

[54] **WEB PERFORATING APPARATUS**

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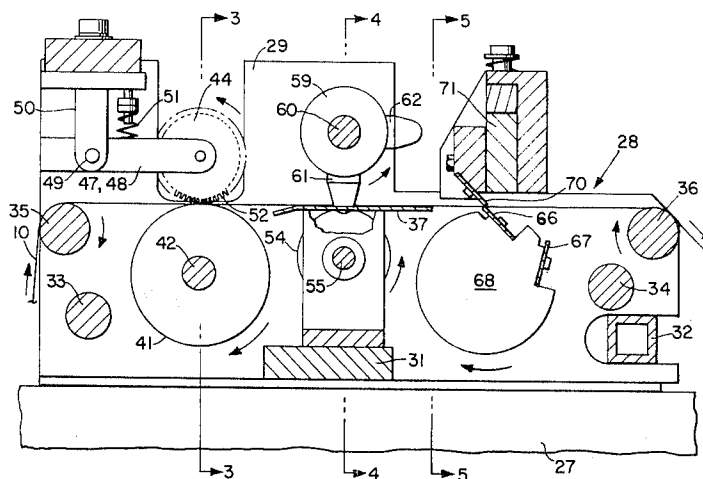
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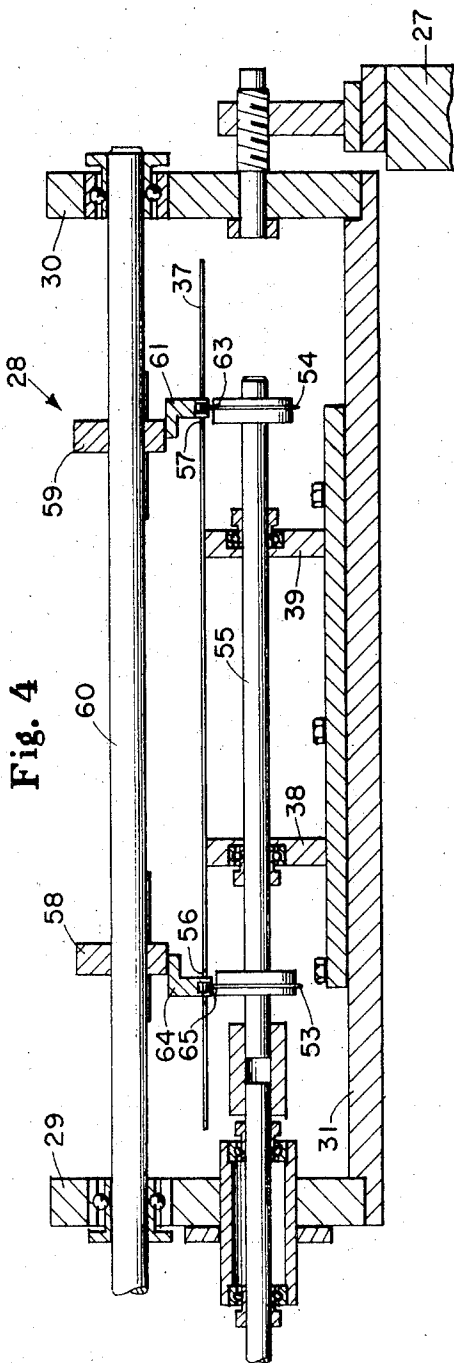
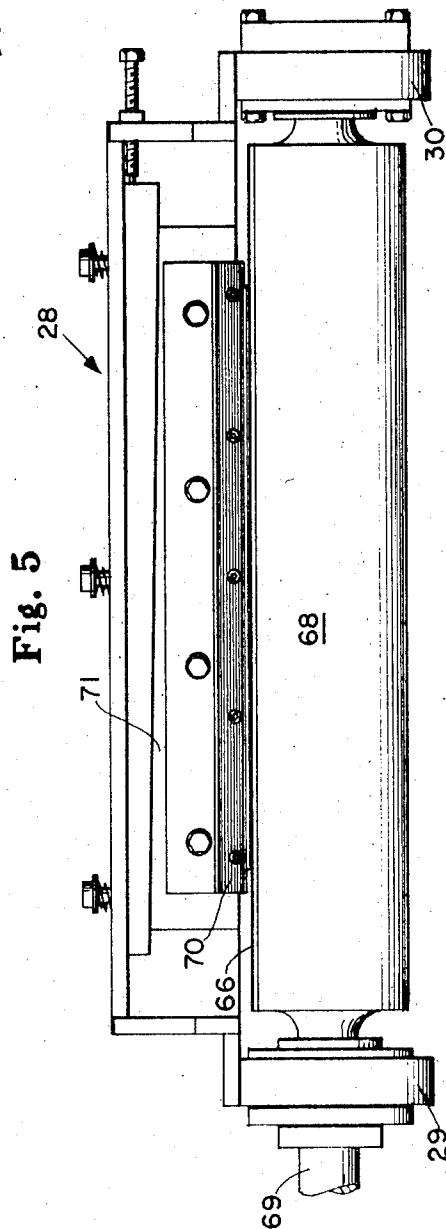
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ABSTRACT

Apparatus for continuously cutting side-by-side rectangular perforated areas in a web of paper or non-woven material. The apparatus includes spaced machine direction perforator wheels with coating anvil wheels, a cammed slitte to cut short slits in the machine direction in the corner areas of the eventual rectangular perforated area and a transverse perforator including flexible rotating knives and a stationary anvil blade for cutting transverse perforations which outline the side-by-side rectangular perforated areas. The apparatus is preferably used for cutting perforated areas in a web which will later be converted into individual diaper topsheets, each of which has a perforated removable area. The perforations are in the form of short cuts, but the corners are preferably formed with elongated slits in order to facilitate removal and separation in the ultimate product.

4 Claims, 6 Drawing Figures





WEB PERFORATING APPARATUS

This is a division, of application Ser. No. 363,937, filed May 25, 1973.

BACKGROUND OF THE INVENTION

The prior art discloses individual elements for forming various cutting and perforating operations on continuously moving webs. For example, the use of perforating wheels for forming longitudinal perforations in paper is illustrated in U.S. Pat. No. 1,542,097 — Ripley, issued June 16, 1925 and in U.S. Pat. No. 3,152,501 — Nassar, issued Oct. 13, 1964.

Individual slitting devices have also been disclosed as illustrated by the disclosures in U.S. Pat. Nos. 2,059,187 — Talbot, issued Oct. 27, 1936 and 3,067,643 — Ward, Jr., issued Dec. 11, 1962. The prior art also teaches the use of flexing blades for forming transverse perforations as exemplified in U.S. Pat. Nos. 2,870,840 — Kwitek, issued Jan. 27, 1959 and 3,261,249 — Holt, issued July 19, 1966.

While, as previously indicated, the above devices illustrated various individual mechanisms for acting on a continuously moving web to perform a specific operation thereon, there is an apparent lack of any apparatus designed to form rectangularly outlined perforated areas in spaced side-by-side relationship on a continuously moving web. The lack of any known device for achieving this type of operation resulted in the need for a suitable apparatus and method that would effectively and efficiently provide such a product.

SUMMARY OF THE INVENTION

The nature and substance of the invention will be more readily appreciated after giving consideration to its major aims and purposes. The principal objects of the invention are recited in the ensuing paragraphs in order to provide a better appreciation of its important aspects prior to describing the details of a preferred embodiment in later portions of this description.

A major object of the invention is the provision of a unique web perforating apparatus.

Another object of the invention is the provision of such an apparatus which is capable of producing an essentially rectangular pattern of perforations on a moving web.

Still another object of the invention is the provision of an apparatus as above enumerated which will produce rectangularly shaped perforations in continuous side-by-side and properly spaced relationship on a moving web.

These and other objects are achieved by the provision of an apparatus which includes means for continuously supporting a web moving therethrough such that successive operative elements can act thereon. The apparatus includes a mechanism for forming continuous spaced lines of longitudinal perforations in proximity to the side edges of the web and may include additional mechanism for forming at least one elongated longitudinal slit at predetermined intervals coextensive with at least one of the originally formed lines of longitudinal perforations. Additionally, the apparatus is provided with means for forming transverse perforations at predetermined spaced intervals on the web such that the transverse perforations extend between the longitudinal perforations and may be made such that they include an elongated transverse slit which intersects each

elongated longitudinal slit, if any. As a consequence, the web is provided with a succession of substantially rectangular side-by-side perforated areas preferably having at least one slitted corner.

BRIEF DESCRIPTION OF THE DRAWINGS

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter regarded as forming the present invention, it is believed the invention will be better understood from the following description taken in connection with the accompanying drawings in which:

FIG. 1 is a plan view of a web of paper or non-woven material illustrating the manner in which the apparatus of the invention is designed to cut perforations into the web to outline side-by-side rectangular areas.

FIG. 2 is a fragmentary side elevation, partially in cross-section, illustrating the major operative elements of the apparatus of the invention.

FIG. 3 is a cross-section taken on the line 3—3 of FIG. 2 illustrating details of the elements that comprise the machine direction perforator mechanism of the apparatus.

FIG. 4 is a cross-section taken on the line 4—4 of FIG. 2 illustrating details of the cammed slitter mechanism of the apparatus.

FIG. 5 is a cross-section taken on the line 5—5 of FIG. 2 illustrating details of the transverse perforator mechanism of the apparatus.

FIG. 6 is a schematic illustration of the drive elements for the apparatus taken from the side opposite to that illustrated in FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

It is believed that the description of the apparatus will be better understood by initially describing the several operations that are performed on the web material as it is moving through the apparatus. Referring to FIG. 1, there is illustrated a fragmentary portion of a continuous web 10 which is perforated by the apparatus of the invention. The web 10 may be formed from wet strength tissue paper or non-woven fabric material or, for that matter, any relatively flexible web material that is capable of being perforated. In a preferred embodiment, the web is formed from a non-woven fabric of the type usually employed as a topsheet for disposable diapers since the ultimate article manufactured by the present invention is eventually converted for such use. As examples of diapers which employ perforated topsheets of this character, reference is made to the commonly owned application of Dale A. Gellert, Ser. No. 313,079, filed Dec. 7, 1972 which is entitled Removable Diaper Topsheet Portion for Disposable of Solid Waste.

The web 10 is provided with longitudinal lines of perforation 11 and 12 along opposite edges, respectively, and transverse lines of perforation 13 and 14. The intersection of the lines of perforations 11, 12 and 13, 14 are provided with longitudinal slits 15, 16, 17 and 18 and transverse slits 19, 20, 21 and 22. It will be noted that the longitudinal slits 15, 16, 17 and 18 are made at predetermined intervals and are coextensive with the lines of perforation 11 and 12. Similarly, the transverse slits 19, 20, 21 and 22 at either end of the transverse perforations 13 and 14 intersect the elongated longitudinal slits 15, 16, 17 and 18, respectively. As a conse-

quence of this procedure, the web 10 is provided with a succession of substantially rectangular side-by-side perforated areas with slitted corners. In subsequent converting operations, the web 10 is cut along lines 23 to form successive individual topsheets 25 which are each preferably assembled into a disposable diaper. The purpose of the perforations 11, 12, 13 and 14 and the slits 15, 16, 17, 18, 19, 20, 21 and 22 is to provide a central removable panel 26 in each individual top-sheet 25.

The web perforating apparatus of this invention is capable of use in conjunction with a disposable diaper converting machine an example of which is illustrated in U.S. Pat. No. 3,607,578 — Berg et al. In using the web perforating apparatus in conjunction with a diaper converting machine, it will be apparent that various elements of the web perforating apparatus can be driven from the main power source or drive shaft of the diaper converting apparatus. This will become more apparent to those skilled in the art particularly in view of the subsequent description herein.

The apparatus, as illustrated in FIGS. 2 and 4 is supported by a base 27 forming a portion of the diaper converting apparatus (not illustrated) which in turn is used to support the frame 28 of the web perforating apparatus by suitable means well-known in the art. The frame 28 includes side plates 29 and 30 and suitably arranged cross members 31 (FIGS. 2 and 4) 32, 33 and 34 (FIG. 2) to give it sufficient rigidity. Idler rolls 35 and 36 are journaled for free rotation intermediate the side plates 29 and 30 and a deadplate 37 is supported from the brackets 38 and 39 (FIG. 4).

The device includes means for continuously supporting the web 10 as it is moving through the apparatus.

The web 10 passes over the idler rolls 35 and 36 and is provided with intermediate support from deadplate 37. Continuous movement is imparted to the web 10 by any suitable mechanism (not shown) for this function such as can, for example, be incorporating in the diaper converting apparatus with which the web perforating apparatus will normally be associated.

Referring now to FIGS. 2 and 3, the apparatus includes means for forming continuous spaced lines of longitudinal perforations along opposite side edges of the web 10. This portion of the apparatus will be referred to as the machine direction perforator. It includes a pair of anvil wheels 40 and 41 secured to the shaft 42 which is journaled in the side plates 29 and 30. The anvil wheels 40 and 41 are preferably formed with hardened outer surfaces, such as case hardened steel, for reasons which will become apparent as the description proceeds.

Spring loaded perforator wheels 43 and 44 are journaled for free rotation, respectively, by pairs of spring biased arm members 45, 46 and 47, 48. The arm member pair 47, 48 supporting the perforator wheel 44 (FIG. 2) is pivoted at 49 to the stationary bracket 50. A spring 51 is provided to bear against the members 47, 48 thereby causing the perforator wheel 44 to be biased downwardly against the peripheral surface of the anvil wheel 41. A similarly configured suspension mount is provided for the spring loaded perforator wheel 43.

As illustrated in FIG. 2 of the drawings, the perforator wheels 43 and 44 each are formed with a plurality of spaced perforating teeth 52 around their periphery. the teeth 52 are provided with relatively sharp cutting edges. Thus, the teeth 52 are pressed against the web

10 due to the bias of the spring 51. As a result, the web 10 has longitudinal lines of perforation 11 and 12 cut thereinto as it passes between the respective pairs of perforator wheels 43, 44 and anvil wheels 40, 41.

The apparatus also includes means for forming spaced pairs of elongated longitudinal slits 15, 16, 17 and 18 at predetermined intervals coextensive with said longitudinal lines of perforation 11 and 12. This portion of the apparatus which is referred to as the cammed slitter is best illustrated in FIGS. 2 and 4 of the drawings. The cammed slitter includes a pair of high speed slitter wheels 53 and 54 secured to the shaft 53 which is journaled in bearings mounted in the brackets 38 and 39. The shaft 55 is continuously driven at high rpm from a motive power source to be hereinafter described. It will be noted in referring to FIG. 4, that the periphery of the slitter wheels 53 and 54 is somewhat below the top surface of the deadplate 37. In addition, the deadplate 37 is provided with openings 56 and 57 above each of the slitter wheels 53 and 54, respectively, for purposes which will hereinafter become evident.

Rotating members 58 and 59 are secured to the shaft 60 which is journaled in the side plates 29 and 30. The shaft 60 is continuously rotated in timed relation to movement of the web 10 by a source to be hereinafter described. As best seen in FIG. 2, the rotating member 59 is provided with radially projecting lobes 61 and 62, the distal ends of which are provided with a slot 63 as best seen in FIG. 4. A similar pair of radially projecting lobes is secured to the rotating member 58 the lobe 64 being illustrated and it being further understood that a second lobe is also provided on the rotating member 58. Referring to FIG. 2, the lobes 61 and 62 projecting from the rotating member 59 will be aligned with the lobes (one of which is illustrated as lobe 64 in FIG. 4) projecting from the rotating member 58. The lobe 64 is provided with a slot 65 at its distal end, it being understood that the other lobe (not shown) on the rotating member 58 is similarly configured.

Referring again to FIG. 4, it will be noted that the slots 63 and 65 in the lobes 61 and 64, respectively, pass beneath the deadplate 37 through the openings 57 and 56, respectively. In addition, the periphery of the slitter wheels 53 and 54 projects into the slots 65 and 63, respectively.

As previously indicated, the high speed slitter wheels 53 and 54 are each provided with a sharp outer knife-like periphery and are continuously driven. Similarly, the members 58 and 59 are continuously rotated such that the lobes 61 and 62 on the member 59, for example, periodically pass through the opening 57 in timed sequence with the movement of the web 10. This action periodically presses a portion of the web 10 downwardly into engagement with the sharp periphery of the slitter wheel 54 and thereby cuts the spaced elongated longitudinal slits 17 and 18 at predetermined intervals coextensive with the line of perforations 12. The corresponding lobes on the rotating member 58 act similarly to cut longitudinal slits 15 and 16 on the line of perforations 11.

The apparatus of the invention also includes means for forming transverse perforations at spaced intervals on the web. The transverse perforations as previously indicated, extend between the longitudinal lines of perforation 11 and 12 and include elongated transverse slits 19, 20, 21 and 22. The transverse perforator is best illustrated in FIGS. 2 and 5. It includes rotating flexing

blade knives which periodically strike a stationary flexing blade anvil knife. The flexing blade knives 66 and 67 are suitably supported in the knife roll 68 which is journaled in the side plates 29 and 30 and driven from its projecting shaft 69. The stationary flexing blade knife 70 is secured to the anvil block 71 by support structure secured to the frame 28 in a manner well-known to those skilled in the art. It will be noted that the knife roll 68 is provided with two flexing blade knives 66 and 67. As a consequence, on each revolution of the knife roll 68, a transverse line of perforations 13 and 14 is cut in the moving web 10. Additionally, it should be noted that the stationary flexing blade knife 70 has its cutting edge formed with a perforating tooth pattern corresponding to the transverse lines of perforations 13, 14 and the transverse slits 19, 20, 21 and 22. The rotating knives 66 and 67 are formed with straight sharp cutting edges and are mounted such that they actually strike the stationary knife 70 to form the desired perforations and slits. However, the flexible nature of these elements allows continuous effective operation without any damage.

The drive for the various elements of the apparatus is schematically illustrated in FIG. 6. The main drive shaft 72 is suitably driven from a motive power source which may form a part of the diaper converting machine of which the present apparatus may form a portion thereof. The shaft 42 supporting the anvil wheels 40 and 41 is driven from the main drive shaft 72 by the chain drive 73 through the right angle gear box 74, and the chain drives 75, 76 and 77. As previously indicated, the shaft 42 is driven at such speed that the surfaces of the anvil wheels 40 and 41 move at matched speed to the speed of the web 10.

Similarly, power from the main shaft 72 is transmitted to the right angle gear box 78 by means of the chain drive 79. The shaft 69 which drives the knife roll 68 is driven from the right angle gear box 78 by means of the chain drive 80. A pair of mating gears 81 and 82 are provided to drive the shaft 60, supporting the rotating members 58 and 59, by means of the chain drive 83. It will be noted that the drive components are preferably designed to provide a positive drive ratio between the shafts 60 and 69. This assures registration of the transverse perforations 13, 14 and transverse slits 19, 20, 21 and 22 with the longitudinal slits 15, 16, 17 and 18. It should also be noted that in a preferred construction, the drive is designed such that the shaft 69 is rotated to give the knife roll 68 a peripheral speed greater than the speed of the web 10. The speed differential can be varied in a range of from about 0 up to 100 percent when making a commercial range of topsheets for various diaper sizes. In practice, a speed differential of from about 4 to 30 percent has been found very satisfactory.

The slitter wheels 53 and 54 supported on the shaft 55 are rotated at relatively high peripheral speeds by the independent motor 84 which rotates the shaft 55 by means of the chain drive 85.

A consideration of the entire apparatus now will make its mode of operation apparent. The uncut web 10 initially passes between the anvil rolls 40, 41 and corresponding spring loaded perforator wheels 43, 44. This causes cutting of the longitudinal lines of perforation 11 and 12 along opposite edges of the web 10. Thereupon the web 10 passes to the cammed slitter section. The lobes projecting from the rotating mem-

bers 58, 59 cause portions of the web 10 to be pushed through the openings 56 and 57 and against the continuously rotating slitter wheels 53 and 54. The latter action is timed and the longitudinal slits 15, 16, 17 and 18 are cut in proper relationship at predetermined intervals coextensive with the longitudinal lines of perforations 11 and 12. Thence, the web is transversely perforated and slitted as it passes over the knife roll 68 by the rotating flexible blade knives 66 and 67 which contact the stationary flexing blade knife 70 in periodic timed sequence. This last step cuts the transverse lines of perforation 13 and 14 as well as the transverse slits 19, 20, 21 and 22.

Throughout this specification, the apparatus has been described in the context of forming a removable panel 26 having intersecting slits at each corner. This is a preferred construction of the web 10 as it will allow a consumer to remove the panel 26 when the individual topsheet 25 is assembled into a diaper by merely grasping any one of the four corners of the panel 26. In alternate constructions, the apparatus can be modified so that only one or two or three corners of the panel 26 are slitted. For example, if only two corners of the panel 26 are to be slitted, then one of the two rotating members 58 or 59 and its corresponding slitter wheel 53 or 54 could be eliminated. Correspondingly, the cutting edge of the flexible blade 70 would be modified to achieve such a construction.

In some special situations, the apparatus may also be operated without the cammed slitter, for example, where slitted corners are not desired or by substituting a second perforator wheel the circumference of which is equal to the width of a topsheet 25 and whose periphery is specially machined to produce any one or more of the longitudinal slits 15, 16, 17 or 18. The manner and details for achieving these modifications are deemed to be within the skill of the art.

While particular embodiments of the invention have been illustrated and described, it will be obvious to those skilled in the art that various changes and modifications can be made without departing from the spirit and scope of the invention and it is intended to cover in the appended claims all such changes and modifications that are within the scope of this invention.

What is claimed as new is:

1. A cammed slitter mechanism for forming a longitudinal slit in a moving web comprising:

- a. a deadplate for supporting said web during movement thereof, said deadplate having at least one opening therein,
- b. slitting means mounted beneath said opening in said deadplate, and
- c. means for periodically pushing said web through said opening and causing it to momentarily contact said slitting means to form an elongated longitudinal slit in said web.

2. A cammed slitter mechanism as claimed in claim 1 wherein said slitting means comprises a continuously rotating slitter wheel.

3. A cammed slitter mechanism as claimed in claim 1 wherein said means for periodically pushing said web comprises a rotating member above said opening, said rotating member having a lobe with a slot at its distal end extending radially therefrom.

4. A cammed slitter mechanism as claimed in claim 2 wherein said means for periodically pushing said web comprises a rotating member above said opening, said rotating member having a lobe with a slot at its distal end extending radially therefrom.

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