STRETCH RESISTANT SAIL WEB

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ABSTRACT

A sail web is provided having a plurality of layers of material, each layer of material being stretch resistant along at least one axis and having threads aligned along the axis which are substantially parallel to each other, the layers being overlapped so that the stretch-resistant axes thereof cross with one another. Preferably the layers are bonded together.

12 Claims, 3 Drawing Figures
STRETCH RESISTANT SAIL WEB

FIELD OF THE INVENTION

This invention relates to sail web for sails, particularly multi-layer stretch resistant sail web.

THE PRIOR ART

For many years, until the late '40s, sails were made traditionally from various types of canvas cloth. This cloth, the best available at the time, suffered performance-wise from wrinkling, being wetted, particularly with salt water and stretched and distorted from exposure to wind and weather, to different shapes or sets in different wind velocities and soon lost its designed shape which lessened its effectiveness. A further serious drawback with canvas was that the cloth was not durable on exposure to wind and weather, showing signs of wear and rot after only two seasons in many cases.

An improved sail cloth became available in the late '40s and early '50s which soon relegated canvas sails to practical obsolescence. These new sail cloths were of synthetic fibers such as woven nylon and woven dacron sailcloth. Sails of this new material proved to be very durable, stand up well to salt water, are impervious to rot, less affected by wrinkling, less subject to shape distortion with use and in general provided and still provide a tougher, durable sail than heretofore. The synthetic sails, particularly those of dacron, which is more stretch-resistant than nylon, continue in widespread use today as the recognized best available sail cloth.

However, even these synthetic sail cloths have their disadvantages, which are recognized by sail designers and sail makers and are factored into the construction of a sail, e.g. a main or jib. For example, in traditional construction of a sail using 5 ounce dacron material, shape distortion occurs under wind pressure in three directions along the bias of the weave, as indicated, for example in FIG. 1. Thus the sail stretches at angles to the direction of the fibers constituting the weave so that the sail takes different shapes in different winds, heavier winds, of course, stretching and distorting the sail shape more than light winds. If a sail is designed and cut to take a proper shape in heavy air or winds, it will take a distorted shape in light winds and vice-versa. Accordingly, the sail made of the above materials must be designed and cut to take a compromise shape that is neither optimum for light or heavy winds but is somewhere in between according to the best guess of the sail designer.

In addition, the synthetic sails of the prior art are subject to the wear of time and typically have a useful racing life, particularly in the jib, of about two years, after which the sail distorts out of its designed shape, the sail cloth wears or loses bonding agent, rendering the sail cloth thinner in places and with the passing of time the sails become more and more out of shape. In addition, the sails are relatively expensive to construct; the fabric must be woven, panels must be cut, the panels must then be sewed together and since this cloth is subject to fraying, a hemming must take place at each edge of the sail. In addition, the corners of the sails are reinforced with "board" and the luff of the sail reinforced with a tape or rope woven therein, which have different stretch rates than the remainder of the sail cloth and under stress, tearing of the sail cloth can occur at the boundary of such sail cloth with these non-stretch or low-stretch zones. When tears occur a time-consuming and expensive sewing operation must be conducted to sew a patch onto the sail, care being taken to align the fibers of the patch with remainder of the sail, which can result in a lumpy air foil for a sail. In addition, these woven sails are not as smooth-surfaced as is desirable with the resultant drag problems attendant thereto.

Because of the above drawbacks, there is a need and market for a durable stretch-resistant sail which obviates the above problems.

There has now been discovered a stretch-resistant sail web which is virtually distortion free, which takes virtually the same shape in light air as in heavy air, subject to trim, which permits the design and cutting of a sail which is a more efficient air foil for various wind conditions; which sail is faster, cheaper and easier to manufacture and to repair; which web does not fray and does not require hemming, which is less subject to tear, due to lack of stretch, non-stretch boundaries in the sail.

SUMMARY

Broadly, the present invention provides a stretch-resistant sail web comprising a plurality of layers of material, each layer of material being stretch-resistant along at least one axis thereof, said layers being overlapped such that the stretch-resistant axes of said layers cross at angles with one another.

In one embodiment, a multi-layered sail web is provided having a plurality of crossed layers of fiberglass bonded together to form a unitary sail material.

DESCRIPTION

These other novel features will become apparent from the following detailed specification and drawings in which:

FIG. 1 is an elevation schematic view of traditionally woven synthetic sail cloth and
FIG. 2 is an elevation schematic view of a multi-layered sail web embodying the present invention.

FIG. 2A is an enlarged fragmentary view of the sail web, taken from 2A of FIG. 2.

Referring now to the drawings, conventional dacron woven sail 10 has panels 12, 14, 16, 18 and 20 sewn together at respectively seams 13, 15, 17 and 19, to define the sail as shown in FIG. 1. A panel, for example, panel 12, is constructed of a weave of dacron threads 22 and 24 in a grid pattern, which threads are stiffened by a bonding agent (not shown). The threads 24 and 22 are subject to stretch in diagonal directions a, b and c as shown by the arrows in FIG. 1. Such stretch will change the shape of the sail in accordance with respective wind velocities into not readily predictable shapes. To protect the weave from fraying at the edges, the sail is turned under and hemmed at the edges and has hems 26, 28 and 30, which terminate respectively at the reinforced corners of the sail, i.e. non-stretch headboards 32, 24 and 36, as shown in FIG. 1.

In cutting this sail of FIG. 1, the sail maker must take into account the type of synthetic fabric being used and its stretch characteristics on the diagonal which varies with the thickness thereof, i.e. the weight thereof, hand cutting the respective panels by exercising his best guess as to what the material will do under wind pressures, by which a compromise factor is added, so that the sail will perform in heavy as well as light airs and although many sail makers employ computers in the
sail design process, the resulting sail is a product of guess work, experience and compromise. The sail web embodying the present invention is constructed into sail 38 which is formed by a plurality of webbed layers 40, 42 and 44 of fiberglass as shown in FIGS. 2 and 2A. The webbed layers of sail 38 as shown in an enlarged fragmentary view, FIG. 2A, are of three superimposed layers of fiberglass, 40, 42 and 44, each layer being woven in a grid pattern, with the threads of each layer, i.e. the non-stretch axes of each layer being positioned at an angle with respect to the axes of the other two layers, such that each layer resists material-stretch or distortion in different directions, as shown in FIG. 2A. In fact, the three layer web as shown in FIGS. 2 and 2A resist stretch in six different directions, i.e. the directions along which the respective threads of each layer lie. As shown schematically in FIG. 2, each layer, 40, 42 and 44 is positioned with one set of its threads parallel to an edge of the sail 38 such that stretch along the three sides of the sail is resisted by threads aligned parallel therewith, as shown in FIG. 2. The corners of sail 38 are reinforced respectively at the tack 50, the clew 46 and the head 48 by adding additional layers of fiberglass material at these locations as shown in FIG. 2. All the fiberglass layers are bonded together with bonding agent (not shown).

The sail web of the invention can be employed to construct a sail as shown in FIG. 2, resulting in a sail that has no appreciable stretch distortion under wind pressure. The result is that an aerodynamically more efficient sail can be designed and manufactured to achieve an air foil which will not change its shape after prolonged use. In fact, the sail of the present invention, including the sail camber, is adjusted for different wind conditions by the sheathing tension applied to the sail, to give the sail the desired shape and to that extent the sail is self-adjusting.

The sail web of the present invention can be constructed from various non-stretch flexible web materials, such as fiberglass, graphite and the like, which exhibit no significant stretch along the axis thereof. Preferred is fine mesh fiberglass material, preferably in the range of 0.51 ounces to 4.0 to 7.0 ounces per square yard.

At least two layers of stretch-resistant material are employed in the sail web of the present invention, normally layers being placed across each other such that their axes of stretch resistance cross at an angle with one another. Each axis is defined by a plurality of threads substantially parallel to each other and parallel to the leach, luff, and the foot of a sail.

Although any number of layers of stretch resistant material can be employed at the sail web of the invention, three crossed layers is preferred to provide a satisfactory stretch resistant sail web, and when a sail is formed, an additional multiple of layers is preferably added to the corners of the sail to build up or reinforce the strength of the same.

Where three layers of stretch resistant material are employed, the materials are preferably crossed so that one set of the threads of each are respectively parallel to the leach, the luff and the foot of the sail to be formed.

The layers of stretch resistant material can be contacted with a bonding agent or formed separately and then bonded together as a multi-layered sail web. Preferably, however, as many layers as are desired are overlaid, one atop the other, and then adhered together by bonding agent, the bonded materials being cured under heat and pressure or merely heat or merely room temperature overnight.

If the stretch-resistant material, e.g. fiberglass is bonded in contact with a glass or other smooth surface the resulting sail web surface adjacent to the glass has a highly smooth sheen thereto which provides an improved air foil. Accordingly, if the sail web of the invention is bonded between two glass surfaces, a sail web results with two smooth sides. In another method, two sail webs which have been cured on a glass surface can thereafter be bonded together at the respective rough sides thereof, resulting in a multi-layered sail cloth having two sheen-smooth sides to provide an advantageous sail foil.

The multi layers of the sail web of the invention are bonded with various bonds suitable in the art, such as neoprene rubber, vinyl adhesives, acrylic latex and the like. For fiberglass material, preferably acrylic latex is employed.

In addition to providing stretch-distortion resistant sails, the sail web of the invention lends itself to fast, efficient low-cost sail assembly in contrast with present day methods of sewing sail cloth panels together. In place of cutting, positioning and sewing panels together and hemming the same, one, under the present invention, may lay out on a suitable surface layers of stretch resistant material, e.g. fiberglass layers, one atop the other at different fiber directions, can merely spray or brush the binder onto the layered material and quickly form the sail subject to the curing thereof. No sewing is required and non-skilled labor may be employed in the fabrication of sails according to the present invention. To reinforce the corners of the above sail, scraps of fiberglass, or rather stretch resistant material, may be added to the corners prior to the binding step. Since the cured sail web is not frayed, no hemming step is required.

The stretch resistant layers of material may be laid out in the form of the sail to be constructed, bonded and cured or such layers may be laid, bonded and cured and either panels may be cut therefrom to be bonded later into a sail or the finished sail may be cut from such bonded layers of the sail web.

Another improvement employed by the present invention is in repair of sails. The sails of dacron, nylon and other materials when torn are repaired by replacing an entire panel and stitching the same or by installing a patch and stitching around the edges of the patch which is laborious and provides an interruption of air flow of said sail. In the repair of the sail web of the present invention, the torn area can merely be cut out of the web, multi-layered replacement material inserted in the cutout portion and bonding agent applied into the multi-layered replacement material and its surrounding sail web and upon curing and setting of the bond, the repaired portion blends with the original sail web in an uninterrupted air foil. Such repair is rapid, low cost and highly effective.

Sail web of the present invention may be colored any desired color, i.e. by latex base paint or other suitable dye means.

To illustrate the low cost production of the sail web and sails according to the present invention, present day dacron sails are produced at manufacturer's costs at about 80 cents per square foot, where sails according
to applicant's invention can be produced at 17 cents per square foot.

What is claimed is:

1. A stretch-resistant sail web comprising a plurality of layers of threaded material, each layer of material being stretch-resistant along at least one axis thereof and having threads aligned along said axis, said threads being substantially parallel to each other, said layers being overlaid such that the stretch-resistant axes of said layers cross at angles and which thread defining axes are aligned respectively substantially parallel with the leach, luff and foot positions of a sail.

2. The sail web of claim 1 wherein said layers are bonded together.

3. The sail web of claim 1 wherein said layers are of fiberglass material bonded together.

4. The sail web of claim 1 wherein said layers are bonded together with acrylic latex.

5. The sail web of claim 1 having three layers of material with stretch-resistant axes aligned respectively substantially parallel with the leach, luff and foot positions of a prospective sail.

6. The sail web of claim 1 having different number of said layers at various positions of said web.

7. The sail web of claim 1 having layers of threaded materials.

8. The sail web of claim 1 having bonded layers of woven material to form a fray resistant web.

9. The sail web of claim 1 having layers of 0.1 to 4.0 ounces per square yard of fiberglass bonded together.

10. The sail web of claim 1 cut and bonded to form a stretch-resistant multi-layer sail.

11. The multi-layer sail of claim 8 having additional layers of material added at the corners thereof to reinforce same.

12. The multi-layer sail of claim 8 having layers of fiberglass bonded together with adhesive.

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