



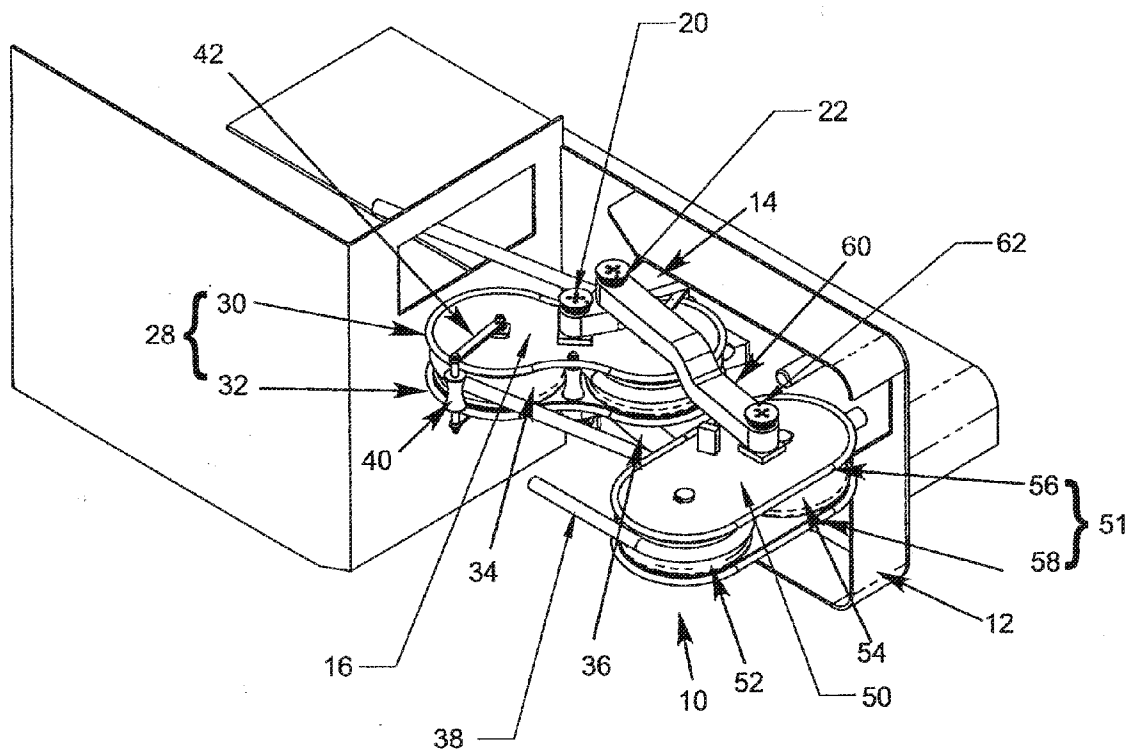
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(19) **United States**(12) **Patent Application Publication**
Bartolone(10) **Pub. No.: US 2011/0089284 A1**(43) **Pub. Date: Apr. 21, 2011**(54) **CABLE TENSIONING DEVICE****Publication Classification**(76) Inventor: **Dean Bartolone**, Lafayette, IN
(US)(21) Appl. No.: **12/885,225**(22) Filed: **Sep. 17, 2010**(51) **Int. Cl.**
B65H 77/00 (2006.01)
B65H 75/44 (2006.01)
B65H 59/36 (2006.01)(52) **U.S. Cl.** **242/417.3**(57) **ABSTRACT**

A cable tensioning device includes a sheave bracket assembly comprising a plurality of sheaves; and an outlet cable guide attached to the sheave bracket assembly, wherein when tension applied to a cable engaging the sheave bracket assembly reaches a first threshold level, the sheave bracket assembly is adapted to move from a wound state to an unwound state to decrease a path length of the cable with respect to the outlet cable guide.

Related U.S. Application Data

(60) Provisional application No. 61/243,946, filed on Sep. 18, 2009.



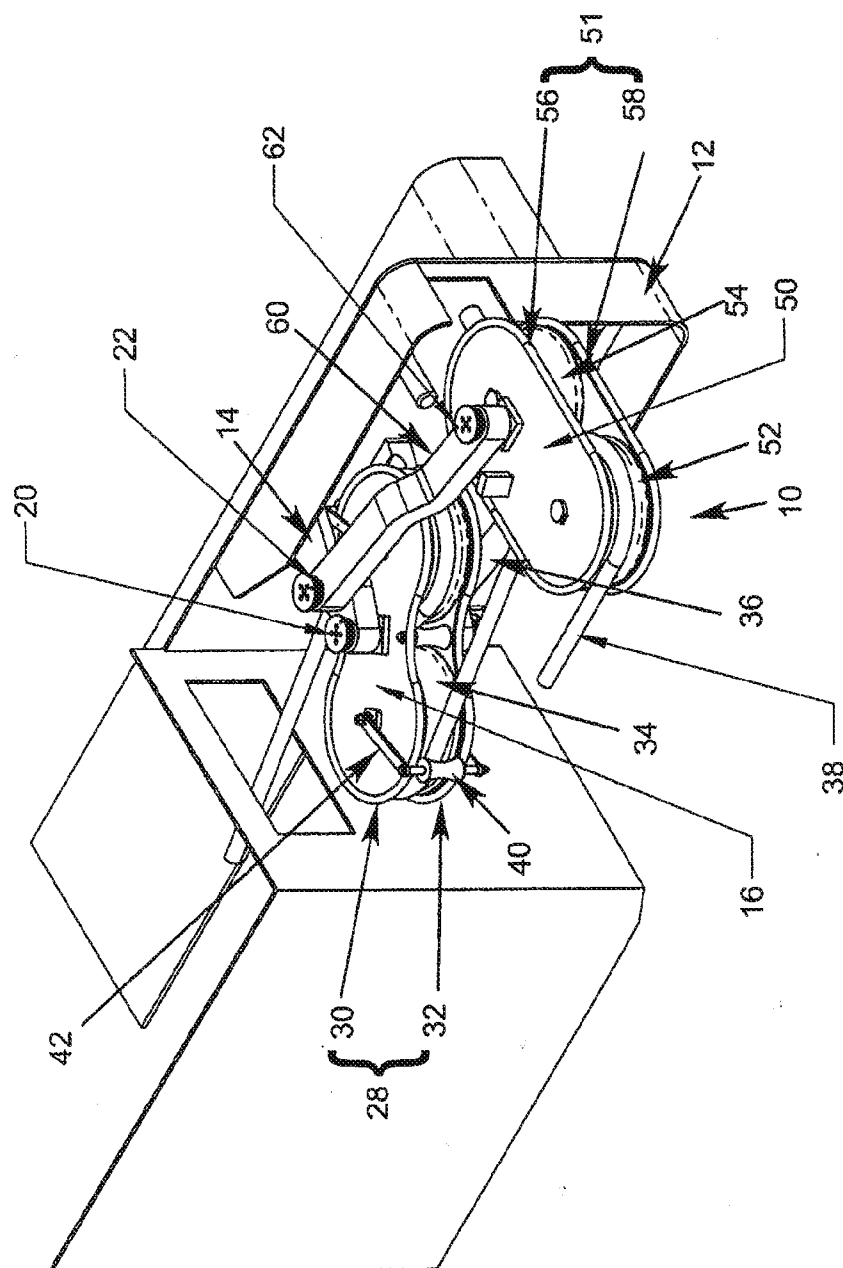


Figure 1a

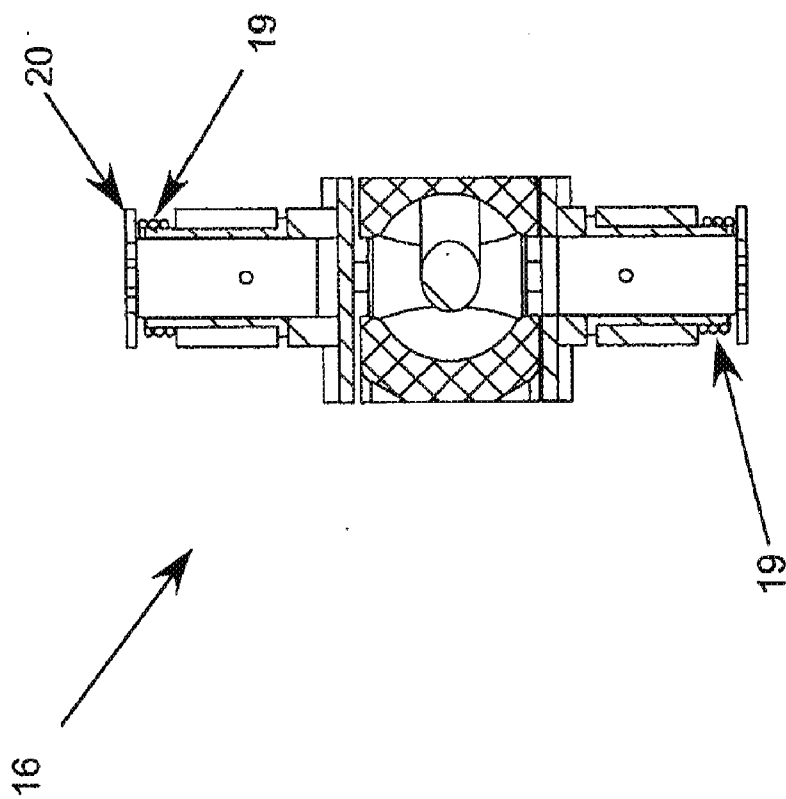


Figure 1b

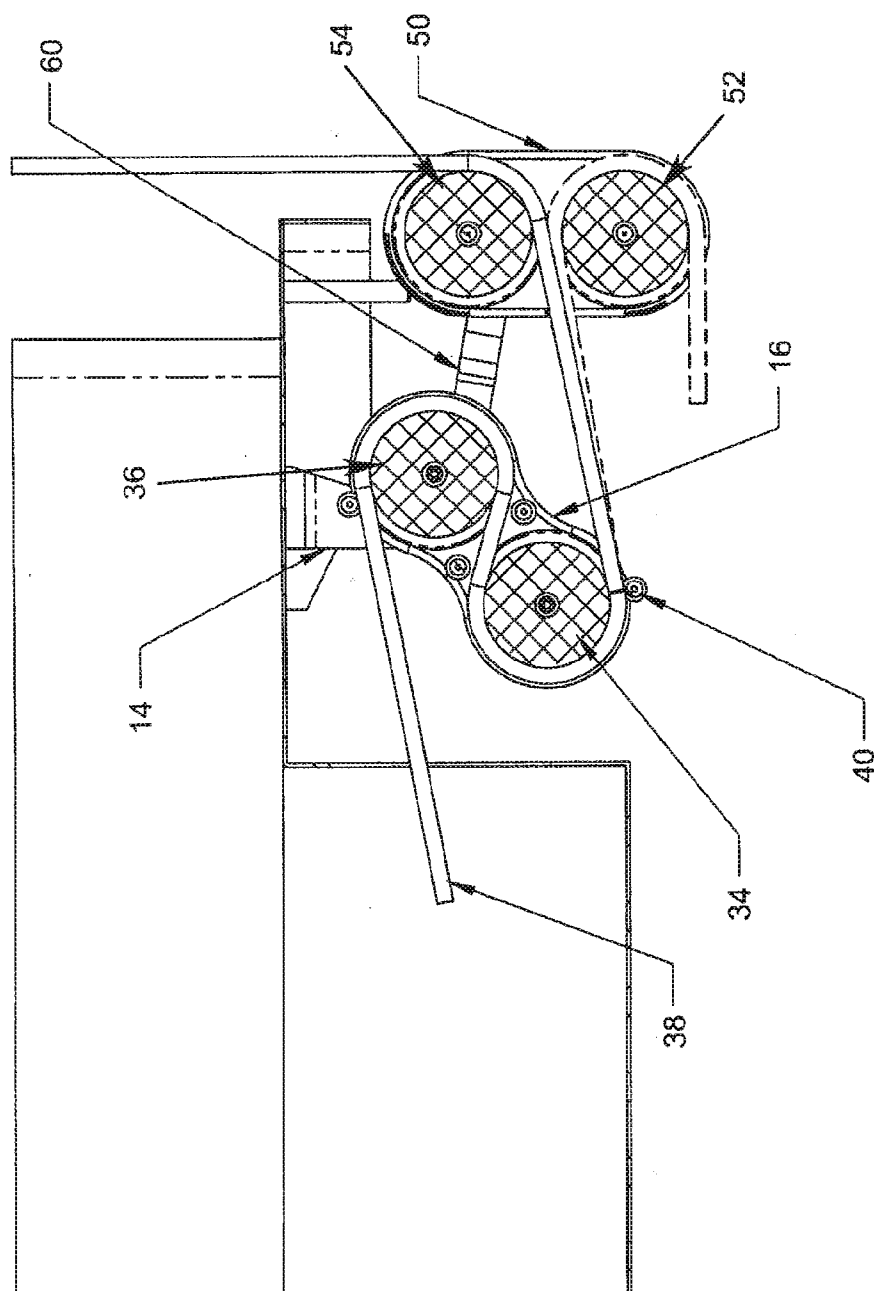


Figure 2

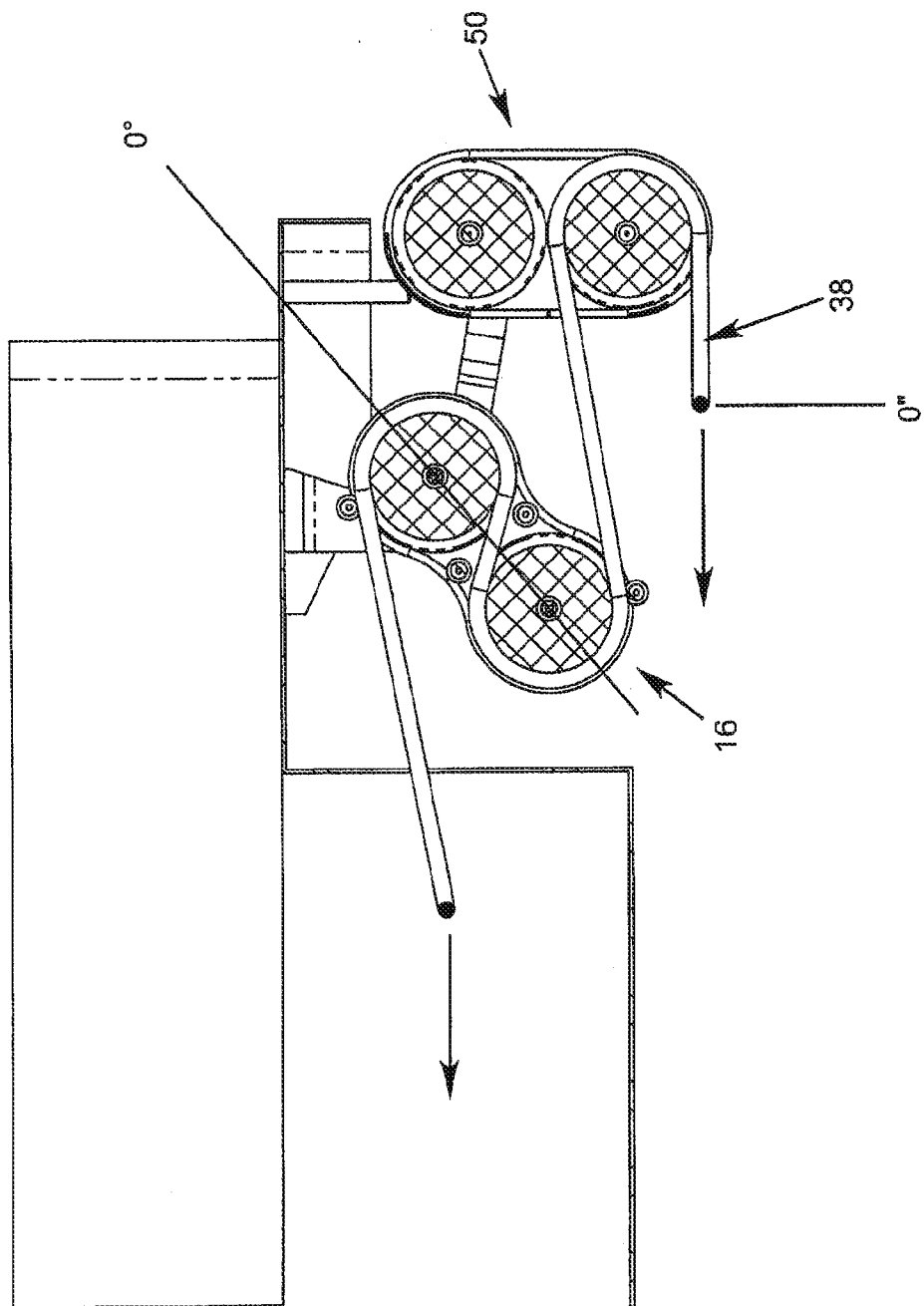


Figure 3

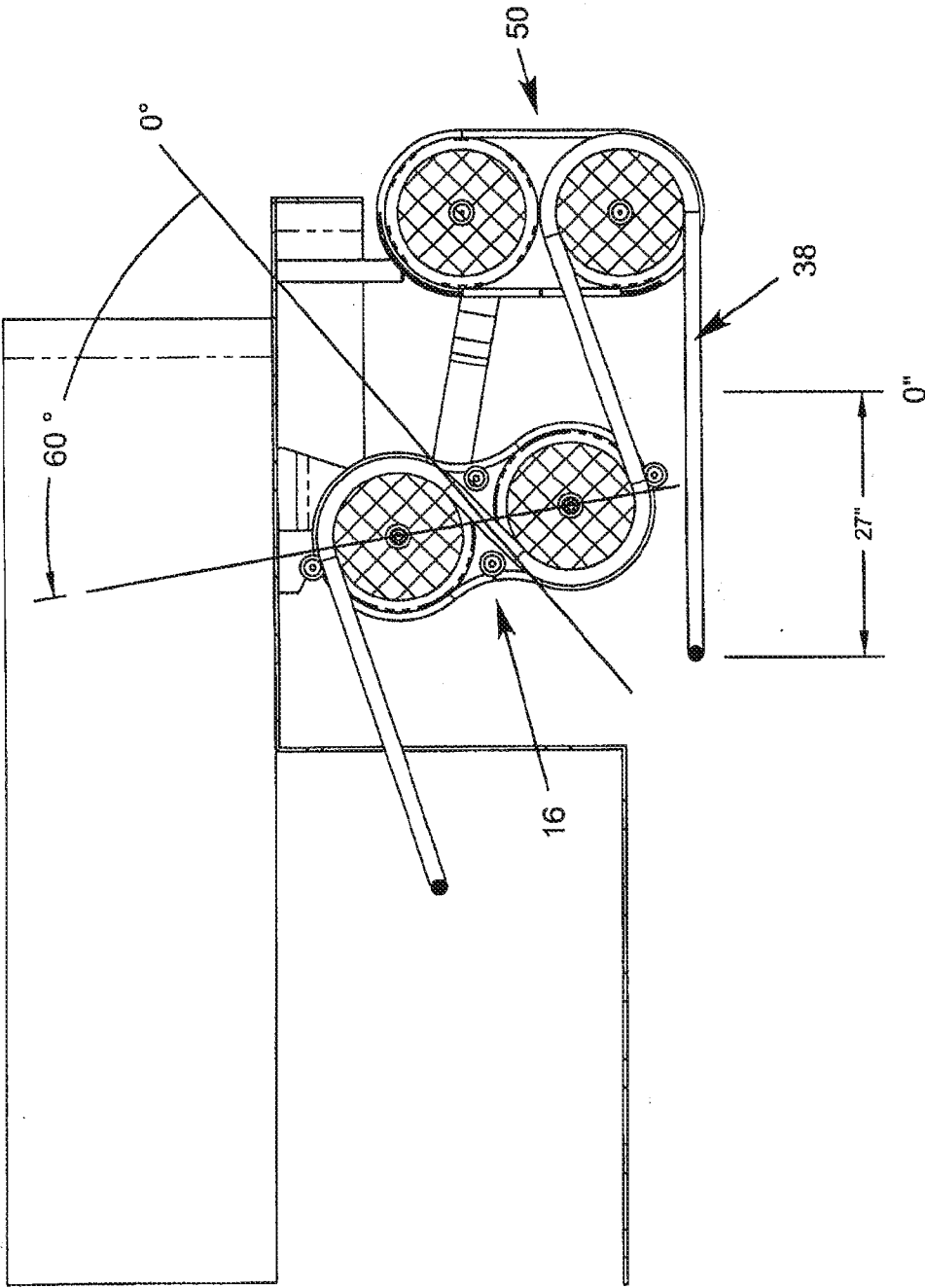


Figure 4

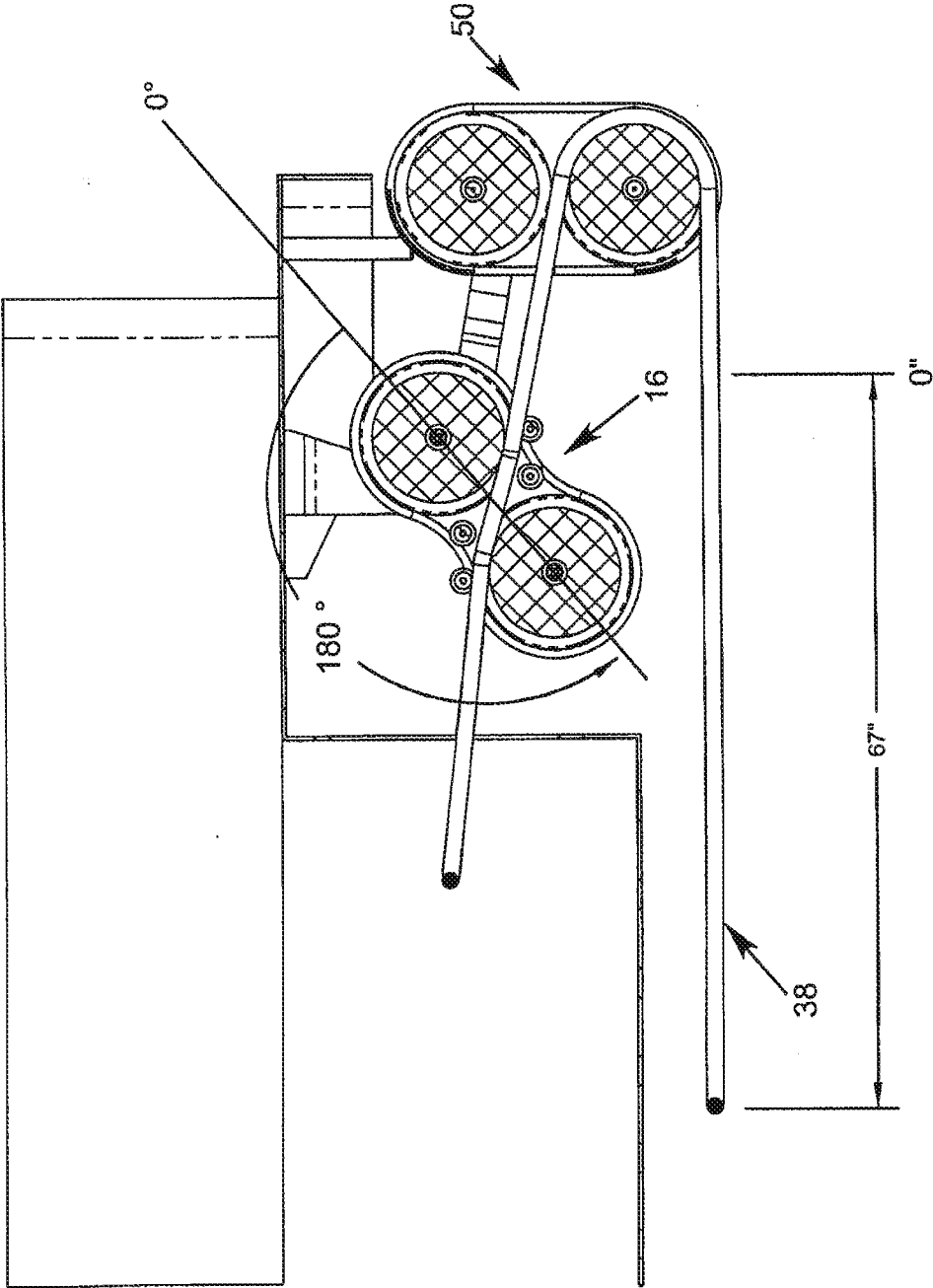


Figure 5

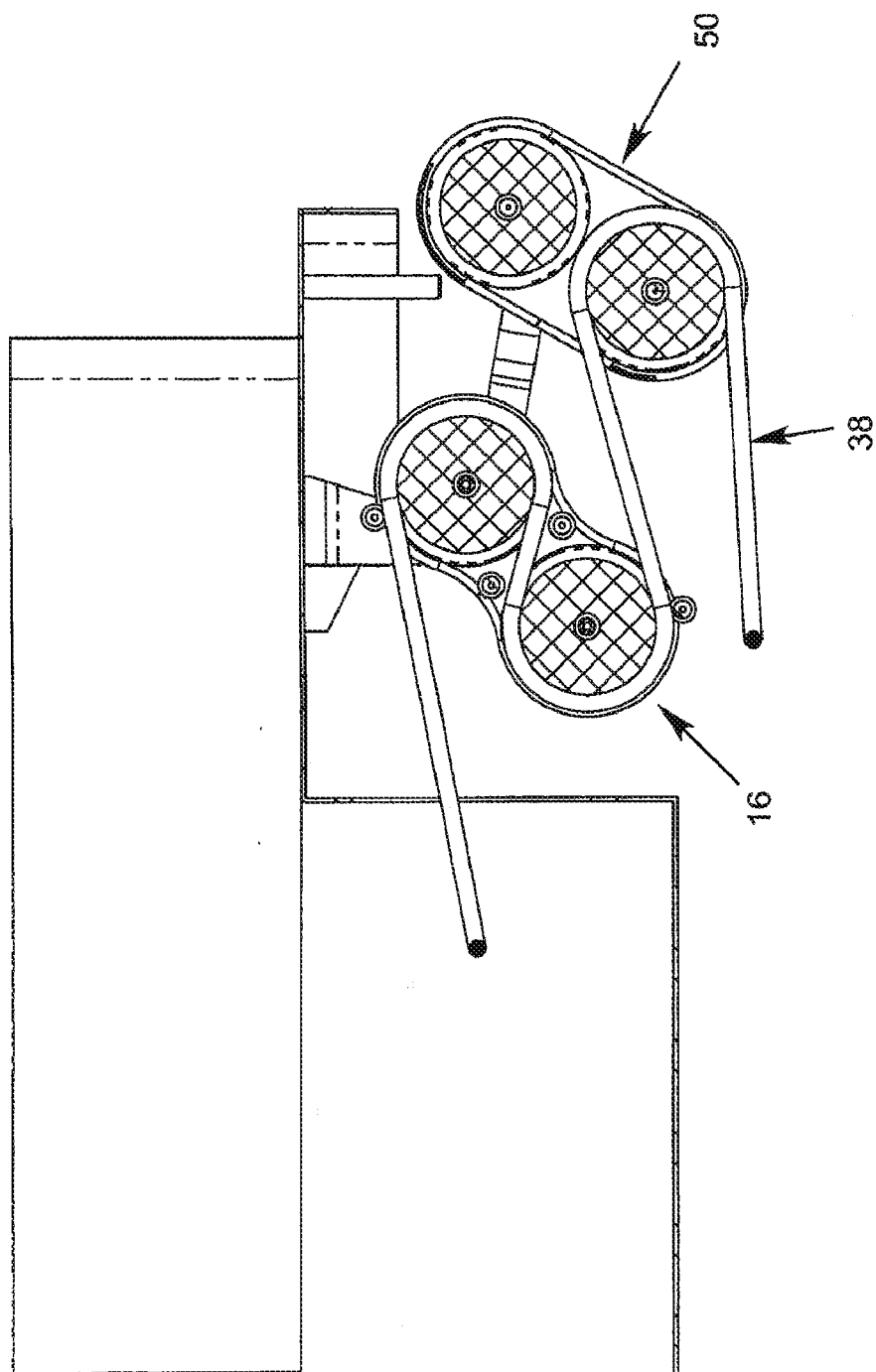


Figure 6

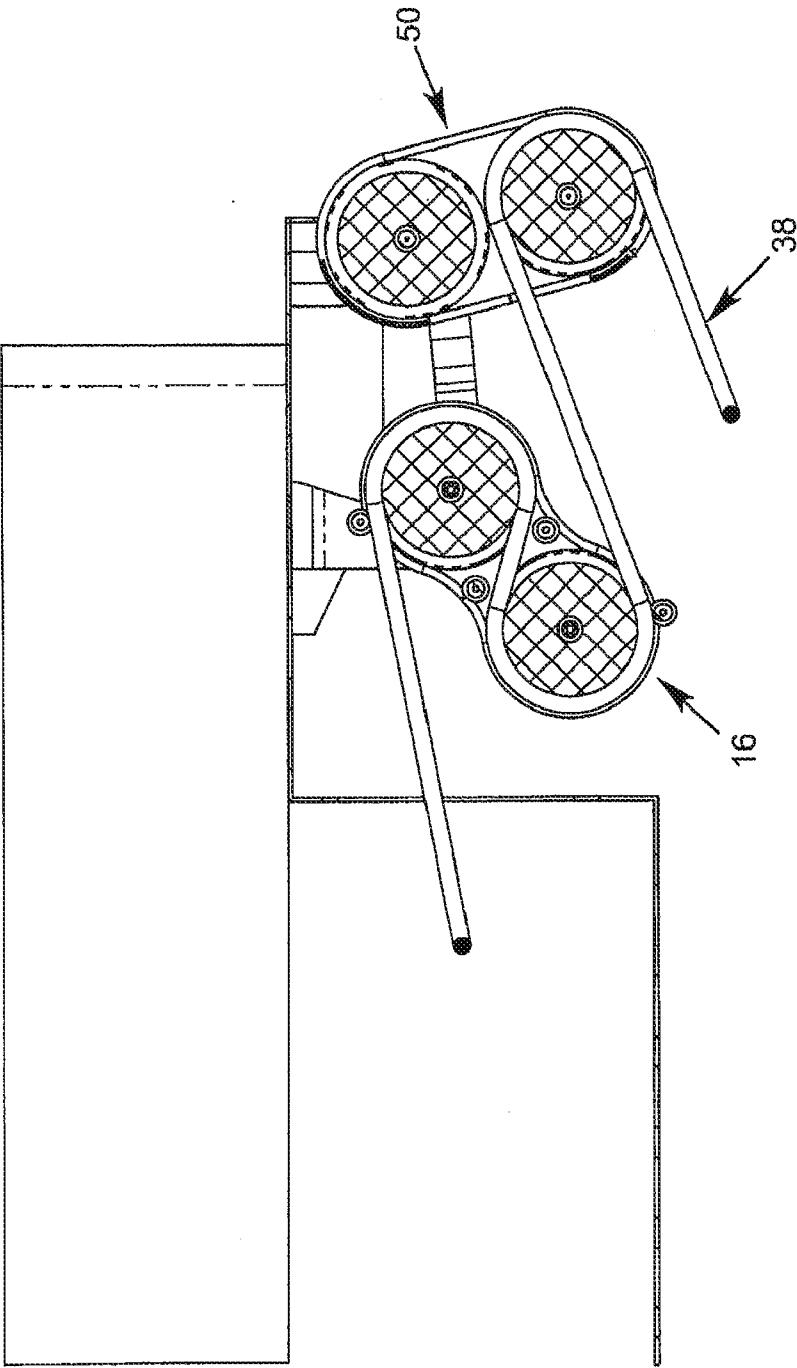


Figure 7

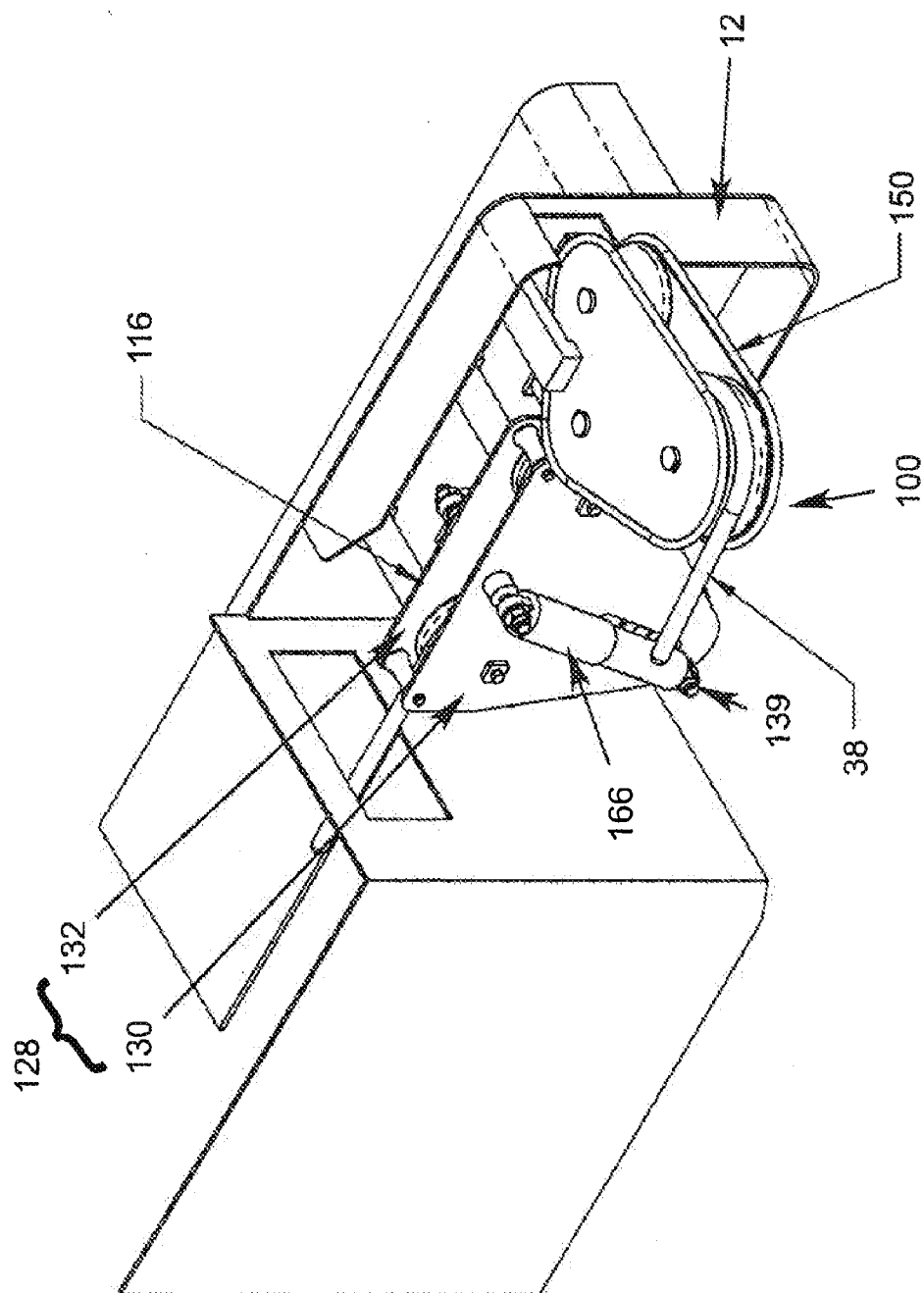
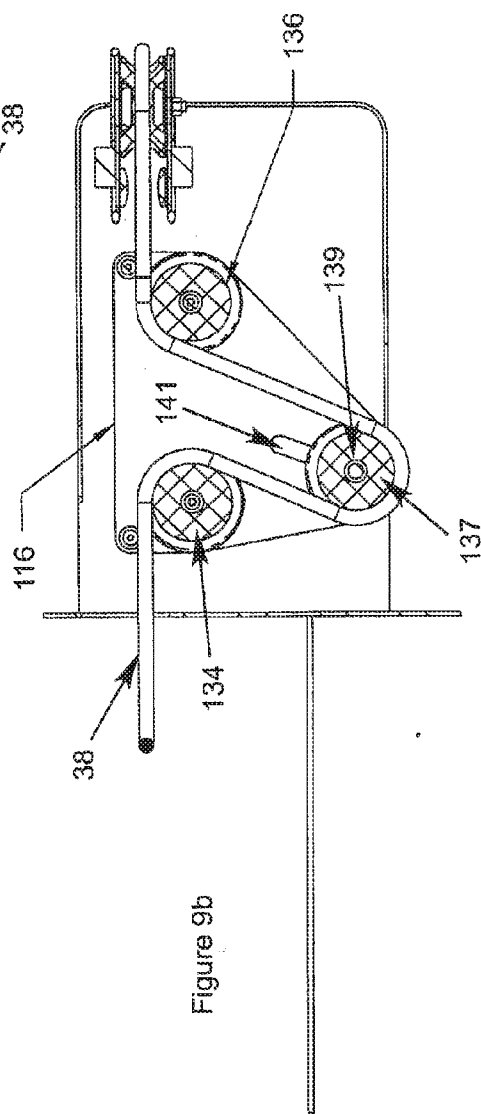
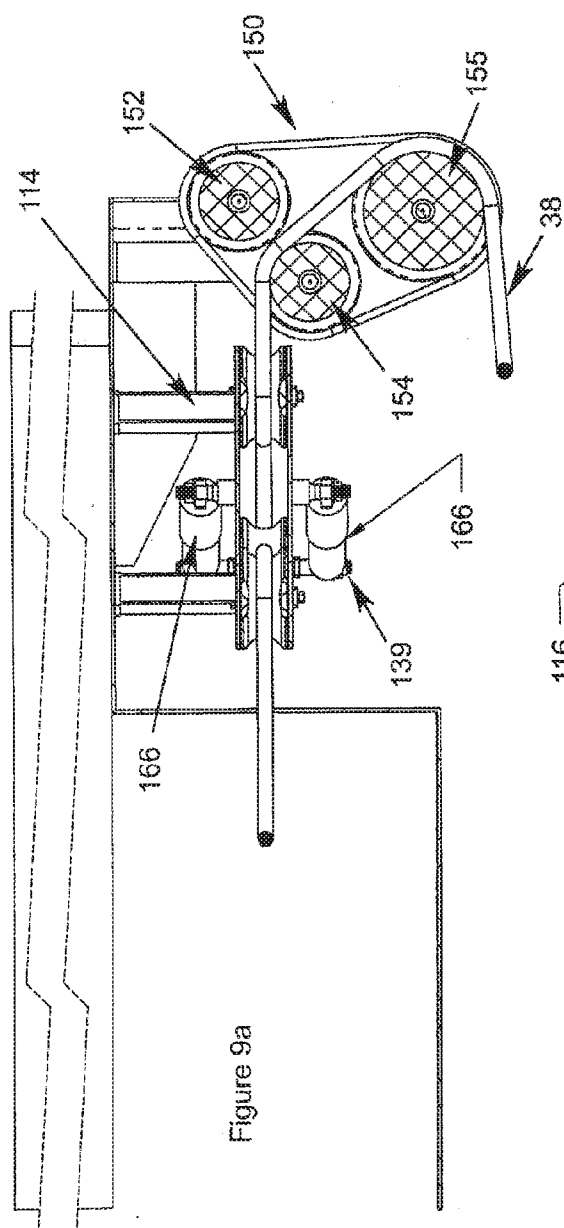
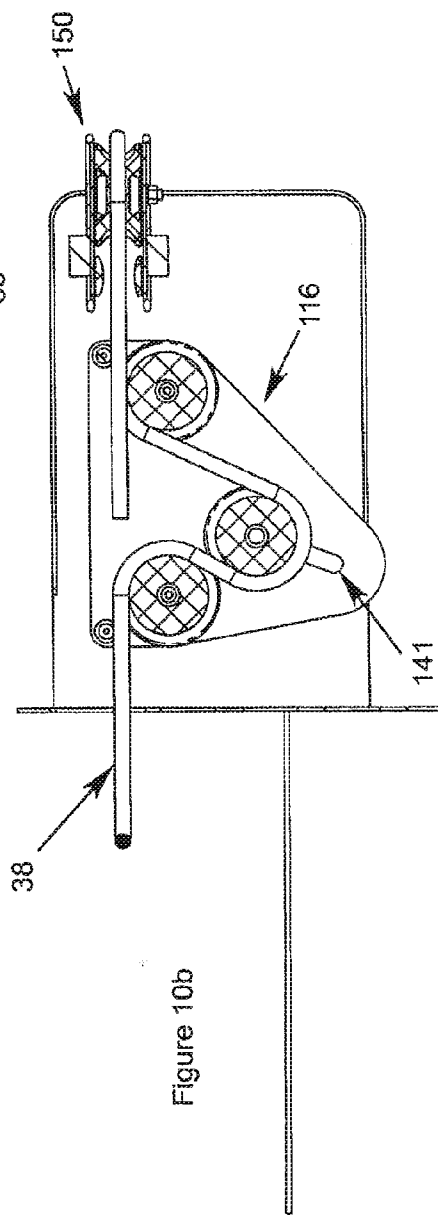
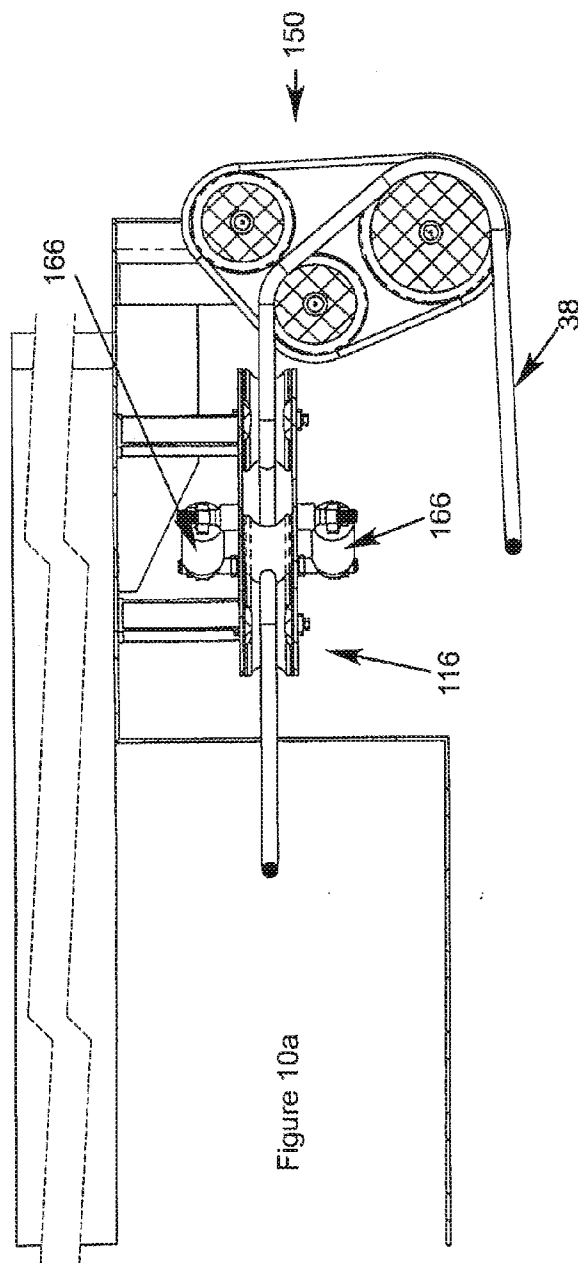


Figure 8





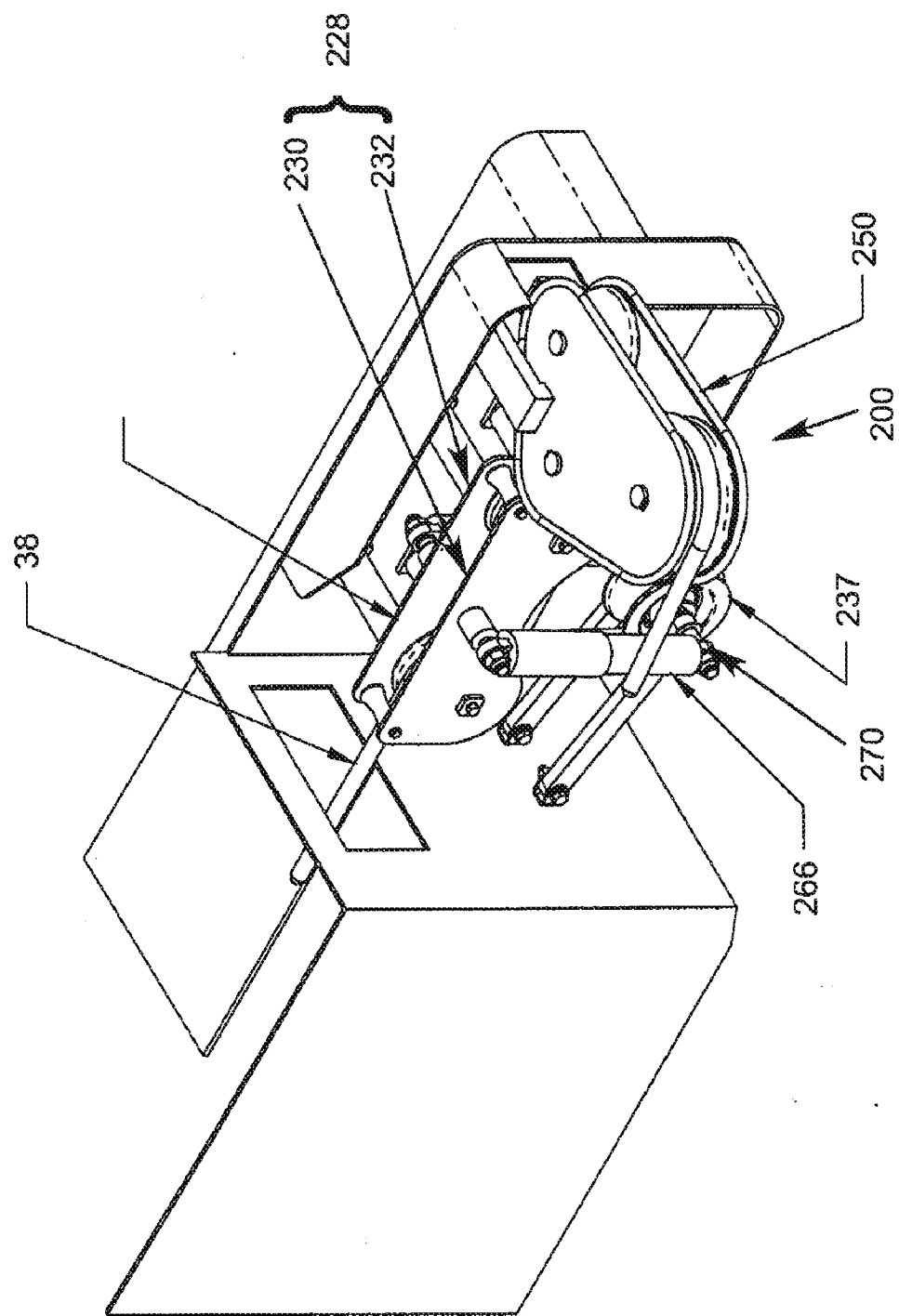
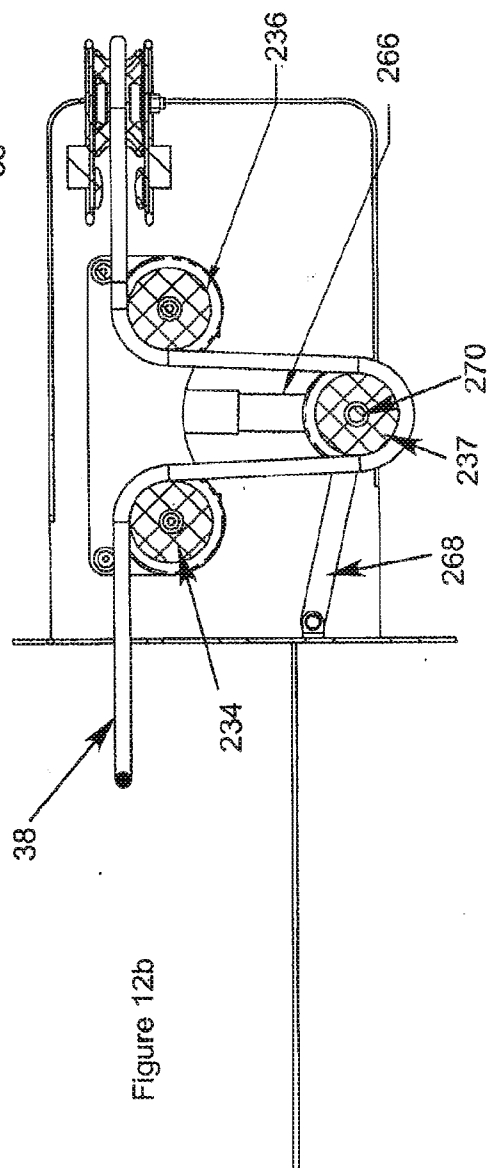
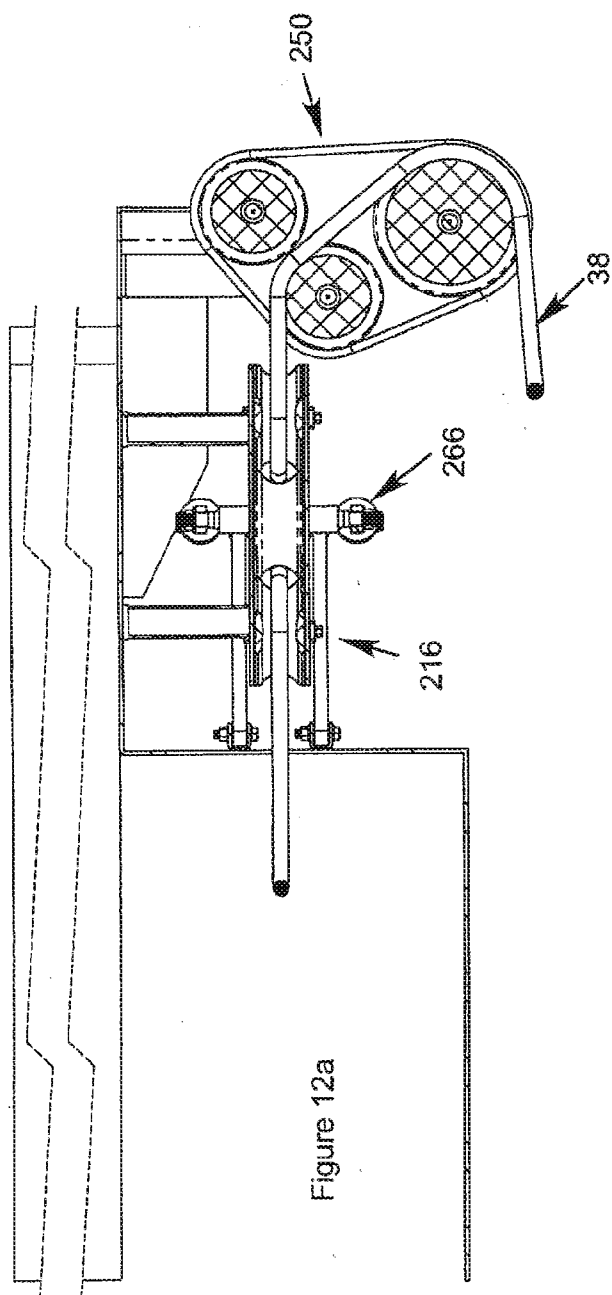
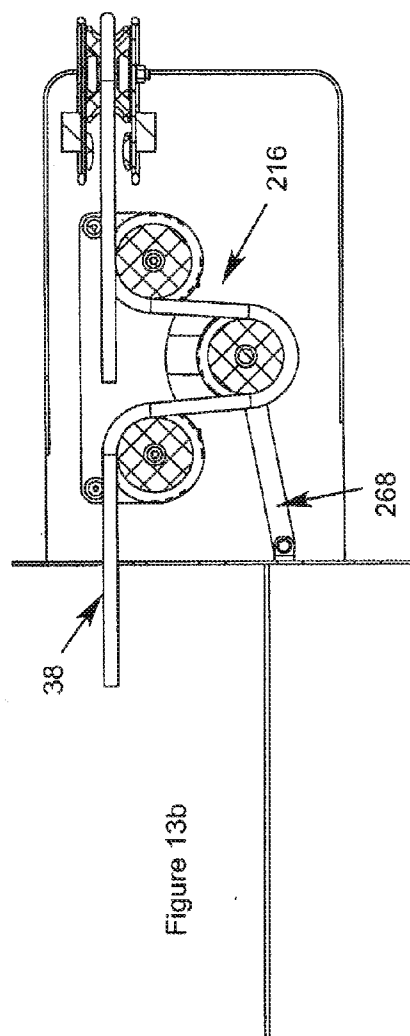
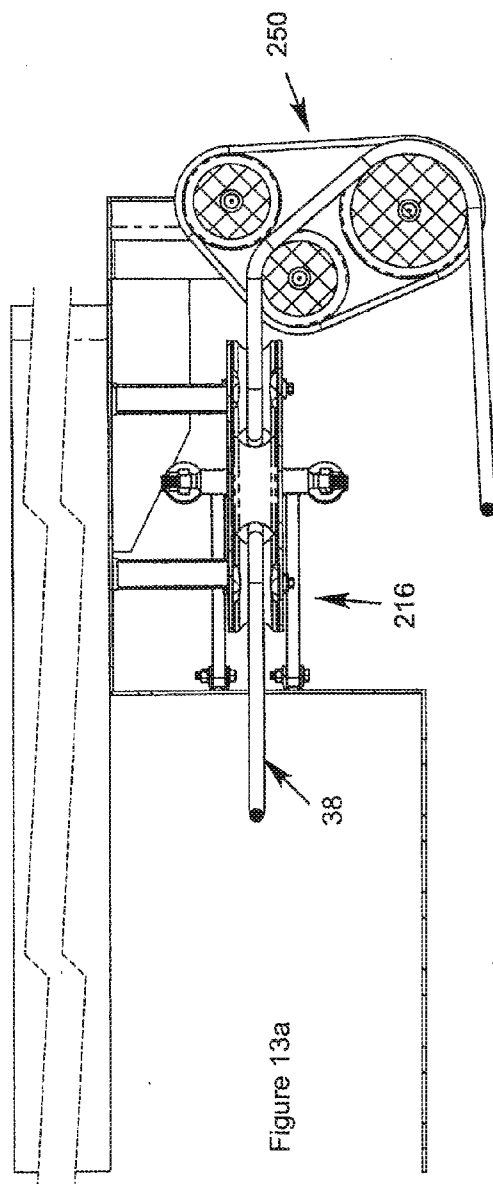


Figure 11





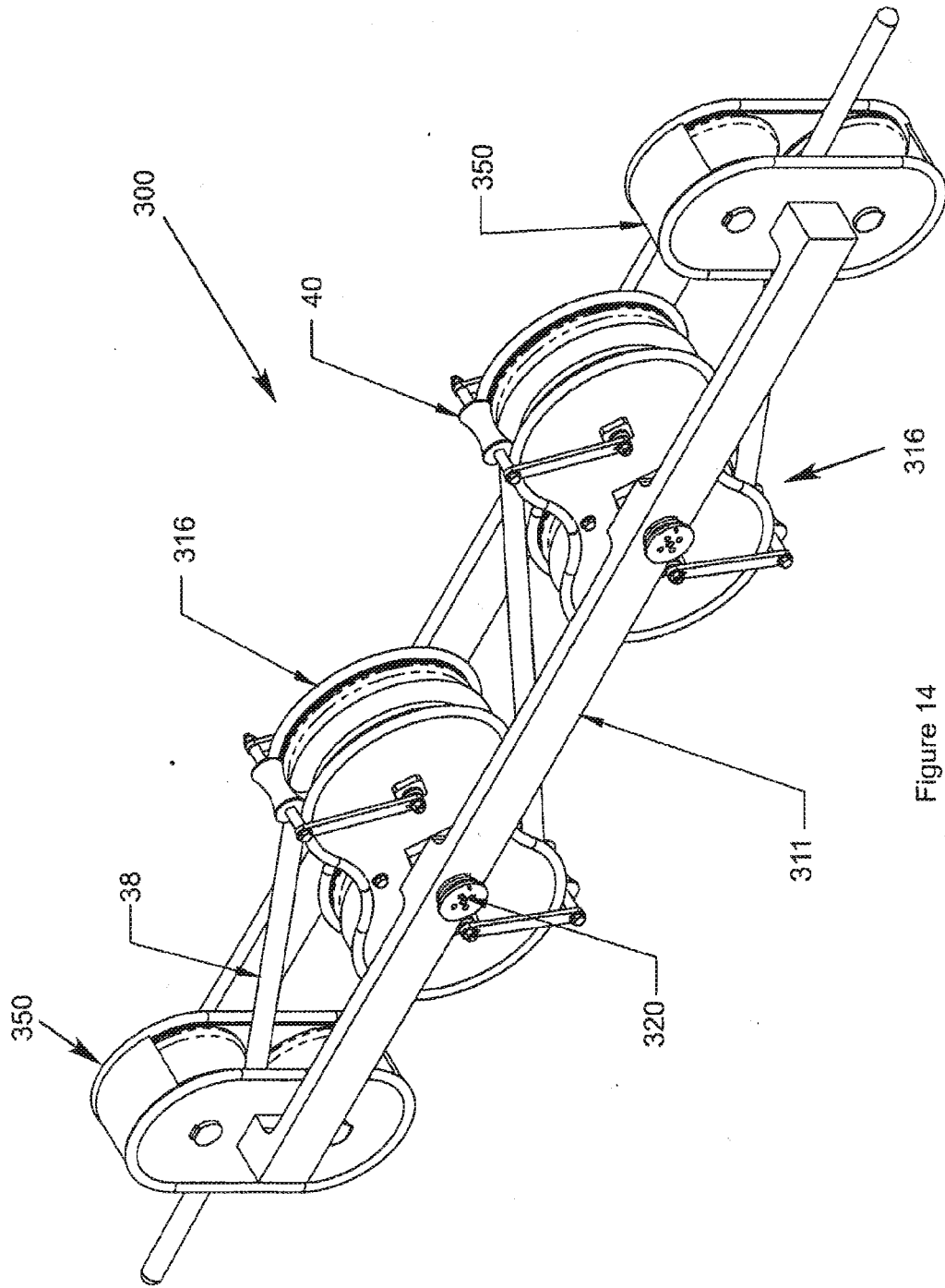


Figure 14

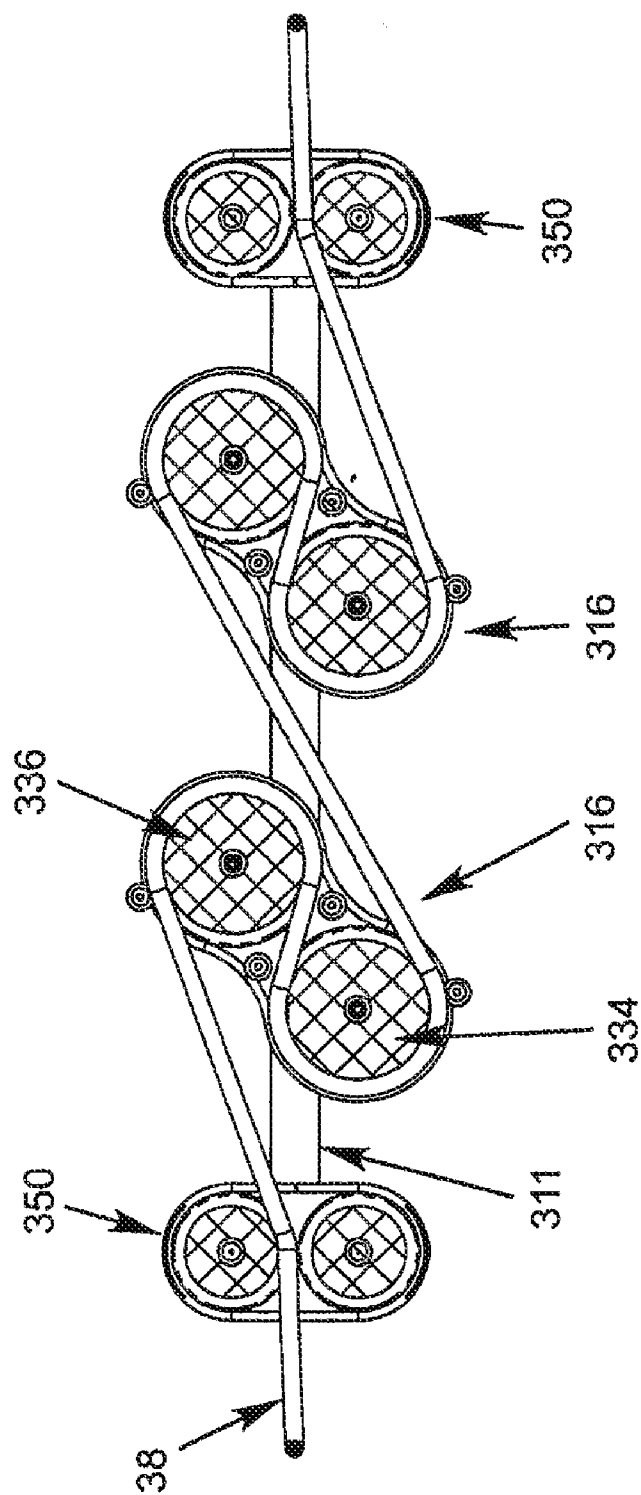


Figure 15

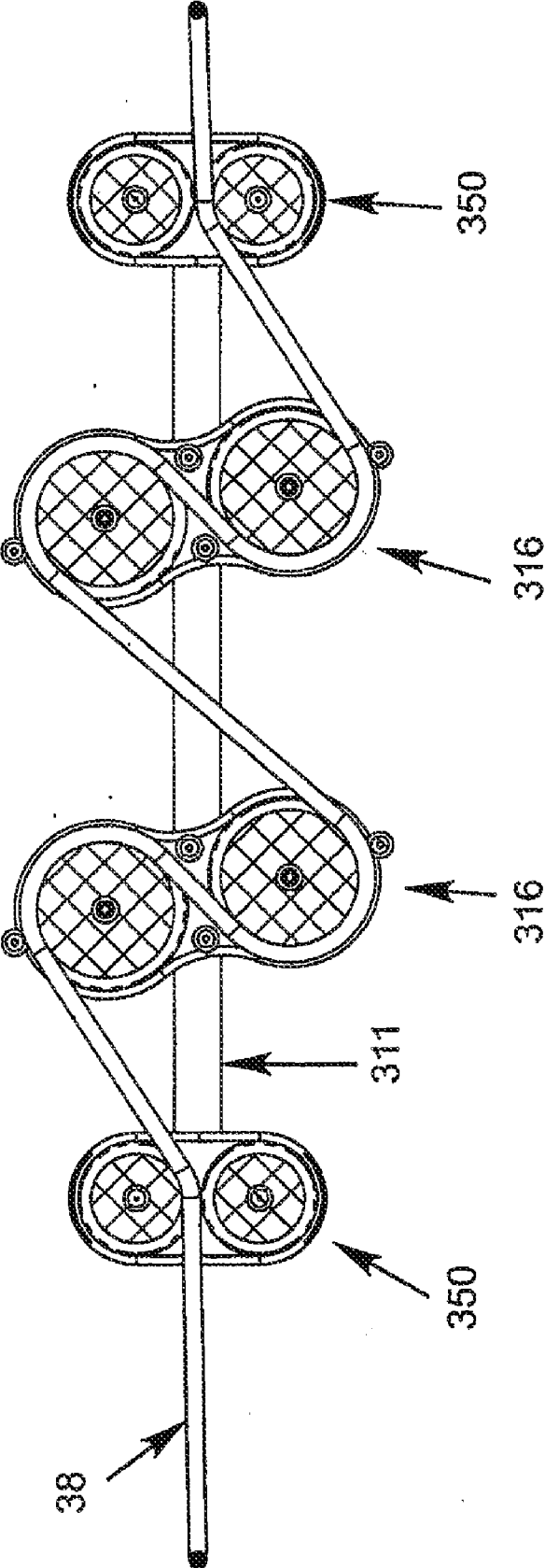


Figure 16

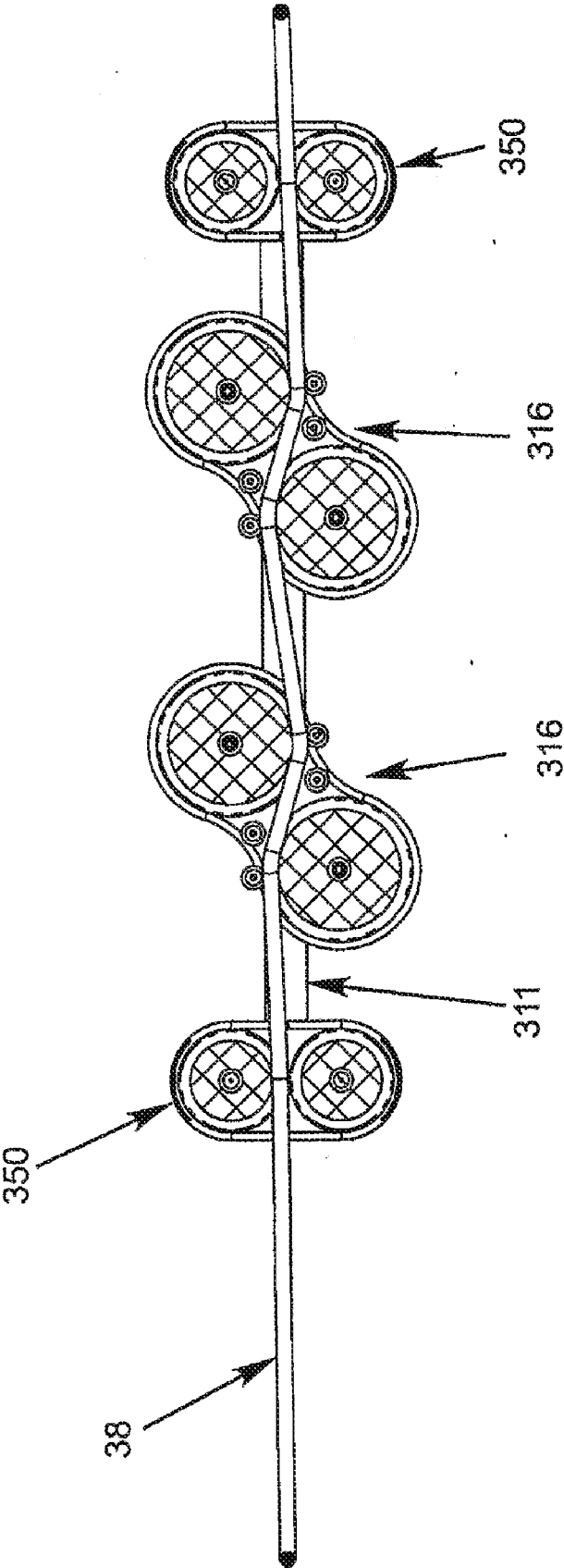
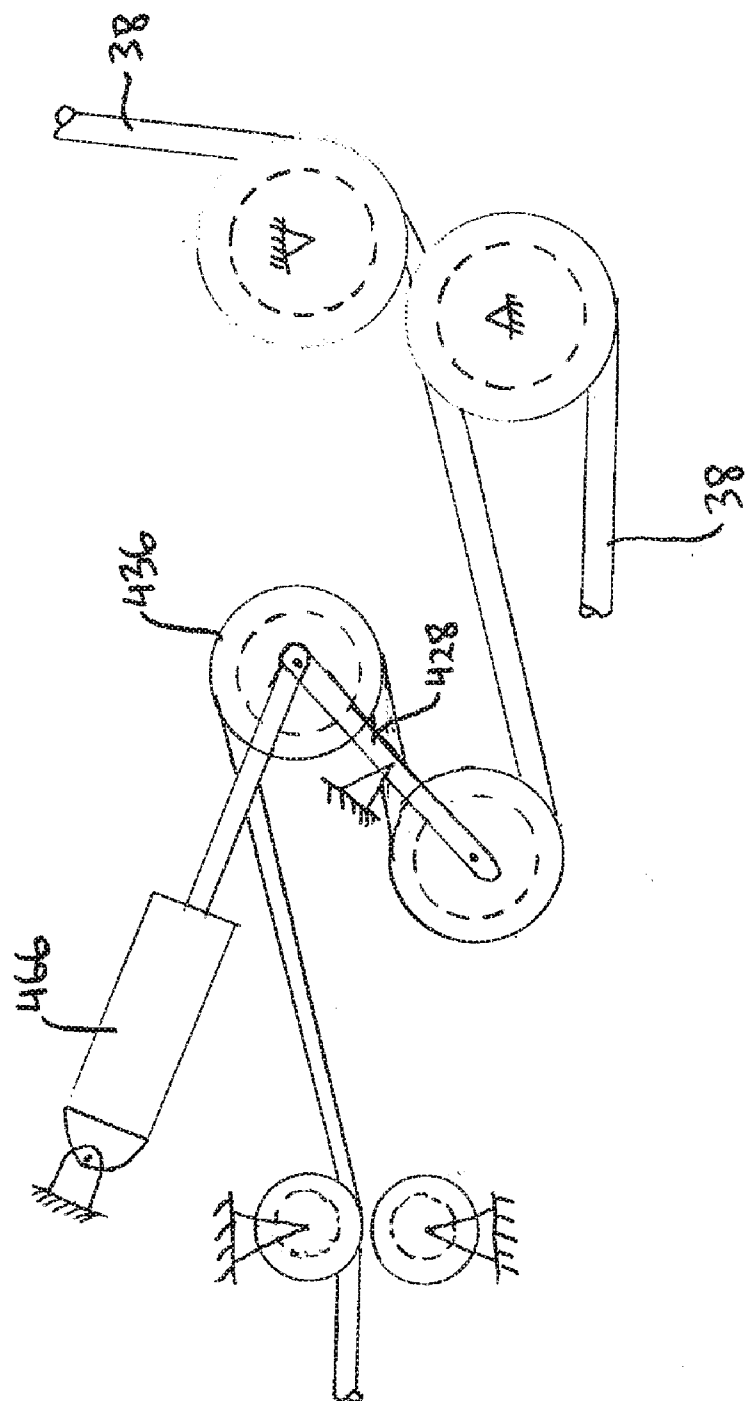
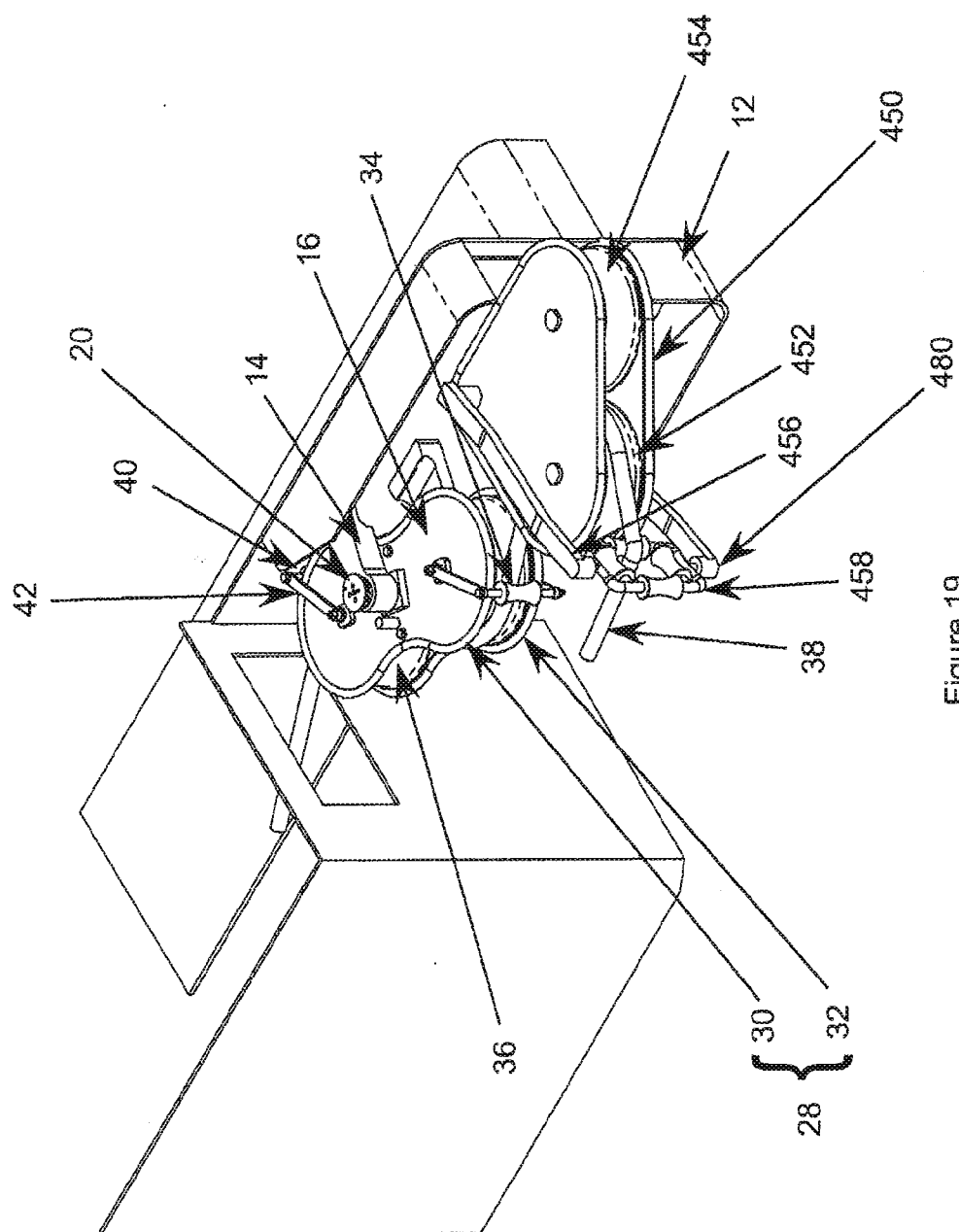


Figure 17





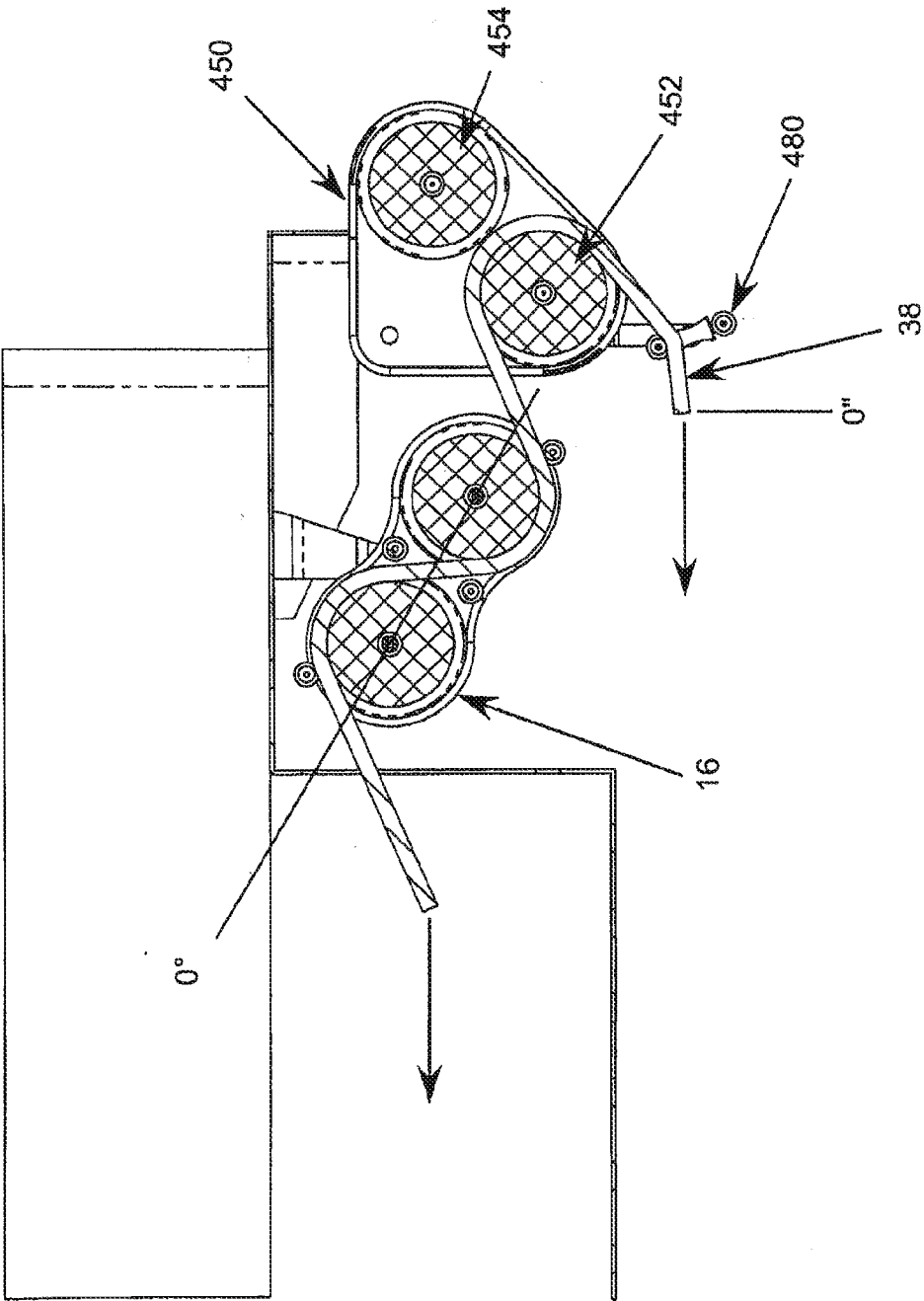


Figure 20a

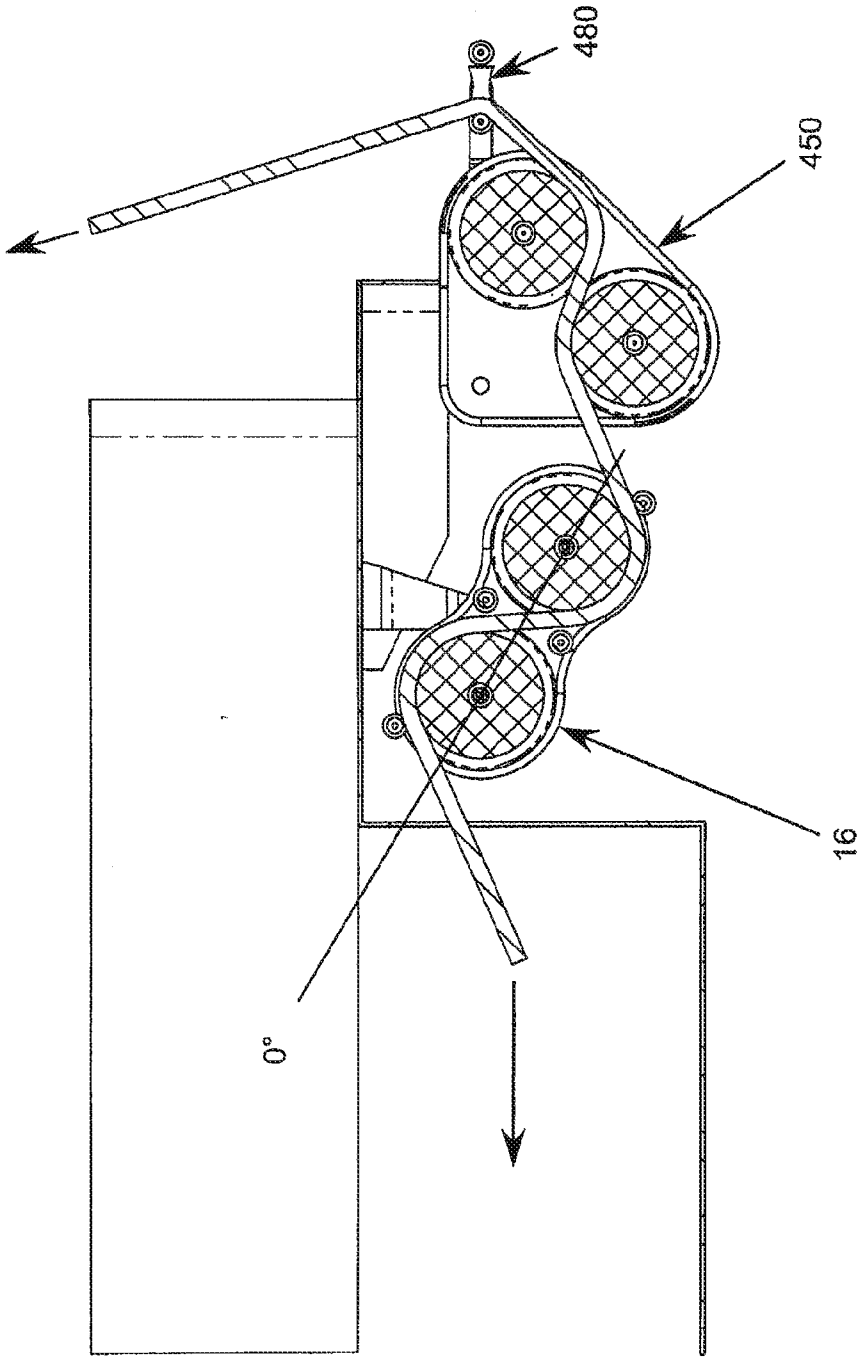


Figure 20b

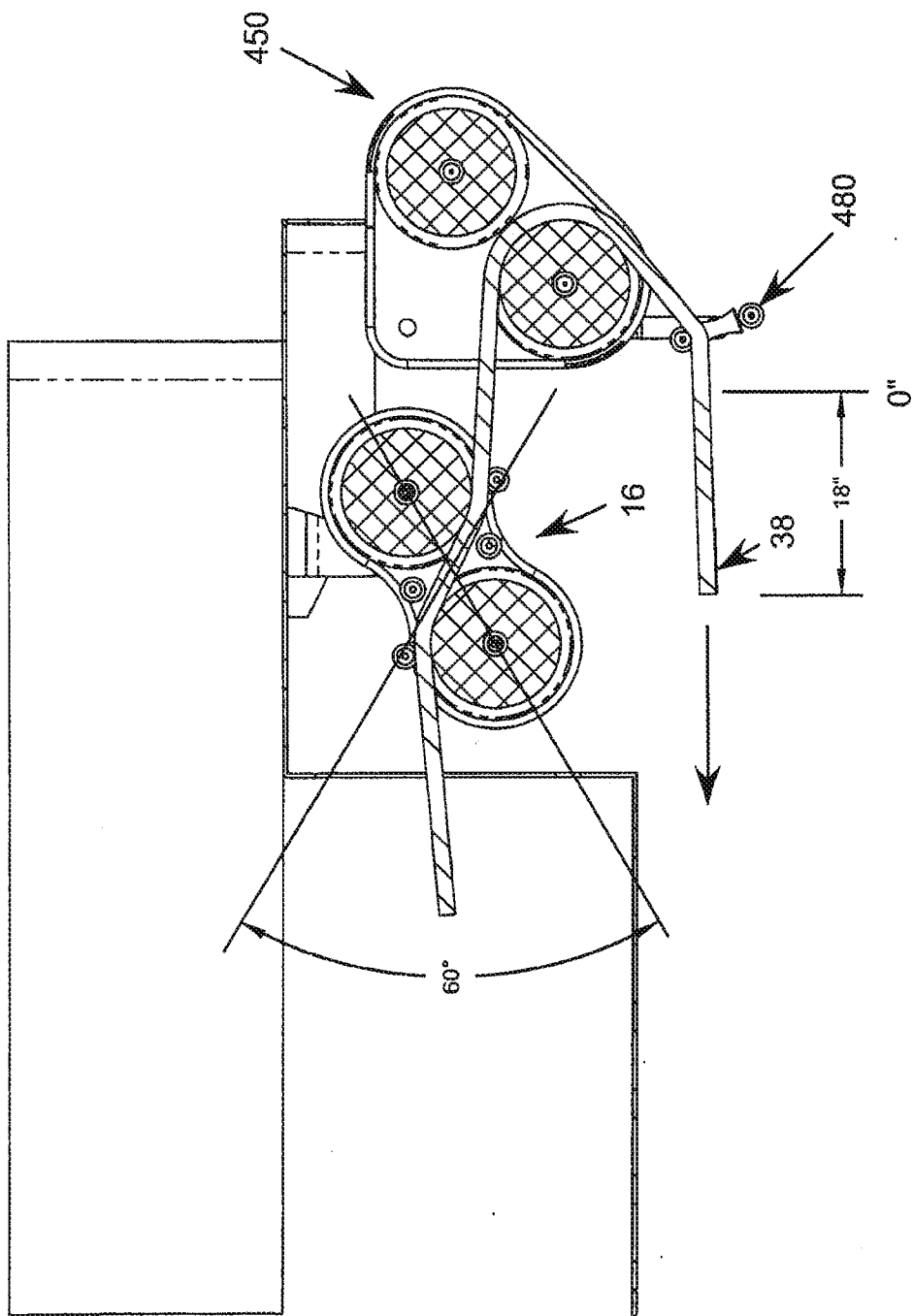


Figure 20c

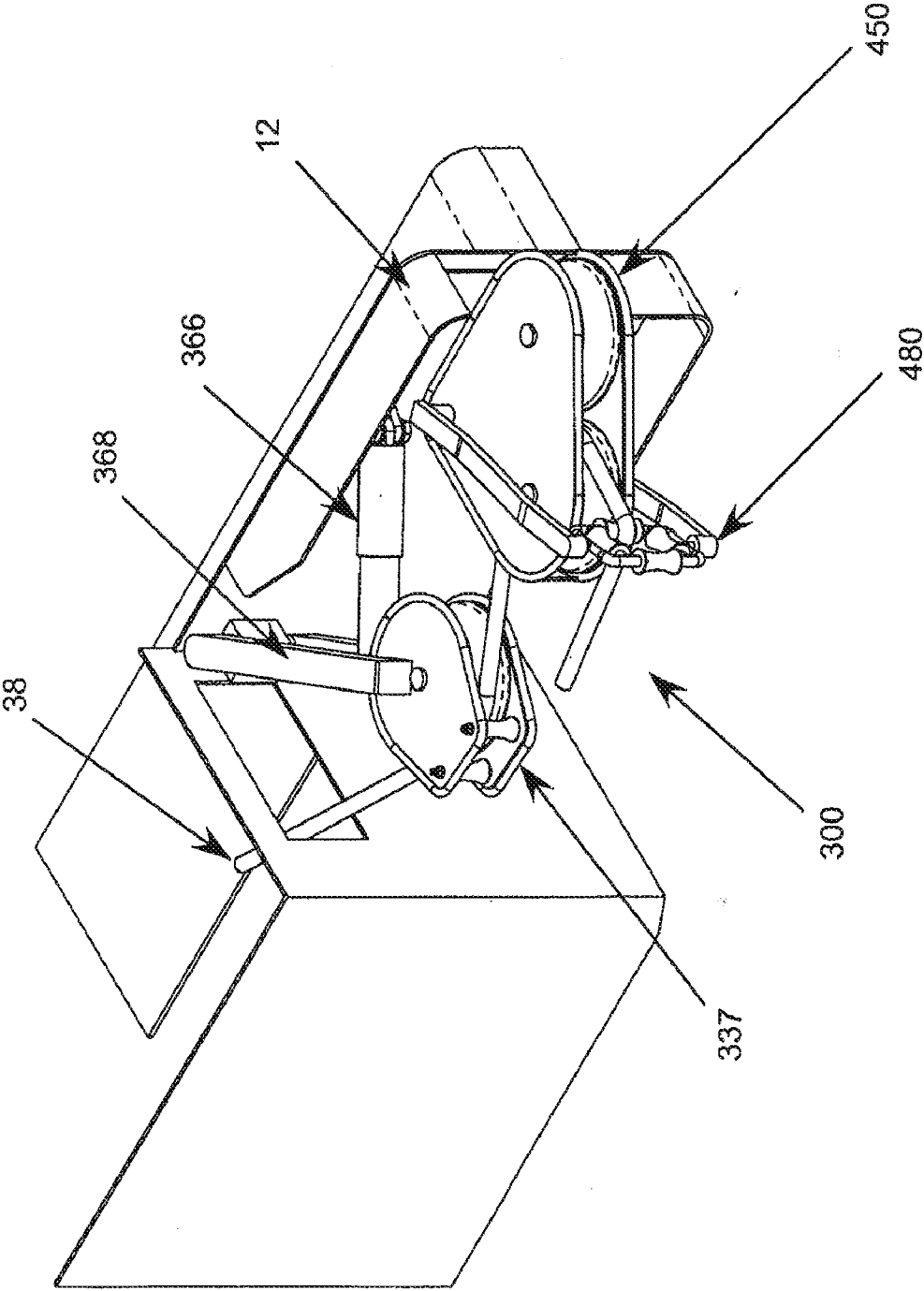


Figure 21

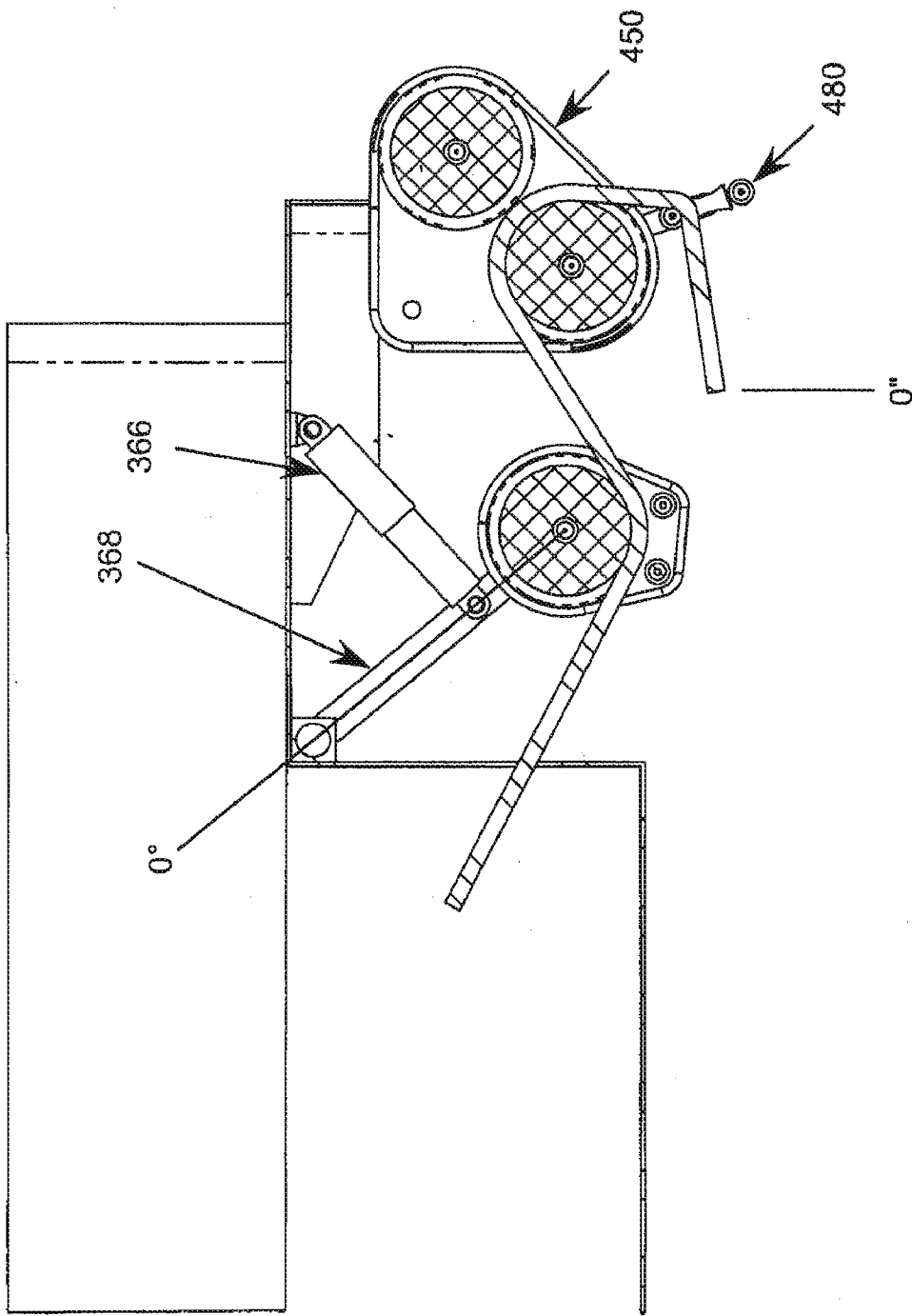


Figure 22a

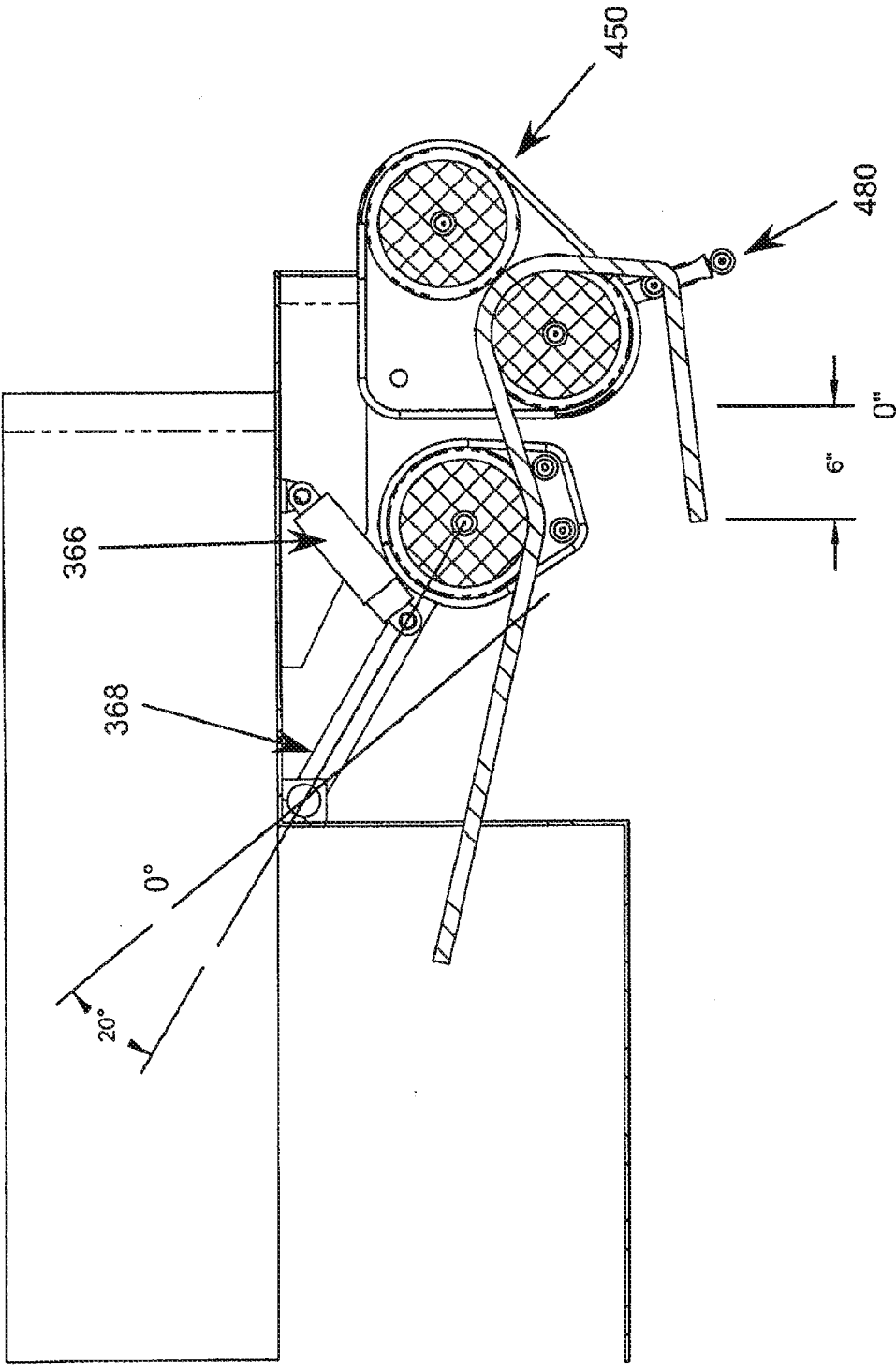


Figure 22b

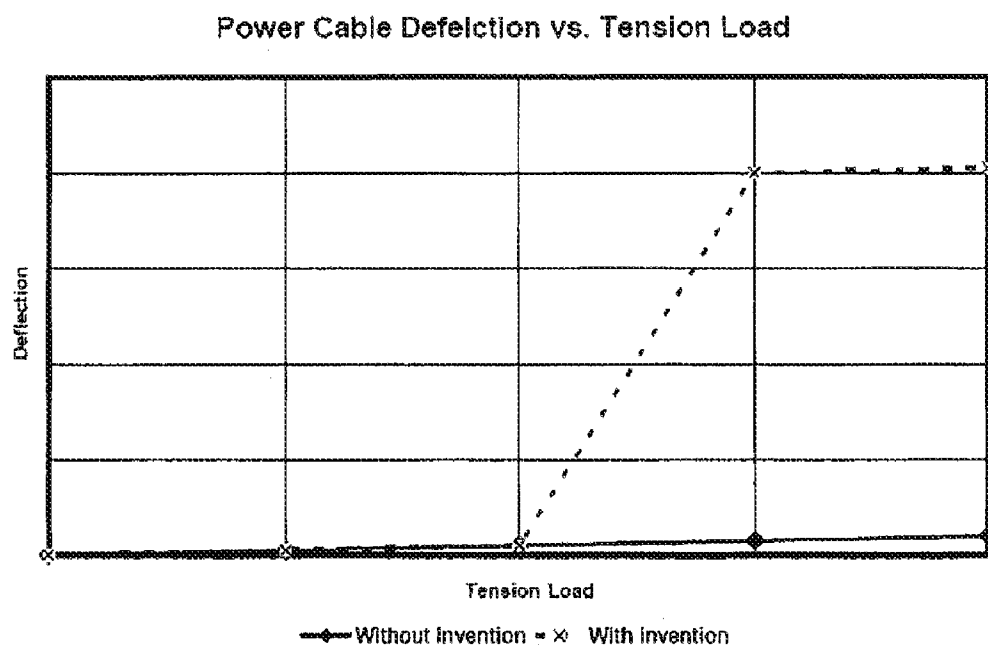


FIG. 23

CABLE TENSIONING DEVICE

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to and the benefit of U.S. Provisional Patent Application No. 61/243,946 filed Sep. 18, 2010 in the U.S. Patent and Trademark Office, the entire content of which is incorporated herein by reference.

BACKGROUND

[0002] Movable electric machinery, such as shuttle cars operated in underground mining operations, shuttle materials like coal from a miner to a fixed conveyor located some distance from the miner. Such electric machinery is typically powered by electricity supplied as DC power from on-board batteries or as AC power from an external umbilical power cable. On AC powered shuttle cars, one end of the umbilical power cable is usually anchored to a mine shaft wall at a fixed location somewhere along the traversing path of the shuttle car and the other end of the power cable is attached to a cable reel mechanism affixed to the shuttle car.

[0003] The cable reel mechanism allows distribution and collection of the power cable at a rate that is substantially the same as the rate at which the shuttle car is moving by supplying a small resistance torque to unreel the power cable and a high collection torque to reel in the power cable. The cable reel mechanism applied torque provides tension in the power cable during the reeling operation and prevents excess slack that can cause the power cable to become tangled in or run over by the shuttle car, thereby damaging it.

[0004] Since the power cable anchor point is often located between the miner and the fixed conveyor to maximize travel distances, the cable reel mechanism must slow down, stop, and reverse direction as the shuttle car passes the anchor point or when the shuttle car stops and resumes travel in the same or opposite direction at any point along its path. While the cable reel mechanism is slowing down, stopping, reversing direction, or resuming operation as the shuttle car continues to move, the cable reel mechanism can become momentarily unsynchronized with the motion of the shuttle car, resulting in impact tension loads in the power cable as the cable reel mechanism resynchronizes its operation with the motion of the shuttle car. Such impact tension loads may cause accelerated wear on the power cable, damage to the power cable, or otherwise shorten the use life of the power cable.

SUMMARY

[0005] According to one embodiment of the present invention a cable tensioning device is provided including a sheave bracket assembly comprising a plurality of sheaves; and an outlet cable guide attached to the sheave bracket assembly, wherein when tension applied to a cable engaging the sheave bracket assembly reaches a first threshold level, the sheave bracket assembly is adapted to move from a wound state to an unwound state to decrease a path length of the cable with respect to the outlet cable guide.

[0006] In embodiments, the sheave bracket assembly and/or the outlet cable guide are rotatable about a pivot pin and further comprise a spring, such as a torsion spring, that preloads the sheave bracket assembly and/or the outlet cable guide. The sheave bracket assembly may be attached to the outlet cable guide by a connecting arm.

[0007] In one embodiment, when tension applied to a cable engaging the sheave bracket assembly decreases below a second threshold level, the sheave bracket assembly is adapted to move from the unwound state to the wound state to increase a path length of the cable with respect to the outlet cable guide. Further, at least one of the sheaves may be movable with respect to another one of the sheaves such that a distance between the at least one of the sheaves and the another one of the sheaves can be altered. In one embodiment, the cable tensioning device is configured to alter the path of the cable by between 50 inches and 75 inches. Additionally, the outlet cable guide may include a housing and a cable guide leader movable with respect to the housing, wherein the cable guide leader is configured to allow an orientation of a cable inserted therethrough to be altered with respect to the outlet cable guide.

BRIEF DESCRIPTION OF THE DRAWING

[0008] FIG. 1a is an orthogonal view of an embodiment of a cable tensioning device of the present invention.

[0009] FIG. 1b is a cross-sectional view of a sheave bracket assembly of the cable tensioning device of FIG. 1a.

[0010] FIG. 2 is a partial bottom cross-sectional view of the cable tensioning device of FIG. 1.

[0011] FIGS. 3, 4 and 5 are partial bottom cross-sectional views of the cable tensioning device of FIG. 1 in a fully wound, mid-wound, and fully unwound position, respectively.

[0012] FIGS. 6 and 7 are partial bottom cross-sectional views of the cable tensioning device of FIG. 1 showing rotation of a cable guide outlet of the cable tensioning device.

[0013] FIG. 8 is an orthogonal view of another embodiment of a cable tensioning device of the present invention.

[0014] FIGS. 9a and 9b are a partial top cross-sectional view and a partial side cross-sectional view, respectively, of the cable tensioning device of FIG. 8 in a fully extended position.

[0015] FIGS. 10a and 10b are a partial top cross-sectional view and a partial side cross-sectional view, respectively, of the cable tensioning device of FIG. 8 in a fully retracted position.

[0016] FIG. 11 is an orthogonal view of another embodiment of a cable tensioning device of the present invention.

[0017] FIGS. 12a and 12b are a partial top cross-sectional view and a partial side cross-sectional view, respectively, of the cable tensioning device of FIG. 11 in a fully extended position.

[0018] FIGS. 13a and 13b are a partial top cross-sectional view and a partial side cross-sectional view, respectively, of the cable tensioning device of FIG. 11 in a fully retracted position.

[0019] FIG. 14 is an orthogonal view of yet another embodiment of a cable tensioning device of the present invention.

[0020] FIGS. 15, 16, and 17 are partial bottom cross-sectional views of the cable tensioning device of FIG. 1 in a fully wound, mid-wound, and fully unwound position, respectively.

[0021] FIG. 18 is a side view of still another embodiment of a cable tensioning device of the present invention.

[0022] FIG. 19 is an orthogonal view of another embodiment of a cable tensioning device of the present invention.

[0023] FIGS. 20*a* and 20*b* are partial cross-sectional views of the cable tensioning device of FIG. 19 in a fully wound position.

[0024] FIG. 20*c* is a partial cross-sectional view of the cable tensioning device of FIG. 19 in an unwound position.

[0025] FIG. 21 is an orthogonal view of yet another embodiment of a cable tensioning device of the present invention.

[0026] FIGS. 22*a* and 22*b* are partial top cross-sectional views of the cable tensioning device of FIG. 21 in a fully extended position and a fully retracted position, respectively.

[0027] FIG. 23 illustrates a power cable deflection version tension load on an assembly incorporating a cable tensioning device of the present invention.

DETAILED DESCRIPTION

[0028] Embodiments of the present invention are directed to a cable tensioning device that provides selective power cable extension by allowing winding of a power cable around a movable sheave arrangement such that the power cable follows a specific variable length path upon being reeled from or toward the cable tensioning device. In general, the movable sheave arrangement is pre-loaded in a position such that if a threshold power cable tension load is achieved, the threshold power cable tension load causes the movable sheave arrangement to overcome the pre-load and move appropriately. The movement of the movable sheave arrangement decreases the amount of power cable wrapped around the sheave, thereby providing a virtual extension of the power cable extension based on the power cable tension load. The unwinding of the power cable about the sheave arrangement provides a momentary additional power cable length (i.e., slack), thus minimizing the effect of any power cable impact tension load that can occur during momentary unsynchronized motion between the cable reel mechanism and the shuttle car.

[0029] Referring now to FIGS. 1*a*-5, in one embodiment the cable tensioning device 10 is attached to a vehicle frame 12, such as a shuttle car frame, by a bracket assembly mount 14. The bracket assembly mount 14 is adapted to receive a pivot pin 20 that allows rotation of a sheave bracket assembly 16, as described in more detail below. As will be appreciated, the cable tensioning device could also be attached to a stationary mount rather than directly to the vehicle.

[0030] The sheave bracket assembly 16 includes a sheave bracket assembly housing 28 having a first plate 30 and a second plate 32 for housing a first sheave 34 and a second sheave 36. The first and second sheaves 34, 36 have substantially concave circumferential surfaces configured to receive a power cable 38 and the sheaves may be spaced by a fixed distance or may be movable with respect to each other, as described in more detail below. The magnitude of the sheave bracket assembly rotational arc, the distance between the first and second sheaves 34, 36, and the sheave diameter govern the magnitude of virtual power cable length extension for the assembly.

[0031] As shown in FIG. 1*a*, the pivot pin 20 about which the sheave bracket assembly 16 rotates is generally centrally located between the first and second sheaves 34, 36 to prevent or significantly reduce the possibility of the sheave bracket assembly 16 being overloaded due to cable tension. However, it will be appreciated that the pivot pin 20 could be placed in a variety of locations on the sheave bracket assembly 16 to allow rotation of the sheave bracket assembly.

[0032] The sheave bracket assembly 16 further includes sheave bracket assembly cable guides 40 extending between the first and second plates 30, 32 of the sheave bracket assembly housing 28 to keep the power cable 38 on the sheaves 34, 36 as it is wound and unwound about them. As shown in FIG. 1*a*, the cable guides 40 may be attached directly to the plates 30, 32 or may be attached to connectors 42 attached to the plates that position the cable guides outside a peripheral edge of the plates. In one embodiment, the cable guides 40 are pivotally mounted and are pre-loaded such that they rotate to maintain their orientation with a tangent point between the power cable 38 and a respective sheave 34, 36, thus preventing power cable binding.

[0033] In one embodiment, the sheave bracket assembly 16 is pre-loaded by a pre-loading device 19 (FIG. 1*b*), such as a torsion spring, to keep the sheave bracket assembly in an unwound position when tension in the power cable 38 is below a threshold level. The pre-loading device 19 may be oriented along an axis substantially parallel to the pivot pin 20, but it will be appreciated that the pre-loading device may also be oriented along a different axis and may also be spaced from the pivot pin, as described in more detail below. When tension on the power cable 38 exceeds the threshold level, the sheave bracket assembly 16 overcomes the pre-loading device bias and rotates about the sheave bracket assembly pivot pin 20 to provide additional virtual cable length to the power cable by shortening a cable path length between sheaves 34, 36 of the sheave bracket assembly. As will be appreciated, the sheave bracket assembly could be pre-loaded with other pre-loading devices, such as a tension spring, compression spring, strut spring/damper mechanism or any other suitable device that keeps the sheave bracket assembly 16 in an orientation that provides an increased cable path length about the sheaves 34, 36 until tension in the power cable 38 reaches a threshold level to overcome the pre-loading device bias. Additionally, while the present embodiment includes only a single sheave bracket assembly, it will be appreciated that additional sheave bracket assemblies could be incorporated into the cable tensioning device to increase the amount of possible virtual power cable extension.

[0034] An outlet cable guide 50 is provided for orienting the power cable 38 away from the vehicle frame 12 as it is reeled in toward or away from the cable tensioning device 10. The outlet cable guide 50 has a similar structure to the sheave bracket assembly 14 and includes first and second sheaves 52, 54 mounted between first and second plates 56, 58 of an outlet cable guide housing 51. The facing sheaves 52, 54 allow the power cable 38 extending through the outlet cable guide 50 the ability to engage a sheave whether the cable extends to the right or to the left of the outlet cable guide, thereby ensuring a smooth extension or retraction of the power cable and minimizing damage to the cable.

[0035] The outlet cable guide 50 is attached to the sheave bracket assembly mounts 14 by connector arms 60. More specifically, the connector arms 60 are pivotally attached to the sheave bracket assembly mounts 14 by the pivot pin 22. Further, the connector arms 60 are pivotally connected to the outlet cable guide 50 by an outlet guide pivot pin 62. Since the outlet cable guide 50 is rotatable about the outlet guide pivot pin 62, the cable tensioning devices provides for a significant amount of range of motion, as illustrated in FIGS. 6 and 7, and allows the outlet cable guide 50 to pivot if the vehicle collides with a fixed object, such as a mine shaft wall, when the vehicle is moving.

[0036] Similarly to the sheave bracket assembly 16, the connector arms 60 and the outlet cable guide 50 can be pre-loaded by a torsion spring, strut spring/damper, or other suitable device to bias them to a pre-loaded position when the outlet cable guide is not contacting a fixed object. As shown in FIG. 1, in one embodiment the outlet cable guide pivot pin 62 is located closer to the second sheave 54 than the first sheave 52 of the outlet cable guide to optimize the range of motion relative to impact from a fixed object, such as a wall. However, it will be appreciated that the outlet cable guide pivot pin 62 could be placed in a variety of locations on the outlet cable guide 50 depending on the range of motion desired and the desired configuration of the cable tensioning device. As shown in FIG. 1, the sheave bracket assembly 16 and the outlet cable guide 50 are oriented such that the sheaves rotate about substantially parallel axes. However, it will be appreciated that the sheave bracket assembly 16 and the outlet cable guide 50 may be oriented such that the sheaves of each mechanism rotate about different axes.

[0037] With particular reference to FIGS. 3-5, an operation of the cable tensioning device 10 will be described. In all figures, Point A represents a point on the end of the power cable 38 that is fixed to the vehicle frame 12 and Point B represents a point on the end of the power cable that is fixed to the ground or to another fixed point. As shown in FIG. 3, the cable tensioning device 10 is in its fully wound state, in which the sheave bracket assembly 16 is in its pre-loaded state and wherein tension on the power cable 38 is below a threshold level. In the fully wound state, the power cable is wound around the sheaves 34, 36 and has a base length, i.e., the amount of virtual cable extension is zero. As tension in the power cable 38 increases past the threshold level, the tension causes the sheave bracket assembly 16 to unwind from its fully wound state (FIG. 3) to a mid-wound state (an exemplary mid-wound state is shown in FIG. 4 in which the sheave bracket assembly 16 has been rotated about 60 degrees, although it will be appreciated that the "mid-wound" state can refer to any orientation of the sheave bracket assembly between the fully wound state (FIG. 3) and a fully unwound state (FIG. 5)) until the sheave bracket assembly reaches the fully unwound state, as shown in FIG. 5. In the fully unwound state, the amount of virtual cable extension is at a maximum. Once the tension in the power cable 38 drops below the threshold level, the sheave bracket assembly 16, biased by the pre-loading device, returns to its fully wound state. It will be appreciated that although tension in the cable may increase over the threshold level, the cable tensioning device 10 may not always reach its fully unwound state, but rather may remain at a mid-wound state before returning to its fully wound state. In one exemplary embodiment, the sheaves 34, 36 have a diameter of about 12 inches, a distance between the centers of each sheave is about 16 inches, and the cable tensioning device 10 is dimensioned to allow between about 50-75 inches of "increased" cable length. In addition to sheave size and spread distance, the magnitude of virtual cable length extension can also be affected by the initial orientation of the sheave bracket arrangement 16. However, as will be appreciated, the cable tensioning device 10 could be dimensioned to allow additional or less cable length as desired or as dictated by space requirements.

[0038] FIG. 23 illustrates power cable deflection versus tension load on the power cable as the tension load increases. As shown in FIG. 23, when the present embodiment of the cable tensioning device 10 is used, the cable tensioning

device acts as a selectively active spring in series with the power cable 38, allowing for significantly increased deflection when the tension reaches a threshold level, as opposed to minimally increased deflection in a cable used without the cable tensioning device.

[0039] With reference to FIGS. 6 and 7, in one embodiment of a cable tensioning device, the outlet cable guide 50 is attached to the connector arm 60 such that the outlet cable guide is movable or rotatable with respect to the sheave bracket assembly 16.

[0040] With reference now to FIGS. 8-10b, another embodiment of a cable tensioning device 100 is provided having a sheave bracket assembly 116 attached to the vehicle frame 12 by sheave bracket assembly mounts 114. Since many of the features of this embodiment are similar to the previously described embodiment, only the differences will be described in detail. In the present embodiment, with reference also to FIGS. 9a and 9b, a sheave bracket assembly housing 128 is oriented such that a first sheave 134, a second sheave 136, and a third sheave 137 within the housing rotate about an axis substantially parallel to the ground, although it will be appreciated that the axis orientation does not need to be parallel to the ground. The third sheave 137 is attached to a pivot pin 139 engaged and movable within a slot 141 in housing plates 130, 132. As such, the third sheave 137 can move with respect to the first and second sheaves 134, 136 along a fixed distance dictated by the slot 141. The pivot pin 139 may be attached at either end to a pre-loading device 166, such as a strut spring that orients the third sheave into a pre-loaded position when the tension on the power cable 38 is below a threshold level. Similarly to the previously described embodiment, when the tension on the power cable 38 exceeds the threshold level, the third sheave 137 moves toward the first and second sheaves 134, 136 to shorten the path length between the sheaves 134, 136, 137 and thereby provide a virtual power cable extension (FIGS. 10a and 10b). When the tension drops below the threshold level, the third sheave 137 returns to its original pre-loaded position. In one embodiment, travel stops may be incorporated into the sheave bracket assembly 116 to limit the movement distance of the third sheave 137.

[0041] The cable tensioning device 100 also includes an outlet cable guide 150 having first, second, and third sheaves 152, 154, 155, wherein the sheaves are oriented substantially perpendicularly to the sheaves 134, 136, 137 of the sheave bracket assembly 116. Additionally, the third sheave 137 has a larger diameter than the first and second sheaves 134, 136. As will be appreciated, different orientations and configurations of the sheave bracket assembly, outlet cable guide and sheaves may be used in conjunction with embodiments of the present invention without departing from the scope and spirit of the invention.

[0042] With reference now to FIGS. 11-13b, another embodiment of a cable tensioning device 200 is shown including a sheave bracket assembly 216 and an outlet cable guide 250, similar to the sheave bracket assembly 116 and outlet cable guide 150 described above. The sheave bracket assembly 216 includes a housing 228 having first and second plates 230, 232 that are attached to and cover only first and second sheaves 234, 236. Pre-loading devices 266, such as strut springs, are attached to the first and second plates 230, 232, respectively, at one end and to a third sheave axle 270 at the other end. Accordingly, when tension over a threshold level is applied to the power cable 38 engaging the sheaves

234, 236, 237, a virtual power cable extension can be provided by moving the third sheave **237** from a fully extended position (FIG. **12b**) to a retracted position (FIG. **13b**). Additionally, alignment arms **268** attached to the vehicle frame **12** and to the third sheave axle **270** ensure that the third sheave remains aligned with the first and second sheaves **234, 236**. Further, in one embodiment, travel stops may be incorporated into the sheave bracket assembly **216** to limit the movement distance of the third sheave **237** and to prevent interference between the sheaves.

[0043] With reference now to FIGS. **14-17**, another embodiment of a cable tensioning device **300** is provided and is adapted to be mounted on the power cable **38** at any point between the vehicle and the power cable fixed anchor point. As will be appreciated, the cable tensioning device **300** can be used alone or in combination with a vehicle-mounted cable tensioning device. As shown in FIG. **14**, the cable tensioning device **300** includes an assembly frame **311** for supporting multiple sheave bracket assemblies **316** and multiple outlet cable guides **350**. The sheave bracket assemblies **316** are attached to the assembly frame **311** by pivot pins **320** that allow the sheave bracket assemblies to rotate relative to the assembly frame. Additionally, the frame may be attached to the same anchor point as the power cable **38** or may be attached to the power cable itself to prevent the assembly frame **311** from “walking” up and down the power cable due to the winding and unwinding action of the sheave bracket assemblies **316**.

[0044] While each sheave bracket assembly pivot pin **320** may be centrally located between two sheaves **334, 336**, the pivot point may also be co-located at the center of one of the sheaves of each sheave bracket assembly and a synchronization bar may be connected between the opposing sheaves.

[0045] With reference to FIGS. **15-17**, the cable tensioning device **300** is shown in a fully wound state, a mid-wound state, and a fully unwound state, respectively, which allows the device to provide additional cable length and retract cable length as dictated by tension on the device. Similarly to the previously described embodiments, a pre-loading device, such as a torsion spring, biases each sheave bracket assembly to the fully wound state to which the sheave bracket assembly returns when tension on the power cable drops below a threshold level. Additionally, it will be appreciated that pre-loading devices having different biasing strengths may be used in the various sheave bracket assemblies such that a certain sheave bracket assembly may be “triggered” before another one.

[0046] With reference now to FIG. **18**, another embodiment of a cable tensioning device **400** is shown wherein a pivot bar **428** connects a first sheave **434** to a second sheave **436**, wherein the pivot bar acts similarly to the first and second plates **30, 32** of the sheave bracket assembly housing **28**, as described above. Further, the pivot bar **428** is connected to a pre-loading device **466**, such as a liquid spring strut, that allows rotation of the pivot bar **428** when a threshold tension is applied to the power cable **38** and biases the pivot bar back to its pre-loaded position when the tension drops below the threshold level.

[0047] With reference now to FIGS. **19** and **20a** to **20c**, another embodiment of a cable tensioning device includes a cable outlet guide **450** fixed to the frame **12** such that sheaves **452** and **454** remain fixed relative to the frame. Additionally, the cable outlet guide **450** includes a cable guide leader **480** that provides direction motion of the cable away from the frame **12** as the vehicle moves relative to a cable anchor point.

As shown in the figures, the cable guide leader **480** is rotatably mounted on the cable outlet guide **450** by a pair of arms **486** and includes a frame **458** configured to accommodate a cable therein and keep the cable oriented with respect to the sheaves **452, 454**. In other words, the cable guide leader **480** ensures that the cable can stay within the convex surface of the sheaves **452, 454** as the cable moves between the sheaves. [0048] With reference now to FIGS. **21, 22a** and **22b**, another embodiment of a cable tensioning device includes a cable outlet guide **450** fixed to the frame **12** and a moveable sheave **337** attached to a preload device **366** and alignment arms **368**. As shown in FIGS. **22a** and **22b**, the sheave **337** can move between an extended position (FIG. **22a**) and a retracted position (FIG. **22b**) to change a path length of a cable extending through the sheave **337** and into the cable outlet guide **450**.

[0049] Although embodiments of the present invention have been shown and described, it will be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the invention.

What is claimed is:

1. A cable tensioning device comprising:

a sheave bracket assembly comprising a plurality of sheaves; and

an outlet cable guide attached to the sheave bracket assembly, wherein when tension applied to a cable engaging the sheave bracket assembly reaches a first threshold level, the sheave bracket assembly is adapted to move from a wound state to an unwound state to decrease a path length of the cable with respect to the outlet cable guide.

2. The cable tensioning device of claim 1, wherein the sheave bracket assembly is rotatable about a pivot pin.

3. The cable tensioning device of claim 1, wherein the sheave bracket assembly further comprises a spring that pre-loads the sheave bracket assembly.

4. The cable tensioning device of claim 3, wherein the spring is a torsion spring.

5. The cable tensioning device of claim 1, wherein the sheave bracket assembly is attached to the outlet cable guide by a connecting arm.

6. The cable tensioning device of claim 1, wherein the outlet cable guide is rotatable about a pivot pin.

7. The cable tensioning device of claim 1, wherein the outlet cable guide further comprises a spring that pre-loads the outlet cable guide.

8. The cable tensioning device of claim 1, wherein the outlet cable guide is rotatable with respect to the sheave bracket assembly.

9. The cable tensioning device of claim 1, wherein when tension applied to a cable engaging the sheave bracket assembly decreases below a second threshold level, the sheave bracket assembly is adapted to move from the unwound state to the wound state to increase a path length of the cable with respect to the outlet cable guide.

10. The cable tensioning device of claim 1, wherein the sheave bracket assembly and the outlet cable guide are oriented substantially parallel to each other.

11. The cable tensioning device of claim 1, wherein the sheave bracket assembly and the outlet cable guide are oriented substantially perpendicular to each other.

12. The cable tensioning device of claim 1, wherein at least one of the sheaves is movable with respect to another one of

the sheaves such that a distance between the at least one of the sheaves and the another one of the sheaves can be altered.

13. The cable tensioning device of claim **1**, wherein the sheave bracket assembly comprises three sheaves.

14. The cable tensioning device of claim **1**, wherein the cable tensioning device is configured to alter the path of the cable by between 50 inches and 75 inches.

15. The cable tensioning device of claim **1**, wherein the outlet cable guide comprises a housing and a cable guide leader movable with respect to the housing, wherein the cable guide leader is configured to allow an orientation of a cable inserted therethrough to be altered with respect to the outlet cable guide.

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