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⑵ Surface winder and method.

⑶ A surface winder for developing a convolutely bound log in which a vacuum roll is positioned between the perforator and the station for applying a core to the web to take up slack developed during transfer.

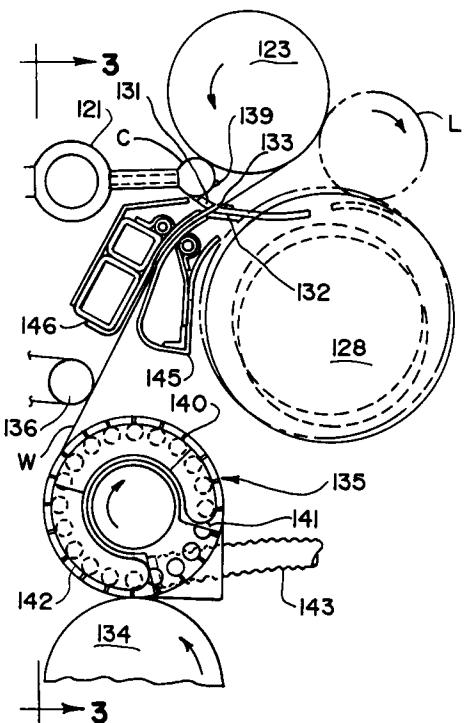


FIG. 2

BACKGROUND AND SUMMARY OF INVENTION:

This invention relates to apparatus and method for making convolutedly wound logs and, more particularly to logs such as toilet tissue and toweling.

Up to about 1950, stop-start winders (sometimes referred to as "rewinders") were used to convert jumbo-sized rolls of paper from the paper machine to retail-sized rolls. The critical feature in winding is cutoff and transfer. When the small roll or log is wound to its predetermined "count", it was necessary to sever the web transversely and transfer the web leading edge to a glue-equipped core. After about 1950, this was done automatically so that the winders could operate at continuous speed.

Two types of winders have been used. The most widely-employed for years has been the "center" wound type. These used a mandrel on which the core was ensleeved -- with the mandrel being turned with a decreasing speed as the log increased in diameter. The cutoff and transfer problem was handled advantageously first by co-owned Patent No. 2,769,600 and thereafter, when higher speeds were required, by co-owned Patent No. 3,179,348.

More recently, surface winders have become popular because of being able to avoid the mechanisms used for the decreasing speed characteristic -- thus, being less complex and cheaper. These have employed a three-roll cradle, a stationary winding roll, a second winding roll which could be movable, and a movable rider roll.

The cutoff and transfer problem was addressed advantageously first by co-owned Patent No. 4,723,724 and, more recently, by co-owned Patent No. 4,828,195.

In the '195 patent, the web was severed, i.e., "cutoff" by a speed differential to produce tension between a downstream point provided by the contact of the almost-finished log with the stationary winding roll and an upstream point where the core pinched the web. This resulted in excess material, i.e., slack, in the web upstream of the core and the compensator bar was inadequate to prevent transverse wrinkles, "necking in" resulting in diagonal wrinkles and poor log end quality and possible web breakage because of non-uniform web tensions at high speeds.

According to the invention, the inability of the compensator bar to move fast enough to quickly lengthen the web path and absorb virtually all of the slack web is remedied by the introduction of a vacuum roll between the perforator and the station which applies the core to the web. In some cases, the mechanical compensator bar is still used because it accurately meters out the web slack during the wind cycle but for less critical applications, only

the vacuum roll is employed.

BRIEF DESCRIPTION OF THE DRAWING:

5 The invention is described in conjunction with an illustrative embodiment in the accompanying drawing, in which --
 FIG. 1 is a fragmentary side elevational view of a surface winder constructed according to prior art patent 4,828,195;
 10 FIG. 2 is a view similar to FIG. 1 but showing the surface winder of the instant invention;
 FIG. 3 is a fragmentary and elevational view of the winder such as would be seen along the sight-line 3-3 applied to FIG. 2; and
 15 FIGS. 4-7 are views similar to FIG. 2 but showing the operation of the instant invention.

DETAILED DESCRIPTION

20 Inasmuch as this invention is an improvement on U. S. Patent 4,828,195, reference to that patent may be made for details of construction and operation not set down herein. It will be appreciated that the basic arrangements are the same and therefore FIG. 1 shows basic details of the '195 patent.

25 There, the symbol W designates a web arranged for advance through a longitudinally extending path within the frame 20 of the winder starting from the unwind and passing through the perforator (illustrated schematically) under the influence of draw rolls 34,35. Shown schematically in the upper left portion of FIG. 1 is a hypocycloidal core inserting mechanism 21, the details of which can be seen in co-owned patent 4,723,724.

30 FIG. 1 illustrates the orientation of the web at the end of one winding cycle and the beginning of the next. The web passes over stationary turning bar 22 and into contact with a core C just prior to cutoff transfer. The web continues toward the stationary winding roll 23 which is mounted on the frame 20 at 24. The web W is finally seen to be in the process of being wound into a log L.

35 The log L is contacted by a rider roll 25 carried by a pair of pivotally mounted arms 26 which are pivotally mounted on the frame as at 27. The log L is also contacted by the lower, movable winding roll 28 which together with rolls 23 and 25 form a three-roll cradle. The lower winding roll 28 is carried by pivot arms 29 which pivot around axis 30. The function of the winding roll 28 in this invention is the same as that described in the '195 patent -- this invention being concerned with what happens upstream of the winding roll 28, so the invention has broader application than just to the '195 construction. To facilitate understanding of the invention in the context of the prior art, similar reference numbers are used for similar elements but in-

creased by "100". Thus, the core inserting mechanism at the upper left portion of FIG. 2 is designated 121 and the side frames which define a longitudinally extending path of web travel are designated 120a and 120b in FIG. 3. Omitted in FIG. 2 for the sake of clarity are the unwind and perforator through which the web W is advanced under the influence of the draw rolls 134, 135 in FIGS. 2 and 3.

The important difference between this invention and that of the '195 patent is the provision of a vacuum roll as at 135 (see FIGS. 2 and 3) for the purpose of taking up the problem-creating slack. For the illustrated embodiment, there is also a relocation of the path of the web W upstream of the surface winding rolls 23, 28 of FIG. 1 and 123, 128 of FIG. 2.

The function of the vacuum roll 135 in eliminating slack not taken up by the compensator bar 136 can be readily appreciated from a consideration of FIGS. 4-7. In FIG. 4, the web has been "snapped" between the core C and the log L. This has been brought about a speed differential between the downstream pinch point 137 and the upstream pinch point 138. As seen in FIG. 5, this results in slack S due to the fact that the web on the log L is traveling at the same speed as the web coming to the draw rolls 134, 135 (i.e., line speed) whereas the web in contact with the core C is proceeding more slowly -- due to the fact that the core is confined between the roll 123 and stationary fingers 132. However, tension in the web is maintained by virtue of the vacuum provided by the upper draw roll 135.

In the preferred embodiment and as depicted in FIG. 6 the compensator bar 136 has moved to the right to cooperate with the vacuum roll 135 in taking up the slack S while still maintaining tension. In FIG. 5, the web has commenced on the core C.

Then in FIG. 7, the core has moved between the nip defined by the rolls 123 and 128 and the slack has effectively wound into the log and the compensator bar has retracted.

Structural Details

In FIG. 2, there is again the three-roll cradle consisting of stationary winding roll 123, the winding roll 128 and the rider roll 125. Contrary to the path of web W in FIG. 1 where it is fed over turning bar 22 into contact with the core C which is pinched between roll 23 and bar 22, the web path in FIG. 2 enters the three-roll cradle downstream of the point where the stationary winding roll 123 pinches the core C against the pinch bar 131. This permits the core to rotate to bring the glue stripe 139 into confronting contact with the web W and avoid additional slack.

The pair of side frames 120a and 120b supports all the rolls in the fashion described in the '195 patent and additionally supports the pinch bar 131 and a transfer bar and stationary fingers 132.

In contrast to the '195 showing, the pinch bar 131 is spaced from the fingers 132 (similar to fingers 32 of the '195 construction) by a throat or gap 133 through which the web W passes in traveling from the draw rolls 134, 135.

The vacuum roll has plurality of ports 140 (see FIGS. 2 and 3) which communicate with axially extending passages 141 in the roll 135. Provided at each end of the roll 135 are stationary vacuum valves 142. Vacuum is applied by a hose 143 connected to a vacuum blower (not shown) but which is adapted to provide about 5-50" (125 - 1250 mm) of water.

The compensator bar 136 is moved by a positioner belt system 144 (see FIGS. 4-7) operated by a servo motor (not shown).

Guiding the web W toward the throat 133 are supporting members 145 and 146.

Operation

It may be advantageous in some cases to use static electricity as contrasted to vacuum as the means for adhering the web to the slack take-up roll. In any event, the take-up roll also provides an advancing function by, in effect, "staking" the web to the roll surface.

Web slack is caused by the difference of web speed between the draw rolls (linespeed) and the winding rolls. In order to generate tension at transfer, a speed difference is necessary.

Immediately following transfer, the speed difference is reduced but it takes a period of time before speed match is achieved. During this time, the web slack is generated.

By maintaining tension on the web during the slack generation part of the wind cycle, the web can be controlled to remain generally flat in the cross-machine direction, viz., the machine direction being in the direction of web movement -- the longitudinally extending path. In this way, the tensions during transfer and winding can be spread uniformly across the web and prevent peak tensions from breaking the web. In addition, holding the web under tension in the machine direction helps to maintain tension in the cross-direction and thus reduces the tendency for the web to neck-in immediately following transfer. This allows rolls to be cut nearer the end of the wound log without any loss in roll quality.

Among the expedients which have been tried in the past is the use of vacuum along the longitudinal web edges. This is only partially effective in that the spreading forces acting on the moving web

are small and difficult to control. This perennial problem has been solved without undue complexity through the use of a heretofore ignored, close at hand means in the form of the draw roll.

Excellent results have been obtained in the production of normal toilet tissue webs, running at typical commercial speeds utilizing about 10" (250 mm) vacuum. Typical tissue webs are about 20 lbs. per ream (32.5 grams/square meter) produced at about 2000 feet per minute (600 meters/minute).

In the practice of the invention it is now possible to reduce the slack from about 2" (50 mm) to virtually zero while maintaining proper web tension.

While, in the foregoing specification, a detailed description of an embodiment of the invention has been set down for the purpose of explanations, many variations in the details given may be made by those skilled in art without departing from the spirit and scope of the invention.

Claims

1. A method of surface winding a web (W) into a convolutely wound log (L) about a central core (C) comprising advancing a web along a longitudinally extending path from an unwind through a perforator, thereafter past a station (121) for applying a core to said web and into a group of surface winding rolls (123, 128, 25), severing said web along a transverse line of perforation at a point between said station and said roll group by exerting tension on said web between an almost wound log and a new core in contact with said web, characterized in adhering said web to a vacuum roll (135) between said perforator and said station to take up slack in said web produced by said tensioning.

2. The method according to claim 1 characterized in that said severing is achieved by creating a speed differential in said web between that portion engaging an almost wound log and an upstream portion engaging a new core to develop tension between said portions and transversely severing said web along a transverse line of perforation and thereby introducing slack into said web upstream of said core engaged portion.

3. The method according to claim 1 characterized in that the adhering of said web to said roll is achieved by providing vacuum in said roll.

4. The method according to claim 1 characterized in that said vacuum roll functions as a draw roll.

5. The method according to claim 4 characterized in that said vacuum roll (135) is one of a pair of draw rolls (134, 135), said draw rolls operating to advance said web from said perforator.

10 6. The method according to claim 1 in which a compensator bar (136) is moved transversely against said web to cooperate with said vacuum roll in taking up slack.

15 7. The method according to claim 1 characterized in that the apparatus for surface winding a web into a convolutely wound log about a central core includes a frame providing a longitudinally-extending path for web travel, means on said frame for advancing a web through a perforator to a group of surface winding rolls, means on said frame between said advancing means and said roll group for moving a core into contact with said web, means operatively associated with said roll group for subjecting said web to a pair of pinch points (137, 138) to tension said web upon contact with a new core and thereby producing web slack upstream of said core contact, and vacuum means operatively associated with said advancing means for taking up said slack.

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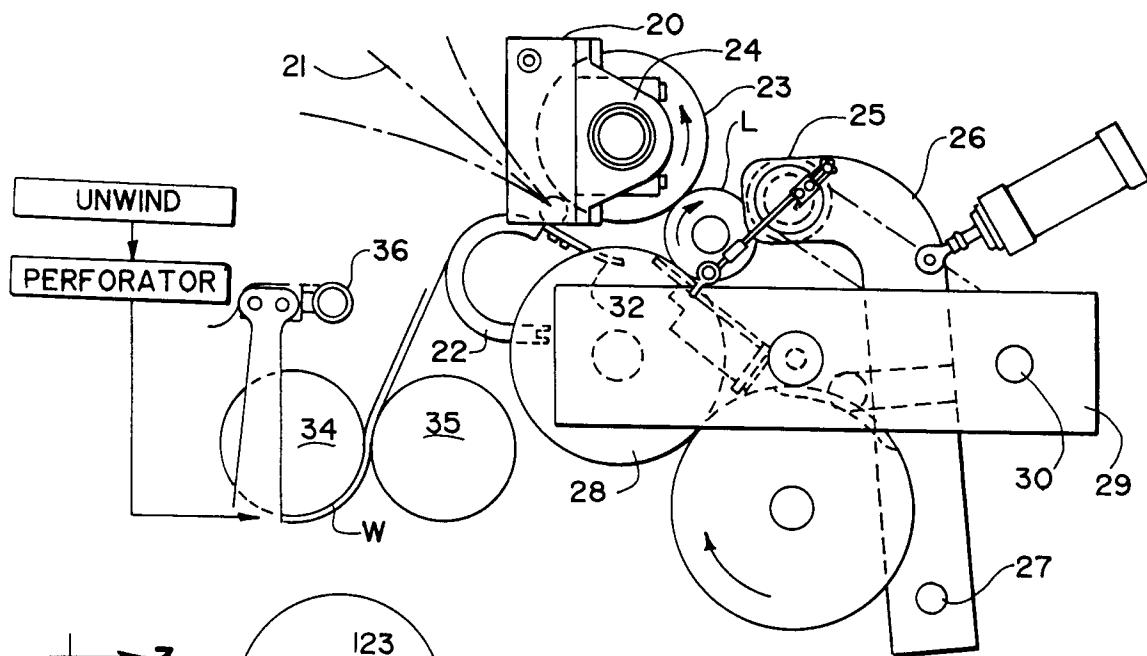


FIG. 1
PRIOR ART

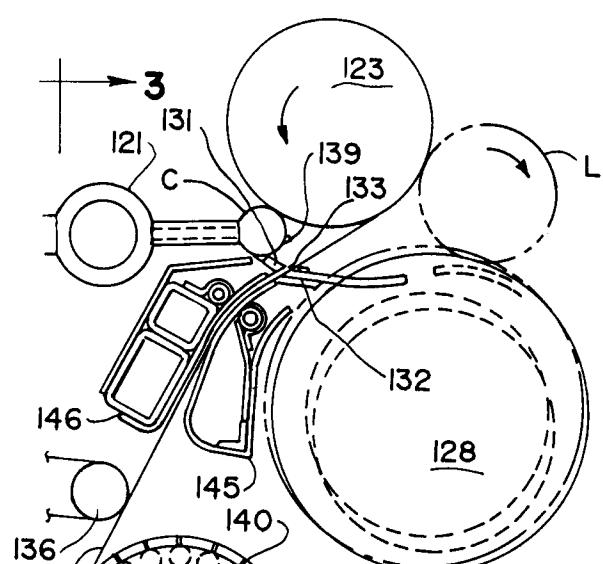


FIG. 2

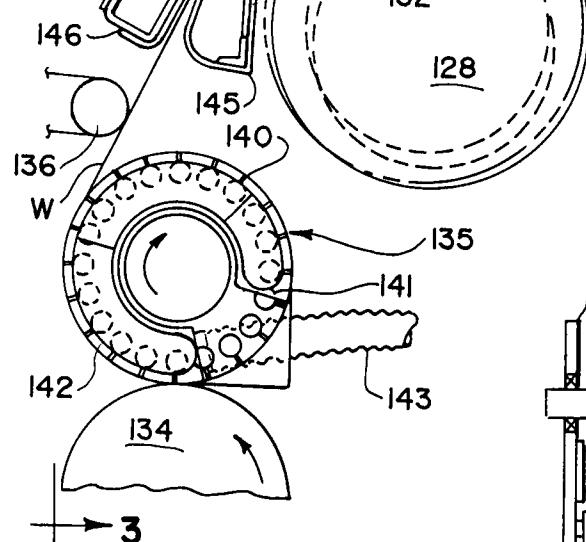
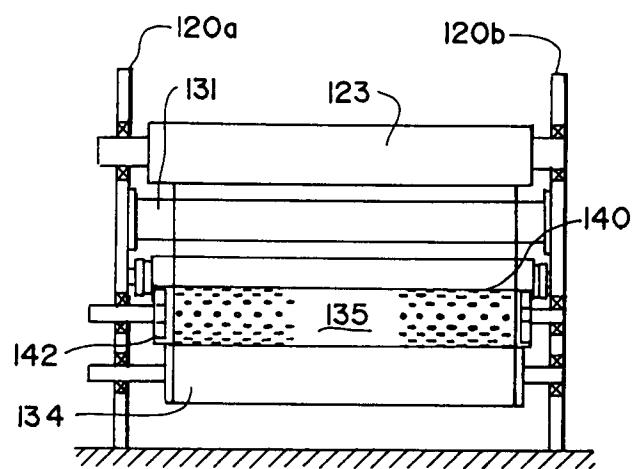


FIG. 3



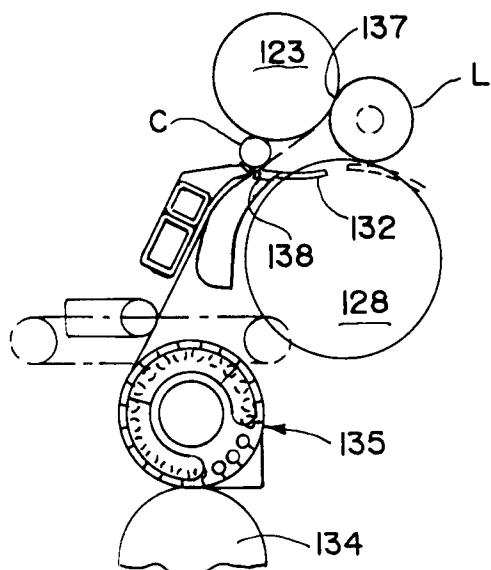


FIG. 4

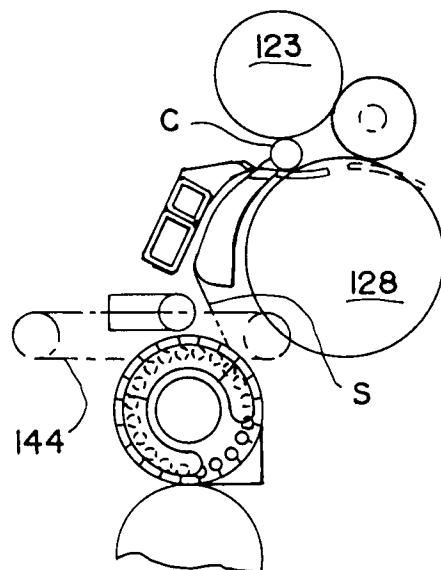


FIG. 5

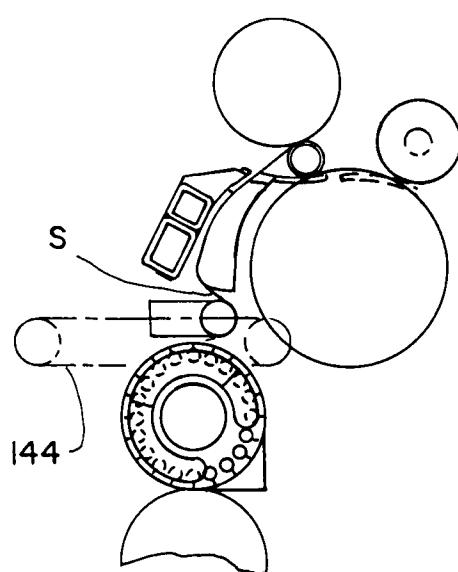


FIG. 6

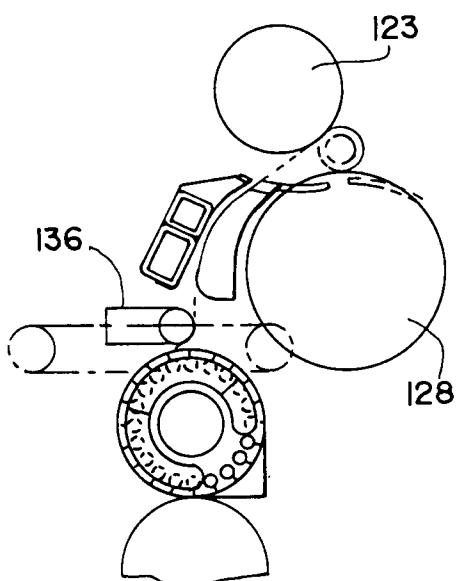


FIG. 7



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EUROPEAN SEARCH REPORT

Application Number

EP 92 10 2496

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	EP-A-0 408 526 (PERINI NAVI S.P.A.) * column 10, line 11 - line 39; figure 11 * * column 7, line 16 - line 37 * * column 9, line 16 - line 46 *	1-3	B65H19/24
Y	---	6	
Y	PATENT ABSTRACTS OF JAPAN vol. 8, no. 237 (P-310)30 October 1984 & JP-A-59 112 454 (SONY K.K.) 28 June 1984 * abstract *	6	
A	PATENT ABSTRACTS OF JAPAN vol. 14, no. 212 (M-969)2 May 1990 & JP-A-02 048 361 (MITSUBISHI HEAVY IND. LTD.) 19 February 1990 * abstract *	1	
D,A	US-A-4 828 195 (PAPER CONVERTING MACHINE COMPANY) -----		TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B65H
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
THE HAGUE	03 JULY 1992	THIBAUT E.E.G.C.	
CATEGORY OF CITED DOCUMENTS	T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document		
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