

[54] METHOD AND APPARATUS FOR TEARING
SECTIONS FROM A WEB

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[51] Int. Cl. B26f 3/00

[58] Field of Search 225/1, 3, 97, 100, 101,
225/106, 93

[56] References Cited

UNITED STATES PATENTS

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FOREIGN PATENTS OR APPLICATIONS

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[57]

ABSTRACT

This invention relates to a method of tearing sections from a continuous web of fibers without causing compression of the fibers at the severance line by grasping the web at spaced portions adjacent to the tearing area, and moving one portion relative to the other portion to stress and tear the web. An apparatus for accomplishing the tearing includes two juxtaposed pairs of jaws, or the like, which receive and engage an intermittently advanced web. One pair of jaws is then displaced from the juxtaposed position to stress and tear the web. The stressing and tearing action substantially eliminates any densified layer or thickened portions between the ends of the section and the engagement line while the engagement of the web creates a transverse densified line near the ends of the sections.

11 Claims, 5 Drawing Figures

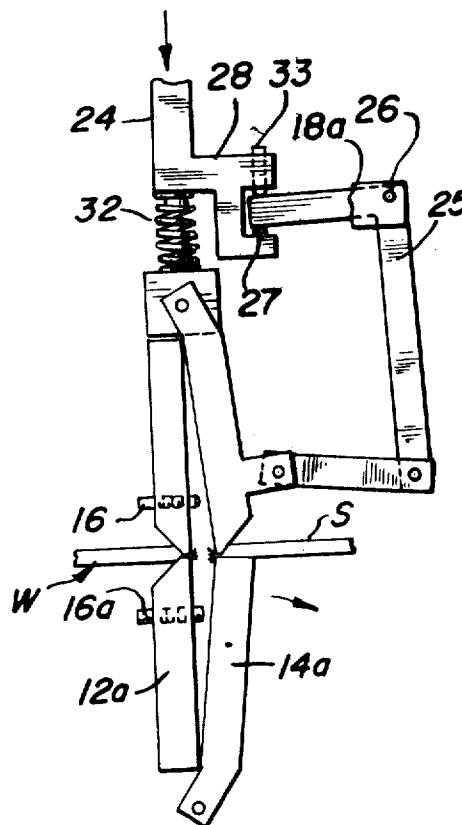


FIG. 1

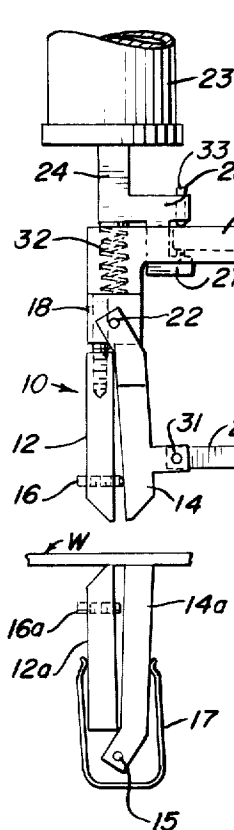


FIG. 2

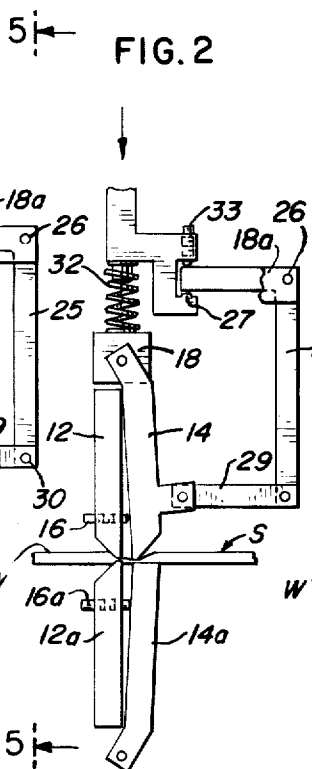


FIG. 3

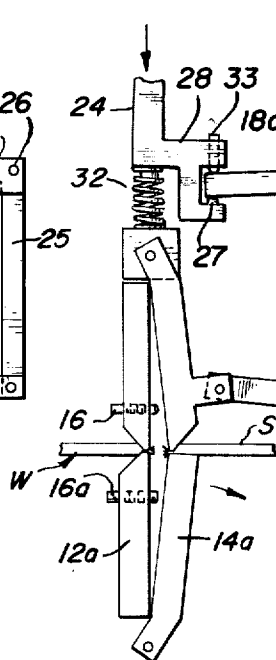


FIG. 4

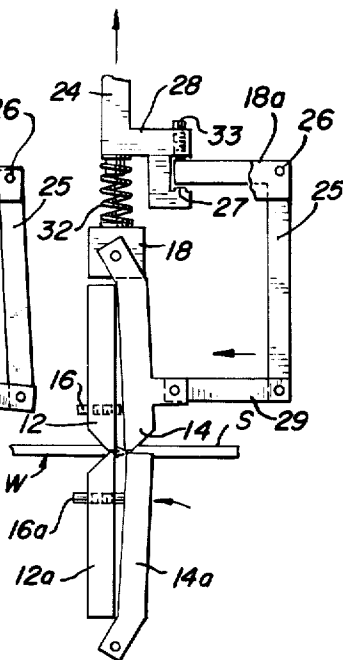
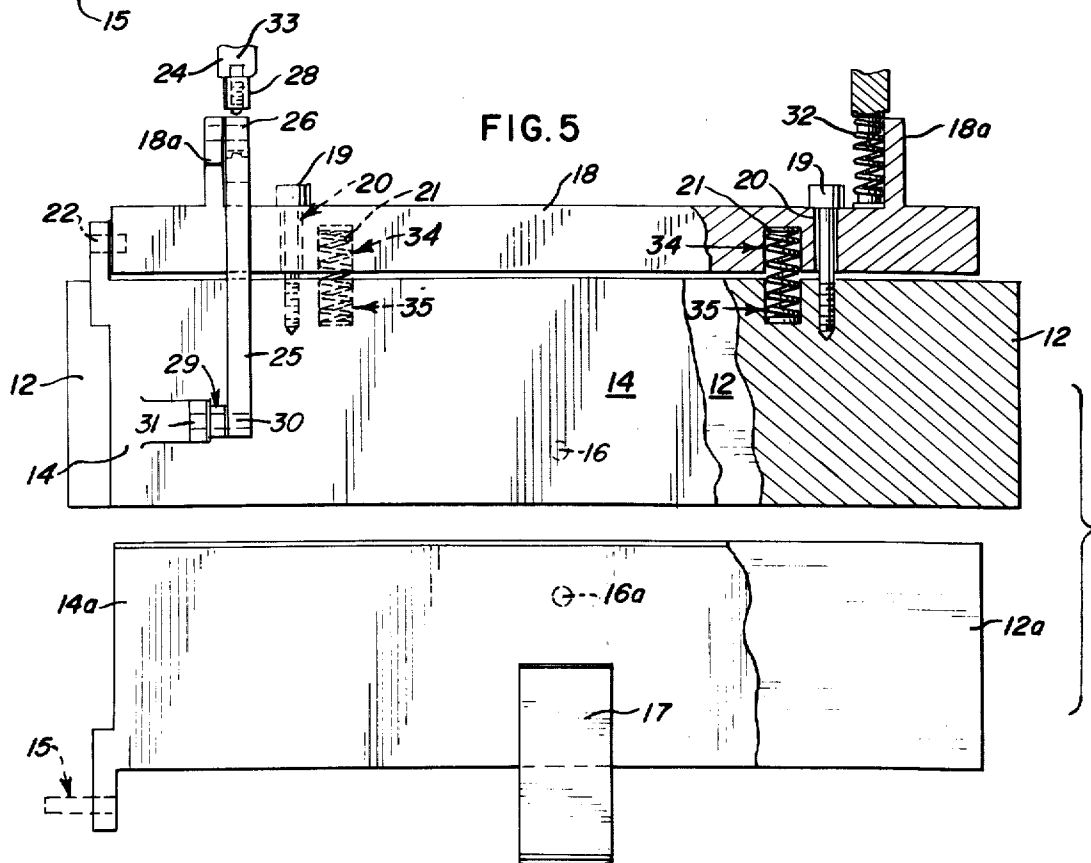


FIG. 5



METHOD AND APPARATUS FOR TEARING SECTIONS FROM A WEB

SUMMARY OF THE INVENTION

The present invention relates to the field of fiber web processing and, more particularly, to the field of air laid web severing. An apparatus of the present invention provides means of transversely tearing a web into sections, such as those used in disposable diapers.

In the past it has been the usual practice to sever web sections from an air laid web by cutting the web, as with a knife or scissors. Due to the loose structure of the fibers in such webs, this type of severance often results in permanent compression of the fibers at the severance line. As a result of this compression, the density of the fibers in this region is greatly increased, and, consequently, the wickability or preferential absorptivity along the line of permanent compression is greatly increased. This result may be most disadvantageous in the formation of diaper web sections since urine will migrate along such a line of densification when it comes into contact with it. If this densification line occurs at an edge, as where the web section has been cut with a knife edge, there is a strong tendency for any liquid coming into contact with the line to be drawn into and concentrated at the line.

Since the structure of air laid webs is loose, these webs may be quite easily torn when stressed. Moreover, if the tearing can be done without compressing the fibers of the web, no densification lines will be created at the edge. The present invention discloses a method and an apparatus which may be used to overcome the severance densification problem by tearing rather than cutting the web, thus severing sections from a web without creating undesirable edge densification lines. The present invention eliminates densification at the line of severance since there is no contact with the web at the line of severance as there is when the web is severed with a knife or the like.

In accordance with the apparatus of the present invention, two juxtaposed pairs of jaws are provided. A nonwoven web is intermittently fed between the pairs of jaws, and the web is engaged by them after the web has been advanced to a predetermined length corresponding to the length of the section to be severed. The juxtaposed jaws on either side of the web are biased together prior to web engagement. When the jaws are brought into contact with the web, the web is engaged due to the opposing orientation of the jaws. Each pair of jaws may be resiliently mounted so that engagement is maintained despite differences in web thickness or positioning of the jaws during engagement. One pair of jaws is then displaced relative to the other pair of jaws during web engagement and the web is torn.

After the web has been torn, the displaced pair of jaws is returned to its biased position, and jaws are taken out of engagement with the web. After the web has been released, the severed section is removed and a new length of web is fed between the pairs of holding means, and the tearing operation is repeated as discussed above.

Where the web has been preformed to provide longitudinal densification lines, which facilitate liquid migration in this direction to compensate for the rectangular shape of the web section to be formed or preformed with a densified layer which provides structural stability to the web, the stress and tearing action of the

present invention substantially eliminates the preformed lines and layer at the ends of the section, and thus minimizes the migration of liquid to the torn ends.

It should be noted that where the web has been preformed to provide longitudinal densification lines, the engaging operation of this invention may be utilized to further facilitate liquid migration. When the jaws of the present invention engage and tear the web, the longitudinal densification lines and densified layer, if any, are substantially eliminated at the ends of the section, as described above, and a transverse densification line will be created at the engagement line by the action of the jaws during web engagement. This transverse densification line will cooperate with the longitudinal lines. This transfer path functions in cooperation with the longitudinal lines to provide maximum dispersion of the liquid to the areas of the web section which are not in direct contact with the liquid depository site.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

For a more complete understanding of the invention, reference is made to the accompanying drawings in which:

FIG. 1 is a side elevational view of an apparatus of this invention demonstrating various phases of the tearing cycle;

FIGS. 2-4 are fragmentary side elevational views of an apparatus of this invention demonstrating various phases of the tearing cycle;

FIG. 5 is a fragmentary elevational view, partially in cross section, of the jaws in the position shown in FIG. 1.

DETAILED DESCRIPTION

While this invention is susceptible of embodiment in many different forms, there is shown in the drawings and will herein be described in detail a preferred embodiment of the invention, with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiment illustrated. The scope of the invention will be pointed out in the appended claims.

An apparatus embodying the present invention is illustrated in FIG. 1, and enumerated in its entirety as 10. Although the embodiment illustrated in the drawings employs jaws to form the holding means, it is not intended to limit the scope of this invention, but is merely illustrative of the preferred embodiment.

The tearing apparatus 10 is comprised of two juxtaposed pairs of opposing jaws 12, 12a, 14 and 14a. The lower set of jaws 12a and 14a in this embodiment are mounted directly to a frame member (not shown). Lower jaw 12a is fixedly positioned to the frame member, and lower holding jaw 14a is pivotally mounted to the frame member at its lower portion by pin 15. Lower holding jaw 14a is biased against spacer pin 16a by the U-shaped spring clip 17 which is positioned beneath the bases of holding jaws 12a and 14a, and acts on the free side surfaces thereof. The lower holding jaws 12a and 14a are positioned beneath one surface of the web W which is intermittently fed from left to right by a feed means (not shown).

The upper set of holding jaws 12 and 14 is disposed directly above the corresponding holding jaws of the lower set 12a and 14a. Holding jaw 12 is resiliently

mounted relative to mounting member 18 by bolts 19, and springs 21. Bolts 19 are slidably retained in bores 20 to permit vertical movement of holding jaw 12. Springs 21, positioned in bores 34 and 35, maintain resilient contact between the holding jaw 12 and the mounting member 18, and cooperate with springs 32 to provide for resilient engagement of the web, as discussed below. Holding jaw 14 is pivotally attached to mounting member 18 at its upper portion by pins 22.

The jaw configuration of the preferred embodiment facilitates proper alignment of the jaws during engagement and tearing. The working edges of jaws 12, 12a and 14 are in the form of truncated right triangles, and the working edge of jaw 14a is in the form of a flat surface. It will be appreciated that since jaws 12 and 12a are not movable in the horizontal direction, the truncated surface of each jaw will always be aligned. However, since jaws 14 and 14a are movable in the horizontal direction, the flat surface of jaw 14a accommodates any mis-alignment that may occur between jaws 14 and 14a due to biasing and during web tearing, as discussed below.

The upper holding jaws 12 and 14 are supported and actuated by actuating bracket 24 through a system of linkages. As best illustrated in FIGS. 1 and 5, the mounting member 18 is raised and lowered by the actuating brackets 24 at the lower end of the piston rods of the air cylinders 23 through a system of linkages including: mounting member bracket 18a, L-shaped link 25, pivot mounts 28, link 29, and jaw 14 which together assume a normally rectangular configuration by reason of the weight of the assembly, as discussed below. The mounting member bracket 18a, which may be integrally formed with mounting member 18, is pivotally attached to the corner joint of link 25 by pin 26. In FIGS. 2, 3 and 4 mounting member bracket 18a is broken away to show more clearly the change in position of link 25. The horizontal free end of link 25 is supported between pivot pad 27, which extends upwardly from the lower portion of the U-shaped pivot mount 28, and pivot pin 33 which extends downwardly from pivot mount 28. The U-shaped pivot mount 28 is integral with the air cylinder actuating brackets. When link 25 is being supported by the pivot pad 27, a clockwise moment is created in link 25 about pin 26 due to the weight of the upper holding jaw assembly. This clockwise moment is transferred to link 29 in the form of a horizontal force directed to the left. Link 29 is pivotally attached to link 25 at one end by pin 30 and to holding jaw 14 at the other end by pin 31. Due to this interconnection between jaw 14 and link 25 and the horizontal force holding jaw 14 is biased against spacer pin 16 which is located in holding jaw 12. Since holding jaw 12 is not free to move in the horizontal direction due to bolts 19, once holding jaw 14 has been biased against pin 16, the entire linkage system consisting of holding jaw 14, link 29, link 25 and mounting member bracket 18a is in equilibrium, and the upper set of holding jaws 12 and 14 are supported on pivot pad 27.

After the web W has been fed between the holding jaw members 12, 12a, 14 and 14a to the desired length of web section to be severed, a sensing means (not shown) temporarily terminates web feed and directs driving fluid above the pistons (not shown) into the air cylinders 23. As the air cylinder pistons are driven downwardly, the actuating brackets 24, which are formed by the air cylinder pistons, are moved down-

wardly, and thus the upper holding jaws 12 and 14 are moved into resilient engagement with the web above their corresponding holding jaws 12a and 14a, as best illustrated in FIG. 2.

After the web W has been engaged, the actuating bracket 24 continues to move downwardly due to the clearance between the mounting member 18 and the actuating bracket 24, thus compressing springs 32. As the actuating brackets 24 compress the springs 32, the clockwise moment in the linkage system is reversed, and a counter clockwise moment is created in the linkage system by pivot pin 33. During this reversal of moment, the holding jaws 12 and 12a are fixedly positioned to grasp the web W, and holding jaw 14 is caused to be displaced to the right by the force transferred by the counter clockwise moment through links 25 and 29. Due to the resilient contact between holding jaws 14 and 14a, holding jaw 14a is also displaced with holding jaw 14 so that the web W is torn and a section S is formed, as illustrated in FIG. 2.

After the web has been torn, a sensing means (not shown) reverses the flow of fluid from above the air cylinder pistons to below the air cylinder piston 23, so that mounting bracket 24 is drawn upwardly. As mounting bracket 24 is drawn upwardly, FIG. 4, the moment in links 25 is again returned to the clockwise direction and holding jaw 14 is returned to the biased position against pin 16. The lower holding jaw 14a is also returned to the biased position by the U-shaped spring clip 17. As mounting bracket 24 continues to move upwardly and the bolts 19 are seated in the bores 20, the upper holding jaws 12 and 14 are removed from engagement with the web and returned to the position shown in FIG. 1. The severed section is removed by means (not shown), the web feed is commenced, and the entire operation is repeated.

As indicated, the preferred embodiment illustrated in the drawings utilizes lower holding jaws 12a and 14a which are fixedly positioned in the frame, however, it will be appreciated that these lower holding jaws may also be mounted on an air cylinder means similar to holding jaws 12 and 14 so that both the upper and lower holding jaws may be reciprocated into resilient engagement with the web.

The preferred embodiment may also be utilized to create transverse compression lines at the engagement lines, which will cooperate with longitudinal densification lines that may have been preformed in the web, thereby forming transfer paths between the longitudinal lines to facilitate liquid migration. Nonetheless, an embodiment of the present invention will sever sections from a web without causing compression of the fibers at the line of severance.

In order to give the transverse densified lines the desired degree of permanence, the web is sprayed with water, as is known in the art, e.g. Burgeni, U.S. Pat. No. 3,017,304, to provide inter fiber bonds between the fibers in the engagement area. This spraying may be done during web formation, and then the web may be conveyed to a tearing apparatus of the present invention, thereby eliminating a separate spraying step prior to the tearing of sections from the web.

The stressing and tearing action of the present invention also substantially eliminates any densified layer or thickened longitudinal regions in the web between the ends of the web section and the engagement area, such as those layers and thickened regions disclosed in the

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Burgeni patent, commonly assigned Repke, U.S. Pat. application Ser. No. 187,239, filed Oct. 7, 1971, and Repke U.S. Pat. application Ser. No. 266,013 filed June 26, 1972.

I claim:

1. A method for successively tearing a continuous fibrous web into sections having a leading edge and a trailing edge comprising the steps of providing a web; providing two juxtaposed pairs of opposing holding means; feeding said web between said pairs of holding means; moving said pairs of holding means into transverse holding engagement with said web; displacing one pair of said holding means relative to the other pair of holding means and in the direction of web movement during said engagement to tear the web and separate a section therefrom without causing a rearward force against the leading edge of the next successive section; and moving the torn section away from said web together with the displaced pair of holding means while the web is held by the other pair of holding means.

2. A method for successively tearing a continuous fibrous web into sections having a leading edge and a trailing edge comprising the steps of transversely grasping between opposed pairs of spaced jaw members adjacent portions of said web to provide a tearing area in the web between the spaced jaw members; compressing the web fibers in areas of web engagement with the jaw members, and moving one of said adjacent portions relative to the other adjacent portion in the direction of web movement to tear the web within said tearing area without causing a rearward movement of the web.

3. Apparatus for severing separate sections from a web comprising:
 frame means;
 tearing means mounted in the frame means;
 said tearing means including two opposed pairs of web engaging jaw members, each pair having a first web holding jaw member and a juxtaposed second jaw member pivotally mounted with respect to the first web holding jaw member;
 driving means moving at least one of said pairs of web engaging jaw members toward the other pair, so

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that both of said web holding jaw members and both of said second jaw members engage said web; and

displacement means pivoting both of said juxtaposed second jaw members substantially simultaneously away from the respective web holding jaw members and in the general direction of web movement when said web holding members engage the web, thereby severing a portion of said web and moving said severed portion away from said web.

4. Apparatus as set forth in claim 3 wherein said displacement means includes a linkage means connected between one of said second jaw members and said driving means so as to generate a moment moving said second jaw members away from the adjacent web-holding jaw members when both of said second jaw members engage said web.

5. Apparatus as set forth in claim 4 wherein said linkage means comprises a train of three elongated links connected at one end to said driving means and at the other end to said one second jaw member together forming a four bar linkage.

6. Apparatus as set forth in claim 3 wherein a bias means is associated with a pair of web-engaging jaw members and acts on said second jaw member thereof urging the second jaw member against the corresponding first web holding jaw member.

7. Apparatus as set forth in claim 6 wherein the bias means is a U-shaped spring clip.

8. Apparatus as set forth in claim 6 wherein the bias means is a compression spring acting on a linkage connecting the second jaw member with said driving means.

9. Apparatus as set forth in claim 3 wherein said displacement means includes a four-bar linkage.

10. Apparatus as set forth in claim 3 wherein at least one pair of jaw members has working edges in the form of truncated triangles.

11. Apparatus as set forth in claim 3 wherein said driving means includes an air cylinder.

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