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(54) **WRAPPING APPARATUS HAVING TOP LOADING AND THREADING FILM DISPENSER**

EINWICKELVORRICHTUNG MIT VON OBEN BESCHICKBAREM UND EINFÄDELBAREM
FILMSPENDER

DISPOSITIF D'EMBALLAGE COMPORTANT UN DISTRIBUTEUR DE FILM A CHARGEMENT ET
MISE EN PLACE PAR LE HAUT

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Description

Technical Field

[0001] The present disclosure relates to a wrapping apparatus for wrapping a load with packaging material, and more particularly, to a wrapping apparatus having a top load packaging material dispenser.

Background

[0002] Various packaging techniques have been used to build a load of unit products and subsequently wrap them for transportation, storage, containment and stabilization, protection and waterproofing. Products may be stacked as a load on a pallet to simplify handling of the products. The load is commonly wrapped with stretch wrap packaging material. One system uses stretch wrapping machines to stretch, dispense and wrap stretch packaging material around a load. Stretch wrapping can be performed as an inline, automated packaging technique that dispenses and wraps packaging material in a stretch condition around a load to cover and contain the load. Stretch wrapping, whether accomplished by a turntable, rotating arm, or vertical rotating ring, typically covers the four vertical sides of the load with a stretchable film such as polyethylene film. In each of these arrangements, relative rotation is provided between the load and the packaging material dispenser to wrap packaging material about the sides of the load.

US 2007/0209324 A1, for example, describes an apparatus and method for wrapping a palletized load. The apparatus preferably includes a film dispenser for dispensing a film web, at least one drive down roller configured to engage the width of the film web, and at least one roping mechanism. The at least one roping mechanism may be a cable rolling element configured to roll a portion of the film web into a rolled cable of film. The apparatus may also include means for providing relative rotation between the load and the dispenser to wrap a roped portion of the film web around a base of the load/top portion of a pallet supporting the load.

US 4,302,920 A describes a process and apparatus for applying stretchable plastic film to loads for containment of the loads using two connected rollers driven by the film web so that the rollers are driven at different speeds to elongate the plastic film beyond its yield point and wrapping the elongated film after it has been stretched past its yield point around a rotating load. A roller can be added to the apparatus to increase the set time for the elongated film after it is stretched by the connected rollers. In addition, a web narrowing device may be placed upstream or downstream from the apparatus to reduce the hazard of edge tear under high elongation forces.

[0003] Such a stretch wrapping apparatus performs admirably in accomplishing its intended goal of wrapping a load with a stretched web of film. However, the procedure of threading the film web through the series of rollers

in the film web dispenser prior to operation of the stretch wrapping apparatus has been found to be time consuming and difficult. Conventional stretch wrapping apparatuses employ a film web dispenser having two closely spaced rollers to stretch between them a web of thermoplastic stretch film packaging material.

[0004] It is preferable that a stretch wrapping apparatus with pre-stretch rollers have the following features. The upstream and downstream pre-stretch rollers should be closely spaced during operation to prevent neckdown of the film web as it is being substantially stretched in the dispensing direction. Since the forces exerted on a wide web of stretch film between the pre-stretch rollers is very significant, in the order of 50 pounds of force, the frame and the mounting of the pre-stretch rollers should be required to be very sturdy. The surface of the pre-stretch rollers should be covered by the stretch film over a sufficient extent such that the stretch film does not slip on the pre-stretch rollers. The rotational inertia of the pre-stretch rollers should not be so high as to require excessively high power to vary their velocity. To accommodate these requirements, a series of idle rollers are used to support the stretch film proximate to the pre-stretch rollers. As a result, the film web follows a tortuous path around the closely spaced pre-stretch and idler rollers. The downstream pre-stretch roller has a faster surface speed than the upstream pre-stretch roller. This stretches the packaging material between the upstream and downstream pre-stretch rollers in the dispensing direction.

[0005] The increased numbers of rollers in the film dispenser for pre-stretch and the close spacing of such rollers with their effective interconnection for pre-stretching the film web prior to dispensing the film web on the load makes it very difficult to thread the film web through the pre-stretch portion of the film dispenser. Before operating a stretch wrapping apparatus having pre-stretch rollers, it is necessary to thread the stretch film along the tortuous path. This threading operation is difficult and time consuming since, due to the close spacing of the rollers, an operator cannot manually carry the stretch wrap packaging material between the rollers. Rather, the operator must feed the stretch wrap packaging material from one side of each roller nip with one hand and pull the stretch film from the other side of the roller nip with the other hand. This procedure is rendered considerably more difficult because of the large widths of the stretch wrap packaging material which are used commercially. Such webs generally have a width in the range of 10 to 30 inches. Other problems in threading resulted from the fact that the operator was required to place his fingers proximate to the nip of the rollers and blindly feed the film from the rear of the frame which carried the rollers, which made the threading operation difficult and more time consuming.

[0006] This threading problem was addressed in U.S. Pat. No. 4,747,254 to Lancaster, issued May 31, 1988, and entitled "Web Threading Device," the entire disclosure of which is incorporated herein by reference. This

earlier arrangement reduced the difficulty of threading a web along a tortuous path by using a retractable leader which ran generally parallel to the path of the film web around the rollers to lead the film along the path. However, this arrangement required the leading end of the film web to be attached to the leader and the leader to be slowly pulled through the tortuous path while rotating the pre-stretch rollers, releasing the film web from the leader and retracting the leader.

[0007] Pre-stretch roll carriages include at least two coated pre-stretch rollers and additional rollers which are necessary for achieving the necessary film path. The pre-stretch rollers are mounted on shafts through bearings on each end. One end has a sprocket or pulley for connecting the rollers to each other and to the drive motor. The guiding rollers are also supported at both ends. Many prior art pre-stretch roll carriages "split" either vertically or horizontally to facilitate film threading around these multiple rollers. Examples of such prior art can be seen in numerous issued patents. Virtually all prior art pre-stretch roll carriages utilize a "W" threading pattern around the pre-stretch rollers which rotate in the same direction.

[0008] For example, a convention pre-stretch roll carriage includes first and second upper frame portions, first and second lower frame portions, and first and second side frame portions. The first frame portions form a first side of a frame, and the second frame portions form a second side of the frame. The first and second sides of the frame are pivotable relative to one another around a hinge. This "split frame" is necessary to permit threading of the film between the first and second sides of the frames and the rollers supported therein. However, splitting or opening the frame each time a roll is loaded, or each time that threading of the film is to be carried out, can be laborious, and can lead to increases in machine downtime.

[0009] An attempt to simplify the threading process is exemplified in very early pre-stretch roll carriage produced by Lantech. The roll carriage utilized two pre-stretch rollers cantilevered and supported only at the top of the roll carriage, such that the bottoms of the rollers were unsupported and unconnected to any structure. This prior art device utilized an "S" threading pattern around the pre-stretch rollers, which rotated in opposite directions. This roll carriage could be threaded from the bottom without the necessity for additional idle rollers or mechanical split of the roller supports. This design was unsuccessful due to very significant problems in dealing with the forces exerted on the unsupported rollers. The forces caused deformation of the rollers and the misalignment of the gears used to maintain relative speeds of the two pre-stretch rollers.

[0010] One way to address deformation and misalignment problems is described in U.S. Patent Application Publication No. 2006/0254225 A1, entitled "Stretch Wrapping Apparatus Having Film Dispenser With Pre-stretch Assembly," filed March 9, 2006, and published

November 16, 2006, the entire disclosure of which is incorporated herein by reference. That disclosure describes a roll carriage frame including a drive plate, and a pre-stretch assembly including first and downstream pre-stretch rollers. A first end of each of the pre-stretch rollers is connected to the drive plate, while a second end of each of the pre-stretch rollers is connected to the second end of the other pre-stretch roller. The connection between the second ends helps to maintain the alignment of the pre-stretch rollers under the high forces generated during the pre-stretching of film. A cantilevered idle roller is positioned between the pre-stretch rollers. A space between the pre-stretch rollers and the idle roller forms a film path that is accessible for threading from the second ends of the pre-stretch rollers and a free end of the idle roller.

SUMMARY

[0011] Object of the invention is to solve one or more of the abovementioned problems.

[0012] This object is achieved by providing a film dispenser with the features of claim 1 and by providing a method with the features of claim 11.

[0013] In accordance with this disclosure, embodiments of a packaging material dispenser including a pre-stretch portion for pre-stretching packaging material as it is dispensed is provided. An apparatus for stretch wrapping a load including a packaging material dispenser having a pre-stretch portion for pre-stretching film as it is dispensed also is provided.

[0014] In accordance with this disclosure, a film dispenser is provided. The film dispenser may include an open top roll carriage having a base plate on which a film dispensing assembly, including an upstream roller and a downstream roller, is mounted. The open top roll carriage includes a first support configured to support an upper end of the upstream roller and a second support configured to support an upper end of the downstream roller. A film path for film travelling through the film-dispensing assembly may be at least partially defined by a surface of the upstream roller and a surface of the downstream roller. The film path is accessible via the open top of the roll carriage. The film dispenser also includes a drive assembly for the upstream roller and the downstream roller mounted below the base plate.

[0015] In accordance with yet another aspect of this disclosure, a method for wrapping a load is provided. The method includes inserting a length of film downward into a film path of a film dispensing assembly mounted on a base plate of a roll carriage. The film dispensing assembly includes an upstream dispensing roller and a downstream dispensing roller. The roll carriage includes a first support configured to support an upper end of the upstream dispensing roller and a second support configured to support an upper end of the downstream dispensing roller. The method also includes providing relative rotation between the film dispensing assembly and the

load. The method also includes driving the downstream dispensing roller of the film dispensing assembly to dispense film for wrapping the load using a drive assembly mounted below the base plate.

[0016] Additional objects and advantages of the disclosed embodiments will be set forth in part in the description that follows, and in part will be obvious from the description, or may be learned by practice of the embodiments. The objects and advantages of the embodiments may be realized and attained by means of the elements and combinations particularly pointed out in the appended claims.

[0017] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the features claimed.

[0018] The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate embodiments of the disclosure and together with the description, serve to explain the principles of the disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] FIG. 1 is an isometric view of a rotating arm of a wrapping apparatus and shows an embodiment of a packaging material dispenser mounted on the arm, according to an aspect of the disclosure;

[0020] FIG. 2 is an enlarged isometric view of the packaging material dispenser of FIG. 1;

[0021] FIG. 3 is a top view of the packaging material dispenser of FIG. 2;

[0022] FIG. 4 is a bottom view of the packaging material dispenser of FIG. 2;

[0023] FIG. 5 is a front view of the packaging material dispenser of FIG. 2;

[0024] FIG. 6 is a side view of the packaging material dispenser of FIG. 2;

[0025] FIG. 7 is an isometric view of the packaging material dispenser of FIG. 2 from a different angle;

[0026] FIG. 8 is an isometric view of another embodiment of a packaging material dispenser, according to an aspect of the disclosure;

[0027] FIG. 9 is a top view of the packaging material dispenser of FIG. 8;

[0028] FIG. 10 is a front view of the packaging material dispenser of FIG. 8; and

[0029] FIG. 11 is a side view of the packaging material dispenser of FIG. 8.

DETAILED DESCRIPTION

[0030] Reference will now be made to the present exemplary embodiments of the disclosure, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

[0031] In accordance with the present disclosure, embodiments of an apparatus are provided, the apparatus being provided for wrapping a load with packaging material. The apparatus includes a packaging material dispenser having a pre-stretch assembly configured to pre-stretch the packaging material, and means for providing relative rotation between a load and the dispenser to wrap the pre-stretched packaging material around the load. The means may include a horizontal rotatable ring assembly, a vertical rotatable ring assembly, a rotatable turntable assembly, or a rotating arm assembly. The rotatable turntable assembly may include a low-profile turntable. As used herein and generally understood in the art, a low profile turntable is a rotatable turntable having a load support surface that is less than or equal to 3 inches above a floor surface supporting the turntable.

[0032] As embodied herein and shown in FIGS. 1-7, a stretch wrapping apparatus (not shown) includes a packaging material dispenser 100. Packaging material dispenser 100 may dispense a sheet of packaging material 102 in a web form. Packaging material dispenser 100 may include a roll carriage 104. Packaging material dispenser 100 may contain a roll 106 of packaging material 102 to be dispensed. A roll support 108 may be mounted on roll carriage 104 for this purpose. Roll support 108 may be constructed to rotatably support roll 106 as packaging material 102 unwinds, moving from roll 106 to a pre-stretch assembly 110.

[0033] In one embodiment, roll support 108 may include a cylindrical member 112 extending vertically therefrom, cylindrical member 112 being sized to be received within an aperture 114 extending axially through the center of roll 106. Roll 106 may rotate freely about cylindrical member 112 when packaging material 102 is being dispensed. Roll support 108 may be top-loaded, such that roll 106 may be loaded into packaging material dispenser 100 from above packaging material dispenser 100 by sliding roll 106 over a free end of cylindrical member 112. Roll support 108 may support a bottom end of roll 106 once roll 106 is loaded. It is also contemplated that roll support 108 may be offset vertically from roll carriage 104, to assist with roping a portion of packaging material 102.

[0034] In an exemplary embodiment, stretch wrap packaging material is used, however, various other packaging materials such as netting, strapping, banding, or tape can be used as well. As used herein, the terms "packaging material," "film," "web," and "film web" are interchangeable.

[0035] As embodied in FIGS. 1-7, packaging material dispenser 100 may include pre-stretch assembly 110. Pre-stretch assembly 110 may include an upstream pre-stretch roller 118 and a downstream pre-stretch roller 120. "Upstream" and "downstream," as used in this application, are intended to define the direction of movement relative to the flow of packaging material 102 from packaging material dispenser 100. Thus, since packaging material 102 flows from packaging material dispenser

100, movement toward packaging material dispenser 100 and against the flow of packaging material 102 from packaging material dispenser 100 is defined as "upstream," and movement away from packaging material dispenser 100 and with the flow of packaging material 102 from packaging material dispenser 100 is defined as "downstream." Upstream pre-stretch roller 118 and/or downstream pre-stretch roller 120 may be connected to a power source (not shown), such as a drive motor; however, they do not need to be, and upstream pre-stretch roller 118 and/or downstream pre-stretch roller 120 therefore may be powered or unpowered.

[0036] Upstream pre-stretch roller 118 and downstream pre-stretch roller 120 may be the same size, and each may have, for example, an outer diameter of approximately 2.5 inches. Alternatively, upstream pre-stretch roller 118 and downstream pre-stretch roller 120 may have different sizes, as shown in FIGS. 1-3, 5, and 7. Each of upstream pre-stretch roller 118 and downstream pre-stretch roller 120 may have a sufficient length to carry a twenty (20) inch wide web of packaging material 102 along their working lengths. In one exemplary embodiment, rollers used for conventional conveyors were used to form upstream pre-stretch roller 118 and downstream pre-stretch roller 120.

[0037] As shown in FIGS. 2, 5, and 6, upstream pre-stretch roller 118 and downstream pre-stretch roller 120 may be mounted on shafts 122 and 124, respectively, which may be hex shafts. Bearings 126, 128, 130, and 132, for supporting shafts 122 and 124, may be press-fit or welded into each end of upstream pre-stretch roller 118 and downstream pre-stretch roller 120, and shafts 122 and 124 may be placed therethrough, such that shafts 122 and 124 may be centrally and axially mounted through the lengths of upstream pre-stretch roller 118 and downstream pre-stretch roller 120. Shafts 122 and 124 may act as the rotational axes of upstream pre-stretch roller 118 and downstream pre-stretch roller 120. Upstream pre-stretch roller 118 and downstream pre-stretch roller 120 may be cantilevered rollers, in that a first end of each of shafts 122 and 124 may be fixed to or supported by a base plate of roll carriage 104, while a second end of each of shafts 122 and 123 may be unsupported, or supported by first and second supports 134 and 136. In the latter case, shafts 122 and 123 are supported in such a way as to provide a film path for packaging material 102 to be brought into engagement with upstream pre-stretch roller 118 and downstream pre-stretch roller 120 that is freely accessible from above upstream pre-stretch roller 118 and downstream pre-stretch roller 120 despite the supports.

[0038] As embodied in FIGS. 4 and 5, a sprocket 138 may be mounted on/attached to upstream pre-stretch roller 118, and similarly, a sprocket 140 may be mounted on/attached to downstream pre-stretch roller 120. Sprockets 138 and 140 may be housed in a drive housing 142 below roll carriage 104. This creates a low-profile drive design, which allows packaging material dispenser

100 to move through a wide range of vertical positions. Additionally, positioning roll carriage 104 above drive housing 142 allows roll carriage 104 to be used to prevent debris from entering into drive housing 142.

[0039] Upstream pre-stretch roller 118 and downstream pre-stretch roller 120 (and sprockets 138 and 140) may be connected to each other through a drive belt 144, and also to a drive motor (not shown). Drive belt 144 may include, for example, a belt, a chain, a cable, one or more gears, and/or any other suitable connection. As shown in FIGS. 4-6, drive belt 144 may be looped around sprockets 138 and 140, with one side of drive belt 144 engaging sprocket 138, and another side of drive belt 144 engaging sprocket 140. As a result of this arrangement, upstream pre-stretch roller 118 and downstream pre-stretch roller 120 rotate in opposite directions. Sprockets 138 and 140 may be selected to produce a desired level of pre-stretch in packaging material 102. For example, sprockets 138 and 140 may be selected such that pre-stretch assembly 110 may maintain a surface speed of downstream pre-stretch roller 120 at a speed that is faster than the speed of upstream pre-stretch roller 118, to stretch packaging material 102 between upstream pre-stretch roller 118 and downstream pre-stretch roller 120. It is contemplated that a clutch mechanism (not shown) may be provided to allow an operator to manually rotate upstream pre-stretch roller 118 and/or downstream pre-stretch roller 120, when the drive motor is not running.

[0040] Positioning the low-profile drive components, such as drive housing 142, sprockets 138 and 140, and drive belt 144 below roll carriage 104 allows the top of roll carriage 104 to be open, thus making the film path freely accessible from above upstream pre-stretch roller 118 and downstream pre-stretch roller 120. Attempting to use conventional drive components to provide the open top, instead of the low-profile drive components, may not be feasible for a few reasons.

[0041] Impacts between bottom-mounted drive components and an object, such as, for example, the ground, a conveyor, or a machine part, may cause damage, resulting in machine downtime. Thus, a clearance must be maintained between the drive components and the object, so that impacts can be avoided. Providing that clearance requires moving the drive components vertically higher relative to a load wrapping surface to provide a clearance distance between the drive components and the object. The packaging material dispensing components on the roll carriage, being positioned above the drive components, must also be moved vertically higher by at least the sum of the clearance distance and the thickness of the drive components. The thicker the drive components, the farther away the packaging material dispensing components are from the load wrapping surface.

[0042] If the packaging material dispensing components are too high relative to the load wrapping surface, they may have difficulty wrapping the bottom surfaces of a load on the load wrapping surface. Even greater diffi-

culties arise if roping assemblies are used to rope up the packaging material before it reaches the load, since roping assemblies may drive the packaging material even higher away from the load wrapping surface. While the use of drive down rollers may help drive the packaging material downward, its capacity to drive down has a limit. When that limit is exceeded, it may not be able to drive the packaging material down any further, or may fail to operate in a desired manner.

[0043] One way to avoid such problems associated with bottom-mounted drive components is by eliminating mechanical drive components, so that packaging material dispensing rollers mounted on the roll carriage are driven by separate motors controlled by a microprocessor unit. Such an arrangement, however, would increase the complexity and cost of a system.

[0044] The overall vertical thickness of low-profile drive components, such as drive housing 142, sprockets 138 and 140, and drive belt 144, allows those components to be mounted below roll carriage 104 (enabling the open top), while avoiding the above-described drawbacks. This is because the vertical thickness of the low-profile drive components is less than that of conventional components. Thus, packaging material 102 can be dispensed at a height closer to the bottom surfaces of a load than would be possible using conventional components. In addition, offsetting the height of roll support 108 relative to roll carriage 104 helps to compensate for the vertical thicknesses of drive housing 142, sprockets 138 and 140, and drive belt 144.

[0045] As embodied in FIGS. 1-3 and 5-7, first and second supports 134 and 136 may extend from roll carriage 104, or from any other suitable structure that is fixed relative to roll carriage 104. In one embodiment, first support 134 may include a bent plate or bracket with a fixed end coupled to a surface on or near an upper portion of roll carriage 104, and a free end configured to receive shaft 122; and second support 136 may include a vertical support 146 coupled to and extending from the base plate of roll carriage 104, and a horizontal support 148 having a fixed end coupled to vertical support 146. A free end of horizontal support 148 may be configured to receive shaft 124. Mounting the first ends of shafts 122 and 124 to roll carriage 104, and providing first and second supports 134 and 136 to support the second ends of shafts 122 and 124, may help to ensure that upstream pre-stretch roller 118 and downstream pre-stretch roller 120 maintain their alignment even under high forces that may be generated during pre-stretching of packaging material 102. This design may also permit easy threading of packaging material fully around upstream pre-stretch roller 118, downstream pre-stretch roller 120, an upstream idle roller 150, a first downstream idle roller 152, a second downstream idle roller 154, and a third downstream idle roller.

[0046] Upstream idle roller 150, first downstream idle roller 152, second downstream idle roller 154, and third downstream idle roller, may each be cantilevered from

the base plate of roll carriage 104, as shown in FIGS. 1-7. Any or all of upstream idle roller 150, first downstream idle roller 152, second downstream idle roller 154, and third downstream idle roller 156 may be the same diameter as or smaller in diameter than upstream pre-stretch roller 118 or downstream pre-stretch roller 120. Upstream idle roller 150, first downstream idle roller 152, second downstream idle roller 154, and third downstream idle roller 156 may be coated or uncoated. As with upstream pre-stretch roller 118 and downstream pre-stretch roller 120, upstream idle roller 150, first downstream idle roller 152, second downstream idle roller 154, and third downstream idle roller 156, should have a sufficient length to carry a twenty (20) inch wide web of packaging material 102 along their working lengths. It is contemplated that upstream idle roller 150 and first downstream idle roller 152 may be cantilevered rollers, in that upstream idle roller 150 and first downstream idle roller 152 may be supported at a first lower end by roll carriage 104, but may not be supported at a second upper end, opposite the first lower end, by additional support structure. This arrangement allows packaging material 102 to be easily threaded through pre-stretch assembly 110 from the open top of roll carriage 104. Second downstream idle roller 154 and third downstream idle roller 156 may be supported on one or both ends by other structures in packaging material dispenser 100.

[0047] Third downstream idle roller 156 may be selectively tiltable from the vertical position shown in FIGS. 1-5 and 7, to a tilted position, such that an angle is formed between the longitudinal axis of third downstream idle roller 156 in the vertical position, and the longitudinal axis of third downstream idle roller 156 in the tilted position. Third downstream idle roller 156 may be actuated into a tilted position, thus driving down packaging material 102 from a first elevation to a second elevation, lower than the first elevation, before applying packaging material 102 to the load being wrapped. By driving down packaging material 102, third downstream idle roller 156 may position at least a portion of packaging material 102 at an elevation lower than the bottom of a load and the top of a pallet supporting the load, thus helping to secure the load to the pallet. Thus, packaging material dispenser 100 does not have travel as low vertically to secure the load to the pallet, which may be beneficial, since drive housing 142 should be kept above the ground or any other support surfaces. One example of how third downstream idle roller 156 can be actuated into the tilted position can be found in U.S. Patent Application Publication No. 2007/0209324 A1, entitled "Method and Apparatus for Securing a Load to a Pallet With a Roped Film Web," filed February 23, 2007, and published September 13, 2007.

[0048] A film path is defined by and between the surfaces of upstream pre-stretch roller 118, downstream pre-stretch roller 120, upstream idle roller 150, first downstream idle roller 152, second downstream idle roller 154, and third downstream idle roller 156. The film path is

easily accessible via the top of pre-stretch assembly 110, as shown in FIGS. 1-3 and 7. A rope of packaging material 102 may be pulled from roll 106, around upstream idle roller 150, between upstream idle roller 150 and upstream pre-stretch roller 118, around upstream pre-stretch roller 118, between upstream pre-stretch roller 118 and downstream pre-stretch roller 120, around downstream pre-stretch roller 120, in between downstream pre-stretch roller 120 and first downstream idle roller 152, around first downstream idle roller 152, between first downstream idle roller 152 and second downstream idle roller 154, over second downstream idle roller 154, over third downstream idle roller 156, and to the load. As shown in FIG. 3, the portion of the film path between upstream idle roller 150 and first downstream idle roller 152 has an S-configuration. It is contemplated that at least one of first, second, and third downstream idle rollers 152, 154, and 156, may be mounted as a "dancer" and may be used to sense any slack in packaging material 102 caused by a change in the size or shape of the load being wrapped, or a break in packaging material 102.

[0049] As embodied in FIGS. 1-7, packaging material dispenser 100 may also include an upstream roping assembly 158, and a downstream roping assembly 160. Upstream roping assembly 158, assisted by the offset between roll carriage 104 and roll support 108, may form a rope from bottom portion of packaging material 102 before packaging material 102 enters pre-stretch assembly 110. Downstream roping assembly 160 may create another rope, or reinforce the rope, after packaging material 102 leaves pre-stretch assembly 110. Thus, it should be apparent that by using the offset between roll carriage 104 and roll support 108, and upstream roping assembly 158, more of packaging material 102 may be formed into the rope than if the offset and upstream roping assembly 158 were not used. Additionally, if the offset was not used, and roll support 108 was level with the base plate of roll carriage 104, then roping up with upstream roping assembly 158 would drive the bottommost edge of packaging material 102 farther upward, thus requiring third downstream idle roller 156 to drive packaging material 102 farther downward in response to ensure that packaging material 102 can be wrapped around the bottom of the load and/or the top of a pallet supporting the load.

[0050] Roping may be carried out at any time during a wrapping cycle, including near the end of a wrapping cycle, to secure the bottom of the load to a pallet (not shown), or during an intermediate portion of a wrapping cycle, to wrap a roped web of packaging material 102 around the sides of the load. A rope may include a portion of packaging material 102 that is concentrated in a tightly compacted, and preferably somewhat round, shape. A rope may be a conventional rope of packaging material, which is gathered, compacted or compressed; or may be a rolled cable of packaging material 102. A more detailed explanation of the general structure, operation, and ben-

efits of various roping assemblies can be found in U.S. Patent Application Publication No. 2007/0209324 A1, entitled "Method and Apparatus for Securing a Load to a Pallet With a Roped Film Web," filed February 23, 2007, and published September 13, 2007.

[0051] Downstream roping assembly 160 may be placed immediately downstream of second downstream idle roller 154. This positioning of downstream roping assembly 160 creates a rolled cable of packaging material 102 that is capable of maintaining its structural integrity as a rope structure during and after wrapping of a load. Downstream roping assembly 160 and second downstream idle roller 154 may form a "rolled cable rolling means" for rolling a portion of packaging material 102 into a rolled cable. The rolled cable rolling means rolls an outer edge of packaging material 102 inward upon itself and toward the center of packaging material 102. The film is rolled upon itself to form a tightly rolled cable of film, or a high tensile rolled cable of film along an edge of the packaging material 102. Further, by placing downstream roping assembly 160 immediately downstream of second downstream idle roller 154, the rolling of packaging material 102 into a rolled cable may begin at a point upstream from second downstream idle roller 154. Additionally, downstream roping assembly 160 may serve to elevate the bottom edge of packaging material 102 before it is driven down by the tilting of third downstream idle roller 156, thus helping to prevent packaging material 102 from sliding off the bottom of third downstream idle roller 156, and causing other malfunctions. A more detailed explanation of the rolled cable rolling means can be found in U.S. Patent Publication No. 2005/0044812, entitled "Method and Apparatus for Securing a Load to a Pallet With a Roped Film Web," filed January 30, 2004, and published March 3, 2005.

It is contemplated that second downstream idle roller 154 may be coated to assist with roping.

[0052] According to one aspect of the disclosure, means for providing relative rotation between a load and packaging material dispenser 100 may be provided. The means for providing relative rotation may include, for example, a rotatable turntable (not shown). In such an embodiment, packaging material dispenser 100 may be mounted on a stationary mast (not shown) upon which packaging material dispenser 100 can be vertically driven and positioned to dispense packaging material 102 to spirally wrap the load, as the load rotates on the turntable. In such an embodiment, the low-profile design of drive housing 142, and the elements contained therein, provides packaging material dispenser 100 with the ability to wrap a bottom portion of the load, including a top portion of a pallet if the load is supported by a pallet, while remaining high enough above the turntable and/or a floor surface (not shown) supporting the turntable, to avoid interference with/from the turntable and/or the floor surface.

[0053] Alternatively, packaging material dispenser 100 may be vertically driven on a rotating arm 116, shown in

FIG. 1, to dispense packaging material 102 spirally about the load, as rotating arm 116 rotates about the load, and packaging material dispenser 100 moves vertically along rotating arm 116. It is also contemplated that packaging material dispenser 100 may be mounted on horizontal wrapping ring (not shown) to dispense packaging material 102 spirally about the load, as packaging material dispenser 100 rotates with the wrapping ring relative to the load. In the rotating arm and horizontal wrapping ring embodiments, a conveyor (not shown) may convey the load into and out of a wrapping area defined by the path of packaging material dispenser 100 around the load. In such embodiments, during wrapping, packaging material dispenser 100 must pass over the conveyor while rotating around the load. The low-profile design of drive housing 142, and the elements contained therein, as well as the offset between roll support 108 and roll carriage 104, provide packaging material dispenser 100 with the ability to wrap a bottom portion of the load, including a top portion of a pallet if the load is supported by a pallet, while remaining high enough above the conveyor to avoid interference with/from the conveyor.

[0054] As embodied herein and shown in FIGS. 8-11, a stretch wrapping apparatus (not shown) includes a packaging material dispenser 200. Packaging material dispenser 200 may dispense a sheet of packaging material 202 (see FIG. 10) in a web form. Packaging material dispenser 200 may include a roll carriage 204. Packaging material dispenser 200 may contain a roll 206 (see FIG. 10) of packaging material 202 to be dispensed. A roll support 208 may be mounted on roll carriage 204 for this purpose. Roll support 208 may be constructed to rotatably support roll 206 as packaging material 202 unwinds, moving from roll 206 to a pre-stretch assembly 210.

[0055] In one embodiment, roll support 208 may include a cylindrical member 212 extending vertically therefrom, cylindrical member 212 being sized to be received within an aperture 214 extending axially through the center of roll 206. Roll 206 may rotate freely about cylindrical member 212 when packaging material 202 is being dispensed. Roll support 208 may be top-loaded, such that roll 206 may be loaded into packaging material dispenser 200 from above packaging material dispenser 200 by sliding roll 206 over a free end of cylindrical member 212. Roll support 208 may support a bottom end of roll 206 once roll 206 is loaded.

[0056] As embodied in FIGS. 8-11, packaging material dispenser 200 may include pre-stretch assembly 210. Pre-stretch assembly 210 may include an upstream pre-stretch roller 216 and a downstream pre-stretch roller 218, that are in many ways similar to upstream pre-stretch roller 118 and downstream pre-stretch roller 120 of packaging material dispenser 100. However, upstream pre-stretch roller 216 and downstream pre-stretch roller 218 may be the same size, and each may have, for example, an outer diameter of approximately 2.5 inches.

[0057] Upstream pre-stretch roller 216 and down-

stream pre-stretch roller 218 may be mounted on shafts 220 and 222. Shafts 220 and 222 are similar to shafts 122 and 124, described above. In packaging material dispenser 200, upstream pre-stretch roller 216 and downstream pre-stretch roller 218 may be cantilevered rollers, in that a first end of each of shafts 220 and 222 may be fixed to or supported by a base plate of roll carriage 204, while a second end of each of shafts 220 and 222 may be unsupported. It is also contemplated that the second end of each of shafts 220 and 222 may be supported by a separate support member 232 coupled to an upper portion of roll carriage 204. In that case, support member 232 may support shafts 220 and 222 in such a way as to provide a film path for bringing packaging material 202 into contact with upstream pre-stretch roller 215 and downstream pre-stretch roller 218, freely accessible from above upstream pre-stretch roller 215 and downstream pre-stretch roller 218 despite the supports.

[0058] As embodied in FIGS. 8 and 10, a sprocket 234 may be mounted on/attached to upstream pre-stretch roller 216, and similarly, a sprocket 236 may be mounted on/attached to downstream pre-stretch roller 218. Sprockets 234 and 236 may be housed in a drive housing 238 below roll carriage 204. This creates a low-profile drive design, and prevents debris from entering into drive housing 238.

[0059] Sprockets 234 and 236 may be connected to each other through a drive belt 240, and also to a drive motor (not shown). Drive belt 240 may include, for example, a chain, a belt, a cable, one or more gears, and/or any other suitable connection. As shown in FIGS. 8, 10, and 11, drive belt 240 may be threaded around sprockets 234 and 236, with a first side of drive belt 240 engaging both of sprockets 234 and 236. This arrangement causes upstream pre-stretch roller 216 and downstream pre-stretch roller 218 may rotate in the same direction. Sprockets 234 and 236 may be selected based on the same criteria as sprockets 138 and 140. It is contemplated that a clutch mechanism (not shown) may be provided to allow an operator to manually rotate upstream pre-stretch roller 216 and/or downstream pre-stretch roller 218, when the drive motor is not running.

[0060] As embodied in FIGS. 8-11, a support member 232 may extend from the upper portion of roll carriage 204, or any other suitable structure fixed relative to roll carriage 204. In one embodiment, support member 232 may include a bent plate or bracket with a base member 242, fixed relative to roll carriage 204, that joins a first support 244 to a second support 246. A gap may exist between first support 244 and second support 246, allowing for threading of packaging material 202 from above upstream pre-stretch roller 216 and downstream pre-stretch roller 218, as is evident in FIG. 9. First support 244 may be configured to receive shaft 220. Second support 246 may be configured to receive shaft 222. Mounting the first ends of shafts 220 and 222 to roll carriage 204, and providing support member 232 to support the second ends of shafts 220 and 222, may help to ensure

that upstream pre-stretch roller 216 and downstream pre-stretch roller 218 maintain their alignment even under high forces that may be generated during pre-stretching of packaging material 202. This design may also permit easy threading of packaging material fully around upstream pre-stretch roller 216, downstream pre-stretch roller 218, an upstream idle roller 248, an intermediate idle roller 250, and a downstream idle roller 252.

[0061] Upstream idle roller 248, intermediate idle roller 250, and downstream idle roller 252, may each be cantilevered from roll carriage 204, as shown in FIGS. 8-11. Any or all of upstream idle roller 248, intermediate idle roller 250, and downstream idle roller 252, may be the same diameter as or smaller in diameter than upstream pre-stretch roller 216 or downstream pre-stretch roller 218. Upstream idle roller 248, intermediate idle roller 250, and downstream idle roller 252 may be coated or uncoated. As with upstream pre-stretch roller 216 and downstream pre-stretch roller 218, upstream idle roller 248, intermediate idle roller 250, and downstream idle roller 252, should have a sufficient length to carry a twenty (20) inch wide web of packaging material 202 along their working lengths. It is contemplated that upstream idle roller 248, intermediate idle roller 250, and downstream idle roller 252 may be cantilevered rollers, in that upstream idle roller 248, intermediate idle roller 250, and downstream idle roller 252 may be supported at a first lower end by roll carriage 204, but may not be supported at a second upper end, opposite the first lower end, by additional support structure. This arrangement allows packaging material 202 to be easily threaded through pre-stretch assembly 210 from the open top of roll carriage 204. Further, support member 232, being C-shaped, as shown in FIGS. 8 and 9, will not obstruct packaging material 202 during threading of pre-stretch assembly 210 from the open top of roll carriage 204.

[0062] A film path is defined by and between the surfaces of upstream pre-stretch roller 216, downstream pre-stretch roller 218, upstream idle roller 248, intermediate idle roller 250, and downstream idle roller 252. The film path is easily accessible via the top of pre-stretch assembly 210, as shown in FIGS. 8 and 9. A rope of packaging material 202 may be pulled from roll 206, around upstream idle roller 248, between upstream idle roller 248 and upstream pre-stretch roller 216, around upstream pre-stretch roller 216, between upstream pre-stretch roller 216 and intermediate idle roller 250, around intermediate idle roller 250, between intermediate idle roller 250 and downstream pre-stretch roller 218, around downstream pre-stretch roller 218, in between downstream pre-stretch roller 218 and downstream idle roller 252, downstream idle roller 252, and to the load. It should be evident from FIG. 9 that the portion of the film path between upstream idle roller 248 and downstream idle roller 252 has a W-configuration. It is contemplated that at least one of upstream idle roller 248, intermediate idle roller 250, and downstream idle roller 252, may be mounted as a "dancer" and may be used to sense any slack in

packaging material 202 caused by a change in the size or shape of the load being wrapped, or a break in packaging material 202.

[0063] According to one aspect of this disclosure, intermediate idle roller 250 may include an idle roller hingedly connected to roll carriage 204 and/or support member 232. As shown in FIGS. 8-10, intermediate idle roller 250 may be mounted in between upstream pre-stretch roller 216 and downstream pre-stretch roller 218, and may be movable outward, away from one or both of upstream pre-stretch roller 216 and downstream pre-stretch roller 218. Movement of intermediate idle roller 250 away from upstream pre-stretch roller 216 and/or downstream pre-stretch roller 218 provides access to the space between upstream pre-stretch roller 216 and downstream pre-stretch roller 218, to permit threading of packaging material 202 around upstream pre-stretch roller 216 and downstream pre-stretch roller 218.

[0064] As shown in FIG. 9, intermediate idle roller 250 may be positioned between upstream pre-stretch roller 216 and downstream pre-stretch roller 218, abutting one of upstream pre-stretch roller 216 and downstream pre-stretch roller 218, and spaced from the other of upstream pre-stretch roller 216 and downstream pre-stretch roller 218. Preferably intermediate idle roller 250 may be aligned to provide a pinching action on upstream pre-stretch roller 216, as shown in FIG. 9, and as disclosed in U.S. Patent No. 5,414,979 to Moore et al., issued May 16, 1995, and entitled "Stretch Wrapping Apparatus." This may reduce the amount of unsupported packaging material 202 by 100%. Reducing the amount of unsupported packaging material 202, reduces the amount of neckdown in the width dimension of packaging material 202. This generates a greater area of stretch of the film. In this embodiment, the inventors have noticed an almost complete elimination of film slippage on upstream pre-stretch roller 216.

[0065] Intermediate idle roller 250 may be biased against the pre-stretch roller which it is abutting, for example, against upstream pre-stretch roller 216. The hinged mounting of intermediate idle roller 250 permits packaging material 202 to bias intermediate idle roller 250 against upstream pre-stretch roller 216. This is achieved through the force vector resulting from the geometry of the mountings and force application by packaging material 202. Alternatively, the biasing may be achieved through the use of a spring or similar element (not shown).

[0066] The result of this arrangement is that intermediate idle roller 250 effectively acts like a pinch roller or press roller in relation to upstream pre-stretch roller 216. As a pinch roller or press roller, intermediate idle roller 250 effectively acts as an extension of upstream pre-stretch roller 216 by offering increased surface for traction to packaging material 202. In doing so, intermediate idle roller 250 pinches the film between itself and upstream pre-stretch roller 216 to offer greater traction. Increased traction of upstream pre-stretch roller 216 re-

duces the damage to packaging material 202 by decreasing the abrasion of packaging material 202. While intermediate idle roller 250 is shown abutting upstream pre-stretch roller 216, it is possible for intermediate idle roller 250 to instead abut downstream pre-stretch roller 218, or may abut neither of upstream pre-stretch roller 216 and downstream pre-stretch roller 218.

[0067] Packaging material dispenser 200 may also include an upstream roping assembly (not shown), and/or a downstream roping assembly (not shown), similar to those described with respect to packaging material dispenser 100.

[0068] According to one aspect of the disclosure, means for providing relative rotation between a load and packaging material dispenser 200 may be provided. The means for providing relative rotation may include, for example, a rotatable turntable (not shown). In such an embodiment, packaging material dispenser 200 may be mounted on a stationary mast (not shown) upon which packaging material dispenser 200 can be vertically driven and positioned to dispense packaging material 202 to spirally wrap the load as the load rotates on the turntable. In such an embodiment, the low-profile design of drive housing 238, and the elements contained therein, provides packaging material dispenser 200 with the ability to wrap a bottom portion of the load, including a top portion of a pallet if the load is supported by a pallet, while remaining high enough above the turntable and/or a floor surface (not shown) supporting the turntable, to avoid interference with/from the turntable and/or the floor surface.

[0069] Alternatively, packaging material dispenser 200 may be vertically driven on a rotating arm (not shown), to dispense packaging material 202 spirally about the load, as the rotating arm rotates about the load, and packaging material dispenser 200 moves vertically along the rotating arm. It is also contemplated that packaging material dispenser 200 may be mounted on a horizontal wrapping ring (not shown) to dispense packaging material 202 spirally about the load, as packaging material dispenser 200 rotates with the wrapping ring relative to the load. In the rotating arm and horizontal wrapping ring embodiments, a conveyor (not shown) may convey the load into and out of a wrapping area defined by the path of packaging material dispenser 200 around the load. In such embodiments, during wrapping, packaging material dispenser 200 must pass over the conveyor while rotating around the load. The low-profile design of drive housing 238, and the elements contained therein, provides packaging material dispenser 200 with the ability to wrap a bottom portion of the load, including a top portion of a pallet if the load is supported by a pallet, while remaining high enough above the conveyor to avoid interference with/from the conveyor.

[0070] Several benefits may be associated with packaging material dispensers 100 and 200. Roll carriages 104 and 204 provide for fast and reliable loading of rolls 106 and 206 during roll changes, and for fast and reliable

loading (threading) of packaging material 102 and 202 through pre-stretch assemblies 110 and 210. One of the reasons that loading is faster and more reliable is because packaging material dispensers 100 and 200 do not have doors that must be opened to load rolls 106 and 206 and to thread packaging material 102 and 202. Rolls 106 and 206 may be loaded from the open tops of roll carriages 104 and 204, and packaging material 102 and 202 may be threaded through the film path from the open tops. Also, less technique is required from an operator to load rolls 106 and 206, and packaging material 102 and 202, from the open tops as compared to conventional roll carriage assemblies. Another added benefit of loading from the open tops is that loading may be accomplished with packaging material dispensers 100 and 200 occupying a vertically low position, such as the usual position occupied at the end of a wrapping cycle after a bottom portion of the load has been wrapped. In conventional assemblies, the roll carriage usually must be raised from the vertically lower position to a height that is ergonomically convenient for the operator, so that the operator can to load and thread a new roll of packaging material. This raising can be time consuming and inconvenient. Yet another benefit is that the open top arrangements allow for threading of roped packaging material, which is stronger and more resistant to breakage than a non-roped web of packaging material. Additionally, the open top S-configuration and W-configuration require fewer parts than conventional assemblies, which may produce cost savings, and may reduce the weight of packaging material dispensers 100 and 200. Further, the parts that are required are less complex, and thus, less costly.

[0071] Additionally, roping packaging material 102 may provide packaging material 102 with extra strength, thus helping to prevent packaging material breaks. Further, by roping packaging material 102, if for some reason packaging material 102 is damaged (e.g., torn or punctured), the rope will help to carry the damaged portions. That is, the strength of the rope allows it to resist breaking, even when the non-roped portion of packaging material 102 is damaged. Thus, damaged portions of packaging material 102 can be carried through by the rope and applied to the load, which prevents the downtime associated with re-loading packaging material dispenser 100 after a complete break occurs.

[0072] Further, by driving down packaging material 102, third downstream idle roller 156 may help to secure the load to the pallet, while maintaining space between drive housing 142 and the ground or other low support surfaces. Upstream from where the driving down occurs, downstream roping assembly 160 may rope up packaging material 102 to prevent packaging material 102 from sliding off the bottom of third downstream idle roller 156 during the driving down.

[0073] One method for loading packaging material 102 in packaging material dispenser 100 will now be described. With packaging material dispenser 100 in a ver-

tically low position, such as that occupied at the end of a previous wrapping cycle, an operator may begin loading packaging material dispenser 100 by sliding roll 106 onto cylindrical member 112 of roll support 108 from above cylindrical member 112. The operator may grasp a leading end of packaging material 102 from roll 106. The operator may pull the leading end to produce a length of film. The length of film may have a distal portion near the leading end, a proximal portion near roll 106, and an intermediate portion between the distal portion and the proximal portion. It is also contemplated that the operator may form at least a portion of the length of film into a rope.

[0074] In order to thread the length of film through pre-stretch assembly 110, the operator may bring the proximal portion into contact with a surface of upstream idle roller 150 from above upstream idle roller 150 or from its side. The operator may bring a part of the intermediate portion into contact with a surface of upstream pre-stretch roller 118 from a location proximate a top portion of upstream pre-stretch roller 118. The operator may bring another part of the intermediate portion into contact with a surface of downstream pre-stretch roller 120 from above downstream pre-stretch roller 120, or from its side. The operator may bring a part of the distal portion into contact with a surface of first downstream idle roller 152 from a location proximate a top of first downstream idle roller 152, and then bring other parts of the distal portion into contact with second downstream idle roller 154 and third downstream idle roller 156, before attaching the leading end to a clamping assembly (not shown) and/or to a load to be wrapped (not shown). During loading, all of the rollers coming into contact with the length of film may remain substantially static.

[0075] Additionally or alternatively, the method for loading may include grasping a leading end portion of packaging material 102, and, while grasping the leading end portion, bringing the leading end portion into contact with a surface of upstream idle roller 150, and then into contact with a surface of upstream pre-stretch roller 118, then into contact with a surface of downstream pre-stretch roller 120, then into contact with a surface of first downstream idle roller 152, and then into contact with second downstream idle roller 154 and third downstream idle roller 156, before attaching the leading end to a clamping assembly (not shown) and/or to a load to be wrapped (not shown).

[0076] After clamping, the operator may ungrasp the leading end portion. In this embodiment of the method, the operator may be required to continually pull the leading end portion around one or more of the contacting rollers as the leading end portion is threaded through pre-stretch assembly 110. Thus, in this embodiment, it may be necessary to provide upstream pre-stretch roller 118 and downstream pre-stretch roller 120 with a clutch mechanism that allows upstream pre-stretch roller 118 and downstream pre-stretch roller 120 to be rotated manually as the leading end portion is pulled by the operator.

[0077] With the leading end being clamped by the

clamping assembly, relative rotation may be provided between the load being wrapped and packaging material dispenser 100, causing packaging material 102 to be wrapped about the load. Packaging material dispenser 100 may travel vertically from a bottom portion of the load to a top portion of the load, and then back down to the bottom portion, while the relative rotation is being provided, to spirally wrap packaging material 102 about the load. During any portion of the wrapping cycle, downstream roping assembly 160 may be actuated to engage a bottom edge of packaging material 102 to form a bottom portion of packaging material 102 into a rope. Packaging material 102, including the roped portion, may be applied to the load being wrapped. Also, near the end of the wrapping cycle, third downstream idler roller 156 may be actuated into its tilted position to drive packaging material 102 downward, to secure a bottom portion of the load to a pallet supporting the load.

[0078] One method for loading packaging material 202 in packaging material dispenser 200 will now be described. With packaging material dispenser 200 in a vertically low position, such as that occupied at the end of a previous wrapping cycle, an operator may begin loading packaging material dispenser 200 by sliding roll 206 onto cylindrical member 212 of roll support 208 from above cylindrical member 212. The operator may grasp a leading end of packaging material 202 from roll 206. The operator may pull the leading end to produce a length of film. The length of film may have a distal portion near the leading end, a proximal portion near roll 206, and an intermediate portion between the distal portion and the proximal portion. It is also contemplated that the operator may form at least a portion of the length of film into a rope.

[0079] In order to thread the length of film through pre-stretch assembly 210, the operator may bring the proximal portion into contact with a surface of upstream idle roller 248 from above upstream idle roller 248. The operator may bring a part of the intermediate portion into contact with a surface of upstream pre-stretch roller 216 from a location proximate a top portion of upstream pre-stretch roller 216, or from its side. The operator may bring another part of the intermediate portion into contact with a surface of intermediate idle roller 250 from above intermediate idle roller 250. The operator may bring yet another part of the intermediate portion into contact with a surface of downstream pre-stretch roller 218 from above downstream pre-stretch roller 218, or from its side. The operator may bring a part of the distal portion into contact with a surface of downstream idle roller 252 from a location proximate a top of downstream idle roller 252, before attaching the leading end to a clamping assembly (not shown) and/or to a load to be wrapped (not shown). During loading, all of the rollers coming into contact with the length of film may remain substantially static.

[0080] Additionally or alternatively, the method for loading may include grasping a leading end portion of packaging material 202, and, while grasping the leading end portion, bringing the leading end portion into contact

with the surfaces of upstream idle roller 248, upstream pre-stretch roller 216, intermediate idle roller 250, downstream pre-stretch roller 218, and downstream idle roller 252, before attaching the leading end to a clamping assembly (not shown) and/or to a load to be wrapped (not shown).

[0081] With the leading end being clamped by the clamping assembly, relative rotation may be provided between the load being wrapped and packaging material dispenser 200, causing packaging material 202 to be wrapped about the load. Packaging material dispenser 200 may travel vertically from a bottom portion of the load to a top portion of the load, and then back down to the bottom portion, while the relative rotation is being provided, to spirally wrap packaging material 202 about the load.

[0082] Other embodiments will be apparent to those skilled in the art from consideration of the specification and practice of the embodiments disclosed herein. It is intended that the specification and examples be considered as exemplary only, with a true scope of the disclosure being indicated by the following claims.

Claims

1. A film dispenser (100, 200) comprising:

an open top roll carriage (104, 204) having a base plate on which a film dispensing assembly, including an upstream roller (118, 216) and a downstream roller (120, 218), is mounted, the roll carriage (104, 204) also having a first support (136, 244) configured to support an upper end of the upstream roller (118, 216) and a second support (134, 246) configured to support an upper end of the downstream roller (120, 218); and
a film path for film (102, 202) traveling through the film-dispensing assembly, the film path being at least partially defined by a surface of the upstream roller (118, 216) and a surface of the downstream roller (120, 218), the film path being accessible via a top of the roll carriage (104, 204); and
a drive assembly (142, 138, 140, 144) for the upstream roller (118, 216) and the downstream roller (120, 218) mounted below the base plate.

2. The film dispenser (100, 200) of claim 1, wherein the upstream roller (118, 216) is supported on a lower end by the base plate of the roll carriage (104, 204).

3. The film dispenser (100, 200) of claim 1, wherein the downstream roller (120, 218) is supported on a lower end by the base plate of the roll carriage (104, 204).

4. The film dispenser (100, 200) of claim 1, wherein the

first support (136, 244) connects the upper end of the upstream roller (118, 216) to the base plate of the roll carriage (104, 204), and the second support (134, 246) connects the upper end of the downstream roller (120, 218) to an upper portion of the roll carriage (104, 204).

5. The film dispenser (100, 200) of claim 1, wherein the first support (136, 244) extends in a first direction from a fixed end to a free end, and the second support (134, 246) extends in a second direction from a fixed end to a free end, the second direction substantially opposing the first direction.

6. The film dispenser (100, 200) of claim 1, wherein the upstream roller (118, 216) and the downstream roller (120, 218) are coupled to a serpentine drive belt (144, 240), the serpentine drive belt (144, 240) being coupled to a drive means, and being configured to rotate the upstream roller (118, 216) and the downstream roller (120, 218).

7. The film dispenser (100, 200) of claim 1, wherein the roll carriage (104, 204) further includes a roll support (108, 208) for supporting a roll of film (106, 206), the roll support (108, 208) being vertically offset downward from the base plate of the roll carriage (104, 204).

8. The film dispenser (100, 200) of claim 7, wherein a top surface of the roller support (108, 208) lies in a plane extending through a drive housing (142) of the drive assembly (142, 138, 140, 144).

9. The film dispenser (100, 200) of claim 1, further including a selectively tiltable film drive down roller (156), the selectively tiltable film drive down roller (156) driving the film (102, 202) from a first elevation to a second elevation, lower than the first elevation, when the selectively tiltable drive down roller (156) is in a tilted position.

10. The film dispenser (100, 200) of claim 1, further including a roping assembly (158, 160), the roping assembly (158, 160) forming at least a portion of the film (102, 202) into a cable during wrapping of the load.

11. A method for wrapping a load, comprising:

inserting a length of film downward into a film path of a film dispensing assembly mounted on a base plate of a roll carriage (104, 204), the film dispensing assembly including an upstream dispensing roller (118, 216) and a downstream dispensing roller (120, 218), and the roll carriage (104, 204) including a first support (136, 244) configured to support an upper end of the up-

- stream dispensing roller (118, 216) and a second support (134, 246) configured to support an upper end of the downstream dispensing roller (120, 218);
 providing relative rotation between the film dispensing assembly and the load; and
 driving the downstream dispensing roller of the film dispensing assembly to dispense film for wrapping the load using a drive assembly (142, 138, 140, 144) mounted below the base plate.
12. The method of claim 11, wherein inserting the length of film (102, 202) downward includes inserting the length of film (102, 202) through one or more passageways above the film dispensing assembly, wherein the one or more passageways are configured to receive a continuous length of film (102, 202) for insertion downward into the film path.
13. The method of claim 11, further including wrapping a bottom portion of the load.
14. The method of claim 11, further comprising rotating an upstream dispensing roller (118, 216) of the film dispensing assembly.
15. The method of claim 14, further including roping a portion of the film (102, 202) prior to the film upstream of the upstream dispensing roller (118, 216).
2. Folienspender (100, 200) nach Anspruch 1, wobei die stromaufwärtige Rolle (118, 216) an einem unteren Ende durch die Basisplatte des Rollengestells (104, 204) gehalten wird.
3. Folienspender (100, 200) nach Anspruch 1, wobei die stromabwärtige Rolle (120, 218) an einem unteren Ende durch die Basisplatte des Rollengestells (104, 204) gehalten wird.
4. Folienspender (100, 200) nach Anspruch 1, wobei der erste Halter (136, 244) das obere Ende der stromaufwärtigen Rolle (118, 216) mit der Basisplatte des Rollengestells (104, 204) verbindet, und der zweite Halter (134, 246) das obere Ende der stromabwärtigen Rolle (120, 218) mit einem oberen Teil des Rollengestells (104, 204) verbindet.
5. Folienspender (100, 200) nach Anspruch 1, wobei der ersten Halter (136, 244) sich in einer ersten Richtung von einem feststehenden Ende zu einem freien Ende erstreckt, und der zweite Halter (134, 246) sich in einer zweiten Richtung von einem feststehenden Ende zu einem freien Ende erstreckt, wobei die zweite Richtung im Wesentlichen zu der ersten Richtung entgegengesetzt ist.
6. Folienspender (100, 200) nach Anspruch 1, wobei die stromaufwärtige Rolle (118, 216) und die stromabwärtige Rolle (120, 218) mit einem Serpentina-Treibriemen (144, 240) gekoppelt sind, wobei der Serpentina-Treibriemen (144, 240) mit einem Antriebsmittel gekoppelt ist und zur Drehung der stromaufwärtigen Rolle (118, 216) und der stromabwärtigen Rolle (120, 218) konfiguriert ist.
7. Folienspender (100, 200) nach Anspruch 1, wobei das Rollengestell (104, 204) weiterhin einen Rollenhalter (108, 208) zum Halten einer Folienrolle (106, 206) umfasst, wobei der Rollenhalter (108, 208) vertikal nach unten versetzt von der Basisplatte des Rollengestells (104, 204) ist.
8. Folienspender (100, 200) nach Anspruch 7, wobei eine obere Fläche des Rollenhalters (108, 208) in einer Ebene liegt, die sich durch ein Antriebsgehäuse (142) der Antriebsanordnung (142, 138, 140, 144) erstreckt.
9. Folienspender (100, 200) nach Anspruch 1, weiterhin umfassend eine selektiv kippbare Rolle (156) zum Abwärtsfahren der Folie, wobei die selektiv kippbare Rolle (156) zum Abwärtsfahren der Folie die Folie (102, 202) von einer ersten Höhe zu einer zweiten Höhe fährt, die niedriger ist als die erste Höhe, wenn die selektiv kippbare Rolle (156) zum Abwärtsfahren der Folie sich in einer gekippten Position befindet.

Patentansprüche

1. Folienspender (100, 200) umfassend:

ein deckellooses Rollengestell (104, 204) mit einer Basisplatte, auf der eine Folienspenderanordnung, umfassend eine stromaufwärtige Rolle (118, 216) und eine stromabwärtige Rolle (120, 218), montiert ist, wobei das Rollengestell (104, 204) auch einen ersten Halter (136, 244), der zum Halten eines oberen Endes der stromaufwärtigen Rolle (118, 216) konfiguriert ist, und einen zweiten Halter (134, 246), der zum Halten eines oberen Endes der stromabwärtigen Rolle (120, 218) konfiguriert ist, aufweist; und einen Foliengang für Folie, wobei die Folie durch die Folienspenderanordnung läuft, wobei der Foliengang mindestens zum Teil durch eine Oberfläche der stromaufwärtigen Rolle (118, 216) und eine Oberfläche der stromabwärtigen Rolle (120, 218) definiert ist, wobei der Foliengang von einer Oberseite des Rollengestells (104, 204) zugänglich ist; und eine Antriebsanordnung (142, 138, 140, 144) für die stromaufwärtige Rolle (118, 216) und die stromabwärtige Rolle (120, 218), die unterhalb der Basisplatte montiert ist.

10. Folienspender (100, 200) nach Anspruch 1 weiterhin umfassend eine Bündelungsanordnung (158, 160), wobei die Bündelungsanordnung (158, 160) während der Verpackung der Ladung mindestens einen Teil der Folie (102, 202) zu einem Seil formt. 5
11. Verfahren zum Verpacken einer Ladung, umfassend:
- Einführen von einer Länge von Folie nach unten in einen Folienweg einer Folienspenderanordnung, die auf einer Basisplatte eines Rollengestells (104, 204) montiert ist, wobei die Folienspenderanordnung eine stromaufwärtige Spenderrolle (118, 216) und eine stromabwärtige Spenderrolle (120, 218) umfasst, und das Rollengestell (104, 204) einen ersten Halter (136, 244), der zum Halten eines oberen Endes der stromaufwärtigen Spenderrolle (118, 216) konfiguriert ist, und einen zweiten Halter (134, 246), der zum Halten eines oberen Endes der stromabwärtigen Spenderrolle (120, 218) konfiguriert ist, umfasst; 10
- Bewirken einer relativen Drehung zwischen Folienspenderanordnung und Ladung und Antreiben der stromabwärtigen Spenderrolle der Folienspenderanordnung zum Spenden von Folie zum Verpacken der Ladung unter Verwendung einer unterhalb der Basisplatte befestigten Antriebsanordnung (142, 138, 140, 144). 15
12. Verfahren nach Anspruch 11, wobei das Einführen der Folienlänge (102, 202) nach unten das Einführen der Folienlänge (102, 202) durch eine oder mehrere Passagen oberhalb der Folienspenderanordnung umfasst, wobei die eine oder mehrere Passagen zur Aufnahme einer kontinuierlichen Folienlänge (102, 202) zur Einführung nach unten in den Folienweg konfiguriert sind. 20
13. Verfahren nach Anspruch 11, weiterhin umfassend das Verpacken von einem unteren Teil der Ladung. 25
14. Verfahren nach Anspruch 11, weiterhin umfassend das Drehen einer stromaufwärtigen Spenderrolle (118, 216) der Folienspenderanordnung. 30
15. Verfahren nach Anspruch 14, weiterhin umfassend das Bündel von einem Teil der Folie (102, 202) vor der Folie stromaufwärts von der stromaufwärtigen Spenderrolle (118, 216). 35

Revendications

1. Distributeur de film (100, 200) comprenant : 40
- un chariot de rouleau décapotable (104, 204) 45

ayant une plaque de base sur laquelle un assemblage distributeur de film comprenant un rouleau en amont (118, 216) et un rouleau en aval (120, 218) est monté, le chariot de rouleau (104, 204) ayant également un premier support (136, 244) configuré pour le support d'une extrémité supérieure du rouleau en amont (118, 216) et un deuxième support (134, 246) configuré pour le support d'une extrémité supérieure du rouleau en aval (120, 218) ; et un chemin de film pour le film (102, 202) se propageant à travers l'assemblage distributeur de film, le chemin de film étant au moins partiellement défini par une surface du rouleau en amont (118, 216) et une surface du rouleau en aval (120, 218), le chemin de film étant accessible de haut du chariot de rouleau (104, 204) ; et un assemblage d'entraînement (142, 138, 140, 144) pour le rouleau en amont (118, 216) et le rouleau en aval (120, 218) monté au-dessous de la plaque de base.

2. Distributeur de film (100, 200) selon la revendication 1, dans lequel le rouleau en amont (118, 216) est supporté sur une extrémité inférieure par la plaque de base du chariot de rouleau (104, 204).
3. Distributeur de film (100, 200) selon la revendication 1, dans lequel le rouleau en aval (120, 218) est supporté sur une extrémité inférieure par la plaque de base du chariot de rouleau (104, 204).
4. Distributeur de film (100, 200) selon la revendication 1, dans lequel le premier support (136, 244) relie l'extrémité supérieure du rouleau en amont (118, 216) à la plaque de base du chariot de rouleau (104, 204), et le deuxième support (134, 246) relie l'extrémité supérieure du rouleau en aval (120, 218) à une partie supérieure du chariot de rouleau (104, 204).
5. Distributeur de film (100, 200) selon la revendication 1, dans lequel le premier support (136, 244) s'étend dans une première direction à partir d'une extrémité fixé jusqu'à une extrémité libre, et le deuxième support (134, 246) s'étend dans une deuxième direction à partir d'une extrémité fixé jusqu'à une extrémité libre, la deuxième direction sensiblement s'opposant à la première direction.
6. Distributeur de film (100, 200) selon la revendication 1, dans lequel le rouleau en amont (118, 216) et le rouleau en aval (120, 218) sont couplés à une courroie d'entraînement serpentine (144, 240), la courroie d'entraînement serpentine (144, 240) étant couplée à un moyen d'entraînement, et étant configuré pour la rotation du rouleau en amont (118, 216) et du rouleau en aval (120, 218).

7. Distributeur de film (100, 200) selon la revendication 1, dans lequel le chariot de rouleau (104, 204) comprend en outre un support de rouleau (108, 208) pour le support d'un rouleau de film (106, 206), le support de rouleau (108, 208) étant à l'écart verticalement vers le bas de la plaque de base du chariot de rouleau (104, 204). 5
8. Distributeur de film (100, 200) selon la revendication 7, dans lequel une surface haute du support de rouleau (108, 208) est mise dans un plan s'étendant à travers un boîtier d'entraînement (142) de l'assemblage d'entraînement (142, 138, 140, 144). 10
9. Distributeur de film (100, 200) selon la revendication 1, comprenant en outre un rouleau de film d'entraînement vers le bas (156) sélectivement basculant, le rouleau de film d'entraînement vers le bas (156) sélectivement basculant entraînant le film (102, 202) à partir d'une première élévation jusqu'à une deuxième élévation, qui est plus bas que la première élévation, lorsque le rouleau de film d'entraînement vers le bas (156) sélectivement basculant est dans une position basculée. 20
10. Distributeur de film (100, 200) selon la revendication 1, comprenant en outre un assemblage cordier (158, 160), l'assemblage cordier (158, 160) formant au moins une partie du film (102, 202) en une corde lors de l'emballage de la charge. 25
11. Procédé pour l'emballage d'une charge, comprenant : 30
- l'insertion d'une longueur de film vers le bas dans un chemin de film d'un assemblage distributeur de film monté sur une plaque de base d'un chariot de rouleau (104, 204), l'assemblage distributeur de film comprenant un rouleau en amont (118, 216) et un rouleau en aval (120, 218), et le chariot de rouleau (104, 204) comprenant un premier support (136, 244) configuré pour le support d'une extrémité supérieure du rouleau en amont (118, 216), et un deuxième support (134, 246) configuré pour le support d'une extrémité supérieure du rouleau en aval (120, 218) ; 35
- fournissant une rotation relative entre l'assemblage distributeur de film et la charge ; et 40
- entraînant le rouleau distributeur en aval de l'assemblage distributeur de film pour distribuer le film pour l'emballage de la charge en utilisant un assemblage d'entraînement (142, 138, 140, 144) monté en-dessous de la plaque de base. 45
12. Procédé selon la revendication 11, dans lequel l'insertion de la longueur de film (102, 202) vers le bas comprend l'insertion de la longueur de film (102, 202) 50
- à travers un ou plusieurs passages en-dessus de l'assemblage distributeur de film, dans lequel l'un ou plusieurs des passages sont configurés pour la réception d'une longueur de film sans fin (102, 202) pour l'insertion vers le bas dans le chemin de film. 55
13. Procédé selon la revendication 11, comprenant en outre l'emballage d'une partie inférieure de la charge.
14. Procédé selon la revendication 11, comprenant en outre la rotation d'un rouleau distributeur (118, 216) de l'assemblage distributeur de film.
15. Procédé selon la revendication 14, comprenant en outre la mise en corde d'une partie du film (102, 202) avant le film en amont du rouleau distributeur en amont (118, 216).

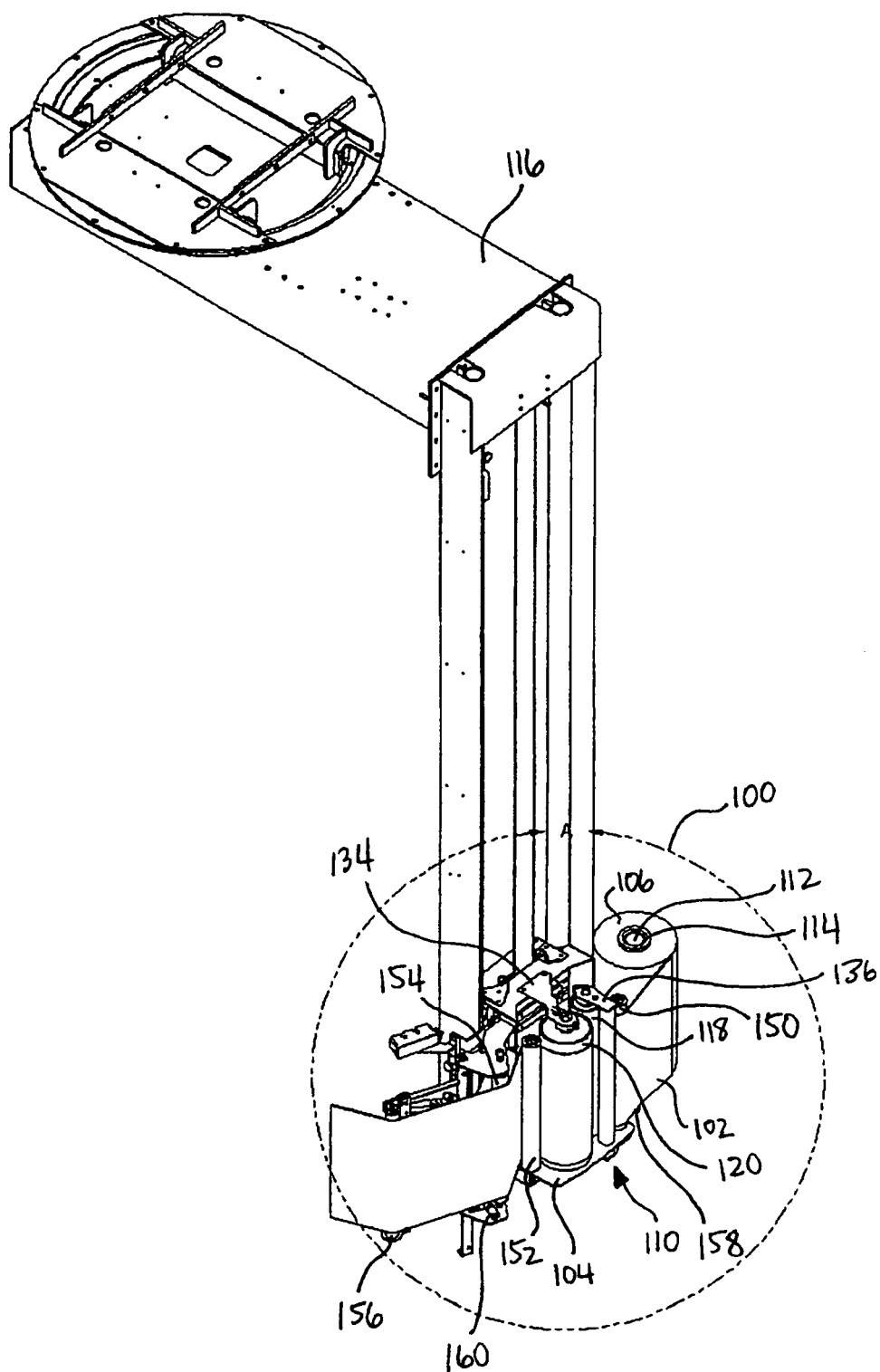
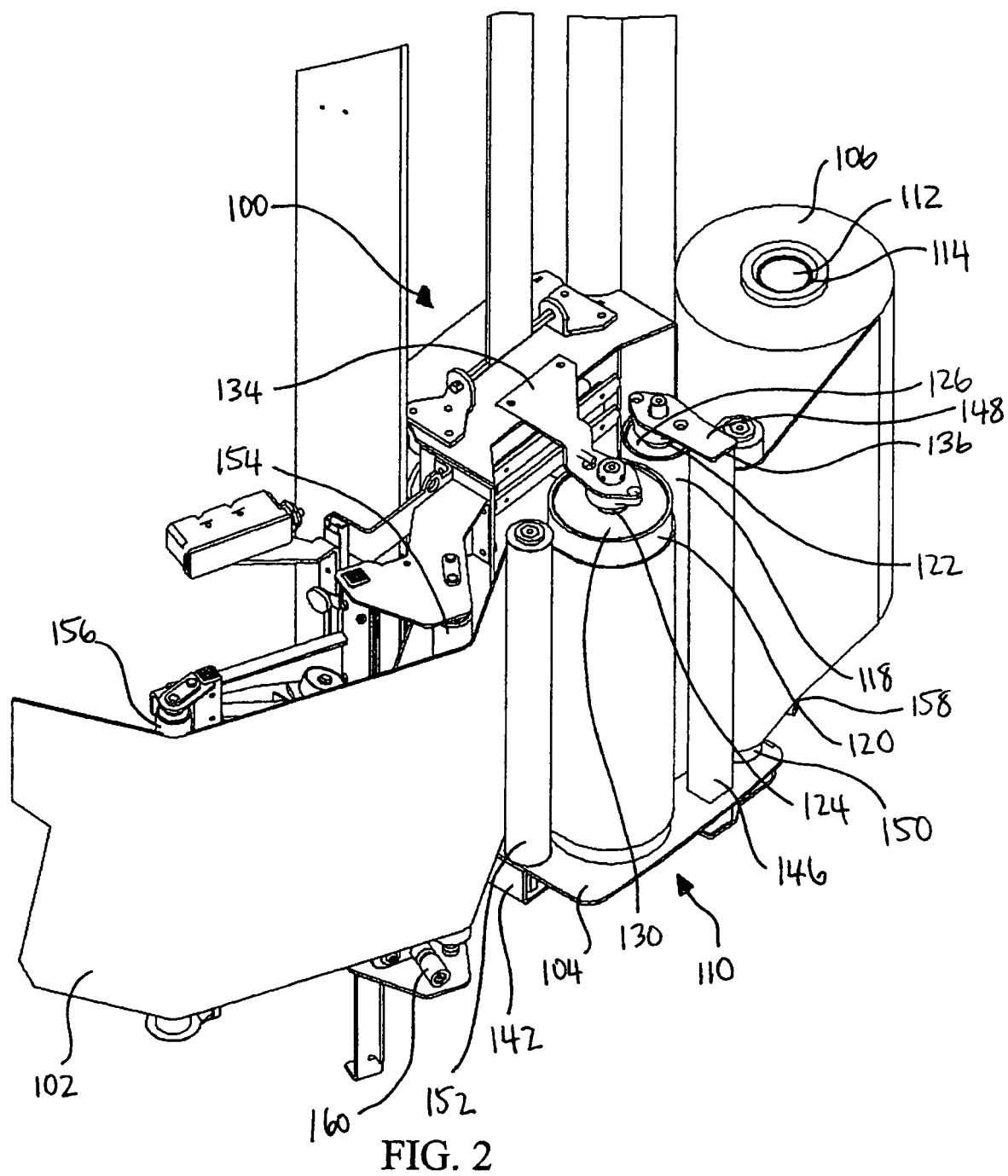
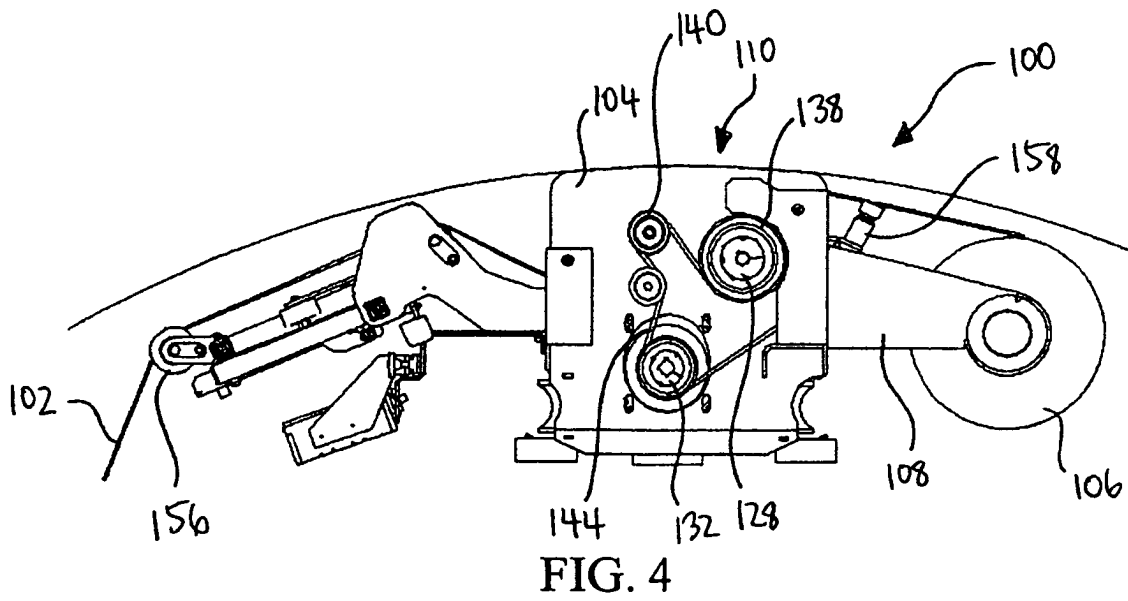
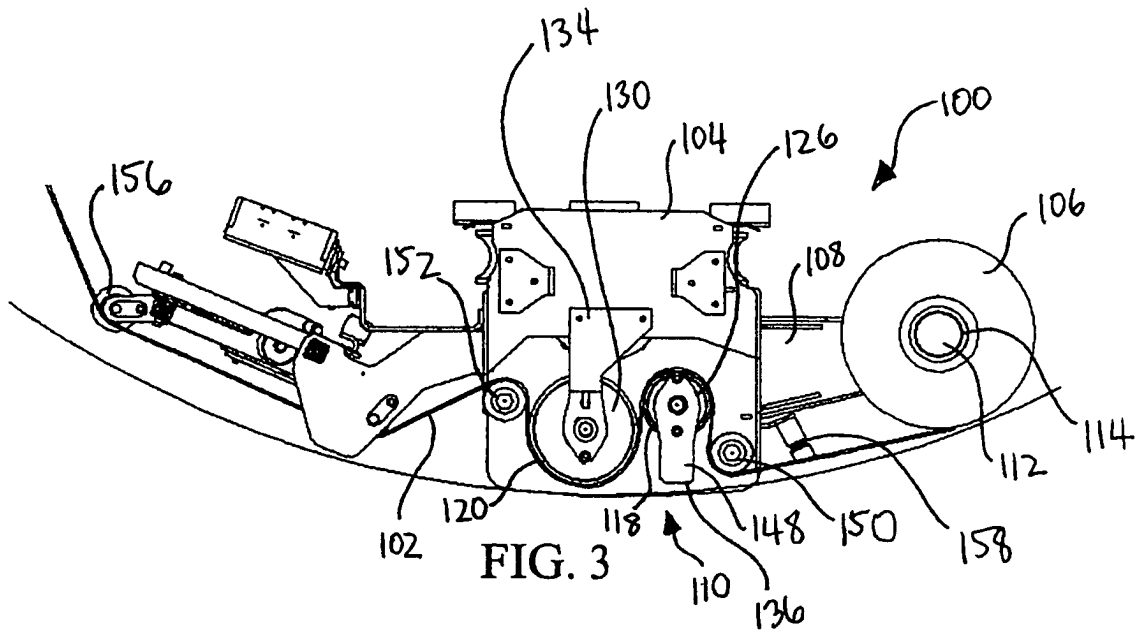


FIG. 1





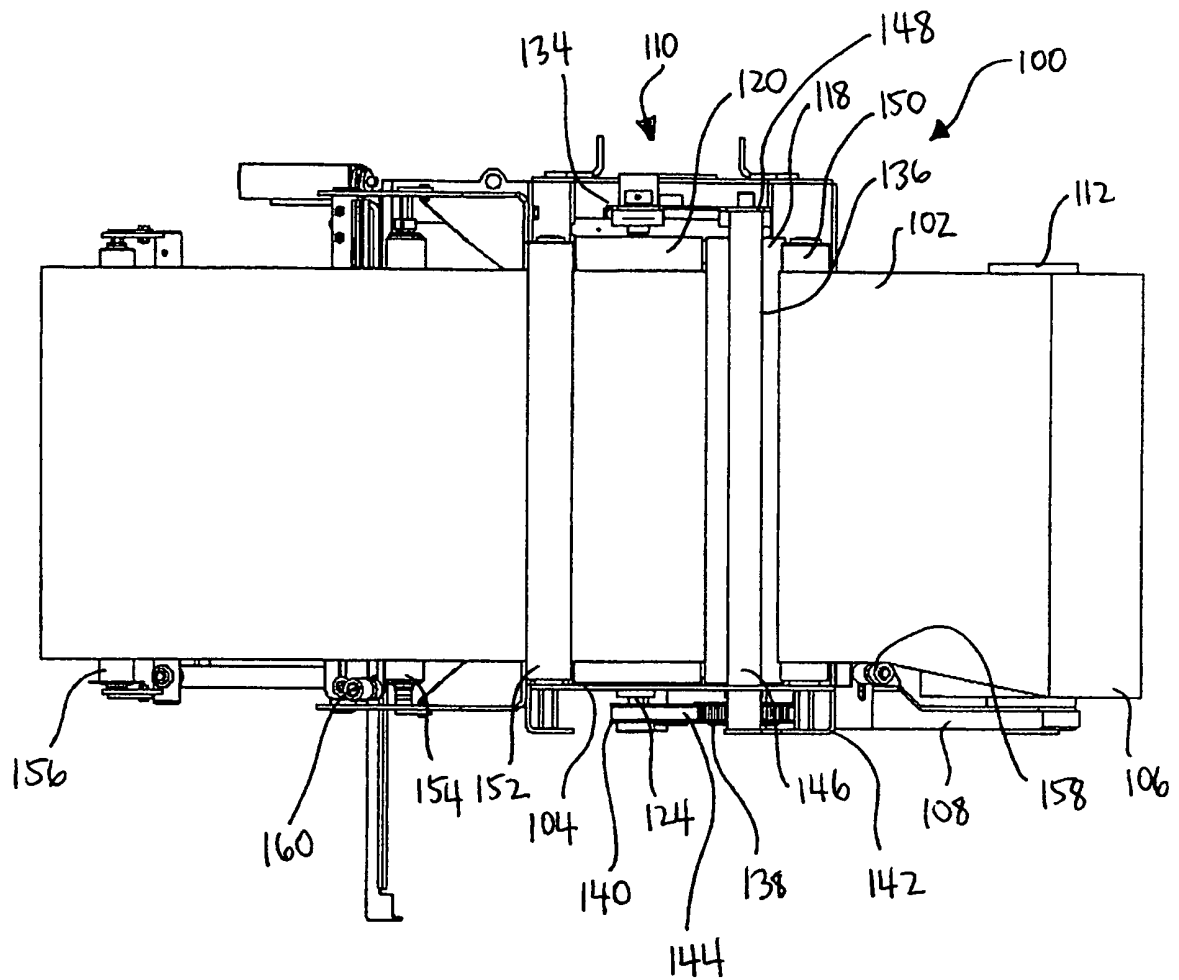


FIG. 5

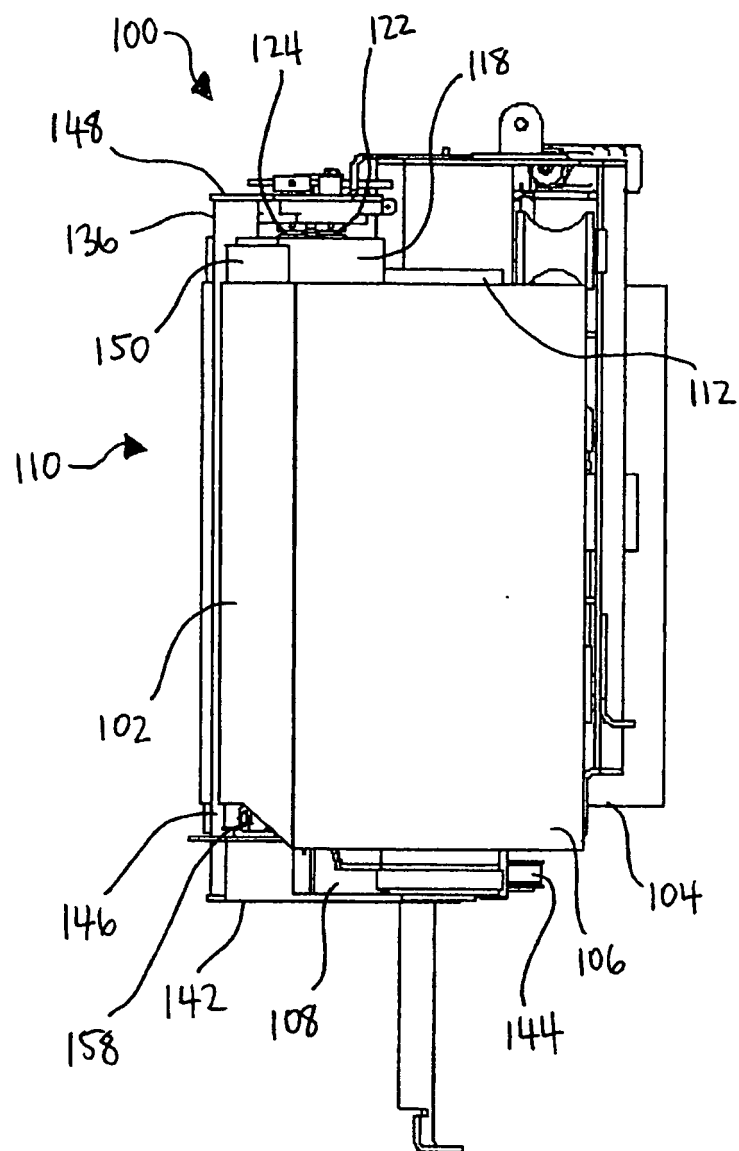
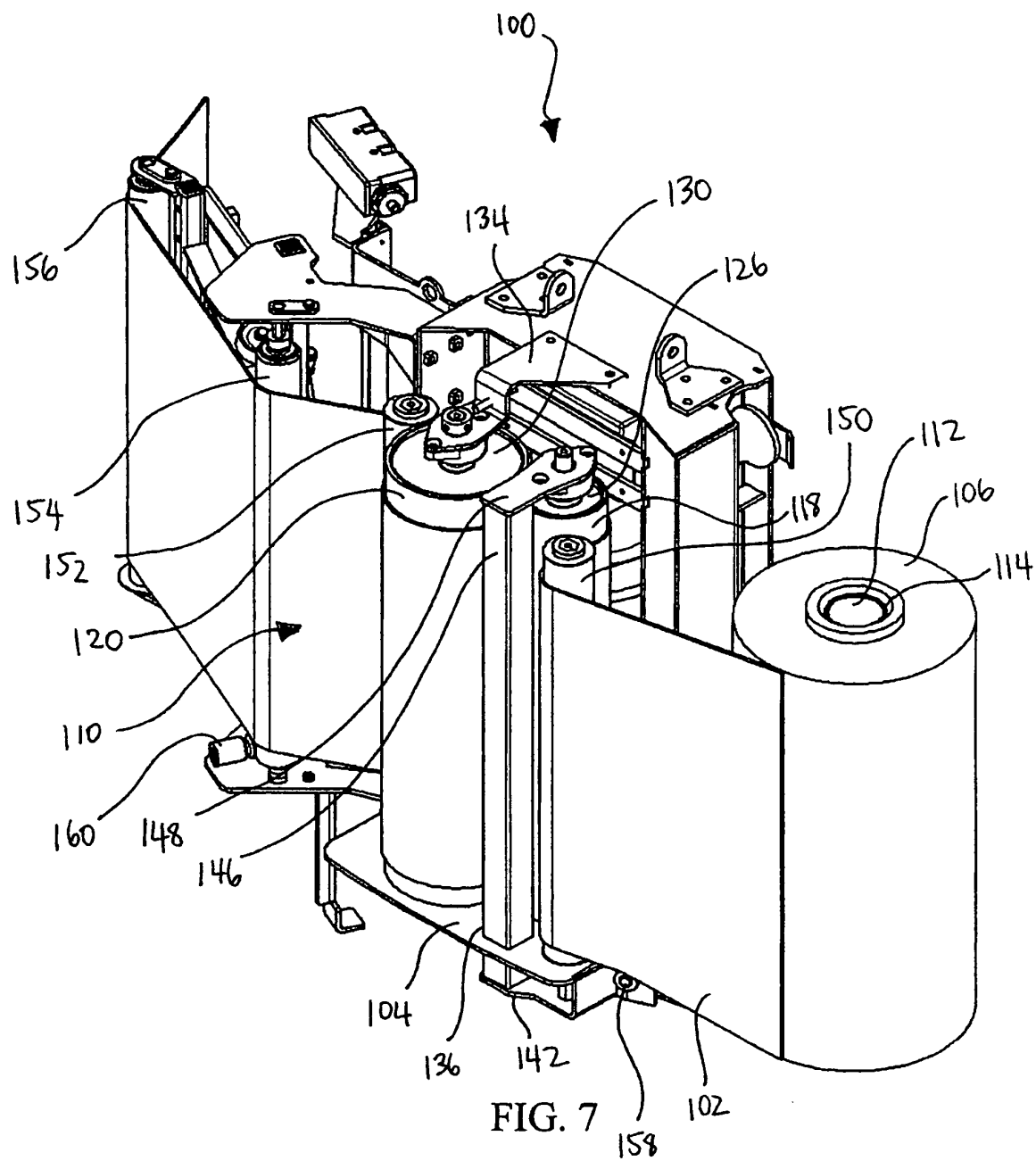


FIG. 6



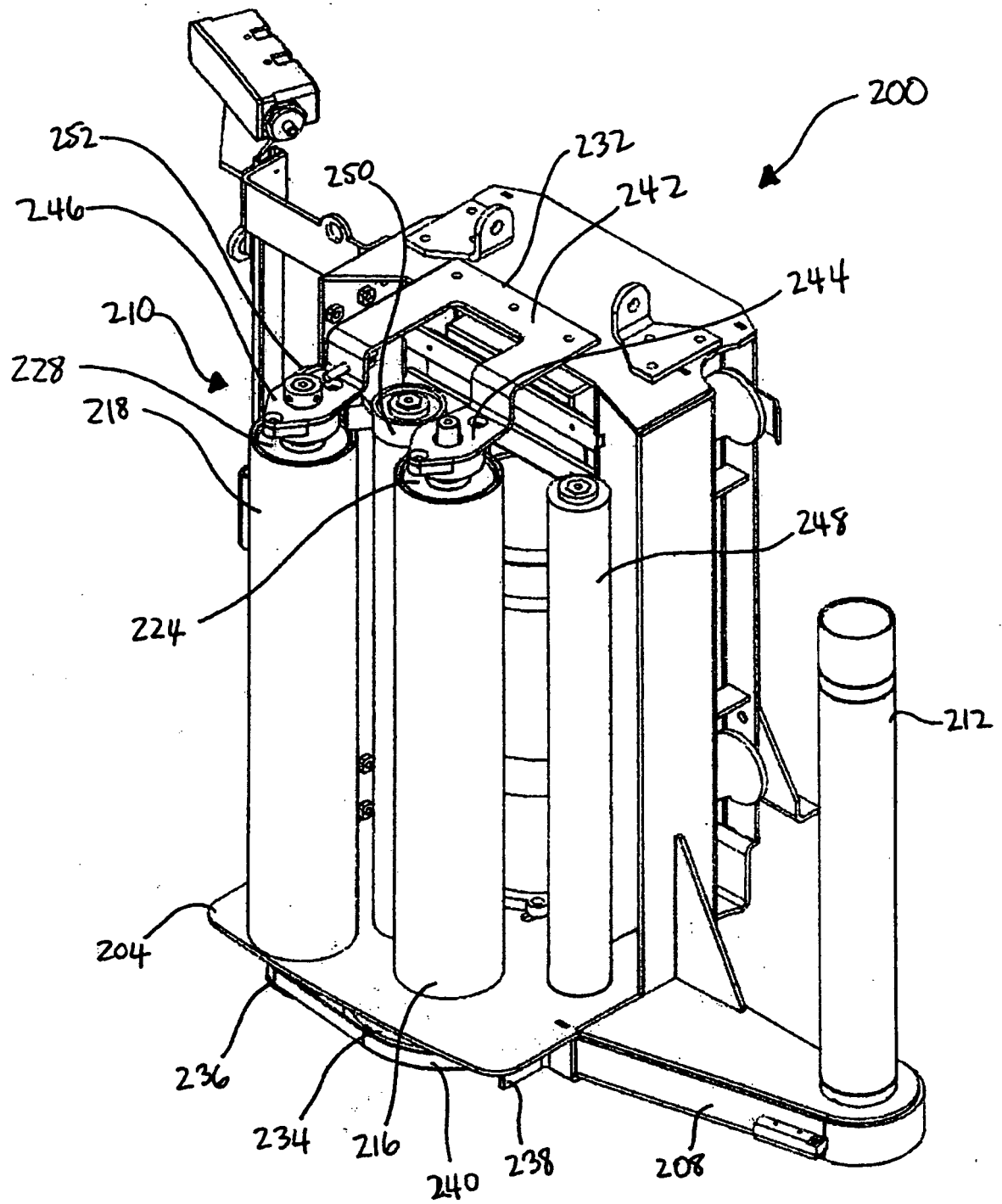


FIG. 8

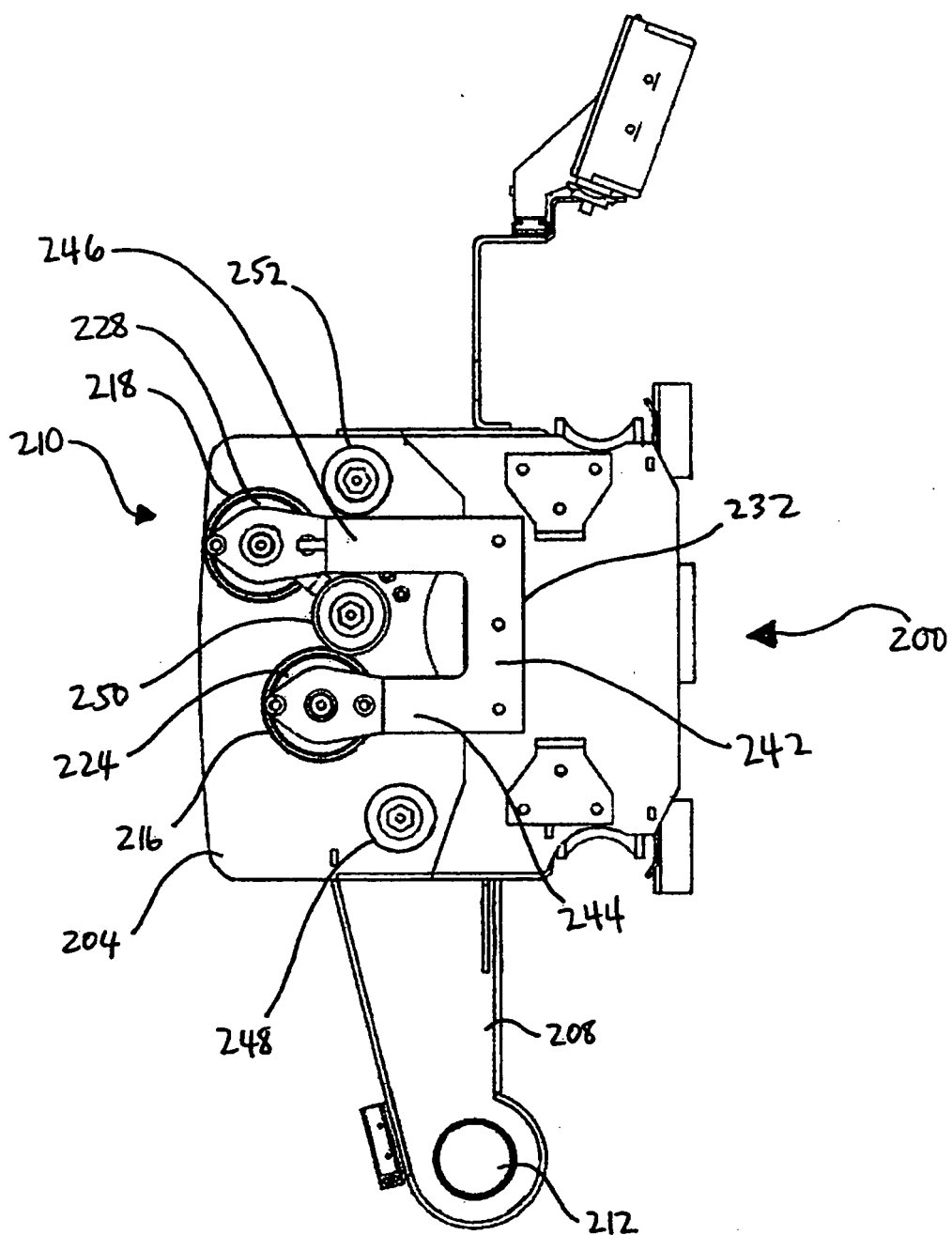
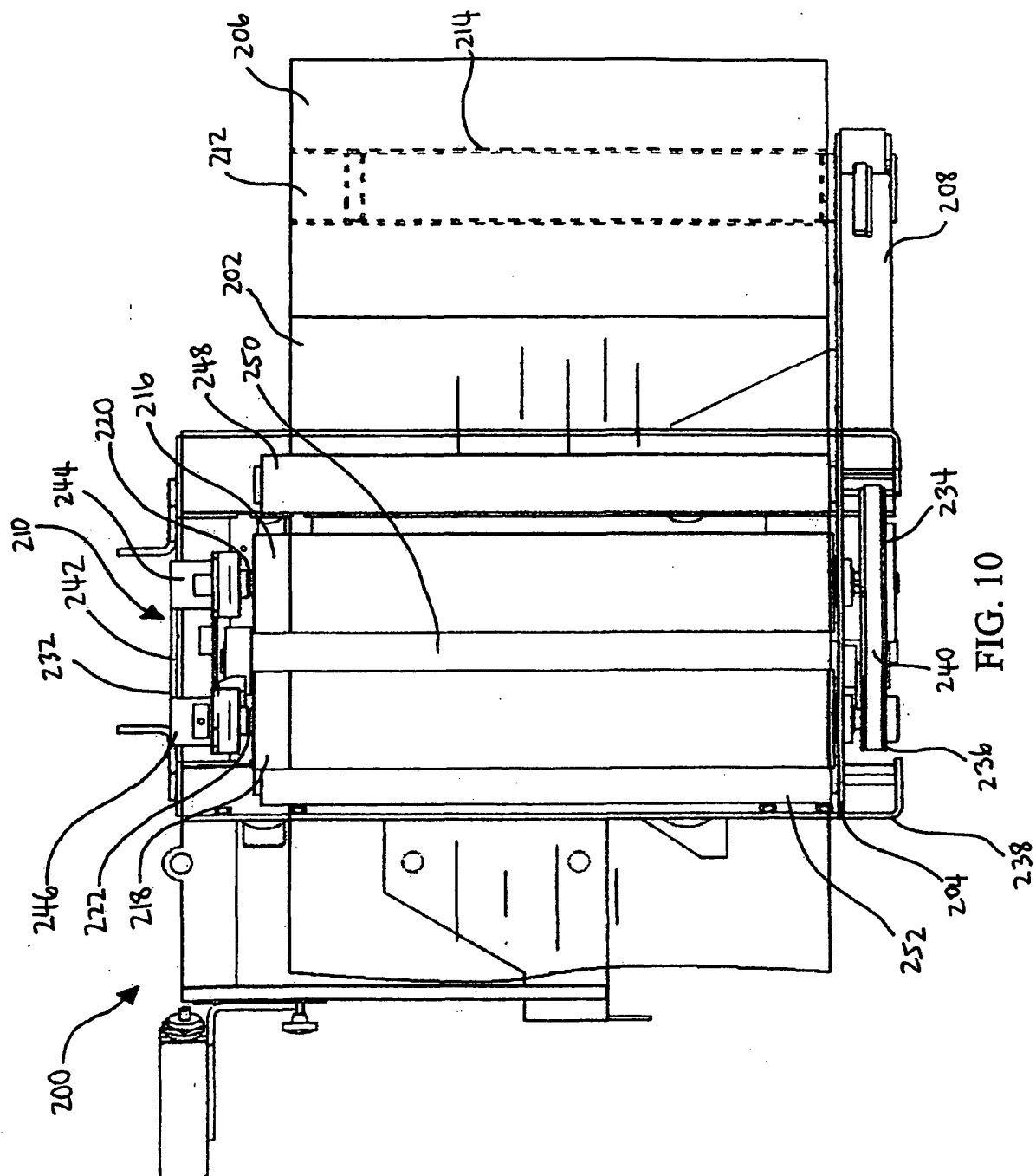
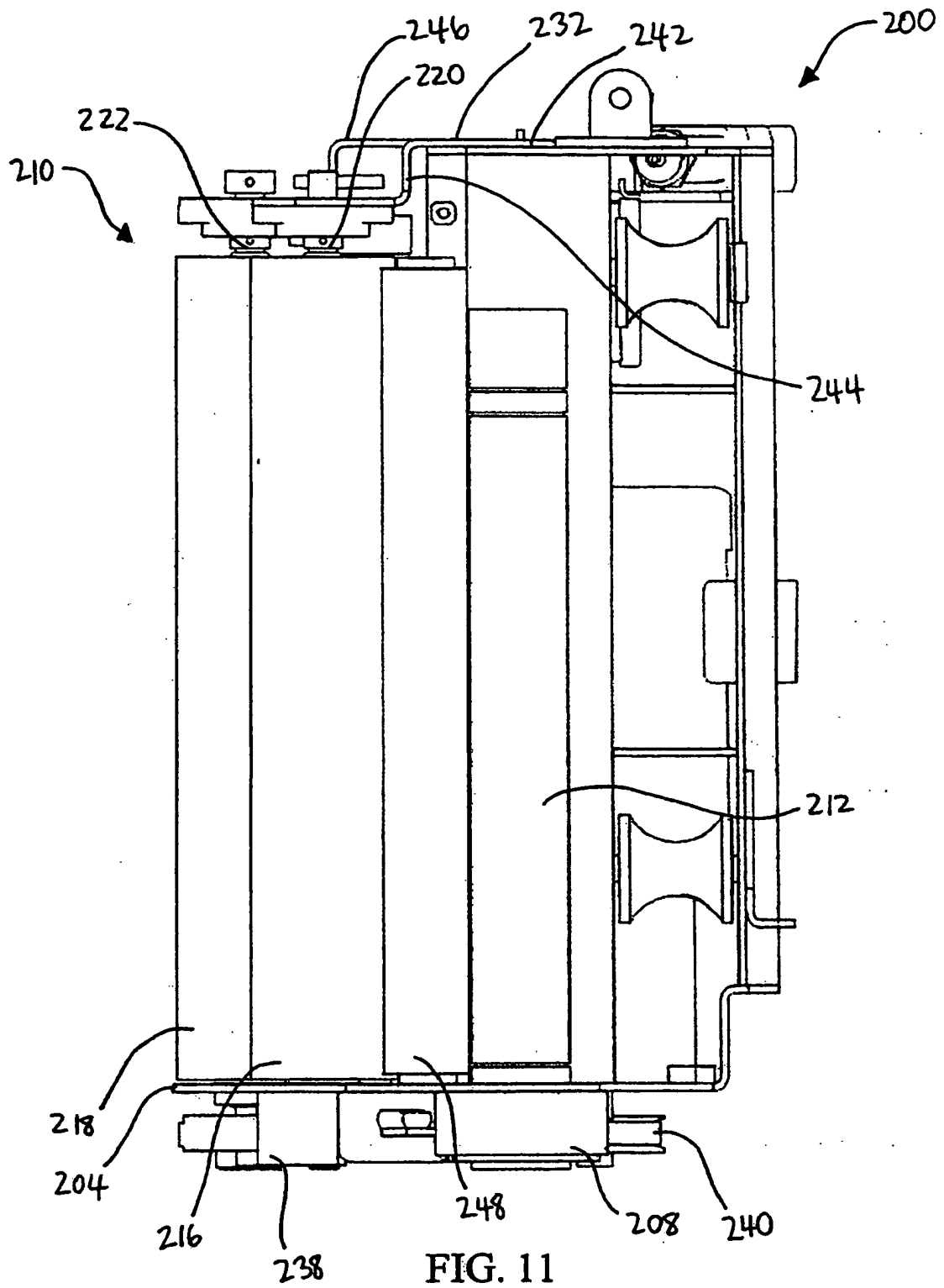


FIG. 9





REFERENCES CITED IN THE DESCRIPTION

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