June 13, 1961 W. R. STRICKEL ET AL 2,988,468

BLANKS OF NON-WOVEN FABRICS

Filed Aug. 22, 1957

Fig. 1.

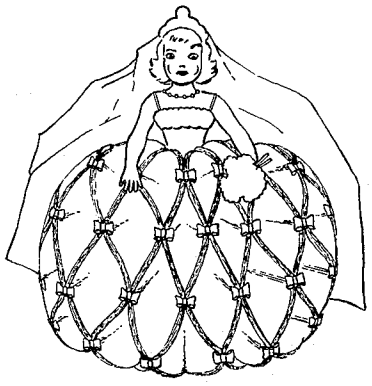


Fig. 2.

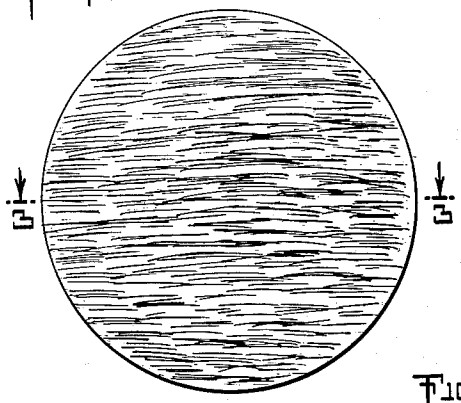


Fig. 4.

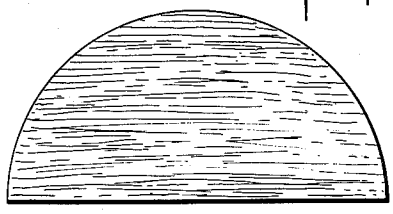


Fig. 5.

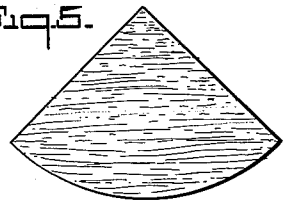


Fig. 3.



Fig. 6.

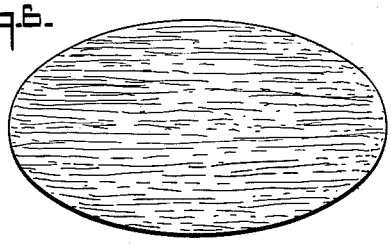


Fig. 8.

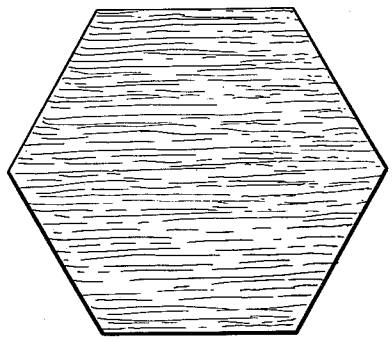
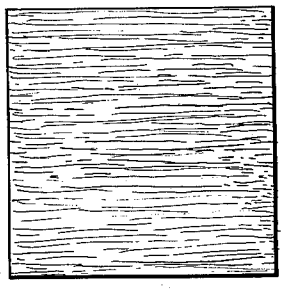


Fig. 7.



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BLANKS OF NON-WOVEN FABRICS

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4 Claims. (Cl. 154—46)

The present invention relates to ornamental blanks of non-woven material, so prepared as to be capable of being made into a decorative form by a further operation. More particularly, the present invention is concerned with relatively flat, dyed ornamental blanks of non-woven fabric having a controlled stiffness and loft and an attractive appearance whereby they are capable of being made into eye-pleasing adornments for dolls, toy animals, and similar figures.

Various blanks and other cut-out forms of sheet material have been used to ornament and add to the attractiveness of toys, dolls, playthings, and similar objects. The most popular figures of this group are, of course, the dolls and the present invention will be described with reference thereto. However, it must be remembered that the ornamental and decorative blanks disclosed herein are of application to other figures.

Ordinary paper has often been used in the past to deck or dress dolls but such materials are flat, flimsy and uninspiring and do not yield a desirable appearance. Additionally, the sewing of such materials, particularly at the edges thereof, has not been satisfactory and the sewn threads have pulled out too easily. Heavier paper and even cardboard have been used to create a thicker, sturdier fabric-like appearance, but they have been found to be too stiff and to lack drapeability. As with thin paper, the sewing of these materials has not been satisfactory.

Woven and knitted fabrics themselves have also been used but the thinness and lack of bulk of the cheaper fabrics and the cost of the more expensive fabrics have prevented their more widespread acceptance and use. Additionally, the stiffness and loft have not been satisfactory and such fabrics have tended to be sleazy and to wilt and sag after a short period of use. Furthermore, the unraveling of the edges of such fabrics has been an objectionable feature and an inherent disadvantage.

Non-woven fabrics have also been used but their flimsiness and lack of strength and sewability, if unbonded, and their poor loft, low bulk and general appearance, if bonded and/or dyed, have militated against their more complete acceptance and use. Non-woven fabrics, however, are normally relatively less expensive to manufacture in a high bulk form than woven and knitted fabrics and are more adaptable to such a use as is involved here wherein the decorative and ornamental effects should be obtainable easily and cheaply. Additionally, the adornments naturally become soiled and, inasmuch as they are very difficult to be cleaned or washed, should be capable of being readily discarded after a single use, without creating any laundering problem. Non-woven fabrics, being basically of a single use, disposable nature lend themselves quite naturally to this use. It is therefore, to these non-woven fabrics that the present invention is directed.

It has been found that ornamental blanks of non-woven fabrics having excellent loft, high bulk, desirable stiffness, pleasing appearance, satisfactory sewability and required drapeability may be prepared in bonded and dyed form by the use of specific fiber formulations in the preparation of the blank material and by selective bonding and dyeing techniques of the prepared blank material.

More specifically, it has been found that if these ornamental non-woven blanks are prepared in such a way

that the surface layers thereof contain a greater concentration of finer fibers and the interior portion thereof contains a lesser concentration of coarser fibers, the desired loft, bulk, stiffness and hand are obtained. It has further been found that, if such a non-woven fabric blank is then subjected to a selective and controlled surface coating treatment with a combined bonding and dyeing composition, the loft and bulk are not undesirably affected and the stiffness and pleasing appearance of the dyed material actually is enhanced.

In the accompanying drawings and following specification, there are illustrated and described preferred designs of ornamental blanks of non-woven fabrics embodying the present invention. It is to be understood, however, that the inventive concept is not to be considered limited to the various constructions disclosed except as determined by the scope of the appended claims. With reference to the accompanying drawings:

FIGURE 1 is a showing of a doll adorned with ornamental blanks of non-woven fabric of the present invention;

FIGURE 2 is a plan view of a circular ornamental blank including the improvements of the present invention;

FIGURE 3 is an enlarged cross section of the circular ornamental blank of FIGURE 2 taken along the line 3—3 of FIGURE 2 in the direction of the arrows;

FIGURE 4 is an ornamental blank of non-woven fabric in the form of a semicircle;

FIGURE 5 is an ornamental blank of non-woven fabric in the form of a quarter circle;

FIGURE 6 is an ornamental blank of non-woven fabric in the form of an ellipse;

FIGURE 7 is an ornamental blank of non-woven fabric in the form of a square; and

FIGURE 8 is an ornamental blank of non-woven fabric in the form of a hexagon.

In the embodiment of the invention shown in FIGURE 1 of the drawing, the ornamental blanks of the present invention are shown adorning a doll. In this particular figure, the ornamental blanks which are used are circular, such as illustrated in FIGURE 2. These blanks are normally folded in half and are then sewn or otherwise secured to the waist or waistband of the doll in sufficient numbers so as to form a full skirt having substantially a spherical shape. The edges of the folded semicircular blanks may be sewn together at intervals with knitting yarns or colored ribbons and ruffled to form a more pleasing appearance.

It is, of course, also possible to start with the semicircular ornamental blank illustrated in FIGURE 4 and to form substantially the same adornment for the doll illustrated in FIGURE 1. Such would avoid the necessity of the initial folding of the circular ornamental blank of FIGURES 2 and 3 but, of course, would require approximately twice the number of blanks.

The quarter circle ornamental blank illustrated in FIGURE 5 can be used in similar fashion to form a substantially hemispherical skirt for the doll. In like manner, the rectangular (square) ornamental blank of FIGURE 7 or the polygonal (hexagon) of FIGURE 8 is used to form adornments of other shapes for the doll of FIGURE 1.

As shown more particularly in FIGURE 3, wherein a cross section of the non-woven blank is shown, as it exists prior to bonding and dyeing, the non-woven blank comprises at least three basic layers, namely: an upper fibrous layer of fine fibers; a central fibrous portion of coarse fibers; and a lower fibrous layer of fine fibers. These individual layers are in the form of fibrous card webs, the products of textile machines such as cards. The upper and lower layers and the central portion may comprise one

or more card webs, up to a total of as many as twelve webs, depending upon the needs and requirements of the particular design in mind.

It is not essential that the fibers in each separate layer be carded or parallelized inasmuch as isotropic non-woven fabrics which have been created by other methods such as by fluid deposition at random may also be utilized.

The fibers in the surface or fine fiber layers and in the central or coarse fiber portion may be selected from a wide range of textile fibers, both natural, synthetic and man-made. Substantially any type of cellulosic or cotton fiber, for example, may be used. Such would include Sea Island cotton, Egyptian cotton, coarse American Upland cotton, fine American Upland cotton, Indian cotton, etc., or the various synthetic cellulosic fibers, notably regenerated cellulose or rayon.

In the case of the synthetic or man-made fibers, a range of deniers may be selected somewhat comparable to the range of finenesses of the cotton fibers, or coarser than such cotton fibers where such coarseness is desired. For example, rayon fibers having a denier of from about 1 to about 2 have been found generally satisfactory for the surface layers, whereas rayon fibers having a denier of from about 2 to about 5.5 have been found more satisfactory for the central portion. These fibers are of staple length, ranging from about ½ inch to about 2 inches.

The important factor to be kept in mind in the preparation of the surface or fine fiber layers is the average relative fineness of the fibers therein. For the purposes of this invention, average fineness values in the range of from about 3 to about 5.6 micrograms per linear inch or a denier of from about 1 to about 2 have been found acceptable. Within the more commercial aspects of the present invention an average fineness value of from about 3½ to about 5.6 micrograms per linear inch has been found acceptable.

In blending fibers having different fineness values and characteristics, fibers may be blended but no particular type should have a fineness below 3 or greater than 8.5 micrograms per inch except when special surface or visual effects are desired. Layers having fibers with an over-all average fineness less than 3 micrograms per linear inch are not desirable as they do not satisfactorily cooperate with the subsequent bonding and dyeing step and do not hide minor imperfections, such as wrinkles or uneven dyeing. Layers having fibers with an average fineness more than 5.6 micrograms per linear inch cannot be used for the surface layers, as the cooperative relationship with the subsequent surface dyeing operation is similarly not present in that the depth of color penetration is not completely satisfactory and the desired appearance is lost in that the deep, full color shade cannot be obtained.

It is not essential that the fibers in the surface or fine fiber layers or in the central or coarse fiber portion, to be described hereinafter, be of the same type. The layers may comprise blends of cotton and rayon and other fibers where such other fibers may be desired to produce special properties and characteristics. Such other fibers would include nylon, cellulose esters such as cellulose acetate; polyester fibers such as "Dacron"; vinyl fibers such as "Vinyon," "Saran," "Velon," "Dynel," etc.; acrylic fibers such as "Orlon," "Acrilan," "Creslan," etc. and the like. These special fibers may be included in small amounts of as low as 2% or 3% by weight up to as much as 50% by weight, where desired or required.

The central or coarse fiber portion of the ornamental blank of non-woven materials comprises heavier or coarser fibers than those found in the surface layers. Suitable fibers for the interior portion of the blank comprise heavier denier synthetic fibers and natural fibers such as cotton, provided the average over-all relative fineness of the fibers in the layer is in the range of from about 5.6 to about 15.5 micrograms per linear inch or from about 2 to about 5.5 denier. Within the more commercial aspects of the present invention, this range is preferably from about 5.8 to about 10.5 micrograms per linear inch. In the formation of blends, fibers may be blended but no particular type should have a fineness below 3 or greater than 15.5 micrograms per inch except when special effects are desired.

If the central portion contains fibers which have an over-all average fineness less than about 5.6 micrograms per linear inch, the result is unsatisfactory. Such fibers are too fine and will show a white appearance in the final product which is undesirable and unattractive. It is believed that the fineness of the fibers is responsible for this effect and consequently only fibers which average at least 5.6 micrograms per linear inch are acceptable. On the other hand, if fibers averaging a fineness greater than about 15.5 micrograms per linear inch are used, the interior portion appears to be flimsy and too open and empty. In other words, the disks lack fullness. Additionally, they do not adhere or hold together but tend to separate into two pieces. It is therefore essential that the average weight of the fibers remain in the stated range.

The fibers in the central layer are heavier and coarser than the fibers in the surface layers and their fineness values, measured in micrograms per linear inch, are normally on the order of from about 1⅓ times to about 5 times the fineness values of the fibers in the surface layers. That is to say, if the fibers in the surface layers have a fineness value of about 4¼ micrograms per linear inch, then the fineness values of the fibers in the central layer should be in the range of at least about 5⅔ micrograms per linear inch.

The weights of the surface layers and the interior portion may be varied within relatively wide ranges. For example, each of the surface layers may have a weight as low as about 100 grains per square yard and may be as high as about 270 grains per square yard. Within the more commercial aspects of the present invention, it has been found that from about 150 to about 220 grains per square yard is industrially preferred. As for the interior portion, it has been found that from about 380 to about 780 grains per square yard represents a suitable working range. Within the more commercial aspects, however, a range of from about 530 to about 660 grains per square yard has been found preferable.

The total weight of the entire ornamental blank is in the range of from about 600 to about 1300 grains per square yard. Within the more commercial aspects of the present invention, from about 850 to about 1,150 grains per square yard is preferred.

The concentration of fibers in the surface layer is greater than the concentration of fibers in the center layer and this is necessarily so if the benefits and advantages of the present invention are to be realized.

For example, in the surface layers which have a weight of from about 100 to about 270 grains per square yard, and preferably from about 150 to about 220 grains per square yard, it has been found that from about 220 to about 550 fibers per square centimeter, and preferably from about 235 to about 420 fibers per square centimeter, are present. In the case of the interior portion which has a weight of from about 380 to about 780 grains per square yard, and preferably from about 530 to about 660 grains per square yard, it has been found that from about 265 to about 900 fibers per square centimeter and preferably from about 400 to about 850 fibers per square centimeter are present.

These figures do not at first glance indicate the true difference in the concentration of the fibers in the surface layers over the interior portion inasmuch as the total weight of the interior portion is so much greater than the weight of each surface layer. As a matter of fact, a casual observer would assume that there is an overlap in these values. However, if one were to set forth the concentration of the fibers in each layer or portion on the basis of a web of 100 grains per square yard, the

marked difference would become more readily apparent and the presence of overlap would be negated.

Using such a basis, for the surface layer, it has been found that a concentration of from about 138 to about 260 fibers per square centimeter, and preferably from about 138 to about 220 fibers per square centimeter, based on a web of 100 grains per square yard, is present.

For the interior portion, it has been found that from about 50 to about 138 fibers per square centimeter, and preferably from about 74 to about 134 fibers per square centimeter, based on a web of 100 grains per square yard, is present.

In general, the concentration of the fibers in the surface layers is from about 1⅓ to about 5 times the concentration of the fibers in the interior portion in order to obtain the desired improvement in the ornamental blank.

The ornamental blank of non-woven fibers containing a greater concentration of finer fibers in the surface layers and a lesser concentration of coarser fibers in the interior portion is then dyed by passage through surface-contacting dyeing means, such as rollers or other applicators whereby a preponderance and usually all of the fibers in the surface layers are bonded and dyed, whereas the preponderance and sometimes all of the fibers in the interior portion are dyed but not always bonded.

It has been discovered that, if the ornamental blanks of the present invention are surface bonded and dyed, the surfaces containing the finer fibers take on and retain the dye and bonding agent very easily and present a very pleasing appearance. On the other hand, however, the interior portions containing the coarser fibers receive and retain the dye but do not retain the bonding agent as readily and consequently the blank maintains its desirable high loft.

This desired effect is accomplished by subjecting the several layers of fibers to a combined bonding and dyeing treatment wherein the several layers are advanced between pressure-exerting means which apply the bonding agent and the dye simultaneously. Sufficient pressure is exerted to compress the layers to about one twenty-fifth to about one sixty-fifth of their uncompressed state, after which they may expand somewhat. The plurality of layers may have a thickness before compression in the range of about one-fifth of an inch (0.200") to about one-half of an inch (0.500"), and after compression in the range of about 0.09" to about 0.15".

It has been discovered that the coarser fibers in the interior portions of the ornamental blank become dyed but do not become bonded. The bonding agent is believed to penetrate completely through the layers along with the dye during the application of pressure but apparently migrates to the outside of the layers during heating and drying. In the finished product, the bonding agent therefore bonds the surface layers completely but bonds only a small part up to about 25% by weight of the fibers of the interior layer on each of its sides adjacent the surface fine fiber layer. In this way a high bulk and pleasing appearance is obtained without undesirably affecting the loft of the resulting product.

Substantially any type of dye suitable for the particular fiber employed may be used. For example, substantially any dye may be employed, such as any F.D. and C. or D. and C. color normally used in foods, drugs, and cosmetics. Such dyes are preferred primarily because of their non-toxicity.

With respect to the proportions of bonded fibers and unbonded fibers, it should be stated that the maximum allowable percentage of unbonded fibers in the disk is about 45% by weight. For example, in the case of a disk having a weight of 1000 grains per square yard, a maximum allowable weight of unbonded fibers is about 450 grains per square yard. If greater than 45% of the fibers, based on weight, are unbonded, the central portion will not cling together and will tend to look undesirably white and empty. Less than that percentage of unbonded

fibers is permissible and percentages down to about 25% by weight have been found acceptable. Optimum results appear to be obtainable when the percentage of unbonded fibers is about 25% to 40% by weight. Percentages of unbonded fibers less than 20% introduce the problem of decreased loft and low bulk.

A pin pull-out test has been devised in the laboratory in order to give an indication of the sewing strength and resistance to pull-out of the sewing thread at the edges of the disk. A pin measuring 0.038 inch in diameter is inserted through a disk ¼ of an inch from the outside edge. The force in pounds required to pull the pin through the edge of the non-woven fabric is determined. The following tables show a comparison of the pull-out strengths of the disks of the present invention and comparable weight and size disks manufactured under other processes and available on the open market.

Invention disks (carded)

Table 1	Table 2
0.48	0.75
0.54	0.68
0.42	0.80
0.48	0.83
0.64	0.73
0.54	0.74
0.59	0.68
0.50	0.61
0.42	0.71
0.65	0.74

Table 1 sets forth the force in pounds required to pull the pin out of invention disks in the direction parallel to the carded fibers. Table 2 sets forth the force in pounds required to pull the pin out of invention disks in a direction crossing the carded fibers. Substantially all of these are considered acceptable for sewing purposes.

Comparable competitive disks (carded)

Table 3	Table 4
0.35	0.46
0.29	0.47
0.46	0.55
0.38	0.58
0.40	0.54
0.40	0.53
0.40	0.55
0.32	0.48
0.42	0.49
0.36	0.35

Consideration of Tables 3 and 4 reveal, respectively, the decreased forces in pounds required to pull the pins out of the disks in a direction parallel to the carded fibers (Table 3) and in a direction at right angles to the direction of the carded fibers (Table 4). The edge weaknesses of these other products and the difficulties which would be present in sewing or stitching the disks together is to be noted.

Another property of the ornamental blanks of non-woven material used for decorative purposes is the relative stiffness of the material whereby it is capable of retaining its shape and configuration after having been fabricated. The following tables set forth the superiority of the ornamental blanks of the present invention over competitive comparable blanks. The stiffness tests are run on a "Handle-O-Meter," manufactured by Thwing-Oliver Instrument Company, with the gap set at 1½ inches for testing in the carded or machine direction and ¾ of an inch for testing in the cross or transverse direction.

Invention blanks

Cross Direction	Machine Direction
Table 5	Table 6
13.5	23.0
11.5	18.0
7.5	13.0
15.0	25.0
14.0	24.0
14.0	20.5
18.0	32.0
12.0	19.0
11.0	22.0
11.0	16.0
17.0	23.0
[1] 13.1	[1] 21.5

[1] Average.

Comparable competitive blanks

Table 7	Table 8
5.0	5.5
4.5	4.0
10.0	6.5
9.5	8.0
9.0	7.0
6.0	5.0
5.5	5.0
7.5	6.5
7.5	6.0
3.0	4.0
[1] 6.8	[1] 5.8

[1] Average.

Comparison of Tables 5 and 6 with Tables 7 and 8 reveal the superiority of the invention blanks over competitive comparable blanks. The obtaining of such desirable stiffness properties is particularly unusual when it is realized that such properties are obtained without suffering the loss of any loft or high-bulk characteristics.

The invention will be further illustrated in greater detail by the following specific examples. It should be understood, however, that although these examples may describe in particular detail some of the more specific features of the invention, it is given primarily for purposes of illustration and the invention in its broader aspects is not to be construed as limited thereto.

Example 1

An ornamental blank of circular non-woven material having a diameter of six inches is prepared according to the following method. The upper surface layer is obtained from a card web comprising 50% by weight of 1.5 denier rayon (a fineness of 4.2 micrograms per linear inch) and 50% by weight of non-absorbent comber cotton with a fineness of 3.6 micrograms per linear inch. The layer has a weight of about 170 grains per square yard with the fibers therein averaging 3.9 micrograms per linear inch. Each surface layer contains 338 fibers per square centimeter or 199 fibers per square centimeter on a 100 grain per square yard basis. This represents 25.3% of the fibers by number. The inner portion comprises two card webs, each made of 50% by weight of 5.5 denier rayon (a fineness of 15.5 micrograms per linear inch) and 50% by weight of a non-absorbent cotton having a fineness of about 5 micrograms per linear inch. Each of the card webs constituting the interior portion weighs about 319 grains per square yard with the fibers therein averaging 7.6 micrograms per linear inch.

The interior portion contains 660 fibers per square centimeter or 103 fibers per square centimeter on a 100 grain per square yard basis. This represents 49.4% of the fibers by number. The lower surface layer is prepared according to the same fiber formulation as the upper surface layer. All the fibers are of staple length and fall within the range of from about ½ inch to about 2 inches. The combined card webs are surface-bonded by a roller-applicator and the final product contains approximately 0.2% by weight of dye and approximately 2½% by weight of a binder material. The card webs after drying are then punched out into circular forms having a diameter of approximately six inches. The dye used in this particular example is a F.D. and C. Blue #2 and the binder material is high viscosity polyvinyl alcohol. Both surface layers are completely dyed and bonded and approximately 37% of the center layer is bonded. Calculating this on the basis of the weight of the entire disk indicates the percentage of unbonded fibers to be about 41%.

Example 2

An ornamental blank of circular non-woven material having a diameter of six inches is prepared according to the following method. The upper surface layer is a card web comprising 100% by weight of 2.0 denier rayon (a fineness of 5.6 micrograms per linear inch). The layer has a weight of about 180 grains per square yard. The inner portion comprises two card webs, each made of 50% by weight of 5.5 denier rayon (a fineness of 15.5 micrograms per linear inch) and 50% by weight of a fiber blend having a fineness of about 5.7 micrograms per linear inch and comprising 17.4% by weight of 1.5 denier rayon, a fineness of 4.2 micrograms per linear inch), 17.4% by weight of non-absorbent comber cotton with a fineness of 3.6 micrograms per linear inch, 32.6% by weight of a non-absorbent cotton with a fineness of 5.0 micrograms per linear inch and 32.6% by weight of 5.5 denier rayon (a fineness of 15.5 micrograms per linear inch).

Each of the card webs constituting the interior portion weighs about 309 grains per square yard with the fibers therein averaging about 8.3 micrograms per linear inch. The lower surface layer is prepared according to the same fiber formulation as the upper surface layer. All the fibers are of staple length and fall within the range of from about ½ inch to about 2 inches.

The combined card webs are surface bonded by a roller-applicator so that the final product contains approximately 0.2% by weight of dye and approximately 2½% by weight of a binder material. The card webs, after drying, are then punched out into circular forms having a diameter of approximately six inches. The dye used in this particular example is F.D. and C. Blue #2 and the binder material is polyvinyl alcohol. Both surface layers are completely dyed and bonded and approximately 57% of the center layer is bonded. Calculating this on the basis of the weight of the entire disk indicates that the percentage of unbonded fibers is about 26%.

Each surface layer, as originally prepared, contains 250 fibers per square centimeter or 139 fibers per square centimeter on a 100 grain per square yard basis. This represents 23.2% of the fibers by number. The interior portion contains 580 fibers per square centimeter or 94 fibers per square yard basis. This represents 53.6% of the fibers by number.

Although two specific examples of the inventive concept have been described, the same should not be construed as limited thereby nor to the specific substances mentioned therein but to include various other compounds of equivalent constitution as set forth in the claims appended hereto. It is understood that any suitable changes, modifications and variations may be made without departing from the spirit and scope of the invention.

We claim:

1. An ornamental blank of non-woven material capable of being made into a decorative form by a further operation comprising an upper surface layer of fibers having an average fineness of from about 3 to about 5.6 micro-

grams per linear inch for a material having the density of cellulose; a lower surface layer of fibers having an average fineness of from about 3 to about 5.6 micrograms per linear inch; and an interior portion of fibers having an average fineness of from about 1⅓ to about 5 times the average fineness of the fibers in the surface layers and in the range of from about 5.6 to about 15.5 micrograms per linear inch; the preponderance of the fibers in the surface layers being bonded and dyed and only a small part up to about 25% by weight of the fibers of the interior layer on each of its sides adjacent the surface fine fiber layers being bonded, said blank having a thickness in the range of about 0.09 to about 0.15 in., a total weight per square yard in the range of about 600 to about 1300 grains, a surface layer weight per square yard in the range of about 100 to 270 grains, and an interior layer weight per square yard in the range of about 380 to 780 grains.

2. An ornamental blank of non-woven material of claim 1 wherein the staple fibers have an average length of from about ½ inch to about 3 inches.

3. An ornamental blank of non-woven material of claim 2 wherein the upper surface layer has a fiber concentration of from about 138 to about 260 fibers per square centimeter on the basis of a 100 grain per square yard layer; the lower surface layer has a fiber concentration of from about 138 to about 260 fibers per square centimeter on the basis of a 100 grain per square yard layer; and the interior portion has a fiber concentration of from about 50 to about 138 fibers per square centimeter, on the basis of a 100 grain per square yard layer.

4. An ornamental blank of non-woven material of claim 2 wherein the upper surface layer has a fiber concentration of from about 220 to about 550 fibers per square centimeter; the lower surface layer has a fiber concentration of from about 220 to about 550 fibers per square centimeter; and the interior portion has a fiber concentration of from about 265 to about 900 fibers per square centimeter.

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