ABSTRACT: Folding apparatus for V-interfolded towels and the like in which transfer of severed webs is made directly from the cutoff bedroll to the gripper and tucker-equipped folding rolls, the tuckers being equipped with vacuum-actuated tips and the grippers being housed within the folding rolls to provide pockets for the accommodation of slack webbing.
APPARATUS FOR INTERFOLDING WEBS

BACKGROUND AND SUMMARY OF INVENTION

In the production of interfolded toweling, tissues, etc., folding rolls are employed in pairs, each pair having at least one tucker element and one gripping element with the tucker of one roll cooperating with the gripper of the other roll to develop a fold. In the past, the machinery required to bring the webbing to the stage of interfolding has been not only complex but lengthy in terms of production line requirements. In particular, the means for severing the webs usually was located at some distance from the folding rolls, and thus it was necessary to trim the sheets in the lengths of web material, a proposition which makes high speed operation difficult. By virtue of the instantaneous wherein folding and cutoff bedrolls are arranged and constructed to provide a discrete amount of slack and means for accommodating the web slackness, I have overcome the heretofore existing drawbacks, particularly the limitations on higher speed operation.

DETAILED DESCRIPTION OF INVENTION

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

FIG. 1 is a side elevational view, partially schematic, of apparatus embodying the teachings of this invention;
FIG. 2 is an enlarged fragmentary side elevational view of the elements therein of FIG. 1;
FIG. 3 is an enlarged sectional view such as would be seen along the sight line 3-3 applied to FIG. 2; and
FIGS. 4 and 5 are fragmentary side elevational views depicting in sequence the handling of webbing between two folding rolls.

Referring now to FIG. 1, the numeral 10 designates generally a frame for the machine and it will be appreciated that the frame normally includes two integral side frames capable of providing journals or bearings for a plurality of rolls supported on the frame. In the illustration given, the numerals 11, 12, 13, and 14 (at the extreme left of FIG. 1) designate expanders which are employed for guiding webs 15, 16, 17, and 18 into the interfolding station. The webs 15 and 16 are joined by being passed over first and second draw rolls 19 and 20 while the webs 17 and 18 are united by passing around in partial wrapping engagement and traveling with) draw rolls 21 and 22.

The numerals 23 and 24 (see the upper portion of FIG. 1) designate, respectively, an upper cutoff roll and an upper cutoff bedroll employed to transversely sever the now united webs 15 and 16. By the same token, the numerals 25 and 26 designate, respectively, a lower cutoff bedroll and a lower bedroll for transversely cutting the joined webs 17 and 18. In FIG. 2, the rolls 25 and 26 are seen, and it will be noted that the roll 25 is equipped with a knife 27 while the roll 26 is equipped with a cooperating slot 28. A plurality of knives and slots of this character are provided in each of the rolls, the number being determined by the relationship of the severed web length to the roll circumference.

The numerals 29 and 30 designate pinch rolls which operate against the bedrolls 24 and 26, respectively, to insure compaction and adherence thereto of the respective webs. The numerals 31 and 32 designate the folding rolls which are seen in greater detail in FIGS. 2 and 4 and 8. Extending to the right (in FIG. 1) of the folding rolls 31 and 32 is a delivery unit 33 in which the interfolded webs are removed from the vicinity of the folding rolls under the guidance of packers 33a and 33b.

OPERATION

It is believed that the operation of the invention can be best understood by reference to the third drawing sheet, i.e., FIGS. 4-8. In FIG. 4, the numeral 31 again designates the upper folding roll, while the numeral 24 designates the upper bedroll. The symbol W designates the web being advanced toward interfolding and which has been made up of the previously described webs 15 and 16. It will be appreciated that the rolls 24 and 31 shown in FIG. 4 are oppositely oriented from the showing in FIGS. 1 and 2, as if viewed from the opposite side of the machine. The bedroll 24 is equipped with a notch 34 in its periphery for each of the cooperating tucker elements 35 provided in the folding roll 31. Additionally, each tucker element is coupled to a vacuum source (not shown) by means of bore 36, channel 37, and bore 37a. The bore 36 is within the block providing the abutment constituting the tucker adjacent channel 37, while the bore 37a extends through the interior of the folding roll 31, ultimately being coupled to a vacuum manifold. Such a manifold is shown relative to the folding roll 32, as at 38, in FIGS. 2 and 3.

The web W is caused to adhere to the periphery of the bedroll 24 by means of another vacuum manifold as at 39 in FIG. 2. The rolls 24 and 31 are sized (in the illustration given) so that gearing of the same diameter as the respective rolls will result in the folding rolls being rotated slower than the bedroll. Phrased alternatively, the surface speed of the roll 31 is slower than that of the bedroll 24. Folding roll 31 is smaller in order to accommodate the tucked in and gripped leading and trailing edges of the cut web sections.

Turning now to FIG. 5, the rolls 31 and 32 are seen a short time later in their respective rotations. The tucker element 35 now has taken control of the web W by virtue of the vacuum applied to the trailing edge 40 of the tucker 35. Due to the difference in speed between the two rolls, a slack portion S is developed on the entering side of the nip defined by the close proximity of the rolls 24 and 31. As the rolls 31 and 32 continue to rotate, the condition of FIG. 6 is reached wherein the slack S is now seen to be received within a pocket 41 provided in the folding roll 31. The pocket 41 also provides a mounting space for a gripper element 42. The gripper element 42, in accordance with conventional practice, is pivotally mounted so as to shift positions, i.e., to that designated 42' in FIG. 8, and thus cooperate with the tucker 35 in confining a web portion.

Referring now to FIG. 7, the rolls 31 and 24 are seen in the condition corresponding to a short time after the condition depicted in FIG. 6. By now the slack S is on the leaving side of the nip between the rolls 24 and 31, thereby being available to accommodate the interfolding action developed between the grippers and tuckers. In FIG. 8 the lower folding roll 32 is also seen which provides the gripper 42' previously mentioned. The gripper 42' acts against an anvil surface 43 which serves to partially define the pocket 41, being urged thereagainst by cam action.

VACUUM ARRANGEMENT

Each of the rolls 24, 26, 31, and 32 is equipped with a vacuum manifold which advantageously may take the construction seen in FIG. 3. There the folding roll 32 is seen to be equipped with a journal 44, and inwardly of the journal is a reduced diameter portion 45 which communicates with the various vacuum bores, i.e., the channels 37, for example. The reduced diameter section 45 is provided as part of the roll 32 and rotates therewith. Provided as a stationary part of the frame 10 (see FIG. 2) is the manifold 38, which is spring-loaded against the section 45, defining a passage 46 therewith. The passage 46 communicates through a suitable conduit 47 (see the lower right-hand portion of FIG. 2) with the vacuum pump (not shown).

Referring now to FIG. 2, it is seen that the lower folding roll 32 is equipped with four tuckers and four grippers. One of the tuckers 35 (here it will be appreciated that all of the remaining tuckers in both of the folding rolls are identical) is seen positioned immediately radially outwardly of the axially extending internal channel 37 provided in the folding roll 32. The channel 37 serves as an initial manifold for applying vacuum substantially along the length of the tucker 35. To communicate the channel 37 with the manifold 38, a bore 37a is provided in the roll 32. This corresponds to the previously referred to bore or passage 37a.
identified in FIG. 4 and relative to the folding roll 31. The passage 37a is provided within the reduced diameter section 48 so as to communicate with the passage 46. In operation, vacuum is applied to the tip of the tucker 35 during the arc of its rotation from about 8 o’clock (as shown) to about 12 0’
clock (as shown). Because of the proximity of the two folding rolls to each other and the difficulty of placing manifolds at the 8 to 12 o’clock positions relative to folding roll 32 in FIG.
2, I have positioned the manifold 39 approximately diametri-
cally opposite to take advantage of more available space. This has necessitated the additional bore 37a previously referred to.

In contrast to the foregoing, there is no such space limitation applicable to the cutoff bedrolls 26 and 24. In FIG. 2, the bedroll 26 is seen to function in conjunction with the manifold 39 and axial bores as at 49 and 50 communicate with the manifold 39. The axial bore 49 (as seen in FIG. 2) is no longer in communication with the manifold 39, thereby releasing its holding force relative to a web traveling therewith. This makes possible the transfer of the web from the bedroll 26 to the folding roll 32, the tucker element 35 now being vacuum actuated to effect this transfer. However, the bore 50 is still in communication with the vacuum manifold 39 so as to retain against the periphery of the roll 26 the tail of a web just released from the bedroll 26, thereby corresponding to the showing in FIG. 5.

In FIG. 2, the configuration of elements is such as to illustrate a transverse cutting just about to occur by coaction of the knife 27 and slot 28. As this does occur, the leading edge of the severed web will be urged against the periphery of the bedroll 26 by the action of the vacuum in the bore 51, spaced just rearwardly of the slot 28 (considered in the direction of roll rotation). It will be noted that the bore 51 communicates with a recess 52 in the periphery of the roll 26 by means of a bore 53. At an instant shortly after that depicted in FIG. 2, the bore 51 is in communication, i.e. in registry, with the manifold 39 which extends between the points 54 and 55 as designated in FIG. 2.

From the foregoing description, it is seen that a highly compact arrangement is provided to transfer the severed web from a bedroll to a folding roll without the need of intervening web supporting and traveling apparatus. Requisite amounts of slack are readily provided, this being necessary to accom-
modate the interfolding operation, but without the need for losing control over the web. Each web segment is under the in-
fluence of the vacuum system from the time it is created (by the transverse severing) until the time of interfolding with a web W’ (see FIG. 8).

1 claim:

1. In folding apparatus for toweling and the like wherein sheets are delivered in a V-interfolded arrangement, means for advancing two continuous webs past cutoff means, means for traveling the severed webs about vacuum-equipped bedrolls, and means for interfolding the webs including vacuum-equipped folding rolls having tuckers and grippers, the improvement characterized by the fact that means are operatively associated with said folding rolls and bedrolls for rotating the folding rolls at a surface speed slower than the surface speed of said bedrolls, each tucker being equipped with a vacuum connection arranged to temporarily adhere the leading edge of a severed web to the tucker tip, each gripper having associated therewith a web-receiving pocket just forwardly of the gripper whereby the slack developed by the speed differential of the folding roll and bedroll is temporarily stored in said pocket.

2. The apparatus of claim 1 in which a vacuum manifold is operably associated with each folding roll, the manifold for each folding roll being located approximately diametrically opposite that section of the folding roll which supports the web approaching interfolding.