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(54) Title: AN ARRANGEMENT FOR UNTWISTING CABLES

(57) Abstract: According to an embodiment, an arrangement (100) for untwisting at least one cable (102) extending from a rotating end (104) to a fixed end (106) is disclosed. The arrangement (100) for untwisting the cable (102) includes a first spring (106) and a second spring (108) arranged in a linear configuration. The cable (102) is wound on the first spring (106) and the second spring (108). The arrangement (100) further includes a freely rotatable element (112). The freely rotatable element (112) is disposed between the first spring (106) and the second spring (108) to connect both the springs in the linear configuration. The first spring (106) and the second spring (108) are arranged in such a way that the compression of the first spring (106) causes the extension of the second spring (108) and the extension of the first spring (106) causes the compression of the second spring (108).

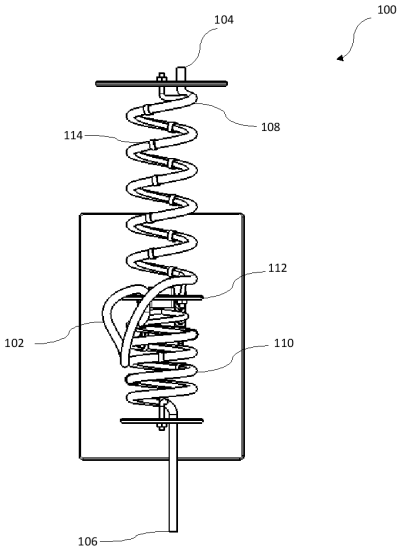

Figure 1

FORM 2

THE PATENTS ACT 1970

(39 OF 1970)

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The Patent Rules, (200)3

Complete Specification

(See Section 10 and Rule 13)

1. TITLE OF THE INVENTION

An arrangement for untwisting cables

2. APPLICANT(S)

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3. PREAMBLE TO THE DESCRIPTION

COMPLETE

The following specification particularly describes the invention and the manner in which it is performed**.**

FIELD OF INVENTION

The invention generally relates to field of cable management, and more particularly to an arrangement for untwisting cables in wind turbine.

BACKGROUND

A typical wind turbine includes a nacelle mounted on top of a wind turbine tower via a yaw bearing. The yaw bearing enables the nacelle to rotate with respect to the tower. The nacelle is mainly rotated to direct the wind turbine blades, mounted on a wind turbine hub, against the direction of wind. A properly positioned nacelle may maximize the use of wind energy thereby making the system more efficient. However, during such rotations of the nacelle, the cables, especially power cables, extending from the nacelle to the bottom of the tower undergoes twisting. This twisting of the cables causes damage to the cables and often leads to wear and tear or breakage of the cables.

Furthermore, the rotation capacity of the nacelle in such wind turbines is quite limited and the nacelle is needed to be rotated back to the initial position to prevent breakage of cables. The act of bringing the nacelle back to the initial position wastes the opportunity to effectively utilize the wind energy. To overcome such issues, the conventional wind turbines usually uses flexible cables or cable twisting arrangements that are too complex to be integrated in the wind turbine systems.

Hence there is a need for an improved arrangement for untwisting cables that undergo excessive twisting.

SUMMARY OF THE INVENTION

According to an embodiment of the invention, an arrangement for untwisting at least one cable extending from a rotating end to a fixed end is disclosed. The arrangement for untwisting the cable includes a first spring and a second spring. The first spring and the second spring are arranged in a linear configuration and the cable is wound on the first spring and the second spring. The arrangement for untwisting the cable further includes a freely rotatable element. The freely rotatable element is disposed between the first spring and the second spring to connect both the springs in the linear configuration. The first spring and the second spring are arranged in such a way that the compression of the first spring causes the extension of the second spring and the extension of the first spring causes the compression of the second spring.

According to another embodiment, an arrangement for untwisting a plurality of cables in a wind turbine is disclosed. The plurality of cables extends from a nacelle of the wind turbine to a tower base of the wind turbine. The arrangement for untwisting the plurality of cables include a first spring having a first end and a second end. The first end is attached to the nacelle and the second end is attached to a rotatable element. The arrangement for untwisting the plurality of cables further include a second spring having a first end and a second end. The first end of the second spring is attached to the rotatable element and the second end of the second spring is attached to a base of the tower. The plurality of cables extending from the nacelle to the tower base is wound on the first spring and the second spring. In the arrangement, the first spring and the second spring are arranged in such a manner that the compression of the first spring causes the extension of the second spring and the extension of the first spring causes the compression of the second spring.

BRIEF DESCRIPTION OF DRAWINGS

Other objects, features, and advantages of the invention will be apparent from the following description when read with reference to the accompanying drawings. In the drawings wherein, like reference numerals denote corresponding parts throughout the several views.

Figure 1 illustrates a front view of an arrangement for untwisting a cable according to an embodiment of the invention.

Figure 2 illustrates a side view of an arrangement for untwisting cables in a wind turbine according to an embodiment of the invention.

Figure 3 illustrates an isometric view of an arrangement for untwisting cables in the wind turbine according to an embodiment of the invention.

DETAILED DESCRIPTION OF DRAWINGS

The following description with reference to the accompanying drawings is provided to assist in a comprehensive understanding of exemplary embodiments. It includes various specific details to assist in that understanding but these are to be regarded as merely exemplary. Accordingly, those of ordinary skilled in the art will recognize that various changes and modifications of the embodiments described herein can be made without departing from the scope and spirit of the invention. In addition, descriptions of well-known functions and constructions are omitted for clarity and conciseness.

Figure 1 illustrates a front view of an arrangement (100) for untwisting at least one cable (102), according to an embodiment of the invention. The arrangement (100) may be employed in systems such as a wind turbine where one or more cables undergo twisting. The arrangement (100) may protect the cable (102) from breaking due to excessive twisting. It will be apparent to a person skilled in the art that the cable (102) referred herein may be a power cable, communication cable, signal cable and any other suitable cables known in the art. According to an embodiment, the cable (102) extends from a rotating end (104) to a fixed end (106). In other words, one end of the cable (102) may be connected to a rotating end (104) and the other end of the cable may be connected to a fixed end (106). The rotational movement of the rotating end (104) of the cable (102) may cause the cable (102) to twist. It should be noted that the rotating end (104) of the cable (102) may rotate either in a clockwise direction or in an anticlockwise direction depending on the system. It should be further noted that the terms ‘cable’ and ‘wire’ may be used interchangeably in the specification without restricting the invention in any way. The cable (102) may be made of materials that may include, but are not limited to copper, aluminium etc and may be shielded by an insulating material.

The arrangement (100) for untwisting the cable (102) may include a first spring (108) and a second spring (110). The first spring (108) and the second spring (110) may be arranged in a linear configuration between the rotating end (104) and the fixed end (106). According to an embodiment, the first spring (108) and the second spring (110) are torsional springs. According to another embodiment, the first spring (108) and the second spring (110) are helical springs. It will be apparent to a person skilled in the art that the size of the first spring (108) and the second spring (110) may be similar or may vary depending on the system where they are employed. It should be noted that the first spring (108) and the second spring (110) may be

arranged in such a way that when the first spring (108) undergoes compression, the second spring (110) undergoes extension and when the first spring (108) undergoes extension, the second spring (110) undergoes compression. For the purpose of illustration, if the first spring (108) undergoes compression when it rotates in a clockwise direction, the second spring (110) undergoes extension when it rotates in the clockwise direction. Similarly, if the first spring (108) undergoes extension when it rotates in an anticlockwise direction, the second spring (110) undergoes compression when it rotates in the anticlockwise direction.

The first spring (108) and the second spring (110) are connected to each other by a freely rotatable element (112). For the purpose of illustration, the first spring (108) is arranged between the rotating end (104) and the rotatable element (112), and the second spring (110) is arranged between the rotatable element (112) and the fixed end (106). The rotatable element (112) may be arranged between the first spring (108) and the second spring (110) thereby enabling the springs (108), (110) to be arranged in a linear configuration. According to an embodiment, the rotatable element (112) may be a circular disc. The circular disc may be arranged perpendicular to the first spring (108) and the second spring (110) and may be freely rotatable around the axis of the first spring (108) and the second spring (110). According to another embodiment, the freely rotatable element (112) may be any element known in the art. For the purpose of illustration, in case of the circular disc, one end of the first spring (108) is attached to one side of the circular disc and one end of the second spring (110) is attached to the other side of the circular disc. It will be apparent to a person skilled in the art that the size of the circular disc may depend on the system. The rotatable element (112) may transfer the rotation of the first spring (108) to the second spring (110). It should be noted that the freely rotatable element (112) may include a passage for the cable (102) to pass from the first spring (108) and the second spring (110). For the purpose of illustration, the passage may be a hole

on the rotatable element (112) through which the cable (102) may pass from the first spring (108) to the second spring (110).

The cable (102) extending from the rotating end (104) to the fixed end (106) is wound on the first spring (108) and the second spring (110). In other words, the cable (102) extending from the rotating end (104) to the fixed end (106) is wound on the coil of the first spring (106) and the second spring (108). The cable (102) may pass from the first spring (108) to the second spring (110) through the passage provided on the rotatable element (112). According to an embodiment, the cable (102) may be clamped (114) on the coils of the first spring (108) and the second spring (110). According to another embodiment, the cable (102) may be arranged on the first spring (108) and the second spring (110) by any other means known in the art. The arrangement of the cable (102) on the first spring (108) and the second spring (110) may be such that when the rotating end (104) of the cable (102) rotates, the cable (102) undergoes twisting leading to the rotation of the first spring (108), which eventually causes the rotation of the freely rotatable element (112) and the second spring (110). According to an embodiment, if the rotating end (104) of the cable (102) rotates in a clockwise direction, the first spring (108) undergoes compression and if the rotating end (104) of the cable (102) rotates in an anticlockwise direction, the first spring (108) undergoes extension. According to another embodiment, if the rotating end (104) of the cable (102) rotates in a clockwise direction, the first spring (108) undergoes extension and if the rotating end (104) rotates in an anticlockwise direction, the first spring (108) undergoes compression.

Figure 2 and Figure 3 illustrates a side view and an isometric view of an arrangement (200) for untwisting a plurality of cables (202) in a wind turbine (not shown), according to another embodiment of the invention. The arrangement (200) may be employed in the wind turbine for

increasing the rotational capacity of a nacelle without causing the cables (202) to break due to excessive twisting. The nacelle may be mounted on top of a tower (204) via a yaw bearing. The yaw bearing may enable the nacelle to rotate in either clockwise direction or in an anticlockwise direction depending on the direction of flow of wind. The plurality of cables (202) extends from the nacelle to the base of the tower (204). The cables (202) may be used to transfer electricity generated by wind turbine blades to a power collection system located at the base of the tower (204). In other words, at one end, the cables (202) may be connected to an equipment within the nacelle and at other end, the cables (202) may be connected to the power collection system. The nacelle may be rotated to direct the wind turbine blades against the wind flow direction for producing maximum electricity generation. The nacelle may be also rotated to prevent the wind turbine blades from getting damaged due to excessive wind force.

The arrangement (200) for untwisting the plurality of cables (202) may include a first spring (206). The first spring (206) may have a first end (208) and a second end (210). The first end (208) of the first spring (206) may be attached to the nacelle and the second end (212) of the first spring (206) may be attached to a freely rotatable element (212). The arrangement for untwisting the plurality of cables (202) may further include a second spring (214). The second spring (214) may have a first end (216) and a second end (218). The first end (216) of the second spring (214) may be attached to the freely rotatable element (212) and the second end (218) of the second spring (214) may be attached to the base of the tower (204). It will be apparent to a person skilled in the art that the first spring (206) and the second spring (214) may be arranged in a linear configuration between the nacelle and the base of the tower (204). The first spring (206) and the second spring (214) may be arranged in a substantially vertical position within the tower (204). As will be appreciated by those skilled in the art, the size of the first spring (206) and the second spring (214) may be similar or may vary depending on the

size of the wind turbine. According to an embodiment, the first spring (206) and the second spring (214) may be torsional springs. According to another embodiment, the first spring (206) and the second spring (214) may be helical springs. It should be noted that the first spring (206) and the second spring (214) may be arranged in such a way that when the first spring (206) undergoes compression, the second spring (214) undergoes extension and when the first spring (206) undergoes extension, the second spring (214) undergoes compression. For the purpose of illustration, if the first spring (206) undergoes compression when it rotates in a clockwise direction, the second spring (214) undergoes extension when it rotates in the clockwise direction. Similarly, if the first spring (206) undergoes extension when it rotates in an anticlockwise direction, the second spring (214) undergoes compression when it rotates in the anticlockwise direction.

The first spring (206) and the second spring (214) are connected to each other by the freely rotatable element (212). According to an embodiment, the rotatable element (212) may be a circular disc. The circular disc may be arranged perpendicular to the first spring (206) and the second spring (214) and may be freely rotatable around the axis of the first spring (206) and the second spring (214). For the purpose of illustration, in case of the circular disc, one end of the first spring (206) is attached to one side of the circular disc and one end of the second spring (214) is attached to the other side of the circular disc. According to an embodiment, the circular disc may be mounted within the tower (204) by a retractable arrangement. The retractable arrangement may include a retractable rod (220) attached to the circular disc at one end and attached to the internal surface of the tower (204) at the other end. The retractable arrangement may be attached to the tower surface by a knuckle joint (222) and may be opened and retracted by a retracting spring set (224). According to another embodiment, the circular disc may be mounted within the tower (204) by a bearing (not shown). The bearing may enable the circular

disc to rotate freely based on the rotation of the first spring (206). It will be apparent to a person skilled in the art that the arrangement for mounting the circular disc described herein is for illustration purposes only and any other suitable mounting means known in the art may be applicable. The rotatable element (212) may transfer the rotation of the first spring (206) to the second spring (214). It should be noted that the rotatable element (212) may include a passage for the cable (202) to pass from the first spring (206) to the second spring (214). According to an embodiment, the passage may be a hole.

The cable (202) extending from the nacelle to the tower base is wound on the first spring (206) and the second spring (214). In other words, the cable (202) extending from the nacelle to the tower base is wound on the coil of the first spring (206) and the second spring (214). The cable (202) may pass from the first spring (206) to the second spring (214) through the passage provided on the rotatable element (212). According to an embodiment, the cable (202) may be clamped 226 on the coils of the first spring (206) and the second spring (214). According to another embodiment, the cable (202) may be arranged on the first spring (206) and the second spring (214) by any other means known in the art. The arrangement of the cable (202) on the first spring (206) and the second spring (214) may be such that when the nacelle rotates, the cable (202) undergoes twisting leading to the rotation of the first spring (206). According to an embodiment, if the nacelle rotates in a clockwise direction, the first spring undergoes compression and if the nacelle rotates in an anticlockwise direction, the first spring (206) undergoes extension. According to another embodiment, if the nacelle rotates in a clockwise direction, the first spring (206) undergoes extension and if the nacelle rotates in an anticlockwise direction, the first spring (206) undergoes compression.

It is understood that the above description is intended to be illustrative, and not restrictive. It is intended to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention as defined in the appended claims. Many other embodiments will be apparent to those of skill in the art upon reviewing the above description. The scope of the invention should, therefore, be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled. In the appended claims, the terms “including” and “in which” are used as the plain-English equivalents of the respective terms “comprising” and “wherein,” respectively.

We claim:

1. An arrangement (100) for untwisting at least one cable (102) extending from a rotating end (104) to a fixed end (106), the arrangement (100) comprising:

a first spring (108) and a second spring (110) arranged in a linear configuration, the at least one cable (102) being wound on the first spring (108) and the second spring (110); and

a freely rotatable element (112) connecting the first spring (108) and the second spring (110),

the first spring (108) and the second spring (110) being arranged such that the compression of the first spring (108) causes the extension of the second spring (110) and the extension of the first spring (108) causes the compression of the second spring (110).

2. The arrangement (100) for untwisting the at least one cable (102) as claimed in claim 1, wherein the rotating end (104) is disposed within a nacelle of a wind turbine.

3. The arrangement (100) for untwisting the at least one cable (102) as claimed in claim 1, wherein the fixed end (106) is disposed on a tower base of the wind turbine.

4. The arrangement (100) for untwisting the at least one cable (102) as claimed in claim 1, wherein the first spring (108) and the second spring (110) are torsional springs.

5. The arrangement (100) for untwisting the at least one cable (102) as claimed in claim 1, wherein the first spring (108) and the second spring (110) are helical springs.

6. The arrangement (100) for untwisting the at least one cable (102) as claimed in claim 1, wherein the freely rotatable element (112) is a circular disc.

7. The arrangement (100) for untwisting the at least one cable (102) as claimed in claim 6, wherein the freely rotatable element (112) includes a provision for passage of the at least one cable (102).

8. An arrangement (200) for untwisting a plurality of cables (202) in a wind turbine, the plurality of cables (202) extend from a nacelle of the wind turbine to a tower base of the wind turbine, the arrangement (200) comprising:

a first spring (206) having a first end (208) and a second end (210), the first end (208) is attached to the nacelle and the second end (210) is attached to a rotatable element (212); and

a second spring (214) having a first end (216) and a second end (218), the first end (216) is attached to the rotatable element (212) and the second end (218) is attached to a base of the tower (204), the plurality of cables (202) being wound on the first spring (206) and the second spring (214),

the first spring (206) and the second spring (214) being arranged such that the compression of the first spring (206) causes the extension of the second spring (214) and the extension of the first spring (206) causes the compression of the second spring (214).

Dated this 20th day of September 2019

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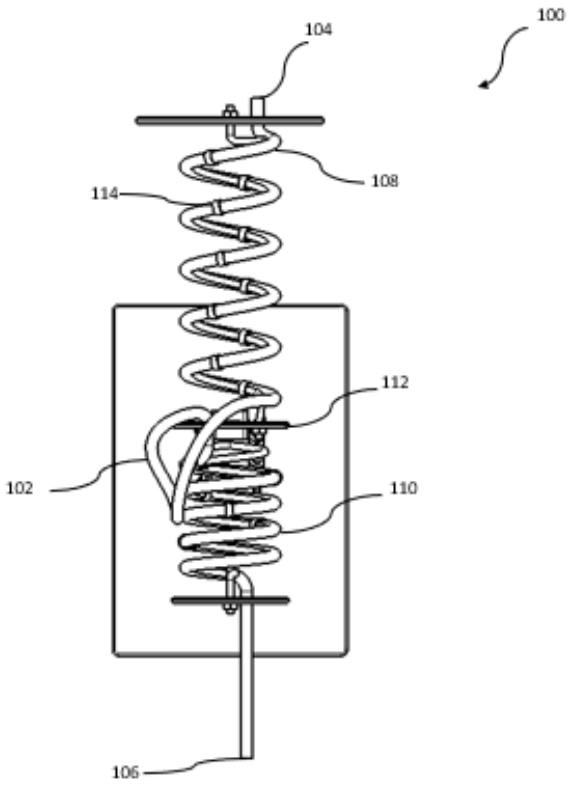
ABSTRACT

An arrangement for untwisting cables

According to an embodiment, an arrangement (100) for untwisting at least one cable (102) extending from a rotating end (104) to a fixed end (106) is disclosed. The arrangement (100) for untwisting the cable (102) includes a first spring (106) and a second spring (108) arranged in a linear configuration. The cable (102) is wound on the first spring (106) and the second spring (108). The arrangement (100) further includes a freely rotatable element (112). The freely rotatable element (112) is disposed between the first spring (106) and the second spring (108) to connect both the springs in the linear configuration. The first spring (106) and the second spring (108) are arranged in such a way that the compression of the first spring (106) causes the extension of the second spring (108) and the extension of the first spring (106) causes the compression of the second spring (108).



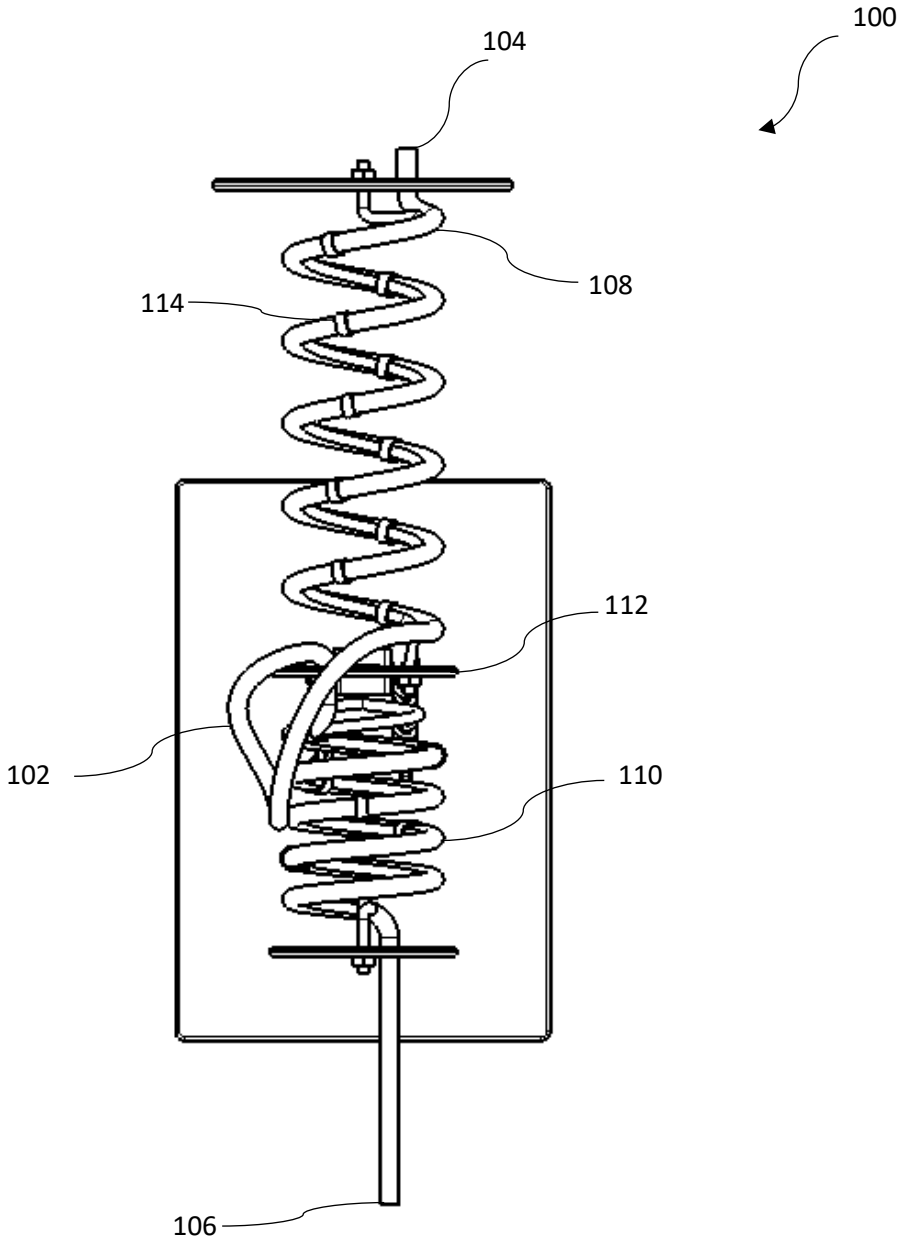


Figure 1

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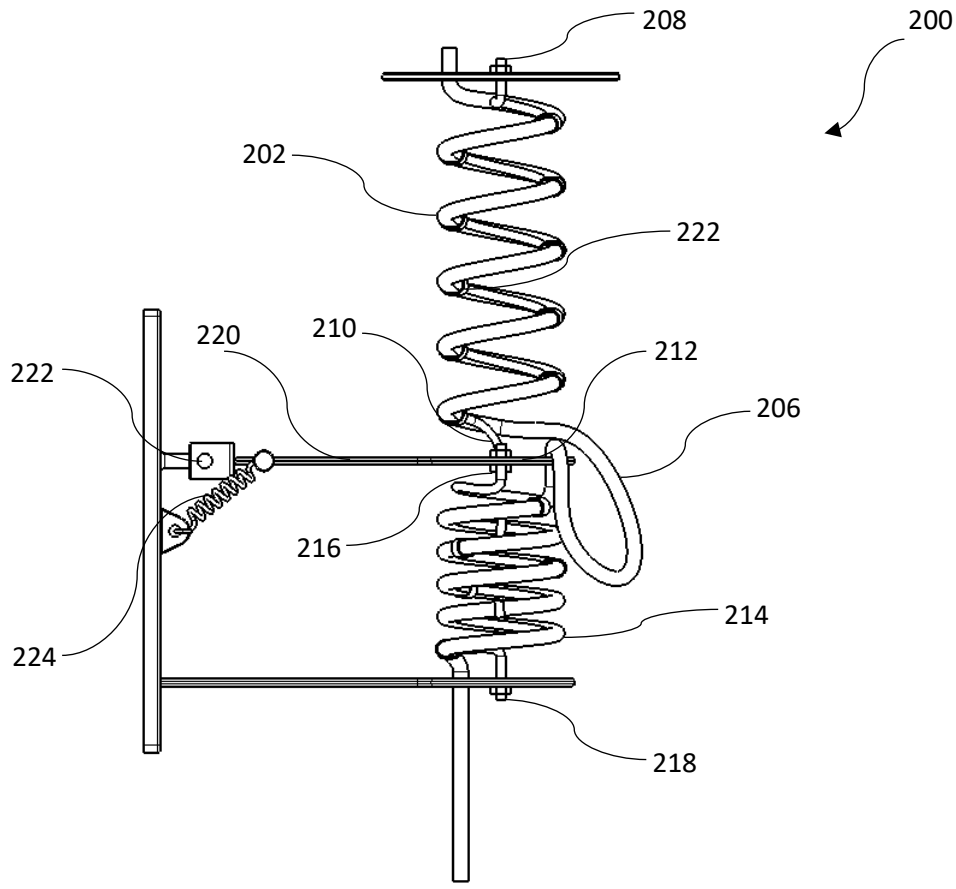

Figure 2

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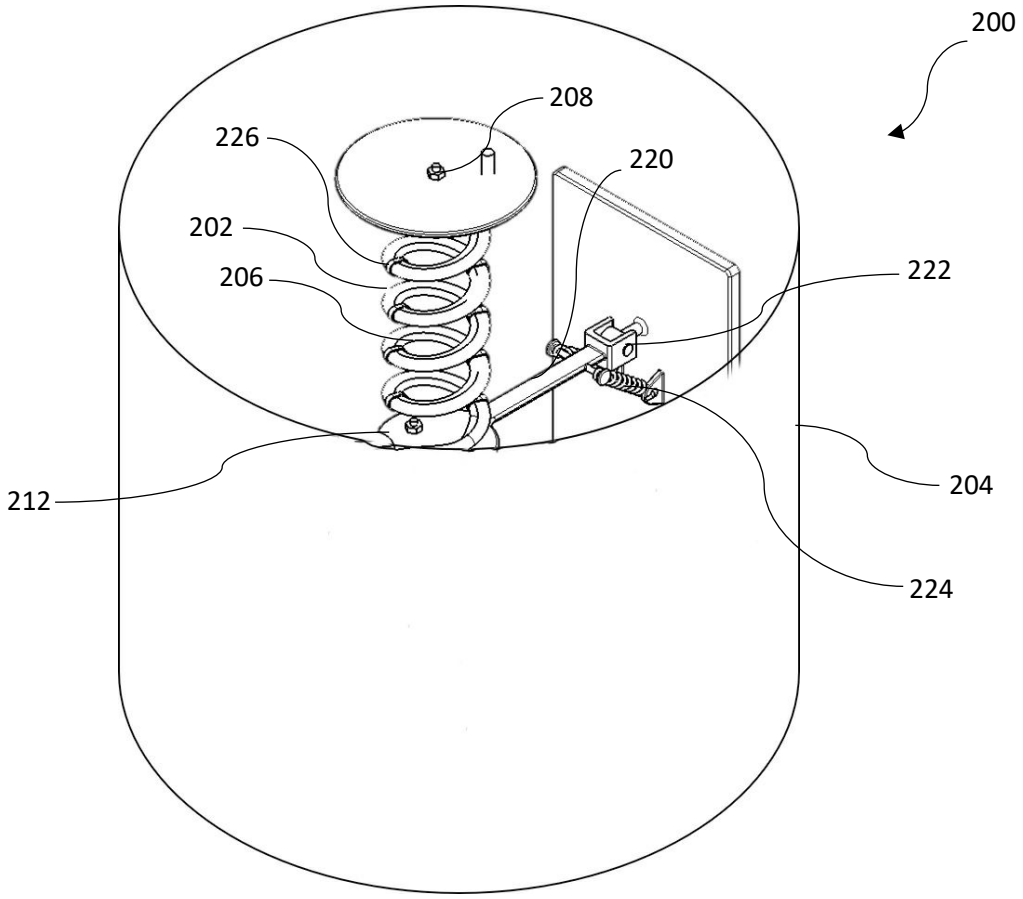

Figure 3

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