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(54) **CYCLOSAIL WIND TURBINE**

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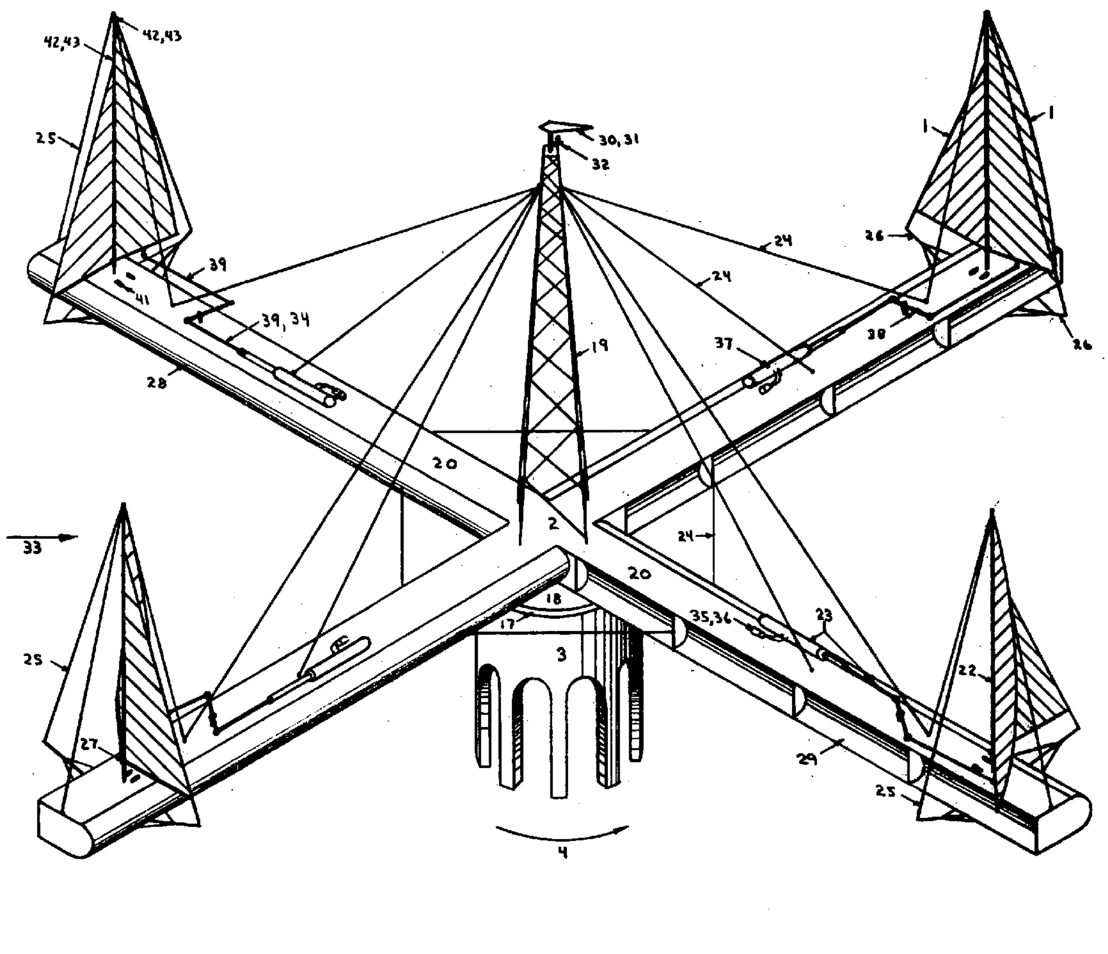
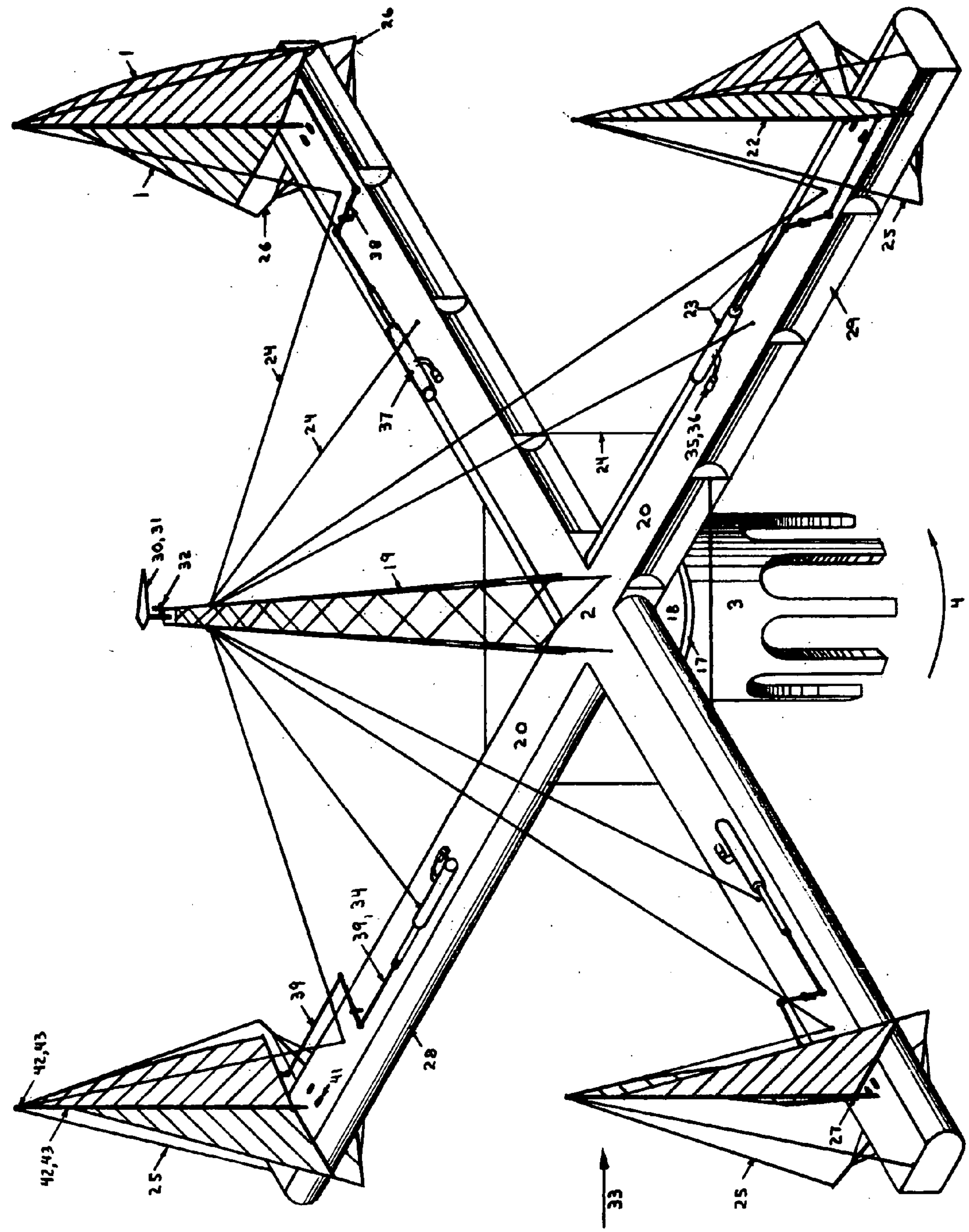
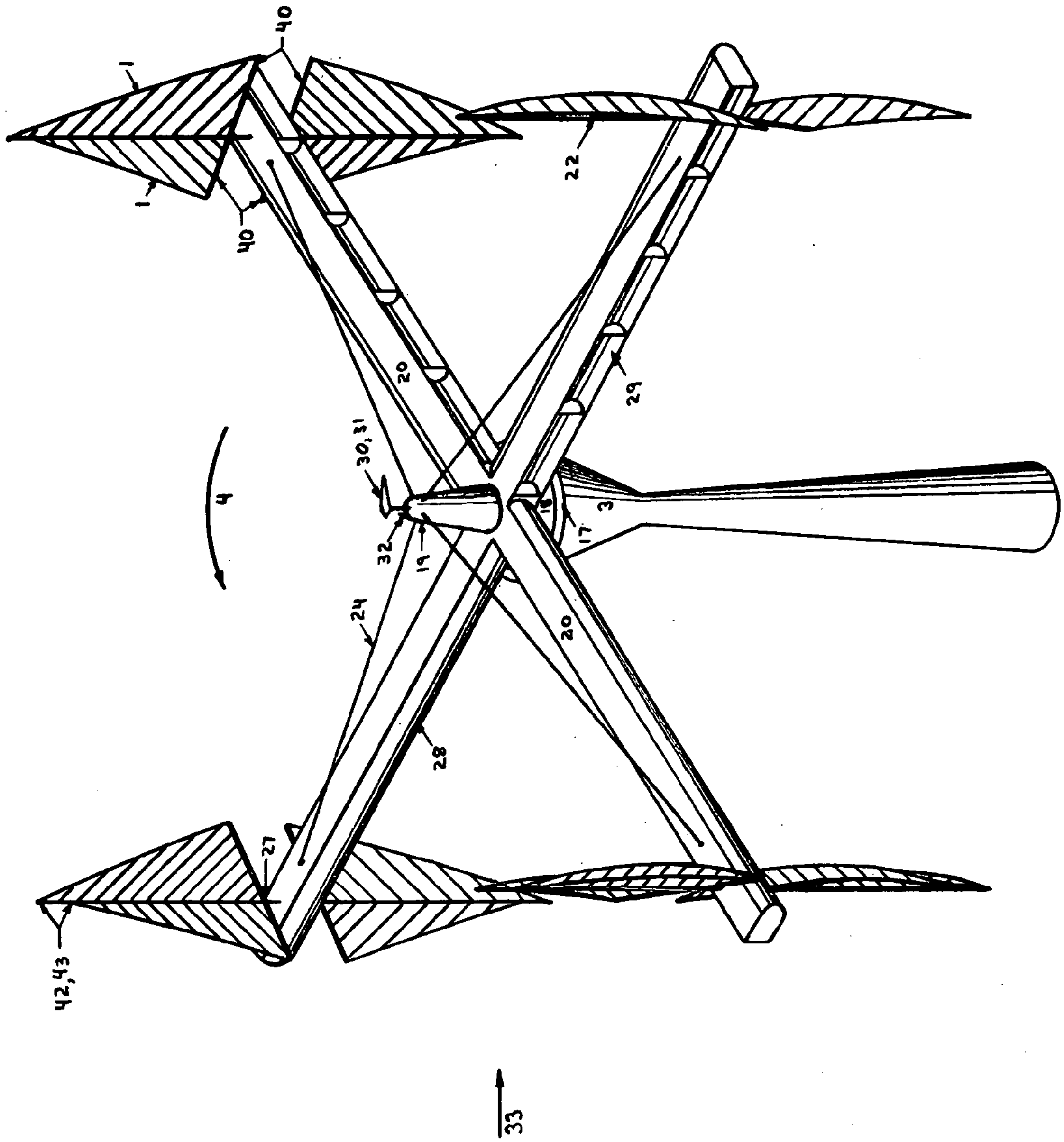
(57) **ABSTRACT**

A Vertical Axis Wind Turbine comprising: A hub housing an alternator or generator, gearbox, arbor, tachometer and programmable logic controller. At the upper outer radius of the hub is a track supporting the landing gear for the wind rotor. Above the hub a large elongated wind rotor is attached to the arbor with landing gear that ride on the track. The rotor is the support structure providing anchoring for masts, sails and boom control systems. Attached to the top/center of the rotor is a tower with cables supporting the outer perimeter portions of the rotor arms. At the top of the tower is a weathervane and position controller. Fabric sails are attached to the mast assemblies and controlled by resolvers. When the wind causes rotation the programmable logic controller adjusts the sails to best catch the wind regardless of wind direction or their position while the rotor is rotating.



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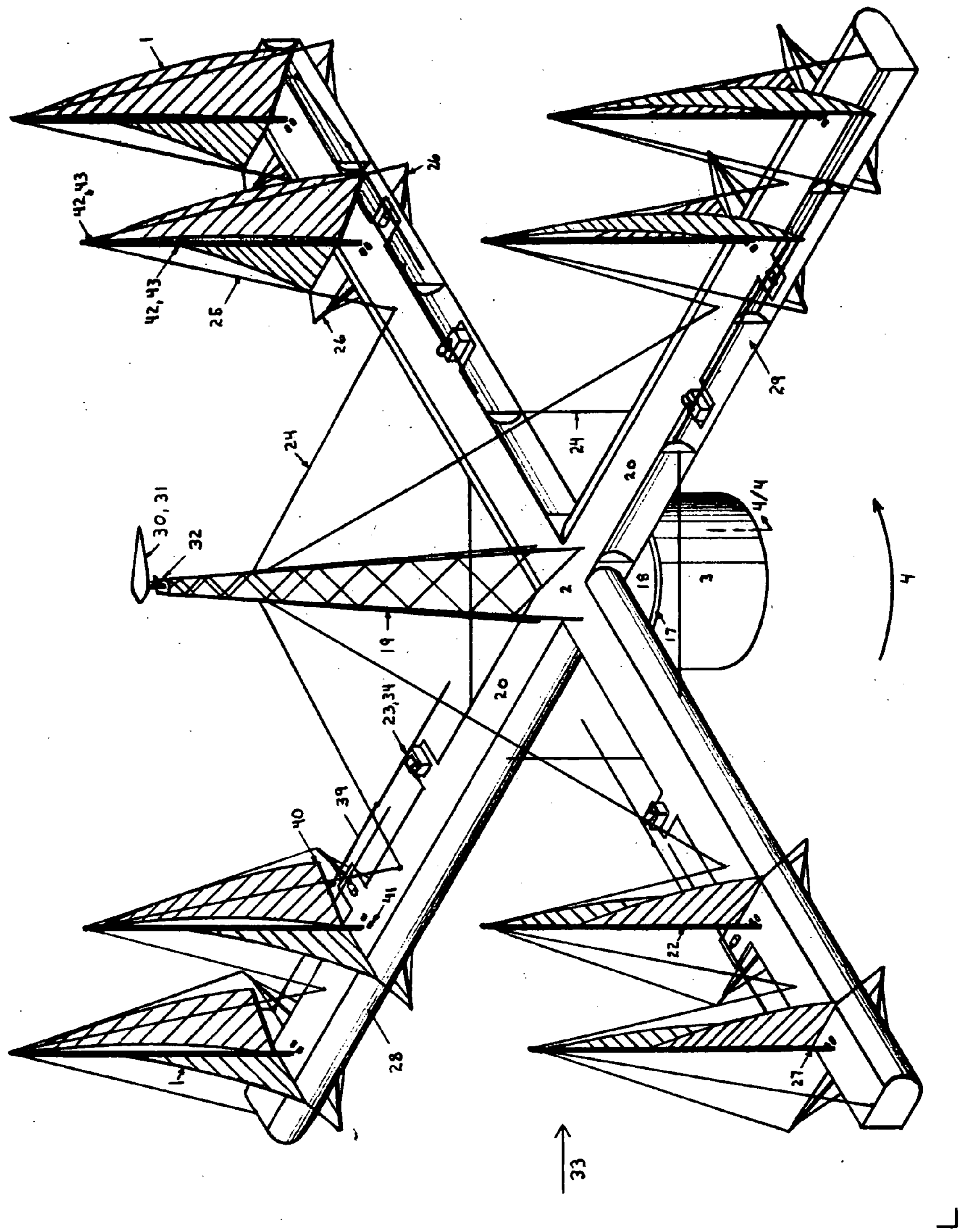
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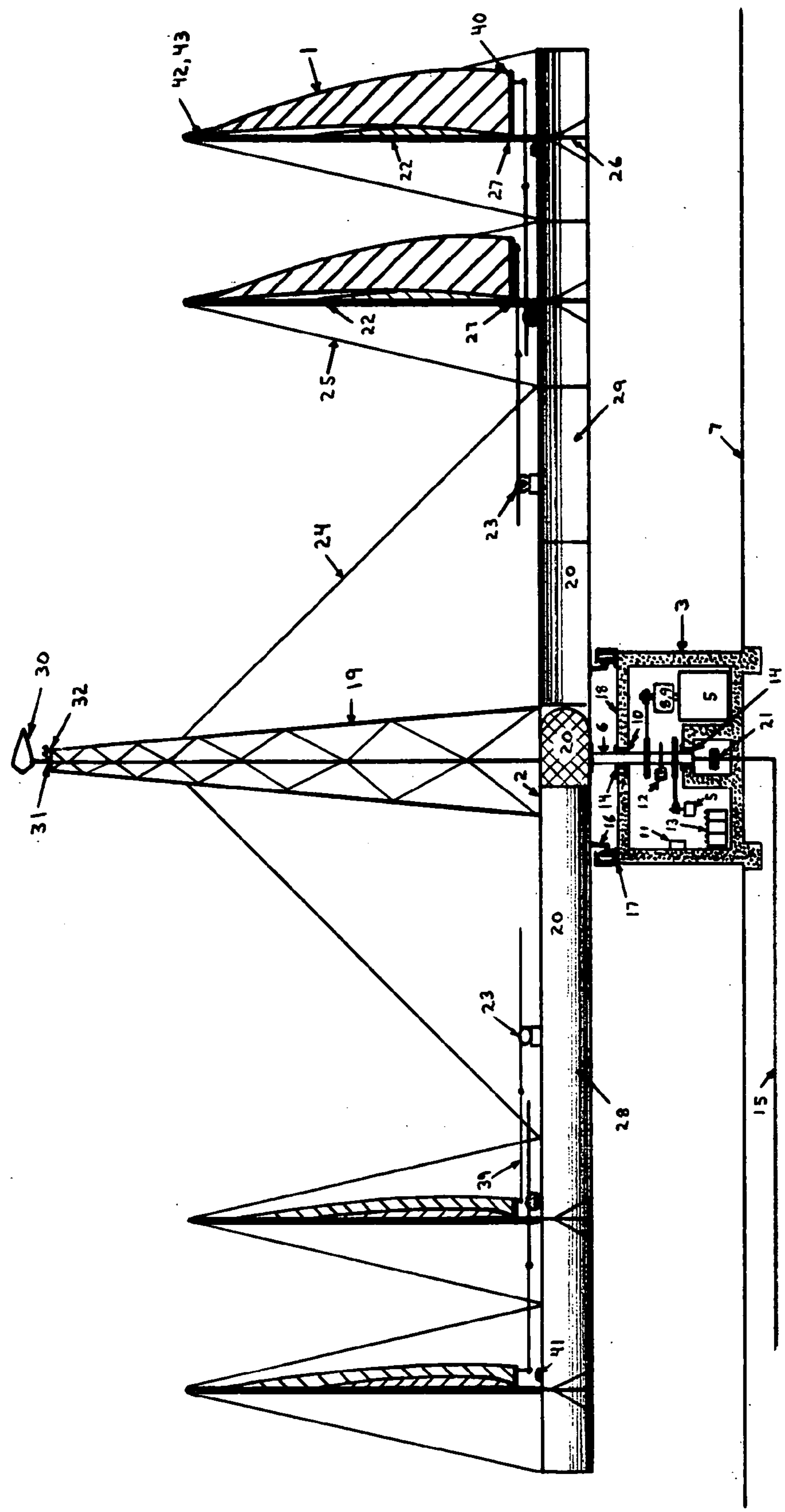

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CYCLOSAIL WIND TURBINE

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BACKGROUND OF THE INVENTION

[0002] 1. Technical Field

[0003] This invention relates to a vertical axis wind turbine of great stature. Using a large wind rotor as the support structure to mount vertical masts and sails to extract energy from the wind.

[0004] Sails and vertical axis windmills are a part of ancient history. Only recent developments in automatic sail controls and advancements in computer technology and control devices have made this invention possible.

[0005] The efficiency of modern sails is well known. Some sails have the ability to actually sail up wind, such as a sloop rigged sail or a rotating mast rigged sail. A machine that uses this type of sail set up in such a way that each sail automatically sails in a circle and pushes the rotor arms in the same way a sail pushes a sailboat would be a great improvement to the original vertical axis windmill.

[0006] The masts and sails must have some sort of structure to be attached to and supported by. To have this structure exposed to the wind would create a great deal of wind resistance lowering the efficiency of the machine so it is reasonable to make this structure aerodynamic. Covering this structure with a light weight material and designing it so the structure would be streamlined for going into the wind and designed so it would capture the wind when going downwind, as a wind rotor, would actually cause the structure to create some power rather than costing power to turn it.

[0007] The use of wind rotors in wind turbines is largely used and typically provides the torque for the turbine to self start. Having the sails a large distance from the center of the rotor would create a great deal of torque but to have a large structure designed to support itself independently may not be feasible, so using lessons learned from the suspension bridge would solve this problem. Utilizing the tower in the center of the rotor structure as a fulcrum and having the rotor arms extend horizontality from the center and connecting them with cables from one rotor arm up to the tower then down to the opposing rotor arm would provide the support required and allow for a light weight cantilever type rotor structure similar to the primary center support section of a self anchoring suspension span or cable stay bridge.

[0008] The sails on this machine must all work in concert so it is necessary for the machine to be oriented into the wind. Having a weathervane and position controller at the top of the tower would provide the ability to correctly position the sails so the machine develops optimum power and gives it the ability to self start.

[0009] The objective of this invention is to provide a solution to problems known to exist with the wind turbines located at wind farms. The great height that is required for such wind turbines makes them visible for miles and reduces the intrinsic value of the surrounding land. The speed at which the blades turn create a hazard for birds and bats putting additional strain on some species already endangered.

[0010] 2. Prior Art

[0011] U.S. Pat. No. 206,631 by Smith describes a wind engine using sails that rotate about a vertical axis. The weight of the sails and masts are supported directly by a boat or a wheeled vehicle. U.S. Pat. No. 802,144 by Harrington describes a windmill with sails that rotate about a vertical axis and uses a tower to support the sails. The sails on this invention collapse when going upwind. U.S. Pat. No. 1,697,574 by Savonious describes a wind rotor that uses curved fixed vanes that rotate about a vertical axis. U.S. Pat. No. 3,995,170 by Graybill describes a wind energy conversion devise that uses sails which collapse when going upwind and are mounted on a frame. U.S. Pat. No. 4,303,835 by Bair describes a wind powered generator with cyclic airfoil latching. This invention uses rigid airfoils that rotate about a vertical axis and are computer controlled so the airfoils turn to catch the wind as the machine rotates. U.S. Pat. No. 4,730,119 by Biscomb describes a sail driven wind motor using fore and aft rigged sails that are mounted on arms. This invention utilizes an oscillating movement of the arm structure and the arms are supported by wheels that ride on a circular track. U.S. Pat. No. 6,672,522 by Lee describes a wind power generating system that uses sails mounted on rotating masts and travel on a race track shaped track and has furling sail devises.

SUMMARY OF THE INVENTION

[0012] The invention is a VAWT consisting of a large elongated horizontal wind rotor with attached vertical tower, vertical masts, horizontal booms and fabric sails all supported by vertical hub.

[0013] It is an object of this invention to provide:

[0014] Large fabric sails mounted on each rotor arm as the primary means for collecting wind energy to be used to power a vertical axis wind turbine (VAWT). The sails are automatically adjusted to cause each sail to sail in a circle around the perimeter of the machine.

[0015] A streamlined horizontally rotating structure to support and to mount the vertical masts and sails. The structure takes the shape and characteristics of a wind rotor. The rotor structure contributes to collecting wind energy. The sails are mounted at a suitable distance from the center of the machine on the rotor arms so the turbulence created from each sail is minimized when it interacts with other sails that are downwind.

[0016] A hub to support and stabilize the rotor and it's attachments as they rotate with the arbor.

[0017] A centralized vertical tower with cables to support most of the weight of the rotor arms and attachments as the rotor arms extend a considerable distance from the center of the machine.

[0018] A programmable logic controller or computer to receive and analyze data input from sensors and devices located on the machine in order to activate the boom control systems and also the automatic furling systems to correctly position the sails so the machine develops the most optimum power output from the available wind conditions without causing any damage to the machine.

[0019] A weathervane with an attached position controller located at the top of the tower and also an anemometer located at the top of the tower, in order to relay wind direction and wind speed information to the programmable logic controller.

[0020] Boom control systems with resolvers to relay boom locations to the programmable logic controller to enable the proper positioning of the booms according to wind direction.

[0021] Halyards with resolvers to relay sail furling information to the programmable logic controller.

[0022] A tachometer located in the hub to relay rotor rpm information to the programmable logic controller to aid in maintaining an optimum rotational speed.

[0023] Electric hydraulic pumps, valves and cylinders which are operated and controlled by the programmable logic controller, to accurately position the booms and sails so they capture wind energy n the most optimum way to cause the machine to rotate or to maintain a certain rpm.

[0024] Automatic boom furling systems, which are also operated and controlled by the programmable logic controller, to raise or lower the sails according to wind conditions in order to prevent damage due to high wind speeds and also to aid in maintaining a certain rpm during higher than optimal wind speed conditions.

[0025] Utilize the torque created by having the sails a large distance from the center of the machine.

[0026] An optional irrigation system that could be installed on suitable machines.

[0027] The hub is attached to the ground and houses alternators, gearbox, transmission, arbor, brake, battery pack, tachometer and programmable logic controller. At the upper outer perimeter of the hub is a circular track to allow the landing gear for the rotor to ride.

[0028] An elongated wind rotor is attached to the arbor above the hub and each rotor arm has landing gear that ride on the track that is designed to help support the weight of the rotor and to stabilize it while the machine is rotating. The wind rotor has structural components designed to support the mast assemblies, standing rigging, support cables, tower, sails and the boom control systems.

[0029] The tower is attached to the top and center of the rotor and rotates with the rotor. The masts are installed on the outer portions of the rotor arms, each rotor arm may have more than one mast and the rotor may have an odd number of rotor arms or an even number of rotor arms. The tower supports cables that stretch diagonally between the tower and the outer portions of the rotor arms. The cables are designed to support the weight of the rotor arms, mast assemblies, sails and boom control systems.

[0030] At the top of the tower is located the weathervane, position controller and anemometer. The weathervane always points into the wind and orientates the position controller as to wind direction. The programmable logic controller extrapolates this information and correlates it with boom location information received from resolvers and rpm information from the tachometer then activates electrically operated hydraulic pumps, valves and cylinders that control the precise position of the booms so the sails are always in the best position to capture the power of the wind regardless of wind direction, change in wind direction, wind speed or the sails position on the machine while the rotor is rotating.

[0031] Having an anemometer at the top of the tower provides wind speed information to the programmable logic controller giving it the ability to raise or lower the sails according to wind conditions.

[0032] Having the sails mounted on the rotor arms will provide the ability to have a very large surface area exposed to the wind without requiring great height giving the machine a much lower profile than existing wind turbines and making it more difficult to see from a distance.

[0033] With the sails mounted a large distance from the center of the rotor will not only utilize the full potential of the sails ability to capture wind power but will also cause the rotor to rotate very slowly allowing birds and bats to avoid the machine as it is operating making it suitable to be placed in areas of migratory or endangered birds and bats.

[0034] Given this inventions ability to irrigate a filed would provide the means for a farm operation to become more productive and efficient allowing more time for other activities.

[0035] There is a clear and present need for clean electrical energy, a wind turbine that can utilize lower altitude winds and create a great deal of electricity would be of tremendous value in helping to minimize the use of fossil fuels, contributing to a cleaner atmosphere and providing minimal environmental impact.

[0036] The invention is a vertical axis wind turbine using a large rotating support structure that takes the shape of a horizontal wind rotor. The rotor is the support structure for all of the components mounted above a centralized hub; where a tower, masts, booms, boom control systems and fabric sails are mounted, directly or indirectly, on the rotor. The sails are configured so each sail automatically sails in a circle providing the power to turn the rotor and thereby the alternator, generator or water pump. The invention could be used to create electricity suitable for the electrical power grid to which the machine is attached, to create electricity in a remote location, to power a hydrogen production facility or it could be used to pump water.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0037] A self starting Vertical Axis Wind Turbine designed to make electricity using the power of the wind and is intended to be very large. The machine utilizes fabric sails **1** as used on a sailboat and an elongated horizontal wind rotor **2** with a vertical hub **3** to create the power required to cause the machine to rotate **4**. Alternators or generators **5** driven by the wind rotor **2** and sails **1** via the arbor **6** provide the source of electricity.

[0038] A central hub **3** is securely mounted to the ground **7** and contains within it the alternators or generators **5**, gearbox **8**, transmission **9**, tachometer **10**, programmable logic controller **11**, arbor **6**, brake **12**, battery pack **13**, thrust bearings **14**, irrigation pipe **15** and the mounting structures for the various equipment. The exterior wall of the hub **3** is designed to be strong enough to support the weight of the rotor **2**. The top of the exterior wall is built at a radius to match the landing gear **16** for the rotor **2**. The track **17** for the landing gear **16** is located at the top of the exterior wall of the hub **3** and is designed to be adjustable to allow for settling and to prevent the landing gear **16** from rising above the track **17** when the machine encounters high winds. The hub **3** has a roof **18** covering the structure to keep the weather out and to protect the interior components. The center of the roof **18** has a thrust bearing **14** to allow the arbor **6** to pass through. The roof **18** is designed to support the thrust bearing **14**, arbor **6**, some of the weight of the rotor **2** and the tower **19**. On models with the ability to irrigate a farmers field the arbor **6** will be hollow to allow the irrigation pipe **15** to pass through and extend along the length of two opposing rotor arms **20** to maintain balance. Beneath the bottom of the arbor **6** the irrigation pipe **15** will have a swivel fitting **21**. The arbor **6** and rotor **2** are securely fastened together.

[0039] The rotor **2** will have four equal arms **20** installed **90** degrees from each other and extend radially from the center of the rotor **2**, maintaining an equal distance between each rotor arm **20** around the perimeter of the machine. The rotor arms **20** are constructed in such a way as to have high strength and light weight, with integral mounting structures for the vertical masts **22**, sails **1**, boom control systems **23**, support cables **24**, standing rigging **25** as well as the support structure for the fore and aft attachment **26** of the standing rigging for each mast **22**. The mast and boom assemblies **27** are mounted on the rotor arms **20** at such a distance from the center of the rotor so that turbulence created by an upwind sail is minimized before it can interact with the function of downwind sails as the machine rotates. Each rotor arm **20** may have more than one mast and boom assembly **27**. The rotor structure **2** is covered with a light weight material and is designed so as a rotor arm **20** is running downwind it would be streamlined on the leeward side **28** and designed to capture the wind on the windward side **29**.

[0040] In the center of the rotor **2** and extending up from the top is a vertical tower **19** designed to support the cables **24** which provide support for the outer perimeter portions of the rotor arms **20**. Utilizing the tower **19** as a fulcrum and having the rotor arms **20** extend horizontally from the center and connecting them with diagonal cables **24** attached at one rotor arm **20** up to the tower **19** then down to the opposing rotor arm **20** in order to provide the support needed for a cantilever type suspension of the rotor arms **20**. The tower **19** is securely fastened to and rotates with the rotor **2**. At the top of the tower **19** is a weathervane **30**, position controller **31** and anemometer **32**. The weathervane **30** always points into the wind and orientates the position controller **31** as to wind direction **33**. The programmable logic controller **11** extrapolates this information and correlates it with information received from resolvers **34** located at the boom control systems **23** as well as rpm information received from the tachometer **10** and activates electric hydraulic pumps **35** and valves **36** located at the boom control systems **23** to cause hydraulic cylinders **37** to extend and retract. Each hydraulic cylinder **37** is connected to a pushrod that is connected to a pivoting lever **38** that is connected to another pushrod **39** that is connected to the accompanying boom **27** to control the accurate position of the boom **27** so the sails **1** catch the wind in the best possible way regardless of the sails **1** position on the machine, machine rpm, wind direction **33** or wind speed. The sails **1** are made of fabric and are similar in design as those used on a sailboat, such as a sloop or rotating mast rigged vessel.

[0041] When the programmable logic controller **11** detects high wind speed of a predetermined velocity, relayed by the anemometer **32**, it will then activate electric motors located at the automatic boom furling system **40** thereby lowering the sails **1** a predetermined amount in relation to wind speed in order to protect the sails **1** from damage due to high winds. This will allow the machine to operate in higher winds than would otherwise be possible without risking damage to the sails **1**. If wind speed continues to rise beyond the sails **1** structural ability to withstand the additional force applied by high wind speed then the programmable logic controller will completely lower the sails **1** and the machine will stop. When the wind storm has subsided the sails **1** would be automatically raised and the machine would self start.

[0042] Each sails leech can be controlled by activating the halyard motors **41** loosening the halyards and not activating the automatic boom furling system **40** thereby loosening the sails **1** giving them the ability to catch more wind when the sails **1** are running downwind. When the sail is traveling upwind the halyard would be tightened to minimize luffing of the sails.

[0043] There is also a limited travel extension spring **42** with a quick release detachment clasp **43**, similar to a pentle hook, at the top of each sail **1**. In the event of a large unexpected gust of wind that is beyond the structural ability of the sail **1** this spring would be fully compressed activating the detachment clasp **43** and the sail **1** would be disconnected from the halyard relieving any undue stress on the sail **1**, preventing damage. The limited travel extension springs **42** will also act as a shock absorber to lessen the stress applied on the sails **1** by large gusts of wind thereby increasing the sails **1** usable life.

[0044] There are many wind turbines and windmills that use fabric sails as the means to collect wind energy. The structures that support these sails are generally exposed to the wind creating a great deal of drag. Using sails **1** mounted on a streamlined wind rotor **2** gives this invention the ability to extract wind energy from both the sails **1** and the wind rotor structure **2**. This also provides an aesthetically pleasing devise.

DESCRIPTION OF THE DRAWINGS:

[**0045**] The drawings depict various combinations of the different components that comprise the invention and show the counterclockwise rotation of the rotor with the sails shown in the approximate position to cause rotation as compared to wind direction. In order to simplify the drawings and because all rotor arms, on any one wind turbine, are identical every other rotor arm. Any numbered component identified on any rotor arm is duplicated on all other rotor arms.

[**0046**] **FIG. 1/4**:

[**0047**] A perspective view showing the invention with a single mast and boom assembly with sloop rigged sails located on the top surface of each rotor arm and near the perimeter of the rotor. A hydraulic version of the boom control system is shown that moves the mainsail booms into position as the machine rotates. Other components shown are symmetrical rotor arms, lattice tower, weathervane located in undisturbed wind, multiple support cables and concrete hub supported by columns and arches. This version of the invention may be suitable for a remote location and possibly with an irrigation system.

[**0048**] **FIG. 2/4**:

[**0049**] A perspective view showing the invention with rotating mast rigged sails mounted on the upper and lower surface of each rotor arm and near the perimeter of the rotor. The invention is shown using masts that do not require standing rigging. The upper and lower masts on each rotor arm are securely fastened together within the rotor arm and a system similar to the boom control system will rotate both upper and lower masts and booms together equally to cause the upper and lower sails to catch the wind. All of the mast and boom and halyard control systems are located within each rotor arm. A short tower is shown on the top/center of the rotor that is designed to be tall enough to adequately support the weight of the rotor arms via steel cables. The weathervane is located on top of the tower. A steel contoured hub is shown and the entire machine is shown supported by a contoured steel pedestal. This version of the invention could be suitable for a wind farm application.

[**0050**] **FIG. 3/4**:

[**0051**] A perspective view showing the invention using two sets of sloop rigged sails mounted on the top surface of each rotor arm with a lattice tower and cylindrical hub. The boom control system is shown using a rack and spur gear system to move the main sail booms.

[**0052**] **FIG. 4/4**:

[**0053**] A sectional view of **FIG. 3/4** showing possible interior components of the hub and the relationship between the hub, arbor, landing gear, track, rotor, tower, masts and sails.

[**0054**] Legend:

[**0055**] **1**. Sail

[**0056**] **2**. Rotor

[**0057**] **3**. Hub

[**0058**] **4**. Direction of rotor rotation

[**0059**] **5**. Alternator/generator

[**0060**] **6**. Arbor

[**0061**] **7**. Ground

[**0062**] **8**. Gearbox

[**0063**] **9**. Transmission

[**0064**] **10**. Tachometer

[**0065**] **11**. Programmable logic controller/computer

[**0066**] **12**. Brake

[**0067**] **13**. Battery pack

[**0068**] **14**. Thrust bearing

[**0069**] **15**. Irrigation pipe

[**0070**] **16**. Landing gear

[**0071**] **17**. Track

[**0072**] **18**. Roof

[**0073**] **19**. Tower

[**0074**] **20**. Rotor arm

[**0075**] **21**. Swivel fitting

[**0076**] **22**. Mast

[**0077**] **23**. Boom control system

[**0078**] **24**. Support cable

[**0079**] **25**. Standing rigging

[**0080**] **26**. Rigging support structure

[**0081**] **27**. Mast and boom assembly

[**0082**] **28**. Leeward side of rotor arm

[**0083**] **29**. Windward side of rotor arm

[**0084**] **30**. Weathervane

[**0085**] **31**. Position controller

[**0086**] **32**. Anemometer

[**0087**] **33**. Wind direction

[**0088**] **34**. Resolver

[**0089**] **35**. Electric hydraulic pump

[**0090**] **36**. Electric hydraulic valve

[**0091**] **37**. Hydraulic cylinder

[**0092**] **38**. Lever

[**0093**] **39**. Pushrod

[**0094**] **40**. Boom furling system

[**0095**] **41**. Halyard motor

[**0096**] **42**. Limited travel extension spring

[**0097**] **43**. Quick release detachment clasp

What is claimed is:

1. A vertical axis wind turbine comprising a large elongated horizontally rotating wind rotor as the support structure for vertical masts and fabric sails that are mounted near the perimeter of rotation on the wind rotor arms;

a tower mounted on the top and center of said rotor supports steel cables that carry the weight of the outer portions of said rotor arms and attachments;

said rotor is supported and stabilized by a hub which is securely attached to the ground;

said rotor may be constructed to rotate clockwise or counterclockwise.

2. A vertical axis wind turbine as set fourth in claim 1 comprising said wind rotor constructed of aluminum, steel, metal alloy, wood, wood composites or synthetic composites and designed similar to a wing, crane boom or bridge using construction components such as longerons, stringers, struts, trusses, bulk heads, lattice and/or gussets;

said wind rotor is securely attached to the arbor and supported at the outer perimeter by said cables making said rotor arm a cantilever type structure that is designed so it is strong as well as light weight and is covered with a light weight material such as aluminum, metal alloy, fabric or composites;

and is designed so as said rotor arm is running downwind the leeward side would be streamlined and the windward side would be designed to capture the wind;

said wind rotor provides some of the power output of said wind turbine.

3. A vertical axis wind turbine as set fourth in claim 1 wherein said rotor arms are installed radially 180 degrees from each other at the center of said rotor and at an equal distance from each other around the perimeter, this would create a said wind turbine with an even number of rotor arms, a said wind turbine with an odd number of said rotor arms could also be built;

said rotor arms will have integral support structures for said arbor, said tower, said masts, said sails and said support cables as well as for the landing gear, catwalks and boom control systems.

4. A vertical axis wind turbine as set fourth in claim 1 comprising said rotor arms constructed to be symmetrical or tapered in length wherein a said rotor arm could be constructed with equal cross sections through out the length of each said rotor arm or said rotor arm could be constructed with cross sections smaller near the ends and larger in cross section near the center of said rotor.

5. A vertical axis wind turbine as set fourth in claim 1 wherein said rotor arms are equipped with said landing gear with wheels that ride on a circular track that is located on the top of the exterior wall of said hub thereby supporting said rotor and stabilizing said rotor as said rotor rotates.

6. A vertical axis wind turbine as set fourth in claim 1 comprising lateral support cables may be installed at the windward side and the leeward side of each said rotor arm and at an equal radius from the center of the rotor and are designed to distribute the force that is applied on the center of the rotor by said sails and said rotor, providing for a light weight center section at said rotor where said rotor arms are attached;

said lateral support cables could be eliminated by having said rotor constructed with internal support structures at the center of said rotor designed to withstand the forces and stress applied by said rotor arms and said sails.

7. A vertical axis wind turbine as set fourth in claim 1 wherein said rotor arms could be built with internal support structures making said rotor arms strong enough to support the weight of said rotor arms, said masts, said sails and said attachments independently thereby eliminating the need for said tower and said suspension cables to support the weight of the outer portions of said rotor arms and said attachments.

8. A vertical axis wind turbine as set fourth in claim 1 comprising vertical vanes located at said windward side of said rotor arms whereby said vanes serve to aid in the collection of energy from the wind by preventing the wind from sliding outwardly along said windward side of said rotor arms as said rotor arm is rotating and traveling downwind.

9. A vertical axis wind turbine as set fourth in claim 1 comprising said fabric sails as used on a sailboat to create most of the power derived from the wind whereby said sails push said rotor arms in the same way as the sails of a sailboat push said sailboat and each said rotor arm must have at least one said mast and sail assembly;

the sails of many different sailboat configurations could be used to cause said rotor to rotate and function such as a sloop rigged vessel, rotating mast rigged vessel, cutter, yawl, ketch, schooner or catboat.

10. A vertical axis wind turbine as set fourth in claim 1 comprising a system whereby said sails must all work in concert as said wind turbine rotates so it is necessary for said sails to be oriented with the wind whereby each said sail moves independently to catch the wind as said sail travels around the perimeter of said rotor thereby each said sail transitions from and to known sail configurations to catch the wind, such as;

when said sail is passing through the said sails furthermost upwind section of travel and approaching downwind travel the said sail is in a beam reach and will transition to and from a broad reach, running, broad reach, beam reach, close reach, close hauled, head to wind, close hauled, close reach and then back to a broad reach to start the cycle all over again repeating said cycle once for every revolution of said rotor as long as wind direction remains constant thereby said sails are configured so each said sail will automatically sail in a circle providing thrust to push said rotor arms around most of the perimeter of said rotor;

when the wind direction changes then each said sails orientation with the wind will change maintaining the rotation of said rotor.

11. A vertical axis wind turbine as set fourth in claim 1 comprising a system to automatically furl said sails when wind speeds begin to rise above the structural capability of said sails the said sails will be automatically furled to prevent damage to said sails or said sails could be partially furled to allow said wind turbine to continue to operate during higher than optimum wind speeds due to less surface area of said sails exposed to the wind;

when wind speeds exceed the structural capability of said sails then said sails will be completely furled and said rotor will stop rotating then after the wind storm has subsided said sails will be automatically unfurled and said wind turbine will self start.

12. A vertical axis wind turbine as set fourth in claim 1 comprising a system for controlling the leech on said sails such as when said sails and said rotor are in motion and traveling around said perimeter of said wind turbine and when said sails begin to travel downwind it is desirable to loosen the tension of said sails, so said sails are able to catch more wind; this can be somewhat accomplished by loosening said halyards while not operating said automatic furling system thereby relieving tension on said sail;

when said sail and said rotor arm begin to travel upwind or during high winds said halyard will be tightened thereby increasing tension on said sail to minimize luffing of said sail allowing said sail to travel upwind with more efficiency.

13. A vertical axis wind turbine as set fourth in claim 1 comprising a limited travel extension spring with a quick release detachment clasp, similar to a pentle hook, located at the top of said sails so that in the event of a large gust of wind or wind sheer that is beyond said sails structural ability said limited travel extension spring would become fully compressed activating said detachment clasp and said sail would become disconnected from the accompanying said halyard preventing damage to said sail caused by high winds; when a said sail becomes detached from said halyard then all of the said sails would be automatically completely furled and said rotor would stop rotating;

said limited travel extension spring will also act as a shock absorber for said sails when said sails experience a large unexpected gust of wind or wind sheer, increasing the service life of said sail.

14. A vertical axis wind turbine as set fourth in claim 1 comprising said sails located only at the top side of the said rotor arms will create a great deal of torsion on said rotor arm structure therefore installing a set of said sails, said mast and said boom assemblies with said boom control systems at the bottom side of said rotor arms where said sails would hang upside down or be vertically inverted and would work in conjunction with said sails on top of said rotor arms would eliminate torsion on said rotor arms and double the available power output from said sails;

this configuration would require increasing the overall height of said rotor by the height of said bottom sails and would probably make having an irrigation system impracticable.

15. A vertical axis wind turbine as set fourth in claim 1 comprising said vertical hub at the center of said wind turbine and said hub is securely attached to the ground using concrete footings, columns, posts or some other method of attachment also said hub may be supported by a pedestal to elevate the wind turbine to gain access to better wind conditions;

the top section of the exterior perimeter wall of said hub is built with a radius to match said landing gear on said rotor arms and made of concrete, steel, bricks, wood or some other suitable material and said perimeter wall should be tall enough to allow farm equipment to pass safely under said wind rotor while said wind turbine is operating and be strong enough to support said wind rotor and said components;

located at the top of said exterior wall is a track is securely fastened to the top of said exterior wall and is designed so said track captures said landing gear wheels to prevent said wheels from rising above said track due to high winds and said track should be adjustable to allow for settling of the soil beneath said perimeter wall of said hub;

preferred components contained within said hub are:

said large alternator or generator for producing electricity suitable for the applicable power grid for which said wind turbine is attached;

gearbox and transmission used to control the power input to the large alternator or generator;

tachometer to determine said rotor rpm;

brake for said arbor;

said arbor;

a small alternator or generator used to charge and maintain the operational battery pack;

programmable logic controller or computer;

operational battery pack used to power said wind turbines operational electronics;

programmable logic controller, anemometer, position controller, tachometer, resolvers, boom control motors and halyard control motors;

auxiliary battery pack suitable for storing electricity for use on calm days could be installed;

irrigation pipe with a swivel fitting for said wind turbines so equipped;

mounting structures for the various said components.

16. A vertical axis wind turbine as set fourth in claim 1 comprising a roof to cover said hub structure whereby the center of said roof has a thrust bearing to allow said arbor to pass through and uses trusses, posts, columns, arches, load bearing walls or some other method to support the center of said roof, said thrust bearing and some of the weight of said rotor and said tower; said thrust bearing will also provide support against lateral stress applied by said rotor.

17. A vertical axis wind turbine as set fourth in claim 1 comprising said vertical tower constructed with metal, wood, composites, or some other suitable material and is securely installed in the center of said wind rotor and on the upper surface of said wind rotor, there is an adjustment at the base of said tower to prevent any hunting motion at the top of said tower as said tower and said rotor rotate together;

said tower is designed to be able to support the weight and stress put on it by said support cables, wind, weathervane and possibly a lightning rod;

said support cables are attached to the outer portions of each said rotor arm and at the upper portion of said tower, so utilizing the tower as a fulcrum would allow the cables to go diagonally up to said tower from one said rotor arm and then diagonally down from said tower to the opposing said rotor arm, or arms for a said rotor with an odd number of said rotor arms, thereby transferring the weight from the outer portions of said rotor arms to said tower and creating a cantilever type rotor arm structure.

18. A vertical axis wind turbine as set fourth in claim 1 comprising said weathervane with an attached position controller is located at the top of said tower, so as the wind blows and said wind rotor is rotating said weathervane is always pointing into the wind and orientates said position controller as to wind direction, said position controller then relays wind direction information to said programmable logic controller.

19. A vertical axis wind turbine as set fourth in claim 1 wherein if said rotor arms are constructed to be self supporting so that said centrally located tower is not necessary to support the said outer portions of said rotor arms then an independent tower could be designed to solely to support said weathervane, position controller and anemometer and be positioned to the side of said wind turbine and clear of said rotor arms as they rotate, making it possible to provide wind direction and wind speed information to several said wind turbines from a single said independent tower.

20. A vertical axis wind turbine as set fourth in claim 1 comprising of a programmable logic controller or computer that extrapolates information received from said position controller and said anemometer then correlates this information with information received from said tachometer and resolvers, then activates electric hydraulic pumps and valves to actuate hydraulic cylinders located at the boom control systems to accurately position the booms or spars so said sails best collect wind power regardless of said sails position on said wind turbine, said sails location around said perimeter while said rotor is rotating, said rotor rpm, wind direction or wind speed.

21. A vertical axis wind turbine as set fourth in claim 1 comprising said boom control system to accurately control the position of each boom or spar as said rotor rotates and said boom control system incorporates a said electronically controlled and operated hydraulic cylinder that when actuated extends or contracts;

said cylinder is connected to a pushrod-pivoting lever-pushrod system that is connected to said boom or spar and causes said boom or spar to move back and fourth pivoting said boom or spar at said mast;

some said wind turbines may incorporate a single said boom control system to operate more than one said boom or spar;

said resolvers detect any motion of said hydraulic cylinder and relay the position of said hydraulic cylinder to said programmable logic controller allowing the precise positioning of said booms or spars;

a sprocket and chain system, gear assembly, flexible drive belt or a direct drive hydraulic system could be used in lieu of the aforementioned said hydraulic cylinder and said pushrod system.

22. A vertical axis wind turbine as set fourth in claim 1 comprising said small alternator or generator and said operational battery pack for the purpose of supplying electricity to power said electronic components that operate said wind turbine and provide said wind turbine the ability to be self dependent by providing the electrical power to correctly position said sails after a period of calm wind or after said wind turbine has furled said sail giving said wind turbine the ability to raise said sails and self start.

23. A vertical axis wind turbine as set fourth in claim 1 whereby some said large alternator configurations work best when a constant rpm is maintained and could be accomplished by feathering said sails in higher than optimum wind speeds, having said sails move into a position of a lesser efficient angle to the wind would cause said wind turbine to have a lower power output to wind speed ratio providing the ability to maintain a constant rpm during higher winds.

24. A vertical axis wind turbine as set fourth in claim 1 comprising said vertical mast assemblies consisting of said mast, said automatic furling boom system, said sails, said halyard motors, said halyards, said halyard resolvers, standing rigging and the support structure for each of the various components.

25. A vertical axis wind turbine as set fourth in claim 1 wherein built into the framework of each said rotor arm where fore and aft of each said vertical mast assembly is located there will be a structure to attach and support the standing rigging for said mast, said structure must extend past said sails fore and aft, providing enough clearance for said sails to operate;

having a mast constructed in such a way as to be strong enough to support itself and the stress applied by said sails and the wind would eliminate the need for said standing rigging and the said fore and aft structure to attach said standing rigging.

26. A vertical axis wind turbine as set fourth in claim 1 wherein said wind turbine is constructed using rotating masts with fixed booms or spars and said booms or spars are attached to said rotating mast and extend fore and aft of said mast enough to provide support and attachment for each fore and aft said sail;

the entire said rotating mast with booms or spars would pivot to cause said sails to catch the wind;

enabling said boom control systems and halyard control systems to be located within said rotor arms.

27. A vertical axis wind turbine as set fourth in claim 1 comprising said arbor consisting of a round shaft mounted vertically in the center of said wind turbine extending through said hub roof and will be supported by one or more said thrust bearings and will be strong enough to withstand the forces applied to it by said rotor, said sails, said gearbox, said transmission, said brake and/or said alternators or said water pump;

a gear, sprocket, flexible drive belt or direct drive is used to power said components attached to said arbor within said hub and a brake disk is securely attached to said arbor for said brake system.

28. A vertical axis wind turbine as set fourth in claim 1 wherein a large water pump could be installed in lieu of said large alternator or generator for the purpose of pumping water.

29. A vertical axis wind turbine as set fourth in claim 1 wherein on said wind turbines equipped with an irrigation system said arbor will be hollow to allow said irrigation pipe to pass through the center and extend out along two or more opposing said rotor arms, maintaining balance;

beneath said arbor a swivel fitting will be installed in said irrigation pipe to allow said irrigation pipe to rotate with said rotor;

said irrigation pipe that passes through said arbor will have a splitter fitting at the top of said arbor allowing said irrigation pipes to be attached to two or more opposing said rotor arms, maintaining balance;

said irrigation pipes will be fitted with water sprinklers that face the said windward side of said rotor arm providing additional thrust;

the height of said rotor above the ground will determine if said irrigation system is feasible.

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