

**UNITED STATES PATENT AND TRADEMARK OFFICE**  
**BEFORE THE PATENT TRIAL AND APPEAL BOARD**

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Crye Precision LLC,  
Petitioner

v.

FirstSpear, LLC,  
Patent Owner

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U.S. Patent No. 9,974,379

Case No. IPR2019-01152

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**DECLARATION OF CHRISTOPHER M. PASTORE, Ph.D.**

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I, CHRISTOPHER M. PASTORE, DECLARE AS FOLLOWS:

**I. INTRODUCTION AND QUALIFICATIONS**

1. Counsel for Crye Precision LLC (“Crye”) has retained me as an expert to offer my opinion regarding the validity of U.S. Patent Nos. 9,565,922 (“’922 patent”) and 9,974,379 (“’379 patent”), collectively the “Challenged Patents.” This declaration focuses on the ’379 patent.

2. I submit this declaration based on my personal knowledge and in support of Crye’s *inter partes* review Petition against the ’379 patent.

3. In 1982, I received my B.S. in Mathematics from LaSalle University in Philadelphia. In 1986, I received my M.S. in Mathematics from Drexel University in Philadelphia, and in 1988, I received my Ph.D. in Material Science, also from Drexel University in Philadelphia.

4. I am currently a tenured Professor at Thomas Jefferson University in Philadelphia, Pennsylvania. In 1988, I became an Assistant Professor of Materials Science and Engineering at Drexel University in Philadelphia, Pennsylvania. From 1990 to 1995, I was an Assistant Professor of Textile Materials Science at North Carolina State University in Raleigh, North Carolina (tenured and promoted to Associate Professor in 1995). In 1995, I joined Philadelphia College of Textiles and Science in Philadelphia, Pennsylvania as an Associate Professor of Textile Engineering, tenured in 2001. The university changed its name to Philadelphia

University in 2000. I was promoted to Professor in 2002. The university merged with Thomas Jefferson University in 2017.

5. My research has focused on textile materials throughout my career. From 1996-1999, I was a participant in the Defense Logistics Agency's Apparel Research Network exploring assembly and design of military clothing. The project focused on reducing cost, shortening response time, and improving the quality of defense clothing. One of the main points of interest in this work was addressing the surge demand associated with unexpected military needs.

6. From 1998-1999, I worked with DARPA exploring novel textiles for military applications. This project focused on new fiber-based technologies that offered the modern soldier a range of new opportunities for sensing, environmental control, camouflage and protection. This study was directed at identifying new technologies that could be exploited to take advantage of these opportunities.

7. In 1998, I was funded by ILC Dover (through NASA) to develop micrometeoroid, tear resistant, and self-healing space suits. In this project, new fabrics were developed and characterized for puncture resistance from large and small threats. Laminated systems were developed including microencapsulated foams that expanded when punctured to fill the opening created.

8. In 2007, I was funded by KDH Inc. to develop ergonomic, comfortable

carriage vests for the US Army. The purpose of this research was to establish a knowledge base of current materials systems available for body armor, create new design concepts for vest carriage and related armor systems, and participate in design review and concept evaluations for new armor systems.

9. I was also funded in 2007 by ILC Dover (through Hamilton Sundstrand) to explore novel closure and attachment systems for space suits. The goal was the development of closure and attachment systems for space suits that can be operated while wearing gloves, but maintaining a tight closure.

10. In 2011-2012, I worked with the US Army on the Warrior Web program focused on the development of chemical protective clothing. This research focused on design and characterization of different fabrics, laminations and sealing methods for the development of chemical protective clothing that minimize the heat stress experienced by the wearer. Coated fabrics and different seam methods were tested for permeability. Garments were produced in the laboratory and tested on a walking, sweating mannequin.

11. Since 2005, I have taught courses on textiles and chemical protective clothing for the Defense Logistics Agency and for the US Army Natick Soldier Systems Center. These courses were developed for the employees' eligibility for textiles certification. The content included basics of textiles, rubber coatings, sealing

methods, and specifications.

12. I have also taught courses at the university in the field of textiles, apparel, testing, and design throughout my career. These courses cover the range of textiles from fiber to yarn to fabric to apparel and industrial applications.

13. In 2017, I was appointed to Fulbright Specialist for the Department of Clothing and Textiles at the Durban University of Technology, South Africa, developing curricula for engineering degrees in Clothing and Textiles.

14. A copy of my Curriculum Vitae (“CV”) is submitted herewith as **Appendix A**, which describes my education, training and experience in greater detail. My CV includes a list of books and publications I have authored.

15. I am billing my work in this matter at \$300 per hour, with reimbursement for actual expenses. My payment is not contingent upon my testimony or the outcome of the case. I have no personal interest in the outcome of the case.

## **II. MATERIALS CONSIDERED**

16. The analysis provided in this declaration is based on my education as well as my experience in the field. In addition to relying upon my knowledge based on written materials and other information that was known in 2011, I have considered the exhibits to the Petition (Exs. 1001-1016), shown below.

Declaration of Christopher M. Pastore, Ph.D.  
IPRs 2019-01152  
U.S. Patent No. 9,974,379

<b>Exhibit</b>	<b>Description</b>
1001	U.S. Patent No. 9,974,379 (“’379 patent”)
1002	File history of U.S. Patent No. 9,974,379 (“’379 FH”)
1003	Declaration of Dr. Christopher M. Pastore (“Ex. 1003-Pastore”)
1004	U.S. Patent No. 9,173,436 (“Crye-436”)
1005	U.S. Patent App. Pub. No. 2013/0312149 (“Asher-149”)
1006	U.S. Patent No. 5,724,707 (“Kirk-707”)
1007	U.S. Patent Publication No. 2009/0277936
1008	U.S. Patent No. 7,200,871
1009	U.S. Patent No. 5,789,327
1010	Technical Manual - Operator’s Manual for Modular Lightweight Load-Carrying Equipment (MOLLE) II, Department of the Army, November 2, 2009, Approved for public release; distribution is unlimited
1011	U.S. Patent Application Publication No. 2008/0318017
1012	Drawing of UBFA (58) of Crye-436 showing slits (80) to total surface area ratio
1013	U.S. Patent No. 3,891,996
1014	Ballistic Resistance of Body Armor, NIJ Standard-0101.06, July 2008, NCJ 223054
1015	U.S. Patent No. 5,692,237 (“Bennett-237”)
1016	U.S. Patent No. 8,132,495



### **III. OVERVIEW AND LEGAL STANDARDS**

#### **A. Relationship between the '922 patent and the '379 patent**

17. Counsel for Crye has explained to me that the '922 patent and the '379 patent (collectively, the "Challenged Patents") are related patents from the same patent family. I, therefore, understand that the '922 and '379 patents have the same specification, but different claims.

#### **B. Priority Date**

18. Counsel for Crye has explained to me that the priority date for the Challenged Patents is August 8, 2012. I have, therefore, applied this date in considering the prior art and the viewpoint of a person of ordinary skill in the art ("POSITA").

19. I understand Petitioner may argue that the Challenged Patents are entitled to a priority date of August 8, 2011. Even if there were true, my opinions would not change.

#### **C. Obviousness**

20. It is my understanding that a claimed invention is unpatentable under 35 U.S.C. § 103 if the differences between the invention and the prior art are such that the subject matter as a whole would have been obvious at the time the alleged invention was made to a person of ordinary skill in the art to which the subject matter pertains. This is sometimes described as "obviousness." I understand that an

obviousness analysis takes into account the level of ordinary skill in the art, the scope and content of the prior art, and the differences between the prior art and the claimed subject matter. The analysis may also consider secondary considerations, such as commercial success, unmet but long felt need and failure of others.

21. It is my understanding that the Supreme Court, in *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398 (2007) and other cases, has recognized several rationales for combining references or modifying a reference to show obviousness of the claimed subject matter. Some of these rationales include the following: combining prior art elements according to known methods to yield predictable results; simple substitution of one known element for another to obtain predictable results; a predictable use of prior art elements according to their established functions; applying a known technique to a known device to yield predictable results; choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; and some teaching, suggestion, or motivation in the prior art that would have led a POSITA to modify the prior art or combine prior art teachings to arrive at the claimed invention.

#### **D. Claim Construction**

22. I understand that the claim terms in these IPRs will be construed according to their ordinary and customary meaning. I further understand that the

claims are read in light of the patent's specification and that claims themselves often provide significant guidance as to the meaning of a particular term.

23. For purposes of these IPRs, I believe no specific constructions are required; the terms used in the claims are used in the specification and the claims according to their ordinary and customary meaning.

**E. Person Having Ordinary Skill in the Art**

24. I understand that my assessment of the claims of the '379 patent must be undertaken from the perspective of what would have been known or understood by a person having ordinary skill in the art, reading the '379 patent on its relevant filing date and in light of the specification and file history of the '379 patent. I will refer to such a person as a "POSITA."

25. I understand that my analysis and opinions expressed in this declaration must be rendered based on the perspective of a POSITA as of the priority date of the Challenged Patents. I also understand that a POSITA is a hypothetical person who is presumed to have known the relevant art at the time of the alleged invention claimed in the '379 patent.

26. I further understand that in determining the level of ordinary skill in the art, I am to consider factors including:

(a) the type of problems encountered in the art or field of invention,

- (b) prior art solutions to those problems,
- (c) the rapidity with which innovations are made,
- (d) sophistication of the technology, and
- (e) the educational level of active workers in the field.

27. I understand that a POSITA is a person of ordinary creativity, but not an automaton, and that a POSITA can often fit multiple patents or prior art references together like pieces of a puzzle as a result of this ordinary creativity. I also understand that I may consider the inferences and creative steps that a POSITA would employ. In addition, I understand that a POSITA would necessarily have been capable of understanding the scientific and engineering principles applicable to the pertinent art. I also understand that when I consider what would have been obvious to a POSITA, I am not considering what would have been obvious to me at the time, nor to the inventors, judges, laymen, those skilled in other arts, or to geniuses in the art.

28. I understand that Crye is in concurrent litigation with Patent Owner (FirstSpear) regarding U.S. Patent No. 9,173,436, owned by Crye. I understand that Crye has used the below definition of POSITA in that litigation.

“A POSITA would have at least a Master’s Degree in an academic area emphasizing textile design and fabrication, or an equivalent field (or a similar technical Master’s Degree, or higher degree) with a

concentration in textile design and fabrication. Alternatively, a POSITA would have had a Bachelor's Degree (or higher degree) in an academic area emphasizing textile design and fabrication with two or more years of work experience in textile design and fabrication. Additional education in a relevant field, or relevant industry experience may compensate for a deficit in one of the other aspects of the requirements stated above.”

29. Based on my review and analysis of the Challenged Patent, the prior art cited herein, and the ordinary skill factors described in this section the definition of POSITA used in the litigation (above) is also appropriate for these proceedings, and I have applied this definition of a POSITA in analyzing the Challenged Patents.

#### **IV. OVERVIEW OF THE CHALLENGED PATENTS**

30. The Challenged Patents relate to “a system and method for removably attaching pouches and other accessories to a carrier, such as a vest or other garment, or other device, and more particularly, which is light weight, non-metallic, resists accumulation of, and degradation of operation from, particulates such as dirt dust and the like, is quiet in operation, and is compatible with some known systems.” ('379 patent at 1:13-19.)

31. Despite this broad characterization, I view the purported advance of the Challenged Patents to be directed to the use of a hook and loop fastener system with the backside of a MOLLE (MOdular Lightweight Load-carrying Equipment)

compatible platform to attach holders (pouches) thereto. This is because the Challenged Patents start by explaining the functionality of the prior art, including prior art MOLLE systems. (*Id.* at 1:27-62.) The Challenged Patents then go on to explain the disadvantages of such prior art systems. (*Id.* at 1:67-2:3.) The Challenged Patents then set forth that its purpose is to find a new use for hook and loop fasteners in the types of attachments systems described by the prior art:

“Although past known carriers utilizing hook and loop fasteners have suffered from these disadvantages, inherent advantages of hook and loop fasteners such as ease and familiarity of use, and non-metallic construction, still make them attractive. The non-metallic attribute is particularly desirable for military applications wherein the carrier is subject to explosions which can cause metallic objects to fragment and possibly injure wearers. As a result, it is still sought to find a manner of use hook and loop type fasteners for attachment of holders and the like, particularly for military carrier applications.

Therefore, what is sought is an attachment system and method that utilizes the advantageous attributes of hook and loop fastening systems, but which overcomes one or more of the know disadvantages thereof, set forth above.” (*Id.* at 2:3-18 (emphasis added).)

32. The Summary of the Invention section confirms that the purpose of the Challenged Patents is to use hook and loop fastening systems in a manner different than that described by the prior art of U.S. Patent No. 5,724,707 to Kirk:

“What is disclosed is an attachment system and method for carrier garments such as, but not limited to, vests, cummerbunds, belts, shirts, jackets, pants, and the like, that utilizes the advantageous attributes of hook and loop fastening systems, but which overcomes one or more of the known disadvantages thereof set forth above.” (*Id.* at 2:21-26 (emphasis added).)

33. The Challenged Patents then explain that the alleged invention uses a hook and loop fastening system in a MOLLE compatible garment by attaching one component (hook or loop) to the backside of a platform while attaching the other component (loop or hook) to a holder / pouch:

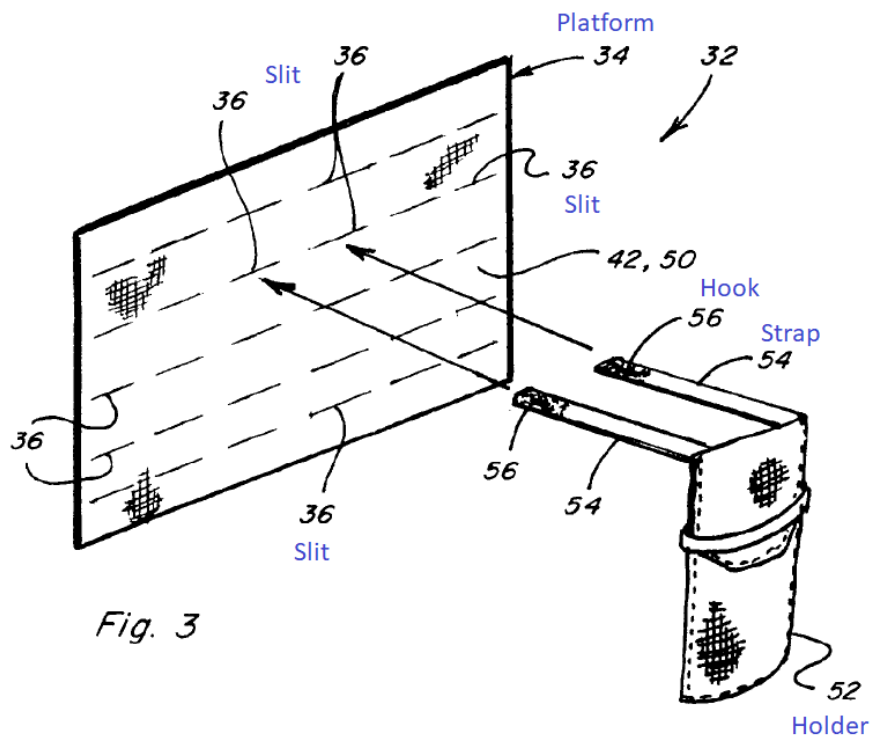
“According to a preferred aspect of the invention, the attachment system utilizes a platform having a front side, an opposite back side, and a plurality of slits through the platform arranged in a predetermined pattern of vertically aligned and spaced apart rows, configured for receiving elements for attaching at least one holder to the platform. As a non-limiting example, adjacent ones of the slits can be spaced vertically apart to correspond to the vertical spacing of loops of currently used MOLLE systems.” (*Id.* at 2:27-35(emphasis added).)

“According to another aspect of the invention, a back side of the platform faces and covers the outer surface of the carrier or backing element and includes a **first fastening component** of a hook and loop fastening system thereon adjacent to, e.g., around or beside, the slits, and disposed in opposing relation to the carrier or backing element surface. ... This is advantageous as the carrier surface or backing

element protects the component of the hook and loop fastener, and with the fastener component located on the back side and in the pocket or cavity, noise generated when detaching from the fastener is contained and muted or muffled so as to be suitable for applications where silence when configuring the system, e.g., adding, removing, moving holders, is required.” (*Id.* at 2:46-63 (emphasis added).)

“According to another preferred aspect of the invention, the system includes at least one holder including at least one tab having a second component of the hook and loop fastening system thereon, e.g., hooks for use with the pile loop fabric, such as commercially available under the trade name ‘Velcro’.” (*Id.* 3:43:48 (emphasis added).)

34. FIG. 3 of the Challenged Patents is representative of this configuration:





As shown, tabs or straps (54) of a holder (52) are inserted through slits (36) of a platform (34). After insertion, the hooks (56) of the straps (54) are attached to corresponding loops (not shown) on the back side of the platform. (*Id.* at 5:25-27 and 8:4-31.)

35. Other portions of the Challenged Patents confirm that the purpose of the alleged invention is to use a component of a hook and loop fastener system on the backside of a platform to attach pouches / holders thereto. For instance, as explained relative to FIGS. 8 and 13:

“[P]latform 34 of the attachment system 32 comprises a back side 48 having a first component of a suitable fastening system thereon, such as, but not limited to, a loop pile fabric 48 of a hook and loop fastening system such as available under the trademark Velcro.” (*Id.* at 7:58-63.)

“FIG. 8 shows the back side 46 of a representative platform 34 of the invention, with top, bottom and middle tabs 54 of a pouch (FIGS. 6 and 7) through respective slits 36 therethrough and attached pile fabric 48. In FIG. 13, V shape tabs have two hook surfaces extending in different direction and attached to the loop fabric.” (*Id.* at 8:32-37.)

36. For at least these reasons, the purported technological advance of the Challenged Patents appears to be directed to facilitating attachment of MOLLE compatible pouches (holders) by using a loop (or hook) material on the back side of a MOLLE compatible platform and using corresponding hook (or loop) material on

straps of the MOLLE compatible pouches to facilitate attachment to the back side of the MOLLE compatible platform.

37. I understand that Patent Owner may contend that its “slits only” platform is inventive:

“According to a preferred aspect of the invention, the attachment system utilizes a platform having a front side, an opposite back side, and a plurality of slits through the platform arranged in a predetermined pattern of vertically aligned and spaced apart rows, configured for receiving elements for attaching at least one holder to the platform. As a non-limiting example, adjacent ones of the slits can be spaced vertically apart to correspond to the vertical spacing of loops of currently used MOLLE systems.” (*Id.* at 2:27-35.)

However, this cannot be. As explained below, Crye-436 discloses, teaches, and suggests a “slits only” platform. Further, U.S. Patent No, 7,200,870 to Carlson et al. discloses a MOLLE compatible slits-only platform. (*See, e.g.,* Carlson at 1:46-52 and FIG. 1.) The Carlson patent was filed in October 2005, so it predates the priority date of August 8, 2012 by nearly seven years. Thus, a POSITA would have understood that a slits-only, MOLLE compatible platform was known prior to the proclaimed priority date for the Challenged Patents.

## V. PRIOR ART REVIEW

### A. Overview of MOLLE and PALS

38. As noted above, the Challenged Patents relate to vests and other articles of clothing designed for compatibility with the military's MOLLE standard. MOLLE (pronounced *MOLLY*) is an acronym for MODular Lightweight Load-carrying Equipment, and is used to define the current generation of load-bearing equipment and rucksacks utilized by the United States Army. (Ex. 1007 [U.S. 2009/0277936A1] at ¶7.)

“The modularity of the [MOLLE] system is derived from the use of Pouch Attachment Ladder System or PALS webbing, rows of heavy-duty nylon precisely stitched onto the vest as to allow for attachment of various MOLLE-compatible pouches and accessories. This method of attachment has become somewhat of a standard for all quality modular military gear, replacing the click and stick system used in the earliest modular vest systems (which is still in use with most Western police departments). It is produced for the United States Government under contract by several contractors. See for example, U.S. Pat. No. 5,724,707.” (*Id.*)

PALS is an acronym for “pouch attachment ladder system.” (*Id.*)

“PALS is a grid of webbing invented and patented by United States Army Natick Soldier Research, Development and Engineering Center used to attach smaller equipment onto load-bearing platforms, such as vests and backpacks. It was first used on MOLLE rucksacks, but is

now found on a variety of American equipment, such as the Improved Outer Tactical Vest, Interceptor body armor, USMC Improved Load Bearing Equipment backpack and Modular Tactical Vest. The PALS grid consists of horizontal rows of 1" Mil-W-43668 Type III nylon webbing (most commercial vendors use Type IIIa), spaced 1" apart, and reattached by reinforced stitches or seams to the backing at 1.5" intervals." (*Id.* at ¶¶8-9.)

39. As recognized by the Challenged Patents, the MOLLE system is conventional and appears to have been first described in U.S. Patent No. 5,724,707. ('379 patent at 1:37-62.) Accordingly, the '379 patent admits that both the MOLLE and PALS systems are well-known to those skilled in the art.

"Modular pouch attachment systems and methods for carrier garments, hereinafter sometimes referred to by the term carrier or carriers, such as, but not limited to, vests, cummerbunds, belts, and the like, for carrying holders such as, but not limited to, pouches for holding items and accessories on a person's body, are **well known**. Advantages include an ability to attach pouches and accessories to a platform and easily remove them; rearrange or configure them; and exchange for other pouches or accessories." (*Id.* at 1:28-36 (emphasis added).)

Further, the strap attachment methodology for MOLLE was known:

"A pouch or other accessory will include one or more elongate straps configured to be inserted through the aligned loops. The straps will typically each be attached at one end to the pouch or accessory, and

have an opposite free end. The backside of the pouch or other accessory will typically include additional loops positioned to be disposed in alternating relation to the loops on the panel, such that the straps can be alternatingly woven through the loops on the panel and the back of the pouch or accessory, for attaching the pouch or accessory to the panel. The free end of the attachment straps can then be secured, using a snap, hook and loop fastener, or the like, to the back of the pouch or accessory.” (*Id.* at 1:50-62.)

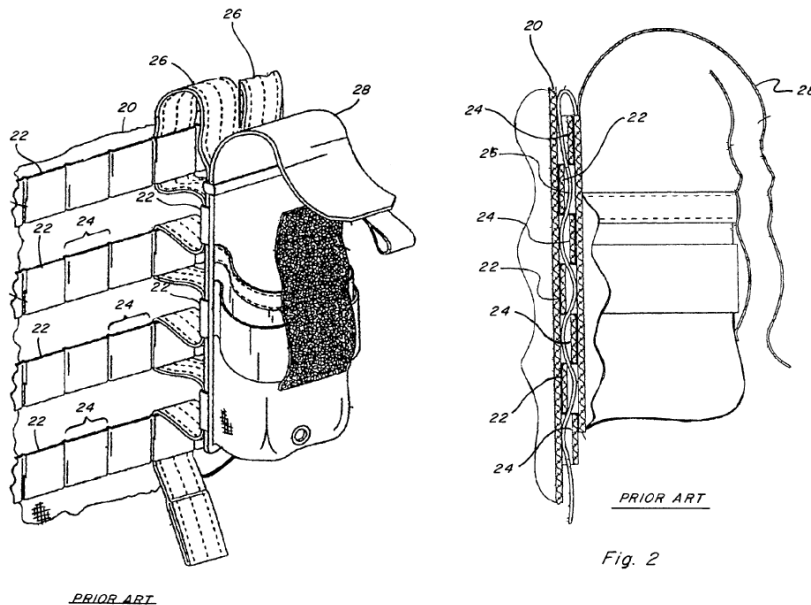


Fig. 1

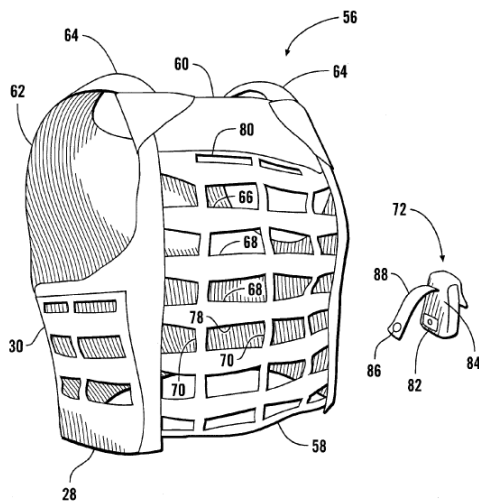
Fig. 2

40. An example of this arrangement is shown in Figures 1-2 of the '379 patent. As shown, the Challenged Patents label Figures 1-2 as “Prior Art.” Counsel for Crye tells me that this is an admission that the subject matter in these figures was known in the art.

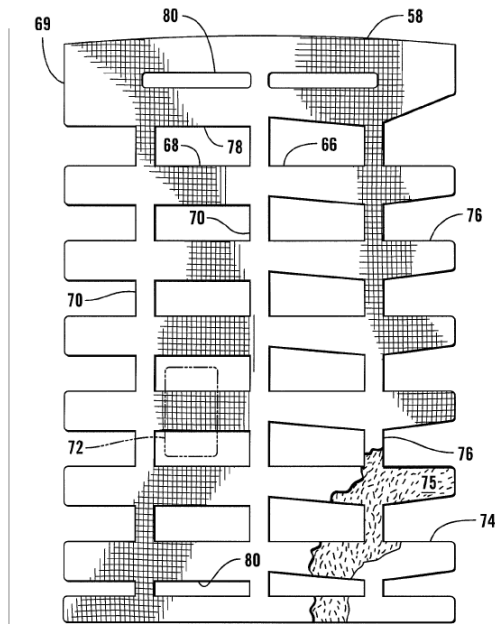
**B. Crye-436**

41. U.S. Patent No. 9,173,436 to Caleb Crye (“Crye-436”) was filed on January 11, 2011, i.e., prior to the priority date of the Challenged Patents. Thus, I understand Crye-436 to be prior art to the Challenged Patents.

42. Crye-436 is entitled “MOLLE compatible lightweight garment,” and describes lightweight garments employing a unitary bearing frame assembly. (Ex. 1004-Crye at 1:53-64.) FIGS. 3-4 (below) illustrate an example garment (56) and a corresponding unitary bearing frame assembly (58) (“UBFA”).



**FIG. 3**



**FIG. 4**

43. As shown, the UBFA (58) includes a plurality of openings or holes (66), which holes (66) may be narrow slots (80) (i.e., *slits*) or full size openings (78). (*Id.* at 2:50-62.) Crye-436 further explains that this type of tactical garment is useful for

“active occupations,” such as police officers and military personnel:

“Soldiers and police officers, for example, must carry weapons, ammunition, lights, food and beverage, etc. Yet in most situations there is a desire to avoid the carriage of extraneous items which might unnecessarily reduce the speed, agility, and endurance of the carrier. Hence it is desirable that accessories be capable of speedy attachment and removal from the wearer’s garment.” (*Id.* at 1:23-29.)

“The equipment carrying garment of the present invention offers a lightweight attachment structure which minimizes the material used by reducing the garment to a skeleton of horizontal bands connected by a few vertical bands. The garment employs a unitary bearing frame assembly which is composed of a glued layup of a substrate which is adhered to an outside layer. The layup is cut to define an array of holes delimiting horizontal bands interrupted at regular intervals by vertical bands. Such an arrangement may not have loops as such, but still is compatible with many PALS accessories, and is very lightweight.” (*Id.* at 1:54-64.)

44. Crye-436 explains that its UBFA may be a single-layer or may be multi-layered, and may include, for instance, synthetic rubbers, such as chlorosulfonated polyethylene materials (e.g., HYPALON) and woven nylon fabrics (e.g., CORDURA). (*Id.* at 2:62-3:17 and 4:44-47.)

45. Crye-436 further explains that it may include “a lightweight barrier fabric” on its interior and which is fastened to the UBFA “in such a way as not to

interfere with the attachment of accessories to the bearing frame assembly, but which serves to prevent the passage of dust, debris, etc., through the bearing frame assembly openings onto the inner garments of the wearer.” (*Id.* at 4:37-43.)

**C. Bennett-237**

46. A POSITA would have understood that hook-and-loop fastener systems (commonly known as VELCRO®) are ubiquitous in the garment art, and can be used for a variety of purposes. A patent illustrating this ubiquity is Bennett-237, i.e., U.S. Patent No. 5,692,237, issued on December 2, 1997. Given it issued many years before the priority date of the Challenged Patents, I understand Bennett-237 is prior art to the ’379 patent.

47. Bennett-237 relates to a military or law enforcement garment having an interior pocket for concealing a weapon. (Ex. 1015-Bennett at 1:2-7, 3:8-19.) This interior pocket is preferably created by attaching a fabric panel to the interior of the garment by a hook-and-loop fastening system:

“The invention comprises first and second flexible fabric panels. The panels are preferably joined along one edge which serves to hingedly connect the two panels, and the panels are releasibly secured to one another in an overlying relationship along at least one additional edge thereof. Preferably the releasable securing is accomplished by means of a hook-and-loop fastener. A holster is secured to one of the panels and the other of said panels, and the other panel thus overlies the



weapon, concealing it from [sic] from view. When the weapon is needed, a pull strap is used to separate the panels and reveal the holster containing the gun.” (*Id.* at 2:33-47.)

48. FIG. 1 of Bennett-237 illustrates one manner of using a hook-and-loop fastening system to create an accessible pocket.

**FIG. 1**

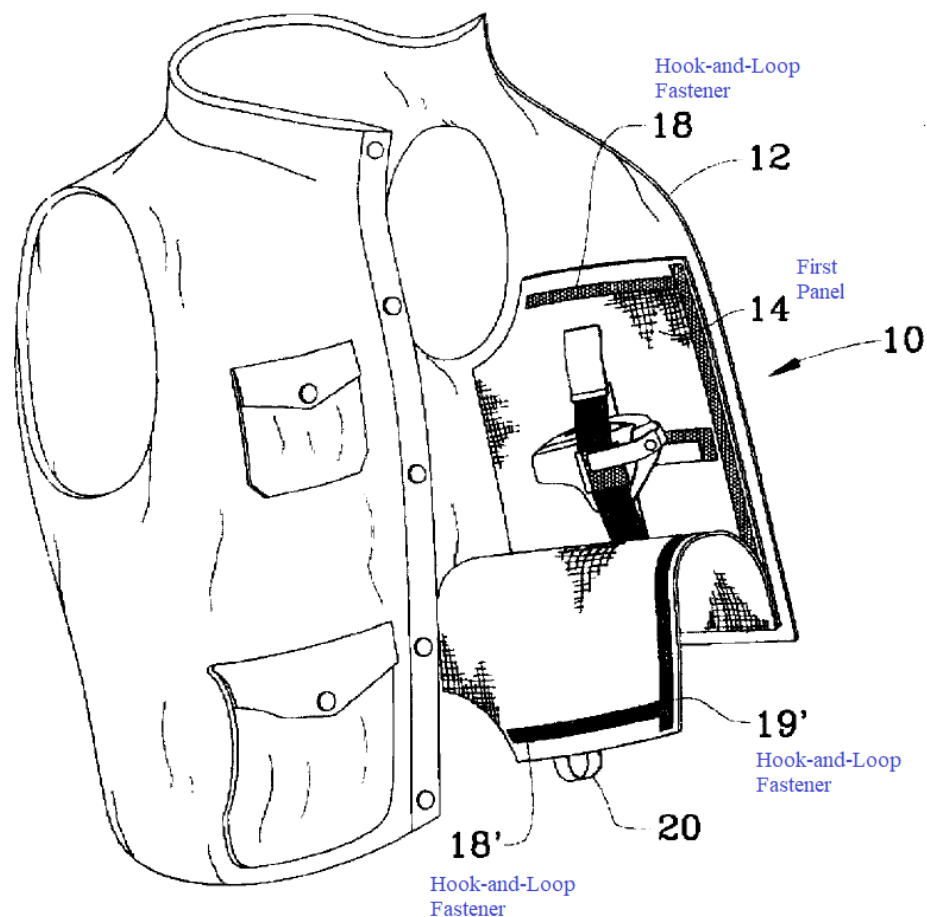


FIG. 2-6 show additional manners of using hook-and-loop fasteners to create a pocket inside a garment.

**D. Asher-149**

49. Another prior art document showing usage of hook-and-loop fasteners with military garments is Asher-145, i.e., U.S. Patent Application Publication No. 2013/0312149, filed February 5, 2007. As Asher-149 was filed many years prior to the Challenged Patents, I understand it to be prior art.

50. Like Crye-436 and Bennett-237, Asher-149 relates to tactical garments for military and other applications:

“The present invention relates to vests and other similar garments and, more particularly, to tactical vests and tactical garments which utilize armor plating in the front and/or back portion thereof for protection of the wea[r]er.” (Ex. 1005-Asher at ¶1.)

For example, FIG. 1 of Asher-149 illustrates a wearable vest:

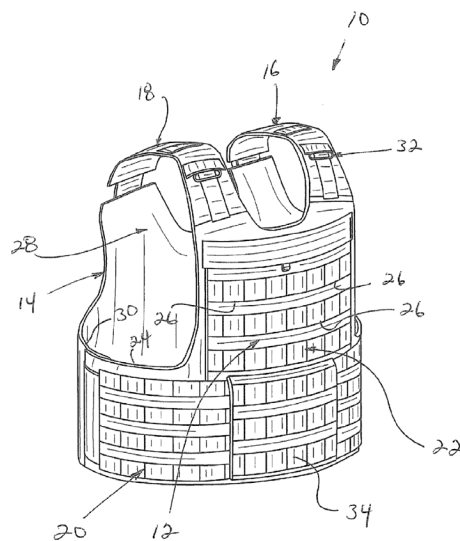


FIG. 1

51. Like Crye-436, the Asher-149 garment is MOLLE compatible. (*Id.* at

¶13.) As the reference explains, such garments were well known and typically included cavities for carrying armor panel/plates:

***“Tactical vests and other similar garments are well known, particularly in the military and law enforcement environments, and such vests and garments typically include pockets, pouches or other means for carrying ballistic armor plating for the protection of the wearer.”*** (*Id.* at ¶2 (emphasis added).)

52. Since at least 2008, ballistic armor panels/plating have been subject to well-established industry standards, including the National Institute of Justice (NIJ) Ballistic Resistance of Body Armor Standard, NIJ Standard-0101.06. The NIJ standard “is a technical document that specifies the minimum performance requirements that equipment must meet to satisfy the requirements of criminal justice agencies and the methods that shall be used to test this performance.” (Ex. 1014 at v.) The NIJ standard requires armor panels/plating to meet, *inter alia*, various size, shape, durability and ballistics capacity requirements. (*Id.* at §§ 2-7.) Section 3 of the NIJ standard provides for various industry standard definitions surrounding ballistic armor panels/plating and corresponding armor carriers. (*Id.* at 5-10.) As noted in this Section 3, the terms “armor panel” and “panel” are synonymous, and refer to the types of armor panels described by Asher-149. (*Id.* at 9.) As the NIJ standard explains:

“As of the publication of this standard, ballistic resistant body armor suitable for full-time wear throughout an entire shift of duty is available in classification Types IIA, II, and IIIA, which provide increasing levels of protection from handgun threats. Type IIA body armor will provide minimal protection against smaller caliber handgun threats. Type II body armor will provide protection against many handgun threats, including many common, smaller caliber pistols with standard pressure ammunition, and against many revolvers. Type IIIA body armor provides a higher level of protection, and will generally protect against most pistol calibers, including many law enforcement ammunitions, and against many higher powered revolvers.” (*Id.* at 71 (emphasis added).)

53. For at least these reasons, no later than 2008, a POSITA knew it was common for law enforcement garments to be equipped with one or more armor panels for preventing ballistics threats.

54. Asher-149 explains how its garments provide for (among other things) an internal pocket or pouch associated with the front and/or rear torso panels of the garment. (Ex. 1005-Asher at ¶16.) These pouches are accessible via conventional openings and corresponding conventional closure systems (e.g., hook and loop fastener elements (VELCRO®)), and are sized and shaped to carry one or more armor panels/plates to protect the wearer of the garment:

“The present invention relates to an internal vest divider member or baffle member 40 associated with an internal pocket or pouch 36 associated with either or both the front and rear torso panels 22 and 28 as will be hereinafter further described. *As best illustrated in FIGS. 3 and 4, the front torso panel 22 includes an internal pocket 36 which is specifically sized and shaped for carrying either a single armor plate member or a pair of armor plate members for providing protection to the wearer when the wearer is exposed to hostile fire and other tactical dangers.* The pocket 36 is located on the inside portion of the front torso panel 22 (FIG. 3) and can be formed by attaching or otherwise overlaying another fabric member such as the member 38 (FIGS. 3 and 4) to the inside portion of the front torso panel 22 and providing an opening 40 through such member 38 for accessing the pocket or cavity 36 formed therebetween. The fabric member 38 may comprise a mesh type material as illustrated in FIG. 3, or such member may be made of any other suitable material. *Access to the pocket 36 is provided by forming a slit, slot or separation along a sufficient portion of the inner panel member 38 such as the slot or opening 41 illustrated in FIG. 3 such that a single armor plate member or a pair of armor plate members can be inserted therethrough for operative positioning within the pocket 36. The opening or slot 41 can be maintained in a closed position through the use of any suitable conventional means such as conventional hook and loop fastener elements 42 associated with the respective end portions of the inner fabric portions 38A and 38B of the internal cover or panel member 38*

adjacent the opening 41 which can be overlapped and easily secured to each other to close access to the pocket 36. Other suitable fastening means for accomplishing this task can likewise be utilized such as conventional snap fasteners, a zipper or button arrangement, and other suitable fastening means.” (*Id.* at ¶16 (emphasis added).)

**E. MOLLE Operator’s Manual**

55. A POSITA knows that military and law enforcements garments may require occasional cleaning. MOLLE compatible garments are no exception as shown by the document “OPERATOR’S MANUAL FOR MODULAR LIGHTWEIGHT LOAD-CARRYING EQUIPMENT (MOLLE) II.” (Ex. 1010 or “the MOLLE manual”). As noted on the face of the MOLLE manual, it was approved for public release, with unlimited distribution, by the Department of the Army on November 02, 2009, i.e., before the priority date of the Challenged Patents.

56. The MOLLE manual appears to be a true and correct copy of a technical manual distributed by the Army. Such documents are, in my experience, routinely made available for free online, including on a part of the Army’s website at <https://armypubs.army.mil>. Here, the MOLLE manual is identified with the typical type of publication number for technical manuals for the Army, in this case specifically TM 10-8465-236-10. (Ex. 1010 at 1.) The manual is also identified with a PIN number 086006-000 (*id.* at 136) and an initial distribution number

256908 (*id.* at 131), both of which match the information provided on the Army website at

[https://armypubs.army.mil/ProductMaps/PubForm/Details.aspx?PUB\\_ID=86006](https://armypubs.army.mil/ProductMaps/PubForm/Details.aspx?PUB_ID=86006)

(accessed May 30, 2019). The web address also uses the ID number 86006 in the URL, which indicates the MOLLE manual is indeed an authentic copy of an Army technical manual. The same Army record at the web address above indicates that a version of TM 10-8465-236-10 was dated November 2, 2009 and was later superseded by a 2013 version of the manual. As stated above, the date on the face of the MOLLE manual is November 2, 2009 as well, which further confirms that the MOLLE manual is what it purports on its face to be, i.e., an authentic copy of the 2009 version of TM 10-8465-236-10.

57. The MOLLE manual provides teachings pertinent to those skilled in the art regarding MOLLE compatible garments, such as those described in Crye-436. (Ex. 1010 at 0001-1 (“This manual covers the fitting and use instruction for the Modular Lightweight Load-Carrying Equipment (MOLLE) II.”))

58. Chapter 4 of the MOLLE manual describes procedures relating to maintenance and cleaning of MOLLE garments, and show that a POSITA would know that MOLLE garments should be regularly inspected and cleaned. (*Id.* at Chapter 4.)

**F. Leach-996**

59. Another prior art document showing the importance of cleaning military or law enforcement garments is Leach-996, i.e., U.S. Patent No. 3,891,996, granted on July 1, 1975. Because Leach-996 was granted many years prior to the Challenged Patents, I understand it to be prior art.

60. Like Crye-436, Leach-996 relates to a bulletproof garment that can be conveniently and comfortably worn by an individual. (Ex. 1013-Leach at 1:4-8.) Leach-996 teaches that such garments may need to be periodically cleaned:

“Although many means have been devised for securing the bulletproof members to the torso of a human being, one convenient method as disclosed herein utilizes two envelope-like members secured to one another by laterally spaced straps which will hold the envelopes in proper relation to the torso of an individual by resting on the shoulders of the individual. Contained within each of these envelopes is one of the protective members constructed as described above. The envelopes are designed with a releasable closure means at the top of each so as to allow the members to be removed and permit the garment, consisting of the envelopes and straps, to be easily cleaned or washed. This is of particular advantage where such garments are to be frequently utilized such as in the day to day activities of a police officer where perspiration would be absorbed by the outer envelopes of cloth and would become extremely annoying after prolonged periods of use.” (Id. at 2:57-3:7 (emphasis added).)

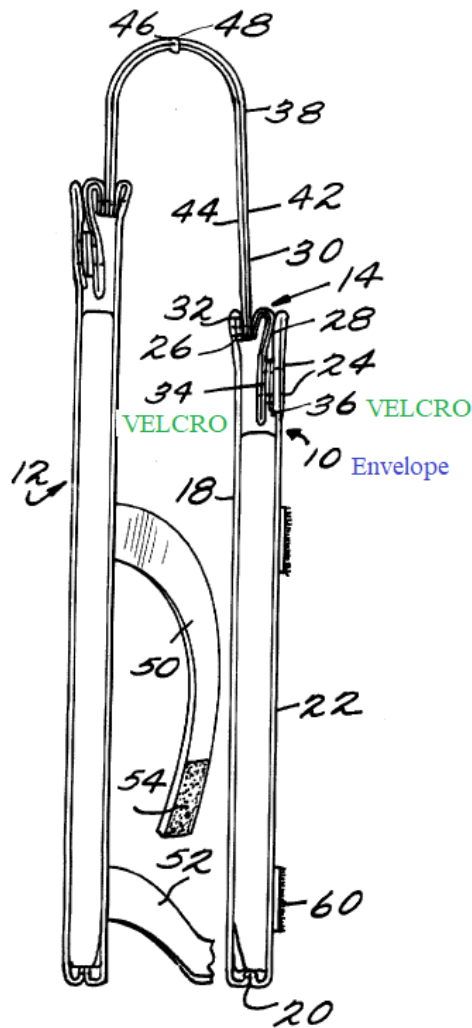


61. Leach-996 further teaches that a hook-and-loop fastening system can be used to facilitate the removal of materials from the garment to accomplish the cleaning. More particularly, envelopes 10 and 12 of the garment may be opened via a VELCRO closure system to allow removal of armor plates therefrom so that the garment may be cleaned.

“A preferred form of the ballistic vest is shown in FIG. 1 disposed properly on a person to provide protection for a major portion of his torso. The ballistic vest contains two envelopes 10 and 12 (best shown in FIG. 3) preferably constructed of non-ballistic material which is easily cleaned or washed, although they may be made of ballistic material if it is so desired so as to increase or provide additional protection.” (*Id.* at 3:45-53 (emphasis added).)

“An additional piece of fabric 28 is folded double and sewn along with strap 30 (to be described more fully below) at 32. One portion 34 of a Velcro fastener is secured to member 28 and another portion 36 is secured to member 22. Naturally, any other means of securing the upper portion of the envelope together may be utilized, such as a zipper.” (*Id.* at 4:9-15 (emphasis added).)

***Fig. 3.***



**VI. THE CHALLENGED CLAIMS OF THE '379 PATENT ARE INVALID**

62. I have been asked by counsel to analyze claims 1-11, 13-14, 17-19, 21-23 (the "Challenged Claims") of the '379 patent and provide my opinion, rendered from the perspective of a POSITA, whether the prior art discloses the limitations of the Challenged Claims. Below I provide below my opinion with respect to each

limitation of the Challenged Claims.

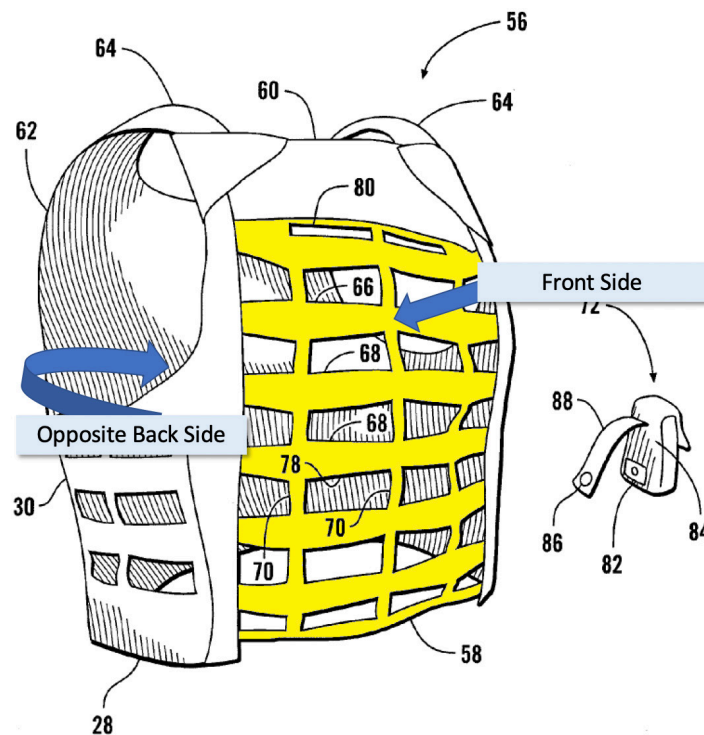
**A. Crye-436 discloses, teaches, and suggests all limitations of claims 1-11, 13-14, 17-19, and 21-23**

**[CLAIM 1-Preamble] “An attachment system, comprising:”**

63. Crye-436 discloses an attachment system as shown below.

**[1a] a platform having a front side and an opposite back side,**

64. Crye-436 discloses a platform (called a unitary bearing frame assembly (“UBFA”) 58). This platform has a front side and an opposite “back side.” FIG. 3 shows the front side. The back side is on the “inside” of the garment that is illustrated in the figure:



(See, e.g., Ex. 1004-Crye at FIG. 3; see also FIG. 4.)

65. For at least these reasons, Crye-436 discloses this limitation.

**[1b] the platform comprising laminated layers including at least one fabric layer,**

66. Crye-436 discloses that the UBFA (58) may be “a composite of multiple layers.” (Ex. 1004-Crye at 4:44-45.) In such a multi-layer configuration, the UBFA layers may be laminated together:

“[UBFA 58] is comprised of a substrate 74 to which an exterior layer 76 is affixed. The substrate 74 may be formed of TEGRIS® material, a polypropylene thermoplastic composite with excellent impact resistance and stiffness and lightweight composition, manufactured by Milliken & Company of Spartanburg, S.C., or a material similar to the chlorosulfonated polyethylene material formerly manufactured by DuPont under the trademark HYPALON, which has a woven fabric core, and is covered in rubber. Alternatively, the substrate may be a singly woven nylon screen or mesh material. The exterior layer should be a lightweight, printable, and abrasion resistant material, such as the CORDURA® nylon fabric manufactured by the Invista subsidiary of Koch Industries, Inc. Thus the exterior layer may be printed with decoration or a camouflage pattern. The exterior layer may be attached to the substrate by a heat activated adhesive, for example the BEMIS thermoplastic adhesive film manufactured by CDNT Company d/b/a Can-Do National Tape 195 Polk Avenue, Nashville, Tenn. The adhesive 75 may be applied as a thin film sheet between the substrate material and the exterior layer material, the

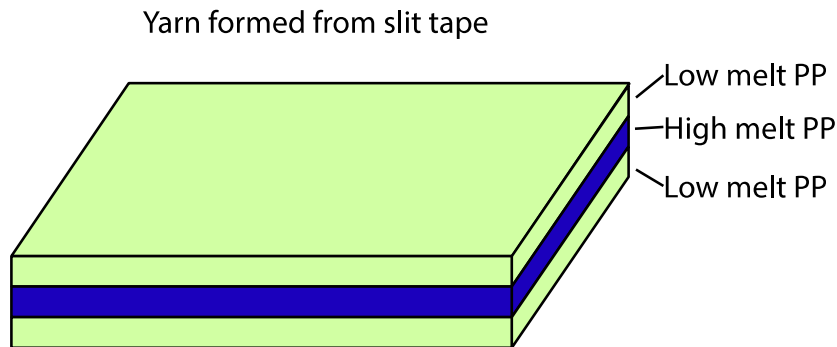
composite being activated by exposure to temperatures of about 300 degrees F. Once the composite is thus formed, it may be cut to the desired configuration to add the through holes of the desired shape and location. The material may be die cut or laser cut, formed in a heat stamping process, or in any way that would be used for cutting fabric.” (Ex. 1004-Crye at 2:64-3:21.)

67. The above excerpt shows that the UBFA (58) may be a laminated body comprising a substrate layer (“74”) and an exterior layer (“76”). For instance, by applying an adhesive between the substrate material and the exterior layer, and then heating, a POSITA knows that a laminate of the two materials is formed.

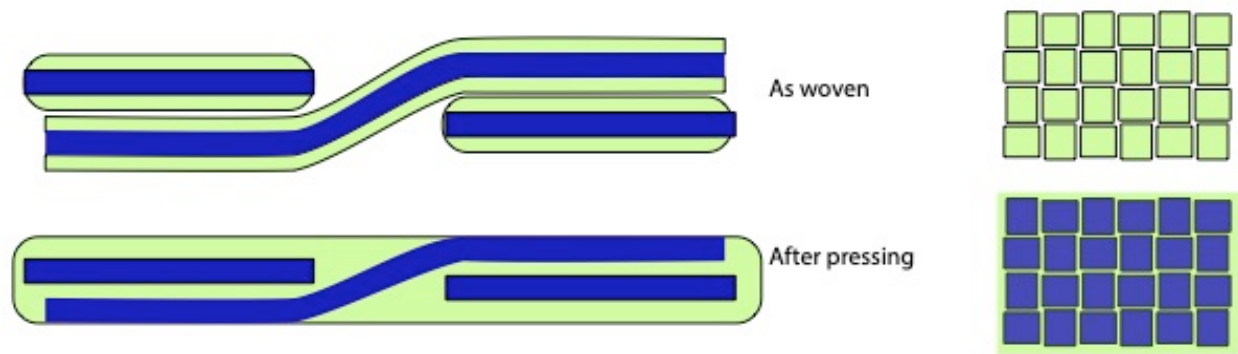
68. Crye-436 also discloses that the substrate layer and/or the exterior layer may include fabric:

*“The substrate 74 may be formed of TEGRIS® material, a polypropylene thermoplastic composite with excellent impact resistance and stiffness and lightweight composition, manufactured by Milliken & Company of Spartanburg, S.C., or a material similar to the chlorosulfonated polyethylene material formerly manufactured by DuPont under the trademark HYPALON, which has a woven fabric core, and is covered in rubber. Alternatively, the substrate may be a singly woven nylon screen or mesh material. The exterior layer should be a lightweight, printable, and abrasion resistant material, such as the CORDURA® nylon fabric manufactured by the Invista subsidiary of Koch Industries, Inc.”* (Ex. 1004-Crye at 2:62-3:8 (emphasis added).)

As shown, the substrate may be formed of a TEGRIS® material, which is a woven material formed from laminates. TEGRIS® is a fabric system formed from slit film yarns, each of which is a laminate of two low melting temperature polypropylene and a central high melting temperature polypropylene, as illustrated:



69. The TEGRIS® fabric is produced by weaving these laminated yarns into a fabric. (*See, e.g.*, Ex. 1016 at 8:57-9:2 (describing at a high level how material like TEGRIS is created).) That fabric is subsequently heated and pressurized to melt the low melt polypropylene while preserving the woven structure of the high melt polypropylene. Consequently, the woven high melt polypropylene fabric is encapsulated in low melt polypropylene, resulting in a laminated woven fabric as illustrated:



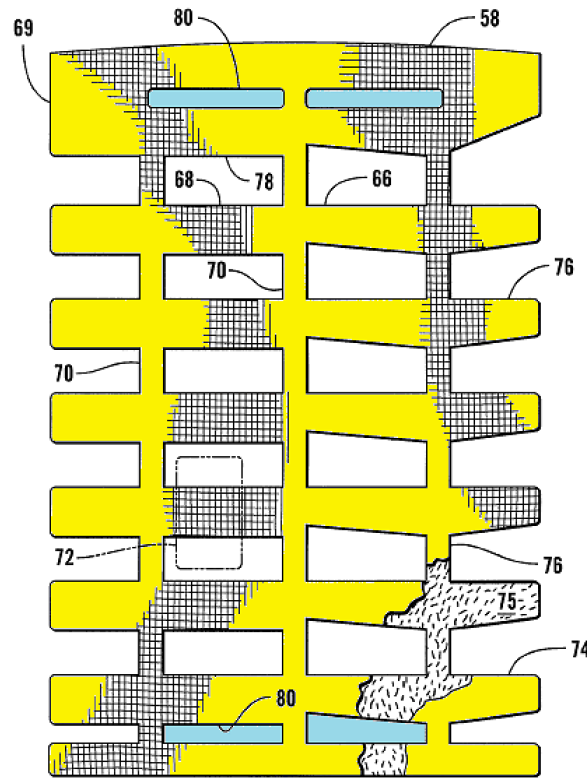
70. Crye-436 also states that the substrate may alternatively be similar to a Hypalon fabric, which “has a woven nylon fabric core” laminated with Hypalon synthetic rubber. (Ex. 1004-Crye at 2:62-3:8.)

71. Finally, the Crye-436 substrate may be a singly woven nylon screen, which is also a fabric layer. (*Id.*) The exterior layer may also be made of fabric, being a “lightweight, printable, and abrasion resistant material, such as the CORDURA® nylon *fabric*....” (*Id.* (emphasis added).)

72. Thus, Crye-436 discloses that at least one layer of its UBFA (58) may be a fabric layer, and therefore discloses this limitation.

**[1c] the platform having a plurality of slits therethrough defined and bound by edges of the layers fused together to have increased wear and abrasion resistance,**

73. Crye-436 discloses UBFA (58) as having slits therethrough, as seen in FIGS. 3-4 of Crye-436 show. The slits (80) are highlighted blue in FIG. 4 below:



**FIG. 4**

74. Crye-436 further discloses that these slits (80) (called slots in Crye-436) are narrow in height:

“The holes 66 also include narrow slots 80, for example at the top of the bearing frame assembly 58, which are as wide as the full height openings 78, but which are merely of sufficient height to allow a strap or other attachment element of an accessory to access the horizontal band partially defined by the slot 80.” (Ex. 1004-Crye at 2:56-61.)

Thus, Crye-436 discloses a platform having a plurality of slits therethrough.

75. The Crye-436 slits may be produced by, for instance, laser cutting of



the UBFA (58):

“Once the composite is thus formed, it may be cut to the desired configuration to add the through holes of the desired shape and location. The material may be die cut or laser cut, formed in a heat stamping process or in any way that would be used for cutting fabric. It will be observed that although the holes may be arranged in a regular array to match the arrangement of a PALS system of webbing, it is not necessary that the horizontal bands be at the same level as they progress across the garment, and may be positioned in any arrangement desired.” (Ex. 1004-Crye at 3:17-26 (emphasis added).)

76. I note that the '379 patent discloses that its slits may be made in an identical manner:

“The slits 36 can be formed in any manner suitable for the anticipated application, as a non-limiting example, by knife or die cutting, using a button hole machine, or more preferably, **by laser cutting**.” ('379 patent at 7:33-36 (emphasis added); *see also id.* at 10:5-10.)

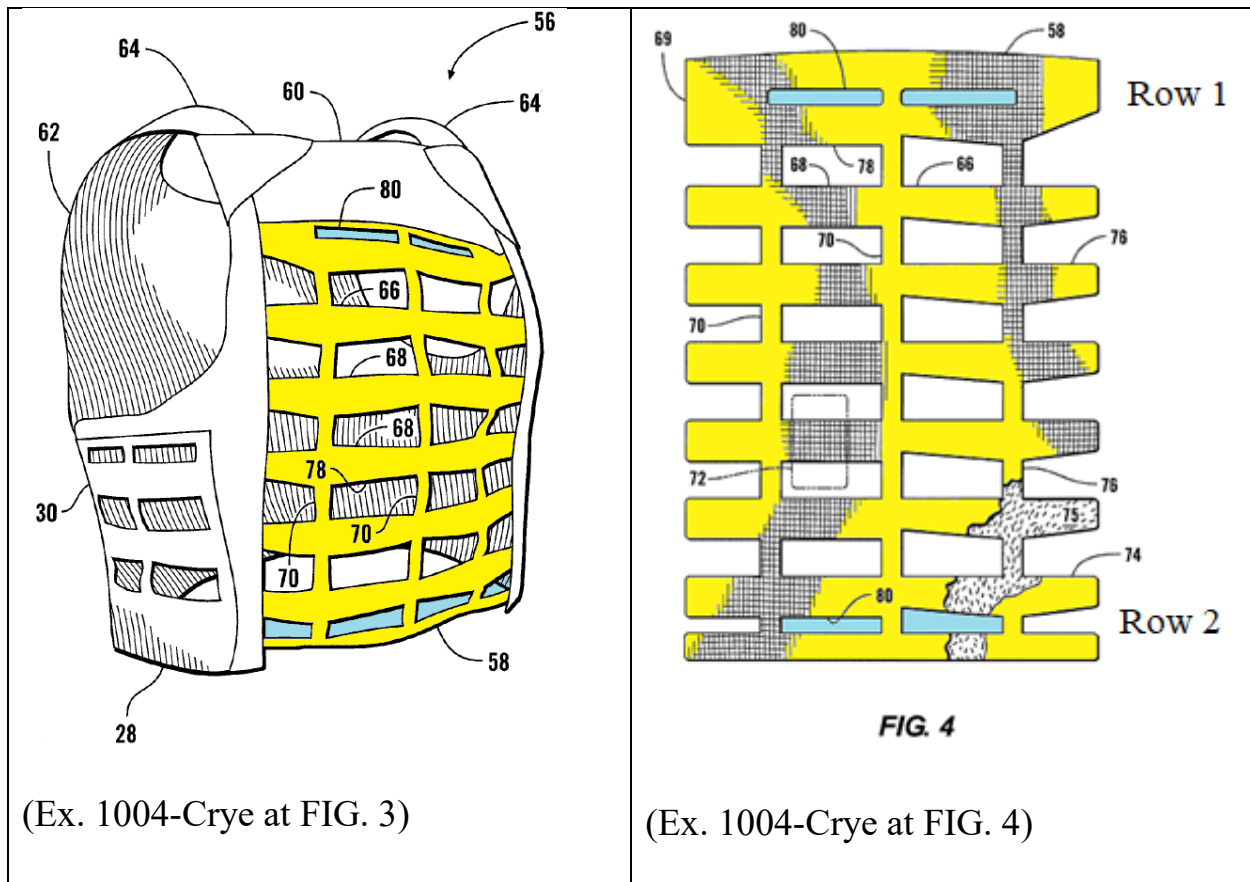
“As another preferred aspect, the fabric layers comprising the edges bounding *the slits are fused together, e.g., using a laser cutting process for forming the slits, so as to be hardened* but at least semi-flexible to allow insertion of flat straps and tabs through the slits, and such that the edges will not fray or wear significantly under expected use.” (*Id.* at 3:32-37 (emphasis added).)

Accordingly, a POSITA would know that, when using laser cutting to make slits (80) in the Crye-436 UBFA (58), those slits would be “defined and bound by edges of the layers fused together to have increased wear and abrasion resistance,” as confirmed by the ’379 patent itself.

77. For at least these reasons, Crye-436 discloses this limitation.

**[1d] the slits arranged in a predetermined pattern of aligned and spaced apart rows,**

78. Crye-436 discloses that the slits (again highlighted blue) are arranged in a predetermined pattern of aligned and spaced apart rows, as shown in FIGS. 3-4:



As these figures show, the slits (80) are in a predetermined pattern and are in spaced apart rows. (*See also* Ex. 1004-Crye at FIG. 2.) Further, the slits (80) are aligned as the slits (80) on the top row are aligned with the slits (80) on the bottom row. Thus, Crye-436 discloses “the slits arranged in a predetermined pattern of aligned and spaced apart rows.”

79. For at least these reasons, Crye-436 discloses limitation 1d.

80. Moreover, a POSITA would know that the specific configuration shown in FIGS. 3-4 of Crye-436 is merely one of many that may be used with UBFA (58). This at least because Crye-436 discloses that any number of slits (80) or full height openings (78) can be used with the garment, and it is preferred to have a ratio of openings to total surface area of from 25 to 75%:

“The equipment carrying garment of the present invention offers a lightweight attachment structure which minimizes the material used by reducing the garment to a skeleton of horizontal bands connected by a few vertical bands.... The layup is cut to define an array of holes delimiting horizontal bands interrupted at regular intervals by vertical bands. Such an arrangement may not have loops as such, but still is compatible with many PALS accessories, and is very lightweight. It is an object of the present invention to provide a load supporting garment which is compatible with the MOLLE system which is very lightweight. It is another object of the present invention to provide a load supporting

garment which can be produced to accommodate attachments at any desired location.” (Ex. 1004-Crye at 1:54-2:3 (emphasis added).)

“The ratio of opening area to total surface area depends on whether the cut pattern of openings is carried to the edge of the sample, as shown in FIG. 4, or is terminated within the perimeter to maintain a solid border around the sample. If the cut pattern is carried out consistently, in a preferred embodiment 43% of the material is removed by the cut holes. It is possible to adjust the size of the uncut material and the cut pattern so that the ratio is as little as 25% or as large as 75%.” (*Id.* at 4:18-25.)

81. Thus, a POSITA would know that Crye-436 discloses, teaches, and suggests that its UBFA (58) may include only slits, only full height openings, or any suitable combination of slits and full height openings, depending on application.<sup>1</sup> Indeed, at least by stating “[i]t is possible to adjust the size of the uncut material,” Crye-436 indicates that any appropriate combination of slits and/or full size openings may be used. Further, a UBFA (58) consisting only of slits may realize the 25-75% opening to total surface area preferred ratio of Crye-436. (Ex. 1012.)

82. Thus, in addition to the embodiment of FIGS. 3-4 (where the two rows of slits are spaced apart), Crye-436 also discloses, teaches, and suggests adjacent

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<sup>1</sup> As noted previously, Carlson (Ex. 1008) also shows that a MOLLE compatible garment may include all slits as its openings.

rows of aligned slits, which also meets the requirements of limitation 1d.

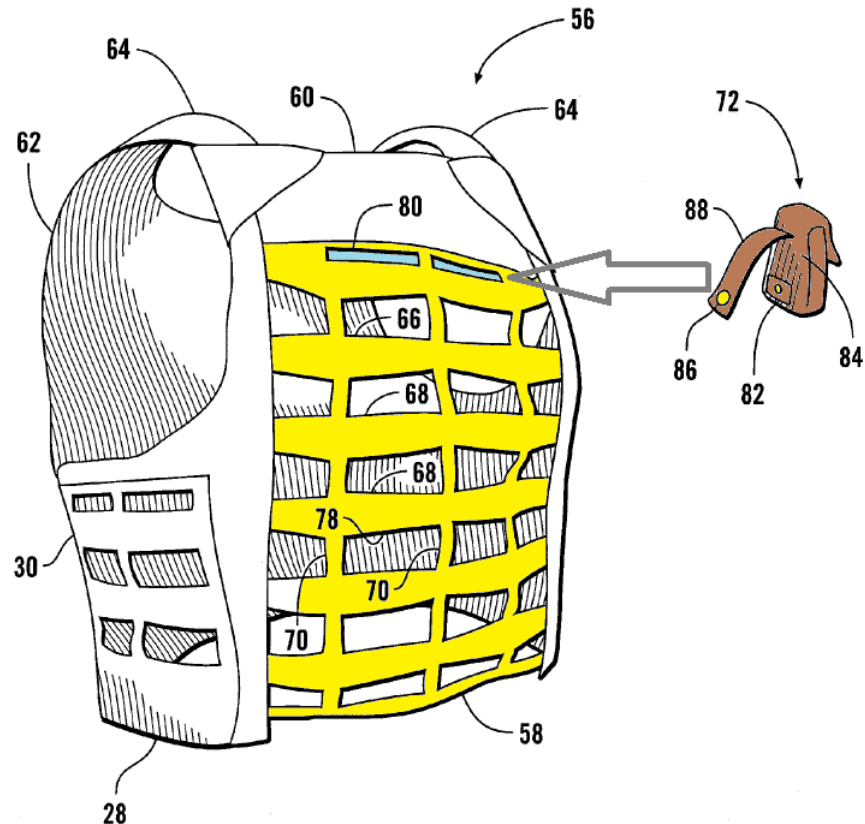
**[1e] the slits being configured to receive flexible, generally flat straps or tabs therethrough between the front side and the back side to attach at least one holder to the platform, and**

83. Crye-436 discloses a strap (88) of a pouch/accessory (72) (a holder) is used to attach the pouch (72) to the platform, as shown in FIG. 3. The Crye-436 patent explains:

*“An accessory 72, as shown in FIG. 3, may be attached to any desired horizontal band of the bearing frame assembly 58. ... A strap 88 is fastened to the accessory rear wall spaced from the loop. A second part of the two-part fastener is configured to mate with the first part of the two-part fastener. The second part is fixed to the strap 88, so the strap is capable of passing through the loop 82, and around the loop to bring the first part and the second part of the fastener into engagement to retain the horizontal band between the strap and the accessory rear wall. The accessory 72 may thus readily be mounted to the garment 20, having loops, or to portions of the garment 56 having horizontal bands without loops.”* (Ex. 1004-Crye at 4:48-67 (emphasis added).)

84. As noted above, Crye-436 also discloses that the slits (66) are “of sufficient height to allow a strap or other attachment element of an accessory to access the horizontal band partially defined by the slot 80.” (Ex. 1004-Crye at 2:56-61.) Thus, a POSITA would know Crye-436 is disclosing that its accessory (72) may be attached to the slit(s) of Crye-436’s UBFA (58). One example of such an

arrangement is illustrated below.



85. For at least these reasons, Crye-436 discloses “the slits being configured to receive flexible, generally flat straps or tabs therethrough between the front side and the back side to attach at least one holder to the platform,” so Crye-436 discloses limitation 1e.

**[1f] the platform being supported by and comprising an element of a carrier configured to be worn against a portion of a user’s body,**

86. Crye-436 discloses this limitation. First, I note that ’379 patent refers to a “carrier” as follows:

“Modular pouch attachment systems and methods for carrier garments, hereinafter sometimes referred to by the term carrier or carriers, such as, but not limited to, vests, cummerbunds, belts, and the like, for carrying holders such as, but not limited to, pouches for holding items and accessories on a person's body, are well known. Advantages include an ability to attach pouches and accessories to a platform and easily remove them; rearrange or configure them; and exchange for other pouches or accessories.” (’379 patent at 1:27-36.)

87. Crye-436 discloses the same types of “carriers” / “carrier garments” (e.g., vests, belts, etc.). (Ex. 1004-Crye at 1:18-20 (“The present invention relates to garments generally, and more particularly to lightweight utility garments which can accommodate various accessory elements”); 1:29-30 (disclosing that garments may be vest and belts, among others), 2:23-32 (describing an “equipment carrying garment”), and FIGS. 2-3.)

88. Crye-436’s UBFA (58) is also part of and supported by a carrier configured to be worn against a portion of a user’s body. In the specific embodiment shown in FIG. 3, the “carrier” takes the form of a vest garment that is worn by a person against his or her body.

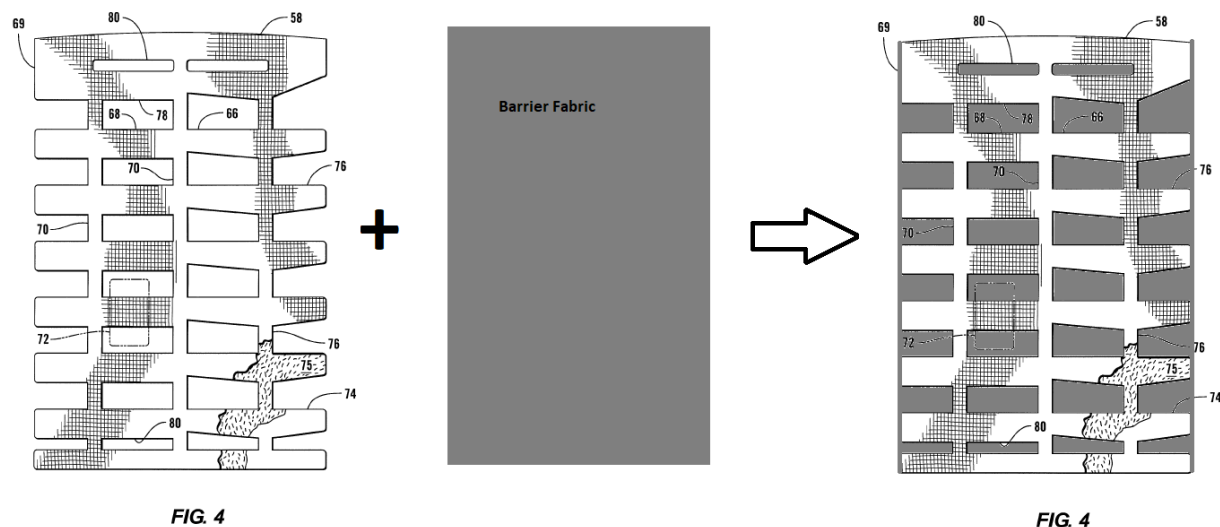
89. For at least these reasons, Crye-436 discloses limitation 1f.

**[1g] the back side and at least one element of the carrier or a backing element bounding a generally flat cavity through which the back side can be accessed.**

90. Crye-436 discloses teaches, and suggests this limitation. Crye-436

discloses a “barrier fabric” that may be “fastened to the bearing frame assembly 58 in such a way as not to interfere with the attachment of accessories to the bearing frame assembly, but which serves to prevent the passage of dust, debris, etc., through the bearing frame assembly openings onto the inner garments of the wearer.” (Ex. 1004-Crye at 4:37-43.)

91. One potential method of fastening the Crye-436 barrier fabric to the Crye-436 UBFA is shown in the below diagram, which is based on FIG. 4 plus the barrier fabric disclosure of Crye-436 (the gray barrier fabric portion is not illustrated in the figures of Crye-436; instead it is described in the text).



92. Crye-436 does not expressly state where to fasten the barrier fabric to the UBFA. However, Crye-436 discloses that its barrier fabric should be attached to the UBFA “in such a way as not to interfere with the attachment of accessories to

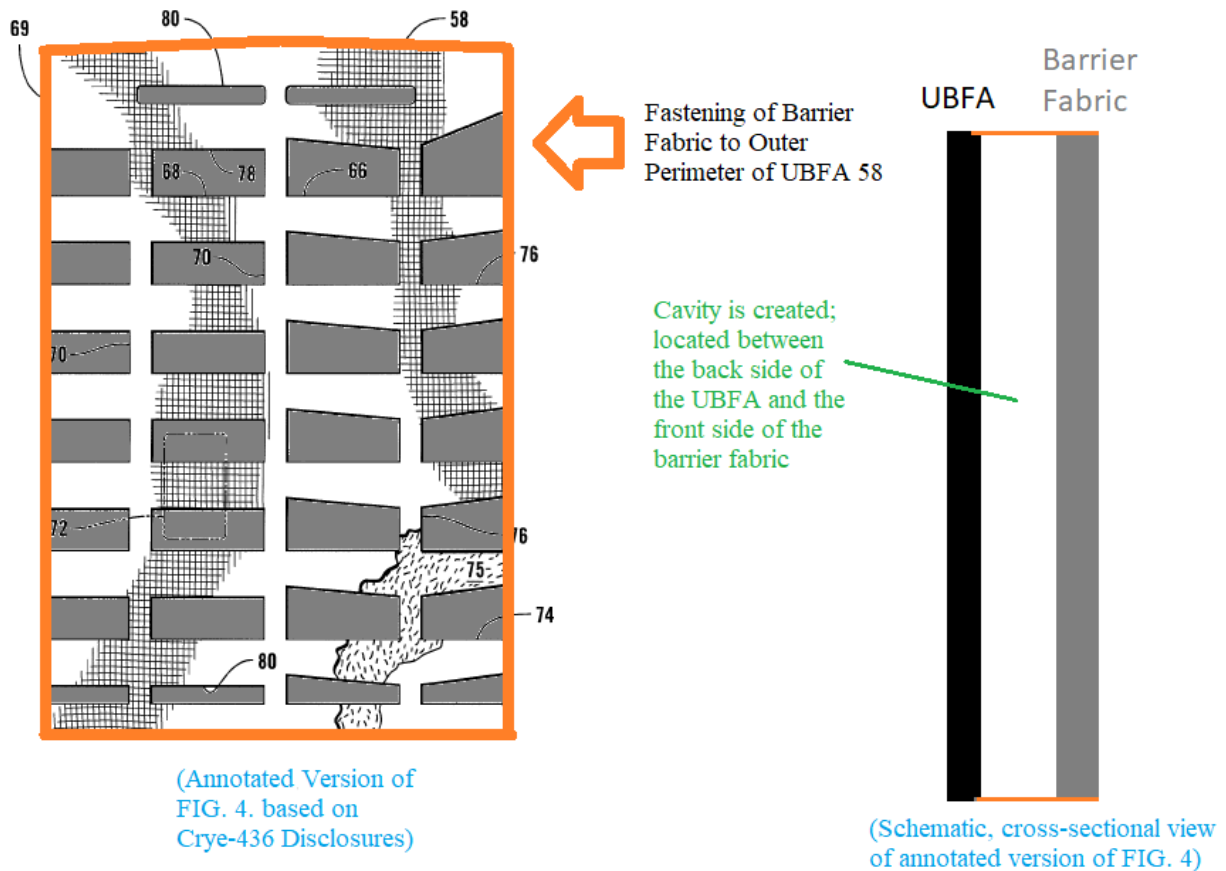


the bearing frame assembly, but which serves to prevent the passage of dust, debris, etc., through the bearing frame assembly openings onto the inner garments of the wearer.” (Ex. 1004-Crye at 4:37-43.)

93. Thus, a POSITA would know to attach the barrier fabric of Crye-436 to the outer perimeter of the UBFA so as to accomplish the stated goal of attaching the barrier fabric in such a “way as not to interfere with the attachment of accessories to the bearing frame assembly, but which serves to prevent the passage of dust, debris, etc., through the bearing frame assembly openings onto the inner garments of the wearer.”

94. By attaching the barrier fabric to the outer perimeter of the UBFA, any debris passing through the openings (66) of the UBFA would be fully contained. Further, attaching to the outer perimeter of the UBFA would not interfere with attachment of accessories because the slits (80) and/or full size openings (78) would remain available for attachment.

95. Fastening the barrier fabric to the UBFA (58) in such a manner would also create a generally flat cavity, as shown by the below example illustration.



96. For at least these reasons, Crye-436 discloses, teaches, and suggests to a POSITA the limitation “the back side and at least one element of the carrier or a backing element bounding a generally flat cavity.”

97. The combination of Crye-436’s UBFA and barrier fabric also allows access to the back side of Crye-436’s UBFA (58). As shown above, Crye436’s UBFA may include full size openings (78). A POSITA would know that a person’s finger(s) would access the backside of the UBFA (58) via these full size openings (78) to, for instance, pull one or more straps (88) of an accessory through one or

more slits (80) and/or full-size openings (78) so as to attach the accessory (72) to the UBFA (58):

“In should be noted that the garment may be provided with a lightweight barrier fabric on the interior which is fastened to the bearing frame assembly 58 in such a way as not to interfere with the attachment of accessories to the bearing frame assembly...” (*Id.* at 4:37-43.)

“An accessory 72, as shown in FIG. 3, may be attached to any desired horizontal band of the bearing frame assembly 58.... The second part is fixed to the strap 88, so the strap is capable of passing through the loop 82, and around the loop to bring the first part and the second part of the fastener into engagement to retain the horizontal band between the strap and the accessory rear wall. The accessory 72 may thus readily be mounted to the garment 20, having loops, or to portions of the garment 56 having horizontal bands without loops.” (*Id.* at 4:48-67 (emphasis added).)

98. For at least these reasons, Crye-436 discloses, teaches, and suggests “the back side and at least one element of the carrier or a backing element bounding a generally flat cavity through which the back side can be accessed,” i.e., discloses teaches, and suggests limitation 1g.

99. For the above reasons, Crye-436 discloses, teaches, and suggests all limitations of claim 1.

**[CLAIM 3] The attachment system of claim 1, wherein at least one of the layers comprises an adhesive.**

100. Crye-436 discloses claim 3. As noted above relative to limitation 1b, Crye-436 discloses the use of an adhesive to create the UBFA (58). (Ex. 1004-Crye at 3:10-17.) For at least this reason, Crye-436 discloses claim 3.

**[CLAIM 4] The attachment system of claim 1, wherein at least one of the layers comprises a synthetic rubber compound.**

101. Crye-436 discloses claim 4. Specifically, Crye-436 discloses that the substrate (74) may be “a material similar to the chlorosulfonated polyethylene material formerly manufactured by DuPont under the tradename HYPALON, which has a woven fabric core and is covered in rubber.” (Ex. 1004-Crye at 2:64-3:4.) Chlorosulfonated polyethylenes, such as HYPALON, are well-known synthetic rubber compounds as evidenced by U.S. Patent No. 5,789,327:

“General reference has been made to an elastomer 32 bonding the layers of ballistic cloth 30 together. Although it is generally anticipated that a number of materials having elastic properties may be used. Examples of such materials include thermoplastics, adhesives, thermo-set adhesives, rubbers, or other materials capable of recovering from large deformations quickly and forcibly. From this group of materials, rubber is preferred. Rubber may be comprised of natural rubber, synthetic rubber, or compounds containing both. **Synthetic rubbers include** polybutadiene rubbers (BRs); polyisoprene rubbers (IRs); the 1000 series of styrene-butadiene rubbers (SBRs); nitrile rubbers

(NBRs); butyl rubber (IIR); ethylene-propylene terpolymer (EPDM); silicone rubbers; types GN, GNA, GW, FB, and GRT neoprenes (CRs); polysulfides; polyacrylate rubbers; epichlorohydrin rubbers; fluoroelastomers (FDM); **HYPALON, a chlorosulfonated polyethylene (CSM)**; halogenated butyl; and chloronited polyethylene rubbers (CPEs).” (Ex. 1009 at 5:51-6:2 (emphasis added).)

For at least these reasons, Crye-436 discloses claim 4.

**[CLAIM 5] The attachment system of claim 4, wherein the platform comprises a woven nylon fabric laminated to the synthetic rubber compound.**

102. Crye-436 discloses claim 5. As explained above relative to claim 4, the substrate layer (74) may “a material similar to the chlorosulfonated polyethylene material formerly manufactured by DuPont under the tradename HYPALON, which has a woven fabric core and is covered in rubber.” (Ex. 1004-Crye at 2:64-3:4.) Such a substrate includes a synthetic rubber exterior, i.e., HYPALON. As explained previously relative to limitation 1b, Crye-436 discloses that the exterior layer (76) of its UBFA (58) may be laminated to the substrate (74), i.e., may be laminated to the synthetic rubber compound. Crye-436 further discloses that the exterior layer (76) may be a woven nylon fabric:

“The exterior layer should be a lightweight, printable, and abrasion resistant material, such as the CORDURA® nylon fabric manufactured by the Invista subsidiary of Koch Industries, Inc.” (Ex. 1004-Crye at 3:5-8.)

103. CORDURA is a known woven nylon fabric as evidenced by U.S. Patent Application Publication No. 2008/0318017:

“Woven fabrics produced from bulky air textured yarns are certified as CORDURA® branded fabrics (CORDURA® is a registered trademark for durable fabrics of INVISTA S. á r. I., Three Little Falls Centre, 2801 Centreville Road, Wilmington, Del., 19808, USA).” (Ex. 1011 at ¶3.)

For at least these reasons, Crye-436 discloses claim 5.

**[CLAIM 6] The attachment system of claim 1, wherein the edges are hardened by laser fusion.**

104. As explained above relative to limitation 1c, Crye-436 discloses using laser cutting to make slits in a laminated platform. In doing so, the slit “edges are hardened by laser fusion,” as expressly noted by the ’379 patent:

“The slits 36 can be formed in any manner suitable for the anticipated application, as a non-limiting example, by knife or die cutting, using a button hole machine, or more preferably, *by laser cutting*.” (’379 patent at 7:33-36 (emphasis added); *see also id.* at 10:5-10.)

“As another preferred aspect, the fabric layers comprising the edges bounding *the slits are fused together, e.g., using a laser cutting process for forming the slits, so as to be hardened* but at least semi-flexible to allow insertion of flat straps and tabs through the slits, and such that the edges will not fray or wear significantly under expected use.” (*Id.* at 3:32-37 (emphasis added).)

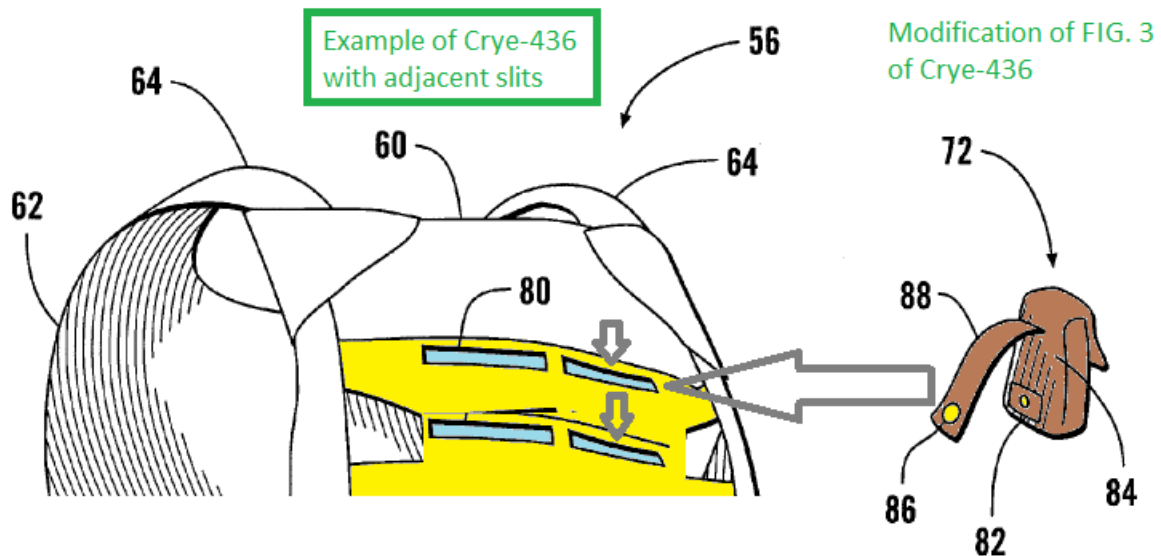
For at least these reasons, Crye-436 discloses claim 6.

**[CLAIM 7] The attachment system of claim 1, further comprising at least one strap woven through selected ones of the slits attaching a holder to the platform.**

105. Crye-436 discloses, teaches, and suggests this limitation. As explained above relative to limitation 1d, Crye-436 discloses using any suitable combination of slits (80) and full height openings (78) with its UBFA (58), including adjacent rows of aligned slits. In such an arrangement, when a strap of a pouch (e.g., the strap (88) of accessory pouch (72) of Crye-436) is attached to the UBFA (58), the strap would be woven through selected ones of the slits to attach that pouch (holder) to the UBFA (58) per standard MOLLE practice, as shown by the below illustrative example.<sup>2</sup>

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<sup>2</sup> This methodology is also confirmed to be known / conventional by FIGS. 1-2 and the *Background Art* section of the '379 patent.



For at least these reasons, Crye-436 discloses, teaches, and suggests claim 7.

**[CLAIM 10] The attachment system of claim 1, wherein the carrier comprises a vest, a cummerbund, or a belt.**

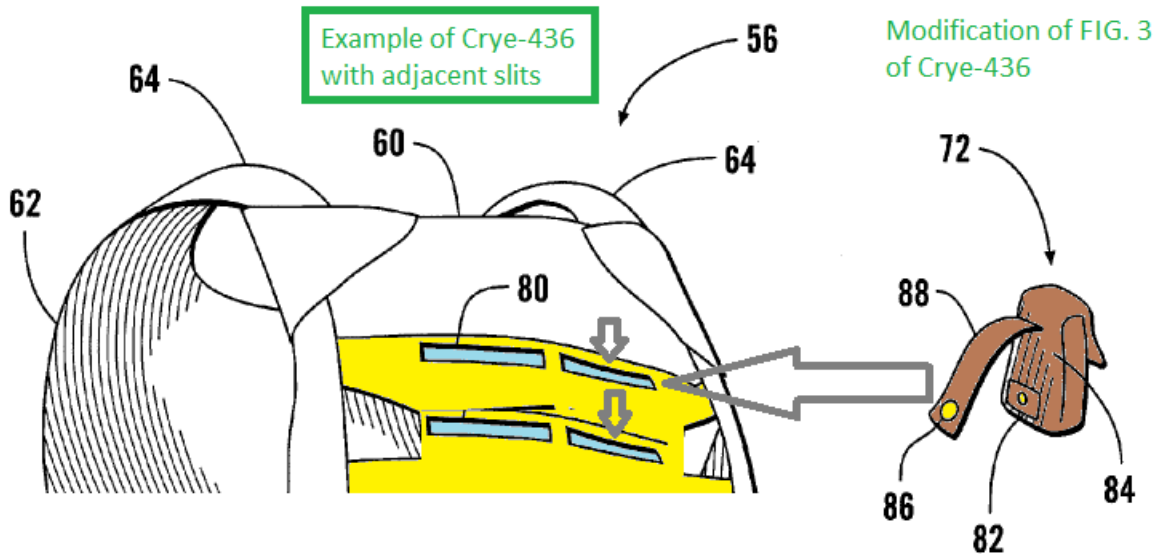
106. As shown above with respect to limitation 1a, FIGS. 3-4 of Crye-436 show that the garment may be a vest. For at least this reason, Crye-436 discloses claim 10.

**[CLAIM 11] The attachment system of claim 1, further comprising a holder configured for holding at least one object or article, having a strap extending therefrom and woven through at least two of the slits interlockingly attaching the holder to the platform.**

107. As explained above relative to limitation 1d and claim 7, Crye-436 discloses, teaches, and suggests using any suitable combination of slits (80) and full height openings (78) with its UBFA (58), including adjacent rows of aligned slits. In such an arrangement, when a strap of a pouch (e.g., the strap (88) of accessory



pouch (72) of Crye-436 is attached to the UBFA (58), the strap would be woven through selected ones of the slits to attach that pouch (holder) to the UBFA (58) per standard MOLLE practice, as shown by the below illustrative example.



For at least these reasons, Crye-436 discloses, teaches and suggests “a holder configured for holding at least one object or article, having a strap extending therefrom and woven through at least two of the slits.”

108. Crye-436 also discloses that its example holder (72) is “interlockingly attach[ed]” to the platform. As shown in FIG. 3, the example holder 72 includes a “two-part fastener 86 such as a snap.” (Ex. 1004-Crye at 4:56-58.) Crye-436 goes on to explain:

“A second part of the two-part fastener is configured to mate with the first part of the two-part fastener. The second part is fixed to the strap 88, so the strap is capable of passing through the loop 82, and around

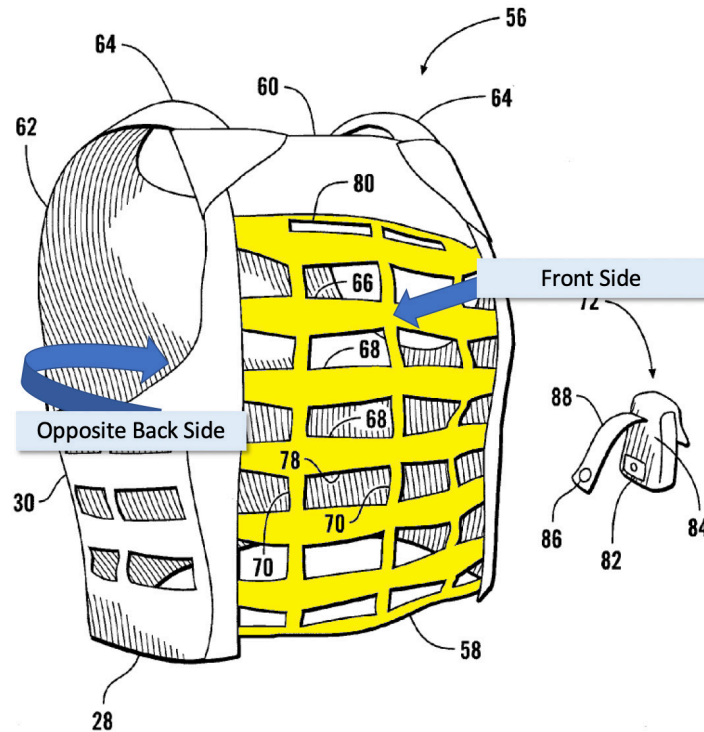
the loop to bring the first part and the second part of the fastener into engagement to retain the horizontal band between the strap and the accessory rear wall. The accessory 72 may thus readily be mounted to the garment 20, having loops, or to portions of the garment 56 having horizontal bands without loops.” (*Id.* at 4:59-67.)

In other words, the strap (88) and two-part fastener (86) of the holder (72) interlockingly attach the holder (72) to Crye-436’s (UBFA (58)).

109. For at least these reasons, Crye-436 discloses, teaches, and suggests claim 11.

**[CLAIM 13-PRE] An attachment system for removably attaching at least one holder to a carrier configured for wear on a human body, the carrier having at least one outer surface oriented to face away from a body on which the carrier is worn, the attachment system comprising:**

110. Crye-436 discloses a garment having a unitary bearing frame assembly (UBFA (58)):



(Ex. 1004-Crye at FIG. 3; *see also* FIG. 4.) As shown in the above figure, the garment is configured to be worn by a human and the outer surface of the garment is oriented away from the wearer. The figure also shows a removable holder (72) (“pouch” or “accessory”) that can be attached to the garment. Crye-436 also explains in detail how the accessory (72) may be attached to the UBFA (58). (Ex. 1004-Crye at 4:48-67.)

111. For at least these reasons, Crye-436 discloses the preamble.

**[13a] a platform supported in an upstanding orientation on the carrier in covering relation to a surface of the carrier or an opposing backing element to bound a generally flat cavity therebetween,**

112. Crye-436 discloses a unitary bearing frame assembly (UBFA) (58),

which is a platform. (*See also* limitation 1a.) The UBFA (58) is supported in an upstanding orientation to a carrier (e.g., a garment such as a vest) as shown by FIG.

3. For at least these reasons, Crye-436 discloses “a platform supported in an upstanding orientation on the carrier.”

113. Crye-436 also discloses that its UBFA (58) is oriented “on the carrier in covering relation to ... an opposing backing element to bound a generally flat cavity therebetween.” This was shown above relative to limitation 1g, where Crye-436 discloses that a “barrier fabric” may be “fastened to the bearing frame assembly 58 in such a way as not to interfere with the attachment of accessories to the bearing frame assembly, but which serves to prevent the passage of dust, debris, etc., through the bearing frame assembly openings onto the inner garments of the wearer.” (Ex. 1004-Crye at 4:37-43.) As I explained above relative to limitation 1g, it would be obvious to a POSITA to attach Crye-436’s barrier fabric to the outer perimeter of Crye-436’s UBFA (58) so as to achieve the stated purpose of preventing “the passage of dust, debris, etc., through the bearing frame assembly openings onto the inner garments of the wearer.” Doing so creates a generally flat cavity between the back side of the UBFA (58) and the front side of the barrier fabric.

114. For at least these reasons, Crye-436 discloses, teaches and suggests limitation 13a.

**[13b] the platform having a front side facing outwardly, an opposite back side facing the cavity,**

115. Crye-436 discloses in FIG. 3 that UBFA (58) is a platform having a front side facing outwardly. As explained above relative to limitations 1g and 13a, the combination of Crye-436's UBFA (58) and barrier fabric creates the cavity, and the back side of Crye-436's UBFA (58) faces this cavity.

116. For at least these reasons, Crye-436 discloses limitation 13b.

**[13c] the platform comprising laminated layers wherein at least one of the layers is a fabric, and**

117. Crye-436 discloses this limitation for the reasons explained above with respect to limitation 1b.

**[13d] a plurality of slits defined and bound by fusion hardened edges of the laminated layers,**

118. Crye-436 discloses this limitation for the reasons explained above with respect to limitation 1c and claim 6.

**[13e] the slits arranged in a predetermined pattern of aligned and spaced apart rows.**

119. Crye-436 discloses, teaches, and suggests this limitation for the reasons explained above with respect to limitation 1d.

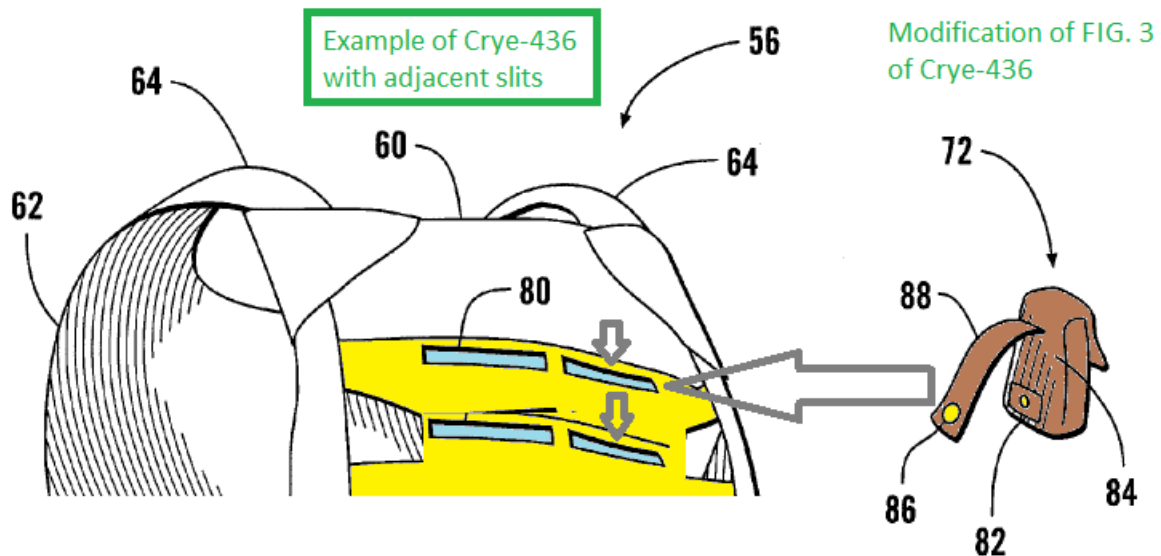
120. For the above reasons, Crye-436 disclose, teaches, and suggests all limitations of claim 13.

**[CLAIM 14] The attachment system of claim 13, further comprising at least one holder configured for holding an article or object, having at least one generally flat, flexible tab or strap extending therefrom and extending through at least one of the slits and attached to the platform or the holder to releasably secure the holder adjacent to the front side of the platform.**

121. Crye-436 discloses claim 14 for the same reasons described above relative to limitation 1e and claims 7 and 11. (*See also* Ex. 1004-Crye at FIG. 3 (illustrating an accessory [holder] (72) with a strap that can be releasably secured to the front side of the Crye-436 garment's platform by extending the strap through one or more slits in the platform).)

**[CLAIM 17] The attachment system of claim 14, wherein the at least one generally flat, flexible tab or strap comprises a strap having one end attached to the holder and woven through at least two of the slits, and a second end releasably fastened to the holder.**

122. As explained above relative to claims 7 and 11, Crye-436's discloses, teaches, and suggests weaving the flexible strap (88) of its accessory (72) through two or more slits of Crye-436's UBFA (58), as shown below.



As Crye-436 explains, a snap (86) may be used to releasably fasten the accessory (72) to the UBFA (58). (*Id.* at 4:47-67.)

123. For at least these reasons, Crye-436 discloses, teaches and suggests claim 17.

**[CLAIM 18] The attachment system of claim 14, wherein the holder comprises a pouch.**

124. Crye-436 discloses claim 18. Crye-436 expressly refers to the accessory (72) of FIG. 3 as a “pouch.” (Ex. 1004-Crye at FIG. 3 & 2:37-40.) For at least this reason, Crye-436 discloses claim 18.

**[19-PRE] An attachment system for supporting holders on a carrier,**

125. Crye-436 discloses the preamble for the same reasons explained above with respect to the preamble of claim 13.

**[19a] including a platform comprising a front side and laminated layers having a plurality of slits therethrough arranged in a predetermined pattern of aligned and spaced apart rows; and**

126. Crye-436 discloses a platform (UBFA (58)) comprising a front side and laminated layers for the reasons provided above relative to limitations 1a and 1b.

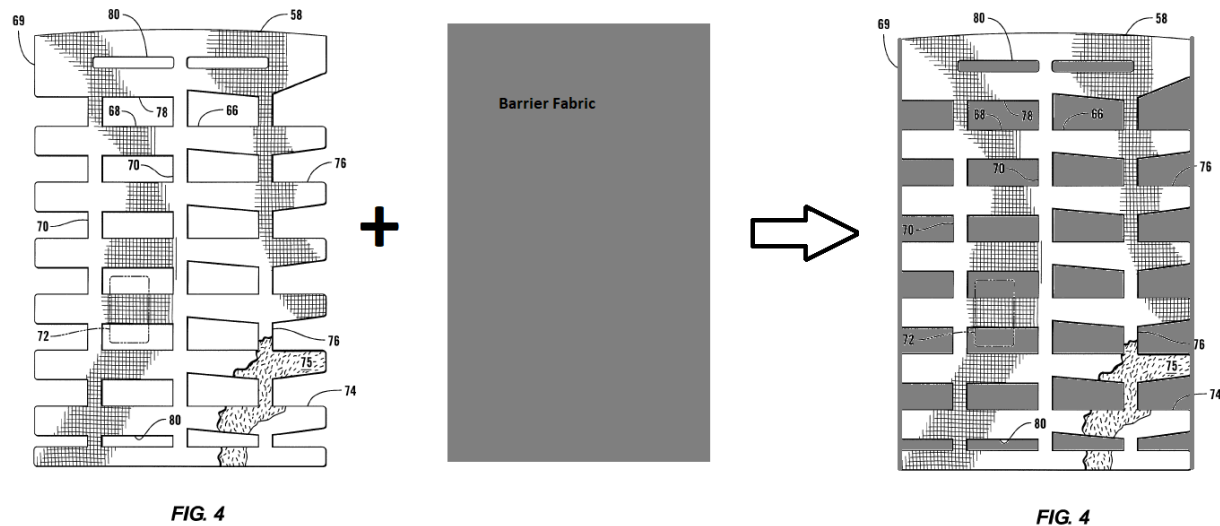
127. Crye-436 also discloses a plurality of slits (80) in his UBFA (58), which slits extend through the UBFA (58) and are “arranged in a predetermined pattern of aligned and spaced apart rows,” as explained above relative to limitations 1c and 1d.

128. For at least these reasons, Crye-436 discloses limitation 19a.

**[19b] the platform having a back side opposite the front side and opposing a surface of the carrier or a backing element to enclose a generally flat cavity therebetween generally coextensive with the platform,**

129. Crye-436 discloses, teaches, and suggests this limitation for the same reasons explained above relative to limitations 1g and 13a and claim 8. As explained above relative to limitations 1g and 13a and claim 8, it would be obvious to attach Crye-436’s barrier fabric to the outer perimeter of the UBFA (58). Doing so would create a “platform having a back side opposite the front side and opposing a surface of ... a backing element to enclose a generally flat cavity therebetween generally coextensive with the platform” (UBFA), as shown below.





130. For at least these reasons, Crye-436 discloses, teaches or suggests limitation 19b.

**[19c] the slits extending through the platform to the cavity and**

131. Crye-436 discloses this limitation. As explained above with respect to limitations 1c, 1g and 13a, Crye-436 discloses, teaches, and suggests a cavity disposed behind the UBFA (58) such that the slits (80) of Crye-436 extend from the front of the platform on one side to the back side of the platform to which the barrier fabric is attached. Thus, Crye-436’s “slits extend through the platform to the cavity.”

**[19d] being defined and bounded by hardened fused edges of the laminated layers and**

132. Crye-436 discloses that its slits are “defined and bounded by hardened fused edges of the laminated layers” for the same reasons described above with respect to limitation 1c.

**[19e] configured for receiving one or more elongate straps or tabs to support a holder adjacent to the front side.**

133. Crye-436 discloses that its slits are “configured for receiving one or more elongate straps or tabs to support a holder adjacent to the front side” for the same reasons described above with respect to limitation 1e.

134. For at least the above reasons, Crye-436 discloses, teaches, and suggests all limitations of claim 19.

**[CLAIM 21] The attachment system of claim 19, further characterized by a holder supported adjacent to the front side of the platform by at least one flexible strap woven through at least two of the aligned slits.**

135. Crye-436 discloses, teaches, and suggests this limitation for the same reasons disclosed above with respect to claims 7, 11, and 17.

**[CLAIM 22] The attachment system of claim 19, wherein at least one of the layers comprises a synthetic rubber compound.**

136. Crye-436 discloses this limitation for the reasons discussed above with respect to claim 4.

**[CLAIM 23] The attachment system of claim 22, wherein at least one of the layers comprises a woven nylon fabric laminated to the synthetic rubber compound layer.**

137. Crye-436 discloses this limitation for the reasons discussed above with respect to claims 4 and 5.

**B. Crye-436 in view of Bennett-237 discloses every limitation of claims 1-11.**

**1. Motivation to Combine Crye-436 and Bennett-237**

138. Crye-436 discloses attaching “a lightweight barrier fabric on the interior which is fastened to the bearing frame assembly 58 in such a way as not to interfere with the attachment of accessories to the bearing frame assembly, but which serves to prevent the passage of dust, debris, etc., through the bearing frame assembly openings onto the inner garments of the wearer.” (Ex. 1004 at 4:37-43.)

139. Crye-436 does not expressly state how the lightweight barrier fabric should be affixed to the platform. However, a POSITA would know that the lightweight barrier fabric should be attached to the UBFA (58) in such a manner to allow cleaning of the cavity created by the barrier fabric and the UBFA (58). As Crye-436 recognizes, the barrier fabric prevents “passage of dust, debris, etc., through the bearing frame assembly openings onto the inner garments of the wearer.” Thus, dust, debris, etc. must be periodically removed as military personnel are required to routinely clean their gear. (Ex. 1010 at Chapter 4 (explaining the need to routinely clean military vests, such as MOLLE vests); Ex. 1013-Leach at 2:57-3:7, 3:45-53, 4:9-15).)

140. A POSITA also would have known that fabric components of a military garment could be repeatedly accessed through an opening created by a detachable

connection for cleaning by using a hook-and-loop fastening system. (Ex. 1013-Leach at 2:65-3:7.) As mentioned previously, hook-and-loop fastening systems are ubiquitous and are well-known for allowing fabrics to be attached and detached repeatedly, e.g., so as to provide a way to clean the interior of the garment.

141. Indeed, Bennett-237 also relates to military and law enforcement garments, and discloses that an inner pocket, such as the one created by Crye-436's barrier fabric, may be readily opened / removed by using a fastening system, such as a hook-and-loop fastening system.

142. Bennett-237 explains:

“The present invention comprises a system for carrying and concealing a weapon, and additionally spare magazines or additional ammunition for the weapon. The invention comprises first and second flexible fabric panels. The panels are preferably joined along one edge which serves to hingedly connect the two panels, and the panels are releasibly secured to one another in an overlying relationship along at least one additional edge thereof. Preferably the releasable securing is accomplished by means of a hook-and-loop fastener....

The panels are so shaped as to conform to the front panel of a jacket or coat, and are intended to be attached to the inside of an article of clothing such as a jacket. The panel may be removably attached or permanently secured inside the garment. This may be accomplished, for example, by sewing the first panel to the inside of the garment.

Alternative fastening systems may be used such as snaps, buttons, adhesives or hook-and-loop fasteners. In this manner, the garment, the holster and the inner panel all cushion the outer side of the weapon, and with different thicknesses of panel, the cushioning may be such as to not merely hide the weapon from view, but also to mask the shape thereof.” (Ex. 1015-Bennett at 2:33-59.)

143. Given the need to periodically clean the inner pocket (cavity) created by Crye-436’s barrier fabric embodiment, it would have been obvious to use the fastening system teachings of Bennett-237 with the barrier fabric embodiment of Crye-436. This would have been obvious to a POSITA because it would allow the wearer to repeatedly open and close the pocket. This would have allowed for easy removal of any “dust, debris, etc.” therein due to the barrier fabric.

144. Applying the fastening system teachings of Bennett-237 to the barrier fabric embodiments of Crye-436 would only require ordinary skill. A POSITA would only have need to utilize the simple technique, taught in Bennett-273, of adding hook-and-loop fasteners to the front side of the barrier fabric and the back side of the platform of Crye-436.

145. There was also a reasonable expectation of success in making this combination because the combination merely requires using conventional fastening components (VELCRO) with the Crye-436 barrier fabric and platform. Only basic garment production skills are required to add such fastening components to Crye-

436's garment, as evidenced by Bennett-237, which shows that such techniques were already well known and conventional by the 1990s.

## **2. Challenged Claims**

### **Preamble [1-PRE] through limitation [1f]**

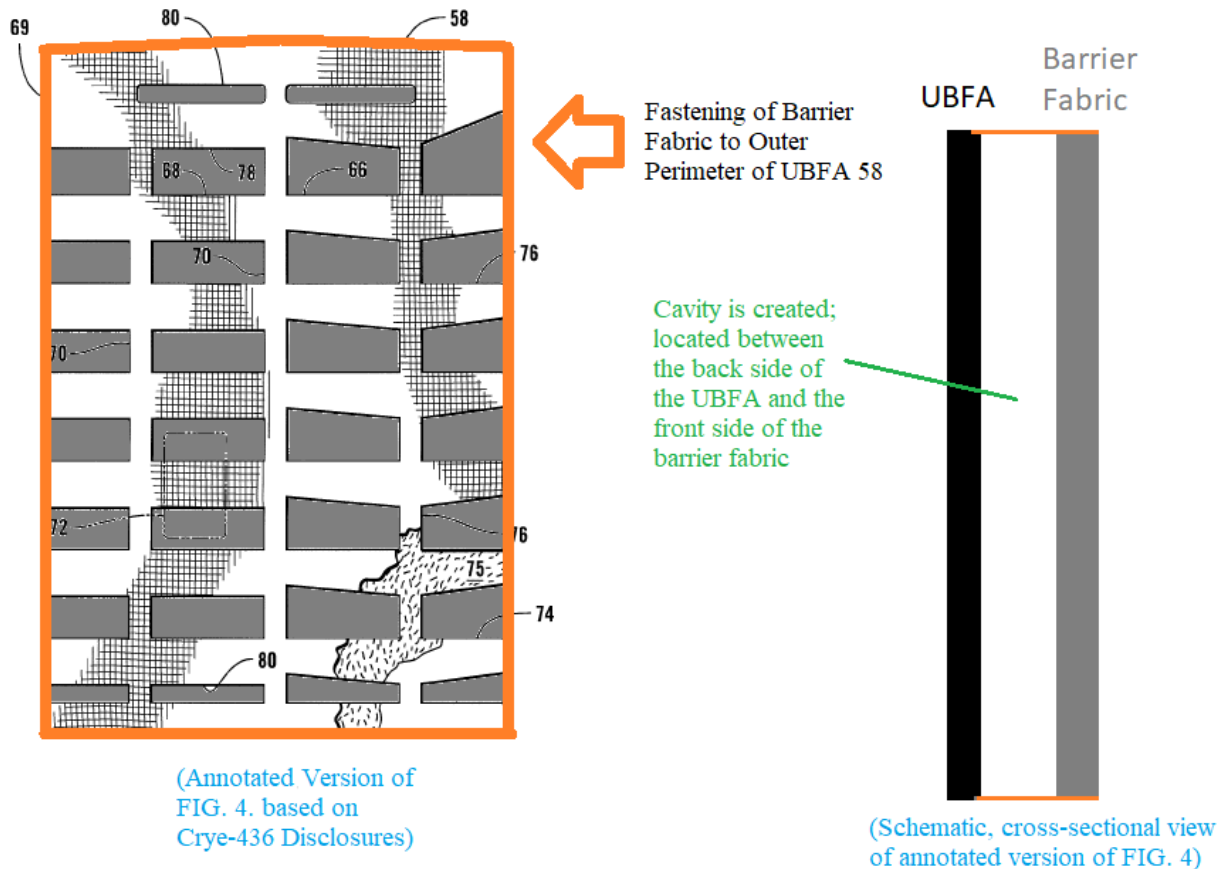
146. Crye-436 discloses the preamble of claim 1 and limitations 1a through 1f for the same reasons described above with respect to Ground 1.

### **[1g] the back side and at least one element of the carrier or a backing element bounding a generally flat cavity through which the back side can be accessed.**

147. Crye-436 in view of Bennett-237 discloses this limitation. As explained above, Crye-436 discloses that a barrier fabric may be “fastened to the bearing frame assembly 58 in such a way as not to interfere with the attachment of accessories to the bearing frame assembly, but which serves to prevent the passage of dust, debris, etc., through the bearing frame assembly openings onto the inner garments of the wearer.” (Ex. 1004-Crye at 4:37-43.)

148. As also explained above, a POSITA would have understood that attaching the barrier fabric of Crye-436 to the outer perimeter of the UBFA would accomplish the stated goal of attaching the barrier fabric in such a “way as not to interfere with the attachment of accessories to the bearing frame assembly, but which serves to prevent the passage of dust, debris, etc., through the bearing frame assembly openings onto the inner garments of the wearer.” Doing so would create

a generally flat cavity, as shown by the below example illustration.

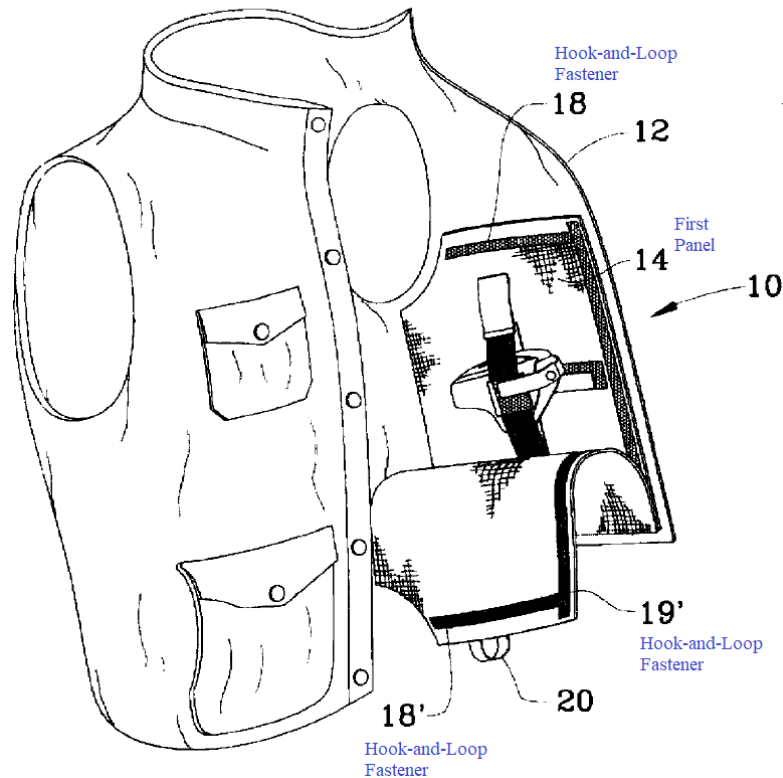


149. Such a generally flat cavity could be accessed via the full size openings (78) of the UBFA. However, Crye-436 does not disclose any manner to remove the “dust, debris, etc.” that are trapped by the barrier fabric.

150. Bennett-237 discloses that Crye-436’s generally flat cavity would be opened using fastening components such as any of “snaps, buttons, adhesives or hook-and-loop fasteners.” (Ex. 1015-Bennett at 2:54:55.) Bennett-237 discloses a preference for hook-and-loop fasteners. (*Id.* at 2:41-43, 3:49-67.)

151. FIG. 1 of Bennett-237 show one embodiment of how to releasably secure a pocket using hook-and-loop fasteners:

*FIG. 1*



Other embodiments are shown in FIGS. 2-5.

152. A POSITA would have implemented the fastening components of Bennett-237, e.g., hook-and-loop fasteners, with the barrier fabric of Crye-436, as explained in detail above in § VIII.B.1. Doing so would improve the Crye-436 garment by making it easier to remove any “dust, debris, etc.” accumulated in the generally flat cavity created by the combination of Crye-436’s platform and barrier



fabric. Adding the fastening components of Bennett-237 to the platform and barrier fabric of Crye-436 would allow for easy access to and cleaning of the generally flat cavity created by the barrier fabric embodiments of Crye-436.

153. Further, it would be obvious to add the hook-and-loop fastener to one or more edges of the created pocket to access the created cavity, as specifically taught by Bennett-237. (Ex. 1015-Bennett at FIGS. 1, 3-4 (showing multiple edges with VELCRO) and FIGS. 2, 5-6 (showing a single edge with VELCRO).)

154. Thus, Crye-436 in view of Bennett-237 discloses “the back side and at least one element of the carrier or a backing element bounding a generally flat cavity through which the back side can be accessed,” and Crye-436 in view of Bennett-237 renders claim 1 obvious.

**[CLAIM 2] The attachment system of claim 1, wherein at least one of the back side and the backing element comprises a fastening component of a hook and loop fastening system.**

155. As explained above relative to claim 1, a POSITA would have used hook-and-loop fasteners with the pocket created by Crye-436’s barrier fabric embodiments to allow for easy opening of and cleaning of such a pocket (cavity). (See limitation 1g.)

156. Thus, Crye-436 in view of Bennett-237 discloses both “the back side ... comprises a fastening component of a hook and loop fastening system” and “the

backing element comprises a fastening component of a hook and loop fastening system,” and, in turn, this combination discloses every limitation of claim 2.

**[CLAIM 3] The attachment system of claim 1, wherein at least one of the layers comprises an adhesive.**

157. Crye-436 discloses claim 3 for the same reasons described above with respect to Ground 1. Thus, Crye-436 in view of Bennett-237 discloses every limitation of claim 3.

**[CLAIM 4] The attachment system of claim 1, wherein at least one of the layers comprises a synthetic rubber compound.**

158. Crye-436 discloses claim 4 for the same reasons described above with respect to Ground 1. Thus, Crye-436 in view of Bennett-237 discloses every limitation of claim 4.

**[CLAIM 5] The attachment system of claim 4, wherein the platform comprises a woven nylon fabric laminated to the synthetic rubber compound.**

159. Crye-436 discloses claim 5 for the same reasons described above with respect to Ground 1. Thus, Crye-436 in view of Bennett-237 discloses every limitation of claim 5.

**[CLAIM 6] The attachment system of claim 1, wherein the edges are hardened by laser fusion.**

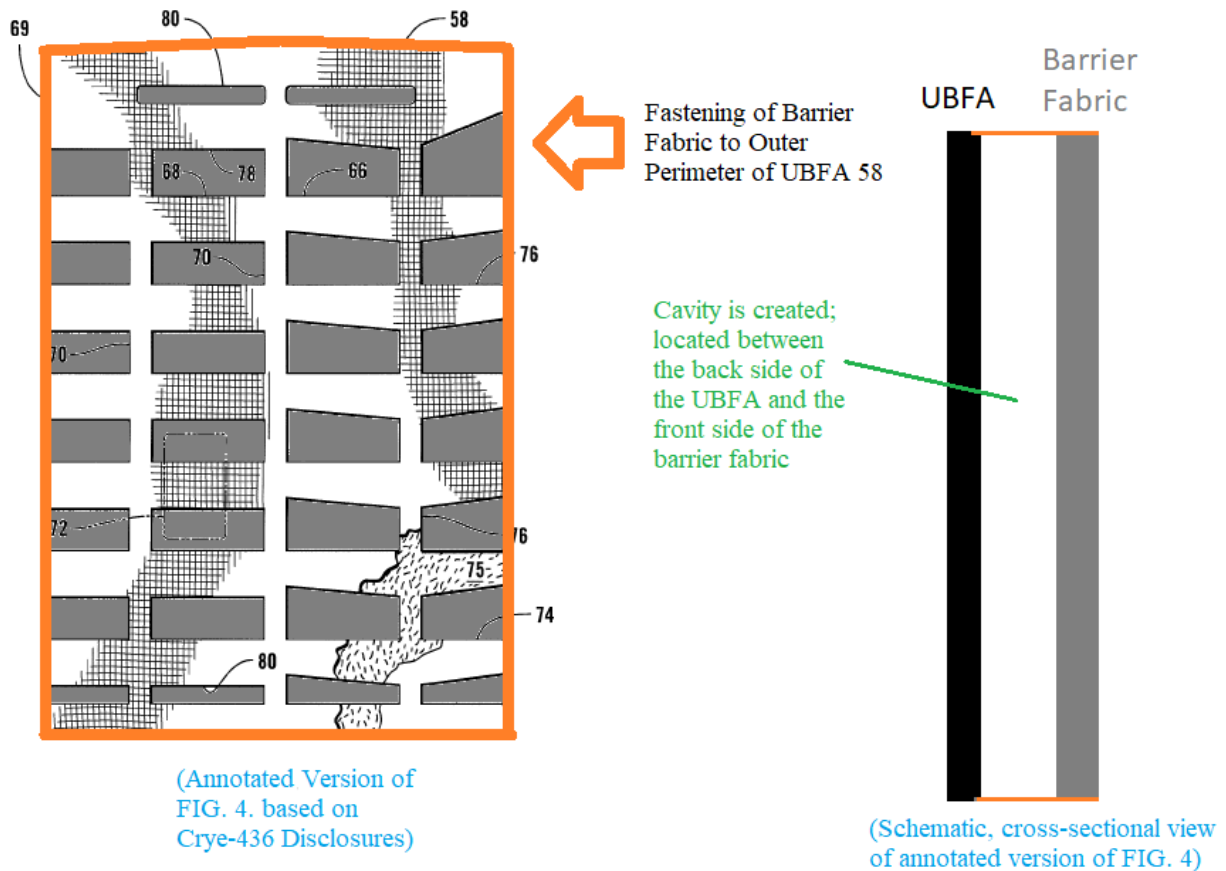
160. Crye-436 discloses claim 6 for the same reasons described above with respect to Ground 1. Thus Crye-436 in view of Bennett-237 discloses every limitation of claim 6.

**[CLAIM 7] The attachment system of claim 1, further comprising at least one strap woven through selected ones of the slits attaching a holder to the platform.**

161. Crye-436 discloses claim 7 for the same reasons described above with respect to Ground 1. Thus Crye-436 in view of Bennett-237 discloses every limitation of claim 7.

**[CLAIM 8] The attachment system of claim 1, wherein the back side and the at least one element of the carrier or the backing element comprise coextensive edges comprising fastening components fastened together to prevent entry of particulates therebetween, the fastening components being unfastenable to allow manually accessing the cavity therebetween.**

162. As explained above, it would have been obvious to attach Crye-436's barrier fabric to the outer perimeter of the UBFA.



Attaching the barrier fabric to the outer perimeter of the UBFA would contain any debris passed through the openings (66) of the UBFA.

163. In addition, attaching to the outer perimeter of the UBFA would not interfere with attachment of accessories because the slits (80) and/or full size openings (78) would remain available for attachment. As explained above with respect to limitation 1g and claim 2, and as shown in FIGS. 1-6 of Bennett-237, a POSITA would have understood that the outer perimeter attachment would be accomplished using hook-and-loop fastening components. This would have been

done at one or more coextensive edges to allow access to the pocket for cleaning.

164. Thus, Crye-436 in view of Bennett-237 discloses both “wherein the back side and ... the backing element comprise coextensive edges comprising fastening components fastened together to prevent entry of particulates therebetween, the fastening components being unfastenable to allow manually accessing the cavity therebetween.”

165. Therefore, Crye-436 in view of Bennett-237 discloses every limitation of claim 8.

**[CLAIM 9] The attachment system of claim 8, wherein the fastening components comprise components of a hook and loop fastening system.**

166. Crye-436 in view of Bennett-237 discloses this limitation for the same reasons as limitation 1g and claims 2 and 8.

167. Thus, Crye-436 in view of Bennett-237 discloses this limitation and this same combination discloses every limitation of claim 9.

**[CLAIM 10] The attachment system of claim 1, wherein the carrier comprises a vest, a cummerbund, or a belt.**

168. Crye-436 discloses claim 10 for the same reasons described above with respect to Ground 1. Thus, Crye-436 in view of Bennett-237 discloses every limitation of claim 10.

**[CLAIM 11] The attachment system of claim 1, further comprising a holder configured for holding at least one object or article, having a strap extending therefrom and woven through at least two of the slits interlockingly attaching the holder to the platform.**

169. Crye-436 discloses claim 11 for the same reasons described above with respect to Ground 1. Thus, Crye-436 in view of Bennett-237 discloses every limitation of claim 11.

**C. Crye-436 in view of Asher-149 discloses every limitation of claims 1-11.**

**1. Motivation to Combine Crye-436 and Asher-149**

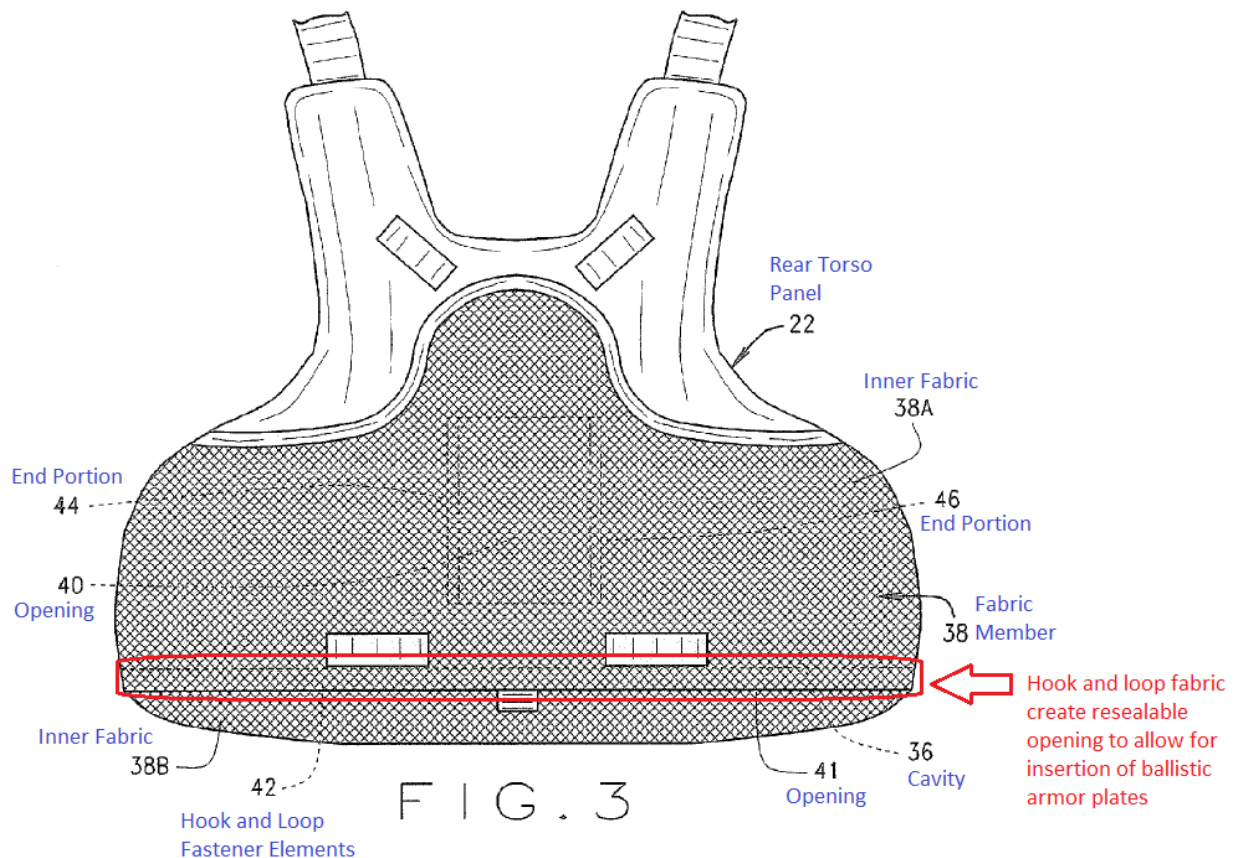
170. As explained previously, the barrier fabric embodiments of Crye-436 create a cavity. One purpose of Crye-436's cavity is to capture "dust, debris, etc." (Crye-436 at 4:37-43.) A POSITA would have understood that this cavity would be also useful in bulletproofing Crye-436's garment. Indeed, it was common to include bulletproof military and law enforcement garments using such cavities. (Ex. 1014 at 71.) This is expressly recognized by Asher-149:

"Tactical vests and other similar garments are well known, particularly in the military and law enforcement environments, and *such vests and garments typically include pockets, pouches or other means for carrying ballistic armor plating for the protection of the wearer.* Such armor plating is typically worn in the front and/or back portion of the vest or other similar garment and is made of suitable material to provide the necessary protection to the wearer depending upon the particular

application such as stopping bullets, sharp metal, and other hazards associated with a particular tactical situation.” (Ex. 1005-Asher at ¶2 (emphasis added).)

171. Thus, it was well-known that military and law enforcement garments (such as those described by Crye-436) may require one or more armor panel compatible pouches (“armor pouches”). Such armor pouches allow the insertion and removal of ballistic armor panels/plating to make the garment “bullet proof.”

172. As Asher-149 explains, these armor pouches are generally accessible via a hook-and-loop fastener system. Indeed, a user can open the armor pouch via the hook-and-loop fastener system, insert the armor panel into the armor pouch, and then close the armor pouch via the same hook-and-loop fastener system. (*Id.* at ¶16.) This is also illustrated in FIG. 3 (annotated) of Asher-149:



173. Since Crye-436's garment may be used for military and other combat ready situations, a POSITA would have known from Asher-149 that it was obvious to add one or more such armor pouches to the Crye-436 garment. Indeed, given both the Crye-436 garment and the Asher-149 garment are MOLLE compatible, a POSITA would have used the teachings of Asher-149 when adding one or more armor pouches to the Crye-436 garment. Further, including one or more armor pouches as per Asher-149 in the garment of Crye-436 would require no more than ordinary skill.



174. Adding a suitable pouch fabric and closure system (e.g., VELCRO) to a known garment was a simple task for an ordinary artisan. There was also a reasonable expectation of success in making this combination because the combination merely requires using conventional and well-known techniques from Asher-149 to include an accessible cavity in the Crye-436 garment. Only basic garment production skills are required to make Crye-436's garment suitable for holding armor panels/plating, as evidenced by Asher-149. Asher-149 shows that such techniques were already typical, well known, and conventional in the field.

175. For at least these reasons, a POSITA would have modified the Crye-436 garments to include one or more armor pouches with a reasonable expectation of making this modification successfully.

## **2. Challenged Claims**

### **Preamble [1-PRE] through limitation [1f]**

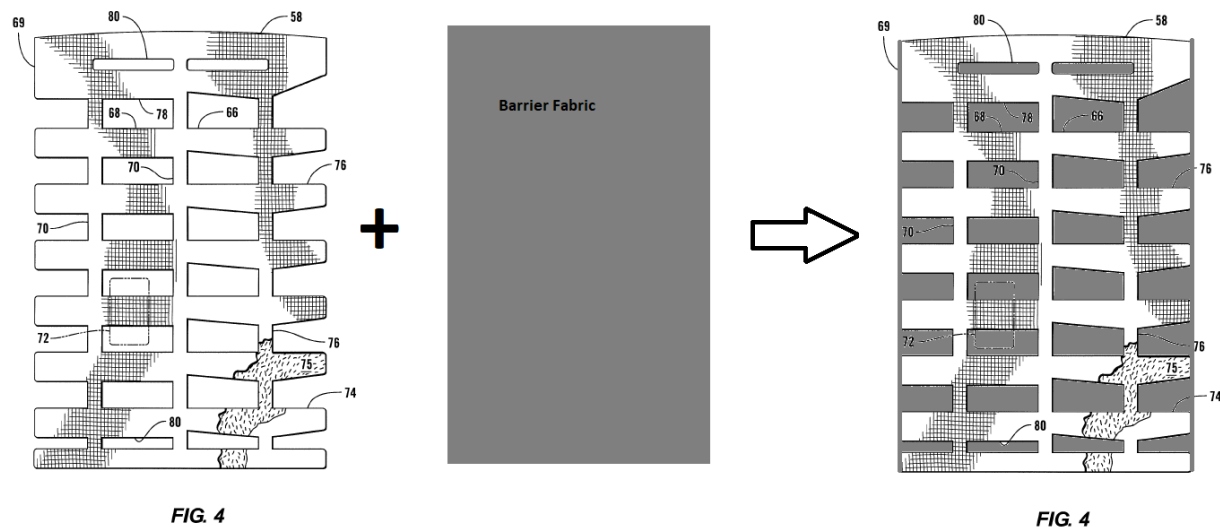
176. Crye-436 discloses the preamble of claim 1 and limitations 1a through 1f for the same reasons described above with respect to Ground 1.

### **[1g] the back side and at least one element of the carrier or a backing element bounding a generally flat cavity through which the back side can be accessed.**

177. Crye-436 discloses that a barrier fabric may be “fastened to the bearing frame assembly 58 in such a way as not to interfere with the attachment of accessories to the bearing frame assembly, but which serves to prevent the passage

of dust, debris, etc., through the bearing frame assembly openings onto the inner garments of the wearer.” (Ex. 1004-Crye at 4:37-43.)

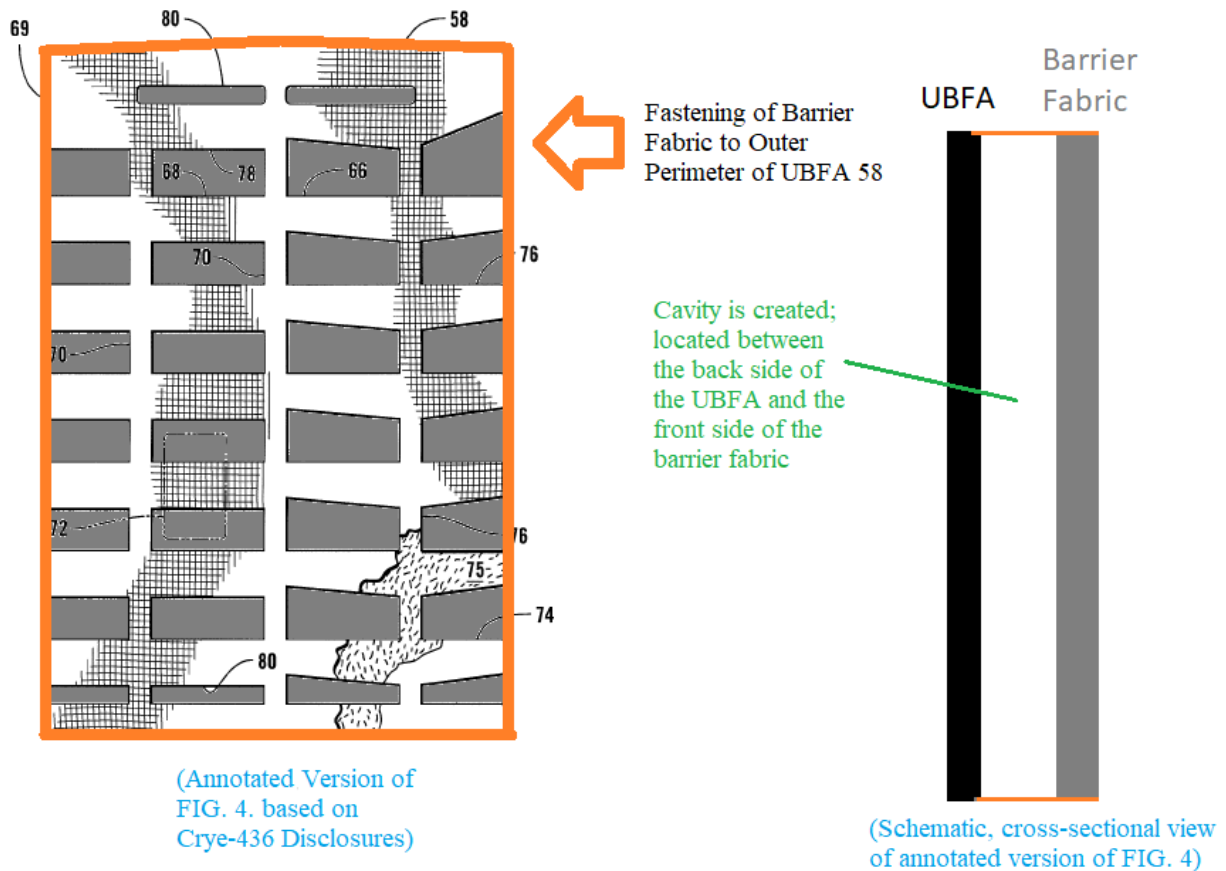
178. One potential method of fastening the Crye-436 barrier fabric to the Crye-436 UBFA is shown in the below diagram, which is based on FIG. 4 plus the barrier fabric disclosure of Crye-436 (the gray barrier fabric portion is not illustrated in the figures of Crye-436; instead it is described in the text).



179. Crye-436 does not expressly state where to fasten the barrier fabric to the UBFA. However, Crye-436 does disclose that its barrier fabric should be attached to the UBFA “in such a way as not to interfere with the attachment of accessories to the bearing frame assembly, but which serves to prevent the passage of dust, debris, etc., through the bearing frame assembly openings onto the inner garments of the wearer.” (Ex. 1004-Crye at 4:37-43.)

180. A POSITA would have attached the barrier fabric of Crye-436 to the outer perimeter of the UBFA so as to accomplish the stated goal of attaching the barrier fabric in such a “way as not to interfere with the attachment of accessories to the bearing frame assembly, but which serves to prevent the passage of dust, debris, etc., through the bearing frame assembly openings onto the inner garments of the wearer.” Attaching the barrier fabric to the outer perimeter of the UBFA would have contained any debris passed through the openings (66) of the UBFA.

181. Attaching to the outer perimeter of the UBFA also would not interfere with attachment of accessories because the slits (80) and/or full size openings (78) would remain available for attachment. By fastening the barrier fabric to the UBFA 58 in such a manner, a cavity would be created, as shown by the below example illustration.



182. Crye-436 discloses MOLLE compatible garments that are designed to enhance the equipment available to the armed forces, e.g., to enhance vests and other garments used by the U.S. Army for military personnel. (Ex. 1004-Crye at 1:32-43 (emphasis added).)

183. Like Crye-436, Asher-149 discloses a MOLLE compatible garment for use in military applications and having one or more cavities for housing armor panels/plates:

“FIGS. 1-4 illustrate one embodiment of a typical side-opening vest which houses at least an internal front torso pocket for receiving armor plate members for protection of the wearer ....*The front torso panel 22 may include a Molle System* which comprises a plurality of vertically and horizontally oriented loops such as the loops 26 which are adapted for receiving attachment means associated with pouches and other accessory equipment which can be easily attached and removed from the front portion of the vest.” (Ex. 1005-Asher at ¶13.)

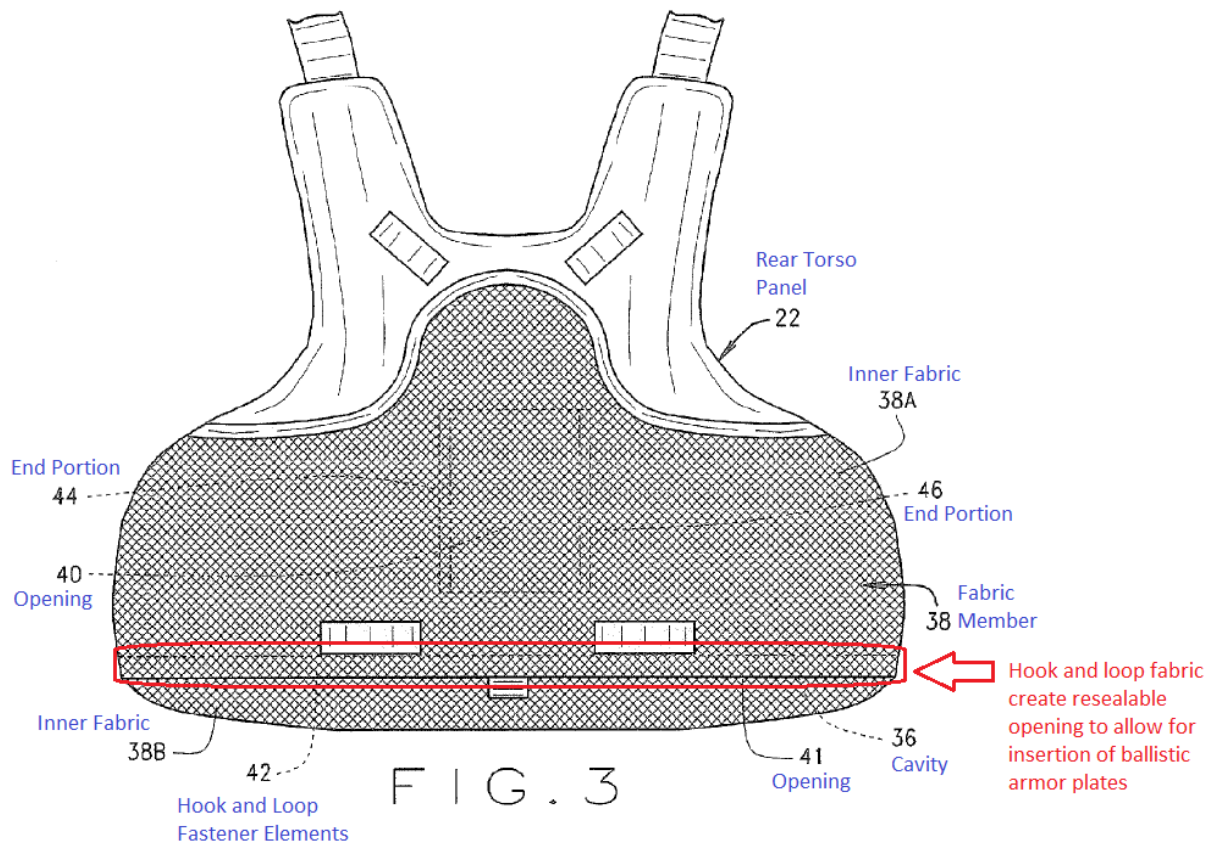
“The present invention relates to an internal vest divider member or baffle member 40 associated with an internal pocket or pouch 36 associated with *either or both the front and rear torso panels 22 and 28* as will be hereinafter further described. *As best illustrated in FIGS. 3 and 4, the front torso panel 22 includes an internal pocket 36 which is specifically sized and shaped for carrying either a single armor plate member or a pair of armor plate members for providing protection to the wearer when the wearer is exposed to hostile fire and other tactical dangers. The pocket 36 is located on the inside portion of the front torso panel 22 (FIG. 3) and can be formed by attaching or otherwise overlaying another fabric member such as the member 38 (FIGS. 3 and 4) to the inside portion of the front torso panel 22 and providing an opening 40 through such member 38 for accessing the pocket or cavity 36 formed therebetween.* The fabric member 38 may comprise a mesh type material as illustrated in FIG. 3, or such member may be made of any other suitable material.” (*Id.* at ¶16 (emphasis added).)

It would have been routine and conventional to implement the armor cavity / pouch teachings of Asher-149 in the garment of Crye-436, as explained in detail above.

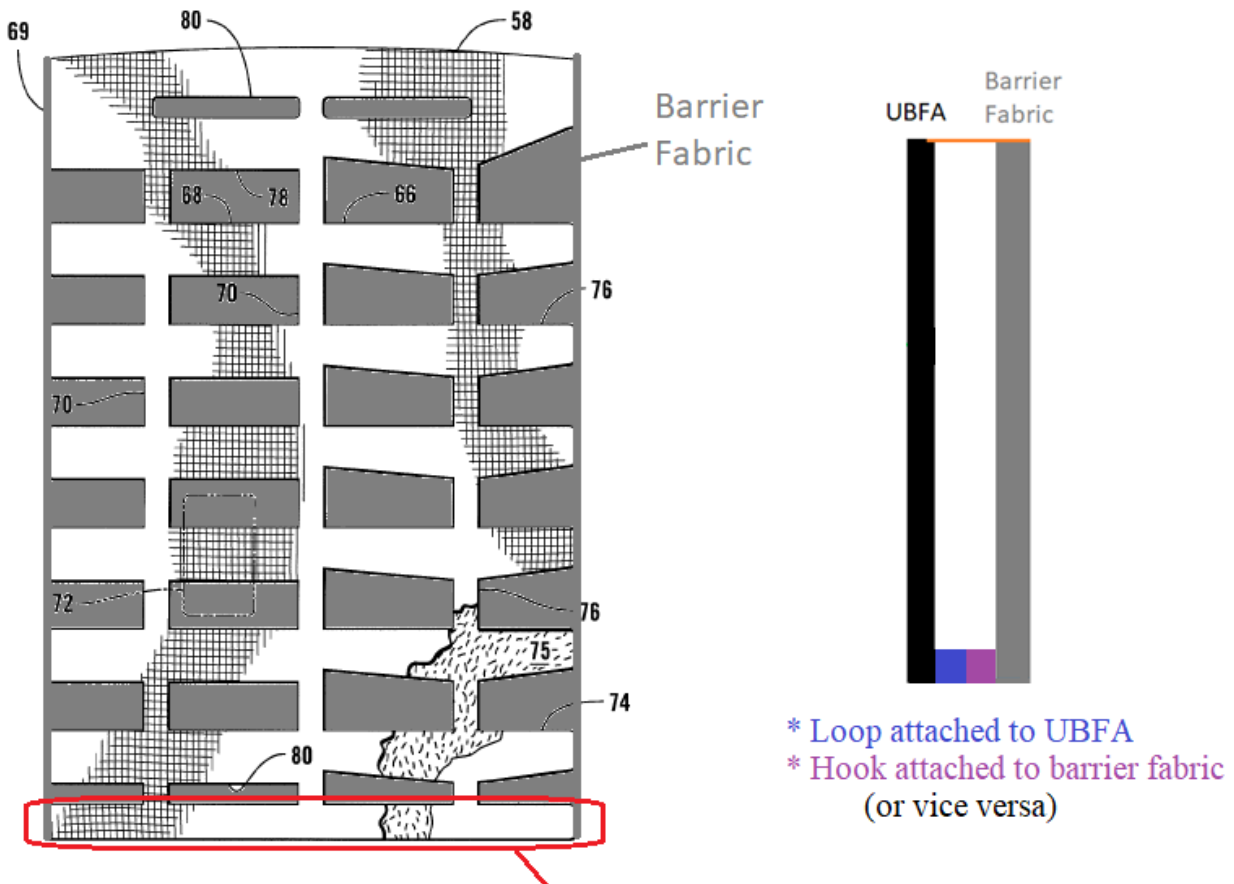
184. Doing so would make the Crye-436 garment ballistics resistant, which is a desirable feature of such garments. Combining the armor pouch feature of Asher-149 with the lightweight garment of Crye-436 would create an improved garment that is lighter than the garment disclosed in Asher-149, while providing a cavity for housing an armor panel/plate that is MOLLE compatible.

185. It would also have been obvious to implement armor pouch(es) in the Crye-436 garments by simply adding hook-and-loop features to the barrier fabric embodiments of Crye-436. This would have been accomplished such as by adding conventional hook material to the backside of the platform and corresponding loop material to the corresponding portion of the barrier fabric, or vice-versa.

186. As shown in FIG. 3 of Asher-149, this is exactly how Asher-149 creates its armor pockets, and Asher-149 does so by placing such hook and loop features at or near bottom portions of its torso panels and corresponding inner fabric.



187. Accordingly, when adding one or more armor pouches to a Crye-436 garment, it would have been obvious to modify the barrier fabric embodiments of Crye-436 to use a hook-and-loop fastener system at or near the bottom of the UBFA and the corresponding barrier fabric.



188. In doing so, an armor panel/plate could be readily inserted and removed via the created armor pouch. Doing so would also create a “generally flat cavity through which the back side can be accessed.” Such a cavity would be suitable for an armor panel/plate as armor panels/plates are designed to be used in a wide variety of environmental conditions. (Ex. 1014 at §§ 5.1 and 6.1, explaining that armor panels are tested in conditions “intended to provide some indication of the armor’s



ability to maintain ballistic performance after being exposed to conditions of heat, moisture, and mechanical wear”; *see also* §§ 5.3.4 and 6.3.4, explaining the durability testing requirements for armor panels, which included temperature, humidity and mechanical wear testing.)

189. Therefore, a POSITA would have used one of a hook or a loop fastener on the back side of the Crye-436 UBFA and the other of a hook or loop fastener on the front side of the barrier fabric in order to form an openable armor pouch (a cavity) for carrying an armor panel/plate.

190. Thus, Crye-436 in view of Asher-149 discloses this limitation and all other limitations of claim 1.

**[CLAIM 2] The attachment system of claim 1, wherein at least one of the back side and the backing element comprises a fastening component of a hook and loop fastening system.**

191. Crye-436 in view of Asher-149 discloses this limitation. In particular, as shown above regarding claim 1, a POSITA would have used one of a hook or a loop fastener on the back side of the Crye-436 UBFA and the other of a hook or loop fastener on the front side of the barrier fabric in order to form an armor pouch (a cavity) for carrying an armor panel/plate. (*See* limitation 1g.)

192. Thus, Crye-436 in view of Asher-149 discloses both “the back side ... comprises a fastening component of a hook and loop fastening system” and “the

backing element comprises a fastening component of a hook-and-loop fastening system.”

193. Therefore, Crye-436 in view of Asher-149 discloses every limitation of claim 2.

**[CLAIM 3] The attachment system of claim 1, wherein at least one of the layers comprises an adhesive.**

194. Crye-436 discloses claim 3 for the same reasons described above with respect to Ground 1. Thus, Crye-436 in view of Asher-149 discloses every limitation of claim 3.

**[CLAIM 4] The attachment system of claim 1, wherein at least one of the layers comprises a synthetic rubber compound.**

195. Crye-436 discloses claim 4 for the same reasons described above with respect to Ground 1. Thus, Crye-436 in view of Asher-149 discloses every limitation of claim 4.

**[CLAIM 5] The attachment system of claim 4, wherein the platform comprises a woven nylon fabric laminated to the synthetic rubber compound.**

196. Crye-436 discloses claim 5 for the same reasons described above with respect to Ground 1. Thus, Crye-436 in view of Asher-149 discloses every limitation of claim 5.

**[CLAIM 6] The attachment system of claim 1, wherein the edges are hardened by laser fusion.**

197. Crye-436 discloses claim 6 for the same reasons described above with

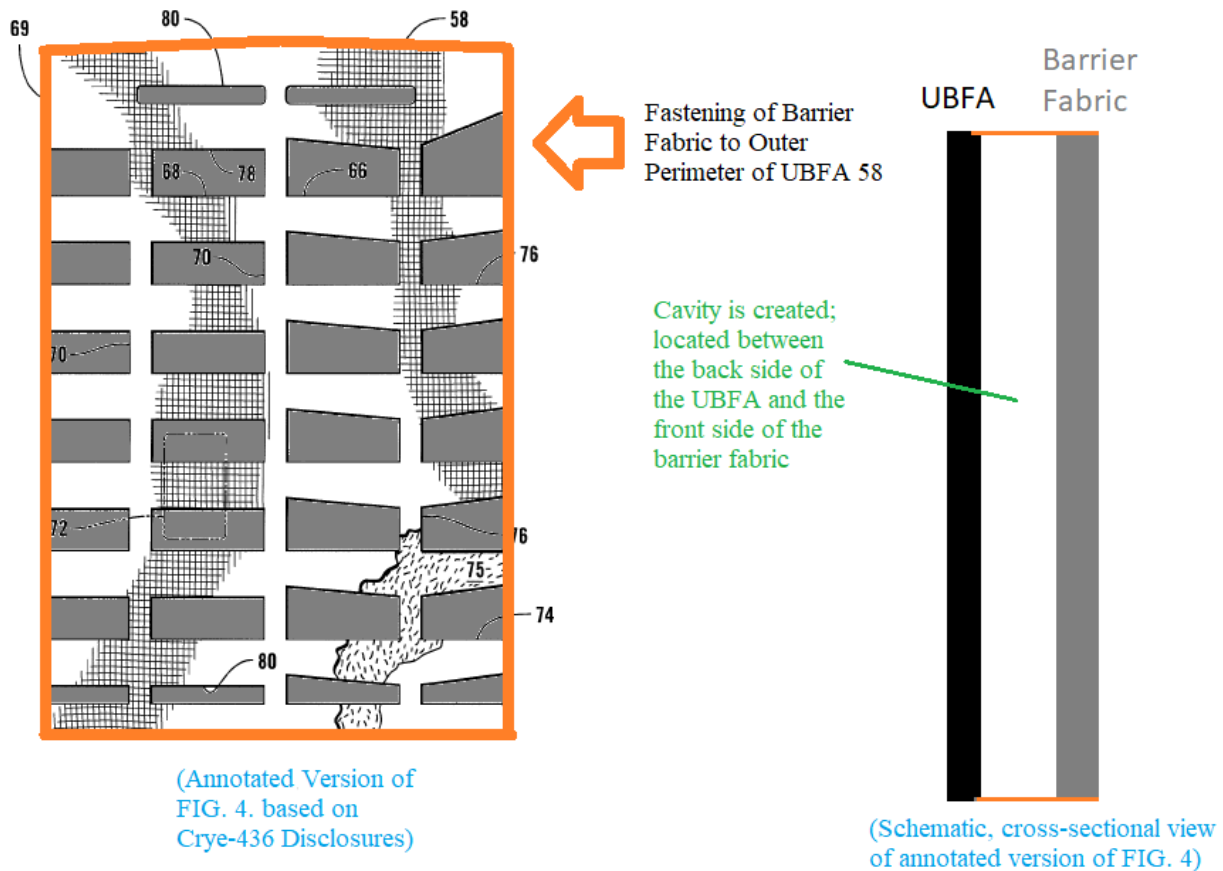
respect to Ground 1. Thus, Crye-436 in view of Asher-149 discloses every limitation of claim 6.

**[CLAIM 7] The attachment system of claim 1, further comprising at least one strap woven through selected ones of the slits attaching a holder to the platform.**

198. Crye-436 discloses claim 7 for the same reasons described above with respect to Ground 1. Thus, Crye-436 in view of Asher-149 discloses every limitation of claim 7.

**[CLAIM 8] The attachment system of claim 1, wherein the back side and the at least one element of the carrier or the backing element comprise coextensive edges comprising fastening components fastened together to prevent entry of particulates therebetween, the fastening components being unfastenable to allow manually accessing the cavity therebetween.**

199. Crye-436 in view of Asher-149 discloses this limitation. As explained above regarding limitation 1g and claim 2, a POSITA would have created one or more openable armor pouches in the Crye-436 garments using the barrier fabric of Crye-436 and components of a hook and loop fastening system, as per Asher-149. Fastening the barrier fabric to the outer perimeter of the UBFA would also accomplish Crye-436's goal of containing debris while allowing attachment of pouches to the UBFA (58). (See limitation 1g.) Doing so results in the barrier fabric being fastened to the UBFA at "coextensive edges," such as per the below example illustration.



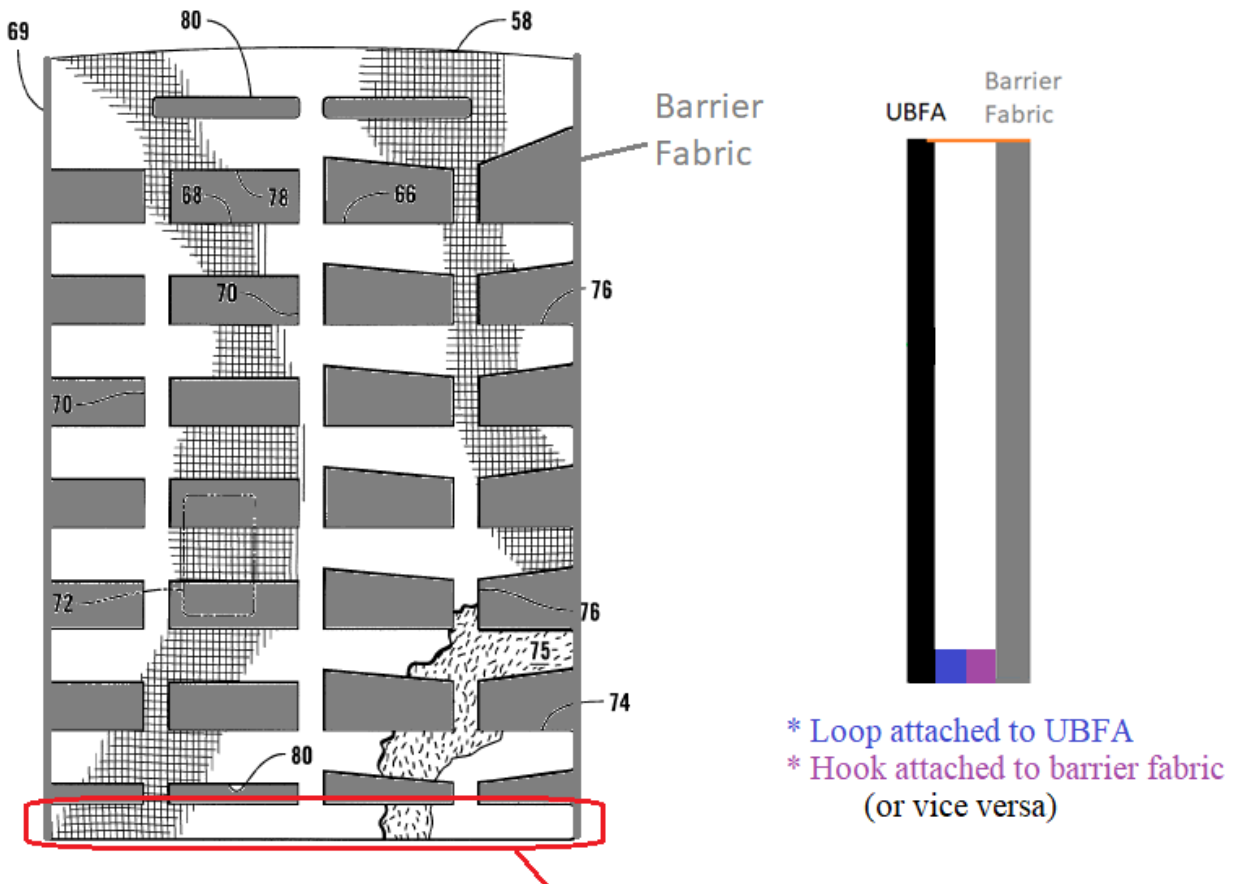
200. By attaching the barrier fabric to the outer perimeter of the UBFA, any debris passed through the openings (66) of the UBFA would be fully contained. Attaching to the outer perimeter of the UBFA also would not interfere with attachment of accessories because the slits (80) and/or full size openings (78) would remain available for attachment.

201. Thus, Crye-436 discloses, teaches and suggests “wherein the back side and the at least one element of the carrier or the backing element comprise coextensive edges... fastened together to prevent entry of particulates

therebetween.” (*See* limitation 1g.)

202. As also explained above, a POSITA would have implemented the armor cavity / pouch teachings of Asher-149 in the garment of Crye-436, by simply adding hook-and-loop features to the barrier fabric embodiments of Crye-436, such as by adding hook material to the backside of the platform and corresponding loop material to the corresponding portion of the barrier fabric, or vice-versa, because this is exactly how Asher-149 creates its armor pockets.

203. When adding one or more armor pouches to a Crye-436 garment, a POSITA would have modified the barrier fabric embodiments of Crye-436 to use a hook and loop fastener system at or near the bottom of the UBFA and the corresponding barrier fabric.



204. In doing so, an armor panel/plate could be readily inserted and removed via the created armor pouch. (See limitation 1g.) Therefore, a POSITA would have used one of a hook or loop fastener on the back side of the Crye-436 UBFA and the other of a hook or loop fastener on the front side of the barrier fabric in order to form an openable armor pouch (a cavity) for carrying an armor panel/plate. Doing so provides for both the UBFA and the barrier fabric to include “fastening components

fastened together to prevent entry of particulates therebetween, the fastening components being unfastenable to allow manually accessing the cavity therebetween.”

205. Thus, Crye-436 in view of Asher-149 discloses this limitation, and indeed discloses every limitation of claim 8.

**[CLAIM 9] The attachment system of claim 8, wherein the fastening components comprise components of a hook and loop fastening system.**

206. As explained above with respect to limitation 1g and claims 2 and 8, a POSITA would have employed a hook and loop fastening system as a way to open and close the armor pouch(es) described above. (*See* limitation 1g, claim 2, claim 8.)

207. Thus, Crye-436 in view of Asher-149 discloses this limitation, and discloses every limitation of claim 9.

**[CLAIM 10] The attachment system of claim 1, wherein the carrier comprises a vest, a cummerbund, or a belt.**

208. Crye-436 discloses claim 10 for the same reasons described above with respect to Ground 1. Thus, Crye-436 in view of Asher-149 discloses every limitation of claim 10.

**[CLAIM 11] The attachment system of claim 1, further comprising a holder configured for holding at least one object or article, having a strap extending therefrom and woven through at least two of the slits interlockingly attaching the holder to the platform.**

209. Crye-436 discloses claim 11 for the same reasons described above with respect to Ground 1. Thus, Crye-436 in view of Asher-149 discloses every limitation of claim 11.

## **VII. CONCLUDING STATEMENT**

210. I reserve the right to offer opinions relevant to the invalidity of the '379 patent claims at issue and/or offer testimony in support of the Declaration.

211. In signing this Declaration, I recognize that the Declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case. If required, I will appear for cross-examination at an appropriate and convenient place and time.

212. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and, further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 28 U.S.C. § 1001.



Declaration of Christopher M. Pastore, Ph.D.  
IPRs 2019-01152  
U.S. Patent No. 9,974,379

Dated: June 10, 2019

Respectfully submitted,

A handwritten signature in blue ink, appearing to read 'C. M. Pastore', with a long horizontal stroke extending to the right.

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Christopher M. Pastore, Ph.D

# Curriculum Vitae

Christopher M. Pastore

## Professional Experience

2012- present	<i>Professor</i> , Transdisciplinary Studies <i>Co-Director</i> , Engineering and Design Institute <i>Nexus Learning Advocate</i> <i>Fulbright Specialist (2017-2020)</i> Kanbar College of Design, Engineering, & Commerce Thomas Jefferson University/Philadelphia University, Philadelphia, PA
2017-present	<i>Honorary Research Professor</i> , Department of Clothing and Textiles, Durban University of Technology, Durban, South Africa
2017	<i>Visiting Research Scientist</i> , Institute of Technical Textiles, RWTH Aachen University, Aachen, Germany
2014	<i>Visiting Research Professor</i> , Oak Ridge National Laboratory, Oak Ridge, TN
2002-2012	<i>Professor</i> , Engineering <i>Co-Director</i> , Engineering and Design Institute, <i>Program Director</i> , Architectural Engineering <i>Secretary of the Faculty (2008-2009)</i> <i>Chair of the Faculty (2009-2010)</i> Kanbar College of Design, Engineering, and Commerce Philadelphia University, Philadelphia, PA
1995-2002	<i>Associate Professor</i> (tenured 2001), <i>Director of Research</i> , <i>Program Director</i> : Textile Engineering <i>Program Director</i> : Fibrous Materials Science, School of Textiles and Materials Technology, Philadelphia University/Philadelphia College of Textiles and Sciences, Philadelphia, PA
1995	<i>Visiting Research Professor</i> , Department of Textiles, University of Gent
1993-95	<i>Associate Professor</i> , (tenured, 1995) Department of Textile Engineering, Chemistry, and Science, North Carolina State University, Raleigh, NC.
1990-93	<i>Assistant Professor</i> , Department of Textile Engineering, Chemistry, and Science, North Carolina State University, Raleigh, NC.
1988-94	<i>Visiting Research Professor</i> , NASA Langley Research Center, Hampton, VA (Summers)
1988-90	<i>Assistant Professor</i> , Department of Materials Engineering, Drexel University, and <i>Associate Director</i> , Fibrous Materials Research Center, Drexel University, Philadelphia, PA.
1984-88	<i>Research Engineer</i> , Department of Materials Engineering, Drexel University, Philadelphia, PA.

## Education

- Ph.D.** Materials Science, Drexel University, Philadelphia, PA, March 1988; *A Processing Science Model for Three Dimensional Braiding*
- M.S.** Mathematics, Drexel University, Philadelphia, PA, June 1986. Concentration: Computer Aided Geometric Design.
- B.A.** Mathematics, LaSalle University, Philadelphia, PA, June 1982

## Recognized Creative and Professional Achievement

*Honorary Research Professor*, Faculty of Applied Sciences, Durban University of Technology, Durban, South Africa, 2017 - present

Associate Editor, *Journal of Engineering Fibers and Fabrics*, SAGE, 2017 - present

*Fulbright Specialist*, Textile Engineering, 2017-2020

*Dr. Jackie Rehkopf Best Paper Award*, "Lightweighting Composites through Selective Fiber Placement", C. Pastore, 2015 SPE Automotive Composites Conference and Exhibition, Sept. 2015.

*President's Award for Excellence*, Philadelphia University, 2014.

*Citation for Distinction*, National Institute of Building Sciences, for the MS Sustainable Design, February 2012,

*Best Practices in Communication – Honorable Mention*, (for EcoMan and The Skeptic podcast), Council for the Advancement and Support of Education, December 2009.

*Excellence in Education Award*, (for MS in Sustainable Design Program) United States Green Building Council, 2009

*Excellence in Sustainability Education*, Delaware Valley Green Building Council, 2007

*Philadelphia Sustainability Award*, Pennsylvania Environmental Council, 2007

*Leadership in Sustainable Building*, Pennsylvania Resources Council, 2004

*Director's Award*, Systems Competency, National Textile Center, 2004

*Best presentation*, National Textile Center, Second Year Projects, 2002, Architectural Fabric Structures

Fiber Society - Award for *Distinguished Achievement in Basic or Applied Fiber Science*, 2000

*Commendation* from Philadelphia School District - Career to School program, advising high school students in engineering curricula, 1998

*Outstanding Teacher of the Year*, 1994, College of Textiles, North Carolina State University

*Academy of Outstanding Teachers*, North Carolina State University, 1994

## Scholarly Activities

### BOOKS OR IN BOOKS

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"The Effects of Fiber Architecture on SiC/SiC Composites", F. Ko, C. Burkland, C. Pastore, and M. Koczak, *Tenth Conference on Composites and Advanced Ceramic Materials*, Cocoa Beach, FL, Jan. 19-24, 1986.

"Control of Fiber Architecture for Tough, Net Shaped Structural Composites", F. Ko and C. Pastore, *Proceedings, Symposium on High Temperature Materials for the 1990's and Beyond*, Phila. PA, May 16, 1986.

"Cardable Glass Fibers for Composites", M. Williams, F. Ko, and C. Pastore, *Proceedings, IFAI Conference*, Boston MA, Oct. 1986.

"Tensile and Shear Properties of Composites by Various Reinforcement Concepts", A. Mayadas, C. Pastore and F. Ko, *Proceedings of the National SAMPE Technical Conference*, Anaheim, CA, 1985.

"Computer Aided Design of Nonwoven Fabrics", F. Ko and C. Pastore, *Proceedings of INDA Technical Symposium*, Boston MA, 1985.

"Design and Formation of 3-D Fabrics for Advanced Composites", Ko, F.K. and Pastore, C.M., *Composite Materials, NASA Publication CP-2420*, Annapolis, MD, November 1985

"Multilayer, Multidirectional Warp Knit for Industrial Applications", F. Ko, P. Fang, and C. Pastore, *Proceedings, IFAI Textile Technology Forum*, New Orleans, LA, Oct. 31, 1985.

"Nonlinear Viscoelasticity of Natural Polyamide Fibers", Ko, F.K. and Pastore, C.M., *Proceedings, 7th International Wool Textile Research Conference*, Tokyo. 1985.

"A Comparison of American and Japanese Primary Hand for Men's Winter Suiting, Ko, F.K., Pastore, C.M. and Kawabata, S., *Objective Measurement: Applications to Product Design and Process Control*, ed. Kawabata et al., The Textile Machinery Society of Japan, 1985, pp. 581-589.

*Role of Processing in the Performance of Textile Reinforced Composite Materials*, C. Pastore, NCSU COT Graduate Seminar Series, Sept. 1992.

*Use of Textile Composites in the Aerospace Industry*, C. Pastore, Society for Plastic Engineers, Southern Pines, NC, April, 1992.

*Design and Analysis of Three Dimensional Preforms for Composites*, C. Pastore, SAMPE Long Island Division, March 14, 1989.

*Manufacture, Design and Analysis of Braided Fabrics and Composites*, C. Pastore, Proceedings, 4th Annual Textile Structural Composites Symposium, Philadelphia, PA July 24-26, 1989.

*Model for Silk-Like Spun Bonded Fabrics*, F. Ko, P. Fang, C Pastore, INDA-TEC: The International Nonwovens Technical Conference, Philadelphia, PA, 1988.

## Courses Taught

### THOMAS JEFFERSON UNIVERSITY

Advanced Textile Composites  
Analytical Methods<sup>S</sup>  
Architectural Engineering Senior Design  
Behavior of Materials<sup>A</sup>  
Chemical Protective Clothing<sup>C</sup>  
Composite Materials: Design and Analysis  
Design of Green Materials<sup>A</sup>  
Eco-Innovation and Sustainability<sup>S</sup>  
Engineering Dynamics  
Engineering Senior Design I & II  
Engineering Statics  
Experimental Materials<sup>A</sup>  
Experimental Structures<sup>A</sup>  
Fabric Mechanics  
Fabric Studies  
Fibrous Composite Materials  
Foundations: Fabric Studies  
Integrative Design Process  
Introduction to Computer Programming  
Introduction to Structural Analysis  
Introduction to Textile Materials<sup>C</sup>  
Introductory Materials Science  
Mechanics of Materials  
Mechanics of Textiles  
Probability and Statistics  
Processing of Polymers and Fibers  
Research Methods  
Structural Design of Compressive Systems  
Structural Design of Tensile Systems  
Structures I <sup>A</sup>  
Structures II<sup>A</sup>  
Textile Engineering Senior Design I & II

Textile Materials

Textile Problem Solving

Yarn Mechanics

### NORTH CAROLINA STATE UNIVERSITY

Design of a Composite Baja Vehicle  
Introduction to Fiber Science  
Introduction to Textiles  
Mechanical Properties of Textiles  
Physical Properties of Textile Fibers  
Physical Properties of Textiles  
Textile Composite Materials  
Textile Composites  
Textile Honors Seminar  
Textile Materials Science Design I  
Textile Materials Science Design II

### DREXEL UNIVERSITY

Advanced Mechanical Behavior of Materials  
Introduction to Materials Science  
Numerical Methods for Materials  
Engineering  
Senior Design Thesis

*A: College of Architecture and the Built Environment*

*S: College of Science, Health and the Liberal Arts*

*C: School of Continuing and Professional Studies*

## Graduate Student Committees

### CHAIR

C. Anderson, *Development of 3D Printed Gelatinous Composites*, PhD, Textile Engineering, May 2018, Thomas Jefferson University.

C. Huang, *Thermal Conductivity and Tensile Properties of Icelandic Horse Hair Fiber Reinforced Poly(Lactic Acid) Green Composites*, MS Textile Engineering, May 2012, Philadelphia University

J. Xu, *The Influence of Braid Angle and Yarn Twist Match on the Mechanical Properties and Knot Performance of Surgical Sutures*, MS Textile Engineering, May 2012, Philadelphia University

K. Fu, *Influence of Alkali Treatment on the Mechanical Properties of Aligned Jute Yarn/PLA Composites*, MS Textile Engineering, May 2011, Philadelphia University

X. Qiu, *Acoustic Qualities of Natural Fiber Reinforced Polylactic Acid Composites* MS Textile Engineering, May 2011, Philadelphia University

R. Wu, *Characterization and Development of Flax/PLA Composites for acoustic properties*, MS Textile Engineering, December 2010, Philadelphia University

Y. Rane, *Development of Triggered Degradation for Chitosan Composites*, Ph.D., August 2009, Textile Engineering, Philadelphia University

M. Owens, *Organic Material for Bone Replacement*, MS December 2009, Textile Engineering, Philadelphia University

T. Periyaswamy, *Ultrasonic Characterization of Flexible Textile Materials*, Ph.D., March 2009, Textile Engineering, Philadelphia University

K. Darrah, *Luminous Fabric Structures*, M.S. May 2010, Textile Engineering, Philadelphia University

H. Khurana, *Effect of Processing on Mechanical and Physical Properties of Chemical Protective Clothing*, M.S., May 2006, Textile Engineering, Philadelphia University

A. Naik, *Ultra-light weight cement products for built environments*, M.S., May 2005, Textile Engineering, Philadelphia, University

S. Ram, *Highly extensible knit fabrics for architectural applications*, M.S., May 2004, Textile Design, Philadelphia University

C. Wollner, *Non-linear anisotropic fabrics for architectural structures*, M. S., May 2002, Textile Engineering, Philadelphia University

K. Hristov, *Tensile Characteristics of Hybrid Braided Structures*, M. S., May 2002, Textile Engineering, Philadelphia University

D. Lee, *Moisture Diffusion in Kevlar®-Epoxy Composites*, M.S. May 2000, Textile Engineering, Philadelphia University.

L. DellaPutta, *Dynamic Response of 3D Woven Tapes Subject to Axial Tensile Load*, M.S., August 1998, Textile Engineering, PCT&S

J. N. Singletary *Analysis of Transverse Compressive Response of Anisotropic Single Fibers*, Ph.D., June 1998, Fiber and Polymer Science

T. Chen, *Effect of Glass Fiber Surface Treatments on the Bonding of Glass Fiber in Resin Matrix Composites*, M. S. , May 1998, Textile Engineering, PCT&S

M. W. Dunn, *Renitent Textile Composites: Formation and permeability analysis of porous media*, M.S., May 1997, Textile Engineering, PCT&S.

A. B. Birger, *Development of Curvilinear Spline Aided Techniques for Structural Analysis of Textile Composites*, Ph.D., June 1997, Fiber and Polymer Science

B. Deepak, *Application of Parametric Splines in Curvilinear Coordinate Systems for the Structural Analysis of Inhomogeneous Materials*, Ph.D., June 1997, Fiber and Polymer Science

G. Loughry, *Analysis of Shear Testing Methods for Braided Composite Cylinders and Plates*, M.S., Dec. 1995, Textile Engineering and Science.

S. Khedekar, *Modelling of Braided Composites with Architectural Defects*, M.S. Sep. 1995, Mechanical and Aerospace Engineering.

C. G. Green, *Cost-Effective Textile Reinforcements for Complex Shaped Automotive Components*, M.S., Dec. 1995, Textile Engineering and Science.

P. W. Duke, *Commingleed Thermoplastic-Glass Composites Formed from Recyclable Carded Webs*, M.S., Dec. 1995, Textile Engineering and Science.

B. Deepak, *Application of Parametric Splines to the Displacement Solution of Textile Composites*, M.S. March. 1995, Textile Engineering and Science and Mechanical and Aerospace Engineering Co-major

E. C. Clyburn, *Application of Neutron Tomography to the Investigation of Textile Reinforcement Geometry in Composites*, M.S., Feb. 1995, Materials Engineering



E. S. Greenhalgh, *Development of Biomimetic Prosthetic Heart Valve Leaflets*, Ph.D., Dec. 1994, Fiber and Polymer Science

Y. Gawayed, *An Integrated Approach to the Mechanical and Geometrical Modelling of Textile Structural Composites*, Ph.D. March 1992, Fiber and Polymer Science, NCSU

E.S. Greenhalgh, *Fabric Geometry Modelling Applied to Finite Element Methodology for the Prediction of Mechanical Behavior of Cylindrical Composite Structures*, M.S., March 1992 Fiber and Polymer Science, NCSU

## Funded Research Activities

Development of a Medical Adhesive with Thermal Release Properties	Saligman Family Surgery Pilot Grant	2018
Effect of Temperature on Strength of Biocompatible Adhesives	Faculty Research Grant	2018
Game Based Learning	Nexus Research Grant	2017
Multi-material preforming of structural automotive composites	Oak Ridge National Laboratory	2013
Development of warp knitted heater panels for helicopter rotors	Cox & Co.	2012-2016
Optimization of braided sutures	Ethicon	2011-2013
Evaluation of energy efficient classrooms	CertainTeed	2011-2012
Development of Cellulose/PLA composites as hardwood replacement	DCED/Comins Guitars	2011
Life Cycle Assessment and Environmental Impact of Textile Products	Federal Mogul	2010-11
Development of braided nerve conduits	Rutgers Univ.	2010-13
Design of Sustainable Classroom Components	CertainTeed	2010
Development of new building products	CS Group	2008
Design of ergonomic, comfortable carriage vests	KDH, Inc.	2007-2009
Effectiveness of stretch fabric for enhanced athletic performance	Lontex, Inc.	2007-2008

Design and Characterization of transparent exterior building insulation materials	Roofscapes, Inc.	2007-2008
Residential Complex Design Charette	Earth Rising, Inc.	2007
Development of wheat gluten polymers	Green Materials R&D	2008
Evaluation of through thickness reinforcement of Carbon/Carbon Composites	MR&D	2007
Pa Green Growth Partnership	PA DCED	2006-2011
Consortium for Sustainable Design and Research	PA DCED	2003-2006
Bioinductive Scaffolds	NIH	2004-2005
Sustainability as a Source of Competitive Advantage	NTC	2003-2005
Representations and Algorithms for Deformable Objects	NSF	2002-2005
Trans-Atlantic Textile Network	FIPSE	2002-2004
Spray-on Insulation System for Housing	State of PA	2002-2004
Engineering and Design Studio	State of PA	2000-2002
Haptic Simulation of Fabric Structures	NTC	2000-2002
Exploring Architectural Fabrics	NTC	2000-2002
Novel Textiles for Military Applications	DARPA	1999
Educating the Educators	NTC	2000-2002
Scale Sensitive Modelling of Braided Hybrid Composites	NTC	1998-2000

Development of self-sealing spacesuit materials	ILC Dover	1998
Materials Characterization of Elastomeric Nonwoven Fabrics	Kimberly Clark	1998
Conversion of natural fiber to textile products	Crane Paper	1998
Dynamic Response of Woven Arresting Tapes	Navy SAWC	1997-99
Apparel Research Network	DLA	1996-1999
Evaluation of Z Fiber Component in Needle Punched Nonwovens	Fiberite	1996-97
A Comparative Theoretical Study of Quasi-Static and Impact Response of Laminated and Textile Composite Structures	ARO	1996-1999
Testing and Analysis of Braided Composite Materials for Automotive Applications	Ford Motor	1994-96
Stress Analysis in Thick Walled Composite Cylinders	ONR	1995-97
Manufacturing and Analysis of Braided Composite Materials	Ford Motor	1993-94
Textile Composite Panels for Improved Indoor Air Quality	EPA	1992-95
Composite Materials for Energy Efficient Structures	Duke Power	1993-95
Prediction of Mechanical Properties of Textile Reinforced Composites	DoC	1992-95
Appearance Defects in Fabrics	DoC	1992-95
Development of Technical Glossary for Textile Composites Industry	NASA	1992
Modelling of Transverse Shear Deformation of Three Dimensionally Woven Composites	State of NC	1992-93
Geometric Modelling of Textile Reinforcements for Structural Analysis	NASA	1991-95