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LAMINATED PAPER WITH REINFORCING SCRIM

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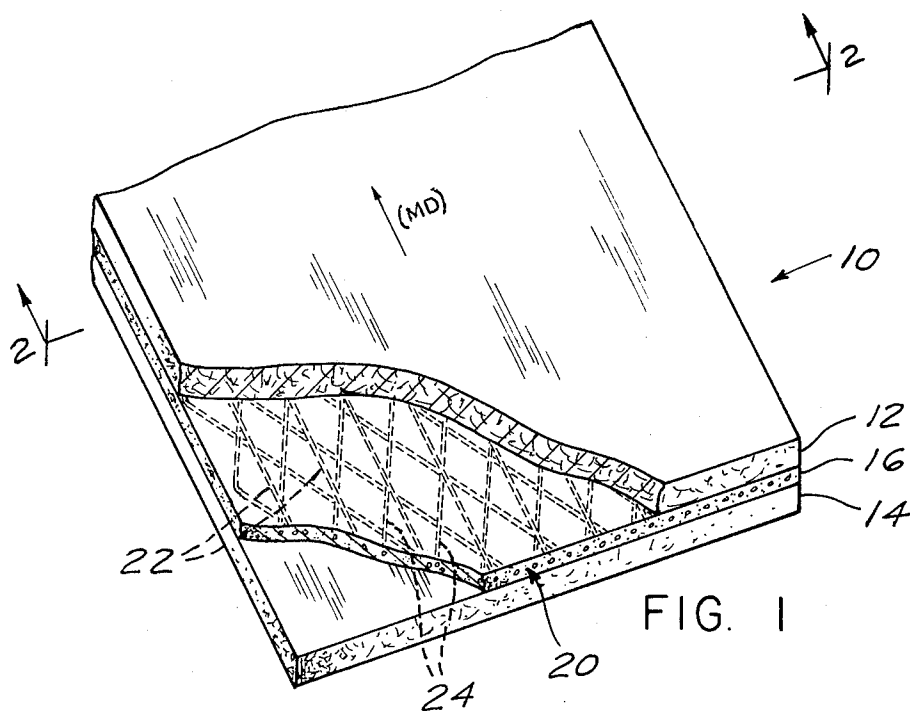


FIG. 1

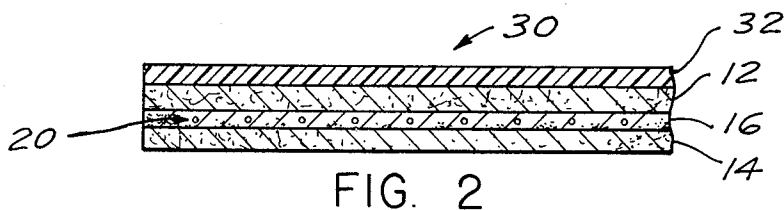


FIG. 2

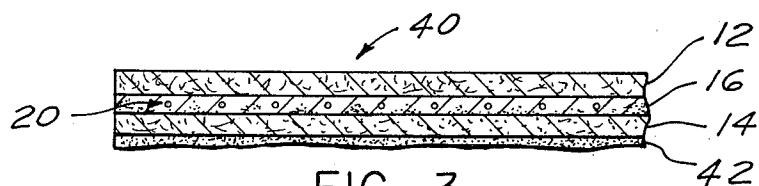


FIG. 3

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## LAMINATED PAPER WITH REINFORCING SCRIM

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16 Claims

### ABSTRACT OF THE DISCLOSURE

An extensible, reinforced laminated paper sheet having the characteristic of withstanding substantial impacts, formed by two superimposed sheets of extensible paper bonded together by a layer of hot-melt laminant having a scrim of polyester fibers embedded therein which transmits stretching forces through the sheets of paper to points remote from the zone of impact to substantially reduce the deformation of the extensible paper sheets in the area of impact.

This invention relates generally to reinforced laminated papers, and more particularly to laminated extensible paper webs which are adapted to stretch and absorb impacts.

Various types of paper webs have been proposed to increase the strength and durability of paper packages or gummed tapes. One such proposal has been the uncreped paper disclosed in Cluett Pat. No. 2,624,245, commonly referred to as extensible paper and manufactured by compressibly shrinking the paper web in the machine direction, that is, in the direction of web length as the web travels through a web shrinking unit, to produce a built-in stretch in the machine direction (MD), which is adapted to absorb impacts and other stresses when the paper is used to form packages, containers, tapes and the like. This paper is adapted to stretch when subjected to impacts or other similar stresses in at least the machine direction, in amounts substantially in excess of its natural machine direction stretchability, and is also adapted to return to its initial shape after the stretching force is removed, providing that the elastic limit of the material has not been exceeded. When this limit is exceeded the paper will be permanently deformed and/or torn.

Extensible paper webs of this type have proved satisfactory for certain applications, however, it is often desirable to provide paper packages and the like which are of substantially increased strength and which are adapted to stretch substantially greater amounts than conventional extensible paper in order to absorb relatively high impacts and stresses.

Accordingly, it is an object of this invention to provide improved paper webs. A further object of the invention is to provide packaging materials for containers and the like which are adapted to withstand abuse in the form of impacting and other stress applications. A still further object of the invention is to provide an impact-resistant web material which is inexpensive in construction, light in weight and moisture and vapor resistant. Yet another object of the invention is to absorb impact stresses in packaging material and return the material to its initial configuration after impact.

In accordance with an aspect of this invention a pair of extensible paper sheets having machine direction stretchability in excess of their natural machine direction stretchability are bonded together in superimposed relation by a layer of stretchable hot-melt laminant adhesive. A scrim of stretchable polyester fibers is embedded in the adhesive layer between the extensible paper sheets and cooperates with the sheets or plies of paper to resist deformation under impact or similar stresses. The polyester scrim stretches and absorbs the work of the impact force

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and transmits this force through the paper plies away from the point of impact, and, subsequent to the impact, the fibers tend to recover from their stretched condition to draw the paper plies toward their original configuration even when the impact stresses are sufficiently great to stretch the extensible paper beyond its elastic limit and normally cause permanent deformation of the paper.

The above, and other objects, features and advantages of this invention will be apparent in the following detailed description of illustrative embodiments of this invention which are to be read in connection with the accompanying drawings, wherein:

FIG. 1 is a perspective view, with parts broken away, of one embodiment of the invention;

FIG. 2 is a sectional view taken on line 2—2 of FIG. 1, but showing another embodiment of the invention having a coating of polyethylene material; and

FIG. 3 is a sectional view similar to FIG. 2 of another embodiment of the invention.

Referring now to the drawings in detail, and initially to FIG. 1 thereof, it will be seen that a reinforced laminated web 10 of the type in which the present invention may be employed generally comprises a pair of superimposed sheets or plies of extensible paper 12 and 14 which are bonded together by an intermediate layer of adhesive 16. Adhesive 16 is, preferably, a hot-melt laminant having the characteristics of high cohesive strength and stretchability. An adhesive of this type, which has been found satisfactory for use in conjunction with the present invention, is manufactured and sold by the Paisley Company under the trade name "Paisley 7502."

As seen in FIG. 1, a scrim 20 formed by a plurality of fibers is embedded within adhesive layer 16. These fibers are formed of a polyester material which is adapted to stretch when subjected to tension and has a high elastic limit so that the fibers will recover to their original configuration when the tension is released. One group of fibers 22 are arranged to extend longitudinally in the machine direction of the paper, that is, in the direction of web length as the web travels lengthwise through the web shrinking unit and in which the stretchability of the extensible paper is produced. A second group of fibers 24 are also embedded in the inner adhesive layer 16 and are arranged in a zig-zag pattern in spaced parallel relation. Each of the fibers 24 is arranged to extend from one edge of sheets 12 and 14 to the opposed edge thereof at an angle of substantially 30° with respect to the machine direction of the web and thereby forms a generally diamond-shaped pattern within layer 16. The scrim fibers in each of the groups 22 and 24 of this embodiment may be formed of a polyester material manufactured by the Fiber Industries Division of the Celanese Corporation under the designation "1000-192-C-34."

During the manufacturing process of web 10, adhesive layer 16 is applied to lower sheet 14 at a temperature range of 350° to 370° F. and the adhesive adheres to both the polyester fibers and sheets 12 and 14 to form an integral bond between the various elements of the web. The fibers 22 and 24 may be embedded in layer 16 during its application to sheet 14 and it is foreseen that the particular pattern of the scrim may be varied in accordance with the reinforcing desired, as by varying the spacing between fibers or by eliminating either the longitudinally extending fibers 22 or the zig-zag fibers 24.

Web 10, formed by the extensible paper plies or sheets 12 and 14 and the stretchable adhesive layer 16 and fibers 22, 24, comprises an extensible laminated structure which is adapted to withstand substantial impact or similar stresses and stretch without permanent deformation or rupturing of the material. Webs formed in accordance with the present invention are particularly adapted for use in constructing paper bags or containers and the like and

when these structures are subjected to an impact stress, the polyester fibers 22 and 24 cooperate with the sheets of extensible paper to stretch and absorb the work of the impact force and yet return the web to its original configuration and resist permanent deformation of the package. As web 10 is stretched, polyester fibers 22 and 24 and extensible paper layers 12 and 14 are correspondingly stretched at the point of impact and the fibers distribute the force of the impact longitudinally along themselves, away from this point, while adhesive layer 16 transmits the distributed impact force from the fibers to the sheets 12 and 14 at points remote from the point of impact. As a result of this force transfer and distribution, the stress on plies 12 and 14 at the area of impact is materially reduced and therefore there is a substantial reduction in the deformation of the web. Subsequent to the impact fibers 22 and 24 recover from their stretched condition and return to their original configuration. These fibers, being bonded to plies 12 and 14 by adhesive layer 16, serve to draw the adhesive and the plies back to their original configuration and thus, even when the impact force is sufficient to create permanent damage or deformation in the extensible paper, as for example, when the paper is stretched beyond its elastic limit, deformation is held to a minimum since fibers 22 and 24 will return the entire structure to its original condition due to its substantially higher elastic limit.

Polyester reinforcing scrim of the character described may be used with regular kraft paper to form a reinforced web, or preferably, these scrim may be used in conjunction with extensible paper of the character described in the above-mentioned Cluett patent. However, far superior results are obtained by the combination of extensible paper with the polyester reinforced scrim since extensible paper can cooperate with the polyester due to its stretchability characteristics. Moreover, the combination of polyester fibers and extensible paper substantially increases the stretchability of the web and increases the toughness or tensile strength of the composite web in the machine direction of the paper sheets. Table I shows a comparison between the use of polyester reinforcing scrim in conjunction with both regular kraft paper and extensible paper, wherein both a one-way pattern and diamond-shaped pattern of the scrim were utilized.

TABLE I  
ONE-WAY PATTERN

| Designation                            | Construction                                                                                                                                                                                           | MD toughness, ft. lbs./ft. <sup>2</sup> | MD percent stretch |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|--------------------|
| Polyester reinforced paper.            | 2 plies of 40 lb. regular kraft, 30 lb. of hot-melt laminant, Paisley 7502, applied at 350°-370° F. Reinforcing: Polyester fiber, Fiber Industries, 1000-192-C-34 2 fibers/in. machine direction only. | 10                                      |                    |
| Polyester reinforced extensible paper. | 2 plies of 40 lb. Extensible kraft, 30 lb. of hot-melt laminant, Paisley 7502, applied at 350°-370° F. Reinforcing: Fiber Industries, 1000-192-C-34 2 fibers/in. machine direction only.               | 44                                      | 11                 |
| DIAMOND PATTERN                        |                                                                                                                                                                                                        |                                         |                    |
| Polyester reinforced paper.            | 2 plies of 40 lb. Regular kraft, 30 lb. of hot-melt Paisley 7502, applied at 350°-370° F. Reinforcing: Polyester fiber, Fiber Industries, 1000-192-C-34 1 fiber/in. zig-zag, 2 fibers/in. MD           | 13                                      | 2                  |
| Polyester reinforced extensible paper. | 2 plies of 40 lb. Extensible kraft, 30 lb. of hot-melt Paisley 7502 applied at 350°-370° F. Reinforcing: Polyester fiber, Fiber Industries, 1000-192-C-34 1 fiber/in. zig-zag, 2 fibers/in. MD.        | 45                                      | 11                 |

As is evident from the above table the machine direction toughness or tensile strength of the reinforced laminated web produced in accordance with the present invention is substantially increased when a combination of extensible kraft paper and polyester scrim are utilized.

This increase in toughness gives far superior strength to packages or the like produced by this material. In addition, the percent of stretch or elongation of the web is also increased, and this characteristic permits the package to absorb greater impact forces and yet resist deformation, that is, to absorb the impact force and yet return to its original configuration without a permanent deformation or bulge in the package.

FIG. 2 illustrates another embodiment 30 of a reinforced laminated web according to the present invention wherein a pair of extensible paper sheets 12 and 14 are bonded together by a layer of adhesive 16 having embedded therein a scrim 20 formed by polyester fibers 22 and 24 in substantially the same manner as illustrated in the embodiment found in FIG. 1. Web 30 in this embodiment however, is provided with a protective coating or sheet of polyethylene 32 which protects the web from water or other moisture. Sheet 32 is stretchable so that it acts as an active component of laminated sheet 30 and stretches with the web when it is subjected to impacts or similar stresses. This embodiment is adapted to be used in the manufacture of waterproof multi-wall bags; the basic weight of top and bottom extensible kraft plies 12 and 14 in this embodiment may be 40 lbs. and 50 lbs. respectively, whereas the polyethylene sheet is between one-half to two mils thick. As with the prior embodiment, the longitudinally extending reinforcing fibers 22 may be omitted when the additional strength that they supply is not required.

Reinforced laminated webs formed in accordance with the present invention are also admirably fitted for use as high strength gummed tape, and such a tape is illustrated in FIG. 3. As seen therein, tape 40 has upon one surface, for example, the lower surface of sheet 14, a layer 42 of adhesive material which is adapted to be activated by water in the conventional manner. The basic weights of the two sheets 12 and 14 in this embodiment may typically be 30 and 40 lbs. respectively, although it is contemplated that other combinations of weights for these sheets may advantageously be utilized.

Although illustrative embodiments of the invention have been described herein with reference to the accompanying drawings, it is to be understood that the invention is not limited to those precise embodiments, and that various changes and modifications may be effected therein by one skilled in the art without departing from the scope or spirit of this invention.

What is claimed is:

1. A laminated reinforced web comprising two sheets of kraft paper bonded together in superimposed relation by a layer of stretchable adhesive material and a plurality of stretchable polyester fibers embedded in said adhesive layer.

2. A laminated reinforced web as defined in claim 1 wherein each of said sheets of kraft paper consists of extensible uncreped kraft paper having machine direction stretchability in excess of its natural machine direction stretchability.

3. A laminated reinforced web as defined in claim 2 wherein said stretchable polyester fibers define a scrim between said sheets of paper.

4. A laminated reinforced web as defined in claim 3 wherein said fibers extend longitudinally in the machine direction of said sheets of paper.

5. A laminated reinforced web as defined in claim 3 wherein said fibers are arrayed in a zig-zag pattern with respect to the machine direction of said sheets of paper.

6. A laminated reinforced web as defined in claim 5 wherein each of said zig-zag fibers forms an angle of substantially 30° to the machine direction of said sheets of paper.

7. A laminated reinforced web as defined in claim 3 wherein said fibers consist of two groups of fibers, the fibers in said first group extending generally longitudinally with respect to the machine direction of said sheets and

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the fibers in said second group being arrayed in a zig-zag pattern with respect to said machine direction.

8. A laminated reinforced web as defined in claim 3 wherein one of said sheets of paper is coated with a water impermeable layer of plastic material to waterproof said web.

9. A laminated reinforced web as defined in claim 3 wherein one of said sheets of paper is coated with an adhesive material.

10. A laminated reinforced web comprising two sheets of extensible kraft paper having a machine direction stretchability in excess of its natural machine direction stretchability and bonded together in superimposed relation by a layer of stretchable hot-melt laminant adhesive, said layer including a plurality of stretchable polyester fibers embedded therein forming a scrim between said sheets of paper whereby said web is adapted to stretch and absorb impacts and similar stresses.

11. A method of producing a stretchable reinforced web comprising the steps of, applying a layer of adhesive material having a plurality of stretchable polyester fibers therein to a first sheet of extensible kraft paper and superimposing a second sheet of said extensible kraft paper on said layer.

12. A method as defined in claim 11 including, the step of, arranging said fibers to extend longitudinally in the machine direction of said sheets of paper.

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13. A method as defined in claim 11 including, the step of, arranging said fibers in a generally zig-zag pattern with respect to the machine direction of said sheets of paper.

14. A method as defined in claim 11 including, the steps of, arranging certain of said fibers to extend longitudinally in the machine direction of said sheets of paper and arranging the remainder of said fibers in a generally zig-zag pattern with respect to said machine direction.

15. A method as defined in claim 11 including the step of, coating one of said sheets of paper with a water impermeable layer of plastic material.

16. A method as defined in claim 11 including the step of, coating one of said sheets of paper with an adhesive material.

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156—278, 309; 161—77, 85, 89, 95, 141, 270

**Disclaimer**

3,671,372.—*Paul Hoffman*, Gainesville, Fla. LAMINATED PAPER WITH RE-  
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Sept. 13, 1982, by the assignee, *Georgia-Pacific Corp.*

Hereby enters this disclaimer to claims 1, 10, 11, 12, 13, 14, 15 and 16 of  
said patent.

*[Official Gazette November 16, 1982.]*