some instances, it is necessary or desirable to provide apparatus and methods for electrically grounding at least a portion of the support surface.

[0004] For example, it may be necessary or desirable to use a temporary or semi-permanent electrically grounded support surface as part of an equipotential zone (EPZ). The EPZ is an arrangement typically designed so that dangerous electric potential differences do not appear across the body of a person working on or near ground-based machinery. An EPZ is often used during projects that involve working in close proximity to an energized power line. For example, in performing overhead power line (OHL) projects, the EPZ may prevent the installation crew from being subject to an electric shock caused by, for example, a circuit flash from the energized line to the conductors being worked on. In the EPZ, the equipment and personnel are typically on a work surface that is electrically conductive and should be grounded to provide a natural path for large electrical voltages to flow.

[0005] Presently know solutions for temporary, or semi-permanent, electrically grounded support surfaces include the use of aluminum access plates bolted together at each corner. These plates are believed to have one or more disadvantages. For example, the plates may not overlap one another and therefore require a flat underlying surface. Otherwise, the edges of the plate(s) may protrude above the underlying surface and form a trip hazard. For another example, the aluminum plates may have considerable scrap value and thus require 24-hour security to prevent theft. For still a further example, these plates may not be useful or adapted to otherwise serve as support surfaces when electrical grounding is not required or needed.

[0006] It should be understood that the above-described features, capabilities and disadvantages are provided for illustrative purposes only and are not intended to limit the scope or subject matter of the appended claims or those of any related patent application or patent. Thus, none of the appended claims or claims of any related application or patent

should be limited by the above discussion or construed to address, include or exclude each or any of the above-cited features, capabilities or disadvantages merely because of the mention thereof herein.

[0007] Accordingly, there exists a need for improved systems, articles and methods useful in connection with providing an electrically grounded support surface having one or more of the attributes or capabilities described or shown in, or as may be apparent from, the various portions of this patent application.

BRIEF SUMMARY OF THE DISCLOSURE

[0008] In some embodiments, the present disclosure involves a system for electrically grounding a reusable load-supporting surface deployed on or near the surface of the earth. The system includes at least two mats at least partially forming the load-supporting surface. Each mat has planar top and bottom faces, multiple sides and at least one edge extending around each side. The mats are configured to support the weight and movement of personnel, vehicles and equipment thereupon. A plurality of removable, planar electrically-conductive covers are constructed at least partially of electrically-conductive material and constructed and arranged to support the weight and movement of personnel, vehicles and equipment thereupon. Each cover extends at least partially across the top face of one of the mats without extending over any of the edges thereof and is flexibly coupled to the mat to allow the mat to flex, expand and contract relative to the cover due to one or more environmental factors and the movement of personnel, vehicles and/or equipment across the load-supporting surface during normal, typical or expected use conditions without decoupling the cover from the mat or undesirably damaging or deforming the cover or mat, while allowing the cover and mat to support the weight and movement of personnel, vehicles and equipment thereupon. Each cover includes

at least one conductive interface configured to electrically couple the cover to another cover in the load-supporting surface. At least one of the covers is configured to be electrically coupled to the earth.

[0009] In many embodiments, the present disclosure involves apparatus for electrically grounding at least two mats of a load-supporting surface deployed on or near the surface of the earth. Each mat includes planar top and bottom faces, multiple sides and at least one edge extending around each side thereof. The mats are constructed and arranged to support the weight and movement of personnel, vehicles and equipment thereupon. The apparatus includes a plurality of removable, planar, electrically-conductive covers constructed at least partially of electrically-conductive material and constructed and arranged to support the weight and movement of personnel, vehicles and equipment thereupon. Each cover extends at least partially across the top face of one of the mats without extending over any of the edges thereof. Each cover includes at least one conductive interface configured to electrically couple the cover to another cover in the load-supporting surface. At least one of the covers is configured to be electrically coupled to the earth. A plurality of adjustable, releasable couplers is configured to releasably couple each cover to its associated mat. A least some of the couplers are loosely engaged between, and not rigidly coupled to, the cover and the mat to allow acceptable relative movement therebetween so that each cover and its associated mat may flex, expand and contract relative to the other during normal, typical or expected use conditions of the load-supporting surface without decoupling the cover from its associated mat or undesirably damaging or deforming the cover or the mat.

[00010] In various embodiments, the present disclosure involves methods of electrically grounding a reusable load-supporting surface deployed on or near the surface of the earth. The load-supporting surface includes at least two mats, each mat having planar

top and bottom faces, multiple sides and at least one edge extending around each side. The mats are configured to support the weight and movement of personnel, vehicles and equipment thereupon. The method includes positioning one among a plurality of removable, planar, electrically-conductive covers at least partially across the top surface of each mat without extending over any of the edges thereof. Each cover is constructed at least partially of electrically-conductive material and configured to support the weight and movement of personnel, vehicles and equipment thereupon. A plurality of selectively adjustable, releasable, couplers is loosely, releasably engaged a between each cover and its associated mat so that each cover stays positioned at least partially across the top face of its associated mat during use of the load-supporting surface and to allow the cover and mat to be moveable relative to one another due to one or more environmental factors during normal, typical or expected use conditions of the load-supporting surface without decoupling the cover from its associated mat and without undesirably damaging or deforming the cover or mat while allowing the cover and mat to support the weight and movement of personnel, vehicles and equipment thereupon. At least one conductive interface of each cover is electrically coupled to at least one conductive interface of at least one other mat in the load-supporting surface. At least one of the mats is grounded.

[00011] Accordingly, the present disclosure includes features and advantages which are believed to enable it to advance support surface technology. Characteristics and advantages of the present disclosure described above and additional features and benefits will be readily apparent to those skilled in the art upon consideration of the following detailed description of various embodiments and referring to the accompanying drawings.

[000123] When included, the electrical connector(s) 288 useful for electrically coupling the electrical connection bar 270 (or other component(s) of the mat 112) to one or more other component or mat 112 may have any suitable form, configuration and construction. In this embodiment, the electrical connector 288 is a rigid bolt 289 coupled to the bar 270. If desired, the electrical connector 288 may be flexible, such as to allow relative movement between the respective mat 112 (or cover 110) and other component without disconnecting therefrom. Other examples of electrical connectors 288 may include one or more pin, flexible member, copper wires, jumper cables 292 (e.g. Figure 37), braided steel strips 298 (e.g. Figure 43C) and the like. If desired, the electrical connector 288 may be coupled with slack (e.g. Figure 37), such as to allow relative movement between the mat 112 (or cover 110) and other component without disconnecting therefrom. In some embodiments, the electrical connector 288 may serve as part of the conductive interface(s) 138 between mats 112.

[000124] Now referring to Figures 36-37, in another independent aspect of the present disclosure, an electrically-conductive corner plate 290 may be used with one or more EPZ mats 112 in the load-supporting surface 16. The corner plate 290 may be used for any suitable purpose, such as to releasably, electrically interconnect multiple EPZ mats 112, ground the EPZ mat 112 or load-supporting surface 16, electrically connect the EPZ mat 112 or load-supporting surface 16 to testing, monitoring, measuring or other equipment, or a combination thereof. For example, the corner plate 290 may be useful to electrically connect the EPZ mat 112 to one or more other EPZ mats 112, serving as part of the conductive interface(s) 138 (e.g. Figure 37). In some embodiments, the corner plate 290 may also or instead be used in addition to one or more other engaged conductive interfaces 138 (e.g. Figure 9) of two or more electrically coupled mats 112 to ensure effective electrical interconnection and/or grounding of the mats 112 and/or other components in the load-

one or more connection ports 278 may be formed in only select corners of the frame 120 or at any other desired location on the frame 120, mesh portion 126, one or more cut-out frames 180 or other component of the EPZ mat 112 or a combination thereof.

[000136] Still referring to Figures 43A-C, the exemplary connection port 278 may receive any desired electrical connection components (e.g. electrical connectors 288, grounding, testing, monitoring or other equipment, wires, cables, connector pins, etc.). If desired, multiple connection ports 278 may be included at each location, such to allow flexibility and multiple options in the position(s) and quantity of electrical connections that can be made to the EPZ mat 112 or other desired purpose. In this embodiment, three connection ports 278 are shown at each location, but other embodiments may include less (one or two) or more (four, five, six, etc.) connection ports 278.

[000137] In some embodiments, one or more electrical connectors 288 may be coupled to one or more of the connection ports 278 of the exemplary mat 112. In Figure 43C, for example, electrical connectors 288 are shown releasably electrically coupled to connection ports 278 on each of four adjacent mats 112 to electrically couple the mats 112 together. The illustrated electrical connectors 288 and connection ports 278 thus serve as the conductive interfaces 138 between the mats 112. In this embodiment, the electrical connectors 288 include flexible, braided steel strips 298 and threaded bolts 296. If desired, similarly as mentioned above, the electrical connectors 288 (e.g. strips 298) may be flexible and/or coupled to one or more of the connection ports 278 with slack, such as to allow relative movement between the respective mats 112 (covers 110, connected electrical components, etc.) without disconnecting therefrom.

[000138] It should be noted that the corner plates 290, electrical connection bars 270 and connection ports 278 formed in mats 112 may be used alone, or in combination with one

CLAIMS

1. System for electrically grounding a reusable load-supporting surface deployed on or near the surface of the earth, the system comprising:

at least two mats at least partially forming the load-supporting surface, each said mat having respective planar top and bottom faces, multiple sides and at least one edge extending around each said side, said mats being configured to support the weight and movement of personnel, vehicles and equipment thereupon; and

a plurality of removable, planar, electrically-conductive covers constructed at least partially of electrically-conductive material and constructed and arranged to support the weight and movement of personnel, vehicles and equipment thereupon, each said cover extending at least partially across said top face of one of said mats without extending over any of said edges thereof and being flexibly coupled to said associated mat to allow said mat to flex, expand and contract relative to said cover due to one or more environmental factors and the movement of personnel, vehicles and/or equipment across the load-supporting surface during normal, typical or expected use conditions without decoupling said cover from said associated mat and without undesirably damaging or deforming said cover or said mat while allowing said cover and said mat to support the weight and movement of personnel, vehicles and equipment thereupon, each said cover having at least one conductive interface configured to electrically couple said cover to another said cover of the load-supporting surface, and at least one of said covers being configured to be electrically coupled to the earth.

2. The system of claim 1 wherein each said cover is releasably coupled to said associated mat with a plurality of releasable couplers, at least some of said couplers being

loosely engaged between said cover and said mat to allow acceptable relative movement therebetween.

3. The system of claim 2 wherein each said cover is releasably coupled to its associated said mat only by said couplers.

4. The system of claims 2 or 3 wherein each said coupler includes an elongated body having an outer diameter and being configured to extend through an aperture formed in said associated mat to secure said associated cover to said mat, wherein at least some of said apertures formed in each said mat have an inner diameter that is larger than said outer diameter of said elongated portion of said associated coupler to allow relative side-to-side movement between said coupler, said mat and said cover.

5. The system of claims 2, 3 or 4 wherein each said coupler is secured to said associated mat below the bottom face of said mat with at least one adjustable, releasable anchor, wherein said at least one anchor associated with at least some of said couplers on each said mat is selectively positioned on said coupler spaced below said bottom face of said associated mat to allow relative up-and-down movement between said coupler, said mat and said cover.

6. The system of any of the preceding claims wherein each said cover includes at least one upwardly facing corner, further wherein said at least one conductive interface includes at least one electrically-conductive corner plate welded to one of said corners, each said corner plate including at least one connection port.

7. The system of claim 6 further including at least one electrically-conductive corner plate welded to each corner of each said cover.

8. The system of claims 6 or 7 further including at least one electrical connector releasably coupled to at least one said connection port of one of said corner plates and at least one of said connection ports of at least one other said cover to electrically couple said associated covers in the load-supporting surface.

9. The system of any of the preceding claims wherein each said cover includes an outer frame and an inner mesh portion connected to said outer frame, said outer frame and inner mesh portion being constructed at least partially of electrically-conductive material, further wherein said outer frame includes said at least one conductive interface.

10. The system of claim 9 wherein each said outer frame is planar.

11. The system of claims 9 or 10 wherein each said mat includes at least one corner and each said outer frame includes at least one corner aligned at least partially over one of said corners of said associated mat, further wherein said at least one conductive interface includes at least one threaded orifice formed in at least one said corner of said outer frame.

12. The system of claim 11 wherein said at least one conductive interface includes three threaded orifices formed in each said corner of each said outer frame.

13. The system of claims 11 or 12 further including at least one electrical connector releasably coupled to at least one said threaded orifice of said outer frame of one of said covers and at

least one of said threaded orifices of said outer frame of another said cover to electrically couple said covers in the load-supporting surface.

14. The system of claim 13 wherein said at least one electrical connector is flexible to allow relative movement between said electrically coupled covers.

15. The system of claims 13 or 14 wherein said at least one electrical connector is coupled between said electrically coupled covers with slack to allow relative movement between said covers.

16. Apparatus for electrically grounding at least two mats of a load-supporting surface deployed on or near the surface of the earth, each mat having respective planar top and bottom faces, multiple sides and at least one edge extending around each side thereof, the mats being constructed and arranged to support the weight and movement of personnel, vehicles and equipment thereupon, the apparatus comprising:

a plurality of removable, planar, electrically-conductive covers constructed at least partially of electrically-conductive material and constructed and arranged to support the weight and movement of personnel, vehicles and equipment thereupon, each said cover extending at least partially across the top face of one of the mats without extending over any of the edges thereof, each said cover including at least one conductive interface configured to electrically couple said cover to another said cover in the load-supporting surface, at least one of said covers being configured to be electrically coupled to the earth; and

a plurality of adjustable, releasable couplers configured to releasably couple each said cover to its associated mat, at least some of said couplers being loosely engaged between, and

not rigidly coupled to said cover and its associated mat to allow acceptable relative movement therebetween so that each said cover and its associated mat may move relative to the other during normal, typical or expected use conditions of the load-supporting surface without decoupling said cover from its associated mat and without undesirably damaging or deforming said cover or its associated mat while allowing said cover and the mat to support the weight and movement of personnel, vehicles and equipment thereupon.

17. The apparatus of claim 16 wherein each said cover is releasably coupled to its associated mat only by said couplers.

18. The apparatus of claims 16 or 17 wherein each said coupler includes an elongated body having an outer diameter and being configured to extend through an aperture formed in the associated mat to secure said associated cover to the mat, wherein at least some of the apertures formed in each mat have an inner diameter that is larger than said outer diameter of said elongated portion of said associated coupler to allow relative side-to-side movement between said coupler, the mat and said cover.

19. The apparatus of claims 16, 17 or 18 wherein each said coupler includes a bolt secured to its associated mat below the bottom face of the mat with at least one nut, wherein said nut associated with at least some of said bolts on each mat is selectively coupled to said bolt spaced away from the bottom face of the associated mat to allow relative up-and-down movement between said coupler, the mat and said cover.

20. Method of electrically grounding a reusable load-supporting surface deployed on or near the surface of the earth, the load-supporting surface including at least two mats, each

mat having respective planar top and bottom faces, multiple sides and at least one edge extending around each side, the mats being configured to support the weight and movement of personnel, vehicles and equipment thereupon, the method comprising:

positioning one among a plurality of removable, planar, electrically-conductive covers at least partially across the top face of each mat without extending over any of the edges thereof, each cover being constructed at least partially of electrically-conductive material and configured to support the weight and movement of personnel, vehicles and equipment thereupon;

selectively, loosely, releasably engaging a plurality of selectively adjustable, releasable, couplers between each cover and its associated mat so that each cover stays positioned at least partially across the top face of its associated mat during use of the load-supporting surface and to allow at least one among the cover and mat to be moveable relative to the other due to one or more environmental factors during normal, typical or expected use conditions of the load-supporting surface without decoupling the cover from its associated mat and without undesirably damaging or deforming the cover or the mat, while allowing the cover and the mat to support the weight and movement of personnel, vehicles and equipment thereupon;

electrically coupling at least one conductive interface of each cover to at least one conductive interface of at least one other cover in the load-supporting surface; and

grounding at least one of the mats.

21. The method of claim 20 wherein each coupler includes an elongated body having an outer diameter and being configured to extend through an aperture formed in the associated mat to secure the associated cover to the mat, wherein at least some of the apertures formed in each mat have an inner diameter that is larger than the outer diameter of the elongated

portion of the associated coupler, further including inserting each coupler into an aperture in its associated mat, and at least some of the couplers moving side-to-side relative to the mat.

22. The method of claims 20 or 21 further including at least one adjustable, releasable anchor securing each coupler to its associated mat below the bottom face of the mat with, and at least some of the anchors associated with each mat engaging their associated couplers spaced below the bottom face of the mat to selectively, releasably loosely secure each cover to its associated mat and allow relative movement therebetween.