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(54) **UNDERGROUND DISASTER SHELTER**

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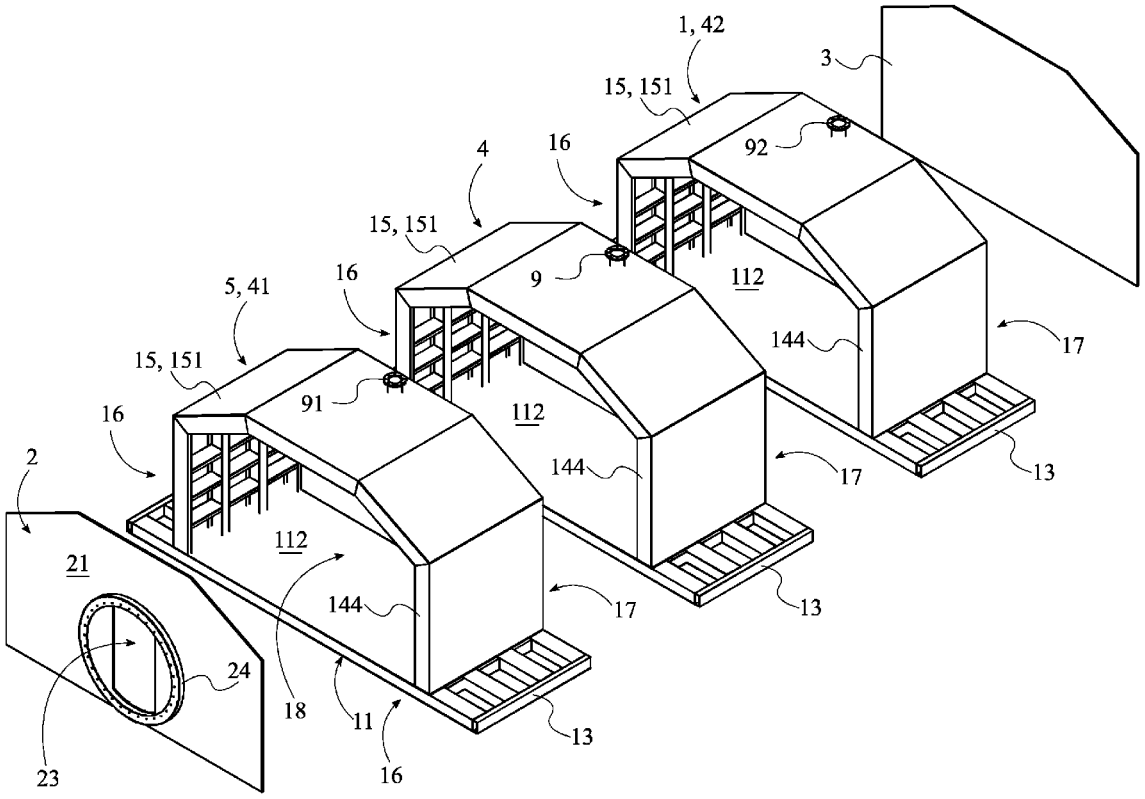
(57) **ABSTRACT**

An underground disaster shelter uses multiple shelter sections, an entranceway panel and a rear panel to create a structure that is protects against hazards in the external world. The underground disaster shelter is formed by serially connecting the shelter sections, connecting the entranceway panel adjacent to the head section of the series, and connecting the rear panel to the tail section of the series. Each of the shelter sections is equipped with a base, a gravity flange, a frame, and an exterior shell. The gravity flange is mounted around the base to retain the underground shelter at a desired depth. The frame is mounted onto the base and the exterior shell is mounted onto the frame. Accordingly, the frame, the base, and the exterior shell create a shelter section. The size of an interior compartment of the underground shelter is delineated by the number



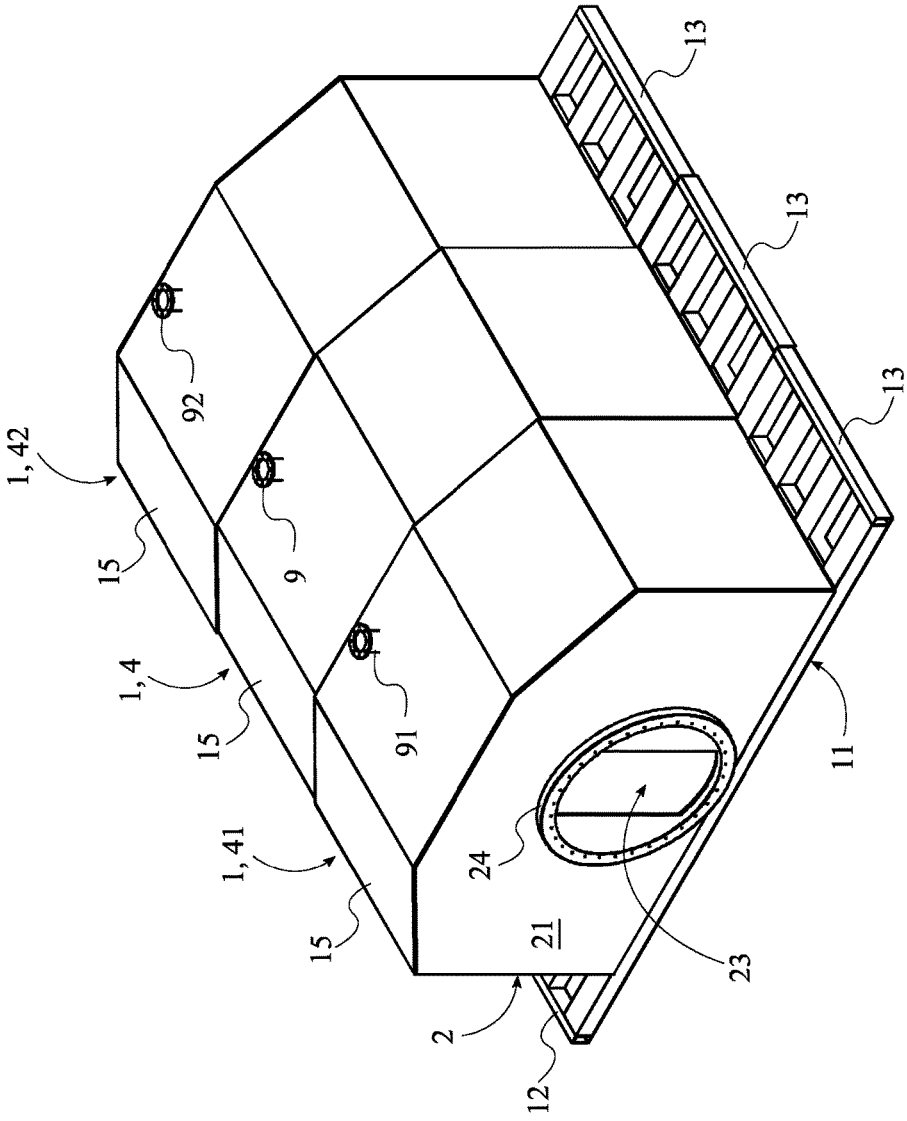


FIG. 1

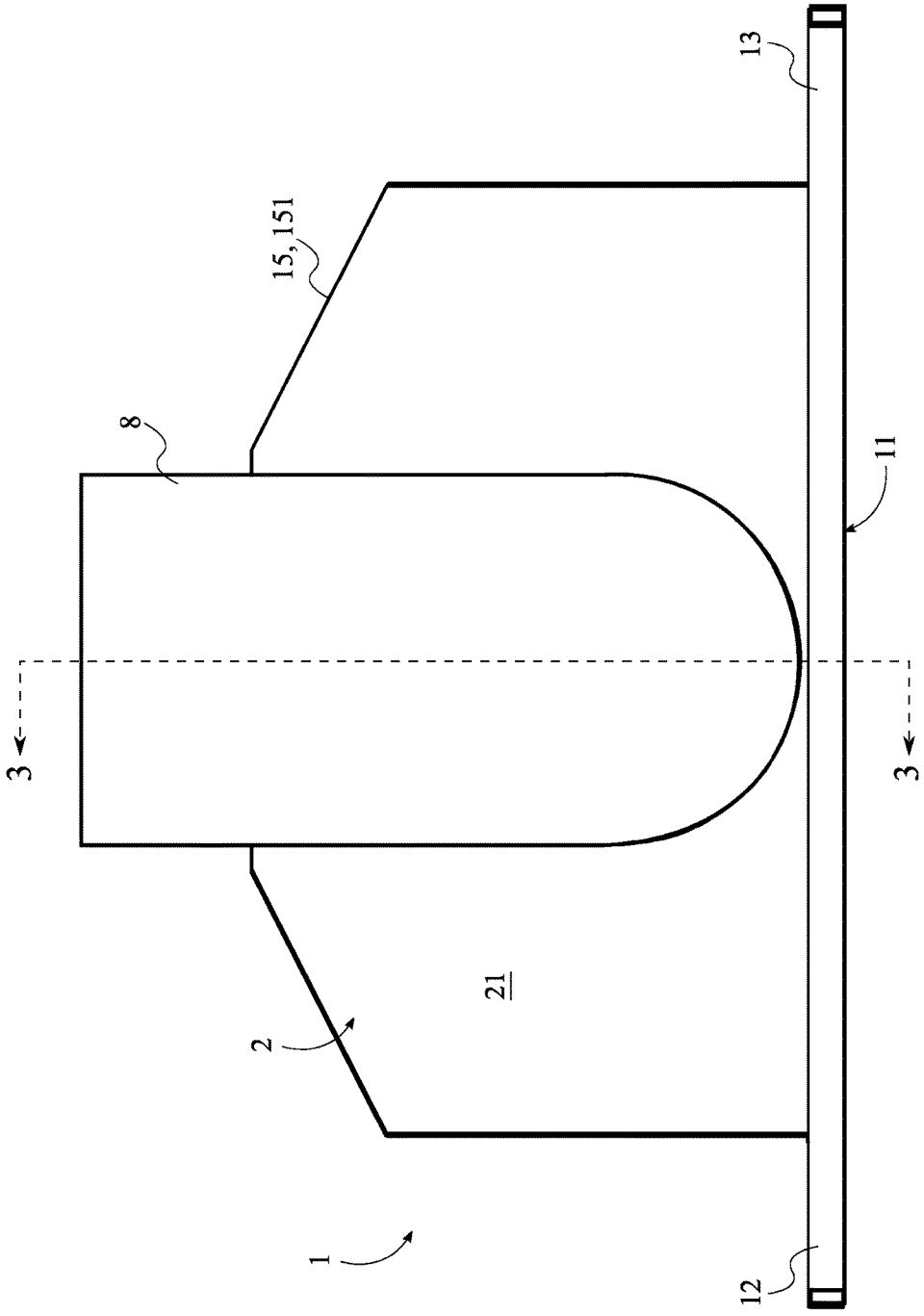


FIG. 2

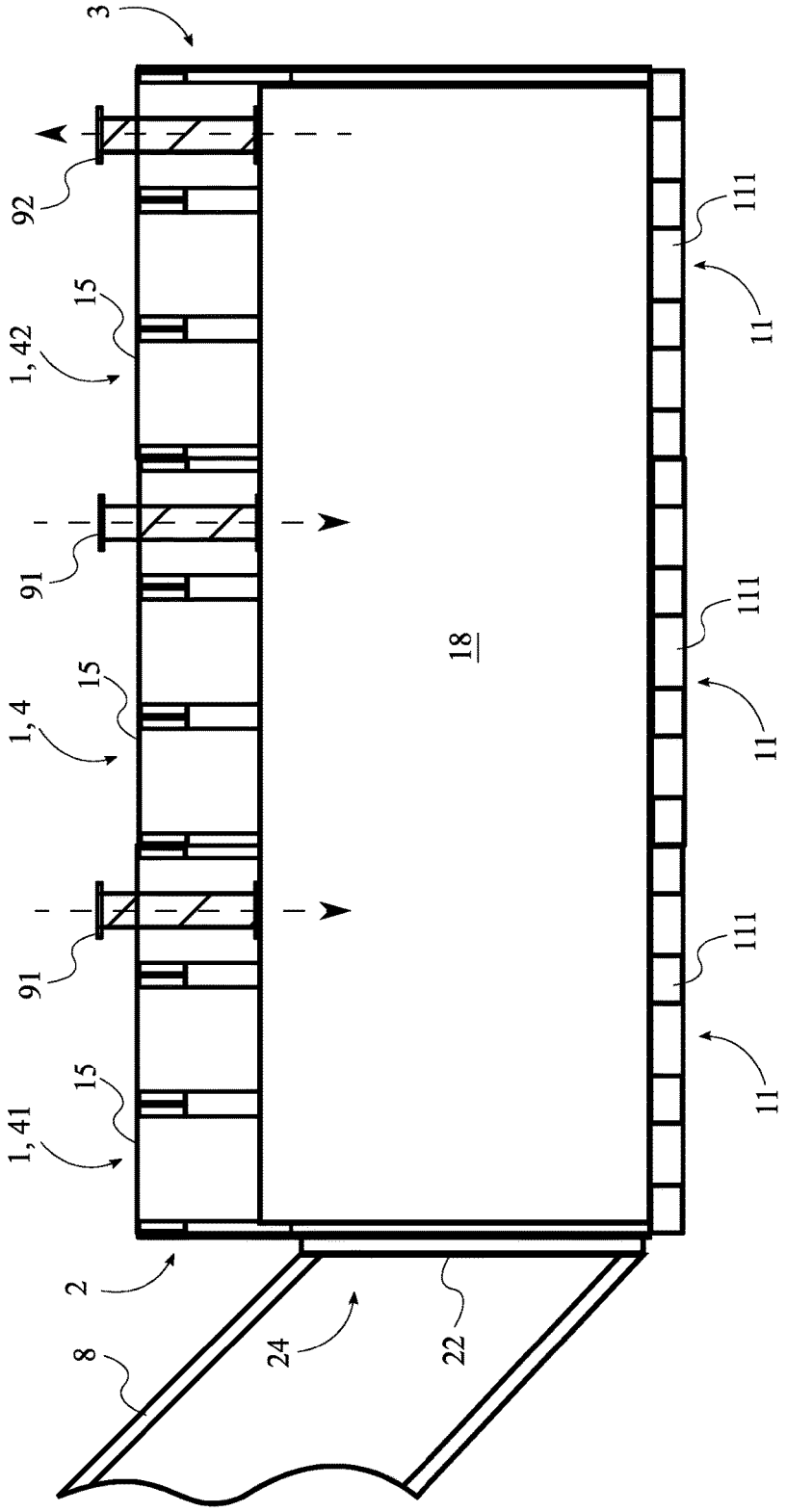


FIG. 3

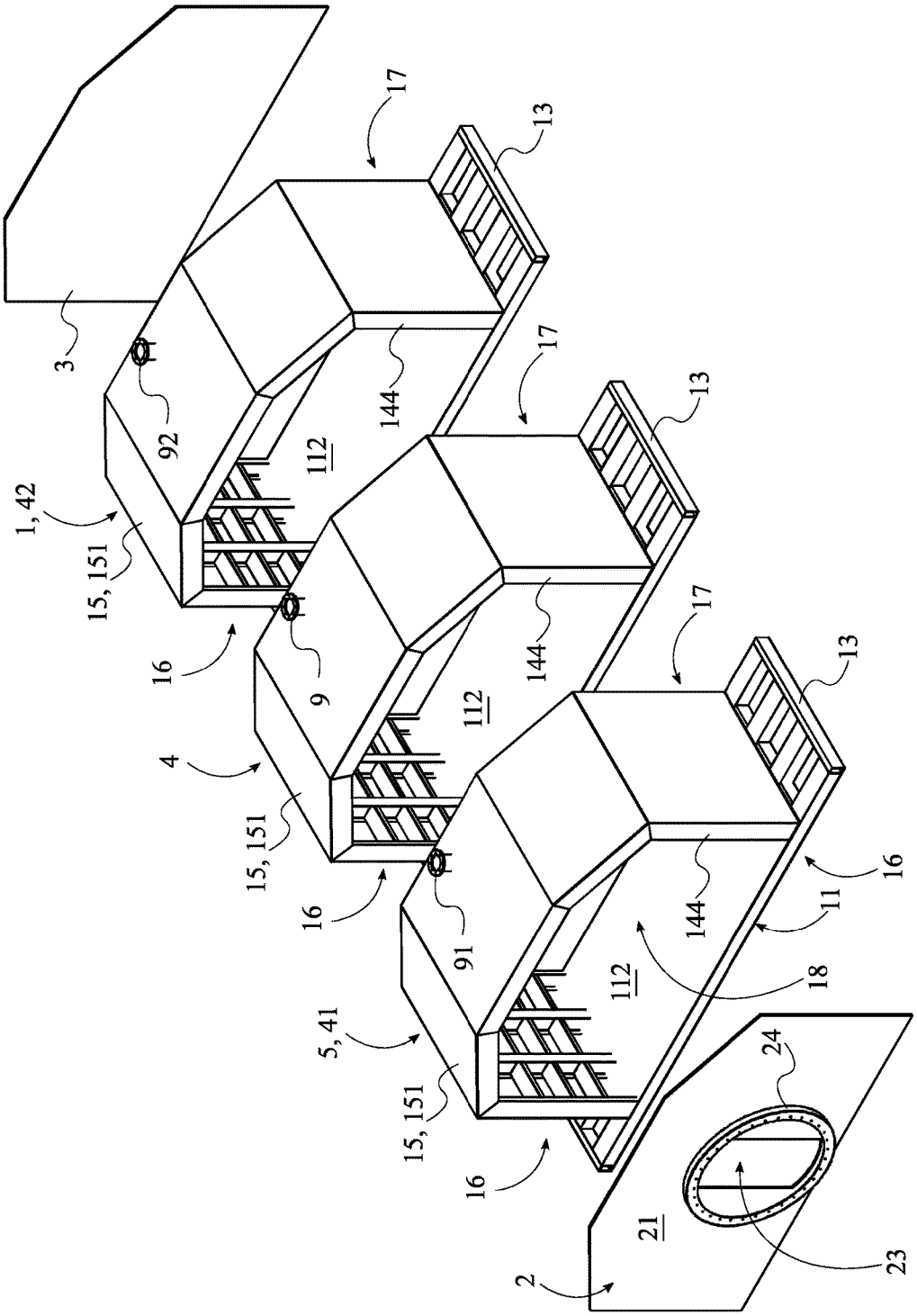

17
13
3
144
17
13
92
112
1, 42
15, 151
16
9
144
17
13
4
112
15, 151
16
91
144
11
16
112
18
5, 41
15, 151
16
24
21
2
23

FIG. 4

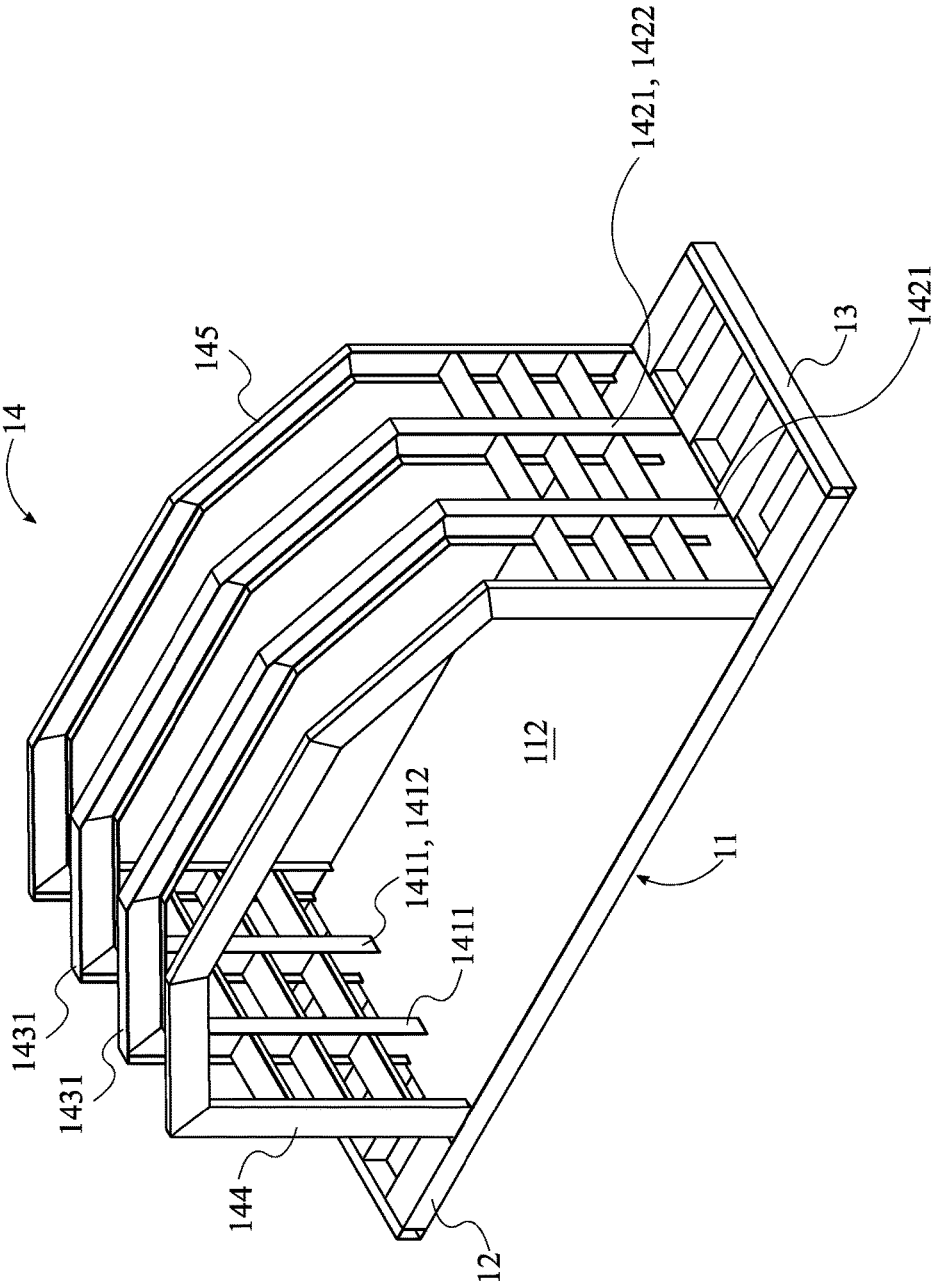


FIG. 5

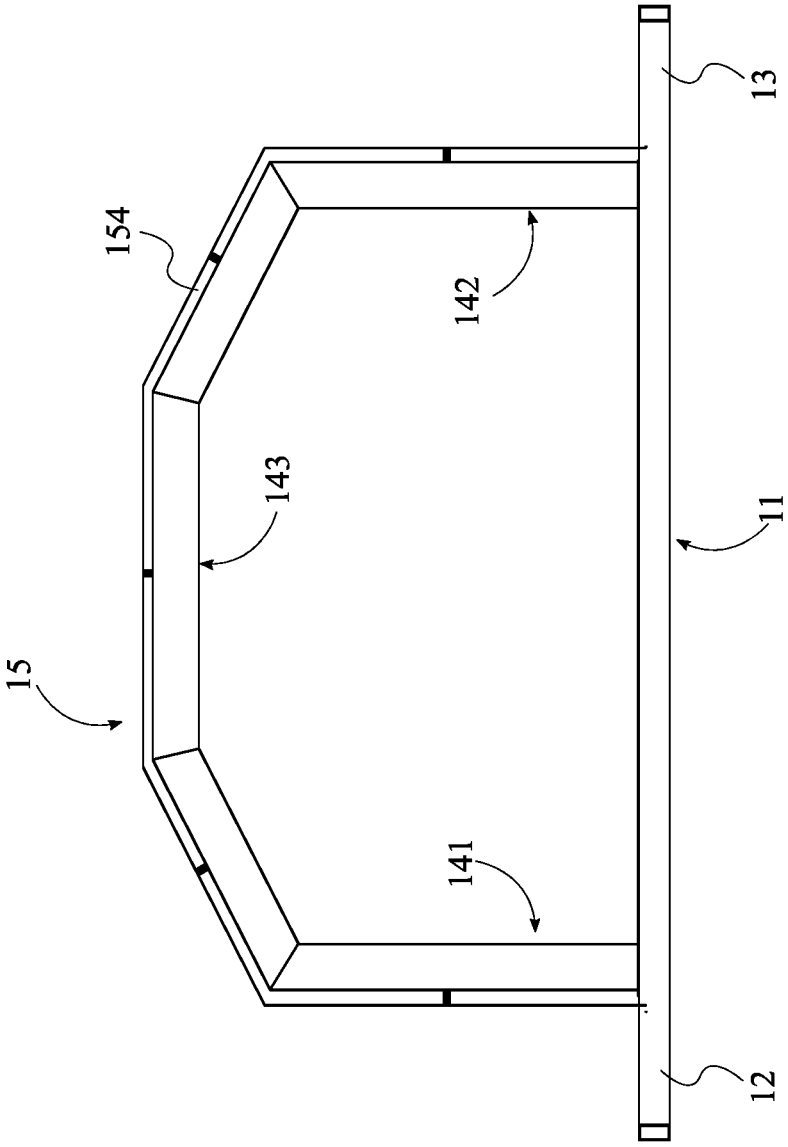


FIG. 6

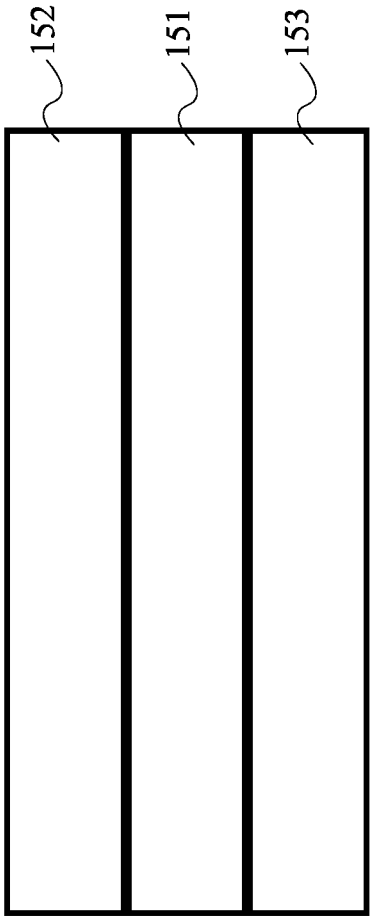


FIG. 7

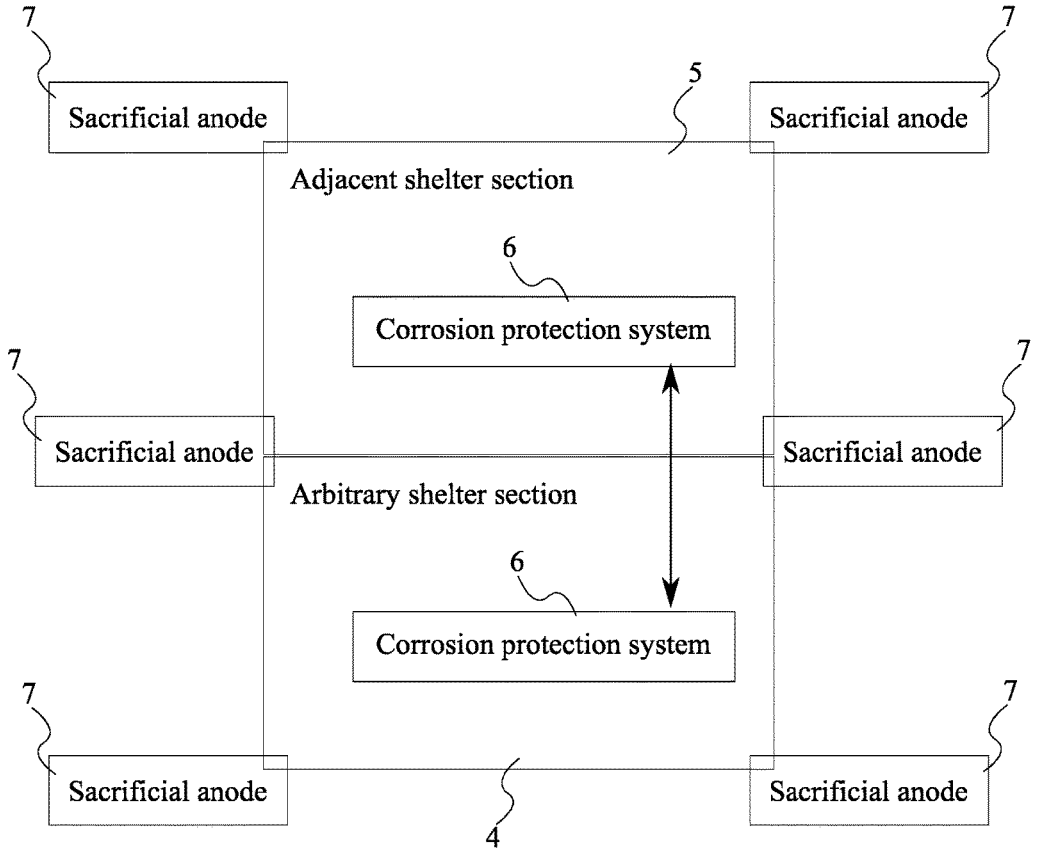

7
Sacrificial anode
5
7
Sacrificial anode
Adjacent shelter section
6
Corrosion protection system
7
Sacrificial anode
7
Sacrificial anode
Arbitrary shelter section
6
Corrosion protection system
7
Sacrificial anode
7
Sacrificial anode
4

FIG. 8

UNDERGROUND DISASTER SHELTER

[0001] The current application claims a priority to the U.S. Provisional Patent application Ser. No. 62/460,237 filed on Feb. 17, 2017. The current application is filed on Feb. 20, 2018 while Feb. 17, 2018 was on a weekend, and Feb. 19, 2018 was on a national holiday (Presidents day).

FIELD OF THE INVENTION

[0002] The present invention relates generally to a pre-fabricated shelter. More particularly, the present invention relates to a disaster shelter that is constructed from a single or series of prefabricated sections.

BACKGROUND OF THE INVENTION

[0003] Most of the information presented to the public about nuclear-biological-chemical weapons has been non-scientific. It is largely based on the Hollywood version of weapons virtually devoid of scientific data. With the right underground shelter, it is possible to survive a full scale protracted nuclear-biological-chemical and EMP war.

[0004] It would make little sense to survive any type of disaster if it were not worth surviving and all life on the planet is doomed. However, the National Academy of Science (NAS) has produced technical reports on the nuclear war and how it could affect the atmosphere which reports that the greatest impact from a full scale nuclear war is not the radiation, the blast, or the heat. The greatest impact is damage to the food producing industries and infrastructure allowing food to be delivered resulting in mass starvation.

[0005] The Civil Defense shelters of the 1960's were designed with faulty science and could only protect people using these shelters if the shelter was at least 100 miles away from ground zero. The first data needed to design an underground shelter capable of properly protecting residents of shelters was to determine the "Design Radiation Dose". This is the dose of radiation that the shelter is designed to operate in and protect the residents. There is a "Design Radiation Dose" for overhead shielding in the shelter based on a nuclear surface burst creating heavy fallout. There is also "Design Radiation Dose" for entranceway shielding based on an air burst which creates no fallout but allows massive rems of radiation to enter the shelter through the entranceway.

[0006] Conventional construction methods should not be used for underground shelters. Concrete is typically used to build underground shelters on site but often develop hairline cracks that allow moisture to enter the shelter which then allows mold to grow on the open pore concrete surface. A concrete floor will also allow radon and methane gas to enter the shelter since concrete is not a barrier for gases commonly found in the ground. Also, concrete structures are considered a permanent structure and require a building permit.

[0007] In order to solve a number of problems with shelters built on site and concrete shelters, the present inventor has developed a pre-fabricated shelter composed of various sections in various spans. One of the first underground shelters the inventor has developed is disclosed in his U.S. Pat. No. 4,660,334 issued on Apr. 28, 1987. In this patent, the inventor of the current invention describes a shelter capable of protecting residents of shelters during and after one or more nuclear blasts. Such a shelter is capable of protecting residents from large doses of neutron and gamma radiation, ground shock, and high overpressures for short term and long-term periods.

[0008] The inventors of U.S. Pat. No. 5,115,613 issued on May 26, 1992, describe an improved shelter that provides even more protection for the residents of shelters, improvements in the entranceway, and more efficient shaped shelter to manufacturer.

[0009] The inventors of U.S. Pat. No. 6,438,907 issued Aug. 27, 2002, describe the shelter as improved further to include an emergency escape manway and entranceway joined to the shelter via a seismic joint that allows the entranceway to move relative to the shelter hull in all directions, except translation.

[0010] Each of these patented shelters are effective at resisting blast effects from a nuclear detonation or other explosive devices and allowing the residents to survive such weapons effects as blast, heat, and radiation. Further, the inventor has continually sought to improve these products and each shelter has demonstrated significant improvement over the former design.

[0011] The current invention has significant and unobvious improvements over all of the previous designs. The current hexagonal design allows the shelter to be shipped in sections, not requiring trucking permits, and can be assembled in the excavated hole in many configurations and sizes. It does not require concrete, provides blast protection, and can be supplied with an internal EMP shielded generator complying with MIL-188-125 shielding requirements. The hull design includes a gravity flange to resist buoyancy which keeps the shelter in the ground during high water tables and the gravity flange also forms the base of the shelter.

[0012] The HEX shape, a name taken from a hex head bolt where the top of the shelter is formed by three sides or half of a hex head bolt. This ceiling shape forms a high ceiling and a very strong structure to resist heavy earth and overpressure loads.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] FIG. **1** is a perspective view of the present invention.

[0014] FIG. **2** is a front view of the present invention.

[0015] FIG. **3** is a right-side sectional view of the present invention taken along line **3**-**3** in FIG. **2**.

[0016] FIG. **4** is an exploded perspective view of the present invention.

[0017] FIG. **5** is a perspective view of the frame mounted onto the base used in the present invention. In this figure, the exterior shell is removed.

[0018] FIG. **6** is a front view of the frame, the exterior shell, and the base used in the present invention.

[0019] FIG. **7** is a block diagram illustrating the positions of the shelter-enhancing exterior coating and the flame-retardant interior coating relative to the shell body used in the present invention.

[0020] FIG. **8** is a block diagram illustrating the cathodic protection system used in the present invention.

DETAIL DESCRIPTIONS OF THE INVENTION

[0021] All illustrations of the drawings are for the purpose of describing selected versions of the present invention and are not intended to limit the scope of the present invention.

[0022] Referring to FIG. **1** through FIG. **8**, the preferred embodiment of the present invention, the underground disaster shelter, is a shelter that is designed to protect and shield a user from hazards within the environment. The present invention is a sectional shelter with a length that can be increased or reduced by adding or removing sections. This enables the user to construct a shelter from one or more shelter sections and have the shelter tailored to the user's needs. The shelter provided by the present invention is preferably made using materials that prevent the transmission of ambient electromagnetic pulse (EMP) energy. As a result, the present invention provides protection for electrical equipment when an EMP weapon is detonated provided that other points of entry (POE) such as the air ducts and entranceway are also EMP shielded. Further, the present invention is designed to function as a general-purpose disaster shelter, and is shielded against environmental threats that include, but are not limited to, radiation, flooding, nuclear weapons, biological weapons, and chemical weapons. Moreover, the present invention employs a hexagonal-shaped framework that is capable of supporting large amounts of externally applied force from heavy earth, vehicle traffic, and nuclear weapon overpressure.

[0023] Referring to FIG. **1** and FIG. **3** through FIG. **5**, to achieve the above-described functionality, the present invention comprises at least one section or a plurality of shelter sections **1**, an entranceway panel **2**, and a rear panel **3**. Each of the plurality of shelter sections **1** forms a section of the overall disaster shelter that is provided by the present invention. Further, each of the plurality of shelter sections **1** comprises a base **11**, a first gravity flange **12**, a second gravity flange **13**, a frame **14**, an exterior shell **15**, a first connection end **16**, and a second connection end **17**. The first gravity flange **12** and the second gravity flange **13** are rigid protrusions that extend from the base **11**. Specifically, the base **11** is connected in between the first gravity flange **12** and the second gravity flange **13**. As a result, the first gravity flange **12** and the second gravity flange **13** generate counter hydrostatic pressure from submerged earth a (70 lbs./ft^3) over these gravity flanges against the hydrostatic pressure, based on generating uplifting force of 62.4 lbs./ft^3 of water displaced by the shelter hull, caused by high water tables, in the ground in which the present invention is interred. That is, because the first gravity flange **12** and the second gravity flange **13** extend from the sides of the base **11**, the present invention is able to use the weight of the earth that is positioned above each of the plurality of shelter sections **1** to resist buoyancy to reach the desired minimum counter hydrostatic pressure safety level of 1.2× hydrostatic pressure. Thus, keeping the present invention interred if the water table reaches the ground surface.

[0024] Referring to FIG. **4** and FIG. **5**, the plurality of shelter sections **1** is designed to be serially connected to form a continuous structure. This enables the frame **14**, the base **11** and the exterior shell **15** of each of the plurality of shelter sections **1** to be connected to form a single elongated shelter. The frame **14** is adjacently mounted onto the base **11**. Consequently, the frame **14** supports the exterior shell **15** and defines the overall shape of each shelter section. Additionally, the exterior shell **15** being adjacently mounted onto the frame **14**, opposite to an interior compartment **18** of the plurality of shelter sections **1**. Thus positioned, the exterior shell **15** forms a protective enclosure that delineates a width of the interior compartment **18**. A length of the interior compartment **18** is delineated by the plurality of serially connected shelter sections **1**. To achieve this, the first connection end **16** of an arbitrary section **4** is adjacently connected to the second connection end **17** of an adjacent section **5**, wherein the arbitrary section **4** and the adjacent section **5** are each from the plurality of shelter sections **1**. As a result, the length of a tail end of the shelter can be increased by connecting the first connection end **16** of a single shelter section **1** to the second connection end **17** of another shelter section **1**. Alternatively, the length of a head end of the shelter can be increased by connecting the second connection end **17** of a single shelter section **1** to the first connection end **16** of another shelter section. Specifically, the plurality of shelter sections **1** is serially connected to each other. Accordingly, adding or removing shelter sections **1** increases or decreases the size of the interior compartment **18**.

[0025] Referring to FIG. **1**, FIG. **3**, and FIG. **4**, in the present invention, the entranceway panel **2** and the rear panel **3** are rigid panels that function as the endcaps for the plurality of shelter sections **1**. The entranceway panel **2** comprises a panel body **21** and a door **22**. This enables the entranceway panel **2** to function as the front door for the plurality of shelter sections **1**. Additionally, the door **22** is adjacently mounted onto the panel body **21** so that the user is able to enter or exit the interior compartment **18** by passing through the door **22**. The entranceway panel **2** is adjacently mounted onto the first connection end **16** of a head section **41**, wherein the head section **41** is from the plurality of shelter sections **1**. Conversely, the rear panel **3** is adjacently mounted onto the second connection end **17** of a tail section **42**, wherein the tail section **42** is from the plurality of shelter sections **1**. Thus positioned, the entranceway panel **2** and the rear panel **3** delineate the first and second ends of the interior compartment **18**. That is, the entranceway panel **2** is mounted onto the first connection end **16** of the first shelter sections **1** from the plurality of serially connected shelter sections **1**. Similarly, the rear panel **3** is mounted onto the second connection end **17** of the last shelter section from the plurality of serially connected shelter sections **1**. Specifically, the interior compartment **18** is delineated by the plurality of shelter sections **1**, the entranceway panel **2**, and the rear panel **3**. Accordingly, the interior compartment **18** is isolated from hazardous conditions in the external environment.

[0026] Referring to FIG. **3**, FIG. **4** and FIG. **5**, the base **11** of the present invention is used to support the frame **14** as well as to prevent hazards from traversing into the interior compartment **18** from beneath the shelter sections **1**. To achieve this, the base **11** comprises a foundation-beam platform **111** and a cover plate **112**. The foundation-beam platform **111** is a rigid planar frame that is composed of interconnected beams. The frame **14** is mounted onto the foundation-beam platform **111** so that the frame **14** is retained in a position that facilitates supporting the exterior shell **15**. The cover plate **112** is a sheet of material. Additionally, the cover plate **112** is adjacently connected to the foundation-beam platform **111**. Further the cover plate **112** is positioned between the frame **14** and the foundation-beam platform **111**. As a result, the cover plate **112** provides a level surface that forms the floor of the interior compartment **18**. The first gravity flange **12** is laterally connected to the foundation-beam platform **111**. Similarly, the second gravity flange **13** is laterally connected to the foundation-beam

platform **111**, opposite to the first gravity flange **12**. Consequently, the first gravity flange **12** and the second gravity flange **13** project from the base **11** parallel to the first connection end **16** and the second connection end **17**. That is, the first gravity flange **12** and the second gravity flange **13** extend to the sides of the base **11** and do not hinder the plurality of shelter sections **1** from being serially connected. Further, the first gravity flange **12** forms a continuous gravity flange with the first gravity flange **12** of each of the serially connected shelter sections **1**. Likewise, the second gravity flange **13** forms a continuous gravity flange with the second gravity flange **13** of each of the serially connected shelter sections **1**. As a result, buoyance resistance is evenly distributed along the lengthwise edges of the present invention.

[0027] Referring to FIG. **4**, FIG. **5**, and FIG. **6**, the present invention is designed to use the frame **14** to create a five-sided enclosure. To achieve this, the frame **14** comprises a first side wall **141**, a second side wall **142**, and a ceiling arch **143**. The first side wall **141** is oriented parallel to the second side wall **142**. Additionally, the first side wall **141** is terminally connected to the base **11**. Further, the second side wall **142** is positioned opposite to the first side wall **141**, across and perpendicular to base **11**. Moreover, the second side wall **142** is terminally connected to the base **11**. As a result, the first side wall **141** and the second side wall **142**, when connected to wide flange beams or some other type of beam or ceiling arch **143**, form vertical support walls that are able to support the weight of the ceiling arch **143**, the exterior shell **15**, and the earth with which the present invention is buried. The ceiling arch **143** is a three-sided arch. Additionally, the ceiling arch **143** is terminally connected to the first side wall **141**, opposite to the base **11**. Further, the ceiling arch **143** is terminally connected to the second side wall **142**, opposite to the base **11**. Consequently, the ceiling arch **143** forms a support structure that bears the weight of a roof portion of the exterior shell **15**.

[0028] Referring to FIG. **3**, FIG. **4**, FIG. **5**, and FIG. **6**, the first side wall **141**, the second sidewall and the ceiling arch **143** are each constructed from a plurality of beams. Specifically, the first side wall **141** comprises a first plurality of wall-support beams **1411**, the second side wall **142** comprises a second plurality of wall-support beams **1421**, and the ceiling arch **143** comprises a plurality of arch-support assemblies **1431**. The plurality of arch-support assemblies **1431** is a collection of support beams that are arranged to form a three-sided arch. Further defining the arrangement of the plurality of beams, the first plurality of wall-support beams **1411** is positioned parallel and offset from each other across the base **11**. Consequently, the first plurality of wall-support beams **1411** forms the studs of the first side wall **141**. Similarly, the second plurality of wall-support beams **1421** is positioned parallel and offset from each other across the base **11**. Accordingly, the second plurality of wall-support beams **1421** forms the studs of the second side wall **142**. Finally, each of the first plurality of arch-support assemblies **1431** is connected in between a corresponding first wall-support beam **1422** and a corresponding second wall-support beam **1422**, wherein the first corresponding wall-support beam is from the first plurality of wall-support beams **1411**, and wherein the second corresponding wall-support beam is from the second plurality of wall-support beams **1421**. As a result, the plurality of arch-support assemblies **1431** forms the rafters of the ceiling arch **143**. Preferably a plurality of shelves is distributed across the first side wall **141** and the second side wall **142**. The preset invention further comprises a first channel beam endcap **144** and a second channel beam endcap **145**. The first channel beam endcap **144** is coextensively connected to the first connection end **16**. Similarly, second channel beam endcap **145** is coextensively connected to the second connection end **17**. Accordingly, the first channel beam endcap **144** and the second channel beam endcap **145** allow the two flat faces of the first connection end **16** and the second connection end **17** to mate together. Preferably, the sealing mount is integrated into this connection to prevent moisture, electromagnetic radiation, and unwanted substances from entering the interior compartment **18**. Further, the first channel beam endcap **144** and the second channel beam endcap **145** facilitate the formation of a robust connection between each of the plurality of shelter sections **1**.

[0029] Referring to FIG. **3** through FIG. **7**, the exterior shell **15** of the present invention is designed to resist corrosion as well as isolate the interior compartment **18** from hazards in the external environment. To achieve this, the exterior shell **15** comprises a shell body **151**, a shelter-enhancing exterior coating **152**, and a flame-retardant interior coating **153**. The shell body **151** is mounted adjacent to the frame **14**. Specifically, an interior surface of the shell body **151** is mounted adjacent the frame **14**. Consequently, the shell body **151** forms the exterior casing that separates the interior compartment **18** from the external environment. The shelter-enhancing exterior coating **152** is preferably an abrasion and corrosion resistant electrically insulating dielectric epoxy. The flame-retardant interior coating **153** is superimposed onto the interior surface of the shell body **151**. Additionally, the flame-retardant interior coating **153** is positioned in between the interior surface and the frame **14**. As a result, the structural integrity of the shelter sections **1** is protected in the event of a fire. In an alternative embodiment, the flame-retardant interior coating **153** is superimposed onto the entirety of the interior compartment **18**. This arrangement further decreases the risk of fire-related structural damage. Each of the plurality of shelter sections **1** further comprises a sealing mount **154**. The sealing mount **154** is a fastener and gasket system that is used to connect the exterior shell **15** to the frame **14**. Additionally, the sealing mount **154** can be used to form a connection between the plurality of shelter sections **1**. Specifically, the sealing mount **154** is connected in between the frame **14** and the exterior shell **15**. Accordingly, the sealing mount **154** prevents moisture and air from leaking into the interior compartment **18**. Further, the sealing mount **154** functions as an EMP-shielding gasket that shields any EMP energy from penetrating connection formed between two shelter segments.

[0030] Referring to FIG. **4** and FIG. **8** the present invention is designed with various damage-deterrence systems that protect the structural integrity of the shelter sections **1**. The abrasion resistant exterior coating is one such system. The shelter sections **1** further comprise a second damage-deterrence system, namely a corrosion protection system **6** that makes use of sacrificial anodes. Alternatively, the corrosion protection is any suitable system for limiting corrosion of the shelter sections **1**. Such systems include, but are not limited to, coating the shelter sections **1** with oil, grease, tar, asphalt, polymer coatings or paints and weathering steel, plating systems and impressed current systems. Stainless underground structures corrode more than carbon steel

because underground is a "anaerobic environment" negating the usual enhanced corrosion properties of stainless steel. The corrosion protection system **6** is a galvanic corrosion protection system **6** with a corrosion meter located inside **18**. The corrosion protection system **6** is composed of multiple anodes mounted on the ground around to the first gravity flange **12** and the second gravity flange **13** outside of the exterior shell **15**. Accordingly, the corrosion protection system **6** is isolated from any environmental hazards that exist outside of the shelter sections **1**. Additionally, the corrosion protection system **6** from each of the plurality of shelter sections **1** is electrically connected to each other. As a result, the shelter sections **1** are able to work in concert to prevent corrosion of the exterior shell **15**, the entranceway panel **2**, the rear panel **3**, the first gravity flange **12**, the second gravity flange **13**, and the base **11**. The plurality of sacrificial anodes **7** is distributed around the base **11**. Additionally, the plurality of sacrificial anodes **7** is mounted offset from the exterior shell **15**. Further, the plurality of sacrificial anodes **7** is electrically connected to the exterior shell **15**. Thus positioned, the sacrificial anodes **7** corrode instead of the exterior surface of the present invention.

[0031] Referring to FIG. **2**, FIG. **3**, and FIG. **4**, the entranceway panel **2** acts as the point of entry into the interior compartment **18**. As such, the entranceway panel **2** further comprises an entranceway hole **23** and an entranceway-connection mount **24**. The entranceway-connection mount **24** is a seismic joint that is designed to absorb the movements of multiple components which are mated together. The entranceway hole **23** normally traverses through the panel body **21** so that the user is able to pass through the entranceway hole **23** when entering or exiting the interior compartment **18**. The entranceway-connection mount **24** is perimetrically connected around the entranceway hole **23**. Accordingly, the entranceway-connection mount **24** is able to mount multiple components onto the entranceway panel **2**. As such, the entranceway-connection mount **24** is connected in between the door **22** and the panel body **21**. Thus connected, the entranceway-connection mount **24** enables the position of the door **22** to shift, relative to the entranceway panel **2**, without becoming disconnected from the entranceway panel **2**. Referring to FIG. **2** and FIG. **3**, to facilitate entering and exiting the interior compartment **18** while the shelter sections **1** are interred, the present invention makes use of a tunnel system that extends from the entranceway hole **23** to the surface of the earth. Specifically, the present invention further comprises an entranceway tube **8**. The entranceway-connection mount **24** is terminally connected to the entranceway tube **8**. Accordingly, the user can exit the interior compartment **18** by passing through the door **22** and traversing the entranceway tube **8**.

[0032] Referring to FIG. **3** and FIG. **4**, because the present invention is designed to provide an isolated living space, it is necessary to integrate an air supply system. To accomplish this, the present invention further comprises at least one air intake duct **91**, at least one air outlet duct **92**. The air intake duct **91** and the air outlet duct **92** are used to supply air to and vent air out of the interior compartment **18**. Specifically, the air intake duct **91** and the air outlet duct **92** are integrated into the exterior shell **15** of the arbitrary section **4**. Further, the air intake duct **91**, and the air outlet duct **92** are in fluid communication with the interior compartment **18**. Accordingly, air and other desirable gasses care able to enter and exit the interior compartment **18** by flowing into the air intake duct **91**, then enter an NBC air filtration system, and then out of the air outlet duct **92**. The air intake duct **91** and the air outlet duct **92** are preferably fitted with EMP-shielding gaskets and EMP shielded wave guides which prevent EMP energy from traveling into the interior compartment **18**. Preferably, an air manifold assembly connects the outside air at ground level to air intake duct **91** of the shelter.

[0033] Although the invention has been explained in relation to its preferred embodiment, it is to be understood that many other possible modifications and variations can be made without departing from the spirit and scope of the invention as hereinafter claimed.

SUPPLEMENTAL DESCRIPTIONS OF THE INVENTION

[0034] The present invention has significant and unobvious improvements over all of the previous designs. The current hexagonal design allows the shelter to be shipped in sections, not requiring trucking permits, and can be assembled in the excavated hole in many configurations and sizes. It does not require concrete, provides blast protection, and can be supplied with an internal EMP shielded generator complying with MIL-188-125 shielding requirements. The hull design includes a gravity flange to resist buoyancy which keeps the shelter in the ground during high water tables and the gravity flange also forms the base of the shelter.

[0035] The HEX shape, a name taken from a hex head bolt where the top of the shelter is formed by three sides or half of a hex head bolt. This ceiling shape forms a high ceiling and a very strong structure to resist heavy earth and overpressure loads.

[0036] The shelter is composed of at least two end wall sections and numerous straight wall sections. Each section is usually 8 ft. in width making it legal to travel on roads without an over width permit. Each section can be lifted by crane with lifting ears by connecting straps around which cannot slip off. The end wall section has a seismic joint annular ring on end wall to accept an entranceway for entry and egress. The straight wall section is open on both ends. A dense rubber gasket is used between all the sections on channel beams to form a watertight seal when sections are bolted together, putting face pressure on the gasket bonded to the face of channel beam. If the shelter hull is to be used as an EMP shielded hull, the dense rubber gasket must be replaced with a copper mesh gasket shielding, 100 MHz at 120 dB, 200 KHz at 70 dB, and 1 GHz at 10 dB.

Base and Gravity Flange

[0037] One of the key features in the design is that the structure has a steel foundation and uses no concrete. A steel foundation is not subject to cracks like concrete and is much more resilient to ground shock. The steel foundation is composed of four rectangular tubes forming a base with a steel plate over for tubes to form a watertight floor which also forms a complete barrier against radon gas, methane gas, and any other gases found in soil. Not having a concrete foundation makes the shelter "redeployable" so it can be excavated, moved, and reinstalled in another location. The base foundation extends beyond the hull forming a gravity ledge where soil on top of the shelter gravity flange keeps the shelter in the ground during high water tables. Each

section is craned off a truck and into the hole onto a level bed of gravel in the bottom of the hole.

[0038] Each cubic foot of water displaced below the ground surface produces 62.4 lbs. of uplifting force or hydrostatic pressure also known as buoyancy. While earth above ground weighs well over 100+ lbs./ft^3, earth below ground with a water table reaching the ground surface is assumed to weigh only 70 lbs/ft^3. The submerged earth plus the weight of the steel shelter must be at least 1.2 times greater than the hydrostatic pressure to remain stable in the ground during high water tables.

Hull Structure

[0039] The shape of the ceiling forms a high and very strong structure to resist 2500 lbs./ft^2 or 17.4 psi with minimal deflections. The two center beams are wide flange beams such as a W12×40. The beams on the outside of each 8 ft. section is a standard steel channel, such as C12×30, to allow the sections to be bolted together with 1.25-inch diameter structural bolts. The hull walls are reinforced by shelving approximately 20 in O.C. from the floor up reinforcing the steel plate sheets welded to the outside of the wide flange beams and channel beams. Each end wall section has air entry ducts for air intake and air outlets duct to connect to an air manifold assembly, intaking fresh air to the shelter, and outlet air manifold assembly spent air to ground surface.

Entranceway Seismic Joint

[0040] The tubular entranceway connects to the shelter hull sections through a seismic joint annular ring welded to the face of the end wall. The face of the annular ring has bolt holes to connect to a mating flange on the tubular entranceway through a rubber or EMP shielded gasket. Flexure in, which is a larger diameter than the tubular entranceway, allows the entranceway independent movement from hull section and ground level. A through hole is located on the end wall section and allows people to enter the shelter.

Cathodic Protection

[0041] The sections' hull exterior and interior are painted prior to shipping. The inside epoxy white coating has excellent flame and smoke properties. The exterior epoxy coating has strong dielectric properties at 1000+ ohms/ft^2/mil, excellent cathodic bonding, and abrasion resistance properties. Underground corrosion is an electrical process and the shelter hull and foundation corrosion is virtually stopped by the Cathodic Protection System. Unlike an underground galvanized tank or culvert where the shelter itself erodes over time requiring the shelter hull pressure rating to be de-rated 2-5% each year, the corrosion protection system forces the underground anodes connected to the shelter sections to erode instead of the shelter hull. The corrosion protection system is monitored by a meter, mounted on the shelter inside wall indicating that the corrosion protection system is operating and when the anodes needs to be replaced. The corrosion protection system allows support of a 30-50-year structural warranty.

What is claimed is:

1. An underground disaster shelter comprises:

a plurality of shelter sections;

an entranceway panel;

a rear panel;

each of the plurality of shelter sections comprises a base, a first gravity flange, a second gravity flange, a frame, an exterior shell, a first connection end, and a second connection end;

the entranceway panel comprises a panel body and a door;

the base being connected in between the first gravity flange and the second gravity flange;

the frame being adjacently mounted onto the base;

the exterior shell being adjacently mounted onto the frame, opposite to an interior compartment of the plurality of shelter sections;

the first connection end of an arbitrary section being adjacently connected to the second connection end of an adjacent section, wherein the arbitrary section and the adjacent section are each from the plurality of shelter sections;

the plurality of shelter sections being serially connected to each other;

the door being adjacently mounted onto the panel body;

the entranceway panel being adjacently mounted onto the first connection end of a head section, wherein the head section is from the plurality of shelter sections;

the rear panel being adjacently mounted onto the second connection end of a tail section, wherein the tail section is from the plurality of shelter sections; and

the interior compartment being delineated by the plurality of shelter sections, the entranceway panel, and the rear panel.

2. The underground disaster shelter as claimed in claim **1** comprises:

the base comprises a foundation-beam platform and a cover plate;

the frame being mounted onto the foundation-beam platform;

the cover plate being adjacently connected to the foundation-beam platform;

the cover plate being positioned between the frame and the foundation-beam platform;

the first gravity flange being laterally connected to the foundation-beam platform; and

the second gravity flange being laterally connected to the foundation-beam platform, opposite to the first gravity flange.

3. The underground disaster shelter as claimed in claim **1** comprises:

the frame comprises a first side wall, a second side wall, and a ceiling arch;

the first side wall being oriented parallel to the second side wall;

the first side wall being terminally connected to the base;

the second side wall being positioned opposite to the first side wall, across the base;

the second side wall being terminally connected to the base;

the ceiling arch being terminally connected to the first side wall, opposite to the base; and

the ceiling arch being terminally connected to the second side wall, opposite to the base.

4. The underground disaster shelter as claimed in claim **3** comprises:

the first side wall comprises a first plurality of wall-support beams;

the second side wall comprises a second plurality of wall-support beams;

the ceiling arch comprises a plurality of arch-support assemblies;

the first plurality of wall-support beams being positioned parallel and offset from each other across the base;

the second plurality of wall-support beams being positioned parallel and offset from each other across the base; and

each of the first plurality of arch-support assemblies being connected in between a corresponding first wall-support beam and a corresponding second wall-support beam, wherein the first corresponding wall-support beam is from the first plurality of wall support beams, and wherein the second corresponding wall-support beam is from the second plurality of wall support beams.

5. The underground disaster shelter as claimed in claim **3**, wherein the ceiling arch is a three-sided arch and each of the plurality of shelter sections forms a hexagonal structure.

6. The underground disaster shelter as claimed in claim **3** comprises:

the frame further comprises a first channel beam endcap and a second channel beam endcap;

the first channel beam endcap being coextensively connected to the first connection end; and

the second channel beam endcap being coextensively connected to the second connection end.

7. The underground disaster shelter as claimed in claim **1** comprises:

the exterior shell comprises a shell body and a shelter-enhancing exterior coating;

the shell body being mounted adjacent to the frame; and

the shelter-enhancing exterior coating being superimposed onto the shell body, opposite the frame.

8. The underground disaster shelter as claimed in claim **1** comprises:

the exterior shell comprises a shell body and a flame-retardant interior coating;

an interior surface of the shell body being mounted adjacent the frame;

the flame-retardant interior coating being superimposed onto the interior surface of the shell body; and

the flame-retardant interior coating being positioned in between the interior surface and the frame.

9. The underground disaster shelter as claimed in claim **1** comprises:

each of the plurality of shelter sections further comprises a sealing mount; and

the sealing mount being connected in between the frame and the exterior shell.

10. The underground disaster shelter as claimed in claim **1** comprises:

each of the plurality of shelter sections further comprises a corrosion protection system and a plurality of sacrificial anodes;

the corrosion protection system being mounted offset from the exterior shell;

the corrosion protection system from each of the plurality of shelter sections being electrically connected to each other;

the plurality of sacrificial anodes being distributed around the base;

the plurality of sacrificial anodes being mounted offset from the exterior shell; and

the plurality of sacrificial anodes being electrically connected to the exterior shell.

11. The underground disaster shelter as claimed in claim **1** comprises:

the entranceway panel further comprises an entranceway hole and an entranceway-connection mount;

the entranceway hole normally traversing through the panel body;

the entranceway-connection mount being perimetrically connected around the entranceway hole; and

the entranceway-connection mount being connected in between the door and the panel body.

12. The underground disaster shelter as claimed in claim **11** comprises:

an entranceway tube; and

the entranceway-connection mount being terminally connected to the entranceway tube.

13. The underground disaster shelter as claimed in claim **11**, wherein the entranceway-connection mount is a seismic joint.

14. The underground disaster shelter as claimed in claim **1** comprises:

at least one air intake duct;

at least one air outlet duct;

the air intake duct being integrated into the exterior shell of the arbitrary section;

the air outlet duct being integrated into the exterior shell of the adjacent section; and

the air intake duct, and the air outlet duct being in fluid communication with the interior compartment.

15. An underground disaster shelter comprises:

a plurality of shelter sections;

an entranceway panel;

a rear panel;

at least one air intake duct;

at least one air outlet duct;

each of the plurality of shelter sections comprises a base, a first gravity flange, a second gravity flange, a frame, an exterior shell, a first connection end, a second connection end, a sealing mount, a corrosion protection system, and a plurality of sacrificial anodes;

the entranceway panel comprises a panel body, a door, an entranceway hole, and an entranceway-connection mount;

the base comprises a foundation-beam platform and a cover plate;

the frame comprises a first side wall, a second side wall, and a ceiling arch;

the exterior shell comprises a shell body, a shelter-enhancing exterior coating, and a flame-retardant interior coating;

the base being connected in between the first gravity flange and the second gravity flange;

the frame being adjacently mounted onto the base;

the exterior shell being adjacently mounted onto the frame, opposite to an interior compartment of the plurality of shelter sections;

the first connection end of an arbitrary section being adjacently connected to the second connection end of an adjacent section, wherein the arbitrary section and the adjacent section are each from the plurality of shelter sections;

the plurality of shelter sections being serially connected to each other;

the door being adjacently mounted onto the panel body;
the entranceway panel being adjacently mounted onto the first connection end of a head section, wherein the head section is from the plurality of shelter sections;
the rear panel being adjacently mounted onto the second connection end of a tail section, wherein the tail section is from the plurality of shelter sections;
the interior compartment being delineated by the plurality of shelter sections, the entranceway panel, and the rear panel;
the frame being mounted onto the foundation-beam platform;
the cover plate being adjacently connected to the foundation-beam platform;
the cover plate being positioned between the frame and the foundation-beam platform;
the first gravity flange being laterally connected to the foundation-beam platform;
the second gravity flange being laterally connected to the foundation-beam platform, opposite to the first gravity flange;
the first side wall being oriented parallel to the second side wall;
the first side wall being terminally connected to the base;
the second side wall being positioned opposite to the first side wall, across the base;
the second side wall being terminally connected to the base;
the ceiling arch being terminally connected to the first side wall, opposite to the base;
the ceiling arch being terminally connected to the second side wall, opposite to the base;
the shell body being mounted adjacent to the frame;
the shelter-enhancing exterior coating being superimposed onto the shell body, opposite the frame;
an interior surface of the shell body being mounted adjacent the frame;
the flame-retardant interior coating being superimposed onto the interior surface of the shell body;
the flame-retardant interior coating being positioned in between the interior surface and the frame;
the sealing mount being connected in between the frame and the exterior shell;
the corrosion protection system being mounted offset from the exterior shell;
the corrosion protection system from each of the plurality of shelter sections being electrically connected to each other;
the plurality of sacrificial anodes being distributed around the base;
the plurality of sacrificial anodes being mounted offset from the exterior shell;
the plurality of sacrificial anodes being electrically connected to the exterior shell;
the entranceway hole normally traversing through the panel body;
the entranceway-connection mount being perimetrically connected around the entranceway hole;
the entranceway-connection mount being connected in between the door and the panel body;
the air intake duct being integrated into the exterior shell of the arbitrary section;
the air outlet duct being integrated into the exterior shell of the adjacent section; and
the air intake duct, and the air outlet duct being in fluid communication with the interior compartment.

16. The underground disaster shelter as claimed in claim **15** comprises:
the first side wall comprises a first plurality of wall-support beams;
the second side wall comprises a second plurality of wall-support beams;
the ceiling arch comprises a plurality of arch-support assemblies;
the first plurality of wall-support beams being positioned parallel and offset from each other across the base;
the second plurality of wall-support beams being positioned parallel and offset from each other across the base; and
each of the first plurality of arch-support assemblies being connected in between a corresponding first wall-support beam and a corresponding second wall-support beam, wherein the first corresponding wall-support beam is from the first plurality of wall support beams, and wherein the second corresponding wall-support beam is from the second plurality of wall support beams.

17. The underground disaster shelter as claimed in claim **15**, wherein the ceiling arch is a three-sided arch and each of the plurality of shelter sections forms a hexagonal structure.

18. The underground disaster shelter as claimed in claim **15** comprises:
the frame further comprises a first channel beam endcap and a second channel beam endcap;
the first channel beam endcap being coextensively connected to the first connection end; and
the second channel beam endcap being coextensively connected to the second connection end.

19. The underground disaster shelter as claimed in claim **15** comprises:
an entranceway tube; and
the entranceway-connection mount being terminally connected to the entranceway tube.

20. The underground disaster shelter as claimed in claim **15**, wherein the entranceway-connection mount is a seismic joint.

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