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Monroe

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(54) **LIFTING DEVICE**

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(51) **Int. Cl.**
B66D 1/26 (2006.01)

(52) **U.S. Cl.** **254/285**; 254/279; 254/281; 254/286; 254/324; 254/326

(58) **Field of Classification Search** 254/278, 254/279, 280, 281, 283, 284, 285, 286, 324, 254/325, 326, 393
See application file for complete search history.

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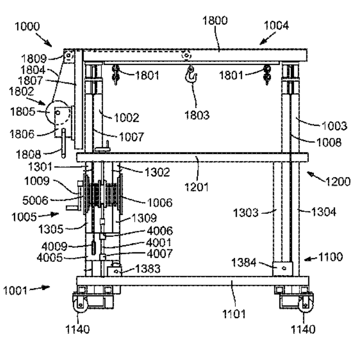
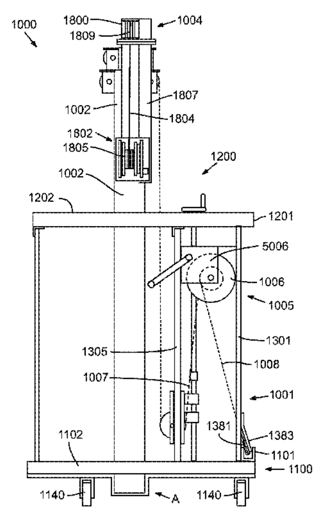
Primary Examiner—Emmanuel M Marcelo
(74) *Attorney, Agent, or Firm*—Joseph P. Curtin, L.L.C.

(57) **ABSTRACT**

A lifting device comprises at least two multi-stage masts and a cable mechanism. Each multi-stage mast comprises a first length and a second length that is longer than the first length. Each multi-stage mast further comprises a plurality of stages, such that at least one stage of a mast is vertically movable with respect to at least one other stage. The cable mechanism comprises a spool and at least one cable that is coupled to the spool and arranged with respect to the multi-stage masts so that when each cable is wound onto the spool, each mast simultaneously and in unison changes length in a direction from the first length to the second length, and when each cable is unwound off the spool, each mast changes length simultaneously and in unison in a direction from the second length to the first length.

31 Claims, 20 Drawing Sheets





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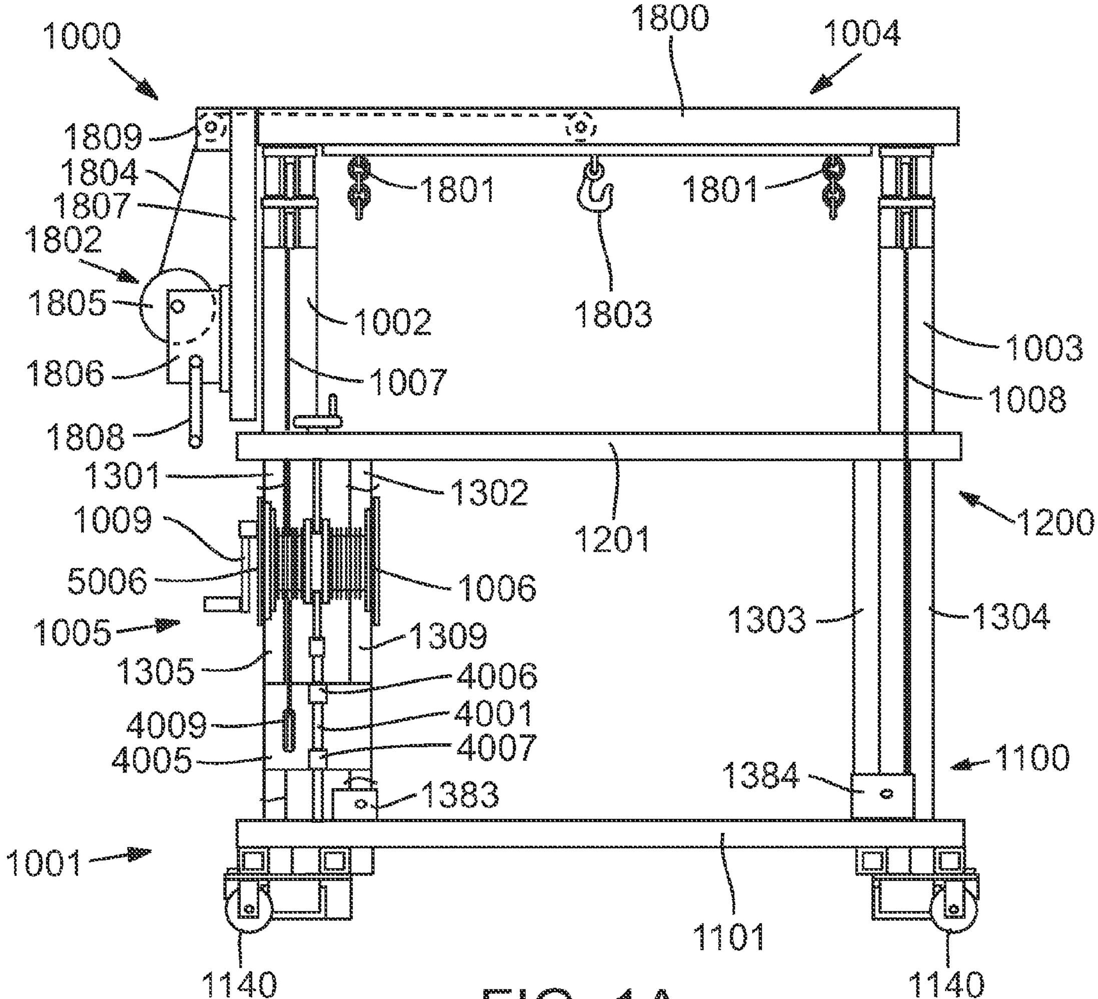
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FIG. 1A

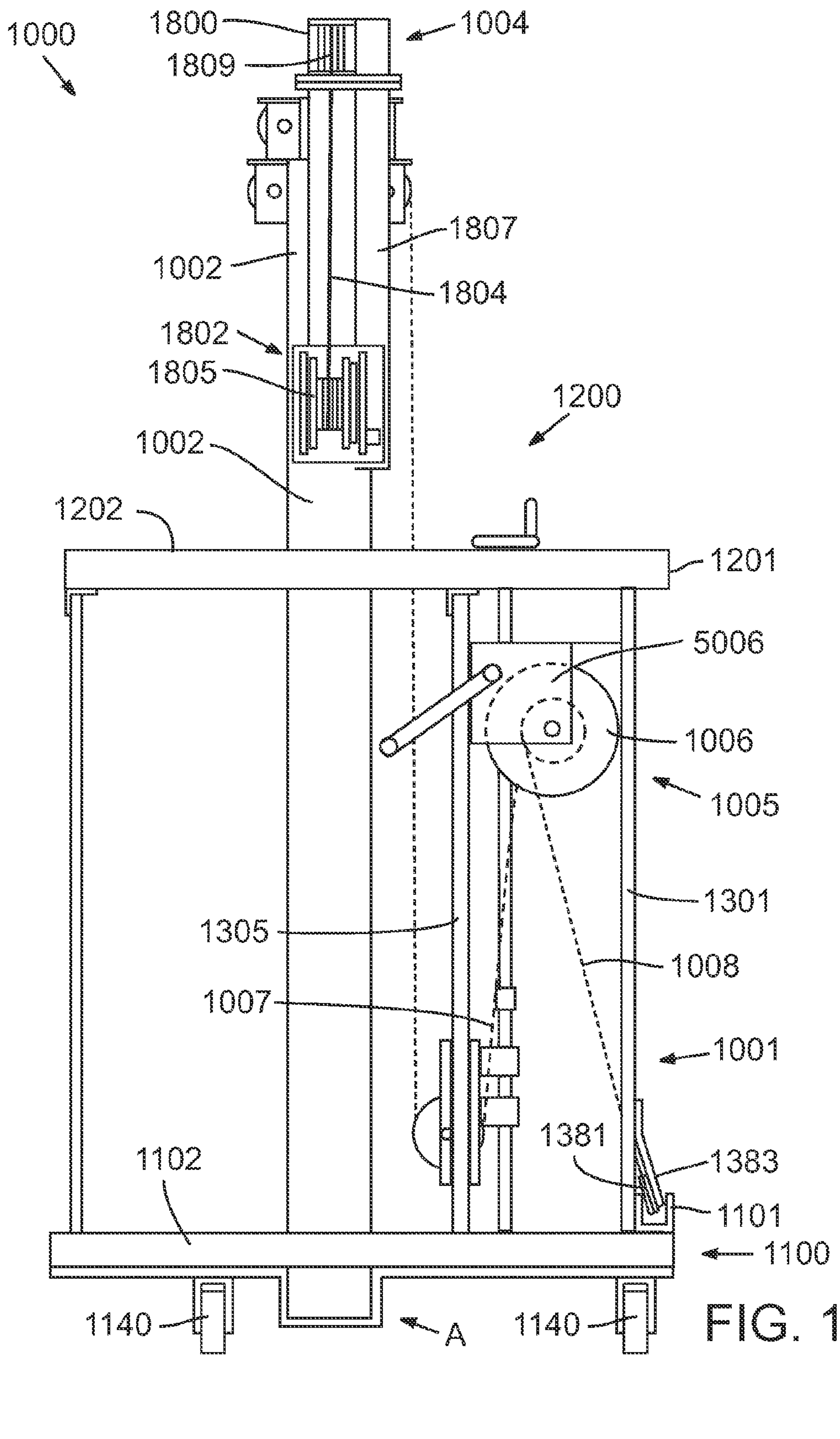
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FIG. 1B

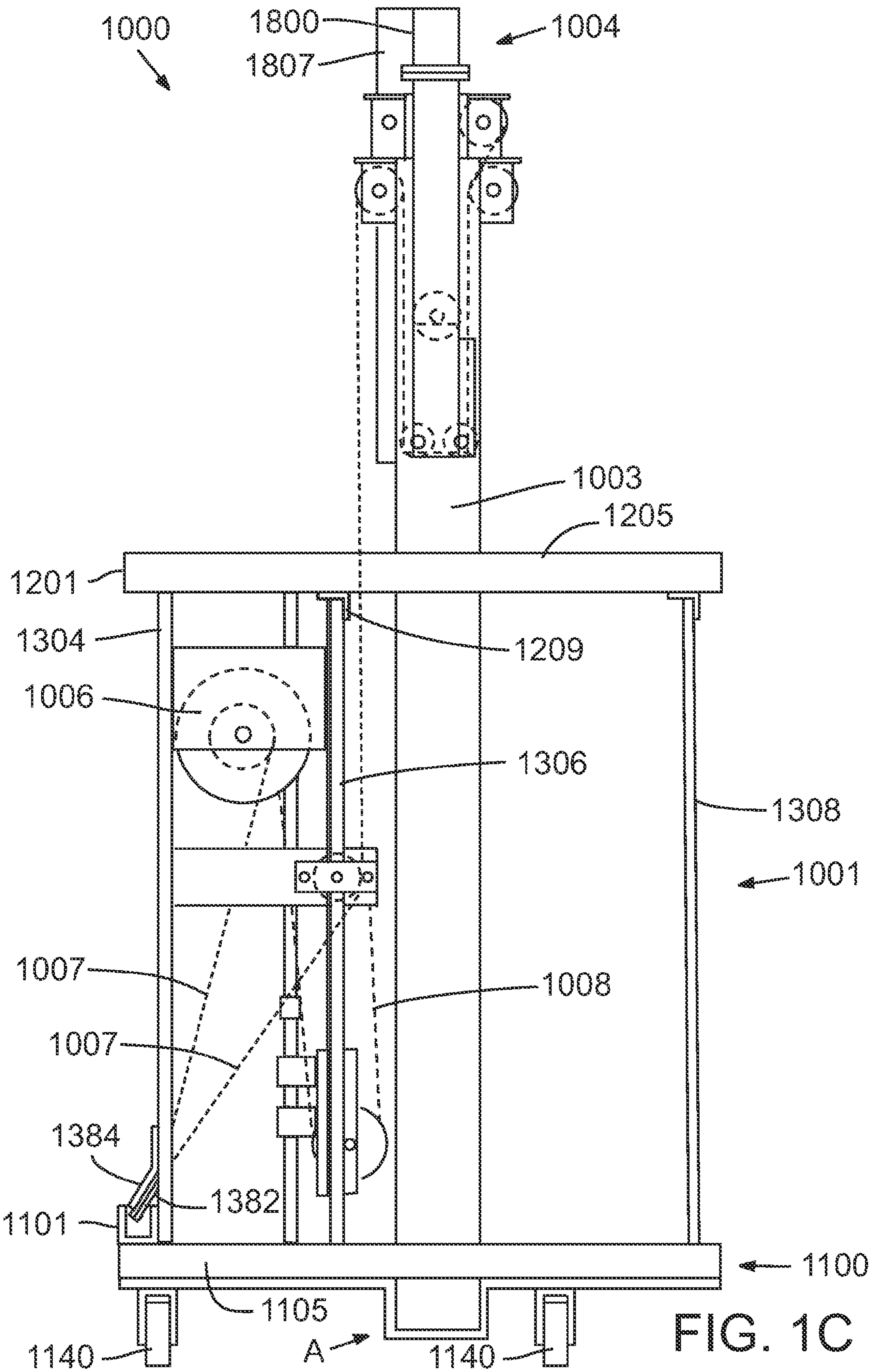
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FIG. 1C

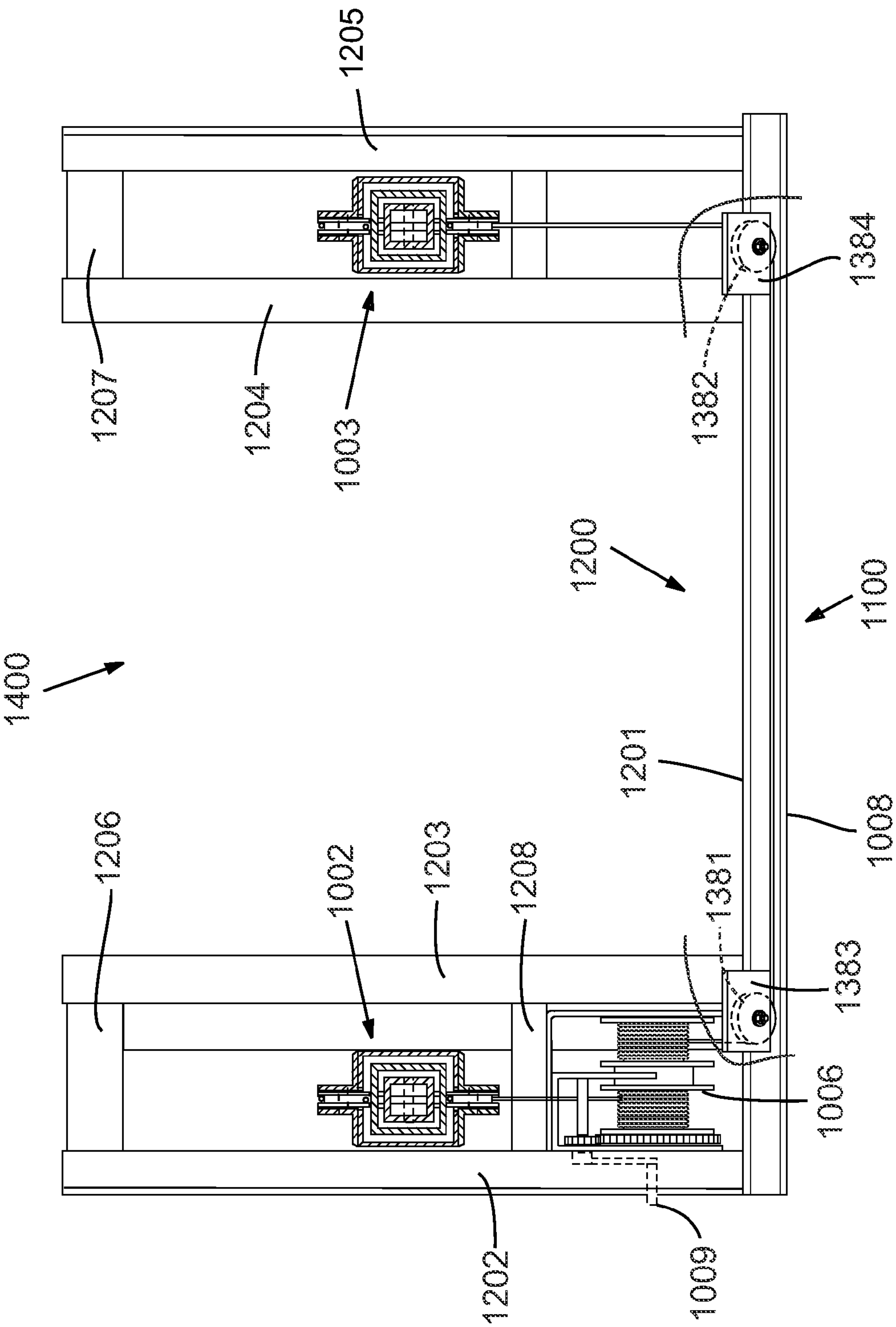
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FIG. 1D

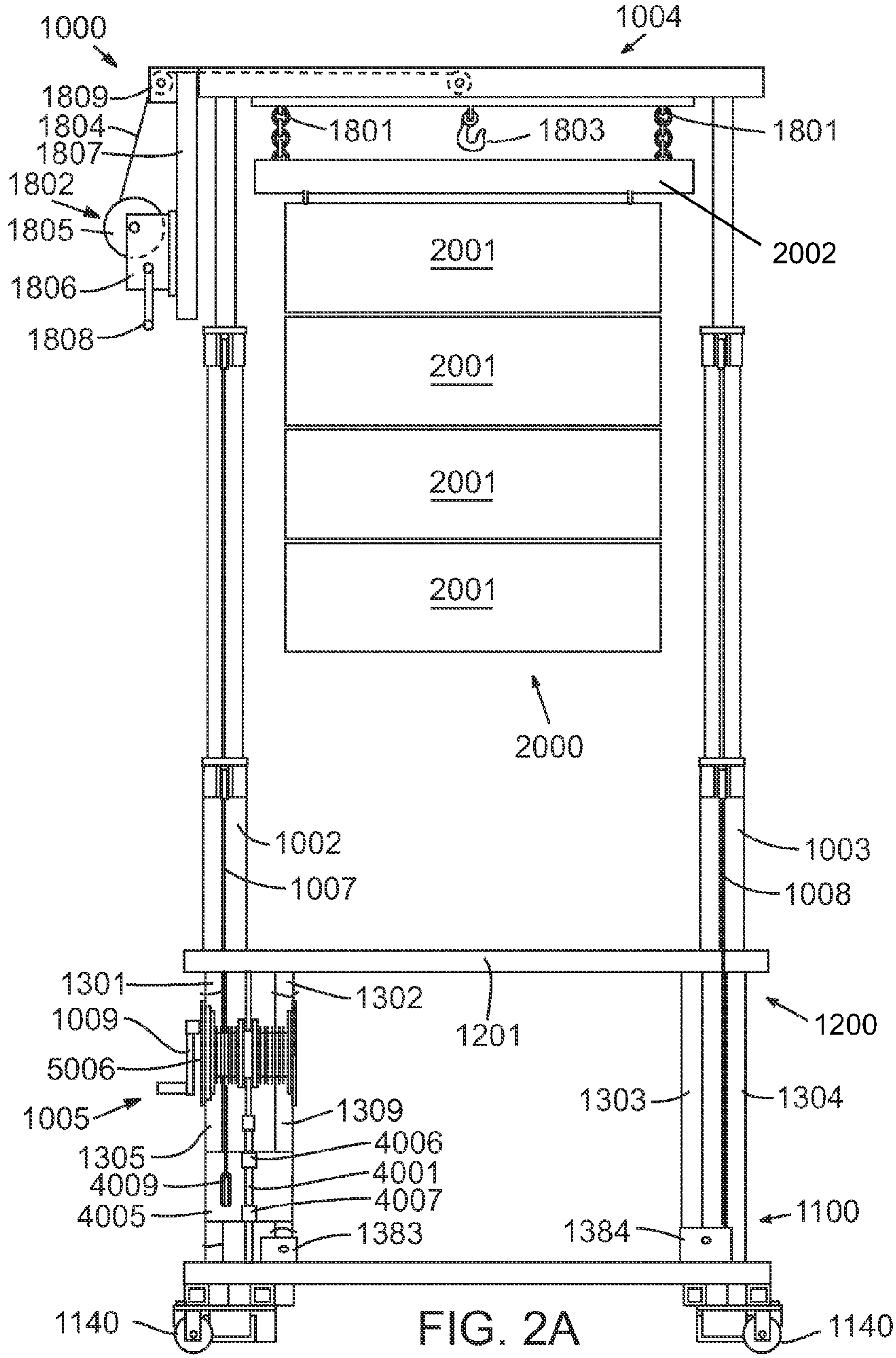
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FIG. 2A

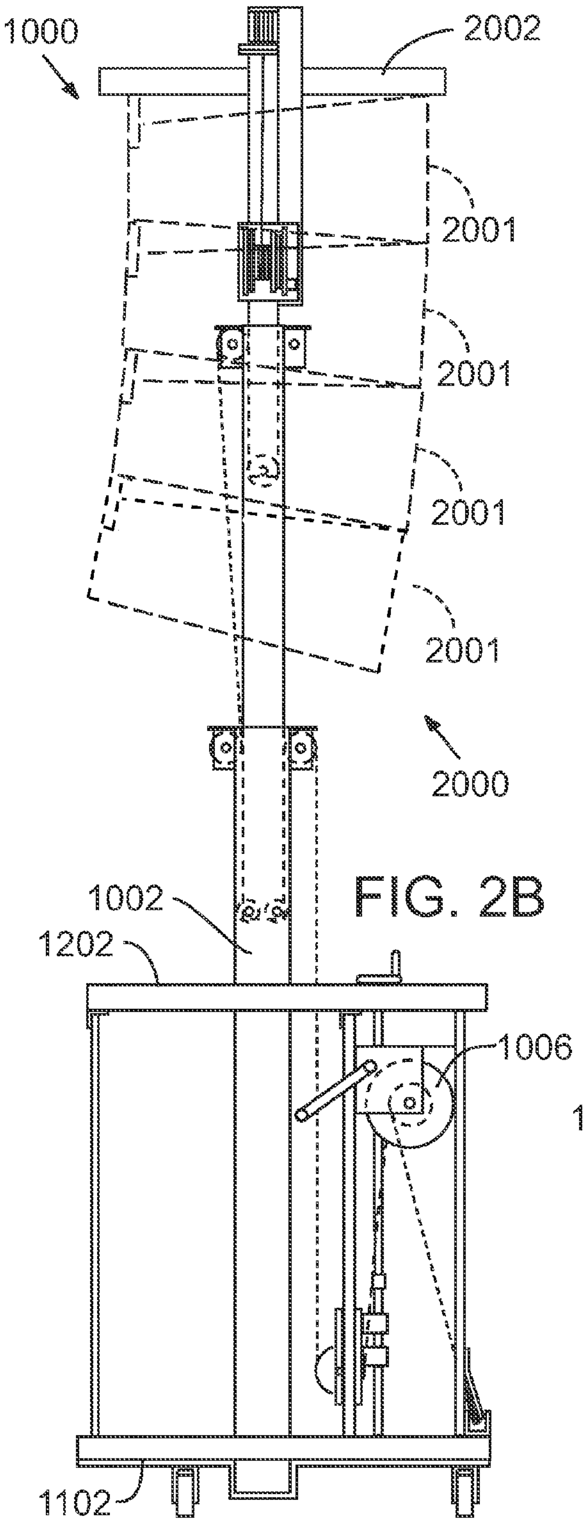
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FIG. 2B

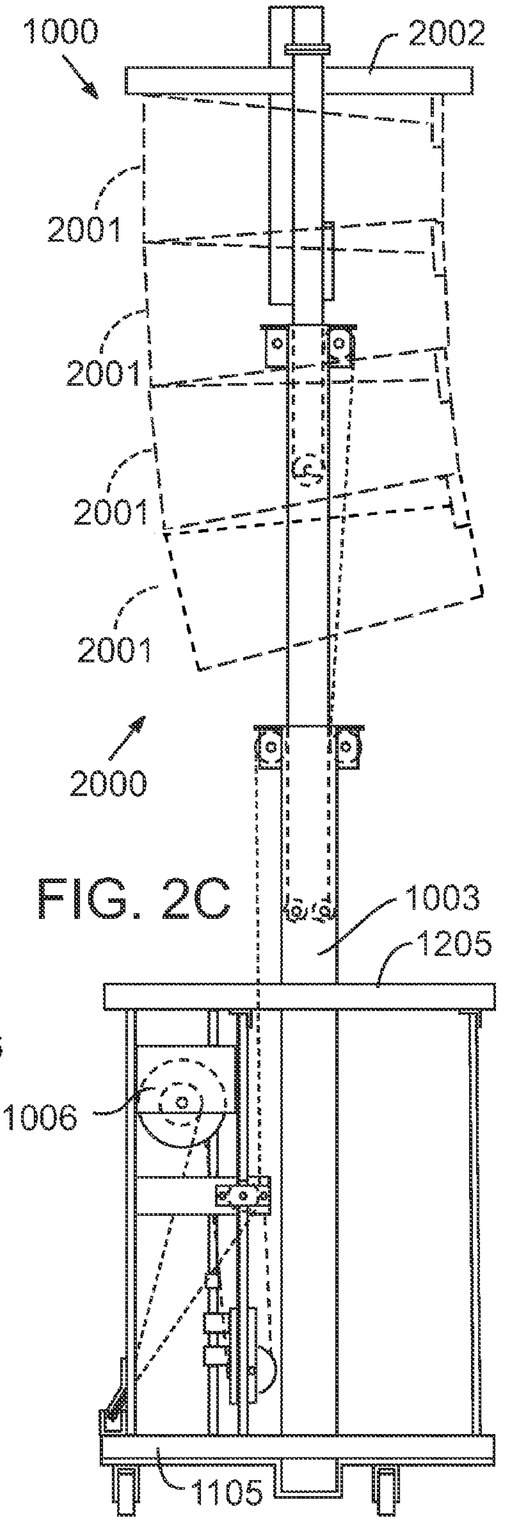
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FIG. 2C

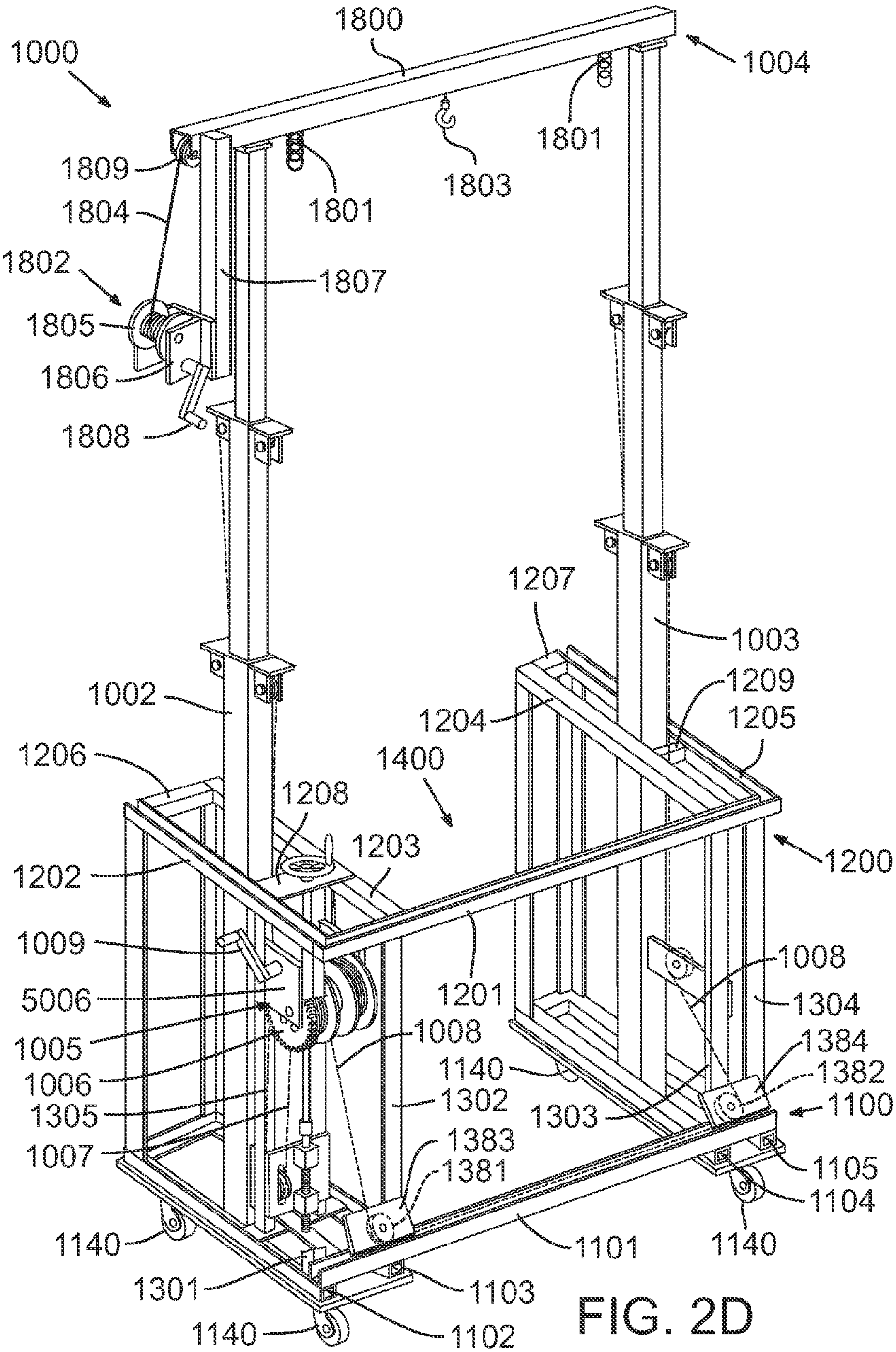
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FIG. 2D

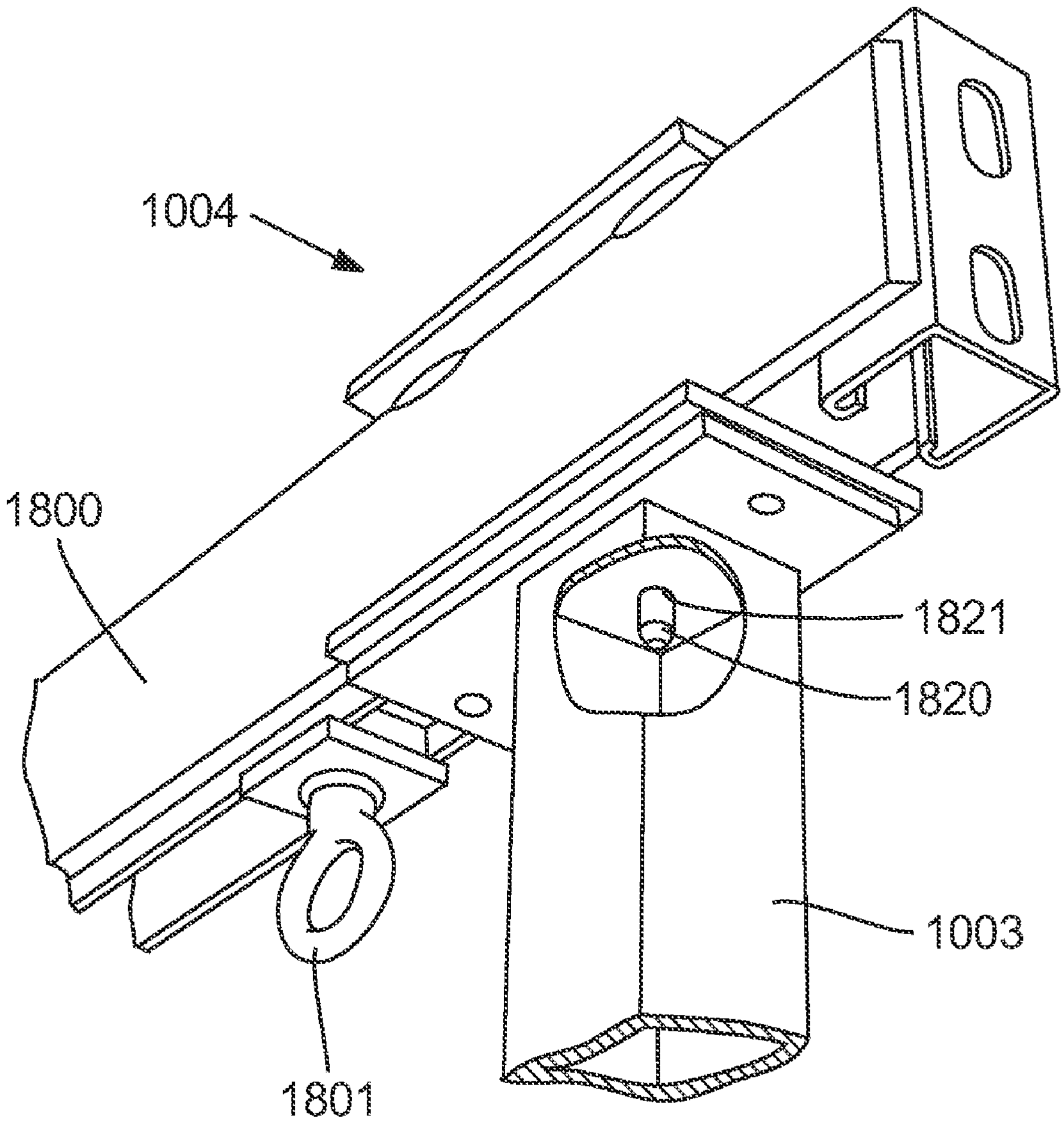

FIG. 2E

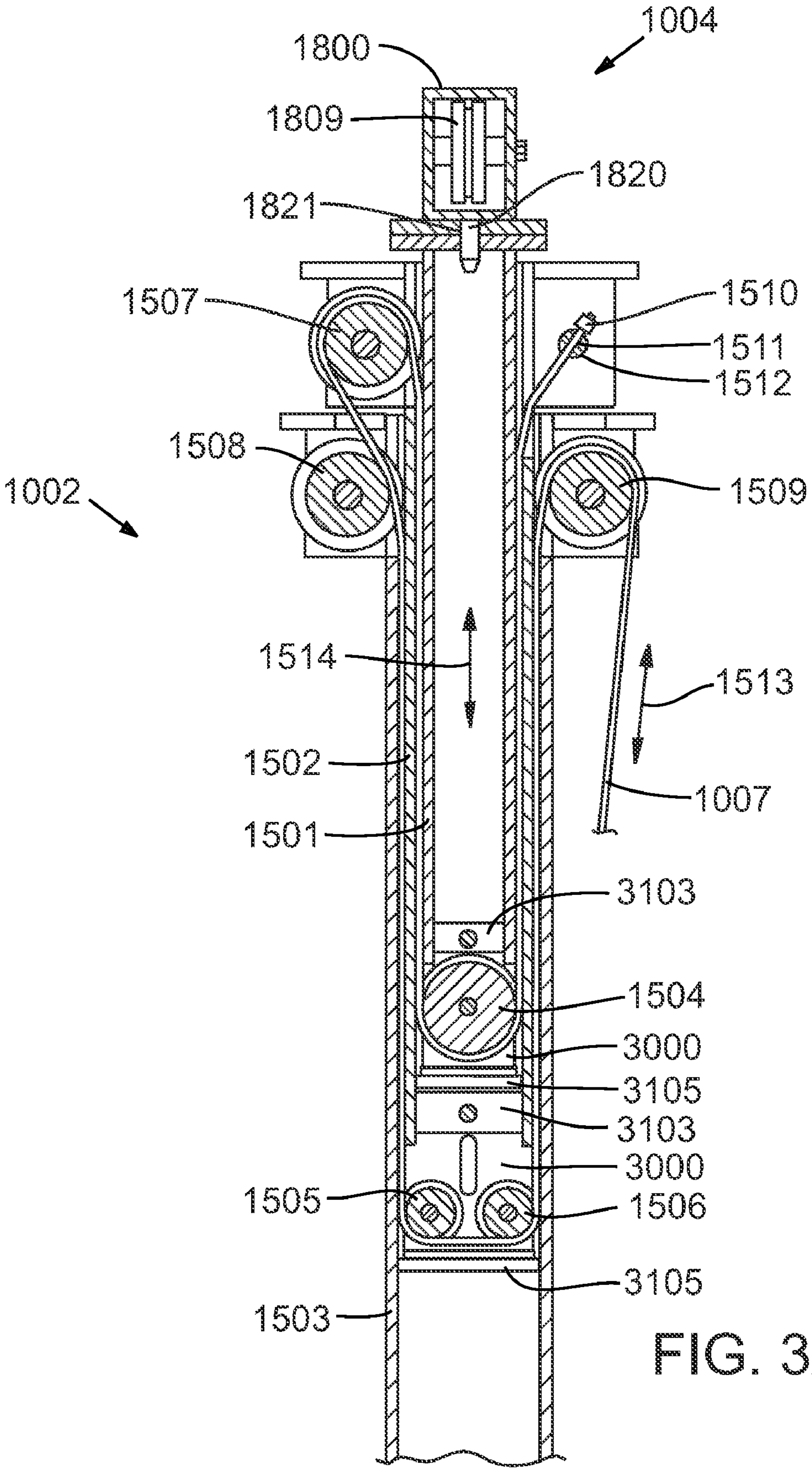
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FIG. 3A

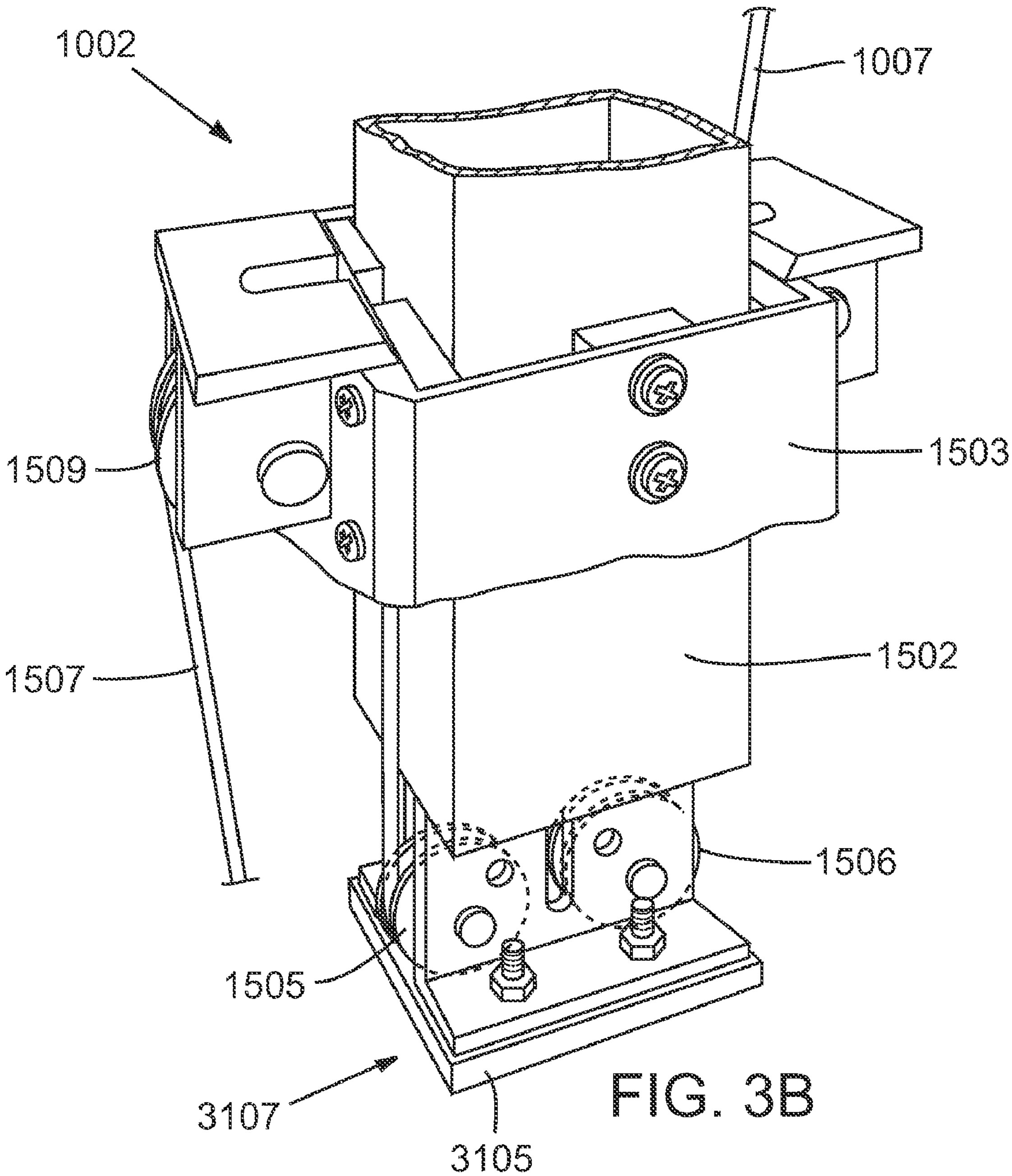


FIG. 3B

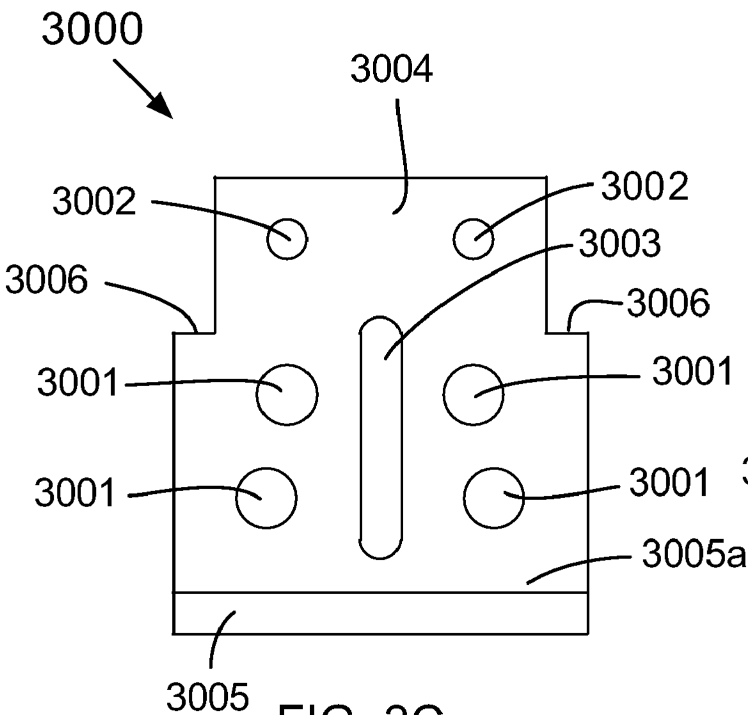


FIG. 3C

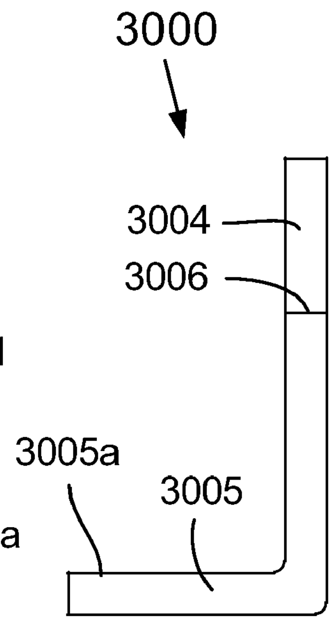
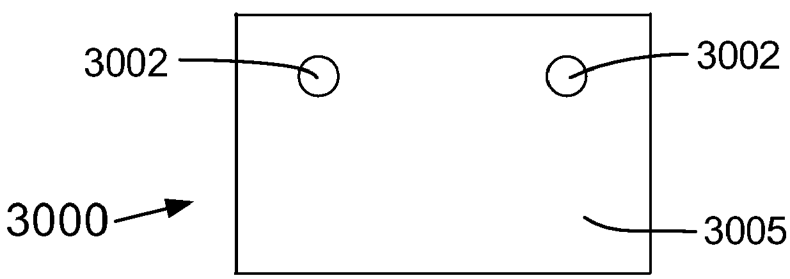


FIG. 3D



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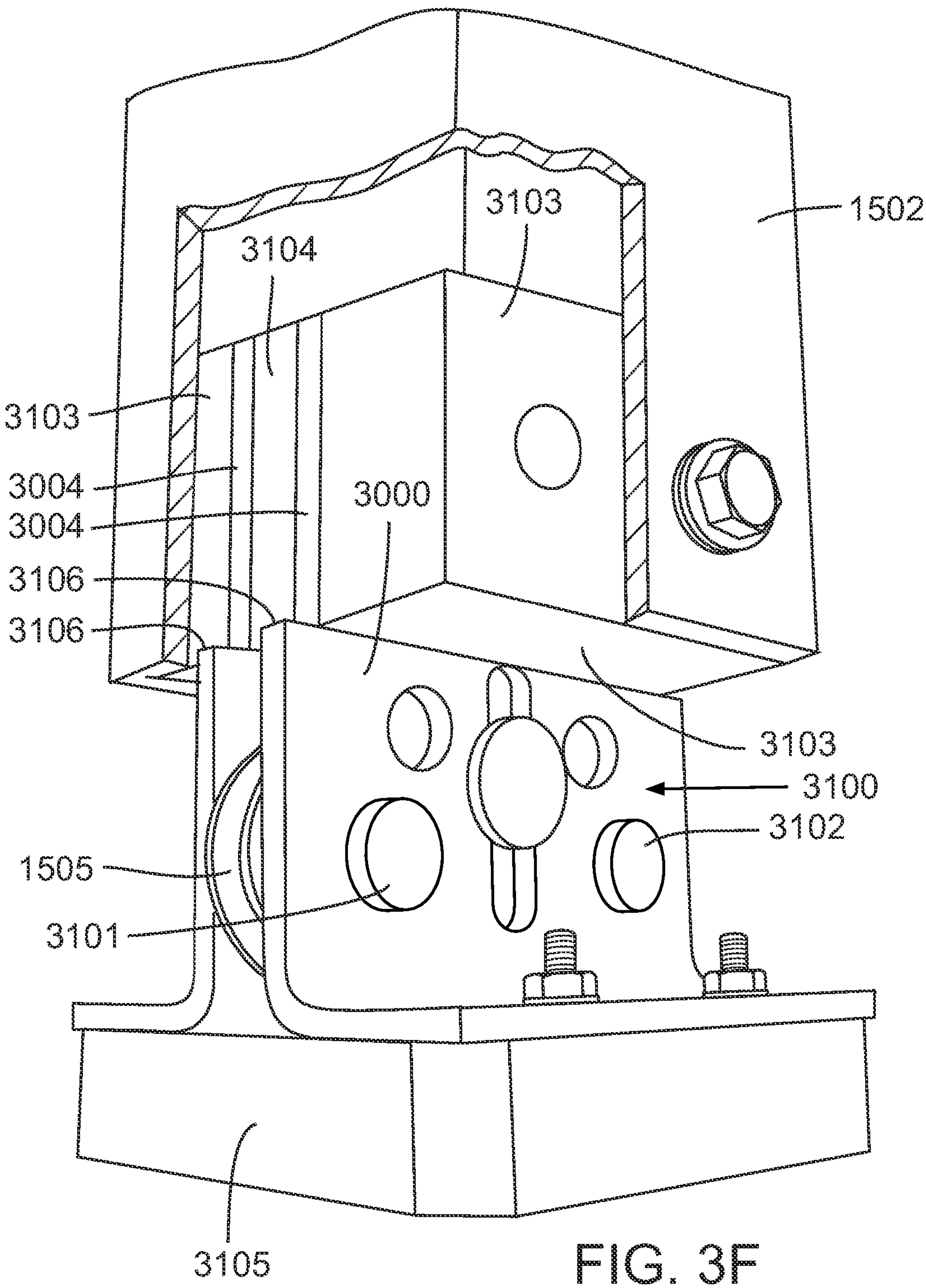
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FIG. 3F

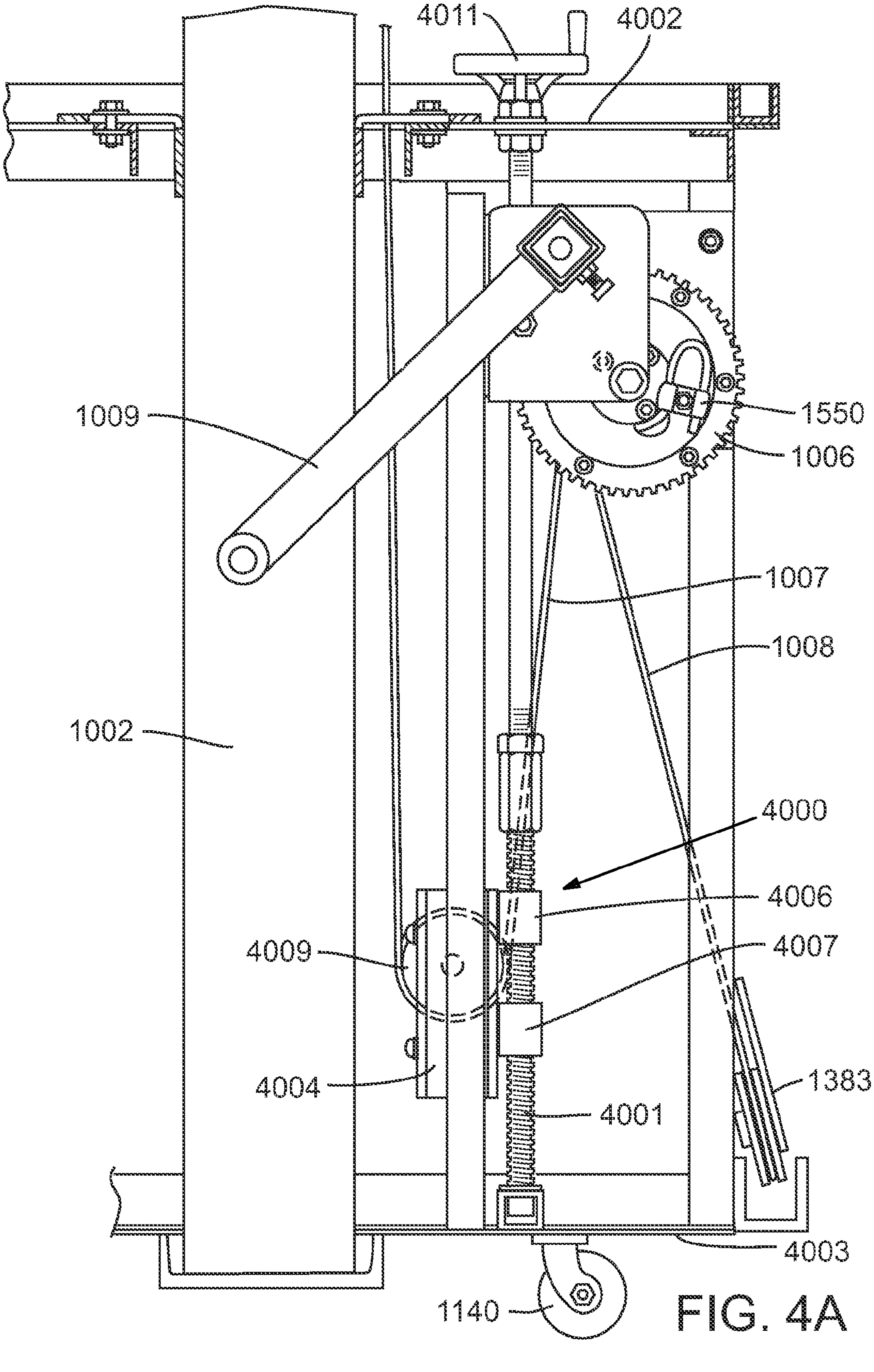
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FIG. 4A

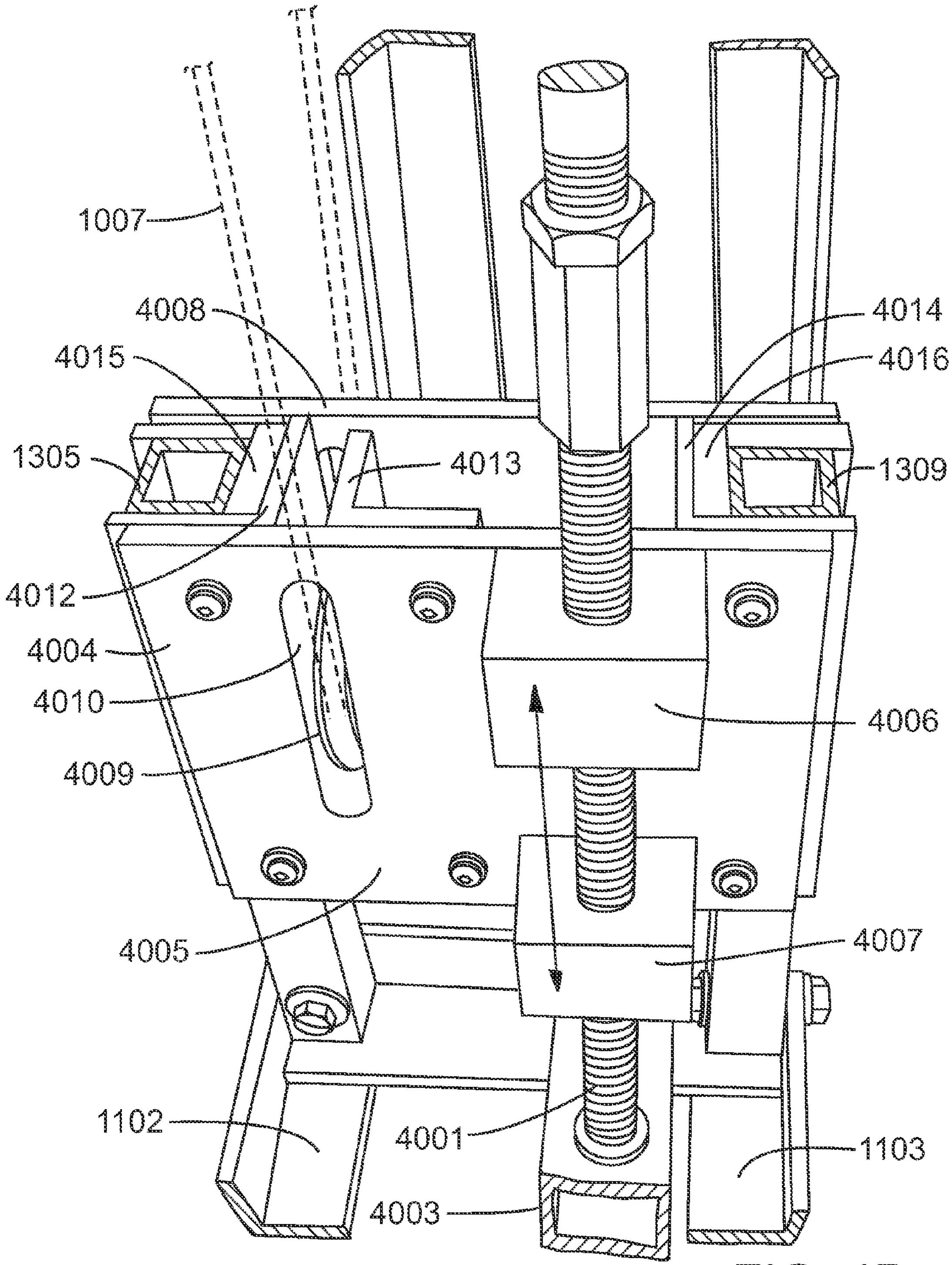
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FIG. 4B

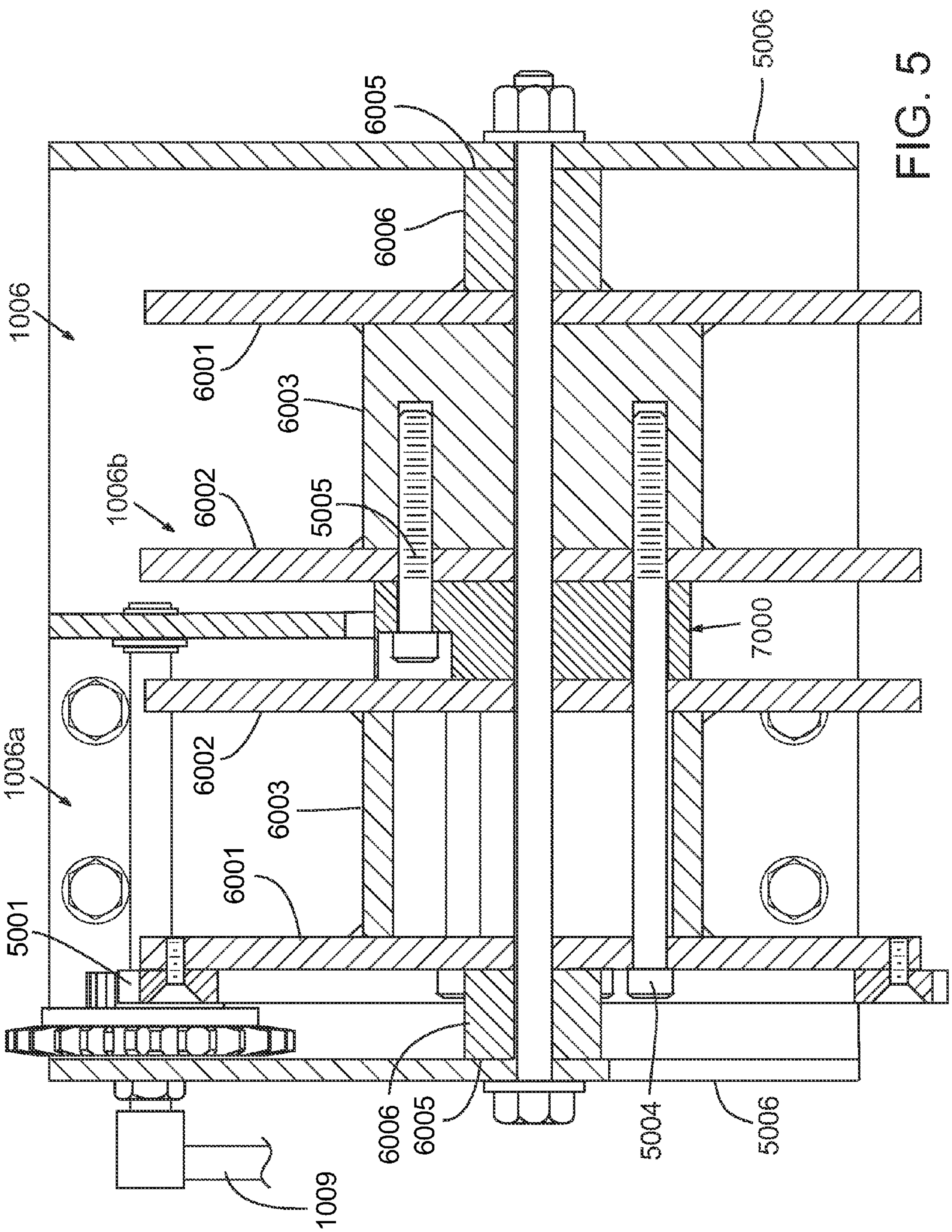
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FIG. 5

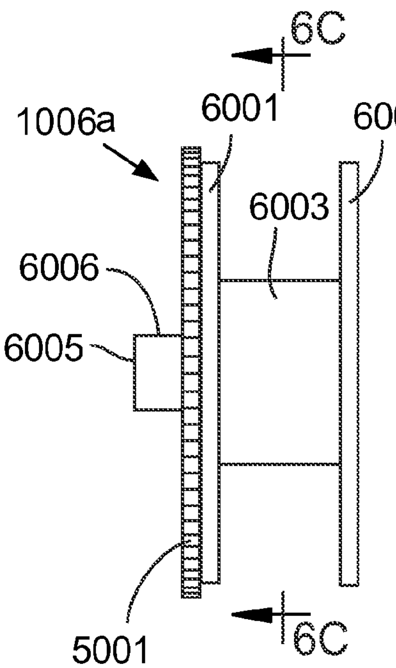

FIG. 6A

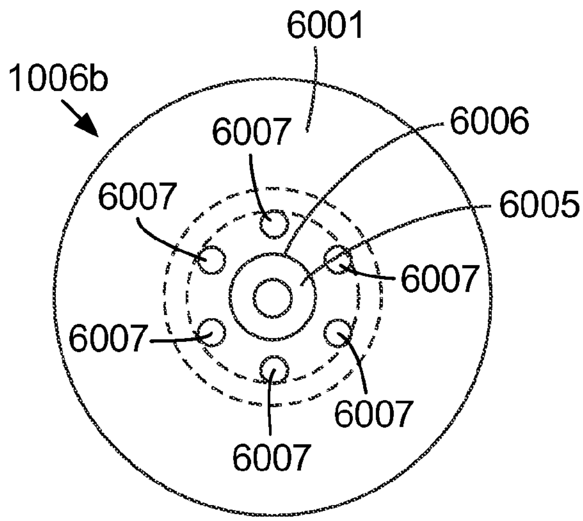

FIG. 6B

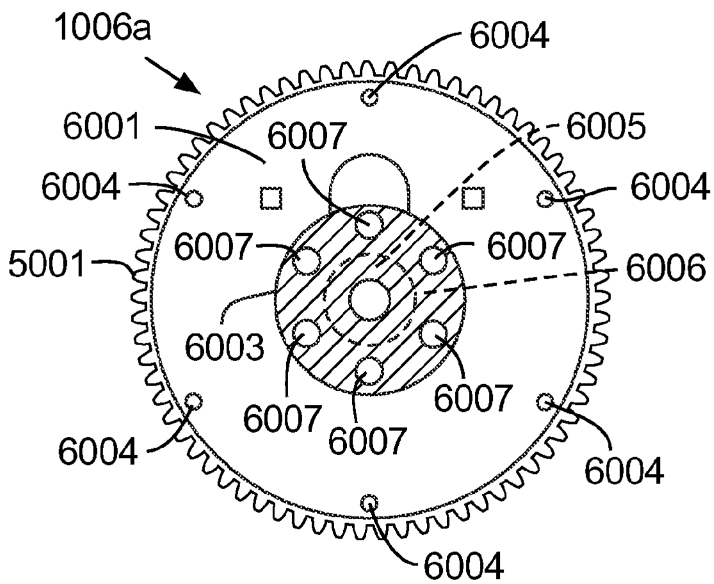

FIG. 6C

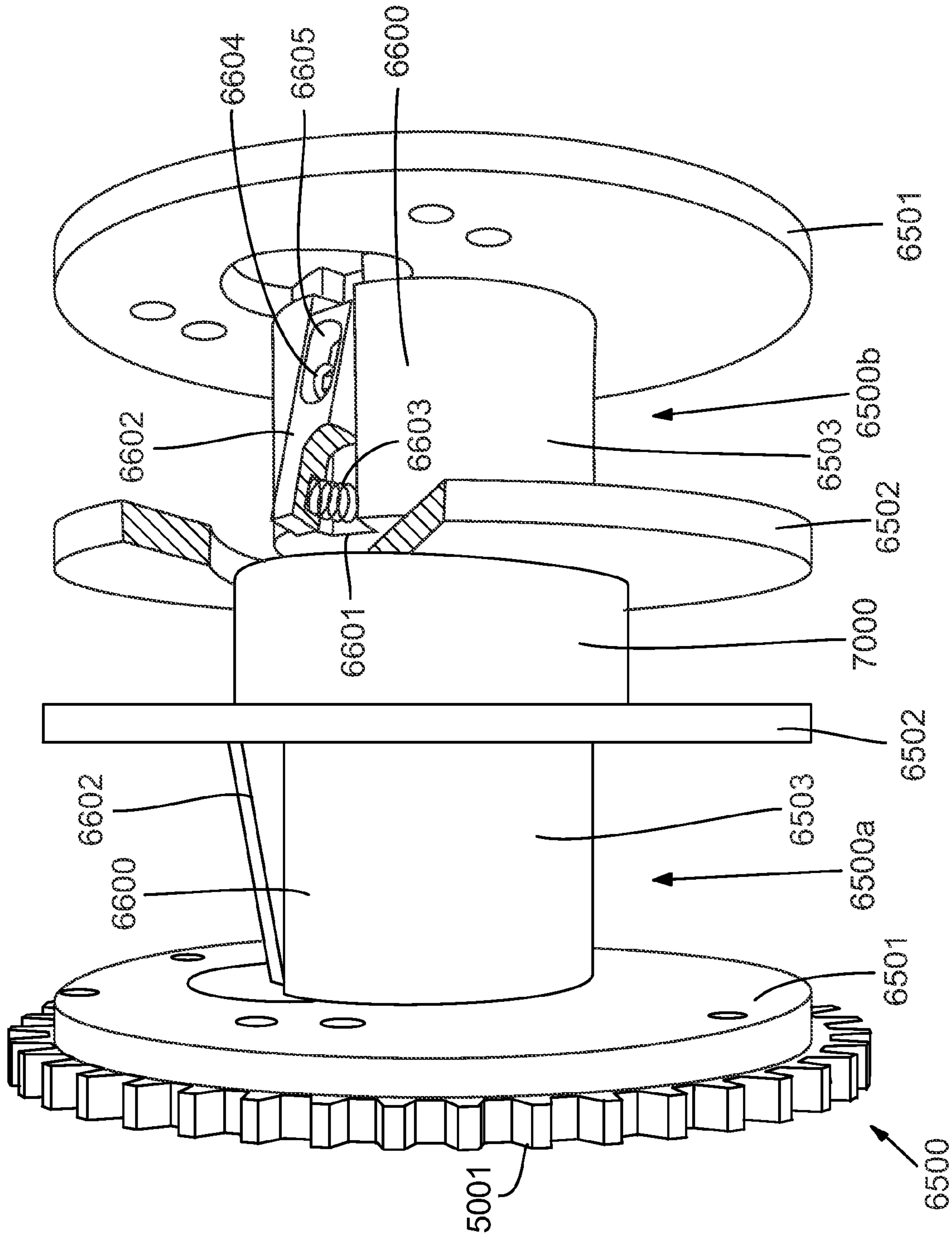
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FIG. 6D

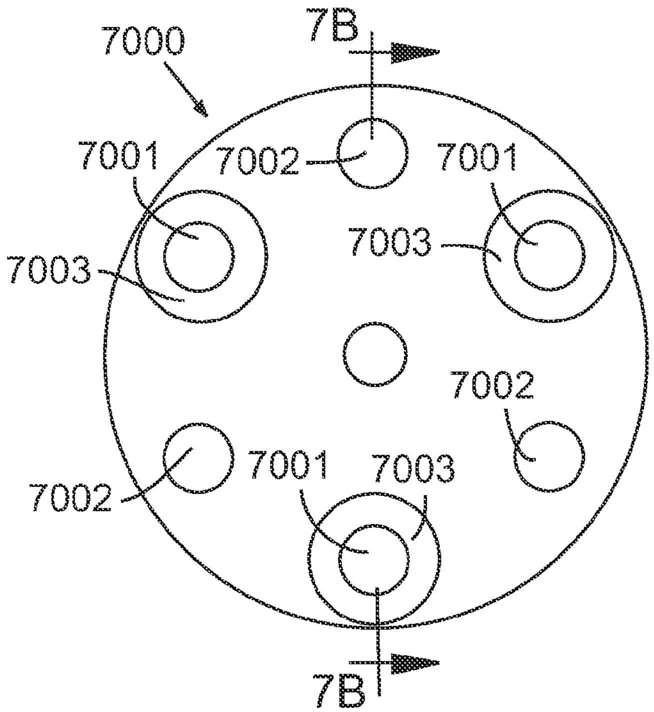
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FIG. 7A

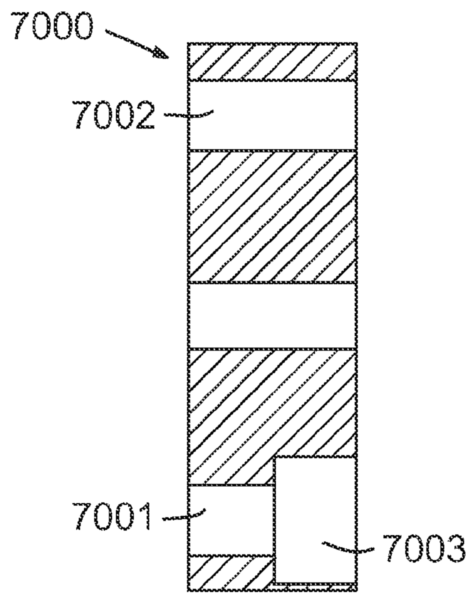
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FIG. 7B

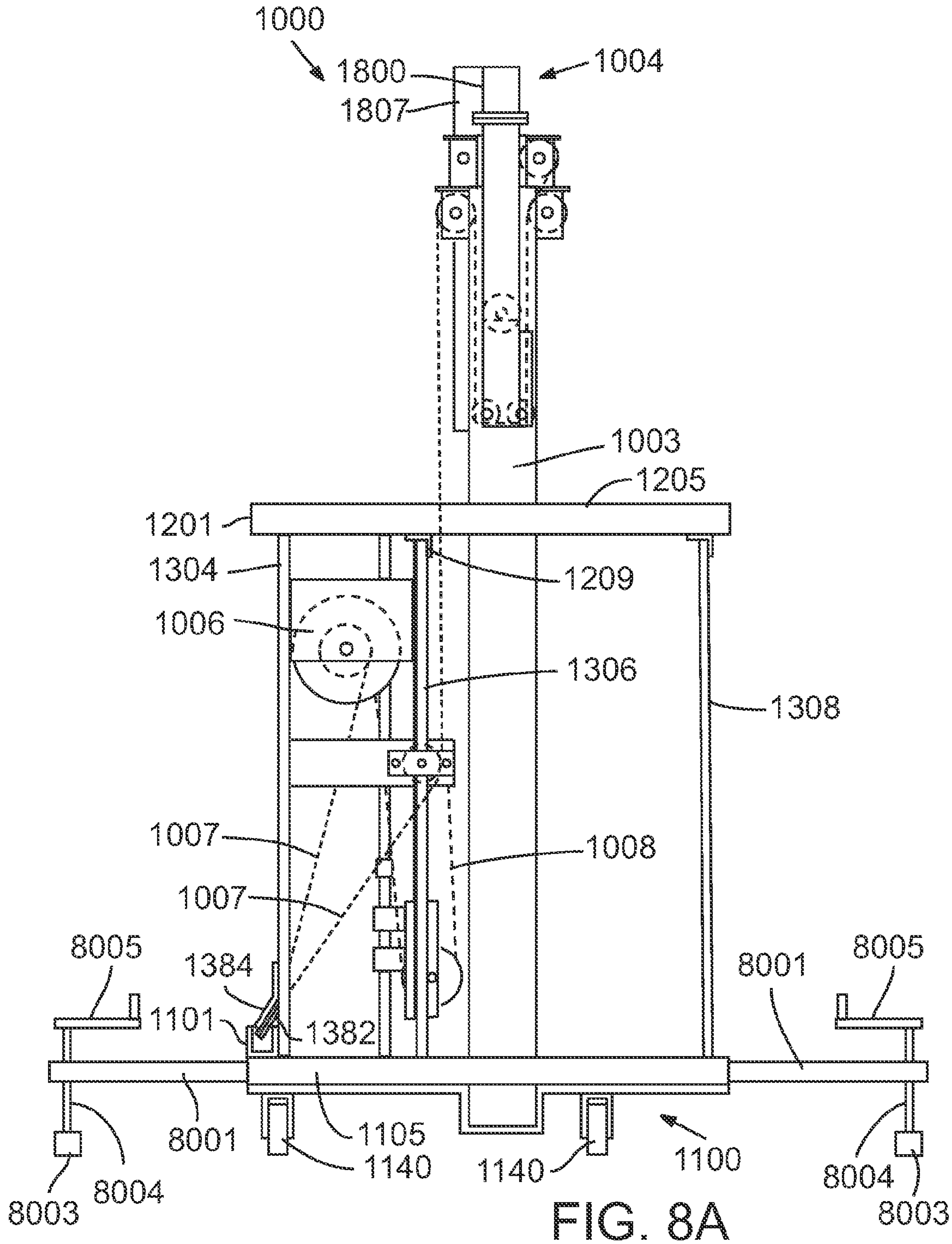
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FIG. 8A

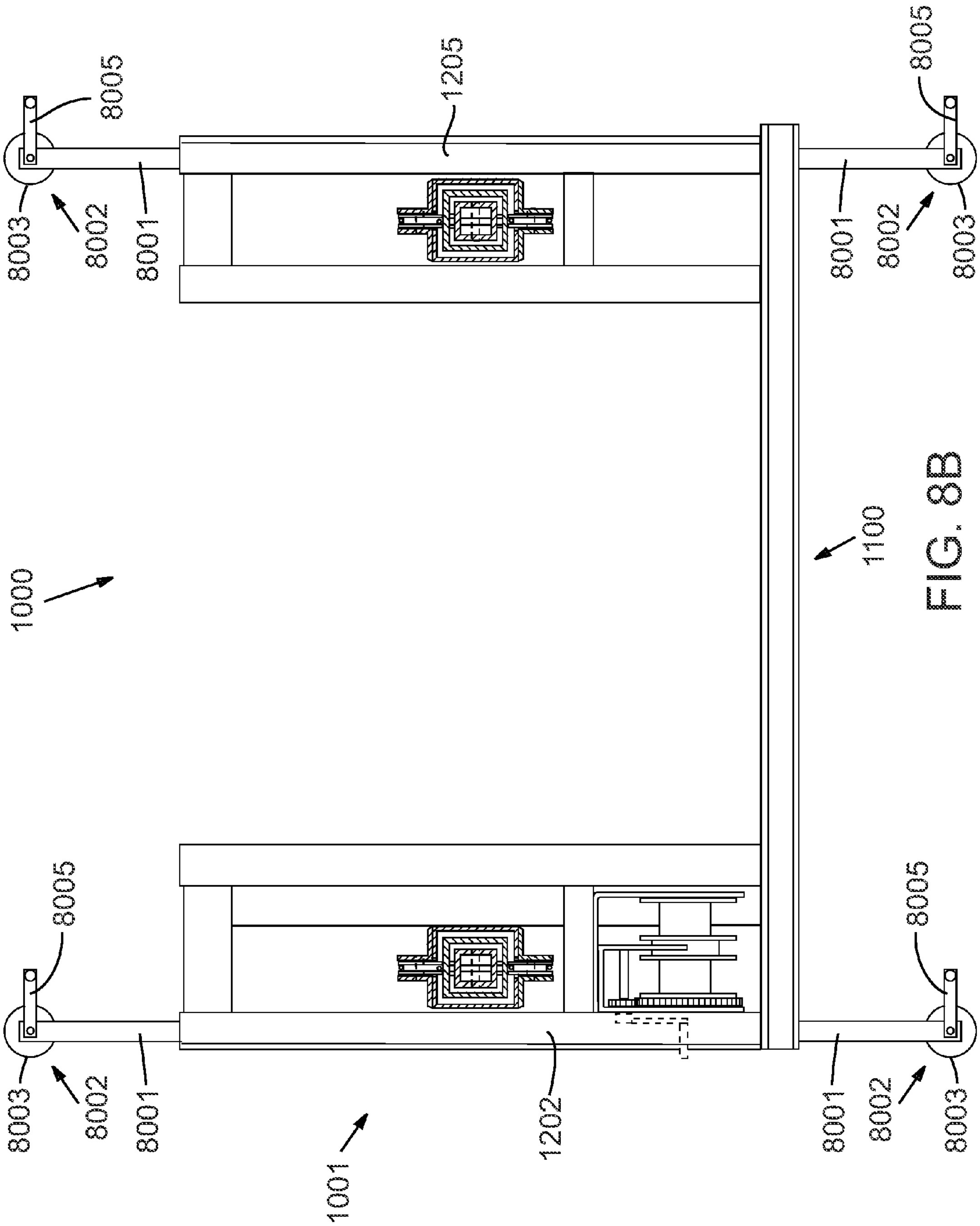

FIG. 8B

LIFTING DEVICE

BACKGROUND

The subject matter disclosed herein relates to a lifting device. In particular, the subject matter disclosed herein relates to a lifting device comprising a plurality of multi-stage masts.

BRIEF DESCRIPTION OF THE DRAWINGS

The subject matter disclosed herein is illustrated by way of example and not by limitation in the accompanying figures in which like reference numerals indicate similar elements and in which:

FIGS. **1**A-**1**D respectively depict front, left, right and top views of an exemplary embodiment of a lifting device comprising two multi-stage masts in a non-telescoped position according to the subject matter disclosed herein;

FIGS. **2**A-**2**C respectively depict front, left, right views of the exemplary embodiment of lifting device of FIGS. **1**A-**1**C in a telescoped position lifting an exemplary object according to the subject matter disclosed herein;

FIG. **2**D depicts a perspective view of the exemplary embodiment of the lifting device in which the multi-stage masts are in a telescoped configuration according to the subject matter disclosed herein;

FIG. **2**E depicts a cutaway perspective view from below of an exemplary embodiment of a multi-stage mast and a fly bar according to the subject matter disclosed herein;

FIG. **3**A depicts a cross-sectional view of a portion of one exemplary embodiment of a multi-stage mast according to the subject matter disclosed herein;

FIG. **3**B shows a portion of an exemplary stage of a multi-stage mast in a telescoped configuration near the top of an outer stage of the mast;

FIGS. **3**C-**3**E respectively show front, side and bottom views of an exemplary embodiment of a mounting plate that can be used in a number of places on a lift device according to the subject matter disclosed herein;

FIG. **3**F depicts a perspective view of a sheave assembly mounted to the bottom of a stage according to the subject matter disclosed herein;

FIGS. **4**A and **4**B depict different views of a fine-adjustment mechanism according to the subject matter disclosed herein;

FIG. **5** shows a cross-sectional view of one exemplary embodiment of dual cable spool that is mounted in a bracket according to the subject matter disclosed herein;

FIGS. **6**A-**6**C respectively show side, end and cross-sectional views of an exemplary embodiment of first spool according to the subject matter disclosed herein;

FIG. **6**D depicts an exemplary embodiment of a cable-adjustor spool that is suitable for use as dual cable spool according to the subject matter disclosed herein;

FIGS. **7**A and **7**B respectively show a front view and a cross-sectional view of an exemplary embodiment of a spacer according to the subject matter disclosed herein; and

FIGS. **8**A and **8**B respectively show side and top views of an exemplary embodiment of lift device comprising an exemplary embodiment of outrigger-type legs to increase the overall stability of the lift device according to the subject matter disclosed herein.

DETAILED DESCRIPTION

The word "exemplary" is used herein to mean "serving as an example, instance, or illustration." Accordingly, any embodiment described herein as "exemplary" should not be construed as necessarily preferred or advantageous over other embodiments.

The subject matter disclosed herein relates to a lifting device. One exemplary embodiment of a lifting device according to the subject matter disclosed herein is suitable for moving and lifting speakers for theatrical productions and/or entertainment events to a selected height. Another exemplary embodiment of a lifting device according to the subject matter disclosed herein is suitable for moving and lifting stage lighting equipment for theatrical productions and/or entertainment events to a selected height. Yet another exemplary embodiment of a lifting device according to the subject matter disclosed herein is designed to fit under the roll-up door of a typical cube-type delivery van so that speakers and/or lighting equipment can be conveniently loaded onto the lifting device at one location and transported to another location. Still another exemplary embodiment of a lifting device according to the subject matter disclosed herein is designed to fit under the roll-up door of a larger truck so that speakers and/or lighting equipment can be conveniently loaded onto the lifting device at one location and transported to another location.

Additionally, one exemplary embodiment of a lift device according to the subject matter disclosed herein is configured to occupy a minimal amount of space when loaded onto a truck, such as a delivery van or larger type truck. For example, one exemplary embodiment of a lifting device according to the subject matter disclosed herein is configured to be less than about 30" in width so that up to three lifting devices can be placed in the interior truck box of a standard trailer having a width of about 90". The approximate 30" width of this exemplary embodiment permits the lift device to be placed far enough to the right or left of the interior space of a standard cube-type van or trailer truck box and thereby not inhibit further loading of the center of the space. Further still, a load, such as a dolly-mounted preconfigured speaker line array and/or lighting equipment, can be placed within a load holding area of the lifting device so that the lifting device provides protection for the load during packing, transporting and/or for generally storing of the load.

FIGS. **1**A-**1**D respectively depict front, left, right and top views of an exemplary embodiment of a lifting device **1000** comprising two multi-stage masts in a non-telescoped position according to the subject matter disclosed herein. FIGS. **2**A-**2**C respectively depict front, left and right views of the exemplary embodiment of lifting device **1000** of FIGS. **1**A-**1**D in which the multi-stage masts are in a telescoped position supporting a lifted object according to the subject matter disclosed herein. FIG. **2**D depicts a perspective view of the exemplary embodiment of lifting device **1000** in which the multi-stage masts are in a telescoped configuration according to the subject matter disclosed herein. FIG. **2**E depicts a cutaway perspective view from below of an exemplary embodiment of a multi-stage mast and a fly bar according to the subject matter disclosed herein. It should be noted that for clarity not all components of lifting device **1000** are indicated and/or shown in each of the accompanying Figures.

Lifting device **1000** comprises a frame **1001**, two multi-stage masts **1002** and **1003** that are attached to frame **1001**, and a support member **1004** (also referred to herein as a fly bar **1004**) that spans between the tops of masts **1002** and **1003**. A cable mechanism **1005** is used for raising and lowering the stages of masts **1002** and **1003** between a non-telescoped position (FIGS. **1**A-**1**D) and a telescoped position (FIGS. **2**A-**2**D). Cable mechanism **1005** comprises a dual cable spool **1006**, cables **1007** and **1008**, and a crank arm **1009**. Cables

1007 and 1008 respectively have paths through sheaves and/or idler wheels that are external and/or internal to multi-stage masts 1002 and 1003. In one exemplary embodiment, cables 1007 and 1008 are respectively wound onto dual cable spool 1006 using a removable crank arm 1009 (not shown in FIGS. 1B and 1C) to raise multi-stage masts 1002 and 1003 simultaneously and substantially in unison from the non-telescoped position to the telescoped position. Conversely, cables 1007 and 1008 are respectively unwound from dual spool 1006 using removable crank arm 1009 (not shown in FIGS. 1B and 1C) in a well-known manner to lower masts 1002 and 1003 simultaneously and substantially in unison from the telescoped position to the non-telescoped position. In one exemplary embodiment, the respective effective lengths of cables 1007 and 1008 can be adjusted so that as cables 1007 and 1008 are wound onto and unwound from dual spool 1006, multi-stage masts 1002 and 1003 are raised and lowered between the non-telescoped position and the telescoped position simultaneously and substantially in unison so that fly bar 1004 remains substantially horizontal. In another exemplary embodiment, the respective effective lengths of cables 1007 and 1008 can be adjusted so that as cables 1007 and 1008 are wound onto and unwound from dual spool 1006, multi-stage masts 1002 and 1003 are raised and lowered between the non-telescoped position and the telescoped position simultaneously and substantially in unison so that fly bar 1004 remains substantially at a selected orientation with respect to the horizontal. While crank arm 1009 has been indicated to be removable, it should be understood that in an alternative exemplary embodiment, crank arm 1009 could be non-removable.

Frame 1001 comprises abase frame 1100 and atop frame 1200. Base frame 1100 comprises base frame members 1101, 1102, 1103, 1104 and 1105, which are fastened together in a well-known manner to form base frame 1100, such as by welding and/or by using fastening devices such as, but not limited to, nuts and bolts, so that base frame 1100 comprises a U shape when viewed from above (FIG. 1D). In one exemplary embodiment, wheels 1140 are attached to the bottom of base frame 1100 in a well-known manner using castors for two or more of the wheels so that lifting device 1000 can be conveniently maneuvered between physical locations. In one exemplary embodiment, wheels 1140 are spaced along base frame member 1102 to allow transport up a two foot wide ramp. Top frame 1200 comprises top frame members 1201, 1202, 1203, 1204, 1205, 1206, 1207, 1208 and 1209, which are fastened together in a well-known manner to form top frame 1200, such as by welding and/or by fastening devices such as, but not limited to, nuts and bolts, so that top frame 1200 comprises a U shape when viewed from above (FIG. 1D).

Base frame 1100 and top frame 1200 are attached to each other using vertical frame members 1301-1308, which extend between base frame 1100 and top frame 1200. In particular, vertical frame members 1301-1308 are fastened to base frame 1100 and top frame 1200 in a well-known manner, such as by welding and/or by fastening devices such as, but not limited to, nuts and bolts. The U-shape formed by base frame 110 and top frame 1200 form a load holding area 1400 (FIGS. 1D and 2D). It should be understood that for the exemplary embodiment shown in FIGS. 1A-1D and 2A-2D, there are base frame members, top frame members, and vertical frame members that are not shown in some and/or all of the Figures because they are hidden from view and, consequently, do not have specific reference numerals. Base frame members 1101, 1102, 1103, 1104, 1105, top frame members 1201, 1202, 1203, 1204, 1205, 1206, 1207, 1208 and 1209, and vertical frame members 1301-1308 could be formed from solid components, tubular components, channel components, and/or angle components. Accordingly, the different embodiments depicted in the Figures and described herein are interchangeably formed from solid components, tubular components, channel components, and/or angle components. In one exemplary embodiment, top frame members 1201, 1202 and 1205 are formed from a channel component have the capability to captively holding, for example, a fabric-type material that can be used for concealing the components forming frame 1001 from view. Additionally, base frame members, top frame members and vertical frame members could be formed from any material having sufficient strength and physical characteristics for handling the stresses that are expected to be experienced by lift device 1000.

Frame 1001 is attached to multi-stage masts 1002 and 1003 in a well-known manner, such as by welding and/or by fastening devices, such as, but not limited to, plates, nuts and bolts. It should be understood that frame 1001 could be configured differently from the exemplary configuration shown in FIGS. 1A-1D and 2A-2D and still provide the same structural benefits. As shown in FIGS. 1A-1C and 2A-2D, multi-stage masts 1002 and 1003 extend below base frame portion 1100 (in particular, see A in FIGS. 1B and 1C) in order to provide a maximal length of the stages respectively forming masts 1002 and 1003 with a corresponding minimal overall height of lifting device 1000 when masts 1002 and 1003 are in the non-telescoped position.

Fly bar 1004 spans between the tops of multi-stage masts 1002 and 1003, and comprises a span member 1800, eye bolts 1801 and a hoist mechanism 1802. (Note that fly bar 1004 is not shown in FIG. 1D for clarity.) The position of each eye bolt 1801 along the bottom of span member 1800 can be independently selected in a well-known manner so that they correspond to grasping holes in an object, such as a speaker and/or lights, that is/are suspended, or supported, from span member 1800 (see, for example, FIG. 2A). Once a position is selected for an eye bolt 1801, the eye bolt can be fastened in a well-known manner so that its position remains fixed until another position is desired. While only two eye bolts 1801 are shown, it should be understood that any number of eye bolts 1801 could be used.

In one exemplary embodiment, fly bar 1004 is removeably mounted on the tops of each multi-stage mast 1002 and 1003 by a pin 1820 (FIGS. 2E and 3A) that engages an aperture 1821 (FIGS. 2E and 3A) in the top of each multi-stage mast 1002 and 1003 in a well-known manner located on the top of each mast. It should be understood that other well-known techniques could alternatively be used for removeably mounting fly bar 1004 to the tops of multi-stage masts 1002 and 1003. As another alternative, fly bar 1004 could be removeably mounted to the side of multi-stage masts 1002 and 1003 using a well-known technique. In yet other exemplary alternative embodiments, fly bar 1004 is fixedly attached either to the tops or to the sides of multi-stage masts 1002 and 1003. One exemplary embodiment of fly bar 1004 comprises a length of a metal framing and hanging system, which is commonly known as Superstrut and available from, for example Thomas and Betts, among other suppliers. In one exemplary embodiment, the length of fly bar 1004 is not significantly greater than the distance between the outside edges of multi-stage masts 1002 and 1003. In another exemplary embodiment, the length of fly bar 1004 is greater than the distance between the outside edges of multi-stages masts 1002 and 1003. That is, for this alternative exemplary embodiment, fly bar 1004 extends beyond the outside edges of multi-stage masts 1002 and 1003. It should also be understood that fly bar **1004** could be configured to additionally and/or alternatively support an object above fly bar **1004**, such as truss adapters that then in turn hold and support a truss system for holding items such as, but not limited to, lighting, banners, video monitors, projection screens, speakers, etc. Still in another exemplary embodiment, extension members (not shown) can be removeably attached to the top of each multi-stage mast **1002** and **1003** using, for example, a pin and aperture arrangement similar to that depicted in FIG. **3**A, thereby lengthening each multi-stage mast by the length of the extension member. For this exemplary embodiment, fly bar **1004** is then removeably attached to the top of each extension member using for example, a pin and aperture arrangement similar to that depicted in FIG. **3**A.

Hoist mechanism **1802** comprises a hook member **1803**, a cable **1804**, a cable spool **1805**, a mounting bracket **1806** in which cable spool **1805** is mounted in a well-known manner, a mounting arm **1807** on which mounting bracket **1806** is fastened in a well-known manner, a crank arm **1808**, and a sheave **1809**. It should be understood that hoist mechanism **1802** may also comprise sheaves that are not indicated and/or that are not shown in the Figures. After the positions of eye bolts **1801** have been selected, hoist mechanism **1802** is used for raising an object-to-be-lifted and suspended from span member **1800**. The object-to-be-lifted is positioned within load holding area **1400** (FIGS. **1**D and **2**D, i.e., the U shape formed by frame **1001**), such as by moving the object into the U shape using a dolly. Alternatively, lift device **1000** could be moved and positioned so that load holding area **1400** surrounds the object-to-be-lifted. The U shape of frame **1001** provides the capability that lifting device **1000** be positioned in close proximate relationship to an object-to-be-lifted. It should be understood that the side members (for example, frame members **1102**, **1103**, **1104**, **1105**, **1202**, **1203**, **1204** and **1205**) of frame **1001** are not required to have a length such that frame **1001** completely surrounds an object-to-be-lifted on three sides.

After the object-to-be-lifted is positioned within load holding area **1400**, hook member **1803** is then lowered using hoist mechanism **1802** and used to hook the object. Hook member **1803** is then raised to a height that is suitable for connecting the object to eye bolts **1801** by winding cable **1804** onto spool **1805** using crank arm **1808**. Clevis pins, chains, and/or shackles (not shown) could be used in a well-known manner for suspending the object-to-be-lifted from eye bolts **1801**. It should be understood that other devices and/or techniques could be used in a well-known manner for fastening an object to and suspending the object from eye bolts **1801**.

Multi-stage masts **1002** and **1003** telescope, or extend, between a non-telescoped position (FIGS. **1**A-**1**D) (i.e., a first length configuration) and a telescoped position (FIGS. **2**A-**2**C) (i.e., a second length configuration) using cable mechanism **1005**. Cable mechanism **1005** comprises a dual cable spool **1006**, cables **1007** and **1008**, and a removable crank arm **1009**. Cables **1007** and **1008** respectively have paths through sheaves and/or idler wheels that are external and/or internal to multi-stage masts **1002** and **1003**. In the exemplary embodiment shown in FIGS. **1**A-**1**D, the path of cable **1008** is across the front of lift device **1000** through sheaves **1381** and **1382**, which are positioned behind cover plates **1383** and **1384**, respectively. In an alternative embodiment, the path of cable **1008** could pass through at least a portion of base frame member **1101** in a well-known manner, such as when base frame member **1101** is configured as a channel component or as a tubular component. In yet another alternative embodiment, the respective paths of cables **1007** and **1008** could be positioned behind cover plates so that they are completely or mostly out of view. It should be understood that cables **1007** and **1008** could have paths that are different from the paths depicted in FIGS. **1**A-**1**D and **2**A-**2**D and still provide the same structural benefits.

As shown in the exemplary embodiment of FIGS. **1**A-**1**D and **2**A-**2**D, cables **1007** and **1008** are respectively wound onto and unwound from dual cable spool **1006** using crank arm **1009** in a well-known manner so that multi-stages masts **1002** and **1003** are raised and lowered between the non-telescoped position and the telescoped position simultaneously and substantially in unison. In another exemplary embodiment, the respective relative lengths of cables **1007** and **1008** can be adjusted so that as cables **1007** and **1008** are wound onto and unwound from dual spool **1006**, multi-stage masts **1002** and **1003** are raised and lowered between the non-telescoped position and the telescoped position simultaneously and substantially in unison so that fly bar **1004** remains substantially horizontal. In yet another exemplary alternative embodiment, cables **1007** and **1008** could be replaced by a single cable that has a cable path through sheaves and/or idler wheels and through multi-stage masts **1002** and **1003** so that as the single cable is wound onto and unwound from a single spool multi-stages masts **1002** and **1003** are raised and lowered between the non-telescoped position and the telescoped position simultaneously and substantially in unison. As yet a further alternative embodiment, it should be understood that the subject matter disclosed herein is not limited to two multi-stage masts, but could comprise two or more multi-stage masts. In still another exemplary alternative embodiment, spool **1006** can be motor driven in a well-known manner.

FIGS. **2**A-**2**C respectively depict front, left, right views of the exemplary embodiment of lifting device **1000** of FIGS. **1**A-**1**C in a telescoped position lifting an exemplary object **2000** according to the subject matter disclosed herein. Exemplary object **2000** can comprise a line-array speaker module comprising a plurality of speaker modules **2001**. Line-array speaker module **2000** is suspended from a speaker bumper **2002** that is configured for attachment to line-array speaker module **2000** in a well-known manner. Speaker bumper **2002** is suspended from eye bolts **1801** in a well-known manner, such as by, but not limited to, using shackles, chains, and/or clevis pins (not specifically indicated in the Figures). Note that part of frame **1001** in FIG. **2**A has been removed so that dual cable spool **1006** is visible.

FIG. **3**A is depicts a cross-sectional view of a portion of one exemplary embodiment of a multi-stage mast **1002** according to the subject matter disclosed herein. Multi-stage mast **1002** is depicted in a non-telescoped position in FIG. **3**A. It should be understood that multi-stage mast **1003** is typically configured in a similar manner to the exemplary embodiment shown for multi-stage mast **1002**, and thereby operates in a similar manner to multi-stage mast **1002**. As shown in FIG. **3**A, multi-stage mast **1002** comprises stages **1501**, **1502** and **1503**. In particular, when multi-stage mast **1002** is in the non-telescoped position, stage **1503** surrounds most of the length of stage **1502**, which, in turn, surrounds most of the length of stage **1501**. The materials and the respective dimensions and wall thickness of stages **1501**-**1503** are accordingly selected based on the stresses that stages **1501**-**1503** are expected to experience and so that stage **1501** fits inside stage **1502**, and so stage **1502** fits inside stage **1503**. Additionally, it should be understood that there is sufficient clearance within stages **1502** and **1503** for cable **1007**, as will become clearer in the following description. In one exemplary embodiment, stages **1501**-**1503** are formed from aluminum. For that exemplary embodiment, stage **1501** has a nominal width of 2", a nominal depth of 2", a nominal length of 59", and a nominal wall thickness of 0.250"; stage **1502** has a nominal width of 3", a nominal depth of 3", a nominal length of 63", and a nominal wall thickness of 0.125"; and stage **1503** has a nominal width of 4", a nominal depth of 4", a nominal length of 63", and a nominal wall thickness of 0.125".

Stage **1501** comprises one sheave **1504** that is depicted in FIG. **3**A as being positioned at the bottom end of stage **1501**. Sheave **1504** is attached to stage **1501** in a well-known manner, such as by using a mounting plate **3000** (FIGS. **3**C-**3**E), and is selected to have a size that allows clearance from the internal dimensions of stage **1502**. Stage **1502** comprises two sheaves **1505** and **1506** that are positioned at the bottom end of stage **1502**, and one sheave **1507** positioned near the top of stage **1502**. Sheaves **1505** and **1506** are attached to stage **1502** in a well-known manner, such as by using a mounting plate **3000** (FIGS. **3**C-**3**E), and are selected to have a size that allows clearance from the internal dimensions of stage **1503**. It should be understood that a single sheave could be used in place of sheaves **1505** and **1506**, but it should be kept in mind that the size of the single sheave would require a larger space between the bottom of stage **1501** and the bottom of stage **1502**, and thereby reduce the overall telescoping length of multi-stage mast **1002** in comparison to using two sheaves. Sheave **1507** is attached near the top of stage **1502** in a well-known manner. Stage **1503** comprises sheaves **1508** and **1509** that are both attached to stage **1503** in a well-known manner near the top of stage **1503**. In one exemplary embodiment, sheaves **1504**-**1509** are aligned along a centerline of stages **1501**-**1503**. In another exemplary embodiment, sheaves **1504**-**1509** are aligned along a line that is not a centerline of stages **1501**-**1503**.

Cable **1007** is attached to the top end of stage **1502** in a well-known manner, such as by using a cable stop **1510** that is too large to pass through an aperture **1511** in a pin **1512**. Cable **1007** is arranged from pin **1512** to enter the space between stages **1501** and **1502** and pass around sheave **1504** at the bottom of stage **1501**. Cable **1007** then is directed upward to pass around sheave **1507** positioned towards the top end of stage **1502**. From sheave **1507**, cable **1007** is directed by sheave **1508** to enter the space between stages **1502** and **1503** and then pass around sheaves **1505** and **1506** at the bottom end of stage **1502**. From sheave **1506**, cable **1007** is directed upward to pass around sheave **1509** located towards the top end of stage **1503**, and then around a sheave **4009** (FIGS. **4**A and **4**B) before being directed to spool **1006***a* of dual cable spool **1006**. Cable **1007** is attached to spool **1006***a* in a well-known manner, such as by a cable clamp mechanism **1550** (FIG. **4**A). It should be understood that cable **1008** is arranged in multi-stage mast **1003** in a manner similar to cable **1007**. It should also be understood that cable **1007** and/or **1008** could be replaced by a chain or other suitable line or device. In the alternative embodiment in which a single cable is used, the cable would be configured to extend beyond cable stop **1510** (FIG. **3**A) and be directed downwardly to frame **1001** and then to have a cable path through multi-stage mast **1003**.

As cable **1007** is wound onto dual cable spool **1006**, the effective length of cable **1007** through sheaves **1504**-**1509** becomes shorter (as indicated by downward portion of arrow **1513**), thereby causing stages **1501** and **1502** to respectively telescope out of stages **1502** and **1503** (as indicated by upward portion of arrow **1514**). FIG. **3**B shows a portion of an exemplary stage **1502** in a telescoped configuration near the top of stage **1503**, which is shown as partially cut away. Surface portion **3005***a* of flange portions **3005** of mounting plates **3000** respectively extend beyond the exterior dimension of stages **1501** and **1503** and engage bottom surfaces (not indicated) in a well-known manner that are located at the top of stages **1502** and **1503** to prevent stages **1501** and **1502** from telescoping completely out of stages **1502** and **1503**. As cable **1007** is unwound from dual spool **1006**, the effective length of cable **1007** through the sheaves becomes longer (as indicated by upward portion of arrow **1513**) thereby causing stages **1501** and **1502** to respectively retract into stages **1502** and **1503** (as indicated by downward portion of arrow **1514**). It should be understood that while multi-stage masts **1002** and **1003** are depicted as having three stages, any number of stages could be used. That is, multi-stage masts **1002** and **1003** could be formed from two or more stages.

FIGS. **3**C-**3**E respectively show front, side and bottom views of an exemplary embodiment of a mounting plate **3000** that can be used in a number of places on lift device **1000** according to the subject matter disclosed herein. Mounting plate **3000** comprises a plurality of apertures **3001**, a plurality of apertures **3002**, a slot **3003**, a tab portion **3004**, a flange portion **3005** and shoulder portions **3006**. In one exemplary embodiment, apertures **3001** can be used for mounting pins on which sheaves, such as sheaves **1504**-**1506** (FIG. **3**A), are mounted. In one exemplary embodiment, apertures **3002** can be used for fastening members, such as bolts or screws, for fastening a low-friction spacer material, such as a polyethylene material, to form an assembly **3100** (FIGS. **3**C-**3**E) that can be fastened to the bottoms of stages **1501** and **1502**. In one exemplary embodiment, slot **3003** can be used for mounting a single sheave when assembly **3100** is configured for a single sheave. In another exemplary embodiment, slot **3003** can be used for a path that allows cables **1007** and **1008** to facilitate cable redirection between stages of multi-stage masts **1002** and **1003** when mounting plate **3000** is used as a vertical-orientation adjustment shim. Slot **3003** also allows a mechanism for allowing adjustment when the mounting plate is used for an exterior vertical adjustment shim on two opposite sides of multi-stage mast. Accordingly, a frame-mounted bolt can be loosened to allow the mounting plate to slide back and forth in order to adjust the vertical plumb orientation of the multi-stage mast.

FIG. **3**F depicts a perspective view of an assembly **3100** mounted to the bottom of a stage **1502** according to the subject matter disclosed herein. Assembly **3100**, in particular, is configured for insertion into the bottom of stage **1502** and for respectively supporting sheaves **1505** and **1506** on pins **3101** and **3102**, which serve as axles. Tab portion **3004** of each mounting plate **3000** of assembly **3100** fits into the bottom end of stage **1502** up to shoulder **3006**. Tab portion **3004** of each mounting plate **3000** is fastened to stage **1502** using a well-known technique, such as by welding and/or by using fastening devices such as, but not limited to, nuts and bolts, which engage apertures **3002** on mounting plate **3000** and corresponding apertures in stage **1502**. Assembly **3100** further comprises low-friction spacers **3103**-**3105** that are used for sizing assembly **3100** so that when assembly **3100** is mounted to the bottom of stage **1502**, the top portion of assembly **3100** fits inside the bottom of stage **1502** and the bottom portion **3107** (See FIG. **3**B) of assembly **3100** fits inside stage **1503**. It should be noted that various fastener devices, such as bolts, washers, nuts and/or screws are depicted in FIG. **3**F, but have not been given reference numerals. Accordingly, it should be understood that the configuration of the fastener devices could be different from the exemplary configuration depicted in FIG. **3**F. While mounting plates **3000** and assembly **3100** are depicted as being configured for mounting on the bottom of stage **1502**, it should be understood that mounting plates **3000** could have a size that is suitable for forming an assembly that mounts to the bottom of stage **1501**.

Because of the two-spool nature of wench/hoist mechanism **1006**, it is possible that winding/unwinding speed differences are encountered between cables **1007** and **1008** respectively winding/unwind onto/from spools **1006***a* and **1006***b* (FIG. **5**) due to constantly varying effective circumferences of spools **1006***a* and **1006***b*. The winding/unwinding speed differences may cause multi-stage masts **1002** and **1003** to ascend or descent to respectively different heights, and thereby cause fly bar **1004** to not be substantially level. Therefore, in order to minimize this potential situation, a fine-adjustment mechanism **4000** is provided for minimizing the potential height differences between multi-stage masts **1002** and **1003**. One exemplary embodiment of a fine-adjustment mechanism **4000** is shown in FIGS. **4**A and **4**B.

Fine-adjustment mechanism comprises an acme screw **4001** (also referred to as an Acme-threaded rod **4001**) that spans between a top support member **4002** and a base support member **4003**, and adjustable sheave assembly **4004**. Adjustable sheave assembly **4004** comprises a front plate **4005** that threadingly engages acme screw **4001** with internal-threaded members **4006** and **4007**, a back plate **4008**, a sheave **4009**, an aperture **4010** and a crank wheel **4011**. Back plate **4008** comprises an aperture that corresponds to aperture **4010**, but is not indicated. Adjustable sheave assembly **4004** is attached to frame **1001** in a well-known manner using, for example, angle members, tubular members, plate members, bolts, nuts, screws and/or welds. Sheave **4009** is attached to assembly **4004** using angle members **4012** and **4013** in a well-known manner. Assembly **4004** further comprises an angle member **4014** disposed distally from angle members **4012** and **4013** that provides spacing support between front plate **4006** and back plate **4008**. Adjustable sheave assembly **4000** is held in place against and between vertical frame members **1305** and **1309** by virtue of the position of acme screw **4001** and internal-threaded members **4006** and **4007**. Pieces of a lubricating material **4015** and **4016**, such as polyethylene, are disposed between vertical frame member **1305** and angle member **4012**, and vertical frame member **1309** and angle member **4014** to minimize the friction that is generated between angle members **4012** and **4014** and the vertical frame members.

The path of cable **1007** is from spool **1006***a* through aperture **4010** around sheave **4009** and then to sheave **1509** (FIG. **3**A) of multi-stage mast **1002**. After a particular height of telescoped multi-stage masts **1002** and **1003** has been chosen using cable mechanism **1005**, crank wheel **4011** is manually operated in a well-known manner to adjust the relative vertical position of adjustable sheave assembly **4004** along acme screw **4001**, thereby adjusting the effective length of cable **1007** with respect to the length of cable **1008**. That is, the relative vertical position of adjustable sheave assembly **4004** is adjusted so that the height of multi-stage mast **1002** is changed independently from the height of multi-stage mast **1003**, thereby making fly bar **1004** substantially level. Fine-adjustment mechanism **4000** can be operated with multi-stage mast **1002** at any height.

It should be understood that a fine-adjustment mechanism could alternatively or additionally be configured to adjust the effective length of cable **1008** with respect to the effective length of cable **1007**. By keeping crank wheel **4011** on the left side of lift device **1000**, however, fine-adjustment mechanism **4000** is positioned on the same side of the lift device as crank arm **1009**, thereby facilitating ease of use and a reduced time needed for lifting and adjusting a load. While fine-adjustment mechanism **4000** has been described as being a manually driven mechanism, it should be understood that a power linear actuator could alternatively be used for varying the position of sheave **4009**. Further, as an alternative exemplary embodiment, a fine adjust mechanism could be configured to adjust the effective length of cable **1007** with respect to the effective length of cable **1008** (or, alternatively, to adjust the effective length of cable **1008** with respect to the length of cable **1007**) by positioning an adjustable position sheave in a horizontal direction and/or a combination of a horizontal and vertical direction.

FIG. **5** shows a cross-sectional view of one exemplary embodiment of dual cable spool **1006** that is mounted in a bracket **5006** according to the subject matter disclosed herein. Dual cable spool **1006** comprises a first spool **1006***a* for cable **1007**, a second spool **1006***b* for cable **1008**, a gear **5001** and a spacer **7000**. FIGS. **6**A-**6**C respectively show side, end and cross-sectional views of an exemplary embodiment of first spool **1006***a* that corresponds to the dual cable spool shown in FIG. **5** according to the subject matter disclosed herein. FIGS. **7**A and **7**B respectively show a front view and a cross-sectional view of an exemplary embodiment of a spacer **7000** that corresponds to the dual cable spool shown in FIG. **5** according to the subject matter disclosed herein.

As shown in FIGS. **6**A-**6**C, first spool **1006***a* comprises two flanges **6001** and **6002** and a hub **6003**. FIG. **6**C is a cross-sectional view of first spool **1006***a* taken along line C-C in FIG. **6**A. The size of the projection of flanges **6001** and **6002** from hub **6003** is selected so that a sufficient length of cable **1007** can be wound onto hub **6003** so that multi-stage mast **1002** can be extended to its fully telescoped position and so that cable **1007** is securely positioned within flanges **6001** and **6002**. Gear **5001**, of which only a portion is shown in FIGS. **6**A and **6**C, is mounted to flange **6001** in a well-known manner, such as by, but not limited to, using flathead screws and nuts and apertures **6004** (FIG. **6**C). Gear **5001** engages in a well-known with a gear **5002** (FIG. **5**) coupled to crank arm **1009** (FIG. **1**A) and is driven in a well-known manner by gear **5002** for raising and lowering multi-stage masts **1002** and **1003**. A sleeve bearing **6005** (FIGS. **6**B and **6**C) is positioned within an aperture **6006** in first spool **1006***a* in a well-known manner to minimize friction with an axle **5003** (FIG. **5**) that is coupled to crank arm **1009** (FIG. **1**A). The axle passes through first spool **1006***a*, spacer **7000** and second spool **1006***b*. Apertures **6007** are formed in flanges **6001** and **6002** and receive bolts **5004** (only one shown in FIG. **5**) for assembling dual cable spool **1006**. It should be understood that the materials and the respective dimensions and thickness of the components forming dual cable spool **1006** are selected based on the stresses that are expected to be experienced by dual cable spool **1006**. In one exemplary embodiment, the components forming dual cable spool **1006** comprise, for example, steel. Exemplary dimensions for such a dual cable spool formed from steel could be that the diameter of flanges **6001** and **6002** would be about 5.75", the diameter of hub **6003** would be about 2.5", the diameter of the crank arm axle would be about 0.5", and the diameter of apertures **6006** would about 0.375". It should be understood that second spool **1006***b* is similar to first spool **1006***a*.

FIGS. **7**A and **7**B respectively show front and cross-sectional views of an exemplary embodiment of a spacer **7000** according to the subject matter disclosed herein. The cross-sectional view of FIG. **7**B is taken along line B-B in FIG. **7**A. Spacer **7000** comprises apertures **7001** and **7002**, and a countersunk inset aperture **7003**. Apertures **7001** and **7002** correspond to apertures **6007** of first spool **1006***a* (FIGS. **6**B and **6**C). Apertures **7001** comprise a countersunk inset aperture **7003** for receiving the head of, for example, an Allen-head bolt **5005** (only one shown in FIG. **5**). The Allen-head bolts **5005** are tightened so that spacer **7000** is fastened to first spool **1006***a*. Apertures **7002** do not comprise a countersunk inset, and each aperture **7002** receives a bolt **5004** (only one shown in FIG. **5**) that passes through first spool **1006***a*, spacer **7000** and into second spool **1006***b*. The arrangement of apertures **6007** in spools **1006***a* and **1006***b* and apertures **7001** and **7002** in spacer **7000** allow the respective lengths of cables **1007** and **1008** to be effectively coarsely adjusted with respect to each other by rotating spool **1006***a* (**1006***b*) with respect to the other spool **1006***b* (**1006***a*) so that any slack or coarse difference between the effective lengths of cables **1007** and **1008** as each cable spans its respective cable path can be taken up onto the spool. After the coarse difference between the effect cable paths has been removed, the bolts are then inserted into apertures **6007**, **7001** and **7002** and tightened. That is, any coarse difference in length of the respective cables can be effectively removed so that multi-stage masts **1002** and **1003** can be raised and lowered in a simultaneous manner substantially equally and so fly bar **1004** remains substantially level as multi-stage masts **1002** and **1003** are raised and lowered simultaneously in unison. In one exemplary embodiment, fine adjustments to the differences in the effective lengths of cables **1007** and **1008** are compensated for by fine-adjustment mechanism **4000**. It should be understood that the materials and the respective dimensions and thickness of spacer **7000** are selected based on the expected stresses that will be experienced by spacer **7000**. For example, in one exemplary embodiment, spacer **7000** could comprise steel or aluminum. Exemplary dimensions for such a steel spacer could be such that the diameter of spacer **7000** is about 3.0", the thickness is about 1.0", and the diameter of apertures **7001** and **7002** would about 0.375".

FIG. **6**D depicts an exemplary embodiment of a cable-adjustor spool **6500** that is suitable for use as dual cable spool **1006** according to the subject matter disclosed herein. Cable-adjustor spool **6500** comprises a first spool **6500***a* for cable **1007**, a second spool **6500***b* for cable **1008**, a gear **5001** and a spacer **7000**. First spool **6500***a* comprises two flanges **6501** and **6502** and a hub **6503**. The size of the projection of flanges **6501** and **6502** from hub **6503** is selected so that cable **1007** can be wound onto hub **6503** and multi-stage mast **1002** can be extended to its fully telescoped position and so that cable **1007** is securely positioned within flanges **6501** and **6502**. Similarly, second spool **6500***b* comprises two flanges **6501** and **6502** and a hub **6503**. The size of the projection of flanges **6501** and **6502** from hubs **6503** is selected so that cable **1007** (and cable **1008**) can be wound onto hub **6503** and multi-stage mast **1002** (and multi-stage mast **1003**) can be extended to its fully telescoped position and so that cables **1007** and **1008** are securely positioned within flanges **6501** and **6502**. Specific dimensions for flanges **6501** and **6502** and hub **6503** may be selected to be similar to those described elsewhere for flanges **6001** and **6002** and hub **6003**. Additionally, it should be understood that FIG. **6**D shows components and features that are similar to the components and features of dual cable spool **1006** described in connection with FIGS. **5**, **6**A-**6**C, **7**A and **7**B, but are not described in connection with cable-adjustor spool **6500** and do not have reference indicators in FIG. **6**D.

Hub **6503** comprises a hub body **6600**, a keyway **6601**, a cable director **6602**, a spring member **6603**, and a holding member **6604**. Keyway **6601** is formed in the surface on hub body **6600** on which a cable is wound. Cable director **6602** fits into keyway **6601** in a well-known manner. For example, one end of cable director **6602** comprises an aperture **6605** that receives a holding member **6604**, such as an Allen-head bolt. Spring member **6603** is received in an aperture **6606** formed in keyway **6601** and biases, or urges, cable director **6602** away from keyway **6601** in a well-known manner.

The configuration of hub **6503** assists cables **1007** and **1008** to wind and unwind from cable-adjustor spool **6500** at the same relative rate. In particular, for the exemplary embodiment of the dual cable spool **1006** shown in FIG. **5**, if cables **1007** and **1008** were constantly under tension, then the first few wraps of the cables onto the spool would be uniform and consistently located on the spool. Over time, the cables would form a memory and winding and unwinding the cables from the spool would continue to be uniform and consistently located. In actuality, when the multi-stage masts are completely retracted (i.e., not telescoped) and when the load gets to the bottom, the tension on cables **1007** and **1008** relaxes so that there is no tension on cables **1007** and **1008**. Over time, cables **1007** and **1008** will exhibit a coil-spring effect such that the first and second wraps of the cables will have a tendency to stay together on the spool, but the third and subsequent wraps will have a tendency to separate from the first two wraps when tension is removed from the cables. Upon reapplying a load to the cables, each cable will "grab" the spool at whatever point it is located, thereby resulting in the possibility that there will be gaps in the spool windings leading to uneven cable wrapping and the possibility that the cables may wind and unwind at significantly different rates. Under certain conditions, the multi-stage masts might telescope at significantly different rates that cannot be adjusted for by fine-adjustment mechanism **4000**. In operation, cable director **6602** of cable-adjustor spool **6500** directs at least the first two windings of a cable toward flange **6501** to form directly adjacent windings. As more cable is wound onto the spool, the compressive forces of the cable winding exceeds the force exerted by spring member **6603** on cable director **6602** and cable director **6602** is pressed into keyway **6601**. As more windings are wrapped onto the spool, the spool operates in a normal manner.

FIGS. **8**A and **8**B respectively show side and top views of an exemplary embodiment of lift device **1000** comprising an exemplary embodiment of outrigger-type legs **8001** to increase the overall stability of the lift device according to the subject matter disclosed herein. For one exemplary embodiment, outrigger-type legs **8001** comprise a height adjustment mechanism **8002**. In one exemplary embodiment, height adjustment mechanism **8002** comprises a base piece **8003**, an adjustment shaft **8004** and a crank arm **8005**. In one exemplary embodiment, outrigger-type legs **8001** are configured to couple in a well-known manner to frame members **1102** (not shown in FIG. **8**A) and **1105** (shown in FIG. **8**A) and extend outwardly from base frame portion **1100**. While FIGS. **1**A, **2**A and **2**D depict base frame members **1103** and **1104** as being tubular members capable of coupling in a well-known manner to outrigger-type legs **8001**, it should be understood that an exemplary alternative embodiment comprises only base frame members **1102** and **1105** that are capable of coupling in a well-known manner to outrigger-type legs **8001**.

Although the foregoing disclosed subject matter has been described in some detail for purposes of clarity of understanding, it will be apparent that certain changes and modifications may be practiced that are within the scope of the appended claims. Accordingly, the present embodiments are to be considered as illustrative and not restrictive, and the subject matter disclosed herein is not to be limited to the details given herein, but may be modified within the scope and equivalents of the appended claims.

What is claimed is:

1. A lifting device, comprising:

a frame comprising two ends that are opposite from each other along a first axis of the frame,

at least two multi-stage masts, each multi-stage mast corresponding to another multi-stage mast to form a pair of multi-stage masts, each multi-stage mast of a pair of multi-stage masts being attached to a respectively opposite end of the frame in an upright configuration with respect to the frame and substantially axially aligned with the other multi-stage mast of the pair of multi-stage masts, the axial alignment of the pair of multi-stage masts being substantially parallel to the first axis of the frame, each multi-stage mast comprising a first length configuration and a second length configuration, the second length configuration being longer than the first length configuration, each multi-stage mast further comprising a plurality of stages, at least one stage of a mast being vertically movable with respect to at least one other stage of the mast; and

a cable mechanism coupled to each multi-stage mast, the cable mechanism comprising:

a spool; and

at least one cable coupled to the spool and arranged with respect to the multi-stage masts so that when each cable is wound onto the spool, each mast simultaneously and in unison changing length in a direction from the first length configuration to the second length configuration, and when each cable is unwound off the spool, each mast changing length simultaneously and in unison in a direction from the second length configuration to the first length configuration.

2. The lifting device according to claim **1**, wherein each first multi-stage mast comprises a bottom end and a top end,

the lifting device further comprising a support member spanning between the top end of a first multi-stage mast and a second multi-stage mast, the support member being capable of supporting an object, the first and second multi-stage masts forming a pair of multi-stage masts, and

wherein at least the first and second multi-stage masts are capable of changing length simultaneously and in unison in a direction from the first length to the second length when an object is supported from the support member when the cable is wound onto the spool, and the first and second multi-stage masts are capable of changing length simultaneously and in unison in a direction from the second length configuration to the first length configuration when an object is supported from the support member when the cable is unwound off the spool.

3. The lifting device according to claim **2**, wherein at least one of the first and second multi-stage masts comprise an outer-most stage that substantially surrounds at least one other stage of the multi-stage mast when the multi-stage mast is in the first length configuration, and one of the stages of the multi-stage mast comprises an inner-most stage that is substantially surrounded by each of the stages comprising the multi-stage mast when the multi-stage mast is in the first length configuration, each stage of the multi-stage mast comprising a bottom end and a top end that respectively correspond to the bottom end and the top end of the multi-stage mast, and

wherein the cable mechanism comprises a first cable for the first multi-stage mast and the second cable for a second multi-stage mast, at least one of the first cable or the second cable being attached to the top end of the stage that is immediately adjacent to and substantially surrounds the inner-most stage of the multi-stage mast corresponding to the cable.

4. The lifting device according to claim **3**, wherein the cable mechanism further comprises an adjusting device capable of changing an effective path length of the first cable with respect to an effective path length of the second cable so that the support member spanning between the top end of the first multi-stage mast and the second multi-stage mast remains substantially in a selected orientation with respect to the horizontal as the first and second multi-stage masts change length simultaneously and in unison between the first length configuration and the second length configuration.

5. The lifting device according to claim **4**, further comprising a hoisting mechanism capable of lifting an object that is to be supported by the support member spanning between the top end of the first and second multi-stage masts into proximity of the support member.

6. The lifting device according to claim **5**, further comprising a frame supporting the multi-stage masts, the frame comprising a shape that is capable of surrounding at least a portion of three sides of an object that is to be supported by the support member spanning between the top end of the first and second multi-stage masts.

7. The lifting device according to claim **6**, wherein the frame comprises a plurality of wheels capable of permitting the lifting device to roll from a first location to a second location.

8. The lifting device according to claim **7**, wherein the spool comprises a spool hub comprising a first end and a second end, and first and second flange members respectively disposed at the first end and the second end of the spool hub, and a cable adjustor disposed in at least part of the spool hub, the cable adjustor capable of guiding a cable to form at least two directly adjacent windings around the spool hub as the cable is wound onto the spool hub.

9. The lifting device according to claim **8**, wherein the spool hub comprises a keyway,

wherein the cable adjustor comprises a cable director and a spring member, the cable director comprising a first end and a second end, the first end of the cable adjustor being disposed substantially within the keyway and the spring member being disposed at the second end and biasing the second end of the cable director away from the spool hub, the second end of the cable adjustor being pressed toward the spool hub into the keyway as the at least two directly adjacent windings of the cable are is wound onto the spool hub, and

wherein the cable adjustor further comprises a holding member holding the first end of the cable director within the keyway.

10. The lifting device according to claim **9**, wherein the cable that is attached to the top end of the stage of the multi-stage mast that is immediately adjacent to and substantially surrounds the inner-most stage of the multi-stage mast is attached using a cable stop.

11. The lifting device according to claim **1**, wherein the cable mechanism comprises a first cable for a first multi-stage mast and a second cable for a second multi-stage mast,

wherein each first multi-stage mast comprises a bottom end and a top end,

the lifting device further comprising a support member spanning between the top end of the first multi-stage mast and the second multi-stage mast, the support member being capable of supporting an object, and

wherein the cable mechanism further comprises an adjusting device capable of changing an effective path length of the first cable with respect to an effective path length of the second cable so that the support member spanning between the top end of the first multi-stage mast and the second multi-stage mast remains substantially in a selected orientation with respect to the horizontal as the first and second multi-stage masts change length simultaneously and in unison between the first length configuration and the second length configuration.

12. The lifting device according to claim **11**, further comprising a frame supporting the multi-stage masts, the frame comprising a shape that is capable of surrounding at least a portion of three sides of an object that is to be supported by the support member spanning between the top end of the first multi-stage mast and the second multi-stage mast.

13. The lifting device according to claim **12**, further comprising a hoisting mechanism capable of lifting the object into proximity of the support member spanning between the top end of the first multi-stage mast and the second multi-stage mast.

14. The lifting device according to claim **13**, wherein the spool comprises a spool hub comprising a first end and a second end, and first and second flange members respectively disposed at the first end and the second end of the spool hub, and a cable adjustor disposed in at least part of the spool hub, the cable adjustor capable of guiding a cable to form at least two directly adjacent windings around the spool hub as the cable is wound onto the spool hub.

15. The lifting device according to claim **14**, wherein the spool hub comprises a keyway,

wherein the cable adjustor comprises a cable director and a spring member, the cable director comprising a first end and a second end, the first end of the cable adjustor being disposed substantially within the keyway and the spring member being disposed at the second end and biasing the second end of the cable director away from the spool hub, the second end of the cable adjustor being pressed toward the spool hub into the keyway as the at least two directly adjacent windings of the cable are is wound onto the spool hub, and

wherein the cable adjustor further comprises a holding member holding the first end of the cable director within the keyway.

16. The lifting device according to claim **15**, wherein at least one multi-stage mast comprises at least one stage that surrounds another stage when the multi-stage mast is in the first length configuration.

17. The lifting device according to claim **1**, wherein each first multi-stage mast comprises a bottom end and a top end,

the lifting device further comprising a support member spanning between the top end of a first multi-stage mast and a second multi-stage mast, the support member being capable of supporting an object, and

a frame supporting the multi-stage masts, the frame comprising a shape that is capable of surrounding at least a portion of three sides of an object that is to be supported by the support member spanning between the top end of the first and second multi-stage masts.

18. The lifting device according to claim **17**, wherein the first and second multi-stage masts are capable of changing length simultaneously and in unison in a direction from the first length configuration to the second length configuration when an object is supported from the support member when the cable is wound onto the spool, and the first and second multi-stage masts are capable of changing length simultaneously and in unison in a direction from the second length to the first length when an object is supported from the support member when the cable is unwound off the spool.

19. The lifting device according to claim **18**, wherein the cable mechanism comprises a first cable for the first multi-stage mast and a second cable for the second multi-stage mast.

20. The lifting device according to claim **19**, wherein the cable mechanism further comprises an adjusting device capable of changing an effective path length of the first cable with respect to an effective path length of the second cable so that the support member spanning between the top end of the first multi-stage mast and the second multi-stage mast remains substantially in a selected orientation with respect to the horizontal as the first and second multi-stage masts change length simultaneously and in unison between the first length and the second length.

21. The lifting device according to claim **20**, further comprising a hoisting mechanism capable of lifting an object that is to be supported by the support member spanning between the top end of the first and second multi-stage masts into proximity of the support member.

22. The lifting device according to claim **21**, wherein the frame comprises a plurality of wheels capable of permitting the lifting device to roll from a first location to a second location.

23. The lifting device according to claim **22**, wherein the spool comprises a spool hub comprising a first end and a second end, and first and second flange members respectively disposed at the first end and the second end of the spool hub, and a cable adjustor disposed in at least part of the spool hub, the cable adjustor capable of guiding a cable to form at least two directly adjacent windings around the spool hub as the cable is wound onto the spool hub.

24. The lifting device according to claim **23**, wherein the spool hub comprises a keyway,

wherein the cable adjustor comprises a cable director and a spring member, the cable director comprising a first end and a second end, the first end of the cable adjustor being disposed substantially within the keyway and the spring member being disposed at the second end and biasing the second end of the cable director away from the spool hub, the second end of the cable adjustor being pressed toward the spool hub into the keyway as the at least two directly adjacent windings of the cable are is wound onto the spool hub, and

wherein the cable adjustor further comprises a holding member holding the first end of the cable director within the keyway.

25. The lifting device according to claim **24**, wherein at least one multi-stage mast comprises at least one stage that surrounds another stage when the multi-stage mast is in the first length configuration.

26. A device, comprising:

a spool comprising a spool hub comprising a first end and a second end, and first and second flange members respectively disposed at the first end and the second end of the spool hub, the spool hub comprising a keyway; and

a cable adjustor disposed in at least part of the spool hub, the cable adjustor capable of guiding a cable to form at least two directly adjacent windings around the spool hub as the cable is wound onto the spool hub, the cable adjustor comprising a cable director and a spring member, the cable director comprising a first end and a second end, the first end of the cable adjustor being disposed substantially within the keyway and the spring member being disposed at the second end and biasing the second end of the cable director away from the spool hub, the second end of the cable adjustor being pressed toward the spool hub into the keyway as the at least two directly adjacent windings of the cable are is wound onto the spool hub.

27. The device according to claim **26**, wherein the cable adjustor further comprises a holding member holding the first end of the cable director within the keyway.

28. The device according to claim **27**, further comprising:

at least two multi-stage masts, each multi-stage mast comprising a first length configuration and a second length configuration, the second length configuration being longer than the first length configuration, each multi-stage mast further comprising a plurality of stages, at least one stage of a mast being vertically movable with respect to at least one other stage of the mast; and

a cable mechanism coupled to each multi-stage mast, the cable mechanism comprising:

the spool; and

at least one cable coupled to the spool and arranged with respect to the multi-stage masts so that when each cable is wound onto the spool, each mast simultaneously and in unison changing length in a direction from the first length configuration to the second length configuration, and when each cable is unwound off the spool, each mast changing length simultaneously and in unison in a direction from the second length configuration to the first length configuration.

29. The device according to claim **28**, further comprising at least one additional spool comprising a spool hub comprising a first end and a second end, and first and second flange members respectively disposed at the first end and the second end of the spool hub, and a cable adjustor disposed in at least part of the spool hub, the cable adjustor capable of guiding a cable to form at least two directly adjacent windings around the spool hub as the cable is wound onto the spool hub.

30. The device according to claim **29**, wherein the spool hub of the additional spool comprises a keyway, and

wherein the cable adjustor of the additional spool comprises a cable director and a spring member, the cable director comprising a first end and a second end, the first end of the cable adjustor being disposed substantially within the keyway and the spring member being disposed at the second end and biasing the second end of the cable director away from the spool hub, the second end of the cable adjustor being pressed toward the spool hub into the keyway as the at least two directly adjacent windings of the cable are is wound onto the spool hub.

31. The device according to claim **30**, wherein the cable adjustor of the additional spool further comprises a holding member holding the first end of the cable director within the keyway.

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