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(71) Applicant: **UNIVERSAL HINGE CORPORATION**
[US/US]; 114 Bay Street, Manchester, New Hampshire
03104 (US).

(72) Inventor: **DEPIETRO, Edward A.**; 44 William Ganem
Road, Manchester, New Hampshire 03104 (US).

(74) Agent: **DELEAULT, Robert R.**; Mesmer & Deleault,
PLLC, 41 Brook Street, Manchester, New Hampshire
03104 (US).

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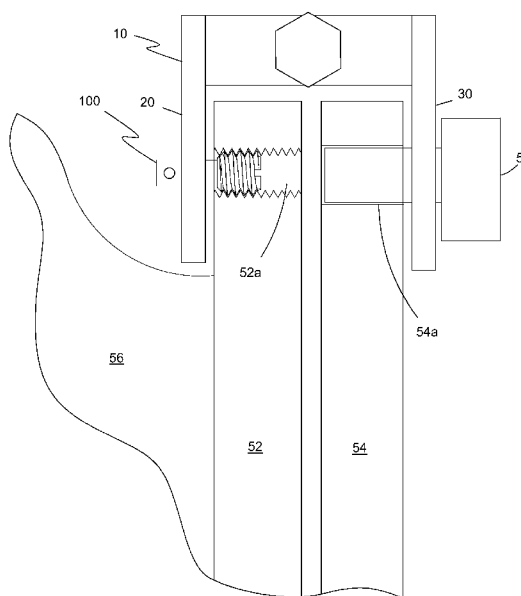


Fig. 3

(57) Abstract: In combination, an attachment bolt assembly and a portable manway hinge for assembly to a manway flange and a manway cover where the attachment bolt assembly has an attachment bolt and a removable retaining pin in which the attachment bolt is configured for insertion into a manway flange opening through a corresponding manway cover opening and a corresponding hinge plate opening of the manway hinge in order to retain a hinge plate of the portable manway hinge against the outside back surface of the manway flange with the removable retaining pin transversely disposed through a transverse opening in a distal hinge portion end of the attachment bolt.

Attachment Bolt for Portable Manway Cover Hinge

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates generally to “manway” covers for access to enclosed spaces such as tanks, conduits, storage areas, heat exchanger tubes, strainers, and the like. Particularly, the present invention relates to attachment bolts used with mechanisms for handling the removal and installation of “manway” covers that are either too hazardous, or too heavy, or too cumbersome to be handled by an unaided individual.

2. Description of the Prior Art

[0002] Manway covers are typically large, heavy, metal plates that are bolted to an opening. For purposes of the present invention, the definition of “manway covers” expressly means any heavy covers or closures used on pressure vessels, vacuum vessels, atmospheric vessels, heat exchangers, heat exchanger channel covers, heat exchanger channels, heat exchanger bonnets, heat exchanger shell covers, dished heads, domed heads, half covers such as on divided water box heat exchangers, chiller condensers, chiller heat exchangers, chiller coolers, inspection ports, strainers, or any type of blanking plate and is not construed to be limited to only covers used on openings that are dimensionally-sized to allow passage of a man. The most common are circularly-shaped and mate to a flange by way of a plurality of bolts evenly spaced around the periphery of the opening. However, it should be understood that the heavy covers may be any shape. The defined manway covers typically provide access to enclosed spaces such as tanks, conduits, storage areas, transfer tubes, pressure vessels, vacuum vessels, atmospheric vessels, heat exchangers, heat exchanger channel covers, heat exchanger channels, heat exchanger bonnets, strainers, and the like. These types of covers are typically found in power plants, co-generation power plants, steam generation plants, chemical plants, petrochemical plants, refineries, pharmaceutical plants, air separation plants, beverage plants, food processing plants, heating and cooling facilities, buildings with central heating and cooling systems, buildings with chiller cooling systems, water treatment plants, waste

management plants, dairies, tank farms, gas storage facilities, liquid natural gas storage facilities, manufacturing facilities and or any facility that has tanks, vessels, piping, heat exchangers, chillers, boilers, turbines, strainers, and/or equipment of similar nature.

[0003] Routine servicing and inspection requirements as well as other operating conditions necessitate periodic removal of these covers. In view of the typical location and weight of the covers, it is not a simple task to remove the cover or to re-install the same. Removal is currently accomplished with the use of hand operated davit swing arms, chain falls, ratchet hoists, and brute force. Except for davit swing arms, it is necessary during the removal process to lower the covers a distance to a level surface.

[0004] Various devices have been devised to facilitate manway cover removal and re-installation. Figures 1A, 1B and 1C illustrate one such prior art device. Fig. 1A is a perspective cover view of hinge plate 30 attached to cover 4. Fig. 1B is a perspective flange view of hinge plate 20 attached to flange 2. Fig. 16C is an outside perspective view of hinge 10 where cover 4 is in an open position relative to flange 2. A linkage member 40 is attached to the pair of elongated hinge plates 20, 30 where each of the hinge plates 20, 30 has one or more hinge plate openings 22, 32 for aligning with corresponding manway flange and manway cover openings. A pivot connection 50 pivotally connects linkage member 40 of hinge plate 20 to linkage member 40 of hinge plate 30, which permits hinge plates 20, 30 to pivot relative to each other and which are configured to swing manway cover 4 away from manway opening 6 providing access to the inside of the manway structure. In this embodiment, an optional cutout or notch 12 provides access to cover bolts not originally removed for attaching hinge 10 to cover 4 and flange 2. An alternative to a cutout or notch 12 is a plurality of apertures that are located in hinge plates 20, 30 that coincide with cover/flange bolts.

[0005] A manway cover 4 is attached to a manway flange 2 with a plurality of bolts 5. The manway flange 2 is permanently affixed to an access tube 3 that typically leads to a much larger internal space such as, for example, a tank. A portable manway hinge device 10 is attachable to and removable from the manway cover 4 and the manway flange 2 using the cover bolts, other standard bolts, or specially-designed expansion bolts. The bolts are inserted from the

outside surfaces of the manway cover 4 and the manway flange 2. Figure 2 is an enlarged partial top view of the removable and portable manway hinge 10 having a flange hinge plate 20 and a cover hinge plate 30 attached to the manway flange 2 and manway cover 4, respectively. The bolts 5 are inserted into the respective flange and cover bolt openings to secure the hinge plates 20, 30 to the manway flange 2 and cover 4.

[0006] U.S. Patent No. 8,038,031 (2011, DePietro et al.) discloses a portable manway cover hinge device. The hinge device has a pair of hinge plates where each hinge plate has a support member with a hinge aperture positioned for alignment with a bolt opening of a manway cover and a manway flange, a linkage member adjacent a first end of each hinge plate and extending out of the plane of the hinge plate, and a pivotal connection coupling overlapping pairs of the linkage member of the pair of hinge plates.

[0007] U.S. Patent No. 8,784,024 (2014, Lison et al.) discloses a pull-up bolt assembly for frictionally supporting a high-weight structure to a hinge component using an opening or recess in the high-weight structure. The bolt assembly includes a pull-up bolt member having a threaded shaft with a first shaft end and a second shaft end, and an abutting member with a tapered surface formed at the first shaft end, the abutting member being wider than and tapering toward the threaded shaft, a nut component with an external torque-applying surface threadably connected to the threaded shaft, a tapered member with a tapered end portion and a flange formed between the external torque-applying surface of the nut component and the tapered end portion wherein the tapered end portion faces toward the tapered surface of the abutting member, and an expandable friction member disposed around the threaded shaft between the abutting member and the tapered member whereby the expandable friction member expands when the nut component is threadably moved toward the abutting member of the pull-up bolt member.

[0008] The prior art devices are a vast improvement over the conventional options available for removing manway covers. So long as there was sufficient space to be able to insert the standard bolts or expansion bolts into both the cover and the flange for securing the portable manway cover hinge, the prior art removable manway hinge is remarkably useful.

SUMMARY OF THE INVENTION

[0009] The portable manway cover hinge has provided an easy and convenient way for removing and/or installing, supporting, and/or storing a manway cover. The portable manway cover hinge has also made it possible for use in confined or congested areas to remove and/or install, support, and/or store a manway cover. The portable manway cover hinge has further made it possible for one man to handle, support, store, and install a manway cover.

[0010] Notwithstanding the advantages of the portable manway cover hinge, there has always been the disadvantage that the portable manway cover hinge could only be used on manway covers where the manway flanges have sufficient access to the bolt holes on the outside (i.e. back) surfaces of the manway flange to insert the bolts that secure the hinge plates of the portable manway cover hinge to the cover and, particularly, the flange. Unfortunately, there are many manway covers that cannot attach the manway hinge in this way.

[0011] It is an object of the present invention to provide an attachment bolt for a portable manway cover hinge for manway covers that have restricted space behind the flange where standard bolts or expansion bolts typically used for attaching the hinge plates to the manway flange cannot be used.

[0012] The present invention achieves these and other objectives by providing, in combination, an attachment bolt and a portable manway hinge where the attachment bolt is configured to permit attaching the portable manway hinge to a manway flange where there is restricted space behind the manway flange to allow use of standard attachment bolts and/or pins. In one embodiment, the manway hinge includes a pair of hinge plates adapted for attaching one of the pair of hinge plates to an outside, back surface of a manway flange and the other of the pair of hinge plates to an outside front surface of a manway cover where each hinge plate has at least one hinge plate opening positioned for alignment with a bolt opening of the manway cover and the manway flange, as the case may be, and a specially-designed attachment bolt for connecting the one of the pair of hinge plates to the manway flange. The attachment bolt has a threaded portion, a hinge plate portion, and a retaining pin. The threaded portion has a first threaded end and a second threaded end where the first threaded end is adapted for receiving a

bolt turning tool to thereby move the threaded portion into and out of a threaded flange bolt opening. The hinge plate portion has a diameter smaller than a minor diameter of the threaded portion and it extends from the second threaded end a predefined distance to a distal hinge portion end. The hinge plate portion has length sufficient to extend through the hinge plate opening in the one of the pair of hinge plates positioned against the outside surface of the manway flange. The distal hinge portion end has a transverse opening for receiving therein a portion of the retaining pin so that the retaining pin retains the hinge plate against the manway flange when the threaded portion is turned to retract the hinge plate portion into the flange bolt opening.

[0013] In another embodiment, the first threaded end of the attachment bolt has a slot that is transverse to the first threaded end where the transverse slot is adapted for receiving a straight screwdriver tool whereby the tool is used to insert and/or retract the attachment bolt.

[0014] In a further embodiment, the first threaded end of the attachment bolt has either a male extension or a female recess adapted for receiving one of an allen-tipped tool, a star-tipped tool, a phillips-tipped tool, and a flat-tipped tool.

[0015] In still another embodiment of the present invention, there is described a method of installing a portable manway hinge to a manway flange that is connected to an access tube where the spacing between the manway flange and an outer surface of the access tube is reduced and/or restricted so that bolts and/or hinge plate securing pins cannot be inserted from the backside of the manway flange. The method includes removing a plurality of manway cover bolts from a portion of the manway cover and manway flange, providing a portable manway cover hinge that has a pair of hinge plates where each hinge plate has at least one hinge opening positioned for alignment with a bolt opening of the manway cover and manway flange, and aligning a hinge plate opening of the hinge plate with one of the plurality of bolt openings of the portion of the manway cover and the manway flange from which the bolts were removed. The method further includes inserting a specially-designed attachment bolt into one of the bolt openings of the manway flange through the corresponding manway cover bolt opening a sufficient distance where the attachment bolt extends beyond the outside, back surface of the manway flange a distance greater than the thickness

of the hinge plate to be attached to the manway flange. The method also includes aligning a hinge plate opening of the hinge plate with one of the plurality of bolt openings of the portion of the manway cover and the manway flange from which the bolts were removed and in which the attachment bolt was inserted and positioning the hinge plate against the manway flange. Once the hinge plate is aligned, then the method requires inserting a removable retaining pin into a transverse opening of the hinge plate portion of the attachment bolt followed by retracting the attachment bolt to a point in the flange bolt opening so that the retaining pin retains the hinge plate against the manway flange. The other of the pair of hinge plates is then attached to the manway cover by aligning the hinge plate aperture(s) with the corresponding manway cover aperture(s), inserting a pin into each hinge aperture and securing each pin within the corresponding cover bolt opening.

[0016] The method further includes providing a specially-designed attachment bolt having a threaded portion and a hinge plate portion connected to the threaded portion where the threaded portion has a length smaller than the length of the manway flange opening such that the threaded portion always remains within the manway flange opening when the attachment bolt is retracted to cause the retaining pin to retain the hinge plate against the manway flange.

[0017] The specially-designed attachment bolt has a threaded portion with a first threaded end and a second threaded end. The hinge plate portion has a diameter smaller than a minor diameter of the threaded portion where the hinge plate portion extends from the second threaded end to a distal hinge plate portion end where the distal hinge plate portion end has the transverse opening through the hinge plate portion. During the inserting step, the attachment bolt is inserted a sufficient distance whereby the transverse opening extends beyond the hinge plate aperture of the one of the pair of hinge plates. To be clear, the hinge plate portion has a length to accommodate the thickness of the hinge plate between the transverse opening and the second threaded end of the threaded portion.

[0018] For manways having split covers, it is contemplated that the present invention may also be used with two portable manway hinge devices. In one embodiment, the optional component is a hinge connector that connects one hinge member of one hinge device to a serially-aligned hinge component of an

adjacent hinge device. The hinge connector may be attached between the two serially aligned hinge components using alignment pins, threaded rods, securing brackets, and the like. In another embodiment, the optional component is a leveling member connected at or adjacent one end of the hinge device. The leveling member on the flange hinge member may be aligned for contact with the peripheral edge of the flange or with the manway extension connected to the flange. The leveling member on the cover hinge member is aligned for contact with the peripheral edge of the cover.

[0019] In yet a further embodiment of the present invention, there is described a specially-designed attachment bolt. The attachment bolt has a threaded portion, a hinge plate portion and a removable retaining pin. The threaded portion has a first threaded end and a second threaded end where the first threaded end is adapted for connecting a bolt turning tool to thereby move the threaded portion into and out of a threaded flange bolt opening. The threaded portion also has a length that will be completely contained within a corresponding manway flange opening in which it is used to securely hold a hinge plate of a manway hinge against the manway flange. Because the manway flange opening is threaded, the hinge plate portion has a diameter smaller than a minor diameter of the threaded portion and extends from the second threaded end a predefined distance to a distal hinge portion end. The distal hinge portion end has a transverse opening through the hinge plate portion where the hinge plate portion is adapted to extend through an attachment bolt opening in a hinge plate of the portable manway hinge and adapted to provide a length between the second threaded end and the transverse opening sufficient to position the transverse opening beyond the hinge plate. The removable retaining pin is insertably disposed within the transverse opening of the hinge plate portion whereby the removable retaining pin retains the hinge plate against the manway flange when the threaded portion is turned to retract the hinge plate portion into the flange bolt opening.

[0020] In another embodiment of the attachment bolt, the attachment bolt has slot in the first threaded end that is transverse to the first threaded end.

[0021] In still another embodiment of the attachment bolt, the first threaded end of the attachment bolt has either a male extension or a female recess adapted for

receiving one of an allen-tipped tool, a star-tipped tool, a phillips-tipped tool, and a flat-tipped tool.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] FIGURE 1A is a perspective view of one embodiment of the manway hinge of the prior art attached to a manway flange and manway cover showing the manway cover in a closed and supported position.

[0023] FIGURE 1B is a perspective view of one embodiment of the manway hinge of the prior art attached to a manway flange and manway cover showing the back side of the manway flange and a portion of an access tube.

[0024] FIGURE 1C is a perspective view of one embodiment of the manway hinge of the prior art attached to a manway flange and a manway cover showing the manway cover in an open position.

[0025] FIGURE 2 is a partial side view of the prior art arrangement of the hinge plates and retaining bolts connected to a manway flange and a manway cover.

[0026] FIGURE 3 is a partial side view of the arrangement of the hinge plates and the attachment bolt of the present invention connected to a manway flange having restricted space between the manway flange and the access tube.

[0027] FIGURE 4 is a back, perspective view of the present invention attached to a hinge plate on the back side of the manway flange showing the removable retaining pin.

[0028] FIGURE 5 is a perspective view of one embodiment of the attachment bolt of the present invention.

[0029] FIGURE 6 is a side view of the attachment bolt shown in Fig. 5.

[0030] FIGURE 7 is a front view of the attachment bolt shown in Fig. 5.

[0031] FIGURE 8 is a top view of one embodiment of the attachment bolt of the present invention showing a tool receiving end.

[0032] FIGURE 9 is a top view of one embodiment of the attachment bolt of the present invention showing another embodiment of a tool receiving end.

[0033] FIGURE 10 is a distal end view of the attachment bolt of the present invention.

[0034] FIGURE 11 is a partial side view of the attachment bolt of the present invention assembled through manway flange and a hinge plate showing the

relationship of the attachment bolt structure to the manway flange bolt opening and the hinge plate.

[0035] FIGURE 12 is a partial side view of the attachment bolt of the present invention assembled through manway flange and a hinge plate showing the relationship of the attachment bolt structure to the manway flange bolt opening and the hinge plate after engagement of the attachment bolt, the hinge plate and the manway flange.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0036] In the present disclosure, certain terms will have particular meanings. The term “allen-tipped tool” means any tool that has a tip portion configured as a male extension or female recess having a shape similar to that known in the art as an allen wrench configuration. The term “star tipped tool” means any tool that has a tip portion configured as a male extension or female recess having a shape similar to that known in the art as a torx wrench configuration. The term “phillips-tipped tool” means any tool that has a tip portion configured as a male extension or female recess having a shape similar to that known in the art as a phillips screwdriver configuration. The term “flat-tipped tool” means any tool that has a tip portion configured as a male extension or female recess having a shape similar to that known in the art as a flat screwdriver configuration.

[0037] The present invention is illustrated in Figs. 3-12. Figure 3 illustrates the use of a portable manway cover hinge 10 on a manway. Hinge 10 includes a pair of elongated hinge members 20, 30, a linkage member 40 and a plurality of support members 40. Elongated hinge member 20 is connected to a manway flange 52 and the elongated hinge member 30 is connected to the peripheral edge of manway cover 54. Linkage member 40 is attached to the pair of elongated hinge members 20, 30 and a pivot connection 50 pivotally connects linkage member 40 of hinge plate 20 to linkage member 40 of hinge plate 30, which permits hinge plates 20, 30 to pivot relative to each other and which are configured to swing manway cover 54 away from manway opening 6 (not shown) providing access to the inside of the manway structure. A plurality of pins 100 and 5 secure hinge plates 20, 30 to a plurality of bolt holes such as manway flange opening 52a and and manway cover opening 54a in manway flange 52 and

manway cover 54, respectively. What is notable about Fig. 3 is the shape of the manway access tube 56 connected to manway flange 52. The manway access tube 56 flares outward to a larger diameter over a relatively short length of manway access tube 56. This widening configuration of manway access tube 56 restricts the space behind and between manway flange 52 and access tube 56 such that the conventional attachment bolts 5 cannot be inserted from the back of manway flange 52. The present invention provides a specially-designed, hinge attachment bolt assembly 100 for the manway flange 52, which will be described later. As shown in Fig. 4, attachment bolt assembly 100 includes a removable retaining pin 130 through distal end portion 110 of attachment bolt 102. Retaining pin 130 prevents hinge plate 20 from disengaging with attachment bolt 102 and secures hinge plate 20 to manway flange 52.

[0038] Turning now to Figures 5-10, there is illustrated various embodiments of specially-designed attachment bolt 100. Fig. 5 is an expanded view of attachment bolt 100. Attachment bolt assembly 100 includes an attachment bolt 102 and a removable pin 130. Attachment bolt 102 has a threaded portion 112, a hinge plate portion 110, a transverse opening 122 in a distal hinge plate portion end 120, and a removable retaining pin 130. Threaded portion 112 has a thread diameter and pitch that matches the threads formed in a manway flange opening 52a and a length that is shorter than a thickness of manway flange 52. In fact, the length of threaded portion 112 must allow for assembling hinge plate 20 onto manway flange 52 and hinge plate portion 110 and then securing hinge plate 20 to manway flange 52 all the while keeping threaded portion 112 completely within manway flange opening 52a. Removable retaining pin 130 has a diameter that is slightly smaller than the diameter of transverse opening 122 so that retaining pin 130 is easily inserted into transverse opening 122 but maintains a close fit to reduce play between the outer surface 130a of retaining pin 130 and the inner surface 122a of transverse opening 122. The length of retaining pin 130 must also be greater than the length of the transverse opening 122 and greater than the diameter of the hinge plate openings through which hinge plate portion 110 extends so that opposite ends 132, 134 of retaining pin 130 extend across portions of hinge plate 20 to retain hinge plate 20 against manway flange 52.

[0039] Fig. 6 is a side view of the embodiment of attachment bolt 100 shown in Fig. 5. Attachment bolt 100 has threaded portion 112 with a first threaded end 114 and a second threaded end 116. In this embodiment, first threaded end 114 has a bolt slot 122 formed into first threaded end 114 where bolt slot 122 is transverse to threaded portion 112. Bolt slot 122 is adapted for receiving a tool such as a flat-tipped screwdriver so that attachment bolt 100 may be inserted into and retracted out of manway flange bolt opening 52a. Although bolt slot 122 is shown extending in substantially the same direction as transverse opening 122 in hinge plate portion 110, bolt slot 122 doesn't have to be but may be positioned at any angle relative to transverse opening 122.

[0040] Fig. 7 is a front view of attachment bolt 102. As can be seen, transverse opening 122 extends completely through hinge plate portion 110. Hinge plate portion 110 has a diameter A that is smaller than the thread minor diameter B of threaded portion 112. The diameter A of hinge plate portion 110 being smaller than the thread minor diameter B is critical so that hinge plate portion 110 can pass through manway flange opening 52a and does not interfere with the internal threads of manway flange opening 52a, which threads are adapted to mate with the external threads of thread portion 112.

[0041] Fig. 8 is a top end view of one embodiment of attachment bolt 102 having a bolt slot 122 formed into first threaded end 114. Bolt slot 122 is sized to accept a flat-tipped tool such as a flat end screwdriver and the like. Fig. 9 is a top end view of another embodiment of attachment bolt 102 having a bolt recess 123 formed into first threaded end 114. Bolt recess 123 is sized to accept an allen-tipped tool such as an allen wrench and the like. It is contemplated that first threaded end 114 may have any male extension or female recess adapted for receiving one of an allen-tipped tool, a star-tipped tool, a phillips-tipped tool, and flat-tipped tool formed into or onto first threaded end 114 to accommodate a tool having a corresponding tool end that is used to insert and/or retract attachment bolt 102 in manway flange opening 52a.

[0042] Fig. 10 is bottom end view of the attachment bolt 102 shown in Fig. 5. As shown, distal hinge portion end 120 has a diameter A that is smaller than thread minor diameter B.

[0043] Turning now to Figure 11, there is illustrated a cross-sectional view of the manway flange opening 52a with one embodiment of the attachment bolt assembly 100 of the present invention. Manway flange opening 52a has an internal thread for receiving the manway cover bolts that secure the manway cover 54 to the manway flange 52. Attachment bolt 102 is positioned within manway flange opening 52a such that threaded portion 112 is adjacent the outside, back surface 53 of manway flange 52. Hinge plate portion 110 extends through hinge plate opening 22 of hinge plate 20 so that hinge plate 20 is positioned between manway flange 52 and transverse opening 122 of hinge plate portion 110. Removable retaining pin 130 extends through transverse opening 122.

[0044] Figure 12 illustrates a cross-sectional view of the manway flange opening 52a with attachment bolt assembly 100. In this illustration, attachment bolt 102 is re-positioned within manway flange opening 52a so that removable retaining pin 130 disposed within transverse opening 122 captures hinge plate 20 against the outside back surface 53 of manway flange 52.

[0045] A method of using the present invention will now be disclosed. Although the present invention is designed to address the problem with limited space behind the manway flange 52 that is connected to an access tube that flares outwardly and has a larger circumferential distance at the connection point to the tank than at the connection point to the manway flange 52, it is contemplated that the present invention may also be used for conventional manway cover/manway flange configurations or where the access tube has constant circumferential distance but that the manway flange is so close to the tank that the space behind the manway flange 52 is so restricted that standard securing bolts and/or pins used for attaching manway hinge 10 to manway flange 52 cannot be used.

[0046] The method involves providing a portable manway cover hinge 100 that has a pair of hinge plates 20, 30 where each hinge plate 20, 30 has a hinge aperture 22, 32, respectively. Hinge apertures 22, 32 are located in hinge plates 20, 30 for alignment with a corresponding bolt opening 52a, 54a of manway flange 52 and manway cover 54. A plurality of manway cover bolts 5 are removed from a portion of manway cover 54 where the plurality of manway cover bolts 5 are

selected to align with the position of the hinge plate apertures 22, 33 of hinge plates 20, 30. Once removed, the specially-designed attachment bolt 100 is inserted into each manway flange opening 52a through the corresponding manway cover opening 54a. Attachment bolt 100 is inserted into each manway flange opening 52a with hinge plate portion 110 being inserted first followed by threaded portion 112 so that hinge plate portion 110 extends beyond the outside, back surface 53 of the manway flange 52 a predefined distance that is greater than the thickness of hinge plate 20. Threaded portion 112 is threaded into manway flange opening 52a to a point so that there is a sufficient length of hinge plate portion 110 to accommodate hinge plate 20 between transverse opening 122 and the outside, back surface 53 of manway flange 52 to allow insertion of removable retaining pin 130 into transverse opening 122. Next, hinge plate 20 is assembled onto attachment bolt 100 by aligning hinge plate aperture 22 of hinge plate 20 with hinge plate portion 110 and sliding hinge plate 20 against the outside, back surface 53 of manway flange 52. Because attachment bolt 100 was inserted to accommodate hinge plate 20 between transverse opening 122 and the outside, back surface 53 of manway flange 52, removable retaining pin 130 is now inserted into transverse opening 122 so that substantially equal portion of removable retaining pin 130 extends from opposite sides of hinge plate portion 110. Alignment bolt 100 is then retracted (i.e. unscrewed) from its position so that removable retaining pin 130 captures hinge plate 20 against the outside, back surface 53 of manway flange 52 to thereby hold hinge plate 20 securely against manway flange 52. Threaded portion 112 has a predefined length so that threaded portion 112 remains completely within manway flange opening 52a after securing hinge plate 20 against the outside, back surface 53 of manway flange 52.

[0047] It is contemplated that the order of attachment bolt 102 insertion into manway flange opening 52a and the assembling of the hinge plate 20 by aligning the hinge plate opening 22 with the manway flange opening 52a may be reversed or switched. That is, one could align the hinge plate opening 22 with the manway flange opening 52a and then insert the attachment bolt 102 into the manway flange opening 52a.

[0048] Although various embodiments of the present invention have been described herein, the above description is merely illustrative. Further modification

of the invention herein disclosed will occur to those skilled in the respective arts and all such modifications are deemed to be within the scope of the invention as defined by the appended claims.

What is claimed is:

1. In combination, a portable manway hinge device and an attachment bolt for securing a hinge plate of the portable manway hinge device to a manway flange connected to an access tube where spacing between the manway flange and the access tube is restricted, the combination comprising:
 - a manway hinge device comprising:
 - a pair of hinge plates adapted for attaching one of the pair of hinge plates to an outside back surface of a manway flange and the other of the pair of hinge plates to an outside front surface of a manway cover wherein each hinge plate has a hinge plate opening positioned for alignment with a bolt opening of the manway cover and the manway flange; and
 - an attachment bolt assembly having an attachment bolt and a removable retaining pin for connecting the one of the pair of hinge plates to the manway flange, the attachment bolt comprising:
 - a threaded portion having a first threaded end and a second threaded end, the first threaded end adapted for receiving a bolt turning tool to thereby move the threaded portion into and out of a threaded manway flange opening; and
 - a hinge plate portion having a diameter smaller than a minor diameter of the threaded portion and extending from the second threaded end a predefined distance to a distal hinge portion end sufficient to extend through a hinge plate opening in the one of the pair of hinge plates positioned against the outside back surface of the manway flange, the distal hinge plate portion end having a transverse opening through the hinge plate portion,
 - wherein the removable retaining pin is insertably disposed within the transverse opening of the hinge plate portion whereby the retaining pin retains the hinge plate against the manway flange when the threaded portion is turned to retract the hinge plate portion into the manway flange opening.

2. The combination of Claim 1 wherein the first threaded end has a slot transverse to the first threaded end.
3. The combination of Claim 1 wherein the first threaded end has either a male extension or a female recess adapted for receiving one of an allen-tipped tool, a star-tipped tool, a phillips-tipped tool, and a flat-tipped tool.
4. A method of installing a portable manway hinge device to a manway flange connected to an access tube where spacing between the manway flange and the access tube is restricted, the method comprising:
 - providing a portable manway cover hinge having a pair of hinge plates wherein each hinge plate has a hinge plate opening positioned for alignment with a bolt opening of a manway cover and a manway flange;
 - removing a plurality of manway cover bolts from a portion of a manway cover whereby the plurality of manway cover bolts are selected to align with the position of the hinge plate opening of the hinge plates;
 - inserting a specially-designed attachment bolt into each manway flange opening through the corresponding manway cover opening a sufficient distance whereby the attachment bolt extends beyond the outside, back surface of the manway flange a distance greater than a thickness of one of the hinge plates, the specially-designed attachment bolt having a threaded portion with a first threaded end and a second threaded end, and a hinge plate portion having a diameter smaller than a minor diameter of the threaded portion wherein the hinge plate portion extends from the second threaded end to a distal hinge plate portion end wherein the distal hinge plate portion end has a transverse opening through the hinge plate portion, the attachment bolt being inserted a sufficient distance whereby the transverse opening extends beyond the hinge plate opening of the one of the pair of hinge plates;
 - aligning the hinge plate opening of the hinge plate with one of the plurality of bolt openings of the portion of the manway cover and the manway flange from which the bolts were removed and in which the attachment

bolt was inserted and positioning the hinge plate against the manway flange;

inserting a removable retaining pin into the transverse opening of the hinge plate portion of the attachment bolt;

retracting the attachment bolt to a point in the manway flange opening whereby the retaining pin retains the hinge plate against the manway flange;

inserting a pin into each hinge opening of one of the pair of hinge plates connected to the outside front surface of the manway cover and corresponding manway cover opening; and

securing each pin within the corresponding manway cover opening.

5. An attachment bolt assembly for securing a hinge plate of a portable manway hinge to a manway flange, the attachment bolt assembly comprising:

an attachment bolt having a threaded portion and a hinge plate portion connected to the threaded portion wherein the threaded portion has a first threaded end and a second threaded end, the first threaded end adapted for connecting a bolt turning tool to thereby move the threaded portion into and out of a threaded flange bolt opening, and wherein the hinge plate portion has a diameter smaller than a minor diameter of the threaded portion and extending from the second threaded end a predefined distance to a distal hinge portion end, the distal hinge portion end having a transverse opening through the hinge plate portion wherein the hinge plate portion is adapted to extend through a hinge plate opening in a hinge plate of the portable manway hinge and adapted to provide a length between the second threaded end and the transverse opening sufficient to position the transverse opening beyond the hinge plate when assembled to the manway flange; and

a removable retaining pin insertably disposed within the transverse opening of the hinge plate portion whereby the removable retaining pin is adapted to retain the hinge plate against the manway flange when the

threaded portion is turned to retract the hinge plate portion into the manway flange opening.

6. The attachment bolt of Claim 5 wherein the first threaded end has a slot transverse to the first threaded end.
7. The attachment bolt of Claim 5 wherein the first threaded end has either a male extension or a female recess adapted for receiving one of an allen-tipped tool, a star-tipped tool, a phillips-tipped tool, and a flat-tipped tool.

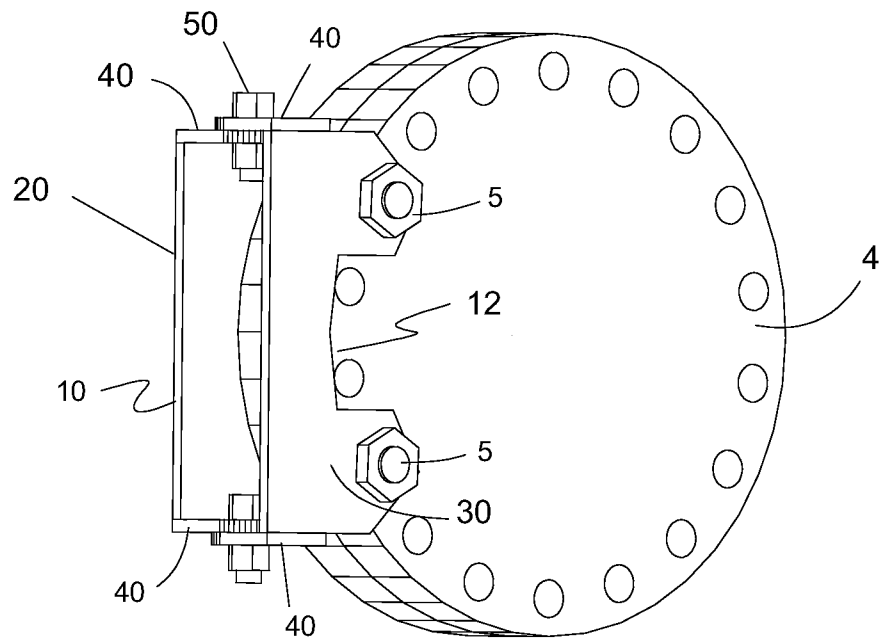


Fig. 1A - *Prior Art*

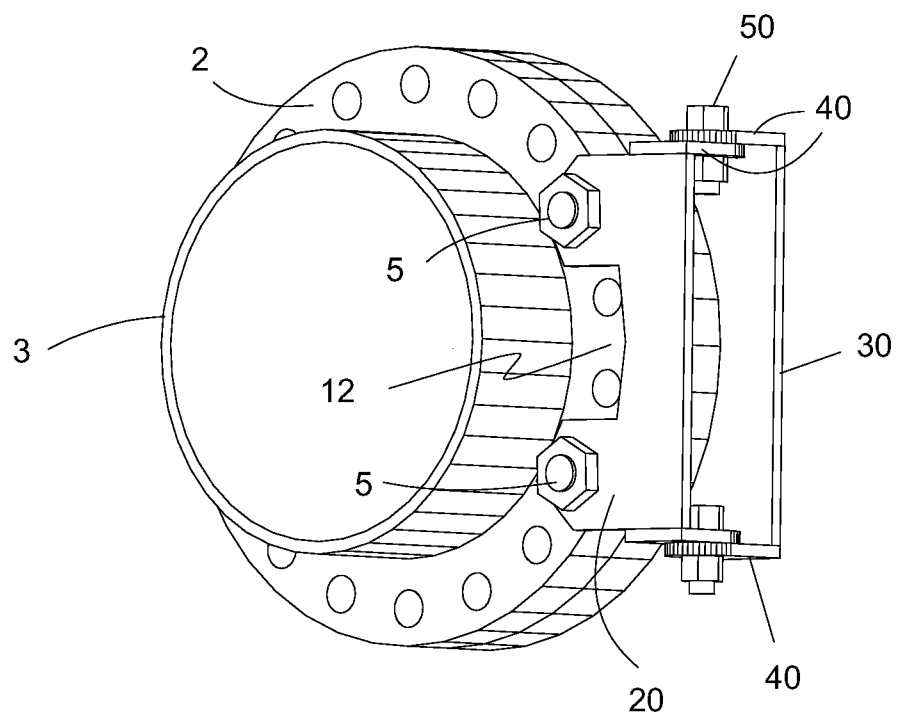


Fig. 1B - *Prior Art*

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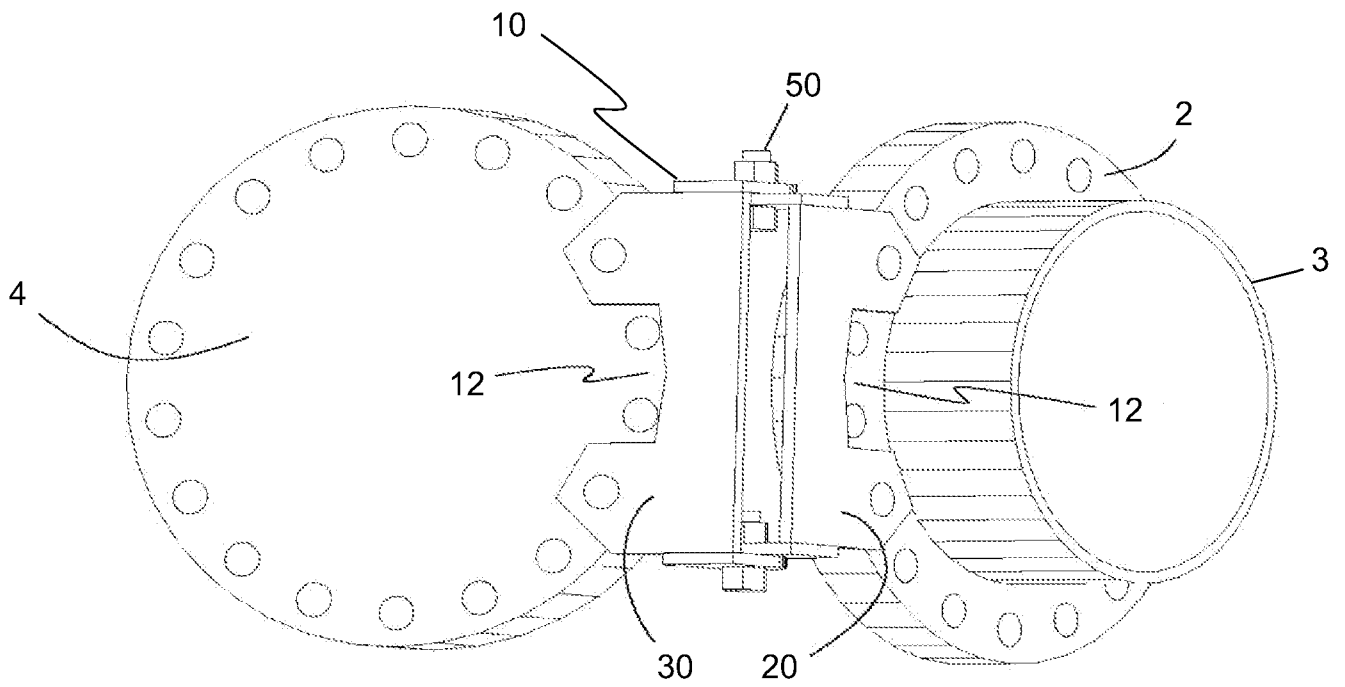


Fig. 1C - *Prior Art*

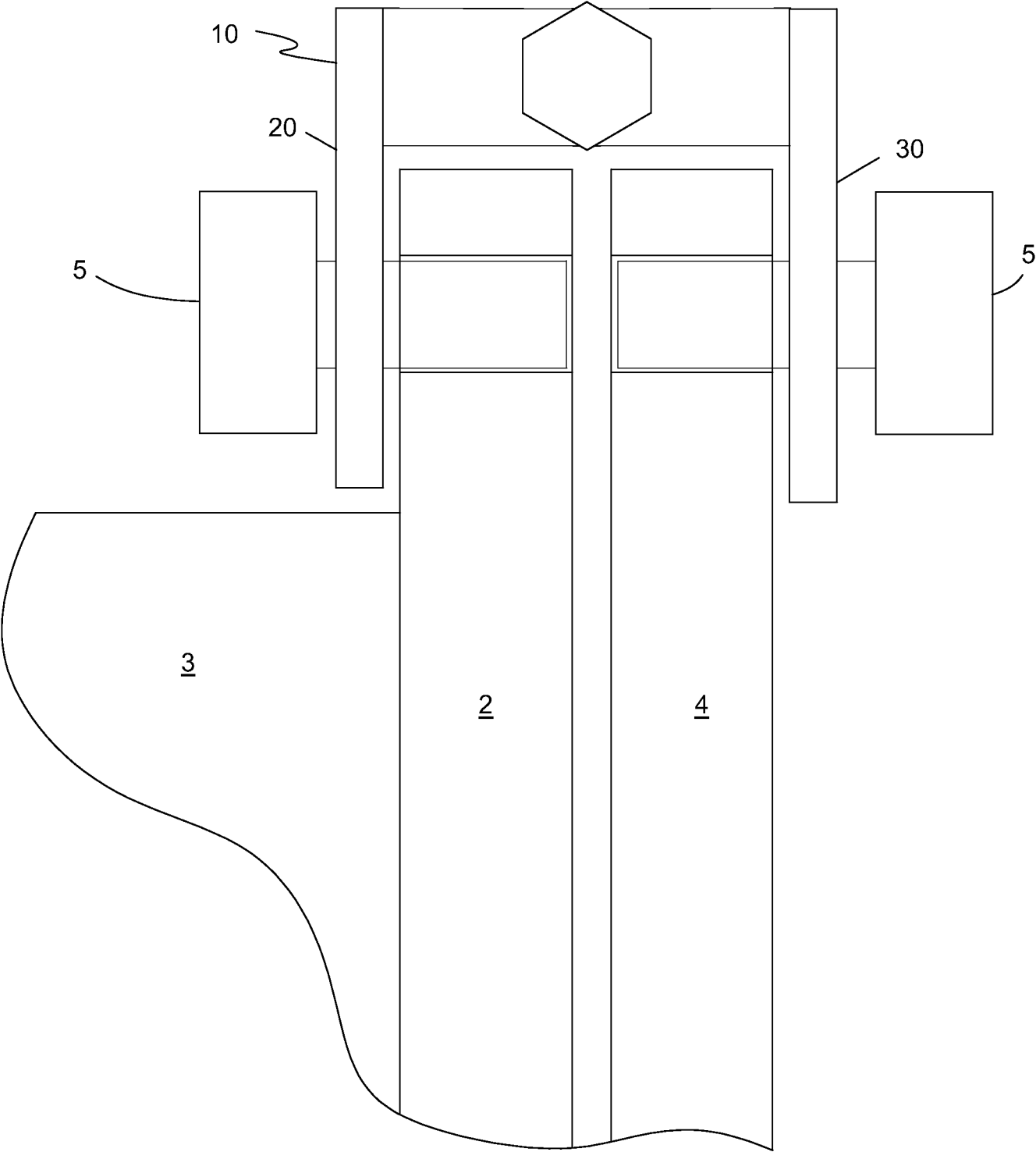


Fig. 2 - *Prior Art*

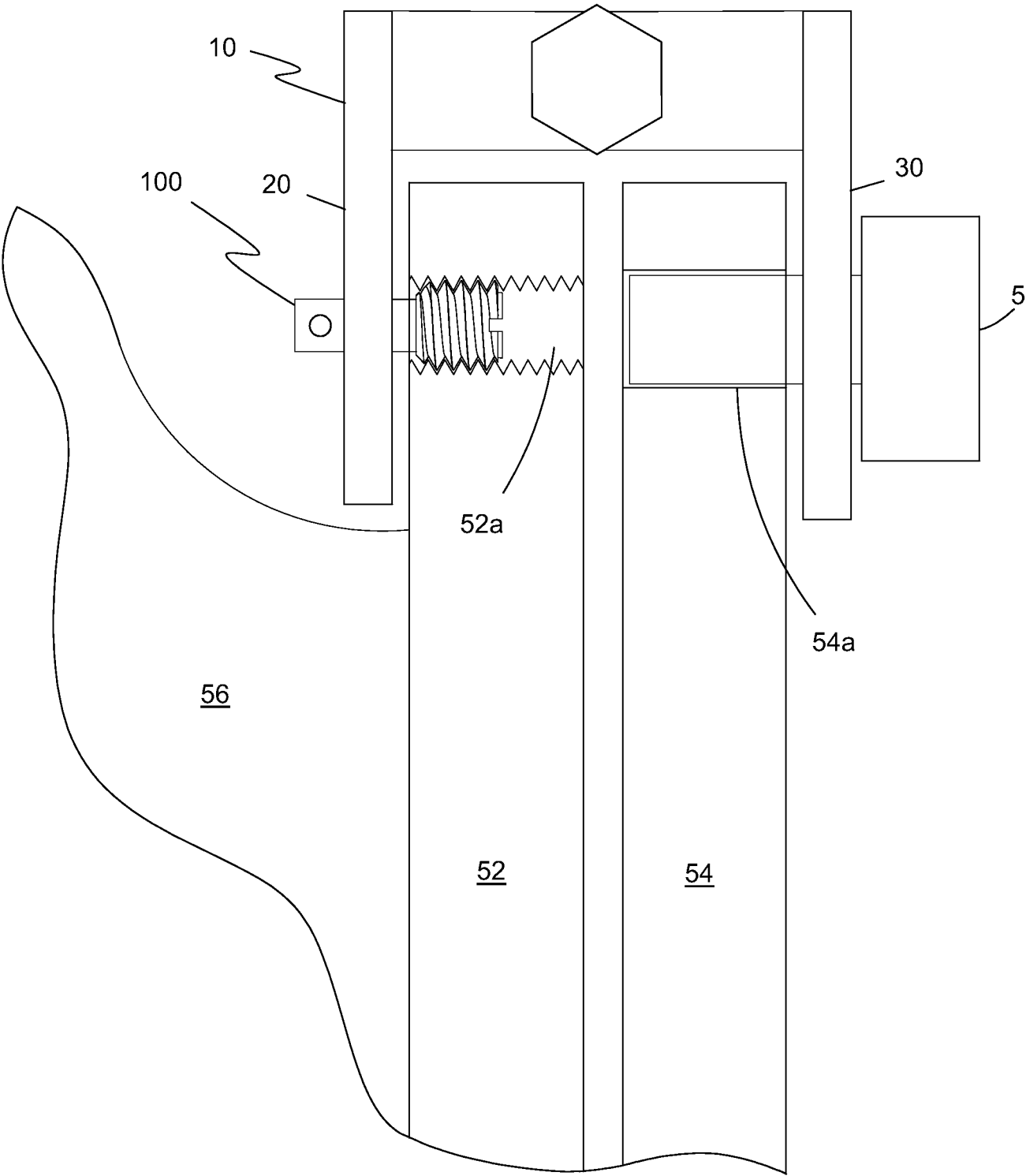


Fig. 3

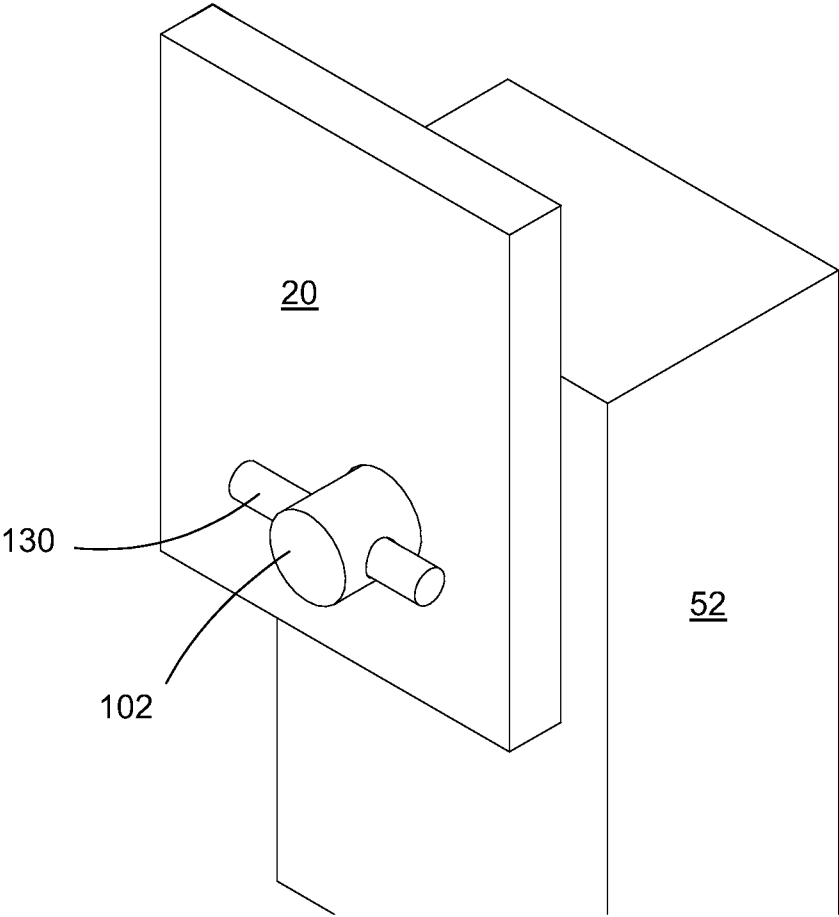


Fig. 4

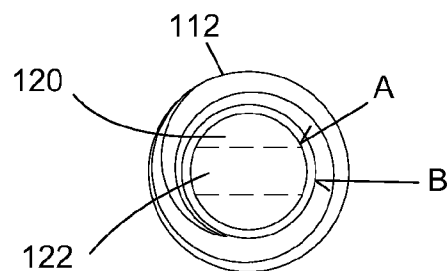
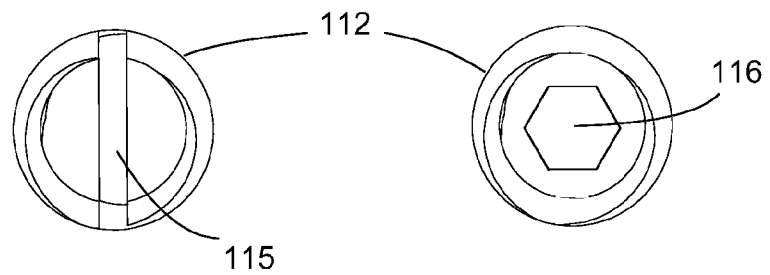
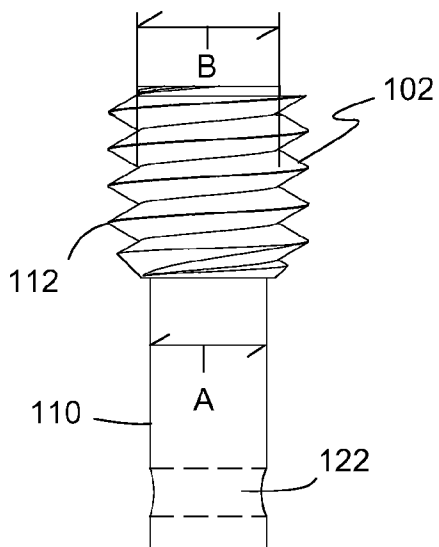
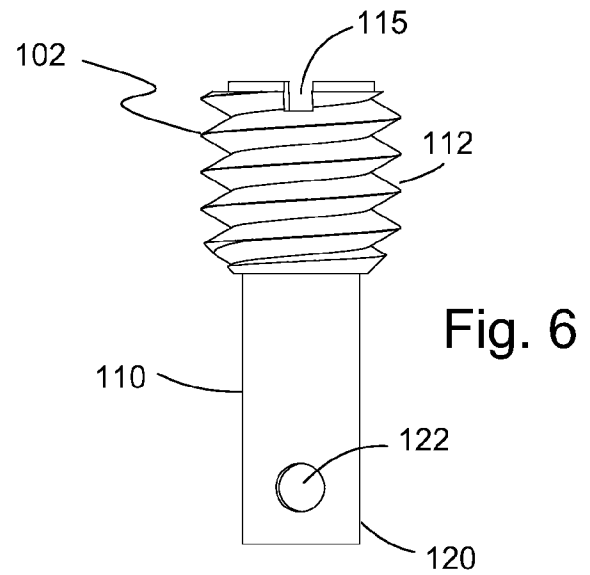
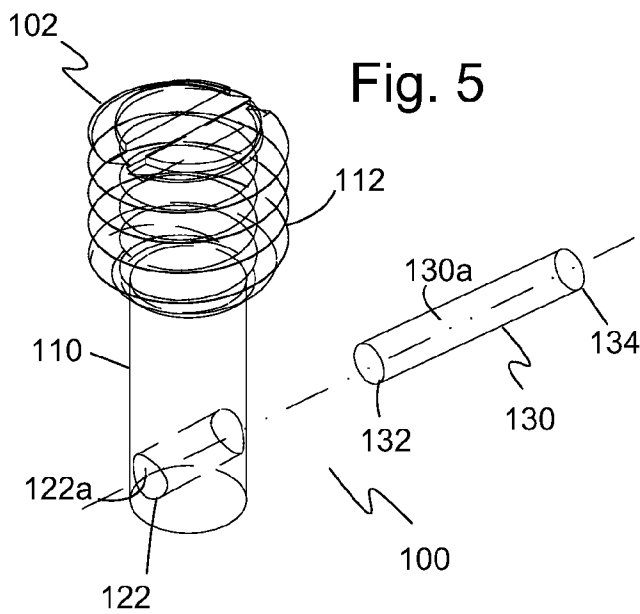


Fig. 11

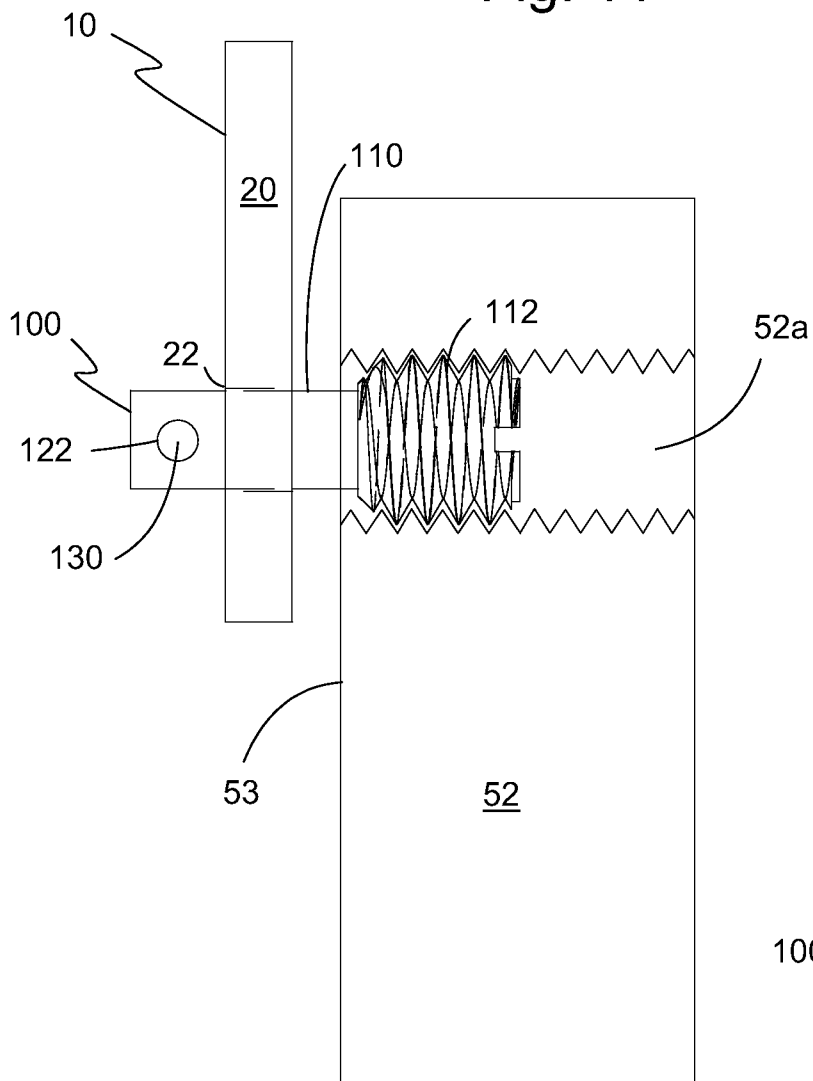
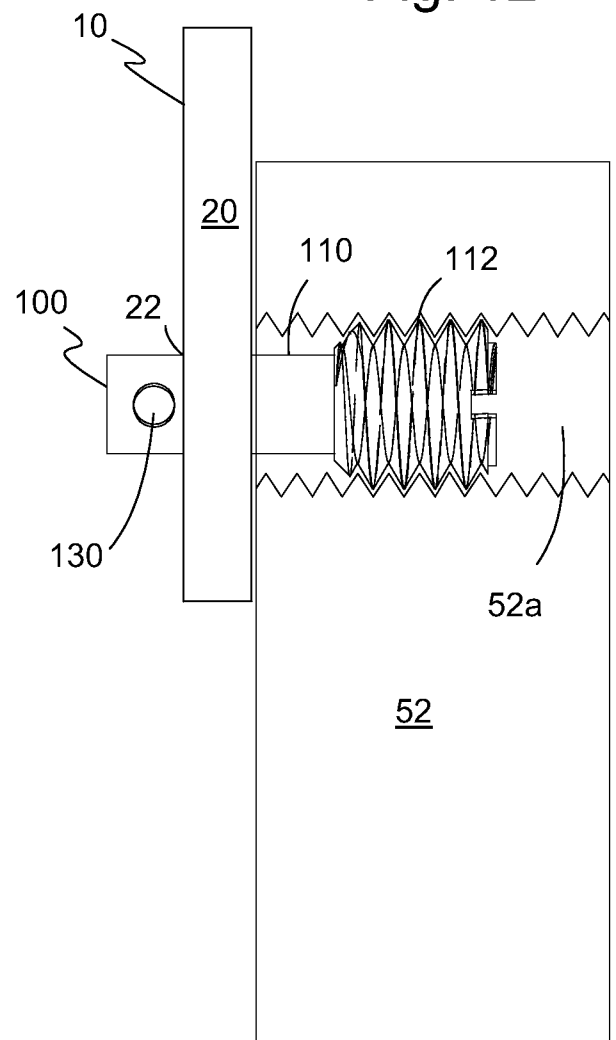


Fig. 12



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/038424**A. CLASSIFICATION OF SUBJECT MATTER****B65D 90/10(2006.01)i, F16B 35/04(2006.01)i, F16B 21/12(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B65D 90/10; F16B 35/04; B65D 51/04; F16B 29/00; F16B 13/08; F16B 21/12

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & keywords: portable, manway, hinge, attachment bolt, hinge plate, threaded portion, retaining pin, and transverse opening**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2011-0017759 A1 (DEPIETRO, EDWARD A.) 27 January 2011 See paragraphs [0107]-[0109] and figures 15A-16C.	1-4
A		5-7
X	WO 00-52345 A1 (FUSCO, PASQUALE) 08 September 2000 See page 4, line 20 - page 6, line 23 and figures 1-5.	5-7
Y		1-4
A	US 1075759 A (BURRIDGE, ALBERT E.) 14 October 1913 See page 1, left column, line 38 - page 2, left column, line 40 and figures 1-3.	1-7
A	JP 02-057711 A (SHIMABUKURO, RINPEI) 27 February 1990 See claim and figures 1-3.	1-7
A	US 2013-0078051 A1 (LISON et al.) 28 March 2013 See paragraphs [0056]-[0057] and figures 2-5.	1-7



Further documents are listed in the continuation of Box C.



See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

07 April 2016 (07.04.2016)

Date of mailing of the international search report

08 April 2016 (08.04.2016)

Name and mailing address of the ISA/KR

International Application Division

Korean Intellectual Property Office

189 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea

Facsimile No. +82-42-481-8578

Authorized officer

RHEE, Jun Ho

Telephone No. +82-42-481-8288



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2015/038424

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