WEB-LAPPING MACHINE

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3 Claims

ABSTRACT OF THE DISCLOSURE

A web-processing machine wherein leading edge portions of transversely severed webs are sequentially transferred from a faster roll to a slower roll to achieve a lapping or shearing effect.


SUMMARY OF THE INVENTION

The invention finds utility in the production of paper products such as towels where the overlapped web segments are thereafter zigzag-folded for sequential dispensing. The present case incidentally discloses the invention claimed here but is directed to novel folding apparatus. The earlier joint case has to do with a different version of web-lapping and employed novel vacuum means for handling the trailing portion of a transferred web. This vacuum means was interposed between the conventionally-employed bedroll and retard roll. The instant invention departs from the previously-employed procedure in utilizing novel recess means for handling a portion of the web just rearward of the leading edge and thereby effect a superior control over the webs being lapped.

The invention is described in conjunction with an illustrative embodiment, in which:

FIG. 1 is a fragmentary elevational view, partially in section, of a machine which is employed for the formation of zigzag-folded toweling and which incorporates the teachings of this invention;

FIGS. 2—5 (on the second drawing sheet) are enlarged fragmentary elevational views, partially in section, of the bedroll and retard roll in different orientations so as to show the development of the web-lap;

FIG. 6 is a fragmentary elevational view, partially in section of the bedroll and retard roll as equipped with vacuum manifolds;

FIG. 7 is a fragmentary and elevational view of the bed and retard rolls; and

FIG. 8 is a fragmentary and elevational view, partially in section, of the above two rolls with associated supporting framework and means for varying the relative positions of the aforesaid rolls.

In the illustration given and with particular reference to FIG. 1, the numeral 10 designates generally one side frame of the towel-producing machine. The other frame is designated 11 and can be seen in FIG. 8. The side frames provide the means for mounting the various rolls which are employed to process the webbing.

GENERAL DESCRIPTION OF WEB TRAVEL

Referring now to the extreme righthand side of FIG. 1, the web 12 is seen to pass first over a spreading roll 13 which is generally known to the trade as a “Mount Hope” roll, having a curved surface for eliminating wrinkles. The frame 10 is equipped with a suitable pedestal and bearing generally designated 14 for the support of the roll 13. Proceeding to the left in FIG. 1, the web 12 is next seen to engage draw rolls 15 and 16 and therefrom is in partial wrapping engagement with a bedroll generally designated 17. Here the web is caused to adhere to the bedroll by vacuum and is cut by serrated blades as at 18 mounted on a cutoff roll 19. Each blade 18 cuts the web 12 as the blade 18 enters a matting groove as at 20 in the bedroll 17.

A pinch roll 21 (as with the rest of the rolls being rotatably carried by the frame 10) prevents the web (now a segment) from backing up at cutoff and insures cleaner and better cutoff. The next roll in the path of the web 12 (now in segmental form) is the so-called “retard” roll generally designated 22. As indicated previously, lapping or shearing has been carried out through the use of two basic rolls—the bedroll and retard roll with the retard roll traveling at a slower surface speed than the bedroll.

As the leading edge of the cut web comes close to the retard roll 22, the vacuum holding the leading edge of the web against the bedroll 17 is valved off and the corresponding vacuum in the retard roll 22 is valved on to transfer the leading edge from the surface of the bedroll 17 to the surface of the retard roll 22. I have found that this transfer is advantageously achieved when there is a space of approximately 0.025” to 0.030” between the rolls when ordinary toweling-grade webbing is being processed.

Once the leading edge of a cut web is transferred to the surface of the retard roll 22, the leading edge slows down while the trailing edge portion of a web is advancing at the same rate as the web 12 previously referred to.

The handling of the slack necessarily developed by this speed differential is disclosed in detail in FIGS. 2—5 to which reference will be had later in this disclosure.

The slower traveling web is confined between the retard roll 22 and a matting or cooperating roll 23. By the time the webbing passes between the rolls 22 and 23, the lap or shingle is developed and the amount of lapping in equal to the difference in distance traveled between each cut of the cutoff roll 5. In the illustration given, the rolls 22 and 23 travel one-third slower than the bedroll 17. Therefore, the overlap is equal to one-third of the cut sheet length. This method of lapping has shown a reliability at high speeds above 500 feet per minute.

The remaining processing of the web segment is described in detail in my above mentioned co-pending application, Ser. No. 644,375, and reference may be had thereto for further details.

Roll 24 is a slitter bedroll equipped with hardened anvil sections. Slitters 25 engage these sections to split the web into commercial widths that can be dispensed from wall cabinets in washrooms. Folding rolls 26 and 27 employ tuckers and grippers to develop a zigzag-folding in the fashion described in application Ser. No. 644,375. Ultimately, the segmented, lapped web 12 is conducted away from the apparatus by means of a conveyor generally designated 28.

Alluded to previously were certain vacuum ports.

Referring now to FIG. 2, it will be seen that the numeral 29 designates a longitudinally-extending bore in the bedroll 17. As the bedroll rotates, the bore 29 comes to register with an arcuate manifold 30 (see FIG. 6), the manifold 30 being coupled to a means of creating a vacuum as at 31. In the illustration given, the bedroll 17 is a “three-time” roll, i.e., having a circumference accommodating three lengths of the web segments used to develop the interfaced toweling. This bore 29 is adapted to urge the leading edge 32 of the web segment 33 against the bedroll. A second longitudinally-extending bore 34 is adapted to urge the leading edge of a succeed-
ing web segment 35 against the periphery of the bedroll 17. The segments 33 and 35 are developed by the action of the knife blade 18 in conjunction with the mating groove 36 (as seen in the upper right-hand corner of Fig. 2). A third longitudinally-extending bore 37 is provided in the bedroll 17 and each of the bores 29, 24 and 37 is in communication with the surface by means of radial extending bores at 38 (designated only relative to the longitudinally-extending bore 29). Each bore 29, 34 and 37, as the case may be, has its associated mating groove as at 36 and following the associated passage 38, a recess or ditch as at 39 which is employed to "take-up the slack" in the tubing as the leading edge is transferred from the bedroll 17 to the retread roll 22.

Also employed in this transfer is a second set of vacuum ports which communicate with the periphery of the bedroll 17 in line with the trailing end portions of the web segments 33 and 35. For example, the trailing end portion of the web segment 33 is urged against the bedroll periphery by virtue of vacuum existing in a longitudinally-extending bore 40 which communicates with the surface of the bedroll by means of a radially-extending passage 41. Similar through bores and passages are provided in association with the other mating grooves 36. It will be noted that the longitudinal diameter of the bore 40 is spaced radially outward of the longitudinally-extending bores 29, 34 and 37 and thus are serviced by means of a second arcuate manifold at as 42 in Fig. 6.

**DETAILED DESCRIPTION OF OPERATION**

Still referring to the second drawing sheet which includes Figs. 2–5, the web segment 33 in Fig. 2 has just been developed by the co-action of the knife blade 18 and the mating groove 36. The leading edge of the web segment 33 is urged against the periphery of the bedroll 17 by virtue of the vacuum existing in the longitudinally-extending bore 29. The trailing edge of the web segment 33 is urged against the periphery of the bedroll 17 by virtue of the vacuum existing in the longitudinally-extending bore 40.

Trundling now to Fig. 3, it will be seen that the bedroll 17 has rotated slightly in a counter-clockwise direction relative to the mating groove 36 associated with the through bore 29 into alignment with the line connecting the centers of the bed and retread rolls 17 and 22, respectively. The vacuum, as illustrated in the drawing given, whereby the three-time bedroll has a diameter of 9.132" and the top retread roll has a diameter of 6.089" is completely removed through the bore 29 about 9/16" above the center line of the retread roll 22 and bedroll 17 nip.

At this point in time, vacuum is removed from the through bore 29 and vacuum is applied to a cooperating through bore 43 provided in the retread roll 22. The through bore 43 communicates with the surface of the retread roll 22 by means of a passage 44 and the retread roll has associated therewith an arcuate manifold as at 45 (see Fig. 6). Because vacuum is released from the bore 29 and applied to the bore 43, the leading edge of the web segment 33 is removed from the surface of the bedroll 17 and urged against the surface of the retread roll 22.

This is seen schematically in Fig. 3 wherein the distance between the surfaces of the rolls 17 and 22 is exaggerated.

As pointed out previously, this distance for the handling of towing is ordinarily 0.025" to about 0.030", in effect defining a "nip" between the rolls.

As the bedroll 17 continues to rotate in a counter-clockwise fashion, slack develops in the web segment 33 by virtue of the fact that the retread roll 22 is moving at a lower surface speed. In the illustration given, the diameters of the retread and bedrolls 22 and 17, respectively, are related by a ratio of 2:3 and rotate at the same angular velocity. Therefore, a surface speed in the retread roll 22 of two-thirds that in the bedroll 17 is achieved. Since the position of the leading edge of the web segment 33 is determined by the position of the through bore 43 in retread roll 22, and since the trailing edge of the web segment 33 is determined by the position of the through bore 40 in bedroll 17, and since the latter is moving more rapidly than the former, slack necessarily develops. This slack, which is designated 46 in Fig. 4, is received within the recess or ditch 39.

It will be appreciated that a plurality of through bores such as that designated 40 may be provided for each web segment as for example in the position designated 47 and 48 and thereby serve to urge the web segment into tight engagement with the bedroll surface 17 rearward of the ditch 39.

Trundling now to Fig. 5, the bedroll 17 is seen to be in still a further degree of rotation, i.e., from that seen in Figs. 4, 3 and 2—in that order. In Fig. 4, the ditch 39 was on the line joining the centers of the rolls 17 and 22. The ditch 39 in Fig. 5 is seen to have been rotated approximately 30° beyond the showing in Fig. 4. By this time the leading edge of the preceding web segment at as 49 (so designated in Figs. 4 and 5) has been detached completely from the bedroll 17. For example, in Fig. 4, the outer through bore 50, which is associated with the trailing edge of the web segment 49, still has vacuum applied thereto and causes the web segment 49 to be detached from the bedroll 17. By the time the configuration of Fig. 5 is reached, the through bore 50 no longer has vacuum applied thereto (by virtue of no longer being in register with the arcuate manifold 42) so that the trailing edge of the preceding web segment 49 now falls by gravity to the position seen in Fig. 5. In Fig. 5, it is seen that the leading edge portion of the web segment 33 is advancing to a position over, i.e., above, the trailing portion of preceding web segment 49. Both segments 33 and 49 are proceeding at the same rate and thus the desired lapping or shingling is achieved.

In the illustration given, by virtue of having the mating grooves 36 provided in the bedroll, there is provided an advantageous crimping of the extreme leading edge of each web segment as at 52 relative to the segment 33 (so designated in Fig. 5). In this fashion, there is no possibility that the leading edge portion of the segment 33 would be spaced away from the surface of the retread roll 22. If, for example, the crimping were the reverse, the uncrimped leading edge portion may result in spacing of the web segment from the port developed by the end of the passage 44 and thus result in inferior holding action of the web segment 33 by virtue of the vacuum existing within the trough bore 43. Also, it is apparent that the vacuum within the various bores acts directly on the web segment in question and not through a preceding or following web segment so that precise positioning of the various web segments is achieved. Still further, the arrangement makes advantage use of gravity since when the vacuum is removed from the through bore 50, the trailing edge of the preceding web segment 49 falls by gravity from the positioning edge in Fig. 4 to that seen in Fig. 5.

Referring now to the third drawing sheet, to which reference has already been made insofar as arcuate manifolds are concerned, it is seen that in Fig. 6, the retread roll 22 has associated therewith the arcuate manifold 45. The manifold 45 is essentially horse-shoe-shaped in end elevation and abuts in sealing relation the end wall 83 of the retread roll 22. Thus, when a given through bore 43 is in the space not covered by the arcuate manifold 45, there is no vacuum on the particular through bore 43.

Further, the extent of arcuate travel in which a given through bore is exposed to vacuum, is regulated by means of end fittings 54 positionally movement, the manifold 45 by means of hex-headed bolts 55. The foregoing description of a manifold is generally known to those skilled in the art and similar manifolds are found, for example, in the previously-identified application, Ser. No. 438,560.

In like fashion, the manifolds 30 and 42 ride against the end wall of the bedroll 17 and have the arcuate extent of 3,490,762
vacuum application adjustable by means of suitable blocks. In certain instances, I find it advantageous to groove the vacuum rolls 17 and 22, respectively, as seen in FIG. 7, and the actual ports 56 and 57 corresponding to the through bores 29 and 43, respectively, are identified in FIG. 7.

As indicated previously, the control of the spacing between the bedroll 17 and the retard roll 22 is important—varying, however, with different calipers of paper. It is apparent that there has to be some clearance in order to accommodate the finite thickness of paper which must pass through the nip between the two rolls. Further, there should be a slight additional spacing to insure that there is a transfer actually achieved by virtue of cessation of vacuum in the through bore 29 and application of vacuum in the through bore 43. This is achieved by means of pivotally positioning the retard roll 22 with relation to the fixed position of the bedroll 17. In the illustration given, the retard roll 22 is journaled in a pair of arms 58 and 59 (see FIG. 8). The arm 59 is seen in side elevational view in the central upper portion of FIG. 1. Each arm is coupled to an actuator generally designated 60 which may take the form of a resilient, hollow donut capable of being internally pressurized so as to pivot the associated arm, i.e., 59, about a stub shaft 61 fixed in position on the frame 10. This determines the vertical clearance between the bedroll 17 and the retard roll 22. A second set of actuators, one of which is designated 62 in FIG. 1, is employed for pivoting the retard roll 22 about the pivot 63 so as to regulate the horizontal clearance between the bedroll 17 and retard roll 22.

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

I claim:

1. In web-lapping apparatus, a frame, a bedroll mounted for rotation in said frame, means for rotating said bedroll at a predetermined surface speed, a retard roll mounted for rotation in said frame in side-by-side relation to said bedroll to define a nip therebetween, means for rotating said retard roll at a surface speed slower than said predetermined surface speed, cutoff means operably associated with said bedroll for providing web segments to sequentially advance toward said nip, and vacuum port means in each of said rolls arranged and contracted to transfer the leading edge portion of a web segment from said bedroll to said retard roll, second vacuum port means in said bedroll rearward of the first-mentioned vacuum port means adapted to urge a trailing portion of said web segment against said bedroll when said leading portion is transferred to said retard roll, valve means operably associated with said bedroll for sequentially de-actuating the first-mentioned bedroll vacuum port means and said second vacuum port means, and recess means in the surface of said bedroll between said first-mentioned bedroll vacuum port means and said second vacuum port means for accommodating the slack in said web segment developed by the leading portion traveling slower than the trailing portion thereof.

2. The structure of claim 1 in which a second retard roll is provided below the first-mentioned retard roll so that the slack developed in said web segment is removed from said recess means by gravity.

3. The structure of claim 1 in which means are provided on said frame for adjustably-positioning said retard roll relative to said bedroll for defining the nip therebetween.

References Cited

UNITED STATES PATENTS

3,338,575 8/1967 Nystrand et al. ________ 270—59
EUGENE R. CAPOZIO, Primary Examiner
P. V. WILLIAMS, Assistant Examiner

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