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(54) **PROTECTIVE GARMENT MATERIAL**

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(57) **ABSTRACT**

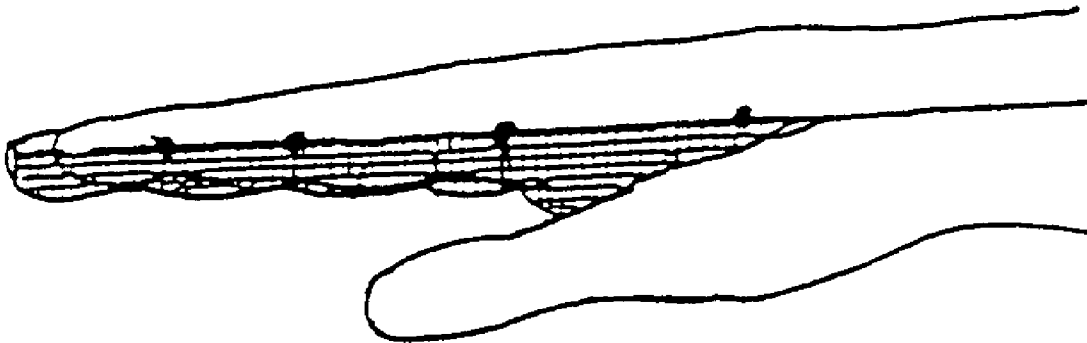
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Related U.S. Application Data

(63) Non-provisional of provisional application No.
60/189,591, filed on Mar. 15, 2000.

A protective garment for protection of body parts against cuts or puncture wounds comprising an inner layer, a protective layer and an outer layer, the protective layer being composed of a wire mesh of woven metal wires, the thickness of the metal wires being between 0.01 mm and 0.20 mm and the apertures in the wire mesh being between 0.001 mm and 0.45 mm.



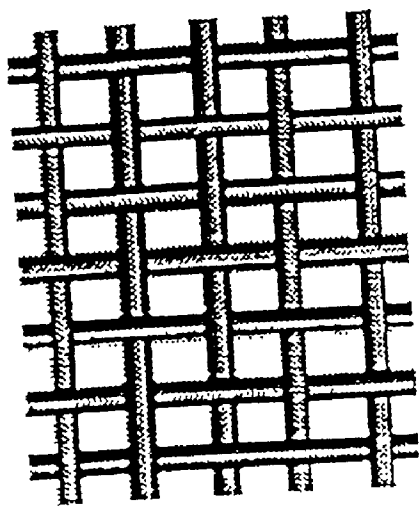


FIG. 1

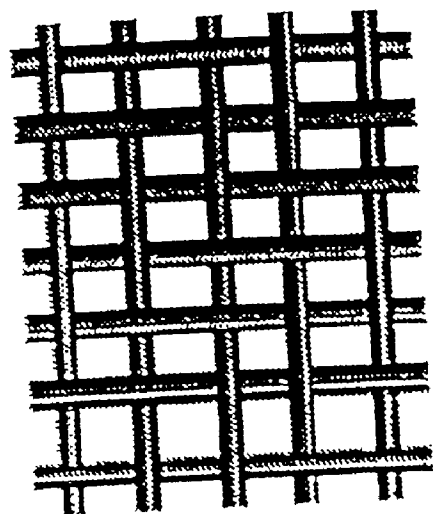


FIG. 2

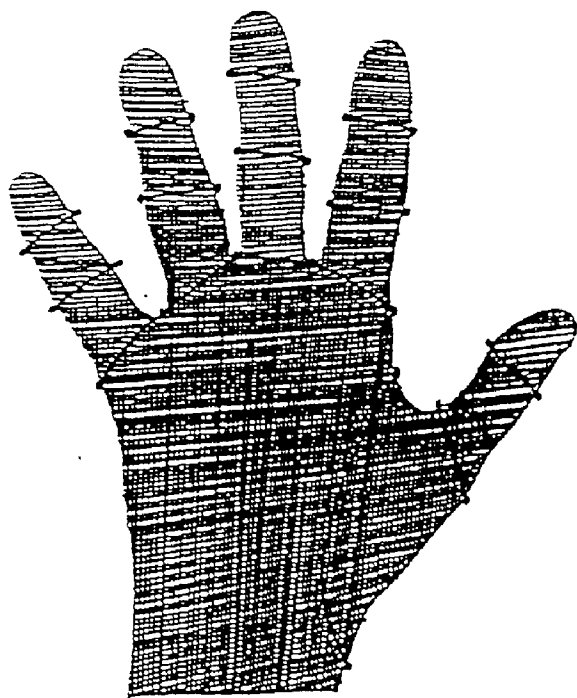


FIG. 3

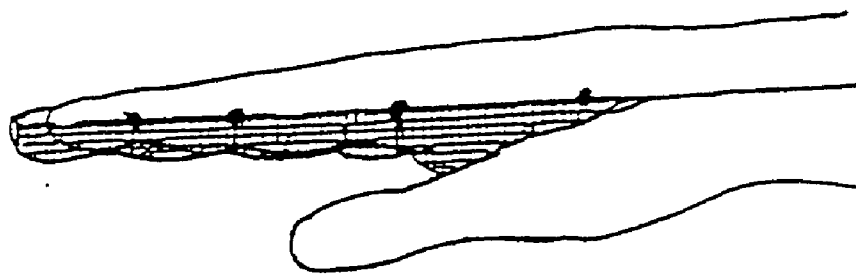


FIG. 4

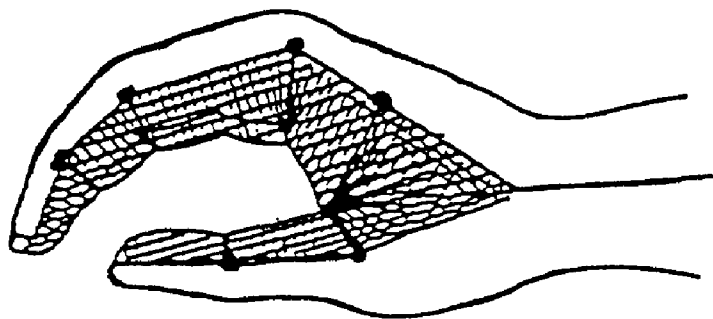


FIG. 5

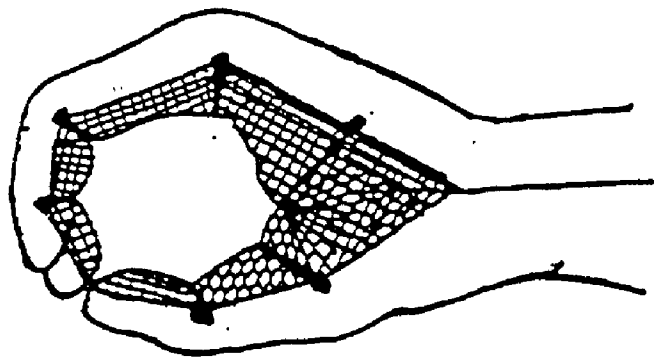


FIG. 6

PROTECTIVE GARMENT MATERIAL

CROSS REFERENCE TO OTHER APPLICATIONS

[0001] This application is a non-provisional application claiming priority of Provisional Application No. 60/189,591 filed Mar. 15, 2000. Reference is also had to co-pending application Ser. No. 09/508,738 filing date Jun. 6, 2000.

FEDERALLY SPONSORED RESEARCH AND DEVELOPMENT

[0002] There are no federally sponsored or funded research or development projects or undertakings in any way associated with the instant invention.

BACKGROUND OF THE INVENTION

[0003] 1. Field of the Invention

[0004] The present invention relates to a protective garment material for protection of body parts against cuts or puncture wounds caused by sharp objects such as, e.g., hypodermic needles, fishhooks, broken glass, nails, awls or knives, where at least a portion of the garment comprises at least one inner layer, at least one protective layer and possibly one or more outer layers.

[0005] 2. Background Information

[0006] People are exposed to cuts or puncture wounds in many different situations. For cleaning personnel the presence of used hypodermic syringes in public places as well as sharp objects in the rubbish is a common problem. Used syringes and broken glass are also used as a threat in situations where people are under attack, and therefore police, watchmen and other security personnel are exposed to injuries of this kind. Nor is it uncommon to find broken glass at the scene of an accident, and in such places the helpers are in danger of receiving cuts in connection with rescue work. Firemen are particularly exposed to such injury when they have to enter buildings where there is a fire, and where broken glass or other sharp objects may be lying on the ground.

[0007] Another situation where it is relevant to use protective clothing is in the field of medical and laboratory work, where sharp objects are employed while blood and other body fluids are also handled with the risk of infection this involves.

[0008] Other cases where there is a need for protective clothing are in the fishing industry, where sharp hooks represent a danger, and in the fish processing or meat production business, e.g. slaughterhouses where cutting instruments such as knives and cleavers are in heavy use thereby increasing the opportunity for workers to suffer lacerations.

[0009] The protective garments for use in the aforementioned and similar such cases should fulfill several requirements. The garments should prevent sharp objects from penetrating them and reaching the skin, they should permit ease of movement when wearing the garments, they should be easy to wash and possibly disinfect, and in general they should be comfortable to use. The latter will lead to the

advantage that the garments are always used when there is any risk of injury, and not only in special, highly exposed situations.

[0010] There are several known solutions for protective garments where the equipment comprises a protective layer, and in some of these solutions the use of metallic materials is involved. Some of these prior art solutions will be described in the following.

[0011] One such solution is described in DE-A1-3,023,990 and is manufactured by braiding or knitting of so-called special steel wire. In a preferred embodiment, the glove is knitted from a steel wire which is enveloped by a textile fiber. The publication also states, however, that the glove can be knitted from uncovered steel wire and subsequently provided with a skin-protecting layer on the inside and a wear layer on the outside. A disadvantage of this glove is that it will be unable to offer the combination of flexibility of use and satisfactory protection against puncture wounds. It is stated that the glove should be made of metal wire in all its parts, both around the fingers, in the palm, and on the back of the hand. If flexibility and mobility are to be achieved with such a glove, it has to be manufactured in large mesh sizes, thus reducing the glove's protective power, especially against penetration of sharp objects. In other words, the more comfortable the glove is to wear, the less protection it offers the wearer.

[0012] Another solution is set forth in U.S. Pat. No. 5,231,700 wherein a glove designed to protect medical personnel against cuts and against penetration of hypodermic needles is disclosed. The glove is woven in its entirety from a yarn which preferably consists of an elastic core of, e.g. Lycra, round which is wound an outer material with great tensile strength such as, e.g. Kevlar. The publication describes the possibility of using metal composites as an additional component in the outer material, but this is not recommended on account of reduced sensitivity and mobility. Those portions of the glove which in addition to protecting against cuts and tears are also meant to be resistant to puncture wounds, e.g. from syringes, are further covered with a puncture-impeding layer, which is preferably made of leather. This glove does indeed offer satisfactory protection to medical personnel when dealing with syringes, bone fragments and the like, but is not sufficiently robust to offer adequate protection under critical circumstances such as, e.g. situations involving an attack or handling broken glass. Reinforcing the glove by addition of metal to the material from which the whole glove is made would again result in reduced flexibility and usefulness, as mentioned in the publication.

[0013] Still another solution may be found in U.S. Pat. No. 4,004,295 wherein is described a glove which is particularly useful for work in the meat production industry. This is achieved by having the glove made of non-metallic fiber yarn, preferably Kevlar, reinforced with metallic fiber wires. This design offers good protection against cuts, e.g. from knives, but not against penetration of sharp objects.

[0014] Another solution may be found in DE-3,805,671 wherein is described a working glove, suitable for deburring metal parts. The glove is made of steel wire with a diameter between 0.2 mm and 0.8 mm, with a mesh between 1 mm and 4 mm. It is internally equipped with an inner glove of leather or fabric. This glove is well suited for its application, but

unsuitable for protection against penetration of sharp objects, due to the large mesh. Any reduction in the mesh in order to make this glove puncture-proof would make it rigid and immobile, and unsuitable for use.

[0015] Finally, a protective glove with built-in metal parts is also described in DE-A-4,341,039. The problem of mobility is solved here by the glove comprising several loose metallic parts which together cover the finger's inner surface and which slide over one another when the finger is moved. However, each metallic part is rigid and the mobility is restricted for this reason.

[0016] In all the known solutions, mobility and comfort have to be sacrificed for the sake of attaining sufficient protection.

OBJECT OF THE INVENTION

[0017] It is therefore a principal object of the present invention to provide an improved protective garment material for protection of body parts against cuts or puncture wounds caused by sharp objects, in which the main disadvantages of the prior art are avoided, by providing a flexible, wearable, durable cut and puncture resistive garment, which provides superior protection, mobility and comfort for the wearer of the garment.

SUMMARY OF THE INVENTION

[0018] The object is achieved according to the invention with a garment material of the type mentioned in the introduction which may be used for fabrication of a wide range of protective garments. The garment constructed utilizing Applicant's novel garment material may all be described as being characterized in that at least one protective layer is composed of a wire mesh consisting of metal wires, where the thickness of the metal wire is between 0.01 mm and 0.2 mm and the apertures in the wire mesh are between 0.001 mm and 0.45 mm.

[0019] In the preferred embodiment of the invention the wire mesh is woven from metal wires consisting of non-corrosive, stainless steel.

[0020] Different portions of the garment manufactured utilizing the protective garment material preferably contain a different number of protective layers of wire mesh.

[0021] At least some surface parts of the protective layers are preferably joined together by applying double coated, self-adhesive tape between the surface parts.

[0022] In addition, at least some surface parts of one protective layer and some surface parts of the inner layer are advantageously joined together by applying double coated, self-adhesive tape between the surface parts.

[0023] The garment advantageously comprises an outer layer, made of a soft, flexible rugged material such as leather.

[0024] The garment according to the invention advantageously also comprises one or more layers of bullet-proof material, e.g. TWARON or KEVLAR.

[0025] As noted above, the garment material may advantageously be constructed into garments in the form of a glove, a mitten, a jacket, a coat, a waistcoat, a vest, a collar, a pair of trousers, an under-or forearm protector, a sole for

a shoe or for a boot, a helmet, a cap or a hood, or practically any article of clothing, hardware or footwear which would normally be used to protect the body from cuts, abrasions, lacerations or punctures.

[0026] In an embodiment of the invention where the garment is a glove, for protecting the wearer's fingers, hand and wrist, the protective layers of wire mesh cover the whole palm and back side of the hand and wrist and all the surfaces of the fingers.

[0027] In an alternative embodiment where the garment is a glove, for protecting the wearer's fingers, hand and wrist, the protective layers of wire mesh cover the whole palm of the hand and fingers, the palm side of the wrist and parts of the lateral surfaces of the fingers.

[0028] In the latter embodiment, the part of the glove corresponding to the palm of the hand is advantageously covered by at least two, and preferably five, protective layers of wire mesh, and the parts of the glove corresponding to the fingers' inner surfaces are advantageously covered by at least one, and preferably two, protective layers of wire mesh.

[0029] In this particular embodiment, the thickness of the metal wires in the wire mesh is advantageously between 0.02 and 0.10 mm and the apertures in the mesh are advantageously between 0.05 mm and 0.2 mm.

[0030] The invention has the surprising effect that it provides good protection with very small dimensions in the wire mesh. This leads to material savings, light weight and to the achievement of substantial mobility when using the protective garment. At the same time, the small aperture in the wire meshes prevents thin, sharp objects from penetrating the protective layer. A particularly high degree of protection, with a further reduction in the ability of sharp objects to penetrate the garment, is achieved by using several protective layers of wire mesh.

[0031] The wire thickness and aperture of the wire mesh, as well as the number of applied protective layers in the garment and in different parts of the garment should be figured out in the light of the desired, final qualities of the garment. That is, while the garment has been described as comprising particular numbers of layers and particular thicknesses (or diameters) of wires, these numbers have been provided merely for purposes of enabling one skilled in the art to produce the article without undue experimentation. Clearly, the instant invention will function well with different thicknesses and numbers of layers, and the choice of thickness and number of layers, for example, should be made based upon the use to which the garment will be put.

[0032] As was noted above, the precise number of layers and precise thicknesses of wires should be figured out in light of the desired, final qualities of the garment. These final qualities may be broadly divided into two categories; the protection qualities and the comfort qualities of the garment. Protection qualities concern the garment's ability to withstand different kinds of sharp objects penetrating the layers of the garment, at variously applied forces, momentums and directions. The comfort qualities, on the other hand, concern the garment's flexibility, its mobility, its overall thickness, its weight and more. These two categories of qualities may be regarded as being of antagonistic nature. In other words, it is quite simple to provide a garment with excellent protection qualities, but with poor comfort qualities. More-

over, it is quite simple to provide a very comfortable garment, with poor protection qualities.

[0033] The garment according to the invention provides an enhanced combination of both protection and comfort qualities, compared to prior art garments. However, the selected wire thickness, the aperture of the wire mesh, and the number of applied protective layers in the garment and in different parts of the garment will give different embodiments of the invention different protection and comfort qualities.

[0034] Wire mesh with smaller dimensions of wire thickness will in general provide higher comfort qualities. Wire mesh with larger dimensions of wire thickness will in general provide poorer comfort qualities.

[0035] Wire mesh with smaller apertures will in general provide a higher protection against penetrations by small, sharp objects. Wire mesh with larger aperture will in general provide a poorer protection against penetration by small sharp objects, but may provide good protection against penetration by less sharp objects.

[0036] Wire mesh with a smaller number of applied protective layers of wire mesh will in general provide higher comfort qualities and poorer protection qualities, especially against penetration by small, sharp objects. Wire mesh with a larger number of applied protective layers of wire mesh will in general provide poorer comfort qualities and better protection qualities, especially against penetration by small, sharp objects, which, although they may penetrate one or a number of mesh layers, most probably will be deflected and obstructed before the complete penetration of all the protective layers.

[0037] When used, e.g., in the medical field, it is important that the fine motor mechanism, i.e. the ability to handle small objects and perform small precise movements, should remain unaltered when using protective garments. For this application an especially thin wire mesh should be used.

A DESCRIPTION OF THE DRAWINGS

[0038] The foregoing objects and advantageous features of the invention will be explained in greater detail by means of the attached drawings.

[0039] FIG. 1 top plan view of section of two types of wire mesh for use in the instant invention.

[0040] FIG. 2 illustrates the placing of the wire mesh in a glove according to the instant invention viewed from the side.

[0041] FIG. 3 illustrates the placing of the wire mesh in a glove according to the invention viewed from the palm side.

A DESCRIPTION OF THE PREFERRED EMBODIMENT

[0042] FIG. 1 illustrates sections of two types of wire mesh for use as a protective layer in a protective garment according to the invention. In a preferred embodiment, indicated by A, the wire mesh is plain woven and consists of stainless, non-corrosive steel, quality AISI 316. The dimensions of mesh A are, by example, 0.05 mm in wire diameter and 0.077 mm in the mesh's aperture. Mesh B shows one of several examples of a wire mesh of an alternative weaving,

a so-called Twill weaving, which may be used as a protective layer in a protective garment according to the invention. Further examples of suitable, alternative weavings are Dutch Plain weaving, Dutch Twill weaving and others. It should be noted that although the wire comprising the wire mesh in the preferred embodiment is described as being, by example, 0.05 mm, other diameter wire may be used, so long as it is sufficiently strong so as to remain intact during slashing or piercing contact with sharpened or pointed instruments such as knives and needles. Furthermore, while the preferred embodiment of Applicant's invention is described utilizing wire mesh having apertures of 0.077 mm, other aperture dimensions may be utilized instead so long as the aperture is sufficiently large as to permit the material to flex comfortably when worn, yet sufficiently small so as to prevent the passage therethrough of needles such as hypodermic needles and small slivers of glass and metal. Furthermore, while Applicant believes that the preferred embodiment of the wire mesh may be best fabricated from of stainless, non-corrosive steel, quality AISI 316, other materials may be used instead, so long as the material does not tend to degrade after contact with liquids including water and more corrosive liquids, and so long as the material has strength qualities comparable to, and tends to resist cutting, cleaving and puncturing comparably to the stainless, non-corrosive steel, quality AISI 316. Finally, while in the preferred embodiment Applicant utilizes a so-called Twill weaving, nearly any weaving pattern may be sufficient so long as it permits the wire mesh to flex without undue damage to the wire mesh and so long as the weave prevents passage therethrough of thin needle-like objects such as hypodermic needles and slivers of glass.

[0043] FIGS. 2 and 3 illustrate the placing of protective layers in an embodiment of the garment according to the invention, the garment being a glove. The glove includes an inner layer (not shown) of a fabric material which is comfortable when in contact with the wearer's skin, preferably constructed of a cotton material, a number of protective layers which are composed of a number of sub-layers of wire mesh, and an outer layer (not shown) of a wear-resistant material, e.g. leather.

[0044] In order to improve mobility while also making the glove lighter, one may construct the glove such that only a few areas of the glove utilize the protective layers of wire mesh. For example, one may construct a glove such that the protective layers cover the palm of the hand and the inner surfaces of the fingers, while the rest of the hand is free from protective layers. The fastening of the various layers to one another is crucial with regard to the glove's flexibility, and in the preferred embodiment the inner layer and the protective layers are joined together by gluing, and the outer layer is sewn together with the inner layer along the glove's natural outer seams or only in the area around the fingertips and/or the wrist. In order to reinforce the glove's protective properties, a greater number of protective layers may be employed in the palm area than in the area covering the inner surfaces of the fingers. While the preferred embodiment joins the inner layer and the protective layers by gluing, it should be obvious that other methods would work equally well, so long as the inner layer and protective layers are permanently joined together, and the method for so joining does not cause the materials to stiffen so as to reduce

mobility, or cause the materials to degrade so as to reduce the ability of the materials to resist cutting, cleaving or puncturing.

[0045] In the illustrated, preferred embodiment, the inner layer and the protective layers are joined together by double coated adhesive tape, preferably a polyethylene or vinyl tape, preferably with an adhesive type that will withstand moisture and washing, and preferably with a tape carrier that is flexible and durable. The use of double coated adhesive tape has been found to give superior flexibility and durability for the assembly of several protective layers. The outer layer is fastened to the inner layer only at the fingertips or near the wrist, preferably by means of seams, or alternatively by adhesive tape, gluing or other functionally similar fastening means. The outer layer may be fastened at other portions, but particularly along the glove's natural outer seams. It is an advantage if only the protective layer located nearest the inner layer is adhered with tape, glue or similar attachment means to the inner layer, and preferably substantially along the entire width of the protective layer. The remaining protective layers are preferably fastened to the protective layer located nearest the innermost layer by self-adhesive tape of the kind mentioned above, alternatively by gluing or similar attachment means. The remaining protective layers may be arranged by folding the wire mesh, or alternatively they may be arranged without fastening, particularly in the case where an outer layer is provided on the garment. All the individual layers, but particularly the inner layer and the protective layers, may however, be joined in other well-known per se ways, e.g. by means of seams, lamination, or other similar attachment means.

[0046] As illustrated in the drawings, the wire mesh in one embodiment of the instant invention covers the palm of the hand and the inner surface of the fingers. The mesh extends only over a part of the fingers' lateral surface, both because it is assumed that the rear or dorsal surface of the hand (i.e. the back of the hand) will not be exposed to harmful influences (for example, various articles likely to cut or pierce the hand while picking those articles up with a gloved hand) to the same extent as the front (ventral) surfaces of the hand (i.e. the palm of the hand and contiguous surfaces of the fingers), and because good flexibility and mobility are better achieved when the mesh is configured in this fashion. In the preferred embodiment of the instant invention, when assembled into a glove, the area covering the palm of the hand, Applicant prefers to include five layers of wire mesh, while only two layers of wire mesh are employed for the remaining portions which are to be protected by the mesh. There are several important reasons for using more layers for the palm area than for the fingers. The palm is often the most exposed surface, particularly for severe stresses, and it does not have such a great need for mobility as do the fingers. A special factor is that the palm represents a more stable point of support in the case of, e.g., a puncture stress, while it will be easier for the fingers to yield and bend away from the dangerous article which comes into contact therewith. Applicant therefore prefers that when the instant invention is utilized in connection with a glove, the glove palm area should therefore be more heavily protected against injury than the finger portions of the glove.

[0047] It should be remembered that the instant invention is specifically a protective garment material which may be used in the fabrication of a great number of different

garments in order to protect portions of the body which are vulnerable to abrasion, laceration, cleaving, and puncturing. In order to ensure that the instant invention is completely understood, Applicant sets forth a number of different uses for the instant invention. Applicant further sets forth, by way of non-limiting example, specific uses and configurations of the instant invention for those specific uses. By setting forth, for example, a number of variants for assembling the component parts of the protective garment material, Applicant believes his invention will be better understood. However, it should be clear that these variants are set forth merely for enabling purposes and understanding's purposes and should not be construed to be the only combinations of the component materials, the only dimensions of the component materials, or the only uses of the protective garment material.

[0048] The protective garment material as set forth above may be constructed to meet different conditions requiring different levels of protection and comfort sought and attained. By way of non-limiting examples, the following variants employing the instant invention.

[0049] A first example variant of said embodiment is a protective glove of a light to medium toughness, suitable for e.g. police, guards or security personnel who may occasionally be exposed to touch with needles or sharp objects. The glove will not provide full protection against a direct attack, nor will it provide protection over the complete surface of the hand. In return, the glove provides excellent mobility and comfort. These properties are achieved by providing two layers of wire mesh in the finger parts and in the palm parts of the glove, the wire mesh having relatively small dimensions of wire thickness and aperture, e.g. in the range of 0.01 mm to 0.10 mm and in the range of 0.001 mm to 0.10 mm, respectively.

[0050] A second variant of said embodiment is a protective glove of medium toughness, also suitable for police, guards or security personnel who may occasionally be exposed to attacks by needles or sharp objects. This glove will provide better protection over larger parts of the hand, at the sacrifice of some reduction in mobility and comfort. This is achieved by providing protective layers which also cover the finger tips, and by providing two layers of wire mesh having slightly larger dimensions of wire thickness and aperture, e.g. in the range of 0.05 mm to 0.20 mm and in the range of 0.01 mm to 0.40 mm, respectively.

[0051] A third variant of said embodiment is a protective glove of high toughness, also suitable for personnel who frequently are exposed to sharp objects, e.g. persons who work with glass fragments, nails or barbed wire. This glove will provide even better protection, at the sacrifice of some further reduction in mobility and comfort. This is achieved by providing three to six layers of wire mesh in the finger parts and seven to nine layers in the palm parts of the glove, the wire mesh having dimensions of wire thickness and aperture in the range of 0.05 mm to 0.20 mm and in the range of 0.01 mm to 0.40 mm, respectively.

[0052] In an alternative embodiment where the garment also is a glove, the entire surface of the hand, wrist and fingers may be covered by protective layers of wire mesh. Such a glove may consist of several pre-manufactured glove-shaped members, where the inner layer constitutes an inner glove-shaped member, made of cotton or another

fabric which is comfortable against the skin and pliable, and where each protective layer constitutes a protective glove-shaped member, made of pieces of wire mesh, cut and assembled as a glove-shaped member by sewing, gluing, adhesive tape or other adhesive means. Advantageously, the glove according to this embodiment also includes an outer layer, which constitutes a glove-shaped outer member, preferably made of a leather material (or material having physical properties comparable to leather). The various glove shaped members are assembled, the inner glove shaped member having assembled about it the protective glove shaped members, and then having assembled about the previously assembled glove shaped members the glove-shaped outer member. Applicant prefers to assemble each glove shaped member to the adjacent glove shaped member by sewing the glove shaped members together proximate to the wrist part of the glove shaped members (naturally, leaving an opening into which the hand may be inserted so that the glove may be worn upon the hand).

[0053] Applicant believes that garments constructed utilizing Applicant's protective garment material may be constructed such that the wire mesh may form any angle whatever between the wire mesh's wires and the main direction of possible seams in the garment. However, Applicant further believes that the best mode for practicing the instant invention when constructing a glove is to align the wire mesh so that the warp or weft wire is parallel to the longitudinal direction of the glove.

[0054] It has been shown to be advantageous to employ at least two layers of wire mesh as a protective layer, and additional layers where necessary with a view to resistance to puncture and injury. However, it is within the scope of this invention to employ any number of layers, one or more, of wire mesh as a protective layer.

[0055] Applicant believes that each protective layer is preferably made of wire mesh with the same design and wire dimensions along the full extent of the protective layer. However, it has been noted above that the protective layer may instead be made of wire mesh of a different design and different wire dimensions, so long as the wire mesh serves the purpose of protecting from abrasions, lacerations, cleavages and punctures. Furthermore, it will be immediately understood that a garment utilizing Applicant's protective garment material may include wire mesh having differing dimensions and/or differing patterns at different locations in the completed article which includes the protective garment material (for example, different wire mesh used in the finger section of a glove from the wire mesh used in the palm section of the same glove). Furthermore, the same piece of fully constructed protective garment material may include one or more protective layers which are composed of wire mesh having differing wire and aperture dimensions from one another.

[0056] Additionally, as has been noted above, the inner layer of the protective garment material may be constructed from a cotton material, but alternatively it may be of a different material which has properties which make it suitable for placing directly against the skin, including, but limited to synthetic fabrics, leather, wool, and various textile mixtures, which may e.g., be knitted, woven or sewn. Listing of every possible material which might be used as the inner layer of the protective garment material would be

virtually impossible given the fact that the ideal material for use as the inner layer of the protective garment material will be dictated in large part by the use to which the protective garment material will be put, and the environmental conditions in which the protective garment material will be expected to function. For example, if the protective garment material is to be used in a boot which is to be worn by Fire or Rescue personnel, the inner layer may be expected to be highly fire resistant. Whereas if the protective garment material is to be used in a glove which is worn by personnel operating under water (e.g. scuba divers), a fire resistant inner layer will not be needed. Irrespective of which particular material is chosen to act as the inner layer, it should meet the minimum criteria of being sufficiently supple such that it does not unduly interfere with mobility and is reasonably comfortable when in direct contact with the skin of the wearer.

[0057] The outer layer of the garment may preferably constructed from leather, but alternatively it may be any other hard-wearing material of appropriate softness, tensile strength, resilience, and resistance to the external conditions to which it may be assumed the garment will be exposed in each individual case (use). Thus, the outer layer may alternatively be constructed from natural fabrics such as canvas or linen cloth, or synthetic fabrics, or any combination thereof, which may, e.g. be knitted, woven or sewn, or may be constructed from rubber or similar soft synthetic materials. As with the case of the inner layer, the precise material from which the outer layer of the protective garment material will be fabricated will depend in large measure upon the use to which the glove will be put, and the environmental conditions under which it will be expected to operate.

[0058] By way of other non-limiting examples, and in furtherance of better understanding the some of the many uses to which the protective garment material may be put, Applicant points out that the instant invention may be fabricated in the form of a removable article of clothing for placing directly on the body or on a body part, or even combined with ordinary clothing by attaching the instant invention on the inside or the outside of ordinary clothing. One example of such a configuration is an article of clothing constructed such that it has an inner layer of soft and comfortable material (e.g. cotton), one or more protective layers (wire mesh) and preferably an outer layer which would ideally be constructed of a soft material (e.g. cotton). Another example of use of the instant invention is configuration as an insert, under clothing, the clothing having a soft outer layer (such as cotton) or even a harder exterior layer (such as leather) when circumstances so dictate. Applicant believes that when the instant invention is to be utilized in conjunction with other articles of clothing, it may be beneficial to locate on the instant invention means for removably attaching the instant invention to the article of clothing. An example of such means for removably attaching would be VELCRO (hook and loop material), however, clasps, clips, buttons, zippers and other such means for removably attaching would work equally well. Obviously, the protective material may be removably fastened directly to an article of clothing, or could just as easily be removably fastened directly to a body or body part (for example, wrapped around a human or animal torso).

[0059] Where the protective garment material is to be configured in a use where both an inner layer and an outer

layer are present, and particularly where the garment is a jacket, a coat, a waistcoat, a vest, an under- or forearm protector, an elbow or shoulder protector, a thigh, knee or calf protector, or a sole for a shoe or for a boot, it has been found advantageous, but not necessary, to omit fastening the protective layer to the other layers (inner and/or outer layers) and instead use the protective layer as an insert, loosely arranged between the inner and outer layers. This feature may also be accomplished in other embodiments of the instant invention.

[0060] Hunting wear and motorcycle suits are further examples of actual uses to which the instant invention may be put. The flexibility inherent in the wire mesh and further its ductility make Applicants protective garment material highly suited for such use.

[0061] It will be obvious to a person skilled in the art that there are many possible applications for the instant invention, including those mentioned in the fields of medicine and laboratory work, the fire service, police, fisheries, military field equipment, hunting equipment, bullet-proof equipment, motorcycle suits, gloves, protective inserts and all other fields in which there is a need for a mobile (flexible), comfortable garment which offers special protection against abrasions, lacerations, cleavages, and punctures.

[0062] Clearly, while a detailed description of a preferred embodiment and numerous other embodiments has been provided for the instant invention, it will be appreciated that other variations can be made without departing from the scope of the invention as set forth above and in the accompanying claims.

I claim:

1. A protective garment for protection of body parts against cuts or puncture wounds caused by sharp objects where at least a portion of the garment comprises at least one inner layer, at least one protective layer and possibly one or more outer layers, characterized in that at least one protective layer is composed of a wire mesh consisting of metal wires, where the thickness of the metal wires is between 0.01 mm and 0.20 mm and the apertures in the wire mesh are between 0.001 mm and 0.45 mm.

2. A protective garment according to claim 1, characterized in that the wire mesh is woven from metal wires consisting of non-corrosive stainless steel.

3. A protective garment according to claim 1, characterized in that different portions of the garment contain a different number of protective layers of wire mesh.

4. A protective garment according to claim 2, characterized in that different portions of the garment contain a different number of protective layers of wire mesh.

5. A protective garment according to claim 1, characterized in that at least some surface parts of the protective layers are joined together by applying double coated, self-adhesive tape between the surface parts.

6. A protective garment according to claim 1, characterized in that at least some surface parts of one protective layer and some surface parts of the inner layer are joined together by applying double coated, self-adhesive tape between the surface parts.

7. A protective garment according to claim 1, characterized in that it comprises an outer layer, made of a soft, flexible and drugged material such as leather.

8. A protective garment according to claim 1, characterized in that the garment also comprises one or more layers of bullet proof material.

9. A protective garment according to claim 1, characterized in that the garment is a glove, a mitten, a jacket, a coat, a waistcoat, a vest a collar, a pair of trousers, an under- or forearm protector, an elbow or shoulder protector, a thigh, knee or calf protector, a sole for a shoe or for a boot, a helmet, a cap or a hood.

10. A protective garment according to claim 9, where the garment is a glove, for protecting the wearer's fingers, hand and wrist, characterized in that protective layers of wire mesh cover the whole palm and back side of the hand and wrist and all the surfaces of the fingers.

11. A protective garment according to claim 9, where the garment is a glove, for protecting the wearer's fingers, and wrist, characterized in that the protective layers of wire mesh cover the whole palm of the hand and fingers, the palm side of the wrist and parts of the lateral surfaces of the fingers.

12. A protective garment according to claim 11, characterized in that the part of the glove corresponding to the palm of the hand is covered by at least two, and preferably five, protective layers of wire mesh, and that the parts of the glove corresponding to the fingers' inner surfaces are covered by at least one, and preferably two, protective layers of wire mesh.

13. A protective garment according to claim 12, characterized in that the thickness of the metal wires in the wire mesh is between 0.02 mm and 0.10 mm, and the apertures in the mesh are between 0.05 mm and 0.20 mm.

14. A protective garment according to one of the claim 3, characterized in that at least some surface parts of the protective layers are joined together by applying double coated, self-adhesive tape between the surface parts.

15. A protective garment according to claim 3, characterized in that at least some surface parts of one protective layer and some surface parts of the inner layer are joined together by applying double coated, self-adhesive tape between the surface parts.

16. A protective garment according to claim 3, characterized in that it comprises an outer layer, made of a soft, flexible and drugged material such as leather.

17. A protective garment according to claim 3, characterized in that the garment also comprises one or more layers of bullet proof material.

18. A protective garment according to claim 3, characterized in that the garment is a glove, a mitten, a jacket, a coat, a waistcoat, a vest a collar, a pair of trousers, an under- or forearm protector, an elbow or shoulder protector, a thigh, knee or calf protector, a sole for a shoe or for a boot, a helmet, a cap or a hood.

19. A protective garment according to claim 18, where the garment is a glove, for protecting the wearer's fingers, hand and wrist, characterized in that protective layers of wire mesh cover the whole palm and back side of the hand and wrist and all the surfaces of the fingers.

20. A protective garment according to claim 18, where the garment is a glove, for protecting the wearer's fingers, and wrist, characterized in that the protective layers of wire mesh cover the whole palm of the hand and fingers, the palm side of the wrist and parts of the lateral surfaces of the fingers.

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