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(54) **BALLISTIC WALL STRUCTURE**

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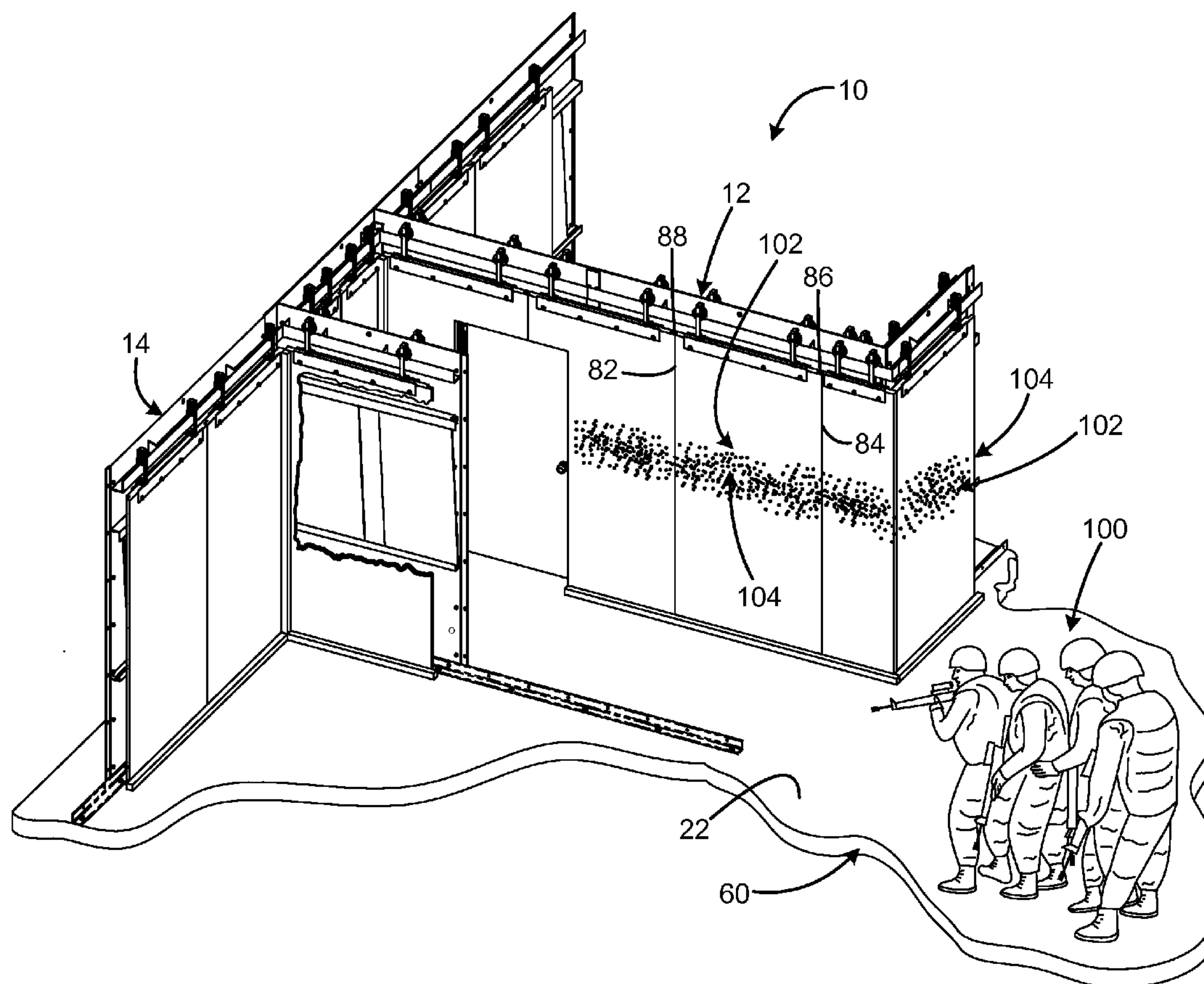
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(57) **ABSTRACT**

A ballistic wall structure has a primary wall panel formed of a ballistic-resistant material, the primary wall panel having a bottom edge adjacent to a floor surface, and extending to an upper edge above head level, a removable secondary wall panel formed of ballistic-resistant material and removably supported adjacent to the primary wall panel, the secondary wall panel having a lower edge at a first level, and an upper edge at a second level, the first level being at a level above the bottom edge of the primary wall panel, and the second level being at a level below the upper edge of the primary wall panel, such that the secondary wall panel bears the effects of bullet strikes at an intermediate level, and may be replaced as wear becomes excessive without replacing the primary wall panel. There may be a curtain layer adjacent to the primary and secondary wall panels.



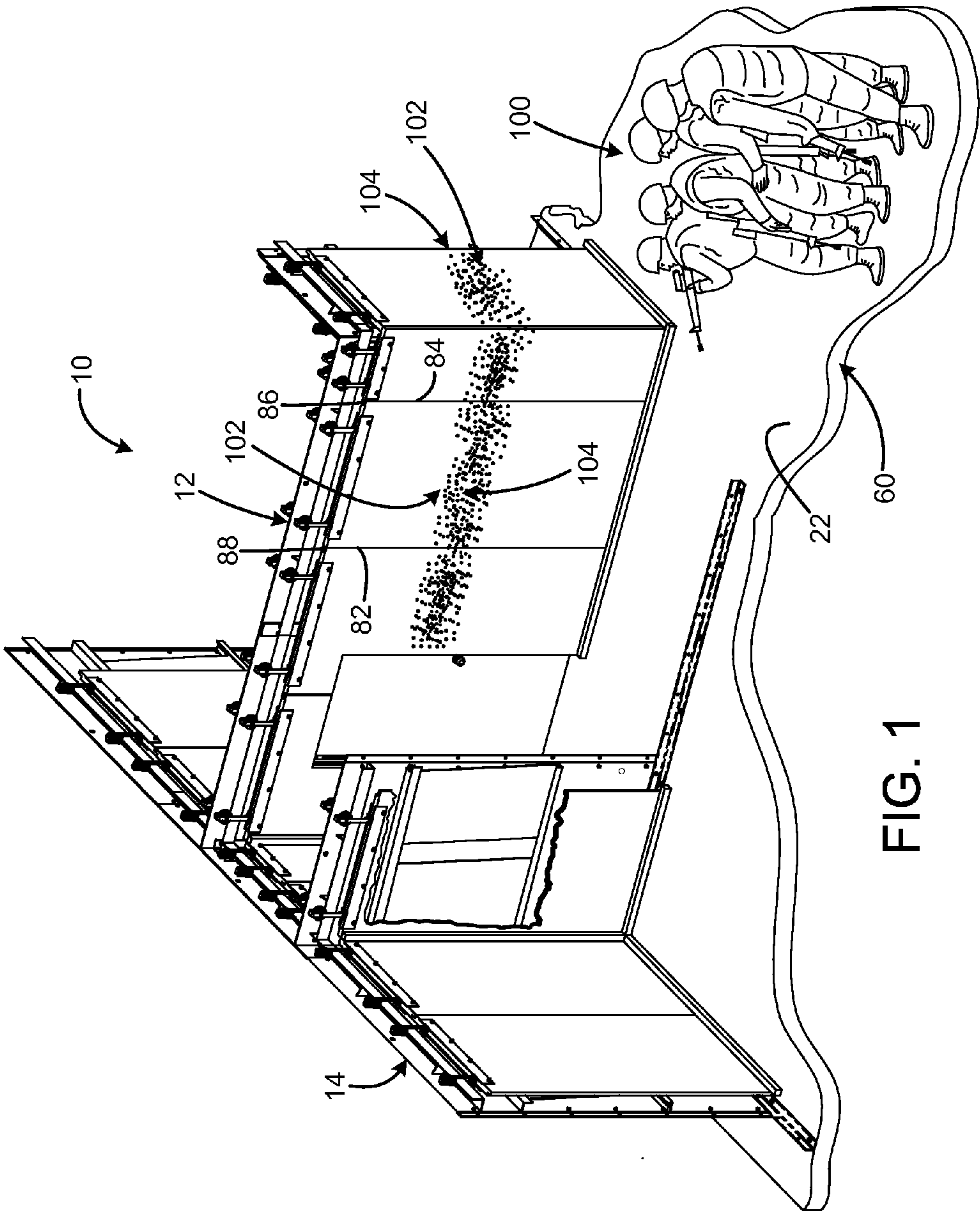


FIG. 2

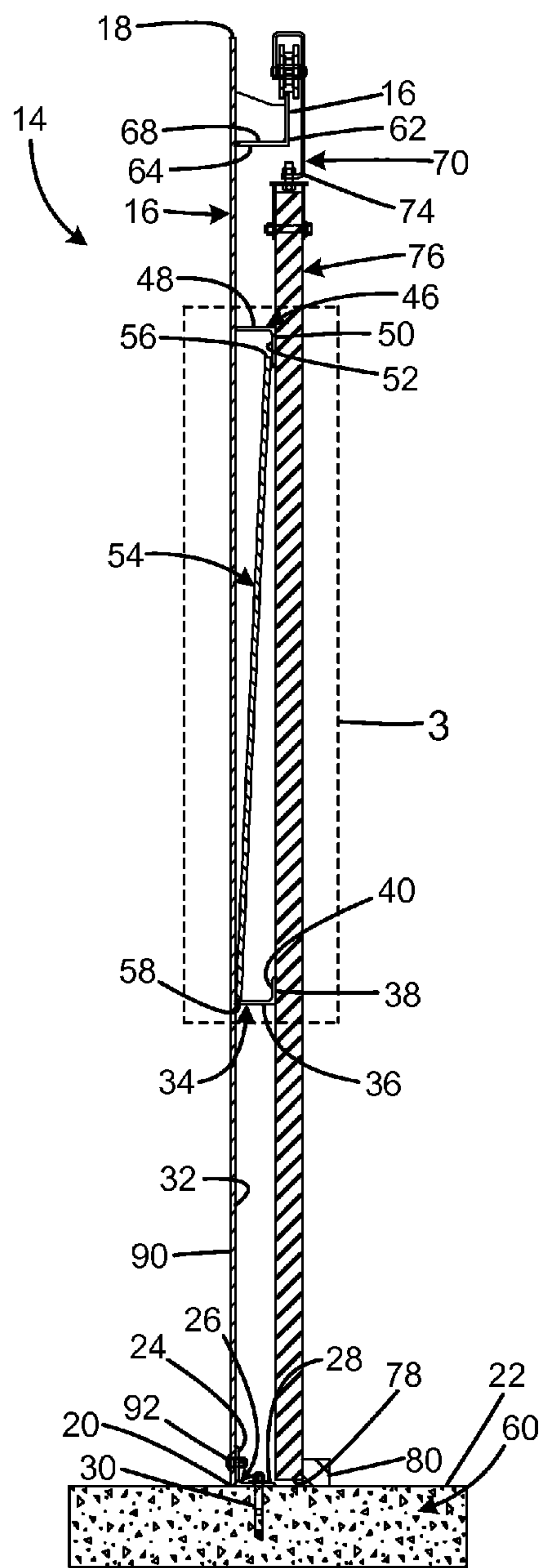


FIG. 3

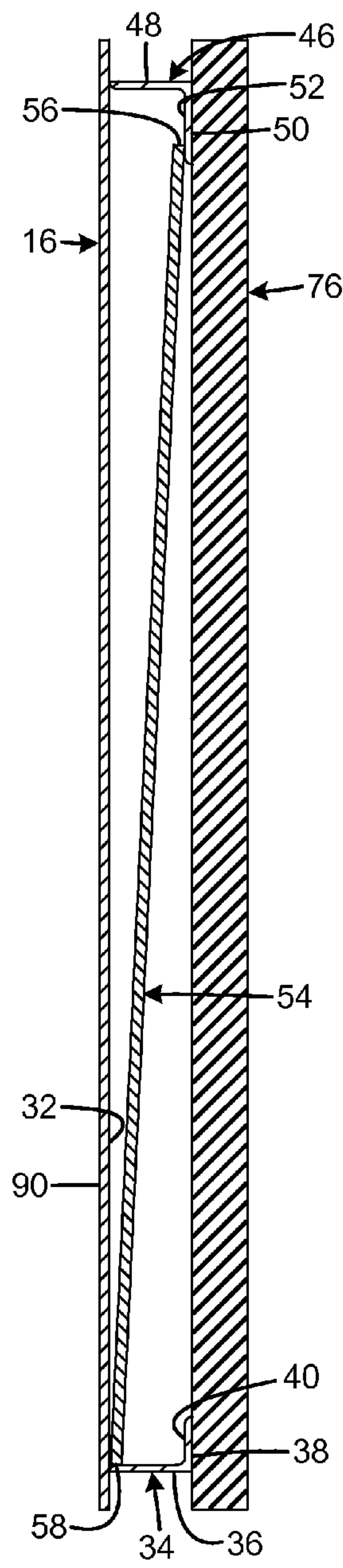


FIG. 4

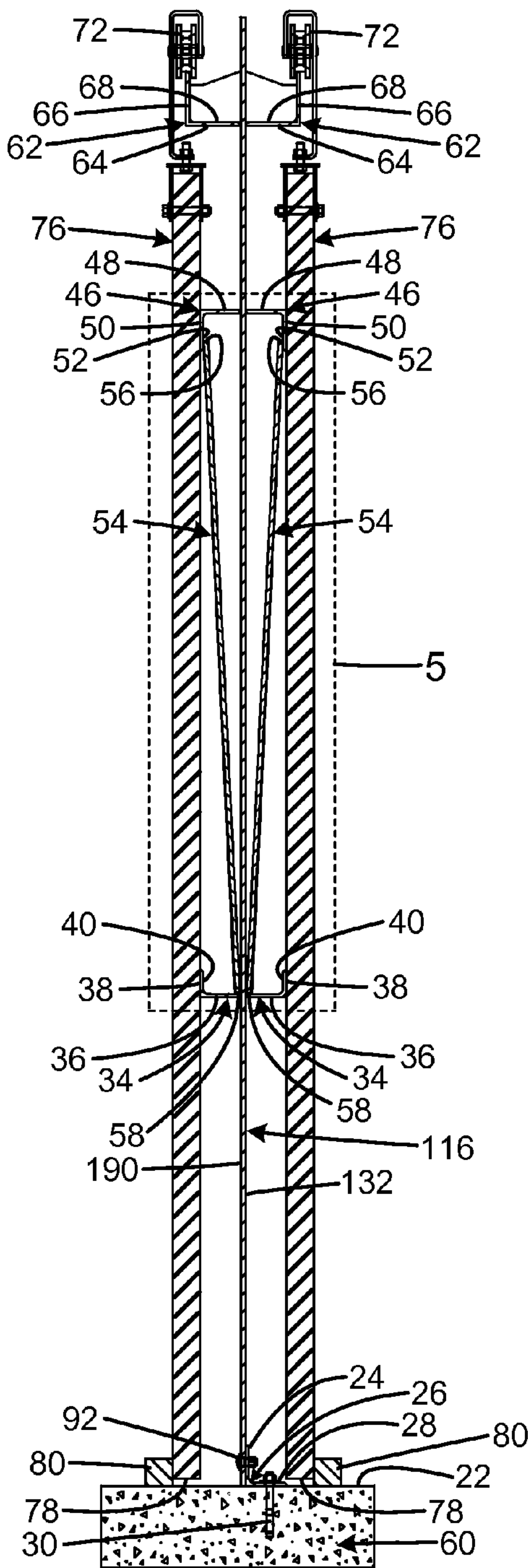
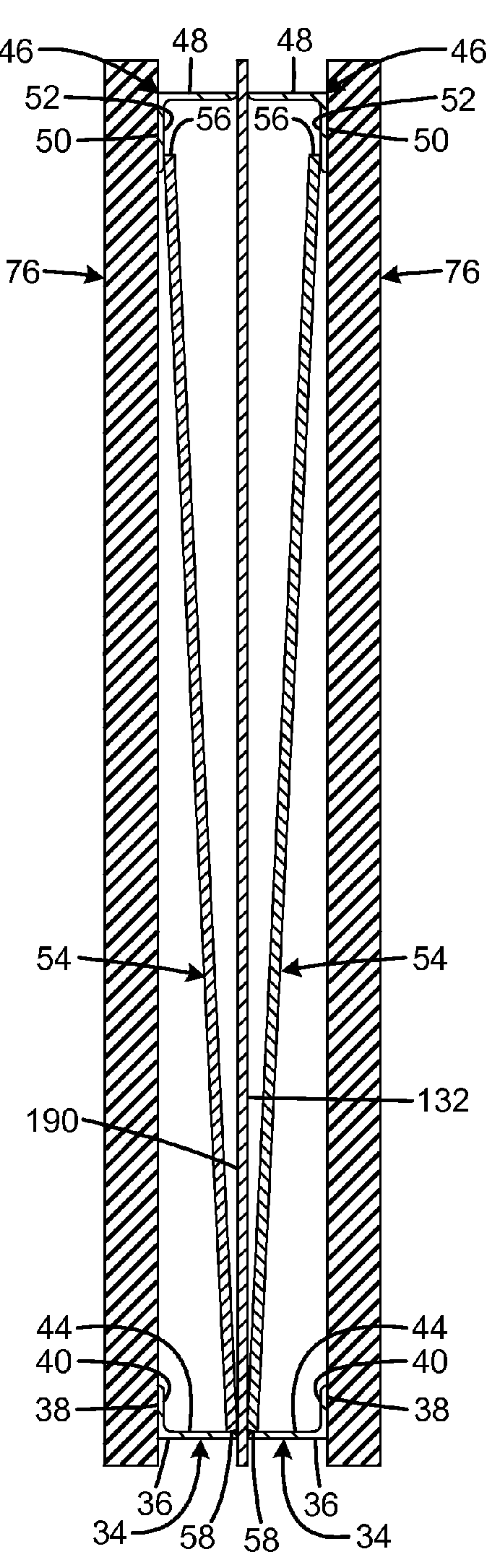


FIG. 5



BALLISTIC WALL STRUCTURE

FIELD OF THE INVENTION

[0001] The present invention relates to shooting ranges, and more particularly to a ballistic wall structure that provides extra protection that can be easily replaced where most bullet strikes occur.

BACKGROUND OF THE INVENTION

[0002] A shoot house is a type of indoor firing range modified to resemble a residential or commercial environment, with the walls and floor being fortified as ballistic wall structures to safely absorb rounds fired from close range. It is used to train military and law enforcement personnel for various urban combat scenarios while permitting them to use their full power service weapons. Because the structures need to absorb gun fire, strong materials for the walls and floors are needed such as concrete, steel, and/or ballistic rubber. Use of materials that cannot absorb gun fire may lead to injuries or death as bullets either penetrate completely through the material or bullets or bullet fragments ricochet back towards the shooter.

[0003] Even ballistic wall structures that include steel plates periodically need to be replaced. When the plates are struck by a bullet, sometimes dimples can be formed. Dimples have the potential to send bullet fragments back at a shooter if they are struck precisely by subsequent bullet. As a result, significantly dimpled steel plates require replacement. When the steel plates are subjected to repeated bullet strikes in close proximity to one another, the plate will eventually fail, which also requires plate replacement. Conventionally constructed shoot houses can be difficult and time-consuming to repair given that steel plates are heavy and are frequently welded or bolted into place.

[0004] Therefore, a need exists for a new and improved ballistic wall structure that provides extra protection that can be easily replaced where most bullet strikes occur. In this regard, the various embodiments of the present invention substantially fulfill at least some of these needs. In this respect, the ballistic wall structure according to the present invention substantially departs from the conventional concepts and designs of the prior art, and in doing so provides an apparatus primarily developed for the purpose of providing extra protection that can be easily replaced where most bullet strikes occur.

SUMMARY OF THE INVENTION

[0005] The present invention provides an improved ballistic wall structure, and overcomes the above-mentioned disadvantages and drawbacks of the prior art. As such, the general purpose of the present invention, which will be described subsequently in greater detail, is to provide an improved ballistic wall structure that has all the advantages of the prior art mentioned above.

[0006] To attain this, the preferred embodiment of the present invention essentially comprises a primary wall panel formed of a ballistic-resistant material, the primary wall panel having a bottom edge adjacent to a floor surface, and extending to an upper edge above head level, a removable secondary wall panel formed of ballistic-resistant material and removably supported adjacent to the primary wall panel, the secondary wall panel having a lower edge at a first level, and an upper edge at a second level, the first level being at a level

above the bottom edge of the primary wall panel, and the second level being at a level below the upper edge of the primary wall panel, such that the secondary wall panel bears the effects of bullet strikes at an intermediate level, and may be replaced as wear becomes excessive without replacing the primary wall panel. There may be a curtain layer adjacent to the primary and secondary wall panels. There are, of course, additional features of the invention that will be described hereinafter and which will form the subject matter of the claims attached.

[0007] There has thus been outlined, rather broadly, the more important features of the invention in order that the detailed description thereof that follows may be better understood and in order that the present contribution to the art may be better appreciated.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1 is a top isometric view of the current embodiment of ballistic wall structures constructed in accordance with the principles of the present invention installed to form a shoot house.

[0009] FIG. 2 is a side sectional view of the current embodiment of a ballistic wall structure of FIG. 1 configured as an exterior wall section.

[0010] FIG. 3 is an enlarged side sectional view of the current embodiment of the belly plate of FIG. 2.

[0011] FIG. 4 is a side sectional view of the current embodiment of a ballistic wall structure of FIG. 1 configured as an interior wall section.

[0012] FIG. 5 is an enlarged side sectional view of the current embodiment of the belly plates of FIG. 4.

[0013] The same reference numerals refer to the same parts throughout the various figures.

DESCRIPTION OF THE CURRENT EMBODIMENT

[0014] An embodiment of a shoot house formed by the ballistic wall structures of the present invention is shown and generally designated by the reference numeral 10.

[0015] FIG. 1 illustrates a section of the improved shoot house 10 of the present invention. More particularly, the shoot house consists of multiple interior wall section ballistic wall structures 12 and multiple exterior wall section ballistic wall structures 14 installed on a floor 60. Interior wall sections have to absorb bullets fired from both sides, while exterior wall sections only have to absorb bullets fired from the interior side. The details of the construction of the exterior wall sections are described in the discussion of FIGS. 2 and 3. The details of the construction of the interior wall sections are described in the discussion of FIGS. 4 and 5. A team of shooters 100 and a typical arrangement of bullet strikes 102 on the ballistic wall structures 12, 14 are shown.

[0016] FIGS. 2 and 3 illustrate the improved exterior wall section ballistic wall structure 14 of the present invention. More particularly, the exterior wall section is shown installed on a floor 60. In the current embodiment, the floor is made of concrete. The exterior wall section has a wall panel 16 with a top 18 and a bottom 20. The bottom 20 of the wall panel is attached to the top 22 of the floor by a carriage bolt 92 attached to one leg 24 of a floor mount 26. The other leg 28 of the floor mount is attached to the floor by a floor anchor 30. In the current embodiment, the wall panel is a 9' tall, 3/8" thick AR 500 steel plate, the floor mount is a 3"×3"×0.25" mild

steel angle, the carriage bolt is ½-13 UNC Grade 8, and the floor anchor is ½-13 UNC wedge type for concrete. “AR 500” refers to abrasion resistant steel with a hardness of 500 on the Brinell hardness scale.

[0017] The interior surface 32 of the wall panel 16 has a bottom support 34 attached thereto such that one leg 36 of the bottom support extends perpendicularly outward from the interior surface of the wall panel and the other leg 38 extends upward parallel to the interior surface of the wall panel. The legs of the bottom support define a channel 40 between them and the exterior surface of the wall panel. In the current embodiment, the bottom support is a 2"33 3"×1.25" mild steel angle and is positioned 3 feet above the bottom 20 of the wall panel. However, the bottom support can be positioned at any suitable location on the interior surface of the wall panel.

[0018] The interior surface 32 of the wall panel 16 has a top support 46 attached thereto above the bottom support 34 such that one leg 48 of the top support extends perpendicularly outward from the interior surface of the wall panel and the other leg 50 extends downward parallel to the interior surface of the wall panel. The legs of the top support define a channel 52 between them and the exterior surface of the wall panel. In the current embodiment, the top support is a 3"×3"×1.25" mild steel angle, and the top support is positioned 4 feet above the bottom support. However, the top support can be positioned at any suitable location on the interior surface of the wall panel above the bottom support. The positions of the top and bottom supports are determined such that the majority of bullet strikes on the exterior wall section 14 will occur between the top and bottom supports, which in the current embodiment is a 4 foot zone covering the typical torso and head height of a human target. The exterior surface 90 of the wall panel is featureless because the exterior surface will not experience bullet strikes.

[0019] A sacrificial liner plate 54 has a top 56 that is inserted into the channel 52 of the top support 46 and a bottom 58 that is inserted into the channel 40 of the bottom support 34. The liner plate is installed at an obtuse angle relative to the shooter so that bullets striking the liner plate are deflected in a single direction, downward and away from the shooter to extend the service life of the liner plate and provide additional safety to the trainee. The liner plate can be angled various degrees from vertical, depending upon the distance between the top and bottom supports and the size of the top support. However, the optimum angle of 3°, is the maximum angle achievable with a 3"×3"×1.25" top support, is preferable to minimize the thickness of the exterior wall section 14 to keep the wall section as thin and realistic relative to conventional non-fortified construction as possible. The channel 52 of the top support is deeper than the channel 40 of the bottom support to ensure the liner plate cannot fall into the interior of the shoot house 10 even if the liner plate were to somehow become vertical. The liner plate protects the portion of the wall panel 16 that would otherwise receive the majority of the bullet strikes. When the liner plate is worn out, the liner plate can be easily removed and replaced without having to detach the wall panel 16 from the floor 60, which greatly decreases the cost associated with replacement. The liner plate considerably extends the life of the wall panel because the liner plate prevents a bullet from penetrating the liner plate and striking the wall panel. In the current embodiment, the liner plate is a ⅜" thick AR 500 steel plate.

[0020] The interior surface 32 of the wall panel 16 has a curtain rail 62 attached thereto such that one leg 64 of the

curtain rail extends perpendicularly outward from the interior surface of the wall panel and the other leg 66 extends upward parallel to the interior surface of the wall panel. The legs of the bottom support define a channel 68 between them and the exterior surface of the wall panel. A curtain hanger 70 has a wheel 72 at one end is that rides on the top edge of the leg 66. A ballistic curtain 76 is attached to the other end 74 of the curtain hanger. The curtain hanger is held outward from the interior surface of the wall panel by the legs 38 and 50 of the bottom support 34 and top support 46, respectively. The bottom 78 of the ballistic curtain is retained by an optional curtain curb 80 attached to the top surface 22 of the floor 60. The sides 82, 84 of the ballistic curtain are notched (86, 88) such that adjacent ballistic curtains overlap to prevent a gap that could permit a deflected bullet or bullet fragments from escaping into the interior of the shoot house 10 through a seam. In the current embodiment, the curtain rail is a 4"×4"×0.25" mild steel angle, the ballistic curtain is a 4'×8' panel of 2 inch thick ballistic rubber, and the curtain curb is made of 2"33 2" ballistic rubber. The ballistic rubber permits an intact bullet to initially penetrate, but slows the bullet prior to the bullet encountering the liner plate 54 or the wall panel 16. The ballistic rubber subsequently captures any ricochets or shrapnel that are created by a bullet strike on the liner plate or wall panel.

[0021] The purpose of the wheeled curtain hanger 70 is to facilitate ease of inspection and removal of both the ballistic curtain and the liner plate 54 during maintenance of the shoot house 10. The six maintenance steps are:

[0022] 1. Remove one of the ballistic curtains 76 and its associated curtain hanger 70 using a suitable lifting device. A preferred starting point is a ballistic curtain in a “high wear” area, such as a corner.

[0023] 2. Inspect the liner plate 54 that was behind the removed ballistic curtain 76. If the liner plate shows signs of wear, but is still usable, the liner plate can be: turned over so bullets strike the other side, rotated to put a worn spot in a different location, or replaced with a new, or “less used” panel.

[0024] 3. While the liner plate 54 is removed for inspection, confirm the primary wall has not been damaged and collect any bullet fragments for disposal.

[0025] 4. Inspect an adjacent ballistic curtain 76 located on either side of the removed ballistic curtain.

[0026] If the ballistic curtain shows signs of wear, but is still usable, the curtain hanger 70 can be removed from the top of the ballistic curtain and attached to the bottom of the ballistic curtain, which reverses the ballistic curtain upon reinstallation. If the wear is such that the ballistic curtain is no longer suitable for use in the “high wear” location it was removed from, the ballistic curtain can alternatively be installed in a “low wear” location or replaced with a new ballistic curtain.

[0027] 5. Roll the newly inspected ballistic curtain 76 into the open space over the liner plate 54 that was just inspected. This action permits inspection access to the adjacent liner plate. This step is repeated until all of the ballistic curtains and liner plates on a given section of wall have been adequately inspected and appropriate maintenance action has been taken.

[0028] 6. Replace the ballistic curtain 76 that was initially removed into the now open space located at the opposite end of the wall from the starting point.

[0029] FIGS. 4 and 5 illustrate the improved interior wall section ballistic wall structure 12 of the present invention. More particularly, the interior wall section is shown installed

on a floor 60. The interior wall section is identical to the exterior wall section 14 except that all of the features attached to the interior surface 32 of the wall panel 16 of the exterior wall section are mirrored on both surfaces 132, 190 of the wall panel 116 of the interior wall section. This duplication is necessary because both surfaces of the wall panel 116 will experience bullet strikes. Since all of the features attached to both surfaces of the wall panel 116 are identical to those attached to the interior surface 32 of the wall panel 16, no further description is needed.

[0030] While current embodiments of a ballistic wall structure has been described in detail, it should be apparent that modifications and variations thereto are possible, all of which fall within the true spirit and scope of the invention. With respect to the above description then, it is to be realized that the optimum dimensional relationships for the parts of the invention, to include variations in size, materials, shape, form, function and manner of operation, assembly and use, are deemed readily apparent and obvious to one skilled in the art, and all equivalent relationships to those illustrated in the drawings and described in the specification are intended to be encompassed by the present invention.

[0031] Therefore, the foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

1. A ballistic wall structure for a shoot house in which live ammunition training exercises are conducted, the structure comprising;

- a primary wall panel formed of a ballistic-resistant material;
- the primary wall panel having a bottom edge adjacent to a floor surface, and extending to an upper edge above head level;
- a removable secondary wall panel formed of ballistic-resistant material and removably supported adjacent to the primary wall panel;
- the secondary wall panel having a lower edge at a first level above the bottom edge of the primary wall panel; and
- the secondary wall panel having an upper edge at a second level below the upper edge of the primary wall panel, such that the secondary wall panel bears the effects of bullet strikes at an intermediate level, and may be replaced as wear becomes excessive without replacing the primary wall panel.

2. The structure of claim 1 further comprising a curtain layer adjacent to the primary and secondary wall panels, the curtain layer being formed of a flexible material that is penetrable by bullets, and impenetrable by bullet fragments resulting from strikes with the wall panels.

3. The structure of claim 1 wherein the primary wall panel includes a support element, and the secondary wall panel rests on the support element.

4. The structure of claim 3 wherein the support element is an upwardly opening channel.

5. The structure of claim 1 wherein the primary wall panel is at least 8 feet tall, and wherein the secondary wall panel is 4 feet high.

6. The structure of claim 1 wherein the bottom of the secondary wall panel is at least about 2 feet above floor level.

7. The structure of claim 1 wherein the top of the secondary wall panel is at least about 6 feet above floor level.

8. The structure of claim 1 wherein an intermediate portion of the wall panel is 5 feet above floor level.

9. The structure of claim 1 wherein the wall structure is articulated to form a plurality of walls that in part define a room.

10. The structure of claim 1 wherein the primary wall panel is vertical, and the secondary wall panel is angularly offset from vertical.

11. The structure of claim 1 wherein the bottom of the secondary wall panel is about 3 feet above floor level, and the top edge of the secondary wall panel is about 7 feet above floor level.

12. A ballistic wall structure comprising:

- a wall having a bottom and an exterior surface;
- a sacrificial liner removably attached to the exterior surface of the wall;
- wherein the liner covers a selected portion of the exterior surface of the wall; and
- wherein the liner prevents a bullet from penetrating the liner and striking the exterior surface of the wall.

13. The structure of claim 12 wherein the liner is attached to the exterior surface of the wall such that the liner is not parallel to the exterior surface of the wall.

14. The structure of claim 12 wherein the liner is a steel plate.

15. The structure of claim 12 wherein the wall is a steel plate.

16. The structure of claim 12 further comprising a plurality of angles attached to the exterior surface of the wall, each of the angles defining a channel that removably receives one end of the liner.

17. The structure of claim 12 further comprising a curtain removably covering the exterior surface of the wall and the liner, wherein the curtain permits an intact bullet to penetrate completely through, but captures any ricochets or shrapnel created by a bullet strike on the exterior surface of the wall or the liner.

18. The structure of claim 13 wherein the exterior surface of the wall is vertical and the liner is offset from vertical by at least 3°.

19. The structure of claim 13 wherein the liner is angled relative to the exterior surface of the wall such that a bullet striking the liner is deflected downward.

20. The structure of claim 12 wherein the selected portion of the exterior surface of the wall covered by the liner is located between 3 feet and 7 feet above the bottom of the wall.

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