

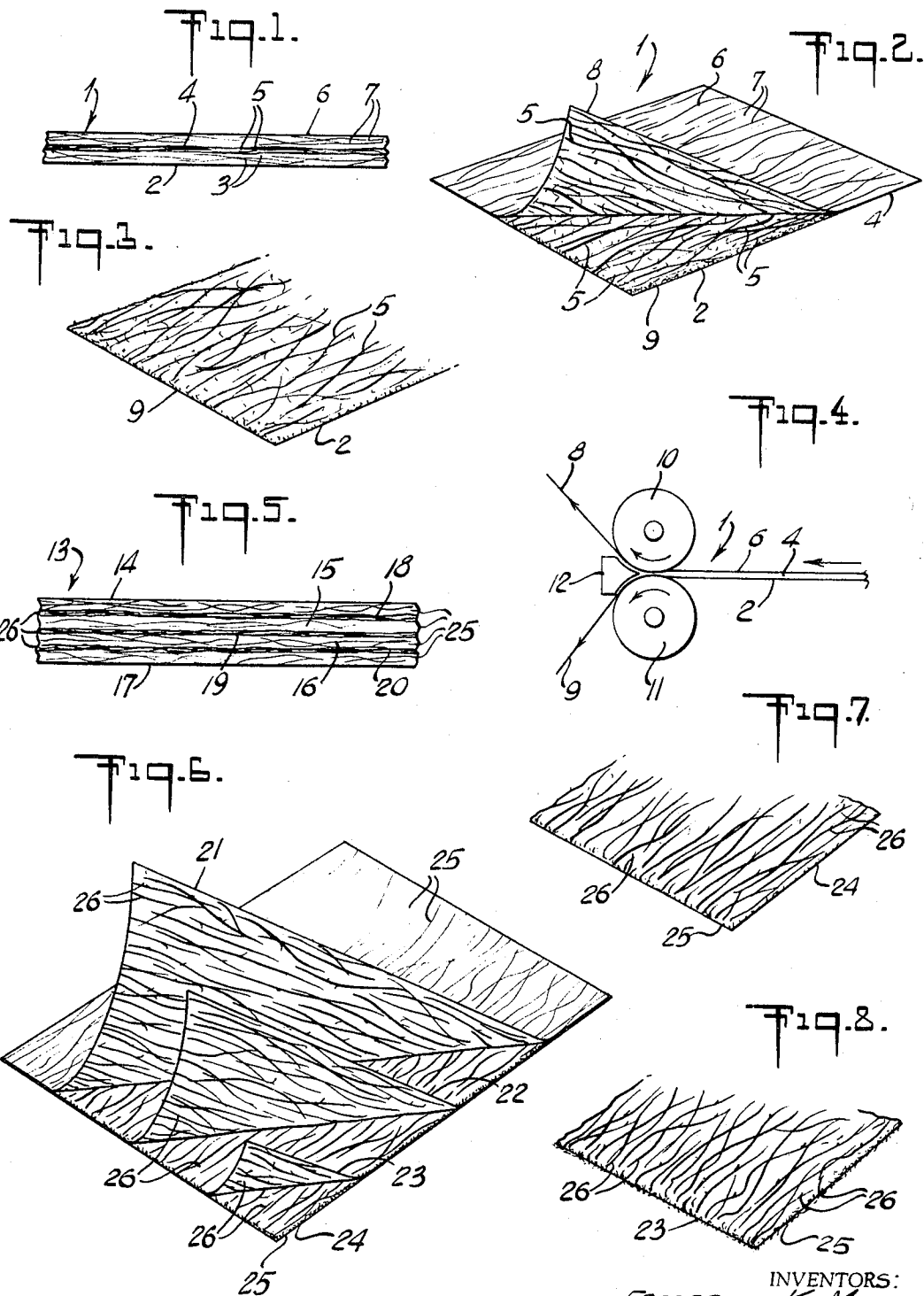
April 8, 1969

F. K. MESEK ET AL

3,437,539

METHOD OF MAKING A NON-WOVEN FABRIC BY SPLITTING

Filed Oct. 18, 1965



INVENTORS:
FREDERICK K. MESEK
WILLIAM R. STRICKEL
BY
Harold L. Varner
ATTORNEY

1

3,437,539

**METHOD OF MAKING A NON-WOVEN FABRIC
BY SPLITTING**

Frederick K. Mesek, Downers Grove, and William R.
Strickel, Chicago, Ill., assignors to Johnson & Johnson,
a corporation of New Jersey

Filed Oct. 18, 1965, Ser. No. 496,841

Int. Cl. B32b 5/26; B26d 3/28

U.S. Cl. 156—254

4 Claims

ABSTRACT OF THE DISCLOSURE

Two non-woven fabrics are made by splitting a composite web having an interlay of fibers having a larger diameter than the web fibers on each side of the interlay. The composite web is split in the area of the interlay.

The present invention relates to non-woven fabrics and to a new and improved method of making the same.

It has heretofore been proposed to make non-woven fabrics by first forming a web of fibers, bonding the fibers on both sides of the web with a bonding agent while taking care that the bonding agent does not completely penetrate the web, and then splitting the fiber web in the intermediate unbonded zone. One of the difficulties involved in making split-fiber webs in this manner is the careful control of bonding required as any nonuniform penetration of the bonding agent into the intermediate portion of the web substantially affects the uniformity of the split product. A further problem is that the fibers on the surface of the split product, which were formerly a portion of the unimpregnated center part of the web prior to splitting, are held only loosely by fiber to fiber friction. As a result there is substantial dusting or sluffing of fibers from this surface of the split webs.

It is, accordingly, an object of the present invention to prepare non-woven fibrous sheet materials by a split web method in which splitting is not dependent solely on controlled penetration of the bonding agent used. It is a further object of the present invention to prepare non-woven fibrous sheet materials in which the amount of loose surface fibers on the split web is substantially reduced. Other objects and advantages of this invention will become apparent from the following description taken in connection with the accompanying drawings, wherein are set forth by way of illustration and example certain embodiments of this invention.

According to the present invention in preparing the fiber web which is to be split, a layer of relatively large denier fibers is interposed in the web in the plane along which splitting is to take place. It has been discovered that where a layer of fibers having a denier substantially larger than the fibers from which the remainder of the web is formed is interposed in the web and the entire web then through bonded, that on splitting, the web will split in the zone of the larger diameter fibers. This is true whether or not the web is completely impregnated with the bonding agent.

By bonding all fibers with the bonding agent prior to the splitting operation the occurrence of loose fibers on the split surface of the separate sheets so formed is substantially eliminated. Also, by placing the interlay of larger denier fibers in the web along the line where splitting is desired, excellent control of the splitting operation with the formation of highly uniform products can be obtained. Webs can be prepared which are adapted to be split into more than two separate sheets by interposing into the web, during its formation, more than one layer of larger denier fibers. The layers of larger denier fibers are separated by layers of the smaller denier fibers and

2

the layered sheet so formed then through bonded prior to splitting.

The fibers in the zone or layer along which splitting is to occur should have a denier of at least twice that of the adjacent fibers between which it is sandwiched. The denier of the interlay of larger denier fibers may be as much as ten times that of the denier of the fibers on each side of the interlay or even larger, and controlled splitting of the web will still be obtained. However, as the difference in size becomes greater particularly where it exceeds about six times that of the fibers of the adjacent layers, it becomes necessary to use larger amounts of the finer denier fibers in order to obtain a uniform and attractive appearing fiber layer over the interlay of large denier fibers because of the relatively uneven surface upon which the finer denier fibers are laid. Accordingly, in practicing the present invention, it is generally preferred to have the denier of the fibers forming the fiber interlay along which splitting is to occur about two to six times that of the adjacent fibers and generally not exceeding more than about ten times the denier of the adjacent fiber layers.

The present invention is further illustrated by reference to the drawings in which

FIGURE 1 is an edge view of a web prior to splitting;

FIGURE 2 is a perspective view of the web of FIGURE 1 in which the sheet of material is partially separated by splitting into two sheets;

FIGURE 3 is a perspective view of one of the sheets of FIGURE 2 after splitting;

FIGURE 4 is a schematic view illustrating one method of splitting the web of FIGURE 1;

FIGURE 5 is an edge view of a fiber web prior to splitting which web is designed to be split into more than two sheets;

FIGURE 6 is a perspective view of the fiber web of FIGURE 5 showing the same partially split along each of the interposed large denier fiber layers;

FIGURE 7 is a sheet from one of the outer surfaces of the web of FIGURE 5 after being separated by splitting; and

FIGURE 8 is a sheet from one of the inner portions of the web of FIGURE 5 after being separated by splitting.

In practicing the present invention a web, such for example as illustrated in FIGURE 1, is first built up by laying down fibers in a series of superimposed fiber layers. The fiber layers, which may be deposited by any conventional fiber-laying apparatus, may be formed of carded fibers or may be formed of randomly disposed fibers depending on the nature of the particular product desired. As better control of the thickness and uniformity of the fiber layer deposited is obtained with carded fibers, it is generally preferred to form the fiber layers, particularly the center fiber layer of carded fibers rather than randomly disposed fibers.

Although fibers of various types may be used in practicing the present invention, in describing the invention with reference to the drawings an all rayon fiber product is described.

The laminate web 1 illustrated in FIGURE 1 is formed by first laying down a layer 2 of carded fibers 3 of 1.5 denier rayon having a length of about $1\frac{1}{16}$ ". These fibers are laid to a fiber weight of about 160 grains. Superimposed on this fiber layer is a layer 4 of carded rayon fibers 5 having a denier of 5.5 and a length of about $1\frac{1}{16}$ ", the fibers being laid to a weight of about 70 grains. A layer 6 of fibers 7 of 1.5 denier and length of about $1\frac{1}{16}$ " is then deposited on the fiber layer 4 of larger denier fibers 5 to a weight of about 160 grains. The fiber web 1 so formed is then impregnated with a solution of acrylate binder, such for example as Hycar resin binder, the impregnation being done by any conventional method as passing the same be-

3

tween rolls which are wetted with the binder solution. The impregnated web is dried and heated for 3 minutes at about 310° F. to set the binder. The amount of binder used will depend on the properties desired in the final product and will generally be on a solids basis of about 1% to 50% by weight of the fiber web.

The resulting bonded fiber web 1 is separated into two separate sheets 8 and 9, as illustrated in FIGURE 2, by splitting along the interlay 4 of large denier fibers 5. Sheet 8 has one surface composed of the large denier fibers 5 and the other surface composed of the finer denier fibers 7 whereas sheet 9 has one surface of large denier fibers 5 and the other surface of the finer fibers 3. Sheet 9 is best illustrated in FIGURE 3 which gives a perspective view of the same.

The interposed layer 4 of large denier fibers 5 is preferably relatively thin to provide primarily a control for the splitting of the fiber web. The larger denier fibers 5 making up the interposed layer 4 in the illustration given would generally be deposited in a weight range of about 20 grains to 200 grains per square yard.

The splitting of the web can be readily accomplished by passing between two rolls the web being split by drawing sheet 8 around one of the rolls and sheet 9 around the other roll as the web passes from the nip between the rolls. This is illustrated schematically in FIGURE 4 where fiber web 1 is passed between rolls 10 and 11 with splitting occurring after the web passes from between the two rolls. Splitting being aided by a wedge shaped member 12 positioned near the exit side of the nip between rolls 10 and 11. After initiating the split, sheets 8 and 9, resulting from splitting web 1, are drawn respectively around rolls 10 and 11.

As previously indicated, more than two sheets can be made simultaneously by practicing the process of the present invention. This is best illustrated by reference to FIGURES 5 through 8 of the drawings.

In FIGURE 5 is illustrated a cross-sectional view of a web formed of superimposed fiber layers and impregnated with a bonding agent in a manner similar to that described in the preparation of the web of FIGURE 1. The web 13 of FIGURE 5, however, has four fiber layers 14, 15, 16 and 17 formed of relatively small denier fibers 25 with layers 18, 19 and 20 of larger denier fibers 26 placed in between. Web 13, after through bonding, is split into four separate sheets 21, 22, 23 and 24 as best illustrated in FIGURE 6. Splitting in each instance occurs along an interposed layer of large denier fibers. Referring to FIGURE 6, the resulting separate sheets 21, 22, 23 and 24 obtained by splitting web 13 are each formed of both the small denier fibers 25 and the larger denier fibers 26. Sheets 21 and 24 formed from the outer portions of web 13 differ from sheets 22 and 23 obtained from the inner portion of web 13 in that sheets 21 and 24 each have one surface formed of the relatively small denier fibers 25 and the other surface formed of the larger denier fibers 26. Sheets 22 and 23, however, have a three ply construction in which a layer of the relatively small denier fibers 25 is sandwiched in between two outer layers of the larger denier fibers 26. Sheets 24 and 23 are illustrated respectively in FIGURES 7 and 8 of the drawings.

As previously indicated, the practice of the present invention is not limited to the use of any particular type of fiber but various types of fibers may be used. Thus, any of the natural fibers such as cotton, linen, hemp, silk, wool or wood pulp fibers or synthetic fibers such as rayon, acetate, polyester, acrylic or modacrylic fibers may be used. Where different fibers are used for the interposed layer of relatively large denier fiber than for the finer denier fibers, a bonding agent should be used which is not selective for the fibers of the interposed web of the larger denier fibers.

The following examples will help further to illustrate the practice of the present invention. The examples are

4

given for the purposes of illustration only, however, and the invention is not limited thereto.

Example I

A carded web is prepared having alternate cotton, rayon, cotton layers as follows:

Cotton 300 grains per square yard,
5.5 denier rayon 100 grains per square yard,
Cotton 600 grains per square yard.

The cotton has a Micronaire fineness of approximately 4.0 which would be equivalent to 1.4 denier. The web is impregnated with a 1 percent solids solution of cornstarch to give a binder pickup on a solids bases of about 2.5 percent.

The impregnated web is dried and then split into two separate sheets by passing through rolls and splitting in a manner similar to that illustrated in FIGURE 4 of the drawings. The sheets so formed each have one fuzzy surface of the 5.5 denier rayon and one relatively smooth surface of the cotton. Splitting occurs uniformly in the rayon layer.

Example II

A web is prepared having the following construction:

1.5 denier rayon 300 grains per square yard,
5.5 denier rayon 70 grains per square yard,
1.5 denier rayon 300 grains per square yard.

The web is impregnated with Hycar No. 2671 (an acrylate resin binder) to a pickup weight of 70 grains of binder per square yard of web on a solids basis. The impregnated web is dried and cured at 310° F. for 3 minutes. The web is then split in the manner previously described. Splitting occurs readily and uniformly in the center layer of 5.5 denier rayon.

Example III

A three layer web is formed using as the outer layers a 50-50 blend of 1.5 denier rayon and nonabsorbent comber cotton and an inner layer of 5.5 denier rayon. The fiber length of the rayon for both layers is approximately $1\frac{1}{16}$ ". The fibers are bonded by impregnating with a solution of Hycar 2671 and drying and curing as in the previous example. The completed web splits uniformly through the center layer of 5.5 denier rayon.

Example IV

Using 1.5 denier rayon of $1\frac{1}{16}$ " fiber length as the outer layers, three layer webs are prepared containing respectively a center fiber interlay of 3.0 denier rayon, a center fiber interlay of 6.0 denier dynel, and a 50-50 blend of 5.5 denier rayon and nonabsorbent comber cotton. The webs with the respective interlays are bonded with Hycar Resin 2600X84 and then split in the manner described for the previous examples. The webs in each instance split readily along the center layer of interposed larger denier fibers.

Particular embodiments of the invention have been used to illustrate the same. The invention, however, is not limited to these specific embodiments. In view of the foregoing disclosure variations or modifications thereof will be apparent, and it is intended to include within the invention all such variations and modifications except as do not come within the scope of the appended claims.

Having thus described our invention, we claim:

1. The method of making non-woven fabric comprising the steps of: forming a composite web having at least one interlay of fibers having a diameter at least twice the diameter of the fibers in said web on each side of said fiber interlay; bonding the larger diameter fibers in said interlay and said adjacent smaller diameter fibers with a bonding agent; and then splitting said web in the area of said fiber interlay.

2. The method of claim 1 wherein the interlay is formed of fibers having a diameter not in excess of 10 times the diameter of the adjacent fibers.

3. The method of claim 1 wherein the interlay is formed of fibers having a diameter from 2 to 6 times the diameter of the adjacent fibers.

4. The method of claim 3 wherein said composite web is formed with a plurality of fiber interlays and said web is split at said plurality of interlays to form a plurality of individual webs.

References Cited**FOREIGN PATENTS**

972,633 8/1963 Great Britain.

5 DOUGLAS J. DRUMMOND, *Primary Examiner*.