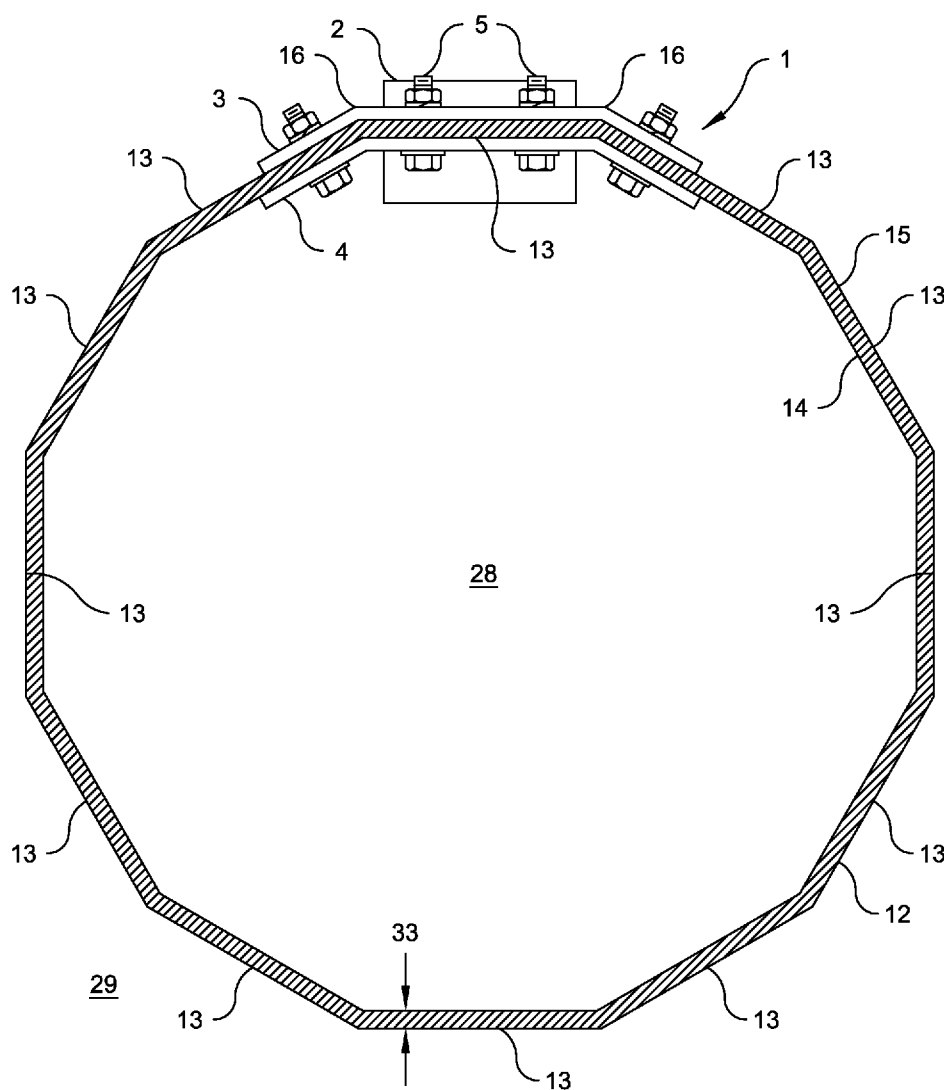




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(19) **United States**(12) **Patent Application Publication**
Taschek(10) **Pub. No.: US 2011/0067322 A1**(43) **Pub. Date: Mar. 24, 2011**(54) **PORTHOLE RETROFIT APPARATUS FOR A
MONOPOLE TOWER**(76) Inventor: **Richard S. Taschek**, Marlton, NJ
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E04H 1/12 (2006.01)(52) **U.S. Cl.** **52/79.7**(57) **ABSTRACT**

An apparatus for the flameless retrofit of a monopole tower with additional portholes is presented. The apparatus includes a frame, a front plate, a back plate, and a plurality of fasteners. The frame has a through hole which defines a porthole allowing access to the interior of the monopole. The front plate has an opening which fits about the frame and is contoured to match the exterior surface of the monopole. The back plate has an opening shaped which fits about the frame. The back plate is fixed to the frame so that the frame extends from both sides of the back plate and through a crude opening cut into the monopole. The back plate is contoured to match the interior surface along the monopole. The front and back plates are disposed about the crude opening and attached to the monopole via the fasteners. Each fastener passes through holes mutually aligned along each of the front plate, monopole, and back plate. The apparatus and mechanical fastening means ensure the structural integrity of a monopole tower and completely avoid the need for welding methods during assembly onto the monopole.



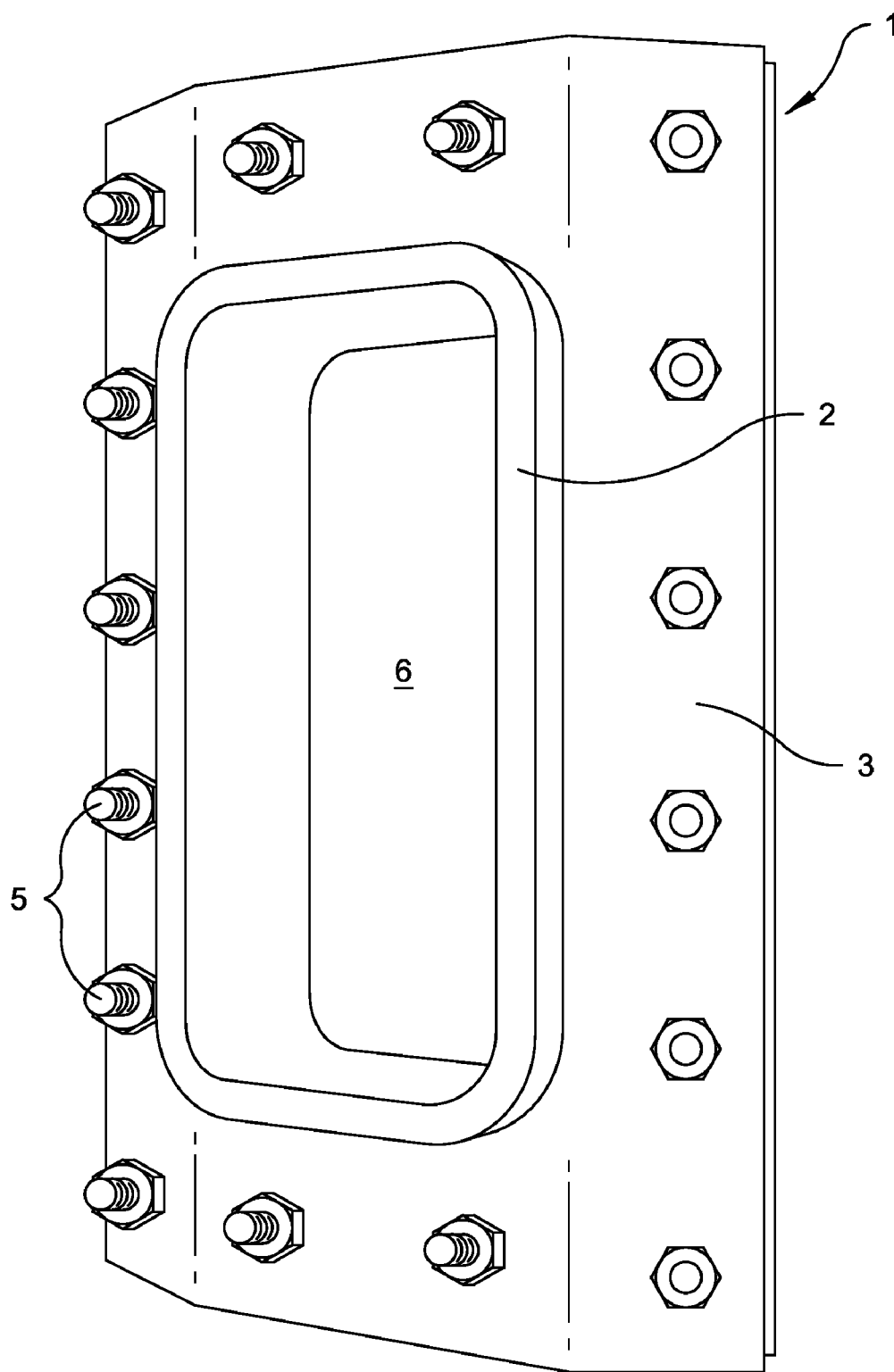


Fig. 1

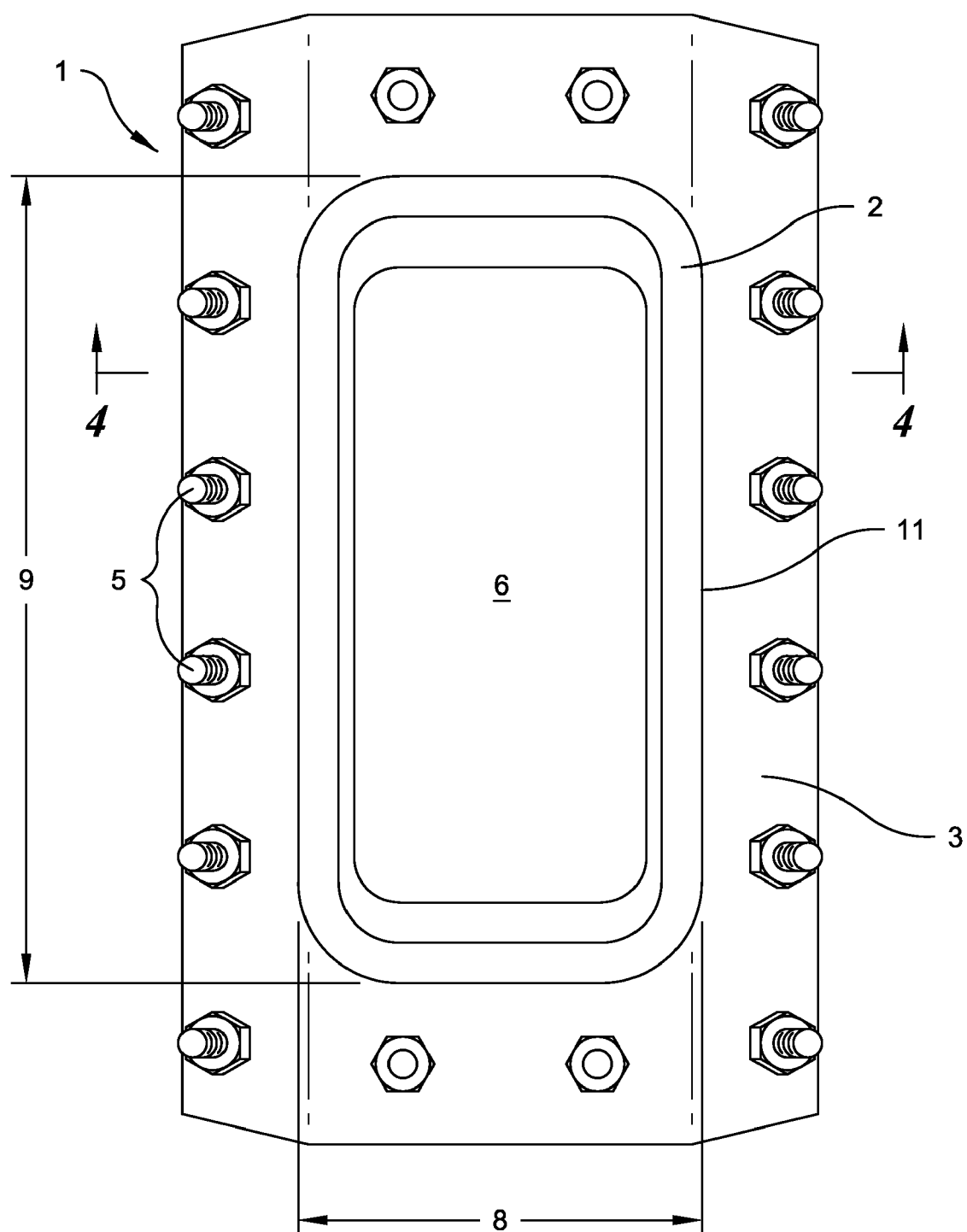


Fig. 2

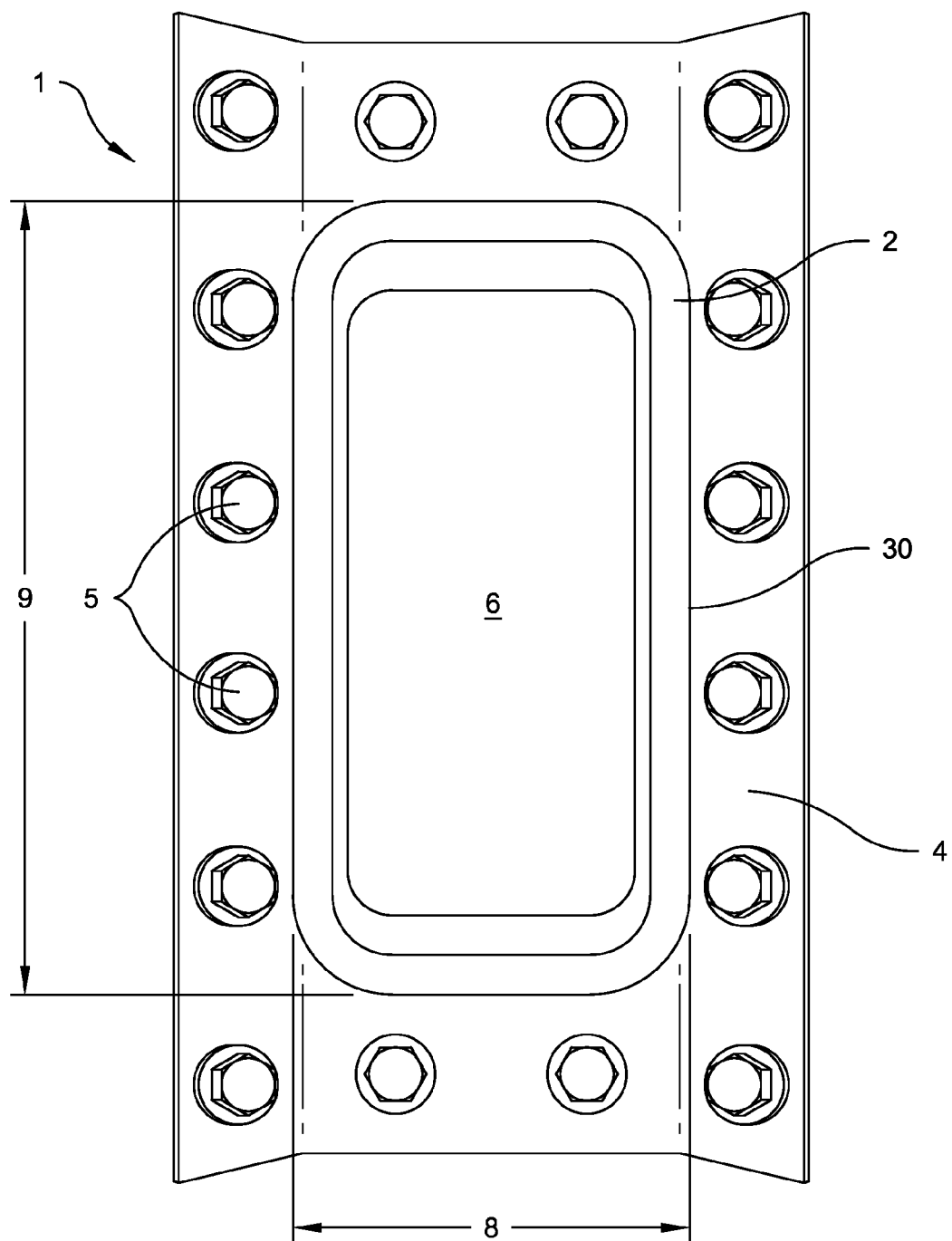


Fig. 3

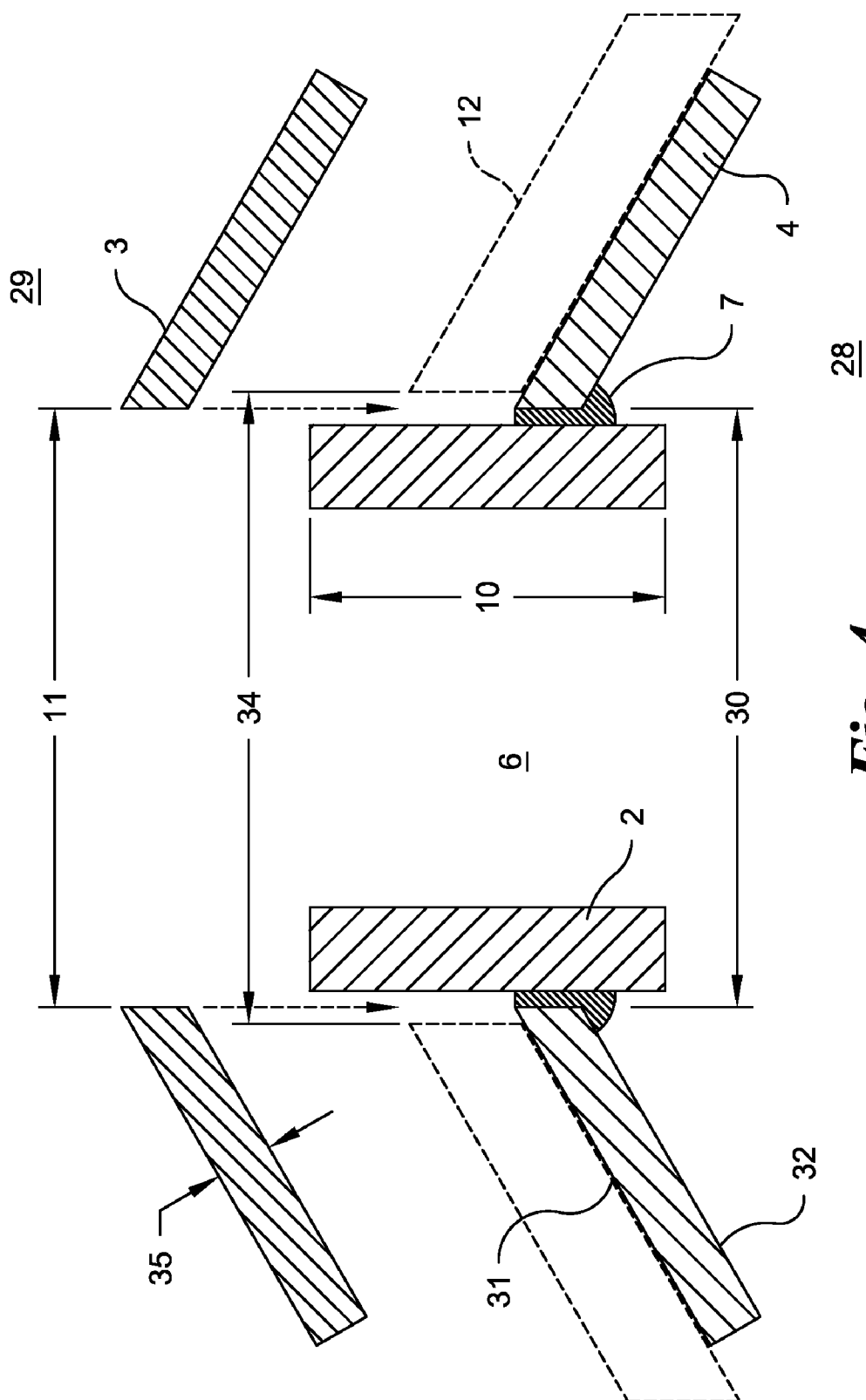


Fig. 4

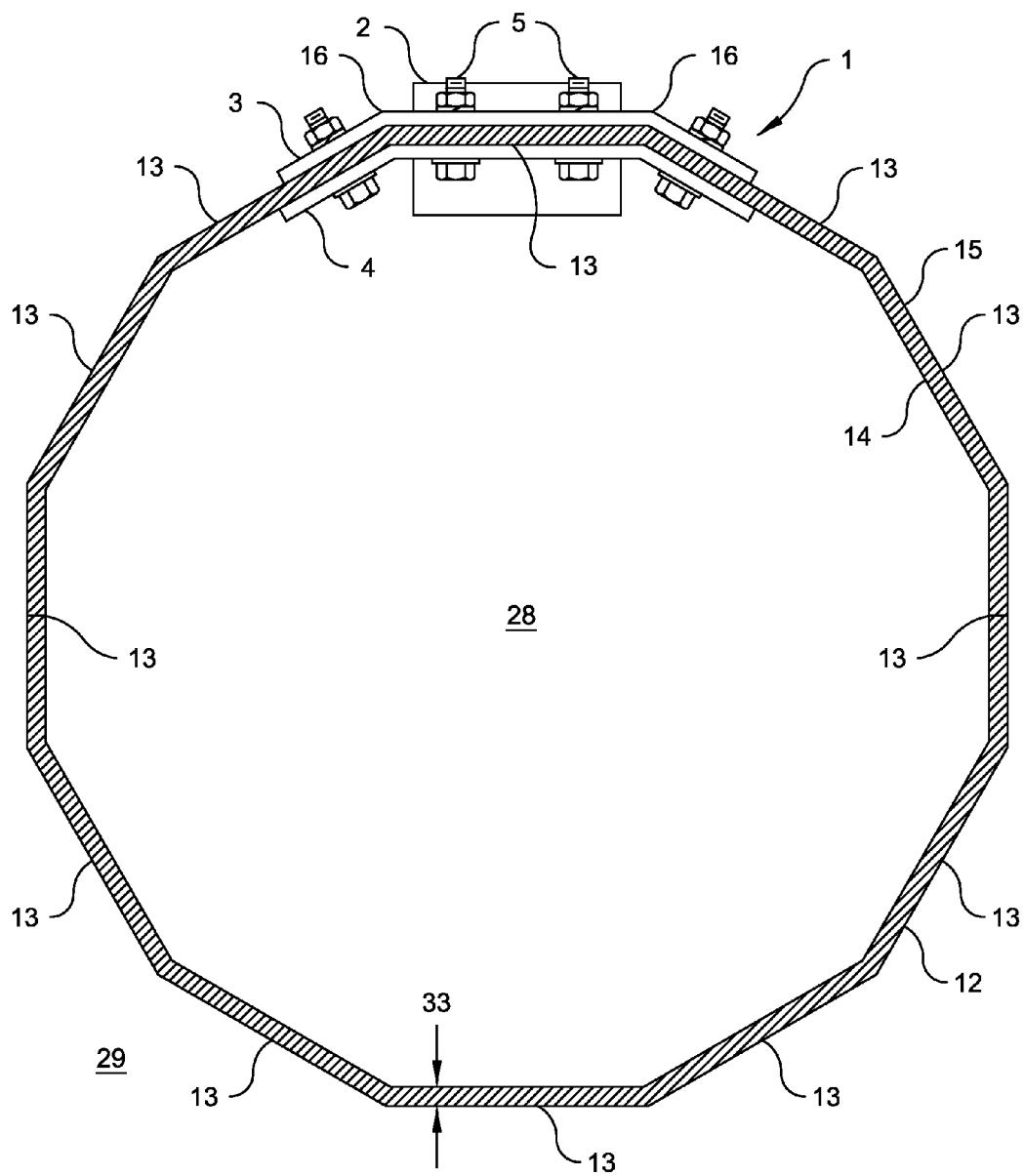


Fig. 5

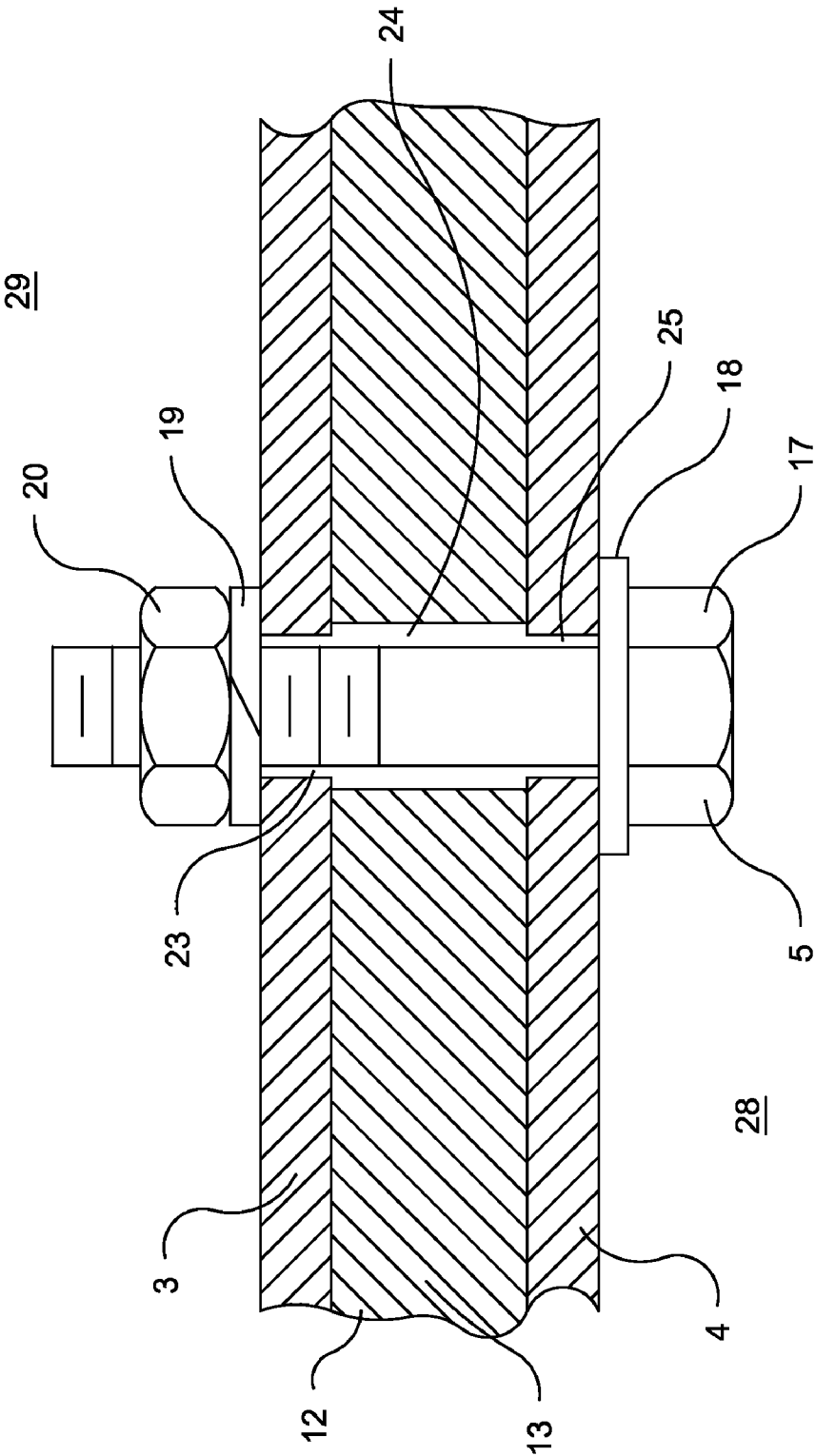


Fig. 6

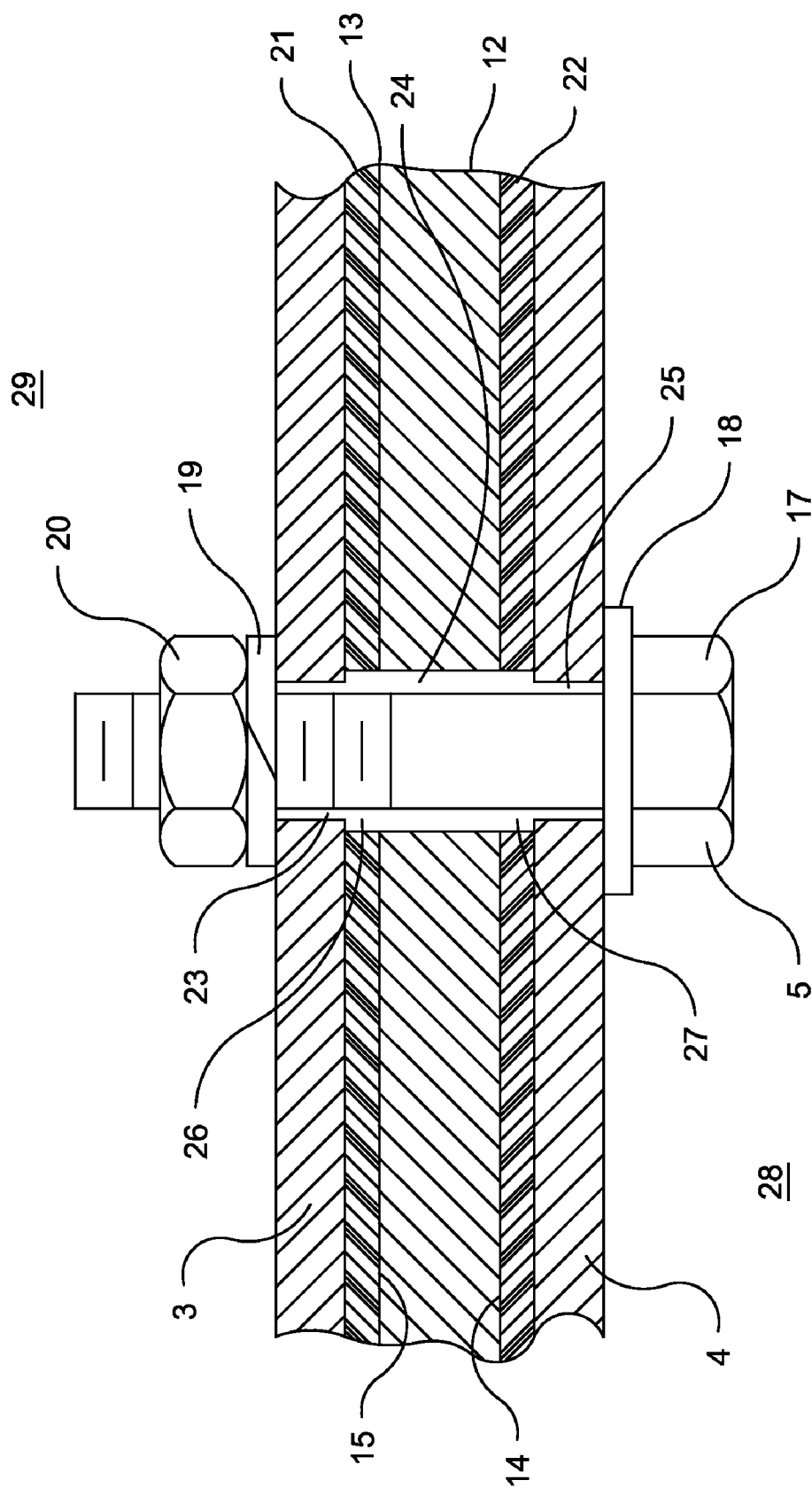


Fig. 7

PORTHOLE RETROFIT APPARATUS FOR A MONOPOLE TOWER

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] None.

FEDERALLY SPONSORED RESEARCH AND DEVELOPMENT

[0002] None.

BACKGROUND OF THE INVENTION

[0003] 1. Field of the Invention

[0004] The invention generally relates to the field of monopole towers. In particular, the invention is an apparatus which is mechanically fastened about a rough opening cut into a wall of a monopole tower so as to provide a porthole facilitating the passage of cables into and out of the tower. The apparatus and mechanical fastening means ensure the structural integrity of the tower and completely avoid the use of welding methods which are a primary cause of fires within monopole towers.

[0005] 2. Background

[0006] A monopole tower is a cylindrically-shaped, hollow structure, typically composed of steel, fixed at its lower end to a foundation and having a support structure at its upper end. Monopole towers are used by the telecommunications industry within cell sites to form a cellular telephone network.

[0007] A cell site usually includes at least one monopole tower, two or more antennas, and other electronic equipment. Antennas are placed onto the support structure at the top of the monopole tower. Transmitters, receivers, transceivers, digital signal processors, control electronics, GPS receivers, and power sources are provided within a shelter immediately adjacent to the base of the tower. Cables are provided within the interior of the monopole between the antennas at the top of the tower and equipment within the shelter at the base of the tower.

[0008] The expansion of antenna capacity at the top of a monopole could require the addition of new openings at one or both ends of a tower. The addition of a new opening along a monopole tower requires a skilled welder to cut a crude opening into the wall structure of a tower. A typical crude opening includes irregular edges which cut or otherwise damage cables entering and exiting the tower. A porthole apparatus is secured about the hole and then welded onto the monopole structure to as to provide a smooth and uniform opening through which cables pass without damage. The welding process produces molten metal which invariably falls into the hollow center of the monopole often initiating a fire. Such fires are particularly difficult to extinguish due to the stack effect.

[0009] The stack effect is the movement of air caused by buoyancy into and out of a vertically-disposed, hollow structure, such as a monopole tower. A positive or upward buoyancy results when hot, less-dense air is produced within a monopole surrounded by cooler, more-dense air. The greater the thermal difference between internal and external conditions and the taller the structure, the greater the buoyancy force and stack effect. The stack effect enables a fire at the base of a monopole tower to quickly progress up along the length of the tower, thus consuming cables within the tower and damaging antennas at the top of the tower. Furthermore,

heat generated within the tower is often sufficient to melt or weaken the structure causing it to bend and/or collapse.

[0010] Coberly, U.S. Pat. No. 7,234,276, describes a porthole apparatus having a rectangular frame with a planar-shaped bar disposed about the periphery of the frame. The rectangular frame traverses a crude opening within the monopole so that the bar contacts the interior surface of the monopole. The rectangular frame and bar are then welded onto the tower. The weld specifications for monopole towers require welds to traverse the wall thickness of the pole so as to avoid a mechanical weakening of the tower. Accordingly, the design and method described by Coberly are unable to prevent molten metal from falling into the center cavity of a tower so as to avoid the possibility of a fire therein.

[0011] As is readily apparent from the discussions above, the related arts do not provide an apparatus for use about a crude opening along a monopole tower which avoids the fire hazards associated with welding while maintaining the structural integrity of the tower.

[0012] Therefore, what is required is a frame apparatus which is mechanically attachable to a monopole structure about a crude opening so as to avoid the fire hazard associated with welding, to minimize the structural impact of the crude opening along the tower, and to provide a port through which cables enter and exit the tower without damage.

SUMMARY OF THE INVENTION

[0013] An object of the present invention is to provide a frame apparatus which is mechanically attachable to a monopole structure about a crude opening so as to avoid the fire hazard associated with welding, to minimize the structural impact of the crude opening along the tower, and to provide a port through which cables enter and exit the tower without damage.

[0014] Various embodiments of the apparatus include a frame, a front plate, a back plate, and a plurality of fasteners. The center open portion of the frame forms the porthole. The front plate has an opening which fits about the frame and is contoured to match the exterior surface of the tower. The back plate has an opening shaped so as to also fit about the frame. The back plate is fixed to the frame so that the frame extends from both sides of the back plate and through the crude opening cut into a side of a monopole tower. The back plate is contoured to match the interior surface along the tower. The front and back plates are disposed about the crude opening and attached to the wall via the fasteners. Each fastener passes through holes mutually aligned along each of the front plate, back plate, and tower.

[0015] Several advantages are offered by the invention. The invention avoids onsite welding, thus avoiding a primary cause of fires within monopole towers. The invention is customizable for a variety of monopole designs. The invention eliminates pre-heating of a monopole during cold weather installations. The invention maximizes antenna capacity of a monopole tower while minimizing attachment of cables along the exterior of the tower.

REFERENCE NUMERALS

- 1 Apparatus
- 2 Frame
- 3 Front plate

-continued

REFERENCE NUMERALS

4	Back plate
5	Fastener
6	Porthole
7	Weld seam
8	Width
9	Length
10	Height
11	Opening
12	Monopole
13	Wall
14	Interior surface
15	Exterior surface
16	Bend
17	Bolt
18	Washer
19	Lock washer
20	Nut
21	Interlayer
22	Interlayer
23	Opening
24	Opening
25	Opening
26	Opening
27	Opening
28	Interior
29	Exterior
30	Opening
31	Front surface
32	Back surface
33	Thickness
34	Crude opening
35	Thickness

BRIEF DESCRIPTION OF THE INVENTION

[0016] Additional aspects, features, and advantages of the invention will be understood and will become more readily apparent when the invention is considered in the light of the following description made in conjunction with the accompanying drawings.

[0017] FIG. 1 is a perspective view illustrating the apparatus including a frame with porthole, front plate, back plate, and a plurality of fasteners in accordance with an embodiment of the invention.

[0018] FIG. 2 is a front view illustrating attachment of a front plate about a central frame with porthole via a plurality of fasteners in accordance with an embodiment of the invention.

[0019] FIG. 3 is a back view illustrating attachment of a back plate about a central frame with porthole in accordance with an embodiment of the invention.

[0020] FIG. 4 is an exploded section view illustrating attachment of a back plate about a central frame with porthole via a weld seam and placement of a front plate about the frame in accordance with an embodiment of the invention.

[0021] FIG. 5 is a partial section view illustrating attachment of an apparatus along three side walls of a twelve-sided monopole in accordance with an embodiment of the invention.

[0022] FIG. 6 is an enlarged partial section view illustrating arrangement of a fastener through a front plate, side wall, and back plate in accordance with an embodiment of the invention.

[0023] FIG. 7 is an enlarged partial section view illustrating arrangement of a fastener through a front plate, optional inter-

layer, side wall, optional interlayer, and back plate in accordance with an embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0024] Reference will now be made in detail to several preferred embodiments of the invention that are illustrated in the accompanying drawings. Wherever possible, same or similar reference numerals are used in the drawings and the description to refer to the same or like parts. The drawings are not to precise scale.

[0025] Referring now to FIGS. 1-3, the apparatus 1 includes a frame 2 which is shaped so as to form a porthole 6 and extends in a generally horizontal arrangement. The frame 2 could be composed a several planar-shaped or arcuate-shaped plates which are welded or otherwise joined to form a single structure. For example, FIGS. 1-3 show a four-sided frame 2 composed of four planar-shaped elements. The frame 2 could likewise include a single circular-shaped element, two or more arcuate-shaped elements, or three or more planar elements. It is also possible for the frame 2 to include both arcuate and generally linear elements providing an infinite variety of opening configurations for the porthole 6.

[0026] A front plate 3 and a back plate 4 are disposed about the frame 2 in a substantially perpendicular arrangement. The front plate 3 is a shaped element having an opening 11 which closely approximates the outer perimeter of the frame 2. For example, FIG. 2 shows the front plate 3 disposed about the frame 2 so that the dimensions of the opening 11 are slightly larger than the width 8 and length 9 of the rectangular-shaped frame 2. The back plate 4 is likewise a shaped element having an opening 30 which closely approximates the outer perimeter of the frame 2. For example, FIG. 3 shows the back plate 4 disposed about the frame 2 so that the dimensions of the opening 30 are slightly larger than the width 8 and length 9 of the rectangular-shaped frame 2. In preferred embodiments, the front plate 3 and back plate 4 should freely slide along the frame 2 without binding. The openings 11, 30 are cut into the front plate 3 and back plate 4, respectively, via methods understood in the art. The lateral dimensions and thickness of the front plate 3 and back plate 4 are design dependent, and based in part on the size the porthole 6 and load requirements imposed by the modified monopole tower. In preferred embodiments, the lateral dimensions for the front plate 3 and back plate 4 are approximately the same.

[0027] The front plate 3 and back plate 4 are mechanically fastened to each other via a plurality of fasteners 5. The fasteners 5 are disposed adjacent to the outer edge of the front plate 3 and back plate 4 and the respective openings 11, 30. The location and number of fasteners 5 are design dependent and determined in part by the stress field within the monopole structure adjacent to the apparatus 1.

[0028] In preferred embodiments, the front plate 3, back plate 4, frame 2, and fasteners 5 could be composed of a metal coated with a rust inhibitor, one example being zinc, and having at least the mechanical strength of the material comprising the monopole. In other embodiments, the front plate 3, back plate 4, frame 2, and/or fasteners 5 could be composed of a non-metallic composite with or without fiber reinforcement or other high-strength, low-weight material.

[0029] Referring now to FIG. 4, the frame 2 is disposed within the opening 30 along the back plate 4 with a height 10 so that a portion of the frame 2 extends beyond the front surface 31 and the back surface 32 of the back plate 4. In preferred embodiments, the length of extension beyond the

front surface 31 should be greater than that beyond the back surface 32 so as to accommodate the thickness 33 of the wall 13 comprising the monopole 12, as represented in FIGS. 4 and 5, and the thickness 35 of the front plate 3 with or without angular adjustments, and further to allow a portion of the frame 2 to extend beyond the front plate 3. The frame 2 is fixed or otherwise attached to the edges of the opening 30 along the back plate 4 via a weld seam 7. The back plate 4 is welded to the frame 2 prior to installation onto a monopole 12.

[0030] The front plate 3 is separately movable within the exterior 29 with respect to the sub-assembly formed by the frame 2 and back plate 4. The front plate 3 is placed over the frame 2 so that the opening 11 surrounds the frame 2. Alignment of the openings 11, 30 about the frame 2 ensures an unobstructed porthole 6 enabling the passage of one or more cables between the interior 28 and exterior 29.

[0031] In preferred embodiments, the frame 2 could closely approximate the general shape of the crude opening 34 cut into the monopole 12. The frame 2 should be dimensionally smaller than the crude opening 34 so as to allow the frame 2 to be freely insertable into the crude opening 34 from the interior 28 of the monopole 12, as represented in FIG. 4.

[0032] The crude opening 34 is cut into the monopole 12 using a flameless device and/or method in order to avoid the introduction of hot or molten metal into the center of the monopole 12. Exemplary flameless devices include, but are not limited to, a saw with diamond tip cutting blade, a water jet, and a laser. The frame 2 covers the otherwise jagged or irregular shaped crude opening 34.

[0033] Referring now to FIG. 5, the apparatus 1 is shown attached to a portion of a monopole 12 having a cross section comprised of twelve generally planar walls 13. It is important to note that the apparatus 1 is applicable to a variety of monopole 12 designs, including configurations having more or less than twelve planar-shaped walls 13, as well as circular and other shaped walls 13.

[0034] The apparatus 1 is attached to the monopole 12 so that the back plate 4 contacts the interior surface 14 and the front plate 3 contacts the exterior surface 15 of two or more walls 13 comprising the monopole 12. This arrangement places the front plate 3 along the exterior 29 and the back plate 4 within the interior 28 of the monopole 12. The angular contour of the monopole 12 is replicated along the front plate 3 and back plate 4 by bends 16 disposed in a symmetrical arrangement about the frame 2. In preferred embodiments, the front plate 3 and back plate 4 should contact the respective exterior and interior surfaces 15, 14 along the monopole 12. In other embodiments, the front plate 3 and back plate 4 could include three or more bends 16 or a curved or arcuate profile.

[0035] A plurality of fasteners 5 are used to secure the front plate 3 to the back plate 4 and frame 2. This arrangement ensures the apparatus 1 is secured to the walls 13 via compression of the walls 13 between the front plate 3 and the back plate 4.

[0036] Referring now to FIG. 6, an exemplary fastener 5 is shown including a bolt 17, a washer 18, a lock washer 19, and a nut 20. However, other high-strength fasteners 5 are likewise applicable. The front plate 3, wall 13, and back plate 4 each include an opening 23, 24, and 25, respectively, which align to allow the passage of the bolt 17 without binding. Openings 23-25 could be mechanically drilled into the front

plate 3, wall 13, and back plate 4 either during fabrication of the apparatus 1 or during installation of the apparatus 1 onto a monopole 12.

[0037] In preferred embodiments, the bolt 17 is positioned perpendicular to the plane of the front plate 3 and back plate 4 immediately surrounding the bolt 17. The washer 18 and lock washer 19 are separately disposed about the front plate 3, wall 13, and back plate 4, as represented in FIG. 6, so as to be perpendicular to the centerline of the bolt 17. The nut 20 is threaded onto the bolt 17 and tightened so as to apply a compressive force onto the front plate 3 and back plate 4, and thereafter onto the wall 13.

[0038] In some embodiments, it might be advantageous to include an interlayer 21, 22 between the front plate 3 and wall 13 and/or between the back plate 4 and wall 13, as shown in FIG. 7. The interlayers 21, 22 could completely or partially surround the frame 2 or reside immediately adjacent to and surround each fastener 5. The interlayers 21, 22 could be a composition that is applied in flowable form, much like a paint or a caulk, or solid form, examples including but not limited to a film, gasket, or plate-shaped element, between the respective elements.

[0039] The front plate 3, interlayer 21, wall 13, interlayer 22, and back plate 4 each include an opening 23, 26, 24, 27, and 25, respectively, which align to allow the passage of the bolt 17 without binding. Openings 23-27 could be mechanically drilled into the respective elements either during fabrication of the apparatus 1 or during installation of the apparatus 1 onto a monopole 12. When the interlayer 21, 22 is applied in a flowable form, the opening 26, 27 through each interlayer 21, 22 could be formed by masking the applicable surface. In some embodiments, the interlayers 21, 22 could extend into the respective openings 23, 25 along the front plate 3 and back plate 4. In other embodiments, the interlayers 21, 22 could extend into the respective openings 23, 25 along and cover the respective front plate 3 and back plate 4 immediately adjacent to contact surface with the lock washer 19 and washer 18.

[0040] In one example, the interlayers 21, 22 could be an adhesive which resides along one surface of the front plate 3 and back plate 4 and immediately contacts the exterior surface 15 and interior surface 14 of the walls 13, respectively. The adhesive could temporarily hold the front plate 3 and back plate 4 onto the monopole 12 during assembly of the apparatus 1 onto the monopole 12.

[0041] In other embodiments, the interlayers 21, 22 could provide a thermal or electrical barrier or short circuit between the monopole 12 and the front plate 3, back plate 4, and/or fastener 5. The interlayers 21, 22 could be composed of materials including, but not limited to, a compressible or non-compressible polymer, elastomer, or rubber composition. These embodiments might also require the fasteners 5 to be composed of or coated with a thermally or electrically non-conductive material.

[0042] In yet other embodiments, the interlayers 21, 22 could provide a fluid barrier which prevents water or air infiltration along the exterior 29 into the interior 28 of the monopole 12. The interlayers 21, 22 could be composed of materials including, but not limited to, a compressible or non-compressible polymer, elastomer, or rubber composition. This arrangement would be beneficial when the interior 28 of the monopole 12 is sealed from the outside environment.

[0043] The description above indicates that a great degree of flexibility is offered in terms of the invention. Although various embodiments have been described in considerable detail with reference to certain preferred versions thereof, other versions are possible. Therefore, the spirit and scope of the appended claims should not be limited to the description of the preferred versions contained herein.

What is claimed is:

1. An apparatus for retrofitting a porthole along a monopole tower comprising:

- (a) a frame having a first opening which defines said porthole;
- (b) a front plate having a second opening shaped so as to fit about said frame, said front plate contoured to match an exterior surface along said monopole tower;
- (c) a back plate having a third opening shaped so as to fit about said frame, said back plate fixed to said frame so that said frame extends from both sides of said back plate and through a crude opening along said monopole tower, said back plate contoured to match an interior surface along said monopole tower; and
- (d) a plurality of fasteners;

where said front plate and said back plate are disposed about said crude opening and attached to said monopole tower via said plurality of fasteners, each said fastener passing through holes mutually aligned along each of said front plate, said monopole tower, and said back plate.

2. The apparatus of claim 1, wherein said front plate and said back plate include at least one bend or curve matching the contour of said monopole tower.

3. The apparatus of claim 1, wherein said back plate is fixed to said frame via welding prior to installation onto said monopole tower.

4. The apparatus of claim 1, further comprising:

- (e) at least one interlayer disposed between said front plate and said monopole tower and/or said back plate and said monopole tower.

5. The apparatus of claim 4, wherein said at least one interlayer is an adhesive.

6. The apparatus of claim 4, wherein said at least one interlayer provides an electrical short circuit between said monopole tower and said front plate, said back plate, said frame, and/or said plurality of fasteners.

7. The apparatus of claim 4, wherein said at least one interlayer provides a thermal short circuit between said

monopole tower and said front plate, said back plate, said frame, and/or said plurality of fasteners.

8. The apparatus of claim 4, wherein said at least one interlayer provides a fluid barrier between said monopole tower and said front plate, said back plate, said frame, and/or said plurality of fasteners.

9. The apparatus of claim 1, wherein said crude opening is cut into said monopole tower via a mechanical device, a water jet, or a laser.

10. The apparatus of claim 1, wherein said front plate, said back plate, said frame, and/or said plurality of fasteners are comprised of a non-metallic composite with or without fiber reinforcement.

11. A method of retrofitting a porthole along a monopole tower comprising the steps of:

- (a) cutting a crude opening into said monopole tower via a flameless method;
- (b) inserting a frame into said crude opening, said frame having a first opening which defines said porthole, a back plate disposed about and fixed to said frame so that said frame extends from said back plate in two directions, said back plate bent and/or curved so as to contact and match an interior surface along said monopole;
- (c) placing a front plate onto said frame, said front plate having a third opening so as to fit about said frame, said front plate bent and/or curved so as to contact and match an exterior surface along said monopole tower; and
- (d) compressing said monopole tower between said front plate and said second plate via a plurality of fasteners.

12. The method of claim 11, wherein said flameless method is performed via a mechanical device, a water jet, or a laser.

- 13. The method of claim 11, further comprising the step of:
 - (e) including an interlayer between said back plate and said monopole and/or said front plate and said monopole.

14. The method of claim 13, wherein said interlayer provides a thermal short circuit between said monopole tower and said front plate, said back plate, said frame, and/or said plurality of fasteners.

15. The method of claim 13, wherein said interlayer provides an electrical short circuit between said monopole tower and said front plate, said back plate, said frame, and/or said plurality of fasteners.

16. The method of claim 13, wherein said interlayer provides a fluid barrier between said monopole tower and said front plate, said back plate, said frame, and/or said plurality of fasteners.

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