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Neighbor

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(54) **TEMPORARY SUPPORT STRUCTURE**

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E02D 37/00 (2006.01)
F16M 11/24 (2006.01)

(52) **U.S. Cl.**
CPC ***E02D 37/00*** (2013.01); ***F16M 11/24*** (2013.01); *E02D 2220/00* (2013.01)

(58) **Field of Classification Search**
CPC E04H 12/2253; E04H 12/2269; E04H 12/2292; E02D 5/64; E02D 37/00; E02D 2220/00; F16M 11/24
See application file for complete search history.

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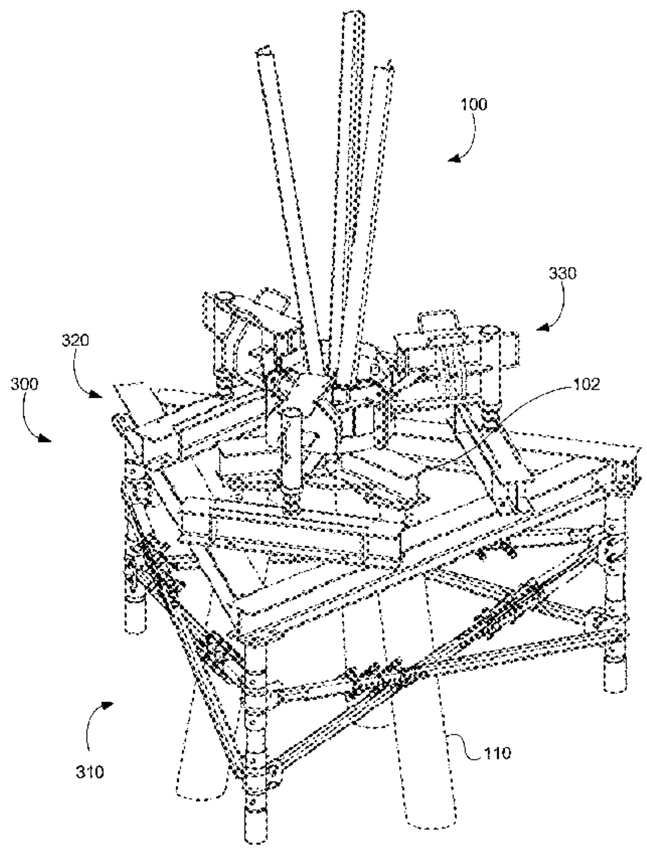
(57) **ABSTRACT**

The disclosed technology includes temporary support structures for use in the repair of a transmission tower. A typical transmission tower includes a tripod that receive the load of the tower and distributes it to piles embedded in the ground. A temporary support structure may temporarily remove the load of the transmission tower from the tripod to allow the tripod to be removed and replaced with a new tripod. A temporary support system may include a pile temporary support system, a beam support structure supported by the pile temporary support system, and a flower pot adapter lifting assembly configured to attach to a portion of the transmission tower to transfer a load of the transmission tower to the beam support structure.

20 Claims, 11 Drawing Sheets



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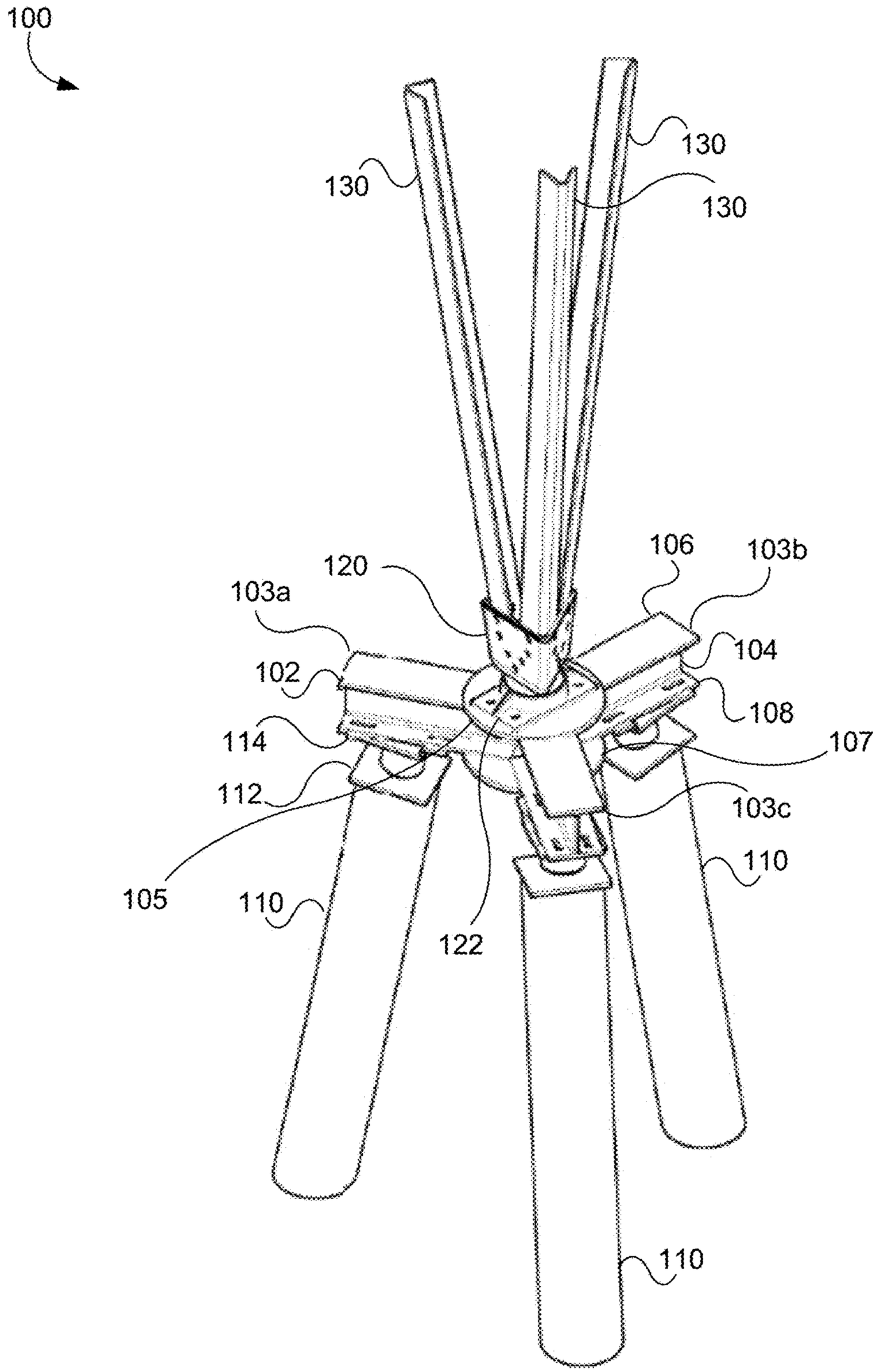

100
130
130
130
120
103a
106
103b
104
102
108
114
107
112
103c
110
105
110
122
110

FIG. 1

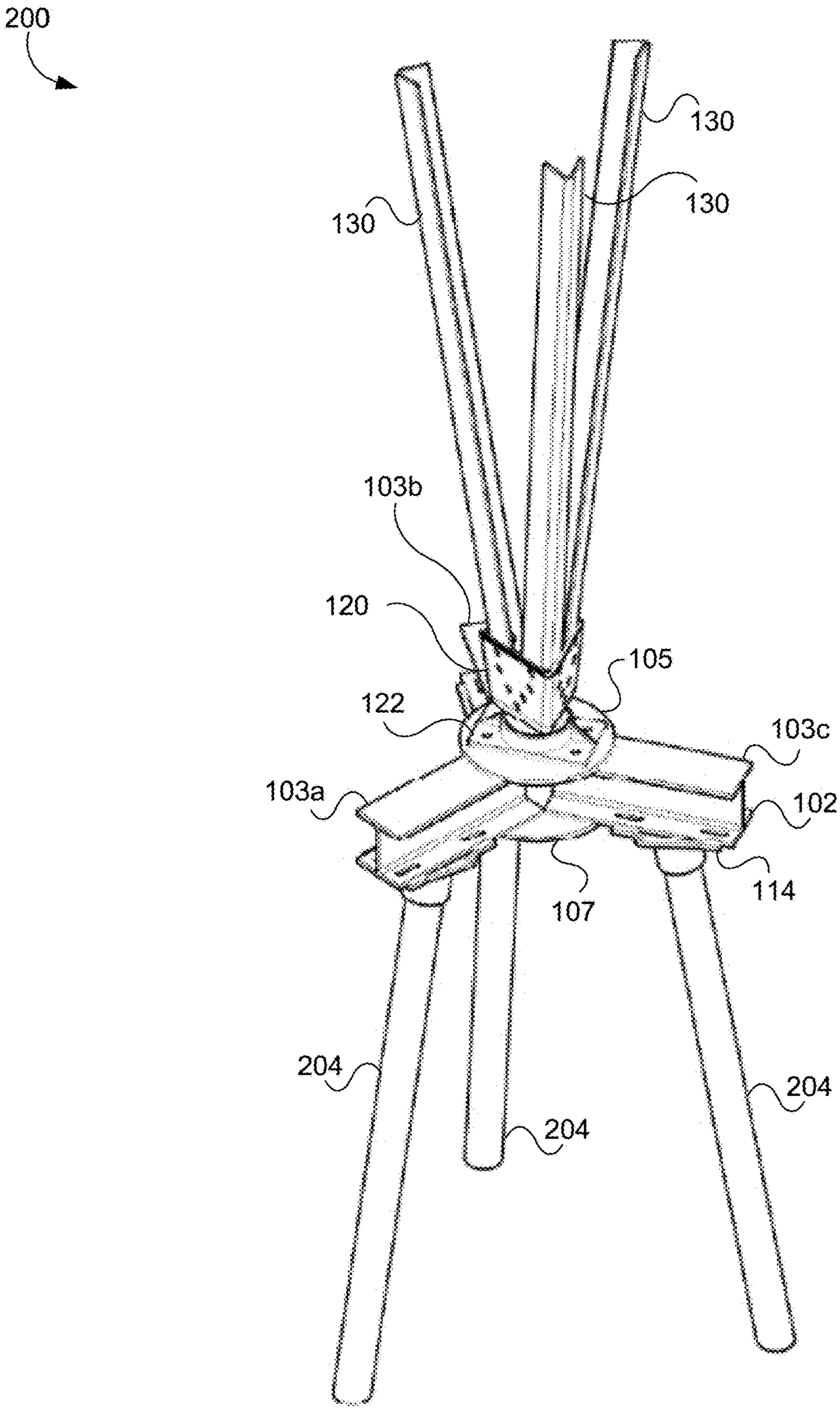

200
130
130
130
103b
120
105
122
103c
103a
102
107
114
204
204
204

FIG. 2

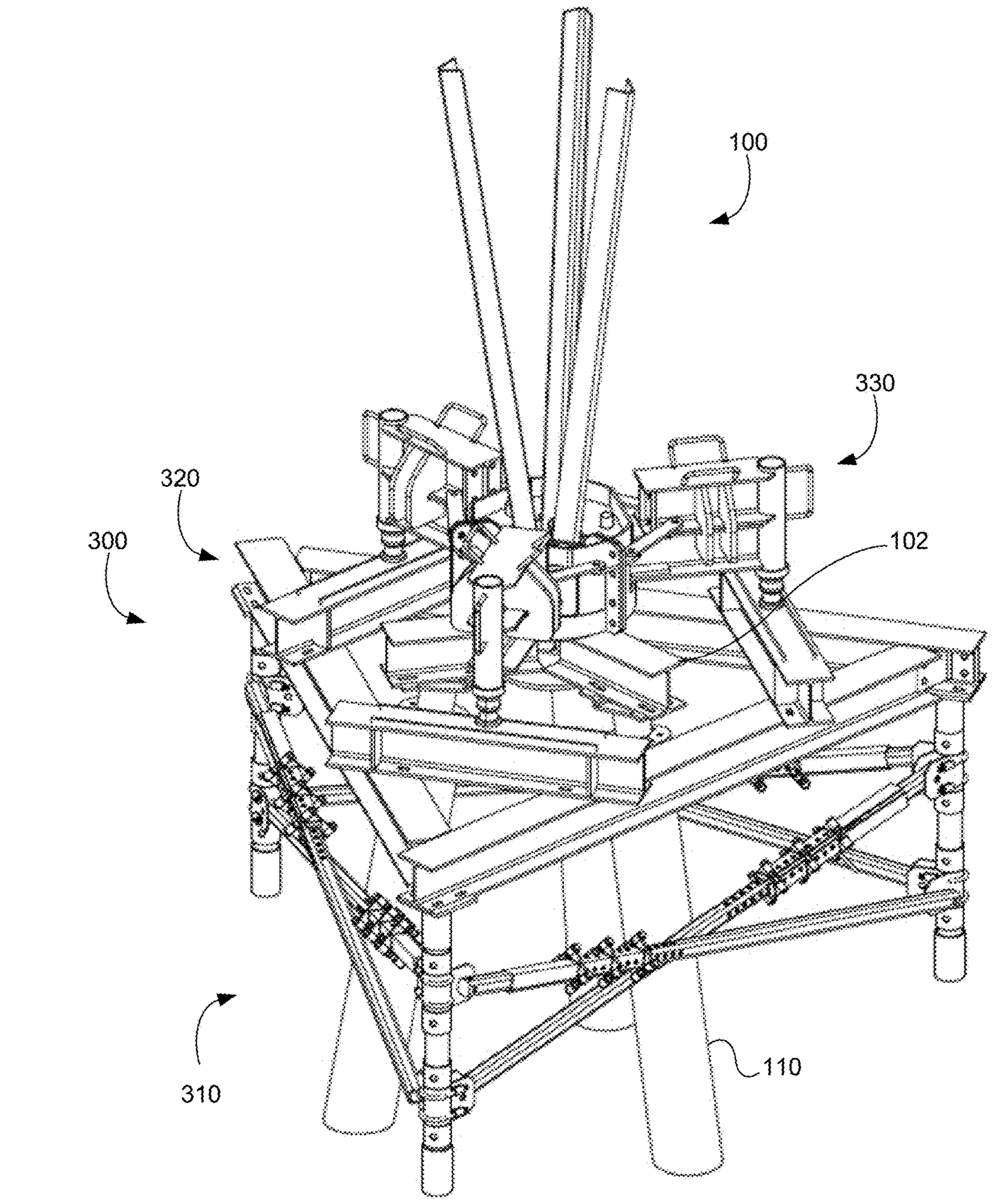


FIG. 3

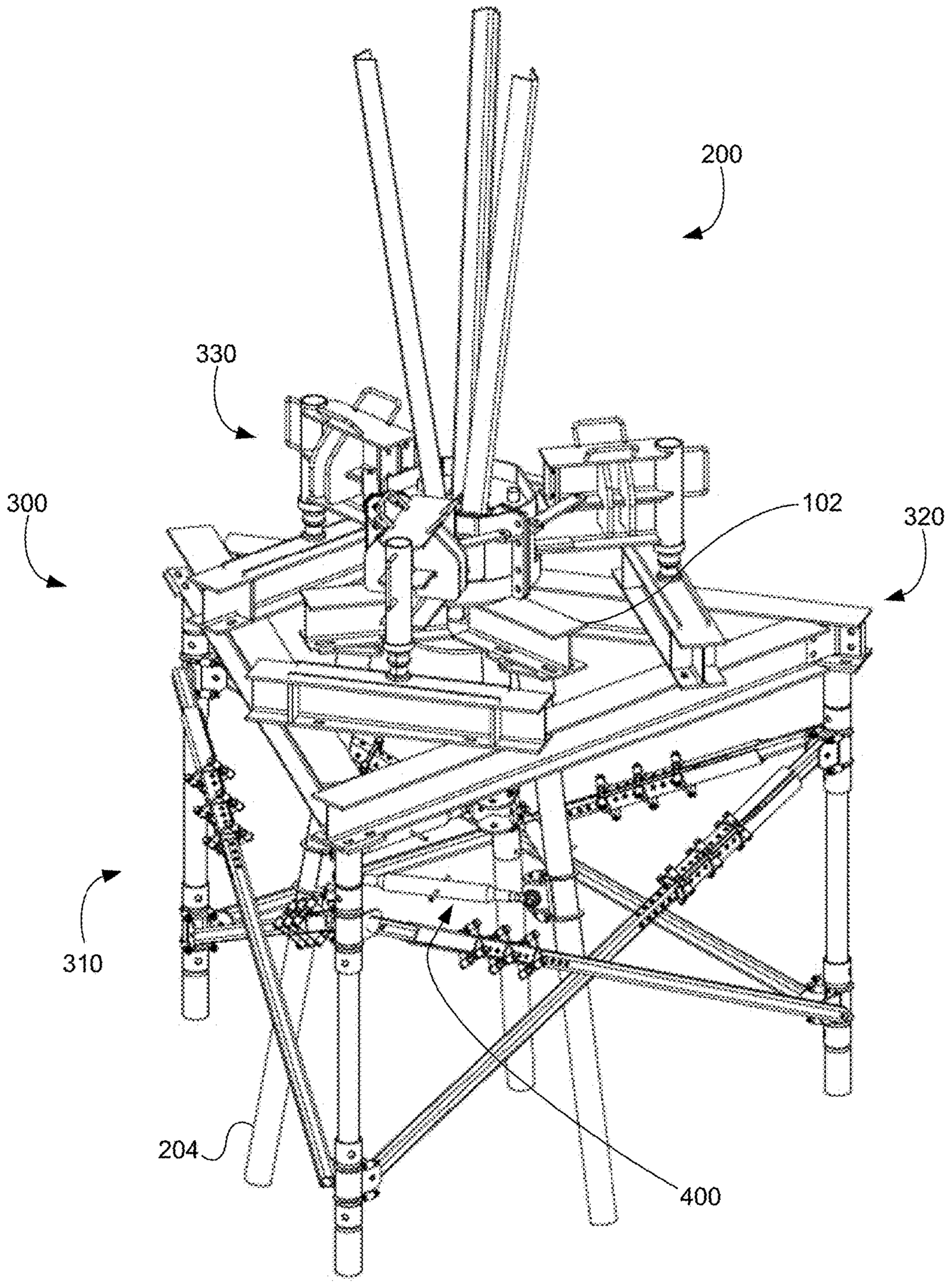


FIG. 4

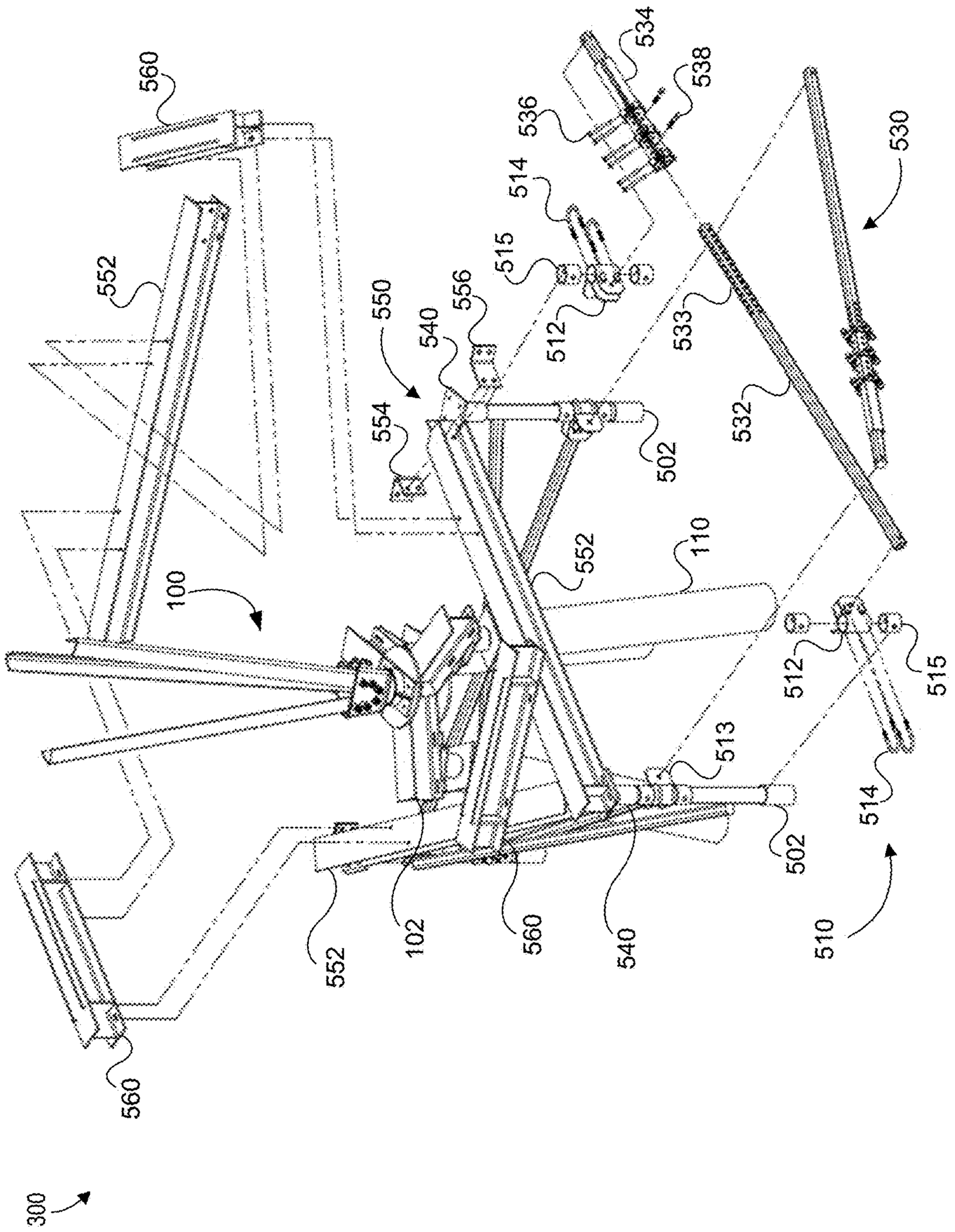

560
552
534
538
536
514
515
550
540
556
512
533
554
502
532
100
110
513
102
510
300

FIG. 5

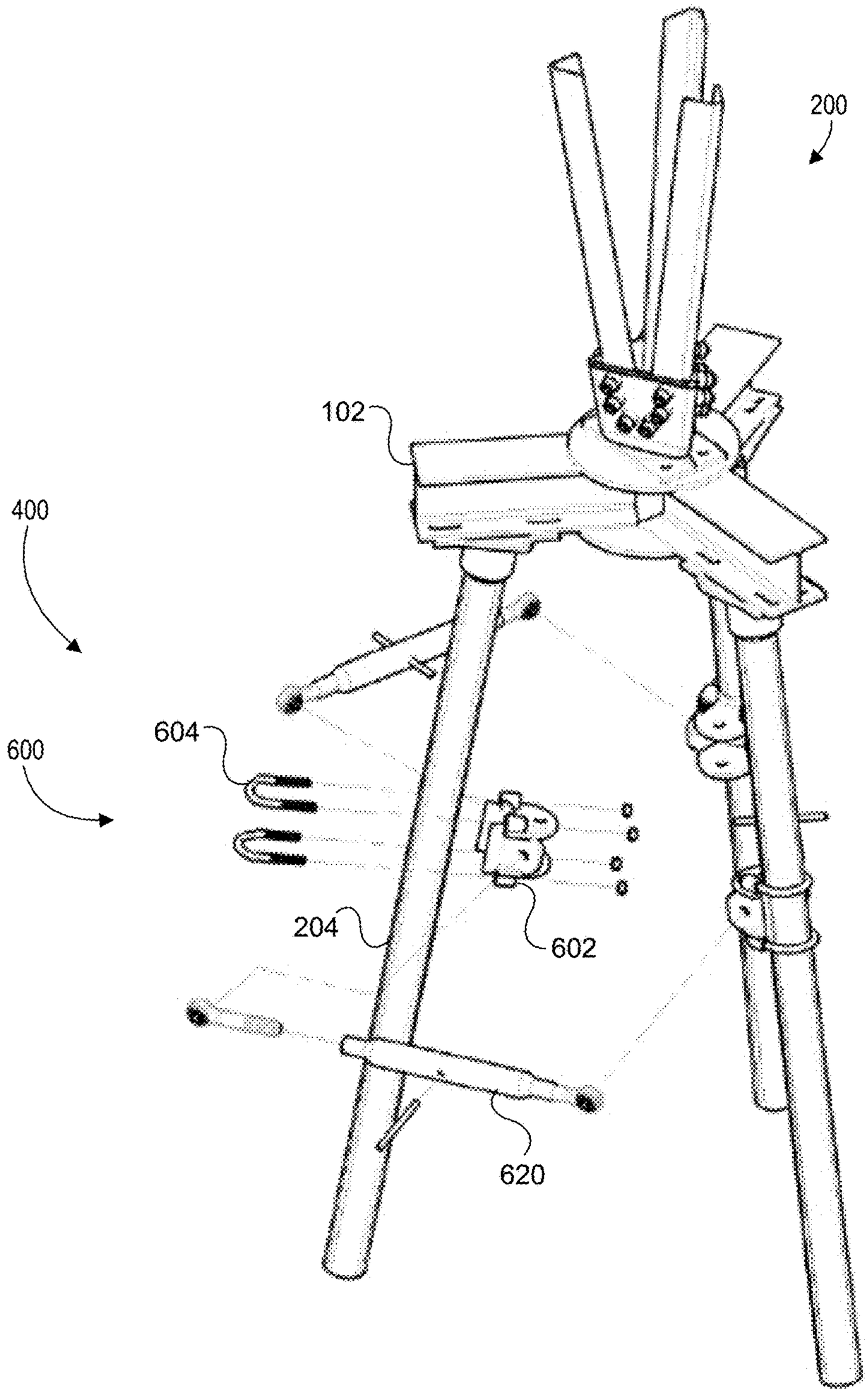


FIG. 6

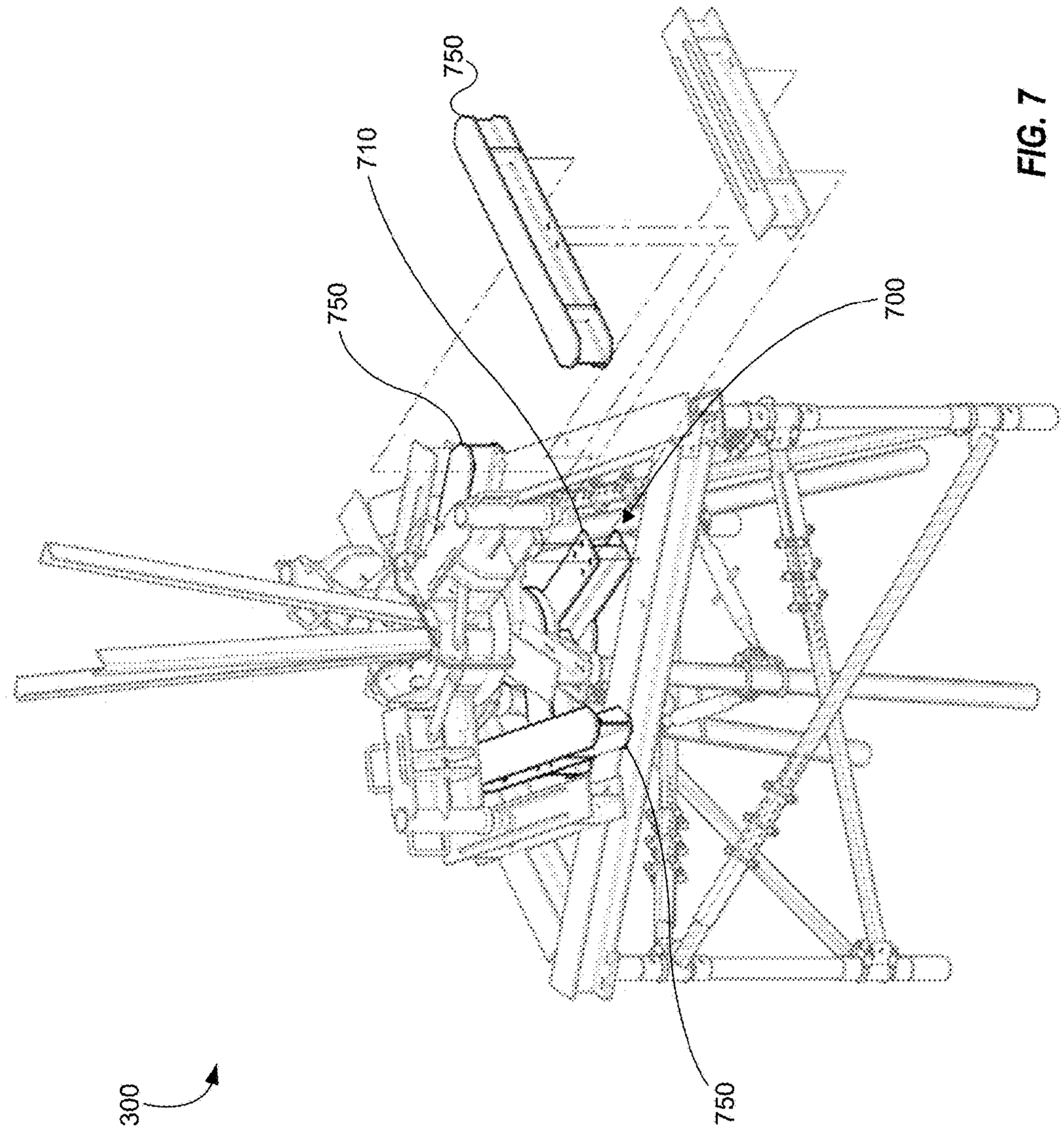


FIG. 7

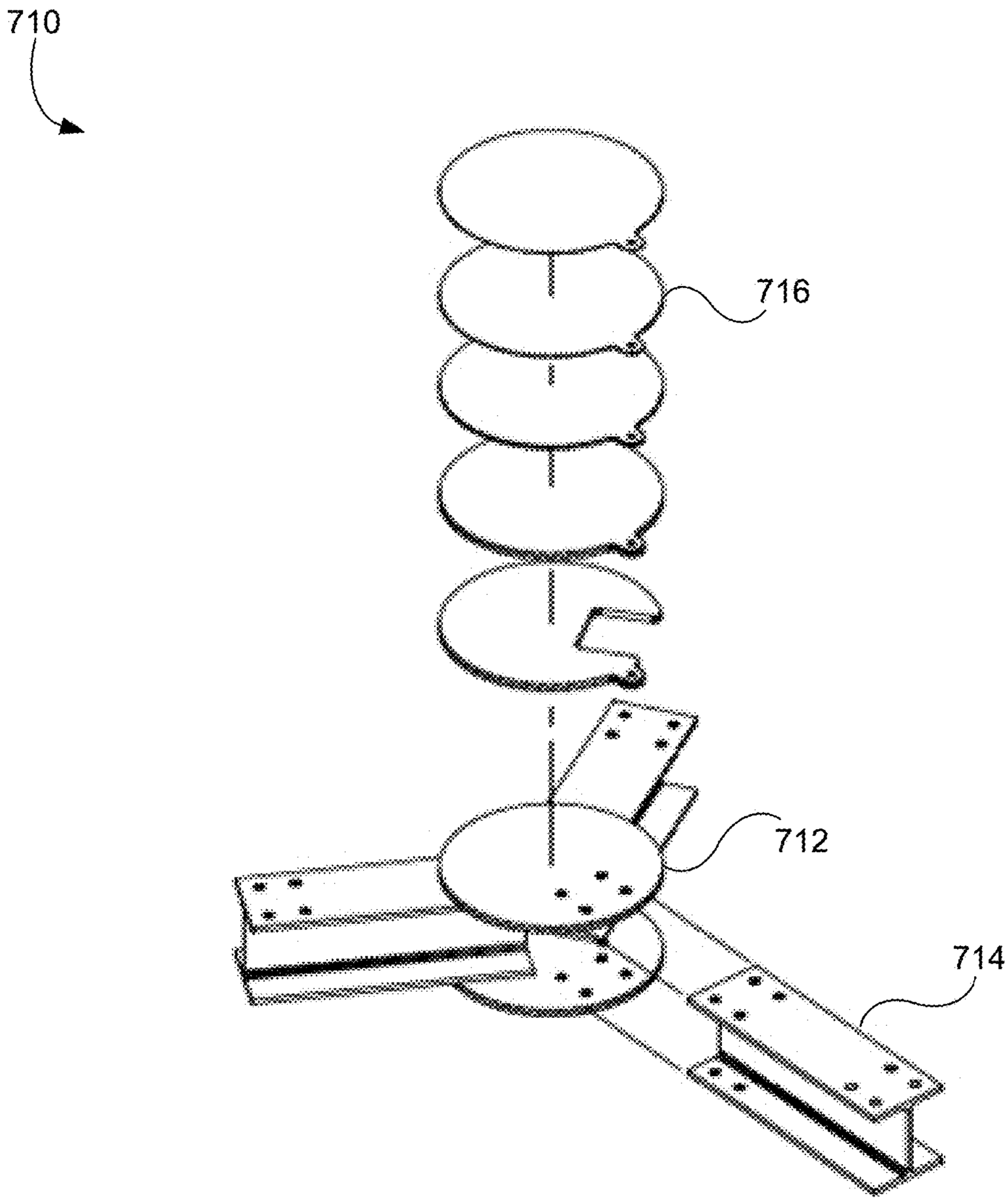
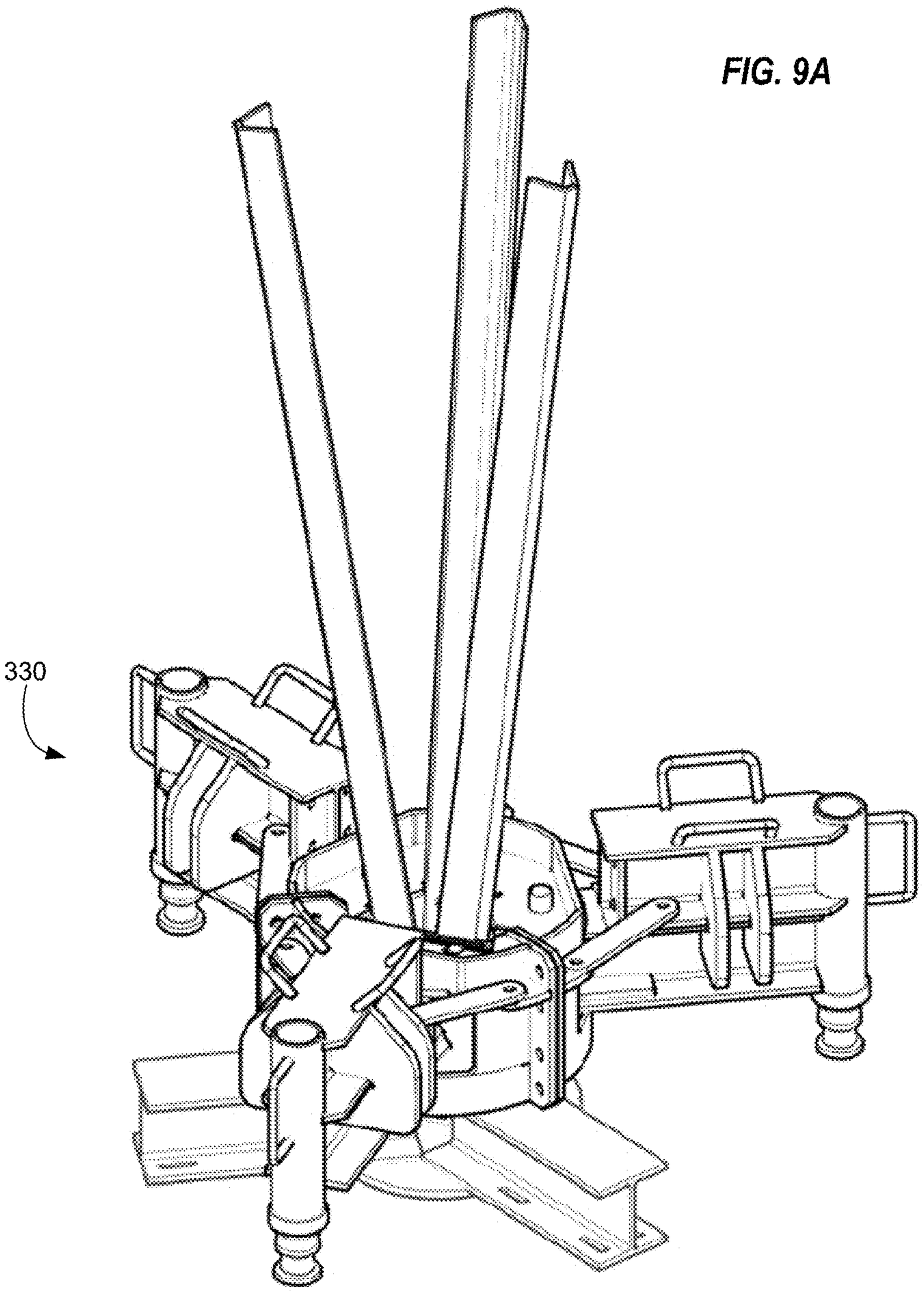


FIG. 8

FIG. 9A



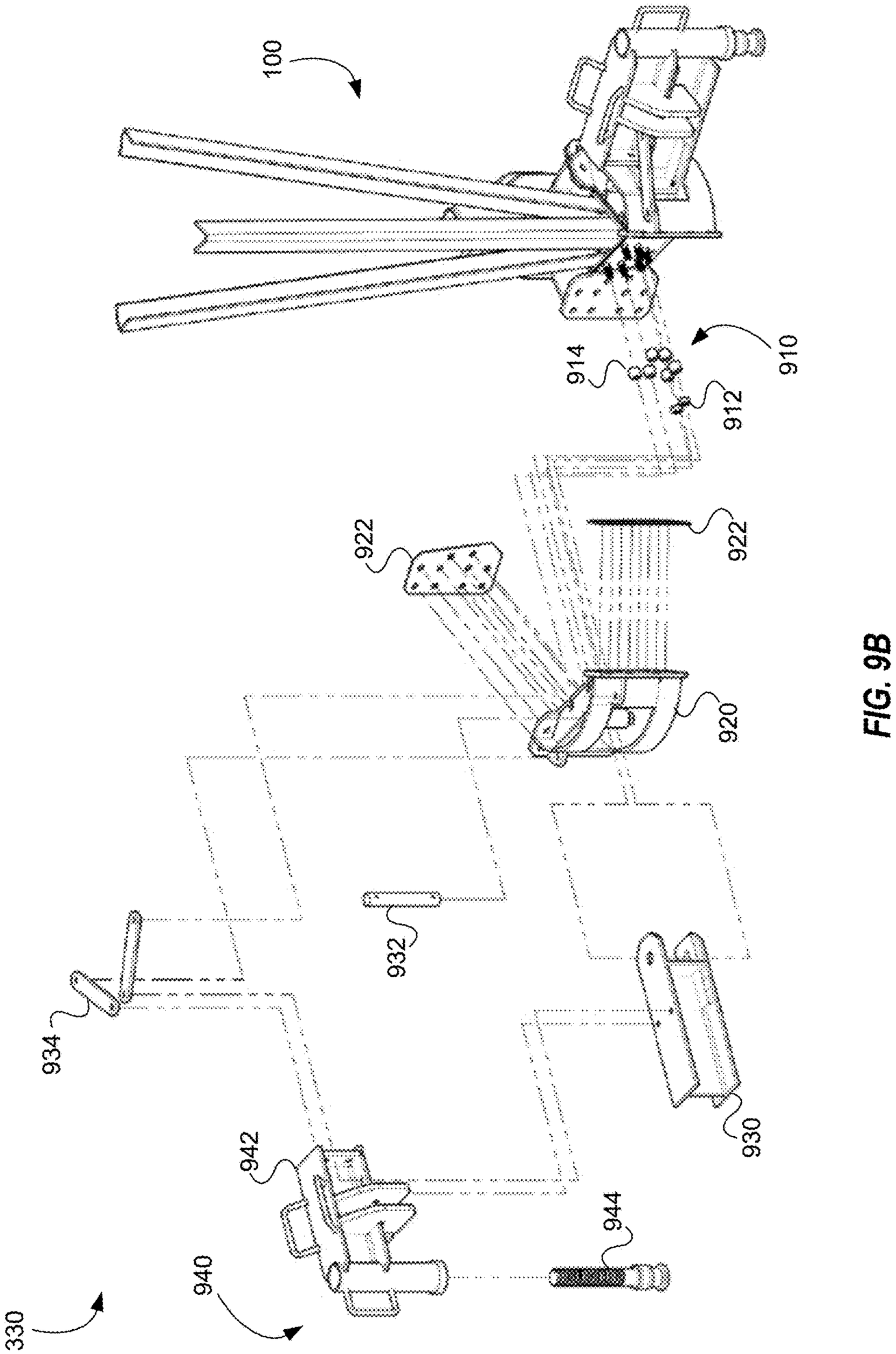


FIG. 9B

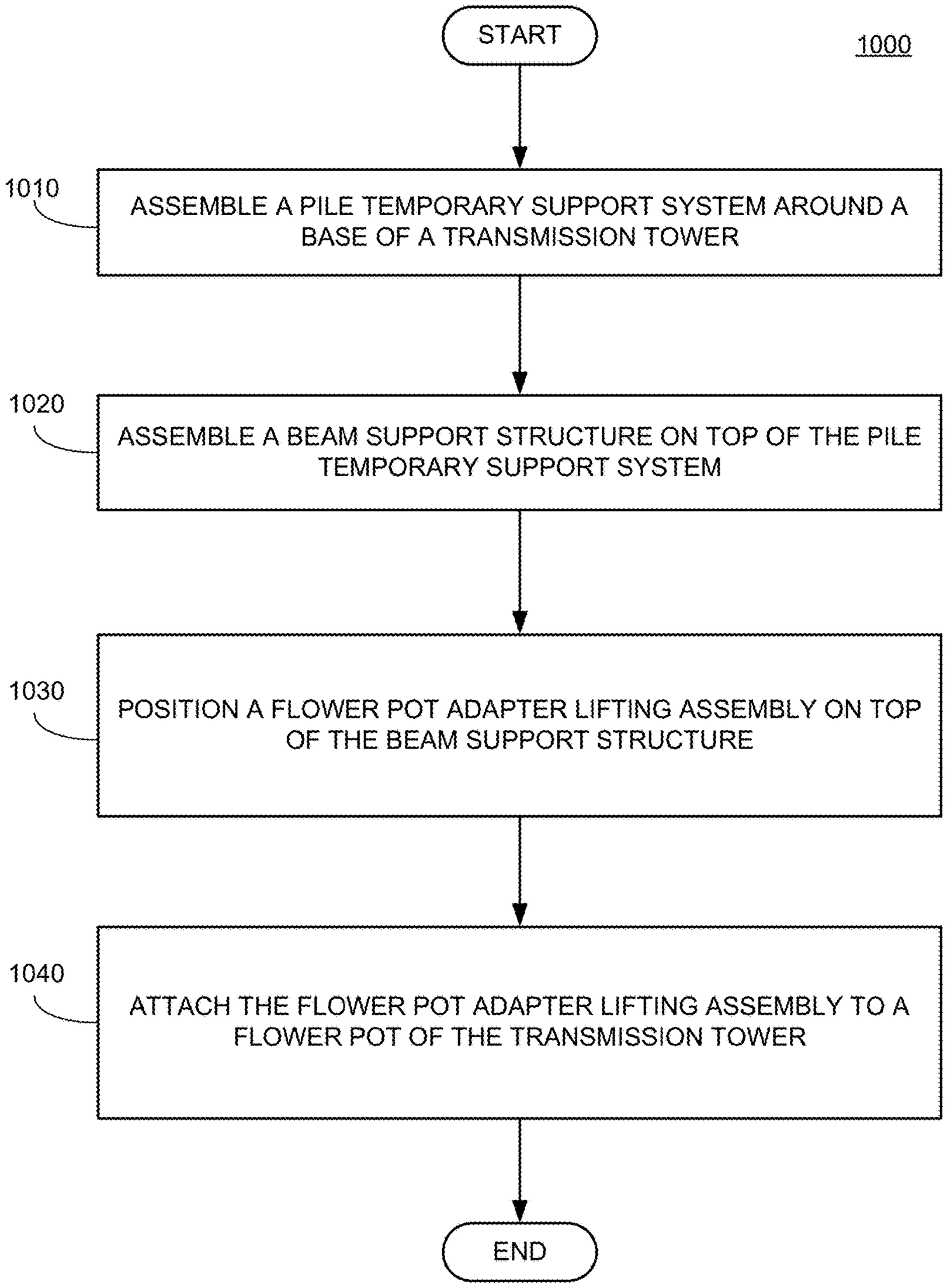

START
1000
1010
ASSEMBLE A PILE TEMPORARY SUPPORT SYSTEM AROUND A BASE OF A TRANSMISSION TOWER
1020
ASSEMBLE A BEAM SUPPORT STRUCTURE ON TOP OF THE PILE TEMPORARY SUPPORT SYSTEM
1030
POSITION A FLOWER POT ADAPTER LIFTING ASSEMBLY ON TOP OF THE BEAM SUPPORT STRUCTURE
1040
ATTACH THE FLOWER POT ADAPTER LIFTING ASSEMBLY TO A FLOWER POT OF THE TRANSMISSION TOWER
END

FIG. 10

TEMPORARY SUPPORT STRUCTURE

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of U.S. Provisional Application Nos. 62/513,014, 62/512,944, 62/513,072, and 62/513,097, all filed 31 May 2017, the entire contents and substance of which are hereby incorporated by reference.

BACKGROUND

Many electrical transmission utility companies utilize guyed lattice tower assets supported by a tripod beam that bears on steel piles (e.g., helical piles), such as 3" small diameter steel pipe piles or 8" large diameter steel pipe piles. These towers are often located in remote wetlands or tidal areas that have fluctuations in the tidal water surface elevation that can lead to accelerated corrosion of the tripod support beam, as well as brackets and adapters positioned at the interfaces between the bottom of the tripod support beam and the top of the support piles. When the tower foundation is in a severe state of deterioration, traditionally a utility's best option was to replace the tower, which is costly and may cause significant environmental disruption to the environmentally sensitive areas in which many such towers are located. The many challenges associated with replacement of such towers, such as environmental access, environmental preservation, critical service requirements, and budgetary issues can make tower replacement a very impractical solution. Therefore, a low impact, moderate cost solution that enables the repair of a tower tripod beam, bracket, and/or adapter without the need to replace the tower would provide economic and environmental benefits. In some cases, a tripod beam of a guyed lattice tower may be so severely deteriorated that it may not be practical to reinforce the structure of the tripod beam, but instead it may be necessary to replace the tripod beam entirely. Accordingly, there is a need for an apparatus that may allow for the replacement of the tripod beam, as well as the associated brackets and adapters, without moving the tower or removing the tower from service.

SUMMARY

Some or all of the above deficiencies may be addressed by certain embodiments of the disclosed technology. For example, embodiments of a temporary support structure ("TSS") as described herein may enable the replacement of the tripod beam, as well as the associated brackets and adapters, without moving the transmission tower or removing the tower from service. The TSS may also enable comprehensive pile repair, such as removing and replacing sections of piles, while the tower load path has been transferred to the TSS. The TSS may be capable of supporting the entire load of a tower, as well as lifting the entire tower.

In general, a TSS may allow a guyed lattice mast tower to be temporarily supported (and raised, if required) independent of the existing foundation piles so that the tripod beam, the brackets, and/or pile adapters of the tower can be replaced, and the upper portions of the piles can be restored. In some embodiments, the TSS may include a pile temporary support system (PTSS) that is a bracket system that allows piles to be driven with diagonal cross bracing attached. The PTSS may allow temporary supports to transfer tower loads to an independent pile system.

According to some embodiments, a TSS may utilize a PTSS to support the temporary support bearing frame of the TSS. A PTSS may have temporary piles that have upper and lower brackets for supporting bracing. For example, the lower bracket of a temporary pile may have a brace attached to the bracket and then the lower bracket of the temporary pile may be driven into an inaccessible location (e.g., below the water line of a swamp) as the pile is driven into the ground, however it may be positioned in such a fashion that the brace extends diagonally upwards out of the inaccessible location (e.g., the brace extends out of the water line at a diagonal angle). At a later point, the cross bracing may be attached to adjacent temporary piles such that bracing attached to a lower bracket on one temporary pile may be attached to an upper bracket of an adjacent pile. After the temporary piles are installed into the ground with the appropriate bracing attached, pile caps may be installed on top of the temporary piles to support the temporary support bearing frame of the TSS. In some embodiments, the pile caps may have bolt holes that align with bolt holes or attachment slots in the bottom of a bearing beam that is attached to the top of the pile cap. Temporary support bearing beams may then be installed on top of the pile caps. In some embodiments, the temporary support bearing beams may form a triangle with three sides, wherein each side is positioned to be approximately perpendicular to a corresponding arm of the existing tripod beam, as shown below. A transfer beam may be installed on top of each pair of adjacent temporary support bearing beams as shown below. In some embodiments, an under-hung temporary tripod beam may be installed under the existing tripod beam to provide additional support if the existing tripod beam is so degraded that it may not support the flower pot adapter and beams. A flowerpot adapter may be installed above the existing tripod beam to transfer the load of the tower to the TSS. The flowerpot adapter may be held by, for example, three jack supports, where each jack support is positioned to rest on top of a corresponding transfer beam as shown below. Once the load of the tower is transferred to the TSS, the existing tripod, brackets, and pile adapters may freely be replaced.

According to an example embodiment, a temporary support structure is provided. The temporary support structure may include a pile temporary support system including a plurality of piles. Each of the plurality of piles may have a base portion that may be configured to be installed into the ground and a pile cap on a top end of the pile. The temporary support structure may include a beam support structure configured to be installed on top of and supported by the pile temporary support system. The beam support structure may include at least a first plurality of support beams. The temporary support structure may also include a flower pot adapter lifting assembly configured to attach to a portion of a transmission tower and to be installed on top of the beam support structure to transfer a load of the transmission tower to the beam support structure and onto the pile temporary support system.

According to an example embodiment, a method of removing the load from a tripod of a transmission tower is provided. The method may include assembling a pile temporary support system including a plurality of piles around a base of a transmission tower. Each of the plurality of piles may have a base portion installed into the ground and may have a pile cap on a top end of the pile. The method may include assembling a beam support structure on top of the pile temporary support system such that the pile temporary support system supports the beam support structure. The

beam support structure may include at least a first plurality of support beams. The method may include positioning a flower pot adapter lifting assembly on top of the beam support structure such that the beam support structure supports the flower pot adapter lifting assembly (i.e., the load of the flower pot adapter lifting assembly may be transferred to the beam support structure). The method may further include attaching the flower pot adapter lifting assembly to a flower pot of the transmission tower. The flower pot may be positioned above the tripod (i.e., the existing tripod beam) and may be configured to hold the guyed lattice mast of the transmission tower. Following the execution of these steps, the load of the transmission tower may be transferred from the transmission tower to the flower pot adapter lifting assembly, from the flower pot adapter lifting assembly to the beam support structure (e.g., from the flower pot adapter lifting assembly to transfer beam assembly and from the transfer beam assembly to the bearing beam assembly), and from the beam support structure to the pile temporary support system.

Other embodiments, features, and aspects of the disclosed technology are described in detail herein and are considered a part of the claimed disclosed technology. Other embodiments, features, and aspects can be understood with reference to the following detailed description, accompanying drawings, and claims.

BRIEF DESCRIPTION OF THE FIGURES

Reference will now be made to the accompanying figures and flow diagrams, which are not necessarily drawn to scale, and wherein:

FIG. **1** is a perspective view of a transmission tower tripod and large pile configuration, according to an example implementation.

FIG. **2** is a perspective view of a transmission tower tripod and small pile configuration, according to an example implementation.

FIG. **3** is a perspective view of an assembled temporary support structure for a transmission tower supported by large piles, according to an example implementation.

FIG. **4** is a perspective view of an assembled temporary support structure for a transmission tower supported by small piles having a small pile support structure, according to an example implementation.

FIG. **5** is a partially exploded perspective view of an assembled temporary support structure for a transmission tower supported by large piles, according to an example implementation.

FIG. **6** is a partially exploded perspective view of a transmission tower tripod and small pile configuration having an attached temporary small pile strut assembly, according to an example implementation.

FIG. **7** is a partially exploded perspective view of an assembled temporary support structure for a transmission tower with underhung two-piece temporary tripod assembly, according to an example implementation.

FIG. **8** is a partially exploded perspective view of an underhung two-piece temporary tripod assembly, according to an example implementation.

FIG. **9**A is a perspective view of a flower pot adapter lifting assembly assembled around a flower pot of a transmission tower, according to an example implementation.

FIG. **9**B is a partially exploded perspective view of a flower pot adapter lifting assembly assembled around a flower pot of a transmission tower, according to an example implementation.

FIG. **10** is a flow diagram of a method **1000**, according to an example implementation.

DETAILED DESCRIPTION

Embodiments of the disclosed technology include a temporary support structure and methods that can be used to repair a transmission tower and, in particular, may be used to replace a degraded tripod installed in the transmission tower without requiring removal of the tower from service or replacement of the tower itself. Embodiments of the disclosed technology include a temporary support structure having an underhung tripod assembly to allow replacement of a tripod that is not capable of supporting the flower pot adapter and screw back beams during the assembly of the temporary support structure, as described herein. Embodiments of the disclosed technology further include a temporary small pile strut assembly to stiffen small piles used to support the currently installed tripod during the process of removing said tripod. Further, although this disclosure is generally directed towards describing the repair or strengthening of transmission towers having a three-sided flower pot, it should be understood that the temporary support structure described herein may be used to repair a wide variety of other types of structures, towers, poles, or the like, including transmission towers have a four-sided flower pot (or any other number of sides) by modifying the flower pot adapter lifting assembly described herein to allow it to securely attach to the outer surface of a portion of said other type of structure, thereby allowing the load of the structure to be supported by the temporary support structure and providing the opportunity to replace parts of the structure from which the load has been temporarily removed.

According to certain embodiments, a temporary support structure according to the embodiments disclosed herein may be used temporarily to remove the load of a transmission tower from an installed tripod and place the load on the temporary support structure to allow removal and replacement of the installed tripod. Embodiments of the temporary support structure described herein may be used in conjunction with transmission towers having a large pile configuration and/or transmission towers having a small pile configuration. In addition to allowing removal and replacement of the installed tripod, other repairs may be made to the tower during installation, such as for example, trimming of corroded portions of piles and replacement of decaying pile adapters and/or pile brackets. According to some embodiments, the temporary support structure may securely support the load of the transmission tower about the flower pot of the tower. As will be appreciated by those of skill in the art, a flower pot may be a container that is configured to securely hold the legs of the transmission tower. Once a tripod has been removed and a new tripod has been attached to the piles and/or pile adapter/brackets, the flower pot that is being held up by the temporary support structure may be lowered into and received by a flower pot adapter positioned on top of the new tripod, such that the load of the tower may be transferred from the temporary support structure to the newly installed tripod. The flower pot may be lowered by, for example, turning threaded screws of a plurality of screw jacks coupled with the flower pot to lower the flower pot. Once the flower pot has been secured to the flower pot adapter of the new tripod, the temporary support structure may be deconstructed and removed.

Some embodiments of the disclosed technology will be described more fully hereinafter with reference to the accompanying drawings. This disclosed technology may,

however, be embodied in many different forms and should not be construed as limited to the embodiments set forth therein.

In the following description, numerous specific details are set forth. However, it is to be understood that embodiments of the disclosed technology may be practiced without these specific details. In other instances, well-known methods, structures, and techniques have not been shown in detail in order not to obscure an understanding of this description. References to "one embodiment," "an embodiment," "example embodiment," "some embodiments," "certain embodiments," "various embodiments," etc., indicate that the embodiment(s) of the disclosed technology so described may include a particular feature, structure, or characteristic, but not every embodiment necessarily includes the particular feature, structure, or characteristic. Further, repeated use of the phrase "in one embodiment" does not necessarily refer to the same embodiment, although it may.

Throughout the specification and the claims, the following terms take at least the meanings explicitly associated herein, unless the context clearly dictates otherwise. The term "or" is intended to mean an inclusive "or." Further, the terms "a," "an," and "the" are intended to mean one or more unless specified otherwise or clear from the context to be directed to a singular form.

Unless otherwise specified, the use of the ordinal adjectives "first," "second," "third," etc., to describe a common object, merely indicate that different instances of like objects are being referred to, and are not intended to imply that the objects so described must be in a given sequence, either temporally, spatially, in ranking, or in any other manner.

Various systems and methods are disclosed for removing the load of a transmission tower from an installed tripod to allow for replacement of the tripod, and will now be described with reference to the accompanying figures.

As described herein, embodiments of the disclosed technology include temporary support structures for supporting the load of a transmission tower to allow for removal and replacement of a degraded tripod. As will be appreciated by those of skill in the art, the base of a transmission tower may be commonly supported by a tripod having a plurality of arms (e.g., three arms) that are supported by piles that have been installed in the ground. For example, FIG. **1** shows a large pile configuration in which a transmission tower base **100** includes a tripod **102** having three tripod arms **103***a,b,c* that are supported by large piles **110**. Each tripod arm **103** may include a top plate **106** that is connected to a bottom plate **108** by a tripod web **104**. According to some embodiments, the top plate **106** and bottom plate **108** of a tripod arm may be approximately the same shape and may be positioned in parallel to one another such that they are both joined by the tripod web **104** at an approximately perpendicular angle. According to some embodiments, the top plate **106** and bottom plate **108** of a tripod arm **103** may be rectangular-shaped plates and the tripod web **104** may be positioned at an axis that corresponds to a center line of the top plate **106** and/or bottom plate **108** that spans the length of the top/bottom plates **106**, **108**. In some embodiments, the tripod web **104** may be a substantially planar plate. According to some embodiments, the tripod arms **103***a,b,c* may be joined or welded together by one or more of an upper member **105** and a lower member **107**, forming the tripod weldment, referred to herein as "tripod **102**." For example, as shown in FIG. **1**, each of the upper member **105** and lower member **107** may be a plate, such as a circular plate or other suitably shaped plate, that may be attached to a portion of each of the tripod arms **103***a,b,c*. According to some embodiments, the upper member **105** and/or lower member **107** may include one or more apertures configured to align with apertures in the top plate **106** and/or bottom plate **108** of a tripod arm **103** so that they may be attached to one another via bolts, screws, fasteners, or the like. According to some embodiments, the upper member **105** may have one or more apertures configured to align with apertures of the flower pot socket **122** to allow the flower pot socket **122** to be attached to the upper member **105**. The tripod **102** may traditionally be made of metal, such as steel or another such suitable material.

According to some embodiments, a transmission tower base **100** may include one-piece pile adapters **112** and brackets **114** that are positioned between the tops of the large piles **110** and the bottoms of each tripod arm **103***a,b,c*. The pile adapters **112** and brackets **114** may serve to create a transition connection between the respective piles **110** and the tripod **102**. During the original installation, the piles **110** may be positioned or field trimmed such that the brackets **114** may be positioned at an approximately equal height so that the tripod **102** may be positioned approximately parallel to the ground in order to provide a flat base to serve as support for the transmission tower. A bracket **114** that is mated with a pile adapter **112** may be secured to the bottom of a tripod arm **103** by being bolted, screwed, fastened, or otherwise secured together. Transmission tower legs **130** may be received by a receiving member designed to securely receive and stabilize the transmission tower legs **130**, such as a flower pot **120**. The flower pot **120** may be positioned in and/or secured to a flower pot socket **122** that is positioned on top of the tripod **102** and is configured to securely receive the base of the flower pot **120**. According to some embodiments, the flower pot socket **122** can be secured (e.g., bolted, screwed, fastened, etc.) to the top of the tripod **102**.

As shown in FIG. **2**, some transmission towers **200** may have small pile configuration in which a transmission tower base **200** has a tripod **102** that is supported by small piles **204**. Unlike the large piles **110**, the small piles **204** may not support pile adapters **112**, and thus the base of the tripod **102** may simply rest on brackets **114** positioned at the top of the small piles **204**. As can be seen in FIG. **2**, each tripod arm **103***a,b,c* of the tripod **102** may extend outwards away from a center point proximate the flower pot socket **122**, such that each arm is positioned at a 120-degree angle relative to each adjacent arm on each side. As shown, in some embodiments, each tripod arm **103***a,b,c* may be an I-beam, W-beam or the like.

FIG. **3** shows an embodiment of a temporary support structure **300** assembled around the base of a transmission tower **100** supported by large piles **110**. According to some embodiments, the temporary support structure **300** may include a pile temporary support system **310**, a beam support structure **320**, and a flower pot adapter lifting assembly **330**. As shown in FIG. **3**, when assembled the temporary support structure **300** may support the beam support structure **320**, which may in turn support the flower pot adapter lifting assembly. According to some embodiments, the flower pot adapter lifting assembly **330** may be configured to securely attach to the flower pot **120** of the transmission tower to remove the load of the transmission tower from the tripod **102** beneath. According to some embodiments, when the temporary support structure **300** is assembled around the base of the transmission tower **100** and attached to the flower pot **120**, the flower pot adapter lifting assembly **330** may transfer the load of the tower from the flower pot **120** to the beam support structure **320**, the beam support structure **320** may transfer the load to the pile temporary support system

310, and the pile temporary support system may transfer the load into the ground. In this way, the temporary support structure **300** may remove the load of the tower from the tripod **102** to allow the tripod **102** to be removed and replaced. As will be described further below, in some embodiments, the flower pot adapter lifting assembly **330** may be configured to vertically raise and/or lower the flower pot adapter **120** to provide access to the existing degraded tripod **102** and to allow installation of a new tripod **102**.

FIG. **4** shows an embodiment of a temporary support structure **300** assembled around the base of a transmission tower **200** supported by small piles **204**. When used with a transmission tower **200** supported by small piles **204**, the temporary support structure **300** may be assembled and used in the same manner as described with respect to use with a transmission tower **100** supported by large piles **110**. According to some embodiments, a temporary small pile strut assembly **400** may be attached to the small piles **204** to keep the small piles **204** in position when the tripod **102** is removed during the process of replacing the tripod **102**. As shown by FIGS. **3** and **4**, the temporary support system **300** for the small pile **204** configuration is exactly the same as the large pile **110** configuration, except that the temporary small pile strut assembly **400** may be used in conjunction with the small pile **204** configuration to provide additional stability to the small piles **204**.

FIG. **5** shows a partially exploded view of an assembled temporary support structure **300** for a transmission tower **100** supported by large piles **110** or small piles **204**. As shown in FIG. **5**, a pile temporary support system **310** may include one or more of a plurality of temporary piles **502**, temporary adjustable pile bracing bracket assemblies **510**, temporary adjustable brace assemblies **530**, and a plurality of temporary pile caps **540**. According to some embodiments, a temporary pile **502** may be a rigid shaft, such as a premanufactured round shaft helical pile, that may provide a temporary load path to soils of sufficient capacity. In some embodiments, a temporary pile **502** may be constructed of multiple segments. As will be appreciated by those of skill in the art, temporary piles **502** may be driven into the ground such that they provide a steady vertical loading bearing support. According to some embodiments, the pile temporary support system **310** may include three temporary piles **502** that are positioned into the ground in an approximately equilateral triangular configuration around the base of the transmission tower **100**, such that the flower pot **120** of the transmission tower is approximately positioned in the center of the temporary piles **502**. Although this disclosure is generally directed to embodiments of a temporary support structure **300** having three temporary piles **502** that forms a triangular configuration, it is contemplated that other embodiments may utilize four or more temporary piles **502** in a square or other polygonal configuration, as may be necessary based on the number of outer sides presented by the flower pot **120**. For example, if the flower pot **120** has four sides, a square configuration of a temporary support structure **300** with four temporary piles positioned in a square shape may be used.

According to some embodiments, a temporary adjustable pile bracing bracket assembly **510** may attach to a temporary pile **502** to provide an attachment point for cross-bracing between temporary piles **502**. For example, in some embodiments, a temporary adjustable brace assembly **530** may attach to a temporary adjustable pile bracing bracket assembly **510** at each end to provide cross-bracing between the two temporary piles **502**. According to some embodiments, a temporary adjustable pile bracing bracket assembly **510** may enable a temporary pile **502** to be installed and/or freely rotated with lower bracing connections attached. In some embodiments, a temporary adjustable pile bracing bracket assembly **510** may include a pile bracing bracket **512** and pile bracing bracket U-bolts **514**. As shown in FIG. **5**, a pile bracing bracket **512** may include a body having a ring-shaped portion configured to slide snuggly onto a temporary pile **502**, with temporary pile shear sleeves **515** above and below the pile bracing bracket **512**, and a brace receiving portion having one or more tabs **513** configured to securely receive one or more ends of one or more cross-bracing members, such as temporary adjustable brace assemblies **530**. For example, in some embodiments, a pile bracing bracket **512** may have two tabs that are offset by an angle of approximately 60 degrees such that the pile bracing bracket **512** of a first temporary pile **502** may attach to two cross-bracing members positioned between each of a second and third temporary pile **502** positioned approximately in the shape of an equilateral triangle. Thus, in some embodiments, in a case where there are three temporary piles **502**, each temporary pile **502** may connect to the other two via cross-bracing between each pair of temporary piles **502**. As shown in FIGS. **3** and **4**, in some embodiments, each temporary pile **502** may have an upper pile temporary adjustable pile bracing bracket assembly **510** attached and a lower temporary adjustable pile bracing bracket assembly **510** attached. According to some embodiments, two cross-bracing members (e.g., temporary adjustable brace assemblies **530**) may be attached between each pair of temporary piles **502** where a first end of each cross-bracing member may be attached to the upper temporary adjustable pile bracing bracket assembly **510** of a respective temporary pile **502** and a second end of the cross-bracing member may be attached to the lower temporary adjustable pile bracing bracket assembly **510** of the respective adjacent temporary pile **502** such that the two cross-bracing members form an "X" pattern between the pair of temporary piles **502**. As shown in FIGS. **3** and **4**, in some embodiments, this pattern may be repeated such that each pair of temporary piles **502** has an "X" shaped cross-bracing between them. Such cross-bracing may provide lateral stability and support to the temporary piles **502** that may prevent the temporary piles **502** from shifting or rotating relative to one other.

According to some embodiments, a tab **513** may be a plate or a pair of plates separated by a space configured to receive the end of a cross-bracing member, that extends away from the body of the pile bracing bracket **512**. The tab **513** may include one or more apertures for receiving a securing member, such a bolt, a screw, fastener, or the like, and may attach to the end of a cross-bracing member by, for example, inserting a bolt through the aperture(s) of the tab **513** and through one or more corresponding apertures of the cross-bracing member and securing the securing member with a nut or the like. According to some embodiments, the end of a cross-bracing member, such as the end of a temporary adjustable brace assembly **530** may be attached to the pile bracing bracket **512** (e.g., via the tab **513**) such that the cross-bracing member may rotate about the pile bracing bracket **512**. For example, if the cross-bracing member is secured by a bolt through the tab **513** as described above, then the cross-bracing member may be free to rotate about the bolt as a hinge, such that the opposing end of the cross-bracing member may be raised or lowered to different heights of an opposing temporary pile **502**. This free rotation of the cross-bracing member may allow an attached cross-bracing member to be folded up prior to drilling or driving the temporary pile **502** into the ground. Thus, in some

embodiments, a temporary pile **502** may be driven into the ground while a cross-bracing member is attached. This is advantageous because a temporary adjustable pile bracing bracket assembly **510** attached to a lower portion of a temporary pile **502** may be inaccessible for attachment of a temporary cross brace when the temporary pile **502** is driven into the ground. Thus, attachment of the cross-bracing member to the pile bracing bracket **512** with the temporary pile shear sleeves **515** installed above and below pile bracing bracket **512** prior to driving the temporary pile **502** into the ground may allow the attached cross-bracing member to be subsequently rotated into position with the pile bracing bracket **512** restrained from translating along the temporary pile **502** by the temporary pile shear sleeves **515** as the temporary pile **502**, pile bracing bracket **512** and the upward folded cross bracing member are driven into their final position. Once the pile is driven, the cross brace (e.g., temporary adjustable brace assembly **530**) may be folded down to be attached to another temporary pile **502**, whereas a technician may otherwise be unable to access and attach the cross-bracing member after the temporary pile **502** has been driven into the ground absent the presence of the temporary adjustable pile bracing bracket assembly **510** disclosed herein. In some embodiments, a lower temporary pile bracing bracket assembly of one or more temporary piles **502** may have one or more cross-bracing members attached prior to the one or more temporary piles **502** being driving into the ground. According to some embodiments, the attached cross-bracing members may then be attached to an upper temporary adjustable pile bracing bracket assembly **510** of an adjacent temporary pile **502** following insertion of the temporary piles **502** into the ground. In some embodiments, the attached cross-bracing members may be attached to an upper temporary adjustable pile bracing bracket assembly **510** of an adjacent temporary pile **502** following the installation of the beam support structure **320**. According to some embodiments, pile bracing bracket **512** may be configured to allow attachment of additional tabs **513** to support the attachment of additional cross-bracing members.

As described above, in some embodiments, each temporary pile **502** may have an upper temporary adjustable pile bracing bracket assembly **510** installed on an upper portion of the temporary pile **502** and a lower temporary adjustable pile bracing bracket assembly **510** installed on a lower portion of the temporary pile **502**. A pile bracing bracket **512** may permit rotation of a temporary pile **502** during installation with lower bracing connections (i.e., a pile bracing bracket **512** attached to a lower portion of the temporary pile **502**) attached. In some embodiments, pile bracing bracket U-bolts **514** may transversely engage a temporary pile **502** and may be inserted through apertures on either side of a pile bracing bracket **512**, as shown in FIG. **5**. In some embodiments, an upper U-bolt **514** and a lower U-bolt **514** may be attached to a pile bracing bracket **512** as shown. According to some embodiments, the play or "slop" between the pile bracing bracket **512** and the temporary pile **502** can be adjusted or removed by tightening a U-bolt **514** once temporary piles **502** have been driven into position. For example, in some embodiments, tightening a U-bolt **514** may draw pile bracing bracket **512** towards the surface of the temporary pile **502**.

According to some embodiments, temporary pile shear sleeves **515** may be attached to a temporary pile **502** above and/or below the pile bracing bracket **512** to prevent linear movement of the pile bracing bracket **512** along the temporary pile **502** without restricting the temporary pile's **502** ability to rotate within the pile bracing bracket **512**. According to some embodiments, the temporary pile shear sleeves **515** may be installed on a temporary pile **502** using a through-bolt installed through the temporary pile shear sleeve **515** and the temporary pile **502**. Temporary pile shear sleeves **515** may also prevent pile bracing bracket **512** from binding as the temporary pile **502** is screwed into the correct elevation or removed following repairs.

According to some embodiments, a pair of temporary adjustable pile bracing bracket assemblies **510** may be attached to the ends of a cross-bracing member, such as a temporary adjustable brace assembly **530**. In some embodiments, a temporary adjustable brace assembly **530** may be adjustable in length to account for actual field installed conditions. For example, a temporary adjustable brace assembly **530** may be adjusted to be longer or shorter in length in order to be positioned snuggly between a pair of temporary piles **502** as shown in FIG. **3** and attached to temporary adjustable pile bracing bracket assemblies **510**. In some embodiments, a temporary adjustable brace assembly **530** may include an adjustment tube **532**, a sleeve assembly **534**, a clamp/spreader bolts **536**, and through-bolts **538**. According to some embodiments, an adjustment tube **532** may be a tube of a fixed length having a series of offset, cross-drilled through-holes **533**. According to some embodiments, through-bolts **538** may be inserted into two aligned holes on both faces of the adjustment tube **532** and the sleeve assembly **534** and a through-bolt nut installed to prevent independent linear movement between the two. A through-bolt **538** may connect the adjustment tube **532** to a temporary adjustable pile bracing bracket assembly **510** as described above to allow the adjustment tube **532** to be rotated upwards during installation of the temporary pile **502**. A through-bolts **538** may be secured by a nut. In some embodiments, a sleeve assembly **534** may provide length adjustment of the temporary adjustable brace assembly **530** by sliding along the drilled end of the adjustment tube **532**. A double-acting clamping system may serve as a secondary compression or friction connection or as a spreader system to solidly clamp around the adjustment tube **532** or increase clearance around the adjustment tube **532**. For example, in some embodiments, there may be a seam in the portion of the sleeve assembly **534** that slides over adjustment tube **532** and when clamp/spreader bolts **536** are tightened, the sleeve assembly **534** may compress around adjustment tube **532**, creating a friction connection in addition to the through bolt shear connection. When the clamp/spreader bolts **536** are loosened, the seam may expand, allowing the sleeve assembly **534** to be adjusted or removed. Once the sleeve assembly **534** is positioned at a desired length, the sleeve assembly **534** may be bolted to a temporary adjustable pile bracing bracket assembly **510** and one or more (e.g., two) through-bolts **538** may be inserted two holes in the same face of the sleeve assembly **534** to provide sliding along the adjustment tube **532**. According to some embodiments, if two holes of the adjustment tube **532** and the sleeve assembly **534** don't align, cross-drilled through-holes at the end of the sleeve assembly **534** may allow the sleeve assembly to be slid off of the end of the adjustment tube **532**, rotated 90 degrees, and slid back onto the adjustment tube **532** for additional hole locations. Once the one or more through-bolts **538** are installed, the clamp/spreader bolts **536** may be tightened to securely clamp around the adjustment tube **532** to remove any play. The clamp/spreader bolts **536** may be used in double-acting clamping/spreader system of the sleeve assembly **534**. According to some embodiments, when clamp/spreader bolts **536** are turned a first direction (e.g., clockwise), a clamping action may be provided, whereas

when turned a second direction (e.g., counterclockwise) a spread action may be provided.

According to some embodiments, each of the temporary piles **502** may have a temporary pile cap **540** mounted on the top end. For example, a temporary pile cap **540** may slide onto and bear on the temporary pile **502**. In some embodiments, a temporary pile cap **540** may be bolted to the bearing frame beam assembly **550** to provide a load path from the bearing frame beam assembly **550** to the temporary pile **502** and to prevent lateral translation of the bearing frame beam assembly **550** relative to the to the temporary pile **502**. According to some embodiments, a temporary pile cap **540** may be through-bolted to the temporary pile **502**.

In some embodiments, as shown in FIG. **5**, the beam support structure **320** may include a bearing beam (or girder) assembly **550** and a plurality of transfer beams **560**. In some embodiments, the bearing beam assembly **550** may include a plurality (e.g., three) of bearing frame beams (or girders) **552**. According to some embodiments, the bearing frame beam assembly **550** may support the plurality of transfer beams **506**. In some embodiments, a bearing frame beam assembly **550** may include a plurality of bearing frame beams **552**, that may be connected together at each pair of adjacent bearing frame beam **552** ends with an acute bent plate **554** of a skewed double bent plate connection and an obtuse bent plate **556** of the skewed double bent plate connection. In some embodiments, each end of a bearing frame beam **552** may directly bear on a respective temporary pile cap **540**, such that each temporary pile cap **540** may support an end of two adjacent bearing frame beams **552**. The adjacent ends of a pair of bearing frame beams **552** may be rigidly connected to one another by attaching an acute bent plate **554** of a first bearing frame beam **552** to an obtuse bent plate **556** of the adjacent second bearing frame beam **552** to create a skewed double bent plate shear connection. As shown in FIG. **5**, an acute bent plate **554** and/or an obtuse bent plate **556** may be attached to the web (i.e., the vertical center plate) of a bearing frame beam **552** by aligning one or more apertures of the bent plate with one or more apertures of the web and attaching them together with securing members such as bolts, screws, fasteners, or the like. The bearing frame beams **552** may connect to each other via bent plates **554**, **556** to create a bearing frame beam assembly **550** that may be in the shape or a triangle (or any other such shape that mirrors the number of sides of the flower pot **120** and the number of temporary piles **502**). Although connection of the bearing frame beams **552** is described with respect to the use of an acute bent plate **554** and an obtuse bent plate **556**, it is contemplated that the bearing frame beams **552** may be connected using other means or methods, such as, for example, connecting the top plates and bolt joining beams to a larger pile cap. According to some embodiments, bearing frame beams **552** may be a steel beam such as a W-section beam, an I-beam, or the like. In some embodiments, one end of a bearing frame beam **552** may have apertures or bolt holes in the web (i.e., the vertical plate in the middle of the beam) and may be coped for a skewed double bent plate shear connection of the acute bent plate **554** and the obtuse bent plate **556**. In some embodiments, the opposite end of the bearing frame beam may contain a stiffener and bolt holes in the web to accept the skewed double bent plate shear connection of an adjacent bearing frame beam **552** and slotted bolt holes in the bottom flange for mounting to a temporary pile cap **540**. In some embodiments, the top flange of the bearing frame beam **552** may include slotted bolt holes to accommodate the attachment of a transfer beam **560**. According to some embodiments, the acute bent plate **554** may be mounted to an interior web side of a coped end of the bearing frame beam **552**. The obtuse bent plate **556** may be mounted to an exterior web side of a coped end of the bearing frame beam **552**. The acute bent plate **554** may work in conjunction with the obtuse bent plate **556** to form a skewed double bent plate shear connection.

As shown in FIGS. **3-5**, in some embodiments, three bearing frame beams **552** may be assembled and connected to one another to form a bearing beam assembly **550**. The bearing beam assembly **550** may be attached to the three temporary pile caps **540** of the temporary piles **502** to form an approximately equilateral triangle around the base of the transmission tower **100**. A plurality of transfer beams **560** may be assembled on top of the bearing frame beam assembly **550**, by, for example, placing each transfer beam **560** across a respective portion of two bearing frame beams **552** as shown in FIG. **5**. In some embodiments, each of the three transfer beams **560** may be placed across a pair of bearing frame beams **552** such that they intersect the bearing frame beams **552** at an approximately 60-degree angle. In some embodiments, each of the transfer beams **560** may be placed across a pair of bearing frame beams **552** such that each transfer beam **560** is aligned approximately parallel to a face of the flower pot **120** of the transmission tower **100**. Each end of a transfer beam **560** may directly bear on the underlying pair of bearing frame beams **552**. When the temporary support structure **300** has been fully assembled, the transfer beams **560** may serve to accept and transfer loads from the flower pot lifting assembly **330** to the bearing frame beam assembly **550**. As shown in FIG. **5**, in some embodiments, the top face of each transfer beam **560** may include ridges or fins to prevent the screw jacks of the flower pot lifting assembly **330** from sliding off of the transfer beam **560**.

As mentioned previously above, the temporary support structure **300** may be used in conjunction with a transmission tower **200** supported by small piles **204**. In such cases, the small piles **204** may require stabilization during the process of removing and replacing the tripod **102**. FIG. **6** shows an embodiment of a temporary small pile strut assembly **400** that may be attached to small piles **204** to provide such stabilization. According to some embodiments, a temporary small pile strut assembly **400** may include a temporary strut bracket assembly **600** and a temporary strut assembly **620**. According to some embodiments, the temporary strut bracket assembly **600** may connect a temporary strut assembly **620** to a small pile **204**. In some embodiments the temporary strut bracket assembly **600** may include a temporary strut bracket **602** and temporary strut bracket U-bolts **604** or other suitable securing members. The temporary strut bracket **602** may provide attachment points for connecting temporary struts to the small piles **204**. The temporary strut bracket **602** may include primary attachment holes for struts in side plates and alternate attachment holes in top and bottom plates. According to some embodiments, a temporary strut bracket **602** may fit around a small pile **204** and may be secured to the small pile **204** by the strut bracket U-bolts **604**. The strut bracket U-bolts **604** may transversely engage the small pile **204**. According to some embodiments, tightening the strut bracket U-bolt **604** nuts may draw the temporary strut bracket **602** against the surface of the small pile **204**. In some embodiments, each end of a temporary strut assembly **620** may connect to a temporary strut bracket assembly **600** attached to a different small pile **204** to help prevent or control movement of the small piles **204**. According to some embodiments, the temporary strut assembly **620**

may include an articulating strut having a left-hand threaded ball joint rod end and a right-hand threaded ball joint rod end, an adjustment tube with matching threads, and an optional turning bar. In some embodiments, rotating the adjustment tube may lengthen or shorten the overall length of the strut. In some embodiments, a temporary strut assembly may be premanufactured.

According to some embodiments, a tripod **102** of a transmission tower **100** may be so degraded that it may be determined by a technician that the tripod **102** cannot support the additional load of the flower pot adapter **920** and/or flower pot adapter beams **930** added to the flower pot **120** during assembly of the temporary support structure **300**. In such cases, additional support may be added to the degraded tripod **102** using an underhung tripod assembly **700**, as shown in FIG. **7**. According to some embodiments, an underhung tripod assembly **700** may include an underhung two-piece temporary tripod assembly **710** and a plurality of temporary tripod transfer beams **750**. Once installed, each of the temporary tripod transfer beams **750** may transfer loads from a beam of the temporary tripod to the bearing frame beam assembly **550**. As shown in FIG. **7**, a temporary tripod transfer beam **750** may be placed on top of a portion of a pair of bearing frame beams **552**, in a manner similar to that as described above with respect to the transfer beams **560**. According to some embodiments, when installed, the underhung two-piece temporary tripod assembly **710** may transfer loads from the degraded tripod **102** to the temporary tripod transfer beams **750**. According to some embodiments, the underhung two-piece temporary tripod assembly **710** may be removed after all of the remaining components of the temporary support structure **300** have been installed such that the load of the existing tower **100** has been transferred from the degraded tripod **102** to the temporary support structure **300**. As shown in FIG. **8**, in some embodiments, the underhung two-piece temporary tripod assembly **710** may include a temporary tripod weldment **712**, a temporary tripod bolt-in beam **714**, and temporary tripod shim plates **716**. The temporary tripod weldment **712** may include two tripod beams oriented at an approximately 120-degree from each other that are welded between two center plates as shown in FIG. **8**. In some embodiments, the top flanges at the ends of the beams may contain apertures that may align with apertures of the temporary tripod transfer beams **750** to allow them to be bolted together. The center plates may include apertures configured to align with apertures of the temporary tripod bolt-in beam **714** to allow the temporary tripod bolt-in beam **714** to be bolted into the temporary tripod weldment **712** at an approximately 120-degree angle from the other two beams of the temporary tripod weldment **712**. The temporary tripod bolt-in beam **714** may be a W-section beam, I-beam or the like, with one end containing apertures in the top and bottom flanges to align with apertures of the temporary tripod weldment **712** to allow attachment to the temporary tripod weldment **712** (e.g., via bolts). The opposite end of the temporary tripod bolt-in beam **714** may include apertures in the top flange to allow for a bolted connection to a temporary tripod transfer beam **750**. According to some embodiments, the temporary tripod shim plates **716** may include a plurality of plates of different thicknesses to shim the gap between the top center plate of the underhung two-piece temporary tripod assembly **710** and the bottom center plate of the degraded tripod **102**. In some embodiments, as shown in FIG. **8**, the first shim plate may include a notch to provide clearance for the bolts (or other securing members) used to secure the temporary bolt-in beam **714** to the temporary tripod weldment **712**. According to some embodiments, the temporary tripod shim plates **716** may each include an aperture configured to align with the aperture(s) of one or more other temporary tripod shim plates **716** to allow the temporary tripod shim plates **716** to be attached to one another using an attachment member such as a bolt, screw or fastener to prevent lateral movement of the shim plates **716** relative to one another. In some embodiments, the temporary tripod shim plates **716** may be steel plates.

FIG. **9**A shows an embodiment of a flower pot adapter lifting assembly **330** that has been assembled around a flower pot **120** of a transmission tower **100**. As shown in more detail in FIG. **9**B, in some embodiments, a flower pot adapter lifting assembly **330** may include a plurality of flower pot adapters **920** that are each configured to securely attach to an outer face of the flower pot **120**. The flower pot adapters **920** may provide a direct connection of the flower pot adapter lifting assembly **330** to the transmission tower **100**. In some embodiments, a flower pot adapter **920** may engage temporary flower pot adapter bearing sleeves with fasteners **910** to the face of the flower pot **120**. In some embodiments, the temporary flower pot adapter bearing sleeves with fasteners **910** may temporarily replace existing flower pot **120** fasteners and provide a bearing connection with a flower pot adapter **920**. For example, in some embodiments, existing nuts and bolts of the flower pot **120** may be removed and replaced with threaded sleeves **914**, studs, and nuts, threaded sleeves **914** and bolts, or unthreaded sleeves **912**, bolts, and nuts, depending on their location. For example, space constraints may not allow a technician to insert a wrench head inside of the flower pot **120** to the lower bolts, so an unthreaded sleeve may be installed on the exterior of the lower bolts and the exterior nut may be tightened with an impact wrench that will tighten an exterior nut without having to turn the bolt head on the interior of the flower pot **120**. As shown in FIG. **9**B, the flower pot adapters **920** may include flower pot adapter bolt flanges and shims **922** to provide connections between adjacent flower pot adapters **920** around the flower pot **120**. Shims may be used between the flanges to provide adjustment of the engagement relative to the faces of the flower pot **120**. In some embodiments, each flower pot adapter **920** may be connected to a flower pot adapter beam **930** by a flower pot adapter pin **932**, which may be an alloy steel pin, such as a premanufactured quick-release pin. A flower pot adapter pin **932** may be inserted into transverse through-holes at both ends of the flower pot adapter beam **930** to provide retention of the flower pot adapter beam **930** within the flower pot adapter **920**. The flower pot adapter beam **930** may be engaged directly by a screw jack lifting beam assembly **940** and may provide a load path to the flower pot adapter **920**. According to some embodiments, reinforced flanges at the connections to flower pot adapter pin **932** may provide increased bearing strength. In some embodiments, bolt holes in the top flange of flower pot adapter beam **930** may be used to restrain the screw jack lifting beam assembly **940** and connect flower pot adapter beam braces **934** which may prevent the pivoting of the flower pot adapter beam **930**. As shown in FIG. **9**B, flower pot adapter beam braces **934** may be attached to both a flower pot adapter beam **930** and a screw jack lifting beam **942** on one end, as well as a flower pot adapter **920** on the opposing end. In some embodiments, the flower pot adapters **920** may be attached to all sides of the flower pot **120** prior to the attachment of the flower pot adapter beams **930** and the screw jack lifting beam assemblies **940**.

According to some embodiments, a screw jack lifting beam assembly **940** may include a screw jack lifting beam **942** and a screw and cap assembly **944**. The screw jack lifting beam **942** may be configured to slide onto and directly engage the top flange of a flower pot adapter beam **930**. According to some embodiments, bolts may be inserted through apertures in the bottom flange of the screw jack lifting beam assembly, apertures of the flower pot adapter beam braces **934** and apertures in the top flange of flower pot adapter beam **930** for retention of the screw jack lifting beam assembly **940** relative to the flower pot adapter beam **930**. The screw jack lifting beam **942** may work in conjunction with the screw and cap assembly **944** to carry all of the load at the end of the flower pot adapter beam **930**. According to some embodiments, the screw and cap assembly **944** may include a rod having a threaded screw portion (e.g., an Acme threaded screw) on one end and a ball bearing swivel cap on the other end. In some embodiments, the screw and cap assembly **944** may be premanufactured. The threaded screw portion may be configured to be rotatably received by a threaded shoulder nut (e.g., an Acme threaded shoulder nut) of the screw jack lifting beam **942**. When the temporary support structure **300** is fully assembled, the ball bearing swivel cap may be positioned on top of a transfer beam **560** such that that load of the tower **100** may be transferred through a plurality of screw jack lifting beam assemblies **940** and into a corresponding plurality of transfer beams **560**. According to some embodiments, the height of a screw jack lifting beam **942** may be raised by rotating the screw and cap assembly **944** in opposing directions. Thus, in some embodiments, once the flower pot adapter lifting assembly **330** is installed on top of the transfer beams **560** and in connection to the flower pot **120**, the height of the transmission tower **100** may be raised or lowered in accordance with the raising and lowering of the plurality of screw jack lifting beam assemblies **940**. In this way, the temporary support structure **300** may be configured to raise the tower to provide room to remove the degraded tripod **102** and lower the tower onto a newly installed tripod **102** following such installation.

FIG. **10** is a flow diagram of a method **1000**, according to an example implementation. As shown in FIG. **10**, in some implementations, the method includes, at **1010**, assembling a pile temporary support system **300** comprising a plurality of piles **502** around a base of a transmission tower **100**. In some embodiments, each of the plurality of piles **502** may have a base portion installed into the ground. For example, as will be appreciated by those of skill in the art, a pile may be driven or screwed into the ground. Each of the plurality of piles **502** may include a pile cap **540** on a top end of the pile **502**, as described above.

According to some embodiments, assembling the pile temporary support system **300** may include attaching a first temporary adjustable pile bracing bracket assembly **510** to a first pile **502** of the plurality of piles **502**, attaching a second temporary adjustable pile bracing bracket assembly **510** to a second pile of the plurality of piles **502**, and attaching a temporary adjustable brace assembly **530** between the first temporary adjustable pile bracing bracket assembly **510** and the second temporary adjustable pile bracing bracket assembly **510**. As previously described above, attachment of a lower temporary adjustable pile bracing bracket assembly **510** to a pile **502** and attachment of an end of a temporary adjustable brace assembly **530** to the lower temporary adjustable pile bracing bracket assembly **510** may occur prior to driving a lower portion of the pile **502** into the ground, as such lower portion may be inaccessible following the insertion of the lower portion of the pile **502** into the ground. Further, in some embodiments, attachment of the other end of the temporary adjustable brace assembly **530** to a temporary adjustable pile bracing bracket assembly **510** attached to an adjacent pile **502** may occur at a later time, such as following the installation of one or more bearing frame beams **552** and/or transfer beams **560**. While the preceding describes the installation of two temporary piles **502** and the installation of cross bracing between them, it should be understood that the method contemplates installation of three temporary piles with the cross bracing attached between each pair of adjacent temporary piles **502** in a manner similar to that as described above to form a triangular configuration. In other words, each of the three temporary piles **502** may have a lower pile bracing bracket **512** attached to the pile **502** and two temporary adjustable brace assemblies **530** are attached to each lower pile bracing bracket **512** before the brace assemblies are folded up and the temporary piles **502** (with attached brace assemblies) are driven into the ground. Once the temporary piles **502** are installed in the ground, the temporary adjustable brace assemblies **530** may be folded down and may be attached to an upper pile bracing brackets **512** of a neighboring temporary **502**, thereby creating an "X" cross brace between each pair of the temporary piles **502**.

At **1020**, the method can include assembling a beam support structure (e.g., beam support structure **320**) on top of the pile temporary support system **310** such that the pile temporary support system **310** supports the beam support structure. In some embodiments, the beam support structure may include at least a first plurality of support beams, such as bearing frame beams **552** that may be assembled together to form a bearing frame beam assembly **550** as described previously above. For example, in some embodiments, these support beams may be attached to one another and to the temporary pile caps **540** as described previously above.

According to some embodiments, assembling the beam support structure may include, for each pair of adjacent piles **502** of the plurality of piles **502**, placing a respective beam of the first plurality of support beams on top of the pile caps **540** of each of the piles **502** of the pair of adjacent piles **502** such that the first plurality of support beams form a substantially enclosed shape around the transmission tower **100** and securing each end of each respective beam of the first plurality of support beams to the pile caps **540** of the respective pair of adjacent piles **502**. According to some embodiments, assembling the beam support structure may further include, for each pair of adjacent beams of the first plurality of support beams, placing a respective beam of a second plurality of support beams (e.g., transfers beams **560**) on top of a portion of each of the respective pair of adjacent beams such that, according to some embodiments, the ends of each of the second plurality of beams may be positioned proximate to an adjacent beam of the second plurality of support beams. As shown in FIG. **5**, each of the second plurality of support beams (e.g., transfer beams **560**) may be securely attached to a pair of the first plurality of support beams (e.g., bearing frame beams **552**) by inserting securing members, such as bolts, screw, fasteners or the like through apertures in the bottom flange of the support beam of the second plurality of support beams and apertures in the top flanges of the support beams of the first plurality of support beams. According to some embodiments, the second plurality of support beams may be supported by the first plurality of support beams and may form an approximately regular polygon around the transmission tower **100**.

At **1030**, the method can include positioning a flower pot adapter lifting assembly **330** on top of the beam support structure such that the beam support structure supports the flower pot adapter lifting assembly **330**. For example, a flower pot adapter lifting assembly **330** may be positioned on top of a beam support structure **320** as described previously above.

According to some embodiments, positioning a flower pot adapter lifting assembly **330** on top of the beam support structure may include positioning a plurality of screw jack lifting beam assemblies **940** on top of the second plurality of support beams (e.g., transfer beams **560**) such that a height-adjustable threaded screw of each of a plurality of screw jacks **940** is positioned on top of an upper surface of a respective beam of the second plurality of support beams.

At **1040**, the method can include attaching the flower pot adapter lifting assembly **330** to a flower pot **120** of the transmission tower **100**. In some embodiments, the flower pot **120** may be positioned of above the tripod **102** and may be configured to hold one of more legs **130** of the transmission tower **100** or the guyed lattice mast of the transmission tower. In some embodiments, in response to the installation of the flower pot adapter lifting assembly **330** on top of the beam support structure and in connection with the flower pot **120**, the load of the transmission tower **100** may be transferred from the transmission tower **100** to the flower pot adapter lifting assembly **330**, from the flower pot adapter lifting assembly **330** to the beam support structure, and from the beam support structure (e.g., beam support structure **320**) to the pile temporary support system **310**. In other words, when installed (i.e., when attached to the flower pot **120** and positioned on top of the beam support structure), the flower pot adapter lifting assembly **330** may create a load path from the transmission tower **100** to the temporary support system **300**, bypassing the existing tripod **102** and enabling the transmission tower **100** to be raised and lowered to replace the tripod **102** and/or other degraded portions of the tower foundation. It should be understood that in some embodiments and as previously described above, attachment of a portion of the flower pot adapter lifting assembly **330** (e.g., flower pot adapters **920**) to the flower pot **120** may occur prior to positioning the flower pot adapter lifting assembly **330** on top of the beam support structure.

According to some embodiments, attaching the flower pot adapter lifting assembly **330** to the flower pot **120** of the transmission tower **100** may include attaching a plurality of flower pot adapters **920** to external surfaces of the flower pot **120** such that the flower pot **120** is substantially surrounded by the plurality of flower pot adapters **920**. In some embodiments, following the attachment of the plurality of flower pot adapters **920** to the flower pot **120**, each of a plurality of screw jacks **940** may be attached to a respective flower pot adapter **920** (e.g., via a respective flower pot adapter beam **930**).

According to some embodiments, the method may further include removing the tripod **102** and installing a new tripod **102**. For example, removing the tripod **102** may include unbolting the tripod **102** from a flower pot socket **122** and/or one or more existing installed brackets **114** that are attached to existing pile adapters. In some embodiments, removing the existing tripod **102** may include cutting the existing tripod **102**, the existing brackets **114** and/or the existing pile adapters **112** out of tower **100** and/or large piles **110**. In some embodiments, installing a new tripod **102** can include installing a new pile adapter **112** to each pile **110** of a plurality of large piles **110**, installing a new pile bracket **114** on each new pile adapter **112** (e.g., via mating the two pieces together), attaching tripod arms **103** of the new tripod **102** to the new pile brackets **114** (e.g., via securing members through aligned apertures of a pile bracket **114** and bottom plate **108** of a tripod arm **103**), attaching a flower pot socket **122** to a top surface of the new tripod **102**, and lowering, by manipulation of the height-adjustable threaded screw of each of the plurality of screw jacks **940**, the flower pot **120** into the flower pot socket **122**. The new tripod **102** and/or flower pot socket **122** may then be attached to the flower pot **120** by, for example, bolting, screwing or fastening them together (e.g., via aligned apertures in each). Following installation of the new tripod **102**, the temporary support structure **300** may be deconstructed.

It will be understood that the various steps of any of the methods described herein are illustrative only, and that steps may be removed, other steps may be used, or the order of steps may be modified.

Certain embodiments of the disclosed technology are described above with reference to flow diagrams of systems and methods according to example embodiments of the disclosed technology. It will be understood that some blocks of the flow diagrams may not necessarily need to be performed in the order presented, or may not necessarily need to be performed at all, according to some embodiments of the disclosed technology.

While certain embodiments of the disclosed technology have been described in connection with what is presently considered to be the most practical embodiments, it is to be understood that the disclosed technology is not to be limited to the disclosed embodiments, but on the contrary, is intended to cover various modifications and equivalent arrangements included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

This written description uses examples to disclose certain embodiments of the disclosed technology, including the best mode, and also to enable any person skilled in the art to practice certain embodiments of the disclosed technology, including making and using any devices or systems and performing any incorporated methods. The patentable scope of certain embodiments of the disclosed technology is defined in the claims, and may include other examples that occur to those skilled in the art. Such other examples are intended to be within the scope of the claims if they have structural elements that do not differ from the literal language of the claims, or if they include equivalent structural elements with insubstantial differences from the literal language of the claims.

I claim:

1. A temporary support structure comprising:

pile temporary support system comprising a plurality of piles, each of the plurality of piles comprising a base portion that is configured to be installed into the ground and comprising a pile cap on a top end of the pile;

a beam support structure configured to be installed on top of and supported by the pile temporary support system, the beam support structure comprising at least a first plurality of support beams; and

a flower pot adapter lifting assembly configured to attach to a portion of a transmission tower and be installed on top of the beam support structure to transfer a load of the transmission tower to the beam support structure and onto the pile temporary support system.

2. The temporary support structure of claim **1**, wherein the flower pot adapter lifting assembly is configured to transfer

the load of the transmission tower off of a tripod installed beneath a guyed lattice mast of the transmission tower.

3. The temporary support structure of claim **1**, the pile temporary support system further comprising one or more pile bracing brackets, each of the one or more pile bracing brackets being configured to connect to a pair of piles of the plurality of piles.

4. The temporary support structure of claim **1**, wherein the first plurality of support beams are configured to be positioned atop the pile caps of the plurality of piles.

5. The temporary support structure of claim **4**, wherein each pile cap comprises an upper flat surface configured to support a portion of one or more the first plurality of support beams and each upper flat surface of each pile cap of the plurality of piles being approximately disposed in horizontal plane such that the pile caps are approximately level with one another when installed.

6. The temporary support structure of claim **1**, wherein the beam support structure further comprises a second plurality of support beams, the second plurality of support beams being configured to be positioned on top of the first plurality of support beams.

7. The temporary support structure of claim **6**, wherein each of the first plurality of support beams has a first end configured to be positioned on top of a first pile cap and a second end configured to be positioned on top of a second pile cap and each of the second plurality of support beams is configured to be positioned on top of a portion of an upper surface of each of two of the first plurality of support beams.

8. The temporary support structure of claim **7**, wherein the flower pot adapter lifting assembly comprises a plurality of screw jack lifting beam assemblies, each screw jack lifting beam assembly having a height-adjustable threaded screw configured to rest on an upper surface of one of the second plurality of support beams, wherein the flower pot adapter lifting assembly is installed the height-adjustable threaded screws are configured to be adjusted to raise and/or lower the transmission tower.

9. The temporary support structure of claim **8**, wherein each of the screw jack lifting beam assembling comprises a flower pot adapter configured to removably attach to an outer surface of a flower pot of the transmission tower that receives a guyed lattice mast of the transmission tower.

10. The temporary support structure of claim **6**, further comprising an underhung tripod assembly comprising a third plurality of support beams and an underhung tripod having one or more underhung tripod legs configured to be attached to a bottom surface of each of the third plurality of support beams.

11. The temporary support structure of claim **10**, wherein each of the third plurality of support beams is configured to be positioned on top of a portion of the upper surface of each of two of the first plurality of support beams such that when installed the underhung tripod is positioned beneath a tripod installed in the transmission tower.

12. The temporary support structure of claim **1**, wherein the plurality of piles comprise one or more small piles and the temporary support structure further comprises a temporary strut bracket assembly configured to attach to the one or more small piles.

13. A method of removing the load from a tripod of a transmission tower to allow replacement of the tripod, the method comprising:

assembling a pile temporary support system comprising a plurality of piles around a base of a transmission tower, each of the plurality of piles comprising a base portion installed into the ground and comprising a pile cap on a top end of the pile;

assembling a beam support structure on top of the pile temporary support system such that the pile temporary support system supports the beam support structure, the beam support structure comprising at least a first plurality of support beams; and

positioning a flower pot adapter lifting assembly on top of the beam support structure such that the beam support structure supports the flower pot adapter lifting assembly; and

attaching the flower pot adapter lifting assembly to a flower pot of the transmission tower, the flower pot being positioned above the tripod and being configured to hold a guyed lattice mast of the transmission tower;

wherein the load of transmission tower is transferred from the transmission tower to the flower pot adapter lifting assembly, from the flower pot adapter lifting assembly to the beam support structure, and from the beam support structure to the pile temporary support system.

14. The method of claim **13**, further comprising:

removing the tripod; and

installing a new tripod.

15. The method of claim **14**, wherein installing a new tripod comprises:

installing a new pile adapter to each pile of a plurality of large piles;

installing a pile bracket in each new pile adapter;

attaching arms of the new tripod to the pile brackets;

attaching a flower pot socket to a top surface of the new tripod; and

lowering, by manipulation of the height-adjustable threaded screw of each of the plurality of screw jacks, the flower pot into the flower pot socket.

16. The method of claim **13**, wherein assembling the pile temporary support system comprises:

attaching a first temporary pile bracing bracket assembly to a first pile of the plurality of piles;

attaching a second temporary pile bracing bracket assembly to a second pile of the plurality of piles; and

attaching a temporary adjustable brace assembly between the first temporary pile bracing bracket assembly and the second temporary pile bracing bracket assembly.

17. The method of claim **13**, wherein assembling the beam support structure on top of the pile temporary support system comprises:

for each pair of adjacent piles of the plurality of piles, placing a respective beam of the first plurality of support beams on top of the pile caps of each of the piles of the pair of adjacent piles such that the first plurality of support beams form a substantially enclosed shape around the transmission tower; and

securing each end of each respective beam of the first plurality of support beams to the pile caps of the respective pair of adjacent piles.

18. The method of claim **17**, wherein assembling the beam support structure on top of the pile temporary support system further comprises:

for each pair of adjacent beams of the first plurality of support beams, placing a respective beam of a second plurality of support beams on top of a portion of each of the respective pair of adjacent beams such that ends of the each of the second plurality of beams are positioned proximate to an adjacent beam of the second plurality of support beams, wherein the second plurality of support beams are supported by the first plurality

of support beams and form an approximately regular polygon around the transmission tower.

19. The method of claim **18**, wherein positioning a flower pot adapter lifting assembly on top of the beam support structure comprises:

positioning a plurality of screw jack lifting beam assemblies on top of the second plurality of support beams such that a height-adjustable threaded screw of each of a plurality of screw jacks is positioned on top of an upper surface of a respective beam of the second plurality of support beams.

20. The method of claim **19**, wherein attaching the flower pot adapter lifting assembly to a flower pot of the transmission tower comprises:

attaching a plurality of flower pot adapters to external surfaces of the flower pot such that the flower pot is substantially surrounded by the plurality of flower pot adapters; and

attaching each of the plurality of screw jacks to a respective flower pot adapter.

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