

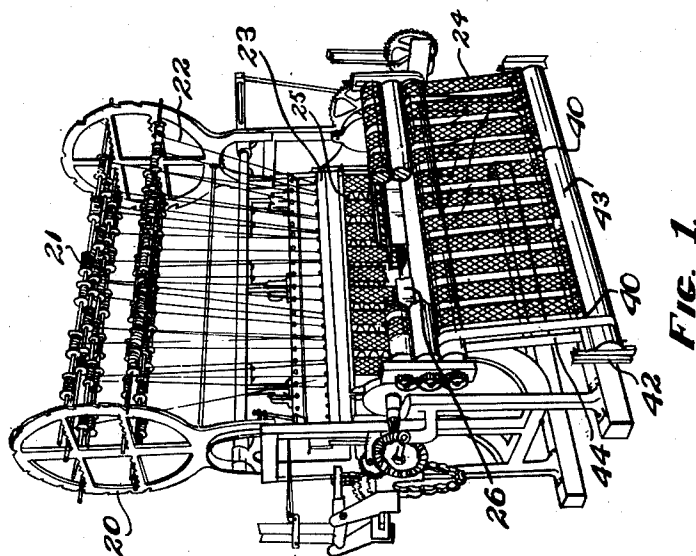
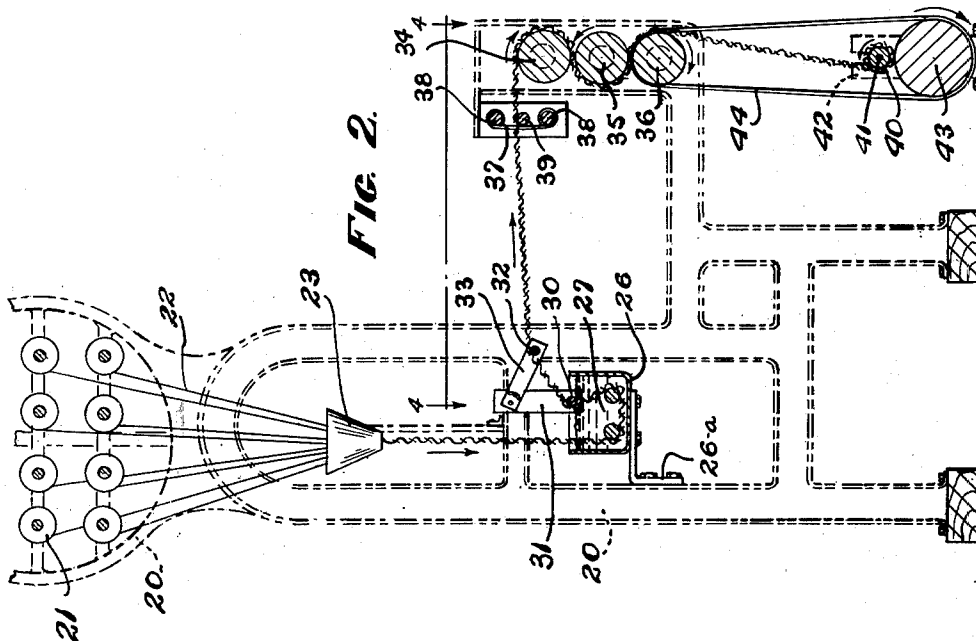
July 1, 1952

H. F. GOLDSMITH
METHOD OF FORMING SHEER OPEN-MESH
MATERIAL AND APPARATUS THEREFOR

2,601,770

Filed June 12, 1948

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

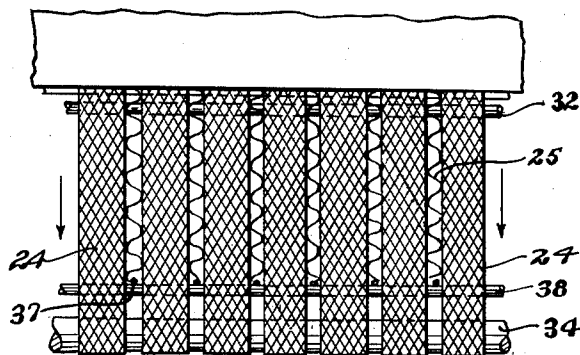


FIG. 4.

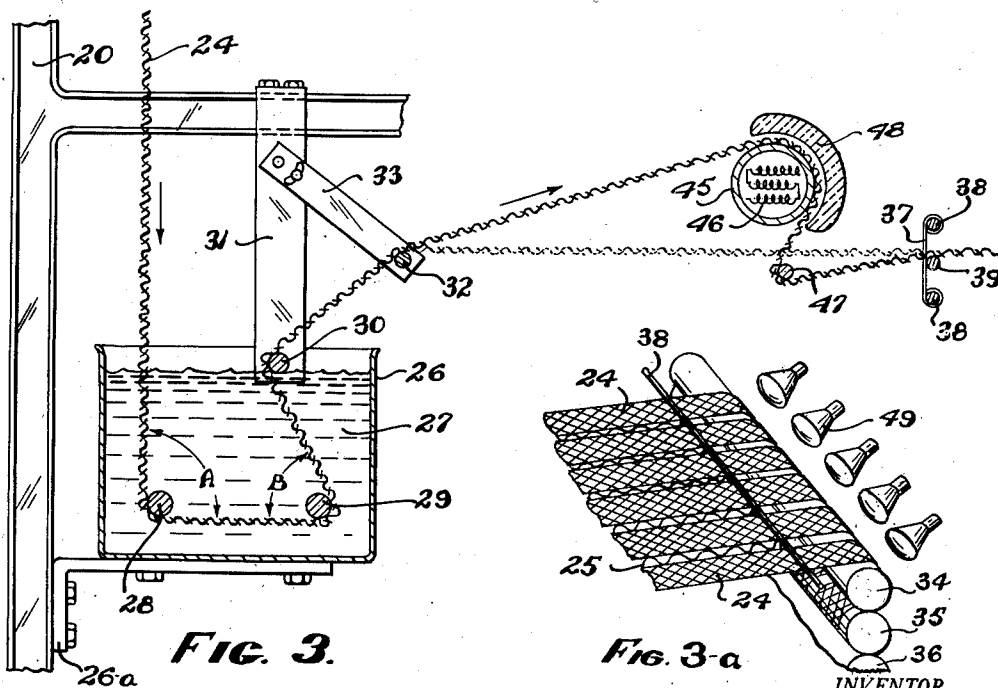


FIG. 3.

FIG. 3-a

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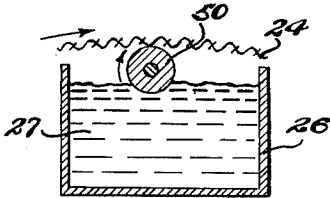


Fig. 5

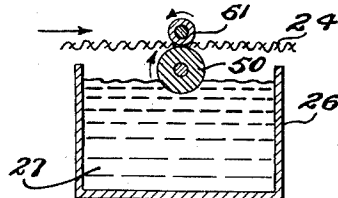


Fig. 6

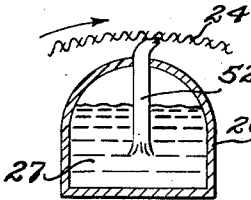


Fig. 7

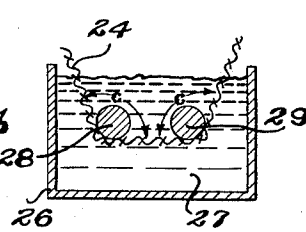


Fig. 8

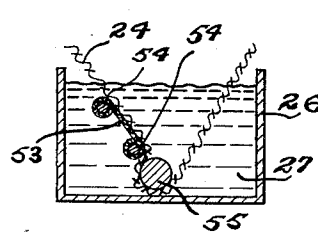


Fig. 9

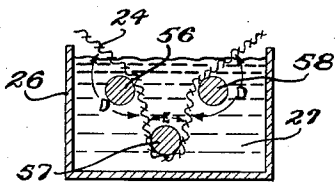


Fig. 10

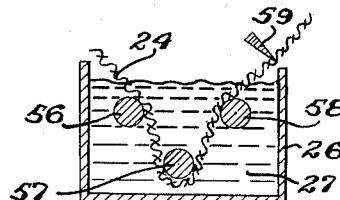


Fig. 11

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2,601,770

METHOD OF FORMING SHEER OPEN-MESH
MATERIAL AND APPARATUS THEREFOR

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Application June 12, 1948, Serial No. 32,645

11 Claims. (Cl. 66—147)

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The present invention relates to sheer open-mesh fabrics for use in hair-nets, veilings and the like and it relates more particularly to a new and improved method, and apparatus for, treating such fabrics so as to render them stronger and easier to handle.

An object of the present invention is to provide a new and improved process of, and apparatus for, manufacturing sheer open-mesh fabrics for hair-nets, veilings and the like. Another object of the present invention is to provide a novel process of, and apparatus for, treating sheer open-mesh fabrics so as to render them stronger and easier to handle. Still another object of the present invention is to provide a relatively strong non-tangling open-mesh fabric at relatively low cost.

Other objects and advantages of the present invention are apparent in the following detailed description, appended claims and accompanying drawings.

Sheer open-mesh fabrics are very widely used for hair-nets, veilings and the like. These fabrics are usually constructed of natural or synthetic fibres (such as silk, nylon, rayon, etc.) and have threads or courses of stitches running diagonally and fastened to adjoining threads or courses of stitches at spaced intervals so as to form a series of diamond-shaped or octagonal or other polygonal openings. The sheer open-mesh fabrics manufactured today are usually manufactured on knitting machines or lace-making machines in a manner well-known in the art.

One such type of sheer open-mesh fabric is shown in my Patent 2,428,071 and is formed of courses of knitted loops which are fastened to adjoining courses at spaced intervals by floating inlay threads to give a series of generally diamond-shaped openings in which is commonly referred to as a Raschel construction.

These sheer open-mesh fabrics are usually knitted or otherwise formed under tension and, when the tension is released, the fabric tends to contract due to the inherent resilience of the structure. When this type of sheer open-mesh fabric is not under tension, it has a marked tendency to tangle and it quite apt to tear during a disentangling operation due to its sheerness and the very fine gauge threads employed.

It has been suggested, in my Patent 2,428,071, to apply a coating of a thermo-setting or thermo-plastic synthetic resin to the open-mesh fabric so as to render it less susceptible to tangling and, at the same time, to strengthen the structure, particularly by bonding the juncture

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points of the threads. However, the application of the synthetic resin to the fabric presents serious problems, from an industrial standpoint. Thus, while the individual threads or fibres can be coated preliminary to the knitting or similar forming operation, this is relatively costly and time-consuming and has not been found to be very practical.

On the other hand, if the sheer open-mesh fabric is first formed and is subsequently coated after leaving the knitting machine or the like, the tendency to tangle, as referred to above, makes it extremely difficult to apply the synthetic plastic properly so as to effect the proper disposition of the coating without tearing or otherwise injuring the fabric.

Accordingly, the present invention contemplates a new and improved process of, and apparatus for, quickly and inexpensively coating sheer open-mesh fabric with natural or synthetic plastic or other sizing material, which overcomes the shortcomings of the prior-art and which gives a final structure which is relatively strong and resistant to tangling.

Generally speaking, the present invention comprehends a novel process of, and apparatus for, applying natural or synthetic resin or plastic or other sizing material to a continuous length of sheer open-mesh fabric immediately after it leaves the needle-bank of the knitting machine or other similar machine and while it is still under tension, and, thereafter, sending it through appropriate drying and/or setting operations whereby it will assume its final sized non-tangling form before release of the original tension under which it was knitted or otherwise formed.

For the purpose of illustrating the invention, there are shown in the accompanying drawings forms thereof which are at present preferred, although it is to be understood that the various instrumentalities of which the invention consists can be variously arranged and organized and that the invention is not limited to the precise arrangements and organizations of the instrumentalities as herein shown and described.

Referring to the accompanying drawings in which like reference characters indicate like parts throughout:

Figure 1 represents a perspective view of a Raschel knitting machine embodying the apparatus of the present invention.

Figure 2 represents a more or less schematic vertical cross-sectional view of the embodiment of Figure 1.

Figure 3 represents a vertical cross-sectional view, on an enlarged scale, of a modification employing a heated drying drum after the sizing-bath.

Figure 3-a represents a fragmentary perspective view showing an alternative form of heating mechanism, employing heating-lamps in place of the heating-cylinder of Figure 3.

Figure 4 represents a top elevational view looking generally in the direction of arrows 4-4 of Figure 2.

Figure 5 represents a vertical cross-sectional view showing a modified form of sizing-bath.

Figure 6 represents a view generally like that of Figure 5 but showing a further modification employing a backing-roll in addition to the coating-roll of Figure 5.

Figure 7 represents a view generally like that of Figure 5 but showing still another form of sizing-bath employing a wick.

Figure 8 represents a view like that of Figure 5 but showing a still further embodiment employing two fully-submerged idler-rolls.

Figure 9 represents a view like that of Figure 5 but showing a still further modification employing a single-submerged idler-roll in conjunction with a coating bed or panel.

Figure 10 represents a view like that of Figure 5 but showing still another embodiment employing three submerged idler-rolls.

Figure 11 shows the embodiment of Figure 10 used in conjunction with a wiper or doctor-blade, or rod.

In Figures 1 and 2 there is shown generally a machine embodying the present invention.

Except as will be hereinbelow specifically described, the machine shown in Figures 1 and 2 is a conventional Raschel knitting machine (as manufactured by George W. Lindley of Philadelphia, Pa., and others) the construction and operation of which are well-known to those skilled in the art and, accordingly, its construction is shown only schematically and its operation described only functionally.

Thus, the frame 20 carries a plurality of spools or bobbins 21 rotatively mounted at its top; the threads 22 being led from the spools 21 downward to the needle-bank which is shown only schematically as at 23 and which is capable of knitting the threads into a sheer open-mesh fabric of the type disclosed in my Patent 2,428,071, wherein the individual courses of knitted loops run in generally zig-zag fashion and are tied alternately to the adjoining courses at either side by floating inlays.

The needle-bank is preferably so arranged that it knits, simultaneously, a plurality of individual strips 24 of sheer open-mesh fabric arranged in side-by-side relationship as indicated particularly in Figures 1 and 4, each strip having a transverse dimension corresponding to that of the hair-nets or veillings or the like to be manufactured therefrom. In order to keep the individual fabric strips in proper laterally-spaced relationship to each other, a temporary individual connector-thread 25 is knitted between adjoining strips, in zig-zag fashion.

The knitted strips 24 leave the needle-bank 23 under tension (exerted by pulling-rolls to be described hereinbelow) and moved downward into an elongated trough 26 which is disposed generally in vertical alignment with the needle-bank and extends parallel thereto so that it can accommodate all of the knitted strips 24. The trough 26 may be supported upon generally

L-shaped brackets 26-a bolted to the frame 20.

The trough 26 contains a liquid treating-bath 27 which may consist of any suitable solution, suspension or emulsion of thermo-setting or thermo-plastic synthetic resin or the like. A wide range of different synthetic resins may be employed in the process of the present invention. Among these are polymers and co-polymers of butadiene and other polymerisable conjugated di-olefins, polystyrenes, poly-acrylonitriles, phenol-formaldehyde and urea-formaldehyde resins, vinyl polymers, and many others. Appropriate modifiers, stabilizers, dispersing agents, etc. may be included in the solution, suspension or emulsion in a manner well-known in the art so as to give proper coating or sizing and to protect the final product against deterioration or the like.

As indicated particularly in Figures 2 and 3, a pair of transversely-spaced idler-rolls 28 and 29 extend longitudinally within the trough 26 near the bottom thereof while another idler-roll 30, rotatably mounted on vertically-extending supporting arms 31, extends longitudinally of the trough just at the liquid level. The fabric-strips 24 are led downward so as to pass beneath the idler-roll 28 (forming a generally right-angle A) and are then led transversely so as to pass beneath and around the idler-roll 29 (forming an acute angle B) after which they pass upward around and above the top roll 30.

It is apparent that, in passing across these idler-rolls, the strips 24 are led through the treating-bath 27 so that they are impregnated with the solution or suspension of the synthetic resin.

From the idler-roll 30, the impregnated strips 24 are led diagonally upward and across another idler-roll 32 rotatively carried by supporting arms 33 which are pivotally mounted upon the arms 31 so as to permit vertical adjustment of the idler-roll 32 relative to the roll 30.

From the idler-roll 32, the fabric-strips 24 may be led more or less horizontally to the uppermost of three inter-gearred juxtaposed power-rolls 34, 35 and 36; the strips passing above and around the top roll 34 and around the rolls 35 and 36 in the manner indicated particularly in Figure 2; the frictional engagement of the strips with the power rolls, and particularly at the contact zones of the power rolls, providing the pull or tension for the strips during the knitting and treating operations described above.

As shown particularly in Figures 2 and 4, the generally horizontal travel of the impregnated strips 24 from the idler-roll 32 to the first power roll 34 is appreciable in order to afford an opportunity for the synthetic resin to dry and harden.

As shown particularly in Figures 2 and 4, a plurality of vertical wires 37 are mounted in spaced relationship intermediate a pair of horizontal rods 38. The wires 37 are so disposed as to cut and strip the connector-threads 25 when the fabric-strips 24 pass across a rod 39 disposed intermediate the rods 38 referred to above. Thus, the individual strips 24 are no longer connected when they reach the power roll 34 and, when they leave the power roll 36, are wound up on individual spools 40 mounted on a shaft 41 supported in vertically-slotted end-plates 42. The individual spools rest against, and are frictionally rotated by, a relatively large diameter roll 43 which is driven from the power roll 36 by a belt 44.

The slotted construction of the end-plates 42

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permit the spools 40 to rise as the strips are rolled up thereon.

The individual threads 22 of which the strips are knitted may be of any natural or synthetic fibre, as for example, silk, rayon, nylon, cotton 5 or the like, or mixtures thereof.

It is to be understood that the present invention is not limited to the particular type of thread or to the particular type of synthetic resin employed. Similarly, the present invention 10 is not limited to the particular type of diamond-shaped open-mesh fabric shown in the drawings, but, instead, comprehends all types of sheer open-mesh fabrics used in hair-nets, veils or the like, regardless of their particular shape or other characteristics.

The present invention contemplates the use of a large variety of synthetic sizing materials including synthetic resins and plastics, organic and inorganic derivatives of cellulose or the like, 20 as for example cellulose ethers, cellulose esters of organic acids (acetic, propionic, butyric and others), cellulose-sodium-zincate or other zinc resins; and many other synthetic sizing materials which are capable of being applied to the netted structure, in the form of a solution, suspension, emulsion or the like and which are capable of drying (either by way of air drying or by use of heat) or otherwise setting so as to give the desired properties to the final structure. 30

Accordingly, the terms "synthetic sizing material" and "synthetic resin" are used in the appended claims in a broad sense as comprehending all the materials referred to hereinabove.

In Figure 3, there is shown a modification of the embodiment described hereinabove, wherein in the treated fabric-strips 24, instead of being led directly from the idler-roll 32 to the power-roll 34, are first passed across an elongated 40 metal cylinder or drum 45 which is provided with internal heating-coils 46. The cylinder 45 is preferably stationary so as to stretch the fabric-strips somewhat and thereby to facilitate drying. However, the cylinder 45 may be made rotatable, especially where it is desirable to cut down on resistance.

From the cylinder 45, the fabric-strips 24 are passed underneath the idler-roll 47 and from there to the power-roll 34 in the manner described hereinabove.

The passage of the impregnated fabric-strips 24 over the heating-cylinder 45 aids in the drying and setting of the synthetic plastic.

A concave shield 48, of heat-resistant material (such as asbestos or the like) may be provided so as to extend along the heating-cylinder in slightly spaced relationship thereto; the strips 24 passing intermediate the cylinder and the shield.

The shield 48 serves to minimize the dissipation of the heat and thereby provides a higher setting temperature for the synthetic plastic.

It is obvious, of course, that various other heating means could be employed. Thus, heating coils could be positioned within the shield, either in addition to or in lieu of those in the cylinder.

Where only slight impregnation of the strips is desired or where the synthetic resin or other sizing material employed is capable of setting or drying without the need for additional heat, the heating-cylinder 45 and the idler-roll 47 can be by-passed and the strips passed directly from 75

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the idler-roll 32 to the power-roll 34 as indicated in dash-dot lines in Figure 3.

In Figure 3-a, there is shown a modification wherein a bank of heating-lamps 49 are positioned generally adjacent the first power-roll 34 so as to facilitate the setting of the synthetic resin, or other sizing material.

Instead of positioning the heating-lamps 49 adjacent the power-roll 34, it is possible to position them adjacent the cylinder 45 of Figure 3. In such case, the shield 48 and the internal heating coils 46 would be omitted.

In Figures 5-11, I have shown various modifications of the treating-bath structure.

Thus, in Figure 5, only a single partly-submerged roller 50 is provided at the top of the trough 26; the fabric-strips 24 passing across the top of the roller, in relatively taut condition so that the treating liquid is carried up by the roller 50 and forced into the interstices of the strips so as to effect impregnation thereof.

In Figure 6, there is shown a modification of the embodiment of Figure 5 wherein a backing-roller 51 is provided above the roller 50 so as to give more effective penetration and impregnation of the fabric-strips by the treating liquid. 25

In Figure 7, there is shown a modified form of trough 26-b which is generally enclosed so as to cut down on evaporation and which is provided with an elongated longitudinally-extending wick 52 which protrudes through a top slot in the trough 26-b. The fabric-strips 24 pass across the exposed portion of the wick 52 in wiping relationship thereto, thereby to impregnate the 35 fabric-strips with the treating liquid which is raised from the trough by the capillary action of the wick.

In Figure 8, there is shown a modification generally like that of Figure 3 except that the rolls 28 and 29 are made slightly larger in diameter; the top roll 30 of Figure 3 being eliminated. In this embodiment, the fabric-strips 24 form a pair of obtuse angles C, C as they pass underneath the rolls 28 and 29. 45

In Figure 9, there is shown a further modification wherein the fabric-strips 24 entering the bath first pass across an elongated length 53 of canvas or like material supported upon rods 54, and thereafter pass around a single idler-roll 55 50 at an acute angle; the canvas strip 53 being transversely inclined and terminating closely adjacent the roll 55. The canvas strip 53 exerts a frictional restraining force upon the moving strips 24 and tends to stretch them so as to give a wiping action resulting in more effective penetration and wetting by the treating liquid. 55

In Figure 10, there is shown still another modification wherein the fabric-strips 24 first pass across an idler-roll 56 disposed slightly below the surface of the treating liquid (the strips 24 forming an obtuse angle D) and thereafter pass across a second idler-roll 57 located near the bottom of the treating-bath (the strips 24 forming an acute angle E) and thereafter pass across a third 65 idler-roll 58 located at generally the same level as the roll 56 (the strips 24 again forming an obtuse angle D) after which they leave the treating-bath.

I have found that an arrangement which moves the fabric-strips 24 across at least one submerged idler-roll at an acute angle provides greater penetration and wetting of the fabric by the treating solution.

In Figure 11, there is shown a modification of the embodiment of Figure 10 which includes a

wiper or doctor-blade or rod 59 across which the fabric-strips 24 pass as they leave the treating-bath. The doctor-blade 59 not only removes excess treating liquid but also further aids in effecting thorough wetting and penetration of the fabric by the synthetic resin.

When the fabric-strips are treated in the manner described hereinabove, the juncture points of the courses of knitted loops (forming the corners of the diamond-shaped designs) are more or less fused together by the solidified-in-situ synthetic resin or other sizing material, in the manner more fully described in my Patent 2,428,071. In addition, there is at least a partial coating of the individual threads making up the knitted loops.

This appreciably increases the tensile strength of the final netted structure and also makes it form-retaining to some degree.

In other words, the final treated open-mesh fabric has some "body" or form-retaining characteristics (particularly advantageous in the case of a hair-net which, as disclosed in my Patent 2,428,071, should preferably retain a somewhat concave configuration) and is less prone to tangle. When sheer open-mesh fabric is treated according to the present invention and is then formed into a hair-net, the final product is highly superior to hair-nets made of ordinary untreated fabric. Thus, the treated hair-nets are much stronger, less apt to tear, and consequently have a much longer useful life. In addition, they can be put into a drawer with other items, after use, with considerably less tendency to tangle or become unusably bunched or knotted. In addition, the treated fabric has less tendency to become entangled with the hair of the user so that it can be removed without disarranging the coiffure. Furthermore, the form-retaining characteristics of the treated fabric make the hair-net easier to put on and remove.

Furthermore, by use of appropriate types of synthetic resin, the hair-nets can be made appreciably more flame-resistant than is ordinarily the case so as to minimize the danger of the net catching on fire from an accidental spark or the like.

It is obvious that the advantages described hereinabove in connection with hair-nets are, for the most part, equally applicable to veilings, curtains and other items which can be made from the sheer open-mesh fabric which has been treated according to the present invention.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and it is therefore desired that the present embodiments be considered in all respects as illustrative and not restrictive, reference being had to the appended claims rather than to the foregoing description to indicate the scope of the invention.

Having thus described my invention, I claim as new and desire to protect by Letters Patent:

1. In a process of continuously knitting an elongated strip of sheer open-mesh fabric under remotely-applied tension; the steps which comprise knitting an unsized strip, treating the threads and juncture points only in the unsized strip immediately after it comes from the knitting operation with a synthetic resin sizing so as to impregnate said strip with substantially all of the sizing the finished fabric is to contain, and thereafter continuously drying the treated strip so as to cause setting of the synthetic resin in-

situ while said strip is still under the original tension.

2. In a process of continuously knitting an elongated strip of sheer open-mesh fabric under remotely-applied tension; the steps of continuously knitting an unsized strip of said fabric, continuously passing the unsized knitted strip through a liquid treating-bath containing synthetic resin sizing so as to impregnate the threads and juncture points only in said strip with substantially all of the sizing the finished fabric is to contain, and thereafter continuously passing the impregnated strip through a drying zone so as to cause setting of the synthetic resin in-situ while said strip is still under the original tension.

3. A process of the character described which comprises continuously knitting a plurality of laterally-spaced elongated unsized strips of sheer open-mesh fabric under remotely-applied tension, simultaneously impregnating the threads and juncture points only in all of said unsized strips with a synthetic resin sizing material so as to impregnate the strips with substantially all of the sizing the finished fabric is to contain, and thereafter simultaneously drying the impregnated strips while moving under the aforesaid tension so as to cause setting of the synthetic resin in-situ.

4. A process of the character described which comprises continuously knitting a plurality of laterally-spaced elongated unsized strips of sheer open-mesh fabric under remotely-applied tension, simultaneously passing all of said unsized strips through a liquid-treating bath containing a synthetic resin sizing thereby to impregnate the threads and juncture points only of said strips with substantially all of the sizing the finished fabric is to contain, and thereafter simultaneously drying the impregnated strips while moving under the aforesaid tension so as to cause setting of the synthetic resin in-situ.

5. In combination, a needle-bank for knitting a continuous elongated unsized strip of sheer open-mesh fabric, remote means for pulling said unsized strip under tension from said needle-bank as it is formed, and means disposed intermediate said needle-bank and said pulling means for applying synthetic sizing material to the threads and juncture points only in said unsized strip so as to apply to the strip substantially all of the sizing the finished fabric is to contain.

6. In combination, a needle-bank for knitting a continuous elongated unsized strip of sheer open-mesh fabric, remote means for pulling said unsized strip under tension from said needle-bank as it is formed, and means disposed intermediate said needle-bank and said pulling means for applying synthetic sizing material to the threads and juncture points only in said unsized strip so as to apply to the strip substantially all of the sizing the finished fabric is to contain, said last-mentioned means including a liquid treating-bath containing the synthetic sizing material and disposed generally below said needle-bank.

7. In combination, a needle-bank for knitting a continuous elongated unsized strip of sheer open-mesh fabric, remote means for pulling said unsized strip under tension from said needle-bank as it is formed, and means disposed intermediate said needle-bank and said pulling means for applying synthetic sizing material to the threads and juncture points only in said unsized strip so as to apply to the strip substantially all of the sizing material the finished fabric is to contain, said last-mentioned means comprising

a liquid treating-bath containing the sizing material, and means for conducting said strip from said needle-bank through said treating-bath while maintaining it under tension.

8. In combination, a needle bank for knitting a continuous elongated unsized strip of sheer open-mesh fabric, remote means for pulling said strip under tension from said needle-bank as it is formed, and means disposed intermediate said needle-bank and said pulling means for applying synthetic sizing material to the threads and juncture points only in said unsized strip so as to apply to the strip substantially all of the sizing the finished fabric is to contain, said last-mentioned means comprising a liquid treating-bath containing the sizing material, means for conducting said strip from said needle-bank through said treating-bath while maintaining it under tension, and means for drying said strip after it leaves the treating-bath thereby to cause setting of the sizing material in-situ.

9. In combination, a needle-bank for knitting a continuous elongated unsized strip of sheer open-mesh fabric, remote means for pulling said unsized strip under tension from said needle-bank as it is formed, and means disposed intermediate said needle-bank and said pulling means for applying synthetic resin sizing to the threads and juncture points only in said unsized strip so as to apply to the strip substantially all of the sizing the finished fabric is to contain, said last-mentioned means comprising a liquid treating-bath containing the synthetic resin, means for conducting said strip from said needle-bank through said treating-bath while maintaining it under tension, and means for drying said strip after it leaves the treating-bath thereby to cause setting of the synthetic resin in-situ, said drying means comprising a heated cylinder of metal or the like over which the strip passes.

10. In combination, a needle-bank for knitting a continuous elongated unsized strip of sheer open-mesh fabric, remote means for pulling said unsized strip under tension from said needle-bank as it is formed, and means disposed intermediate said needle-bank and said pulling means for applying synthetic resin sizing to the threads and juncture points only in said unsized strip so as to apply to the strip substantially all of the

sizing the finished fabric is to contain, said last-mentioned means comprising a liquid treating-bath containing the synthetic resin, means for conducting said strip from said needle-bank through said treating-bath while maintaining it under tension, and means for drying said strip after it leaves the treating-bath thereby to cause setting of the synthetic resin in-situ, said drying means comprising a heated cylinder of metal or the like over which the strip passes, and a generally concave reflector shield spaced slightly from said cylinder to minimize heat-loss.

11. In combination, a needle-bank for knitting a continuous elongated unsized strip of sheer open-mesh fabric, remote means for pulling said unsized strip under tension from said needle-bank as it is formed, and means disposed intermediate said needle-bank and said pulling means for applying synthetic resin sizing to the threads and juncture points only in said unsized strip so as to apply to the strip substantially all of the sizing the finished fabric is to contain, said last-mentioned means comprising a liquid treating-bath containing the synthetic resin, means for conducting said strip from said needle-bank through said treating-bath while maintaining it under tension, and means for drying said strip after it leaves the treating-bath thereby to cause setting of the synthetic resin in-situ, said drying means comprising a heating-lamp disposed in operative juxtaposition to the moving strip.

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