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<p>(54) Title: ENGINEERED TEXTILE</p>		
<p>(57) Abstract</p>		
<p>A lightweight, strong, durable engineered textile for use in a shoe upper and other applications is described. In one aspect, a first stretchable layer is formed. Stitching lines overlay the layer, and reinforce it against stresses. An alternate embodiment of the engineered textile includes a second layer. The second layer may be inter-woven with the first layer, or may be attached to the first layer via the stitching lines.</p>		

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## ENGINEERED TEXTILE

### Background of the Invention

The invention relates to a lightweight, strong, durable, engineered textile. The engineered  
5 textile may be used in a variety of applications, such as in a shoe upper.

Shoes for use in various athletic activities, such as running, training, basketball, soccer, baseball, football and the like have uppers constructed of various  
10 materials, such as leather or synthetic materials, and some combine materials. For example, it is known to construct shoe uppers with one or more areas of multiple layers. Although such shoes are durable, the use of multiple layers of material can cause hot spots, and can  
15 make the shoe upper bulky and uncomfortable to wear.

Synthetic uppers have been generally preferred for running shoes because they are lightweight and generally retain properties of comfort and softness during use. Some synthetic uppers move about the foot  
20 during use causing friction instead of stretching to conform to the foot, while other synthetic materials are not air permeable, resulting in overheating problems within the shoe.

Regarding competitive running shoes, the  
25 weight of such running shoes is of primary importance, and thus relatively thin fine leather has been used to construct the upper. The stretching capability of the fine leather permits such uppers to mold to the form of the particular users foot. However, relatively thin  
30 leather can sometimes stretch unabated, so that the upper eventually stretches out of shape. Further, the foot of a competitive runner will perspire during training or a race, and fine leather uppers typically do not provide adequate ventilation to cool the foot.

Competitive runners also sometimes compete under difficult weather conditions which can adversely affect the shoe upper and thus the runner's performance. For example, if it rains, shoe uppers made of leather and/or a multi-layer construction tend to get wet easily and retain water and mud for days. Prolonged use of such shoes can result in blisters and such maladies as trench-foot.

Thus, there is a need for a strong, lightweight, durable and air permeable textile for use in shoe uppers, which also will dry quickly.

#### Summary of the Invention

In general, in one aspect, the invention features a lightweight, strong, durable and engineered textile including a first stretchable layer, and stitching lines overlaying the first layer.

Preferred embodiments include the following features. The first layer may be a mesh-like layer having apertures. A second mesh-like layer having apertures may be cross-woven into the first layer, or attached to the first layer by the stitching lines, and may have apertures of a different size than the apertures of the first mesh-like layer. Alternately, a second non-stretchable layer could be applied to at least a portion of the first layer, and may be attached to the first layer by some of the stitching lines. The stitching lines form a pattern that is substantially evenly distributed across at least a portion of the layer or layers. The stitching pattern could also form a non-evenly distributed, non-random pattern across at least a portion of the mesh-like layer. Alternately, the stitching lines form a pattern that is substantially random and distributed over at least a portion of the layer or layers. The textile may further include a

wicking layer, and/or an insulating layer. When used to form the upper of a shoe, the engineered textile may comprise one or more air permeable layers. The engineered textile provides a stabilized and strengthened  
5 sidewall portion without requiring additional layers or underlying support members. Embodiments include an upper embodying a textile layer having a stitching pattern resembling a net, and another having a stitching line pattern resembling the cabling of a suspension bridge. A  
10 U-shaped lacing area maybe contained in the upper having attached lace elements. In some embodiments, at least some of the stitching lines terminate at or near the lace elements.

Use of the textile according to the invention  
15 improves breathability of a shoe upper and the cross ventilation of the foot. In addition, the synthetic mesh construction enables the engineered textile to dry quickly when wet. When a runner's foot perspires, the textile permits the moisture to dissipate, thus cooling  
20 the foot. Further, the textile is light weight and the stitching pattern provides tensile lateral strength. In addition, when a mesh-like layer is used, the aperture size of each opening is such that ventilation is permitted but solid objects, such as rocks, sand, insects  
25 and the like, are screened from entering the interior of the shoe.

The engineered textile can be used in any items where performance is affected by weight and stress considerations. For example, the textile according to  
30 the invention could be used in shoe uppers, outdoor gear, sailing gear, duffel bags, apparel and the like, where high strength and durability is necessary, and where it is desirable to keep weight at a minimum.

Other advantages and features will become apparent  
35 from the following description and the claims.

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