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(54) PROTECTIVE HAND COVERING

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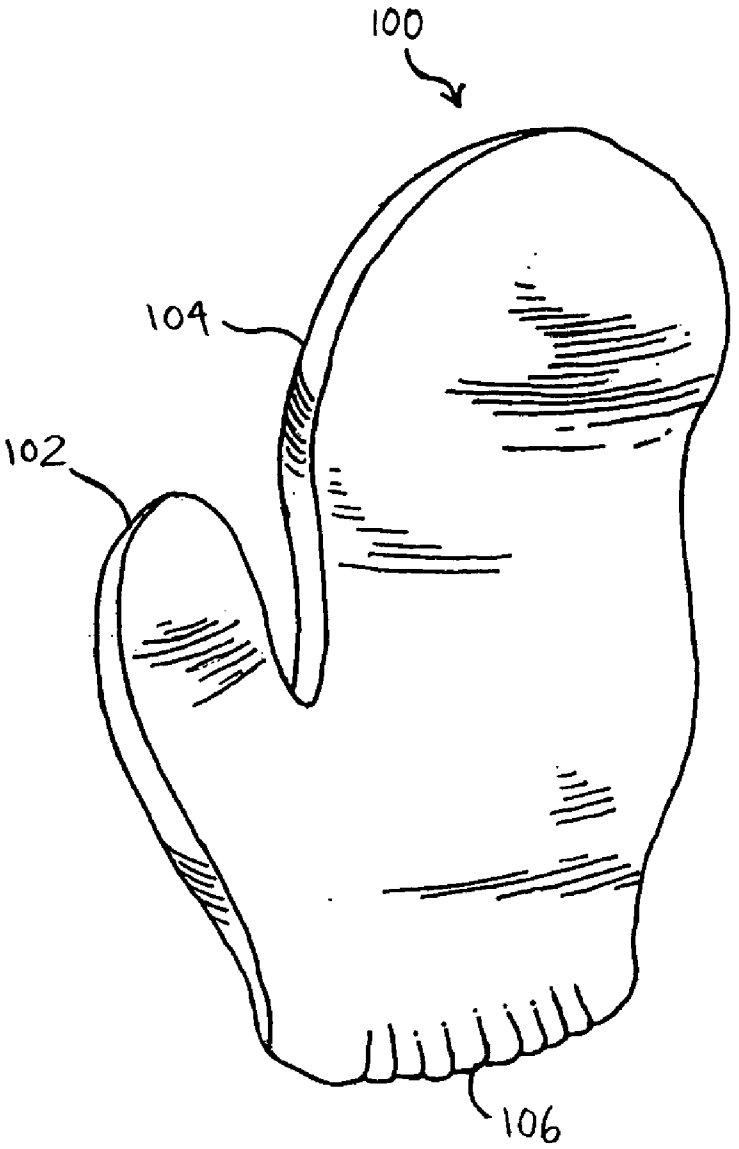
(57) **ABSTRACT**

Disclosed is an appropriately-sized protective hand cover for children that is made of a suitable barrier material and is used for reducing the potential adverse health impacts associated with dermal and ingestion exposures to infectious disease pathogens and environmental contaminants that are often found in areas where children frequent, such as public bathrooms, and during certain activities, such as painting and baking. The device is preferably mitten-shaped and includes a fastening device adapted to securely fasten the device around at least a portion of the child's hand.



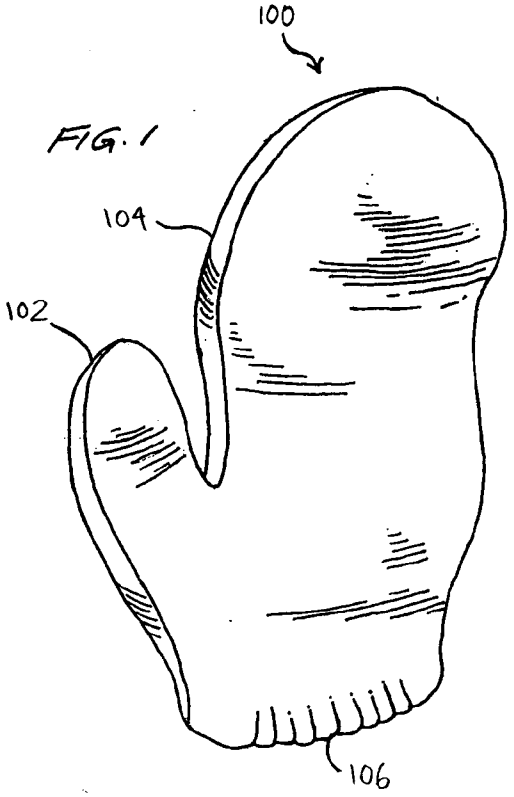


FIG. 1

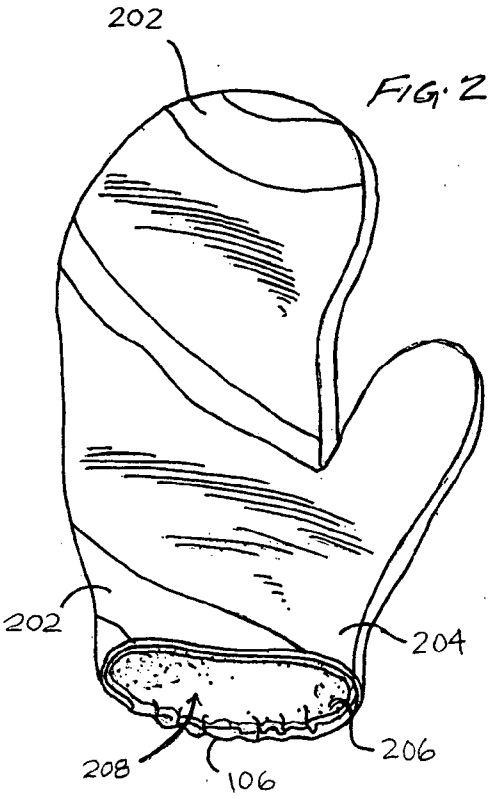


FIG. 2

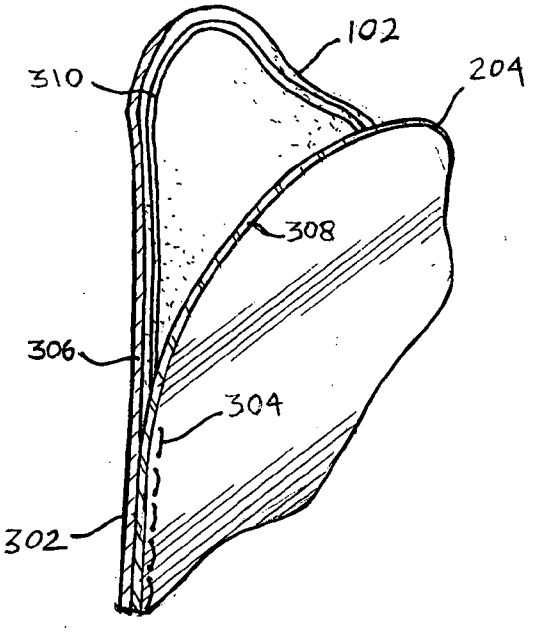


FIG. 3

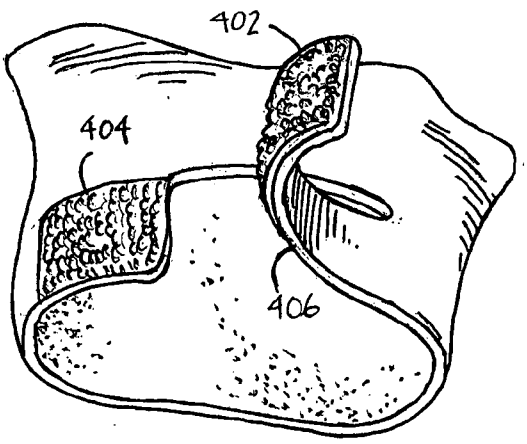


FIG. 4

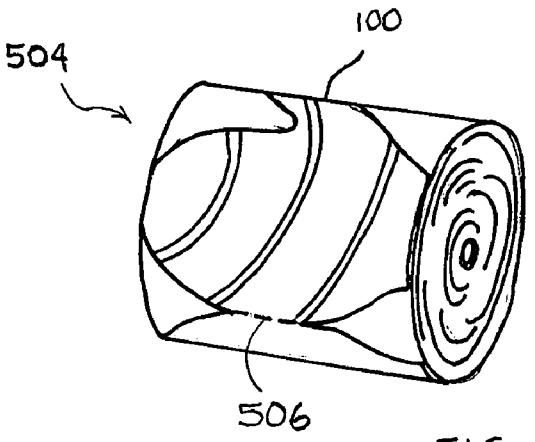


FIG. 5b

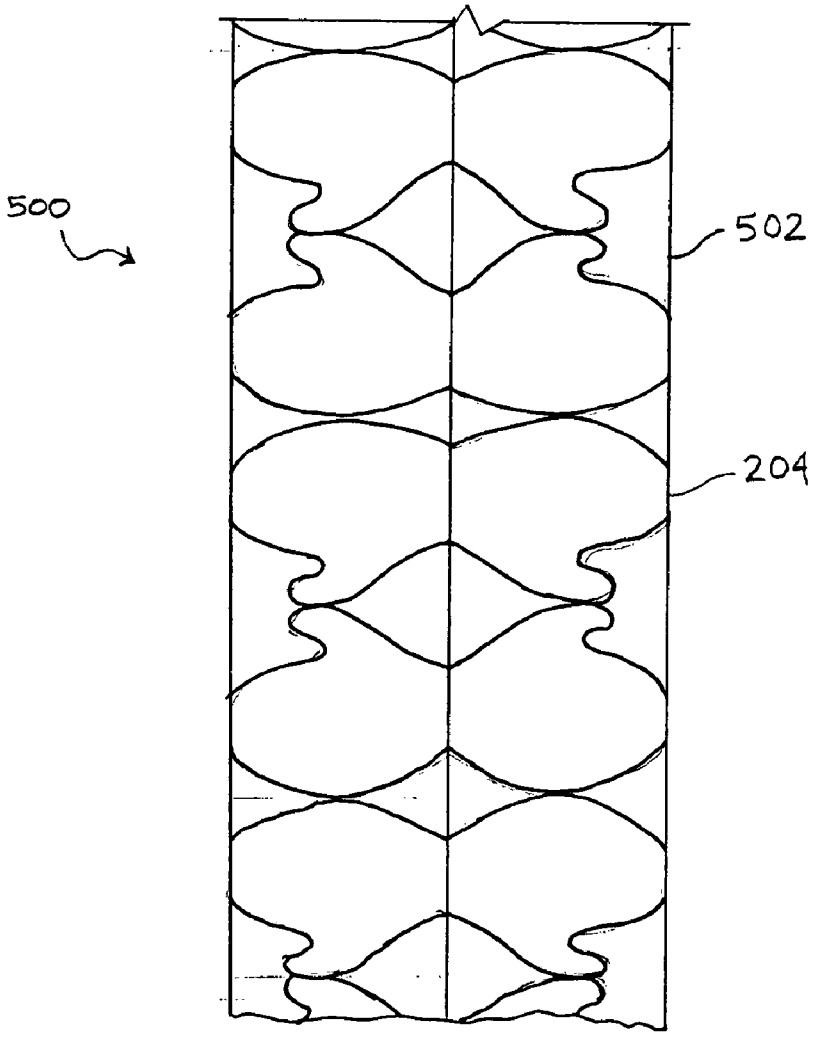


FIG. 5a

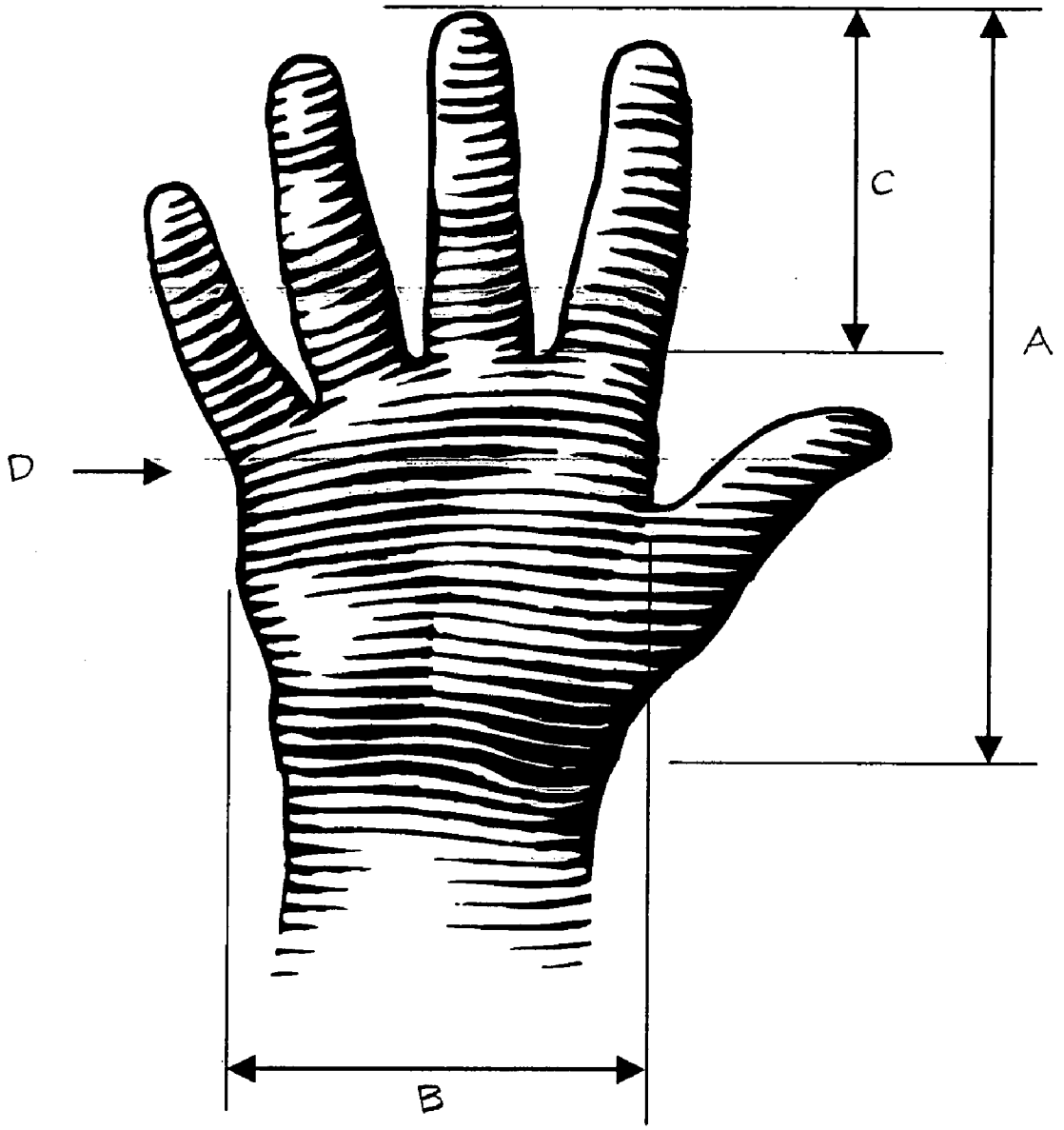


FIG. 6
PRIOR ART

PROTECTIVE HAND COVERING

BACKGROUND OF THE INVENTION

[0001] 1. Field of Invention

[0002] The present invention relates generally to prophylactic devices. In particular, the present invention relates to protective hand coverings for use by children to reduce their exposure to infectious disease pathogens, environmental contaminants, and other materials that may be present in locations where those children frequent, such as public restrooms.

[0003] 2. Description of the Related Art

[0004] Personal protective equipment (PPE) and personal protective apparel (PPA) for adults have been known in the art for many years. For example, medical professionals have relied on examination gloves, splash masks, gowns, footwear covers, and other devices to protect themselves from exposure to infectious disease pathogens. Environmental professionals have relied on masks, respirators, gloves, bibs, boots, and other devices to protect themselves from exposure to toxic hazardous materials and hazardous wastes. Firefighters, police, military, and countless other professionals have relied on many of those devices as well as other types of PPE/A to protect themselves while they perform their job.

[0005] Gloves are one of the more ubiquitous types of prophylactic PPE/A, finding uses in virtually any environment. Gloves are used to protect hands from mechanical shearing and impact forces. Gloves are also used to prevent heat transfer that occurs as a result of high and low temperature extremes. Gloves are also used to prevent dermal contact with substances that can cause adverse health impacts, such as pathogens and toxic chemicals.

[0006] In children, the major routes of exposure to pathogens and environmental contaminants are: (1) adsorption followed by absorption and/or diffusion through the dermal layer (i.e., dermal exposure); (2) ingestion; and (3) inhalation. It is well documented that hand-to-mouth exposure in children is greater than in adults due to the higher rates of hand-to-mouth contact in children, and the relatively higher probability and duration of contact events where a child's hand may become contaminated. The proper use of hand protection devices, like gloves, can generally reduce a child's exposure to pathogens and environmental contaminants due to dermal and ingestion exposure pathways.

[0007] The potential for exposure to pathogens increases in public locations, such as in schools, restrooms, commuter transportation facilities, and restaurants. U.S. Pat. No. 6,146,365 to Nguyen discloses an invention that partially addresses that concern. The Nguyen patent describes a rectangular-shaped envelope formed by two layers of material and sealed at three peripheral edges into which a person's hand is inserted. The device is used as a contamination and moisture barrier during grasping and wiping activities in a bathroom, and it is intended to replace the standard roll of tissue paper. The Nguyen invention is aimed at protecting a person from exposure to pathogens in his or her own waste and, consequently, the spreading of those pathogens, rather than as a protective barrier to exposure to pathogens left by others on a surface that a person may come in contact with. A similar invention is disclosed in U.S. Pat. No. 5,971,138 to Soughan.

[0008] U.S. Patent Application Publication No. 2004/0022833-A1 to Hartwig et al. discloses a similar invention, but one used specifically by children. The Hartwig et al. patent discloses a disposable "glove"-like sheath into which a child's hand it inserted and that is used to remove urine and fecal waste by the child during bathroom activities. The invention, which may also take the shape of a mitten, is provided in the form of a roll, like toilet paper, having a plurality of individual gloves adapted to be separated at a perforated edge. The invention may also take the form of a dispenser, whereby individual gloves may be removed in a manner similar to a box of tissues or tub of "pop-up" baby wipes. The Hartwig et al. invention is also aimed at protecting a child from exposure to pathogens present in his or her own waste rather than as a protective barrier to exposure to pathogens left by others on a surface that the child may come in contact with.

[0009] U.S. Pat. No. 6,119,272 to Tebbe discloses a rectangular-shaped glove worn by health care practitioners made of a flexible material that is impermeable to bacteria and viruses. The glove includes a self-adhesive closure strap for gathering the glove tightly around the wrist of the user. One problem with the glove disclosed in the Tebbe patent is that it is not easily adapted for use by a child because of its size and square shape. Gloves can dramatically lower the dexterity of a child's hand if the seams around the glove fingers are bulky. Also, an child's hand has different anthropometric proportions than an adult's hand, so even making the glove smaller may not provide adequate tactile feel and dexterity that a child may need. A mitten, if properly sized to account for the relatively shorter fingers on a child's hand (compared to an adult's hand), can provide more dexterous feel than a comparable glove.

[0010] U.S. Patent Application Publication No. 2004/0221367 to Darrow discloses a mitten-shaped device for picking up animal waste left by pets. One problem with the invention disclosed in the Darrow patent is that the opening is not adapted to being secured around the wrist of the user, making it practically unusable by a child because a child's hand is even smaller than an adult hand. Moreover, without a fastening device, the mitten could easily fall off of an inattentive child's hand.

[0011] U.S. Pat. No. 5,020,160 to Cano discloses a protective hand covering in the shape of a glove or mitten for protecting the wearer from exposure at self-service gasoline stations, health care facilities, and clean rooms, and also for protecting the wearer while conducting domestic cleaning and gardening activities. The focus of the Cano invention is its tear-away seam that facilitates removing the glove after use. The glove disclosed in the Cano patent is not identified as being adapted for use by a child or being secured around the wrist of a child.

[0012] U.S. Pat. No. 5,864,883 to Reo discloses a self-sealing tissue mitt for use in capturing pathogens shed by an individual though his or her bodily fluids (e.g., during a sneeze or other voluntary or involuntary discharge). The Reo invention is aimed at preventing the transport of pathogens away from a person, rather than preventing the person's exposure to pathogens left behind by others.

[0013] Thus, what the aforementioned prior art prophylactic gloves and mitten devices fail to address is the need for an appropriately-sized protective hand cover, preferably

in the shape of a mitten, which can be securely fastened around the wrist of a child and used to protect the child from exposure to pathogens and environmental contaminants often found in areas where children frequent.

SUMMARY AND OBJECTS OF THE INVENTION

[0014] As indicated above, a need has been identified for an appropriately-sized protective hand cover for children that is made of a suitable barrier material and is used for reducing the potential adverse health impacts associated with dermal and ingestion exposures to infectious disease pathogens and environmental contaminants that are often found in areas where children frequent, such as public bathrooms, schools, and other locations.

[0015] It is, therefore, an object of the present invention to provide a protective hand cover suitable for use by a child.

[0016] It is another object of the present invention to provide a protective hand cover that is adapted to the unique shape of a child's hand to prevent significant loss of dexterity.

[0017] It is still another object of the present invention to provide a protective hand cover in the shape of a mitten that includes a fastening device for securely attaching the device to a child's wrists.

[0018] It is another object of the present invention to provide a protective hand cover formed from a suitable barrier material that reduces the probability of a child's hand being exposed to pathogens or environmental contaminants left on a surface of an object when the child comes in contact with that object.

[0019] It is another object of the present invention to provide a protective hand cover that discourages hand-to-mouth contact behavior in children during and after activities where the probability of exposure to pathogens and environmental contaminants is higher.

[0020] Those objects may be accomplished by a prophylactic mitten adapted to substantially cover and protect a child's hand from exposure to infectious disease pathogens and chemicals that can cause adverse health impacts, the mitten having an outer layer laminated to an inner layer, and a fastener adapted to securely fasten the mitten around a wrist of the child, wherein the outer layer is made from a thin polymeric fibrous web thick enough to prevent breakthrough of a liquid medium after continuous contact between the outer layer and the liquid medium for an extended period of time. The mitten may further include a decorative layer attached to the outer layer, wherein the decorative layer includes indicia. The inner layer may be made from a polypropylene web. The fastener may be elastic, hooks-and-loops, a zipper, a button, a snap, and/or a drawstring. A plurality of mittens may be removably attached to each other at a perforated edge.

[0021] With those and other objects, advantages and features of the invention that may become hereinafter apparent, the nature of the invention may be more clearly understood by reference to the following detailed description of the invention, the appended claims and to the several drawings attached herein.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] **FIG. 1** is a perspective drawing of a protective hand cover to be worn by a child according to a preferred embodiment of the present invention;

[0023] **FIG. 2** is another perspective drawing of the protective hand cover shown in **FIG. 1** but showing an alternative view of the elastic fastening device;

[0024] **FIG. 3** is a partial, cross-sectional, perspective drawing of a portion of a seam of the protective hand cover shown in **FIG. 1**;

[0025] **FIG. 4** is a partial, perspective drawing of an alternative fastening device according to another embodiment of the present invention;

[0026] **FIG. 5*a*** is a plan view of a sheet of protective hand covers formed on a web according to the present invention;

[0027] **FIG. 5*b*** is a perspective drawing of a dispenser for dispensing individual hand protective devices made from the sheet shown in **FIG. 5*a*** according to the present invention; and

[0028] **FIG. 6** is a perspective drawing of the palm-side of a child's hand indicating various anthropometric distances used to characterize the size of the hand.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0029] In the present invention, several preferred embodiments are described for illustrative purposes, it being understood that other embodiments not specifically shown herein are also contemplated as part of the invention.

[0030] Referring now in detail to the drawings, wherein like parts are designated by like reference numerals throughout, **FIG. 1** is a perspective drawing of a protective hand cover **100** to be worn by a child according to a preferred embodiment of the present invention. The protective hand cover **100** is shown in the shape of a mitten with a thumb portion **102** and a finger portion **104**. An elastic wrist portion **106** provides a means for securing the protective hand cover **100** to the wrist of a child (additional fastening structures are described below).

[0031] Mittens are preferred over gloves for many children because gloves can be difficult to put on. Gloves can also reduce dexterity. Mittens do not interfere as much with whole hand and pincher biomechanics that small children rely on to grasp objects. Nevertheless, gloves are also contemplated as being within the scope of the present invention. So-called "thumb-less" mittens and finger-only mittens are also contemplated as being within the scope of the invention.

[0032] The protective hand cover **100** is designed as a barrier to reduce the exposure of a child's hand to infectious disease pathogens and environmental contaminants that can then be dermally absorbed or ingested when the child mouths his or her hand, causing adverse human health impacts. Examples of infectious disease pathogens include Group A *streptococcus* bacterium (causes strep throat), coxsackievirus A16 (causes hand-foot-mouth disease), and enterotoxigenic *E. coli* (causes diarrhea and vomiting), among others. Examples of environmental contaminants include potentially acutely toxic, carcinogenic, or mutagenic

substances like acidic and basic chemicals, heavy metals, and aromatics (causing, among other things, skin irritation, swelling, staining, respiratory problems, vomiting, headaches, etc.). Infectious disease pathogens may be found in bathrooms, public transportation facilities, even in kitchens. Environmental contaminants may be found in many common products, such as cleaning solvents and paints. Thus, the protective hand cover **100** may be effectively used during cooking, cleaning, painting, playing, and bathroom activities, to name a few.

[**0033**] To be effective, it is preferred that the protective hand cover **100** substantially cover a child's hand. That is, the protective hand cover **100** should extend from at least the wrist and cover the palm, the back of the hand, and the fingers. That distance is illustrated in **FIG. 6**, which is a perspective drawing of the palm-side of a child's hand indicating various anthropometric lengths. Specifically, reference A in **FIG. 6** represents the length of the hand that should be covered by the hand protective device **100**. Statistically, the value of A ranges from a mean of 8.8 centimeters for a 12-month old child, to a mean of 11.9 centimeters for a five-year old child (those dimensions and ages are for illustrative purposes only, and should not be construed as limiting the scope of the present invention in any way).

[**0034**] The width of the child's hand should also be taken into account to ensure proper fit and operation of the protective hand cover **100**. Reference B in **FIG. 6** represents the width of a child's hand. Statistically, the value of B ranges from a mean of 4.4 centimeters for a 12-month old child, to a mean of 5.5 centimeters for a five-year old child.

[**0035**] The length of the middle finger is also an important consideration. The finger portion **104** of the protective hand cover **100** should be long enough to accommodate the middle finger length, but not too long that it forms excess material that can bunch up or fold over the fingers of the child wearing the device. Reference C in **FIG. 6** represents the length of the middle finger of a child's hand. Statistically, the value of C ranges from a mean of 3.6 centimeters for a 12-month old child, to a mean of 5.0 centimeters for a five-year old child.

[**0036**] Finally, the minimum hand clearance diameter should be considered when sizing the finger portion **104** and the maximum opening size of the insertion opening **208** (**FIG. 2**) of the protective hand cover **100**. Reference D in **FIG. 6** represents the point where the hand clearance diameter is measured (the measurement is made around the knuckles when the fingers and thumb are brought together). Statistically, the value of D ranges from a mean of 3.99 centimeters for a 12-month old child, to a mean of 4.73 centimeters for a five-year old child.

[**0037**] In addition to size, there are many factors and options to consider in selecting and using protective hand covers, including, but not limited to, the degree of protection required, the environment in which the devices will be used, the activity involved, the types of pathogens and/or contaminants likely to be present in those environments and during those activities, price, quality, and appearance. Many of those factors can be addressed by selecting the appropriate materials of construction for the protective hand cover **100**.

[**0038**] For example, bacteria and viruses are very small and can easily pass through many materials. However, viable pathogens are usually dispersed in a medium, such as a liquid or a dry or semi-dry solid, which covers a surface of an object (e.g., a toilet seat, door handle, cooking surface, play toy, etc.). Thus, the protective hand cover **100** must be made of a material that is at least impermeable to liquids under conditions of normal use so that it prevents the liquid from passing through the barrier material (permeability refers to the physical process of a liquid penetrating a material in a generally perpendicular or acute angle relative to a plane formed by the surface of the material at the point of contact).

[**0039**] Moreover, the material chosen for the protective hand cover **100** must be suitable for the frequency and duration of a contact event with a contaminated object because the protective hand cover may be unintentionally placed in contact with a contamination source for an extended period of time. The extended period of time is referred to as the breakthrough period.

[**0040**] Various types of knitted, woven, and non-woven fibrous webs, with chemically treated or untreated fibers, can be used alone or in combination with each other to achieve an effective barrier. A laminate formed from two or more layers of materials, as shown in **FIG. 2**, is preferred.

[**0041**] In **FIG. 2**, the outer layer **204** is formed from a single layer of liquid impermeable material, which may be a thin, polymeric film such as polyethylene. A suitable thickness is 1.0 mil, but the thickness may be increased if additional protection is required to prevent breakthrough where the protective hand cover **100** is partially or completely immersed in a contamination source. A suitable breakthrough time period is determined based on the time a child is expected to wear the protective hand cover **100** under normal activities in which the protective hand cover **100** is in contact with an infectious disease pathogen or environmental contaminant. A suitable breakthrough period may be a few minutes up to 15 minutes or more, depending on the types of infectious disease pathogens and environmental contaminants.

[**0042**] The inner layer **206** may be formed from a single layer of liquid impermeable material, or a knitted fibrous web that provides a soft, fabric-like texture that is comfortable for the wearer. Polypropylene or a similar web material may be sufficient for that purpose. Whichever material is selected, it is desirable that both the inner layer **206** and the outer layer **204** be breathable and allow vapors to penetrate the material from the inside to the outside of the protective hand cover **100** so that the child's hand does not become overheated, sweat, and cause the device to be uncomfortable and undesirable to use.

[**0043**] In addition to the outer layer **204** and the inner layer **206**, an outermost layer **202** made from a woven or non-woven fibrous web that provides a soft, fabric-like texture, or better grip, may be used. A polypropylene, polyethylene, or similar material may be sufficient for those purposes. The outermost layer **202** may be laminated to the outer layer **204** using any suitable laminate adhesive or other attaching device.

[**0044**] The outermost layer **202** may include a decorative design, such as stripes (as shown in **FIG. 2**), or it may include other types of indicia, such as caricatures and representations of athletic devices or toys. Alternatively, the

decorative design may be formed directly on the outer layer **204**. One method of applying the decorative design **202** is to use a print screen or other color transfer device that transfers color directly onto the web material before it is formed into the shape of the final product. Another method is to emboss the web. The decorative design **202** may take the form of a thin sheet of material that is attached to the outer layer **204** using a suitable adhesive.

[**0045**] **FIG. 3** is a partial, cross-sectional, perspective drawing of a portion of a seam **302** of the protective hand cover **100**. The seam **302** may be made by using conventional stitches **304**. However, since stitches create through-holes in the underlying material that can allow liquids to permeate from the outside to the inside of the protective hand cover **100**, the edges **306**, **308** of the outer layer **204** may need to be doubled over and sealed (not shown). A film of pressure or heat-activate adhesive **310** may be peripherally laminated adjacent or near the edges **306**, **308** (only the adhesive film adjacent the edge **308** is shown).

[**0046**] **FIG. 4** is a partial, perspective drawing of an alternative fastening structure according to another embodiment of the present invention. In particular, a hook-and-loop type fastener (i.e., Velcro®) is shown, which includes a hook bed **402** and loop bed **404** (or their equivalent) that can be engaged by bringing the two beds together. The hook bed **402** is attached to a strip of material **406**. A zipper, button, snap, drawstring, strap, or other type of fastener may also be used to secure the protective hand cover **100** to the child's hand.

[**0047**] Turning now to **FIG. 5***a*, shown therein is a plan view of a sheet **500** that is made from a continuous web **502** according to the present invention. The individual mitten shaped outer layers **204** may be formed in the web **502** using a die cutting machine, laser, or some other technique (not shown). If the final protective hand cover **100** is to include an inner layer **206**, then a sheet of inner layers **206** (not shown) is preferably attached to the surface of the sheet **500** before the halves of the sheet **500** are folded over along the centerline. Once the two halves are folded over and the seam **302** is formed, the sheet **500** may be rolled or folded accordion-style.

[**0048**] **FIG. 5***b* is a perspective drawing of a dispenser roll **504** for dispensing individual hand protective devices **100** made from the sheet **500** after the sheet **500** has been folded over along the centerline and the seams **302** formed. The sheet **500** may need to be chemically treated to prevent the overlapping layers of the roll from sticking together. Individual hand protective devices **100** may be separated from each other at perforation **506**. The dispenser roll **504** may be inserted into a housing (not shown), which facilitates removal of individual hand protective devices **100** one at a time (in the same or similar manner that a baby "pop-up" wipe is dispensed from a tub housing, or a tissue is dispensed from a tissue box).

[**0049**] **FIG. 6** is a plan perspective drawing of the palm-side of a child's hand indicating various anthropometric distances used to characterize the size of the hand.

[**0050**] Although only preferred embodiments are specifically illustrated and described herein, it will be appreciated that many modifications and variations of the present invention are possible in light of the above teachings and within the purview of the appended claims without departing from the spirit and intended scope of the invention.

I claim:

1. A protective hand cover for a child's hand comprising:

a material assembled into a hand covering, wherein the material comprises a first layer having first and second sides and a second layer attached to the first side of the first layer; and

a fastener adapted to securely fasten the hand covering to at least a portion of the child's hand,

wherein the hand covering substantially protects the child's hand from exposure to infectious disease pathogens and/or substances that can cause adverse human health impacts.

2. The protective hand cover according to claim 1, wherein the material further comprises a third layer attached to the second side of the first layer.

3. The protective hand cover according to claim 2, wherein the third layer is a decorative layer.

4. The protective hand cover according to claim 1, wherein the first layer is made from a thin polymeric film.

5. The protective hand cover according to claim 4, wherein the thin polymeric film is polyethylene.

6. The protective hand cover according to claim 4, wherein the polyethylene film is thick enough to prevent breakthrough of a liquid or solid medium after continuous contact between the polyethylene film and the liquid or solid medium for an extended period of time.

7. The protective hand cover according to claim 1, wherein the second layer is made from a polypropylene web.

8. The protective hand cover according to claim 1, wherein the first layer is an outer layer of the protective hand cover and the second layer is an inner layer of the protective hand cover.

9. The protective hand cover according to claim 1, wherein the fastener is one of elastic, hooks-and-loops, zipper, button, snap, drawstring, and strap.

10. The protective hand cover according to claim 1, wherein the first and second layers are attached to each other using adhesive.

11. A protective hand cover for a child's hand comprising:

a material assembled into a mitten or glove, wherein the material comprises a first layer having first and second sides and a second layer attached to the first side of the first layer; and

a fastener adapted to securely fasten the protective hand cover to at least a portion of the child's hand,

wherein the first layer is made from a thin polymeric fibrous web, and wherein the protective hand cover substantially protects the child's hand from exposure to infectious disease pathogens and/or substances that can cause adverse human health impacts.

12. The protective hand cover according to claim 11, wherein the material further comprises a third layer attached to the second side of the first layer.

13. The protective hand cover according to claim 12, wherein the third layer is a decorative layer.

14. The protective hand cover according to claim 11, wherein the second layer is made from a polypropylene web.

15. The protective hand cover according to claim 11, wherein the first layer is an outer layer of the protective hand cover and the second layer is an inner layer of the protective hand cover.

16. The protective hand cover according to claim 11, wherein the fastener is one of elastic, hooks-and-loops, zipper, button, snap, drawstring, and strap.

17. The protective hand cover according to claim 11, wherein the first and second layers are laminated to each other using adhesive.

18. The protective hand cover according to claim 11, wherein the thin polymeric fibrous web is thick enough to prevent breakthrough of a liquid or solid medium after continuous contact between the thin polymeric fibrous web and the liquid or solid medium for an extended period of time.

19. A prophylactic mitten adapted to be worn by a child engaged in an activity during which the child may be exposed to substances that can cause adverse human health impacts, the mitten comprising an outer layer laminated to an inner layer, and a fastener adapted to securely fasten the mitten to at least a portion of the child's hand, wherein the outer layer is made from a thin polymeric fibrous web thick enough to substantially prevent breakthrough of a liquid or solid medium after continuous contact between the outer layer and the liquid or solid medium for an extended period of time.

20. The mitten according to claim 19, wherein the mitten further comprises a decorative layer attached to the outer layer, wherein the decorative layer includes indicia.

21. The mitten according to claim 19, wherein the inner layer is made from a polypropylene web.

22. The mitten according to claim 19, wherein the fastener is one of elastic, hooks-and-loops, zipper, button, snap, and drawstring.

23. The mitten according to claim 19, wherein the activity is conducted in one of a school, a bathroom, a kitchen, and a public transportation facility.

24. A device for covering and protecting a child's hand from exposure to infectious disease pathogens and substances that have the potential to cause adverse human health impacts comprising:

a plurality of mitten-shaped or glove-shaped protective hand covers removably attached to each other along a perforation, the protective hand covers comprising a first layer having first and second sides and a second layer attached to the first side of the first layer; and

a fastener adapted to securely fasten the protective hand cover around at least a portion of the child's hand,

wherein the plurality of protective hand covers are adapted to being rolled into a cylinder shape or folded into a stack.

25. The device according to claim 24, wherein the protective hand cover further comprises a third layer attached to the second side of the first layer.

26. The device according to claim 25, wherein the third layer is a decorative layer.

27. The device according to claim 24, wherein the first layer is made from a thin polymeric film.

28. The device according to claim 27, wherein the thin polymeric film is polyethylene.

29. The device according to claim 28, wherein the polyethylene film is thick enough to prevent breakthrough of a liquid or solid medium after continuous contact between the polyethylene film and the liquid or solid medium for an extended period of time.

30. The device according to claim 24, wherein the second layer is made from a polypropylene web.

31. The device according to claim 24, wherein the first layer is an outer layer of the protective hand cover and the second layer is an inner layer of the protective hand cover.

32. The device according to claim 24, wherein the fastener is one of elastic, hooks-and-loops, zipper, button, snap, drawstring, and strap.

33. The device according to claim 24, wherein the first and second layers are attached to each other using adhesive.

* * * * *