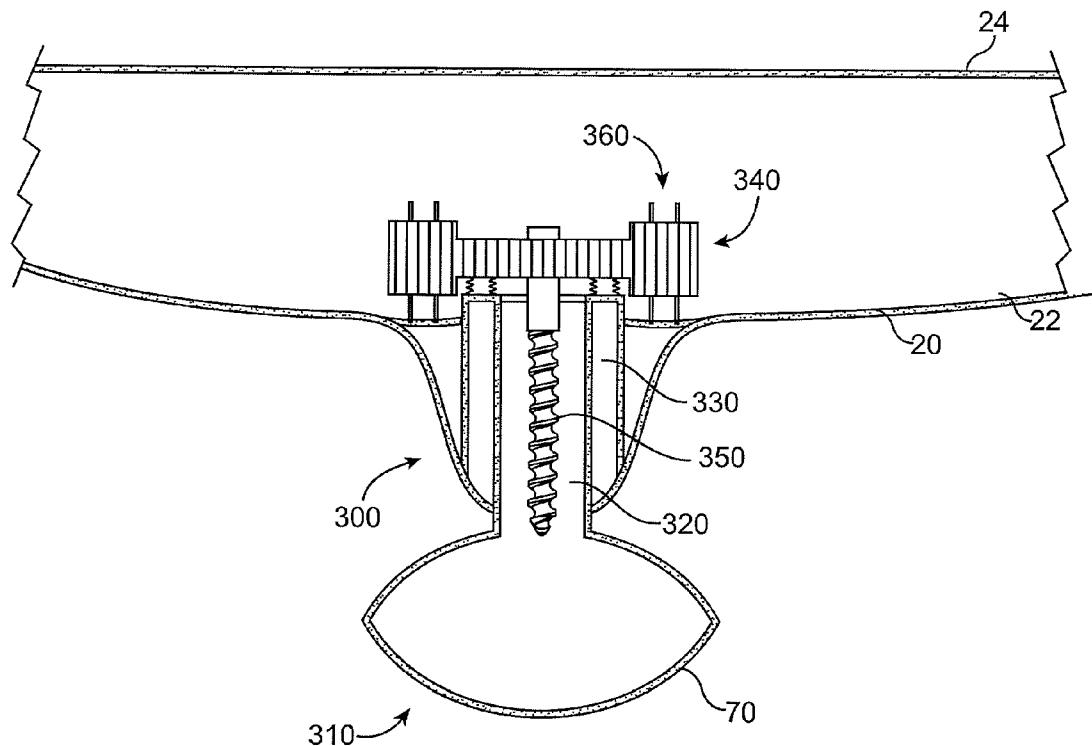




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BARUH(10) **Pub. No.: US 2009/0288586 A1**(43) **Pub. Date: Nov. 26, 2009**(54) **ADJUSTABLE KEEL FOR A SAILBOAT**(76) Inventor: **Bradford G. BARUH,**
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8, 2007, provisional application No. 60/920,957, filed
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B63B 43/06 (2006.01)
(52) **U.S. Cl. 114/124; 114/141; 114/121; 137/565.01;**
137/565.11(57) **ABSTRACT**A sailboat, which include an extendable keel having a move-
able inner member positioned within a fixed keel and a control
system for lowering or retracting the inner member.

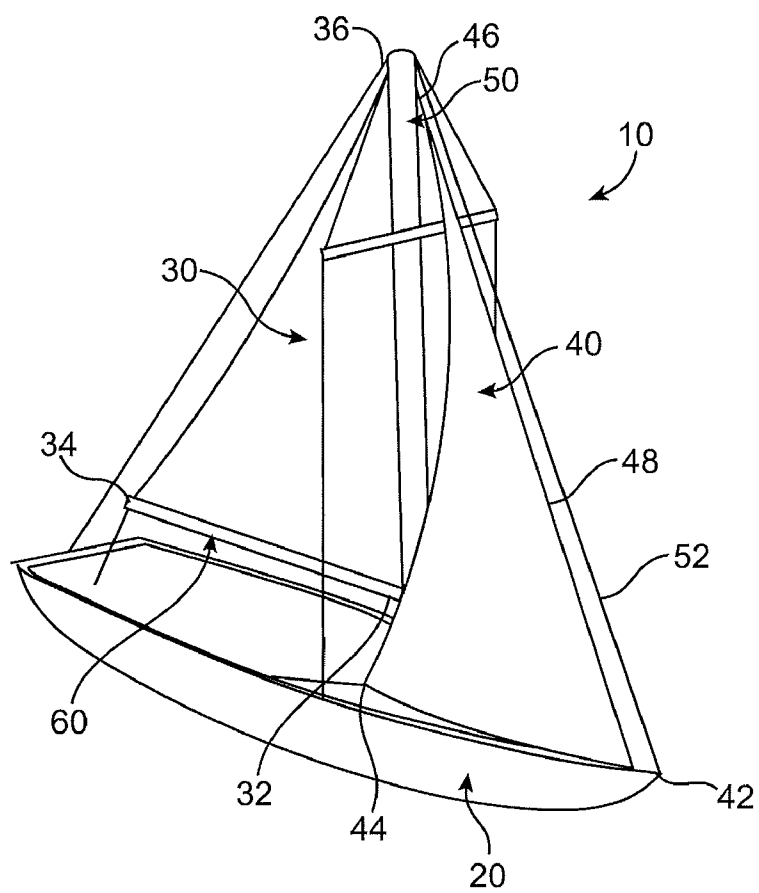


FIG. 1

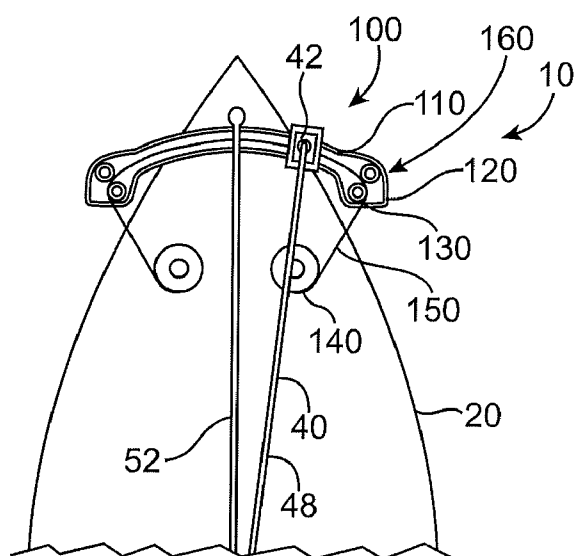
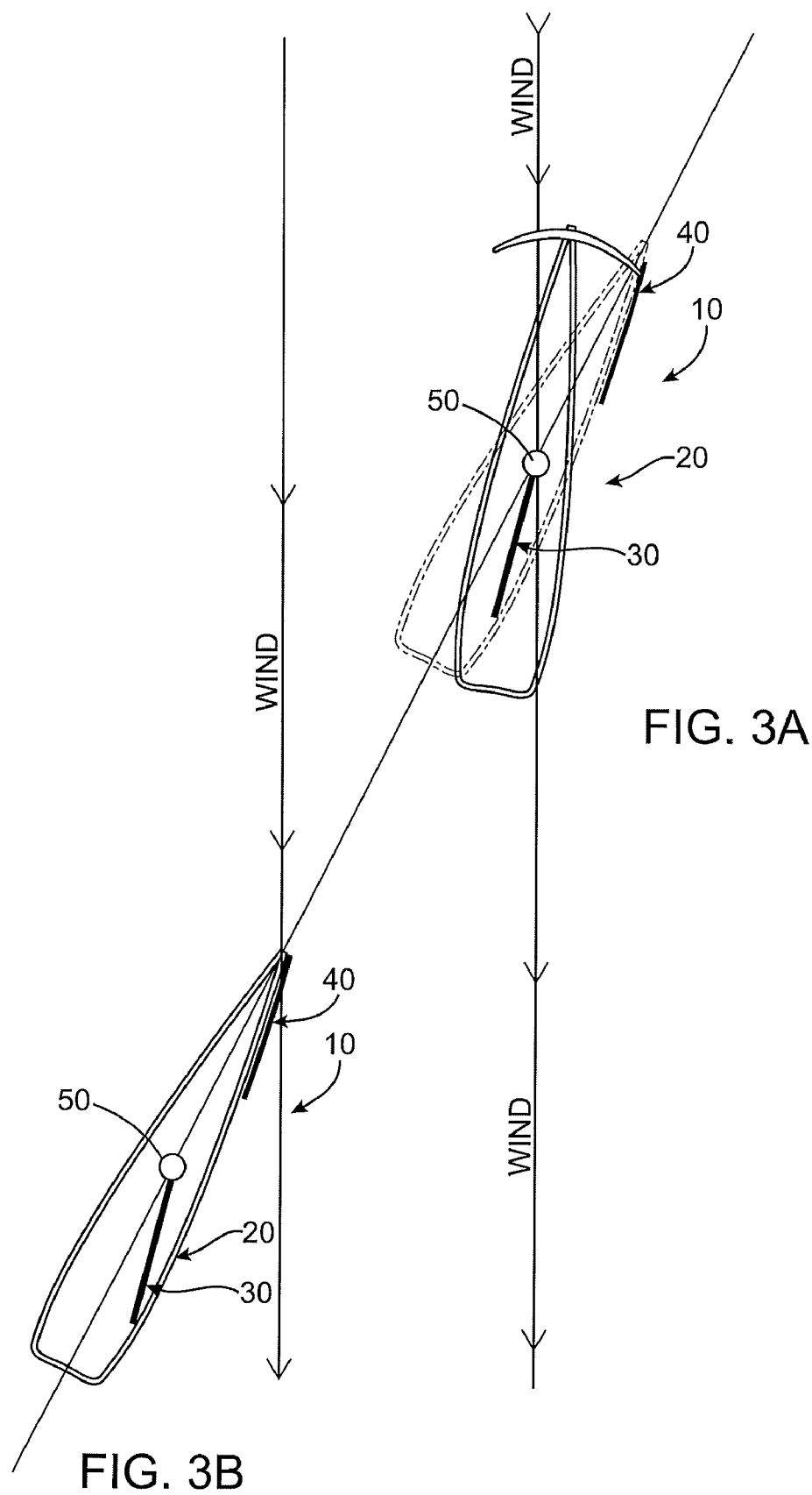


FIG. 2



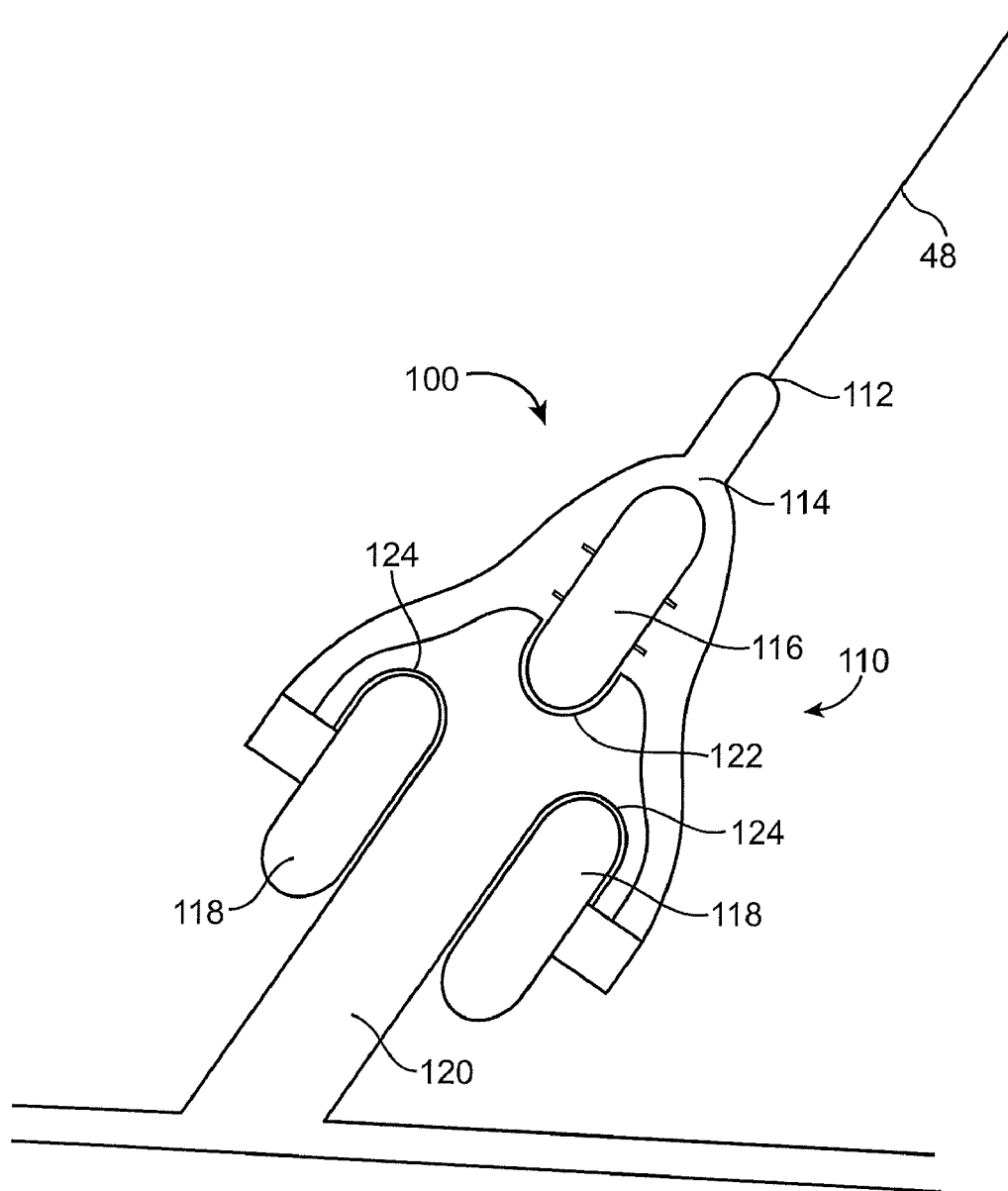


FIG. 4

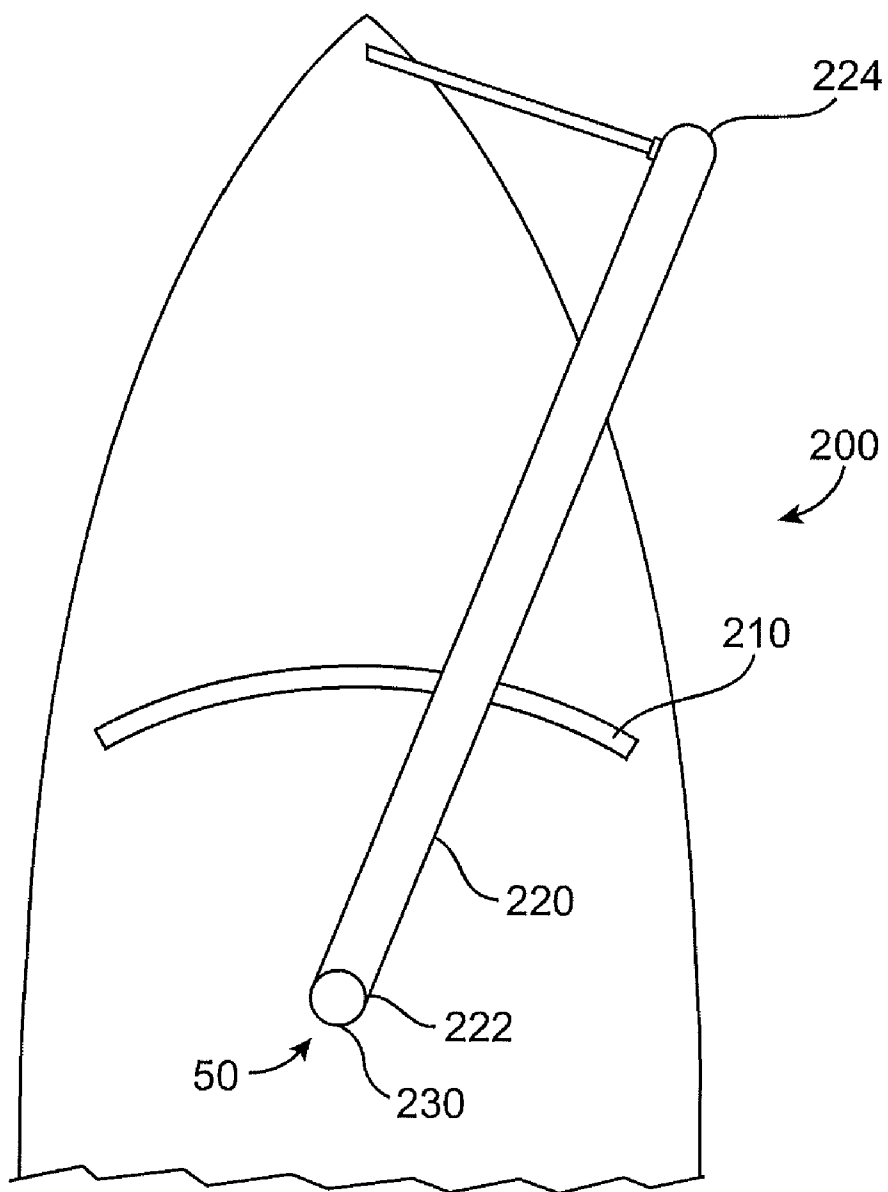


FIG. 5

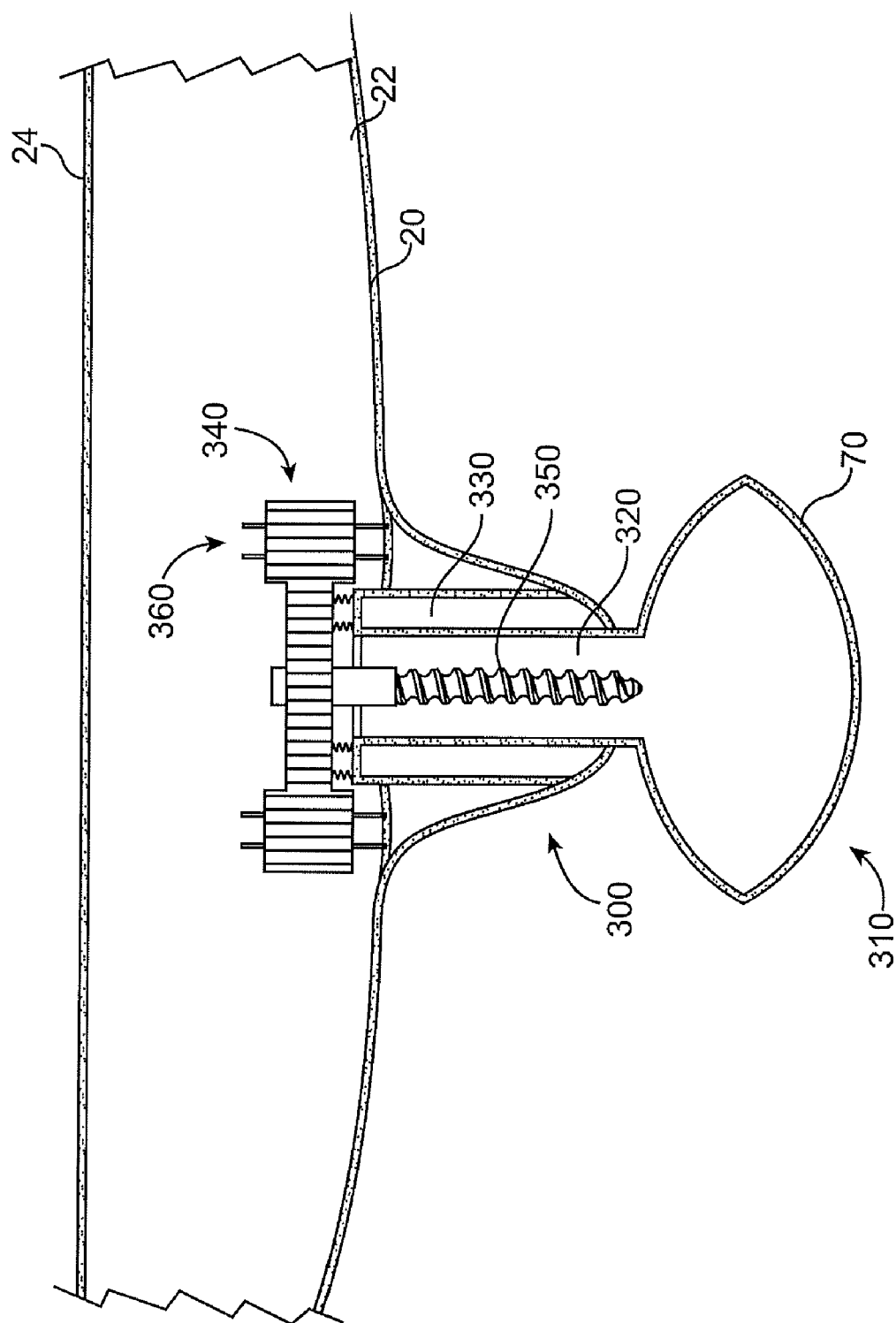


FIG. 6

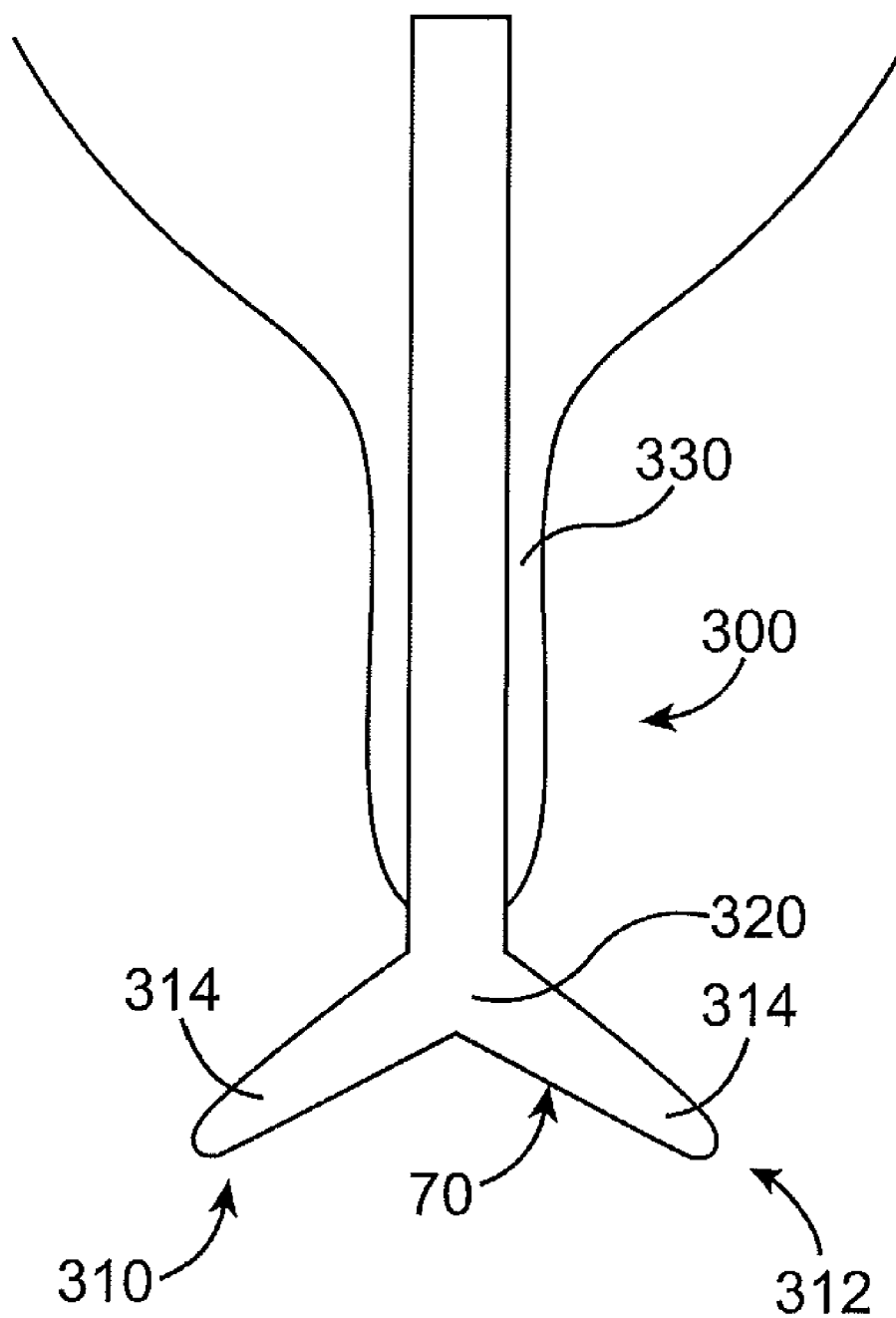


FIG. 7

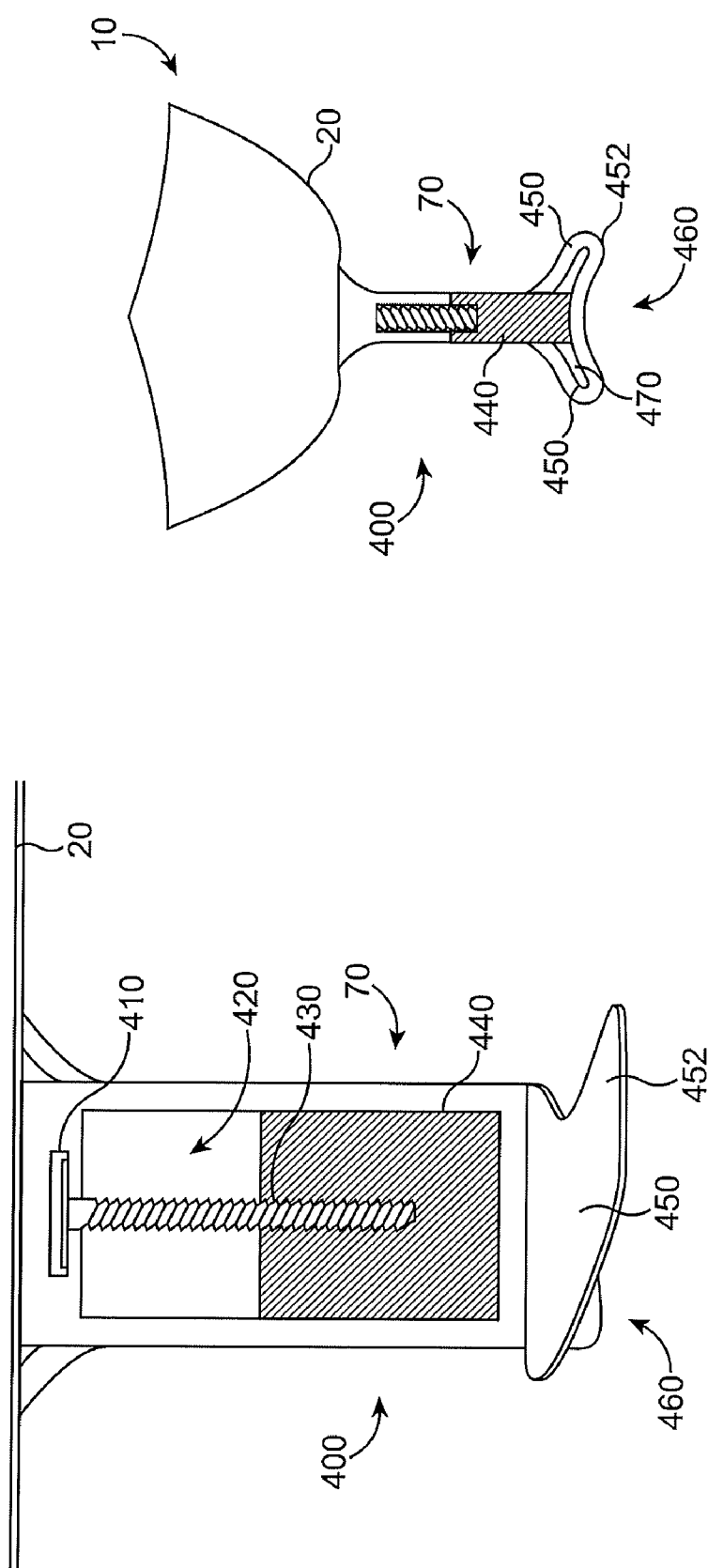


FIG. 9

FIG. 8

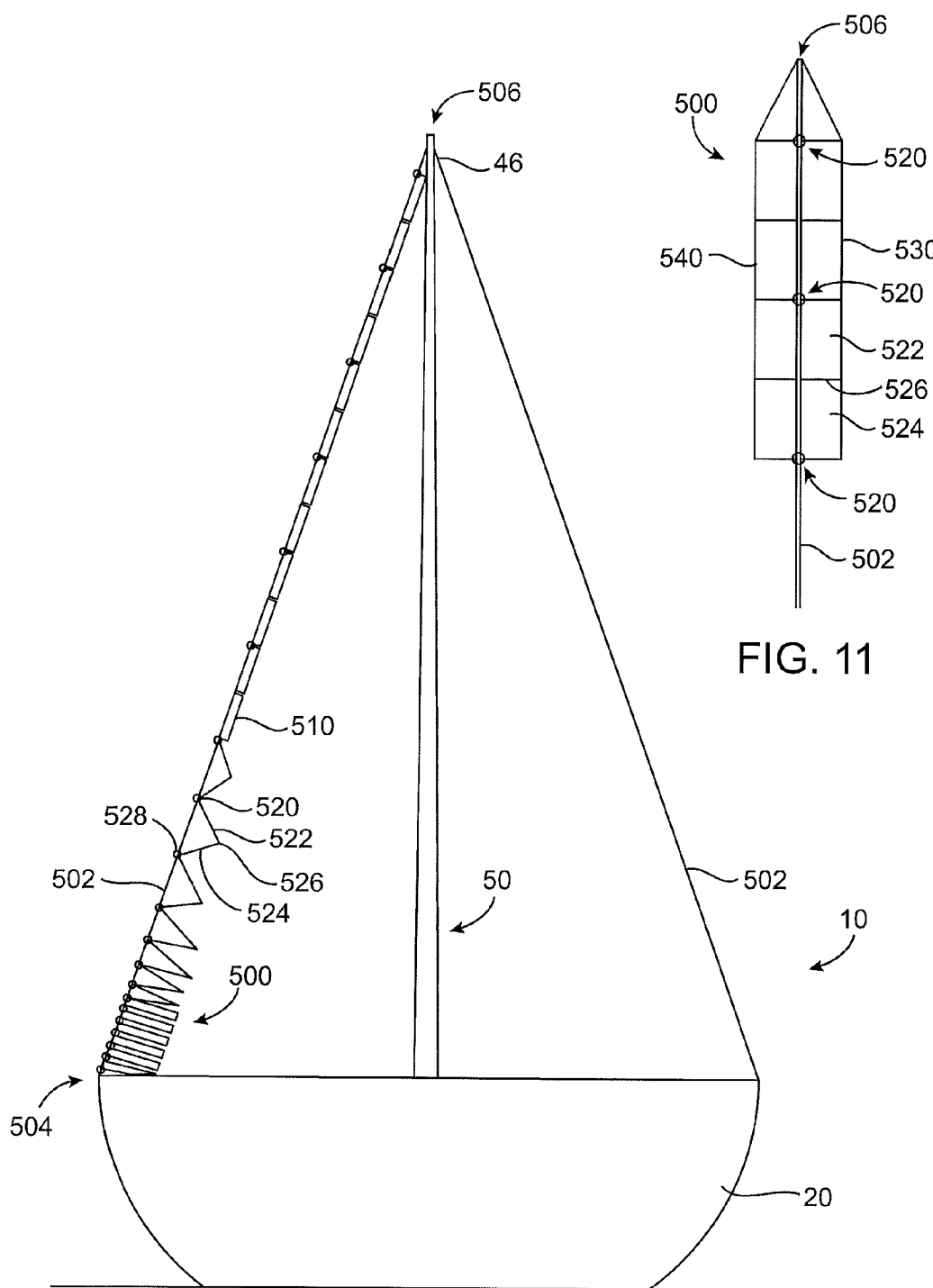


FIG. 10

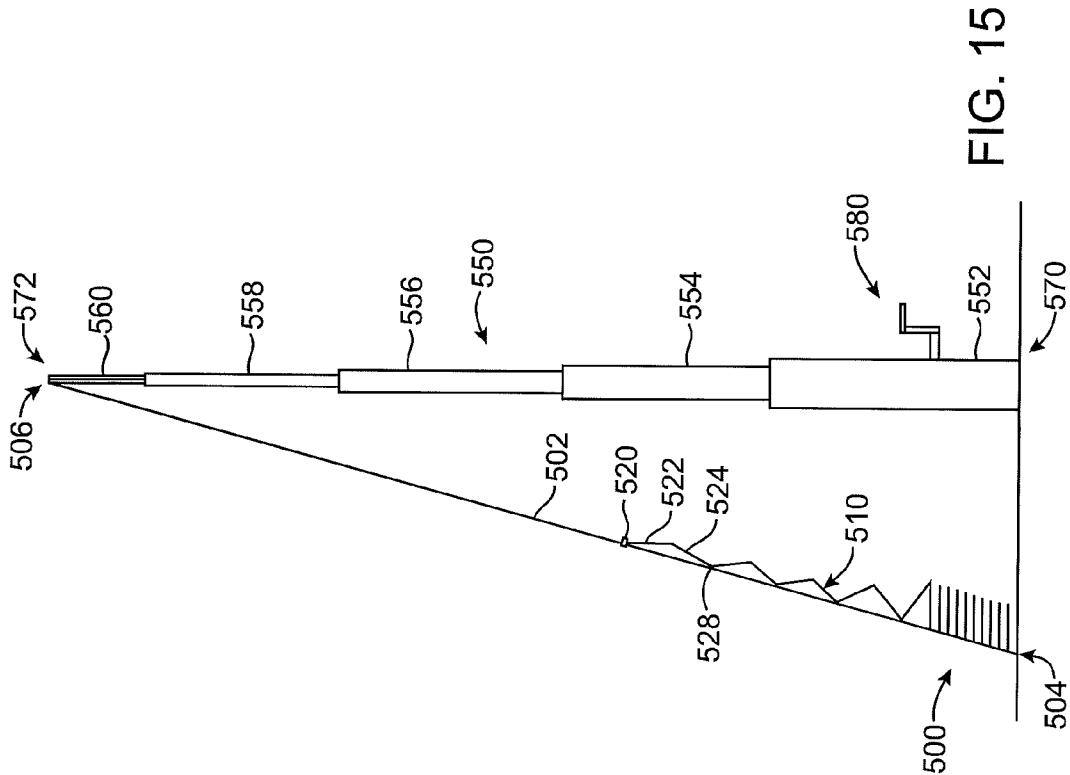


FIG. 15

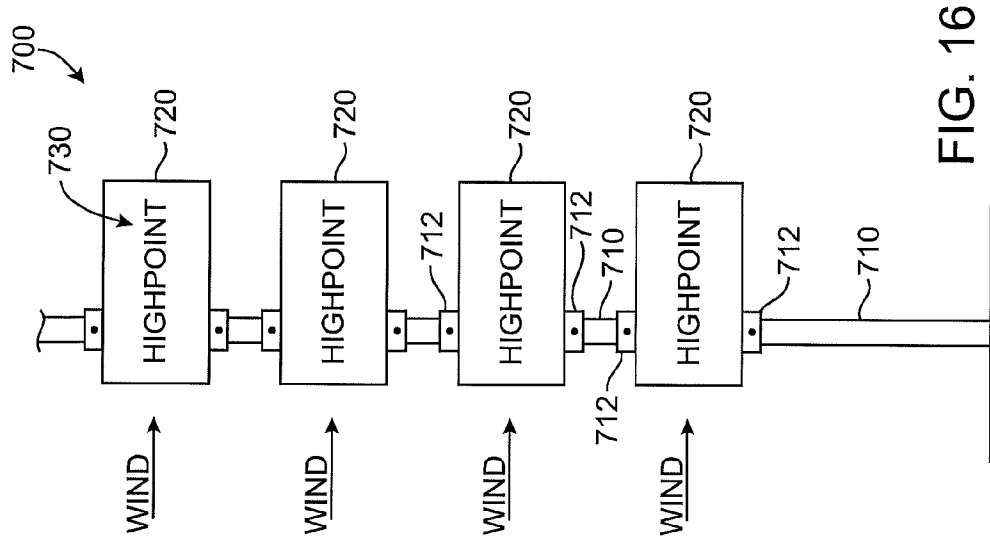


FIG. 16

ADJUSTABLE KEEL FOR A SAILBOAT

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. patent application Ser. No. 11/788,785, filed Apr. 19, 2007, which claims priority to U.S. Provisional Patent Application Ser. No. 60/900,549 filed on Feb. 8, 2007, and U.S. Provisional Patent Application Ser. No. 60/920,957 filed on Mar. 30, 2007, the contents, which are incorporated herein their entirety.

FIELD OF THE INVENTION

[0002] This invention generally relates to an adjustable keel, and more particularly to an adjustable keel, which includes having a moveable inner member positioned within a fixed keel and a control system for lowering or retracting the inner member.

BACKGROUND

[0003] Typically, a sailboat includes a hull that sits in the water, a mast extending upwardly from the hull, sails supported by the mast, and either a centerboard or fixed keel extending downwardly from the hull into the water. The sails catch the wind and cause the hull to move forwardly through the water. Although, a sailboat cannot sail directly into the wind, a sailboat can sail in a generally windward direction. It can be appreciated that with skill and a combination of maneuvers, a sailor can maneuver a sailboat in almost any desired direction.

[0004] Because of the design of the sails, a sailboat can sail to windward, which is typically in a direction no less than about 15 to 25 degrees from the wind, depending upon the design of the boat and the skill of the sailor. Headway directly upwind or windward is typically achieved in a series of sequential maneuvers called tacks, in which the boat is first sailed windward with the wind over one side of the bow, and then turned through the wind so that the wind comes over the other side of the bow. In each tack, some headway upwind is achieved even though the boat does not move directly into the wind, and eventually the sailboat reaches an upwind objective after sailing a zig-zag course covering a distance greater than the straight line distance from the initial position to the upwind objective.

[0005] When a sailboat sails to windward, the forces on the sails can be resolved into a thrust component that moves the sailboat forwardly through the water and a drift component that pushes the sailboat sideways in a downwind direction. The sailboat therefore moves in a net direction that is forward, but also is slight downwind opposite to the net intended direction of movement. The sideways drift is called leeway or "slide slipping."

[0006] The downwardly projecting centerboard or keel of the sailboat offers resistance to the leeway produced by the sideways sail force, but at least some leeway remains. This leeway is being constantly accumulated, as there is a downwind movement as long as the sailboat is being sailed into the wind. The leeway significantly increases the time required for the sailboat to sail from its downwind starting position to the upwind objective, as it forces the sailboat to sail much further to make up for the accumulated sideways movement.

[0007] Attempts have been made to reduce the amount of leeway. For example, a movable centerboard or fixed keel

extending into the water below the sailboat presents a broad surface to resist sideways drift. There have also been attempts to modify the shape of the centerboard or keel to provide a lifting force to counteract the sideways drift. These attempts have been based upon the observation that the centerboard or keel moving through the water is somewhat similar to the wing of an airplane that creates a lift as the wing is moved through the air. The lift of an airplane wing causes the airplane to move upward against the force of gravity, and the corresponding lift of a sailboat centerboard or keel that extends downwardly can cause the sailboat to be lifted in the upwind direction, thereby countering the sideways drift producing the leeway.

[0008] Fixed keels are typically used in larger sailboats. The keels are usually filled with lead or other dense material to act as ballast for the sailboat. For example, the keels of 12-meter sailboats may extend 10 feet below the surface of the water, and weigh 40,000 to 50,000 pounds.

[0009] It would be desirable to have a system or method of adjusting or changing the relative position of the fixed connection of the foresail, such that the angle of attack in the windward direction is slightly altered in the direction of the wind. Accordingly, it would be desirable to have a system and/or method of changing the angle or direction of the boat in a windward direction and/or use of an extendable keel, which is capable of providing a lifting force to counteract leeway, and is sufficiently reliable to be acceptable for general and racing use.

[0010] In addition, it would be desirable to have a retractable solar panel system, which can provide a source of energy to the sailboat. The solar panel system can be attached to a nautical stay, wherein the stay is fixed at one end to a hull of the sailboat and at a second end to a mast of the sailboat. The solar panel system includes a plurality of solar panels, which are attached to a system for extending and retracting the plurality of solar panels, such that when not in use, the solar panels can be stacked.

SUMMARY

[0011] In accordance with an embodiment, a keel for a sailboat comprising: an extendable keel comprising: an outer member; an inner member, which extends from within the outer member; and a foil member attached to the inner member; and a control system for lowering or retracting the inner member.

[0012] In accordance with a further embodiment, a keel for a sailboat comprising: a fixed keel; a moveable inner member positioned within the fixed keel; and a control system for lowering or retracting the inner member.

[0013] In accordance with another embodiment, A keel for a sailboat comprising: a keel member having an inner chamber; an adjustable ballast system within the inner chamber; and a ballast control system for adjusting a depth of the ballast system within the inner chamber.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] FIG. 1 is a perspective view of a sailboat with a system and method of adjusting the location and position of the foresail in accordance with one embodiment.

[0015] FIG. 2 is a top view of the sailboat of FIG. 1 with a system and method of adjusting the location and position of the foresail.

[0016] FIG. 3A is a schematic view of a sailboat in accordance with one embodiment with a system and method of adjusting the location and position of the foresail in comparison with a sailboat without a system and method of adjusting the location and position of the headsail, jib, genoa, or spinnaker.

[0017] FIG. 3B is a schematic view of a sailboat without a system and method of adjusting the location and position of the foresail.

[0018] FIG. 4 is a cross-sectional view of a portion of the track system on a sailboat with a system and method of adjusting the location and position of the foresail.

[0019] FIG. 5 is a top view of a sailboat with a system and method of adjusting the location and position of the foresail in accordance with another embodiment.

[0020] FIG. 6 is a cross-sectional view of a sailboat with an extendable keel in accordance with one embodiment.

[0021] FIG. 7 is a front view of a sailboat with the extendable keel having a winged foil (or underwater wing) in accordance with another embodiment.

[0022] FIG. 8 is a cross-sectional view of a portion of a sailboat with a fixed keel and an adjustable ballast or weight system in accordance with a further embodiment.

[0023] FIG. 9 is a cross-sectional view of a sailboat with a fixed keel with a hollow winged keel and an adjustable ballast or weight system in accordance with another embodiment.

[0024] FIG. 10 is a plan view of a sailboat with a retractable solar panel system in accordance with one embodiment.

[0025] FIG. 11 is a front view of the retractable solar panel system of FIG. 10.

[0026] FIG. 12 is a plan view of a retractable solar panel array in accordance with one embodiment.

[0027] FIG. 13 is a plan view of a retractable solar panel array in accordance with another embodiment.

[0028] FIG. 14 is a front view of a retractable solar panel system in accordance with another embodiment.

[0029] FIG. 15 is a plan view of a retractable solar panel system in accordance with another embodiment.

[0030] FIG. 16 is a plan view of a solar panel system in accordance with a further embodiment.

DETAILED DESCRIPTION

[0031] As described above, because of the design of the sails, a sailboat (or boat) 10 can sail to windward, in a direction no less than about 15 to 25 degrees from the wind, depending upon the design of the boat and the skill of the sailor. Headway directly upwind is achieved in a series of sequential maneuvers called tacks, in which the boat is first sailed windward with the wind over one side of the bow, and then turned through the wind so that the wind comes over the other side of the bow. In each tack, some headway upwind is achieved even though the boat does not move directly into the wind, and eventually the sailboat reaches an upwind objective after sailing a zig-zag course covering a distance greater than the straight line distance from the initial position to the upwind objective.

[0032] In addition, when a sailboat 10 sails to windward, the forces on the sails can be resolved into a thrust component that moves the sailboat forwardly through the water and a drift component that pushes the sailboat sideways in a downwind direction. The sailboat 10 therefore moves in a net direction that is forward, but also is slight downwind opposite to the net intended direction of movement. The sideways drift is called leeway.

[0033] The downwardly projecting centerboard or keel of the boat offers resistance to the leeway produced by the sideways sail force, but at least some leeway remains. This leeway is being constantly accumulated, as there is a downwind movement as long as the sailboat is being sailed into the wind. It can be appreciated that the leeway can significantly increase the time required for the sailboat to sail from its downwind starting position to the upwind objective, as it forces the sailboat to sail much further to make up for the accumulated sideways movement.

[0034] FIG. 1 shows a perspective view of a sailboat 10 with a system and method of adjusting the location and of at least one of the sails 40 of the sailboat 10, and more particularly a system and method of adjusting the foresail 40 (or headsail, jib, genoa, or spinnaker) in accordance with one embodiment. As shown in FIG. 1, a sailboat 10 typically includes a hull 20 that sits in the water, a mast 50 extending upwardly from the hull 20, and at least one sail in the form of a mainsail 30 supported by the mast 50 and a boom 60, and an optional centerboard or keel 70 (FIG. 6) extending downwardly from the hull 20 into the water. Typically, most sailboats 10 also include a second sail 40 in the form of a foresail, jib, genoa, or spinnaker. The sails 30, 40 catch the wind and cause the hull 20 to move forwardly through the water. It can be appreciated that the sailboat can also include a mainstay 52, which preferably extends from an upper portion of the mast 50 to the bow 42 of the sailboat 10.

[0035] It can be appreciated that the use of the term "sailboat" 10 has a broad meaning and can include yachts, (large sailboats) and smaller vessels of many configurations, which use wind as the primary means of propulsion. Typically, some of the variations other than size are hull configuration (monohull, catamaran, and trimaran), keel type (full, fin, wing, centerboard etc.), purpose (sport, racing, cruising), number and configuration of masts, and the sail plan. The most common sailboat 10 is the "sloop" which features one mast 50 and two sails, a mainsail 30 and a foresail 40 or jib, genoa, or spinnaker. This simple configuration has been proven over time to be very efficient for sailing into the wind. The mainsail 30 is attached to the mast 50 and the boom 60, which is a beam or spar capable of swinging across the sailboat 10, depending on the direction of the wind. Depending on the size and design of the foresail 40, the foresail 40 is called a jib, genoa, or spinnaker. Although not common, a sloop or sailboat 10 can include two foresails from a single forestay 48 at one time (wing on wing). The forestay 48 is a line or cable running from near the top of the mast 50 to a point near the bow 42 (or front of the sailboat 10). It can be appreciated that the forestay 48 is attached at either the top of the mast, or in fractional rigs between about $\frac{1}{4}$ and $\frac{1}{8}$ from the top of the mast 50. The other end of the forestay 48 is attached to the stern or bow 42 of the boat 10. The forestay 48 can be made from stainless steel wire, a solid stainless steel rod, a carbon rod, a galvanized wire or natural fibers.

[0036] As shown in FIG. 1, the mainsail 30 is attached to the mast 50 and the boom 60. The boom 60 is typically a metal or wooden beam or spar, which is configured to stabilize the bottom of the mainsail 30. The boom 60 is attached to the mast 50 at a lower end 32 of the mast 50 and extends towards the stern 43 (or back of the sailboat 10). An outhaul or line 34, which is part of the running rigging of a sailboat 10, is used to extend the mainsail 30, and control the shape of the curve of the foot of the mainsail 30. The outhaul 34 runs from the clew (the back corner of the sail 30) to the end of the boom. The line

is pulled taut to the appropriate tension (to provide the desired shape to the foot), and then secured to a cleat on the boom 60. The mainsail 30 is also attached to the top 36 of the mast 50. The mainsail 30 extends aftward and is secured the whole length of its edges to the mast 50 and to the boom 60 hung from the mast 50.

[0037] The foresail 40, which is also known as a headsail, jib, genoa, or spinnaker is secured to the top 46 of the mast 50 and is typically secured to the bow 42 of the sailboat 10. Typically, the foresail 40 is secured along its leading edge to a forestay 48 (strong wire) strung from the top 46 of the mast to the bowsprit 42 on the bow (nose) of the boat. Alternatively, the foresail 40 can be a genoa, which is a type of jib that is larger, and cut so that it is fuller than an ordinary jib. It can also be appreciated that fore-and-aft sails can be switched from one side of the sailboat 10 to the other, in order to alter the sailboat's course. When the sailboat's stern crosses the wind, this is called jibing; when the bow crosses the wind, it is called tacking. Tacking repeatedly from port to starboard and/or vice versa, called "beating", is done in order to allow the boat to follow a course into the wind.

[0038] It can be appreciated that a primary feature of a properly designed sail is an amount of "draft", caused by curvature of the surface of the sail. When the sail is oriented into the wind, this curvature induces lift, much like the wing of an airplane. Modern sails are manufactured with a combination of broadseaming and non-stretch fabric. The former adds draft, while the latter allows the sail to keep a constant shape as the wind pressure increases. The draft of the sail can be reduced in stronger winds by use of a Cunningham and outhaul, and also by increasing the downward pressure of the boom by use of a boom vang. A boom vang is a line or piston system on a sailboat used to exert downward force on the boom and thus control the shape of the sail. In British English, it is known as a "kicking strap". The vang typically runs from the base of the mast 50 to a point about a third of the way out the boom 60. Due to the great force necessary to change the height of the boom 60 while a boat is under sail, a line based boom vang usually includes some sort of a pulley system. Hydraulic piston vangs are used on larger sailboats and controlled by manual or electric hydraulic pumps.

[0039] FIG. 2 shows a top view of the sailboat 10 of FIG. 1 with a system and method of adjusting the location and position of the foresail 40. As described above, the foresail 40 is typically attached to the bow 42 of the sailboat 10 via the forestay 48. In accordance with one embodiment, as shown in FIG. 2, the foresail 40 can be attached to a track system 100. The track system 100 is attached to the bow 42 of the boat 10 and is configured to change the location or position of the foresail 40 and the forestay 48 relative to the hull 20 of the boat 10 during a tacking maneuver.

[0040] It can be appreciated that tacking typically describes the position of a sailboat's bow with respect to the wind. For example, if the vessel's bow is positioned so that the wind is blowing across the starboard (right) side of the vessel, then the vessel is said to be on a starboard tack. If the wind is blowing across the port (left) side of the vessel, then the vessel is said to be on a port tack. It can be appreciated that by definition, this is opposite to the side, which the boom is carried, since it can be difficult when a boat is sailing downwind or nearly downwind from which side the wind is coming. In addition, a sailing vessel on a starboard tack always has the right-of-way over another sailing vessel on "port tack" by both the rules of the road and racing rules.

[0041] The track system 100 preferably includes a moveable track fixture 110, upon which the forestay 48 is securely fixed or attached, a fixed track 120 configured to receive the track fixture 110, and a control system 130 for securing the location of the track fixture 110 within the track 120 relative to the bow 42 of the boat 10. In accordance with one embodiment, the control system 130 for securing the location of the track fixture 110 can include a winch 140, a flexible wire or rod 150 attached to the track fixture 110, and a guide system 160. The winch 140 is preferably a mechanical device that is used to wind up the flexible wire or rod 150 (also called "cable"). In its simplest form, it consists of a spool and attached crank. The spool can also be called the winch drum. It can be appreciated that the winch 140 can include suitable gear assemblies and can be powered by electric, hydraulic, pneumatic or internal combustion drives. In addition, the winch 150 can include a solenoid brake and/or a mechanical brake or ratchet (not shown) that prevents the winch 150 from unwinding.

[0042] FIG. 3A shows a schematic view of a sailboat 10 in accordance with one embodiment with a system and method of adjusting the location and position of the foresail 40 in comparison with a sailboat 10 without a system and method of adjusting the location and position of the foresail 40. As shown in FIG. 3A, the control system 130 is configured to adjust or change the relative location of the foresail 40 to the bow 42 of the boat 10 during tacking maneuvers, such that the bow 42 of the boat 10 can sail into the wind more than if the foresail 40 and forestay 48 is fixed to the bow of the boat 10.

[0043] FIG. 3B shows a schematic view of a sailboat without a system and method of adjusting the location and position of the foresail. As shown in FIG. 3B, a typical sailboat 10 performs a tacking maneuver by sailing at an angle into the wind. However, as shown in FIG. 3A, if the relative position of the foresail 40 to the bow 42 of the boat 10 is changed or altered without change the relative position of the mainsail 30 and foresail 40 to one another, the bow 42 of the boat 10 can sail more into the wind resulting in a shorter distance or path of travel for the sailboat during tacking.

[0044] FIG. 4 shows a cross-sectional view of a portion of the track system 100 on a sailboat with a system and method of adjusting the location and position of the foresail 40 in accordance with one embodiment. The track system 100 preferably includes a track fixture 110, and a fixed track 120. The foresail 40 (not shown) is attached to the forestay 48, which is secured to the track fixture 110 at an upper end 112. As shown in FIG. 4, the track fixture 110 can include an upper end 112, a main body 114, an upper wheel 116, and a pair of lower wheels 118. The fixed track 120 can include an upper groove 122 configured to receive the upper wheel 116 and a pair of lower grooves 124 configured to receive the pair of lower wheels 118. The track fixture 110 moves from side to side (starboard to port) on the fixed track 120 resulting in the relative position of the forestay 48 (and the foresail 40) to the bow 42 of the boat 10 facing in a more windward direction during tacking maneuvers.

[0045] FIG. 5 shows a top view of a sailboat 10 with a system and method of adjusting the location and position of the foresail 40 in accordance with another embodiment. As shown in FIG. 5, a beam or spar system 200 comprised of a foresail track system 210, a foresail beam 220, and a pivot member 230. The foresail beam 220 is attached to the pivot member 230 (or mast 50) at one end (mast end) 222 and the other end (bow end) 224 of the foresail beam 220 moves from

side to side (starboard to port). The foresail beam 220 is preferably attached to an optional foresail track system 210, which assists the foresail beam 220 in movement from side to side. The forestay 48 (not shown) is preferably securely fixed or attached to the bow end 224 of the foresail beam 220. In addition, a series of lines 226 can be used to control the bow end 224 of the foresail beam 220.

[0046] It can be appreciated that the system as shown in FIG. 5, the beam or spar system 200 can also include a control system 130 (not shown) comprised of a winch 140, a flexible wire or rod 150 attached to the track fixture 110, and a guide system 160. As described above, the winch 140 is preferably a mechanical device that is used to wind a wire rod or wire rope (also called "cable"). In its simplest form, it consists of a spool and attached crank. In addition, it can be appreciated that the winch 150 can also include gear assemblies and can be powered by electric, hydraulic, pneumatic or internal combustion drives. The winch 150 can also include a solenoid brake and/or a mechanical brake or ratchet, which prevents the winch 150 from unwinding.

[0047] FIG. 6 shows a cross-sectional view of a sailboat 10 with an extendable keel 300 in accordance with another embodiment. As shown in FIG. 6, the extendable keel 300 includes a foil member 310, an extendable inner member 320 and a fixed outer member 330. The foil member 310 is attached to the extendable inner member 320 and uses the forward motion of the boat 10 to generate lift to counter the lateral force from the sails (i.e., mainsail 30 and foresail 40). It can be appreciated that sailboats 10 typically have much larger keels than non-sailing hulls. In addition, the keel 70 is made of a heavy material to provide ballast to stabilize the sailboat 10. Accordingly, it would be desirable to have the ability to adjust the depth or length of the keel 70, which provide a righting moment of the sailboat 10 during tacking, and reducing the weight of the keel 70. It can be appreciated that by reducing the weight of the keel 70, which in turn reduces the overall weight of the sailboat 10, the sailboat 10 will in turn move faster through the water. Thus, the sailboat 10 will be quicker and will be faster during sailing competitions and/or races. In addition, the perpendicular distance from weight to pivot is increased. Thus, with the use of an extendable keel 300, a larger righting moment can be produced. The extendable keel 300 also provides for easier transportation of the sailboat 10 by retracting the keel 70 and allows for the sailboat 10 to sail in shallower water with the keel 70 retracted.

[0048] As shown in FIG. 6, the extendable inner member 320 is positioned within the fixed outer member 330. A suitable fit between the inner member 320 and the outer member 330 preferably exists such that the sailboat 10 does not take water on and the fit is suitable to withstand the corrosive environment that most sailboats 10 typically encounter. In accordance with one embodiment, the inner member 320 extends and retracts through a control system 340 and an inner screw member 350 positioned within the inner member 320. As shown in FIG. 6, the control system 340 controls the depth or position of the inner screw member 350, which in turn lowers or retracts the inner member 320. The inner screw member 350 is preferably attached to a winch system 360 or other suitable system for lowering or extending and/or retracting the keel 70.

[0049] In accordance with one embodiment, the winch system 360 can include a mechanical device that is used to control the relative position of the inner screw member 350

and the inner member 320 to the outer member 330, which in turn controls the depth of the foil member 310 of the keel 70. In accordance with one embodiment, the winch system 360 consists of a spool or drum and an attached crank. It can be appreciated that the winch 140 can also include suitable gear assemblies and/or can be powered by electric, hydraulic, pneumatic or internal combustion drives. The winch system 360 also preferably includes a solenoid brake and/or a mechanical brake that prevents the winch system 360 from unwinding and/or releasing from a fixed position. The winch system 360 can be positioned below the deck of the sailboat 10 as shown in FIG. 6, or alternatively can be positioned above or on the deck of the sailboat 10.

[0050] It can be appreciated that the extendable keel 300 can also be extendable telescopically, wherein the keel 300 comprises a plurality of inner members 320 having a core containing a plurality of sealed air chambers, which are pressurized when the keel 300 is fully extended. An air compressor, which can be powered by the boat engine or other suitable systems, can be utilized to supply pressurized air to extend or retract the inner members 320. Valves can control the pressure release for extension or retraction. The keel 300 can also be operated hydraulically, by stored or generated pressurized gas, or mechanically through a suitable mechanical system.

[0051] FIG. 7 shows a front view of a sailboat 10 with the extendable keel 300 having a foil member 310 having a winged foil 312 (or underwater wing) in accordance with another embodiment. As shown in FIG. 7, the foil member 310 is positioned on a distal end (or of the inner member 320 and has a pair of wings or foils 314. The winged foil 312 (or underwater wing), which has recently become popular for racing sailboats, the lift of such a winged foil 312 is largely upwardly (rather than laterally, as for a leeway reducing keel) to reduce the wetted area of the hull 20 and thence its drag as the sailboat 10 moves forwardly.

[0052] FIG. 8 shows a cross-sectional view of a portion of a sailboat 10 with a fixed keel 70 and an adjustable ballast or weight system 400. Typically, by placing the weight of the ballast or weight system 400 as low as possible (often in a large bulb 460 at the bottom of the keel) the maximum righting moment can be extracted from the given mass. However, it can be appreciated that in certain sailing conditions, it may be desirable to adjust the location of the weight system 400 within the keel 70.

[0053] As shown in FIG. 8, the ballast or weight system 400 is comprised of a moveable weight 440 comprised of a high density material, such as concrete, iron, or lead, which is placed within the keel 70. The weight system 400 is adapted to fit within an inner chamber 420 of the keel 70 and includes a control system 410 for adjusting the depth of the weight system 40 within the chamber 420. In accordance with one embodiment, the control system 410 can include an inner screw member 430, which raises and lowers the weight system 400 within the inner chamber 420. The control system 410 controls the depth or position of the inner screw member 430, which in turn lowers or retracts the weight system 400. The inner screw member 430 is preferably attached to a winch system or other suitable system for lowering or extending and/or retracting the weight system 400 within the keel 70.

[0054] In accordance with one embodiment, the control system 410 can include a mechanical device that is used to control the relative position of the inner screw member 430, which in turn controls the depth of the weight system 400 within the inner chamber 420 of the keel 70. In accordance

with one embodiment, the control system **410** consists of a spool or drum and an attached crank. It can be appreciated that the control system **410** can also include suitable gear assemblies and/or can be powered by electric, hydraulic, pneumatic or internal combustion drives. The control system **410** also preferably includes a solenoid brake and/or a mechanical brake that prevents the system from unwinding and/or releasing from a fixed position.

[0055] As shown in FIG. 8, the keel **70** also can include a foil member **450** having a winged foil **452** (or underwater wing) positioned on a distal end of the keel **70**. The foil member **450** with a winged foil **452** provides lift in a largely upwardly direction (rather than laterally, as for a leeway reducing keel) to reduce the wetted area of the hull **20** and thence its drag as the sailboat **10** moves forwardly.

[0056] FIG. 9 shows a cross-sectional view of a sailboat **10** with a fixed keel **70** with a hollow winged keel **460** and an adjustable ballast or weight system **400** in accordance with another embodiment. As shown in FIG. 9, the hollow winged keel **460** includes a foil member **450** having a winged foil **452** with a chamber **470** therein. The chamber **470** can be attached to a ballast system (not shown), which can be filled with either outside water or pressurized. The ballast system can be configured to provide the chamber **470** within the foil member **450** with a positively buoyant condition, weighing less than the volume of water it displaces, or negative buoyancy, which either increases its own weight or decreases the displacement of the water.

[0057] FIG. 10 is a cross-section view of a sailboat **10** with a retractable solar panel system **500** in accordance with another embodiment. As shown in FIG. 10, the retractable solar panel system **500** includes a plurality of solar panels **510**, which are attached to a nautical stay **502**. It can be appreciated that the stay (or shroud) **502** can include any suitable line, rope, wire or rod running from the masts to the hull, usually fore-and-aft along the centerline of the sailboat **10** or a shroud running from the mast **50** to the side of the sailboat **10**. The stay or shroud **502** preferable is fixed at a one end **504** to the hull **20** of the sailboat **10** and at a second end **506** to the top or a top portion **46** of the mast **50**.

[0058] The solar panels **510** are preferably any suitable panel or array of smaller panels, which converts sunlight into an energy source. It can be appreciated that any solar panel **510** can be used including flat solar thermal collector, such as a solar hot water or air panel used to heat water, air, or otherwise collect solar thermal energy, or any photovoltaic module, which is an assembly of solar cells used to generate electricity. The solar panels **510** are preferably flat, and can be various heights and widths. It can be appreciated, however, that the solar panels **510** can be slightly curved or of a suitable flexible design. In addition, each solar panel **510** can be comprised of an array of solar-thermal panels or photovoltaic (PV) modules, which are be connected either in parallel or series depending upon the design objective.

[0059] In accordance with one embodiment, the retractable solar panel system **500** preferably includes a plurality of solar panels **510**, which are attached to the stay **502** via a connector **520** such as a connecting rod or hook. The system **500** also includes a system for the unfolding the plurality of solar panels **510** and extending the connector **520** (i.e., connecting rod or hook) upward towards the top portion **46** of the mast **50** when in use. It can be appreciated that when not in use, the solar panels **510** can be retracted and stored on the deck of the sailboat **10**. The system for extension and retraction of the

solar panels **510** is preferably a winch (e.g., **140**) or other suitable mechanical device that is used to wind up a rope, or cable. The winch preferably includes a spool (or winch drum) and attached crank. It can be appreciated that the mechanical device or winch can be powered by electric, hydraulic, pneumatic or internal combustion drives, and includes a solenoid brake and/or a mechanical brake or ratchet that prevents it from unwinding.

[0060] A protective cover is preferably placed over the stack of solar panels **510** during storage thereof or when the solar panels **510** are not in use. As shown in FIG. 10, a pair of solar panels **522**, **524** are attached to each preferably via the connector **520**, which preferably is a connecting rod or hook, and can include a pair of hinges **526**, **528** such that the plurality of solar panels **510** can be stored in a stack (i.e., z-fold) when not in use.

[0061] FIG. 11 is a front view of the retractable solar panel system **500** of FIG. 10 in accordance with one embodiment. As shown in FIG. 11, the panel system **500** comprises a pair of solar panels **522**, **524** having a hinge **526**, **528** between to allow the plurality of panels **510** to be stacked when not in use. The plurality of panels can also include at least one edge member **530**, **540**, which assists with the alignment of the solar panels **510** during use. The at least one edge member **530**, **540** is preferably a wire, a hook attaching the outer edge of the solar panels to one another or other suitable method of attaching the panels to one another.

[0062] FIG. 12 is a plan view of a retractable solar panel array **600** in accordance with one embodiment. As shown in FIG. 12, a retractable solar panel array **600** can be comprised of a plurality of vertical solar panel systems **500**. The solar panel systems **500** preferably includes a plurality of solar panels **510** attached to one another and attached to a fixed stay **502**, or in the case of land fixed systems, the stay **502** can be a wire, a rope, a rod, or other suitable device, wherein the plurality of solar panels **510** can be stacked during non-use and unfolded during use. It can be appreciated that the use of the solar panel system **500** is not limited to sailboats **10**, and that the solar panel system **500** can be placed on any suitable structure including residential and commercial buildings, windmills, water towers, billboards, support structures such as bridges, radio masts, antennas, and towers, and natural landforms, including hills, cliffs, fields, berms, mounds and valleys. In addition, the solar panel system **500** can be attached to modes of transportation such as buses, cars or automobiles, trucks, ships, aircraft and trains. In accordance with another embodiment, the solar panels **510** can be placed on floatation devices or a floatable element (not shown), and the retractable solar panel system **500** can be placed on any suitable body of water including lakes, ponds, rice paddies, oceans, and swimming pools.

[0063] FIG. 13 is a plan view of a retractable solar panel array **600** in accordance with another embodiment, wherein the retractable solar panel array **600** is fixed between a pair of vertical members **602**, **604**. As shown in FIG. 13, the solar panel systems **500** is positioned e horizontally fixed between the pair of vertical members **602**, **604**.

[0064] FIG. 14 is a front view of a retractable solar panel system **500** in accordance with another embodiment. As shown in FIG. 14, the retractable solar panel system **500** comprises a plurality of solar panels **510** (FIG. 11), or a roll of solar panel material **610**, stored on a roll or drum system **620**. During non-use, the plurality of solar panels **510** or the roll of solar panel material **610** are wound around a drum **630** or

other suitable device. An optional handle **632** as shown or other suitable system, such as a small winch can be used to unroll and/or wrap the solar panel material **610** around the drum **630**. During use, the plurality of solar panels **510** or the roll of solar panel material **610** is unwound extending from the drum **630** to a fixed point **506**. It can be appreciated that the solar panels **510** or the roll of solar panel material **610** are preferably photovoltaic cells or modules.

[0065] In accordance with one embodiment, the solar panels **610** in the form of photovoltaic cells or modules (or a group of cells electrically connected and packaged in one frame), which convert sunlight directly into electricity. The photovoltaic (PV) cells can be made of a semiconductor material such as silicon, such that when light strikes the cell, a certain portion of it is absorbed within the semiconductor material. The energy of the absorbed light is transferred to the semiconductor, and knocks the electrons loose, allowing them to flow freely. In addition, photovoltaic (PV) cells also all have one or more electric fields that act to force electrons freed by light absorption to flow in a certain direction. The flow of electrons is a current, which can be used externally by placing metal contacts on the top and bottom of the PV cell. This current, together with the cell's voltage (which is a result of its built-in electric field or fields), defines the power (or wattage) that the solar cell produces.

[0066] FIG. **15** is a plan view of a sailboat with a retractable solar panel system **500**, which is attached to a telescoping or retractable mast **550**. As shown in FIG. **15**, the retractable solar panel system **500** includes a plurality of solar panels **510** attached to one another and attached to a fixed stay **502**, which is attached at one end **504** to the hull of the sailboat at the other end **506** to an upper end **572** of a telescoping or retractable mast **550**. The telescoping or retractable mast **550** is comprised of a plurality of tubular sections **552**, **554**, **556**, **558**, **560** that slid inside each other for easier storage when not being used. The telescoping mast **550** can be lengthen and shorten as desired. It can be appreciated that the tubular sections **552**, **554**, **556**, **558**, **560** can have any suitable cross-sectional design, which accommodates a telescoping design, including rectangular and/or square. A handle or mechanical winch system **580** can be used to raise and lower the mast **550**.

[0067] The panel system **500** includes a pair of solar panels **522**, **524** having a hinge **526**, **528** between to allow the plurality of panels **510** to be stacked when not in use. It can be appreciated that the use of the solar panel system **500** and telescoping and/or retractable mast is not limited to sailboats **10**, and that the solar panel system **500** and telescoping and/or retractable mast **550** can be placed on any suitable structure including residential and commercial buildings, windmills, water towers, billboards, support structures such as bridges, radio masts, antennas, and towers, and natural landforms, including hills, cliffs, fields, berms, mounds and valleys.

[0068] FIG. **16** is a plan view of a solar panel system **700** in accordance with a further embodiment. As shown in FIG. **16**, the solar panel system **700** is comprised of a plurality of solar panels **720**, which are attached to a support member **710**, in the form of a pole or tubular member. In accordance with one embodiment, the plurality of solar panels **720** is rotatable, such that the solar panels **720** will lie in the same plane as the wind blows. The rotatable solar panels **720** provide the solar panel system **700** with the ability to be placed in areas of high winds without requiring the face **730** of the solar panels **720** to be positioned directly into the wind. Rather the solar panels **720** rotate such that the main face **730** of the solar panel lies

in the same direct as the wind blows. If the direction of the wind changes, the solar panels **720** rotate, such that the face **730** of the solar panel **720** is always in the same plane as the direction of the wind.

[0069] In accordance with one embodiment, the solar panels **720** can be attached to the support member **710** by any suitable means, which allows the solar panels **720** to rotate. For example, as shown in FIG. **16**, the solar panels **720** can be attached to the support member **710** with a coupling member **712**, which rotates around the support member **710**. The solar panels **720** can also include indicia, such as "HIGHPOINT" or other trade names for advertising or marketing purposes.

[0070] It will be understood that the foregoing description is of the preferred embodiments, and is, therefore, merely representative of the article and methods of manufacturing the same. It can be appreciated that many variations and modifications of the different embodiments in light of the above teachings will be readily apparent to those skilled in the art. Accordingly, the exemplary embodiments, as well as alternative embodiments, may be made without departing from the spirit and scope of the articles and methods as set forth in the attached claims.

What is claimed is:

1. A keel for a sailboat comprising:
 - an extendable keel comprising:
 - an outer member;
 - an inner member, which extends from within the outer member; and
 - a foil member attached to the inner member; and
 - a control system for lowering or retracting the inner member.
2. The keel of claim 1, wherein the control system is comprised of an inner screw member and a winch system
3. The keel of claim 2, wherein the winch system comprises a mechanical device that is used to control the relative position of the inner screw member and the inner member to the outer member, which in turn controls the depth of the foil member of the keel.
4. The keel of claim 1, wherein the outer member is fixed.
5. The keel of claim 1, wherein the foil member is a winged foil.
6. The keel of claim 1, wherein the inner member is a telescoping inner member comprised of a plurality of inner members.
7. The keel of claim 6, wherein the plurality of inner members have a core containing a plurality of sealed air chambers, which are pressurized when the plurality of inner members are lowered.
8. The keel of claim 7, further comprising an air compressor, which supplies pressurized air to the plurality of sealed air chambers to lower and retract the plurality of inner members.
9. The keel of claim 8, further comprising at least one valve, which controls the pressurized air upon the lowering and retracting of the plurality of inner members.
10. The keel of claim 1, further comprising an adjustable ballast system positioned within the inner member.
11. The keel of claim 10, wherein the adjustable ballast system is comprised of a moveable weight positioned within the inner member and includes a ballast control system for adjusting a depth of the moveable weight within the inner member.

12. A keel for a sailboat comprising:

a fixed keel;

a moveable inner member positioned within the fixed keel;
and

a control system for lowering or retracting the inner member.

13. The keel of claim **12**, wherein the control system is comprised of an inner screw member and a winch system

14. The keel of claim **13**, wherein the winch system comprises a mechanical device that is used to control the relative position of the inner screw member and the inner member, which in turn controls a depth of the inner member within the keel.

15. The keel of claim **12**, further comprising a winged foil member attached to the moveable inner member.

16. A keel for a sailboat comprising:

a keel member having an inner chamber;

an adjustable ballast system within the inner chamber; and

a ballast control system for adjusting a depth of the ballast system within the inner chamber.

17. The keel of claim **16**, further comprising a foil member attached to the keel member.

18. The keel of claim **17**, wherein the foil member is a winged foil.

19. The keel of claim **16**, wherein the adjustable ballast system is comprised of a moveable weight positioned within the inner member.

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