PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

Assignment ID: PATI280332

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	Asset Purchase Agreement

CONVEYING PARTY DATA

Name	Execution Date
Aluma Tower Company, Inc.	04/30/2024

RECEIVING PARTY DATA

Company Name:	Will-Burt Integration & Elevation Systems, Inc.
Street Address:	401 Collins Blvd.
City:	Orrville
State/Country:	OHIO
Postal Code:	44667

PROPERTY NUMBERS Total: 2

Property Type	Number
Patent Number:	8046970
Patent Number:	8365471

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NAME OF SUBMITTER:	RITA SULIC
SIGNATURE:	RITA SULIC
DATE SIGNED:	06/06/2024

Total Attachments: 53
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ASSET PURCHASE AGREEMENT

This Asset Purchase Agreement ("Agreement"), dated April 30, 2024, is made by and between **Aluma Tower Company, Inc.**, a Florida corporation ("Seller"), and **Will-Burt Integration & Elevation Systems, Inc.**, an Ohio corporation ("Buyer"). **William C. Main, Robert A. Main, Jr., and Susan E. Flannery** ("Main Family") and **Robert A. Main & Sons Holding Co., Inc.**, a New Jersey corporation ("Parent"), join this Agreement in their individual capacity for purposes of Articles 4 and 10 and Sections 7.9 and 9.4.

WHEREAS, Seller is engaged in the business of the design and manufacture of sectional mast systems (collectively, the "Business").

WHEREAS, Parent directly owns one hundred percent (100%) of the issued and outstanding capital stock of Seller.

WHEREAS, Buyer desires to purchase from Seller, and Seller desires to sell to Buyer, substantially all of the personal property, tangible and intangible, used by Seller in the operation of the Business.

WHEREAS, the parties hereto desire to set forth certain representations, warranties, and covenants made by each to the other as an inducement to the execution and delivery of this Agreement and certain additional agreements relating hereto.

NOW THEREFORE, in consideration of the mutual promises and conditions herein contained, and for good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the parties covenant and agree as follows:

Article 1
Definitions

[redacted] [redacted]

[redacted] [redacted]

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[redacted] [redacted]

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(n) "Intellectual Property" means all patents and patent rights, trademarks and trademark rights, trade names and trade name rights, service marks and service mark rights, service names and service name rights, brand names, inventions, processes, formulae, copyrights and copyright rights, trade dress, business and product names, logos, slogans, trade secrets, industrial models, processes, designs, methodologies, computer programs (including all source codes) and related documentation, technical information, manufacturing, engineering and technical drawings, know-how and all pending applications for and registrations of patents, trademarks, service marks and copyrights licensed to or owned by Seller.

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Article 2
Purchase and Sale of Assets

2.1 **Purchased Assets**. Subject to the terms and conditions of this Agreement, Seller agrees to sell, convey, set over, transfer, assign, and deliver to Buyer, free from any liens or encumbrances, and Buyer agrees to purchase from Seller all of the Purchased Assets (as hereafter defined), wherever situated, that are used by Seller in the Business and used in the generation of sales, manufacturing of product, inventory, work in process, and including without limitation the following (collectively "Purchased Assets"):

[redacted]

[redacted]

[redacted]

(d) All of Seller's right, title, and interest in all of the Intellectual Property used in connection with the Business including without limitation the Intellectual Property set forth more specifically in Schedule 2.1(d) attached hereto and made a part hereof;

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4.25 **Intellectual Property**. Except as set forth on Schedule 4.25, Seller has not granted or licensed to any third person any rights with respect to any Intellectual Property and no third person has any rights in or to any of the Intellectual Property (including, without limitation, any rights to market or distribute any of the Intellectual Property). For purposes of providing services to third parties, the Intellectual Property is sufficient for the conduct of the Business as such is presently conducted. Except as set forth on Schedule 2.1(d), Seller has no patents, patent applications, trade names, trademarks, service marks, and copyrights used by Seller in the operation of its Business or in which it has any rights or licenses. There is no claim, litigation, or proceeding pending or threatened alleging that Seller has infringed, and, to the best of Seller's Knowledge, Seller has not infringed, and is not now infringing, on any patent, trade name, trademark, service mark, or copyright belonging to any other Person. Seller is not a party to any license, agreement, or arrangement, whether as licensor, licensee, or otherwise, with respect to any patents, trademarks, service marks, trade names, or applications for them, invention, design model, process, trade secret or formulae, or any copyrights. Seller owns, or holds adequate Intellectual Property rights, licenses or other rights or authority to use, all such trade secrets, inventions, processes, designs and formulae, trademarks, service marks, trade names, and copyrights necessary for it to conduct the Business as now conducted by it, and such use does not, and will not, conflict with, infringe on, or otherwise violate any rights of others.

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[Asset Purchase Agreement Signature Page]

EXECUTED by the parties hereto, intending to be legally bound, effective as of the day and year first above written.

SELLER:

Aluma Tower Company, Inc.

By: ______________________
Name: Robert A. Main Jr.
Title: President

BUYER:

Will-Burt Integration & Elevation Systems, Inc.

By: ______________________
Name: Richard Lewin
Title: President and CEO

PARENT:
(as to Articles 4 and 10 and Sections 7.9 and 9.4)

Robert A. Main & Sons Holding Co., Inc.

By: ______________________
Name: Robert A. Main Jr.
Title: President

MAIN FAMILY:
(as to Articles 4 and 10 and Sections 7.9 and 9.4)

____
William C. Main, individually

____
Robert A. Main, Jr., individually

____
Susan E. Flannery, individually

Schedule 2.1(d)
Intellectual Property[3]

Patents and Trademarks

- **Trademarks**- Aluma Tower Company, Inc has four trademarks on file, as follows:

TRADEMARK NUMBER	**TITLE**	Description
5,854,660	ALUMA	Company logo
5,796,172	SMARTTOWER	Trademark associated to the name with patent no. 8,365,471 (above.) "SMART" is an acronym which stands for "self-monitoring and retracting tower."
4,327,209	ALUMA TOWER	Use of Aluma Tower company name
4,034,243	SCORPION	Aluma's best-selling trailer model, designed to accommodate the tower from patent no. 8,046,970 (above)

Patents- Aluma Tower Company, Inc. has two patents as follows:

[3]All of Seller's right, title, and interest in all of the Intellectual Property used in connection with the Business

US008046970B2

(12) **United States Patent**
Diniz et al.

(10) **Patent No.: US 8,046,970 B2**
(45) **Date of Patent: Nov. 1, 2011**

(54) **UNGUYED TELESCOPING TOWER**

(75) Inventors: **Ronald L. Diniz**, Vero Beach, FL (US); **Craig A. Davis**, Vero Beach, FL (US)

(73) Assignee: **Aluma Tower Company, Inc.**, Vero Beach, FL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 39 days.

(21) Appl. No.: **12/418,004**

(22) Filed: **Apr. 3, 2009**

(65) **Prior Publication Data**

US 2010/0251634 A1 Oct. 7, 2010

(51) **Int. Cl.**
E04H 12/18 (2006.01)

(52) **U.S. Cl.** **52/632**; 52/123.1; 52/651.01; 52/651.07

(58) **Field of Classification Search** 52/632, 52/651.01, 651.07, 123.1, 121, 831, 745.17
See application file for complete search history.

(56) **References Cited**

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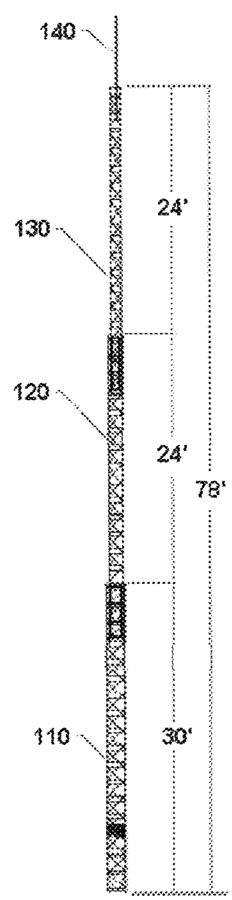
* cited by examiner

Primary Examiner — Brian Glessner
Assistant Examiner — Adam Barlow
(74) *Attorney, Agent, or Firm* — Myers Wolin, LLC

(57) **ABSTRACT**

A telescoping tower comprises a plurality of telescoping tower sections, each tower section having a pressure member that engages with a respective pressure member on a respective tower section when the tower sections are moved from a nesting condition to an extended position, the engagement of the pressure members occurring at the overlap of the tower sections to increase stability of the telescoping tower and reduce unwanted play at the overlap regions.

20 Claims, 10 Drawing Sheets



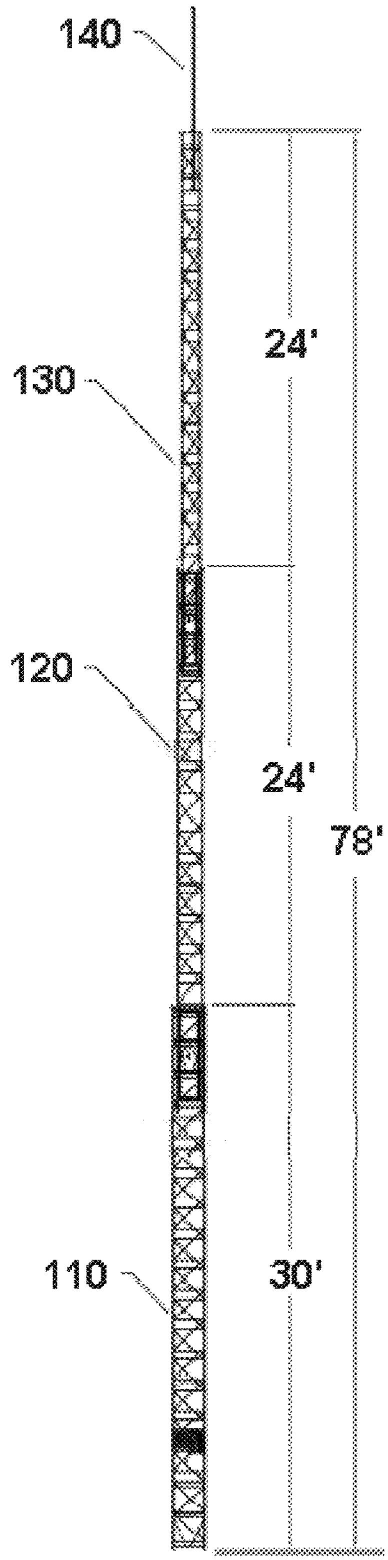


FIG. 1

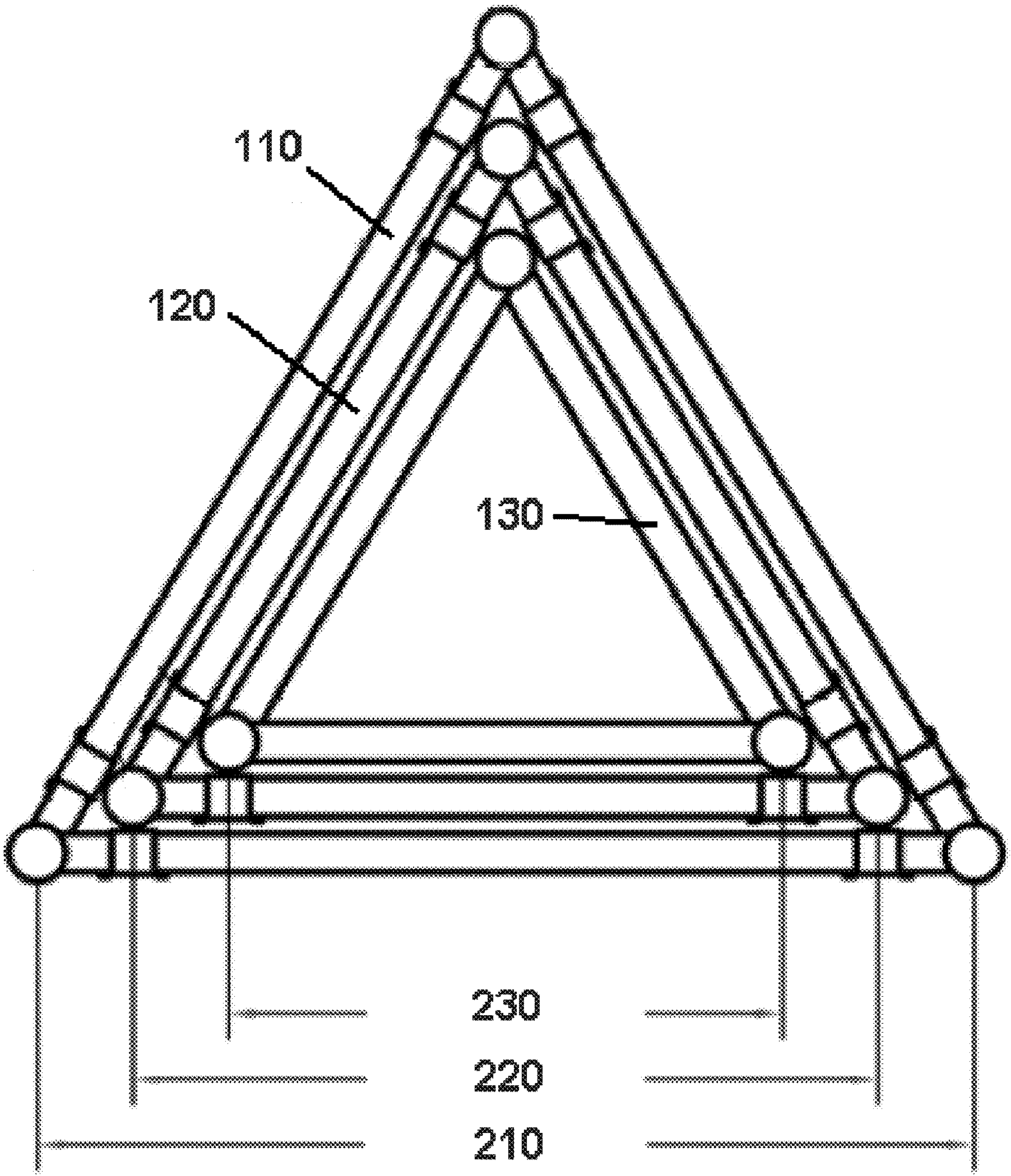


FIG. 2

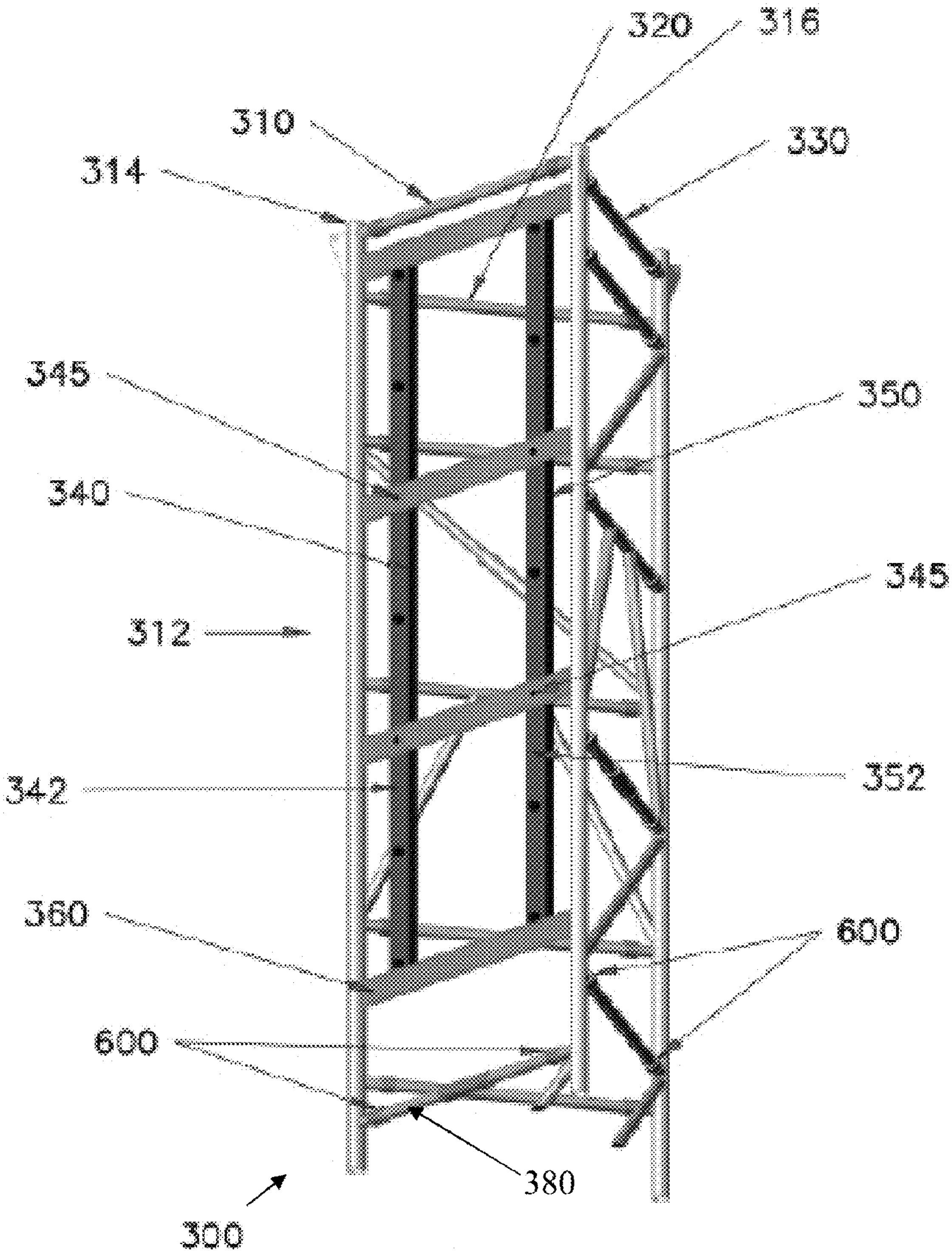

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FIG. 3A

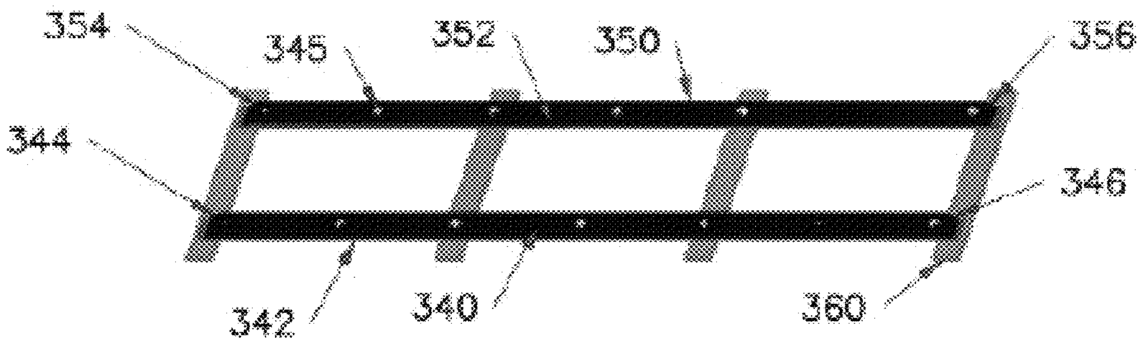

FIG. 3B

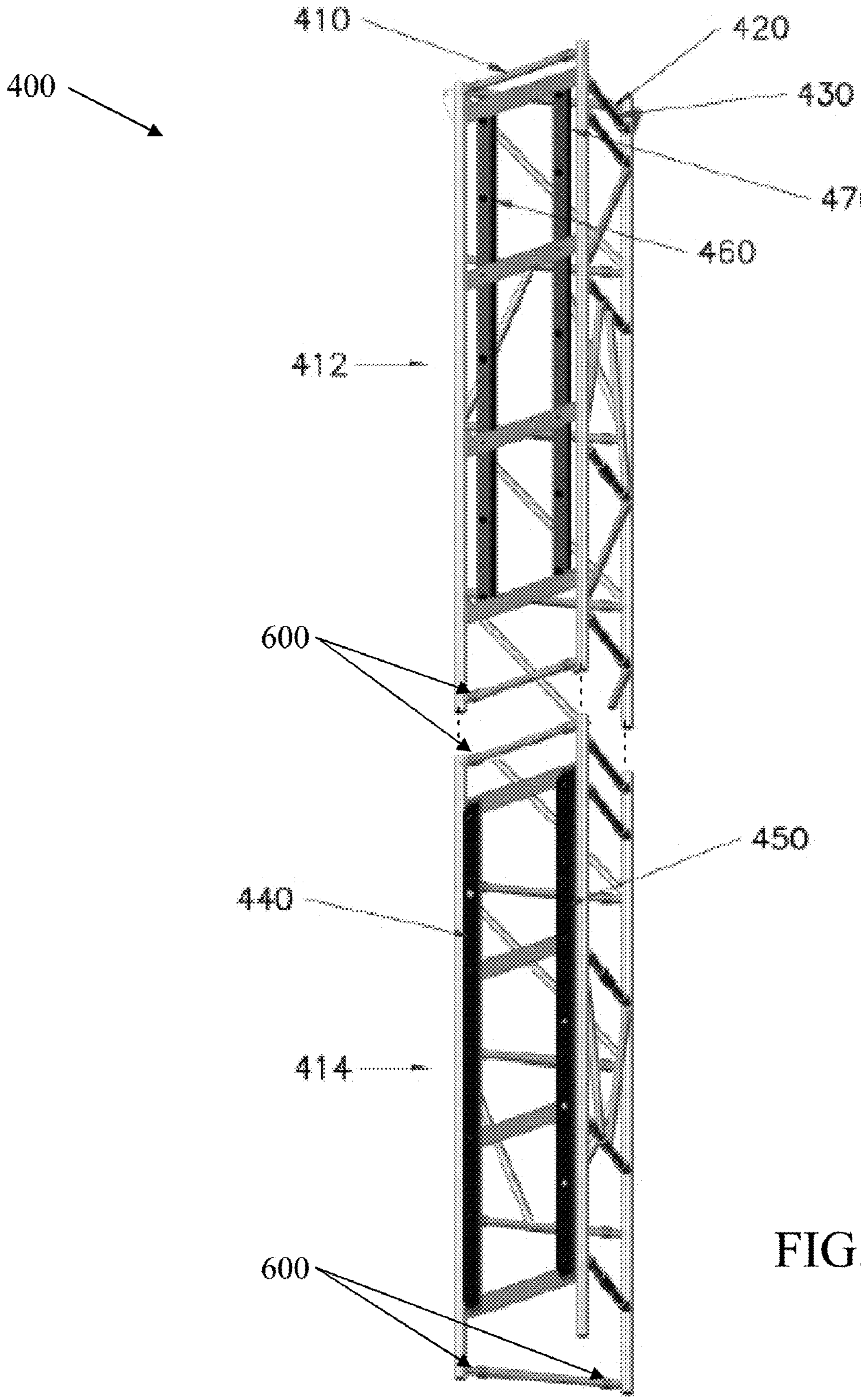

FIG. 4

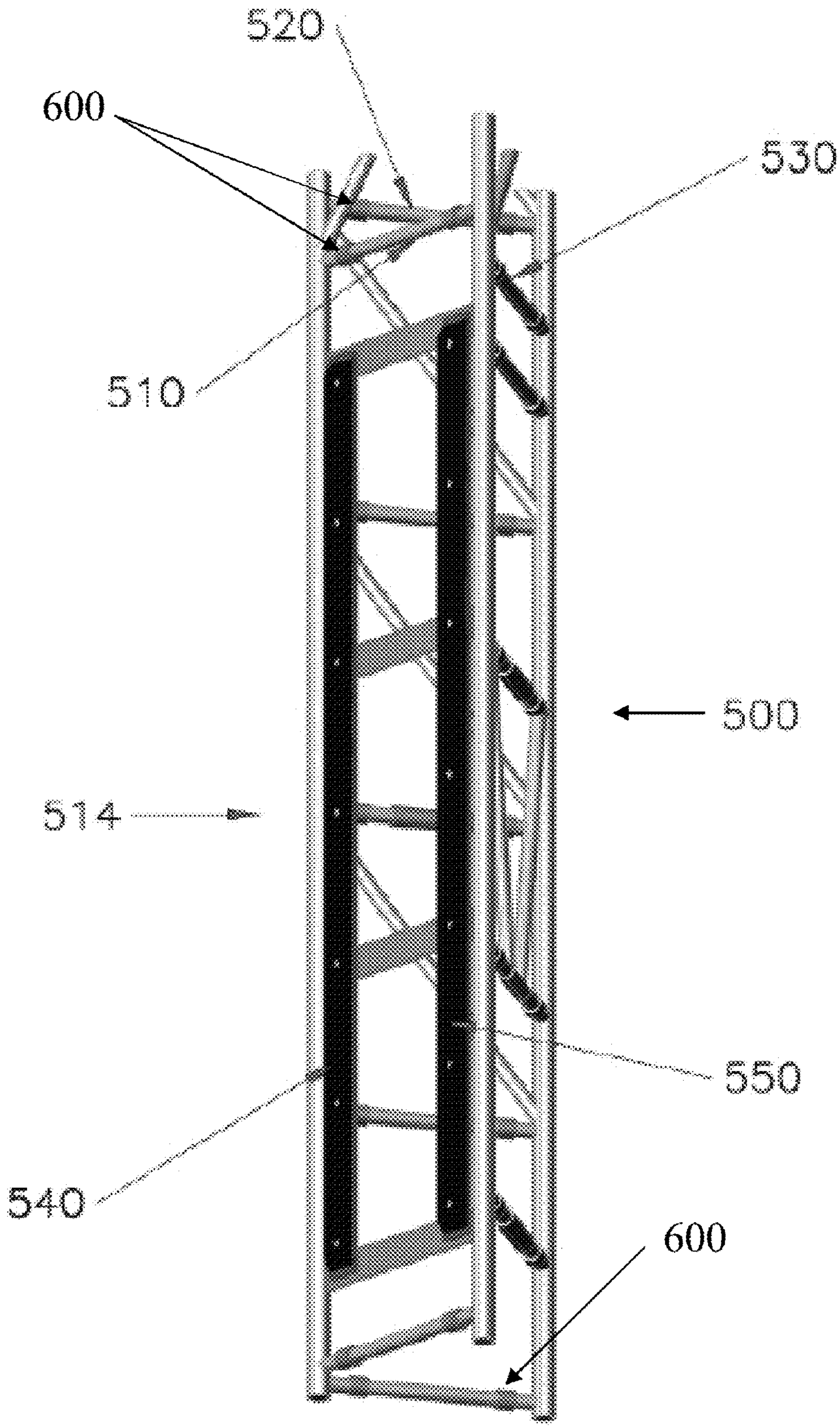

FIG. 5

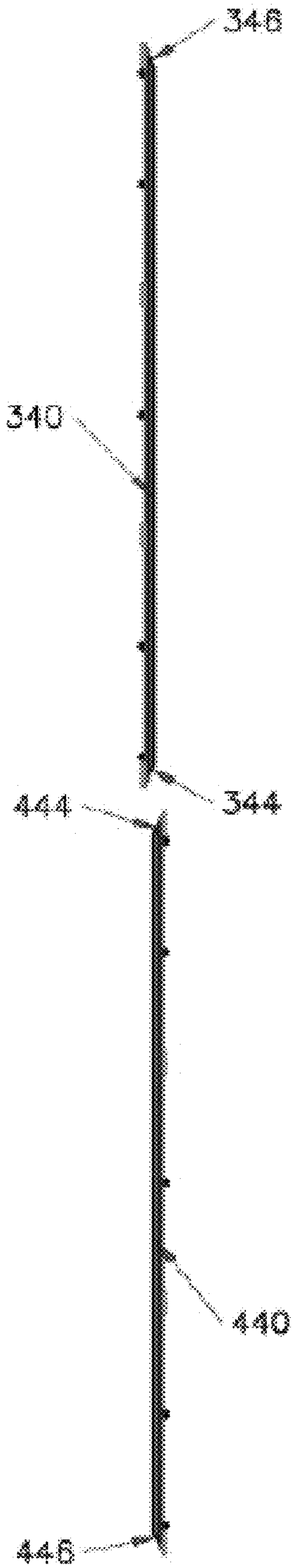

FIG. 6A

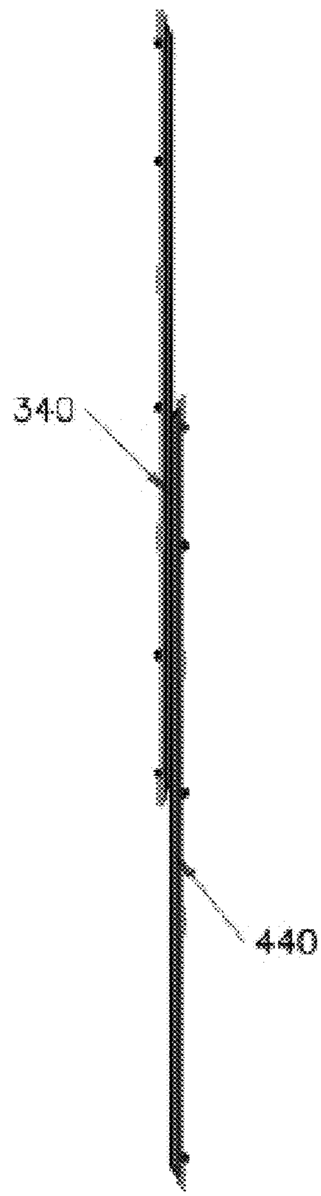

FIG. 6C

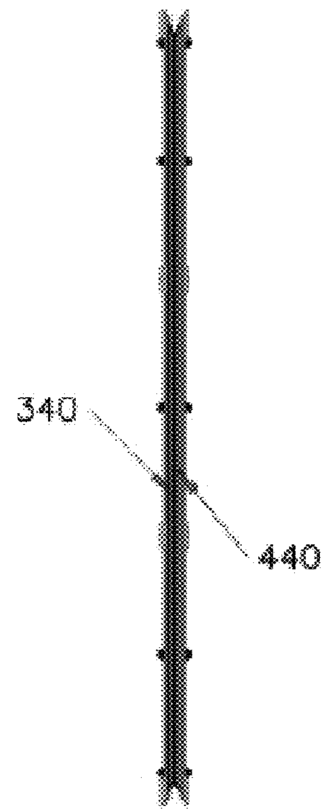

FIG. 6D

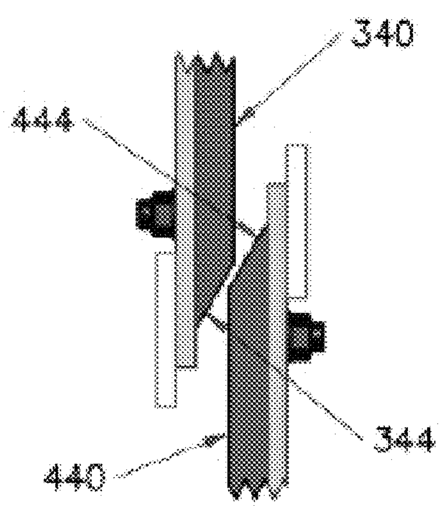

FIG. 6B

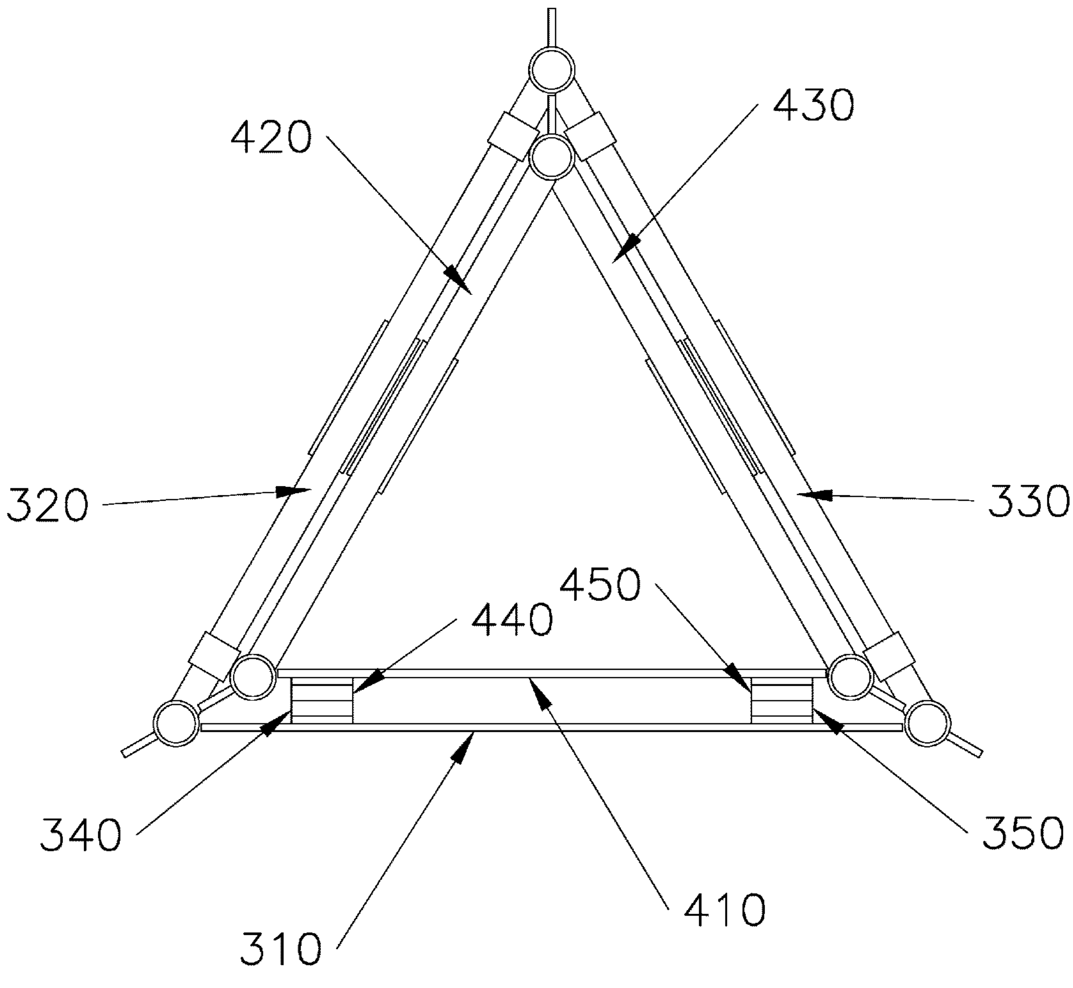

FIG. 7

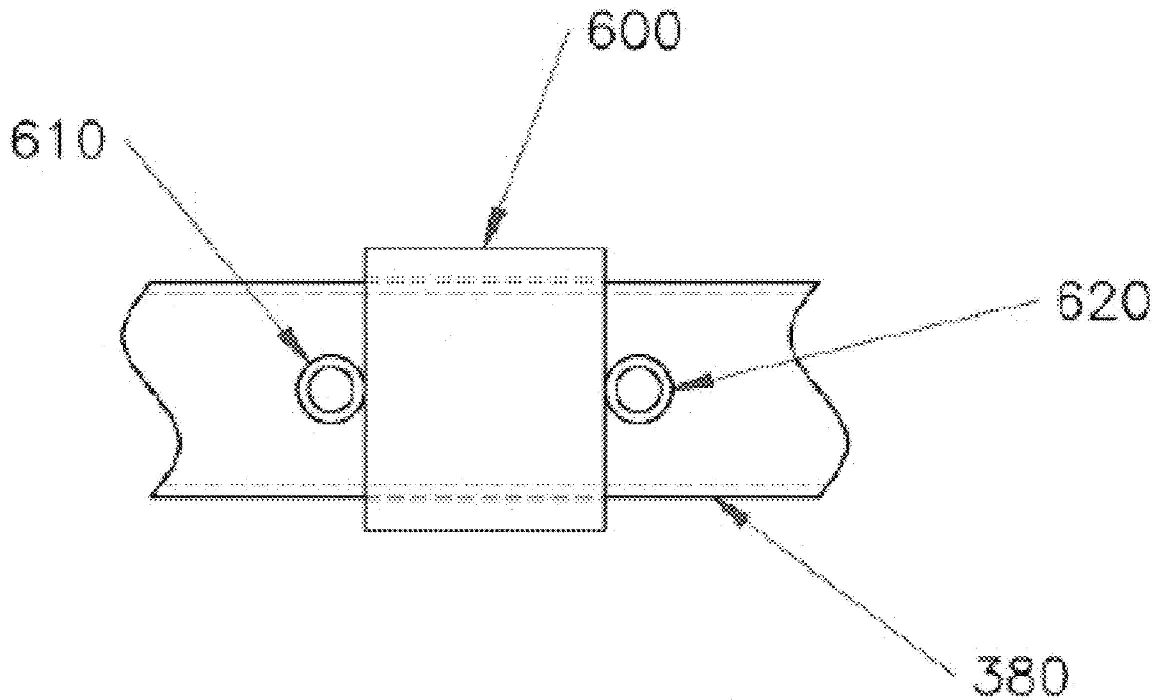

FIG. 8

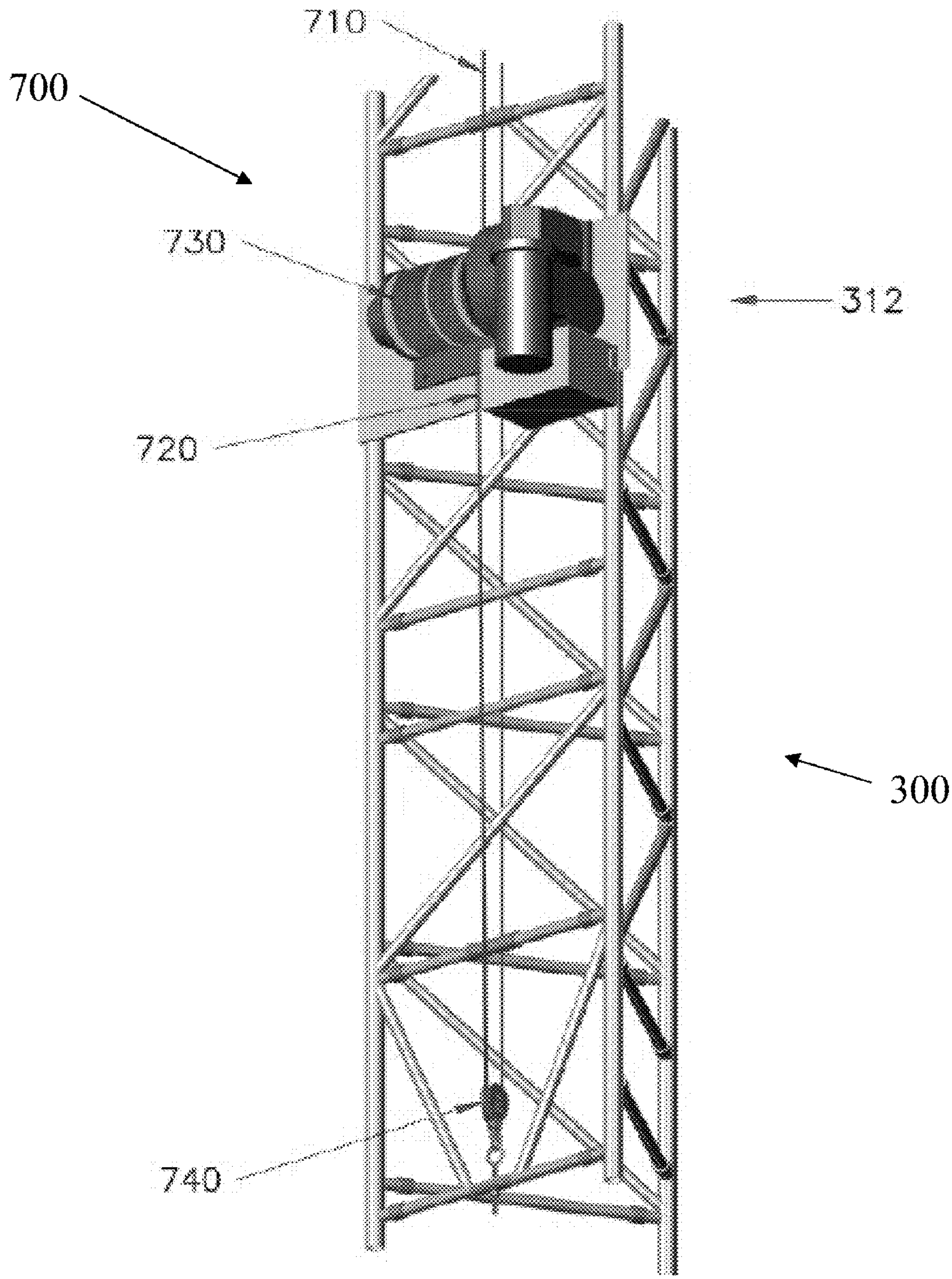

FIG. 9

UNGUYED TELESCOPING TOWER

FIELD OF THE INVENTION

The present invention relates to a telescoping tower generally, and more particularly to an unguyed telescoping tower implementing a pressure bar system to impart stability to the tower structure.

BACKGROUND

Telescoping towers are traditionally used in areas unsuited for permanent tower installations such as in a military arena, a news hot spot, a disaster zone where existing communication lines have been temporarily or permanently disabled, and the like. Other uses include, but are not limited to, site surveys, testing and monitoring, data collection, and wireless data transfer. Most commonly, telescoping towers are used to facilitate the establishment of mobile communications in a relatively short period of time.

There are generally two known problems with mobile telescoping tower applications. First, as the height of the tower increases, the stability of both the tower and the interface or overlap between tower sections decreases. This is traditionally remedied with guy wires or the like. However, the process of installing guy wires can add an average of an hour to the installation and possibly require additional manpower, which are time and resources that are usually unavailable in an emergent or crisis situation, and which results in the second problem.

These two problems are resolved through the use of unguyed towers. By eliminating the need for guy wires, the time spent on guy wire installation can be better utilized during crucial emergency instances where communication towers are vital. Furthermore, unguyed towers can be advantageous where the use of guy wires and anchors are not feasible. Specific applications where guy wire use would be obstructed include urban areas with many buildings, near bodies of water, presence of underground cables or pipes, heavily wooded areas or hard, rocky ground.

There is a need, therefore, for an unguyed tower that can be erected quickly and efficiently, and that is stable at heights that traditionally require guy wire support. This need is met by the telescoping tower of the present disclosure.

SUMMARY

A telescoping tower having a plurality of telescoping tower sections is provided with pressure bar assemblies on each tower section. When a first tower section is extended relative to a second tower section, a pressure bar assembly on one side of the first tower section engages with another pressure bar assembly on a mating side of the second tower section at the overlap between the two tower sections, with the engagement of the pressure bar assemblies causing a pressure or force to act on the other sides of the first and second tower section to close the gap and thereby reduce unwanted play between such respective tower sections. The increased pressure at the overlap results in increased stability of the telescoping tower as a whole and enables the tower to withstand environmental challenges in an unguyed condition.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is one embodiment of an erected telescoping tower in accordance with the present invention.

FIG. **2** is one embodiment of a telescoping tower in a nested condition.

FIG. **3**A is one embodiment of one section of a telescoping tower.

FIG. **3**B is one embodiment of a portion of the section of FIG. **3**A.

FIG. **4** is one embodiment of one section of a telescoping tower.

FIG. **5** is one embodiment of one section of a telescoping tower.

FIGS. **6**A-**6**D are schematic illustrations of one embodiment of the engagement of pressure bars of two tower sections.

FIG. **7** is a schematic illustration of a two section tower.

FIG. **8** is one embodiment of a rung implemented roller.

FIG. **9** is one embodiment of a drive structure implemented in the present disclosure.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

This disclosure describes the best mode or modes of practicing the invention as presently contemplated. This description is not intended to be understood in a limiting sense, but provides an example of the invention presented solely for illustrative purposes by reference to the accompanying drawings to advise one of ordinary skill in the art of the advantages and construction of the invention. In the various views of the drawings, like reference characters designate like or similar parts.

FIG. **1** illustrates one embodiment of an erected telescoping tower **100** formed generally from a first section **110**, a second section **120**, and a third section **130**. A mast **140** may extend from the third section **130** for supporting an antenna or some other data collection device. Other attachments are contemplated. In the embodiments described herein, a telescoping tower **100** of triangular cross-section will be used for purposes of illustration, it being understood that other cross-sectional configurations are within the scope of the present disclosure. It will also be appreciated that while three tower sections are shown, it will be understood that a telescoping tower in accordance with the present disclosure can have as few as two sections and more than three sections if desired. The size, shape, length and cross-section configurations described herein are illustrated for purposes of example and are not intended to be limiting. However, for purposes of explanation and by way of example only, for an illustrated seventy-eight foot tower installation, each tower section would have a height of thirty feet with a six foot overlap at the transition between each tower section, resulting in the first section **110** having a visible height of thirty feet, and the second and third tower sections **120**, **130** each having a visible height of twenty-four feet. Of course, other dimensions, overlaps, etc., are contemplated to meet specific environmental demands.

As shown in FIG. **2**, which illustrates a schematic, nested view of the tower sections **110**, **120** and **130**, the first section **110** has the largest width **210**, the third section **130** has the smallest width **230**, and the second section **120** has a width **220** that is between the first and third widths **210**, **230**. In certain embodiments, the first section **110** might be anchored to a base of some sort, a fixed building, a portable trailer structure or the like (all not shown). However, for purposes of this discussion, the anchoring of the telescoping tower to the ground or some other support structure will not be illustrated or described in detail, it being understood that a variety of anchoring means now known or hereinafter developed may be utilized as desired.

Each of the tower sections **110**, **120**, **130** will now be described in more detail in FIGS. **3A-5** as first, second and third tower sections **300**, **400** and **500**. Each tower section generally has three sides, with first tower section **300** (FIG. 3A) having sides **310**, **320**, **330** and second tower section **400** (FIG. **4**) having sides **410**, **420**, **430** and third tower section **500** (FIG. **5**) having sides **510**, **520**, and **530**. Each side has an interior that faces the other sides, and an exterior that faces away from the respective tower section. In a nested condition, when the three tower sections **300**, **400**, **500** are fully collapsed, the exterior of the second tower section **400** faces the first tower section **300**, and the exterior of the third tower section **500** faces the second tower section **400**.

Positioned along an upper section **312** (only the upper section **312** of tower section **300** is shown in FIG. 3A for clarity) of the interior of side **310** of the first section **300** is preferably a pair of pressure bars **340**, **350** supported on the side **310** by a plurality of horizontally-aligned, vertically-spaced rungs **360**. FIG. 3B illustrates a close up view of the pressure bar arrangement shown in FIG. **3**A shown from the interior of the tower section **300**. While a pair of pressure bars is preferred and shown in the embodiments discussed herein for purposes of explanation, it will be appreciated that at least one and more than two pressure bars can be utilized as desired. Similarly, while the pressure bars are situated on certain illustrated sides, it will be appreciated that other sides may be used as long the relative engagement of pressure bars between tower sections is maintained as will be described in more detail.

More specifically, each pressure bar **340**, **350** is preferably formed from a static-dissipative ultra-high molecular weight (UHMW) polyethylene rectangular material with a low coefficient of friction, high impact strength and weather resistance. Of course, other types of materials are contemplated. In one example where the first tower section **300** is approximately thirty feet long, each pressure bar **340**, **350** is preferably two inches wide, one-half inch thick and sixty inches (five feet) long, and is bolted at a plurality of locations with countersunk bolts **345** to further support bars **342**, **352**, that are then welded or otherwise fixed to laterally extending rungs **360**, that are then welded or otherwise fixed to the longitudinally-extending side frames **314**, **316** that form the side **310** (see FIGS. 3A and 3B). In the illustrated embodiment, these horizontal rungs **360** replace the traditional horizontal and diagonal rungs present along the remainder of the side **310**.

Similar pressure bar assemblies are provided on the second and third tower sections **400**, **500** as shown in FIGS. **4** and **5**. More specifically on the second tower section **400**, pressure bars **440**, **450** are situated on an exterior side of a lower section **414** of side **410** in a facing relationship with side **310** of the first tower section **300**, and additional pressure bars **460**, **470** are situated on an interior side of an upper section **412** of side **410** in a facing relationship with side **510** of the third tower section **500**, with only the upper and lower sections **412**, **414** of the tower section **400** being shown for clarity. On the third tower section **500** (only the lower section **514** of tower section **500** shown in FIG. **5** for clarity), pressure bars **540**, **550** are situated on an exterior side of a lower section **514** of side **510** in a facing relationship with side **410** of the second tower section **400**.

Returning to FIG. **3**, the pressure bars **340**, **350** are positioned along the upper section **312** of the interior side **310** of the first section **300** because such region forms the overlap between the first and second tower sections **300**, **400** when the second tower section **400** is extended relative to the first tower section **300**. The overlap region is traditionally the region of greatest concern from the perspective of the tower as a whole, since the overlap constitutes an effective joint in the tower structure, and there is typically some play that exists between tower sections at the overlap region. Excessive play at the overlap can increase the instability of the entire tower particularly during undesirable environmental conditions. It is for this reason that the pressure bars are preferably disposed at the overlap regions. Thus, with a six foot overlap between tower sections, for example, the pressure bars **340**, **350** would preferably occupy five of the last six feet of height of the first tower section **300**, with a one foot offset preferably provided to accommodate different installation spacing. Similarly, pressure bars **440**, **450** of the second tower section **400** would preferably occupy five of the first six feet of height of such tower section, while pressure bars **460**, **470** would occupy five of the last six feet of height of such tower section.

FIGS. **6**A-**6**D illustrates the engagement of pressure bar **340** of tower section **300** with pressure bar **440** of tower section **400**, it being understood that pressure bars **350** and **450** would simultaneously engage with the engagement of pressure bars **340**, **440**. For purposes of illustration, the third tower section **500** will not be shown and only pressure bars **340**, **440** will be shown for illustration even though pressure bars **350**, **450** will also be described below. As shown in FIG. **6**A, when tower section **400** is extended relative to tower section **300**, the pressure bars **440**, **450** approach pressure bars **340**, **350** along a collision course. In order to facilitate mounting engagement of the two pressure bar assemblies, each pressure bar is provided with a tapered edge **344**, **346**, **354**, **356**, (see also FIG. 3B) **444**, **446**, **454**, **456** that acts as a cam to allow the pressure bars to ramp up on each other as shown in FIG. **6**B. Once the pressure bars are in respective planar engagement (FIG. **6**C), the pressure bars **440**, **450** continue to advance over pressure bars **340**, **350** with the continued extension of the second tower section **400** relative to the first tower section **300** until the pressure bar assemblies are effectively in parallel alignment and there is sufficient overlap between the first and second tower sections as shown in FIG. **6**D. As will be appreciated, the sliding engagement of the pressure bar assemblies is aided by the low coefficient of friction material and the countersunk bolts used to secure the pressure bars to the support plates.

As shown in FIG. **7**, the engagement of the pressure bar assemblies along sides **310**, **410** forces the other two sides **420**, **430** of the second tower section **400** against the other two sides **320**, **330** of the first tower section **300** in order to close the gap that normally exists between the tower sections and that enables the tower sections to freely move relative to each other. This additional pressure exerted across all three sides of each tower section at the overlap between the tower sections imparts a measurable increase in stability throughout such overlap region and thereby reduces the play between the two tower sections that might otherwise be problematic in certain adverse environmental conditions. This also imparts additional stability to the entire telescoping tower structure as the two tower sections effectively function as a unified tower section, which also enables the tower section to be erected without guy wires and the like.

In order to accommodate the relative movement of the tower sections while the pressure bar assemblies are engaged, given that such engagement causes the tower sections to effectively be forced together, rollers **600** (FIGS. **3**-**5**) are provided on rungs (FIGS. **3**A-**5**) at strategic locations relative to the force applied by the pressure bars so as to provide the maximum length of support. As shown in FIG. **8**, a roller **600** is typically formed from a cylindrical collar that is situated on a rung **380** (see FIG. 3A, for example) between a pair of stops **610**, **620**. The roller **600** may be a single cylindrical collar or it may be formed from multiple collars placed in series. Other roller configurations are contemplated. The rollers **600** accommodate the sliding movement of the tower sections relative to each other. Without the rollers **600**, the tower sections might get damaged or be prevented from moving relative to each other as a result of the increased pressure imparted by the engagement of the pressure bar assemblies.

In a preferred embodiment, all of the tower sections **300**, **400**, **500** are moved simultaneously via a cabled rigging disposed between the tower sections. In other words, in such an embodiment, while the second tower section **400** is erected relative to the first tower section **300**, and the pressure bar assemblies **340**, **350** are engaged with pressure bar assemblies **440**, **450**, the same process occurs simultaneously with respect to the erection of the third tower section **500** relative to the second tower section **400**. Thus, as the second tower section **400** is moving relative to the first tower section **300**, the third tower section **500** is moving relative to the second tower section **400**, which, in such embodiment, allows the tower assembly to be erected rather quickly. During extension of the third tower section **500** relative to the second tower section **400**, the pressure bars **540**, **550** approach pressure bars **460**, **470** and initiate engagement with the assistance of cam surfaces. Once the pressure bars are in respective planar engagement, the pressure bars **540**, **550** continue to advance over pressure bars **460**, **470** with the continued extension of the third tower section **500** relative to the second tower section **400** until the pressure bar assemblies are effectively in parallel alignment and there is sufficient overlap between the second and third tower sections. When the second and third tower sections are fully extended and the pressure bar assemblies are fully engaged at the overlap regions of the tower sections, the entire tower functions as a single unit with increased overall stability. While simultaneous movement of the tower sections is preferred, non-simultaneous movement may be contemplated if desired.

In order for the pressure bar assemblies to impart sufficient force on the tower sections to increase the structural integrity at the overlap sections and for the tower as a whole, the pressure is preferably great enough such that the tower will not collapse under the force of gravity alone. In other words, in the described embodiment, the tower sections will preferably need to be pulled apart when it is desired to return the tower to its fully nested condition for storage or transport or the like.

FIG. **9** illustrates one embodiment of a drive structure **700** that may be attached to the first tower section **300** to aid in the separation of the tower sections. While FIG. **9** illustrates the attachment of the drive **700** to the first tower section **300**, it will be appreciated that other attachment scenarios are possible, that are either connected to a tower section or anchored to something apart from the tower such as a nearby building, support trailer or the like. More specifically, in this embodiment, drive structure **700** is a winch that simultaneously uses two separate cables **710**, **720**, each moving in the opposite direction, on a single grooved drum **730**. In other words, when cable **710** is being fed from the drum **730**, the other cable **720** is being fed onto the drum **730**, and vice versa, which enables the winch to move the tower sections relative to each other, either during erection or disassembly of the tower. While a single-drum winch is preferred, it will be appreciated that other drive structures are contemplated. In addition, the drum **730** is preferably grooved to insure that the cables track correctly. A series of pulleys **740** (only one being shown for purposes of example) are strategically positioned throughout the tower sections to accommodate the cables **710**, **720** and create the appropriate rigging necessary to quickly and efficiently, and preferably simultaneously, raise and lower a telescoping tower assembly. More specifically, in a preferred arrangement, each respective cable **710**, **720** is associated, through a rigging assembly, with a respective tower section, for purposes of erecting one tower section relative to its adjacent tower section by pulling such respective tower sections relative to each other, and similarly, for pulling such tower sections apart when it is desired to disassemble the tower sections into their nested condition.

While the present invention has been described at some length and with some particularity with respect to the several described embodiments, it is not intended that it should be limited to any such particulars or embodiments or any particular embodiment, but it is to be construed with references to the appended claims so as to provide the broadest possible interpretation of such claims in view of the prior art and, therefore, to effectively encompass the intended scope of the invention. Furthermore, the foregoing describes the invention in terms of embodiments foreseen by the inventor for which an enabling description was available, notwithstanding that insubstantial modifications of the invention, not presently foreseen, may nonetheless represent equivalents thereto.

What is claimed is:

1. A telescoping tower comprising:

a) a first tower section having a first pressure member mounted on a length of a rung on a flat side of the first tower section and a first overlap region; further comprising a corner member at the end of each rung and the first pressure member mounted between two corner members and

b) a second tower section having a second pressure member mounted on a length of a rung on a flat side of the second tower section and a second overlap region and being movable relative to the first tower section from a nested position to an extended position, further comprising a corner member at the end of each rung and the second pressure member mounted between two corner members wherein the space to be occupied by the second pressure member is at least partially common to the space occupied by the first pressure member when in the extended position;

c) wherein the second pressure member engages the first pressure member upon movement of the second tower section from the nested position to the extended position such that the first and second pressure members give way relative to each other over the at least partially common space to increase stability of the telescoping tower and reduce unwanted play between the first and second overlapping regions by causing a pressure or force to act between a rung of the first tower section and a rung of the second section on the other flat sides of the first and second tower section respectively; and

d) wherein the increased stability at the overlapping regions prevents disengagement of the first and second pressure members through gravity alone.

2. The telescoping tower of claim **1**, wherein the first and second pressure members are respectively situated in the first and second overlap regions.

3. The telescoping tower of claim **1**, wherein the first pressure member is situated on an inner side of the first tower section, and the second pressure member is situated on an outer side of the second tower section.

4. The telescoping tower of claim **1**, wherein at least one pressure member has a cam surface to facilitate the initial engagement of the pressure members.

5. The telescoping tower of claim **1**, further comprising a drive member that moves the second tower relative to the first tower.

6. The telescoping tower of claim **5**, wherein the drive member further comprises a winch having a drum, a first cable attached to the drum, and a second cable attached to the drum, the first and second cables being movable in opposite directions relative to the drum for moving the tower sections relative to each other.

7. The telescoping tower of claim **6**, wherein the drum is grooved to facilitate tracking of the first and second cables.

8. The telescoping tower of claim **1**, wherein each pressure member further comprises a static-dissipative, ultra-high molecular weight (UHMW) polyethylene material.

9. The telescoping tower of claim **1**, wherein each pressure member is attached to its respective tower section with countersunk fasteners.

10. The telescoping tower of claim **1**, further comprising rollers to accommodate relative sliding movement of the tower sections during engagement of the pressure members.

11. The telescoping tower of claim **10**, wherein the rollers are situated on rungs on each tower section.

12. The telescoping tower of claim **11**, wherein the pressure members are situated on one side of each tower section and the rollers on rungs are situated on at least one other side of each tower section.

13. A telescoping tower comprising:

a) a first tower section having a first pressure member mounted on a length of a rung on a flat side of the first tower section in a first overlap region; further comprising a corner member at the end of each rung and the first pressure member mounted between two corner members

b) a second tower section having a second pressure member mounted on a length of a rung on a flat side of the second tower section in a second overlap region and being movable relative to the first tower section from a nested position to an extended position, further comprising a corner member at the end of each rung and the second pressure member mounted between two corner members wherein the space to be occupied by the second pressure member is at least partially common to the space occupied by the first pressure member when in the extended position; and

c) a drive member that moves the second tower relative to the first tower;

d) wherein the second pressure member engages the first pressure member, through a cam surface on at least one of the first and second pressure members, upon movement of the second tower section from the nested position to the extended position such that the first and second pressure members give way relative to each other over the at least partially common space to increase stability of the telescoping tower and reduce unwanted play between the first and second overlapping regions and prevent disengagement of the first and second pressure members through gravity alone by causing a pressure or force to act between a rung of the first tower section and a rung of the second section on the other flat sides of the first and second tower section respectively; and

e) wherein the drive member is used to disengage the first and second pressure members when it is desired to return the second tower section to the nested position.

14. The telescoping tower of claim **13**, wherein the first pressure member is situated on an inner side of the first tower section, and the second pressure member is situated on an outer side of the second tower section.

15. The telescoping tower of claim **14**, wherein the drive member further comprises a winch having a grooved drum, a first cable attached to the drum, and a second cable attached to the drum, the first and second cables being movable in opposite directions relative to the drum for moving the tower sections relative to each other.

16. The telescoping tower of claim **13**, wherein each pressure member further comprises a static-dissipative, ultra-high molecular weight (UHMW) polyethylene material.

17. The telescoping tower of claim **13**, further comprising rollers to accommodate relative sliding movement of the tower sections during engagement of the pressure members.

18. A telescoping tower comprising a first tower section having a first pressure member mounted on a length of a rung on a flat side of the first tower section and a first overlap region; further comprising a corner member at the end of each rung and the first pressure member mounted between two corner members and a second tower section having a second pressure member mounted on a length of a rung on a flat side of the second tower section and a second overlap region; and a drive member that moves the second tower relative to the first tower from a nested position to an extended position, further comprising a corner member at the end of each rung and the second pressure member mounted between two corner members wherein the space to be occupied by the second pressure member is at least partially common to the space occupied by the first pressure member when in the extended position; and further comprising a drum, a first cable attached to the drum, and a second cable attached to the drum, the first cable runs off from the top of the drum and the second cable runs off from the bottom of the drum, the first and second cables being movable in opposite directions relative to the drum for moving the tower sections relative to each other; wherein the second pressure member engages the first pressure member upon movement of the second tower section from the nested position to the extended position such that the first and second pressure members give way relative to each other over the at least partially common space to increase stability of the telescoping tower and reduce unwanted play between the first and second overlapping regions by causing a pressure or force to act between a rung of the first tower section and a rung of the second tower section on the other flat sides of the first and second tower section respectively.

19. The telescoping tower of claim **18**, wherein the drum is grooved to facilitate tracking of the first and second cables.

20. The telescoping tower of claim **18**, further comprising a third tower section that is movable relative to the second tower section simultaneously with the movement of the second tower section relative to the first tower section.

* * * * *

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(12) **United States Patent**
Diniz et al.

(10) **Patent No.: US 8,365,471 B2**
(45) **Date of Patent: Feb. 5, 2013**

(54) AUTOMATED TELESCOPING TOWER

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(73) Assignee: **Aluma Tower Company, Inc.**, Vero Beach, FL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 303 days.

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(22) Filed: **Feb. 1, 2010**

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(51) **Int. Cl.**
E04H 12/18 (2006.01)

(52) **U.S. Cl.** **52/1**; 52/111; 52/121; 52/632; 340/601

(58) **Field of Classification Search** 52/1, 111, 52/121, 632; 340/601
See application file for complete search history.

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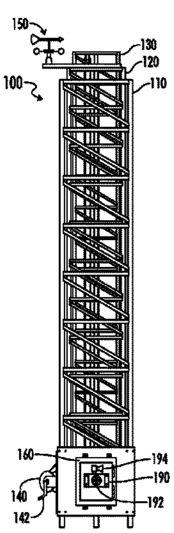
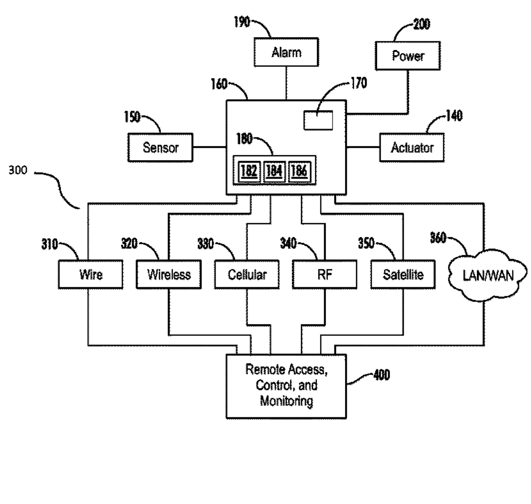
(74) *Attorney, Agent, or Firm* — Myers Wolin, LLC

(57) **ABSTRACT**

A telescoping tower comprising a sensor for monitoring an environmental condition, a processor for comparing the monitored environmental condition to a predetermined value, and an actuator for automatically retracting the telescoping tower if the environmental condition is equal to or greater than the predetermined value.

8 Claims, 5 Drawing Sheets





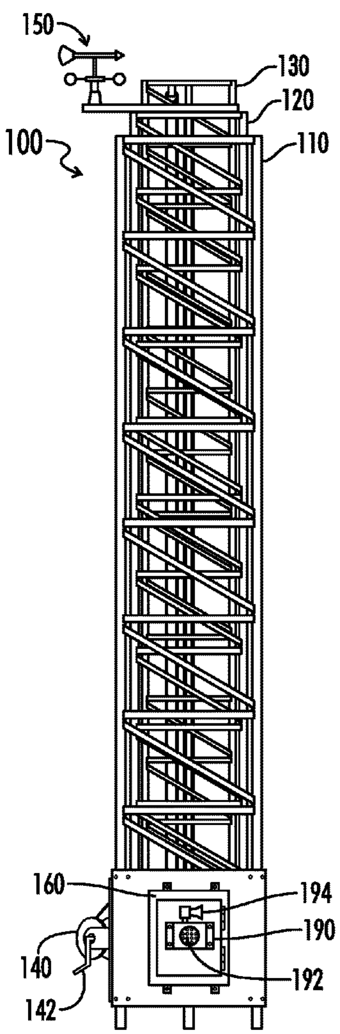


FIG. 1

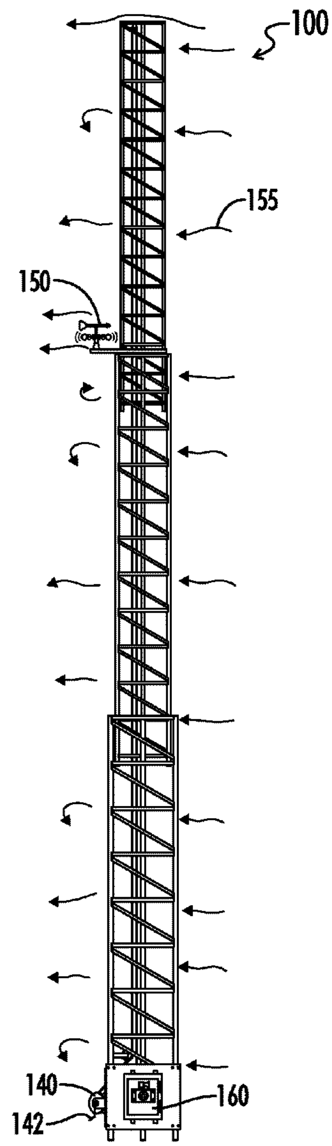


FIG. 2

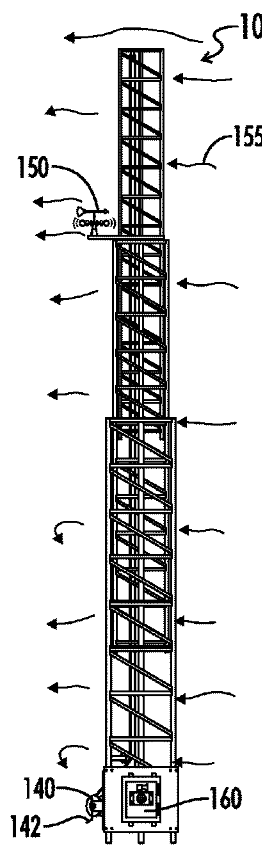


FIG. 3

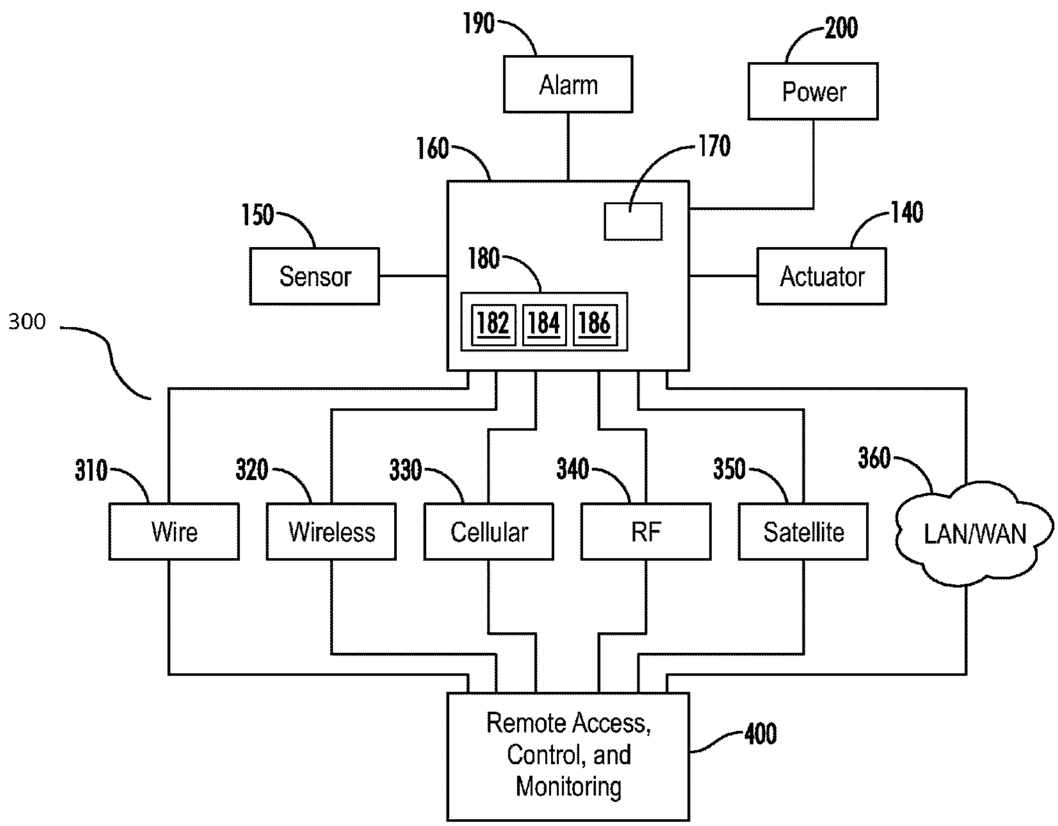

190
Alarm
200
Power
160
170
150
Sensor
180
182
184
186
140
Actuator
300
310
Wire
320
Wireless
330
Cellular
340
RF
350
Satellite
360
LAN/WAN
Remote Access, Control, and Monitoring
400

FIG. 4

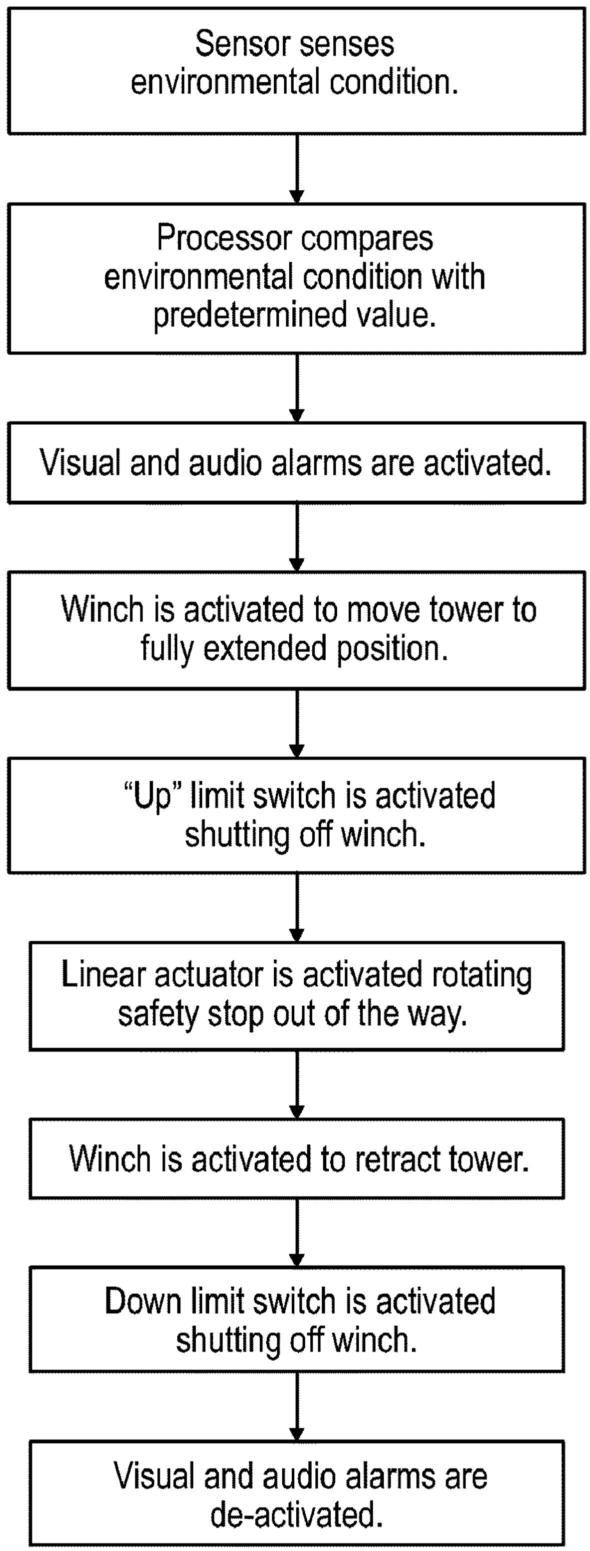

Sensor senses environmental condition.
Processor compares environmental condition with predetermined value.
Visual and audio alarms are activated.
Winch is activated to move tower to fully extended position.
"Up" limit switch is activated shutting off winch.
Linear actuator is activated rotating safety stop out of the way.
Winch is activated to retract tower.
Down limit switch is activated shutting off winch.
Visual and audio alarms are de-activated.

FIG. 5

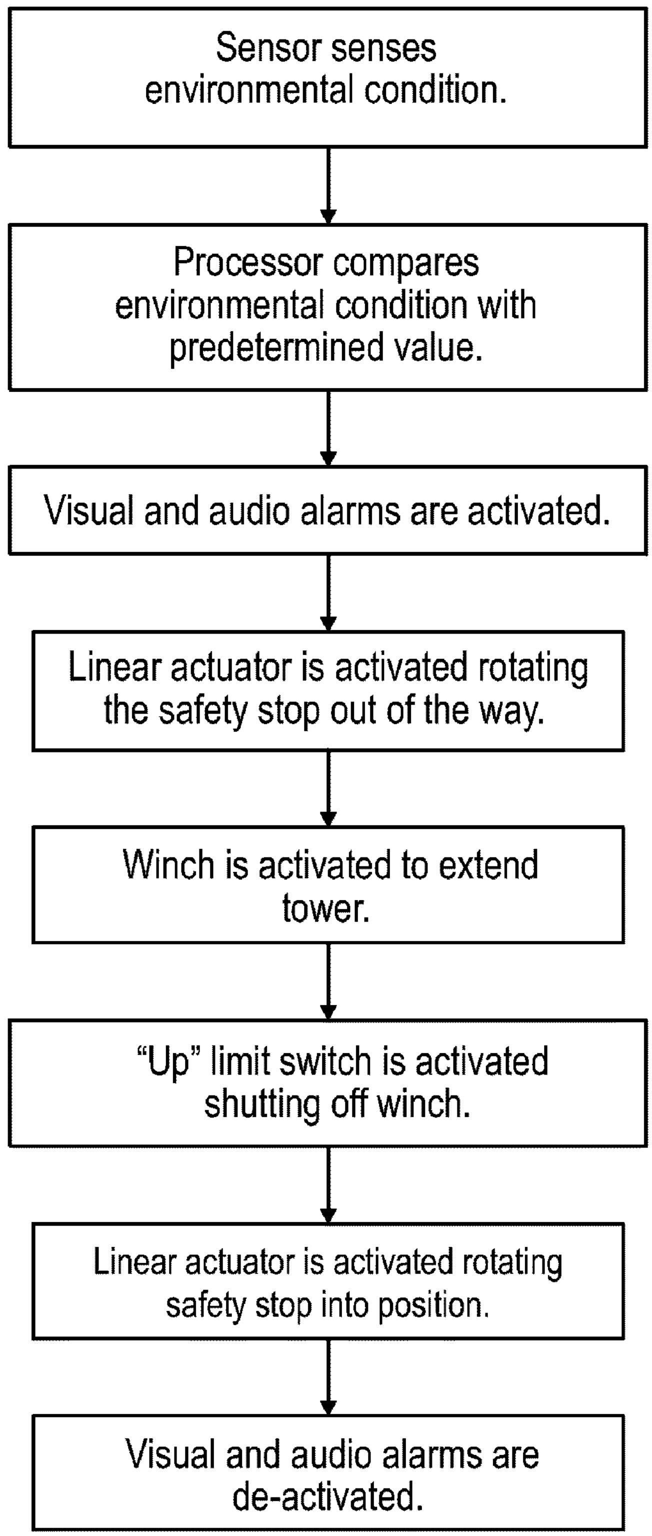

Sensor senses environmental condition.
Processor compares environmental condition with predetermined value.
Visual and audio alarms are activated.
Linear actuator is activated rotating the safety stop out of the way.
Winch is activated to extend tower.
"Up" limit switch is activated shutting off winch.
Linear actuator is activated rotating safety stop into position.
Visual and audio alarms are de-activated.

FIG. 6

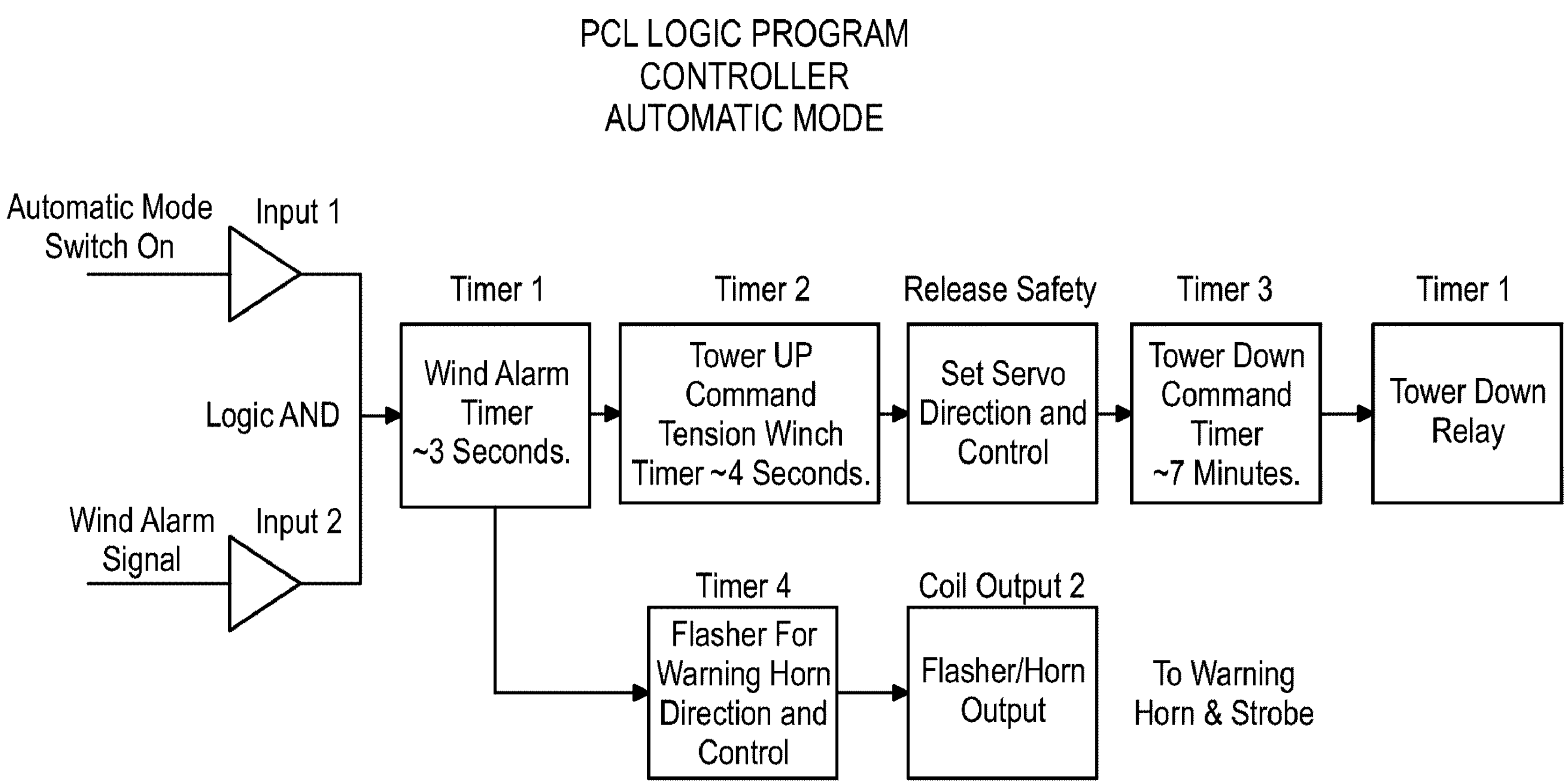

PCL LOGIC PROGRAM
CONTROLLER
AUTOMATIC MODE
Automatic Mode Switch On
Input 1
Logic AND
Wind Alarm Signal
Input 2
Timer 1
Wind Alarm Timer ~3 Seconds.
Timer 2
Tower UP Command Tension Winch Timer ~4 Seconds.
Release Safety
Set Servo Direction and Control
Timer 3
Tower Down Command Timer ~7 Minutes.
Timer 1
Tower Down Relay
Timer 4
Flasher For Warning Horn Direction and Control
Coil Output 2
Flasher/Horn Output
To Warning Horn & Strobe

FIG. 7

AUTOMATED TELESCOPING TOWER

FIELD OF THE INVENTION

The present invention relates to telescoping towers in general, and more particularly to a telescoping tower that automatically retracts in response to adverse environmental conditions.

BACKGROUND

Rapidly deployable telescoping towers are typically utilized to provide temporary communications, disaster recovery, testing, monitoring, surveillance, site survey and wireless data transfer functions to name a few. Such towers are generally constructed from aluminum or other lightweight materials for ease of transport and operation, and are often candidates for remote and/or unattended operations.

When such towers are deployed to areas where extreme inclement weather is prevalent, it is prudent to fully or partially retract the telescoping tower when winds rise to the point that the tower design limit is approached. If the tower is deployed in an unattended operation or the operator is temporarily away from the site, retraction of the tower will not take place and a potentially undesirable condition may develop. Once the retraction is made and the environmental (or other) danger has passed, it is desirable to have the tower to extend and return to its original operating condition.

SUMMARY

There is provided a telescoping tower comprising, in one embodiment, a sensor and control system that automatically monitors an environmental condition, such as wind speed, compares the monitored condition against a predetermined value, such as an over speed value, and automatically retracts the telescoping tower if the environmental condition is equal to or greater than the predetermined value. Once retracted, the system can, in one embodiment, automatically extend the telescoping tower when environmental conditions are no longer a concern. The system may be further provided with remote access, control and monitoring to provide for full command and control of any towers located anywhere in the world from anywhere in the world.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is one embodiment of a telescoping tower of the invention in the fully retracted position.

FIG. **2** is one embodiment of a telescoping tower in the fully extended position.

FIG. **3** is one embodiment of a telescoping tower in a partially retracted position.

FIG. **4** illustrates one embodiment of a control diagram incorporating elements of the invention.

FIG. **5** illustrates one embodiment of an automatic retraction of a telescoping tower.

FIG. **6** illustrates one embodiment of an automatic extension of a telescoping tower.

FIG. **7** illustrates one embodiment of a logic program for a controller exhibiting an automatic mode.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

This disclosure describes the best mode or modes of practicing the invention as presently contemplated. This description is not intended to be understood in a limiting sense, but provides an example of the invention presented solely for illustrative purposes by reference to the accompanying drawings to advise one of ordinary skill in the art of the advantages and construction of the invention. In the various views of the drawings, like reference characters designate like or similar parts.

FIG. **1-4** illustrate one embodiment of a telescoping tower **100** in accordance with aspects of the present invention comprising a plurality of telescoping tower sections **110**, **120** and **130** slidably movable relative to each other and connected together by an actuator line (not shown) associated with an actuator **140**. While FIG. **1** illustrates three tower sections, it will be appreciated that two tower sections or more than three tower sections are possible. In addition, while aspects of the this disclosure focus on a telescoping tower including relatively slidable telescoping sections, it will be appreciated that the system of the present invention can be utilized with towers that are raised and lowered using other than telescoping means. Furthermore, for purposes of discussion, the actuator **140** is referenced as a motor-powered winch that is anchored to the tower section **110** for extending and retracting the tower sections by automatic or manual operation as will be described below, although other methods of actuation are possible. An environmental sensor **150**, such as heated ultrasonic wind sensor, for example, is attached to one of the tower sections for monitoring environmental conditions in the vicinity of the tower **100**, where the environmental sensor **150** in the illustrated embodiment is an anemometer **150** that measures wind conditions **155** (FIGS. **2-3**). Other sensors can be employed that measure other conditions such as, but not limited to, surveillance and intrusion monitoring. The environmental sensor **150** if FIG. **1** is connected to a control panel **160** that includes a processor or microprocessor **170**, a mode switch **180** for controlling the operation of the telescoping tower **100**, and an alarm **190** including a visual component **192** and an audio component **194** for alerting operators and people in the vicinity that the tower **100** is going to retract or extend. A power system **200** (FIG. **4**) is provided for powering the components of the telescoping tower assembly **100** including, but not limited to, the actuator **140**, sensor **150**, processor **170**, and alarm **190**. The power system **200** can be connected to a direct current source such as household current, current from a nearby facility, generator or the like, and can be either 110 VAC or 12 VDC power, for example. Various options are available. For remote locations, a 12 VDC system with a solar battery charger may be preferred as a standalone back-up system.

The environmental sensor **150** measures an environmental condition such as wind speed, wind gusts and the like, to determine if the tower assembly **100** is being exposed to adverse environmental conditions that might damage or otherwise impair the operation of the tower. Rapidly deployable, lightweight telescoping towers are typically designed to withstand certain wind conditions in a fully extended position before partial or complete retraction becomes necessary. For example, exposure to a certain wind speed, such as 50 mph for example, for a certain period of time, such as 30 minutes for example, might overstress a fully extended tower assembly **100** such that partial retraction of tower sections **120** and/or **130** relative to tower section **110**, or complete retraction of tower sections **120** and **130** into tower section **110**, becomes necessary to protect the integrity of the tower section **100** and prevent damage to the tower sections **110**, **120**, **130** and/or any sensors or other monitoring equipment situated thereon. An operator of the tower assembly can establish predefined environmental conditions, or in the present example combinations of wind speed and duration, depending on a variety of factors including, but not limited to, tower material and/or weight, height of the tower sections, the actuator assembly connection, the anchoring system used to anchor the tower assembly to a support structure or to the ground, the type of sensor or other equipment attached to the tower, or combinations of the same. If the sensor **150** measures a condition that is equal to or greater than a certain predefined environmental condition as compared by the processor **170**, then in an automated operation as described below the processor **170** would cause the actuator **140** to partially or fully retract the tower assembly **100** until the sensor **150** measures an environmental condition that is below the certain predefined condition. Once the adverse environmental condition dissipates, the processor **170** would cause the actuator **140** to return to the tower assembly **100** to an extended condition awaiting further instruction from an operator or until adverse conditions require another partial or full retraction.

It is preferable when the tower assembly **100** is deployed in an unattended operation or a remote location for the control panel **160** to be accessed remotely through some form of communication means **300**. For example, as shown in FIG. **4** for example, to provide full command and control, links to a remote control center anywhere in the world can be established through hard wire **310**, wireless **320**, cellular **330**, RF (radio frequency) link **340**, satellite **350** or other communications means. For example, the control panel **160** could be connected through a network **360** such as a LAN (local area network) or a WAN (wide area network) to a remote operator interface **400** that could remotely monitor the operation of the tower assembly **100**, the sensor output, the actuator operation and the like, and that could remotely access and control the control panel **160** and other tower systems in general if desired. Cameras and other visual monitoring equipment could be integrated into the tower assembly and hooked into the control panel **160** for providing a remote user with enhanced visual observation of the tower assembly and also ambient environmental conditions. If a remote operator desired to retract the tower assembly **100** absent any adverse environmental conditions, then the operator could bypass the sensor control system and directly cause the actuator **140** to retract or extend the tower assembly **100** as desired. The control panel **160** could also receive instructions based on external sources of information such as, for example, weather advisories from the National Weather Service (NWS). For example, if the tower assembly **100** is situated in a certain zip code, and the NWS issues a tornado warning or hurricane alert for such zip code, then such warning or alert could trigger the processor **170** to retract the tower assembly **100** while such alert is in effect, and to extend the tower assembly when such alert is no longer active.

The control panel **160** is further provided with a mode switch **180** that is controlled by the processor **170** and preferably has a first mode **182**, a second mode **184** and a third mode **186** that are designated in the embodiment described herein as the "Off", "Manual", and "Automatic" modes respectively. While such modes **182**, **184** and **186** are shown in FIG. **4** in a certain order, it will be appreciated that other positioning is possible with departing from the functionality of the mode switch. In addition, while the switch **180** is accessible directly at the control panel **160**, remote control and operation of the switch **180** as described above is possible.

In one embodiment, the "Off" mode **182** disables the control system so that no power is supplied to the control panel or the actuator **140**, requiring the actuator **140** to be operated manually or by hand using an actuator handle **142** or the like. If the tower **100** is supplied with a dual mode actuator or winch that allows the winch to be operated mechanically, the tower **100** may be extended or retracted by inserting a crank into the winch **140**. The "Off" mode is preferable while the tower **100** is being manually adjusted, maintained, repaired or otherwise being worked on by company personnel or the like.

In one embodiment, the "Manual" mode **184** allows an operator to manually control the operation of the actuator **140**, with power being supplied to the actuator **140**, to raise or lower the tower **100** to the desired height. Once fully extended or retracted, limit switches (not shown) will deactivate the winch to prevent damage to the tower or lifting system. This manual operator control can occur on site through direct access to the control panel **160**, or remotely through remote access to the control panel through a communication means **300**.

In one embodiment in the "Automatic" mode as shown in FIGS. **5-7**, the sensor **150**, such as an anemometer for example, senses the wind speed and, when a predefined speed is met or exceeded for a certain period of time, a set of normally open contacts close. Closure of these contacts begins a series of events. First, the alarm **190** is activated, which preferably includes a light **192** and a horn **194** for warning personnel in the area that the tower **100** is about to retract or extend. While workers generally should have put the mode switch **180** into the "Off" mode **182** prior to working on the tower, they may have forgotten to do so. Generally, the alarm **190** will be set for thirty seconds allowing ample time for workers to clear the area. After the warning period is over, the winch **140** is preferably activated to move the tower **100** to the fully extended position (FIG. **2**) in case it has come down and rests on the safety stop. An "up" limit switch is activated shutting off the winch **140**. A linear actuator is activated rotating the safety stop out of the way and then the winch **140** is activated to move the tower to a partially (FIG. **3**) or more preferably a fully retracted (FIG. **1**) position. Thereafter, a "down" limit switch is activated shutting off the winch **140** and then the alarm **190** is de-activated.

Returning the tower from a retracted position to an extended position is illustrated, in one embodiment, in FIG. **6**. While the tower is in the retracted position, the sensor **150** senses an environmental condition, such as wind speed, for a predetermined amount of time, that is at or below the environmental condition or wind speed that triggered the tower retraction described above. For example, if retraction of a fully extended tower is caused by a fifty mph wind speed or wind gust, then resumed extension of a fully retracted tower might only occur if the wind speed does not exceed forty mph over a thirty minute period. Setting the environmental condition of the extension trigger at or below the environmental condition of the retraction trigger ensures that the extension of the tower takes place during safe environmental conditions relative to the environmental conditions that resulted in the retraction of the tower. Alternately, a remote command may be given from a remote location **400** (FIG. **4**) to override the system and raise the tower. Thereafter, the alarm **190** is activated for a period of time to allow ample time for workers to clear the area. The linear actuator is activated rotating the safety stop out of the way, and the winch is activated to move the tower to the fully extended position. Thereafter, the "up" limit switch is activated shutting off the winch, the linear actuator is activated rotating safety stop into position, and the alarm **190** is de-activated.

The telescoping tower system of the present invention can be implemented in a variety of different phases depending on, for example, user demands and system cost. One relatively simple implementation would only allow an automated retraction of the tower assembly, with a manual reset required thereafter to raise or extend tower. A next stage implementation would provide a fully automatic operation of lowering and raising the tower. A fully integrated implementation would provide a fully automated system with remote access, control and monitoring of all system functions. In urban areas, for example, the remote connection may be via wireless connection. In remote areas, it can be via satellite phone or other means. The fully integrated implementation will allow remote monitoring and control of towers located anywhere in the world from anywhere in the world.

While the present invention has been described at some length and with some particularity with respect to the several described embodiments, it is not intended that it should be limited to any such particulars or embodiments or any particular embodiment, but it is to be construed with references to the appended claims so as to provide the broadest possible interpretation of such claims in view of the prior art and, therefore, to effectively encompass the intended scope of the invention. Furthermore, the foregoing describes the invention in terms of embodiments foreseen by the inventor for which an enabling description was available, notwithstanding that insubstantial modifications of the invention, not presently foreseen, may nonetheless represent equivalents thereto.

Most preferably, aspects of the invention including the control system, processor or microprocessor, may be implemented as any combination of hardware, firmware and software. Moreover, software is preferably implemented as an application program tangibly embodied on a program storage unit or computer readable medium. The application program may be uploaded to, and executed by, a machine comprising any suitable architecture. Preferably, the machine is implemented on a computer platform having hardware such as one or more central processing units ("CPUs"), a memory, and input/output interfaces. The computer platform may also include an operating system and microinstruction code. The various processes and functions described herein may be either part of the microinstruction code or part of the application program, or any combination thereof, which may be executed by a CPU, whether or not such computer or processor is explicitly shown. In addition, various other peripheral units may be connected to the computer platform such as an additional data storage unit and a printing unit.

What is claimed is:

1. A telescoping tower comprising:

a) an anemometer for monitoring a wind speed;

b) a processor for comparing the monitored wind speed to a first predetermined value;

c) a timer for measuring a duration which the wind speed is equal to or greater than the first predetermined value; and

d) an actuator for automatically retracting the telescoping tower if the wind speed is equal to or greater than the first predetermined value for a duration longer than a predetermined period.

2. The telescoping tower of claim **1**, further comprising a control system for controlling the movement of the telescoping tower.

3. The telescoping tower of claim **2**, wherein the control system is remote from the telescoping tower.

4. The telescoping tower of claim **3**, wherein the telescoping tower is connected to the control system by at least one of a hard wire, wireless, cellular, RF (radio frequency) link, satellite communications or through a network.

5. The telescoping tower of claim **1**, wherein the actuator is a winch attached to the telescoping tower.

6. The telescoping tower of claim **1**, further comprising an audible or visual alarm that is triggered prior to the retraction of the telescoping tower.

7. The telescoping tower of claim **1**, wherein the actuator automatically extends the retracted tower if the wind speed is equal to or less than a second predetermined value.

8. The telescoping tower of claim **7**, wherein the second predetermined value is equal to or less than the first predetermined value.

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