

EXHIBIT 1003

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

NORTH SAILS GROUP, LLC
Petitioner

v.

TEAM NEW ZEALAND LIMITED
Patent Owner

**Declaration of Daniel G. Neri in Support of
Petition for Post-Grant Review of U.S. Patent No. 12,110,089**

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I, Daniel G. Neri, hereby declare that:

1. I am employed by North Sails Group, LLC as a consultant on managerial, product and production related topics, having retired from the position of Chief Executive Officer on January 1, 2023.

2. I graduated from Miami University in Oxford, Ohio with a degree in Business Administration in 1979. I began a career in the field of sailmaking that same year and have been continuously employed as a sailmaker for the last 44 years.

3. In keeping with the tradition of the field of sailmaking, I began my career as an apprentice and learned the fabrication skills and the principles of sail design from those with prior years of experience in the art. I was fortunate to find myself in position to learn firsthand from several masters of sailmaking including Greg Fisher, Bill Shore, Rod Stevens, Ted Hood, Peter Conrad, JB Braun, Michael Richelsen, Gerard Gautier, and the team of America's Cup sail designers at North Sails. It is worth noting that the lessons and knowledge base associated with the sailmaking trade, whether confidential or commonly held is disseminated almost exclusively through interpersonal communications as opposed to the trade journals or academic papers common to other fields. It is something you learn through

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many years of practice.

4. After two years learning to design and build sails for small one-design sailboats at Shore Sails in Columbus, Ohio, I took the position of general manager at a new Shore Sails loft in the Virgin Islands in the early 1980s. This coincided with the growth period of Windsurfing. Working with the local Windsurfing racers, I designed what may have been the first “Fathead” wind surf sails utilizing two compression battens and a camber inducing rigid luff cap. These early sails had elastic Dacron luff panels and much stiffer mylar leech panels. These are the same concepts that are central to the claims of U.S. Patent No. 12,110,089 to Collie some 40 years later.

5. In the mid-1980s I took a position managing the central office for Shore Sails International, in Newport RI. In this role I was involved daily in the development and testing of the Shore Sails Spider Series of sail designs. The Spider Series sails were made for racing keelboats and leveraged the introduction of laminated, warp-oriented sailcloth. These new styles of laminated sailcloth gave the sailmaker the ability to arrange panels in a vertical orientation and to use different weights and different fiber types in the leech, middle and luff of the sail. These vertical panel arrangements quickly gave way to radial panel layouts and all

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sailmakers learned to use the elastic polyester materials in the lower loaded luff area and the stiffer, aramid-based materials in the leech area.

6. My partner, Ken Read and I bought the Shore Sails Newport RI business in 1986 and built our company's reputation around sails engineered for the most competitive racing boat classes of that period; the J-24 and J-35. In addition to being the president of the company I was also the lead sail designer. The sails we designed and marketed for those boats were refinements of the Spider Series sails featuring lighter weight, elastic materials in the luff areas and the lowest stretch materials of the time in the leech panels and the "tack spike" panels.

7. Upon selling our company to North Sails Group in 1996, I assumed the dual role of managing both the global design staff and the North America manufacturing operations. As the design staff manager, I oversaw the expansion of North's pioneering 3DL sail designs, which used continuous yarn path sails to replace paneled sails in the most competitive race boat markets and in many cruising and recreational sail applications.

8. In 2005, I moved to Nevada and took on the role of general manager of North's 3DL manufacturing facility. While in Nevada, we acquired the rights to the IP for a new, composite sail technology that would be later marketed as "3Di".

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I was the project manager for the 3Di development effort from the first day of the acquisition, and as such, I am intimately familiar with the history of the material, process, and design evolution. The second stage materials; pre-impregnated, spread filament tapes, were invented during this period. As a result of guiding the development of the 3Di tape catalogue and firsthand experience with all phases of materials testing, I am an expert in these materials' properties and application.

9. As the 3Di product line matured in the period between 2012 and 2020, I was instrumental in the development efforts that led to specialized 3Di design concepts for around-the-world ocean race boats, very high-performance day-race boats, super-yachts, cruising boats, and small, high-performance dinghies. Each of these categories have specific requirements that require different solutions which are obtained through variations in fiber type, tape weights, number of tapes and orientation of the tapes. At the beginning of this period of rapid development, we worked with hybrid tape constructions using carbon, aramid, and UHMWPE fiber filaments. In the latter half of this period, we solved the problems associated with the use of polyester fiber filaments, and subsequently the polyester family of tapes was added to the menu available to designers. It is important to note that all of the data associated with the 3Di materials properties and recommended uses

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were always freely shared with North designers and clients at the America's Cup or similar levels.

10. I served as CEO of North Sails Group, the sailmaking industry leader in market share, product innovation and quality, from 2015 through 2022. Every team competing in the America's Cup and The Ocean Race now use North Sails 3Di sails exclusively.

11. Throughout my career I was in regular contact with all of the industry suppliers for sailcloth and precursor materials for composite sail manufacturing. I am considered an expert in the industry on the development paths and uses of those materials.

12. I am also considered an expert sailboat racer having competed successfully in one person dinghies, coastal racing keelboats and ocean-going race boats for over 50 years. I am an experienced navigator, having competed in single-handed ocean racing and long-distance cruising with no outside assistance. I can competently handle small foiling sailboats and foiling surfboards.

13. I have published multiple articles about sail technology in *Sailing World*, *Cruising World* and *Sail* magazines. I also wrote “The Complete Guide to Sail Care and Repair” for Beowulf publishing.

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14. A copy of my Curriculum Vitae is submitted as EX1004 with this Declaration. I consider myself and others consider me to be an expert in the art of sailmaking and design of high performance sails, such as those used in the America's Cup.

15. I have read and understand U.S. Patent No. 12,110,089 to Collie ("Collie'089"; EX1001).

16. The earliest application I am aware of that resulted in the issuance of Collie'089 was U.S. Provisional Application No. 63/127,127, which was filed on December 17, 2020. I am familiar with the technology at issue in Collie'089, and the provisional application to which it claims priority, which relates to high-performance yacht and racing sail design. I am also aware of the state of the art at this time, and leading up to this time. In my opinion, a person of ordinary skill in the art (POSITA) of sailmaking and sail design of high-performance sails (e.g., for yacht and racing sails) at this time would have a bachelor's degree, preferably in an engineering field, followed by at least 3 years of full time employment working as a sail designer under the tutelage of a senior sail design expert in high-performance yacht and racing sails. Alternatively, a person of ordinary skill in the art could have progressed through a longer apprenticeship in the field of

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sailmaking for high-performance sails, learning the fabrication skills from more experienced craftsman, before moving into the design office. This longer path, without the benefit of a formal engineering education would normally require up to 5 years of apprenticeship and 2 years of design office training. The person of ordinary skill in the art of high-performance sail design will have access to, and functional expertise with a sail design software application. In most cases the person of ordinary skill in the art of high-performance sail design will also have a keen interest in racing sailboats and hundreds of hours of time in boats spent tuning and adjusting sails, although the latter is not an absolute requirement.

17. My analysis and opinions expressed below are made from the perspective of a POSITA in the field of high-performance sail design at the time of the Collie provisional patent application and the subsequently filed PCT application (PCT/IB2021/061985, filed December 17, 2021) to which Collie'089 claims priority.

18. I first became aware of Stephen Collie, the inventor listed on Collie'089, in 2005 when he was employed by the Shosholoza America's Cup team. Collie is a Computational Fluid Design ("CFD") engineer and has specialized in aerodynamics work for America's Cup and Volvo Ocean Race

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teams. He spent some months working for North Sails New Zealand as an apprentice sailmaker in his very early days but most of his sailmaking knowledge has been acquired through collaboration with the North Sails design team. The disciplines of sail design and CFD aerodynamics analysis are directly coupled in the America's Cup environment. At Shosholoza he was first exposed to the North Sails suite of sail design software, working closely with Chris Williams, a member of the North Sails design team, while I was the design staff manager. Collie was granted access to the North Sails sail design software by means of a confidentiality agreement signed in 2006. Most of Collie's career following Shosholoza has been spent working for Team New Zealand as a member of their America's Cup aerodynamics staff. North Sails has been an equipment supplier to Team New Zealand through all of their campaigns. Team New Zealand uses the North Sails Design software suite to model sail structures and to produce sail aero force coefficients to drive the team's velocity prediction programs. In January 2018, Collie was invited to attend an exclusive working party of North Sails designers who gathered for the purpose of developing the sail modeling software and sail structures for the America's Cup 36 Soft Wing Concept. It was at this meeting when the foundation was laid for the sails used by all America's Cup teams since.

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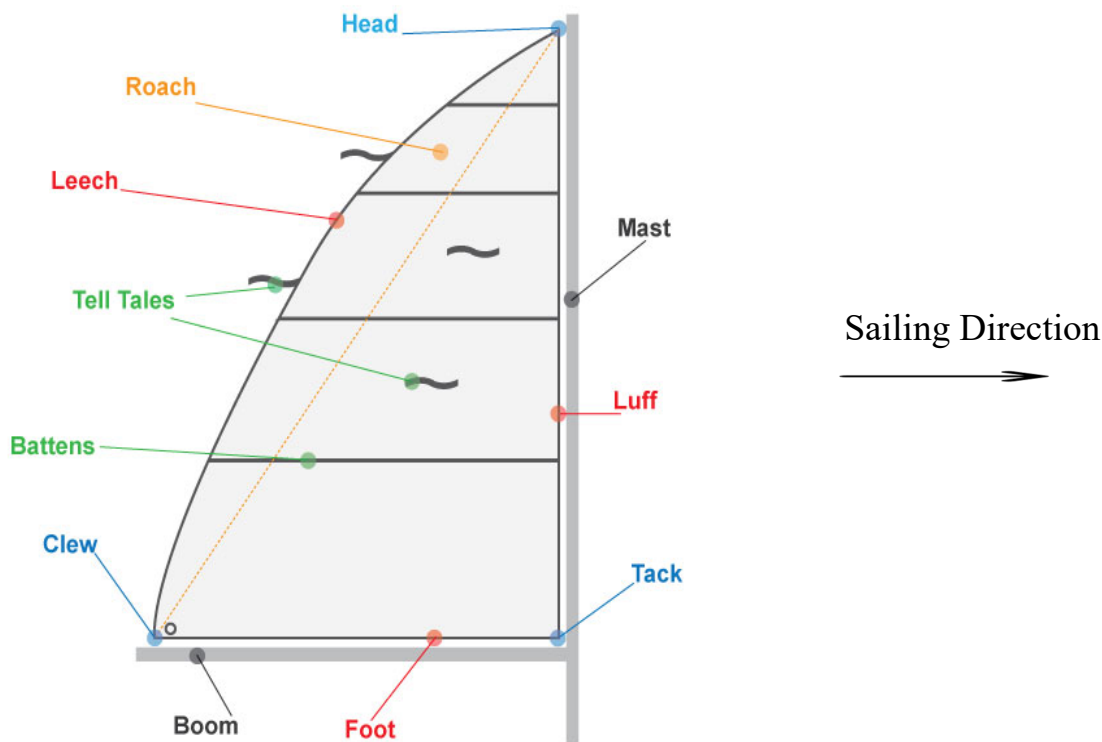
Collie was allowed to participate by virtue of his signing an additional North Sails Confidentiality Agreement effective August 18, 2017. Since that time Collie has had access to and cooperation from the North Sails design staff and the materials engineers at the 3DL/3Di manufacturing facility in Minden, Nevada where North Sails 3Di sails are manufactured, including those for patent owner Team New Zealand.

19. Therefore, the technology that was known at the time was made available to Collie from North Sails. It is my opinion that Collie'089 is an application of the technology of North Sails which was commonly known to designers and manufacturers of racing and high-performance sails at the time of the priority provisional application for Collie'089, and is considered prior art. The sails upon which Collie'089 was based were made by North Sails in its Minden, Nevada, facility and were sold to Team New Zealand beginning early in 2019. This is discussed in detail in the Declaration of Per Andersson (EX1005) based on regularly kept business records which I can verify.

20. Before discussing Collie'089, I would like to provide some nomenclature about sails. A typical sail is defined by three vertices referred to as the "tack" and the "clew" at the bottom of the sail, and the "head" at the top of the

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sail. The front part of the sail, facing into the direction of sailing, runs from the tack up to the head and is called the "luff." The back part of the sail, which runs from the clew up to the head is called the "leech." This is illustrated in the following diagram:



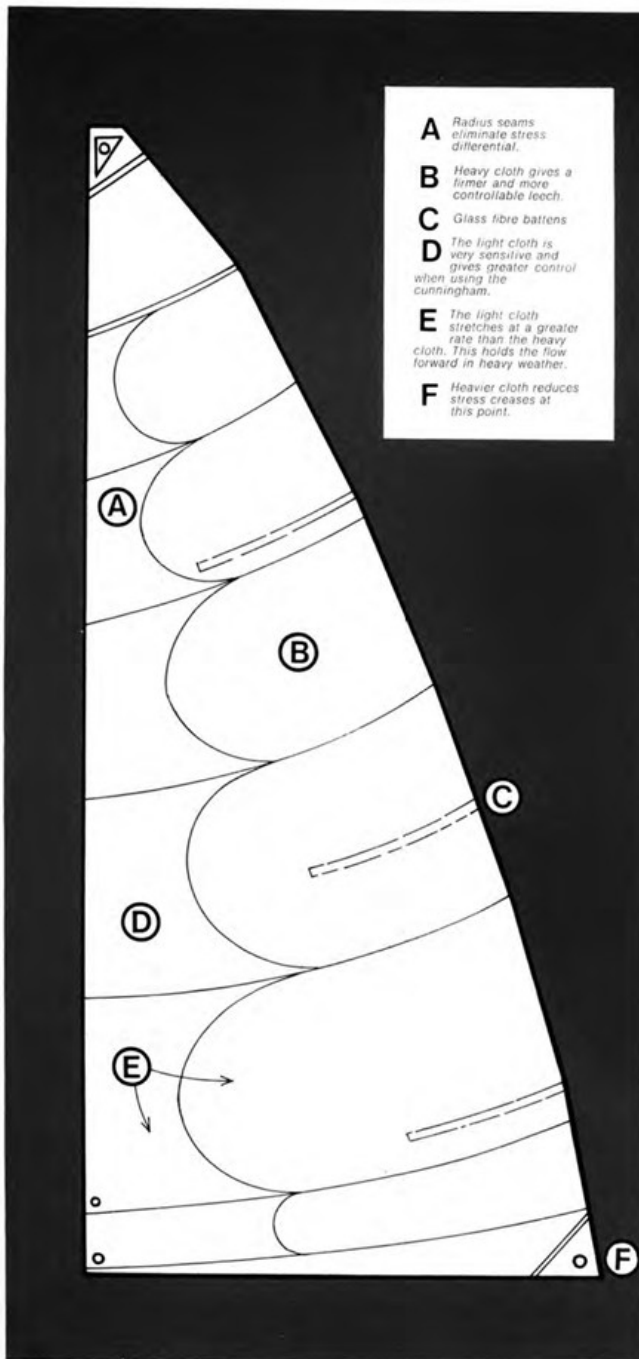
21. The sail shape can be altered by applying tension on the leech, luff or foot using controls at each corner. The control attached to the head is the halyard. The control at the tack is the cunningham, or in larger boats the tack ram and the control at the clew is the outhaul.

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22. The basic point of the Collie'089 claims is that the sailcloth of the luff region of the sail is "more elastic" than the "remainder of the sail" which allows the sailor to apply tension to the luff through the use of a cunningham or halyard control and stretching the material in the vertical axis (parallel to the luff) while shortening the material in the horizontal axis. This commonly used action results in a reduction in the depth of the sail which is desirable as the apparent wind strength increases. Sometimes Collie'089 refers to the remainder of the sail as being "stiffer" than the luff region. According to Collie'089, the more elastic luff (or stiffer remainder of the sail) can be achieved by using different types of sailcloth. The use of more elastic material in the luff region compared to the rest of the sail, including the leech, is an old concept. It is in fact over 50 years old.

23. EX1011 is a 1974 advertisement in *Offshore* magazine for a brand of sail called "The Compensator" which states: "The secret of the 'Compensator' sails...is that they use a combination of cloths of varying weights." The advertisement provides the following illustration (EX1033):

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24. As described in the inset box in the upper right of the 1974 advertisement illustration, the circled letters in the illustration identify the types of sailcloth:

B. "Heavy cloth gives a firmer and more controllable leech."

D. "The light cloth is very sensitive and gives greater control."

E. "The light cloth stretches at a greater rate than the heavy cloth. This holds the flow forward in heavy weather."

25. As indicated as "E" in the advertisement, the light cloth in the luff of the "Compensator" sail stretches at a greater rate than the heavy cloth, which holds the flow forward in heavy weather. This is precisely the "more elastic luff" which provides the same performance advantage that Collie'089 broadly claims to be its invention, although the "Compensator" advertisement disclosed this concept 50 years ago. The Compensator sail was introduced when the most advanced sail materials available were various grades of Dacron. The Compensator sailmakers were using the same concept as presented in Collie'089 with the best materials of the day. As the materials improved over the next decades the concept was improved in parallel.

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26. The advertisement for “The Compensator” states that it is the design used for Australia’s Challenger for the 1974 America’s Cup.

27. EX1012 is a history of sails for the America’s Cup, which is from the North Sails Group website, available at "<https://www.northsails.com/en-us/blogs/north-sails-blog/a-winning-combination-for-four-decades>", and discusses the 1983 race, among others, including the boat *Australia II* for which “polyester panels in the luff had been sewn to a Kevlar leech.” This means the luff is more elastic than the rest of the sail due to the known differences in elasticity between polyester and Kevlar, as discussed more below. Based on my experience and personal knowledge of the sail making business, I can confirm the accuracy of this published history. The design for the *Australia II* sails was even discussed in a 1983 New York times article (EX1009) which discusses *Australia II* having sails that combined Kevlar and Mylar, a polyester film. At this time, Kevlar laminated sailcloth was the stiffest (least elastic) material available and polyester sailcloth was the most elastic laminated material available. The designer of the *Australia II* sails would therefore have achieved the greatest differential elasticity between the first material in the luff and the second material in the remainder of the sail, as claimed in Collie’089. Of note, these sails were designed by Tom Schnackenberg,

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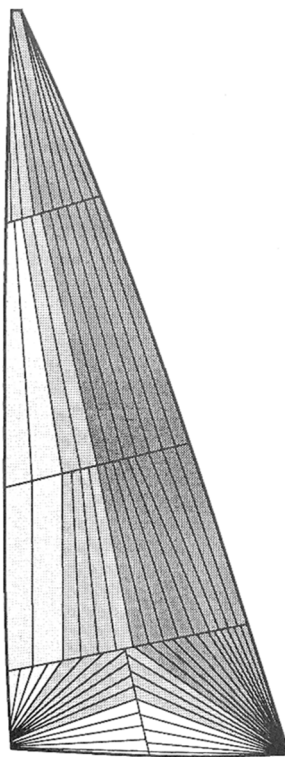
a pioneering North Sails designer, and manufactured by North Sails.

28. It is well known that a sail needs to be more elastic in the luff area than in the leech area to enhance the sailors ability to change the shape of the sail for different wind strength and apparent wind angles. While the sail needs to have this degree of adjustability, it also needs to be smooth so that the air flow across the sail is undisturbed. When the sailmaker uses two materials, each with different degrees of elasticity, the sail shape will often have a pronounced ridge where the transition is made from the first material to the second material. One method of eliminating the transition ridge is to align the warp direction of the first material with the line of transition from the first material in the luff region to the second material in the remainder of the sail (usually a line bisecting the angle of the clew corner and extending towards the middle of the luff). With the warp of the first material aligned with the transition line, the bias direction of the material will be aligned with the luff. The bias direction is the most elastic direction because there are no yarns or fibers aligned with the bias. Thus, the transition ridge is eliminated when the luff is highly elastic.

29. EX1010 is an excerpt from the first edition of the book *The Art and Science of Sails* by Tom Whidden and Michael Levitt, St. Martin's Press, New

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York, NY (1990), including pages 131-133 and 225. According to this book, published in 1990, sail design advanced beyond the *Australia II* design since 1983 including the use of more sections and smaller panels to construct the sail (EX1010, p. 132). One such sail is the "Maxi" mainsail, which had as many as ninety panels. Figure 7.3, from page 132 of EX1010, "shows a typical Maxi mainsail." A higher contrast version of Figure 7.3 is shown below (EX1037):



30. The caption of Figure 7.3 states : "Panel layout for a Maxi mainsail. The white areas are polyester/Mylar and the shaded areas are Kevlar/Mylar. Each shade of Kevlar/Mylar denotes a different material, with darker shades

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representing the heavier materials." In the illustrated Maxi mainsail, a POSITA would understand that the luff region is on the left, (white) and includes the polyester/Mylar panels, while the middle and leech region of the sail are made up of the shaded Kevlar/Mylar panels. Thus, the Maxi mainsail is yet another sail design with a more elastic polyester luff combined with less elastic Kevlar in the remainder of the sail. In this example, using the language of Collie'089, the first material is polyester, and the second material is a much less elastic Kevlar.

31. The tri-radial panel layout has been the industry standard approach to arranging panels cut from sailcloth roll goods since the 1980's. Tri-radial arrangement of the panels allows the sailmaker to use the heavier, lower stretch Kevlar or Carbon fiber panels in the leech area of the sail (the second material) where the sailmaker is mostly interested in restricting stretch to maintain the designed cord depth. The luff area of the sail (the first material) can then be covered by materials with greater elasticity to give the sail a measure of depth adjustability. The greater stretch is achieved by substituting lighter weight cloth or cloth made with more elastic fiber types. These lighter weight or more elastic materials are typically less expensive than the materials used in the leech which allows the price of the sail to be lower or the profit margin to be greater. Finally,

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the triradial layout allows the sailmaker flexibility in decisions about the size of the first and second region and the number of radial panels to use to cover those regions, so the sailmaker can optimize the layout to reduce the material consumption, reducing cost.

32. This idea of a more elastic or flexible luff also is discussed in other prior art including reports in sailing magazines from the 1970s and 1980s as well as several patents, books, magazines, and other publications referred to in this Declaration. The ideas of using different types of sailcloth and having an elastic luff region have been well known to those making sails for a long time. As a sail designer of successful race sails through the period from 1980-1996, I can attest to the fact that combining the available materials to result in the lowest stretch leech area with a much more elastic luff area was a guiding principle of the art.

33. The relative properties of carbon fiber, aramid fiber, polyester fiber and UHMWPE fiber are common knowledge and the optimal use of these various fiber types is understood by the POSITA. For example, references such as the 2003 book entitled *Maximum Sail Power: the Complete Guide to Sails, Sail Technology, and Performance* (EX1017), includes a discussion of common sailcloth materials in Chapters 2 and 3, pages 13-50. For sails that require a high

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degree of depth or shape adjustability, the sailmaker would not be inclined to employ carbon in the luff area. Instead the sailmaker would naturally choose either polyester, aramid or UHMWPE, or a combination of those fiber types depending on the degree of shape change required. Besides the differences in elasticity, these fibers also differ in terms of tensile and fracturing properties. Carbon is brittle and tends to shatter if it is folded or subject to impact (see e.g., EX1017, p. 23). Carbon is rarely used in isolation but rather it is paired with another fiber-type, such as UHMWPE (e.g., Spectra brand UHMWPE) or an aramid (e.g., Kevlar brand aramid) that is less susceptible to fracturing (*id.*). The second fiber type effectively bridges any gaps in the fractured carbon and prevents the sail from tearing.

34. I helped prepare Tables 1 and 2, attached to this Declaration, which show in tabular form where each limitation in claims 1-12 and 16-23 can be found in the prior art referred to in this Declaration.

35. Table 1 relies primarily on the teachings of the 2003 book *Maximum Sail Power: the Complete Guide to Sails, Sail Technology, and Performance*, by Brian Hancock, Nomad Press (2003) (also referred to in this Declaration as "*Maximum Sail Power*") (EX1017) supplemented with other references for some

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claims.

36. Table 2 relies primarily on the teachings of U.S. Patent No. 5,097,783 to Linville ("Linville") of March 24, 1992 (EX1018) supplemented with other references for some claims.

37. Tables 1 and 2 provide a convenient reference for understanding the lack of novelty and/or the obviousness of the Collie'089 claims 1-12 and 16-23 in view of the references discussed therein and below. Claims 13-15 are dealt with separately in the Declaration of Thomas A. Whidden (EX1007) which I have read, understood, and agree with.

38. I have also read, understood, and agree with the Declaration of Per Andersson (EX1005).

I. Claim Construction and Indefinite Claims.

39. Many of the terms in the claims have little to no support in the written description of the specification or in the drawings, and I have been asked, where possible, to construe certain claim terms as would be done by a POSITA. Some claim terms cannot be construed and, accordingly, I believe are indefinite.

40. I have been advised that the claim construction standard set forth in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) applies to this proceeding.

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83 Fed. Reg. 51,341 (Oct. 11, 2018); 37 C.F.R. §42.200. As I understand this standard, words in a claim are given their plain meaning, which is the meaning understood by a person of ordinary skill in the art at the time of the alleged invention after reading the entire patent. *Phillips*, 415 F.3d at 1312-13.

41. I understand that the threshold test for indefiniteness under §112(b) is set forth in *Nautilus, Inc. v. Biosig Instruments, Inc.*, 134 S. Ct. 2120, 2130 (2014). Under the *Nautilus* standard, a patent claim is invalid for indefiniteness if the claims, "read in light of the specification delineating the patent, and the prosecution history, fail to inform, *with reasonable certainty*, those skilled in the art about the scope of the invention." *Nautilus*, 134 S. Ct. at 2124. The particular claim terms that I believe are indefinite are discussed below.

A. "Higher Degree of Elasticity".

42. It is my opinion that a POSITA reading Collie'089 would construe the terms "higher degree of elasticity" as "lower stiffness," "higher failure strain," or "higher deformability" with each of these terms being interchangeable.

43. A POSITA would understand that the basic point of the Collie'089 claims is that the sailcloth of the luff region of the sail has a "higher degree of elasticity..." than the "remainder of the sail." This allows the sailor to stretch the

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luff to a greater extent under high-load/higher apparent wind strength and heavy weather conditions to move the position of maximum draft air flow of the sail forward and to flatten the sail.

44. The specification of Collie'089 provides differing definitions or statements regarding the meaning of "elasticity" or "elastic." As stated in col. 7, ll. 20-23 of Collie'089, "...the term 'higher degree of elasticity' includes the meaning of 'lower stiffness' and/or the meaning of 'higher failure strain', and/or generally 'higher deformability'." Col. 4, ll. 53-56, states "The term 'elastic' as used in the specification in relation to regions of a sail, or materials used therein, means 'being more deformable than a material not indicated as being elastic'." At col. 4, l. 66 to col. 5, l. 3, it discusses "lower stiffness" and states "it is to be understood that the term 'elastic' as used in this specification encompasses this meaning [lower stiffness] as well."

45. However, as discussed below, a POSITA would find that these different terms lead to different conclusions as to whether or not there is infringement. *Interval Licensing LLC v. AOL Inc.*, 766 F.3d 1364, 1371 (Fed. Cir. 2014) states "If the claim language might mean several different things and no informed and confident choice is available among the contending definitions, the

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claim is indefinite.").

46. There is no guidance in Collie'089 as to how these terms could differ or be interchangeable. Thus, a POSITA would not be able to determine with reasonable certainty what the term "elasticity" means in independent claims 1 and 21 and how "elasticity" differs from "stiffness," "average stiffness," or "higher failure strain" as used in various claims of Collie'089.

47. There is also a clear lack of precision for these claims. For example, how and which way is elasticity of the sail measured – up, down, bending, or the surface flexibility? Where is it measured? How do you measure an "average stiffness"? There are no standardized measurement techniques known or used by a POSITA to make these measurements.

B. "Average Stiffness" and "Average Elasticity".

48. The terms "average stiffness" (claim 1) and "average elasticity" (claim 7) cannot be construed directly because there are no art recognized methods, nor are there any methods identified in Collie'089, for measuring an "average stiffness" or "average elasticity" of a region of a sail. Therefore, for purposes of assessing the prior art, the term "average stiffness" and "average elasticity" should be given their broadest reasonable interpretations. In my opinion, the broadest

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reasonable interpretation of “average stiffness” for different portions of a sail is a "stiffness" value (such as a Young’ modulus, or failure strain value) of any portion the region of interest (e.g., luff region, remainder of the sail, or third region). In the case of the Collie’089 claims, a stiffness or elasticity for any portion of the ”luff region” compared to a stiffness or elasticity of any portion of the remainder of the sail can be used to assess whether the prior art sail meets the 2-20 or 2-25 times higher stiffness limitations of claims 1 and 23, or the 100% to 2400% greater elasticity limitation of the claim 7. The prior art cited herein provides values for elasticity or stiffness within the ranges of these claims. Because Collie’089 treats the terms elasticity, stiffness, deformability, and failure strain as interchangeable, they should be given the same consideration.

49. The choices of directionality, where the stiffness or elasticity is measured, and how to measure an "average stiffness" or "average elasticity" on a sail would all lead to different results when measured by different persons of ordinary skill in the art. For example, to a POSITA, elasticity or stiffness of a material can be measured along any angle of orientation and each degree of orientation will deliver a different result. This is because different fabrics have different elasticity/stiffness depending on the direction of measurement. The

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elasticity/stiffness in the “warp” direction generally is different from the elasticity in the “weft” (also called the “fill”) direction or the elasticity/stiffness in the “bias” direction. The area defining the “luff region” , what constitutes the first material, second and third material, and the area defining the “third region” all can be defined differently by different POSITAs and each differently defined region or material will result in a different degree of elasticity or stiffness for the selected material or region, and a different ratio between two different regions or materials. There is no guidance given for where to select the data samples, or how many samples to extract that will comprise the average properties for the material or region. Different locations within the area determined to represent the first, second and third materials will result in different average property values. For the second material in particular, representing the remainder of the sail, different data point location decisions will potentially yield very different values.

50. A POSITA would not use “average stiffness” or "average elasticity" nor would the POSITA understand exactly how such averages would be measured, absent a specified test protocol for the measurement. There is no POSITA recognized way to measure “average stiffness” or "average elasticity" for sails, particularly for complex sail designs such as laminate and tape-based composite

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sails. Collie'089 does not provide any guidance as to how to measure “average stiffness” of a portion of a sail or where the measurements are to be made.

C. Indefiniteness of “Higher Degree of Elasticity”, “Average Stiffness” and “Average Elasticity”.

51. Collie'089 uses the terms “higher degree of elasticity,” “lower stiffness,” “higher failure strain,” and “higher deformability” interchangeably. Thus, the “average” stiffness and elasticity referred to in Collie'089 also should be considered interchangeable with those terms. However, a POSITA would recognize that equating all of these terms can lead to different conclusions regarding infringement. Collie'089 also treats “failure strain” and “Young's Modulus” as alternatives for gauging elasticity and stiffness (see claim 16).

52. For example, Collie'089 says the first material in the luff region can be a polyester and the second material in the remainder of the sail can be an aramid (col. 10, l. 35). Collie'089 conflates elasticity/Young's Modulus/stiffness/failure strain/higher deformability and treats these terms as being interchangeable. Claim 1 calls for the stiffness of the second material to be 2-20 times that of the first material which is the luff region. Similarly, claim 23 calls for the stiffness of the remainder of the sail to be 2-25 times higher than the stiffness of the luff region. That means that the failure strain of the first material (or luff region) can be 2-20

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(or 2-25) times that of the second material (or remainder), or the modulus of the second material (or remainder) can be 2-20 (or 2-25) times that of the first material (or luff region). EX1022 is a published article entitled “Comparison of commonly used sailcloths through photogrammetric acquisitions, experimental tests and numerical aerodynamic simulations”, by Michele Cali *et al.*, *Procedia Manufacturing*, 11 (2017) 1651-1658 (“Cali”), which provides elasticity/stiffness values for commonly used sailcloth materials. Looking at Table 2 of Cali, DIAX 60P and Pentex FLEX 13 are polyesters, while Kevlar FLEX and Kevlar CZ15 are both aramids. The values below are taken from Table 2 of Cali and are consistent with Collie’089, col. 8, ll. 45-54. Using the values given, the ratio of “average stiffness” of the second material to the first material can be calculated using failure strain (referred to as “Strain max” in Cali) as one stiffness parameter, and Young's Modulus as another stiffness parameter .

	Failure Strain	Young’s Modulus
DIAX 60P	6.4	2600
Kevlar FLEX	2.7	3800
Ratio	2.3	1.46
Result	Infringement	No infringement

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	Failure Strain	Young's Modulus
DIAX 60P	6.4	2600
Kevlar CZ15	2.3	2600
Ratio	2.78	1.00
Result	Infringement	No infringement

	Failure Strain	Young's Modulus
Pentex FLEX 13	7.8	3700
Kevlar FLEX	2.7	3800
Ratio	2.89	1.03
Result	Infringement	No infringement

	Failure Strain	Young's Modulus
Pentex FLEX 13	7.8	3700
Kevlar CZ15	2.3	2600
Ratio	3.39	1.42
Result	Infringement	No infringement

53. On the question of infringement, the results vary. The same materials can result in a finding of infringement or no infringement depending on the stiffness/elasticity property being measured. The same applies to the term "average elasticity" used in claim 7. Therefore, the determination of infringement varies depending on which measurement is actually made, using terms that Collie'089 says are interchangeable. Thus, all the claims fail to inform those skilled in the art about the scope of the invention. See *Nautilus* 134 S.Ct. 2124 (2014).

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D. Indefiniteness of “Luff Region”.

54. The limitation "luff region" in claims 1 to 23 fails to define the extent, shape, and location of where the luff region ends and the "remainder of the sail" begins.

55. An indefinite factor for a POSITA is where does the luff region begin and end other than that it runs along the luff of the sail? There is no guidance in Collie'089 for how to determine this. For example, a composite sail comprises many different clusters or groupings of overlapping warp yarns running different directions embedded in a resin base, forming a unitary sail structure, such as the sails referred to as 3Di sails made by North Sails Group. This is shown in the Declaration of Per Andersson (EX1005). In such sails, the selection of where the luff region begins and ends would necessarily be arbitrary, because there are no well-defined panels or regions in such sails. Claims 13-15 also talk about the “luff region” and “remainder of the sail” and a “third region” between the luff region and the remainder of the sail. Not even the grammar works in these claims. The plain meaning of "the remainder" to a POSITA is *everything except the luff region*, yet somehow there is a "third region" which is not part of the "remainder." This adds even further confusion to how one of ordinary skill in the art would determine

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where one region ends and another region begins.

56. Collie'089 gives no guidance on how elasticity or stiffness are to be measured and there is no standard way used by a POSITA. It is not an exaggeration to say that high performance sails are “one of a kind” so each would have to be subjected to a claims test individually. Destructive testing is not practical as sails tend to be large and expensive, and there is no commonly accepted non-destructive means of measuring such properties on a finished sail available to the POSITA. In short, the POSITA has no way to determine whether or not infringement exists. This makes the claims indefinite to a POSITA and therefore invalid.

E. “Remainder of the Sail”.

57. The term “remainder of the sail” should be construed as a panel of a second material that is different from the first material, this panel having a defined margin being connected along the border with the luff region. As stated at col. 9, ll. 19-20, “at the margin between the elastic region and the rest of the sail...”

F. “First and Second Materials”.

58. The “first and second materials” should be construed as separate panels of different materials with a defined margin between the two different

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materials. As stated in the Abstract and col. 4, l. 20, the panels are connected by “curing or sewing the sail to form a cohesive structure.” Also in col. 8, ll.16-31, the two materials are clearly described as being different fabrics.

G. Lack of Written Description for “Third Region”.

59. The “third region”, if possible, should be construed as a band of third material between the first material and second material. See col. 3, ll. 49-50, and claims 13-15 of Collie'089.

60. Claims 13-15 call for a third region along a portion of a margin of the luff region, but the phrase “third region” appears nowhere in the Collie'089 description, nor is it shown in any drawing as required by 37 C.F.R. §1.83. The closest is the use of the term “third material” which is only described by functional language as having a higher stiffness. Col. 3, ll. 49-52. As such, it is only identified by functional language as used in 35 U.S.C. §112(f). Compounding the problem is that the claims call for a “luff region” and a “remainder of the sail.” The two terms collectively cover the whole sail and do not leave room for a “third region.” The “luff region” plus the “remainder” equals the whole sail.

61. In scouring the drawings of Collie'089 for a defined “third region”, the only likely potential candidate appears to be element 16 such as shown in

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Figure 2. However, element 16 cannot be the “third region” of claim 13-15, because Collie’089 says that element 16 is “the edge of the stiffer region” [i.e., the remainder of the sail], col. 10, ll. 61-64.

62. Because no structure or element is either shown or described, there is no support for the term “third region”, and therefore claims 13-15 are invalid under 35 U.S.C. §112.

II. Invalidity Based on Written Prior Art.

A. Invalidity Based on *Maximum Sail Power* (EX1017) as the Primary Reference.

63. At least two primary prior art references anticipate claims of Collie’089, including the 2003 textbook *Maximum Sail Power* (EX1017) and the 1992 patent to Linville (EX1018). The teachings of these references can also be supplemented with the teachings of additional references in the field of sail design for claims where certain claim limitations may not be explicitly taught by the primary references. These supplemental, or "secondary" references include the article by Michele Cali et al., described above in paragraph 52 (EX1022), U.S. Patent No. 5,097,783 (1992) to Linville ("Linville") (EX1018); U.S. Patent No. 6,260,497 (2001) to Keire ("Keire") (EX1019), U.S. Patent No. 1,613,890 (1927) to Herreshoff ("Herreshoff") (EX1024); a 2017 technical guide for Kevlar Fibers

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from DuPont Corp. (“DKG”) (EX1032), the Rules for the America’s Cup race adopted in 2018 (“ACR”) (EX1013), a 2019 publication about the patent owner Team New Zealand (“TNZ”) (EX1014), U.S. Patent No. 2,561,253 (1951) to Wells-Coates (“Wells-Coates”) (EX1015), U.S. Patent No. 2,569,318 (1951) to Kersten (“Kersten”) (EX1016), and U.S. Patent No. 4,064,821 (1977) to Roberts (“Roberts”) (EX1021).

i. *Claims 1-12 and 19-23 Are Anticipated by *Maximum Sail Power*.*

64. As described below, the 2003 textbook *Maximum Sail Power: the Complete Guide to Sails, Sail Technology, and Performance*, by Brian Hancock, Nomad Press (2003) (EX1017), discloses all of the limitations of claims 1-12 and 19-23 (see also Table 1, attached).

65. Regarding claim 1, page 60 of *Maximum Sail Power* shows a radial headsail in Fig. 4.10, where the luff is on the left, the leech is on the right, the head is at the top, the tack is at the lower left corner, and the clew is at the lower right corner.

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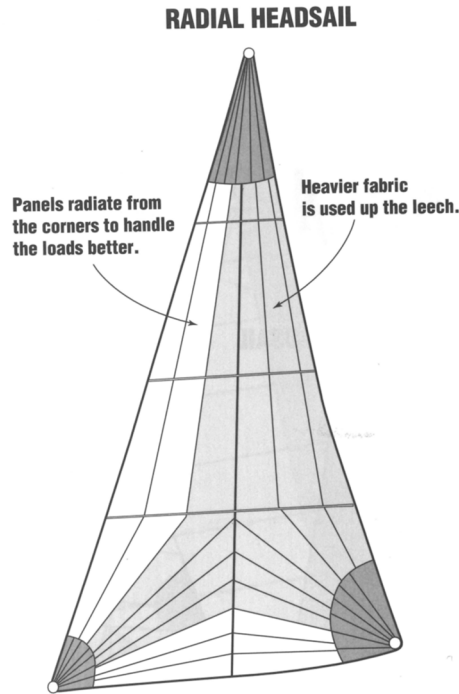


Fig. 4.10

66. Although the claim terms "tack", "head", and "luff" used in claim 1 are part of the common knowledgebase of a POSITA long before Collie'089 was filed, the glossary of *Maximum Sail Power* nonetheless defines the "head" as the top of the sail on page 275, the "tack" as the lower forward corner of a sail on page 278, and the "luff" as the leading edge of the sail on page 276. Giving the term "luff region" its broadest reasonable interpretation as a region or portion of a sail near or at the luff, a POSITA would understand that the luff region of the sail in Fig. 4.10 is made up of the light-colored panels on the left side of the sail, running between the tack and the head. The remainder of the sail is made up of the darkest

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panels in the corners of the sail, the medium-shaded panels along the leech and in the middle of the sail, and the and the lighter panels at the foot (bottom) of the sail. Most of the remainder of the sail is made up of the medium-shaded panels. Based on my experience, a POSITA in the field of high-performance yacht and racing sails would understand that it is common to illustrate sails using darker shading to differentiate heavier, more stretch-resistant materials and lighter shading for lighter more elastic materials (see e.g., paragraphs 29 and 30 above, which provides an illustration of the Maxi sail with a caption that explains the shading, taken from page 132 of EX1010).

67. As stated on page 60 of *Maximum Sail Power*: “the sail designer can engineer different fabrics in different areas of the sail to address specific loads. In other words, heavier fabrics can be used along the leech..., while lighter fabrics can be used in the lower load areas like along the luff....[T]he sailmaker can design the sail with low stretch Kevlar yarns in the high load areas and a regular polyester in the rest of sail.” This meets the limitation of claim 1 of Collie’089 that “the luff region has a higher degree of elasticity compared to a remainder of the sail” because the luff region of the sail is formed of stretchy polyester, and the remainder of the sail is shown in darker shades with the exception of the foot,

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which is illustrated in a lighter shade. This passage of *Maximum Sail Power* also meets the limitation of claim 1 that "...the luff region of the sail includes a first material [regular polyester] and a remainder of the sail includes at least a second material [Kevlar]", and that "...the first material and the second material are different..."

68. *Maximum Sail Power* at page 20 points out that Kevlar "is stronger than steel for its weight and has a modulus five times greater than polyester." Modulus is defined on page 276 of *Maximum Sail Power* to be "a measure of a material's ability to resist stretch. Initial modulus is usually expressed as grams of load per unit stretch for a certain fiber denier. The higher the modulus, the less the fiber will stretch." It is my opinion that a POSITA would understand that Kevlar having a modulus that is five times greater than polyester meets the limitation of claim 1 of Collie'089 "wherein an average stiffness of the second material [Kevlar] is in a range of 2-20 times higher than an average stiffness of the first material [regular polyester]" (I have added the bracketed terms as examples in the preceding quote). A second material with a modulus that is five times higher than the first material would equate to the second material (Kevlar) being five times more resistant to stretching, and thus 5 times stiffer, at least to the extent resistance

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to stretching and stiffness can be equated. Arriving at the full range of values in claim 1 would just involve routine optimization well within the level of skill of a POSITA in the field of high-performance sail design. Thus, the book *Maximum Sail Power* (EX1017) discloses all of the limitations of claim 1 of Collie'089 and claim 1 is anticipated.

69. Claim 2 of Collie'089 depends on claim 1, and specifies that the sail is a mainsail. Page 60 of *Maximum Sail Power* refers to a mainsail in the section discussing Figure 4.10. Mainsails are also discussed throughout *Maximum Sail Power*. Thus, *Maximum Sail Power* discloses the added limitation of claim 2 and claim 2 is anticipated.

70. Claim 3 of Collie'089 depends on claim 1, and specifies that the sail is a headsail. Figure 4.10 on page 60 of *Maximum Sail Power* refers to the illustrated sail as a headsail and on page 275 gives the definition of headsail. Thus, *Maximum Sail Power* discloses the added limitation of claim 3 and claim 3 is anticipated.

71. Regarding claims 4-6, Michele Calì et al., "Comparison of Commonly Used Sailcloths through Photogrammetric Acquisitions, Experimental Tests and Numerical Aerodynamic Simulations" *Procedia Manufacturing*, Volume 11, 2017, pages 1651-1658 ("Cali") (EX1022), which discusses the properties of commonly

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used sailcloth material, explains and supplies all of the limitations not explicitly disclosed in *Maximum Sail Power*. Cali is evidence of the properties of sailcloth as used in the claims. Therefore, claims 4-6 are anticipated by *Maximum Sail Power* as evidenced by Cali, as discussed in more detail below. In the alternative, since Cali is directed to commonly used sailcloth, it would be obvious to combine the teachings of Cali with *Maximum Sail Power* to meet all of the limitations of claims 4-6.

72. Claim 4 depends on claim 1, and adds that the first material has a failure strain of at least about 2.5% to about 30%. As noted for claim 1, above (see paragraph 67) *Maximum Sail Power* teaches that the material of the luff (i.e., the first material of Collie'089) can be polyester. It is common knowledge to a POSITA that failure strain is just another way to characterize elastic properties, e.g., in addition to or as an alternative to modulus. It is also common knowledge to a POSITA that polyester is a low modulus material, as evidenced by Cali (EX1022) on page 1652, in the nomenclature section defines Dacron as a polyester; and on page 1654, Table 2, which states that the strain max (failure strain) of Dacron TNF 240 is 12.2% which is within the range of claim 4. Thus, claim 4 is anticipated by *Maximum Sail Power* in view of common knowledge of a

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POSITA.

73. In the alternative, claim 4 is obvious over the *Maximum Sail Power* in view of Cali (EX1022). A POSITA would have been motivated to look to Cali for when choosing materials for a sail because Cali describes common sailcloth materials. A POSITA would have been motivated to choose Dacron TNF 240 as a possible polyester for use in the luff of a high-performance sail as described in *Maximum Sail Power*, since it is a commonly used polyester sailcloth. Arriving at the full range of values in claim 4 would just involve routine optimization well within the level of skill of a POSITA in the field of high-performance sail design. Thus, the combination of *Maximum Sail Power* with Cali renders claim 4 obvious.

74. Claim 5 depends on claim 1, and specifies that failure strain for the “first material” is about “2 to about 10 times the failure strain of the second material.” Page 60 of *Maximum Sail Power* states that “... the sailmaker can design the sail with low-stretch Kevlar yarns in the high-load areas and a regular polyester in the rest of the sail.” *Maximum Sail Power* also teaches that Kevlar has a modulus 5 times the modulus of polyester (see paragraph 68, above). It is common knowledge to a POSITA that failure strain is just an alternative way of characterizing elasticity and stiffness, thus a POSITA would understand that a five

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times higher modulus for Kevlar versus polyester, which is well within the stiffness range of 2-20 of claim 1, also would likely fall within the range of 2-10 times the failure strain found in claim 5, as evidenced by Cali (EX1022). Page 1652 of Cali, in the nomenclature section, defines Dacron as a polyester; and on page 1654, Table 2 states that the Strain max (failure strain) of Dacron TNF 240 is 12.2% and the Strain max of Kevlar CZ 15 is 2.3. Based on these numbers, Dacron TNF 240 has a failure strain that is 5.3 times greater than Kevlar CZ 15. Thus, *Maximum Sail Power* in view of common knowledge of a POSITA, as evidenced by Cali, anticipates claim 5.

75. In the alternative, claim 5 is obvious over *Maximum Sail Power* in view of Cali. The motivation for combining *Maximum Sail Power* with Cali is discussed above in paragraph 73 in relation to claim 4, as is the motivation for choosing Dacron TNF 240 as a possible polyester for use in the luff, and Kevlar CZ 15 as the Kevlar material in the remainder of the sail. Arriving at the full range of values in claim 5 would just involve routine optimization well within the level of skill of a POSITA in the field of high-performance sail design. Thus, the combination of *Maximum Sail Power* with Cali renders claim 5 obvious.

76. Claim 6 depends on claim 1, and specifies an average Young's

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Modulus of about 1 to about 60 GPa for the first material. *Maximum Sail Power* teaches using polyester as the first material. It is common knowledge of a POSITA that polyester is a relatively low modulus material, as evidenced by Cali (EX1022) and the Kevlar Aramid Fiber Technical Guide, 2017, DuPont Corp. (“DuPont Kevlar Guide”) (EX1032) both of which provide properties of polyester and other sailcloth materials.

77. Table 2 of Cali reports the modulus values of common polyester sailcloth materials Dacron TNF 240 polyester (1.050 GPa in the weft) and Pentex FLEX 15 (3.4 GPa in the warp and 3.56 GPa in the weft), both of which are within the range of claim 6. In addition, the 2017 Dupont Kevlar Guide (“DKG”, EX1032, p. 7, Table II-2) reports that of polyester yarn has a modulus of 2.0×10^6 psi, which is equivalent to 13.7 GPa, which is also in the range of claim 6. Both of these polyesters are recommended for sailcloth and meet the claim limitation. Thus, *Maximum Sail Power* as evidenced by Cali or DKG anticipates claim 6.

78. In the alternative, claim 6 is obvious over *Maximum Sail Power* in view of Cali or DKG. A POSITA would be motivated to choose a polyester material for the luff region of the sail because *Maximum Sail Power* teaches sails with a polyester luff and stiffer Kevlar in the remainder of the sail, as discussed

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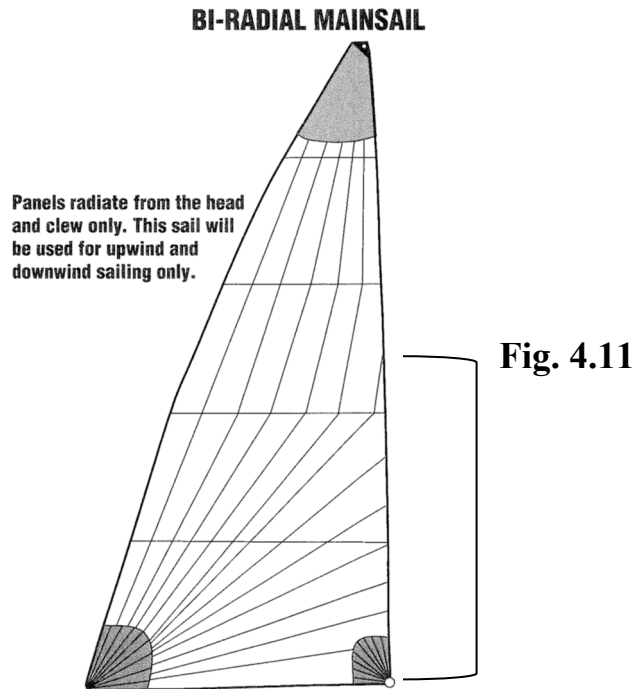
above in paragraph 67. A POSITA would be motivated to look to Cali and DKG for information about polyester and Kevlar materials because both references provide properties for such materials. Arriving at the full range of values in claim 6 would just involve routine optimization well within the level of skill of a POSITA in the field of high-performance sail design. Thus, claim 6 is obvious over *Maximum Sail Power* in view of Cali or DKG.

79. Claim 7 depends on claim 1 and specifies that the first material has an average elasticity that is at least about 100% to about 2400% higher (i.e., 2 to 25 times greater) than an average elasticity of the second material. As noted above in the discussion of claim 1 in paragraphs 67 and 68, above, *Maximum Sail Power* teaches that the first material can be polyester and the second material can be Kevlar. *Maximum Sail Power* at pp. 19-20 also teaches “[Kevlar] is stronger than steel for its weight and has a modulus five times greater than polyester.” A POSITA would understand that a modulus for Kevlar that is five times greater than the modulus of polyester means that the polyester (the first material) would have an elasticity that is five times greater than Kevlar (the second material), for sailcloths of the same cross-sectional dimensions. Five times greater elasticity equates to 400% higher elasticity. Thus, *Maximum Sail Power* anticipates claim 7.

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80. Claim 8 depends on claim 1 and adds the limitation that there is an absence of sail fibres, or sailcloth fibres, that extend in a direction parallel, or at least substantially parallel, to the luff in the luff region of the sail. *Maximum Sail Power*, on page 61 and in Fig. 4.11, as noted in the figure caption, shows a bi-radial sail in which load-bearing gores (panels) radiate out of the head and the clew only. Page 59 of *Maximum Sail Power* states: "...warp-oriented laminates were used to build radial sails." A POSITA would understand that orienting panels of the first material at an angle as in the lower right side of the sail as shown in Fig. 4.11 (below) of *Maximum Sail Power* places the more elastic bias of the fabric parallel to the luff resulting in greater elasticity along the luff region, which I have indicated by adding a bracket on the lower right side of the figure where the panels make a significant angle relative to the luff itself (i.e., the right edge of the sail, as illustrated). This technique is common knowledge in the sailmaking industry.

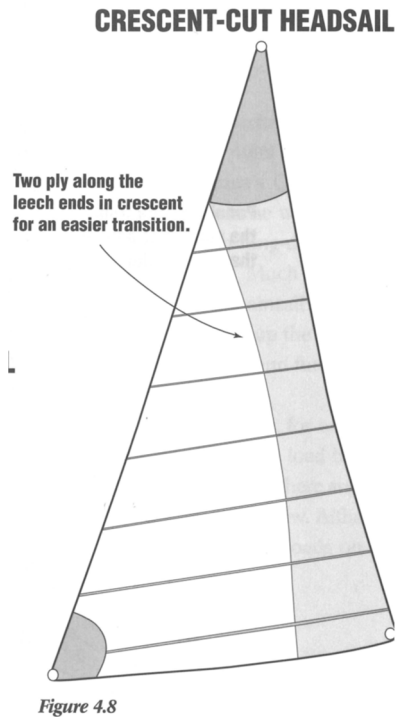
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81. Thus, the load-bearing warp fibers and the perpendicular fill fibers of the panels in the lower luff area of Fig. 4.11 on the right side of the sail in the area beside the bracket I have added next to this area, above, are at an angle such that there is an absence of sail fibers, or sailcloth fibers, that extend in a direction parallel, or at least substantially parallel, to the luff in the luff region of the sail. In the same way in *Maximum Sail Power*, Fig. 4.8 (shown below) has all the fibers at an angle to the luff, because the sail fibers run in a direction parallel to and perpendicular to the bottom and top of each panel in such sails. In contrast, the luff (left edge) of the sail runs at an angle relative to the panels. Thus, *Maximum*

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Sail Power anticipates claim 8.



82. It is well known that a sail needs to be more elastic in the luff area than in the leech area to enhance the sailors ability to change the shape of the sail for different wind strength and apparent wind angles. While the sail needs to have this degree of adjustability, it also needs to be smooth so that the air flow across the sail is undisturbed. When the sailmaker uses two materials, each with different degrees of elasticity, the sail shape will often have a pronounced ridge where the transition is made from the first material to the second material. One method of eliminating the transition ridge is to align the warp direction of the first material

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with the line of transition from the first to the second material (usually a line bisecting the angle of the clew corner and extending towards the middle of the luff). With the warp of the first material aligned with the transition line, the bias direction of the material will be aligned with the luff. The bias direction is the most elastic direction because there are no yarns or fibers aligned with the bias. Thus the transition ridge is eliminated and the luff is highly elastic.

83. Claim 9 depends on claim 6, and specifies that there are sailcloth fibers in the luff region of the sail which extend in an angle “greater than or equal to about 15 degrees free from fibres” parallel to the luff of the sail. According to *Maximum Sail Power*, page 59, the panel orientations in Fig. 4.11, the panels are so-called “warp-oriented” panels, meaning that the load-bearing warp fibers are oriented in the same direction as the panels are oriented. Thus, a POSITA would recognize that the warp fibers of the panels in the lower luff area in the lower right side of the sail are oriented at an angle significantly greater than 15 degrees free relative to the direction parallel to the luff.

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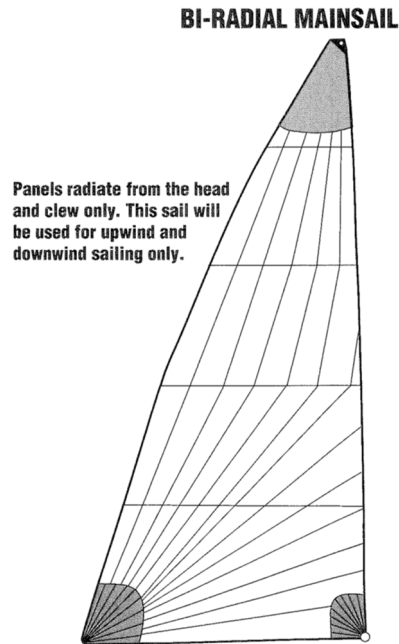


Fig. 4.11

84. A POSITA would also recognize that the fill and weft fibers would be at an angle significantly greater than 15 degrees free relative to the direction parallel to the luff, since the fill is generally perpendicular to the warp in most fabrics. The same applies to Fig. 4.8, shown above after paragraph 81, where the panels run in the direction from leech to luff. Thus, claim 9 is anticipated by *Maximum Sail Power* (EX1017), as evidenced by Cali (EX1022) or DKG (EX1032), as applied to claim 6.

85. In the alternative, claim 9 is obvious over the combination of *Maximum Sail Power* (EX1017), in view of Cali (EX1022) or DKG (EX1032).

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The motivations to combine *Maximum Sail Power* (EX1017), with Cali (EX1022) or DKG (EX1032) are discussed with regard to claim 6 in paragraph 78, above.

86. Claim 10 depends on claim 1 and specifies that the first material extends at least 50% to about 95% of a distance between the head and tack of the sail. As shown in *Maximum Sail Power*, Fig. 4.10, below, the more elastic polyester luff panels on the left-hand side of the sail extend between dark reinforced areas near the head and the tack, which appears to be approximately 70% to 80% of the distance between the head and the tack. Thus, *Maximum Sail Power* discloses the added limitation of claim 10. See Fig. 4.10 from p. 60 of *Maximum Sail Power*, below:

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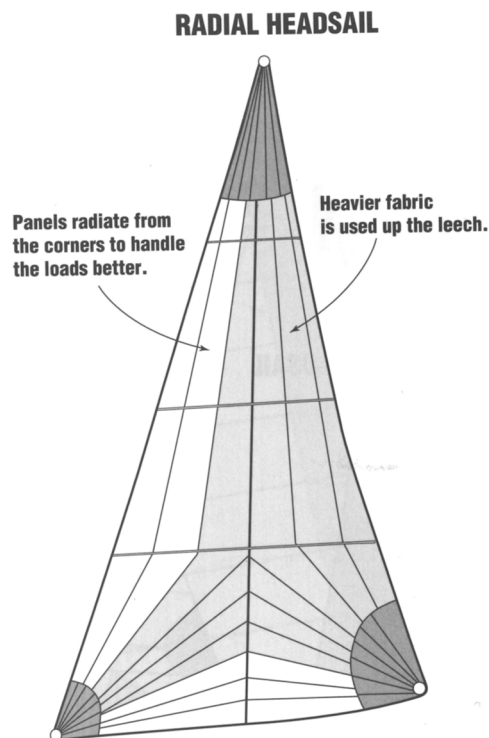


Fig. 4.10

87. Claim 11 depends on claim 1, and specifies that the first material extends up to about 10% to about 50% of a width of the sail towards a leech of the sail. Page 60 and Fig. 4.10 of *Maximum Sail Power* (above) shows that the lighter-colored luff panels on the left side of the sail extend about 1/3 of the way from the luff to the leech at their widest point. Thus, *Maximum Sail Power* anticipates claim 11.

88. Claim 12 depends on claim 9, and specifies that “first material extends towards a leech of the sail to a greater extent in the middle of the sail

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relative to a height of the sail compared to the luff regions towards the head and tack of the sail.” See *Maximum Sail Power*, p. 60, Fig. 4.10 wherein the panels (light shading) along the luff have a width of at least 10% of the sail width in the middle of the sail - approximately $\frac{1}{3}$ of the distance from luff to leach based on the number of panels in each area. The technique of extending the region of the first material more towards the leech in the middle of sail relative to the height of the sail is common as it results in the lighter weight material following the natural arc of the lines defining the loads the sail is subject to from wind pressure and sail controls.

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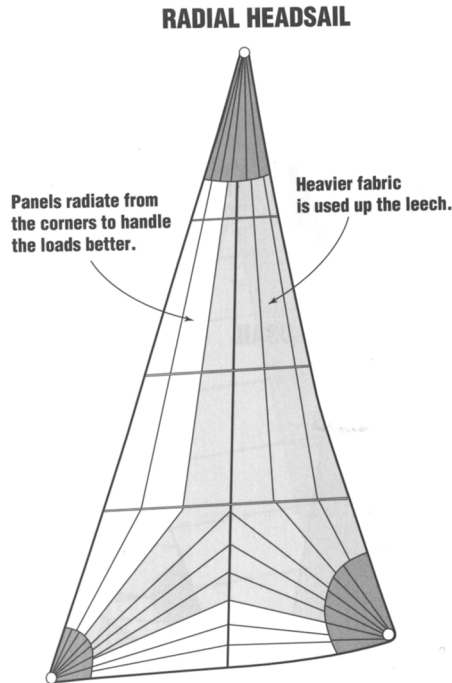


Fig. 4.10

89. Thus, claim 12 is anticipated by *Maximum Sail Power*, as evidenced by Cali or DKG, as applied to claims 6 and 9 (see paragraphs 77 and 84, above).

90. In the alternative, claim 12 is obvious over *Maximum Sail Power*, in view of Cali or DKG, as applied to claims 6 and 9, with the motivations for combining the reference being the same as recited above in paragraphs 78 and 85. In addition, a POSITA would have been motivated to orient the panels according to the load as discussed in *Maximum Sail Power* to increase the elasticity of the luff region toward the middle to better flatten the sail when under high wind conditions.

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91. Claim 19 depends on claim 1, and specifies that a difference in elasticity is achieved by a lesser material thickness in the luff region compared with the remainder of the sail. Pages 56-59 and Figure 4.8 (reproduced below) of *Maximum Sail Power* discuss known sail configurations in which two plies of fabric are used in the leech where loads are heaviest, and a single ply in the luff. A POSITA would understand that two plies of the same material would be twice as stretch resistant (or stiffer) as one ply, to the extent that stiffness and stretch resistance can be related.

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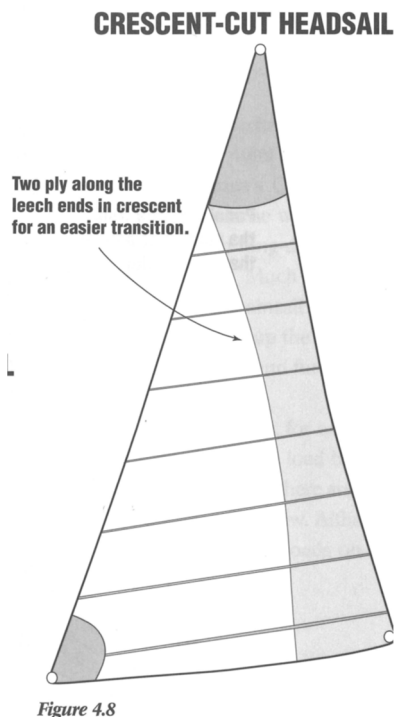


Fig. 4.8

92. See also *Maximum Sail Power*, page. 38: "...there is little need to have heavy fabric along the luff or in the body of the sail since these areas are subjected to very little loading. The leech, on the other hand, is an area in which a sail designer needs to be sure to place a fabric with both high modulus and tensile strength." Thus, *Maximum Sail Power* anticipates claim 19.

93. Claim 20 depends on claim 1, and adds the limitations that an orientation of a material in the luff region is different from an orientation of a material in the remainder of the sail, such that the luff region has a higher degree

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of elasticity compared to the remainder of the sail. *Maximum Sail Power*, at page 59, states: "...warp-oriented laminates were used to build radial sails." *Maximum Sail Power*: p. 61 notes in the caption for Fig. 4.11, that this figure shows a "bi-radial main with load-bearing gores radiating out of the head and clew only..." The term "gore" means a panel. The reproduction of Fig. 4.11 below is annotated to outline in red the lower panels of the sail that radiate out from the clew.

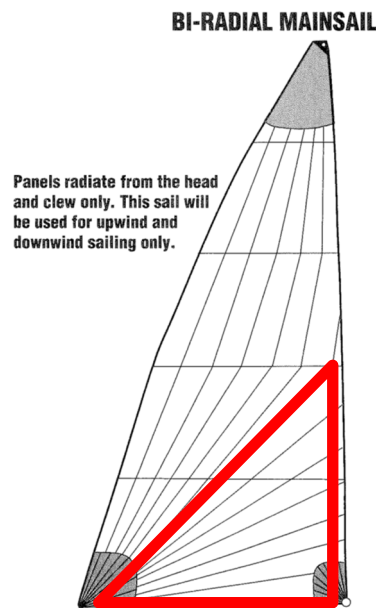


Fig. 4.11

94. Additionally, *Maximum Sail Power* states on page 60: "One of the principal benefits of radial sails is that the sail designer can engineer sails with different fabrics in different areas of the sail to address specific loads. In other words, heavier fabrics can be used along the leech of the sail or at the head and

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clew where loads are highest, while lighter fabrics can be used in lower load areas like along the luff.... the sailmaker can design the sail with low-stretch Kevlar yarns in the high-load areas and a regular polyester in the rest of the sail.” A POSITA would understand from these passages and Figure 4.11 in *Maximum Sail Power* that the teaching of the panels along the leech at the left side of Fig. 4.11 can be oriented generally in a different direction from the orientation of the panels in the lower half of the luff on the right side of the sail shown in red. The same applies to Fig. 4.10. Since the fabrics of the panels are "warp-oriented" the warp fibers in the panels will be oriented in the same direction as the panels themselves. The different orientations of the warp fibers in the lower luff area would make this area stretchier in the direction from tack to clew, than the leech in the same direction. Thus, *Maximum Sail Power* anticipates claim 20.

95. Claim 21 depends on claim 1, and specifies that the luff region does not comprise any carbon fibers oriented within 15 degrees of parallel to the luff, whereas “the remainder of the sail” does have carbon fibers oriented within 15 degrees of parallel to the luff. According to *Maximum Sail Power*, page 60, the benefit of radial sails is that “the sailmaker can design the sail with low-stretch Kevlar yarns in the high-load areas and a regular polyester in the rest of the sail.”

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There is no mention of carbon fibers in the polyester luff region. In on page 23 of *Maximum Sail Power*, in regard to carbon fiber: "When used in sails carbon fibers are combined with more durable fibers like Kevlar ... The result is a measure of durability, without a sacrifice in modulus." Also in *Maximum Sail Power*, p. 20 photo caption: "Some fabrics are made from a blend of fibers such as Kevlar and carbon in order to maximize benefits of each." While *Maximum Sail Power* does not mention the orientation of carbon fibers when combined with Kevlar, a POSITA would understand that the carbon fibers would be oriented substantially vertically or following the major lines of force on the sail in a fabric sail panel in order to provide strength in the direction where it is most needed, thus such carbon fibers would generally be oriented within 15 degrees of parallel to the luff. Thus, claim 21 is anticipated by *Maximum Sail Power*.

96. In the alternative, claim 21 is obvious over *Maximum Sail Power*. A POSITA would consider it to be an obvious design choice to use a blend of Kevlar and carbon fibers in the remainder of the sail, including the leech, to provide the desired high modulus of carbon with the improved durability of Kevlar as taught by *Maximum Sail Power*. Thus, a POSITA would be motivated to make a stronger and longer lasting sail by adding carbon fibers to the Kevlar in the orientation

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specified in the claim.

97. Claim 22 depends on claim 1, specifying a twin-skin mainsail wherein each skin has a luff region extending along the luff and each luff region has a higher degree of elasticity compared to a remainder of the respective skin sail. As noted above, in paragraph 68, claim 1 is anticipated by *Maximum Sail Power* (EX1017). The twin-skin sail configuration added by claim 22 nothing more than common knowledge to a POSITA, as evidence by numerous patents and other documents, such as the 1927 U.S. Patent No. 1,613,890 to Herreshoff ("Herreshoff") (EX1024). In particular, Fig. 2 and claim 1 of Herreshoff disclose a sailboat with two mainsails each having a twin-skin sail design. The Herreshoff patent does not describe any difference in construction for the two skins and as discussed above, more elastic luffs are common. Many other patents teach the use twin-skin sails over the years since 1927, including U.S. Patent No. 2,561,253 (1951) to Wells-Coates ("Wells-Coates") (EX1015), U.S. Patent No. 2,569,318 (1951) to Kersten ("Kersten") (EX1016), and U.S. Patent No. 4,064,821 (1977) to Roberts ("Roberts") (EX1021). The figures showing the twin-skins for each of these patents are provided in Table 1. In addition, patent owner Team New Zealand was instrumental in including the twin-skin sail design into the rules for

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the America's Cup race in March of 2018 (ACR, EX1013) (see also Team New Zealand's own discussion of twin-skin sails in 2019 (TNZ, EX1014). Thus, claim 22 is anticipated by *Maximum Sail Power* as applied to claim 1, and common knowledge of a POSITA as evidenced by any of the other references listed above in this paragraph.

98. In the alternative, claim 22 is obvious over *Maximum Sail Power* (EX1017) in view of any or all of Herreshoff (EX1024), Wells-Coates (EX1015), Kersten (EX1016), and Roberts (EX1021), the TNZ publication (EX1014), or the America's Cup Rules (EX1013). Based on the teachings of these references, it would be an obvious design choice to make a twin-skin sail with both sail skins having the same construction, since the sail has to operate in exactly the same manner on each side, depending on the boats sailing direction relative to the wind direction. A POSITA would know that a twin-skin mainsail has the advantage of less drag because it better diverts the wind flow around the mast, e.g., as taught by Herreshoff.

99. Claim 23 is very similar to claim 1 with regard to the initial limitations labeled 23.A through 23.F in Table 1, attached. Thus, my discussion in paragraphs 64 to 68, above, regarding the teachings of *Maximum Sail Power*,

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applies equally to the corresponding limitations of claim 23.

100. With respect to the last limitation of claim 23 "wherein in a luff direction, a ratio of a stiffness of regions outside the luff region and the stiffness of the luff region is in the range of 2-25 times greater" (limitation 23.G), this limitation is very similar to the last limitation of claim 1, except that it specifies stiffness in "a luff direction" and increases the range of stiffness for the regions outside the luff region (i.e., the "remainder of the sail" in claim 1) from 2-20 times higher in claim 1, to 2-25 times greater in claim 23. A POSITA would look at the elasticity or stiffness of the luff region in the luff direction because it is the direction the sail is stretched when sailing. As discussed above for claim 1, *Maximum Sail Power* teaches that a sail can be constructed with a Kevlar leech area and polyester in the remainder of the sail (see *Maximum Sail Power*, at page 60). At page 20, *Maximum Sail Power* points out that Kevlar "is stronger than steel for its weight and has a modulus five times greater than polyester." Modulus is defined on page 276 of *Maximum Sail Power* to be "a measure of a material's ability to resist stretch. Initial modulus is usually expressed as grams of load per unit stretch for a certain fiber denier. The higher the modulus, the less the fiber will stretch." A POSITA would understand that Kevlar having a modulus that is

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five times greater than polyester meets the limitation of claim 23 of Collie'089

"wherein a ratio of stiffness of regions outside the luff region and the stiffness of the luff region is in a range of 2-25 times greater." A material in the areas outside the luff region with a modulus that is five times higher than the material in the luff region would equate to the stiffness of the regions outside the luff region being five times greater than the stiffness in the luff region. Also, it is applying tension to the tack to adjust the sails so it is the stiffness in the luff direction that matters. Thus, the 2003 textbook *Maximum Sail Power* (EX1017) discloses all of the limitations of claim 23 of Collie'089.

**ii. Claims 4-6, 9, 12-18, 21 and 22 are Rendered Obvious by
Maximum Sail Power as Primary Reference.**

101. While *Maximum Sail Power* may not explicitly disclose the added limitations of claims 4-6, 9, 12-18, 21 and 22, these additional limitations are disclosed in other references in the same field of high-performance sail design, which together with *Maximum Sail Power* render these claims obvious. Other prior art from the last 50 years discloses sails meeting these limitations and provides specific examples and teachings for the various designs and fabrics used in sail making by a wide range of manufacturers

102. As discussed above, in paragraphs 73, 75, 78, 85, 90, 96, and 98,

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claims 4-6, 9, 12, 21, and 22 are alternatively rendered obvious over *Maximum Sail Power* (EX1017) in view of the references discussed in those paragraphs.

103. Claim 16 depends on claim 1, and specifies the first material comprises a gradient of reducing elasticity in a direction from luff to leech, defined by its failure strain or average Young's Modulus, or a combination. Claim 16 is obvious based on *Maximum Sail Power* in view of U.S. Patent No. 5,097,783 to Linville ("Linville") (EX1018). See col. 8, l. 13-35 which discloses a gradient of fabric denier from 5000 to 10,000 to 18,000 denier/g in direction from luff to leech. See also Linville Claim 2: "wherein the denier density of strands of stretch resistant polymer in layer (ii) varies between the segments in each panel, the high density [18,000 denier/g] being located nearest the leech of said sail and the lower density [5,000 denier/g] being located in segments nearest the luff of the sail." It is well known that denier density is directly proportional to stretch resistance and inversely proportional to how much reversible stretch a fiber can undergo. To the extent possible, a POSITA would be motivated to utilize a range of materials that were more elastic in the luff and progressively less elastic towards the leech for greater control of sail shape. In the case of composite sails in particular, the density of the fibers used to address the loads in each region of the sail can be

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varied smoothly and extensively. These concerns, techniques and benefits are well known to a POSITA. A POSITA would have been motivated to combine the teachings of Linville with *Maximum Sail Power*, because both references are related to the field of high performance sail design. It would be an obvious design choice to use fabrics with different modulus and failure strain in place of different denier density to achieve a gradient as in Linville, since modulus and failure strain are just alternative ways to characterize elasticity.

104. Claim 17 depends on claim 16, and specifies that the first material comprises polyester. As noted above for claim 1, page 60 of *Maximum Sail Power* states: “.... the sailmaker can design the sail with low-stretch Kevlar yarns in the high-load areas and a regular polyester in the rest of the sail.” The rest of the sail referred to in this passage includes the luff. Thus, *Maximum Sail Power* discloses the added limitation of claim 17, since this passage discloses using polyester in the luff of the sail, which is the first material in Collie’089 claim 1. Consequently, claim 17 is obvious over *Maximum Sail Power* in view of Linville as applied to claim 16 in paragraph 103, above.

105. Claim 18 depends on claim 16, and adds the limitation that the first material comprises polyester in combination with one or more of aramid and

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UHMWPE. *Maximum Sail Power* (EX1017) in Chapter Two on yarns used for sailcloth, states, on page 24, that “Fabric makers are not the type to let the bad properties of a particular yarn stand in the way of progress, and they are constantly working to combine fibers. These hybrid fabrics exploit the strengths of individual yarns while minimizing the weaknesses.” Thus, absent a showing of criticality, it is an obvious design choice to combine polyester with another common sailcloth fiber, such as UHMWPE or an aramid, to exploit the strengths and minimize the weaknesses of the fibers, as taught by *Maximum Sail Power*. Thus, claim 18 is obvious over *Maximum Sail Power* in view of Linville, as applied to parent claim 16.

B. Invalidity Based on U.S. Patent No. 5,097,783 (EX1018), to Linville as the Primary Reference.

106. The Linville patent (EX1018) anticipates many of the claims. The teachings of Linville can also be supplemented with the teachings of additional references in the field of sail design for claims where certain claim limitations may not be explicitly taught by the primary references. These supplemental, or "secondary" references discussed herein include *Maximum Sail Power* (EX1017), an article on common sailcloth materials by Michele Cali et al. ("Cali") (EX1022); a 1927 U.S. Patent No. 1,613,890 to Herreshoff ("Herreshoff") (EX1024), a

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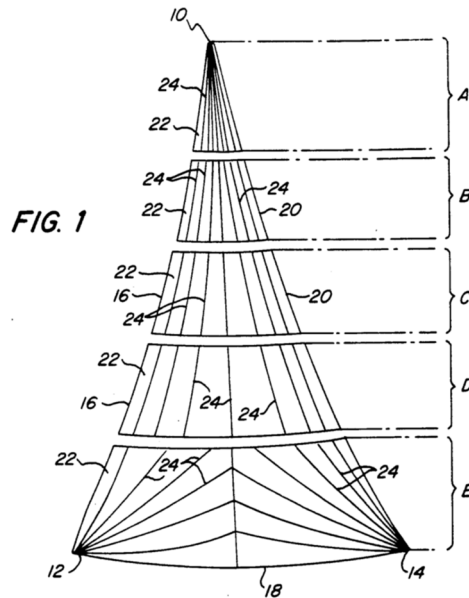
technical guide for Kevlar brand fibers (“DKG”) (EX1032), U.S. Patent No. 2,561,253 (1951) to Wells-Coates (“Wells-Coates”) (EX1015), U.S. Patent No. 2,569,318 (1951) to Kersten (“Kersten”) (EX1016), U.S. Patent No. 4,064,821 (1977) to Roberts (“Roberts”) (EX1021), the 2018 America’s Cup Rules (ACR, EX1013), and a 2019 publication from patent owner Team New Zealand (TNZ, EX1014).

i. Claims 1-3, 7, 10, 11, 16-20, 22, and 23 Are Anticipated by Linville (EX1018)

107. As also discussed below, U.S. Patent No. 5,097,783 to Linville (“Linville”) (EX1018), either alone or in view of common knowledge of a POSITA, discloses all the limitations of claims 1-3, 7, 10, 11, 16-20, 22, and 23 (see also Table 2, attached). Thus, these claims are anticipated by Linville.

108. Regarding Claim 1, Linville shows a conventional sail assembly in Fig. 1:

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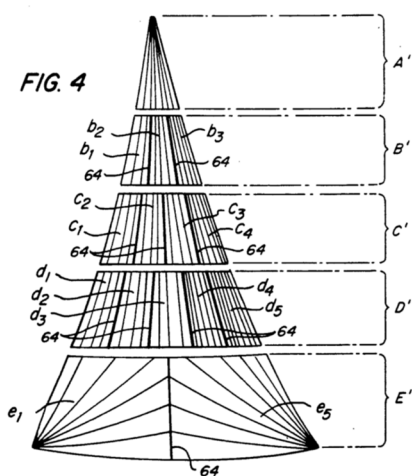
Linville Fig. 1

As Linville states, Fig. 1; col 4, lines 49-51; "...the sail when assembled from the five panels would have a head (10), a tack (12), a clew (14), a luff (16), a foot (18) and a leech (20)." Giving the term "luff region" its broadest reasonable interpretation as a region or portion of a sail near or at the luff, a POSITA would understand that the luff region of the sail in Fig. 1 is made up of the panels on the left side of the sail, running between the tack and the head. The remainder of the sail is made up of the panels along the leech and in the middle of the sail.

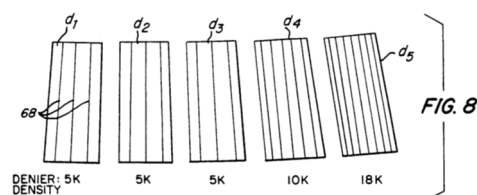
109. The luff region of Linville has a higher elasticity because the denier density increases from the luff to the leech as described with Fig. 4 and Fig. 8 at col. 8, lines 19-32 by the numbers given for different materials. This is graphically shown in Fig. 8 where the lines 68 represent denier with the stiffest material on the

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right at 18K. The lower strand denier which is at the luff region (5000) is more elastic than the higher strand denier which is at the leech region (18000). To a POSITA, this means that the luff is more elastic than the remainder of the sail. Thus, this limitation of claim 1 is met.



Linville Fig. 4



Linville Fig. 8

110. Claim 1 calls for the luff region being “a first material and a remainder of the sail includes at least a second material...” and the materials are different. The different materials used in the luff and leech regions having different denier densities discussed meets this limitation and the next limitation which is that the two materials be different.

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111. Finally, claim 1 calls for “an average stiffness of the second material is in a range of 2-20 times higher than an average stiffness of the first material.” It is well known to a POSITA that the fabric stiffness in the direction of the fibers is directly proportional to the denier density. Denser fabrics of the same material are stiffer and the term “denier density” or “denier per inch” (DPI) is commonly used in the art to describe different levels of stiffness. Linville describes a leech panel of 18000 denier density which is **3.6 times stiffer** than the described luff panel of 5000 denier density. See col. 8, lines 19-32; see also Fig 4 and Fig. 8. Arriving at the full range of values in claim 1 would just involve routine optimization well within the level of skill of a POSITA in the field of high-performance sail design. Therefore, Linville discloses a sail with a remainder and luff stiffness values in the range of claim 1. All of the claim elements of claim 1 are met by Linville and therefore it is anticipated.

112. Claim 2 depends on claim 1, and specifies that the sail is a mainsail. The Linville Abstract begins with: “A composite sail (mainsail, ...): Claim 9 of Linville also is directed to mainsail. Thus, Linville anticipates claim 2.

113. Claim 3 depends on claim 1, and specifies that the sail is a headsail. The Linville Abstract subsequently refers to a jib and spinnaker which is known in

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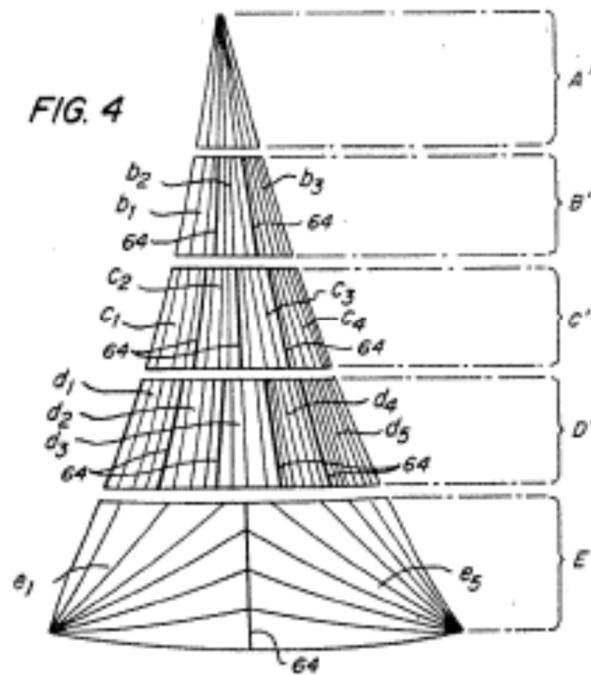
the art as a headsail. Claim 8 of Linville also is directed to a jib, which is a headsail. Thus, Linville anticipates claim 3.

114. Claim 7 of Collie'089 depends on claim 1, and specifies that the first material has an average elasticity that is at least about 100% to about 2400% higher (i.e., 2 to 25 times greater) than an average elasticity of the second material. Col. 8, lines 19-32 of Linville, discusses the different denier densities of leech and luff materials which also allows a calculation of the different elasticities. In this passage of Linville, the first material (luff) is 5000 denier density and the second material (leech) has a denier density of 18000. The 10000 denier density portion of the remainder or "second material" is twice as stiff as the luff region. This means that the luff region has an elasticity that is 2 to 3.6 times greater than the leech or remainder of the sail ($10000/5000 = 2$; $18000/5000 = 3.6$). A 3.6 times greater elasticity equates to 260% higher elasticity and two times greater elasticity equates to 100% higher elasticity. Thus, Linville anticipates claim 7.

115. Claim 10 depends on claim 1 and specifies that the first material extends at least 50% to about 95% of a distance between the head and tack of the sail. As shown in Linville Fig. 4, below, the luff panels on the left-hand side of the sail extend between the tack 12 and the head 10 with panels b_1 , c_1 and d_1 being

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about 70 to 75 percent of the distance.



Thus, Linville anticipates claim 10.

116. Claim 11 depends on claim 1, and specifies that the first material extends up to about 10% to about 50% of a width of the sail towards a leech of the sail. Fig. 4 of Linville (above) shows that the luff panels on the left side of the sail (panels b₁, c₁ and d₁) extend about 20% to 33% of the way from the luff to the leech. Thus, Linville anticipates claim 11.

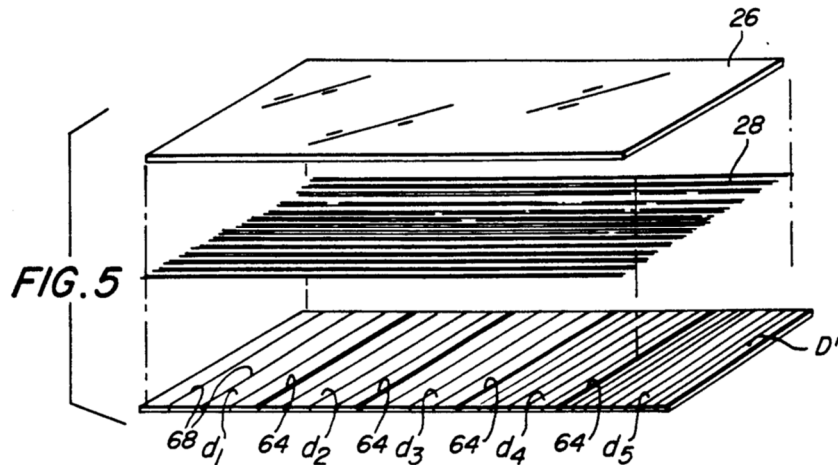
117. Claim 16 depends on claim 1, and specifies the first material comprises a gradient of reducing elasticity in a direction from luff to leech, defined

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by its failure strain or average Young's Modulus, or a combination. See col. 8, lines 13-35 which discloses a gradient of fabric denier from 5000 to 10,000 to 18,000 denier/g in direction from luff to leech. See also Linville Claim 2: "wherein the denier density of strands of stretch resistant polymer in layer (ii) varies between the segments in each panel, the high density [18,000 denier/g] being located nearest the leech of said sail and the lower density [5,000 denier/g] being located in segments nearest the luff of the sail." It is common knowledge to a POSITA that denier density is directly proportional to stretch resistance and inversely proportional to how much reversible stretch (elasticity) a fiber can undergo. In addition, it is common knowledge to a POSITA that failure strain and Young's Modulus are just alternatives to using denier density to characterize the elasticity or stiffness of a material. Thus, claim 16 is anticipated by Linville.

118. Claim 17 depends on claim 16, and specifies that the first material comprises polyester. As shown in Linville Fig. 5 and discussed at col. 5, lines 21-23, "Layer (26) is a dimensionally stable polymeric film such as an oriented polyester film of which Mylar is typical."

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The d_1 side of Fig. 5 is the luff region (see Fig. 4), and is the first material according to the language of Collie'089. Thus, Linville anticipates claim 17, since this passage discloses using polyester in the luff of the sail, which is the first material in Collie'089 claim 1.

119. Claim 18 depends on claim 16, and specifies that the first material “comprises polyester in combination with one or more of aramid and UHMWPE.” Linville teaches this combination. Col. 7, lines 41-45 of Linville discloses that luff material comprises Mylar polyester film in combination with Kevlar fibers “The material illustrated in FIG. 7 comprises a web (66) of film such as Mylar to which has been bonded by adhesive a warp of individual substantially parallel strands (68) of Kevlar fiber or like stretch resistant synthetic polymer.” Linville discloses that Mylar is a polyester and Kevlar is an aramid; see e.g., col. 4, l. 55-57

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“Illustrative are the drawn, oriented polyester films such as available under the trademark Mylar”; and col. 5, l. 1: “...an aramid such as Kevlar.” Thus, claim 18 is anticipated by Linville.

120. Claim 19 depends on claim 1, and specifies that a difference in elasticity between the luff region and the remainder of the sail is achieved by a lesser material thickness in the luff region compared with the remainder of the sail. It is common knowledge to a POSITA that one way to achieve a more elastic portion of a sail is to include fewer yarns in a given area where higher elasticity is desired, compared to a greater number of yarns in other areas, assuming the yarns are made from the same material. FIG. 4 of Linville, provided in paragraph 115, above, shows just such a sail, in which the greater number of Kevlar yarns is used in the leech area of the sail (on the right hand side) and fewer Kevlar yarns in the luff area (on the left). A POSITA would understand that a sailcloth fabric with a higher yarn density would also be thicker than a sailcloth panel with a lower yarn density, as more yarns generally equates with thicker fabric. Thus, Linville also anticipates claim 19.

121. Claim 20 depends on claim 1 and adds the limitation that an orientation of a material in the luff region is different from an orientation of a

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material in the remainder of the sail, such that the luff region has a higher degree of elasticity compared to the remainder of the sail. Fig. 12 of Linville shows the panels I'-V' "cut substantially parallel to the leech" as stated in column 8, ll. 48-50. Fig. 12 of Linville is shown below:

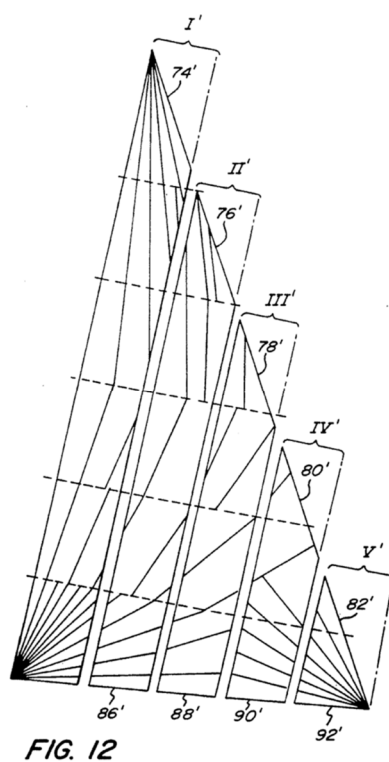


Fig. 12 is illustrated with the leech to the left and the luff to the right. The panels in the luff region of II', III', and IV' are all oriented with the warp strands at angles relative to the luff, which would align the stretchier bias of the panels generally in the direction of the luff. In contrast, the panels along the leech are oriented with the warp fibers running roughly parallel to the leech, making the leech stiffer than

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the luff region. Thus, Linville discloses this added limitation and anticipates claim
20

122. Claim 22 depends on claim 1, specifying a twin-skin mainsail wherein each skin has a luff region extending along the luff and each luff region has a higher degree of elasticity compared to a remainder of the respective skin sail.

123. The twin-skin sail configuration is common knowledge to a POSITA, as evidenced by the 1927 patent, U.S. Patent No. 1,613,890 to Herreshoff ("Herreshoff") (EX1024). Many other patents teach the use of twin-skin sails, over the years since 1927, including U.S. Patent No. 2,561,253 (1951) to Wells-Coates ("Wells-Coates") (EX1015), U.S. Patent No. 2,569,318 (1951) to Kersten ("Kersten") (EX1016), and Patent No. 4,064,821 (1977) to U.S. Roberts ("Roberts") (EX1021). In addition, patent owner Team New Zealand was instrumental in including the twin-skin sail design into the rules for the America's Cup race in March of 2018 (ACR, EX1013). See also Team New Zealand's own discussion of twin-skin sails in 2019 (TNZ, EX1014). In particular, Fig. 2 and claim 1 of Herreshoff disclose a sailboat with two mainsails each having a twin-skin sail design. The patents above do not describe any difference in construction for the two skins. Thus, claim 22 is anticipated by Linville (EX1018) and common

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knowledge of a POSITA as evidenced by any one of Herreshoff (EX1024), Wells-Coates (EX1015), Kersten (EX1016), Roberts (EX1021), the 2018 America's Cup Rules (EX1013) and the 2019 Team New Zealand publication (EX1014).

124. In the alternative, claim 22 is obvious over Linville in view of any of Herreshoff (EX1024), ACR (EX1013), TNZ (EX1014), Wells-Coates (EX1015), Kersten (EX1016), and/or Roberts (EX1021). Based on the teachings of these references, it would have been obvious for a POSITA to combine the teachings of Linville with any of these other references to make a twin-skinned mainsail because of the advantage of such sails providing less drag because it better diverts the wind flow around the mast as taught. It would be an obvious design choice to make both sail skins with the same construction since the sail has to operate in the same manner on each side, depending on the boat's sailing direction relative to the wind direction. A POSITA would know that a twin-skin mainsail has the advantage of less drag because it better diverts the wind flow around the mast as taught.

125. Claim 23 is very similar to claim 1 with regard to the initial limitations numbered 23.A through 23.F in Table 2, attached. Thus, my discussion in above paragraphs 108 to 111 regarding the teachings of Linville, applies equally

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to the corresponding limitations of claim 23.

126. With respect to the last limitation of claim 23 "wherein in a luff direction, a ratio of a stiffness of regions outside the luff region and the stiffness of the luff region is in the range of 2-25 times greater", this limitation is very similar to the last limitation of claim 1, except that it specifies stiffness in "a luff direction" and increases the range of stiffness for the regions outside the luff region (i.e., the "remainder of the sail" in claim 1) from 2-20 times higher in claim 1, to 2-25 times greater in claim 23. As can be seen by Fig. 7A, the Linville panels are cut in the direction of strands 68 and the specification discusses the denier density of the strands that are aligned from the foot 18 upward toward the head 10, so the luff direction is what Linville uses when disclosing stiffness. Thus, Linville discloses all of the limitations of claim 23 of Collie'089.

ii. Claims 4-6, 9, 12, 17-19, 21, and 22 are Obvious over Linville as Primary Reference.

127. While Linville (EX1018) may not explicitly disclose the added limitations of claims 4-6, 9, 12, 17-19, 21 and 22, a POSITA would find that these additional limitations are disclosed in several other references in the same field of high-performance sail design, which are discussed in more detail, below.

128. Regarding claims 4-6, Cali (EX1022) discusses the properties of

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commonly used sailcloth materials, explains and supplies all of the limitations not explicitly disclosed in Linville.

129. Claim 4 depends on claim 1, and specifies that the first material has a failure strain of at least about 2.5% to about 30%. Linville teaches that the first material can comprise a polyester, such as Mylar (see col. 5, ll. 21-23, which refers to Fig. 5, and states: “Layer (26) is a dimensionally stable polymeric film such as an oriented polyester film of which Mylar is typical.”). Linville col. 5, lines 27-30 states “The inner layer (28) of the laminate comprises a warp of substantially parallel, spaced apart strands of a synthetic polymer, advantageously Kevlar or like aramides[sic]”. It is common knowledge of a POSITA that failure strain is just another way of characterizing elasticity or stiffness of a material. Cali (EX1022), in Table 2 on p. 1654, lists the failure strain (referred to as “Strain max” in Cali) of a number of commonly used sailcloth materials, all of which comprise various yarns sandwiched between sheets of polyester (e.g., Mylar) as in Linville. All of the sailcloth materials listed in Table 2 of Cali have failure strains within the range specified in claim 4 (about 2.5% to about 30%). While Kevlar CZ 15 has a listed failure stain of 2.3%, a POSITA would still consider this to be “about 2.5%” as there is no specific definition of how much variance is allowed by the word

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“about” in Collie’089. In addition, Kevlar FLEX, which comprises Kevlar yarns disposed between polyester sheets, like the materials of Linville, has a failure strain of 2.7%, which is literally within the range of Collie’089 claim 4. Thus, claim 4 is obvious over Linville (EX1017) in view of Cali (EX1022). A POSITA would have been motivated to combine the teachings of Cali with Linville because both references are in the field of sail design, and Cali provides elasticity property information on common sailcloth materials of similar design as the materials of Linville.

130. Claim 5 depends on claim 1, and specifies that failure strain for the “first material” is about “2 to about 10 times the failure strain of the second material.” As discussed in paragraph 103 above, a POSITA would understand that denier density is just another way of characterizing stiffness or elasticity, as is failure strain, and that denier density is roughly directly proportional to stiffness and inversely proportional to elasticity. As discussed above in paragraph 114 above, Linville teaches using a denier density of 5000 in the luff region and 1000 to 18000 in the remainder of the sail (Linville, col. 8, lines 19-32). This equates to about 2 to 3.6 times greater stiffness in the second material of the remainder of the sail compared to the luff region. Since denier density and failure strain are just

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alternative characterizations of stiffness, a POSITA would recognize that the failure strain of the luff region of Linville will also have a failure strain that is within the range of 2 to 10 times greater than the failure strain of the second material. Thus, claim 5 is obvious over Linville.

131. Claim 6 depends on claim 1, and specifies an average Young's Modulus of about 1 to about 60 GPa for the first material. In addition, U.S. Patent No. 6,260,497 (2001) to Keire ("Keire") (EX1019), teaches the use of polyester fibers in the luff region of a sail similar in design to that of Linville. In particular, claim 10 of Keire states: "...the yarns of the third panel are continuous filament polyester yarns." The "third panel" referred in Keire is in the luff region of the sail (see Keire claim 8): "...a third panel...with a forward outer luff edge..."). The 2017 Kevlar Fiber Technical Guide (DKG) from DuPont (EX1032) disclosed on p. 7, Table II-2, that of polyester yarn has a modulus of 2.0×10^6 psi, which is equivalent to 13.7 GPa, which is also within the range of claim 6. Arriving at the full range of values in claim 6 would just involve routine optimization well within the level of skill of a POSITA in the field of high-performance sail design.

132. A POSITA would have been motivated to utilize the polyester yarns of Keire in the luff region of the Linville sails, because the sail designs of Linville

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and Keire are similar, and polyester is a known alternative to the aramid yarns for achieving a more elastic luff, as taught by Keire. A POSITA would look to DKG for properties of yarns used in composite sails such as those of Linville and Keire because Kevlar is one of the yarns specified in both Linville and Keire. Thus, claim 6 is obvious over Linville in view of Keire (EX1019), and further in view of DKG (EX1032).

133. Claim 7 depends on claim 1, and specifies that the first material has an average elasticity that is at least about 100% to about 2400% higher (i.e., 2 to 25 times greater) than an average elasticity of the second material. Col. 8, ll. 19-32 of Linville discusses the different denier densities of the leech and luff materials: "The denier density can be varied by varying number and/or the denier of strand (68) in the web ...The denier density of the intermediate segments may increase gradually from the luff to the leech...of the order of 18000 in segments b3, c4, d5 and e5, dropping to 10000 in segments b2, c3, d4 and e4, and dropping further to 5000 in all other segments..." This also allows a calculation of the different elasticities. It is common knowledge to a POSITA that fabric elasticity in the direction of the fibers is inversely proportional to the denier density. A luff panel with a denier density of 5000 is 3.6 times more elastic than a leech panel of 18000

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denier density, and twice as elastic as the intermediate panel of 10000 denier density. Two times more elastic equates to 100% higher elasticity, and 3.6 times more elastic equates to 260% higher elasticity. Thus, the luff region is between 100% and 260% more elastic than the remainder of the sail.

134. Claim 9 depends on claim 6, and specifies sailcloth fibers in the luff region of the sail which extend in an angle “greater than or equal to about 15 degrees free from fibres” parallel to the luff of the sail. Linville Fig. 12 (below) shows the panels I’-V’ “cut substantially parallel to the leech” as stated in column 8, lines 48-50. This indicates that the sail in Fig 12 is illustrated below with the leech to the left and the luff to the right. The panels in the luff region of II’, III’ and IV’ are all oriented with the warp strands at angles more than 15 degrees relative to the luff. for the luff on the left side being angled about 15 degrees relative to the luff. Thus, claim 9 is obvious over Linville in view of Keire (EX1019), and further in view of DKG (EX1032), for the same reasons as for parent claim 6.

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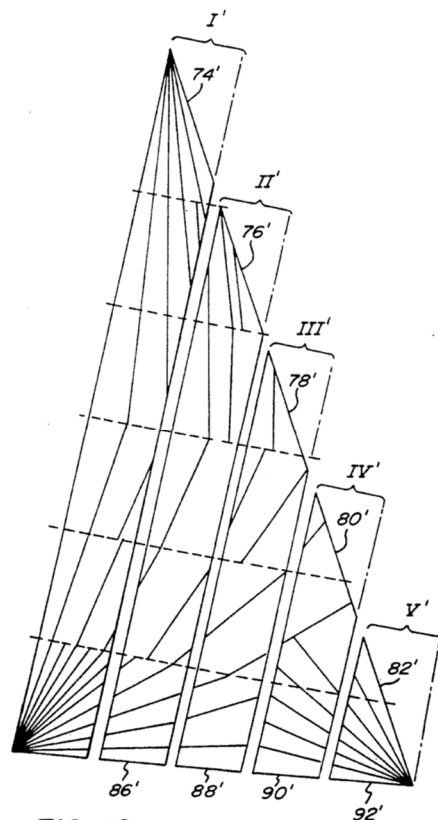
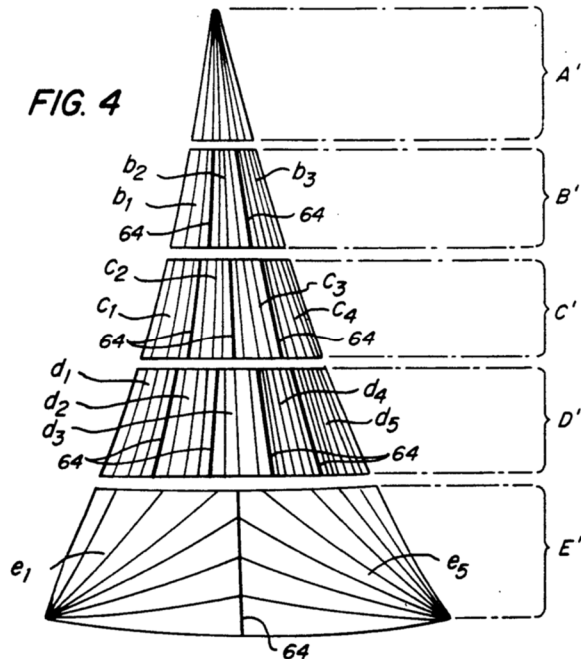


FIG. 12

135. Claim 12 depends on claim 9, and specifies that “first material extends towards a leech of the sail to a greater extent in the middle of the sail relative to a height of the sail compared to the luff regions towards the head and tack of the sail.” Linville in Fig 4 (below) shows the first material of the luff region on the left side of C¹ and D¹ extending further toward the middle of the sail than it does in B¹.

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In particular, FIG. 4, panels b_1 , c_1 , and d_1 constitute a first material in the luff region that extends to a greater extent in the middle of the sail than toward the head or the tack. Therefore, Linville also discloses this added limitation of claim 12. A POSITA would have been motivated to combine the teachings of Linville in view of Keire (EX1019), and further in view of DKG (EX1032) for the same reasons as set forth with regard to parent claim 6.

136. Claim 17 depends on claim 16, and specifies that the first material comprises polyester. U.S. patent No. 6,260,497 to Keire (EX1019) discloses a sail similar in structure to that of Linville, in that the sail is composed of yarns disposed between sheets of Mylar film, see e.g., Keire Fig. 2, below, showing warp

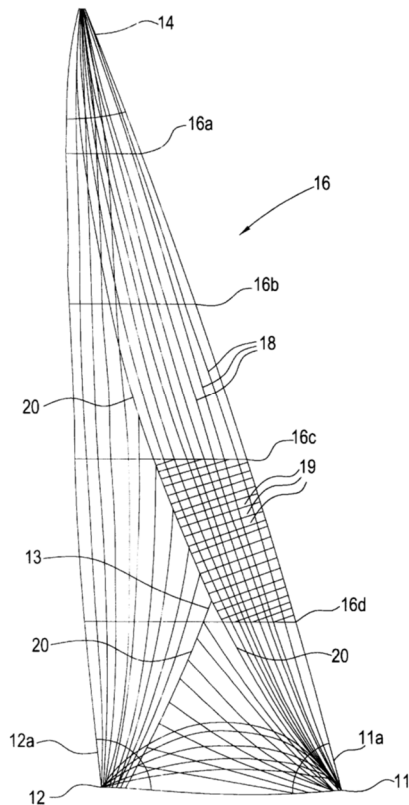
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threads 18 running from clew to head (on the right), from tack to head (on the left), and from tack to clew (at the bottom) forming three distinct panels, one in the luff region (on the left), one from the leech to the luff region (on the right), and one at the foot of the sail (at the bottom). Claim 8 of Keire describes the panel at the leech (right) side of the sail from clew to head as “a first panel”, the foot panel between the tack and the clew as “a second panel”, and the luff region panel running from tack to head as “a third Panel.” Claim 10 of Keire depends on claim 8, and specifies that the “third panel”, i.e., the luff region, comprises polyester yarns. Linville discloses a lower denier density in the luff region compared to the remainder of the sail, which a POSITA would recognize results in a luff region that is more elastic than the remainder of the sail that has higher denier density of yarns, as discussed above in paragraphs 109 to 111, with respect to claim 1. A POSITA would have been motivated to utilize the polyester yarns of Keire in the luff region of the Linville sails, because the sail designs of Linville and Keire are similar, and polyester is a known alternative to the aramid yarns for achieving a more elastic luff, as taught by Keire. Thus, claim 17 is obvious over Linville (EX1018) in view of Keire (EX1019).

Keire Fig. 2:

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FIG. 2



137. Claim 18 depends on claim 16, and adds the limitation that the first material comprises polyester in combination with one or more of aramid and UHMWPE. Linville teaches the use of aramid fibers in the luff region, as noted above in paragraph 119. *Maximum Sail Power* (EX1017), in Chapter Two on yarns used for sailcloth, states, on page 24, that “Fabric makers are not the type to let the bad properties of a particular yarn stand in the way of progress, and they are constantly working to combine fibers. These hybrid fabrics exploit the strengths of

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individual yarns while minimizing the weaknesses.” Thus, absent a showing of criticality, it is an obvious design choice to use a combination of the aramid of Linville with a polyester to exploit the strengths and minimize the weaknesses of the fibers, as taught by *Maximum Sail Power*. Thus, claim 18 is obvious over Linville in view of *Maximum Sail Power*.

138. Claim 21 depends on claim 1, and specifies that there are no carbon fibers oriented within 15 degrees of parallel to the luff in the luff region of the sail, whereas “the remainder of the sail” does have carbon fibers oriented within 15 degrees of parallel to the luff. Linville does not disclose using carbon fibers in the luff region of the sails described therein. According to *Maximum Sail Power*, page 23, “When used in sails carbon fibers are combined with more durable fibers like Kevlar ... The result is a measure of durability, without a sacrifice in modulus.” Also in *Maximum Sail Power* (EX1017), p. 20 photo caption: “Some fabrics are made from a blend of fibers such as Kevlar and carbon in order to maximize benefits of each.” A POSITA would be motivated to use a blend of carbon fibers in combination with Kevlar in areas of high load, like the leech area, as an obvious design choice to provide the desired high modulus of carbon with the improved durability of Kevlar, as taught in *Maximum Sail Power*. Thus, claim 21 is obvious

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over Linville (EX1018) in view of *Maximum Sail Power* (EX1017).

139. Claim 22 is discussed, above, as alternatively being obvious over Linville (EX1018) in view of any of Herreshoff (EX1024), Wells-Coates (EX1015), Kersten (EX1016), Roberts (EX1021), the 218 America's Cup Rules (EX1013) or the Team New Zealand publication (EX1014).

140. For the above reasons, I believe that U.S. Patent No. 12,110,089 to Collie is invalid.

DANIEL G. NERI, the undersigned declarant, further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18, United States Code.

Dated: June 26, 2025



Daniel G. Neri

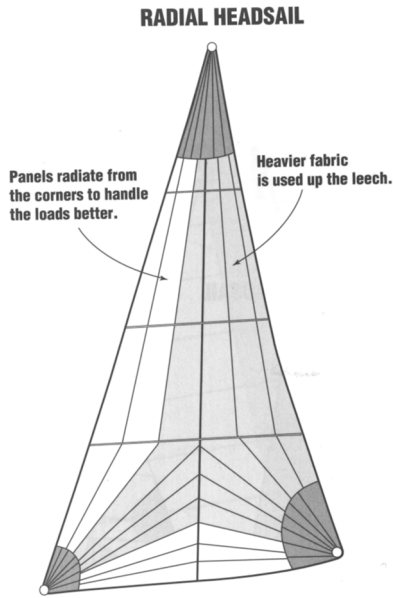
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TABLE 1

<p>Claim of Collie U.S. Pat. No. 12,110,089</p>	<p>Citations to Prior Art with the 2003 book <i>Maximum Sail Power</i> (MSP) by Brian Hancock, Nomad Press, as Primary Reference (EX1017)</p>
	<p>Secondary Refs:</p> <p>Cali: Michele Cali et al., "Comparison of Commonly Used Sail Cloths through Photogrammetric Acquisitions, Experimental Tests and Numerical Aerodynamic Simulations" <i>Procedia Manufacturing</i>, Volume 11, 2017, pages 1651-1658 (EX1022)</p> <p>Linville: US 5,097,783, Reinforced Sailcloth (1992) (EX1018)</p> <p>Herreshoff: US 1,613,890, Sail Boat (1927) (EX1024)</p> <p>Wells-Coates: US 2,561,253, Sailing Craft (1951) (EX1015)</p> <p>Kersten: US 2,569,318, Sail for Sailing Craft (1951), (EX1016)</p> <p>Roberts: US 4,064,821, Variable Camber Wing Sail (1977) (EX1021)</p> <p>DKG: Kevlar Aramid Fiber Technical Guide, 2017, DuPont Corp. ("DuPont Kevlar Guide") (EX1032)</p>

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TABLE 1

Claim of Collie U.S. Pat. No. 12,110,089	Citations to Prior Art with the 2003 book <i>Maximum Sail Power</i> (MSP) by Brian Hancock, Nomad Press, as Primary Reference (EX1017)
	TNZ: Team New Zealand publication (2019) (EX1014) ACR: America's Cup Rules (2018) (EX1013)
Claim 1	
[1.A] A sail comprising	MSP: p. 60, Fig. 4.10  <p style="text-align: center;">RADIAL HEADSAIL</p> <p>Panels radiate from the corners to handle the loads better.</p> <p>Heavier fabric is used up the leech.</p>
[1.B] a head,	MSP: p. 275, definition of head: "top of a sail";
[1.C] a tack,	MSP: p. 278, definition of tack: "the lower forward corner of a sail where it attached to the yacht"

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TABLE 1

Claim of Collie U.S. Pat. No. 12,110,089	Citations to Prior Art with the 2003 book <i>Maximum Sail Power</i> (MSP) by Brian Hancock, Nomad Press, as Primary Reference (EX1017)
[1.D] a luff extending between the head and the tack;	MSP: p. 276, definition of luff: "the leading edge of a sail"
[1.E] and a luff region extending along the luff;	MSP: p. 60, Fig. 4.10; "while lighter fabrics can be used in lower load areas like along the luff...."
[1.F] wherein the luff region has a higher degree of elasticity compared to a remainder of the sail,	<p>MSP: p. 60 "One of the principal benefits of radial sails is that the sail designer can engineer sails with different fabrics in different areas of the sail to address specific loads. In other words, heavier fabrics can be used along the leech of the sail or at the head and clew where loads are highest, while lighter fabrics can be used in lower load areas like along the luff.... the sailmaker can design the sail with low-stretch Kevlar yarns in the high-load areas and a regular polyester in the rest of the sail."</p> <p>MSP: p. 20 "[Kevlar] is stronger than steel for its weight and has a modulus five times greater than polyester."</p>
[1.G] wherein the luff region of the sail includes a first material	MSP: p. 60 "lighter fabrics can be used in lower load areas like along the luff...."

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TABLE 1

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[1.H] and a remainder of the sail includes at least a second material,	MSP: p. 60 “heavier fabrics can be used along the leech of the sail or at the head and clew where loads are highest”
[1.I] wherein the first material and the second material are different, and	MSP: p. 60 “.... the sailmaker can design the sail with low-stretch Kevlar yarns in the high-load areas and a regular polyester in the rest of the sail.”
[1.J] wherein an average stiffness of the second material is in a range of 2-20 times higher than an average stiffness of the first material.	<p>MSP: p. 60 “.... the sailmaker can design the sail with low-stretch Kevlar yarns in the high-load areas and a regular polyester in the rest of the sail.”</p> <p>MSP: p. 20 “[Kevlar] is stronger than steel for its weight and has a modulus five times greater than polyester.”</p> <p>MSP: p. 276 Definition of modulus: "a measure of a material's ability to resist stretch. Initial modulus is usually expressed as grams of load per unit stretch for a certain fiber denier. The higher the modulus, the less the fiber will stretch."</p>
Claim 2	The above for claim 1 and:
[2.A] The sail of claim 1, wherein the sail is a mainsail.	MSP: p. 60 "if the sail is going to be used for long cruising passages, similar patches can be used in other high-chafe

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TABLE 1

Claim of Collie U.S. Pat. No. 12,110,089	Citations to Prior Art with the 2003 book <i>Maximum Sail Power</i> (MSP) by Brian Hancock, Nomad Press, as Primary Reference (EX1017)
	areas, for example, where a mainsail rubs against shrouds or spreaders." <i>Thus, MSP discloses the sail can be a mainsail.</i>
Claim 3	The above for claim 1 and:
[3.A] The sail of claim 1, wherein the sail is a headsail.	MSP: p. 60, Fig. 4.10 includes the heading "Radial Headsail"
Claim 4	The above for claim 1 and:
[4.A] The sail of claim 1, wherein the first material has a failure strain of at least about 2.5% to about 30%.	MSP: p. 60 "... the sailmaker can design the sail with low-stretch Kevlar yarns in the high-load areas and a regular polyester in the rest of the sail." Cali: p. 1652: Nomenclature section defines Dacron as a polyester; p. 1654, Table 2: Strain max (failure strain) of: Dacron TNF 240: 12.2%
Claim 5	The above for claim 1 and:
[5.A] The sail of claim 1, wherein the first material has a failure strain of at least about 2 to about 10 times the failure strain of the second material.	MSP: p. 60 "... the sailmaker can design the sail with low-stretch Kevlar yarns in the high-load areas and a regular polyester in the rest of the sail."

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TABLE 1

Claim of Collie U.S. Pat. No. 12,110,089	Citations to Prior Art with the 2003 book <i>Maximum Sail Power</i> (MSP) by Brian Hancock, Nomad Press, as Primary Reference (EX1017)
	<p>Cali: p. 1652: Nomenclature section defines Dacron as a polyester, and Kevlar as a polyamide; p. 1654, Table 2: Strain max (failure strain) of: Dacron TNF 240: 12.2%; Kevlar CZ 15: 2.3%.</p> <p><i>Based on these numbers Dacron TNF 240 has a failure strain that is 5.3 times greater than Kevlar CZ 15.</i></p>
Claim 6	The above for claim 1 and:
[6.A] The sail of claim 1, wherein the first material has an average Young's Modulus of about 1 to about 60 GPa.	<p>MSP: teaches polyester as a first material (see claim 1, above).</p> <p>Cali: p. 1652: Nomenclature section defines Dacron as a polyester; p. 1654, Table 2: Weft modulus: Dacron TNF 240 polyester: 1050 MPa which is 1.050 GPa Pentex FLEX 15 (another polyester) weft modulus 3560 MPa (i.e., 3.560 GPa), warp modulus: 3400 MPa (i.e., 3.400 GPa).</p> <p><i>Alternatively, see DKG (EX1032): p. 7, Table II-2 showing the modulus of polyester yarn is 2.0×10^6 psi, which is equivalent to 13.7 GPa</i></p>

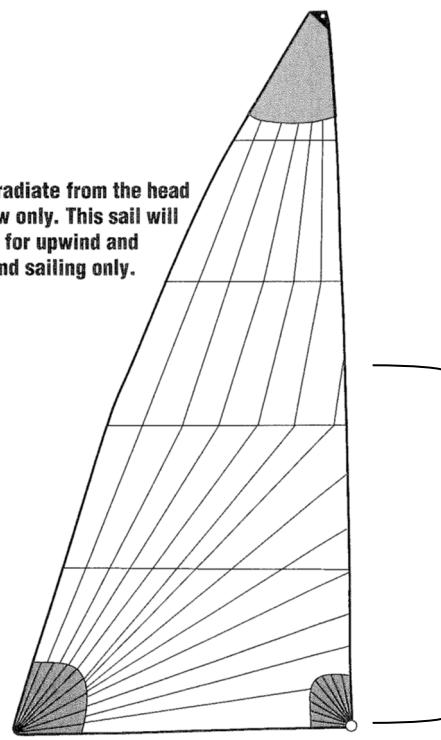
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TABLE 1

Claim of Collie U.S. Pat. No. 12,110,089	Citations to Prior Art with the 2003 book <i>Maximum Sail Power</i> (MSP) by Brian Hancock, Nomad Press, as Primary Reference (EX1017)
Claim 7	The above for claim 1 and:
[7.A] The sail of claim 1, wherein the first material has an average elasticity that is at least about 100% to about 2400% higher than an average elasticity of the second material.	<p>MSP: <i>MSP teaches polyester as a first material and Kevlar as a second material (see claim 1, above).</i></p> <p>MSP: p. 20 “[Kevlar] is stronger than steel for its weight and has a modulus five times greater than polyester.”</p> <p><i>Five times greater modulus is 400% greater stiffness for the second material relative to the first material. Conversely, this is equivalent to 400% greater elasticity for the first material relative to the second material as stiffness and elasticity are inversely related.</i></p>
Claim 8	The above for claim 1 and:
[8.A] The sail of claim 1, wherein there is an absence of sail fibres, or sailcloth fibres, that extend in a direction parallel, or at least substantially parallel, to the luff in the luff region of the sail.	<p>MSP: p. 61 Fig. 4.11: <i>as noted in the figure caption, this figure shows a bi-radial sail in which load-bearing gores (panels) radiate out of the head and the clew only.</i></p> <p>MSP page 59, "...warp-oriented laminates were used to build radial sails."</p>

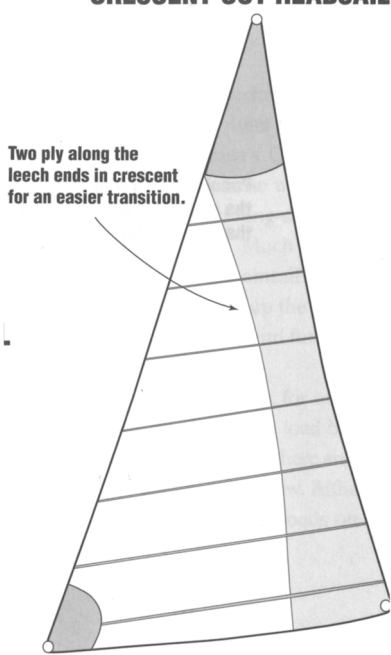
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TABLE 1

	<p>FIG. 4.11 on p. 61 of MSP:</p> <p>BI-RADIAL MAINSAIL</p> <p>Panels radiate from the head and clew only. This sail will be used for upwind and downwind sailing only.</p>  <p>The diagram illustrates a BI-RADIAL MAINSAIL, which is a triangular sail. It features a head (top vertex) and a clew (bottom right vertex). The sail is divided into several panels by lines radiating from the head and clew. The top panel is shaded gray. The bottom left corner is also shaded gray. The sail is shown in a vertical orientation, with a vertical line to its right representing the mast or boom.</p>
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TABLE 1

	<p>Fig. 4.8 on p. 59 of MSP:</p> <p style="text-align: center;">CRESCENT-CUT HEADSAIL</p>  <p style="text-align: center;"><i>Figure 4.8</i></p> <p><i>Giving “luff region” its broadest reasonable interpretation, the luff region can be defined as the portion opposite the bracket, in Fig. 4.11, and the light colored area of Fig. 4.8, both illustrated above. The panels of radial sails are all oriented in the warp direction, as noted on MSP page 59, quoted above. Thus, the load-bearing warp fibers of the panels luff region on the lower right portion of Fig. 4.11 are oriented at an angle such that there is an absence of sail fibers, or sailcloth fibers, that extend in a direction parallel, or at least</i></p>
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TABLE 1

Claim of Collie U.S. Pat. No. 12,110,089	Citations to Prior Art with the 2003 book <i>Maximum Sail Power</i> (MSP) by Brian Hancock, Nomad Press, as Primary Reference (EX1017)
	<i>substantially parallel, to the luff in the luff region of the sail. This is because both warp and weft (fill) fibers are at relatively large angle to the luff direction.</i>
Claim 9	The above for claims 1 and 6, and:
[9.A] The sail of claim 6, wherein there are sail fibres, or sailcloth fibres, in the luff region of the sail,	<p>MSP: p. 61 Fig. 4.11: as noted in the figure caption, this figure shows a bi-radial sail in which load-bearing gores (panels) radiate out of the head and the clew only.</p> <p>MSP page 59, "...warp-oriented laminates were used to build radial sails."</p>
[9.B] the sail fibres, or sailcloth fibres, extending in a line that leaves an angle of greater or equal than about 15 degrees free from fibres relative to a direction parallel to the luff of the sail.	<i>As noted above for claim 7, the panels are all oriented in the warp direction, as noted on MSP page 59, quoted above. As shown by the panel orientations in Fig. 4.11 illustrated above for claim 8, the load-bearing warp fibers of the panels in the lower right side of the sail (luff region) would be oriented at an angle significantly greater than 15 degrees free relative to the direction parallel to the luff. The fill or weft fibers would also be at an angle significantly</i>

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TABLE 1

Claim of Collie U.S. Pat. No. 12,110,089	Citations to Prior Art with the 2003 book <i>Maximum Sail Power</i> (MSP) by Brian Hancock, Nomad Press, as Primary Reference (EX1017)
	<i>greater than 15 degrees free relative to the direction parallel to the luff, since the fill is generally perpendicular to the warp in most fabrics.</i>
Claim 10	The above for claim 1 and:
<p>[10.A] The sail of claim 1, wherein the first material extends at least 50% to about 95% of a distance between the head and tack of the sail.</p>	<p>MSP: p. 60, Fig. 4.10</p> <div data-bbox="852 1003 1242 1596"> <p>The diagram, titled "RADIAL HEADSAIL", illustrates a sail with a triangular shape. It features a central vertical line (the luff) and several diagonal lines radiating from the top corner (the head) towards the bottom corners (the tacks). These lines divide the sail into multiple panels. Two callout boxes with arrows provide additional information: one points to the diagonal panels with the text "Panels radiate from the corners to handle the loads better.", and the other points to the outer edge (the leech) with the text "Heavier fabric is used up the leech." The sail is shown with a light-colored luff and darker panels, as described in the text below.</p> </div> <p><i>See light colored panels along the luff, which occupy at least about 70% to 80% of the distance from head to tack along the luff, as measured between the dark</i></p>

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TABLE 1

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	<i>colored reinforcement areas at the head and tack.</i>
Claim 11	The above for claim 1 and:
[11.A] The sail of claim 1, wherein the first material extends up to about 10% to about 50% of a width of the sail towards a leech of the sail.	MSP: p. 60, Fig. 4.10 <i>See panels along the luff which have a width of at least 10% of the sail width in the middle of the sail - approximately 1/3 of the distance from luff to leach based on the number of panels in each area.</i>
Claim 12	The above for claims 1, 6 and 9, and:
[12.A] The sail of claim 9, wherein the first material extends towards a leech of the sail to a greater extent in the middle of the sail relative to a height of the sail compared to the luff regions towards the head and tack of the sail.	MSP: p. 60, Fig. 4.10 <i>See panels along the luff which have a width of at least 10% of the sail width in the middle of the sail - approximately 1/3 of the distance from luff to leach based on the number of panels in each area.</i>
Claims 13-15	
	See Declaration of Thomas Whidden and Table 3 thereof.
Claim 16	The above for claim 1 and:
[16.A] The sail of claim 1, wherein the first material comprises a gradient of reducing elasticity in a direction from luff to leech, as defined by its:	Linville: col. 8, l. 13-35 discloses a gradient of fabric denier from 5000 to 10,000 to 18,000 denier/g in direction from luff to leech: col. 8, l. 25-33 "The denier density of the intermediate segments may increase gradually from

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TABLE 1

Claim of Collie U.S. Pat. No. 12,110,089	Citations to Prior Art with the 2003 book <i>Maximum Sail Power</i> (MSP) by Brian Hancock, Nomad Press, as Primary Reference (EX1017)
	<p>the luff to the leech of each panel. Illustratively, the denier density as expressed as total denier per inch measured transverse to the individual strands can be of the order of 18000 ... dropping to 10000 ... and dropping further to 5000 in all other segments."</p> <p><i>See also Linville</i> Claim 2: "wherein the denier density of strands of stretch resistant polymer in layer (ii) varies between the segments in each panel, the high density being located nearest the leech of said sail and the lower density being located in segments nearest the luff of the sail."</p> <p><i>It is well known that denier density is directly proportional to stretch resistance and inversely proportional to how much reversible stretch a fiber can undergo.</i></p>
<p>[16.B] (i) failure strain, or</p>	<p><i>Obvious design choice to use fabrics with different failure strain in place of different denier density to achieve a gradient as in Linville, since failure strain is just an alternative way to characterize elasticity.</i></p>

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[16.C] (ii) average Young's Modulus, or	<i>Obvious design choice to use fabrics with different modulus in place of different denier density to achieve a gradient as in Linville, since modulus is just an alternative way to characterize elasticity.</i>
[16.D] (iii) both (i) and (ii).	<i>Obvious design choice to use fabrics with different modulus and failure strain in place of different denier density to achieve a gradient as in Linville, since modulus and failure strain are just alternative ways to characterize elasticity.</i>
Claim 17	The above for claims 1 and 16, and:
[17.A] The sail of claim 16, wherein the first material comprises polyester.	<p>MSP: p. 60 “.... the sailmaker can design the sail with low-stretch Kevlar yarns in the high-load areas and a regular polyester in the rest of the sail.”</p> <p><i>Polyester corresponds to the first material of claim 1.</i></p>
Claim 18	The above for claims 1 and 16, and:
[18.A] The sail of claim 16, wherein the first material comprises polyester	MSP: p. 60 “.... the sailmaker can design the sail with low-stretch Kevlar

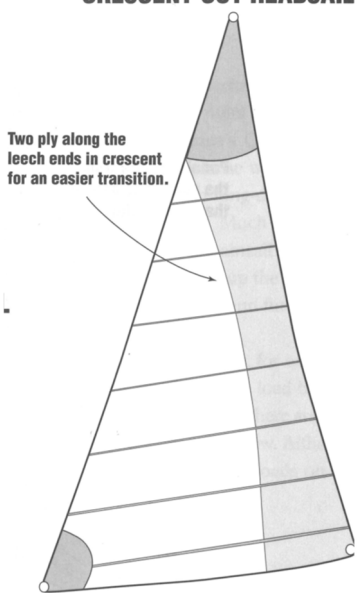
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TABLE 1

Claim of Collie U.S. Pat. No. 12,110,089	Citations to Prior Art with the 2003 book <i>Maximum Sail Power</i> (MSP) by Brian Hancock, Nomad Press, as Primary Reference (EX1017)
in combination with one or more of aramid and UHMWPE.	<p>yarns in the high-load areas and a regular polyester in the rest of the sail.”</p> <p>MSP: p. 24, “Fabric makers are not the type to let the bad properties of a particular yarn stand in the way of progress, and they are constantly working to combine fibers. These hybrid fabrics exploit the strengths of individual yarns while minimizing the weaknesses.”</p> <p><i>Absent a showing of criticality, it is an obvious design choice to combine polyester with another common sailcloth fiber, such as UHMWPE or an aramid, to exploit the strengths and minimize the weaknesses of the fibers, as taught by Maximum Sail Power.</i></p>
Claim 19	The above for claim 1 and:
[19.A] The sail of claim 1, wherein a difference in elasticity is achieved by a lesser material thickness in the luff region compared with the remainder of the sail.	MSP: FIG. 4.8 is illustrative:

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TABLE 1

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	<p style="text-align: center;">CRESCENT-CUT HEADSAIL</p>  <p style="text-align: center;"><i>Figure 4.8</i></p> <p>MSP: p. 56-59, Figs. 4.7, 4.8 and 4.9; use of two plies of fabric in the leech where loads are heaviest, and a single ply in the luff; two plies would be twice as stiff as one ply.</p> <p>See also MSP: p. 38: "...there is little need to have heavy fabric along the luff or in the body of the sail since these areas are subjected to very little loading. The leech, on the other hand, is an area in which a sail designer needs to be sure</p>

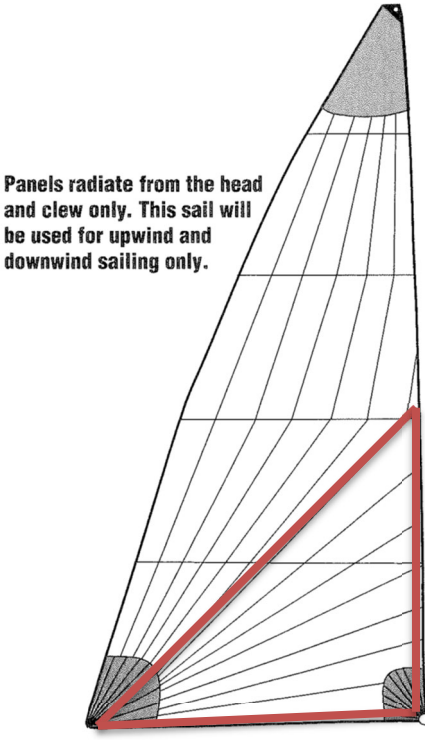
***Declaration of Daniel G. Neri in Support of
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TABLE 1

Claim of Collie U.S. Pat. No. 12,110,089	Citations to Prior Art with the 2003 book <i>Maximum Sail Power</i> (MSP) by Brian Hancock, Nomad Press, as Primary Reference (EX1017)
	to place a fabric with both high modulus and tensile strength."
Claim 20	The above for claim 1 and:
[20.A] The sail of claim 1, wherein an orientation of a material in the luff region is different from an orientation of a material in the remainder of the sail,	<p>MSP: p. 61 Fig. 4.11: as noted in the figure caption, this figure shows a bi-radial sail in which load-bearing gores (panels) radiate out of the head and the clew only.</p> <p>MSP page 59, "...warp-oriented laminates were used to build radial sails."</p>

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<p>Claim of Collie U.S. Pat. No. 12,110,089</p>	<p>Citations to Prior Art with the 2003 book <i>Maximum Sail Power</i> (MSP) by Brian Hancock, Nomad Press, as Primary Reference (EX1017)</p>
	<p>Fig. 4.11 (with the luff region in red): BI-RADIAL MAINSAIL</p>  <p>Panels radiate from the head and clew only. This sail will be used for upwind and downwind sailing only.</p>
<p>[20.B] such that the luff region has a higher degree of elasticity compared to the remainder of the sail.</p>	<p>MSP: p. 60 “One of the principal benefits of radial sails is that the sail designer can engineer sails with different fabrics in different areas of the sail to address specific loads. In other words, heavier fabrics can be used along the leech of the sail or at the head and clew where loads are highest, while lighter</p>

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	<p>fabrics can be used in lower load areas like along the luff.... the sailmaker can design the sail with low-stretch Kevlar yarns in the high-load areas and a regular polyester in the rest of the sail.”</p> <p><i>In the luff region adjacent the bracket, above (see claim 7 discussion above) the panels, and thus the warp and fill fibers, are oriented at an angle to the luff, such that the bias of the fabric is oriented generally in the luff direction. A POSITA would understand that the bias is more elastic than the warp or fill of a fabric.</i></p>
Claim 21	The above for claim 1 and:
[21.A] The sail of claim 1, wherein the luff region does not comprise any carbon fibres oriented within 15 degrees of parallel to the luff,	<p>MSP: p. 60 “One of the principal benefits of radial sails is that the sail designer can engineer sails with different fabrics in different areas of the sail to address specific loads. In other words, heavier fabrics can be used along the leech of the sail or at the head and clew where loads are highest, while lighter fabrics can be used in lower load areas like along the luff.... the sailmaker can design the sail with low-stretch Kevlar</p>

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	yarns in the high-load areas and a regular polyester in the rest of the sail.” <i>There is no mention of carbon fibers in the polyester luff.</i>
[21.B] and wherein the remainder of the sail does comprise carbon fibres oriented within 15 degrees of parallel to the luff.	MSP: p. 23, section on carbon fiber: "When used in sails carbon fibers are combined with more durable fibers like Kevlar ... The result is a measure of durability, without a sacrifice in modulus." MSP: p. 20 photo caption: "Some fabrics are made from a blend of fibers such as Kevlar and carbon in order to maximize benefits of each." <i>In the alternative, it is an obvious design choice to use a blend of Kevlar and carbon fibers to provide the desired high modulus of carbon with improved durability of Kevlar. There is no limitation of directionality of modulus in the passage on p. 20 of MSP.</i>

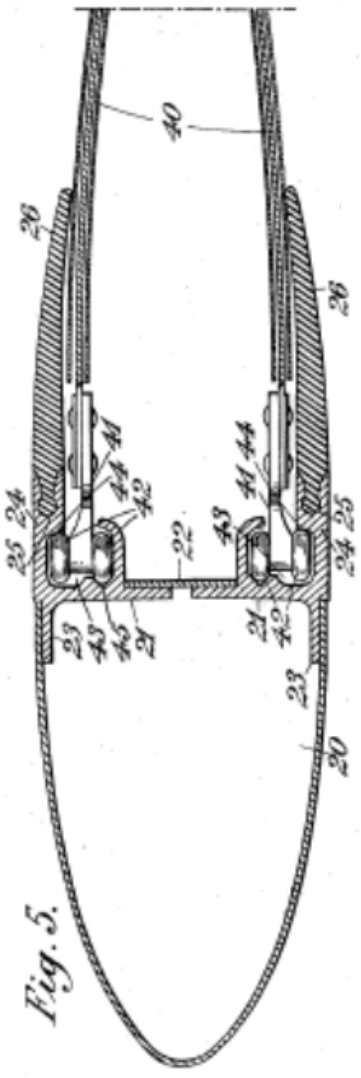
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<p>Claim 22</p>	<p>The above for claim 1 and:</p>
<p>The sail of claim 1, [22.A] wherein the sail is a twin skin mainsail</p>	<p><i>A twin skin mainsail design is common knowledge of a POSITA as evidenced by: Herreshoff. Claim 1 and FIG. 2.</i></p> <div data-bbox="987 804 1203 1430" data-label="Image"> </div> <p><i>The 1927 patent shows a sail boat with two mainsails each having a twin-skin sail design.</i></p>

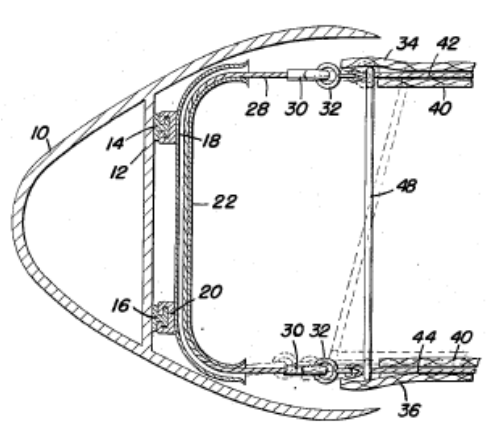
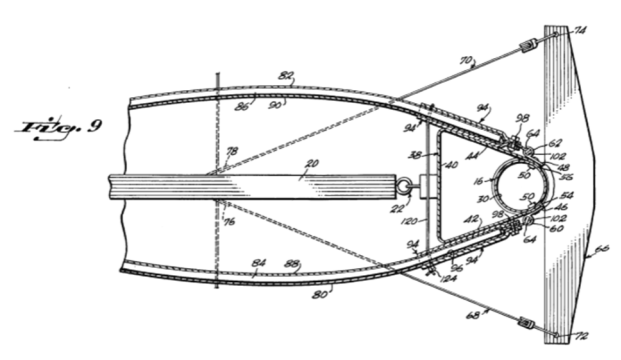
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TABLE 1

<p>[22.B] having two skins defining the sail,</p>	<p>Wells-Coates: US 2,561,253, Sailing Craft (1951) (EX1015), Fig. 5 shows twin-skins 40:</p>  <p style="text-align: center;"><i>Fig. 5.</i></p>
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TABLE 1

	<p>Kersten: US 2,569,318, Sail for Sailing Craft (1951), (EX1016), Fig. 4 shows twin-skins 34 and 36:</p>  <p style="text-align: center;"><i>Fig. 4.</i></p> <p>Roberts: US 4,064,821, Variable Camber Wing Sail (1977) (EX1021), Fig. 9 shows twin-skins 90 and 82:</p>  <p style="text-align: center;"><i>Fig. 9</i></p>
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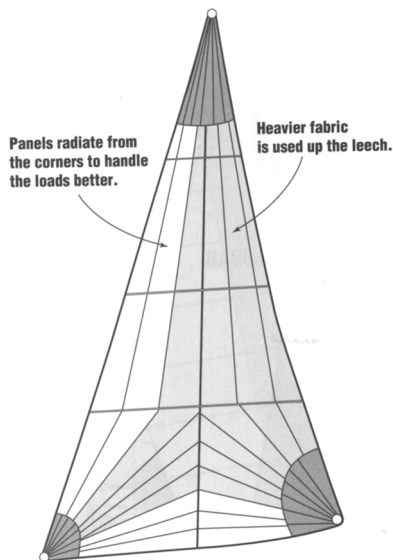
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	<p>TNZ: Team New Zealand publication (2019) (EX1014)</p> <p>ACR: America’s Cup Rules (2018) (EX1013)</p> <p><i>The above references show a sail boat with two mainsails each having a twin-skin sail design.</i></p>
<p>[22.C] wherein each skin has a luff region extending along the luff, [1.D] and wherein each luff region has a higher degree of elasticity compared to a remainder of the respective skin.</p>	<p><i>The above references show a sail boat with two mainsails each having a twin-skin sail design. The patents do not describe any difference in construction for the two skins. Thus, the same type of more elastic luff can be used.</i></p> <p><i>In the alternative, it would be an obvious design choice to make a twin skin mainsail of the same design as claim 1 and make both sail skins with the same construction, because both sail skins are subjected to the same wind conditions.</i></p>

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TABLE 1

Claim of Collie U.S. Pat. No. 12,110,089	Citations to Prior Art with the 2003 book <i>Maximum Sail Power</i> (MSP) by Brian Hancock, Nomad Press, as Primary Reference (EX1017)
Claim 23	
[23.A] A sail comprising	<p>MSP: p. 60, Fig. 4.10</p> <p style="text-align: center;">RADIAL HEADSAIL</p>  <p>The diagram illustrates a radial headsail with a triangular shape. It features a central vertical line and several diagonal lines radiating from the corners towards the center. Shaded regions are present along the edges and in the center. Two callout boxes with arrows point to specific areas: one on the left side pointing to the radiating panels, and one on the right side pointing to the leech edge.</p> <p>Panels radiate from the corners to handle the loads better.</p> <p>Heavier fabric is used up the leech.</p>
[23.B] a head,	MSP: p. 275, definition of head: "top of a sail";
[23.C] a tack,	MSP: p. 278, definition of tack: "the lower forward corner of a sail where it attached to the yacht"
[23.D] a luff extending between the head and the tack;	MSP: p. 276, definition of luff: "the leading edge of a sail"
[23.E] and a luff region extending along the luff;	MSP: p. 60, Fig. 4.10; "while lighter fabrics can be used in lower load areas like along the luff...."

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[23.F] wherein the luff region has a higher degree of elasticity compared to a remainder of the sail,	<p>MSP: p 60 “One of the principal benefits of radial sails is that the sail designer can engineer sails with different fabrics in different areas of the sail to address specific loads. In other words, heavier fabrics can be used along the leech of the sail or at the head and clew where loads are highest, while lighter fabrics can be used in lower load areas like along the luff.... the sailmaker can design the sail with low-stretch Kevlar yarns in the high-load areas and a regular polyester in the rest of the sail.”</p> <p>MSP: p. 20 “[Kevlar] is stronger than steel for its weight and has a modulus five times greater than polyester.”</p>
[23.G] wherein in a luff direction, a ratio of a stiffness of regions outside the luff region and the stiffness of the luff region is in the range of 2-25 times greater.	MSP: p. 60 “.... the sailmaker can design the sail with low-stretch Kevlar yarns in the high-load areas and a regular polyester in the rest of the sail.” The stretching is done in the direction of the luff.

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	<p>MSP: p. 20 “[Kevlar] is stronger than steel for its weight and has a modulus five times greater than polyester.”</p> <p>MSP: p. 276 Definition of modulus: "a measure of a material's ability to resist stretch. Initial modulus is usually expressed as grams of load per unit stretch for a certain fiber denier. The higher the modulus, the less the fiber will stretch."</p> <p><i>The statement in MSP about differences in modulus of polyester and Kevlar is not limited to any directionality. In addition, it is force on the tack which adjusts the sail because of the elasticity of the luff region in the luff direction.</i></p>

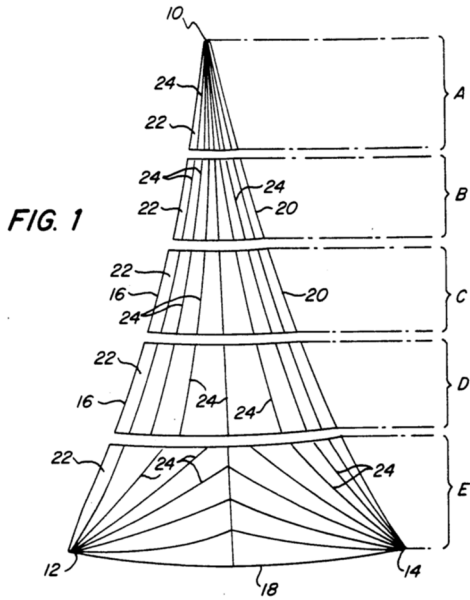
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TABLE 2

Claim of U.S. Pat. No. 12,110,089	Citations to Prior Art with Linville US 5,097,783 (EX1018) as Primary Reference
	<p>Secondary Refs:</p> <p>MSP: <i>Maximum Sail Power</i> (MSP) by Brian Hancock, Nomad Press (2003) (EX1017)</p> <p>Cali: Michele Cali et al., "Comparison of Commonly Used Sail Cloths through Photogrammetric Acquisitions, Experimental Tests and Numerical Aerodynamic Simulations" <i>Procedia Manufacturing</i>, Volume 11, 2017, pages 1651-1658</p> <p>Herreshoff: US 1,613,890, Sail Boat (1927) (EX1024)</p> <p>Wells-Coates: US 2,561,253, Sailing Craft (1951) (EX1015)</p> <p>Kersten: US 2,569,318, Sail for Sailing Craft (1951), (EX1016)</p> <p>Roberts: US 4,064,821, Variable Camber Wing Sail (1977) (EX1021)</p> <p>Keire: US 6,260,497 (2001) (EX1019)</p> <p>DKG: Kevlar Aramid Fiber Technical Guide, 2017, DuPont Corp. ("DuPont Kevlar Guide") (EX1032)</p>

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	<p>TNZ: Team New Zealand publication (2019) (EX1014)</p> <p>ACR: America's Cup Rules (2018) (EX1013)</p>
Claim 1	
[1.A] A sail comprising	<p>Linville: Fig. 1; col 3, l. 64-66; "FIG. 1 is a plan view of a conventional sail assembly..."</p> 
[1.B] a head,	<p>Linville: Fig. 1; col 4, l. 49-51; "...the sail when assembled from the five panels would have a head (10), a tack (12), a</p>

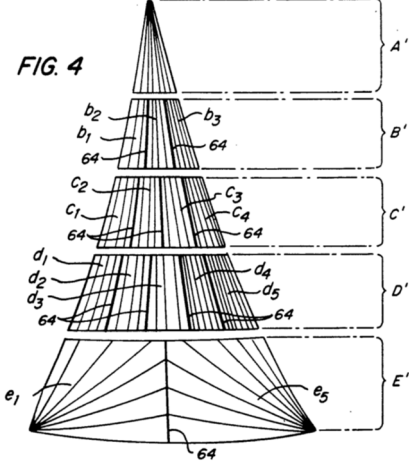
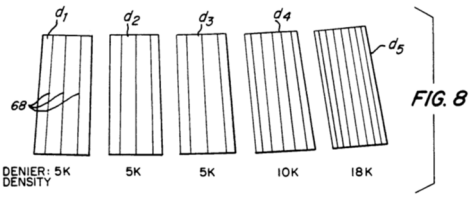
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TABLE 2

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	clew (14), a luff (16), a foot (18) and a leech (20)."
[1.C] a tack,	Linville: Fig. 1; col 4, l. 49-51; "...the sail when assembled from the five panels would have a head (10), a tack (12), a clew (14), a luff (16), a foot (18) and a leech (20)."
[1.D] a luff extending between the head and the tack;	Linville: Fig. 1; col 4, l. 49-51; "...the sail when assembled from the five panels would have a head (10), a tack (12), a clew (14), a luff (16), a foot (18) and a leech (20)."
[1.E] and a luff region extending along the luff;	Linville: Fig. 1; col 4, l. 49-51; "...the sail when assembled from the five panels would have a head (10), a tack (12), a clew (14), a luff (16), a foot (18) and a leech (20)." FIG. 4, col. 7, l. 27-38; panels b ₁ , c ₁ and d ₁ comprise a luff region extending along the luff.

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TABLE 2

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<p>[1.F] wherein the luff region has a higher degree of elasticity compared to a remainder of the sail,</p>	<p>Linville: FIG. 4; Fig. 8; col 8, l. 19-32; "The denier density can be varied by varying number and/or the denier of strand (68) in the web ... The denier density of the intermediate segments may increase gradually from the luff to the leech... of the order of 18000 in segments b₃, c₄, d₅ and e₅, dropping to 10000 in segments b₂, c₃, d₄ and e₄, and dropping further to 5000 in all other segments..."</p> 

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TABLE 2

Claim of U.S. Pat. No. 12,110,089	Citations to Prior Art with Linville US 5,097,783 (EX1018) as Primary Reference
	It is common knowledge to a POSITA that fabric elasticity in the direction of the fibers is inversely proportional to the denier density.
[1.G] wherein the luff region of the sail includes a first material	<p>Linville: Fig. 8; col 8, l. 19-32; "The denier density can be varied by varying number and/or the denier of strand (68) in the web ...The denier density of the intermediate segments may increase gradually from the luff to the leech...of the order of 18000 in segments b₃, c₄, d₅ and e₅, dropping to 10000 in segments b₂, c₃, d₄ and e₄, and dropping further to 5000 in all other segments..."</p> <p>A POSITA would recognize that segments with different denier densities are different materials, since the panels are not the identical and one cannot replace another without changing the properties of the sail.</p>
[1.H] and a remainder of the sail includes at least a second material,	<p>Linville: Fig. 8; col 8, l. 19-32; "The denier density can be varied by varying number and/or the denier of strand (68) in the web ...The denier density of the intermediate segments may increase gradually from the luff to the leech...of the order of 18000 in segments b₃, c₄, d₅</p>

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TABLE 2

Claim of U.S. Pat. No. 12,110,089	Citations to Prior Art with Linville US 5,097,783 (EX1018) as Primary Reference
	<p>and e₅, dropping to 10000 in segments b₂, c₃, d₄ and e₄, and dropping further to 5000 in all other segments..."</p> <p>A POSITA would recognize that segments with different denier densities are different materials, since the panels are not the identical and one cannot replace another without changing the properties of the sail.</p>
[1.I] wherein the first material and the second material are different, and	<p>Linville: Col 8, l. 19-32; "The denier density can be varied by varying number and/or the denier of strand (68) in the web ...The denier density of the intermediate segments may increase gradually from the luff to the leech...of the order of 18000 in segments b₃, c₄, d₅ and e₅, dropping to 10000 in segments b₂, c₃, d₄ and e₄, and dropping further to 5000 in all other segments..."</p> <p>Col. 8, lines 12-33 <i>discloses a sail with a stiffer material in the leech compared to the luff</i>: In particular, col 8, lines states: "In general, it is desirable to cut segments such as b, c, d, and e, which are located at the luff of each panel from webs in which the denier density is lower than that in the segments b₃, c₄, d₅, and e₅ located at the leech of each panel."</p>

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TABLE 2

Claim of U.S. Pat. No. 12,110,089	Citations to Prior Art with Linville US 5,097,783 (EX1018) as Primary Reference
	<p>A POSITA would recognize that segments with different denier densities are different materials, since the panels are not the identical and one cannot replace another without changing the properties of the sail.</p>
<p>[1.J] wherein an average stiffness of the second material is in a range of 2-20 times higher than an average stiffness of the first material.</p>	<p>Linville: Col 8, l. 19-32; "The denier density can be varied by varying number and/or the denier of strand (68) in the web ...The denier density of the intermediate segments may increase gradually from the luff to the leech...of the order of 18000 in segments b₃, c₄, d₅ and e₅, dropping to 10000 in segments b₂, c₃, d₄ and e₄, and dropping further to 5000 in all other segments..."</p> <p>It is common knowledge to a POSITA that fabric stiffness in the direction of the fibers is directly proportional to the denier density. A leech panel with a denier density of 18000 is 3.6 times stiffer than a luff panel of 5000 denier density, and the intermediate panel of 10000 denier density is twice as stiff as a luff panel of 5000 denier density in the direction of the fibers. Thus, the "second material of the remainder of the sail is at least twice as</p>

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TABLE 2

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	stiff as the “first material” of the luff region.
Claim 2	The above for claim 1 and:
[2.A] The sail of claim 1, wherein the sail is a mainsail.	<p>Linville: Abstract: “A composite sail (mainsail...)”;</p> <p>”Claim 9 "... wherein the sail is a mainsail."</p>
Claim 3	The above for claim 1 and:
[3.A] The sail of claim 1, wherein the sail is a headsail.	<p>Linville: Abstract: “A composite sail (mainsail, jib...)”</p> <p>Claim 8 "... wherein the sail is a jib sail."</p> <p><i>It is common knowledge to a POSITA that jibs are headsails.</i></p>
Claim 4	The above for claim 1 and:
[4.A] The sail of claim 1, wherein the first material has a failure strain of at least about 2.5% to about 30%.	<p>The above for claim 1 and:</p> <p>Linville: col. 5, ll. 21-23 refers to Fig. 5, and states: “Layer (26) is a dimensionally stable polymeric film such as an oriented polyester film of which Mylar is typical.”</p> <p>Cali: p. 1652: Nomenclature section defines Dacron as a polyester;</p>

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	<p>p. 1654, Table 2: Strain max (failure strain) of: Dacron TNF 240: 12.2%</p> <p>Table 2 of Cali also identifies that the Max strain (failure strain) of all but one of the listed common sailcloth fabrics is between 2.7 and 12.2. This includes Kevlar FLEX, which comprises Kevlar yarns disposed between polyester sheets, like the materials of Linville, has a failure strain of 2.7%, which is in the range of Linville, which also uses Kevlar fibers between Mylar sheets.</p> <p>Cali (EX1022), in Table 2 on p. 1654, lists the failure strain (referred to as “Strain max” in Cali) of a number of commonly used sailcloth materials, all of which comprise various yarns sandwiched between sheets of polyester (e.g., Mylar).</p> <p>It is common knowledge of a POSITA that failure strain is just another way of characterizing elasticity or stiffness of a material.</p> <p>A POSITA would have been motivated to combine the teachings of Cali with Linville because both references are in the field of sail design, and Cali provides elasticity property information on</p>

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	common sailcloth materials of similar design as the materials of Linville.
Claim 5	The above for claim 1 and:
[5.A] The sail of claim 1, wherein the first material has a failure strain of at least about 2 to about 10 times the failure strain of the second material.	<p>A POSITA would understand that denier density is just another way of characterizing stiffness or elasticity, as is failure strain, and that denier density is roughly directly proportional to stiffness and inversely proportional to elasticity.</p> <p>As discussed above for claim 1, Linville teaches using a denier density of 5000 in the luff region and 10000 to 18000 in the remainder of the sail (Linville, col. 8, lines 19-32). This equates to about 2 to 3.6 times greater stiffness in the second material of the remainder of the sail compared to the luff region. Since denier density and failure strain are just alternative characterizations of stiffness, a POSITA would recognize that the failure strain of the luff region of Linville will also have a failure strain that is within the range of 2 to 10 times greater than the failure strain of the second material.</p> <p>Arriving at the full range of values in claim 5 would just involve routine optimization well within the level of skill</p>

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TABLE 2

Claim of U.S. Pat. No. 12,110,089	Citations to Prior Art with Linville US 5,097,783 (EX1018) as Primary Reference
	of a POSITA in the field of high-performance sail design.
Claim 6	The above for claim 1 and:
[6.A] The sail of claim 1, wherein the first material has an average Young's Modulus of about 1 to about 60 GPa.	<p>Keire: (EX1019), teaches the use of polyester fibers in the luff region of a sail similar in design to that of Linville.</p> <p>In particular, claim 10 of Keire states: “...the yarns of the third panel are continuous filament polyester yarns.”</p> <p>The “third panel” referred in Keire is in the luff region of the sail (see Keire claim 8): “...a third panel...with a forward outer luff edge...”). , which is also within the range of claim 6. Arriving at the full range of values in claim 6 would just involve routine optimization well within the level of skill of a POSITA in the field of high-performance sail design.</p> <p>DKG: the 2017 Dupont Kevlar Guide (“DKG”, EX1032, p. 7, Table II-2) reports that of polyester yarn has a modulus of 2.0×10^6 psi, which is equivalent to 13.7 GPa, which is within the range of claim 6.</p> <p>Arriving at the full range of values in claim 6 would just involve routine</p>

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TABLE 2

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	<p>optimization well within the level of skill of a POSITA in the field of high-performance sail design.</p> <p>A POSITA would have been motivated to utilize the polyester yarns of Keire in the luff region of the Linville sails, because the sail designs of Linville and Keire is similar, and polyester is a known alternative to the aramid yarns for achieving a more elastic luff, as taught by Keire. A POSITA would look to DKG for properties of yarns used in composite sails such as those of Linville and Keire because Kevlar is one of the yarns specified in both Linville and Keire.</p>
Claim 7	The above for claim 1 and:
<p>[7.A] The sail of claim 1, wherein the first material has an average elasticity that is at least about 100% to about 2400% higher than an average elasticity of the second material.</p>	<p>Linville: Col 8, l. 19-32; "The denier density can be varied by varying number and/or the denier of strand (68) in the web ...The denier density of the intermediate segments may increase gradually from the luff to the leech...of the order of 18000 in segments b₃, c₄, d₅ and e₅, dropping to 10000 in segments b₂, c₃, d₄ and e₄, and dropping further to 5000 in all other segments..."</p> <p>It is common knowledge to a POSITA that fabric elasticity in the direction of the</p>

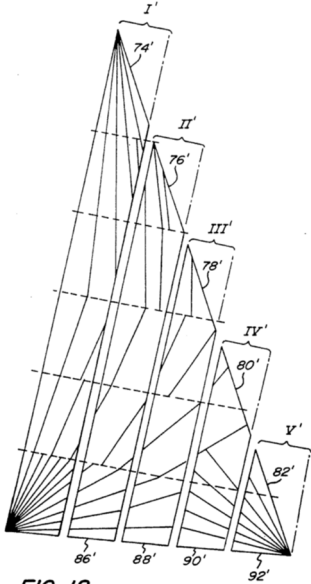
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	<p>fibers is inversely proportional to the denier density. A luff panel with a denier density of 5000 is 3.6 times more elastic than a leech panel of 18000 denier density, and twice as elastic as the intermediate panel of 10000 denier density in the remainder of the sail.</p> <p>Two times more elastic equates to 100% more elastic, and 3.6 times more elastic equates to 260% more elastic. Thus the luff region is between 100% and 260% more elastic than the remainder of the sail.</p>
Claim 8	Omitted:
Claim 9	The above for claims 1 and 6, and:
[9.A] The sail of claim 6, wherein there are sail fibres, or sailcloth fibres, in the luff region of the sail,	Linville: Fig. 12 shows the panels I'-V' "cut substantially parallel to the leech" as stated in Col. 8, ll. 48-50

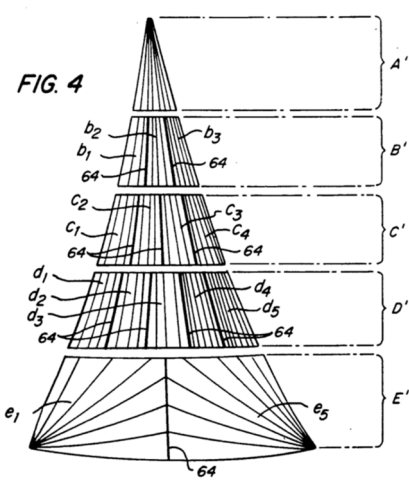
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Claim of U.S. Pat. No. 12,110,089	Citations to Prior Art with Linville US 5,097,783 (EX1018) as Primary Reference
	 <p style="text-align: center;">FIG. 12</p> <p>This indicates that the sail in Fig 12 is illustrated with the leech to the left and the luff to the right.</p>
[9.B] the sail fibres, or sailcloth fibres, extending in a line that leaves an angle of greater or equal than about 15 degrees free from fibres relative to a direction parallel to the luff of the sail.	The panels in the luff region (right side of FIG. 12) of II', III' and IV' are all oriented with at angles more than 15 degrees relative to the luff and thus the warp strands are also oriented more than 15 degrees relative to the luff. The fill (weft) strands in a fabric are oriented perpendicular to the warp strands. Thus,

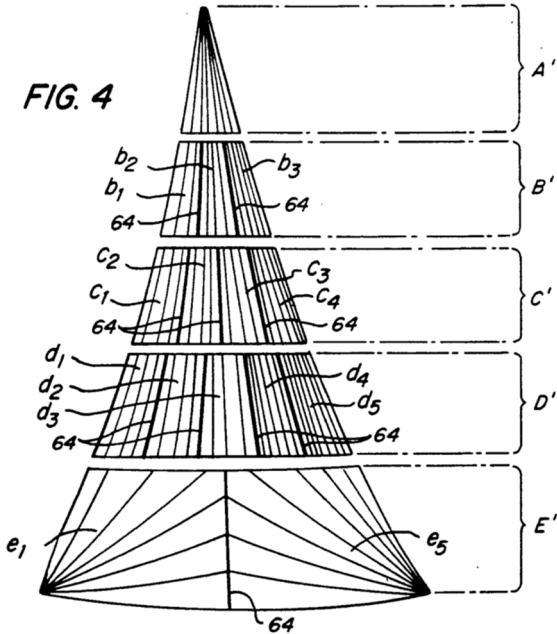
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	the fill strands are also oriented more than 15 degrees relative to the luff.
Claim 10	The above for claim 1 and:
[10.A] The sail of claim 1, wherein the first material extends at least 50% to about 95% of a distance between the head and tack of the sail.	Linville: FIG. 4, panels b ₁ , c ₁ , and d ₁ constitute a first material in the luff region that extends 70% to 80% of the distance between the head and the tack. See claim 11 below for Fig. 4.
Claim 11	The above for claim 1 and:
[11.A] The sail of claim 1, wherein the first material extends up to about 10% to about 50% of a width of the sail towards a leech of the sail.	<p>Linville: FIG. 4, panels b₁, c₁, and d₁ constitute a first material in the luff region that extends 10% to 50% of a width of the sail toward the leech.</p>  <p>Fig. 4 of Linville (above) shows that the luff panels on the left side of the sail</p>

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	(panels b ₁ , c ₁ and d ₁) extend about 20% to 33% of the way from the luff to the leech of the sail.
<p>Claim 12</p> <p>[12.A] The sail of claim 9, wherein the first material extends towards a leech of the sail to a greater extent in the middle of the sail relative to a height of the sail compared to the luff regions towards the head and tack of the sail.</p>	<p>The above for claims 1, 6, and 9, and:</p> <p>Linville: in FIG. 4, the left-most subpanels b₁, c₁, and d₁ together constitute a first material that extends towards a leech of the sail to a greater extent in the middle of the sail relative to a height of the sail compared to the luff regions towards the head and tack of the sail.</p> 

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Claims 13-15	
	See Declaration of Thomas Whidden and Table 3 thereof.
Claim 16	The above for claim 1 and:
[16.A] The sail of claim 1, wherein the first material comprises a gradient of reducing elasticity in a direction from luff to leech, as defined by its:	<p>Linville: col. 8, l. 13-35 discloses a gradient of fabric denier from 5000 to 10,000 to 18,000 denier/g in direction from luff to leech: col. 8, l. 25-33 "The denier density of the intermediate segments may increase gradually from the luff to the leech of each panel. Illustratively, the denier density as expressed as total denier per inch measured transverse to the individual strands can be of the order of 18000 ... dropping to 10000 ... and dropping further to 5000 in all other segments."</p> <p><i>See also Linville</i> Claim 2: "wherein the denier density of strands of stretch resistant polymer in layer (ii) varies between the segments in each panel, the high density being located nearest the leech of said sail and the lower density being located in segments nearest the luff of the sail."</p> <p>It is common knowledge of a POSITA that denier density is related to elasticity/stiffness.</p>

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[16.B] (i) failure strain, or	<p>It is common knowledge to a POSITA that failure strain is just an alternative to using denier density to characterize the elasticity or stiffness of a material.</p> <p>It is an obvious design choice to use fabrics with different failure strain in place of different denier density to achieve a gradient as in Linville.</p>
[16.C] (ii) average Young's Modulus, or	<p>It is common knowledge to a POSITA that Young's Modulus is just an alternative to using denier density to characterize the elasticity or stiffness of a material.</p> <p>It is an obvious design choice to use fabrics with different modulus in place of different denier density to achieve a gradient as in Linville.</p>
[16.D] (iii) both (i) and (ii).	<p>It is common knowledge to a POSITA that failure strain and Young's Modulus are just alternatives to using denier density to characterize the elasticity or stiffness of a material.</p> <p>It is an obvious design choice to use fabrics with different modulus and different failure strain in place of different</p>

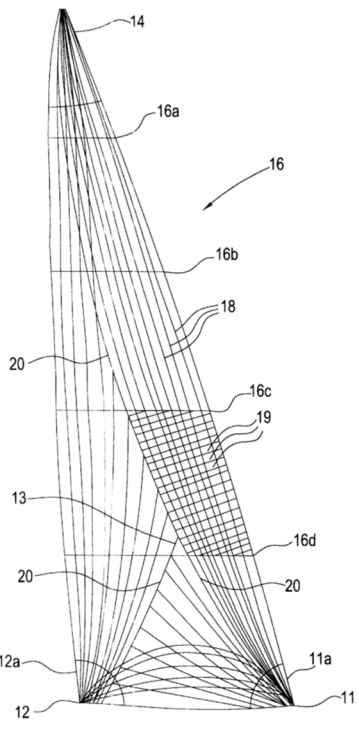
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Claim of U.S. Pat. No. 12,110,089	Citations to Prior Art with Linville US 5,097,783 (EX1018) as Primary Reference
	denier density to achieve a gradient as in Linville.
Claim 17	The above for claim 1 and:
[17.A] The sail of claim 1, wherein the first material comprises polyester.	Keire: Discloses a sail similar in structure to that of Linville, in that the sail is composed of yarns disposed between sheets of Mylar film, see e.g., Keire Fig. 2, showing warp threads 18 running from clew to head (on the right), from tack to head (on the left), and from tack to clew (at the bottom) forming three distinct panels, one in the luff region (on the left), one from the leech to the luff region (on the right) and one at the foot of the sail (in the bottom).

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	<p style="text-align: center;">FIG. 2</p>  <p>Claim 8 of Keire describes the panel at the leech (right) side of the sail from clew to head as “a first panel”, the foot panel between the tack and the clew as “a second panel”, and the luff region panel running from tack to head as “a third Panel.”</p> <p>Claim 10 of Keire depends on claim 8, and specifies that the “third panel”, i.e.,</p>

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	<p>the luff region, comprises polyester yarns. Linville discloses a lower denier density in the luff region compared to the remainder of the sail, which a POSITA would recognize results in a luff region that is more elastic than the remainder of the sail which has higher denier density of yarns.</p> <p>A POSITA would have been motivated to utilize the polyester yarns of Keire in the luff region of the Linville sails, because the sail designs of Linville and Keire is similar, and polyester is a known alternative to the aramid yarns for achieving a more elastic luff, as taught by Keire.</p>
Claim 18	The above for claim 1 and:
<p>[18.A] The sail of claim 1, wherein the first material comprises polyester in combination with one or more of aramid and UHMWPE.</p>	<p>Linville: Col. 7, lines 41-45 discloses luff material comprises Mylar polyester film in combination with Kevlar fibers: “The material illustrated in FIG. 7 comprises a web (66) of film such as Mylar to which has been bonded by adhesive a warp of individual substantially parallel strands (68) of Kevlar fiber or like stretch resistant synthetic polymer.”</p>

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	<p>MSP: Chapter Two on yarns used for sailcloth, states, on page 24, that “Fabric makers are not the type to let the bad properties of a particular yarn stand in the way of progress, and they are constantly working to combine fibers. These hybrid fabrics exploit the strengths of individual yarns while minimizing the weaknesses.”</p> <p>Thus, absent a showing of criticality, it is an obvious design choice for a POSITA to use a combination of the aramid of Linville with a polyester to exploit the strengths and minimize the weaknesses of the fibers, as taught by MSP.</p>
<p>Claim 19</p> <p>[19.A] The sail of claim 1, wherein a difference in elasticity is achieved by a lesser material thickness in the luff region compared with the remainder of the sail.</p>	<p>The above for claim 1 and:</p> <p>It is common knowledge to a POSITA that an alternative way to achieve a stiffer portion of a sail is to increase the thickness of the same material in a given area where stiffness is desired.</p> <p>It is common knowledge to a POSITA that one way to achieve a more elastic portion of a sail is to include fewer yarns in a given area where higher elasticity is desired, compared to a greater number of yarns in other areas, assuming the yarns are made from the same material. FIG. 4 of Linville, provided in paragraph 115,</p>

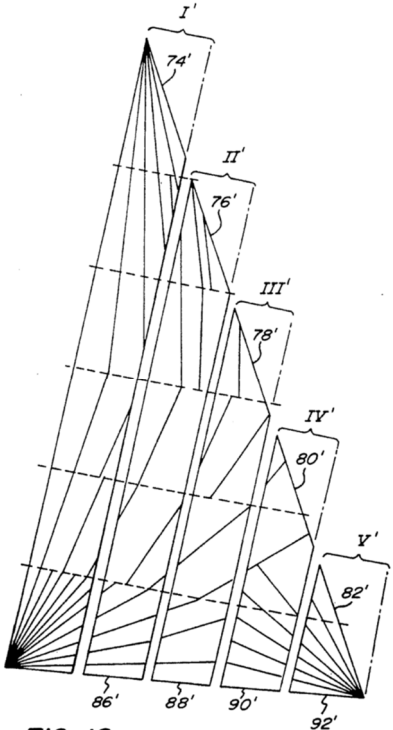
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	<p>above, shows just such a sail, in which the greater number of Kevlar yarns is used in the leech area of the sail (on the right hand side) and fewer Kevlar yarns in the luff area (on the left). A POSITA would understand that a sailcloth fabric with a higher yarn density would also be thicker than a sailcloth panel with a lower yarn density, as more yarns generally equates with thicker fabric.</p> <p>Linville: col 8, lines 21-25 states: “In general, it is desirable to cut segments such as b, c, d, and e, which are located at the luff of each panel from webs in which the denier density is lower than that in the segments b3, c4, d5, and e5 located at the leech of each panel.”</p>
Claim 20	The above for claim 1 and
[20.A] The sail of claim 1, wherein an orientation of a material in the luff region is different from an orientation of a material in the remainder of the sail,	<p>Linville: Fig. 12 of Linville shows the panels I’-V’ “cut substantially parallel to the leech” as stated in column 8, ll. 48-50.</p>

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	 <p style="text-align: center;">FIG. 12</p>
[20.B] such that the luff region has a higher degree of elasticity compared to the remainder of the sail.	Fig. 12 is illustrated with the leech to the left and the luff to the right. The panels in the luff region of II', III', and IV' are all oriented with the warp strands at angles relative to the luff, which would align the stretchier bias of the panels generally in the direction of the luff. In contrast, the

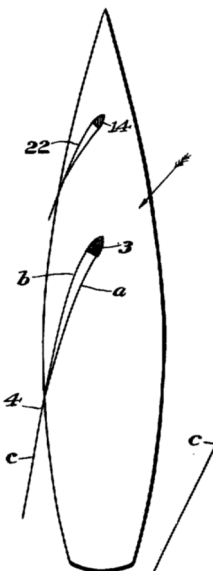
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	panels along the leech are oriented with the warp fibers running roughly parallel to the leech, making the leech stiffer than the luff region. Thus, Linville discloses this added limitation and anticipates claim 20.
Claim 21	The above for claim 1 and:
[21.A] The sail of claim 1, wherein the luff region does not comprise any carbon fibres oriented within 15 degrees of parallel to the luff,	Linville: does not disclose using carbon fibers in the luff region.
[21.B] and wherein the remainder of the sail does comprise carbon fibres oriented within 15 degrees of parallel to the luff.	<p>MSP: p. 23, section on carbon fiber: "When used in sails carbon fibers are combined with more durable fibers like Kevlar ... The result is a measure of durability, without a sacrifice in modulus.";</p> <p>MSP: p. 20 photo caption: "Some fabrics are made from a blend of fibers such as Kevlar and carbon in order to maximize benefits of each."</p> <p>Obvious design choice to use a blend of Kevlar and carbon fibers to provide the desired high modulus of carbon with improved durability of Kevlar, as taught by MSP.</p>

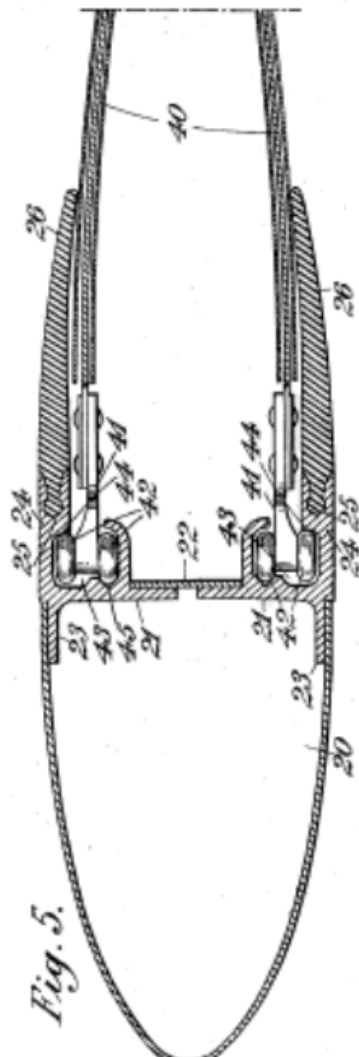
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<p>Claim 22</p> <p>The sail of claim 1, [22.A] wherein the sail is a twin skin mainsail</p>	<p>The above for claim 1 and:</p> <p>A twin skin mainsail design is common knowledge of a POSITA as evidenced by: Herreshoff: Claim 1 and FIG. 2:</p>  <p style="text-align: center;">Fig. 2</p> <p><i>The 1927 patent shows a sail boat with two mainsails each having a twin-skin sail design.</i></p>
<p>[22.B] having two skins defining the sail,</p>	<p>Wells-Coates: US 2,561,253, Sailing Craft (1951) (EX1015), Fig. 5 shows twin-skins 40:</p>

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	 <p>Kersten: US 2,569,318, Sail for Sailing Craft (1951), (EX1016), Fig. 4 shows twin-skins 34 and 36:</p>

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	<div data-bbox="846 604 1318 1041" data-label="Image"> <p style="text-align: center;">Fig. 4.</p> </div> <p data-bbox="800 1094 1430 1218">Roberts: US 4,064,821, Variable Camber Wing Sail (1977) (EX1021), Fig. 9 shows twin-skins 90 and 82:</p> <div data-bbox="800 1352 1373 1665" data-label="Image"> <p style="text-align: center;">Fig. 9</p> </div>

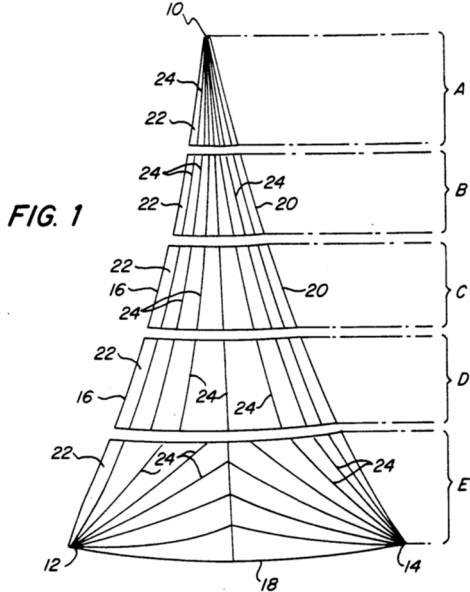
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Claim of U.S. Pat. No. 12,110,089	Citations to Prior Art with Linville US 5,097,783 (EX1018) as Primary Reference
	<p>TNZ: Team New Zealand publication (2019) (EX1014)</p> <p>ACR: America's Cup Rules (2018) (EX1013)</p> <p>The above references show a sail boat with two mainsails each having a twin-skin sail design.</p>
[22.C] wherein each skin has a luff region extending along the luff, [1.D] and wherein each luff region has a higher degree of elasticity compared to a remainder of the respective skin.	<p>The above references show a sail boat with two mainsails each having a twin-skin sail design. The patents do not describe any difference in construction for the two skins. Thus, the same type of more elastic luff can be used.</p> <p>In the alternative, it would be an obvious design choice to make a twin skin mainsail of the same design as claim 1 and make both sail skins with the same construction, because both sail skins are subjected to the same wind conditions.</p>
Claim 23	
[23.A] A sail comprising	Linville: Fig. 1; col 3, l. 64-66; "FIG. 1 is a plan view of a conventional sail assembly..."

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Petition for Post-Grant Review of U.S. Patent No. 12,110,089***

TABLE 2

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	 <p style="text-align: center;">FIG. 1</p>
[23.B] a head,	Linville: Fig. 1; col 4, l. 49-51; "...the sail when assembled from the five panels would have a head 910), a tack (12), a clew (14), a luff (16), a foot (18) and a leech (20)."
[23.C] a tack,	Linville: Fig. 1; col 4, l. 49-51; "...the sail when assembled from the five panels would have a head 910), a tack (12), a clew (14), a luff (16), a foot (18) and a leech (20)."
[23.D] a luff extending between the head and the tack;	Linville: Fig. 1; col 4, l. 49-51; "...the sail when assembled from the five panels would have a head 910), a tack (12), a

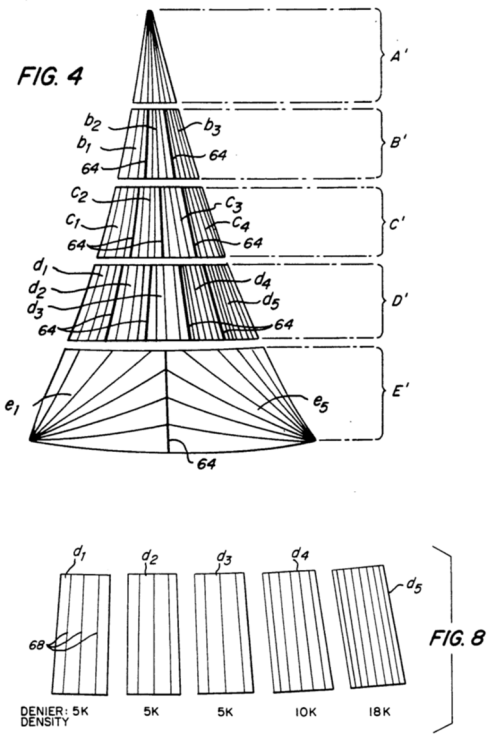
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	clew (14), a luff (16), a foot (18) and a leech (20)."
[23.E] and a luff region extending along the luff;	Linville: Fig. 1; col 4, l. 49-51; "...the sail when assembled from the five panels would have a head 910), a tack (12), a clew (14), a luff (16), a foot (180 and a leech (20)." FIG. 4, col. 7, l. 27-38; panels b ₁ , c ₁ and d ₁ comprise a luff region extending along the luff.
[23.F] wherein the luff region has a higher degree of elasticity compared to a remainder of the sail,	Linville: FIG. 4; Fig. 8; col 8, l. 19-32; "The denier density can be varied by varying number and/or the denier of strand (68) in the web ...The denier density of the intermediate segments may increase gradually from the luff to the leech...of the order of 18000 in segments b ₃ , c ₄ , d ₅ and e ₅ , dropping to 10000 in segments b ₂ , c ₃ , d ₄ and e ₄ , and dropping further to 5000 in all other segments..."

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	 <p>FIG. 4 is a perspective view of a tapered web structure, likely a luff, showing a series of segments (64) arranged in a conical shape. The segments are labeled with various identifiers: b₂, b₁, b₃, c₂, c₁, c₃, c₄, d₁, d₂, d₃, d₄, d₅, e₁, and e₅. The structure is divided into five horizontal sections labeled A', B', C', D', and E' from top to bottom. FIG. 8 shows five individual segments (68) labeled d₁, d₂, d₃, d₄, and d₅, arranged in a row. Below these segments, the text 'DENIER: 5K DENSITY' is followed by '5K', '5K', '10K', and '18K' corresponding to the segments d₁, d₂, d₃, d₄, and d₅ respectively.</p> <p>It is common knowledge to a POSITA that fabric stretchiness in the direction of the fibers is inversely proportional to the denier density.</p>
[23.G] wherein in a luff direction, a ratio of a stiffness of regions outside the luff region and the stiffness of the luff region is in the range of 2-25 times greater.	<p>Linville: Col 8, l. 19-32; "The denier density can be varied by varying number and/or the denier of strand (68) in the web ... The denier density of the intermediate segments may increase gradually from the luff to the leech...of the order of 18000 in segments b₃, c₄, d₅ and e₅, dropping to</p>

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	<p>10000 in segments b₂, c₃, d₄ and e₄, and dropping further to 5000 in all other segments..."</p> <p>It is common knowledge that fabric stretchiness in the direction of the fibers is inversely proportional to the denier density. A leech panel with a denier density of 18000 is 3.6 times stiffer than a luff panel of 5000 denier density, and the intermediate panel of 10000 denier density is twice as stiff as a luff panel of 5000 denier density in the direction of the fibers.</p> <p>The fibers run in the luff direction in the Figures.</p>