhibits a second desired property, for example, heat- resistance, and is knitted into a different region of the glove than the first yarn. Gloves in accordance with embodiments of the invention comprise many different yarns having different properties, such as cut-resistance, heat- or flame-resistance, moisture-control, chemical resistance, flexibility, impact-resistance, abrasion-resistance, and other desirable properties imparted by various yarns and/or structures. Also, embodiments of the present invention comprise where the gloves are knitted vertically. In other words, the courses of the knitted glove run along the longitudinal axis **140** of the glove. Furthermore, some gloves in accordance with embodiments of the present invention comprise a three-dimensional aspect. For example, regions may comprise tapered sections or variable thickness layers, bumpers, ridges, etc., or other structures on a knitted glove in a z-direction with respect to the horizontally and vertically knitted courses.

[0018] The glove may comprise one or more yarns, and may include one or more plaited layers. A glove may be knitted by conventional knitting processes and comprise various yarns, deniers, and gauges. Gloves in accordance with embodiments of the invention may be knitted using automatic seamless glove knitting machines. Gloves knitted with the courses running vertically, which may be seamless, are knitted by the SWG (single whole garment) machine manufactured by Shima Seiki Mfg., Ltd.

[0019] Knitted gloves in accordance with embodiments of the invention comprise yarns, such as, but not limited to, cotton, rayon, steel wire, glass fibers, filaments, ultra-high molecular weight polyethylene, nylons, modacrylic yarns, oxidized-polyacrylonitrile (O-PAN), NOMEX®, TWARON®, KEVLAR®, DYNEEMA®, SPECTRA®, VECTRAN®, and the like or any blend of the fibers and materials. Any yarn may comprise one or more yarns, such as can be created by ring spun, rotor spun, friction spun, braiding, and other processes for blending yarns. Some yarns may be used for cut-resistance, such as steel wire, glass fibers, filaments, ultra-high molecular weight polyethylene, NOMEX®, TWARON®, KEVLAR®, and DYNEEMA®. Other yarns provide dexterity and fit properties, such as stretchable yarns, for example, SPANDEX® and LYCRA®. Yarns capable of moisture control, such as STA-COOL® polyesters, HYDROTEC®, AQUARIUS®, and DRYENERGY®, may be included to withdraw moisture and perspiration from the skin, which also provide comfort. Some yarns, for example, OPAN, such as PANOX®, and ARSELON®, provide enhanced heat-resistance. Also, additional cut resistant layers may be plaited with a main body yarn, i.e., two yarns in the same knitted stitch. The additional cut resistant layer comprises, as indicated above, steel wire, glass fibers, filaments, ultra-high molecular weight polyethylene, nylons, NOMEX®, TWARON®, KEVLAR®, DYNEEMA®, SPECTRA®, VECTRAN®, and the like or any blend of these fibers and materials.

[0020] FIG. **2** depicts a close up view of a region **120** of glove **100** of FIG. **1**, in accordance with embodiments of the invention. The region **120** comprises three yarns **150**, **160**, and **170** intermeshing in loops to form the courses **172**, **174**, and **176** of knitted stitches in horizontal rows, laterally across a section of the liner.

[0021] FIG. **3** depicts a close up view of a region **130** of the glove **100** from FIG. **1**, according to embodiments of the invention. The region **130** is taken from the lower palm **130**. The region **130** comprises the three yarns **180**, **182**, and **184** intermeshing in loops to form the courses **186**, **188**, and **190** of knitted stitches in vertical rows, i.e., longitudinally within a section parallel to the longitudinal axis **140**. Although FIGS. **1-3** depict a glove wherein the upper palm and fingers comprise horizontal courses and a lower palm having vertical courses, in practice, any finger, thumb, palm, or other region of the glove may comprise vertical and/or horizontal courses. Therefore, many designs of liners can be made, tailored to varied specifications for different in-service applications.

[0022] FIG. **4** depicts a plan view of the palm side of the glove **200**, in accordance with embodiments of the invention. The glove **200** comprises a thumb **202**, an index finger **204**, a middle finger **206**, a ring finger **208**, and a little finger **210**. The glove **200** optionally comprises a cuff **212**. In some embodiments according to the present invention, the thumb **202**, the index finger **204**, and the middle finger **206** comprise a first yarn. For example, a first yarn comprises a yarn for cut-resistance, such as an aramid, such as a yarn including KEVLAR® while the ring finger **208** and the little finger **210** comprise a second yarn, for example, a heat- and flame-resistant yarn, such as a yarn including OPAN, such PANOX®, and ARSELON® brand yarns. Also, in this embodiment of the present invention, the entire glove **200** has vertical courses. Therefore, part of an upper palm **214** comprises a cut-resistant yarn (the lighter colored yarn in the index finger **204**, the middle finger **206**, and the thumb **202** regions and under while the upper palm **216**, near the little finger **210** and the ring finger **208**, comprises a heat-resistant yarn (the darker colored yarn). Also, because of the vertical courses, the borderline **222**, connecting the first and second yarns can, but need not, embody a non-linear line, as shown, the borderline **222** comprises a parabolic border. Programming instructions for a Shima Seiki SWG model are shown in Table 1 or knitting an exemplary embodiment of the invention.

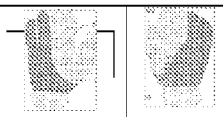
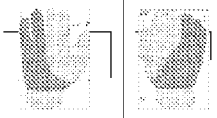
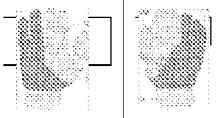
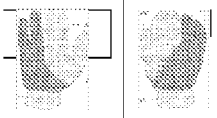
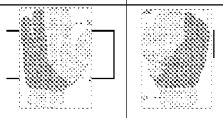
[0021] Table 1

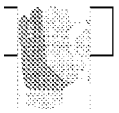
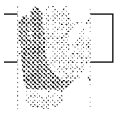
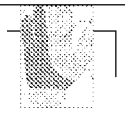
Table 1

Ends	Position	ASPN	Description		
	1				
2	Main 2		CarbonX 24s/2 (103189)		
2	Main 3		CarbonX 24s/2 (103189)		
1	Main 4		16/1 Kevlar Spandex YN17009		
1	X-Yarn 5		WE872 P Brown		
1	Elastic 6		WE853P SPC		

Over edge/X-yarn color: Brown Former:

Machine Type: SWG Code: MFG: File:

KNITTING SECTION FIG. 1, 4, 5			Needles L/R & F/B				Economizer		Stitch Value F/B			Elast. ARM i-DSCS		Courses	
			L/F/B		R/F/B		Eco No.	Qty	No.	F	B	No.	%	Start	Stop
210															
			18		18		5	14							
							15	15	2	38	38				
209															
			20		20		3	18	2	38	38				
							13	19							
206															
			21		21		2	33	5	32	32				
							12	13							
204															
			20		20		1	29	5	32	32				
							11	29							
214 216 222															
			20	20	35	35		9	2	38	38				
									5	32	32				
214 216222															
			35	35	35	35	8	11	2	38	38				
			35	35	35	35			5	32	32				

202				23			7	26								
							17	27	5	32	32					
218 219 220 224			35	67	35	3		59	2	38	38					
			35	29	35	41			5	32	32					
212			70		70			68	25	34	34	1	80			

Cuff Elastic Pattern		X-Y Crs	Elastic Crs						Stitch No. & Value						
Cr	Wl									1	30	Transf	37	28	2nd L
										3	30	Nail	38	35	3rd L
1	2 x 1	3	2							33	24	F.tip	39	35	4rd L

[0023] In embodiments of this type, a user can protect the fingers from cuts while, the little finger and the side of the palm (in interface between the palm side and back hand side along the little finger) comprises the heat-resistant OPAN yarn, protecting from burns from a hot cutting surface or a pot handle.

[0024] FIG. **5** depicts a plan view of the backhand side of the glove **200**, in accordance with embodiments of the invention. The backhand side of the glove **200** has the thumb **202**, the index finger **204**, the middle finger **206**, the ring finger **208**, the little finger **210** and the cuff **212**. In this embodiment of the present invention, the cut-resistant yarn, such as a KEVLAR® yarn, is on the same features as on the palm side of the glove **200**. Also, the heat-resistant yarn, such as an OPAN yarn, is also on the same features as on the palm side of the glove **200**. However, as discussed above, this need not be the case. Because of the vertical courses, the backhand of the glove could comprise different yarns in different regions of the glove **200**. For example, in the glove **200**, on the backhand side, the borderline **224** embodies a completely distinct pattern than the borderline **222** on the palm side of the glove **200**. The borderline **222** on the backhand side appears parabolic and transfers into a stepped function, as shown as steps **224**. Additionally, in embodiments of the present invention, gloves knitted with programmable knitting machines of the SWG type, manufactured by Shima Seiki, may switch from knitting vertical courses to horizontal courses easily and on-the-fly, so that patterns of several different types using different yarns can be created, allowing varied glove designs having different physical and chemical properties in any desired region of the glove. In other words, many multifunctional gloves can be created. Moreover, before the present invention, it was required to invert a glove so that the courses that run horizontally on an exterior of a glove would run vertically on the exterior. Because of vertical course knitting in accordance with the present invention, inversion is no longer necessary.

[0025] FIGS. **4-5** may also show that glove **200** or other embodiments according to the present invention comprise yarns having colors contrasting to each other. For example, as discussed above, gloves in accordance with the invention, comprise at least a first yarn and a second yarn. And, the first yarn and the second yarn comprise two differently colored yarns. For example, the first yarn can be a cut-resistant yarn of a certain color while the second yarn is a flame-resistant yarn of a different color than the first yarn. Where the color of one region of the glove differs from another region, the user can easily and visually identify the particular glove type, so that where a particular glove is heat- and/or flame-resistant and cut-resistant is known to the user as discussed above.

[0026] Gloves in accordance with embodiments of the invention may be specified for specific end uses. For example, a glove intended for use by a food-service employee, who often use sharp knives and grab hot handles on pans, may comprise a cut-resistant yarn in one region of the glove and a heat- and/or flame-resistant yarn in another region. Furthermore, because each hand of a food service employee, when using a knife, is performing a different function, a glove for each hand may be tailored to the function. For example, the glove for the hand holding the knife may comprise a cut-resistant yarn in one region, such as the index finger and middle finger. However, in the off-knife hand, the glove comprises a cut-resistant yarn in a different region, for example, the thumb. Furthermore, different color cut resistant yarns may be used in different gloves, providing visual indicia of the protection a specific region offers that a worker may recognize. And, any of the yarns may comprise different colors to provide visual recognition of specific properties. For example, a user can be made aware that a yellow yarn represents cut-resistance while a black yarn indicates heat-resistance. A user can therefore choose a glove having those properties in areas of the glove as needed for a specific task.

[0027] The gloves **100** and/or **200** may comprise a polymeric, elastomeric, or latex coating disposed on all or part of the gloves. Transparent or translucent coatings provide a glove in which the indicia provided by different colored yarns, as discussed above, may still be known to the user (not shown). FIG. **6** depicts a plan view of FIG. **5** having a polymeric coating disposed thereon, in accordance with embodiments of the invention. FIG. **6** comprises the liner of FIG. **5**, showing the backhand side of the glove **200** has the thumb **202**, the index finger **204**, the middle finger **206**, the ring finger **208**, the little finger **210** and the cuff **212**. The glove further comprises a polymeric coating **230**.

[0028] The polymeric coating **230** may comprise natural or synthetic polymeric coatings or mixtures thereof. Any knitted liner may be coated with a polymeric material. For example, a latex coating may comprise a natural latex, such as guayule or polyisoprene, synthetic latexes, such as synthetic polyisoprene, carboxylated acrylonitrile butadiene, non-carboxylated acrylonitrile butadiene, butyl latex, polychloroprene, nitriles, acrylics, aqueous- and non-aqueous-polyurethanes, styrene-butadiene, acrylonitrile-butadiene, and the like, or mixtures thereof. The coating **230** on, for example, liners **100** and/or **200**, can comprise a palm dip, a knuckle dip, a finger dip, a full dip, and the like, or, as shown, a ¾ dip, as needed for specific applications using the dip processes as described in commonly assigned U.S. Pat. No. 7,814,571, which is incorporated herein by reference in its entirety.

[0029] Knitted liners of the gloves **100** and **200** and other embodiments of the present invention may be dipped or sprayed with a coagulant, such as calcium nitrate, calcium chloride, calcium citrate, and the like, and other salts known to those in the art. In some embodiments of the invention, the coagulant comprises an aqueous and/or alcoholic solution of an acid, for example, a 5-20% solution of trichloroacetic, acetic, formic, or citric acid. The coagulant causes the polymeric coating to set on the fabric of the liner, preventing strikethrough of the coating. Also, gloves in accordance with embodiments of the invention may further comprise coatings that are foamed (open cell or closed cell) or unfoamed. Additionally, coatings may be built up in layers or in varying thickness. The layers may comprise the same or different polymeric materials. Additionally, the coatings may further comprise textured surfaces (not shown). Open cell and closed cell foamed layers and/or textured coatings may impart additional friction during use, allowing superior gripability and safety properties, as is disclosed in commonly-assigned U.S. Pat. No. 7,378,043, 7,771,644, and 8,001,809 which are incorporated by reference in their entireties.

[0030] Additional layers may be plaited into a glove in several ways. For example, an additional layer can be formed by changing a main yarn to an additional cut resistant yarn while varying stitch dimensions, for example, yarn tension. The tension of the yarn may be varied by adjusting the tension of the yarn between a pinch roller and a knitting head by computer control of a knitting machine, as is disclosed in commonly-assigned U.S. Pat. No. 7,434,422, which is herein

incorporated by reference in its entirety. Stitch dimensions can also be controlled by varying the depth of penetration of the knitting needle into the knitted glove, formed by a main yarn, and by casting off or picking up additional stitches in a knitted course. An additional layer may also be formed by variable plaiting the additional cut resistant yarn on top of the main yarn while varying the tension of the plaited cut resistant yarn. Substituting or plaiting one course at a certain tension forms a glove having additional cut resistance. Knitting two or more courses, such as three, four, five, etc., courses, provides a glove having an even greater density to the additional layer, thereby providing a more cut resistant glove. Building up on a knitted course in a z-direction also provides zonal reinforcement in desired regions of the glove.

[0031] In some embodiments of the invention, the main body yarn comprises yarns such as SPANDEX® or LYCRA®, which imparts for stretchability for ease of donning, doffing, and comfort during use. Also, the main body yarn may comprise yarns capable of moisture management, such as STA-COOL® polyesters, HYDROTEC®, AQUARIUS®, and DRYENERGY®. Such yarns have high wicking properties, which promote the transfer of moisture away from wet or sweaty skin to less wet areas or to reservoirs for eventual storage and/or evaporation, technologies that are disclosed in commonly assigned U.S. Provisional Application Ser. No. 61/571,569, which is incorporated herein by reference in its entirety.

[0032] While the foregoing is directed to embodiments of the present invention, other and further embodiments of the invention may be devised without departing from the basic scope thereof, the scope thereof determined by the claims that follow.

What is claimed is:

1. A knitted glove, comprising:

a knitted liner, the knitted liner including at least a first yarn and a second yarn, the first and second yarns forming knitted courses, wherein the knitted courses are disposed along a longitudinal axis of the liner.

2. The knitted glove of claim **1**, wherein the knitted liner comprises finger regions, a thumb region, an upper palm region, a lower palm region, and a cuff region.

3. The knitted glove of claim **2**, wherein at least one of the finger regions, the thumb region, the upper palm region, the lower palm region, and the cuff region comprises at least two different yarns.

4. The knitted glove of claim **2**, wherein the knitted liner comprises a first yarn in some regions and a second yarn in other regions.

5. The knitted glove of claim **2**, wherein at least one region comprises a structure of knitted courses knitted along a non-longitudinal direction of the liner.

6. The knitted glove of claim **1**, wherein the first yarn and second yarn comprise different characteristics.

7. The knitted glove of claim **6**, wherein the characteristics comprise differing colored yarns.

8. The knitted glove of claim **1**, wherein each of the first yarn and second yarn comprise different physical properties from each other.

9. The knitted glove of claim **8**, wherein the physical properties comprise at least one of flame-resistance, heat-resistance, cut-resistance, chemical-resistance, abrasion-resistance, comfort-control, moisture-control, or flexibility.

10. The knitted glove of claim **1**, wherein at least one of the first yarn and second yarn includes at least one of a textured nylon, a nylon wrapped SPANDEX®, polyester, nylon, a moisture-controlling yarn, aramid, ultra-high molecular weight polyethylene, SPANDEX®, LYCRA®, NOMEX®, KEVLAR®, TWARON®, DYNEEMA®, SPECTRA®, VECTRAN™, STA-COOL®, AQUARIUS®, steel wire, fiberglass, or any blend of the fibers and materials thereof.

11. The knitted glove of claim **6**, wherein at least one the first yarn and second yarn comprises at least one of polyester, nylon, a moisture-controlling yarn, aramid, ultra-high molecular weight polyethylene, NOMEX®, KEVLAR®, TWARON®, DYNEEMA®, SPECTRA®, VECTRAN™, STA-COOL®, AQUARIUS®, modacrylic yarns, oxidized-polyacrylonitrile (O-PAN), steel wire, fiberglass, or any blend of the fibers and materials thereof.

12. The knitted glove of claim **1**, further comprising a plaited yarn.

13. The knitted glove of claim **1**, further comprising a polymeric coating.

14. The knitted glove of claim **13**, wherein the polymeric coating comprises natural latex, guayule, polyisoprene, synthetic latexes, non-carboxylated acrylonitrile butadiene, carboxylated acrylonitrile butadiene, butyl latex, polychloroprene, polyurethane, styrene-butadiene, acrylonitrile-butadiene, nitriles, acrylics, or blends thereof.

15. The knitted glove of claim **13**, wherein the polymeric coating is foamed or unfoamed.

16. The knitted glove of claim **13**, wherein the polymeric coating is textured.

17. A method of knitting a glove, comprising:

knitting a liner comprising a plurality of courses, where the plurality of courses are knitted longitudinally along a longitudinal axis of the liner and wherein at least two of the plurality of knitted courses includes a first yarn and a second yarn.

18. The method of claim **17**, wherein the first yarn and the second yarn comprise different characteristics.

19. The method of claim **17**, wherein the first yarn and the second yarn comprise polyester, nylon, a moisture-controlling yarn, aramid, ultra-high molecular weight polyethylene, NOMEX®, KEVLAR®, TWARON®, DYNEEMA®, SPECTRA®, VECTRAN™, STA-COOL®, AQUARIUS®, modacrylic yarns, oxidized-polyacrylonitrile (O-PAN), steel wire, fiberglass, or any blend of the fibers and materials thereof.

20. The method of claim **17**, wherein at least one of the first yarn and the second yarn has a third yarn plaited therewith.

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