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(54) Title: BALLISTIC BARRIER PARTITION SYSTEM AND RETROFIT KIT

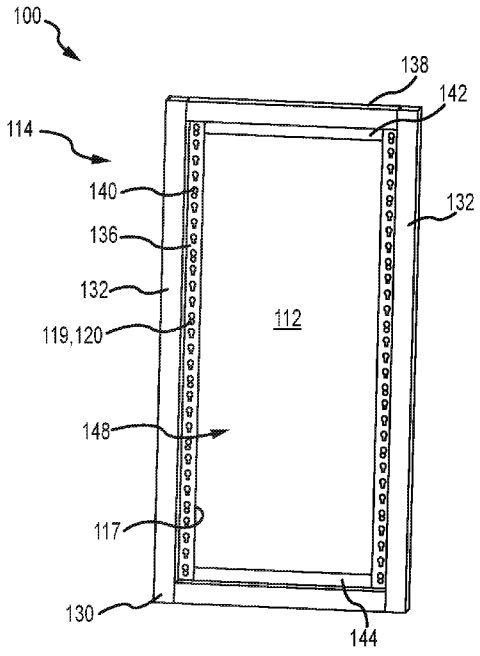

FIG.8A

(57) Abstract: A ballistic barrier partition system. The system has a substantially rectangular frame in which two parallel opposing sides, a top side and a bottom side defining an opening. Two keyhole brackets are attached to an interior of of the partition frame on each of the opposing sides. The keyhole brackets have a plurality of keyhole-shaped openings spaced at along the length of the keyhole brackets. The system also includes a substantially rigid ballistic barrier panel, substantially the same size as the opening and having embedded in a plurality of fasteners aligned with and received by the keyhole-shaped openings.

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BALLISTIC BARRIER PARTITION SYSTEM AND RETROFIT KIT

TECHNICAL FIELD

The present invention relates to modular panel systems in general and more specifically to equipping office and partition systems with a laminated ballistic barrier.

BACKGROUND ART

Commercial modular panel (e.g., partition) systems are plentiful in many public and commercial spaces, such as office buildings, courthouses, call centers, banks, military recruiting centers and administrative offices of hospitals, schools and many other businesses. In the event of gunfire in public or commercial spaces, the natural instinct of those trapped by the gunfire is to hide behind any available structure, including partition or modular panel systems.

DISCLOSURE OF INVENTION

According to embodiments described herein, ballistic barrier partition system, includes a substantially rectangular frame, with two parallel opposing sides, a top side and a bottom side, the substantially rectangular frame defining an opening. Two keyhole brackets are attached to an interior of of the partition frame on each of the opposing sides of the partition frame; the keyhole brackets have a plurality of keyhole-shaped openings spaced at along the length of the keyhole brackets. A substantially rigid ballistic barrier panel of substantially the same size as the opening includes a plurality of embedded fasteners aligned with and received by the keyhole-shaped openings.

BRIEF DESCRIPTION OF THE DRAWINGS

Illustrative and presently preferred embodiments of the invention are shown in the accompanying drawing(s) in which:

FIG. 1 is an exploded view of the retrofit of a frame and tile system with ballistic barrier panels according to an embodiment of present invention;

FIG. 2 shows multiple views of a top bracket for attaching ballistic barrier panels onto a frame and tile modular panel system;

FIG. 3 shows multiple views of a bottom right bracket for attaching ballistic barrier panels onto a frame and tile system modular panel system;

FIG. 4 shows multiple views of a bottom left bracket for attaching ballistic barrier panels onto a frame and tile modular panel system;

FIG. 5 shows components of a retrofit kit of embodiments of the present invention;

FIG. 6 shows openings in the bracket for receiving retrofit clips of an embodiment of the retrofit kit of the present invention;

FIG. 7 illustrates a method of retrofitting a partition system according to an embodiment of the present invention;

FIG. 8 shows views of a front and back of ballistic barrier panel installed in a partition system of the present invention;

FIG. 9 shows cutaway views of the ballistic barrier partition system from the back side of the ballistic barrier panel;

FIG. 10 shows the mounting system of and embodiment of the ballistic barrier partition system;

FIG. 11 shows seam protection between adjacent ballistic barrier panels; and

FIG. 12 illustrates a method of retrofitting a partition system according to an embodiment of the present invention.

BEST MODE(S) FOR CARRYING OUT THE INVENTION

Mass shootings are on the rise in the U.S. and around the world. Instead of running for an exit, the immediate reaction of those trapped by gunfire is to drop to the floor and hide behind any structure, including the modular panel or partition system comprising their workspace. However, existing office systems (e.g., frame and tile systems and other modular panel systems) provide no meaningful protection from gunfire. Embodiments of ballistic barrier partition system 10 of the present invention provide meaningful ballistic barrier protection for partition and office systems found in public and commercial spaces by stopping bullets fired from firearms (e.g., pistols, handguns, rifles, shotguns, etc.) and impeding the forward progress of projectiles fired from higher velocity weapons.

The present invention is directed to a system and method for retrofitting partition systems to make ballistic barrier partition systems 10, 100. As used herein, the term "partition system" includes any office, furniture or room partition system, such as a frame-and-tile modular panel system, other modular panel systems, and moveable walls, examples of which are widely commercially available; the panels or “walls” of the partition system may range in height and may extend from floor to ceiling or anywhere in between. However, when retrofit kit 11, 111 of the present invention is used

to produce ballistic barrier partition system 10, 100 then ballistic barrier partition system 10, 100 can support ballistic barrier panels 12 and withstand repetitive bullet impacts from either direction. In the event of unexpected gunfire in a location equipped with ballistic barrier partition systems 10, 100 of the present invention, those being fired upon may position themselves behind any side of ballistic barrier partition system 10, 100 to be shielded from the impact of bullets fired from weapons, including handguns, shotguns and rifles. Should an assailant shoot at a person taking shelter behind ballistic barrier partition system 10, 100 of the present invention, a projectile fired from a weapon would pass through an outer layer of ballistic barrier panel 12, 112 which would become lodged in ballistic barrier panel 12, 112. In the case of very high velocity weapons, the ballistic barrier panel 12, 112 would act to dissipate the force of the projectile, as is explained in greater detail below.

Embodiments of ballistic barrier partition system 10 and retrofit kit 11 will now be described in greater detail with reference to FIGs. 1-6. As shown in FIGs. 2-6 retrofit kit 11 comprises ballistic barrier panel 12, as well as a variety of retrofit clips 20, as well as suitable fasteners (e.g., rivets 38) for securing retrofit clips 20 to ballistic barrier panel 12. Ballistic barrier panel 12 comprises multiple ply sheets of ballistic barrier material that are laminated and consolidated. In embodiments of the present invention, ballistic barrier panel 12 comprises para-aramid synthetic fiber (e.g., poly paraphenylene terephthalamide) sold commercially under the trademark Kevlar® from DuPont. Other similar materials, such as Twaron® commercially available from Teijin Aramid, may also be used, as may be sheets made from S2 glass fiberglass or ultra-high molecular weight polyethylene, both of which are also commercially available. In still other embodiments, extruded-type ballistic barrier material forming a single layer may also be used; therefore, while embodiments herein are described with reference to ballistic barrier panel 12, the invention should not be viewed as being limited in that respect. Combinations of these materials, including cementitious materials, may also be used. In an embodiment, use of poly paraphenylene terephthalamide may be advantageous because it is lighter in weight than other materials mentioned. In embodiments described herein, approximately nine to twelve sheets of ballistic material were laminated and consolidated into rigid panels, approximately 5.23 millimeters (mm) (0.206 inches (in)) to about 9.52 mm (0.375 in) in thickness or until the desired level of ballistic protection is achieved. As is explained in more detail below, ballistic barrier panel 12 of certain shapes and sizes was tested repeatedly for its ability to

withstand gunfire, although the invention should not be viewed as being limited to number or size of sheets of ballistic barrier material. For example, as would be familiar to one of ordinary skill in the art after becoming familiar with the teachings of the present invention, additional sheets or plies of ballistic barrier material may be used to afford greater protection, such as that desired to withstand gunfire from shotguns and rifles. Ballistic barrier panel 12 may also be coated with other various types of materials, such as cementitious materials.

As can be best seen in FIG. 1, ballistic barrier panel 12 may be cut and sized to fit within opening 17. The substantially rigid ballistic barrier panels 12 may be cut to a desired size or shape using a commercial cutting system, such as a diamond blade circular saw, computer numerical control (CNC) machine or wet-jet cutting system. In another embodiment, ballistic barrier panel 12 may be formed or molded to the desired size and shape without cutting. In one embodiment, ballistic barrier panel 12 is sized to be substantially the same size as tiles 16, 16' to fit snuggly within opening 17. In another embodiment, ballistic barrier panel 12 may be covered with cementitious or other types of material that may be molded or spray applied. In yet another embodiment, ballistic barrier panel 12 may be cut and sized to replace tile 16, 16' all together. Once sized, ballistic barrier panel 12, 112 may then be inserted into embodiments of ballistic barrier partition system 10, 100 in accordance with embodiments of method 200, 300.

The manner in which tiles 16, 16' are attached to frame 14 using plastic and thin metal clips (in the original equipment manufacturer (OEM) partition system) does not permit installation of ballistic barrier panel 12 due to its weight or force when under gunfire. Therefore, retrofit clips 20 of the present invention are required to secure ballistic barrier panel 12 within frame 114. As shown in FIGs. 2-4 and 5, retrofit clips 20 comprise top clip 22, bottom right clip 24 and bottom left clip 26. In one embodiment, as best seen in FIG. 2, top clip 22 comprises an inverted J-shaped hook 23 attached to short-side 19 of an elongate, generally-rectangular body 21 so that end 27 is substantially parallel to and extends down over body 21. As shown, the width of hook 23 is approximately one quarter of the width of the short side 19, but may be up to about half of the length, so long as it is sized to fit securely within top opening 40 of bracket 36. Hook 23 is substantially centered on side 19. With reference to FIG. 3, bottom right clip 24 comprises an L-shaped hook 25 attached to side 19 of body 21 so that end 27 is substantially parallel to and extends out and away from body 21. As shown in FIG. 3, hook 25 is attached to the far right of side 19 substantially flush with long side 29

of body 21. As shown, the width of hook 25 is approximately one quarter of the width of the short side 19, but may be up to about half of the width of side 19, so long as it is sized to fit securely within bottom opening 42 of bracket 36. With reference to FIG. 4, bottom left clip 26 comprises an L-shaped hook 25 attached to side 19 of body 21 so that end 27 is substantially parallel to and extends out and away from body 21. As shown in FIG. 4, hook 25 is attached to the far left of side 19 substantially flush with long side 29' of body 21. As shown, the width of hook 25 is approximately one quarter of the width of the short side 19, but may be up to about half of the width of side 19, so long as it is sized to fit securely within bottom opening 42 of bracket 36. In embodiments shown herein, retrofit clips 20 were fashioned as an integral component from a single piece of metal so that hook 23, 25 is integral with body 21. However, in other embodiments hooks 23, 25 and body 21 may be individual components attached together using means familiar to one of ordinary skill in the art. Clips 20 are fashioned from 11-gauge mild steel, although other metals and gauges, as well as other suitable materials could be used as would be familiar to one of ordinary skill in the art after becoming familiar with the teachings of the present invention.

In one embodiment, ballistic barrier partition system 10 comprises retrofit kit 11, as well as components for the frame-and-tile partition system, including tiles 16, 16' which are mounted on frame 14 as shown in FIG. 1. In one embodiment, tiles 16, 16' comprise sheet metal shell including tile frame 36 wrapped in fabric. In another embodiment, tiles 16, 16' comprise sheet metal without a wrapping. Materials other than fabric could also be used for the wrapping. In other embodiments, materials other than metal can be used to form the internal structure of tiles 16, 16'. In still other embodiments, acoustic tiles could be used. In embodiments in which ballistic barrier panel 12 is used alone without tile 16, 16', ballistic barrier panel 12 may be wrapped in fabric or other suitable wrapping material. Center brace 34, both ends of which are secured to frame 14, is used to support large sections of frame 14. Base 30 is attached to frame 14 at its base and can be used to house electrical components and wires to outfit the ballistic barrier partition system 10 with electricity, phone, and data systems. In addition, in embodiments base 30 may be used to add a counterweight or otherwise secure ballistic barrier partition system 10 to the floor. Sides of the ballistic barrier partition system 10 are covered with side plates 32 after the ballistic barrier panel 12 has been secured to tile 16, 16' using brackets 20 in the manner described below. In another embodiment, ballistic barrier partition system 10 may also include a counterweight system.

Advantageously, clips 20 are designed and sized to fit within openings 40, 42 of existing tile frame bracket 36 so clips 20 can be located in the same locations as the OEM clips, with no alterations to the frame 14 or tile 16, 16'. As explained in more detail below, this facilitates a simple installation as well as ensures the brackets 36 are placed properly. Once retrofit kit 11 is installed to produce ballistic barrier partition system 10, there is no visible difference with the OEM partition system.

With reference to FIG. 7, according to an embodiment of method 200 of the present invention, the OEM partition system may be retrofitted as follows: At step 202, tile 16, 16' would be popped off or removed from frame 14. In one embodiment, tile 16, 16' may be pulled off frame 14 without any tools. Existing OEM clips would be removed next at step 204. At step 206, ballistic barrier panel 12 is then flexed or fitted into the interior 18 of tile 16' as shown in FIG. 1 (see, arrows 28) so it fits within existing tile frame bracket 36. In the embodiment shown, tile frame bracket 36 comprises top opening 40 and bottom opening 42. However, in another embodiment separate brackets could be installed on at least opposite sides of the the tile frame. As shown in FIG. 6, retrofit clips 20 would be attached (e.g., riveted) to the sheet metal of tile 16' in substantially the same location as occupied by the OEM clips that were removed within openings 40, 42 to form a retrofitted tile at step 208. More specifically, top clip 22 is inserted into opening 40 of tile frame bracket 36 and riveted to the sheet metal through body 21 so that hook 23 extends out and down from tile 16'. Right bottom clip 24 and left bottom clip 26 are each inserted into separate openings 42 and riveted to the sheet metal through body 21 so that hook 25 extends out and down from tile 16'. Advantageously, this attachment system allows the new retrofit clips 20 to engage frame 14 without any modification to frame 14 itself. Then, tile 16' would then be installed back onto the frame 14 using retrofit clips 20 at step 212 to produce the retrofitted ballistic barrier partition system 10 according to an embodiment of the present invention. Similarly, in an embodiment in which ballistic barrier panel 12 is used without tiles 16, 16', clips 20 and brackets 36 would be attached directly to ballistic barrier panel 12 as described herein.

In an embodiment described above, only a single tile 16' was removed; however, tile 16 could also be removed or both tiles 16, 16' could be removed with either one or a plurality of ballistic barrier panels 12 installed in the interior 18 of tiles 16, 16'. The invention should not be viewed as being limited in this respect. Only tiles 16, 16' on one side of frame 14 would need to be

retrofitted with the ballistic barrier panel 12 and clips 20 to make system 10 of the present invention bullet resistant consistent with the testing described herein. In one embodiment, tiles 16, 16' span the entire horizontal width of frame 14, but they could be configured as a single tile or multiple tiles vertically. As described in more detail below, where multiple tiles are used, the seam between tiles 16, 16' can be fortified against ballistic impact with additional protection. For the most part, outer tiles 16 would be removed from frame 14 to be retrofitted, so that the workspace would not need to be disrupted or dismantled.

Once tiles16 on one side of the system are retrofitted, the ballistic barrier partition system 10 will be able to withstand a ballistic impact when fired upon from either direction. As explained below, ballistic barrier panel 12, 112 has been tested for ballistic resistance in accordance with various widely accepted standards. In addition, ballistic barrier partition system 10 was also tested for ballistic impact. Seventeen rounds from a .357 Magnum were fired into ballistic barrier partition system 10 from a distance of 25 yards. Ballistic barrier panel 12 remained intact and was not dislodged in whole or in part from partition frame 14, which remained upright. No round passed through ballistic barrier panel 12.

In another embodiment, ballistic barrier partition system 100 and retrofit kit 111 are described with reference to FIGs. 8-11. Ballistic barrier partition system 100 comprises partition frame 114, ballistic barrier panel 112 and mounting system 119 for securely mounting ballistic barrier panel 112 in partition frame 114, as described in more detail below.

Partition frame 114, which, in the embodiments shown is substantially rectangular in shape, comprises two parallel side pieces 132 both of which are attached to top piece 138 and base 130. Partition frame 114 defines opening 117. As shown in embodiments herein, partition frame 114 is made of steel, but could also be made of other suitable metals or material including plastic and wood, so long as the strength of the material is sufficient to support the weight of ballistic barrier panel 112 and mounting system 119, as well as the impact from ballistic projectiles. A plurality of partition frames 114 may be connected together to form self-supporting ballistic barrier partition system 100 of the present invention. In another embodiment, system 100 may comprise supplemental support for partition frame 114.

Ballistic barrier partition system 100 further comprises ballistic barrier panel 112. As described above, ballistic barrier panel 112 is made in the same manner and of the same materials as

ballistic barrier panel 12, and will not be described further here. In one embodiment shown in FIG. 8, ballistic barrier panel 112 is cut to be substantially the same size as opening 117. In another embodiment shown in FIG. 11, ballistic barrier panel 112 may comprise multiple panels 112, 112' positioned adjacent to one another. However, in that case, as shown, ballistic protection 150 for seam 113 may be provided.

Ballistic barrier partition system 100 also comprises mounting system 119 as shown in FIGs. 9-10. Mounting system 119 comprises keyhole brackets 136, bolts 154 or screws 120 and inserts 126. In one embodiment, mounting system 119 further comprises seam protection 150. In the embodiments shown, keyhole brackets 136 comprise long metal strips equipped with keyholes 140 at substantially evenly spaced intervals along the length of keyhole bracket 136, each keyhole 140 comprising circular opening 139 connected to longitudinal opening 141 having a width narrower than the diameter of circular opening 139. As shown in FIG. 9, keyhole bracket 136 comprises an angle bracket. In another embodiment, keyholes may be drilled or inserted directly into partition frame 114 (e.g., side pieces 132) as retrofitted or originally manufactured. In an alternative embodiment, individual keyhole brackets could also be used. As shown, keyhole brackets 136 are affixed with self-tapping screws to opposing side pieces 132 on the interior of partition frame 114, although the invention should not be viewed as being limited in this respect. In addition, partition frame 114 further comprises top insert 142 and bottom insert 144 which are connected parallel to top piece 138 and base 130, respectively, and perpendicular to side pieces 132. Keyhole brackets 136 may also be affixed to top insert 142 and bottom insert 144. Other means and configurations for attaching keyhole brackets 136 to partition frame 114 may also be used as would be familiar to one of ordinary skill in the art after becoming familiar with the teachings of the present invention.

Keyhole brackets 136 work in cooperation with screws 120 and inserts 126 which are embedded in ballistic barrier panel 112 to secure ballistic barrier panel 112 to partition frame 114; screws 120 are configured to fit within and be retained by keyholes 140 so that, when gunfire is directed at panel back side 146 or panel front side 148, the integrity of ballistic barrier panel 112 is intact and it remains securely within partition frame 114. Screw 120 fits through ballistic barrier panel 112 and is secured within insert 126, which may be a threaded insert. In embodiments shown in FIGs. 9-10, insert 126 comprises t-nut 128. Other types of threaded inserts may also be used. T-nut 128 is inserted into panel back side 146 in a configuration that aligns with selected keyholes 140

of keyhole bracket 136. In another embodiment in which ballistic barrier panel 112 includes a cementitious layer, insert 126, or screws 120 or both may be embedded in the cementitious layer during the process of manufacturing ballistic barrier panel 112.

Not every keyhole 140 of keyhole bracket 136 need be filled with screw 120 to hold ballistic barrier panel 112 securely within partition frame 114. In one embodiment, the placement of insert 126 (e.g., t-nut 128) was at substantially uniform intervals ranging from between about 15.25 centimeters (cm) (6 in.) to about 17.78 cm (7 in.) apart, but could be as much as about 22.86 cm (9 in.) apart. Screw 120 is configured to be inserted through panel front side 148 into each insert 126 to a substantially uniform depth so that each drive head 121 sits above the surface of front side 148 at a substantially uniform predetermined interval that permits ballistic barrier panel 112 to fit securely within frame 114 when screws 120 are inserted in keyholes 140. In an embodiment shown in FIGs. 9-10, screw 120 comprises shoulder screw 123 with shoulder 123, threads 125 and spanner head 124. In another embodiment, double-headed screw 127 may also be used, particularly to maintain the substantially uniform interval above the surface of panel front side 148. Spanner head 124 may be preferred as it provides additional support for drive head 121so that it is not sheared off due to forces generated by projectiles impacting ballistic barrier panel 112. Drive head 121 must be sized to fit through (e.g., be smaller than) circular opening 139, but be retained by (e.g., be larger than) longitudinal opening 141 of keyhole 140. The total length of screw 120 must be sufficiently long to permit screw 120 be be secured within insert 126 while maintaining the predetermined depth so that drive head maintains the substantially uniform interval above the surface of panel front side 148. As shown in FIGs. 8-10, ballistic barrier panel 112 is secured to partition frame 113 by passing spanner heads 124 through circular openings 139 and retaining them in longitudinal openings 141 so ballistic barrier panel 112 is held securely within frame 114. Ballistic barrier panel 112 may comprise an exterior cover or wrapping, which may be fabric or could be a rigid sheet adhered to ballistic barrier panel 112 to give the ballistic barrier partition system 100 of the present invention a finished appearance, such as one may expect of an interior office partition system, for example.

In another embodiment, when ballistic barrier panel 112 comprises multiple panels, ballistic barrier partition system 100 may further comprise seam protection 150, as shown in FIG. 11. At seam 113 where multiple ballistic barrier panels 112, 112' adjoin one another, a weakness is created in the ballistic barrier protection of system 100 of the present invention, making system 100

vulnerable to bullet penetration; therefore, in an embodiment, system 100 is equipped with protection plate 152 overlaying seam 113 to fortify seam 113 from panel front side 148 and panel back side 146 from being penetrated by bullets or other projectiles. In an embodiment, protection plate 152 comprises mild steel, which may be between about 5.08 cm (2 in.) and 7.62 (3 in.) wide and less than 1.27 (0.5 in.) thick, but the invention should not be viewed as being limited in this respect. Protection plate 152 may comprise other materials, including ballistic barrier material (as is used in ballistic barrier panel 12, 112), ballistic steel made from quenched and tempered armor steel plate meeting the ballistic resistant standards set forth herein, or a combination of such materials.

As shown in FIG. 11, in an embodiment, protection plate 152 is sized to fit substantially perpendicularly between side pieces 132. Protection plate 152 covers seam 113 where ballistic barrier panels 112, 112' overlap or abut one another. Protection plate 152 may be secured to ballistic barrier panels 112, 112'in a manner similar to that explained above with respect to mounting system 119. T-nut 128 is inserted into the panel back side 146 of ballistic barrier panel 112'. Bolt 154, sized to penetrate protection plate 152 and ballistic barrier panels 112, 112', is inserted through protection plate 152 and panel front side 148 of ballistic barrier panel 112 into t-nut 128 and tightened.

Thus, when used in accordance with an existing OEM partition system, retrofit kit 111 may comprise ballistic barrier panel 112 and mounting system 119. With reference to FIG. 12, according to an embodiment of method 300 of the present invention, the OEM partition system may be retrofitted as follows using retrofit kit 111: Partition frame 114 is provided. In an embodiment, at least one tile is removed from the partition frame 114 at step 302, leaving opening 117. At step 304, at least two keyhole brackets 136 having a plurality of substantially evenly-spaced keyholes 140 are attached to the interior of partition frame 114 on opposing sides of partition frame 114 in perpendicular relation to top piece 138 and base 130 of partition frame 114. Ballistic barrier panel 112 is then prepared to be installed within partition frame 114 (although this can be done at any time prior to installation). Ballistic barrier panel 112 is sized (e.g., cut) to be substantially the same size as opening 117. At step 306, a plurality of inserts 126 (e.g., t-nuts 128) are inserted into panel back side 146 at substantially uniform intervals that align with placement of keyholes 140 in keyhole brackets 136. At step 308, a plurality of fasteners (e.g., screws 120), each having drive head 121 (e.g., spanner head 124) is installed in panel front side 148 and inserted into insert 126, so each drive head 121 is at substantially uniform distance from the surface of panel front side 146, each drive

head 121 being sized to fit through and be retained by keyholes 140, as explained above. At step 310, ballistic barrier panel 112, equipped with the fasteners inserted in the inserts 126, is secured to partition frame 114 by inserting the drive heads 121 of the fasteners through keyholes 140 so they are held in place by longitudinal openings 141. Thus, ballistic barrier panel 112, 112' is secured within partition frame 114 to produce ballistic barrier partition system 100.

Ballistic barrier partition system 100 will be able to withstand a ballistic impact when fired upon from either direction consistent with the ballistic ratings discussed herein. When subjected to such impacts, ballistic barrier partition system 100 remains upright and ballistic barrier panel 112, 112' remains in partition frame 114 and absorbs the impact from the bullets without being partially or completely dislodged. Ballistic barrier partition system 100 was tested for ballistic impact using a 44 Magnum handgun to fire 240 grain flat nose cartridges from a distance of 16 feet. Three shots were fired from a first direction into panel front side 146. Three shots were fired from a second direction into panel back side 148. Four additional shots were fired specifically at seam 113 fortified with seam protection 150. No bullets penetrated ballistic barrier partition system 100. Of the bullets aimed at seam 113, one bullet hit protection plate 152, which comprised mild steel, and fell out without penetrating ballistic barrier partition system 114.

Ballistic Testing

As is explained in more detail below, ballistic barrier panel 12, 112 of certain shapes and sizes was tested repeatedly for its ability to withstand gunfire, although the invention should not be viewed as being limited to number or size of sheets of ballistic barrier material. For example, as would be familiar to one of ordinary skill in the art after becoming familiar with the teachings of the present invention, additional sheets or plies of ballistic barrier material or additional ballistic barrier panels 12, 112 may be used to afford greater protection, such as that desired to withstand gunfire from shotguns and rifles. Ballistic barrier panel 12, 112 as described herein in the various embodiments of the present invention was subjected to eight rounds of ballistic resistance testing conducted in compliance with the test parameters established by the National Institutes of Justice (NIJ). In all cases, ballistic barrier panel 12, 112 exceeded NIJ performance requirements for shield products (NIJ 0108.01) and body armor (NIJ 0108.06), as well as Underwriters Laboratories (UL) performance requirements for ballistic glass (UL 752) when being fired upon using a 44 Magnum or 9 mm handgun (NIJ I, II-A, II and III-A ratings; UL 752 Levels 1-3, 6) or using 7.62 mm 149 grain

full metal jacket projectiles (e.g., rifle). Performance requirements were assessed using a V_{50} ballistic limit rating. The V_{50} rating, a military standard for the upper limit of effectiveness for ballistic shields, armor and glass, is an average of an equal number of highest partial penetration and lowest complete penetration velocities. The V_{50} rating for NIJ III-A armor type requires that the ballistic material being tested withstand penetration at a required bullet velocity of 426 ± 15 m/s (1400 ± 50 ft/s) (NIJ 0108.01for shield products) or 436 m/s (1430 ft/s) (NIJ 0101.06 for body armor) when fired upon using a .44 Magnum or 9 mm pistol. In testing performed, ballistic barrier panel 12 substantially exceeded the V_{50} rating performance requirement of 436 m/s, as explained in more detail below. The V_{50} rating for NIJ III armor type requires that the ballistic material being tested withstand penetration at a required bullet velocity of 838± 15 m/s (2750 ± 50 ft/s) (NIJ 0108.01for shield products) or 847 m/s (2880 ft/s) (NIJ 0101.06 for body armor) when fired upon using a 7.62 mm, 149 grain, full metal jacket (FMJ), steel jacketed projectiles. In testing performed, ballistic barrier panel 12, 112 substantially exceeded the V_{50} rating performance requirement of 847 m/s, as explained in more detail below.

Test Round No. 1

In this test round, the ballistic barrier panel 12, 112 target was approximately 0.145 square meters (m^2) (225 in^2) in size, with an average thickness of 5.23 mm (0.206 in) and a weight of 0.92 kilograms (kg) (2.03 lbs.), with a linear mass fiber density of 3000 denier (d). Average surface density was 6.35 kilograms per square meter (kg/m^2) (1.3 $lbs./ft^2$). Test conditions were: obliquity, 0.0°; primary velocity screens; 1.52 m (5.00 ft), 1.62 m (5.30 ft); primary velocity location, 2.95 m (9.67 ft); range to target; 3.05 m (10.00 ft); target to witness 0.19 m (7.50 in), 0.38 m (15.00 in), 0.00 m; temperature, 19.39 °C (66.9 °F); barometric pressure 10.10 kilopascal (kPa) (2.98 inches of mercury (inHg)); relative humidity; 44.2%. The witness was a thin sheet of aluminum (i.e., around 0.51 mm (0.020 in) of 2024T3 aluminum). Panels were clamped according to MIL-STD-662F. Ballistic barrier panel 12, 112 was subjected to testing in this manner with a 9 mm pistol with 124 grain (gr) full metal jacket (FMJ) ammunition with Accurate No. 2 powder.

A summary of test results using three high and three low points as set forth below in Table 1 is: V_{50}, 505.36 meters per second (m/s) (1658 ft/s; high partial, 499.87 m/s (1640 ft/s); low complete, 505.97 m/s (1660 ft/s); and range of results, 36.27 m/s (119 ft/s). In all of the tables shown below, the results for partial are abbreviated with "P;" complete, with "C."

Table 1

Shot No.	Powder/ Seating	Time 1 (μs)	Vel. 1 (ft/s)	Vel. 1 (m/s)	Time 2 (μs)	Vel. 2 (ft/s)	Vel. 2 (m/s)	Avg. Vel. (ft/s)	Avg. Vel. (m/s)	Result	Include in V_{50}
1	8.2	3321	1506	459.03	2875	1507	459.33	1506	459.03	P	False
2	9.0	3121	1602	488.29	2705	1602	488.29	1602	488.29	P	True
3	9.5	2904	1722	524.87	2518	1721	524.56	1721	524.56	C	True
4	9.2	3050	1639	499.57	2640	1641	500.18	1640	499.87	P	True
5	9.4	2958	1690	515.11	2561	1692	515.72	1691	515.42	C	True
6	9.2	3014	1659	505.66	2609	1661	506.27	1660	505.97	C	True
7	9.0	3067	1630	496.82	2655	1632	497.43	1631	497.13	P	True

Test Round No. 2

In this test round, the ballistic barrier panel 12, 12 target was approximately 0.145 m^2 (225 in^2) in size, with an average thickness of 5.44 mm (0.214 in) and a weight of 0.93 kg (2.06 lbs.), with denier of 3000d. Average surface density was 6.35 kg/m^2 (1.3 $lbs./ft^2$). Test conditions were: obliquity, 0.0°; primary velocity screens; 1.52 m (5.00 ft), 1.62 m (5.30 ft); primary velocity location, 2.95 m (9.67 ft); range to target, 3.05 m (10.00 ft); target to witness 0.19 m (7.50 in), 0.38 m (15.00 in), 0.00 m; temperature, 19.5 °C (67.1 °F); barometric pressure 10.10 kPa (2.98 inHg); relative humidity; 45.5%. The witness was a thin sheet of aluminum (i.e., around 0.51 mm (0.020 in) of 2024T3 aluminum). Panels were clamped according to MIL-STD-662F. Ballistic barrier panel 12, 112 was subjected to testing in this manner with a 9 mm pistol with 124 gr FMJ ammunition with Accurate No. 2 powder.

A summary of test results using three high and three low points as set forth below in Table 2 is: V_{50}, 515.64 m/s (1695 ft/s); high partial, 513.28 m/s (1684 ft/s); low complete, 518.46 m/s (1701 ft/s); and range of results, 23.77 m/s (78 ft/s).

Table 2

Shot No.	Powder/ Seating	Time 1 (μs)	Vel. 1 (ft/s)	Vel. 1 (m/s)	Time 2 (μs)	Vel. 2 (ft/s)	Vel. 2 (m/s)	Avg. Vel. (ft/s)	Avg. Vel. (m/s)	Result	Include in V_{50}
1	8.3	3280	1524	464.52	2840	1526	465.12	1525	464.82	P	False
2	9.3	2930	1706	519.99	2541	1705	519.68	1706	519.99	C	True
3	8.5	3161	1582	482.19	2732	1586	483.41	1584	482.80	P	False

4	8.9	2976	1680	512.06	2578	1681	512.37	1680	512.06	P	True
5	9.2	2971	1683	512.98	2572	1685	513.59	1684	513.28	P	True
6	9.5	2877	1738	529.74	2491	1739	530.05	1739	530.05	C	True
7	9.3	2937	1702	518.77	2548	1701	518.47	1701	518.46	C	True
8	9.0	3011	1661	506.27	2608	1661	506.27	1661	506.27	P	True

Test Round No. 3

In this test round, ballistic barrier panel 12, 112 target was approximately 0.145 m^2 (225 in^2) in size, with an average thickness of 5.33 mm (0.210 in) and a weight of 0.842 kg (1.86 lbs.), with denier of 3000d. Average surface density was 5.96 kg/m^2 (1.22 $lbs./ft^2$). Test conditions were: obliquity, 0.0°; primary velocity location, 1.52 m (5 ft); range to target, 4.57 m (15 ft); target to witness 0.10 m (4 in); temperature, 21.1 °C (70 °F); barometric pressure 10.10 kPa (2.98 inHg); relative humidity; 44%. The witness was a thin sheet of aluminum (i.e., around 0.51 mm (0.020 in) of 2024T3 aluminum). Panels were clamped according to MIL-STD-662F. Ballistic barrier panel 12, 112 was subjected to testing in this manner with a .44 Magnum pistol with 240 gr Speer 4453 ammunition with Bullseye powder.

A summary of test results using two high and two low points as set forth below in Table 3 is: V_{50}, 481.89 m/s (1581 ft/s); high partial, 489.20 m/s (1605 ft/s); and, low complete, 479.15 m/s (1572 ft/s).

Table 3

Shot No.	Powder (g)	Vel. 1 (ft/s)	Vel. 1 (m/s)	Vel. 2 (ft/s)	Vel. 2 (m/s)	Avg. Vel. (ft/s)	Avg. Vel. (m/s)	Result	Include in V_{50}
1	1.00	1631.0	497.13	1629.0	496.52	1630.0	496.82	C	True
2	1.02	1640.0	499.87	1638.0	499.26	1639.0	499.57	C	False
3	0.88	1504.0	458.42	1501.0	457.50	1502.5	457.96	P	False
4	0.94	1573.0	479.45	1571.0	478.84	1572.0	479.15	C	True
5	0.90	1521.0	463.60	1518.0	462.69	1519.5	463.14	P	True
6	0.98	1607.0	489.81	1605.0	489.20	1606.0	489.51	P	True

Test Round No. 4

In this test round, ballistic barrier panel 12, 112 target was approximately 0.145 m^2 (225 in^2) in size, with an average thickness of 5.33 mm (0.210 in) and a weight of 0.838 kg (1.85 lbs.), with

denier of 3000d. Average density was 5.96 kg/m^2 (1.22 lbs./ft^2). Test conditions were: obliquity, 0.0°; primary velocity location, 1.52 m (5 ft); range to target, 4.57 m (15 ft); target to witness 0.10 m (4 in); temperature, 21.1 °C (70 °F); barometric pressure 9.55 kPa (2.82 inHg); relative humidity; 44%. The witness was a thin sheet of aluminum (i.e., around 0.51 mm (0.020 in) of 2024T3 aluminum). Panels were clamped according to MIL-STD-662F. Ballistic barrier panel 12, 112 was subjected to testing in this manner with a .44 Magnum pistol with 240 gr Speer 4453 ammunition with Bullseye powder.

A summary of test results using two high and two low points as set forth below in Table 4 is: V_{50}, 479.76 m/s (1574 ft/s); high partial, 471.83 m/s (1548 ft/s); and, low complete, 487.07 m/s (1598 ft/s).

Table 4

Shot No.	Powder (g)	Vel. 1 (ft/s)	Vel. 1 (m/s)	Vel. 2 (ft/s)	Vel. 2 (m/s)	Avg. Vel. (ft/s)	Avg. Vel. (m/s)	Result	Include in V_{50}
1	0.98	1609.0	490.42	1607.0	489.81	1608.0	490.12	C	True
2	0.96	1599.0	487.38	1596.0	486.46	1597.5	486.92	C	True
3	0.92	1544.0	470.61	1542.0	470.00	1543.0	470.31	P	True
4	0.93	1549.0	472.14	1546.0	471.22	1547.5	471.68	P	True

Test Round No. 5

In this test round, ballistic barrier panel 12, 112 target was approximately 0.145 m^2 (225 in^2) in size, with an average thickness of 5.33 mm (0.210 in) and a weight of 0.846 kg (1.87 lbs.), with denier of 3000d. Average surface density was 5.96 kg/m^2 (1.22 lbs./ft^2). Test conditions were: obliquity, 0.0°; primary velocity location, 1.52 m (5 ft); range to target, 4.57 m (15 ft); target to witness 0.10 m (4 in); temperature, 21.1 °C (70 °F); barometric pressure 9.55 kPa (2.82 inHg); relative humidity; 44%. The witness was a thin sheet of aluminum (i.e., around 0.020 in of 2024T3 aluminum). Panels were clamped according to MIL-STD-662F. Ballistic barrier panel 12, 112 was subjected to testing in this manner with a .44 Magnum pistol with 240 gr Speer 4453 ammunition with Bullseye powder.

A summary of test results using two high and two low points as set forth below in Table 5 is: V_{50}, 484.33 m/s (1589 ft/s); high partial, 481.89 m/s (1581 ft/s); and, low complete, 486.77 m/s (1597 ft/s).

Table 5

Shot No.	Powder (g)	Vel. 1 (ft/s)	Vel. 1 (m/s)	Vel. 2 (ft/s)	Vel. 2 (m/s)	Avg. Vel. (ft/s)	Avg. Vel. (m/s)	Result	Include in V_{50}	Notes
1	0.88	1493.0	455.07	1492.0	454.76	1492.5	454.91	P	False	
2	0.92	1553.0	473.35	1552.0	473.05	1552.5	473.20	P	True	
3	0.96	1582.0	482.19	1580.0	481.58	1581.0	481.89	P	True	
4	1.00	1598.0	487.07	1596.0	486.46	1597.0	486.77	C	True	
5	1.02	1629.0	496.52	1627.0	495.91	1628.0	496.21	C	True	
6	0.94	1562.0	476.10	1561.0	475.79	1561.5	475.95	C	False	Delaminated too much

Test Round No. 6

In this test round, ballistic barrier panel 12, 112 target was approximately 0.145 m^2 (225 in^2) in size, with an average thickness of 5.33 mm (0.210 in) and a weight of 0.846 kg (1.87 lbs.), with denier of 3000d. Average surface density was 5.96 kg/m^2 (1.22 $lbs./ft^2$). Test conditions were: obliquity, 0.0°; primary velocity location, 1.52 m (5 ft); range to target, 4.57 m (15 ft); target to witness 0.10 m (4 in); temperature, 21.1 °C (70 °F); barometric pressure 9.55 kPa (2.82 inHg); relative humidity; 44%. The witness was a thin sheet of aluminum (i.e., around 0.51 mm (0.020 in) of 2024T3 aluminum). Panels were clamped according to MIL-STD-662F. Ballistic barrier panel 12, 112 was subjected to testing in this manner with a .44 Magnum pistol with 240 gr Speer 4453 ammunition with Bullseye powder.

A summary of test results using two high and two low points as set forth below in Table 6 is: V_{50}, 471.83 m/s (1548 ft/s); high partial, 466.65 m/s (1531 ft/s); and, low complete, 479.45 m/s (1573 ft/s).

Table 6

Shot No.	Powder (g)	Vel. 1 (ft/s)	Vel. 1 (m/s)	Vel. 2 (ft/s)	Vel. 2 (m/s)	Avg. Vel. (ft/s)	Avg. Vel. (m/s)	Result	Include in V_{50}	Notes
1	0.96	1573.0	479.45	1572.0	479.15	1572.5	479.30	C	True	
2	0.94	1576.0	480.36	1573.0	479.45	1574.5	479.91	C	True	
3	0.90	1532.0	466.95	1530.0	466.34	1531.0	466.65	P	True	
4	0.88	1516.0	462.08	1513.0	461.16	1514.5	461.62	P	True	

5	0.96	1585.0	483.11	1584.0	482.80	1584.5	482.96	C	False	
6	0.89	1513.0	461.16	1511.0	460.55	1512.0	460.86	C	False	Delaminated too much

Test Round No. 7

In this test round, ballistic barrier panel 12, 112 target was approximately 0.145 m^2 (225 in^2) in size, with an average thickness of 23.65 mm (0.931 in) and a weight of 3.26 kg (7.18 lbs.). Test conditions were: obliquity, 0.0°; primary velocity location, 2.44 m (8 ft); range to target, 15.24 m (15 ft); target to witness 0.15 m (6.0 in); temperature, 20.28 °C (68.5 °F); barometric pressure 100.91 kPa (29.8 inHg); relative humidity; 44.6%. The witness was a thin sheet of aluminum (i.e., around 0.508 mm (0.020 in) of 2024T3 aluminum). Panels were clamped according to MIL-STD-662F. Ballistic barrier panel 12, 112 was subjected to testing in this manner with a 7.62mm, 149-grain FMJ, steel jacketed projectile fired from a universal receiver fitted with an appropriate barrel and mounted; powder was N133.

A summary of test results using three high and three low points as set forth below in Table 7 is: V_{50}, 883.62 m/s (2899 ft/s); high partial, 889.41 m/s (2918ft/s); and, low complete, 877.82 m/s (2880 ft/s).

Table 7

Shot No.	Powder (g)	Vel. 1 (ft/s)	Vel. 1 (m/s)	Vel. 2 (ft/s)	Vel. 2 (m/s)	Avg. Vel. (ft/s)	Avg. Vel. (m/s)	Result	Include in V_{50}
1	148.0	2915	888.49	2921	890.32	2918	889.41	P	Yes
2	148.1	3021	920.80	3024	921.71	3023	921.41	C	No
3	147.8	2976	907.08	2982	908.91	2979	908.00	C	No
4	147.2	2935	894.59	2941	896.42	2938	895.50	C	No
5	148.0	2882	878.43	2890	880.87	2886	879.65	P	Yes
6	147.5	2907	886.05	2913	887.88	2910	886.97	C	Yes
7	147.2	2879	877.52	2882	881.48	2880	877.82	C	Yes

Test Round No. 8

In this test round, ballistic barrier panel 12, 112 target was approximately 0.145 m^2 (225 in^2) in size, with an average thickness of 23.83 mm (0.938 in) and a weight of 3.26 kg (7.18 lbs.). Test

conditions were: obliquity, 0.0°; primary velocity location, 2.44 m (8 ft); range to target, 15.24 m (15 ft); target to witness 0.15 m (6.0 in); temperature, 20.39 °C (68.7 °F); barometric pressure 100.91 kPa (29.8 inHg); relative humidity; 43.9%. The witness was a thin sheet of aluminum (i.e., around 0.508 mm (0.020 in) of 2024T3 aluminum). Panels were clamped according to MIL-STD-662F. Ballistic barrier panel 12, 112 was subjected to testing in this manner with a 7.62mm, 149-grain FMJ, steel jacketed projectile fired from a universal receiver fitted with an appropriate barrel and mounted; powder was N133.

A summary of test results using two high and two low points as set forth below in Table 8 is: V_{50}, 893.67 m/s (2932 ft/s); high partial, 896.11 m/s (2940 ft/s); and, low complete, 893.06 m/s (2930 ft/s).

Table 8

Shot No.	Powder (g)	Vel. 1 (ft/s)	Vel. 1 (m/s)	Vel. 2 (ft/s)	Vel. 2 (m/s)	Avg. Vel. (ft/s)	Avg. Vel. (m/s)	Result	Include in V_{50}
1	147.9	2896	882.70	2899	883.62	2897	833.01	P	Yes
2	148.1	3015	918.97	3021	920.80	3018	919.87	C	No
3	148.4	2962	902.82	2967	904.34	2964	903.43	C	Yes
4	148.0	2938	895.50	2941	896.42	2940	896.11	P	Yes
5	148.2	2973	906.17	2979	908.00	2976	907.08	C	Yes
6	148.2	2927	892.15	2933	893.98	2930	893.06	C	Yes
7	148.1	2882	878.43	2887	879.96	2885	879.35	P	Yes

In understanding the scope of the present invention, the terms "comprising," having" and "including" and their derivatives, as used herein, are intended to be open ended terms. Terms of degree such as "substantially," "about" and "approximate" as used herein mean a reasonable amount of deviation of the modified term such that the end result is not significantly changed. For example, these terms can be construed as including a deviation of at least ±5% of the modified term if this deviation would not negate the meaning of the word it modifies.

While selected embodiments have been chosen to illustrate the present invention, various changes and modifications can be made herein without departing from the scope of the invention as defined in the claims. For example, the size, shape, location or orientation of the various components can be changed as needed and/or desired. Components that are shown directly

connected or contacting each other can have intermediate structures disposed between them. The functions of one element can be performed by two, and vice versa. Structures and functions of one embodiment can be adapted to another embodiment. The present invention could also be used in conjunction with various components and in other configurations, either now known in the art or that may be developed in the future, so long as the objects and features of the invention are achieved, as would become apparent to persons having ordinary skill in the art after having become familiar with the teachings provided herein. Consequently, the present invention should not be regarded as limited to that shown and described herein for the purpose of limiting the invention as defined by the appended claims and their equivalents.

Having herein set forth preferred embodiments of the present invention, it is anticipated that suitable modifications can be made thereto which will nonetheless remain within the scope of the invention, including all changes that come within the meaning and range of equivalents. The invention shall therefore only be construed in accordance with the following claims:

What is claimed is:

1. A method for equipping a partition system comprising a plurality of tiles removably attached with a plurality of clips to a substantially rectangular partition frame with a ballistic barrier panel, comprising:

removing at least one tile from the partition frame, the tile comprising at least two brackets attached to an interior side of the tile on opposing sides, the two brackets comprising openings to support the clips;

removing the clips;

fitting the ballistic barrier panel to the interior side of the tile within the two brackets;

fitting a plurality of retrofit clips within the openings;

after the fitting of the plurality of retrofit clips, fastening the retrofit clips to the bracket to form a retrofitted tile;

using the retrofit clips to reposition the retrofitted tile on the partition frame to produce retrofitted partition system.

2. The method of claim 1, wherein the openings comprise a top opening and a bottom opening.

3. The method of claim 2, wherein the retrofit clips comprise a top clip shaped to be received by the top opening and a bottom clip shaped to be received by the bottom opening.

4. The method of claim 1, wherein retrofitted partition system is configured to absorb impact of projectiles fired from a firearm without being dislodged from the frame.

5. A method for retrofitting a partition system comprising a plurality of tiles secured within a substantially rectangular partition frame with a ballistic barrier panel, the ballistic barrier panel having a front side and a back side, comprising:

removing at least one tile from the partition frame;

attaching at least two keyhole brackets to the interior of the partition frame on opposing sides of the partition frame, the keyhole brackets comprising a plurality of keyhole-shaped openings;

installing a plurality of inserts through the back side of the ballistic barrier panel;

installing a plurality of fasteners each having a drive head through the front side of the ballistic barrier panel into the plurality of inserts so each drive head is a substantially uniform

distance from a surface of the front side of the ballistic barrier panel, the drive head being sized to fit through and be retained by the keyhole-shaped openings; and

securing the ballistic barrier panel to the partition frame by inserting the drive heads of the plurality of fasteners through the keyhole shaped openings.

6. The method of claim 6, wherein the keyhole-shaped openings are keyholes substantially evenly spaced along the length of the keyhole brackets.

7. The method of claim 6, wherein the installing comprises installing the plurality of inserts through the back side of the ballistic barrier panel at predetermined intervals established to line up with a plurality of the keyholes.

8. The method of claim 1, wherein the insert is a threaded insert and the fastener is a screw with a spanner-type drive head.

9. The method of claim 8, wherein the threaded insert is a t-nut.

10. A ballistic barrier partition system, comprising:

a substantially rectangular frame, comprising two parallel opposing sides, a top side and a bottom side, the substantially rectangular frame defining an opening;

two keyhole brackets attached to an interior of of the partition frame on each of the opposing sides, the keyhole brackets comprising a plurality of keyhole-shaped openings spaced at along the length of the keyhole brackets;

a ballistic barrier panel, the ballistic barrier panel being substantially rigid and substantially the same size as the opening, the ballistic barrier panel comprising a plurality of embedded fasteners aligned with and received by the keyhole-shaped openings.

11. The ballistic barrier partition system of claim 10, further comprising a wrapping placed on the outside of the ballistic barrier panel.

12. The ballistic barrier partition system of claim 10, wherein the ballistic barrier panel has a V_{50} rating of at least 471 meters per second.

13. The ballistic barrier partition system of claim 10, wherein the ballistic barrier panel comprises a first subpanel and a second subpanel adjoined at a seam; and further comprising a protection plate covering the seam and a fastener, the fastener being configured to laminate the protection plate, first subpanel and second subpanel.

14. The ballistic barrier partition system of claim 10, wherein the ballistic barrier partition system is configured to have the ballistic barrier panel absorb impact of projectiles fired from a handgun without being dislodged from the partition frame.

15. The ballistic barrier partition system of claim 10, wherein the embedded fasteners comprise plurality of screws inserted through a front side of the ballistic barrier panel into a plurality of threaded inserts installed through a second side of the ballistic barrier panel, the threaded inserts each comprising an open threaded portion for receiving the screw.

16. The ballistic barrier partition system of claim 10, wherein the ballistic barrier panel has a V_{50} rating of at least 883 meters per second.

17. The ballistic barrier partition system of claim 10, wherein each keyhole-shaped opening comprises a circular opening connected to a longitudinal opening having width narrower than the diameter of the circular opening.

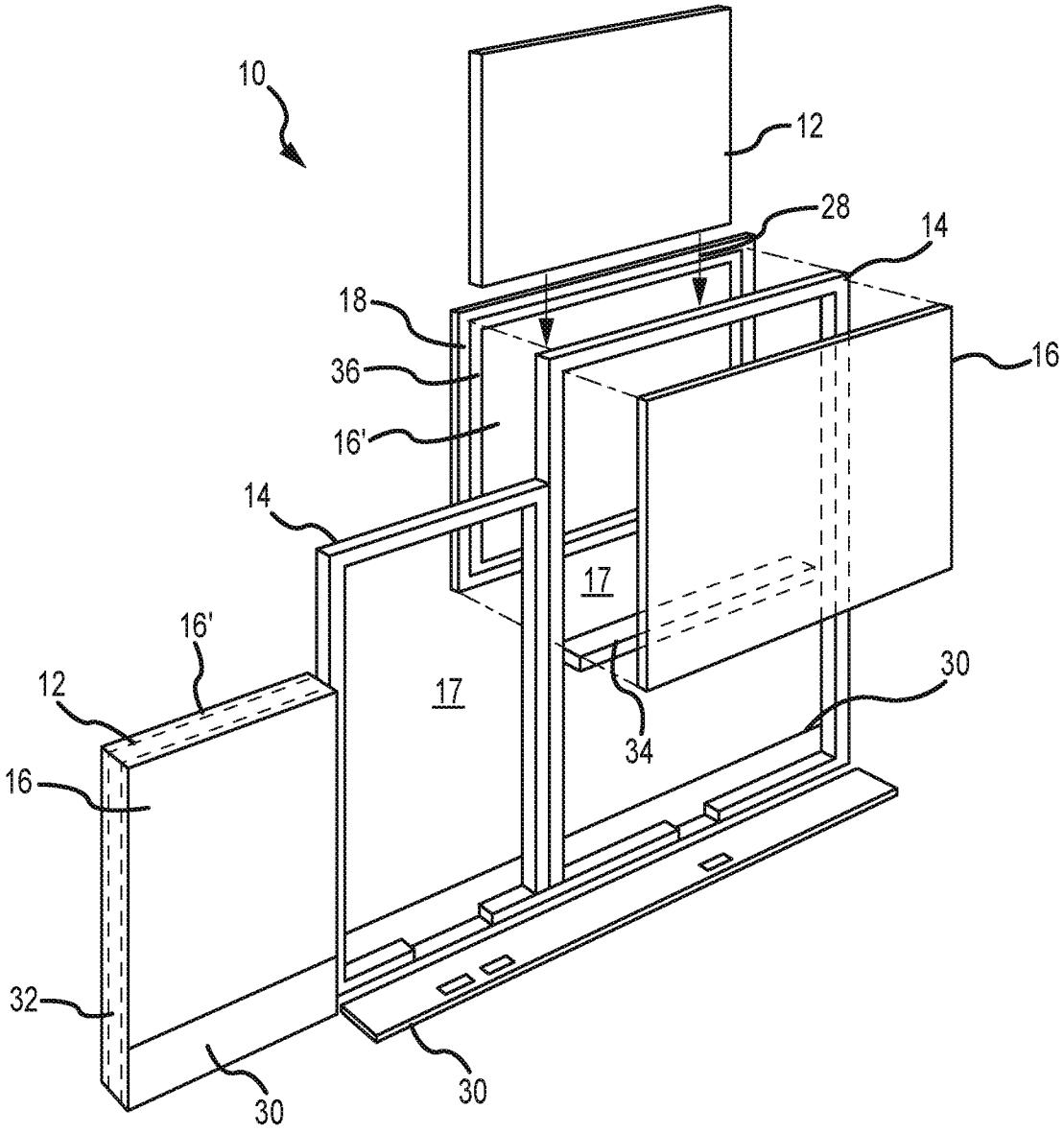

FIG.1

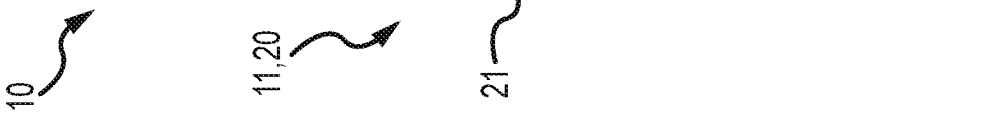

FIG.2A

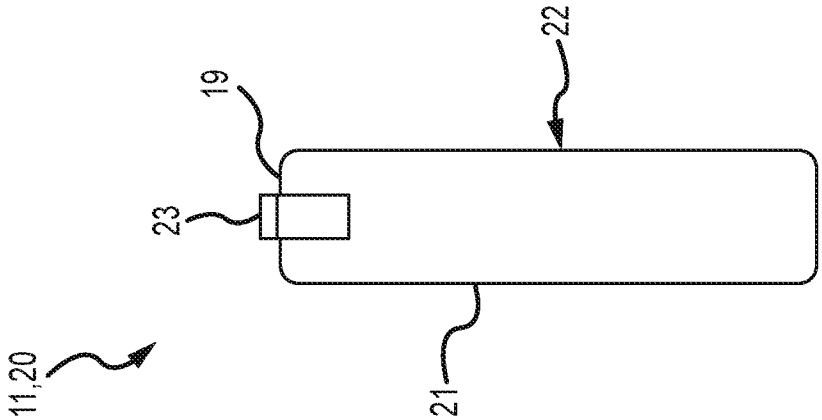

FIG.2B

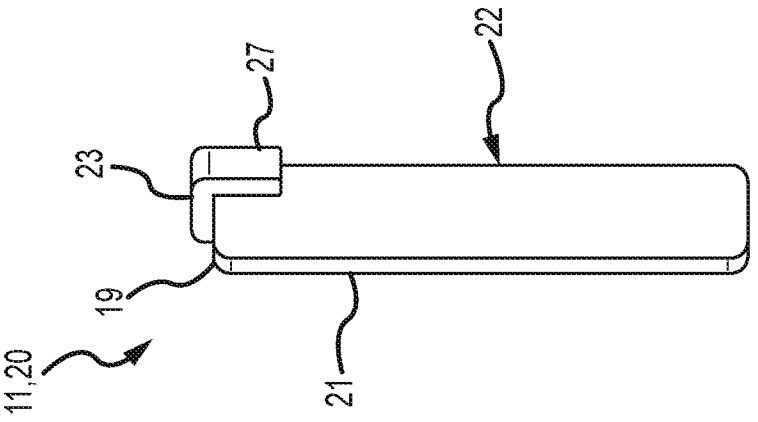

FIG.2C

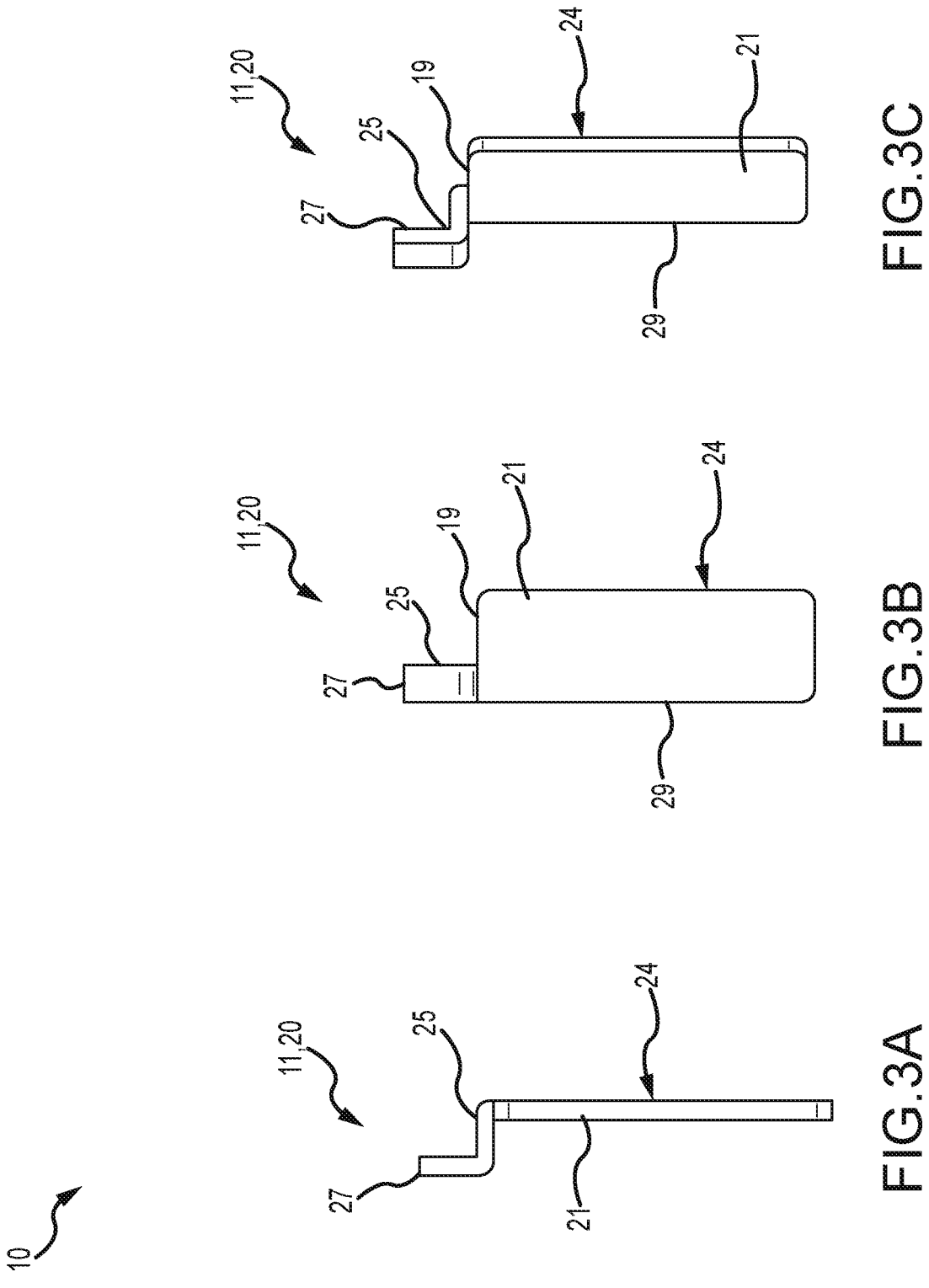

FIG.3A

FIG.3B

FIG.3C

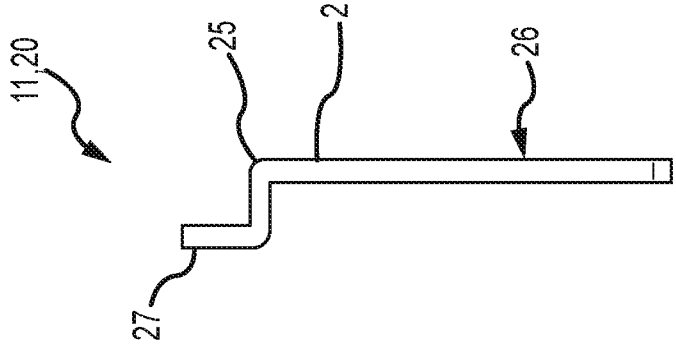

FIG.4A

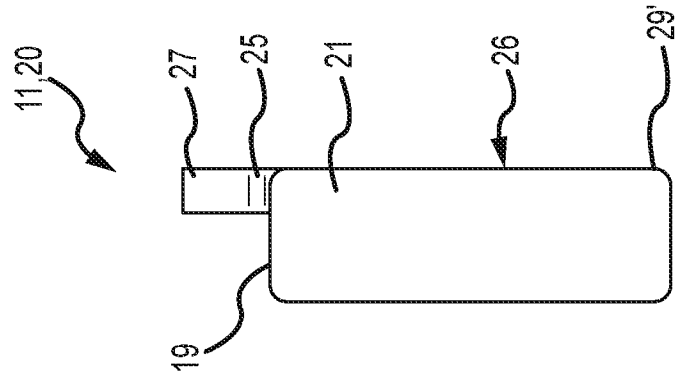

FIG.4B

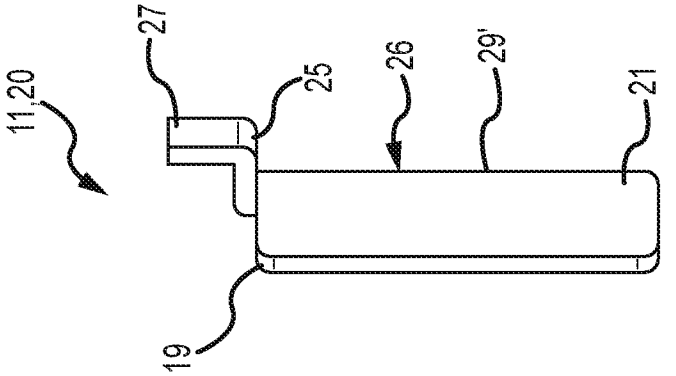

FIG.4C

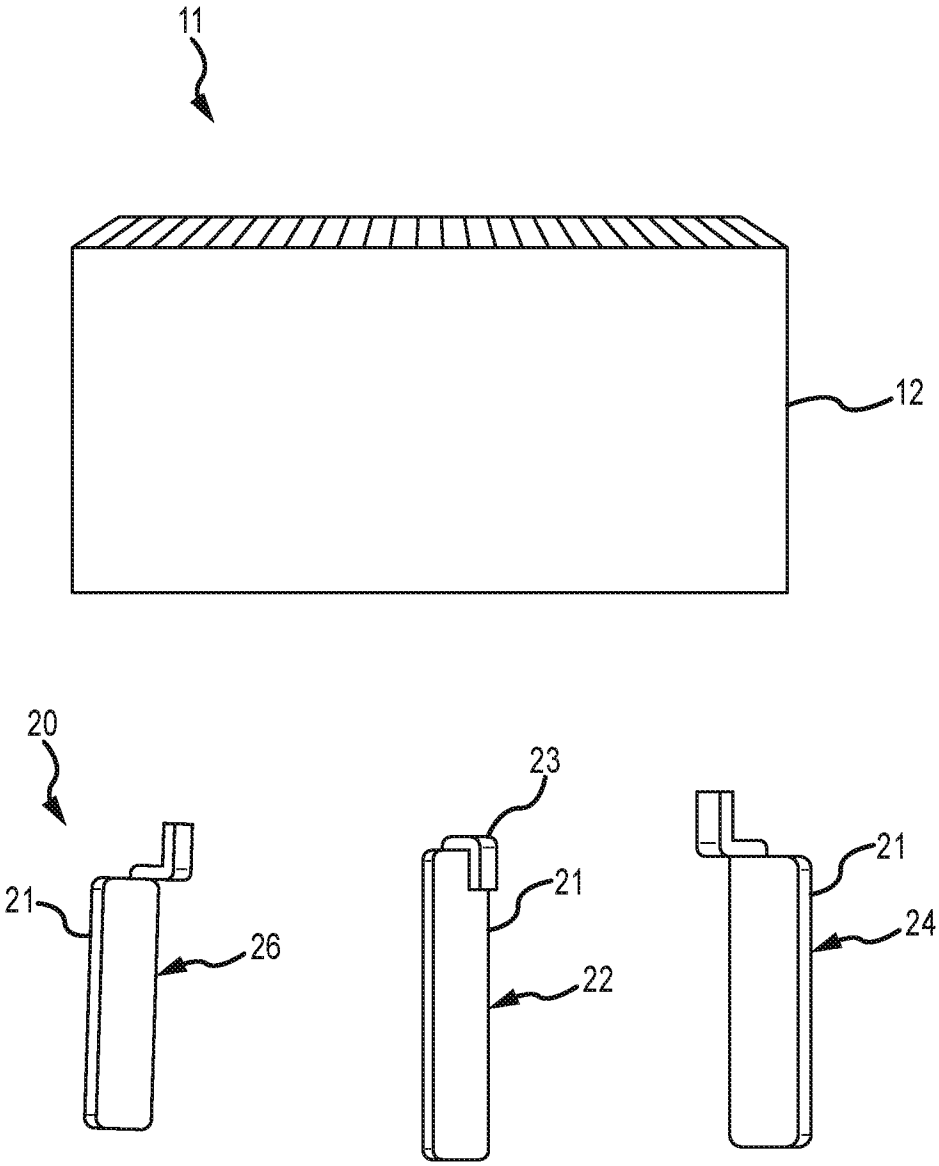

FIG.5

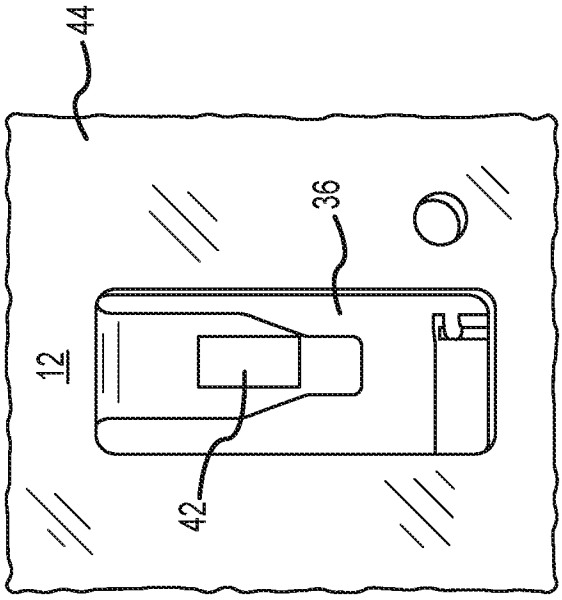

FIG.6B

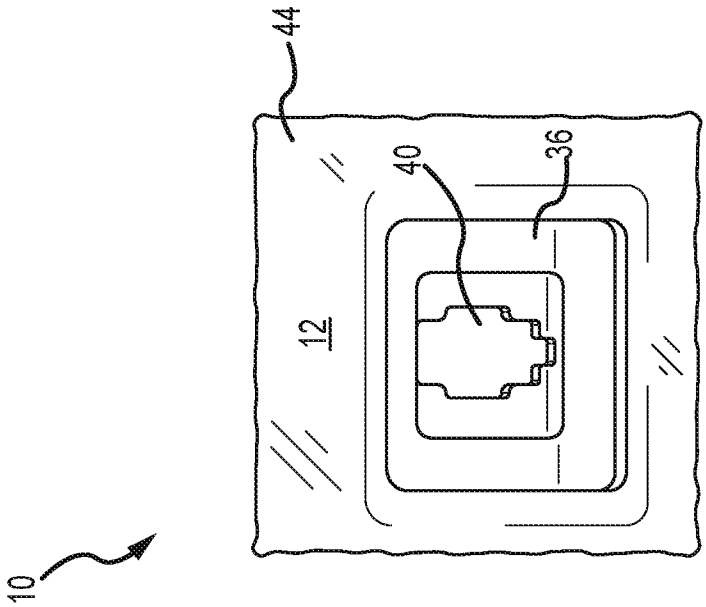

FIG.6A

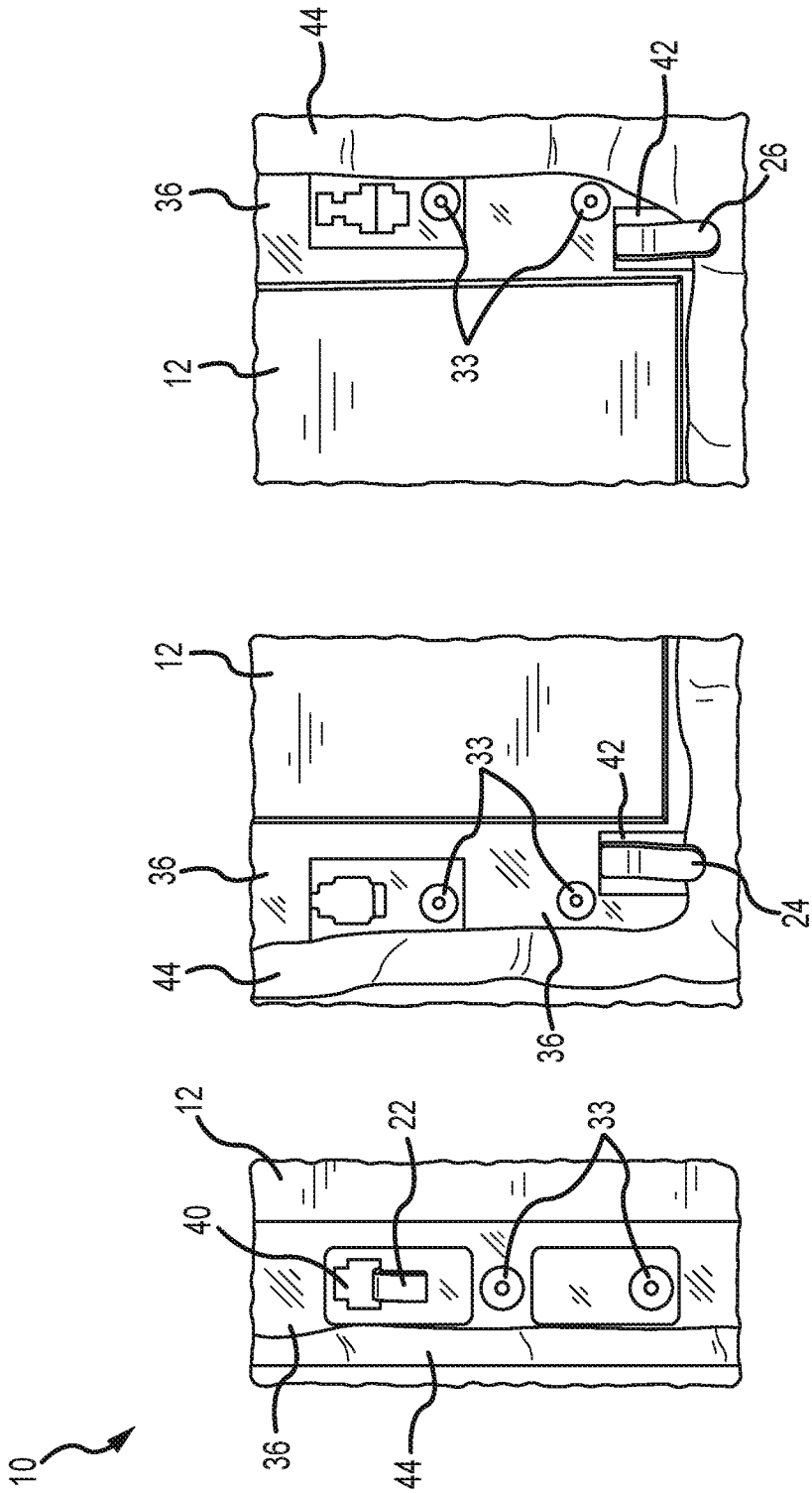

FIG.6C

FIG.6D

FIG.6E

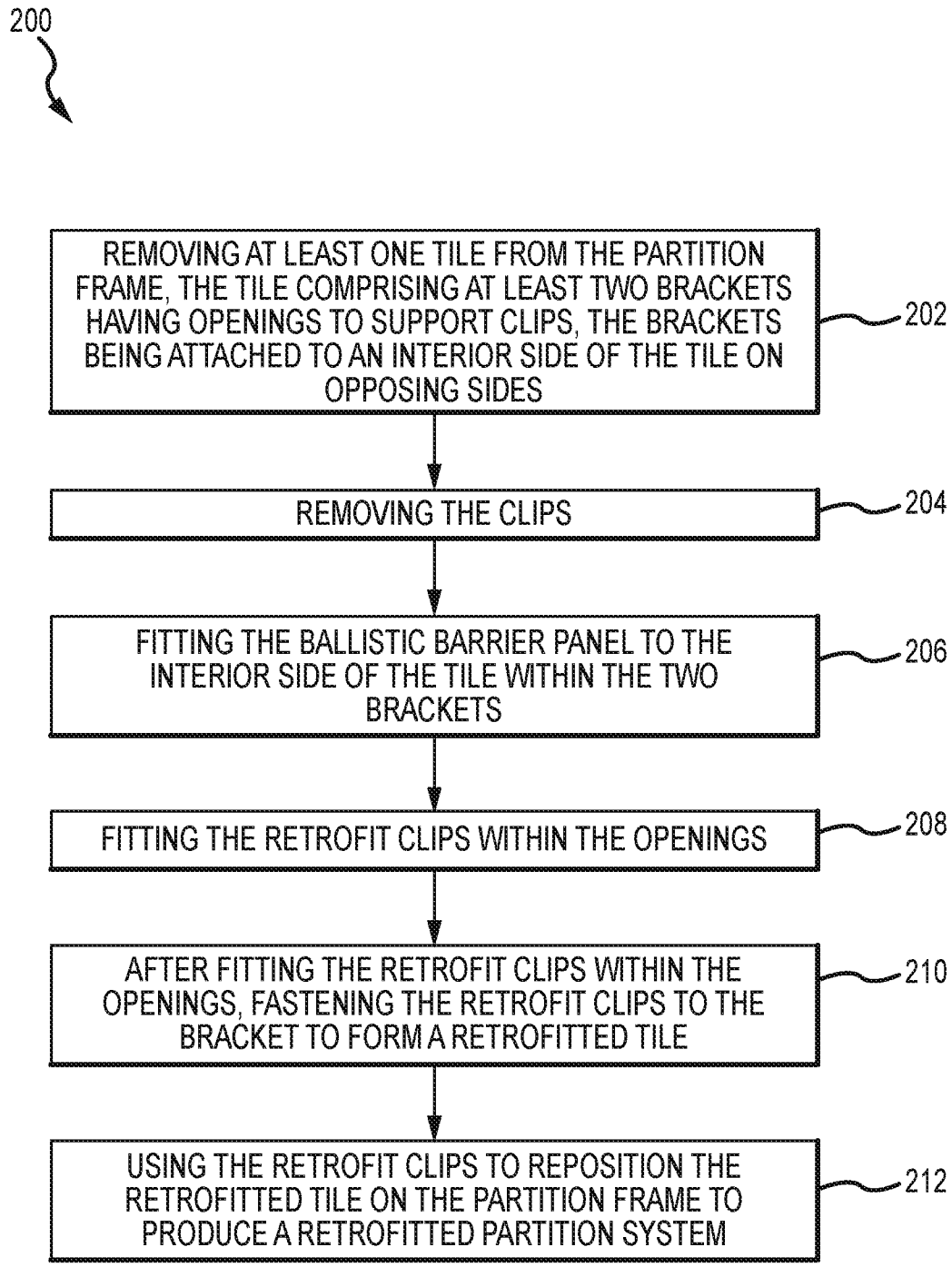
200
REMOVING AT LEAST ONE TILE FROM THE PARTITION FRAME, THE TILE COMPRISING AT LEAST TWO BRACKETS HAVING OPENINGS TO SUPPORT CLIPS, THE BRACKETS BEING ATTACHED TO AN INTERIOR SIDE OF THE TILE ON OPPOSING SIDES
202
REMOVING THE CLIPS
204
FITTING THE BALLISTIC BARRIER PANEL TO THE INTERIOR SIDE OF THE TILE WITHIN THE TWO BRACKETS
206
FITTING THE RETROFIT CLIPS WITHIN THE OPENINGS
208
AFTER FITTING THE RETROFIT CLIPS WITHIN THE OPENINGS, FASTENING THE RETROFIT CLIPS TO THE BRACKET TO FORM A RETROFITTED TILE
210
USING THE RETROFIT CLIPS TO REPOSITION THE RETROFITTED TILE ON THE PARTITION FRAME TO PRODUCE A RETROFITTED PARTITION SYSTEM
212

FIG.7

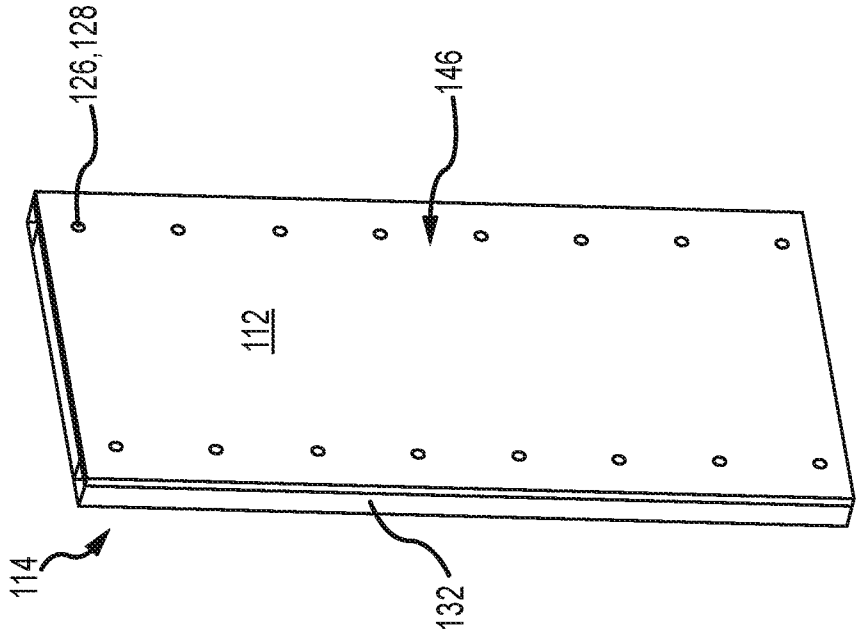
126,128
146
112
114
132

FIG.8B

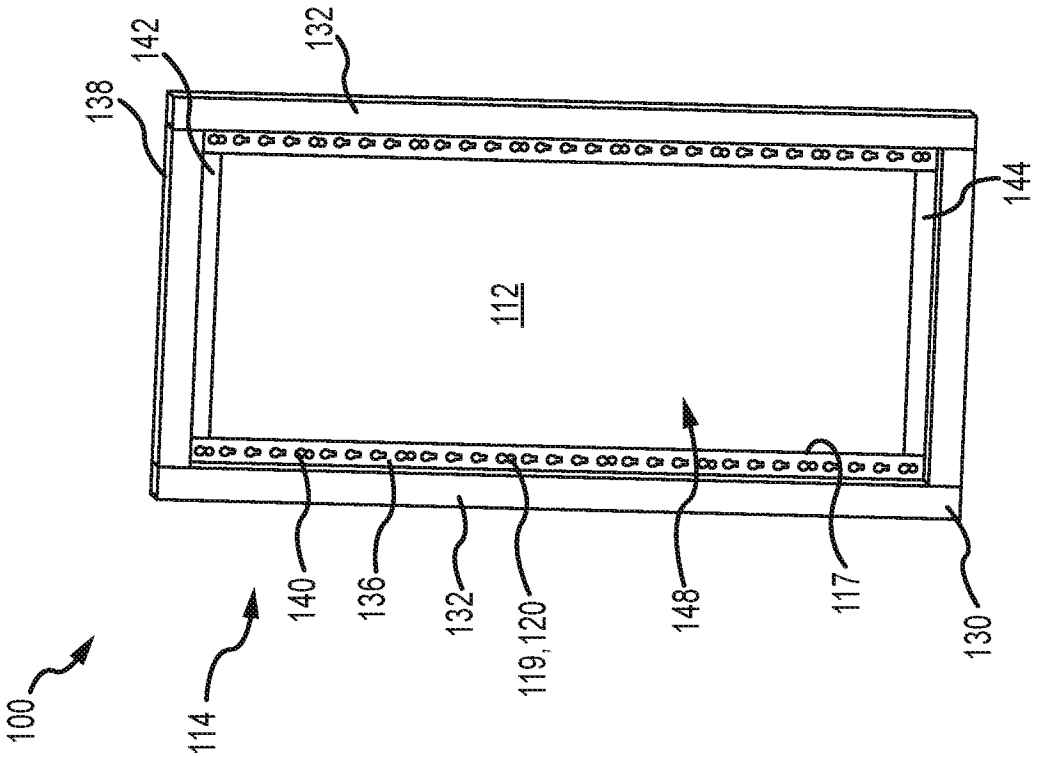
142
132
138
144
112
140
136
132
119,120
148
117
130
114
100

FIG.8A

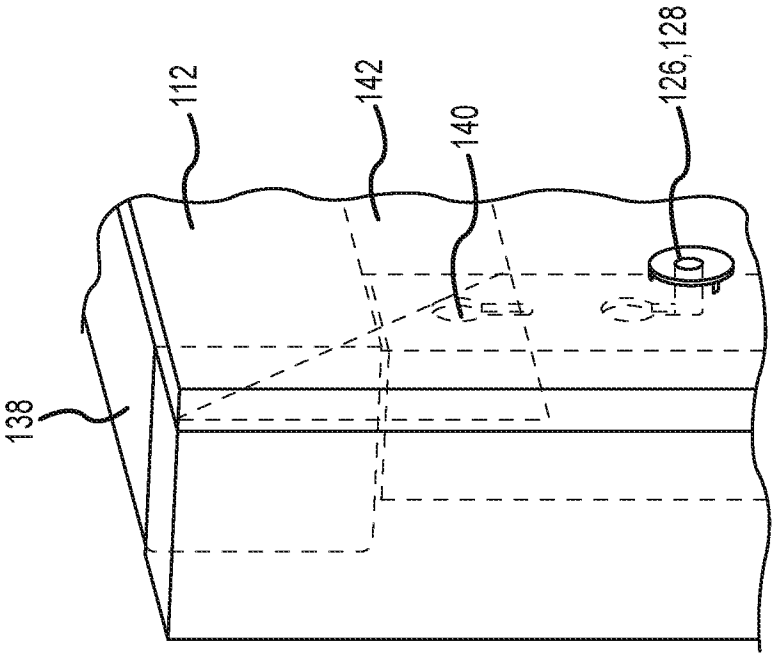
112
142
140
126,128
138

FIG.9B

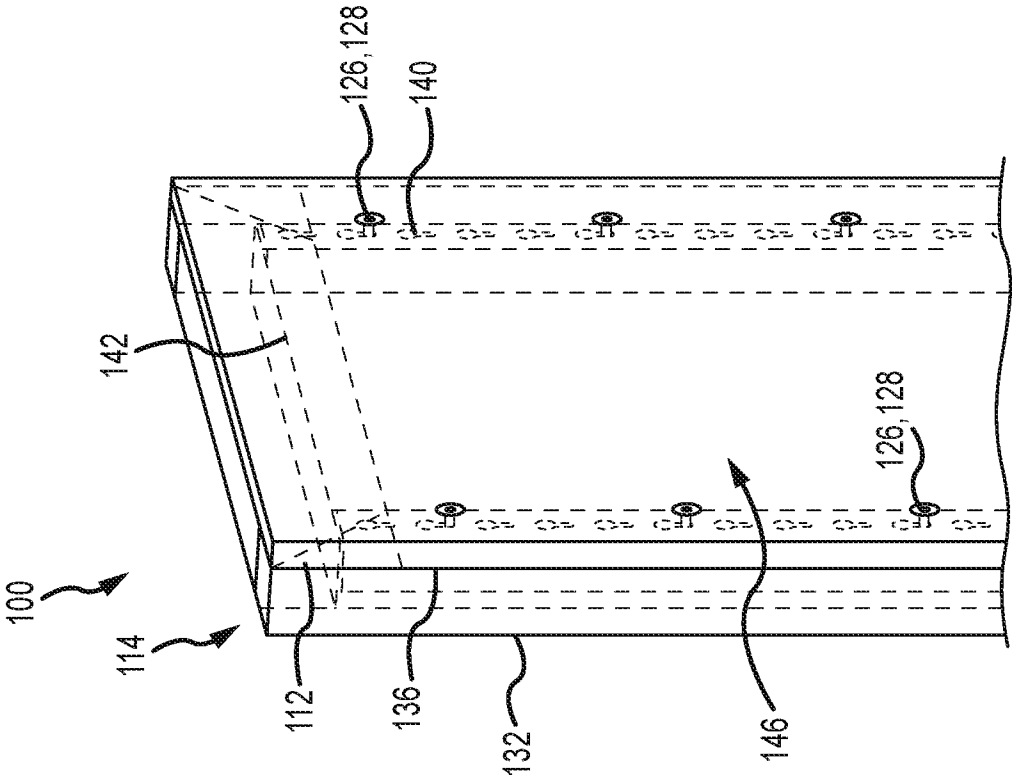
126,128
140
142
126,128
100
114
112
136
132
146

FIG.9A

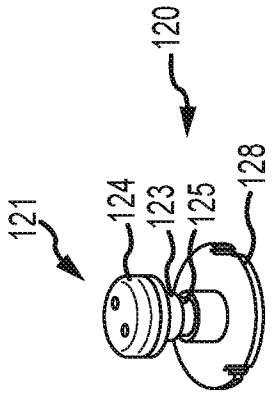

FIG.10C

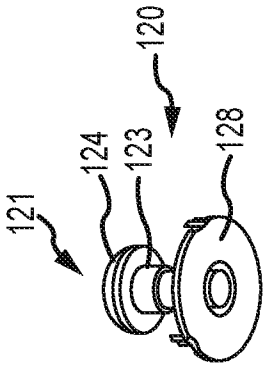

FIG.10D

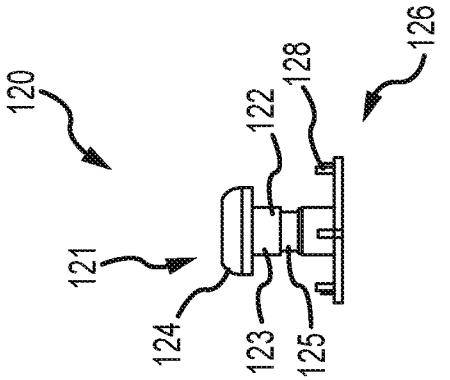

FIG.10B

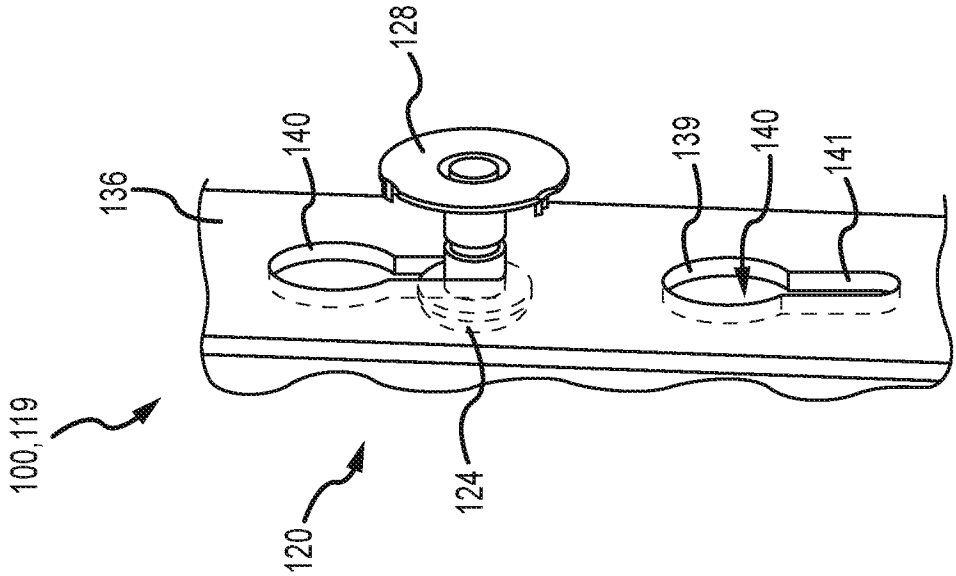

FIG.10A

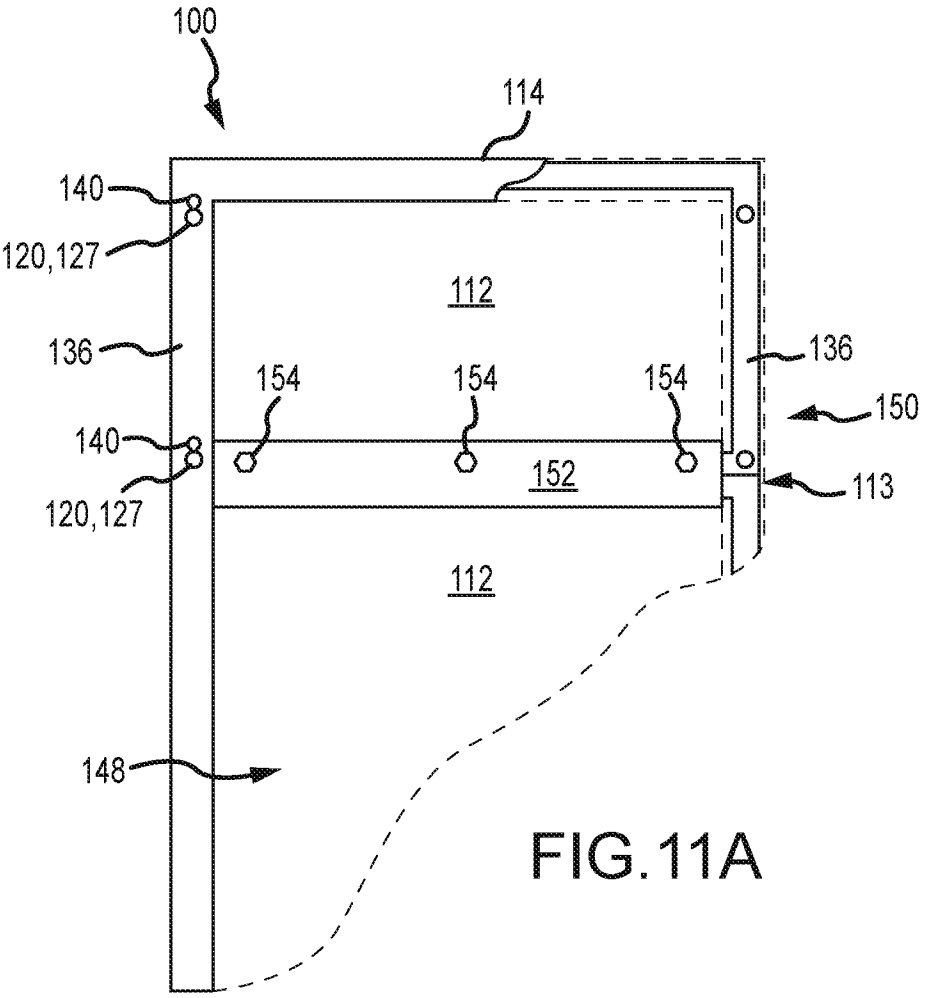

FIG.11A

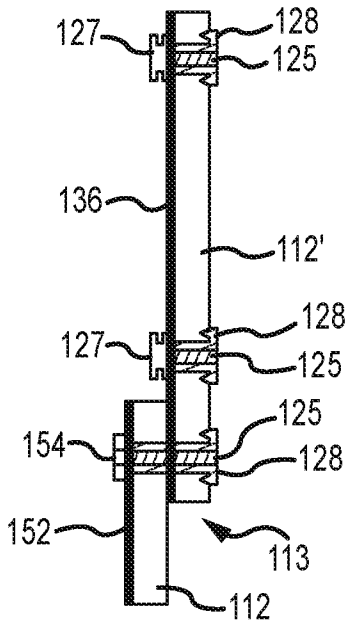

FIG.11B

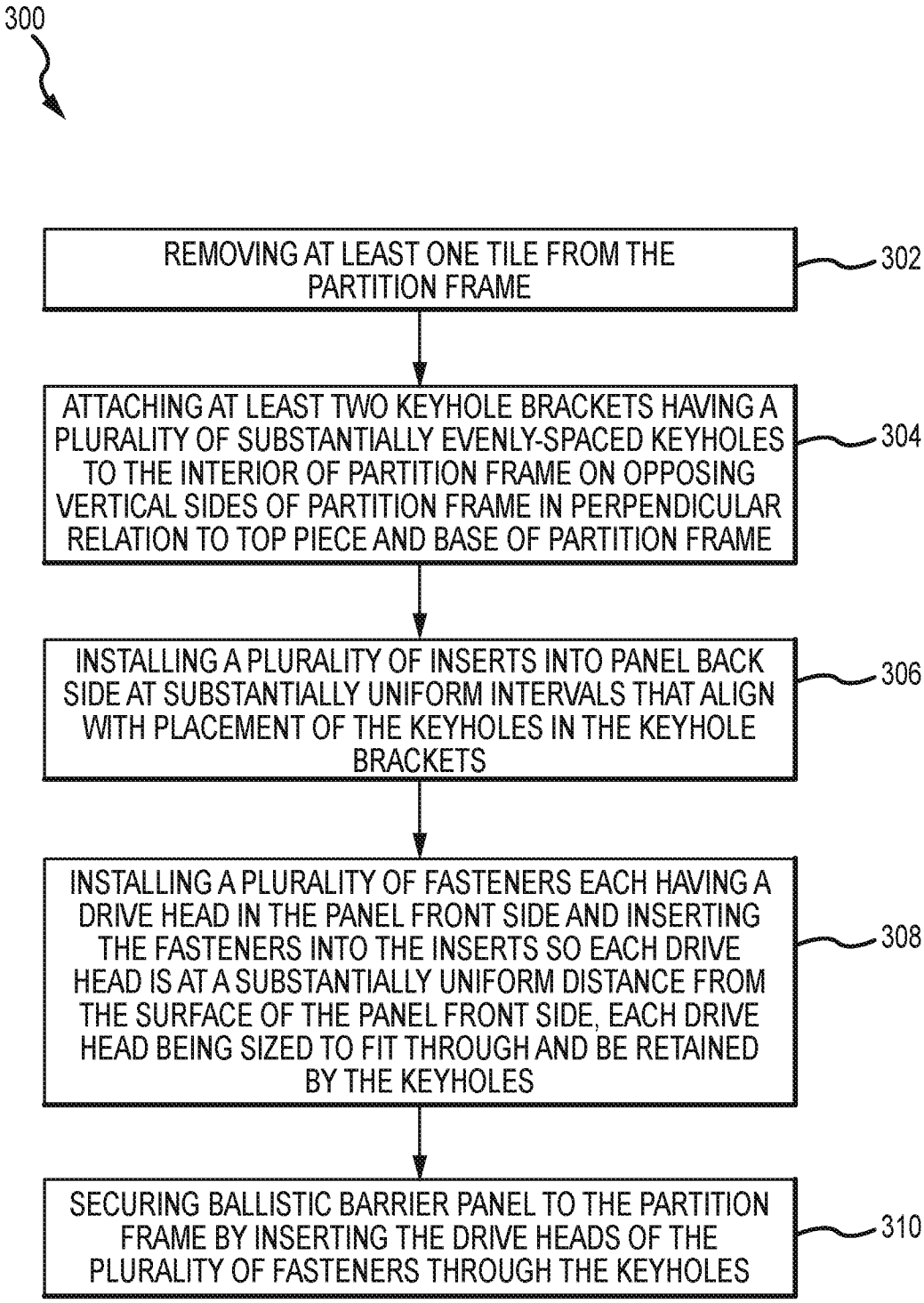
300
REMOVING AT LEAST ONE TILE FROM THE PARTITION FRAME
302
ATTACHING AT LEAST TWO KEYHOLE BRACKETS HAVING A PLURALITY OF SUBSTANTIALLY EVENLY-SPACED KEYHOLES TO THE INTERIOR OF PARTITION FRAME ON OPPOSING VERTICAL SIDES OF PARTITION FRAME IN PERPENDICULAR RELATION TO TOP PIECE AND BASE OF PARTITION FRAME
304
INSTALLING A PLURALITY OF INSERTS INTO PANEL BACK SIDE AT SUBSTANTIALLY UNIFORM INTERVALS THAT ALIGN WITH PLACEMENT OF THE KEYHOLES IN THE KEYHOLE BRACKETS
306
INSTALLING A PLURALITY OF FASTENERS EACH HAVING A DRIVE HEAD IN THE PANEL FRONT SIDE AND INSERTING THE FASTENERS INTO THE INSERTS SO EACH DRIVE HEAD IS AT A SUBSTANTIALLY UNIFORM DISTANCE FROM THE SURFACE OF THE PANEL FRONT SIDE, EACH DRIVE HEAD BEING SIZED TO FIT THROUGH AND BE RETAINED BY THE KEYHOLES
308
SECURING BALLISTIC BARRIER PANEL TO THE PARTITION FRAME BY INSERTING THE DRIVE HEADS OF THE PLURALITY OF FASTENERS THROUGH THE KEYHOLES
310

FIG.12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/023167

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - E04B 2/46; E04B 2/00; E04B 9/00; F41H 5/04 (2016.01)
CPC - E04B 2/46; E04B 9/22; F41H 5/04; F41H 5/263 (2016.05)
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC - E04B 2/00; E04B 2/46; E04B 9/00; F41H 5/04
CPC - E04B 2/46; E04B 9/22; F41H 5/04; F41H 5/263

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC - 52/506.05; 52/506.06; 52/506.07; 52/582.1; 52/745.1; 89/36.04; 109/79 (keyword delimited)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatBase, Google Patents, Google Scholar, Google
Search terms used: retrofit, partition, clip, bracket, ballistic, panel, openings, fitting, barrier, tile, system

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2012/0073233 A1 (HARRINGTON et al) 29 March 2012 (29.03.2012) entire document	1-4
A	US 8,069,769 B2 (CARBERRY et al) 06 December 2011 (06.12.2011) entire document	1-4
A	US 8,549,809 B2 (GOLDEN et al) 08 October 2013 (08.10.2013) entire document	1-4
A	US 7,886,651 B2 (HALL) 15 February 2011 (15.02.2011) entire document	1-4
A	US 2011/0289872 A1 (HISCOCK et al) 01 December 2011 (01.12.2011) entire document	1-4

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 June 2016	28 JUL 2016
Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450 Facsimile No. 571-273-8300	Authorized officer Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/023167

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
See supplemental page

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-4

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/023167

Continued from Box No. III Observations where unity of invention is lacking

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees need to be paid.

Group I, claims 1-4 are drawn to a method for equipping a partition system comprising a plurality of clips.

Group II, claims 5-17 are drawn to a method for retrofitting a partition system comprising at least two keyhole brackets.

Note, Claims 6, 8 are objected to under PCT Rule 66.2(a)(v) as lacking clarity under PCT Article 6 because claims 6, 8 are indefinite for the following reasons: Claim 6 is originally dependent upon itself, which is improper. It is best understood that claim 6 depends from independent claim 5 because it further limits the keyhole-shaped openings introduced in claim 5. Claim 8 is originally dependent upon claim 1. However, claim 8 further limits the insert introduced in independent claim 5. Therefore, it is best understood that claim 8 depends from independent claim 5.

The inventions listed in Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1, because under PCT Rule 13.2 they lack the same or corresponding special technical features for the following reasons:

The special technical features of Group I, a method for equipping a partition system comprising a plurality of clips a tile comprising at least two brackets attached to an interior side of the tile on opposing sides, the two brackets comprising openings to support the clips, removing the clips, fitting a ballistic barrier panel to the interior side of the tile within the two brackets, fitting a plurality of retrofit clips within the openings, fastening the retrofit clips to the bracket to form a retrofit tile, using the retrofit clips to preposition the retrofitted tile on the partition frame, are not present in Group II; and, the special technical features of Group II, a method for retrofitting a partition system comprising attaching at least two keyhole brackets to an interior of a partition frame on opposing sides of the partition frame, the keyhole brackets comprising a plurality of keyhole-shaped openings, installing a plurality of inserts through a backside of a ballistic barrier panel, installing a plurality of fasteners each having a drive head through a front side of the ballistic barrier panel into the plurality of inserts so each drive head is substantially uniform, are not present in Group I.

Groups I and II share the technical features of a method of equipping a partition system comprising a plurality of tiles removably attached to a substantially rectangular partition frame with a ballistic barrier panel, removing at least one tile from the partition frame, and at least two brackets.
However, these shared technical features do not represent a contribution over the prior art. Specifically, US 7,520,207 B1 to Fuqua et al. teaches of a method of equipping a partition system (ballistic wall assembly 10, Fig. 1) comprising a plurality of tiles (14, Fig. 2; Col. 4, Lns. 55-58 regarding in another implementation consistent with principles of the invention, an assembly of ceramic tiles (not shown) may be attached to a threat side 19 of one or more of the wall panels 14 to provide additional ballistic protection) removably attached (see removably attached 14 in Fig. 2) to a substantially rectangular partition frame (uprights 21, 22 and cross-members 24, Fig. 2) with a ballistic barrier panel (14, Fig. 2; Col. 4, Lns. 16-19 regarding each wall panel 14 comprises a substantially planar, four-sided, hard or soft armor structure), removing at least one tile from the partition frame (see removably attached 14 in Fig. 2), and at least two brackets (26, 38, Fig. 4) .

Since none of the special technical features of the Groups I-II inventions are found in more than one of the inventions, unity is lacking.