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(54) Title: HEAT RESISTANT AND CUT AND PUNCTURE PROTECTIVE HAND COVERING

(57) Abstract

A hand covering in the form of a glove is provided which provides protection against cutting, puncturing and lacerations as well as thermal insulation for protection against burning of the user's hand by grasping hot objects. A knobbed silicone surface is formed on the palm portion of the glove to enhance the heat insulating and gripping abilities of the glove.

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HEAT RESISTANT AND CUT AND PUNCTURE PROTECTIVE HAND COVERING

Background of the Invention

1. Field of the Invention

The present invention relates to a protective hand covering which is formed of materials resistant to heat and which provide protection against cutting or puncturing of the hands of the user. Those whose employment brings them in contact with flame or into the presence of high temperatures, such as firepersons and foundry workers find their hands exposed to conditions capable of bringing about substantial injury to their hands. In the case of a fireperson, the fighting of a structural fire can bring about exposure to a limitless number of unexpected hazards. Cuts, punctures and lacerations may result from grasping or pushing, or brushing against broken glass, sharp metal, nails, wood splinters and innumerable other objects. Further, burns can result from handling hot objects, particularly those which are unexpectedly hot, from contacting open flames, and from being exposed to radiant thermal energy. Due to poor visibility, as the result of smoke and poor lighting, the chances of a fireman subjecting himself to cuts or punctures from grasping a hot object is ever present.

2. Description of Related Art Including Information Disclosed under Secs. 1.97-1.99

In the past, others have addressed the need to provide hand coverings for the same or similar purposes. Examples of such hand coverings are set forth in the following United States patents:

PATENT NO.	INVENTOR	ISSUE DATE
2,578,183	Ionides et al	12/11/51
4,302,851	Adair	12/1/81
4,433,439	Sidman et al	2/28/84
4,454,611	Tschirch et al	6/19/84
4,847,918	Sturm	7/18/89

4,869,962	McCullough Jr. et al	9/26/89
4,918,756	Grilliot et al	4/24/90

The Ionides et al patent reveals a heat-resistant covering comprising three layers, the outer layer of which absorbs a vaporizing agent which is vaporized when subjected to heat. The Adair patent reveals a heat resistant protective hand covering in which a wool knit liner is enclosed within an outer layer of woven "Kevlar" material with layers of aluminum foil and flexible fiberglass sandwiched therebetween. Secured to the outer layer is a pleated pad of flexible material woven from fiberglass yarns.

The Sidman et al patent reveals a heat-resistant protective glove having first and second shells formed from a temperature-resistant aromatic polyamide fiber such as "Kevlar" with the first shell being made of a twill weave fabric and the second shell of a knitted fabric. An elastomeric coating is provided on the inner liner between the two liners. The Tschirch et al patent reveals a heat-resistant protective hand covering having a fabric shell made of a temperature-resistant aromatic polyamide fiber. The outer surface of the shell is coated with a fire-resistant elastomer. A liner made of a felt fabric of a temperature-resistant aromatic polyamide fiber is disposed within and secured to the shell. A friction-inducing surface is formed by waffling or dimpling the palm side of the glove by incorporating small particles of insoluble material which will cause an irregular surface on a coating.

The Sturm patent reveals a method of manufacturing a protective hand covering wherein a flexible fire-retardant and heat insulating inner glove is mounted within and secured to a flexible water-tight vapor permeable plastic glove. A flexible reinforcement element having the outline of the plastic glove is cemented to one face of the plastic glove to provide securement tabs for stitching or tacking the tips of the fingers of a reversed (i.e., inside-out) leather glove, which is then pulled over the plastic glove and the reinforcement element. The Grilliot et al patent is directed to a waterproof firefighter's glove wherein a sealing piece covers a portion of a waterproof layer attached to a thermal barrier layer which layer is located within the waterproof

layer.

Summary of the Invention

Accordingly, it is an object of this invention to provide a covering for a hand which provides protection from heat as well as cuts, punctures, and abrasion. It is further object of this invention to provide a hand covering, the palm of which provides an enhanced gripping surface.

In accordance with this invention, a hand covering is provided which protects the user's hand from cuts, punctures and abrasion and further provides protection from heat. The hand covering is formed with multiple layers. The innermost layer or inner liner which contacts the user's hand is formed of a material which provides thermal protection, and is not irritating to the user's hand. The inner liner may be contained within a second liner or waterproof bladder which is made from a waterproof, breathable material. The second liner or bladder prevents water from reaching the inner layer and the user's hand, while permitting the expiration of moisture from the hand and inner liner. An outer layer is formed of a heat resistant strong, cut, puncture and abrasion resistant material such as an aromatic polyamide fiber. The back hand portion of the outer layer is preferable made from a jersey-type fabric while the palm portion is preferably made from an interlock-type fabric.

To enhance both the heat-resistance or thermal protection of the palm portion of the hand covering and the gripping ability of the user of the hand covering, an additional layer of heat-insulating material having enhanced gripping or friction characteristics is provided over the outer layer on the palm side of the hand covering. A preferred material for the enhanced heat insulating and gripping surface on the palm portion of the hand covering is a silicone compound. Instead of a second liner or bladder, the hand covering may be made waterproof by providing a waterproof coating or layer on the outer surface of the inner liner or the inner surface of the outer layer. Or as an alternative, the hand covering may not be made waterproof, wherein the preferred outer layer is water resistant.

Brief Description of the Drawing

FIG. 1 is a perspective view, with a portion broken away of a hand covering shown as a glove formed and constructed in accordance with this invention.

FIG. 2 is a perspective view of a portion of the enhanced heat insulating and thermal protective and gripping surface provided on the palm portion of the glove.

Detailed Description of the Preferred Embodiment

Referring to FIG. 1, a hand covering in the form of a glove constructed in accordance with this invention is shown. The glove 10 includes an inner liner 12. The inner liner 12 preferably is made using the commonly called clute-cut glove construction. A suitable material for the inner liner 12 is a wool or wool blend fabric. However, any other material which provides thermal insulation and is suitable for contact with the skin of the user could be used. As shown in FIG. 1, inner liner 12 is formed with a felt inner surface 14 and a knit outer surface 16. The felt portion being a 67% wool blend and the outer knit surface being cotton. Placed over the outer surface of inner liner 12 is a bladder or waterproof, breathable layer 18. In one form of this invention, the waterproof, breathable layer or bladder is formed as a separate glove, again using the clute-cut glove construction. A suitable material for the waterproof breathable layer 18 is polyurethane. However, other materials which are waterproof and breathable may be used. An adhesive, stitching, or any other suitable fastening means may be used to secure the tips of the fingers and the thumb of the inner liner 12 to the waterproof breathable layer 18. In another form of this invention, the waterproof layer 18 may be provided as a coating on the inner liner 12. The coating may be formed by dipping the inner liner 12 in a liquid material such as neoprene which when hardened forms a waterproof, bladder over the wool liner. While such a neoprene bladder is not breathable, it does have the desirable characteristic of being chemically resistant.

An outer layer 20 is made from a temperature-resistant aromatic polyamide fiber, such as "Kevlar". Other materials which would be suitable are "Nomex", manufactured by

DuPont and "P.B.I.", manufactured by Celanese. The preferred form of polyamide fiber utilized to form the back hand portion of the outer layer is a nine ounce/sq. yd. jersey-type fabric, while that for the palm portion is a six ounce interlock-type fabric. Again, an adhesive or any other suitable fastening means such as stitching, may be used to secure the tips of the fingers of the waterproof, breathable layer 18, if provided, to the outer layer 20.

In accordance with this invention, the heat protection and gripping ability of the glove is enhanced by providing a silicone uneven or knobbed surface 22 to the palm portion of the outer layer 20. The silicone knobbed surface may be applied to the interlock polyamide fabric by a molding process. In one manner of manufacturing the palm surface, a flat portion of the interlocked fabric is placed on a mold base under a mold cover which is provided with indentations, such that an uneven or knobbed surface is formed in silicone rubber material which is injected into the mold. The silicone rubber material utilized to form the heat-resistant and knobbed surface has high strength, high tear resistance, excellent heat stability and is flame retardant.

FIG. 2 shows in outline form one embodiment of a mold which may be utilized to form the knobbed surface on the silicone layer bonded to the palm portion of the outer layer 20. A portion of fabric 24 used to form the outer layer 20 is placed over a mold base 26. A mold cover 28 having indentations 30 on its inner surface is placed over the portion of outer layer 24 on the base 26 and is held thereon with sufficient force to resist the pressure of silicone rubber material injected between the fabric 24 and the cover 28. The outer layer fabric 24 with the knobbed surface 22 formed thereon is thereafter cut to the required shaped to form the palm portion of the outer layer 20.

The silicone knobbed surface may also be applied to the interlock polyamide fabric by a coating process. A first generally smooth layer of silicone rubber material is applied as a coating to the fabric. Thereafter, a second layer of silicone rubber material, also applied as a coating, is while still unhardened engaged by a roller which has indentations

formed thereon, such that an uneven or knobbed surface is formed in the silicone rubber material.

The outer layer 20 may be constructed so as to make the hand covering waterproof and breathable. For instance, the silicone material applied to the palm portion forms a waterproof barrier. It has been found that when a molding process is used to form the silicone surface on the palm side of the glove, the silicone rubber material is forced completely through the interlock polyamide fabric, so as to impregnate it and form a waterproof barrier. By laminating a waterproof and breathable film to the inside surface of the jersey-type fabric forming the back hand portion of the outer layer, the outer layer 20 provides the desired waterproof and breathable hand covering, but for the seams joining the portions of the outer layer. If for instance the seams are stitched, the hand covering may be made waterproof by applying a sealing material to the seams.

To complete the assembly of the glove, a wristlet 32, also formed of a polyamide fabric of the knit type, is secured to all layers of the glove by a suitable securing method such as stitching. The wristlet is of a suitable length to protect the wrist and lower arm of the user.

It should be apparent to those skilled in the art, that while what has been described is considered at present to be the preferred embodiment of the protective hand covering of this invention, in accordance with the patent statutes, changes may be made in the hand covering without actually departing from the true spirit and scope of this invention.

The appended claims are intended to cover all such changes and modifications which fall within the true spirit and scope of this invention.

CLAIMS

I claim:

1. A hand covering having back hand and palm portions, for providing protection of the user's hand from being cut by engagement with sharp objects or burned by contact with hot objects, and which is provided with an enhanced gripping surface on the palm side, said hand covering being formed with multiple layers, comprising:

a first layer formed of a material which provides thermal insulation and is suitable for contact with the user's hand,

a second layer formed of a strong, high temperature resistant cut, puncture and abrasion resistant material, said second layer forming an outer surface for the back hand portion of said hand covering, and

a third layer formed on the outer surface of said second layer forming the palm portion of said hand covering, said third layer formed of a heat-insulating material to further protect the hand when grasping a hot object.

2. The hand covering of claim 1, wherein said first layer is formed from a fabric which includes wool fibers.

3. The hand covering of claim 1, wherein said second layer is formed of a fabric which comprises high temperature resistant aromatic polyamide fibers.

4. The hand covering of claim 1, wherein said third layer is formed of a silicone compound.

5. The hand covering of claim 4, wherein said third layer is applied to said third layer by a molding process.

6. The hand covering of claim 5, wherein said third layer is formed with an uneven outer surface to enhance the

gripping ability of said hand covering.

7. The hand covering of claim 4, wherein said third layer is applied to said third layer by a coating process.

8. The hand covering of claim 7, wherein said third layer is formed with an uneven outer surface to enhance the gripping ability of said hand covering.

9. The hand covering of claim 1, wherein an intermediate layer is provided between said first and second layers, said intermediate layer formed of a waterproof, breathable material which is provided to keep water from reaching the hand, while permitting water, such as that due to sweating, to pass outward from the hand and first layer.

10. The hand covering of claim 1, wherein said back hand portion of said second layer is formed of jersey-type fabric.

11. The hand covering of claim 1, wherein said palm portion of said second layer is formed of an interlock-type fabric.

12. The hand covering of claim 1, wherein said back hand portion of said second layer is formed of nine ounce/sq. yd. jersey-type fabric.

13. The hand covering of claim 1, wherein said palm portion of said second layer is formed of six ounce/sq. yd. interlock-type fabric.

14. The hand covering of claim 1, wherein said second layer is formed of a fabric comprising "Nomex" fibers.

15. The hand covering of claim 1, wherein said second layer is formed of a fabric comprising "P.B.I." fibers.

16. The hand covering of claim 1, wherein said second layer

is formed of a fabric comprising "Kevlar".

17. The hand covering of claim 1, wherein said first layer and said second layer are secured to each other such that said first layer does not come out of said second layer when a hand is removed from said hand covering.

18. The hand covering of claim 1, being in the form of a glove.

19. The hand covering of claim 16, wherein said first layer and said second layers are secured to each at the finger tips by an adhesive.

20. The hand covering of claim 1, wherein a waterproof breathable material is provided on the inside surface of the back hand portion of said second layer.

21. The hand covering of claim 20, wherein the third layer is waterproof, said back hand and said palm portions of said second layer being joined at sealed seams, such that said second and third layers provide a waterproof, breathable layer to keep water from reaching the hand, while permitting water, such as that due to sweating, to pass outward from the hand and inner layer.

22. The hand covering of claim 1, wherein said heat-insulating material is a silicone compound.

Fig. 1

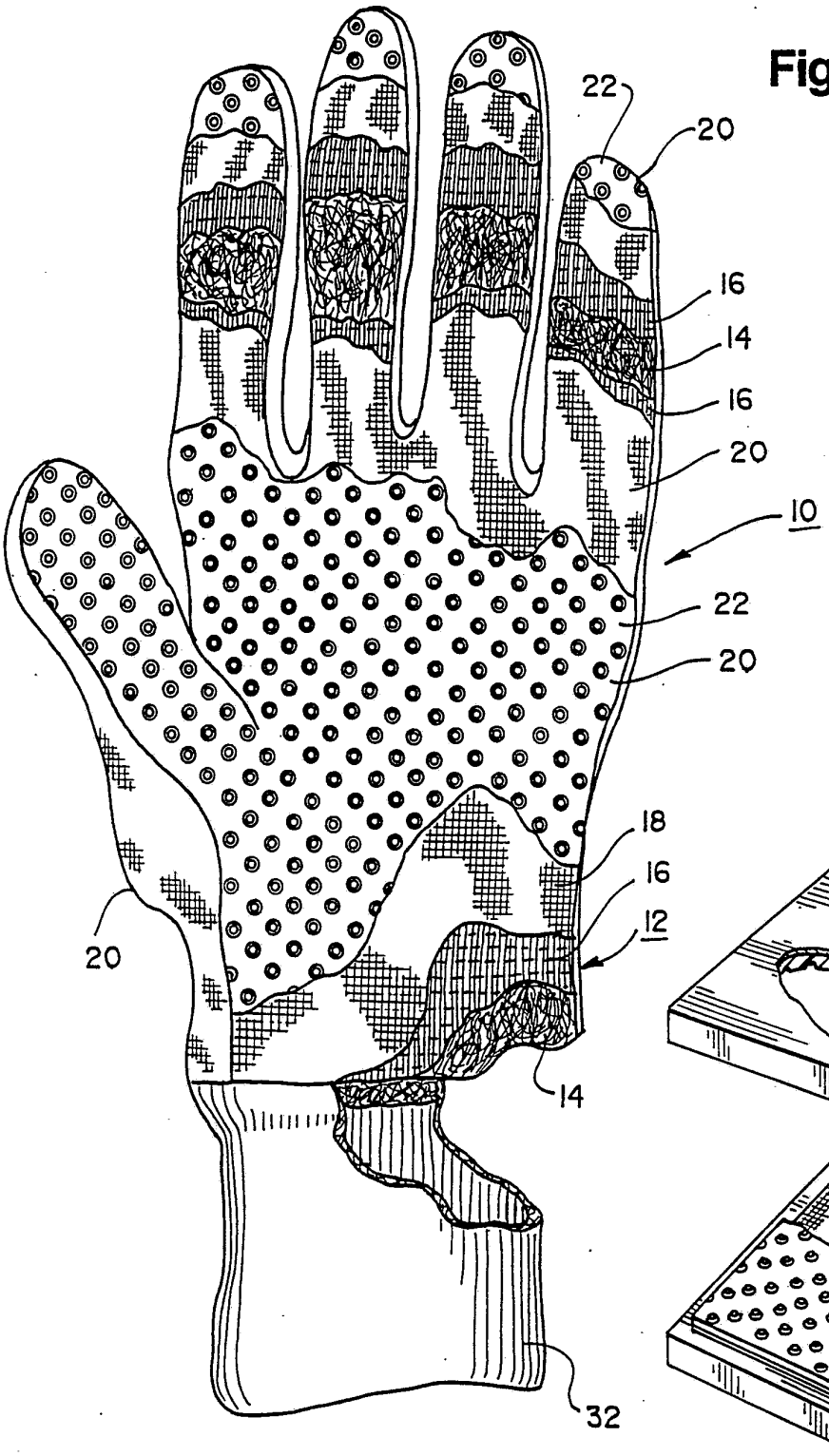
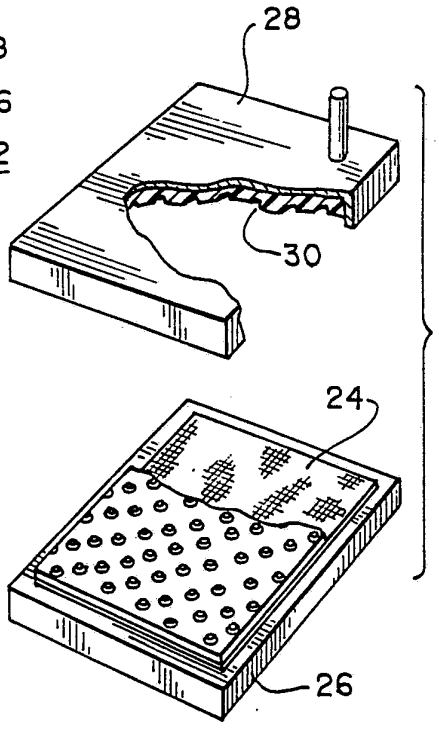


Fig. 2



INTERNATIONAL SEARCH REPORT

PCT/US 92/08147

International Application No

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 A41D13/10; B32B5/26

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	A41D ; B32B

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No.[13]
A	US,A,4 454 611 (R.P. TSCHIRCH ET AL.) 19 June 1984 cited in the application see column 1, line 14 - line 18; figures see column 2, line 11 - line 34 see column 3, line 2 - line 59	1,3, 16-18
A	US,A,4 433 439 (K.R. SIDMAN ET AL.) 28 February 1984 cited in the application see column 2, line 11 - column 4, line 17; figures	1,3, 9-11, 16-18

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° Special categories of cited documents :[10]

"A" document defining the general state of the art which is not considered to be of particular relevance

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
20 JANUARY 1993	28. 01. 93
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	PAMIES OLLE S.

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	EP,A,0 103 039 (BECTON, DICKINSON AND COMPANY) 21 March 1984 see page 1, line 1 - page 3, line 11; claims 1-12 see page 5, line 19 - line 30 see page 6, line 27 - page 7, line 17	1-4,7,8, 10,16-18
A	EP,A,0 118 898 (BETTCHER INDUSTRIES, INC.) 19 September 1984 see page 2, line 1 - page 3, line 13; figures see page 4, line 1 - page 5, line 2 see page 8, line 28 - page 10, line 25	1-4,7,8, 14, 16-18,22
A	US,A,4 918 756 (W.L. GRILLIOT ET AL.) 24 April 1990 cited in the application see column 3, line 32 - column 4, line 23; figure 2	1,9,17, 18,20,21
A	US,A,4 847 918 (F.C. STURM) 18 July 1989 cited in the application see column 2, line 62 - column 4, line 54; figures	1

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

US 9208147
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
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