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54 **Method and apparatus for coreless winding.**

57 A method and apparatus for making a coreless convolutely wound web roll which has a hollow axially extending interior which includes prior to removing the log from a winding mandrel applying a stabilizing agent to the interior.

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BACKGROUND AND SUMMARY OF INVENTION:

This invention relates to a method and apparatus for coreless winding and more particularly including the stabilization of the interior portion of a coreless wound log of paper or the like. A "log" has the same diameter as the commercial sized roll (toilet tissue, toweling, etc.) but is much longer. Current practice is to transversely cut the log into rolls, viz., in the U.S. 4-1/2" long for toilet tissue and 11" long for kitchen toweling.

A few coreless wound products have been in existence for the last 10 or 15 years. These can be separated into three categories. First, there is the large diameter tissue and towel rolls made to dispense from the center and exemplified by U.K. Patent 1,554,619. Second, there are tissue rolls with very small "core" diameters made to dispense either from special, barbed shafts or without the use of any dispensing shaft but rather using a cradle. The use of these two categories has been generally confined to Europe. Third, there is a category which is frequently discussed but has never caught on. Exemplary of this is a bathroom tissue roll for a standard home dispenser but without the core. One of the obstacles in developing such a product is the instability of the interior of the coreless log. Without a core the center of the log is subject to collapse or unwinding from the interior. This causes problems first at the log saw -- wherein the elongated "log" is transversely cut into retail size lengths or rolls, and also during packaging and shipping and finally when the user attempts to install it on the dispenser shaft.

According to the invention, the problems associated with the third category is solved through stabilizing the log interior by applying a fixing agent to the inside plies. In a sense, this could be considered analogous to tail sealing (see U.S. Patent 3,044,532 to Ghisoni) except that it works on the inside tail.

More particularly, the invention contemplates winding a web in convolute fashion on a "bare" mandrel and applying the stabilizing agent prior to complete removal of the wound log from the mandrel. In one embodiment, the stabilizing or fixing agent can be applied during the course of the log winding -- as by delivering the agent through axially or spirally spaced ports in the mandrel. Alternatively, the stabilizing agent can be applied prior to or during the "stripping" of the log from the mandrel. This is achieved through the use of a discharge orifice means adjacent the end of the mandrel from which the log is removed.

The invention also provides a variety of means and steps for maintaining the web in contact with the mandrel, particularly during the initial stages. This can be done through the use of a vacuum --

as in the same axially or spirally, i.e., longitudinally, spaced ports used to deliver the stabilizing agent.

Advantageously, the stabilizing agent has adhesive characteristics such as starch/water mixtures, tail seal adhesives, polyvinyl alcohol and the like. Even heated water or steam may be employed to provide bonding of the inner plies. Where the stabilizing agent may include liquids or liquids atomized into droplets and dispersed in air, it can be employed to pressurize the log and additionally help reduce the force required to strip the log from the mandrel. Also, the operations may be combined by using a two-part adhesive procedure -- as in the well-known epoxy materials. For example, the first part may be applied during winding throughout the length of the mandrel and the second part is sprayed at the end of the mandrel during the stripping operation.

Other objects and advantages of the invention may be seen in the details of construction and operation set forth in the ensuing specification.

BRIEF DESCRIPTION OF DRAWING:

The invention is described in conjunction with the accompanying drawing, in which --

FIG. 1 is a side elevational view (somewhat schematic) of a winder which can be employed to advantage in the practice of the invention;

FIG. 2 is a fragmentary end elevational view (essentially schematic) of the winder of FIG. 1;

FIG. 3 is a fragmentary end elevational view of another embodiment of mandrel employed in the practice of the invention;

FIG. 4 is a fragmentary side elevational view, partially in section of another form of turret useful in the practice of the invention and particularly with the mandrel of FIG. 3; and

FIG. 5 is an enlarged fragmentary view of the central portion of FIG. 4.

DETAILED DESCRIPTION:

In the illustration given in FIG. 1, the numeral 10 designates generally a frame which is conventional in winders --very often referred to as "rewinders". This term stems from the fact that the web is "rewound" from an already wound parent roll of sizeable length and diameter into retail sized logs or rolls.

More particularly the frame 10 includes a pair of longitudinally extending side frames, one of which is illustrated generally schematically at 10a in FIG. 2. The frame provides an elongated path and supports a number of rolls therebetween in rotatable fashion.

Returning to FIG. 1, the numerals 11 and 12 at the upper left hand portion of the view designate

pull rolls or draw rolls which operate to advance a web W from a parent roll (not shown). The web is further advanced by a perforator bedroll 13 and a transfer bedroll 14. Cross perforations are provided in the web by the knife-equipped perforator bedroll 13 operating against a stationary anvil 15. The widely used perforator is seen in co-owned, expired Patent No. 2,870,840.

The web in proceeding along the path defined by the frame 10 is in partial wrapping relation with the transfer bedroll 14. The numeral 16 designates a knife roll which cooperates with the bedroll 14 for the cutoff and impalement of the free leading edge of the web W. This feature is described in co-owned, expired Patent No. RE. 28,353.

Still referring to FIG. 1, the numeral 17 designates generally a mandrel-equipped turret which is mounted for rotation in the rewinder frame 10 and which is disposed in parallel, side-by-side relation with the bedroll 14. In the illustration given, the turret 17 is equipped with six mandrels as at 18, the mandrels being arranged for sequential movement through an orbit into web-contacting relation. In the operation of the turret 17, the mandrel 18 is moved from station A through stations B and C with no operations being performed. When the mandrel reaches station D, the rotation of the mandrel is started via drive belts 19 as described in more detail in co-owned, expired Patent No. 3,116,890. One of the belts operates to raise the rotational speed of the mandrel 18 to exactly transfer speed at the time of actual transfer. In the station D, the mandrel 18 is engaged with the accelerating driving belt and is accelerated to web speed as pointed out above. As the mandrel 18 moves toward station E, transfer occurs.

During movement from station E to station F, the mandrel 18 continues moving down and increasingly away from the bedroll 14. It also is now in contact with the decelerating driving belt. Prior to reaching station F, a discrete predetermined length of the web has been wound and cut off, after which the mandrel arrives in station F, which is the finished roll-removing station.

Finished roll removal is achieved at station F by a mechanism such as is seen in co-owned, expired Patent No. 2,769,600. Reference may be had thereto for details of construction and operation not set forth herein. For example, the operation of the turret 17 is achieved through a Geneva gear and other suitable mechanism (not shown) which indexes the turret.

Construction Details

Referring now to FIG. 2, the numeral 20 designates the mandrel drive pulleys for the mandrel 18. These pulleys receive the accelerating and

decelerating belts 19 referred to above. In FIG. 2, the details of construction for practicing the inventive method are shown. For example, each of the mandrels 18 has an axially extending passage 21 for applying both vacuum for adhering the web and pressure for delivering the stabilizing fluid. For this purpose, each mandrel 18 is equipped with a plurality of ports 22 connected to the passage 21. As illustrated, these ports are disposed in a spiral arrangement but other arrangements can be employed. It is advantageous to have the ports spaced axially, i.e., longitudinally, so as to insure thorough coverage of the interior plies of the web roll being developed in the rewinder.

In the practice of the invention according to the embodiment of FIGS. 1 and 2, vacuum is applied first to the ports 22 to maintain the leading edge of the severed web in contact with the surface of the mandrel. Once this is achieved, winding progresses so that the vacuum can be terminated. Then the passage 21 and ports 22 are available for use in delivering the stabilizing fluid.

For this purpose, the turret is equipped with a subframe as at 23 and which necessarily rotates with the turret 17 and therefore the mandrels 18. Provided as part of the frame 10a and thus not rotatable is a vacuum valve 24 which is generally horseshoe shaped. This applies vacuum only at a predetermined or preselected portion of the rotation of the turret, i.e., only during a portion of the orbit of each mandrel 18. For example, this would occur just shortly before transfer as when a mandrel is approaching station E. Vacuum is developed by a vacuum reservoir 25 coupled to a vacuum pump 25a and which is coupled to the stationary vacuum valve 24 by means of vacuum line 26. Thus, as illustrated in FIG. 2, the vacuum is connected to chamber 22 associated with mandrel 18.

The drive shaft for the turret subframe 23 is designated 27 -- see the central part of FIGS. 1 and 2. Provided at a point offset from the drive shaft 27 and associated drive (not shown) is the means for supplying the stabilizing fluid. This includes a source 28, a pump 29 and a reservoir 30. Fluid is discharged through line 31 to a pressure fluid valve 32. More particularly, pressurized adhesive from source 28 is mixed with air flow at 33 using a venturi or atomizing nozzle.

It will be appreciated that the subframe 23 has a plurality of conduits therein for selective coupling with the valves 24, 32. As illustrated in FIG. 2, there is a chamber or conduit 34 coupling the vacuum in valve 24 with the upper mandrel while the chamber 35 couples the lower mandrel to the valve 32.

More particularly, each mandrel 18 is coupled to a chamber or conduit 34, 35 which in one position of the turret is coupled to the horseshoe vacuum valve 24 and in another rotated position to

the pressure adhesive valve 32. Thus, at the beginning of the wind, vacuum is applied so as to adhere the leading edge of the web to the mandrel and after winding has progressed enough to develop a few convolutions or turns of the web on the mandrel, the vacuum is removed from the passage 21 by virtue of the rotation of the turret 17 and thus brings the conduit aligned with the particular mandrel into the position wherein it is coupled to the pressure system for applying adhesive or fixing material to the inner plies.

Embodiment of FIGS. 3-5

This embodiment as illustrated first in FIG. 3 again has an axially extending passage 121 but instead of a plurality of ports 22 disposed along its length has a plurality of radially aligned ports 127 located adjacent the discharge or cantilevered end of the mandrel. For example, in station F of FIG. 1, the end of the mandrel from which the log is to be stripped is unclamped from its location within the turret and provides a free, cantilevered end so that the stripping mechanism can operate.

This embodiment also utilizes a different way of maintaining the leading edge of the severed web against the mandrel 118. Essentially, this is "envelopment", thereby avoiding the need for vacuum. An advantageous means for achieving this is seen in co-owned, expired patent 3,679,010 and express reference is made for details of constructions and operation not set forth herein. However, the principal features are described in connection with FIGS. 4 and 5.

The condition of the machine 110 in FIG. 4 corresponds to the time in the winding cycle when the web has just been cut and the leading edge L (see FIG. 5) is about to be blown into the nip defined by the mandrel 118 and the main rider roll 137. This is achieved through the air assist delivery from the member 136. Once this is achieved, a winding cycle is initiated relative to the mandrel 118.

Shortly after transfer, the air-assist member 136 is retracted by downward movement of the arm 138 to the position 138'. This is achieved by the cylinder and piston rod unit 139 operating through linkage 140. The member 136 remains in the retracted position -- as at 138' throughout the major portion of the winding cycle. This shifting of the member 136 permits the mandrel 118 to be moved out of the winding position to make room for a subsequent mandrel.

At the same time the member 136 is retracted (by virtue of the actuation of the cylinder and piston rod unit 139), arms 141 are moved upwardly to the dotted line position in FIG. 4 and designated 141'. This is achieved through the actuation of the

cylinder and piston rod unit 142. Thus, the knife assembly 143 and the idling roll 144 are moved out of the orbital path which will be described by the next mandrel when it moves into the winding position previously occupied by the mandrel 118.

When the web has been wound to a predetermined amount on the mandrel 118, the turret (not shown herein) begins to index and the rider roll 137 is retracted by the actuation of the cylinder and piston rod unit 145. This clears the orbital path. As the indexing is completed, air is delivered to the cylinder unit 139.

This results in the elevation of the air-assist member 136 to the position indicated in FIG. 6. When the air-assist member 136 reaches the uppermost position, the cylinder 146 is actuated to trigger the knife arc and slice the web W. For this purpose, the machine 110 is equipped with a microswitch (not shown) which is actuated by the air-assist member 136 when it is in its uppermost position -- this delivering a signal for actuating the cylinder and piston rod unit 146. This same signal is employed to open a valve (not shown) associated with air delivery pipe so as to create the air jets in the passages 148 (see FIG. 5). The air jets are employed for driving the leading edge L into the nip defined by mandrel 118 and the rider roll 137.

Thus, the air-assist member 136 develops the desired enveloping action of the web W relative to the mandrel 118. More particularly, the air-assist member 136 does this in conjunction with cutoff. For this purpose, the member 136 is equipped with a slot 149 into which the knife 147 moves for cutoff. At this time the web is supported on each side of the slot 149. The air jet emanating from the passage 148 on the right side of the slot 149 (as seen in FIG. 5) urges the leading edge L into the nip between rider roll 137 and mandrel 118 to wrap itself around mandrel 118.

The foregoing arrangement avoids the need for vacuum to hold the web against the mandrel and thus frees the passage 121 in the mandrel 118 for the delivery of the stabilizing fluid, i.e., the adhesive.

SUMMARY

The invention is practiced in making coreless convolutely wound web rolls by first transferring the leading edge portion of a web to a mandrel and maintaining the web in contact with the mandrel ultimately to provide a hollow axially extending interior in the wound roll. Winding is continued until a predetermined diameter log has been achieved. Then the log is removed from the mandrel by means of a stripping mechanism such as that seen at 37 in FIG. 1 -- just below station F.

In its broadest aspect, the interior of the log has a stabilizing agent applied thereto sometime prior to the complete removal of the log from the mandrel. This can be done either during the wind as illustrated in FIG. 2 or after the wind and incident to the stripping as seen in FIG. 3.

Claims

1. A method of making a coreless convolutely wound web roll comprising the steps of transferring the leading edge portion of a web to a mandrel (18, 118) and maintaining the web in contact with said mandrel to provide a hollow axially extending interior, winding said web on said mandrel to a predetermined diameter log, removing said predetermined diameter log from said mandrel, characterized in prior to completely removing said log applying a stabilizing agent to said interior. 10 15 20
2. The method of claim 1 in which the step of applying a stabilizing agent is performed during the step of winding said web on said mandrel. 25
3. The method of claim 1 in which the step of applying a stabilizing agent occurs during the removal of the log from the mandrel. 30
4. The method of claim 1 in which said stabilizing agent is a fluid including a pressurized gas and liquid droplets disposed therein.
5. The method of claim 1 in which said stabilizing agent includes a liquid applied by pressure through said mandrel. 35
6. The method of claim 1 in which said step of maintaining the web in contact with said mandrel includes providing passage means (21) extending generally longitudinally of said mandrel and terminating in port means (22) disposed generally along the mandrel length, said applying step introducing a pressure fluid into said passage means and distributing said pressure fluid through said port means. 40 45
7. The method of claim 6 in which said maintaining step includes coupling said passage means to vacuum means (25, 25a, 26) incident to maintaining said web on said mandrel. 50
8. The method of claim 1 in which said steps include providing passage means (121) extending generally longitudinally of said mandrel and terminating in port means (122) being radially aligned adjacent the end of said mandrel, 55

said applying step including introducing a pressure fluid into said passage means and discharging the same through said port means incident to stripping said log from said mandrel.

9. The method of claim 1 in which said maintaining step includes the step of enveloping the leading edge portion of said web within a convolutely wound layer.
10. Apparatus for practicing the method of claim 1 for making a coreless convolutely wound web roll comprising a frame, a mandrel (18, 118) rotatably mounted on said frame and equipped with interior passage means (21, 121) for delivering stabilizing fluid to the interior of a web roll on said mandrel, and means (25, 136) operably associated with said mandrel for maintaining a web in contact with said mandrel at least during the beginning of winding said web to develop said roll.

FIG. 1

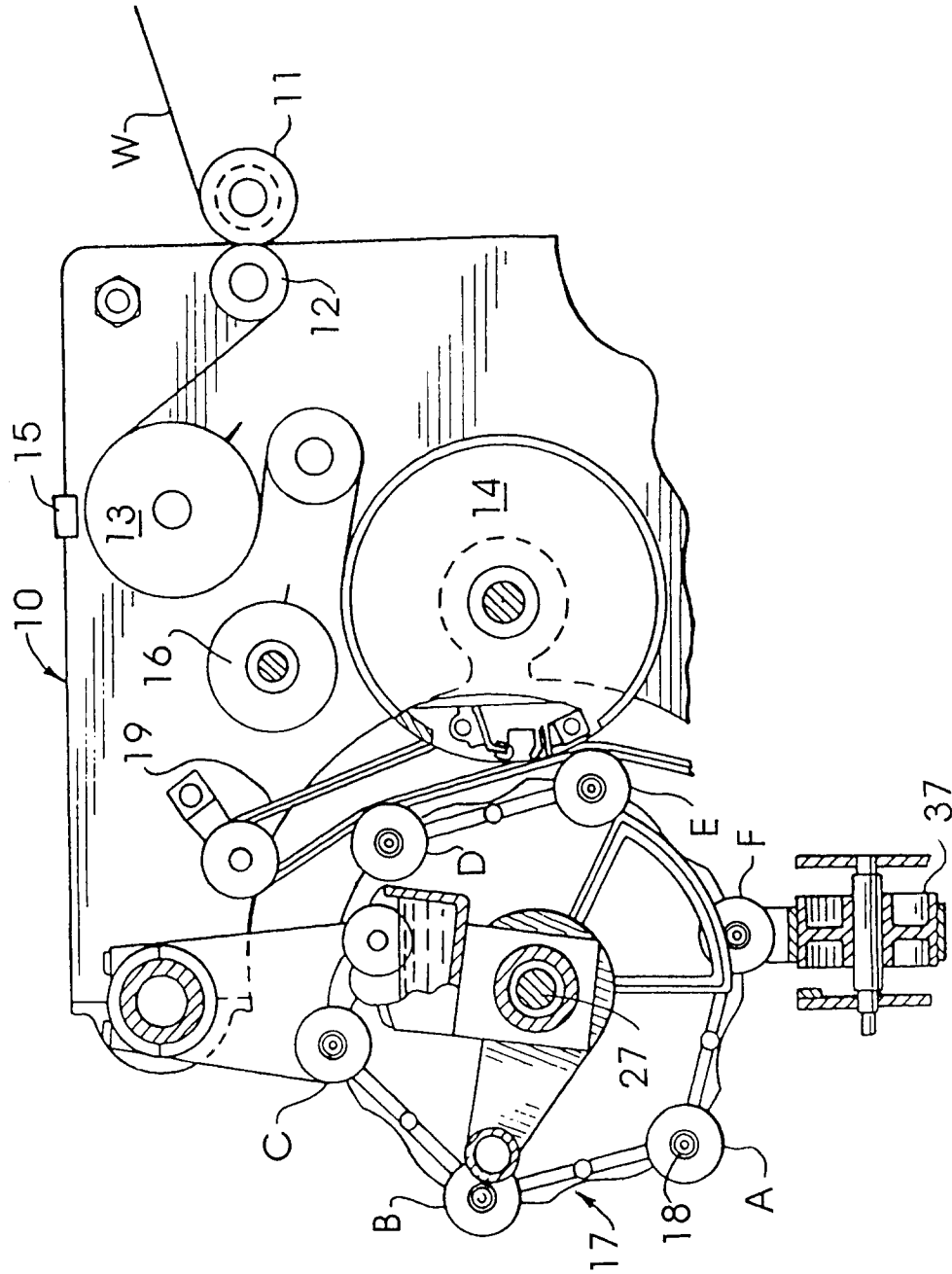


FIG. 2

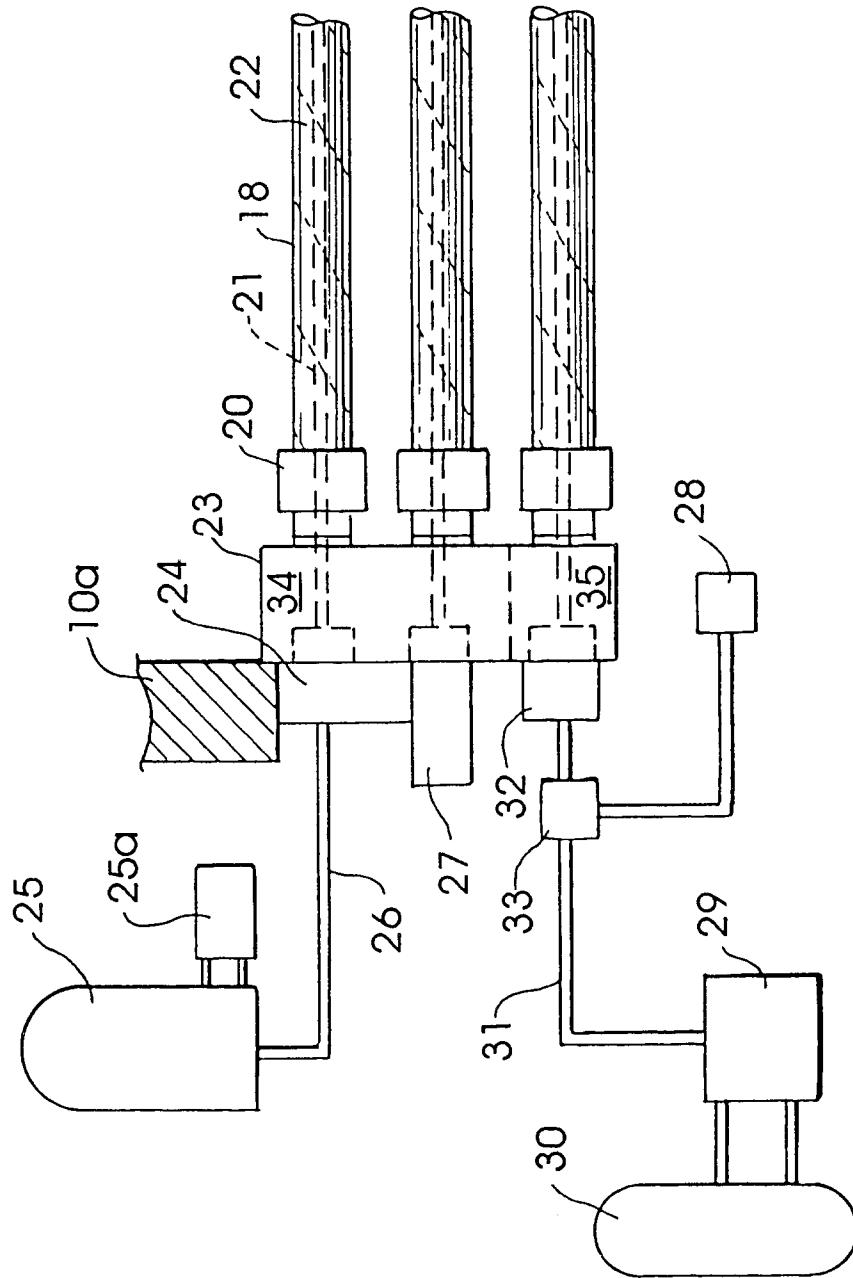


FIG. 3

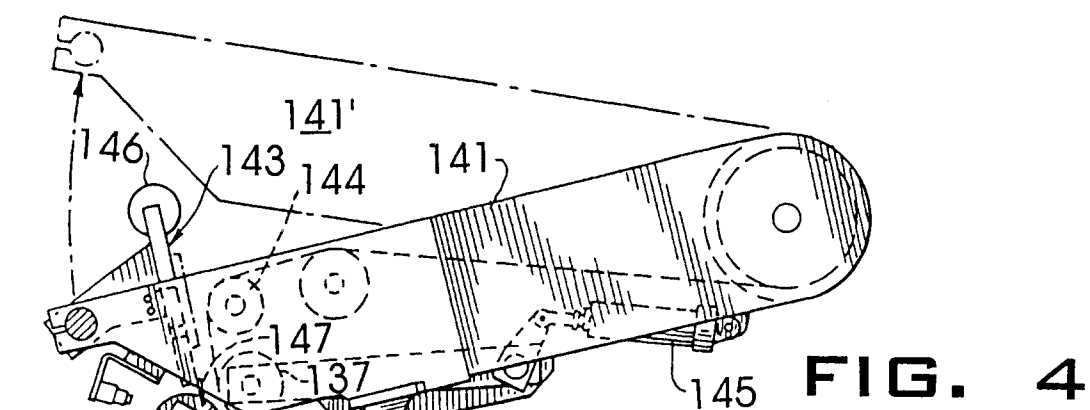
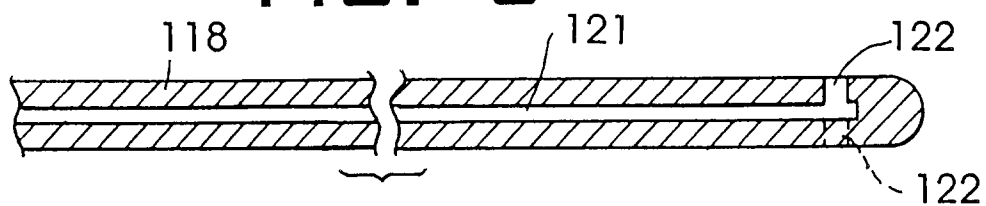


FIG. 4

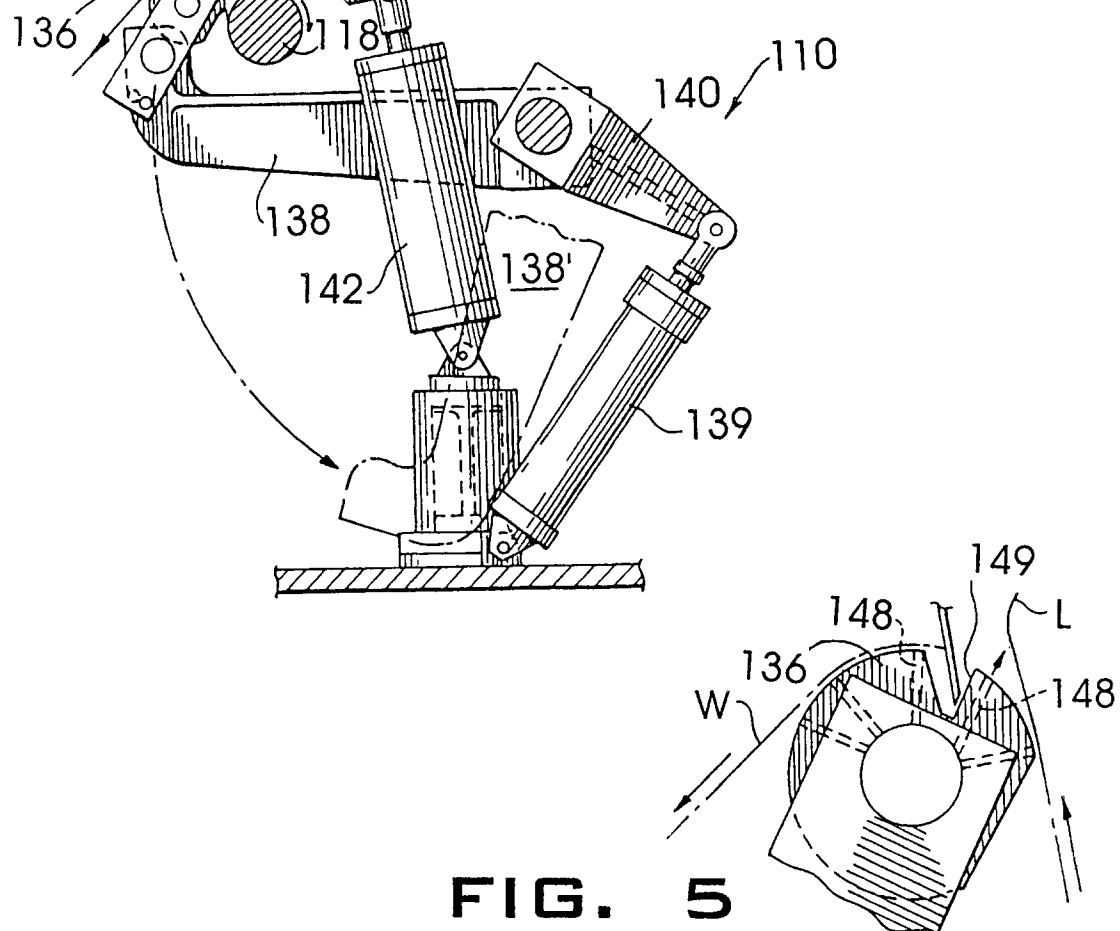


FIG. 5