US 20150360800A1

(19) United States

(12) Patent Application Publication

(10) Pub. No.: US 2015/0360800 A1

(43) Pub. Date: Dec. 17, 2015

Shelander

(54) **SYSTEM AND METHOD FOR SECURING FREE END OF WOUND CABLE**

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(21) Appl. No.: **14/737,237**

(22) Filed: **Jun. 11, 2015**

Related U.S. Application Data

(60) Provisional application No. 62/011,013, filed on Jun. 11, 2014.

Publication Classification

(51) **Int. Cl.**

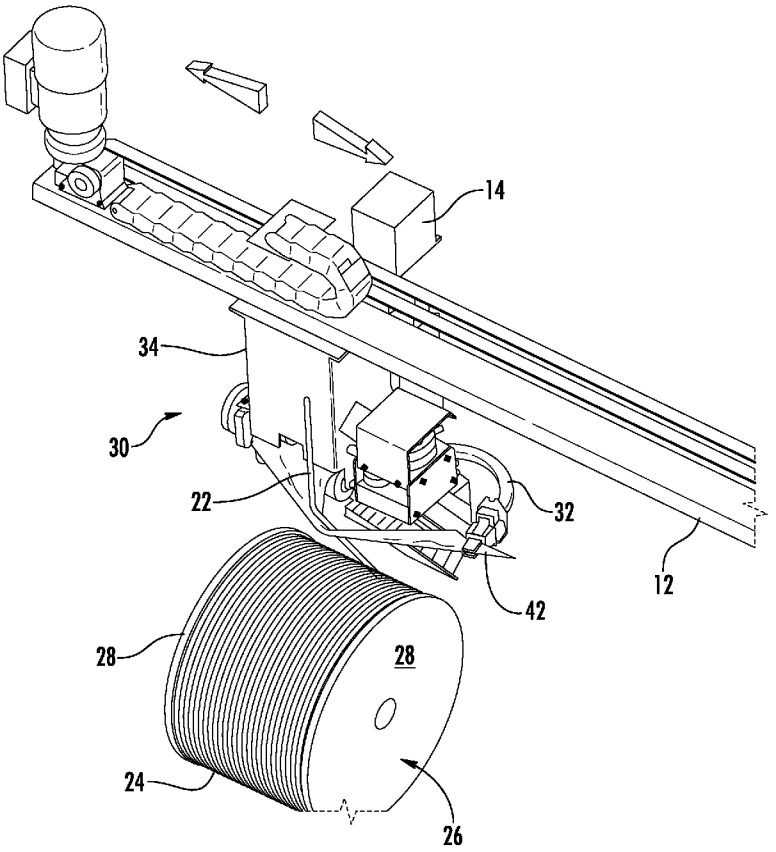
B65B 53/00	(2006.01)
B65B 11/54	(2006.01)
B65B 61/06	(2006.01)
B65B 45/00	(2006.01)
B65B 11/02	(2006.01)
B65B 41/12	(2006.01)

(52) **U.S. Cl.**

CPC ***B65B 53/00*** (2013.01); ***B65B 11/02*** (2013.01); ***B65B 41/12*** (2013.01); ***B65B 61/06*** (2013.01); ***B65B 45/00*** (2013.01); ***B65B 11/54*** (2013.01)

(57) **ABSTRACT**

A system for securing a free end of a cable wound on a spool includes a spooling machine having at least one spooling head for winding a length of the cable onto the spool and a stretch wrap applicator for securing the free end of the cable on the spool with stretch wrap that is pinched between the free end of the cable and the outermost windings of the cable wound on the spool. A stretch wrap applicator for a spooling machine having at least one spooling head includes a housing, a roll of stretch wrap disposed within the housing and a pulling clamp for gripping and pulling a starting end of the stretch wrap so as to position the stretch wrap between a spool of wound cable having outermost windings and a free end of the cable wound on the spool. A method for securing the free end of a cable wound on a spool includes providing the spooling machine and the stretch wrap applicator, moving the pulling clamp from an initial position around a free end of the cable, gripping a starting end of the stretch wrap, moving the pulling clamp and the stretch wrap back to the initial position with the stretch wrap disposed between the free end and the outermost windings of the cable and moving the pulling clamp in a downward direction so as to pinch the stretch wrap within a nip defined between the outermost windings and the free end of the cable.



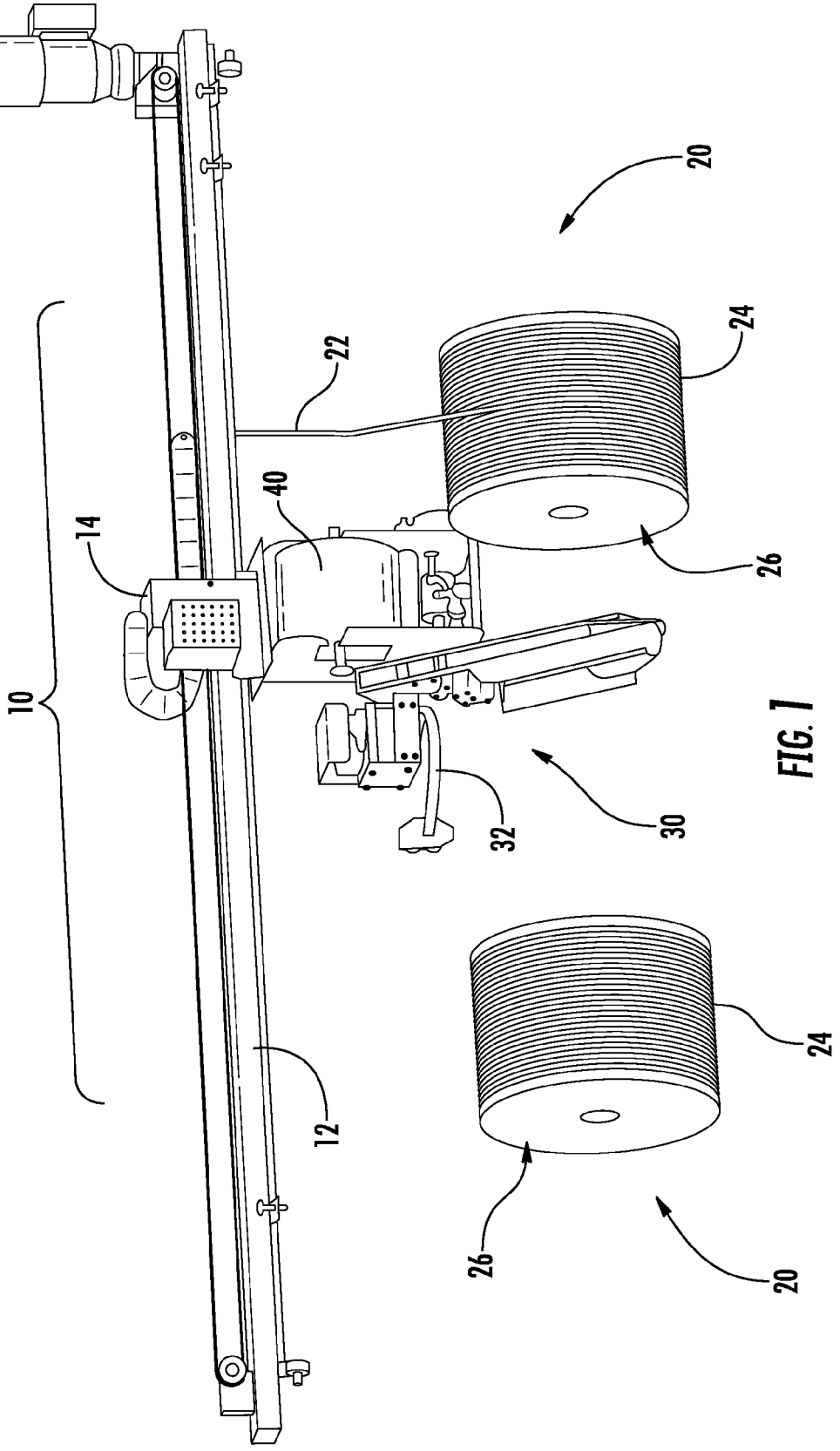


FIG. 1

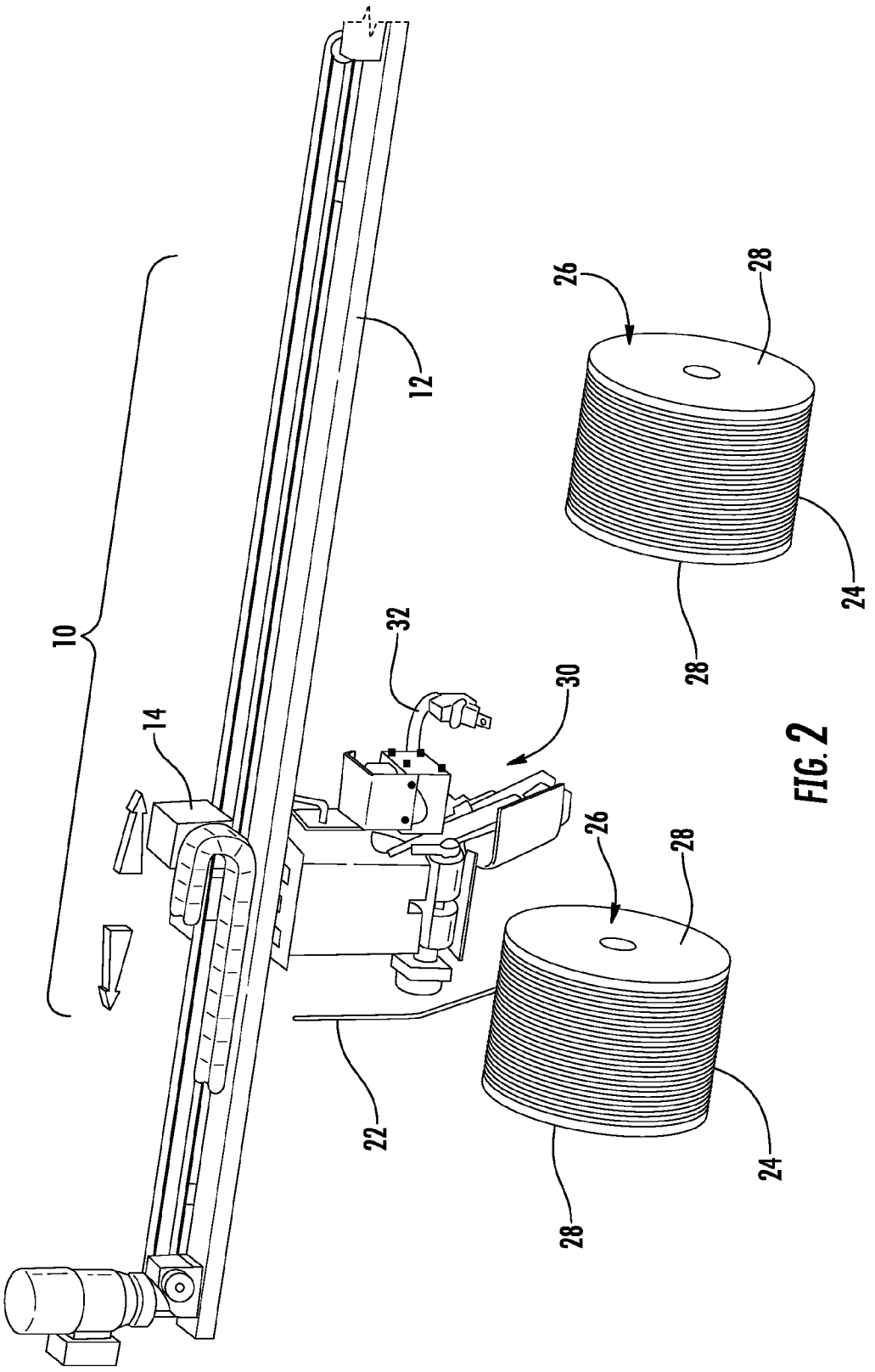


FIG. 2

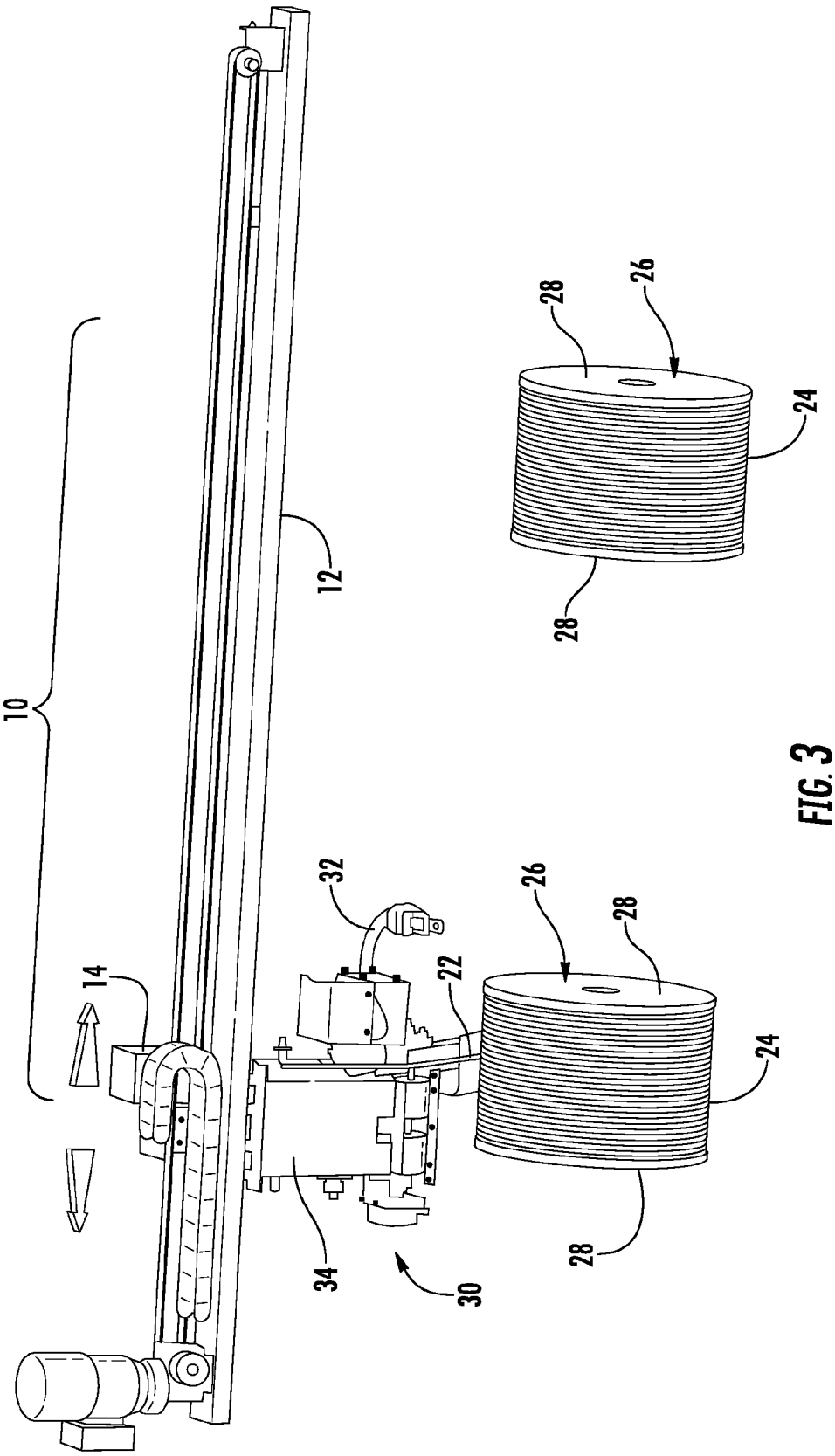


FIG. 3

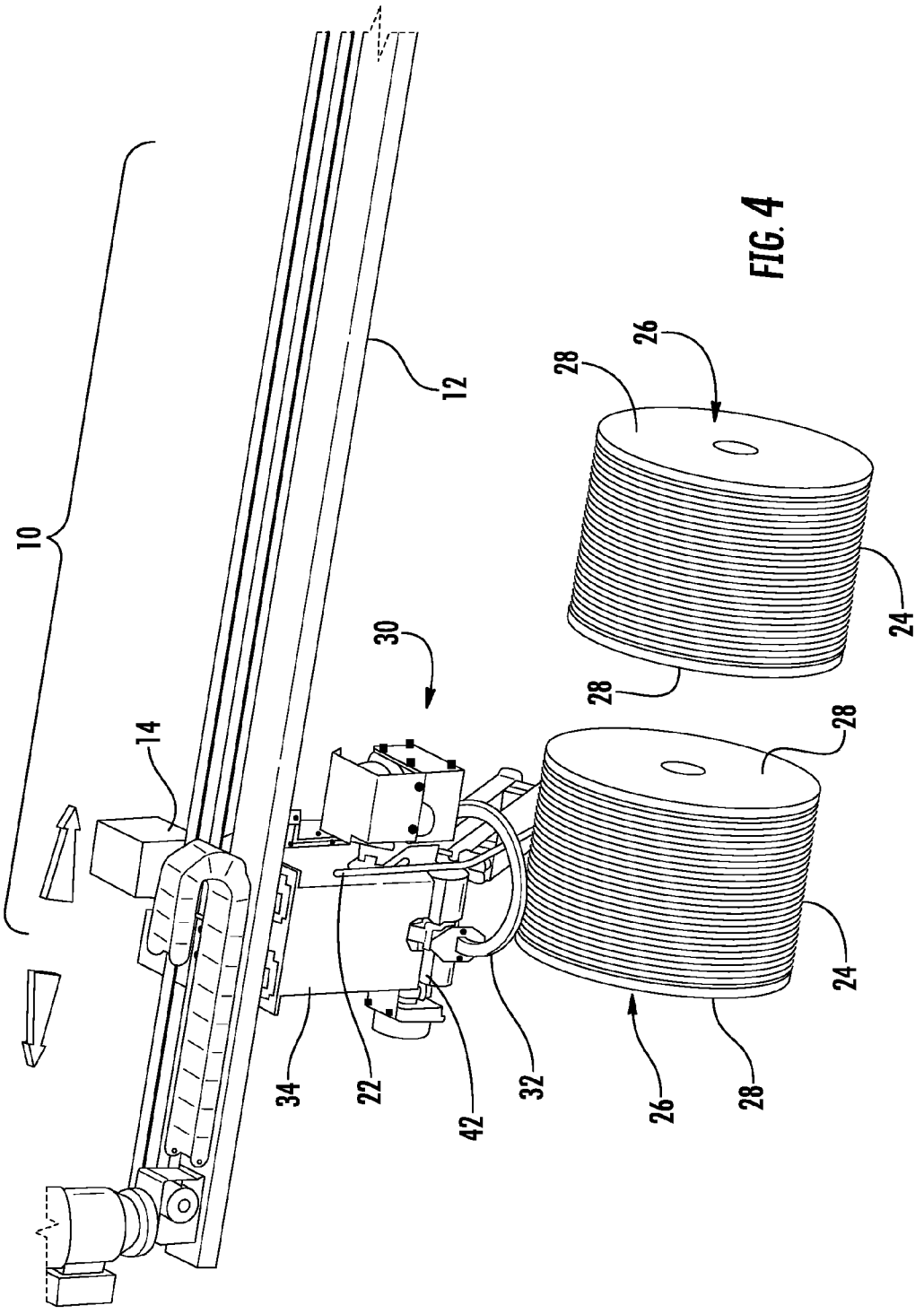
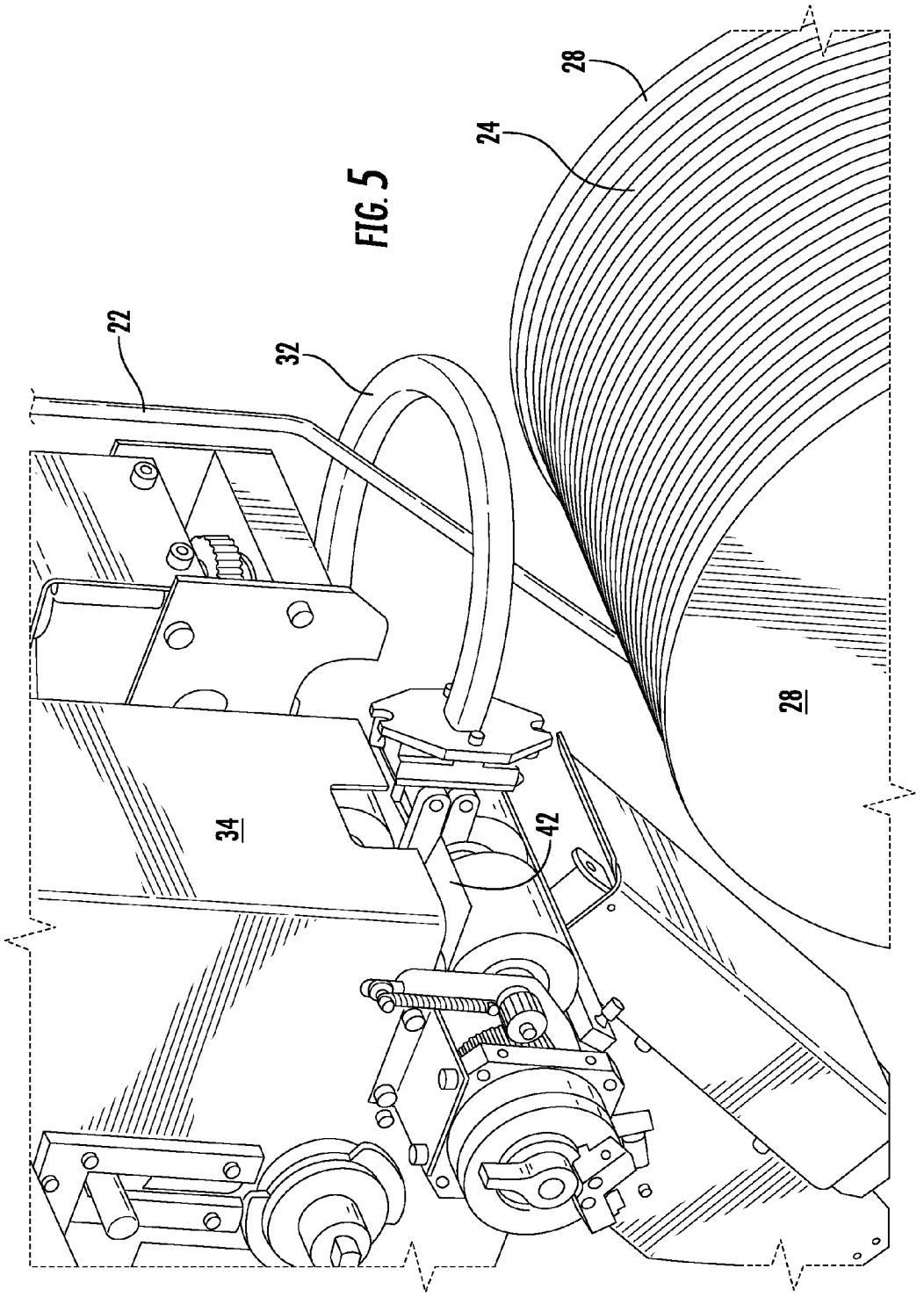


FIG. 4

FIG. 5



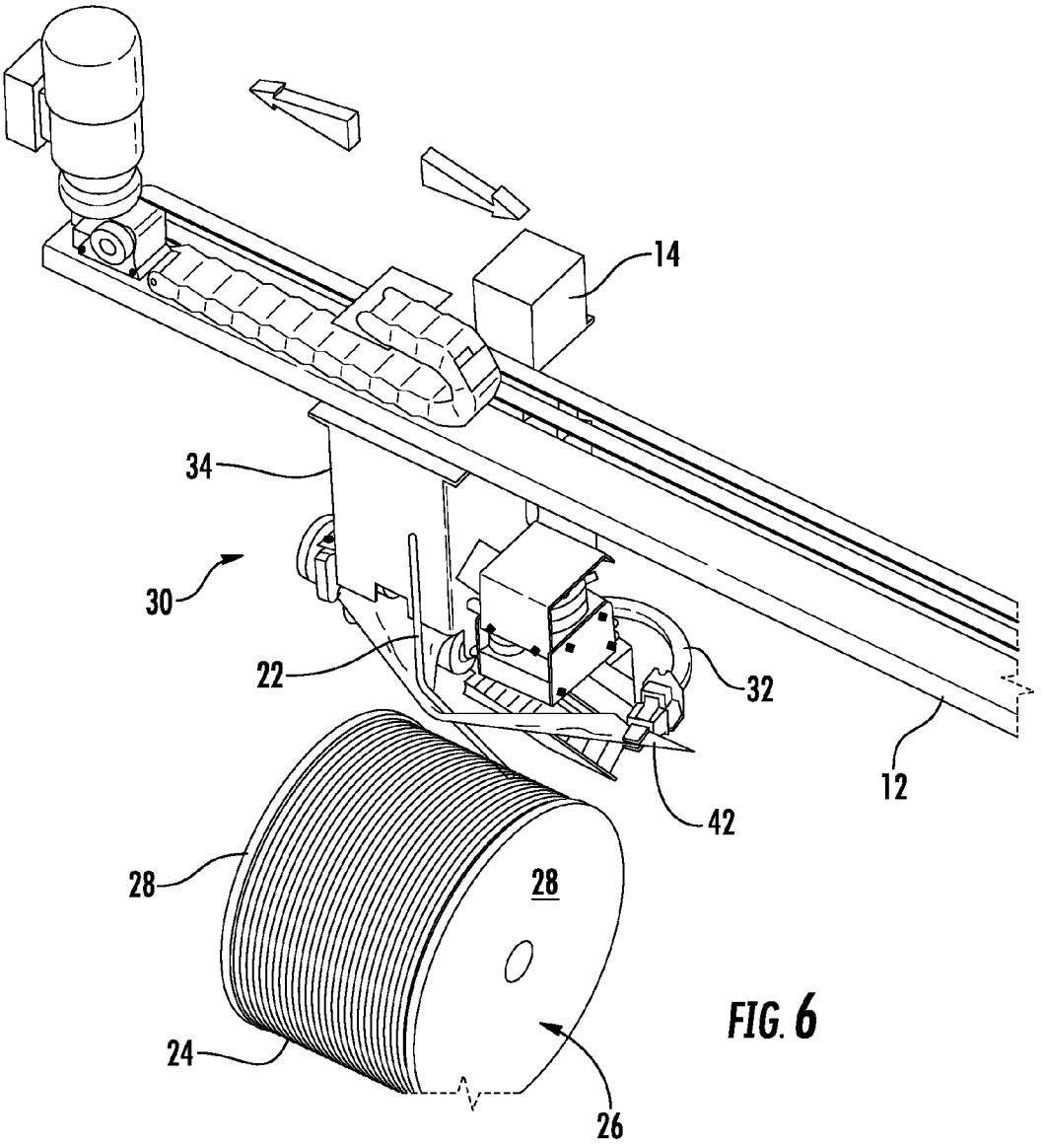


FIG. 6

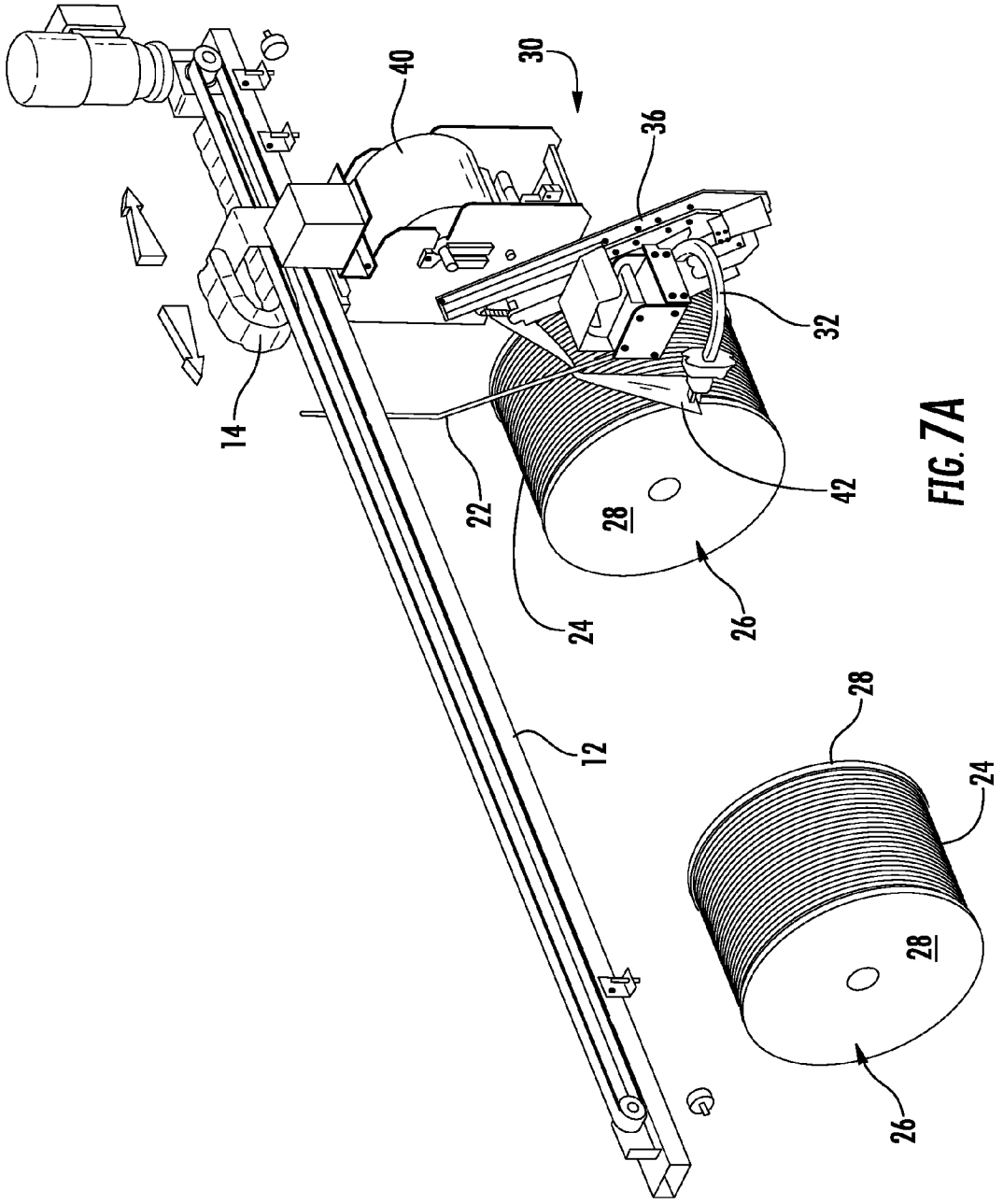


FIG. 7A

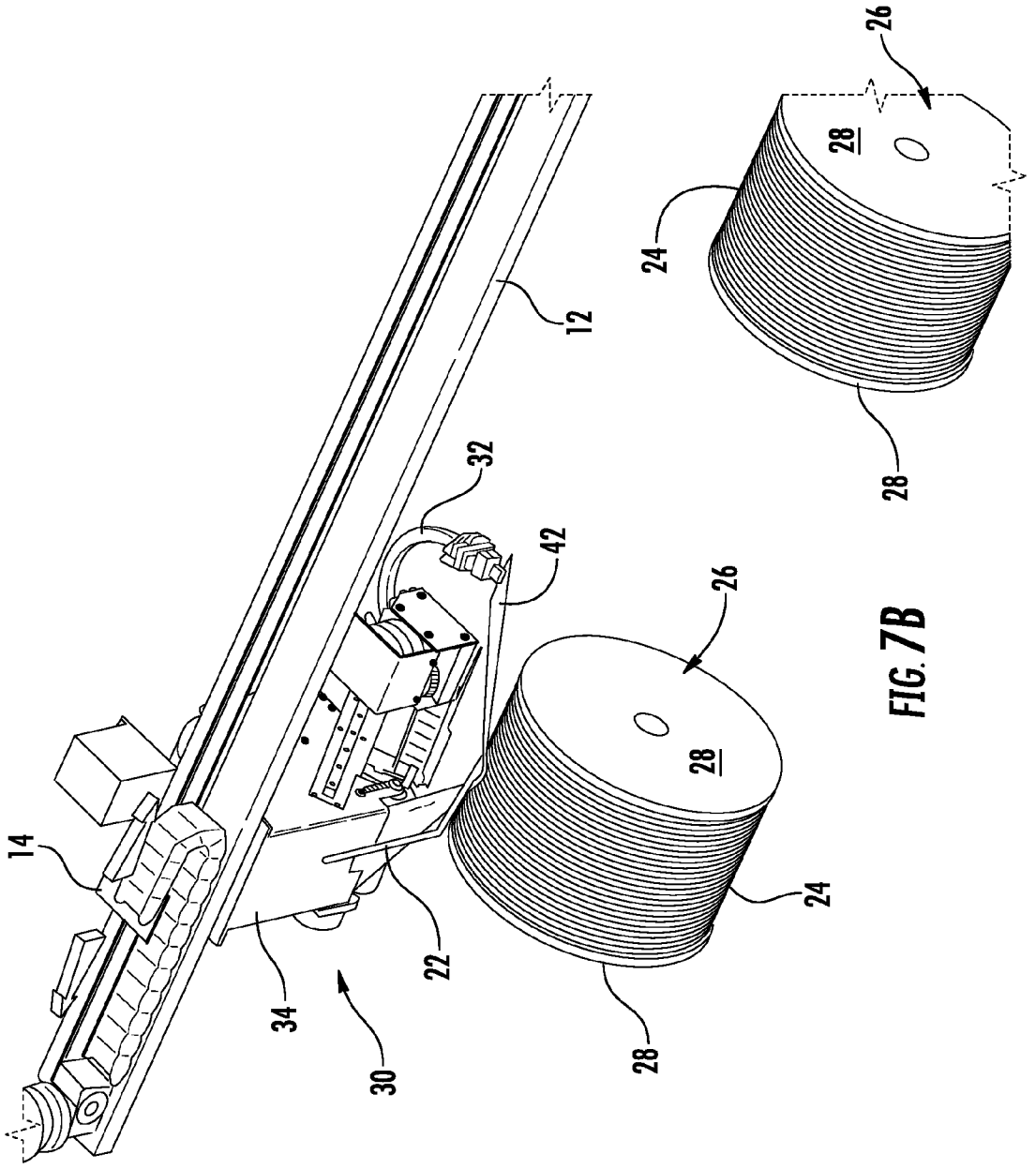


FIG. 7B

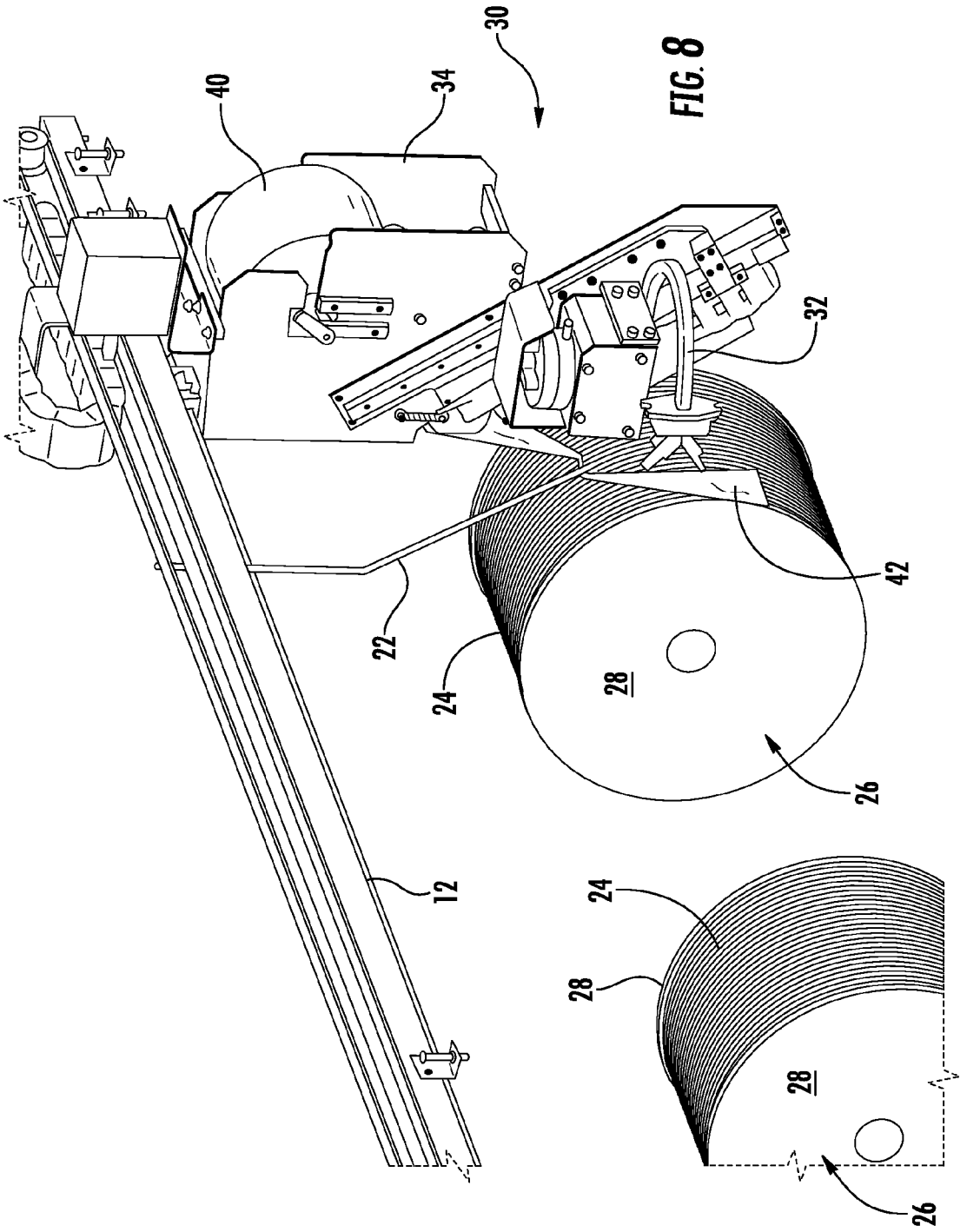


FIG. 8

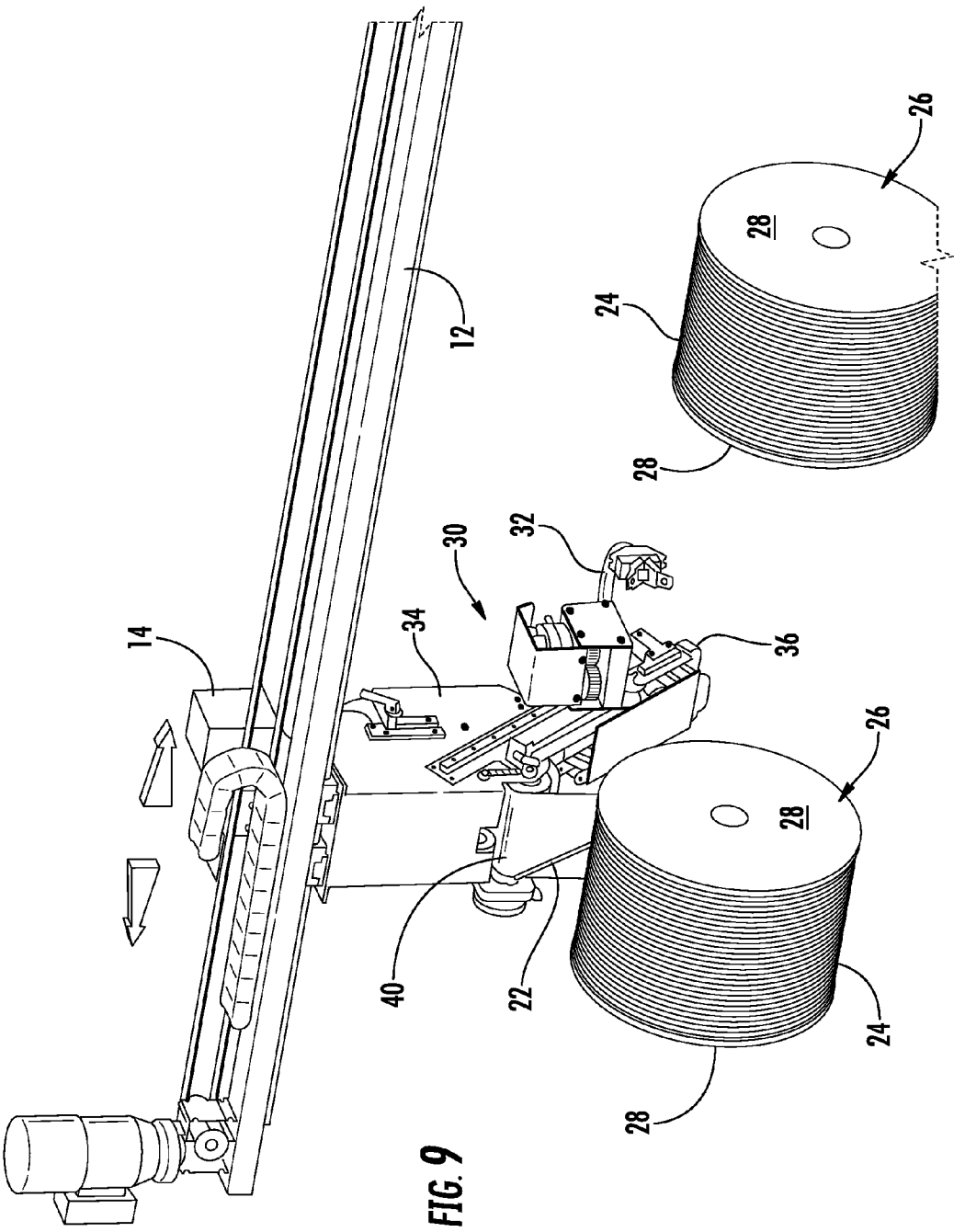


FIG. 9

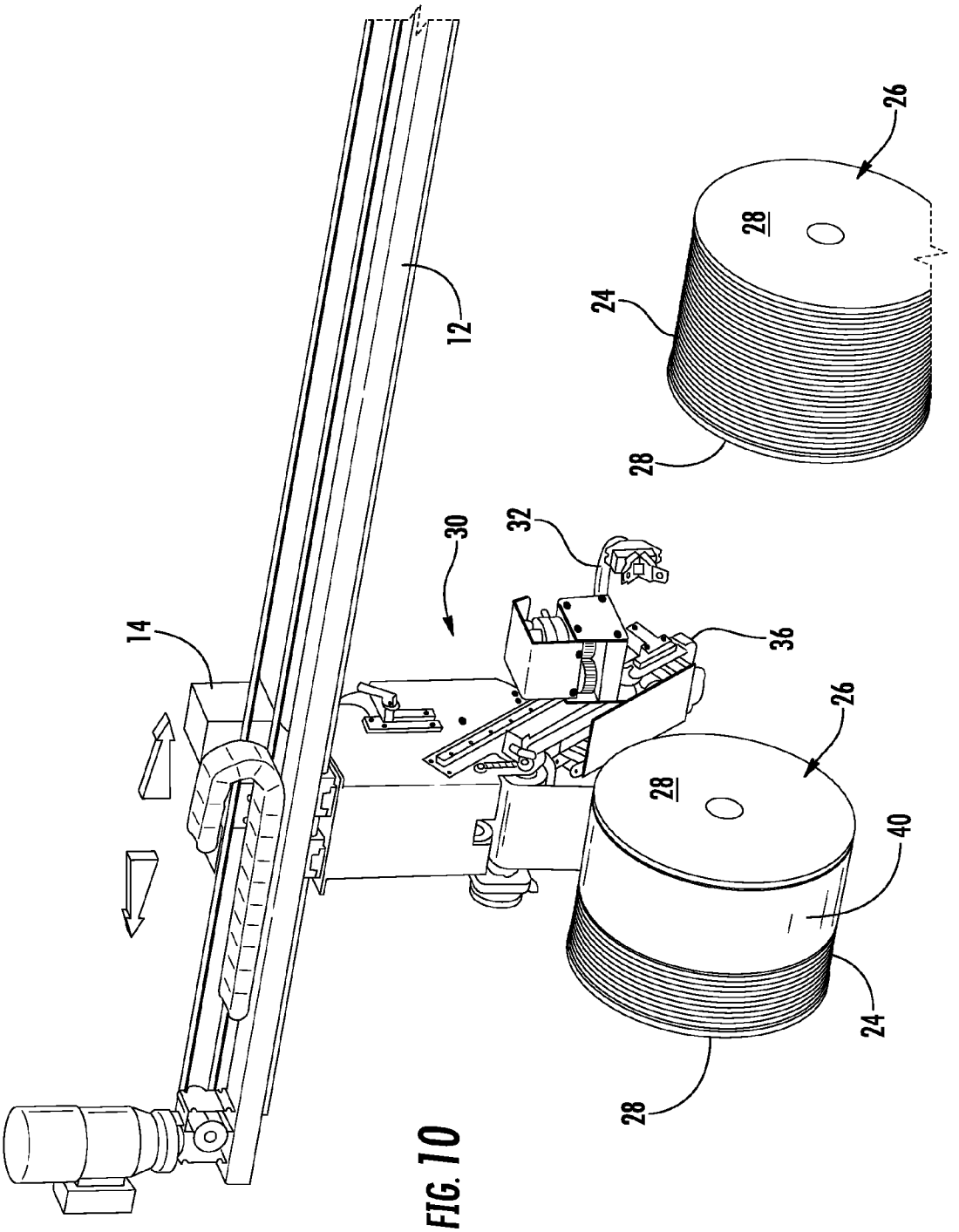


FIG. 10

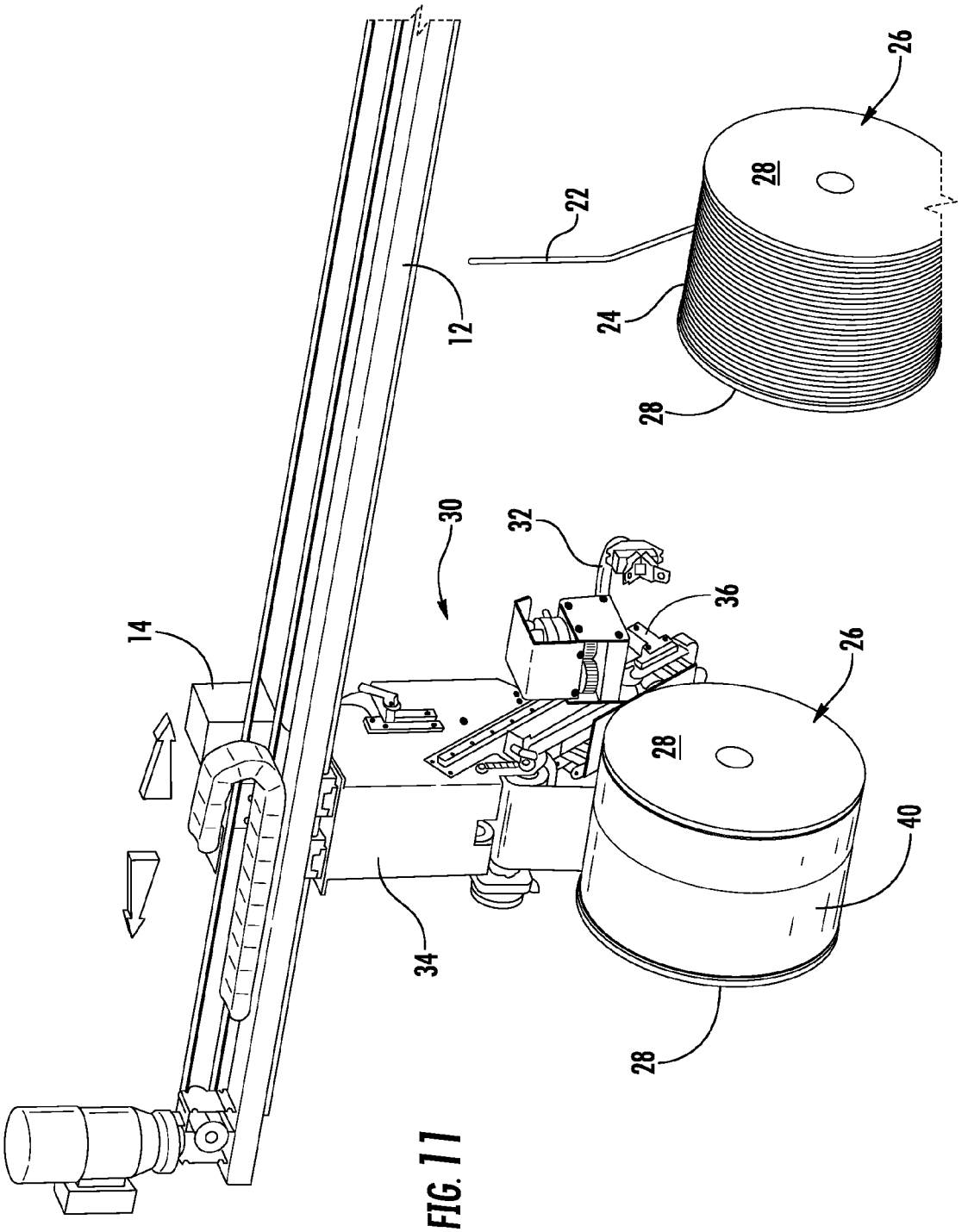


FIG. 11

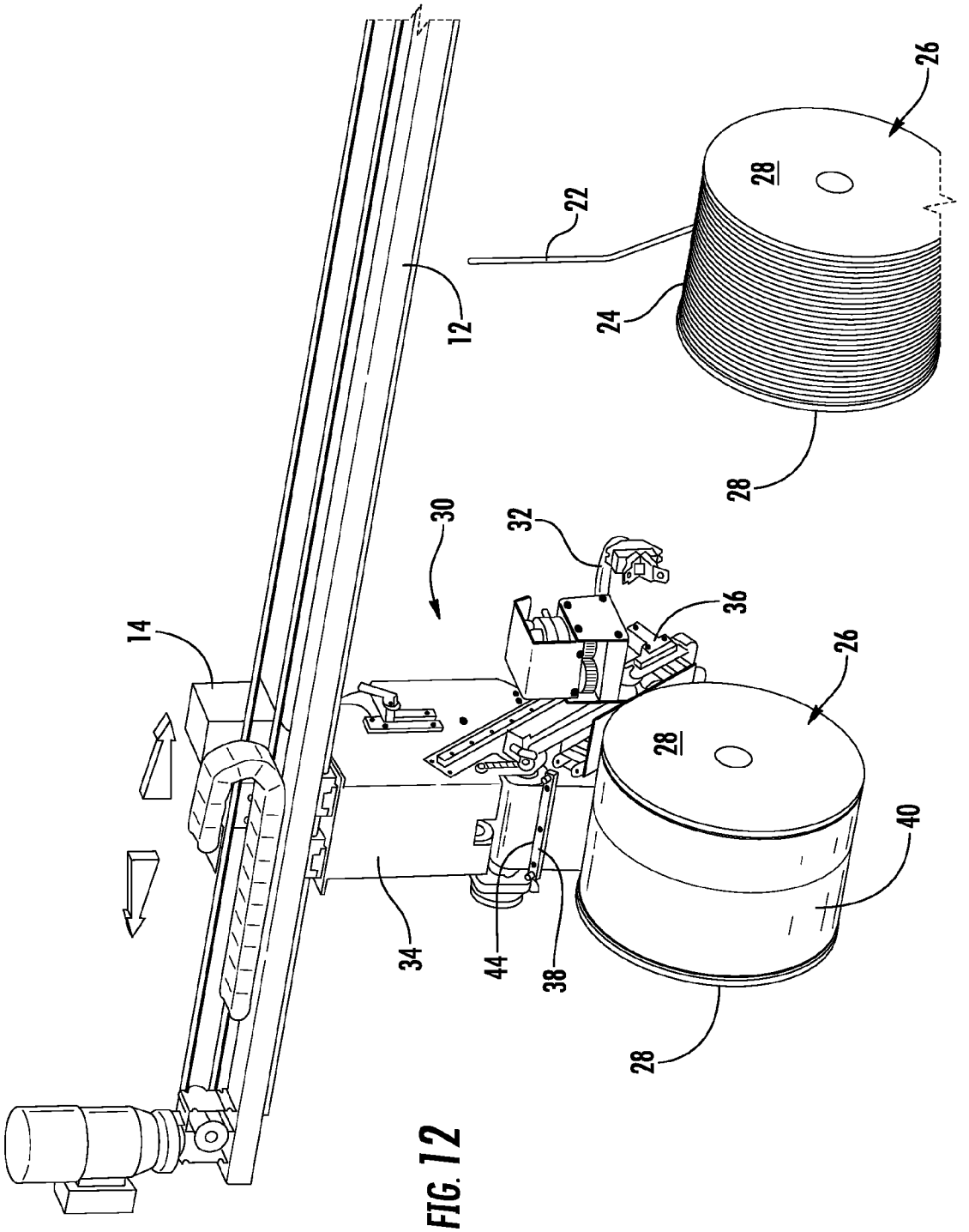


FIG. 12

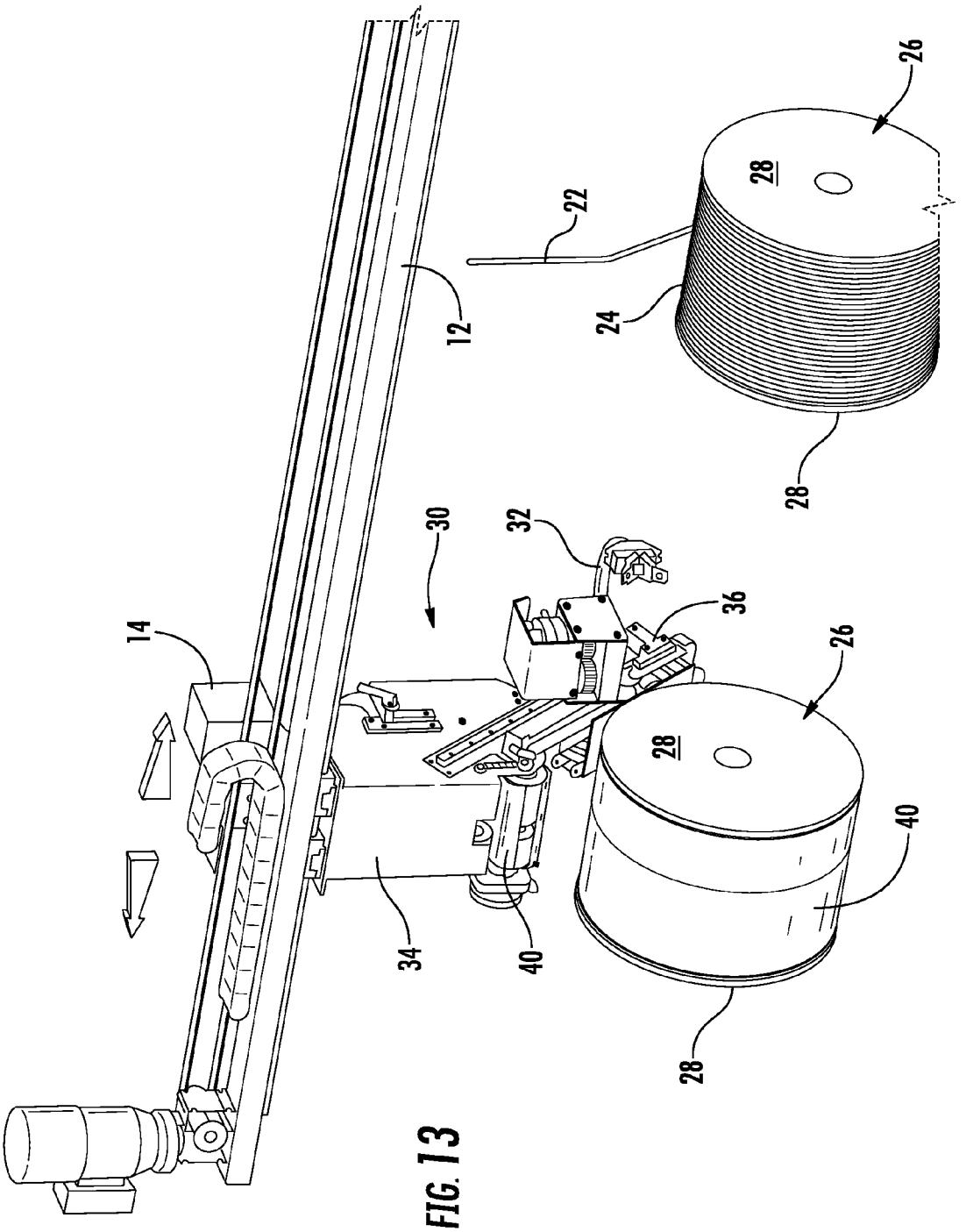


FIG. 13

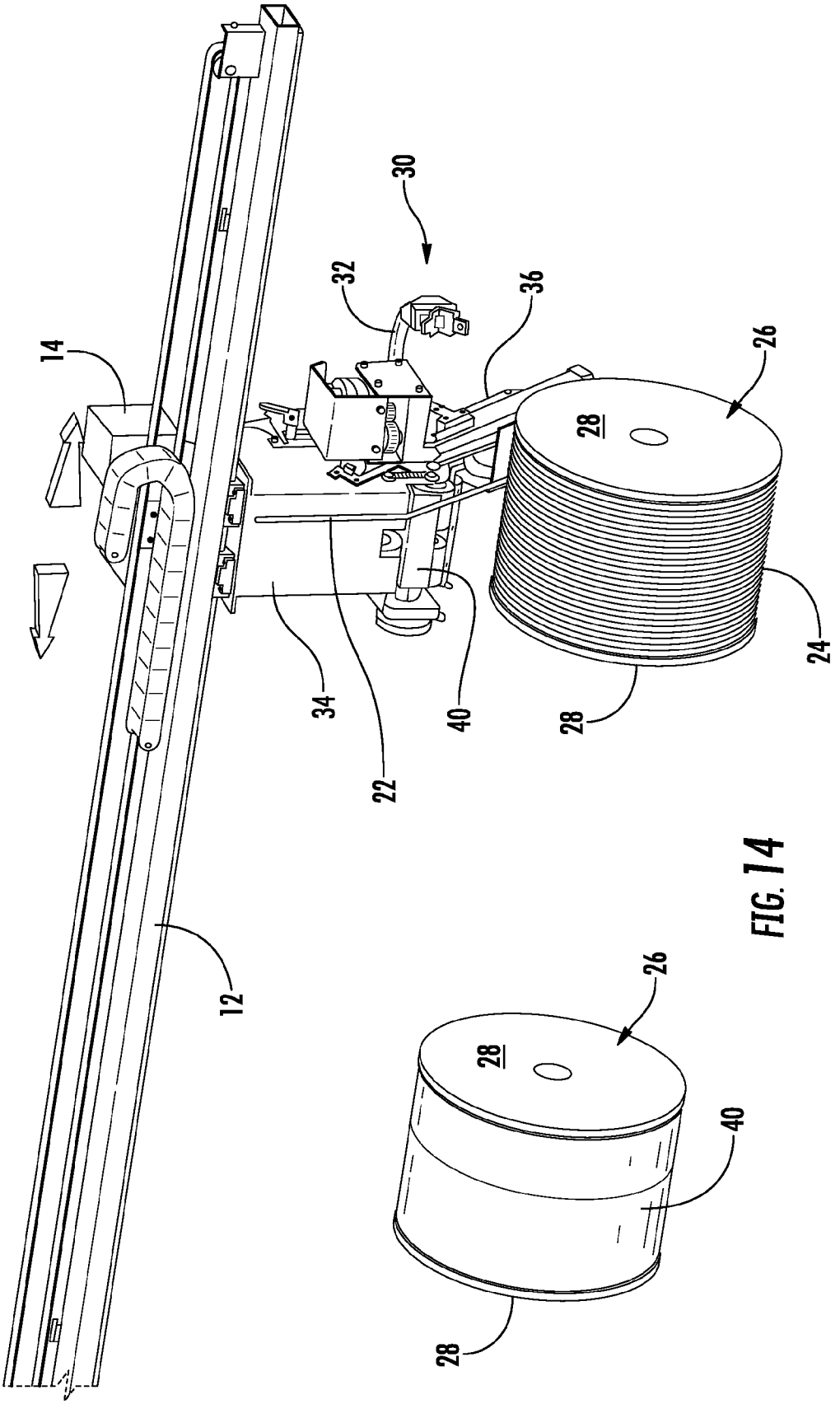


FIG. 14

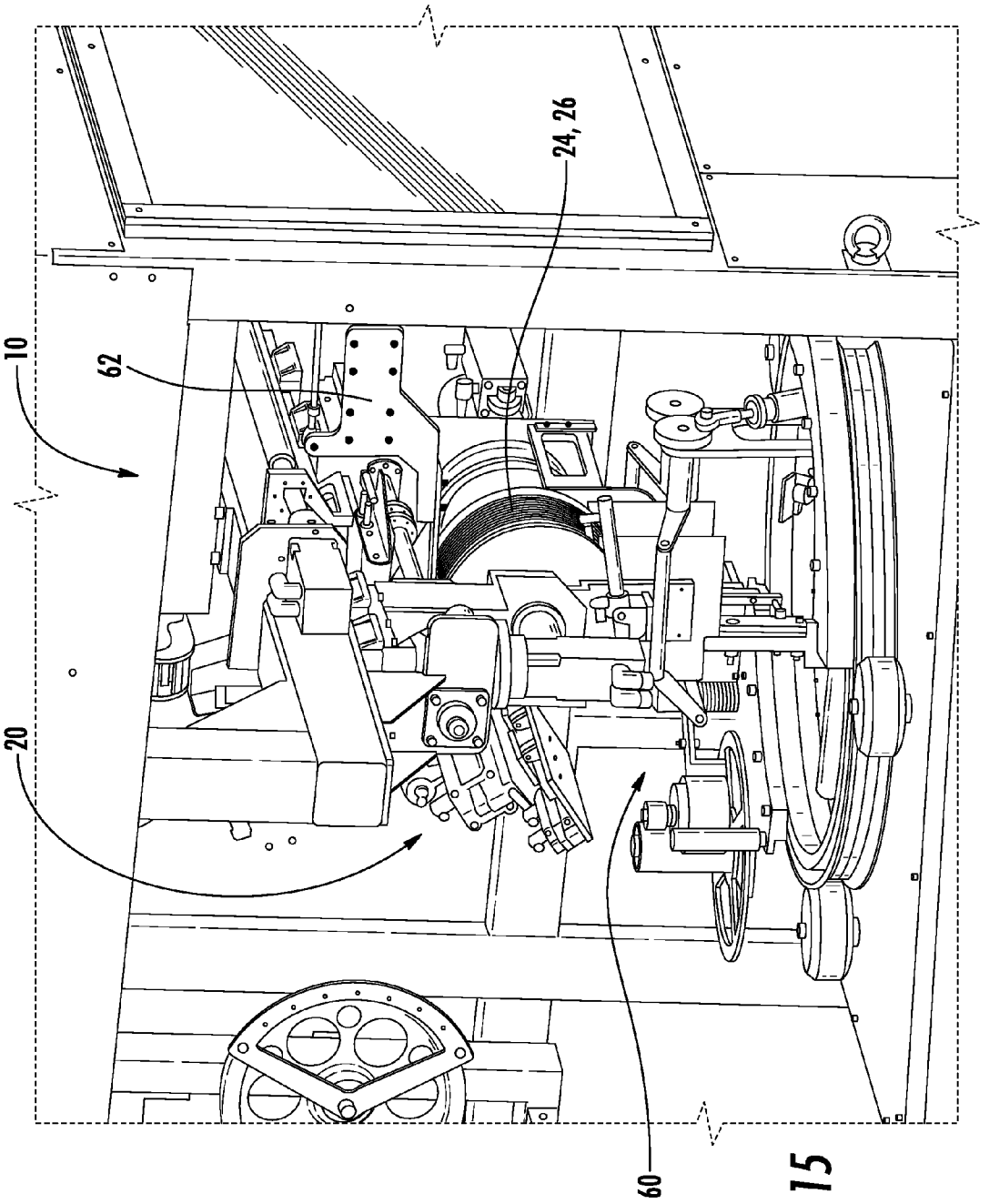


FIG. 15

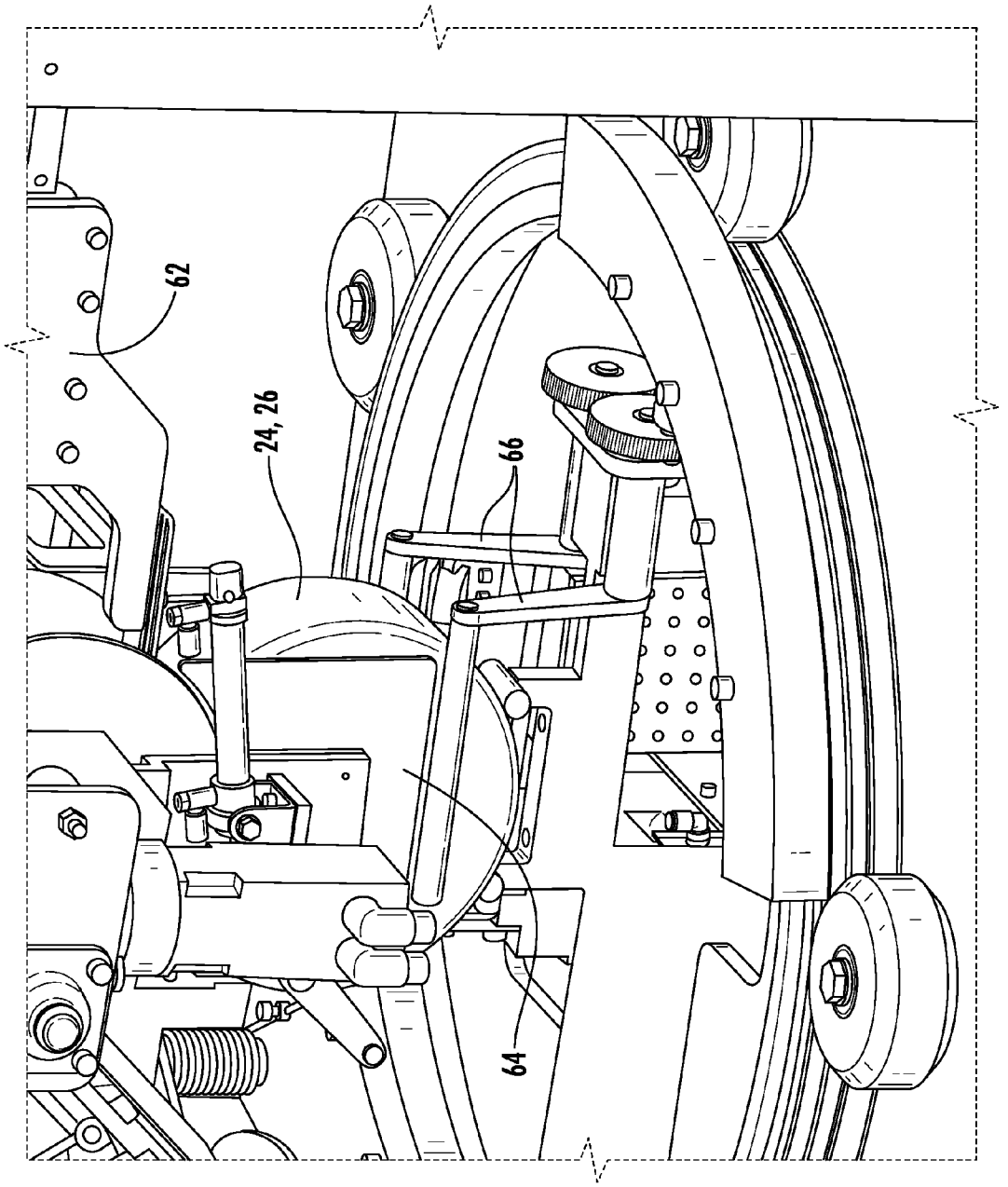


FIG. 16

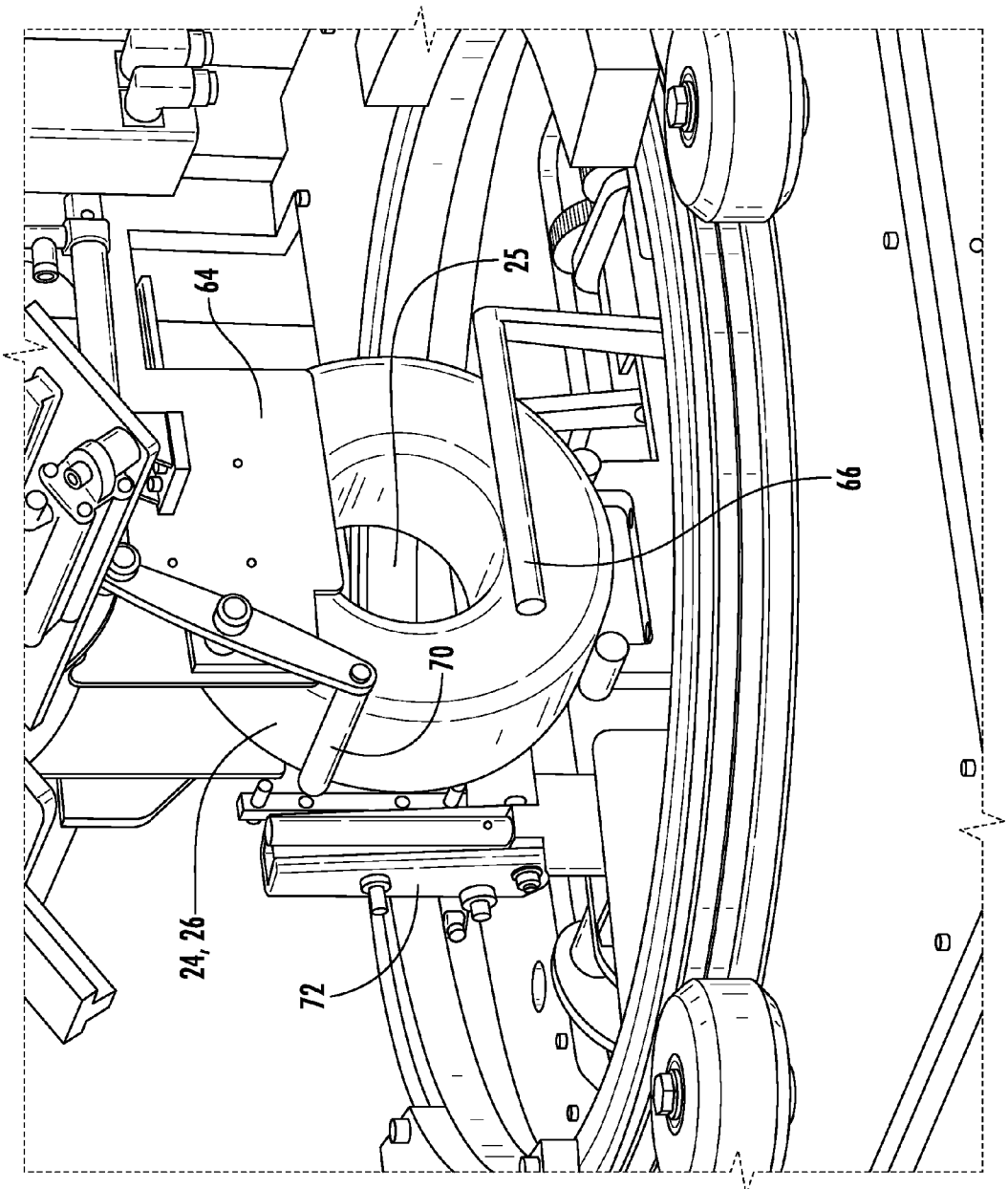


FIG. 17

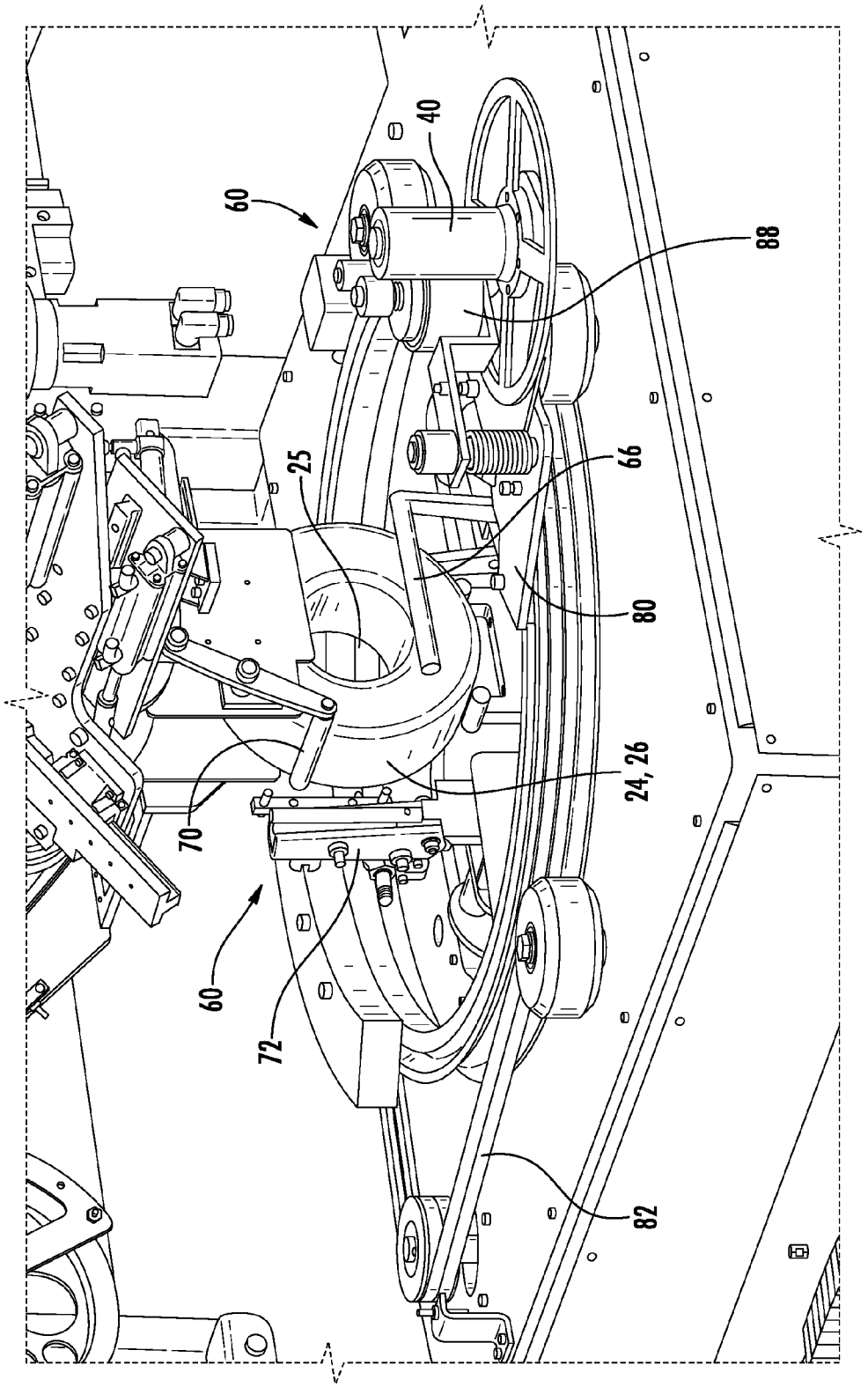


FIG. 18

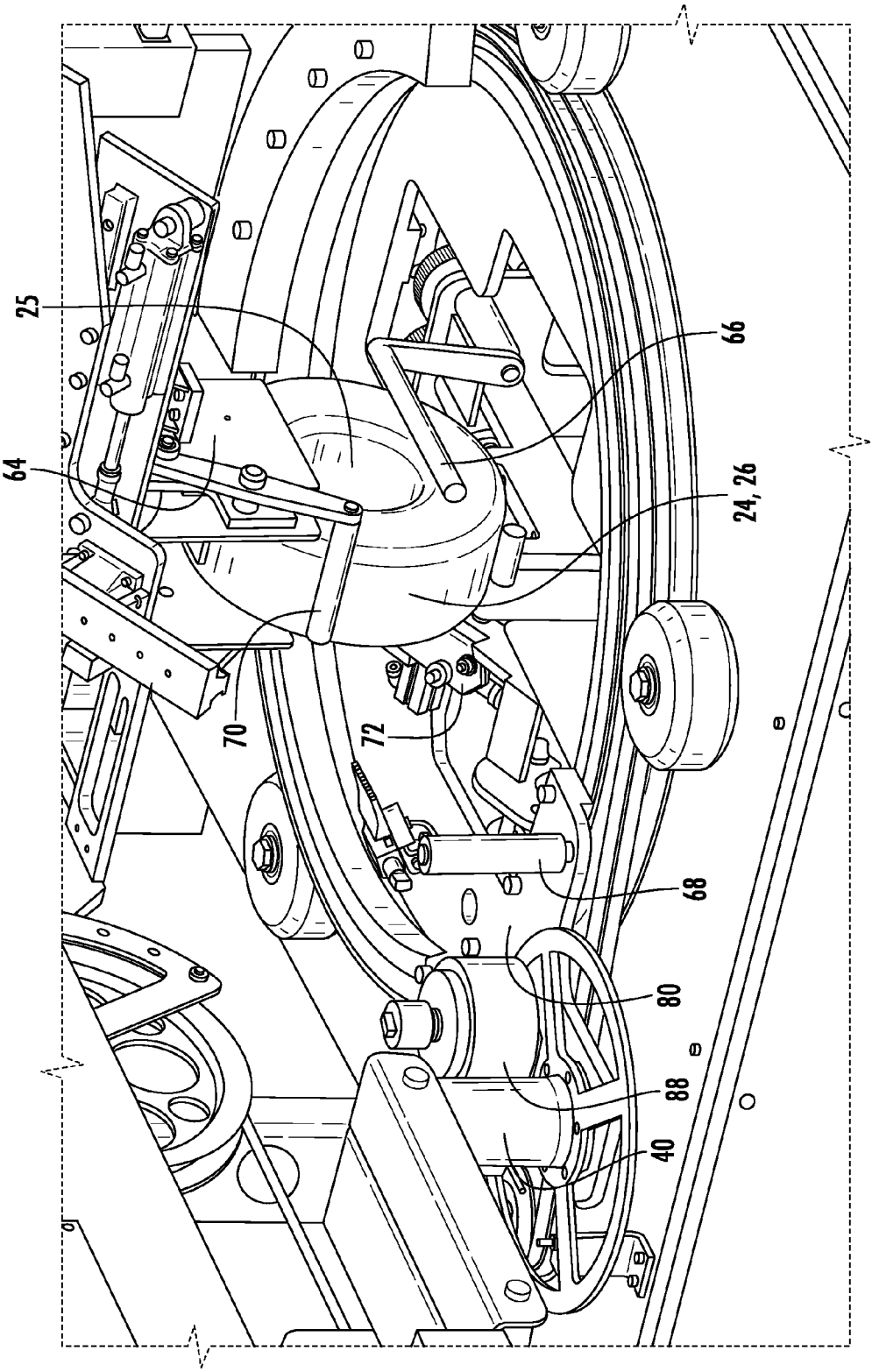


FIG. 19

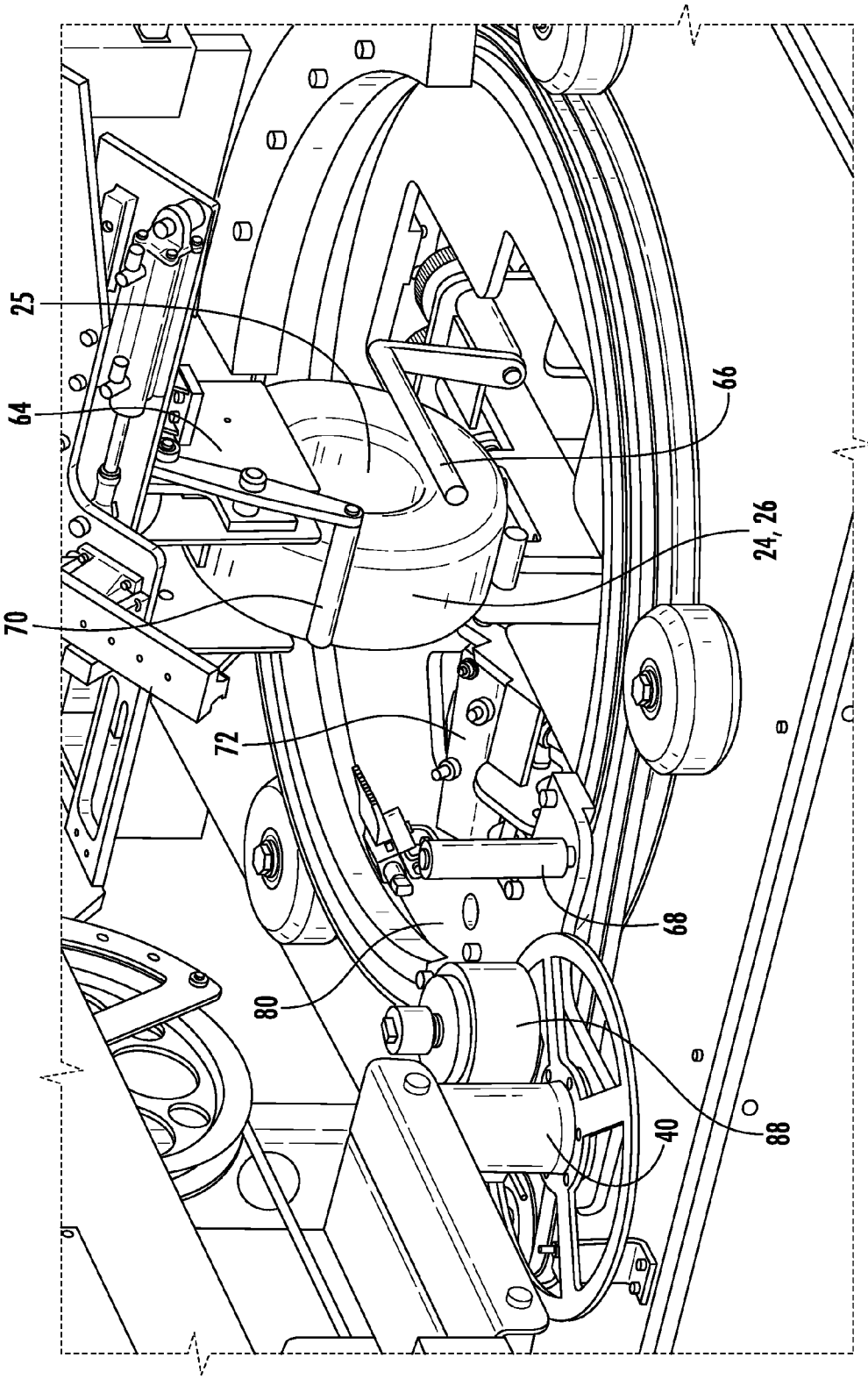


FIG. 20

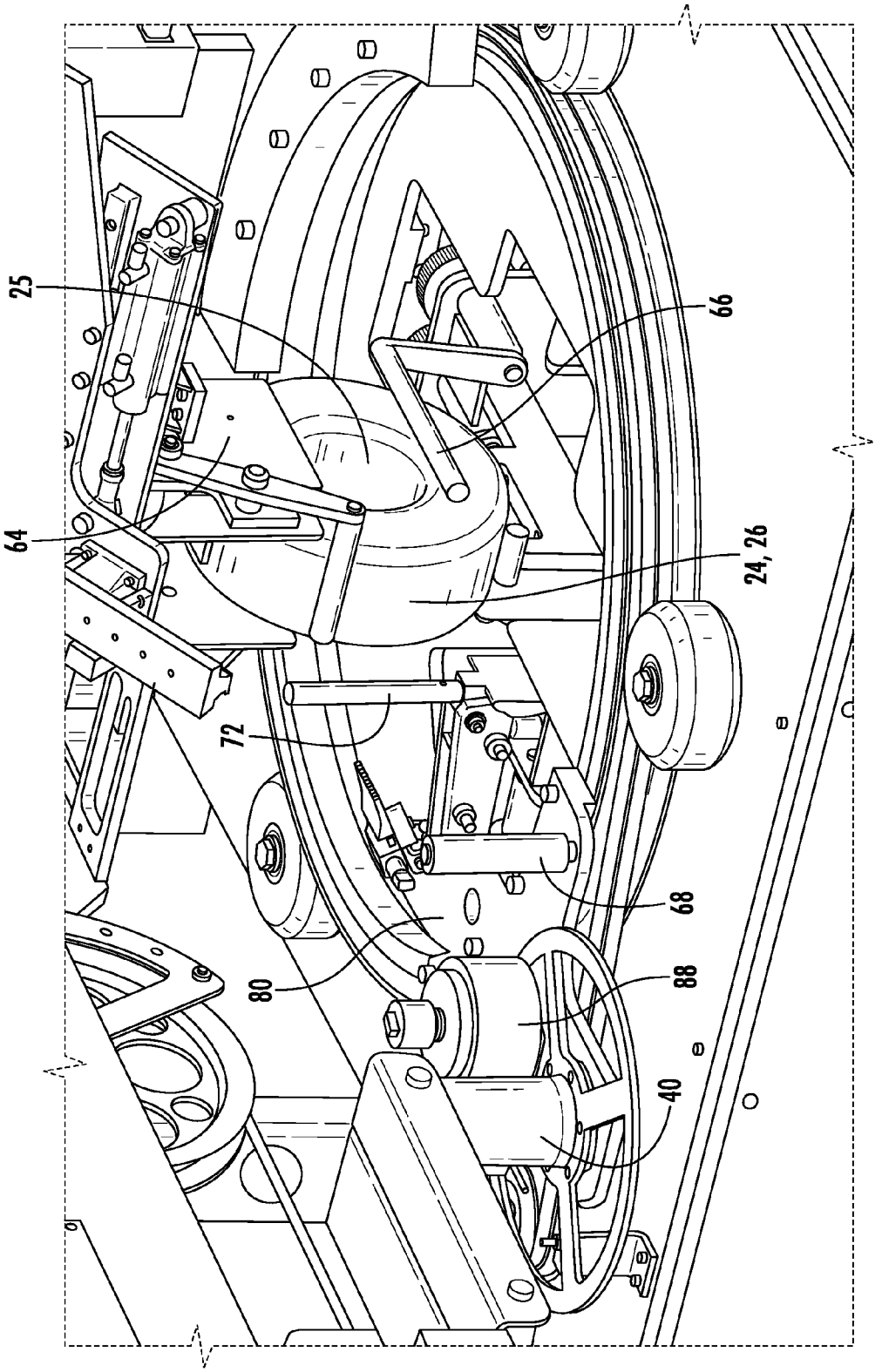


FIG. 21

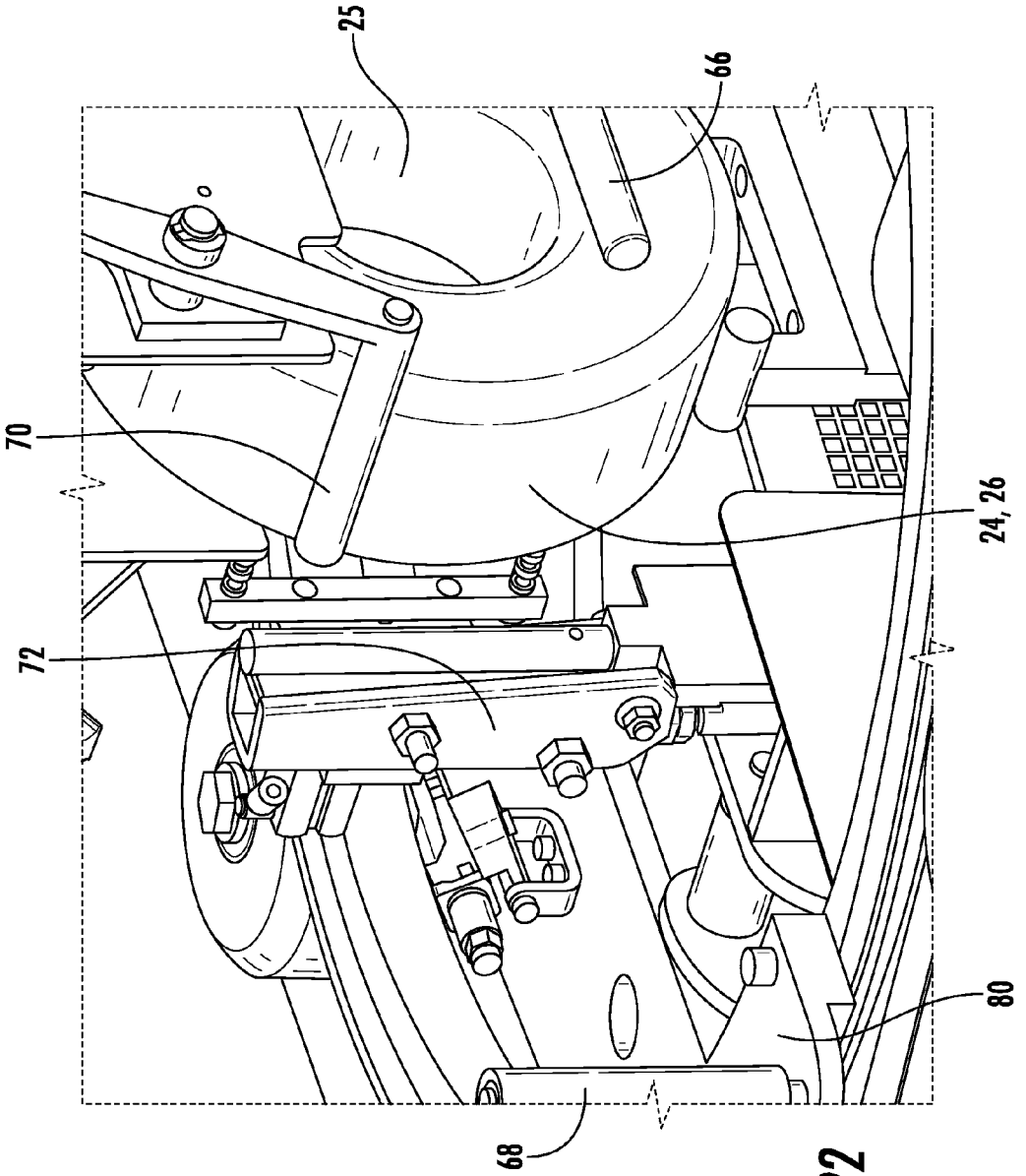


FIG. 22

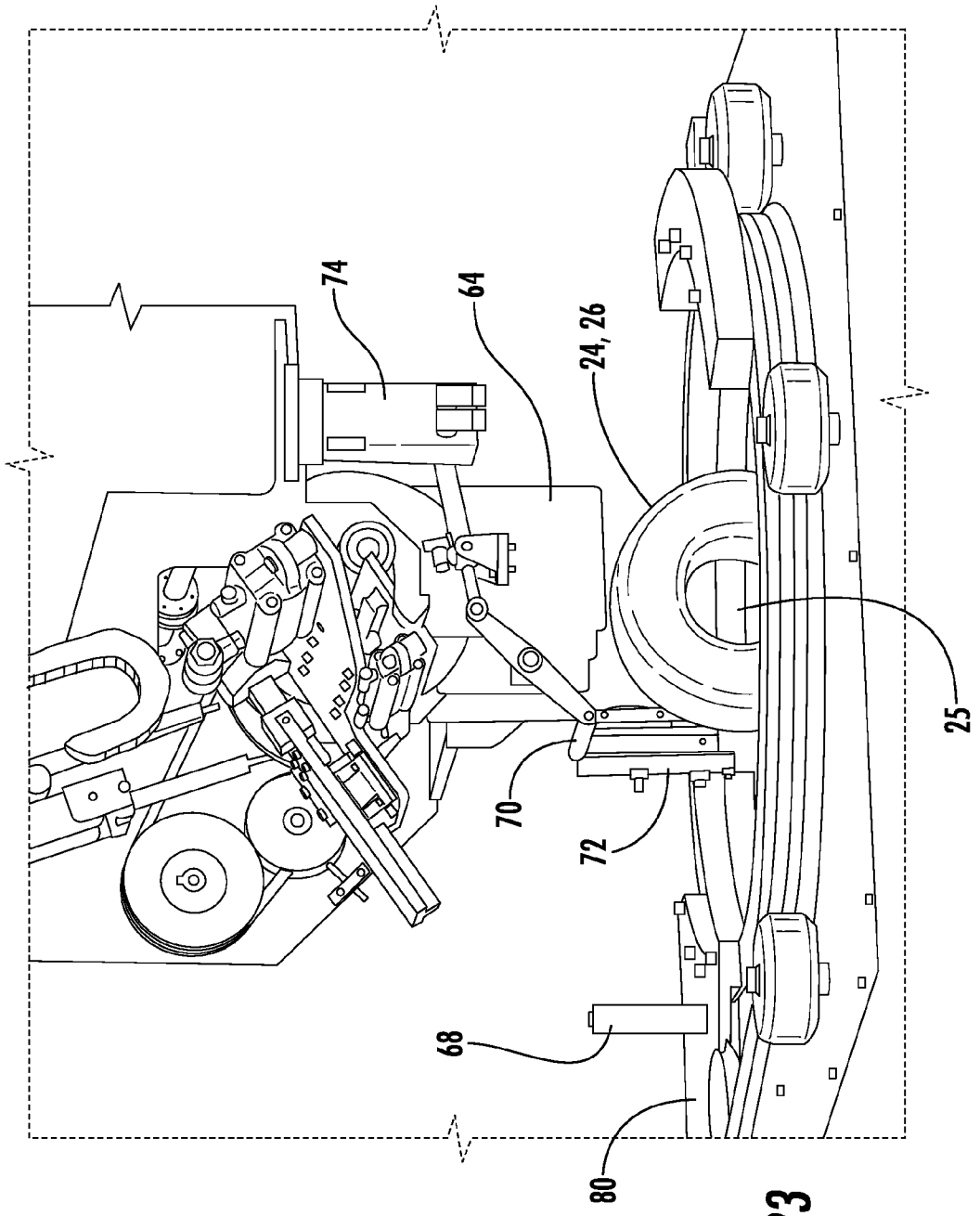


FIG. 23

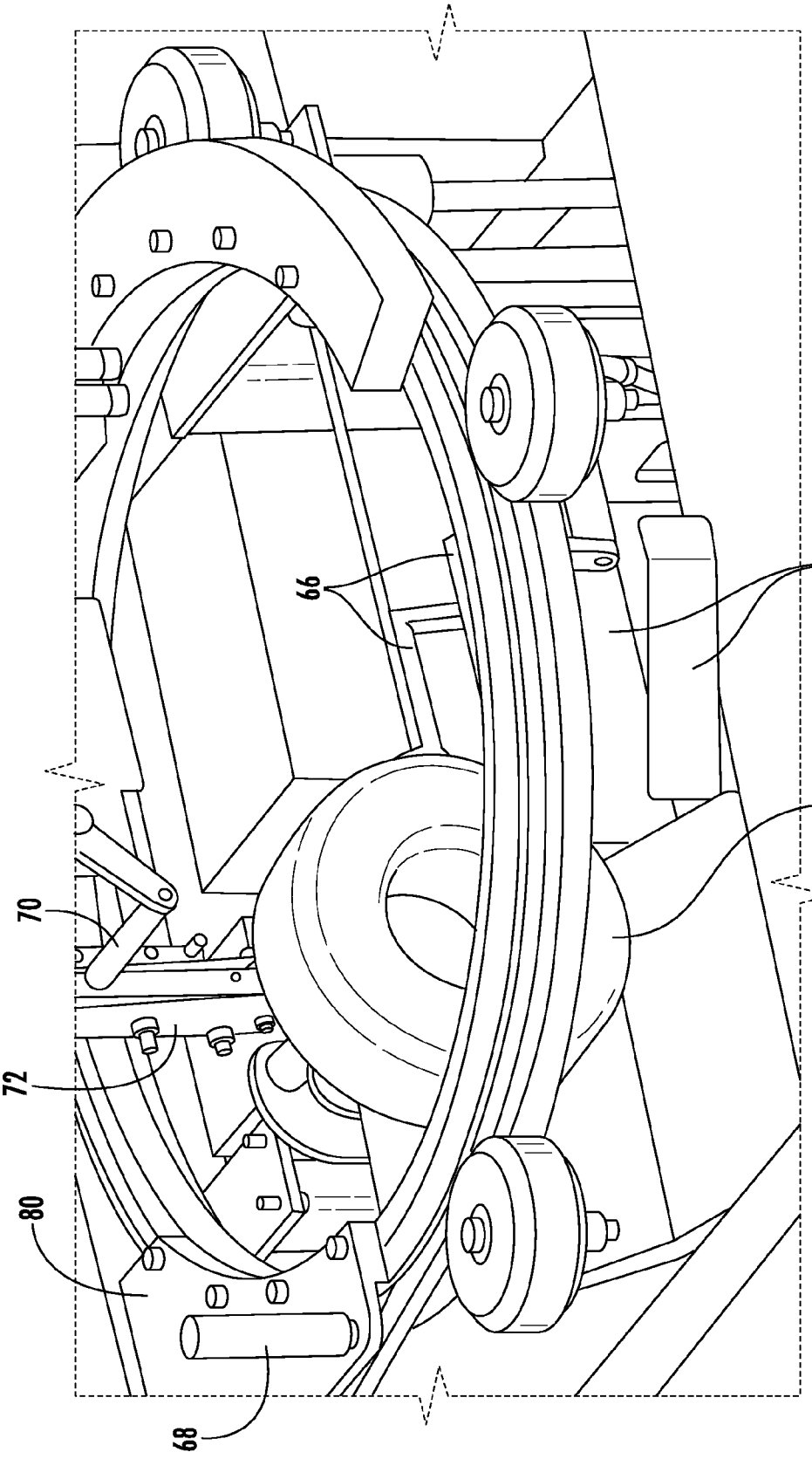


FIG. 24

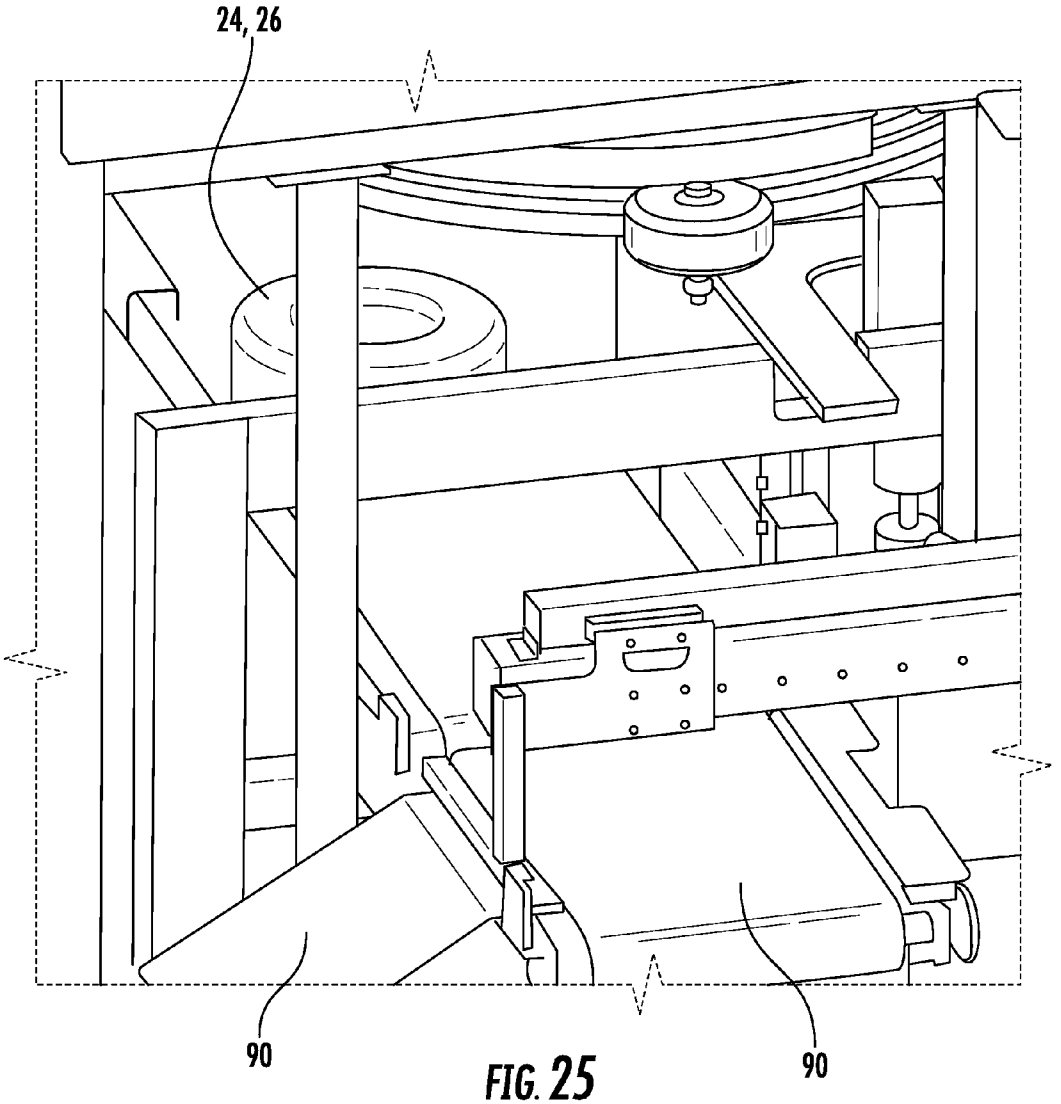


FIG. 25

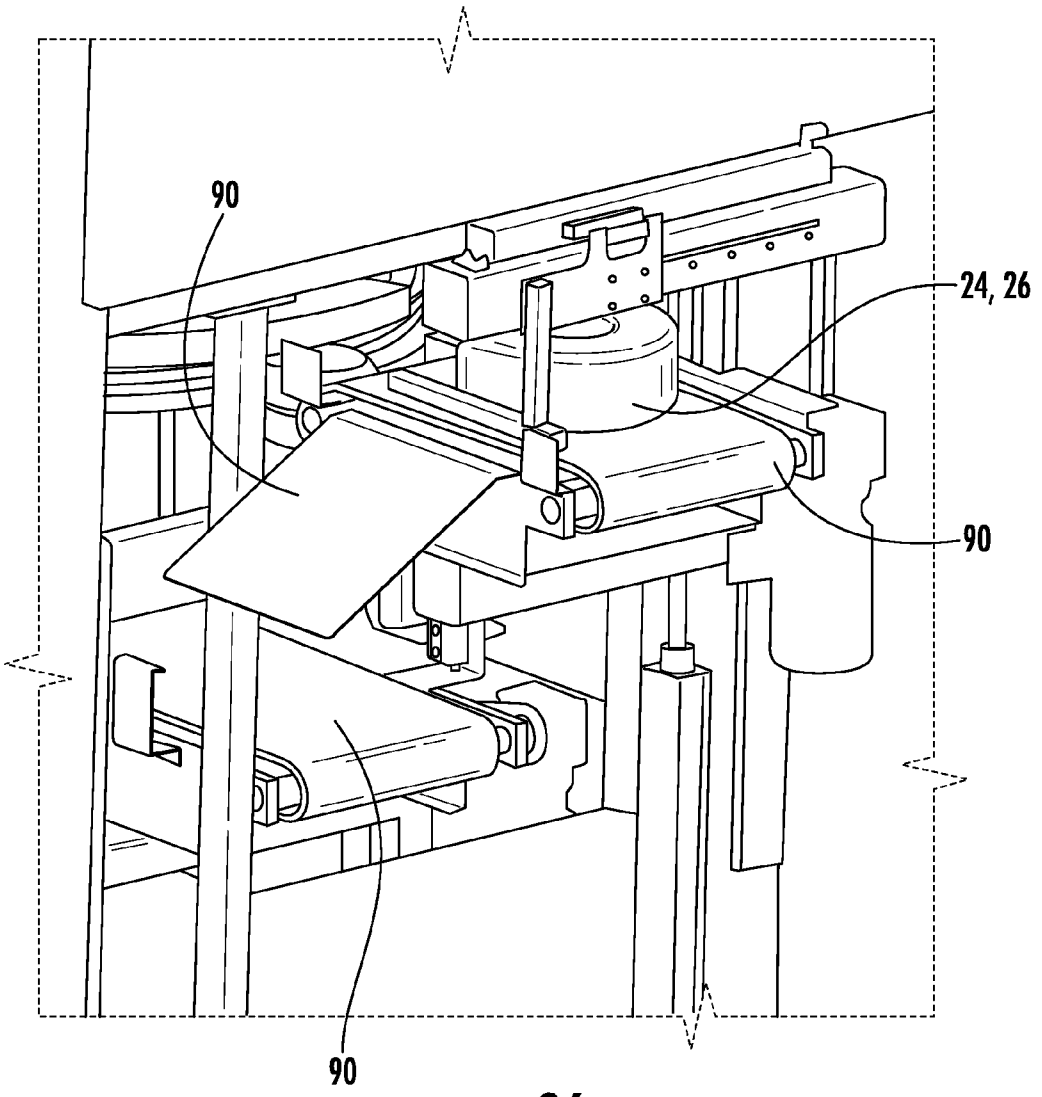


FIG. 26

SYSTEM AND METHOD FOR SECURING FREE END OF WOUND CABLE

CROSS-REFERENCE To RELATED APPLICATION

[0001] This application claims the benefit of priority to U.S. Provisional Patent Application No. 62/011,013 filed on Jun. 11, 2014, the entire disclosure of which is incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention relates generally to systems, apparatus and methods for securing the free end of wound cable. More particularly, the invention is a system and method for securing the free end of a length of an elongate, flexible cable that is wound onto a spool by a spooling machine. The free end of the cable is secured using stretch wrap that is automatically applied to a spool of wound cable as the cable is being cut so that the leading end of the stretch wrap is nipped between the spool of wound cable and the free end of the cable. In an exemplary embodiment, the stretch wrap system is mounted horizontally and movable in a transverse direction to service at least two cable spooling stations on a spooling machine.

BACKGROUND OF THE INVENTION

[0003] It is common practice for lengths of elongate, flexible components, such as strands of wire, tubing or cable to be wound onto a spool. Oftentimes, the free end of the wound cable is retained on the spool by a relatively thin layer of stretch wrap that is wrapped around the spool after the desired length of cable has been wound onto the spool. Typically, the free end of the cable is temporarily held in place and a rotary arm is moved around a stationary spooling head to wrap the stretch wrap onto the spool of wound cable. The stretch-wrapped spool of wound cable is then removed from the spooling head of the spooling machine and transferred into a container or onto a pallet for transporting a plurality of the cable spools to an end user.

[0004] Spooling machines are known for automatically winding a length of elongate, flexible cable, for example coaxial cable or fiber optic cable, onto a spool and for automatically applying stretch wrap to the spool of wound cable. A spooling machine including fully automatic dual take-ups for on-line or off-line packaging of cable products is available from the Hall Industries division of the MGS Group having its corporate offices located in Rome, New York, USA. The MGS/Hall spooling machine includes two winding stations for winding a length of cable onto a spool and for applying a relatively thin layer of stretch wrap to the spool of wound cable to secure the free end of the cable onto the spool. Each winding station has a spooling head that is provided with a positive automatic stretch wrap applicator. The stretch wrap applicator operates to apply the stretch wrap to the spool of wound cable so that the starting end of the stretch wrap is positively pinched under the free end of the cable just prior to the conclusion of the winding cycle.

[0005] The automatic stretch wrap applicator provided at each winding station of the MGS/Hall spooling machine includes two clamps and a push-down roller. The first stretch wrap clamp operates to pull the starting end of the stretch wrap from a stretch wrap roll to a position that is relatively close to the spool of wound cable. The push-down roller next operates to move the stretch wrap to the opposite side of the wound cable. The second stretch wrap clamp then operates to grab the stretch wrap from the opposite side and to pull the stretch wrap back across the spool of wound cable. However, a number of disadvantages, deficiencies and problems are associated with the automatic stretch wrap applicator of the MGS/Hall spooling machine. The MGS/Hall stretch wrap applicator requires an excessive number of separate components, which results in high cost and reduced reliability of the applicator. In addition, the MGS/Hall stretch wrap applicator does not pull the stretch wrap between layers of the wound cable. Therefore, the relatively thin layer of stretch wrap can slip on a wound cable having an excessively smooth or slick jacket, and as a result, not be pulled around the spool of wound cable. As previously mentioned, the MGS/Hall spooling machine utilizes two vertically oriented spooling heads and requires a separate stretch wrap applicator for each spooling head. Since the spooling heads are oriented vertically, the free end of the cable can bend downwardly under the influence of gravity relative to the feed direction of the stretch wrap. Thus, the free end of the cable can extend outwardly from beneath the stretch wrap and potentially snag causing premature removal of the stretch wrap. Furthermore, the use of a separate stretch wrap applicator for each of the two spooling heads unnecessarily duplicates components of the spooling machine and increases acquisition, maintenance and operating costs.

SUMMARY OF THE INVENTION

[0006] The present invention is a system and method for winding a length of cable onto a spool and automatically applying stretch wrap onto the spool of wound cable to secure the free end of the cable on the spool. More particularly, the invention is a stretch wrap applicator for a spooling machine having two spooling heads and a method for applying stretch wrap onto a spool of wound cable at each spooling head to secure the free end of the cable on the spool.

[0007] In one aspect, the invention is embodied by a system including a spooling machine having at least one spooling head for winding a length of an elongate, flexible component onto a spool and a stretch wrap applicator configured for and operable for securing a free end of the elongate, flexible component on the spool with stretch wrap. The stretch wrap applicator pinches the stretch wrap between the free end and outermost windings of the elongate flexible component wound on the spool. In one embodiment, the spooling machine has two spooling heads and the stretch wrap applicator is mounted on the spooling machine for transverse movement relative to the spooling heads. The spooling machine may have a rail and a drive mechanism and the stretch wrap applicator may be operably coupled with the drive mechanism for transverse movement along the rail relative to the two spooling heads. The two spooling heads of the spooling machine may be positioned at transversely spaced-apart locations along the rail and the stretch wrap applicator may be operable for transverse movement between the spooling heads. In another embodiment, the stretch wrap applicator includes a pulling clamp configured for and operable for being moved from an initial position around the free end of the elongate, flexible component wound on the spool and into engagement with a starting end of the stretch wrap. The pulling clamp is further configured for and operable for moving back to the initial position while gripping the starting end of the stretch wrap such that the stretch wrap is disposed

between the free end and the outermost windings of the elongate, flexible component wound on the spool. The pulling clamp is further configured for and operable for moving downwardly relative to the elongate, flexible component wound on the spool so that the stretch wrap is pinched within a nip defined between the outermost windings of the elongate, flexible component and the free end of the elongate, flexible component.

[0008] In another aspect, the invention is embodied by a stretch wrap applicator for a spooling machine having at least one spooling head. The stretch wrap applicator includes a housing, a roll of stretch wrap disposed within the housing and a pulling clamp configured for and operable for gripping and pulling a starting end of the roll of stretch wrap so as to position the stretch wrap between a spool of wound cable having outermost windings and a free end of the cable wound on the spool. The stretch wrap is pinched within a nip defined by the outermost windings of the cable wound on the spool and the free end of the cable. The pulling clamp is further configured for and operable for moving downwardly relative to the spool of wound cable so as to dispose the stretch wrap between the outermost windings of the cable wound on the spool and the free end of the cable. In one embodiment, the pulling clamp is mounted on an angled rail that is movably attached to the housing with a predetermined angle such that the pulling clamp and a starting end of the stretch wrap are moved in a generally tangential direction relative to an outer periphery of the cable wound on the spool. The pulling clamp is further configured for and operable for releasing the starting end of the stretch wrap in contact with at least a portion of the outermost windings of the cable wound on the spool so that the stretch wrap disposed between the outermost windings of the cable and the free end of the cable is wrapped around the spool as the remaining length of the cable is wound onto the spool.

[0009] In yet another aspect, the invention is embodied by a method for securing the free end of an elongate, flexible component wound onto a spool. The method includes providing a spooling machine having at least one spooling head for winding a length of the elongate, flexible component onto the spool and providing a stretch wrap applicator operably coupled with the at least one spooling head for applying stretch wrap to the elongate, flexible component wound on the spool. The stretch wrap applicator includes a pulling clamp and a length of the stretch wrap. The method further includes moving the pulling clamp from an initial position around a free end of the elongate, flexible component wound on the spool. The method further includes gripping a starting end of the stretch wrap with the pulling clamp. The method further includes moving the pulling clamp and the starting end of the stretch wrap back to the initial position with the stretch wrap disposed between the free end of the elongate, flexible component and outermost windings of the elongate, flexible component. The method further includes moving the pulling clamp in a downward direction so as to pinch the stretch wrap within a nip defined between the outermost windings of the elongate, flexible component and the free end of the elongate, flexible component. The method further includes cutting the free end of the elongate, flexible component and wrapping the stretch wrap around the outermost windings of the elongate, flexible component until the free end of the elongate, flexible component is secured by the stretch wrap. In one embodiment, the spooling machine includes two spooling head and a transverse rail and the stretch wrap applicator is configured for and operable for moving in a transverse direction along the rail relative to the spooling heads. The stretch wrap applicator moves between a first spooling head of the spooling machine and a second spooling head of the spooling machine subsequent to securing the free end of the elongate, flexible component wound on a spool of the first spooling head. In another embodiment, the pulling clamp is mounted on an angled rail that is movably attached to the housing with a predetermined angle such that the pulling clamp and a starting end of the stretch wrap are moved in a generally tangential direction relative to an outer periphery of the cable wound on the spool.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. **1** is a front perspective view of a stretch wrap applicator for a spooling machine having two spooling heads that is operable for automatically applying stretch wrap to a spool of wound cable according to an exemplary embodiment of the invention.

[0011] FIG. **2** is a rear perspective view illustrating the stretch wrap applicator of FIG. **1** moving transversely relative to the spooling heads to locate the stretch wrap applicator adjacent to one of the spooling heads having a length of cable wound on a spool.

[0012] FIG. **3** is a rear perspective view illustrating the stretch wrap applicator of FIG. **1** moving transversely relative to the one of the spooling heads to locate the stretch wrap applicator in line with the free end of the wound cable.

[0013] FIG. **4** is a rear perspective view illustrating the stretch wrap applicator of FIG. **1** moving the pulling clamp from an initial position around the free end of the wound cable and into engagement with the starting end of the stretch wrap.

[0014] FIG. **5** is a detailed rear perspective view showing the pulling clamp of the stretch wrap applicator of FIG. **1** in gripping engagement with the starting end of the stretch wrap.

[0015] FIG. **6** is a rear perspective view illustrating the pulling clamp of the stretch wrap applicator of FIG. **1** being moved back to the initial position such that the stretch wrap is disposed between the spool and the free end of the wound cable.

[0016] FIG. **7**A is a front perspective view illustrating the pulling clamp of the stretch wrap applicator of FIG. **1** being moved downwardly relative to the spool of wound cable such that the stretch wrap is pinched within a nip defined by the outermost windings of the cable and the free end of the wound cable.

[0017] FIG. **7**B is a rear perspective view corresponding to the front perspective view of FIG. **7**A.

[0018] FIG. **8** is a front perspective view illustrating the puling clamp of the stretch wrap applicator of FIG. **1** releasing the starting end of the stretch wrap such that the stretch wrap will be wrapped around the spool of wound cable by the free end of the cable being wound onto the spool.

[0019] FIG. **9** is a rear perspective view illustrating the stretch wrap applicator of FIG. **1** cutting the free end of the cable and then subsequently winding the free end of the cable onto the spool beneath the stretch wrap as the stretch wrap is wrapped around the spool of wound cable.

[0020] FIG. **10** is a rear perspective view illustrating the stretch wrap applicator of FIG. **1** moving transversely relative to the spooling head of the spooling machine to thereby wrap the spool of wound cable with the stretch wrap entirely from one outer flange to the other outer flange.

[0021] FIG. **11** is a rear perspective view illustrating the spool of wound cable wrapped with the stretch wrap transversely between one outer flange and the other outer flange.

[0022] FIG. **12** is a rear perspective view illustrating the stretch wrap applicator of FIG. **1** moving the stretch wrap cutter into a cutting position relative to the finishing end of the stretch wrap.

[0023] FIG. **13** is a rear perspective view showing the finishing end of the stretch wrap being cut by the stretch wrap cutter of the stretch wrap applicator of FIG. **1** and subsequently being wrapped around the spool of wound cable to thereby secure the free end of the wound cable so that the finished spool may be removed from the spooling machine.

[0024] FIG. **14** is a rear perspective view illustrating the stretch wrap applicator of FIG. **1** moving transversely relative to the two spooling heads of the spooling machine to locate the stretch wrap applicator adjacent to the other one of the spooling heads having a length of cable wound on a spool.

[0025] FIG. **15** is a perspective view of a stretch wrap applicator for applying stretch wrap to a coil of a desired length of cable wound onto a spool according to another exemplary embodiment of the present invention.

[0026] FIG. **16** is a perspective view showing the coil engaged by a pair of side grippers of the stretch wrap applicator of FIG. **15**.

[0027] FIG. **17** is a perspective view showing the free end of the cable engaged by a cable end holder of the stretch wrap applicator of FIG. **15**.

[0028] FIGS. **18-23** are perspective views illustrating the stretch wrap sequence for applying stretch wrap to the coil of wound cable using the stretch wrap applicator of FIG. **15**.

[0029] FIGS. **24-26** are perspective views illustrating the coil of wound cable wrapped with stretch wrap moving from the stretch wrap applicator of FIG. **15** to a driven conveyor system for delivering the stretch wrapped coil to a container or a pallet for storage and transport.

DETAILED DESCRIPTION OF VARIOUS EMBODIMENTS OF THE INVENTION

[0030] Referring now to the accompanying drawings, in which like reference characters in the drawing figures refer to the same or similar parts, a spooling machine, indicated generally at **10**, having two spooling heads, each indicated generally at **20** with the corresponding winder not depicted for purposes of clarity, and a stretch wrap applicator, indicated generally at **30**, is shown in FIGS. **1-14**. The single stretch wrap applicator **30** is configured for and operable to secure a free end **22** of a length of cable **24** wound onto a spool **26** by wrapping the spool of wound cable with stretch wrap **40** (see e.g., FIGS. **8-13**). In the exemplary embodiments shown and described herein, the stretch wrap applicator **30** is movable transversely relative to the two spooling heads **20** of the spooling machine **10** so that the single stretch wrap applicator is configured for and operable to service both spooling heads. However, as will be readily appreciated by those skilled in the art, if desired each spooling head **20** of the spooling machine **10** may be provided with a separate stretch wrap applicator **30** configured for and operative to secure the free end **22** of a length of cable **24** wound onto a spool **26** at each spooling head. Furthermore, the spooling machine **10**, including the stretch wrap applicator **30** may be configured for use with any elongate, flexible component, including without limitation wire, tubing or cable, to form a spool of the wound component, and to thereafter, wrap stretch wrap around the spool of the wound component to secure the free end of the elongate, flexible component on the spool. In preferred embodiments, the elongate, flexible component is a cable, such as coaxial cable or fiber optic cable. Those of ordinary skill will readily understand and appreciate that the spooling machine **10** and the stretch wrap applicator **30** may be used alone or in combination with one another in various other applications without departing from the scope of the invention, as broadly interpreted in light of this written description. For purposes of illustration only, the spooling machine **10** including the spooling heads **20** and the stretch wrap applicator **30** are shown and described herein for use with reference to coaxial or fiber optic cable **24** of the type commonly utilized by an end user in communications applications.

[0031] FIG. **1** shows a spooling machine **10** including two spooling heads **20** and a stretch wrap applicator **30** mounted for transverse movement on the spooling machine relative to the spooling heads. As shown, the spooling machine **10** comprises a transversely (i.e., generally horizontal) extending rail **12** and a drive mechanism **14**, such as a belt or chain driven by one or more rotating gears, pulleys or the like, configured for and operable for moving the stretch wrap applicator **30** along the rail transversely in a generally horizontal direction relative to the spools **26** of the spooling heads **20**.

[0032] FIG. **2** illustrates the stretch wrap applicator **30** being moved transversely relative to the spooling heads **20** of the spooling machine **10** to locate the stretch wrap applicator adjacent to one of the spooling heads on which a length of the cable **24** is being wound onto a spool **26** between a pair of outer flanges **28**. The opposing arrows depicted in certain of the drawing figures indicate the generally horizontal direction of movement of the stretch wrap applicator **30** relative to the spooling heads **20** of the spooling machine **10**.

[0033] FIG. **3** illustrates the stretch wrap applicator **30** moved transversely relative to the spooling heads **20** of the spooling machine **10** so as to position the stretch wrap applicator in line with the free end **22** of the cable **24** being wound onto the spool **26** between the outer flanges **28**.

[0034] FIG. **4** illustrates a pulling clamp **32** of the stretch wrap applicator **30** moved from an initial position shown in FIG. **3** around the free end **22** of the cable **24** being wound onto the spool **26**. The pulling clamp **32** is moved from the initial position into engagement with the starting end **42** of a roll of the stretch wrap **40** housed within an interior of a housing **34** of the stretch wrap applicator **30**. The pulling clamp **32** may be affixed to the starting end **42** of the stretch wrap **40** in any manner suitable for gripping the starting end sufficiently to unwrap the stretch wrap off the roll of stretch wrap, as will be described in greater detail hereinafter.

[0035] FIG. **5** is a detailed view showing the pulling clamp **32** disposed around the free end **22** of the cable **24** and in gripping engagement with the starting end **42** of the stretch wrap **40**.

[0036] FIG. **6** illustrates the pulling clamp **32** of the stretch wrap applicator **30** moved back to the initial position, while gripping the starting end **42** of the stretch wrap **40**, such that the stretch wrap is pulled behind the free end **22** of the cable **24**. As used herein, the term "behind" is intended to mean that the stretch wrap **40** is disposed between the fee end **22** of the cable **24** and the remaining length of the cable wound on the spool **26**. More particularly, the stretch wrap **40** is disposed between the free end **22** of the cable **24** and the outermost windings of the cable already wound onto the spool **26** between the outer flanges **28**.

[0037] FIG. **7**A is a front perspective view of the spooling machine **10** illustrating that the pulling clamp **32** of the stretch wrap applicator **30** is next moved downwardly relative to the spool **26** of wound cable **24**. The pulling clamp **32** may be moved downwardly in any suitable manner, such as mechanically, electrically or pneumatically. As shown herein, the pulling clamp **32** is mounted on an angled rail **36** that is movably attached to the housing **34** of the stretch wrap applicator **30** with a predetermined angle such that the pulling clamp **32** and the starting end **42** of the stretch wrap **40** are moved in a generally tangential direction relative to the periphery of the cable **24** wound on the spool **26**. In this manner, the stretch wrap **40** is pulled downwardly relative to the spool **26** so as to be pinched within a nip defined between the outermost windings of the cable **24** already wound on the spool and the free end **22** of the cable.

[0038] FIG. **7**B is a rear perspective view of the spooling machine **10** illustrating the stretch wrap **40** disposed between the outermost windings of the cable **24** and the free end **22** of the cable.

[0039] FIG. **8** is a front perspective view of the spooling machine **10** illustrating the stretch wrap **40** released by the pulling clamp **32** of the stretch wrap applicator **30** with the stretch wrap in contact with at least a portion of the outermost windings of the cable **24** wound on the spool **26**. In this manner, the stretch wrap **40** disposed between the outermost windings of the cable **24** and the free end **22** of the cable is next wrapped around the spool **26** of wound cable as the remaining length of the free end of the cable is being wound onto the spool.

[0040] FIG. **9** shows the free end **22** of the cable **24** is cut so that the free end of the cable will be disposed beneath the stretch wrap **40** as the stretch wrap continues to be wrapped around the spool **26** of wound cable.

[0041] If desired, the stretch wrap **40** may be moved across the spool **26** of wound cable **24** between the outer flanges **28** of the spool so that the entire width of cable on the spool is covered by the stretch wrap as the stretch wrap is wrapped around the spool. FIG. **10** shows the stretch wrap **40** optionally being moved across the width of the spool **26** to traverse the cable **24** wound on the spool and thereby wrap the entire spool of wound cable with the stretch wrap. FIG. **11** is a rear perspective view showing the entire width of the cable **24** wound onto the spool **26** and optionally wrapped with the stretch wrap **40**.

[0042] FIG. **12** is a rear perspective view showing a stretch wrap cutter **38** of the stretch wrap applicator **30** located in a position to cut a finishing end **44** of the stretch wrap **40**. The stretch wrap cutter **38** may be any suitable means for cutting stretch wrap **40**, such as a blade, hot knife or the like. As shown herein, stretch wrap cutter **38** is a heated cutter configured for and operative to cut the finishing end **44** of the stretch wrap **40** at a desired position so that the pulling clamp **32** of the stretch wrap applicator **30** can subsequently grip another starting end **42** of the stretch wrap **40** for wrapping a length of cable **24** wound onto a subsequent spool **26**.

[0043] FIG. **13** is a rear perspective view showing the finishing end **44** of the stretch wrap **40** cut and wrapped around the cable **24** wound onto the spool **26**. As a result, the finished cable spool (i.e. a desired length of the cable **24** wound onto spool **26** and wrapped with stretch wrap **40**) is available to be removed from the spooling machine **10** and transferred to a shipping container, such as a corrugated box, or to a pallet for being transported with other finished cable spools to an end user, such as an installer of communications cable. Once the finished cable spool is removed from the spooling machine **10**, a subsequent spool **26** may be positioned on the spooling head **20** so as to receive the free end **22** of the cable **24** to be wrapped onto the spool and wrapped with the stretch wrap **40**, as previously described herein, and form another finished cable spool.

[0044] FIG. **14** is a rear perspective view illustrating the stretch wrap applicator **30** being moved transversely, in the manner previously described, to a location adjacent the other of the two spooling heads **20** of the spooling machine **10**. As such, the same stretch wrap applicator **30** is utilized to apply a relatively thin layer of the stretch wrap **40** onto a length of cable **24** wound onto a spool **26** at the other spooling head **20** of the spooling machine **10**. In this manner, there is no unnecessary duplication of components of the stretch wrap applicator **30**, thereby reducing the overall cost, complexity and maintenance of the stretch wrap applicator and the spooling machine **10**. Furthermore, the other spooling head **20** may be utilized to form the subsequent spool **26** of wound cable **24** while the stretch wrap applicator **30** is being utilized to apply (i.e., wrap) the first spool of wound cable with stretch wrap **40**.

[0045] A stretch wrap applicator **60** according to another exemplary embodiment of the present invention is shown in FIGS. **15-26**. The stretch wrap applicator **60** comprises a pair of servo-driven coil movers **62** operable for moving a length of cable **24** wound onto a spool **26** at a spooling head **20** of the spooling machine **10**. Hereinafter, the cable **24** wound onto the spool **26** is also referred to as coil **24**, **26**.

[0046] FIG. **15** shows the coil **24**, **26** gripped between the pair of coil movers **62** just before the length of cable **24** is cut. The coil movers **62** are positioned so as to grip the coil **24**, **26** as the cable **24** is cut to create a free end of the cable. If necessary, the coil **24**, **26** is rotated up to about one-quarter turn to locate the free end of the cable in an optimum position. When the coil **24**, **26** is properly positioned, the coil movers **62** move the coil downwards with the coil supported by a pair of side guides **64**.

[0047] As shown in FIG. **16**, when the coil **24**, **26** is low enough for a pair of side grippers **66** to clear the side guides **64**, the side grippers are engaged with the coil in a suitable manner, such as by a pneumatic cylinder. A position sensor, for example a Hall Effect sensor, may be utilized to identify that the side grippers **66** are in the correct position as they move upwards to engage the coil **24**, **26**. Ideally, the movement of the side grippers **66** into engagement with the coil **24**, **26** should be accomplished while the coil is being moved downwards without an additional interruption (stoppage) of the movement of the coil.

[0048] As shown in FIG. **17**, when the center **25** of the coil **24**, **26** clears the side guides **64**, a cable end holder **70** is engaged to hold the free end of the cable **24**. A position sensor, for example a Hall Effect sensor, may be utilized to indicate when the cable end holder **70** is in the proper position to engage the free end of the cable **24**. Ideally, the movement of the cable end holder **70** into engagement with the free end of the cable **24** should be accomplished while the coil **24**, **26** is being moved downwards without an additional interruption (stoppage) of the movement of the coil.

[0049] FIG. **18** shows the coil **24**, **26** in the stretch wrap position to begin the stretch wrap process. The starting end of the stretch wrap **40** is held by a gripper **72**. The stretch wrap **40** mounted on an orbiter **80** (e.g. rotary arm) is rotated

around the coil **24**, **26**, for example in a counter-clockwise direction. The orbiter **80** may comprise a belt drive **82**, a suitable motor, for example a 3 KW AC motor, and a pulse encoder in a known manner. The tension on the stretch wrap **40** may be controlled by a manually adjusted mechanical brake roller **88**. In addition, a guide **68** (see e.g., FIG. **19**) may be provided for guiding the stretch wrap **40** between the orbiter **80** and the gripper **72**. For purposes of convenience, the guide **68** may be disposed, for example, on the orbiter **80**.

[0050] As shown in FIG. **19**, just before the first revolution of the stretch wrap **40** on the orbiter **80** is completed, the gripper **72** tilts downward. As a result, the starting end of the stretch wrap **40** is secured by the next layer of the stretch wrap. As shown in FIG. **20**, when the starting end of the stretch wrap **40** is secured under the next layer of the stretch wrap, the gripper **72** releases the plastic stretch wrap and an air blower is used to force the free end of the cable **24** under the next layer of the stretch wrap.

[0051] As shown in FIG. **21**, when the stretch wrap **40** is on its final revolution, the open gripper **72** moves back upwards and the roll of stretch wrap **40** is stopped in its home position. As shown in FIG. **22**, the finishing end of the stretch wrap **40** is secured by the gripper **72** and the stretch wrap is cut in a suitable manner, for example by a blade, a hot knife or a hot wire driven in a suitable manner, for example by a pneumatic cylinder. The loose finishing end of the stretch wrap **40** is forced against the coil **24**, **26** by an air blower.

[0052] FIG. **23** shows that the cable end holder **70** can then release the free end of the cable **24**. An upper coil mover spade **74** is moved into position by a pneumatic cylinder to ensure that it is clear for the coil movers **62** to move upwards relative to the coil **24**, **26**. At this point in time, the coil **24**, **26** wrapped in stretch wrap **40** is held in place by the side grippers **66** alone, which are not visible in FIG. **23**.

[0053] FIG. **24** illustrates that when a side gripper valve is operated to release the pressure of the side grippers **66** on the stretch wrapped coil **24**, **26**, the side grippers are not yet opened. The coil **24**, **26** is then pushed out from between the side grippers **66** by suitable means, for example a pusher operated by a pneumatic cylinder. As a result, the stretch wrapped coil **24**, **26** slides down a guide **89** onto a driven conveyor system **90**, as shown in FIG. **25** and FIG. **26**. The pusher then moves back inwards and the side grippers **66** are opened so that the lower coil mover **62** can be moved upwards to repeat the cycle. FIG. **25** and FIG. **26** illustrate how the stretch wrapped coil **24**, **26** is moved along the driven conveyor system **90** and dropped into a container, such as a corrugated box (not shown) or onto a pallet for storage and transport, in a manner similar to that previously described with respect to stretch wrap applicator **30**.

[0054] The foregoing has described exemplary embodiments of a stretch wrap applicator for a spooling machine having one or more spooling heads for winding a desired length of cable onto a spool and wrapping the finished cable spool with stretch wrap to secure the free end of the cable on the spool. The exemplary embodiments of the present invention described herein are shown and/or illustrated in the accompanying drawing figures. In an exemplary embodiment, a single stretch wrap applicator is transversely moveable on the spooling machine relative to two spooling heads so that the stretch wrap applicator is usable with both of the spooling heads. The stretch wrap applicator includes a pulling clamp for gripping and pulling a starting end of the stretch wrap into a nip between the outermost windings of the cable already wound onto the spool and the free end of the cable. The stretch wrap is then wrapped around the spool of wound cable and the free end of the cable is cut and secured beneath the stretch wrap. In another exemplary embodiment, a stretch wrap applicator includes a pair of coil movers that position a coil of cable wound on a spool relative to the starting end of stretch wrap. The free end of the cable is secured while the stretch wrap mounted on a rotary arm is wrapped around the coil with the free end of the cable secured beneath the stretch wrap. The coil is then released and pushed onto a driven conveyor system to be delivered to a container or a pallet for storage and transport.

That which is claimed is:

1. A system, comprising:

a spooling machine having at least one spooling head for winding a length of an elongate, flexible component onto a spool; and

a stretch wrap applicator configured for and operable for securing a free end of the elongate, flexible component on the spool with stretch wrap;

wherein the stretch wrap is pinched between the free end and outermost windings of the elongate flexible component wound on the spool.

2. The system of claim **1**, wherein the spooling machine comprises two spooling heads and wherein the stretch wrap applicator is mounted on the spooling machine for transverse movement relative to the spooling heads.

3. The system of claim **2**, wherein the spooling machine further comprises a rail and a drive mechanism and wherein the stretch wrap applicator is operably coupled with the drive mechanism for transverse movement along the rail relative to the two spooling heads.

4. The system of claim **2**, wherein the two spooling heads of the spooling machine are positioned at transversely spaced-apart locations along the rail and wherein the stretch wrap applicator is operable for transverse movement between the spooling heads.

5. The system of claim **1**, wherein the stretch wrap applicator comprises a pulling clamp configured for and operable for being moved from an initial position around the free end of the elongate, flexible component wound on the spool and into engagement with a starting end of the stretch wrap.

6. The system of claim **5**, wherein the pulling clamp is affixed to the starting end of the stretch wrap sufficiently to unwrap the stretch wrap off a roll of the stretch wrap.

7. The system of claim **5**, wherein the pulling clamp is further configured for and operable for moving back to the initial position while gripping the starting end of the stretch wrap such that the stretch wrap is disposed between the free end of the elongate, flexible component and the remaining length of the elongate, flexible component wound on the spool.

8. The system of claim **7**, wherein the stretch wrap is disposed between the free end of the elongate, flexible component and outermost windings of the elongate, flexible component wound on the spool.

9. The system of claim **7**, wherein the pulling clamp is further configured for and operable for moving downwardly relative to the elongate, flexible component wound on the spool so that the stretch wrap is pinched within a nip defined between the outermost windings of the elongate, flexible component and the free end of the elongate, flexible component.

10. The system of claim **9**, wherein the pulling clamp is mounted on an angled rail and is moved downwardly along the angled rail such that the pulling clamp and the starting end of the stretch wrap are moved in a generally tangential direction relative to a periphery of the elongate, flexible component wound on the spool.

11. A stretch wrap applicator for a spooling machine having at least one spooling head, the stretch wrap applicator comprising:

a housing;

a roll of stretch wrap disposed within the housing; and

a pulling clamp configured for and operable for gripping and pulling a starting end of the roll of stretch wrap so as to position the stretch wrap between a spool of wound cable having outermost windings and a free end of the cable wound on the spool.

12. The stretch wrap applicator of claim **11**, wherein the stretch wrap is pinched within a nip defined by the outermost windings of the cable wound on the spool and the free end of the cable.

13. The stretch wrap applicator of claim **11**, wherein the pulling clamp is further configured for and operable for moving downwardly relative to the spool of wound cable so as to dispose the stretch wrap between the outermost windings of the cable wound on the spool and the free end of the cable.

14. The stretch wrap applicator of claim **13**, wherein the pulling clamp is mounted on an angled rail that is movably attached to the housing with a predetermined angle such that the pulling clamp and a starting end of the stretch wrap are moved in a generally tangential direction relative to an outer periphery of the cable wound on the spool.

15. The stretch wrap applicator of claim **14**, wherein the pulling clamp is further configured for and operable for releasing the starting end of the stretch wrap in contact with at least a portion of the outermost windings of the cable wound on the spool so that the stretch wrap disposed between the outermost windings of the cable and the free end of the cable is wrapped around the spool as the remaining length of the cable is wound onto the spool.

16. A method for securing the free end of an elongate, flexible component wound onto a spool, the method comprising:

providing a spooling machine having at least one spooling head for winding a length of the elongate, flexible component onto the spool;

providing a stretch wrap applicator operably coupled with the at least one spooling head for applying stretch wrap to the elongate, flexible component wound on the spool, the stretch wrap applicator comprising a pulling clamp and a length of the stretch wrap;

moving the pulling clamp from an initial position around a free end of the elongate, flexible component wound on the spool;

gripping a starting end of the stretch wrap with the pulling clamp;

moving the pulling clamp and the starting end of the stretch wrap back to the initial position with the stretch wrap disposed between the free end of the elongate, flexible component and outermost windings of the elongate, flexible component;

moving the pulling clamp in a downward direction so as to pinch the stretch wrap within a nip defined between the outermost windings of the elongate, flexible component and the free end of the elongate, flexible component; and

cutting the free end of the elongate, flexible component and wrapping the stretch wrap around the outermost windings of the elongate, flexible component until the free end of the elongate, flexible component is secured by the stretch wrap.

17. The method of claim **16**, wherein the spooling machine comprises two spooling heads and a transverse rail and wherein the stretch wrap applicator is configured for and operable for moving in a transverse direction along the rail relative to the spooling heads.

18. The method of claim **16**, wherein the stretch wrap applicator is configured for and operable for moving between a first spooling head of the spooling machine and a second spooling head of the spooling machine subsequent to securing the free end of the elongate, flexible component wound on a spool of the first spooling head.

19. The method of claim **16**, wherein moving the pulling clamp in a downward direction comprises mounting the pulling clamp on an angled rail that is movably attached to the housing with a predetermined angle such that the pulling clamp and a starting end of the stretch wrap are moved in a generally tangential direction relative to an outer periphery of the elongate, flexible component wound on the spool.

20. The method of claim **16**, further comprising releasing the starting end of the stretch wrap in contact with at least a portion of the outermost windings of the elongate, flexible component wound on the spool so that the stretch wrap disposed between the outermost windings of the elongate, flexible component and the free end of the elongate, flexible component is wrapped around the spool as the remaining length of the elongate, flexible component is wound onto the spool.

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