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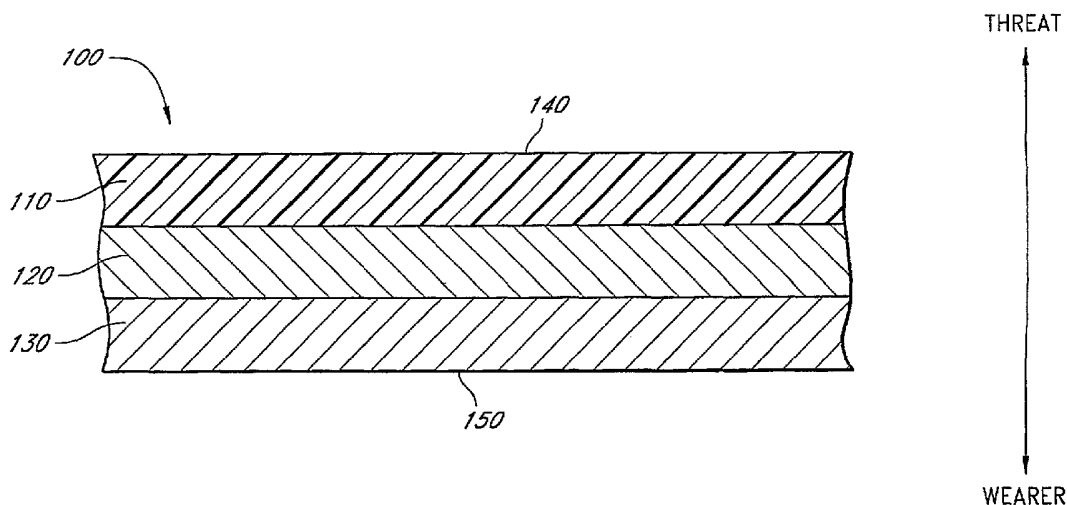
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(54) Title: SOFT ARMOR



(57) Abstract: According to one embodiment, there is provided soft armor. The soft armor comprises an armor structure having a threat side and an inner side inward of the threat side. The armor structure is formed from soft armor material, and the armor structure is substantially imperforable by rifle fire.

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SOFT ARMOR

Background of the Invention

Field of the Invention

[0001] Certain disclosed embodiments relate generally to armor for protection of personnel and/or vehicles, buildings, etc.

Description of the Related Art

[0002] Currently known armor includes "hard" and "soft" armor. Hard armor can be made very strong, but may be too rigid for some applications. Soft armor has some advantages, but is generally weaker than hard armor.

Summary of the Invention

[0003] According to one embodiment, there is provided soft armor. The soft armor comprises an armor structure having a threat side and an inner side inward of the threat side. The armor structure is formed from soft armor material, and the armor structure is substantially imperforable by rifle fire.

[0004] According to another embodiment, there is provided soft armor. The soft armor comprises an armor structure having a threat side and an inner side inward of the threat side. The armor structure is formed from soft armor material, and the armor structure is sufficiently strong to defeat rifle fire.

[0005] According to another embodiment, there is provided soft armor. The soft armor comprises an armor structure having a threat side and an inner side inward of the threat side. The armor structure is formed from soft armor material, and the armor structure provides at least NIJ type III ballistic protection.

[0006] According to another embodiment, there is provided a soft armor garment. The soft armor garment comprises a torso portion formed from soft armor material and configured to wrap around a torso of a wearer. The torso portion provides at least NIJ type III ballistic protection to at least a portion of the torso against threats from any side of the torso.

[0007] According to another embodiment, there is provided a soft armor garment. The soft armor garment comprises a torso portion formed from soft armor material and configured to wrap around a torso of a wearer. The torso portion provides at

least NIJ type III ballistic protection to the torso against threats within a 360-degree threat envelope.

[0008] Certain objects and advantages of the invention are described herein. Of course, it is to be understood that not necessarily all such objects or advantages may be achieved in accordance with any particular embodiment of the invention. Thus, for example, those skilled in the art will recognize that the invention may be embodied or carried out in a manner that achieves or optimizes one advantage or group of advantages as taught herein without necessarily achieving other objects or advantages as may be taught or suggested herein.

[0009] All of the embodiments summarized above are intended to be within the scope of the invention herein disclosed. However, despite the foregoing discussion of certain embodiments, only the appended claims (and not the present summary) are intended to define the invention. The summarized embodiments, and other embodiments of the present invention, will become readily apparent to those skilled in the art from the following detailed description of the preferred embodiments having reference to the attached figures, the invention not being limited to any particular embodiment(s) disclosed.

Brief Description of the Drawings

[0010] Figure 1 is a schematic sectional view of one embodiment of an armor structure.

[0011] Figure 2 is a schematic sectional view of another embodiment of an armor structure.

[0012] Figure 3 is a schematic sectional view of another embodiment of an armor structure.

[0013] Figure 4 is a schematic sectional view of another embodiment of an armor structure.

[0014] Figure 5 is a schematic sectional view of another embodiment of an armor structure.

[0015] Figure 6 is a schematic sectional view of another embodiment of an armor structure.

[0016] Figure 7 is a schematic top view of an armored vest and a threat envelope defeated by the armored vest.

[0017] Figure 8 is a front view of another embodiment of an armored vest.

[0018] Figure 9 is a rear view of the armored vest of Figure 8.

[0019] Figure 10 is a front view of another embodiment of an armored vest.

[0020] Figure 11 is a schematic exploded sectional view of a technique usable for constructing various armor structures disclosed herein.

[0021] Figure 12 is an elevation view of a stitch pattern usable for constructing various armor structures disclosed herein.

[0022] Figure 13 is an elevation view of another stitch pattern usable for constructing various armor structures disclosed herein.

Detailed Description of the Preferred Embodiment

[0023] Figure 1 depicts one embodiment of a soft armor structure 100 which generally comprises a layered construction of a first section 110, second section 120 and third section 130. The armor structure 100 is configured to be worn, mounted or otherwise employed such that the first section 110 is located closest to a threat (e.g., incoming gunfire) and the third section 130 is located closest to the wearer, vehicle, aircraft, building, etc. to be protected by the armor structure 100. Accordingly, the armor structure 100 includes a threat side 140 and an inner side 150.

[0024] In some embodiments, each of the first, second and third sections 110, 120, 130 is formed from soft armor material. In certain such embodiments, the first section 110 comprises ZYLON, the second section 120 comprises KEVLAR, and the third section 130 comprises KEVLAR. In still other such embodiments, any one or more of the first, second and third sections 110, 120, 130 may comprise woven ZYLON or woven KEVLAR, or multiple layers of woven ZYLON or woven KEVLAR.

[0025] In one such embodiment, the first section 110 comprises 10 layers of ZYLON-530 (i.e., ZYLON similar to style no. 530 available from Hexcel Schwebel of Anderson, SC), the second section 120 comprises 6 layers of KEVLAR-704 (i.e., KEVLAR similar to style no. 704 available from Hexcel Schwebel), and the third section 130 comprises 8 layers of KEVLAR-726 (i.e., KEVLAR similar to style no. 726 available from Hexcel Schwebel). (In addition, if desired, the layers of the third section 130 may be laminated to improve resistance to backface deformation.) This embodiment of the armor structure 100 achieves type IIIa protection as established in the National Institute of Justice

(“NIJ”) standard no. 0101.04 (June 2001). In addition, this embodiment of the armor structure 100 protects against the following “supplemental” threats under test circumstances similar to those set forth in NIJ standard no. 0101.04: (1) a 60 grain, 9mm RBCD armor-piercing bullet at 2105 feet per second (FPS); (2) a 52 grain, 9mm MagSafe Agent Load bullet at 2120 FPS; (3) a 77 grain, .40 caliber MagSafe bullet at 1920 FPS; and (4) a 92 grain, .45 caliber MagSafe Agent Load bullet at 2020 FPS.

[0026] In further type IIIa-compliant embodiments of the armor structure 100, the first section 110 comprises 10 or more (e.g., 11, 12, 15, 20, 25 or more) layers of ZYLON-530, the second section 120 comprises 6 or more (e.g., 7, 8, 10, 12, 15, 20 or more) layers of KEVLAR-704, and the third section 130 comprises 8 or more (e.g., 9, 10, 12, 15, 20 or more) layers of KEVLAR-726. (In certain of these embodiments, one or more layers of soft armor material other than ZYLON-530, KEVLAR-704 and KEVLAR-726 may be employed in the first, second or third layers 110, 120, 130, respectively, in addition to the layers specified above.) All of these embodiments also protect against the “supplemental” threats enumerated above.

[0027] In still further type IIIa-compliant embodiments of the armor structure 100, an “overbuilt” section (i.e., more than 10 (e.g., 11, 12, 15, 20, 25 or more) layers of ZYLON-530 employed in the first section 110, more than 6 (e.g., 7, 8, 10, 12, 15, 20 or more) layers of KEVLAR-704 employed in the second section 120, or more than 8 (e.g., 9, 10, 12, 15, 20 or more) layers of KEVLAR-726 employed in the third section 130) is employed in one or two of the sections 110, 120, 130, and an “underbuilt” section (i.e., fewer than 10 layers of ZYLON-530 employed in the first section 110, fewer than 6 layers of KEVLAR-704 employed in the second section 120, or fewer than 8 layers of KEVLAR-726) is employed in the balance of the sections 110, 120, 130. In other type IIIa-compliant embodiments of the armor structure 100, such an “overbuilt” section is employed as one or two of the sections 110, 120, 130, and the balance of the sections 110, 120, 130 are omitted.

[0028] Figure 2 depicts another embodiment of a soft armor structure 200 which generally comprises a layered construction of a first section 210 and a second section 220. The armor structure 200 is configured to be worn, mounted or otherwise employed such that the first section 210 is located closest to a threat (e.g., incoming gunfire) and the second section 220 is located closest to the wearer, vehicle, aircraft, building, etc. to be

protected by the armor structure 200. Accordingly, the armor structure 200 includes a threat side 240 and an inner side 250.

[0029] In some embodiments, both of the first and second sections 210, 220, are formed from soft armor material. In certain such embodiments, the first section 210 comprises ZYLON and the second section 220 comprises KEVLAR. In still other such embodiments, one or both of the first and second sections 210, 220 may comprise woven ZYLON or woven KEVLAR, or multiple layers of woven ZYLON or woven KEVLAR.

[0030] In one such embodiment, the first section 210 comprises 22 layers of ZYLON-530 and the second section 220 comprises 3 layers of KEVLAR-726. (In addition, if desired, the layers of the second section 220 may be laminated to improve resistance to backface deformation.) This embodiment of the armor structure 200 achieves NIJ type IIIa protection. In addition, this embodiment of the armor structure 200 protects against the following “supplemental” threats under test circumstances similar to those set forth in NIJ standard no. 0101.04: (1) a 60 grain, 9mm RBCD armor-piercing bullet at 2600 feet per second (FPS); (2) a 52 grain, 9mm MagSafe Agent Load bullet at 2600 FPS; (3) a 77 grain, .40 caliber MagSafe bullet at 2400 FPS; and (4) a 92 grain, .45 caliber MagSafe Agent Load bullet at 2500 FPS.

[0031] In further type IIIa-compliant embodiments of the armor structure 200, the first section 210 comprises 22 or more (e.g., 23, 24, 25, 30, 35, 40, 50 or more) layers of ZYLON-530, and the second section 220 comprises 3 or more (e.g., 4, 5, 6, 9, 10, 12, 15 or more) layers of KEVLAR-726. (In these embodiments, one or more layers of soft armor material other than ZYLON-530 or KEVLAR-726 may be employed in the first or second layers 210, 220, respectively, in addition to the layers specified above.) All of these embodiments also protect against the “supplemental” threats enumerated above.

[0032] In still further type IIIa-compliant embodiments of the armor structure 200, an “overbuilt” section (i.e., more than 22 (e.g., 23, 24, 25, 30, 35, 40, 50 or more) layers of ZYLON-530 employed in the first section 210, or more than 3 (e.g., 4, 5, 6, 9, 10, 12, 15 or more) layers of KEVLAR-726 employed in the second section 220) is employed in one of the sections 210, 220, and an “underbuilt” section (i.e., fewer than 22 layers of ZYLON-530 employed in the first section 210, or fewer than 3 layers of KEVLAR-726 employed in the second section 220) is employed in the other of the sections 210, 220. In other type IIIa-compliant embodiments of the armor structure 200, such an “overbuilt”

section is employed as one of the sections 210, 220, and the other of the sections 210, 220 is omitted.

[0033] Figure 3 depicts another embodiment of a soft armor structure 300 which generally comprises a first armor substructure comprising any of the embodiments disclosed herein of the armor structure 100, positioned adjacent a second armor substructure comprising any of the embodiments disclosed herein of the armor structure 200. The armor structure 300 is configured to be worn, mounted or otherwise employed such that the first section 110 of the armor structure 100 is located closest to a threat (e.g., incoming gunfire) and the second section 220 of the armor structure 200 is located closest to the wearer, vehicle, aircraft, building, etc. to be protected by the armor structure 300. Accordingly, the armor structure 300 includes a threat side 340 and an inner side 350. The various embodiments of the armor structure 300 defeat handgun fire and various “supplemental” threats as discussed above, and achieve NIJ type IIIa protection.

[0034] Figure 4 depicts another embodiment of a soft armor structure 400 which generally comprises a layered construction of a first section 410 and a second section 420. The armor structure 400 is configured to be worn, mounted or otherwise employed such that the first section 410 is located closest to a threat (e.g., incoming gunfire) and the second section 420 is located closest to the wearer, vehicle, aircraft, building, etc. to be protected by the armor structure 400. Accordingly, the armor structure 400 includes a threat side 440 and an inner side 450.

[0035] In some embodiments, both of the first and second sections 410, 420, are formed from soft armor material. In certain such embodiments, the first section 410 comprises ZYLON and the second section 420 comprises KEVLAR. In still other such embodiments, one or both of the first and second sections 410, 420 may comprise woven ZYLON or woven KEVLAR, or multiple layers of woven ZYLON or woven KEVLAR.

[0036] In one such embodiment, the first section 410 comprises 90 layers of ZYLON-530 and the second section 420 comprises 26 layers of KEVLAR-726. (In addition, if desired, the layers of the second section 420 may be laminated to improve resistance to backface deformation.) This embodiment of the armor structure 400 defeats both handgun and rifle fire, and achieves NIJ type III protection.

[0037] In further type III-compliant embodiments of the armor structure 400, the first section 410 comprises 90 or more (e.g., 91, 92, 95, 100, 110, 125, 150 or more) layers

of ZYLON-530, and the second section 220 comprises 26 or more (e.g., 27, 28, 30, 35, 40, 50 or more) layers of KEVLAR-726. (In these embodiments, one or more layers of soft armor material other than ZYLON-530 or KEVLAR-726 may be employed in the first or second layers 410, 420, respectively, in addition to the layers specified above.)

[0038] In still further type III-compliant embodiments of the armor structure 400, an “overbuilt” section (i.e., more than 90 (e.g., 91, 92, 95, 100, 110, 125, 150 or more) layers of ZYLON-530 employed in the first section 410, or more than 26 (e.g., 27, 28, 30, 35, 40, 50 or more) layers of KEVLAR-726 employed in the second section 420) is employed in one of the sections 410, 420, and an “underbuilt” section (i.e., fewer than 90 layers of ZYLON-530 employed in the first section 410, or fewer than 26 layers of KEVLAR-726 employed in the second section 420) is employed in the other of the sections 410, 420. In other type III-compliant embodiments of the armor structure 400, such an “overbuilt” section is employed as one of the sections 410, 420, and the other of the sections 410, 420 is omitted.

[0039] Figure 5 depicts another embodiment of a soft armor structure 500 which generally comprises a single section 510 formed from soft armor material and having a threat side 540 and an inner side 550. The armor structure 500 is configured to be worn, mounted or otherwise employed to protect a human wearer, vehicle, aircraft, building, etc.

[0040] In some embodiments, the armor structure 500 is formed from ZYLON; in certain such embodiments, the armor structure 500 may be formed from woven ZYLON, or multiple layers of woven ZYLON. In still another such embodiment, armor structure 500 comprises 258 layers of ZYLON-530. This embodiment of the armor structure 500 defeats both handgun and rifle fire, and achieves NIJ type III protection.

[0041] In further type III-compliant embodiments of the armor structure 500, the structure 500 comprises 258 or more (e.g., 259, 260, 265, 275, 300, 350, 400 or more) layers of ZYLON-530. (In these embodiments, one or more layers of soft armor material other than ZYLON-530 may be employed in addition to the layers specified above.)

[0042] Figure 6 depicts another embodiment of a soft armor structure 600 which generally comprises a layered construction of a first section 610 and a second section 620. The armor structure 600 is configured to be worn, mounted or otherwise employed such that the first section 610 is located closest to a threat (e.g., incoming gunfire) and the second section 620 is located closest to the wearer, vehicle, aircraft, building, etc. to be

protected by the armor structure 600. Accordingly, the armor structure 600 includes a threat side 640 and an inner side 650.

[0043] In some embodiments, both of the first and second sections 610, 620, are formed from soft armor material. In certain such embodiments, the first section 610 comprises ZYLON and the second section 620 comprises SPECTRASHIELD PLUS. In still other such embodiments, one or both of the first and second sections 610, 620 may comprise woven ZYLON or woven SPECTRASHIELD PLUS, or multiple layers of woven ZYLON or woven SPECTRASHIELD PLUS.

[0044] In one such embodiment, the first section 610 comprises 100 layers of ZYLON-530 and the second section 620 comprises 135 layers of SPECTRASHIELD PLUS-902 (i.e., SPECTRASHIELD PLUS similar to style no. 902 available from Hexcel Schwebel of Anderson, SC, or from Honeywell Corp. of Morristown, NJ). This embodiment of the armor structure 600 defeats both handgun and rifle fire, and achieves NIJ type III protection.

[0045] In further type III-compliant embodiments of the armor structure 600, the first section 610 comprises 100 or more (e.g., 101, 102, 105, 110, 125, 150, 200 or more) layers of ZYLON-530, and the second section 220 comprises 135 or more (e.g., 136, 137, 140, 150, 175, 200 or more) layers of SPECTRASHIELD PLUS-902. (In these embodiments, one or more layers of soft armor material other than ZYLON-530 or SPECTRASHIELD PLUS-902 may be employed in the first or second layers 610, 620, respectively, in addition to the layers specified above.)

[0046] In still further type III-compliant embodiments of the armor structure 600, an "overbuilt" section (i.e., more than 100 (e.g., 101, 102, 105, 110, 125, 150, 200 or more) layers of ZYLON-530 employed in the first section 610, or more than 135 (e.g., 136, 137, 140, 150, 175, 200 or more) layers of SPECTRASHIELD PLUS-902 employed in the second section 620) is employed in one of the sections 610, 620, and an "underbuilt" section (i.e., fewer than 100 layers of ZYLON-530 employed in the first section 610, or fewer than 135 layers of KEVLAR-726 employed in the second section 620) is employed in the other of the sections 610, 620. In other type III-compliant embodiments of the armor structure 600, such an "overbuilt" section is employed as one of the sections 610, 620, and the other of the sections 610, 620 is omitted.

[0047] Any of the embodiments of the soft armor structures 100, 200, 300, 400, 500, 600 disclosed herein may be employed to construct any of a variety of armored equipment. For example, any of the disclosed armor structures may be employed to construct soft body armor, such as a bulletproof vest. In one embodiment shown in Figure 7, such a vest 705 is entirely constructed from one or a combination of the armor structures disclosed herein, providing ballistic protection of a given type (e.g., type IIIa, type III, type 2.7A, rifle-fire-defeating) that “wraps” completely around a torso T of a wearer W. In other words, such a vest provides 360-degree protection for the torso T (at the ballistic protection level provided by the armor structure 100/200/300/400/500/600 chosen to construct the vest 705), by defeating threats 715 approaching the standing/kneeling/sitting wearer W from any angle as depicted in Figure 7. (For example, “360-degree” level III protection may be facilitated by constructing the vest 705 from any suitable embodiment of the armor structures 300/400/500/600 disclosed above.) The vest 705 may also be configured to cover the tops of the wearer’s shoulders, to protect the torso T from threats from above.

[0048] Figures 8-9 depict front and rear views, respectively, of another embodiment of a vest 805 that may be constructed with any one or combination of the armor structures 100/200/300/400/500/600 disclosed herein. (The dimensions and specifications listed on Figures 8-9 are merely exemplary, and may be varied or omitted in other embodiments of the vest 805.) The vest 805 generally comprises a torso cover 807 and one or more trauma plates 809. The torso cover may be constructed from any of the armor structures disclosed herein, or any other suitable material, and the trauma plate(s) 809 may likewise be constructed from any of the herein-disclosed armor structures. The torso cover 807 extends behind or in front of the trauma plate(s) 809 so that enhanced protection is provided at the trauma plate(s). As seen in Figure 9, the rear of the vest 805 may feature a spinal trauma plate to provide added protection at the wearer’s spinal region. The spinal trauma plate may be formed from any of the armor structures disclosed herein, or may be formed from an outer section of 5 or more layers of ZYLON-530, a middle section of 6 or more layers of KEVLAR-726, and an inner section of 4 or more layers of KEVLAR-724 (i.e., KEVLAR similar to style no. 704 available from Hexcel Schwebel).

[0049] Figure 10 depicts a front view of another embodiment of the vest 805, which may be generally similar to the embodiment of the vest 805 shown in Figures 8-9, except as indicated in Figure 10. (As with Figures 8-9, the dimensions and specifications

listed on Figure 10 are merely exemplary, and may be varied or omitted in other embodiments of the vest 805.)

[0050] Alternatively, any of the disclosed armor structures may be employed to construct soft body armor panels which may be sewn into, and/or enclosed in pockets formed in, a vest constructed from other suitable materials or fabrics.

[0051] Any of the disclosed armor structures 100, 200, 300, 400, 500, 600 may also be employed to form armor panels for use in vehicles, either on or against the vehicle "skin" or in critical locations like seats, cockpits, fuel tanks, hydraulic lines, ammunition stores, etc. Similarly, any of the disclosed armor structures 100, 200, 300, 400, 500, 600 may be employed to construct helmets or armor panels for buildings.

[0052] In constructing the armor structures and/or armored articles disclosed herein, each of the layers of soft armor material may be laser-cut into the desired perimeter shape. The layers may be cut individually or in groups of 2 or more. Laser cutting has proven advantageous in that it prevents fraying of woven soft armor materials as the laser heat tends to "heat-seal" the edges of the cut material. In some embodiments, an infrared laser or a carbon-dioxide laser may be employed.

[0053] Figure 11 depicts a construction technique that may be employed in joining together a number (e.g., 5, 10 or more) of layers 902 of soft armor material, to form a section or partial section of any of the armor structures 100/200/300/400/500/600 disclosed herein, or to form a complete armor structure. The technique involves applying an adhesive tape 904, such as a polymer tape, over some or all of the perimeter edges of the "sandwich" of layers 902. (In one embodiment, a polyethylene tape is employed.) After the tape 904 is applied, stitching 906 is passed through the tape 904 and layers 902, using any suitable stitching process. The technique illustrated in Figure 11 may be employed in addition to the laser-cutting technique disclosed above.

[0054] Figure 12 depicts a stitch pattern that may be employed in stitching together a number of sections, layers, etc. to form any of the armor structures disclosed herein, or to form an armor panel or other armored article. The pattern includes a number (8 are depicted; alternatively, a smaller or larger number may be employed) of radial stitch lines 1002 that pass through the approximate center C of a panel/article 1000. In one embodiment, as shown in Figure 12, the radial stitch lines 1002 are approximately equally angularly spaced about the center C. A number of optional perimeter stitch lines 1004 may

also be employed near the edges of the panel/article 1000. (Although a square panel/article 1000 is depicted in Figure 12, the depicted stitch pattern may be used in constructing panels/articles having any of a variety of perimeter shapes.)

[0055] Figure 13 depicts another stitch pattern that may be employed in stitching together a number of sections, layers, etc. to form any of the armor structures disclosed herein, or to form an armor panel or other armored article. Like the pattern shown in Figure 12, the “spider-web” pattern of Figure 13 includes a number of radial stitch lines 1002 that pass through the approximate center C of the panel/article 1000. A number of generally concentric circular stitch lines 1006 are also made to create the spider-web form shown in Figure 13.

[0056] Either of the stitch patterns shown in Figures 12 or 13, or any other suitable stitch pattern, may be employed with the laser cutting procedure disclosed above, and/or the construction technique shown in Figure 11, in constructing any of the armor structures or armored articles disclosed herein. In addition, any of the armor structures, panels, sections etc. may be encased in an appropriate structural or waterproofing casing during or after fabrication.

[0057] Specifications for various materials discussed above are as set forth in the following tables.

ZYLON-530: SPECIFICATIONS		
Yarn Type	Warp Yarn	Zylon AS, 500 denier
	Fill Yarn	Zylon AS, 500 denier
Fabric Weight	4.00	oz/yd ²
	136	g/m ²
Weave Style	Plain	
Nominal Construction (yarns/inch)	Warp Count	30
	Fill Count	30
Fabric Thickness	8.0	mils
	0.20	mm
Breaking Strength	1080	lbf/in
	1020	lbf/in

KEVLAR-704: SPECIFICATIONS		
Yarn Type	Warp Yarn	Kevlar 129, 840 denier
	Fill Yarn	Kevlar 129, 840 denier
Fabric Weight	7.0	oz/yd ²
	237	g/m ²
Weave Style	Plain	
Nominal Construction (yarns/inch)	Warp Count	31
	Fill Count	31
Fabric Thickness	12.0	mils
	0.3	mm
Breaking Strength	900	lbf/in
	950	lbf/in

KEVLAR-724: SPECIFICATIONS		
Yarn Type	Warp Yarn	Kevlar 129, 1000 denier
	Fill Yarn	Kevlar 129, 1000 denier
Fabric Weight	6.5	oz/yd ²
	220	g/m ²
Weave Style	Plain	
Nominal Construction (yarns/inch)	Warp Count	24
	Fill Count	24
Fabric Thickness	11.0	mils
	0.28	mm
Breaking Strength	763	lbf/in
	776	lbf/in

KEVLAR-726: SPECIFICATIONS		
Yarn Type	Warp Yarn	Kevlar 129, 840 denier
	Fill Yarn	Kevlar 129, 840 denier
Fabric Weight	6.0	oz/yd ²
	203	g/m ²
Weave Style	Plain	
Nominal Construction (yarns/inch)	Warp Count	26
	Fill Count	26
Fabric Thickness	10.0	mils
	0.25	mm
Breaking Strength	760	lbf/in
	770	lbf/in

SPECTRASHIELD PLUS-902: SPECIFICATIONS		
Yarn Type	Warp Yarn	Spectra 900, 1200 denier
	Fill Yarn	Spectra 900, 1200 denier
Fabric Weight	5.5	oz/yd ²
	187	g/m ²
Weave Style	Plain	
Nominal Construction (yarns/inch)	Warp Count	17
	Fill Count	17
Fabric Thickness	18.0	mils
	0.46	mm
Breaking Strength	900	lbf/in
	850	lbf/in

[0058] Although this invention has been disclosed in the context of certain preferred embodiments and examples, it will be understood by those skilled in the art that the present invention extends beyond the specifically disclosed embodiments to other alternative embodiments and/or uses of the invention and obvious modifications and equivalents thereof.

Thus, it is intended that the scope of the present invention herein disclosed should not be limited by the particular disclosed embodiments described above, but should be determined only by a fair reading of the claims that follow.

WHAT IS CLAIMED IS:

1. Soft armor comprising:
an armor structure having a threat side and an inner side inward of said threat side;
said armor structure being formed from soft armor material;
said armor structure being substantially imperforable by rifle fire.
2. The soft armor of Claim 1, wherein said armor structure comprises at least 258 layers of ZYLON-530.
3. The soft armor of Claim 1, wherein said armor structure comprises a first section of at least 100 layers of ZYLON-530, adjacent to a second section of at least 135 layers of SPECTRASHIELD PLUS.
4. The soft armor of Claim 1, wherein said armor structure comprises a first section of at least 90 layers of ZYLON-530, adjacent to a second section of at least 26 layers of KEVLAR-726.
5. The soft armor of Claim 1, wherein said armor structure comprises:
a first section of at least 10 layers of ZYLON-530, overlying a second section of at least 6 layers of KEVLAR-704, overlying a third section of at least 8 layers of KEVLAR-726, overlying a fourth section of at least 22 layers of ZYLON-530, overlying a fifth section of at least 3 layers of KEVLAR-726.
6. An armor panel formed from the soft armor of Claim 1.
7. A garment comprising at least one of the armor panel of Claim 6.
8. A vest comprising at least one of the armor panel of Claim 6.
9. A helmet comprising the soft armor of Claim 1.
10. Soft armor comprising:

an armor structure having a threat side and an inner side inward of said threat side;

said armor structure being formed from soft armor material;

said armor structure being sufficiently strong to defeat rifle fire.

11. The soft armor of Claim 10, wherein said armor structure comprises at least 258 layers of ZYLON-530.

12. The soft armor of Claim 10, wherein said armor structure comprises a first section of at least 100 layers of ZYLON-530, adjacent to a second section of at least 135 layers of SPECTRASHIELD PLUS.

13. The soft armor of Claim 10, wherein said armor structure comprises a first section of at least 90 layers of ZYLON-530, adjacent to a second section of at least 26 layers of KEVLAR-726.

14. The soft armor of Claim 10, wherein said armor structure comprises: a first section of at least 10 layers of ZYLON-530, overlying a second section of at least 6 layers of KEVLAR-704, overlying a third section of at least 8 layers of KEVLAR-726, overlying a fourth section of at least 22 layers of ZYLON-530, overlying a fifth section of at least 3 layers of KEVLAR-726.

15. An armor panel formed from the soft armor of Claim 10.

16. A garment comprising at least one of the armor panel of Claim 15.

17. A vest comprising at least one of the armor panel of Claim 15.

18. A helmet comprising the soft armor of Claim 10.

19. Soft armor comprising:

an armor structure having a threat side and an inner side inward of said threat side;

said armor structure being formed from soft armor material;

said armor structure providing at least NIJ type III ballistic protection.

20. The soft armor of Claim 19, wherein said armor structure comprises at least 258 layers of ZYLON-530.

21. The soft armor of Claim 19, wherein said armor structure comprises a first section of at least 100 layers of ZYLON-530, adjacent to a second section of at least 135 layers of SPECTRASHIELD PLUS.

22. The soft armor of Claim 19, wherein said armor structure comprises a first section of at least 90 layers of ZYLON-530, adjacent to a second section of at least 26 layers of KEVLAR-726.

23. The soft armor of Claim 19, wherein said armor structure comprises: a first section of at least 10 layers of ZYLON-530, overlying a second section of at least 6 layers of KEVLAR-704, overlying a third section of at least 8 layers of KEVLAR-726, overlying a fourth section of at least 22 layers of ZYLON-530, overlying a fifth section of at least 3 layers of KEVLAR-726.

24. An armor panel formed from the soft armor of Claim 19.

25. A garment comprising at least one of the armor panel of Claim 24.

26. A vest comprising at least one of the armor panel of Claim 24.

27. A helmet comprising the soft armor of Claim 19.

28. A soft armor garment comprising:

a torso portion formed from soft armor material and configured to wrap around a torso of a wearer;

said torso portion providing at least NIJ type III ballistic protection to at least a portion of said torso against threats from any side of said torso.

29. A soft armor garment comprising:

a torso portion formed from soft armor material and configured to wrap around a torso of a wearer;

said torso portion providing at least NIJ type III ballistic protection to said torso against threats within a 360-degree threat envelope.

THREAT ← → WEARER

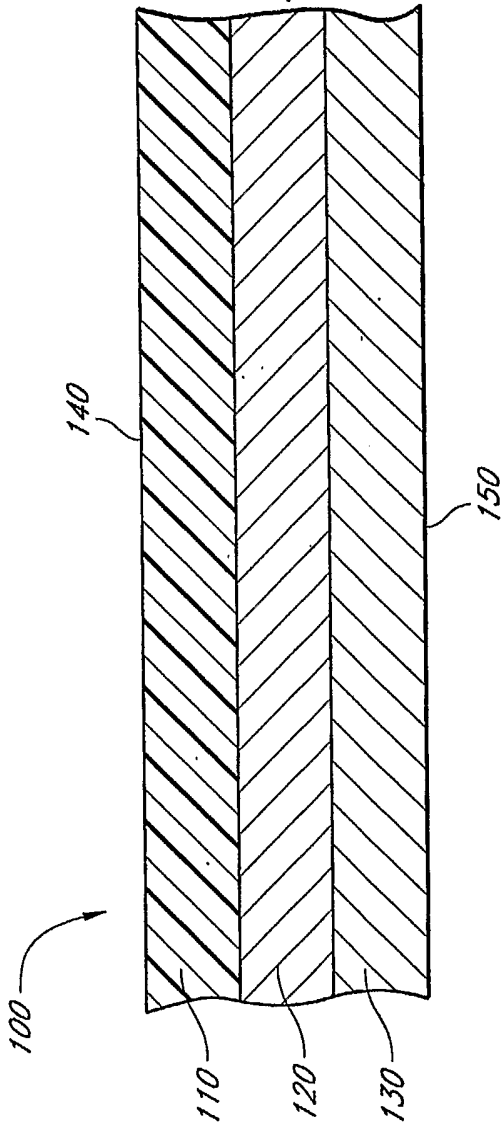


FIG. 1

THREAT ← → WEARER

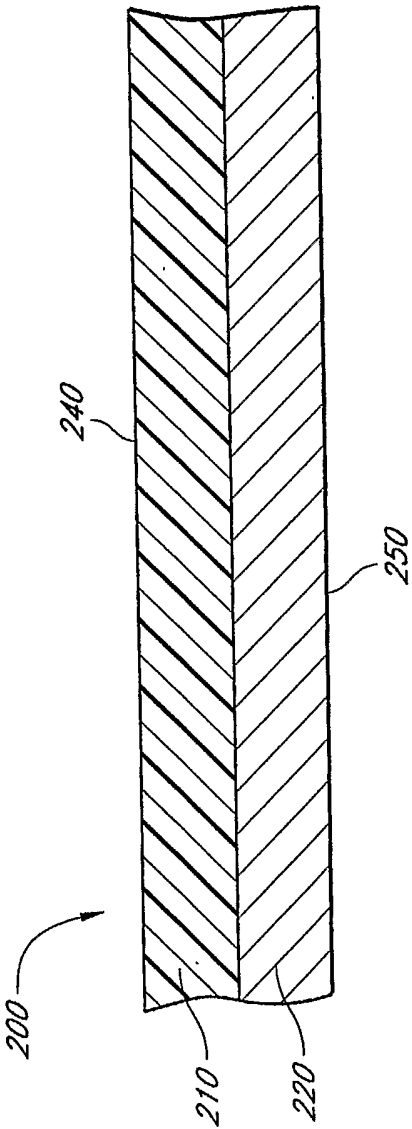


FIG. 2

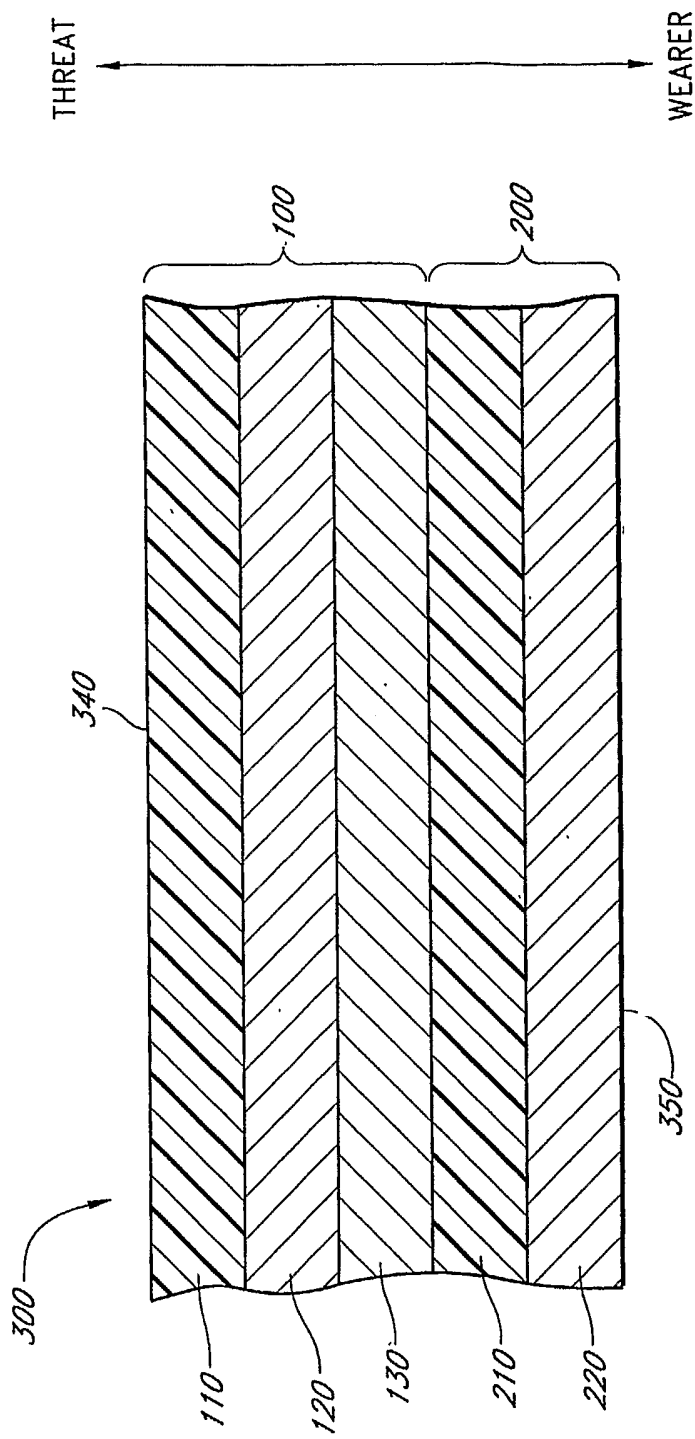


FIG. 3

THREAT ←

→ WEARER

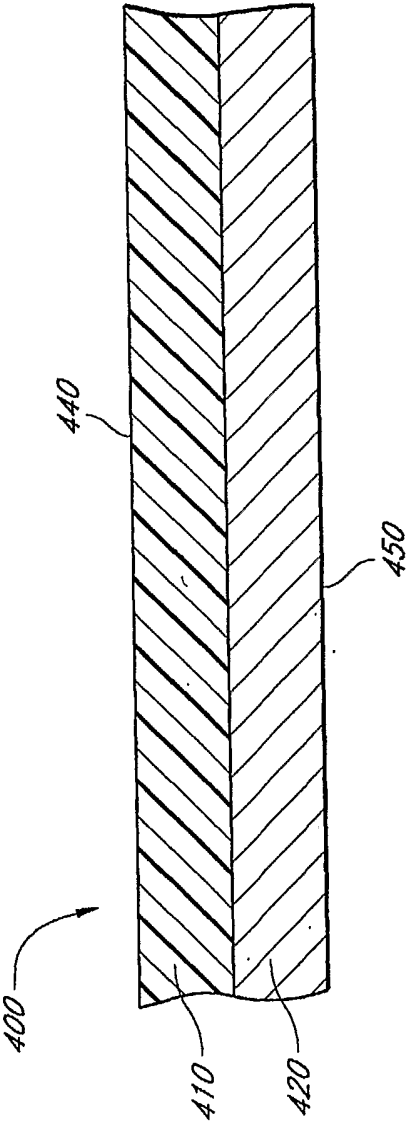


FIG. 4

THREAT ← → WEARER

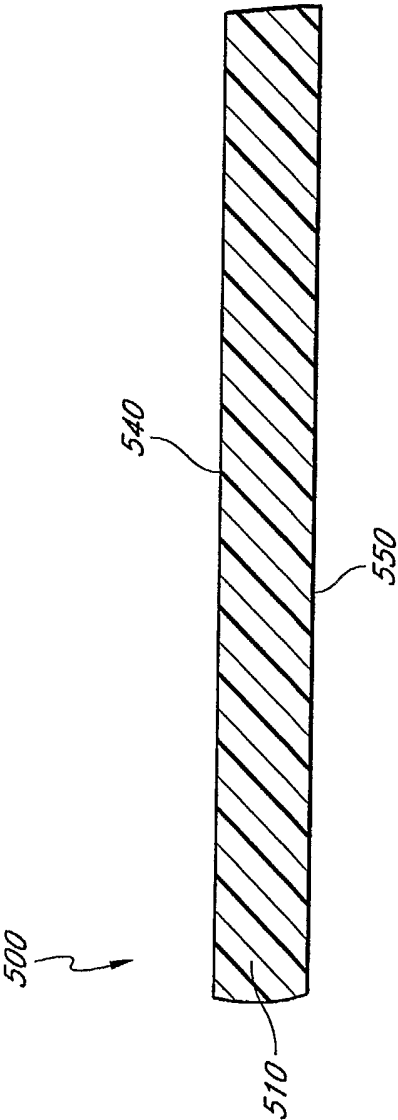


FIG. 5

THREAT ← → WEARER

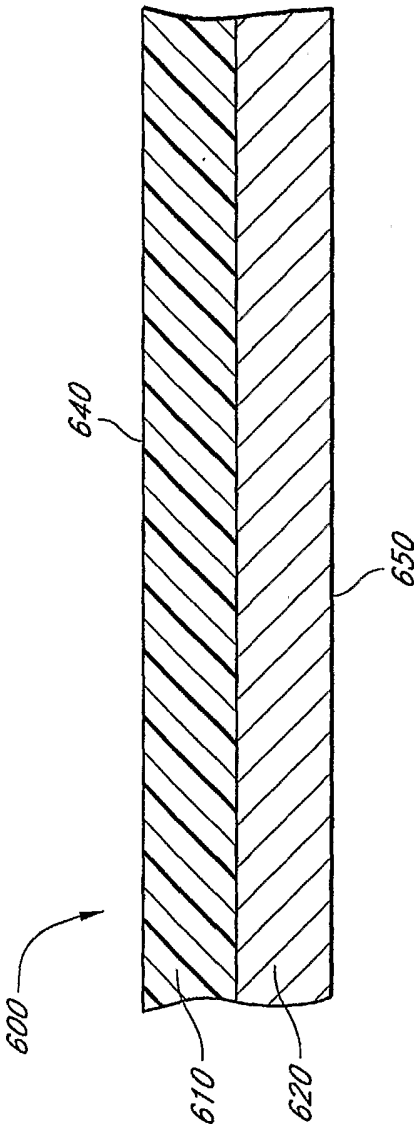


FIG. 6

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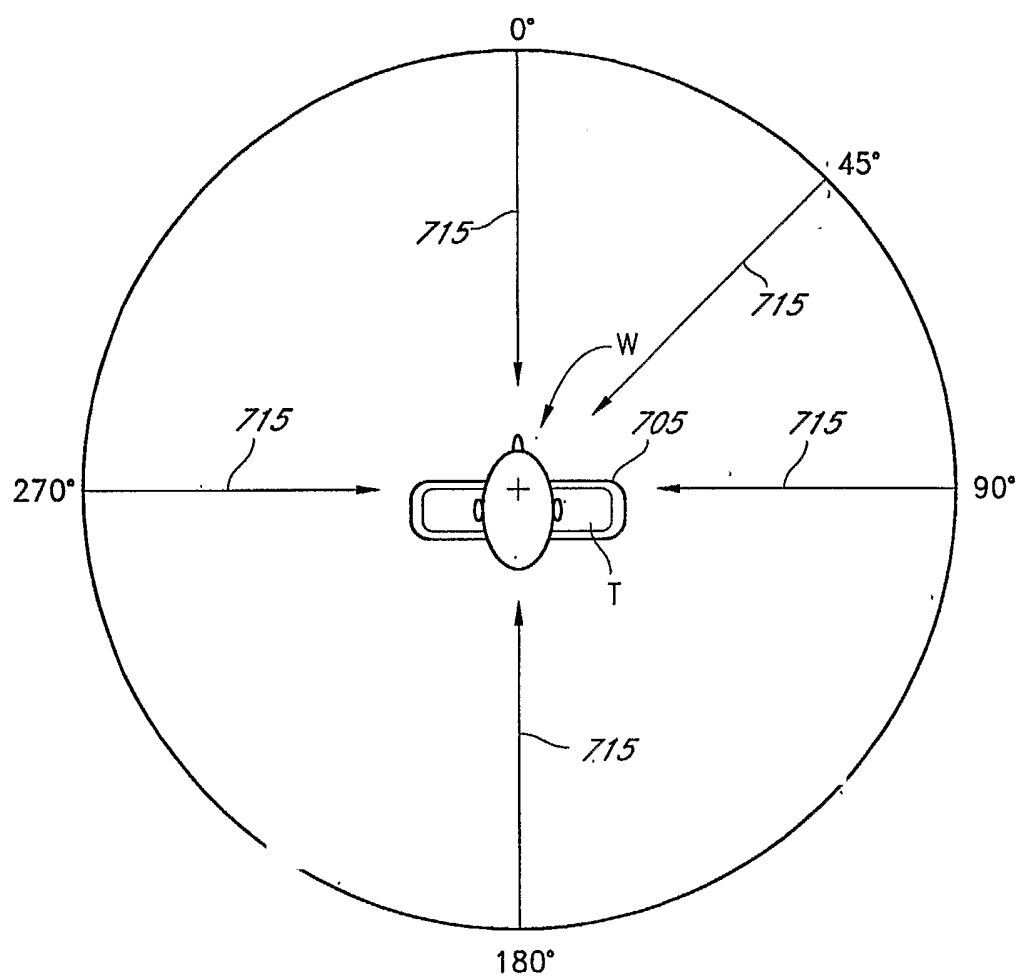


FIG. 7

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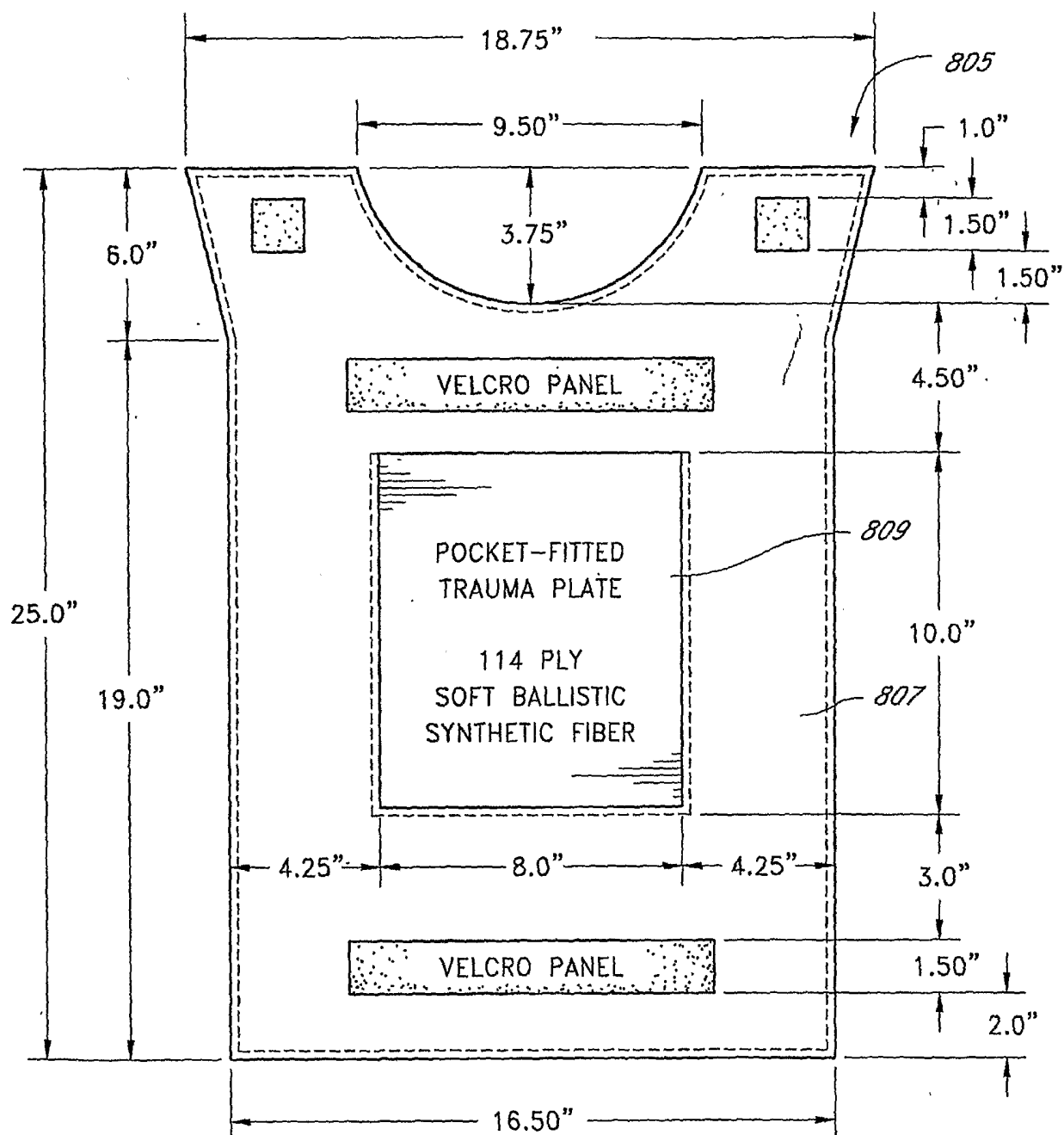


FIG. 8

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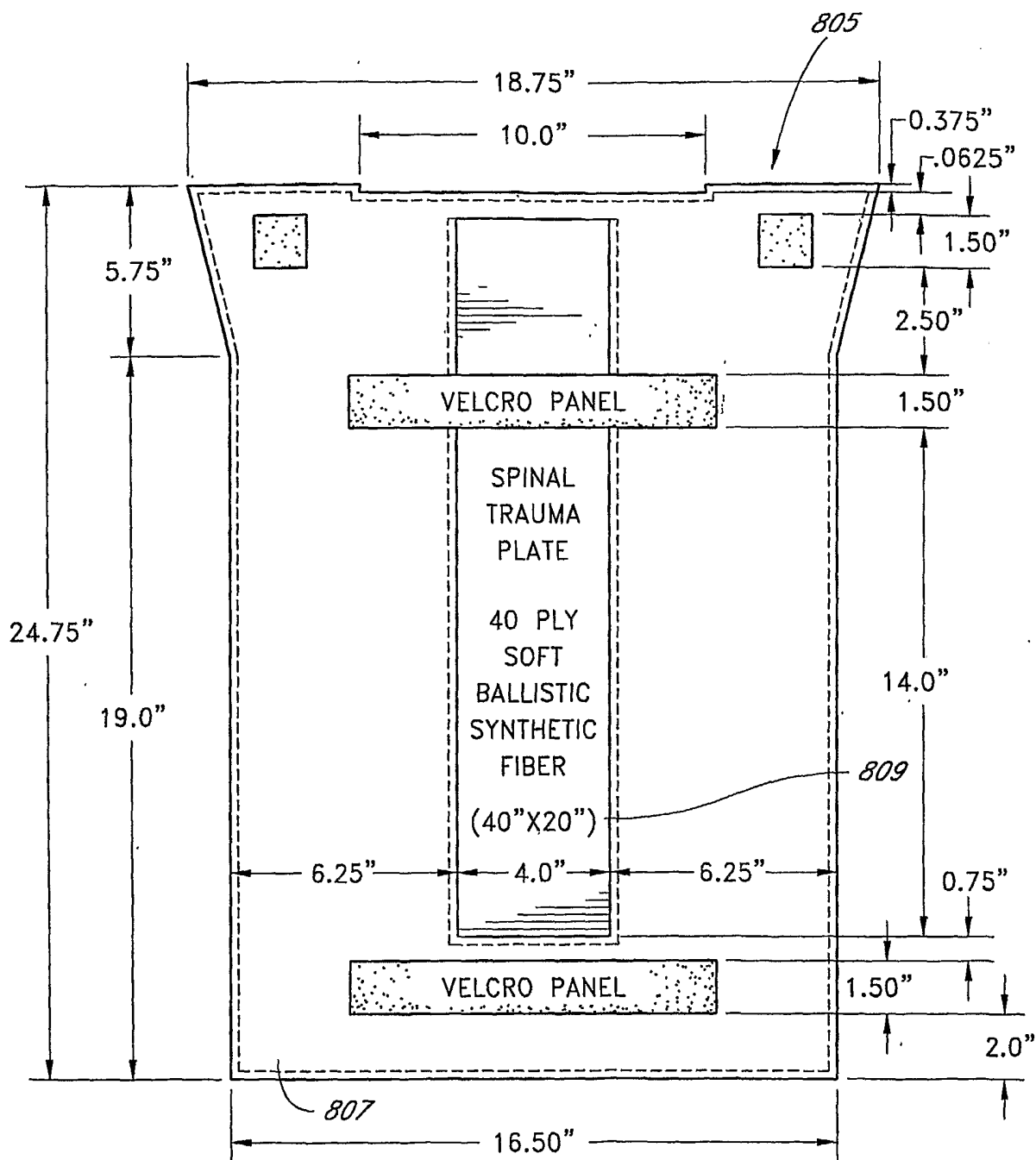


FIG. 9

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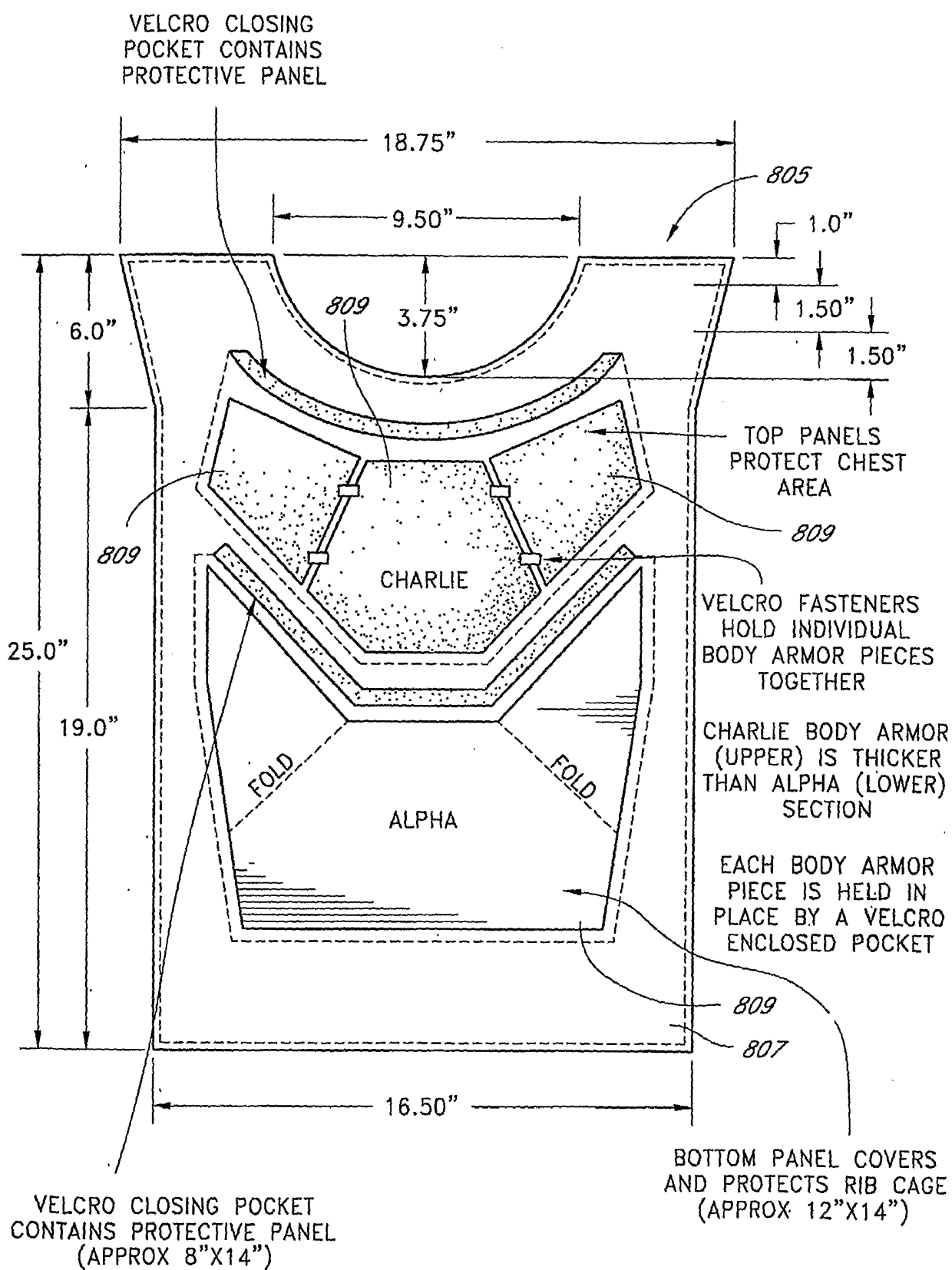


FIG. 10

SUBSTITUTE SHEET (RULE 26)

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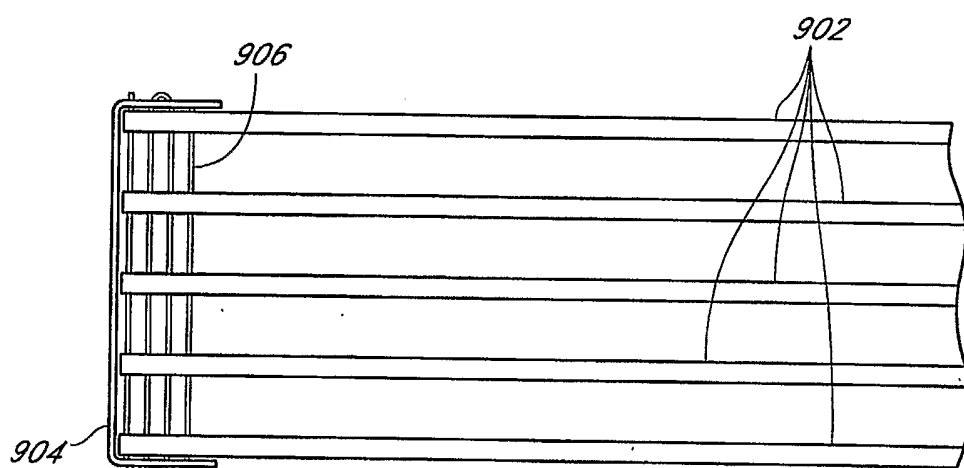


FIG. 11

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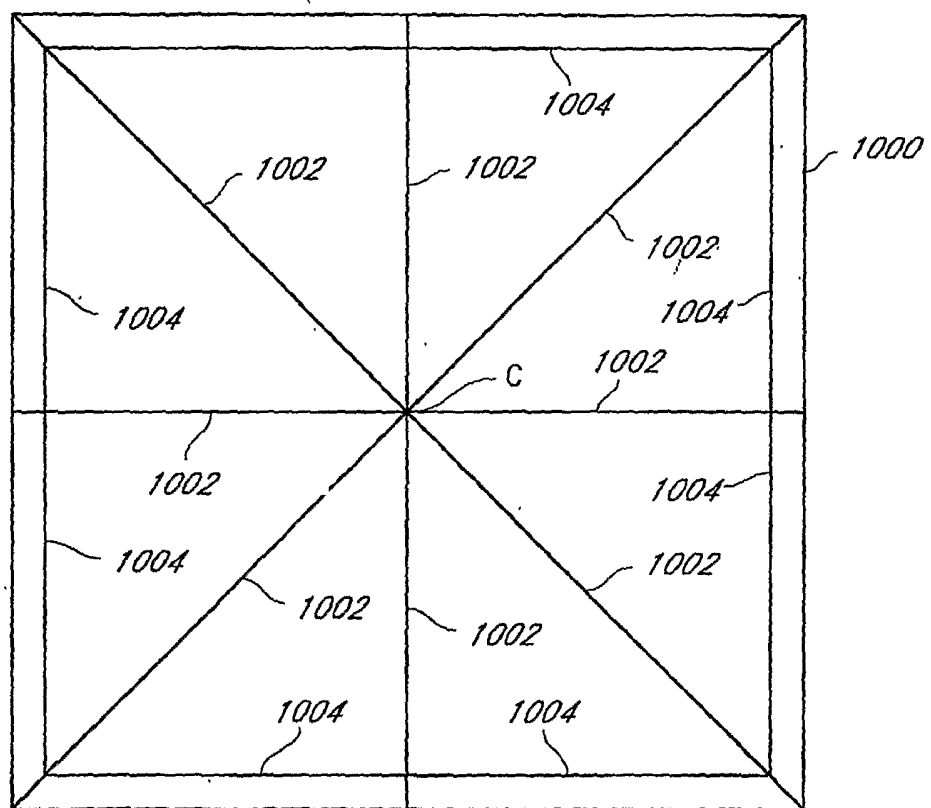


FIG. 12

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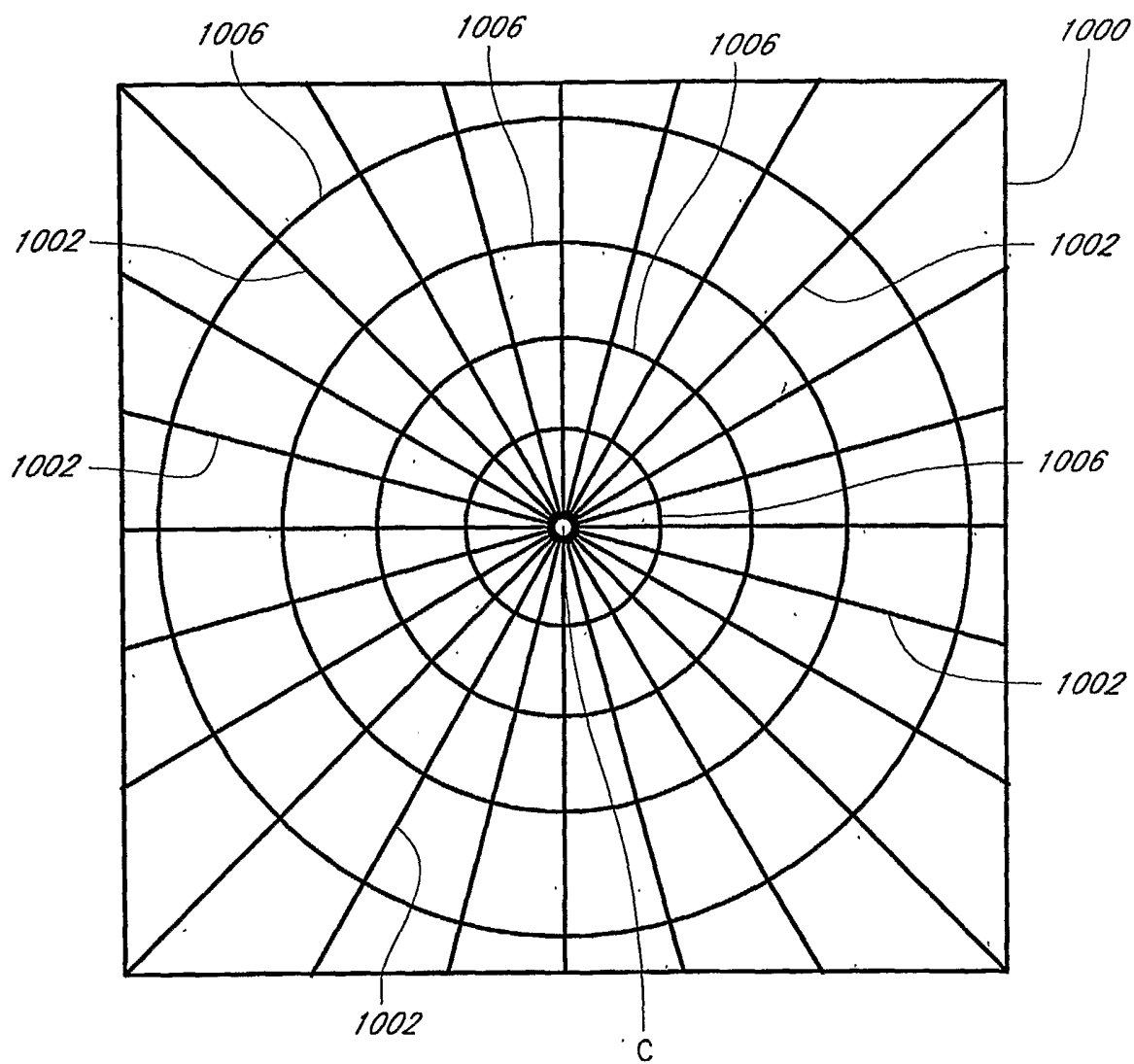


FIG. 13