Feb. 28, 1967 R. CHAPMAN ETAL 3,305,911

FABRICS

Filed Aug. 5, 1963

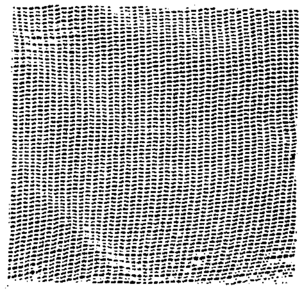

Fig. 1.

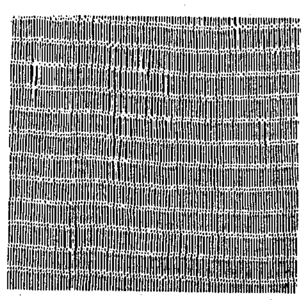

Fig. 2.

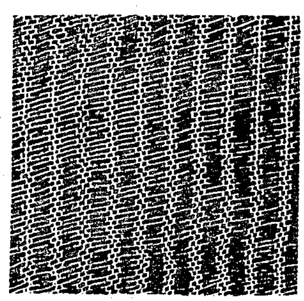

Fig. 3.

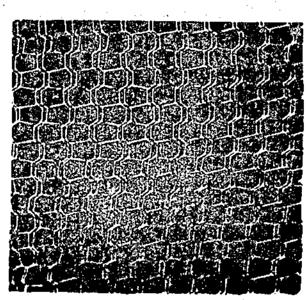

Fig. 4.

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United States Patent Office

3,305,9

Patented Feb. 28, 19

3,305,911

FABRICS

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Filed Aug. 5, 1963, Ser. No. 299,978
Claims priority, application Great Britain, Aug. 30, 1962, 33,382/62
7 Claims. (Cl. 28—72)

This invention relates to fabrics having an open mesh construction.

We have made the observation that useful fabrics having an open mesh construction can be made by knitting or weaving a fabric from an as-spun synthetic filament yarn capable of being elongated followed by drawing the fabric in at least one direction in the plane of the fabric.

When drawing the fabrics of most but not all constructions, the filament yarns become drawn, i.e. irreversibly elongated, in the regions between their intersections to a greater extent than that at their crossover regions. This becomes apparent when the drawn fabric is dyed, since it then has dye flecks of darker colour at the crossover regions of the yarns. However these regions should be sufficiently strong not to affect adversely the mechanical properties of the fabric.

According to the present invention, therefore, a process for making a fabric having an open mesh construction comprises knitting or weaving a fabric from synthetic yarn capable of being irreversibly elongated at least 1.75 times its length, and drawing the knitted or woven fabric uniformly over substantially the whole area of the fabric at least 1.75 times in at least one direction. If desired, the fabric may also be drawn at least 1.75 times in another direction, preferably at right angles to the first drawing direction.

Undrawn or partially drawn yarn may be used in the invention. In the case of polyethylene terephthalate yarn, a birefringence in the range of 2×10^{-3} to 20×10^{-3} preferably 12×10^{-3} to 16×10^{-3} is suitable. Such a yarn is capable of being elongated 2–6 times its length.

In the case of polypropylene yarn this should be capable of being elongated at least 1.75 and up to 9 times its length. Suitable polypropylene yarns have a birefringence of 1×10^{-3} to 30×10^{-3} and preferably between 10×10^{-3} and 20×10^{-3}.

In the case of polyethylene terephthalate yarn draw ratios of 2.0 to 4.5 times are suitable. Suitable temperatures for drawing the fabric are above the 2nd order transition temperature.

The fabric may be drawn between pairs of rolls, rotating at suitable speeds to give the desired draw ratio in the fabric in the longitudinal direction. For drawing in the transverse direction the fabric may be gripped at the edges by clips which can be made to separate by a given amount corresponding to the desired draw ratio. We have found that equipment used for biaxially orienting film may be used for drawing our fabric.

The fabrics are useful for industrial applications e.g. as reinforcements for laminates, as laundry bags and fishnets as well as for domestic textile applications, such as net curtains.

If, during the drawing of a fabric made from polyethylene terephthalate, temperatures substantially below the second order transition are used, fabrics having high shrinkage can be made. It will be appreciated that in this context the yarns can be made to shrink by the application of heat so that at least some of the elonga-

tion imparted during drawing is lost. In this connecti the rate of drawing is also of importance, since the w done in drawing, generates heat. Under very high ra of drawing, and in the absence of forced cooling, hea generated under virtually adiabatic conditions. W lower rates of drawing, and with forced cooling, the dra ing process can be made to function under almost i thermal conditions, e.g. at room temperature. For co ing, draughts of cold air or liquids e.g. water may used. After drawing the fabrics may be subjected heat-setting to impart dimensional stability, and genera improved fabric appearance.

One suitable form of apparatus comprises means forward drawing and sideways drawing the fabric w means for heat setting the fabric on a stenter before is wound up. The forward drawing means compri hot nip rollers which may be heated by hot water e to about 85° C. and cold nip rollers. The draw point located between the two sets of nip rollers beneath infra red heater. The draw ratio is determined by t relative speeds of the cold and hot nip rolls. The f ward drawn fabric is fed from the cold nip rolls into sideways draw stenter where it is held by self-grippi clips with means for controlling the temperature for ample between 80 and 100° C. Following this sidewa draw stenter is a second and larger part where the fab is heat set and which is provided with means for movi the fabric and heating it to temperatures up to abo 240° C. Means are provided for cooling the fabric forced air before it is wound up on a beam which driven from the fabric forwarding means on the sten by an arrangement adapted to compensate for the bui up of fabric on the beam.

Evenly drawn fabrics can be obtained by this successi drawing technique, first length-wise and then in wid The fabric is preferably provided with selvedges to fac itate gripping for drawing in width.

A preferred embodiment of the invention will now described by way of example with reference to the a companying drawings which are photographic represen tions on a reduced scale of fabric samples and in whic

FIG. 1 shows a sample warp-knitted from undra polyethylene terephthalate yarn,

FIG. 2 shows a similar sample as shown in FIG. after drawing 3.5 times in length only,

FIG. 3 shows a similar sample as shown in FIG. after drawing 3.5 times in width only, and

FIG. 4 shows a similar sample as shown in FIG. after drawing 3.5 times in both length and width.

Referring to FIG. 1, the fabric has been knitted fro 80 denier yarn on a 28 gauge high speed warp-knitti machine to 60 courses per inch, using a marquisette co struction.

After drawing the fabric to 3.5 times in length on a pattern effect is obtained as shown in FIG. 2. Drawi the fabric in width, but not in length results in a patte as shown in FIG. 3.

Because of the different drawing effected in one dire tion, not only a different pattern effect is obtained, b on dyeing such fabrics a multi-tone such as a two to effect may be obtained from a single dye bath. Su fabrics find application as curtain nets.

Referring to FIG. 4, a fabric with a wide open me is obtained after drawing the fabric, as shown in FIG. to 3.5 times its length followed by drawing to 3.5 tim its width. Such fabrics are sheer, light in weight a suitable for reinforcement in coated or laminated stru tures.

abrics suitable as laundry and dye bags are obtained ısing heavier denier yarns.

: should be appreciated that the drawing may be car- out on sections of fabric e.g. in width or when folded :hat it is not necessary to use very wide machines obtaining fabric of considerable width, such as could be obtained on commercially available knitting ma- .es or weaving looms.

he following examples illustrate other preferred em- iments of our invention.

Example 1

. warp knitted reverse locknit fabric was knitted from denier undrawn polyester yarn of birefringence 10^{-3}. The yarn crystallinity was so small that there no appreciable embrittlement. The fabric was for- d-drawn in length by a factor of 3.0 at 85° C. and ıequently continuously sideways-drawn in width in plane of the fabric by a factor of 4.2 at 100° C. ı the same continuous process the fabric was heat set 00° C. before being wound up at a speed of 75 feet minute. The initial width of the fabrics was 16" the final width 48". It will be noticed that the width ot increased by the factor of the sideways draw ratio ıuse contraction occurs in the forward-drawing stage, ıely from 16' to about 12". The drawn denier is roximately 25. Speeds of up to 300 feet per minute be used. The mesh obtained by this use of the pres- invention is considerably larger than could be ob- ed by conventional knitting of such a fine denier yarn.

Example 2

i) A warp knitted reverse locknit fabric, having pat- notation as follows: back 1.0/2.3, front 1.2/1.0, was ted from 125 denier undrawn polyethylene tereph- ate polyester yarn of birefringence 15×10^{-3}. The :ic was forward drawn in length by a factor of 3.0 '5° C. and subsequently continuously drawn in width he plane of the fabric by a factor of 3.0 at 130° C. he same continuous process the fabric was heat set at ° C. before being wound up at 25 ft./min.

'he further following fabrics were knitted using the ıs and conditions as in Example 2, except for the owing data:

Useful fabrics were obtained, which on examination showed that:

(1) Heat setting at 200° C. at 25 ft./min. does not noticeably weaken any of the above structure knitted from 15×10^{-3} birefringence yarn, although some weakening was observed in the case of a similar fabric knitted from undrawn yarn of 8×10^{-3}.

(2) In the above examples 5, 6 and 7 were more evenly drawn (along the individual filaments) than 2, 3 and 4. This is a direct consequence of knitting construction. In all cases however the overall effect is one of extreme regularity of drawing.

What we claim is:

1. A process for making knitted and woven fabrics having an open mesh construction over substantially the entire area of the fabric comprising making the fabric from undrawn synthetic yarn capable of being irreversibly elongated at least 1.75 times its length, said yarn being selected from the group consisting of polyethylene terephthalate and polypropylene; and uniformly drawing the fabric at a temperature above the second order transition temperature in at least one direction uniformly over substantially the whole area of the fabric in the plane of the fabric at least 1.75 times.

2. A process as in claim 1 wherein the fabric is also drawn at least 1.75 times in a second direction.

3. A process as in claim 2 wherein the two directions in which the fabric is drawn are at right angles to each other.

4. A process as in claim 1 including the step of subjecting the drawn fabric to a heat setting operation to impart dimensional stability and generally improved fabric appearance.

5. A process as in claim 1 wherein the undrawn yarn is polyethylene terephthalate having a birefringence in the range 2×10^{-3} to 20×10^{-3}.

6. A process as in claim 5 including the step of subjecting the drawn fabric to a heat setting operation to impart dimensional stability and generally improved fabric appearance.

7. A process as in claim 1 including the step of dyeing the drawn fabric whereby multi-tone effects are given by a single dyebath.

:xample/Fabric		Pattern notation		Longitudinal draw factor	Temp. of drawing, ° C.	Transverse draw factor	Temp. of drawing, ° C.
		Back	Front				
--	Queenscord	1.0/2.3	0.1/1.0	3.0	75	3.0	130
--	Sharkskin	1.0/3.4	1.2/1.0	3.0	75	3.0	120
--	Net	0.0/1.1/0.1/3.3/2.2/3.3	0.1/1.0	2.5	75	2.5	115
--	Net	0.0/1.1/0.0/2.2/1.1/2.2	2.1/1.2/2.1/1.0/0.1/1.0	2.5	75	3.0	115
--	Net	0.0/1.1/0.0/4.4/0.0/4.4/3.3/4.4	1.0/0.1	2.5	75	3.0	115

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