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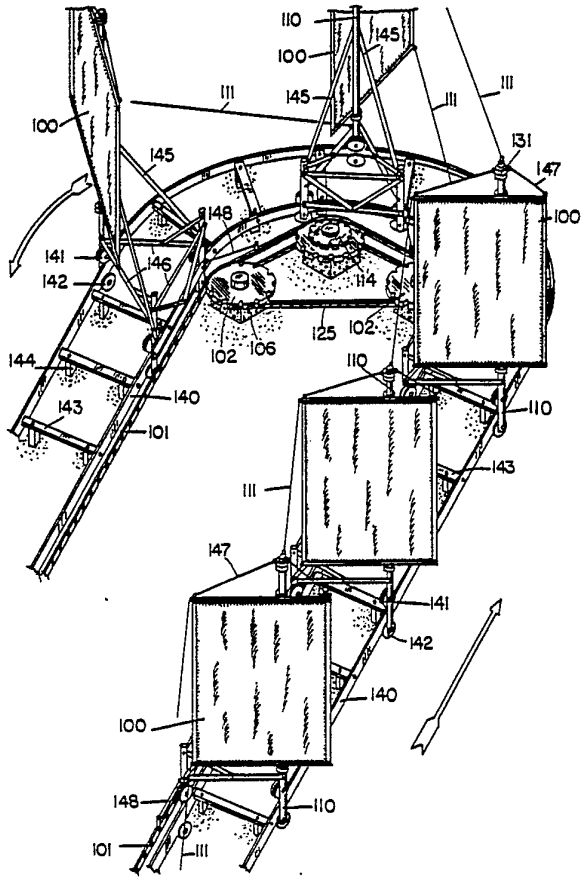
(54) Title: UNITED SAIL WINDMILL

(57) Abstract

The object of this invention is to provide a large scale but low cost windmill by maximizing wind-contact out of the least cost of materials with least cost of maintenance. This is attained by making the sails (100) as large as possible using light materials such as framed fabrics or aluminum sheets, by arranging the large sails (100) to form a long line of parading sails in one direction transverse to the wind and another long line of the same kind parallel to the first line but moving to the opposite direction with which the first line makes a closed loop, by using a strong light weight cable chain (101) that is tugged by the large sails and which also turns the terminal gears (102) located at the two ends of the loop, by using light weight vehicles to carry the large sails.



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Description

UNITED SAIL WINDMILL

Technical Field

My invention relates to new designs of windmills in several types to obtain maximum benefit from the energy offered by the wind in a given limited space at a minimum cost.

In the convertion of the wind energy particularly by means of the windmill, it is very essential that the windmill be in contact with as much wind as possible that passes thru a given space at the minimum cost of materials, labor, maintenance, operation cost, and minimum use of space (land or sea), in order to provide competative energy cost to the user. This maximization of wind contact is done by the use of large wind sails made as large as possible, as in the sail boat, with the use of a specially designed mechanical device that handles the large sails in great quantities, at least cost.

In this invention, particular attention is concentrated on the maximum harnessing of the wind energy that is available in a given space in the maximum effeciency and effectiveness of energy convertion out of whatever strength of wind that arrives at the windmill at the least cost of energy production. It is also the objective of this invention to produce a large scale windmill that is capable of driving a large irrigation pump, or to make a remote area energy independent by making the windmill able to work during violent weather conditions to a certain limit (when energy is abundant) and able to store the energy in the form of compressed air, electricity, and/or hydrogen gas at any location — land or ocean. It is also the objective of this invention to make the ordinary man able to construct his own energy machine and to free the poor nations from highly commercialized high technology machines. It is to ease the pressing problem of having to import energy from other nations when in fact there so much energy at home. Self sufficiency on energy promotes peace around the world.

Background Art

The first prior art is the rotary blade windmill which has very limited power output capacity because it cannot be expanded large enough as much as it is wanted so as to increase the wind contact. To increase the wind contact of the old rotary windmill is done only by attatching longer blades but only to a limited extent because the tip of the blades will be moving faster than the wind - that means loss of energy. This means that the old rotary type of windmill cannot be constructed to a very large scale for purposes of having as much wind contact as it might be wanted. The available wind being offered by nature is so much on land as well as on the ocean from sea level to 3 miles up all over the earth -- but the rotary windmill is just too small to tap the opportunity. From this view point, there must be another design of a windmill that can maximize wind contact any where in order to maximize benefits from the available wind, hence, the new invention herein presented.

The second prior art is that presented by H. A. STENNER under U.S. Patent No. 3,504,988 which makes use of a wind sail carried by a trolley which assembly is linked to other several trolleys with sail in a closed circuit traveling along an elongated closed loop double track railway. The system is provided with electro-mechanical control system to keep the sail oriented to the direction of the wind. This system is also provided with a closed loop drive chain which is tugged by each of the trolleys, and which drives the terminal gear that drives directly an electric generator. The mast holding the sail stands alone without guy wires. The sail which is supported vertically along the middle axis by the single mast is built rigid thick and solid designed not to bend any part against the wind force. The Trolleys are supported vertically on its four (4) corners by wheels running inside a channel-shaped beam laid on its side that serves as rail track. The principle envolved is best because it attemps to make the several sails to work in consortium but the following defects prevents the commcercial use of this invention:

1. It drives the electric generator directly without the use of a compressed air storage that would stabilize the electric out put even after the wind had stopped;
2. The mast that holds the sail is not provided with guy wires and/or strut braces. This reduces the size of sail it can hold against the forces of the wind. Wind contact/cost ratio therefor is very low;

3. The sail is built rigid and thick with double wall designed not to bend any part against the wind force. This makes the sail very heavy with too much materials used. Wind-contact/-cost ratio therefor is very low;
4. The trolleys are supported on four (4) corners by wheels for vertical loads only. There are no wheels to take care for horizontal loads which are directly imparted by the wind -- causing great amounts of friction upon the vertical inner walls of the channel-beam track by the wheels — hence, low effeciency in energy convertion due to energy losses;
5. The drive chain having been placed inside the channel-beem-rail track exerts too much friction upon the vertical inner wall of the said track at the curved turn around of the rail track system preventing any forward movement of the trolleys resulting to zero (0) energy out put. Therefor, this machine does not work;
6. The wheels on the left side of the trolleys are de-railed when making the turn around at the curved end of the rail track system which prevents this machine from operating;
7. There is so much electro-mechanical work control system placed on the trolleys to keep the sails oriented to the wind, making the output/cost ratio very low, when in fact automatic orientation of the sail can be done by strings only.
8. This invention makes no mention about maximizing wind-contack/cost ratio that is why the design of the sail and its support system is in error.

The third prior art is that presented by Reinhold H. Nilberg, U. S. Patent No. 4,175,910 which makes use of several vanes as sail suspended vertically by two level cable conveyor system. Each of the vanes are supported by two vertical control bars connected at the top to the upper conveyor cable and connected at the bottom to the lower conveyor cable. Each of the vanes contribute force to move forward the upper and the lower cable which in turn rotate the terminal gears at the same speed (upper and lower gear) to keep the vanes always vertical and prevent distortion of the system. The principle envolved is best because it attempts to cover a wide path of the wind, increasing the wind contact, and attempts to unite the efforts of several sails to work in consortium, but the following defects prevents the commercial use of this invention in large scale, to wit:

1. There are no vertical supports along the length of the span to prevent sag of the conveyor cable against the weight of vanes and support frames, which makes the windmill limited to a very short span -- not a large scale;
2. There are no horizontal supports for the upper and the lower conveyor cable to work against the horizontal forces of the wind upon the vanes along the length of the span. This allows the conveyor cables to be swaying too far sidewise when pushed by the wind causing over stress or overload on the said cables and on the terminal gears. This limits the use of this invention to a very small scale. Therefore, maximization of wind contact using this invention cannot be achieved at low cost;
3. There are too many vertical bars to support the vanes making the system too heavy forcing the conveyor cables to sag down to the ground. This limits the construction of this windmill to a very short span -- not a large scale;
4. The vanes must oe constructed thick and rigid enough to resist twisting as the wind exert force on them because the spring support is acting at one end only at a time. This tends to make the vanes very heavy causing an overload of the system, hence, this invention is limited to a very short span;
5. To provide or to install counter weight 19 is an error because it will desalign the wheels from the catenary slope of the conveyor cable. This will cause friction upon the lips of the gear wheel pulley and wear out the cable conveyor;
6. This windmill drives directly an electric generator without using a compressed air that would be coming from a large storage tank. This will cause a very unstable supply of electricity.

The fourth (4th) prior art is that presented by GODFREY BLACKMAN, British Patent No. 1,588,600, April 1981 which makes use of several wind sails on vertical mast carried by upper and lower bar chain 13,14 which in turn run on wheels following an elongated closed loop upper and lower railway on top of a two-span bridge 1 which in turn rests at its ends on another arc railway track 6,7 on the ground. The theory in this invention is best only on the matter that it attempts to unite the efforts of several sails to work in consortium which

is the same principle or objective that the aforementioned 2nd and 3rd prior art are trying to accomplish, but the following defects prevents the commercial use of this invention in large scale or in small scale, to wit:

1. There is too much materials to be used and too much expenses in the construction of the bridge that carry the whole windmill system ;
2. There is too much massive structures to be constructed all over the bridge that will carry the upper level rail track on top of the sails;
3. The fact that the whole system is a two span bridge, the maximum wind contact is limited only to the maximum length of bridge span possible. Summing up all the above listed defects, the energy-output/cost ratio is very very low, hence, it does not achieve the primary objective.

The Fifth (5th) is that presented by LAIRD B. GOGINS, U.S. Patent No. 4,302,684 dated Nov. 24, 1981 which attempts, as in aforesaid prior arts, to unite the efforts of several airfoils, in this case, in the form of vertically and rigidly standing airplane wing -- one wing mounted on and independently carried by separate trolleys that run around an elongated closed loop railway. Each trolley carry its own electric generator and produces electricity thru the turning of the individual wheels and in turn the electric energy is transmitted to a common bussalong the railway track. Each trolley carry its own independent Diesel Engine to continue running the trolley around the railway track during the times when the wind is insufficient so that the wheels of the trolley will continue turning which in turn keep on driving the individual electric generators in order to maintain a continuous power output. The theory in this invention is best only on the matter that it attempts to unite the efforts of several airfoils such as the standing wing to work in consortium which is the same principle or objective that the aforementioned 2nd, 3rd, and 4th prior art are trying to accomplish, but the following defects prevents the commcercial use of this invention in large scale or in small scale, to wit:

1. The standing airplane wing 300 ft high requires a heavy frame contruction to stand rigid against the wind it being supported

on two points only, and to stand rigid like a crane boom against the downward compression effects of the guy wires;

2. The rail track requires a heavy concrete construction in order to produce an open trapezoid channel section rail large enough to accomodate the wheels into the internal dimentions of the channel. The horizontal cantelever lips of the rail that serve as bearing to hold the wheels must be constructed strong enough to be able to contain the heavy vertical weight of the trolleys;
3. The ground which serves as footing for the heavy rail track needs to be horizontal, level and well compacted roadway which requirements makes this invention very selective of project site and is limited to a very few available choice lands;
4. The design of the airfoil, being a wing, is very very narrow which in effect, with all the wings arranged along the rail track, will contact or deflect 1/7th only of the total wind available that is traversed by the rail track, hence, this particular prior art has the least wind-contact among all the prior arts;
5. In summary, this prior art is very expensive due to the construction of heavy structural framework for the wing, due to the construction of heavy concrete trapizoid channel rail, due to the construction of a level& well compacted roadway to serve as footing for the heavy rail track, due to the requirement of having 48 wheels for every trolley, due to the requirement of having one diesel engine for every trolley, due to the requirement of having one electric generator for every trolley, and because the wing has a very small wind-contact the resulting output/cost ratio is very small and disappointing.

The Sixth (6th) prior art is that presented by RUTLER under France Patent No. 2523220 dated Sept., 1983 which makes use of and unites the efforts of several sails as in the aforementioned prior arts. The sails are double wall, rigid like that of the airplane wing, supported by a rotating vertical mast(without guy wires) which is in turn erected on top of a continuous circular horizontal frame

that turn around on rollers on top of a circular horizontal rail track. The pick-up wheels fixed on the ground driving the electric generator, is actuated by a continuous circular friction plate attached to the main circular frame that act as venicle for the sails. The theory in this invention is best only on the matter that it attempts to unite the efforts of several sails to work in consortium which is the same principle or objective that the aforementioned 2nd, 3rd, 4th, & 5th prior arts are trying to accomplish, but the following defects prevent the commercial use of this invention in in any scale, to wit:

1. One-half (1/2) of the total number of sails cover each other from the wind which reduces down to 30% the wind force acting upon said sails while traveling along the direction of the wind, hence, less wind-contact or less energy converted per sail;
2. One-fourth (1/4) of the total number of sails must stay nutral while traveling against the wind, nence, less energy converted per sail;
3. This design cannot be erected on rough land terrain where the wind is mostly stronger, and further, there is wider land occupation per sail, hence, it is very expensive;
4. The sail is designed to act stiff against the wind like an airplane wing -- so it requires a heavy structural frame it being a double wall with the assistance of guy ropes, hence, it is an expensive construction;
5. The mast,which supports the heavy sail,stands alone without the assistance of a guy wire, must be a heavy structure to withstand the tremendous bending stress at the base, otherwise, the size of the sail must be a small one;
6. The system being a circular horizontal structure occupies a very wide level land, hence, the maximum size of this type of windmill is limited only to the available diameter of the level land project site;
7. The main circular frame (part 4) which revolve around on top of the circular rail track requires a very massive structural construction in order to be able to hold the heavy mast

upright against the wind, and since this main frame is continuous around the circualr rail track it is a very expensive structure. Summing up all the aforementioned defects of this design, the resulting energy-output/cost ratio is very small.

The Seventh (7th) prior art is that presented by Bruno May under Deutschland Patent No. 2836922 dated March 13, 1980 consisting of large quantities of composit sail mounted on a continuous floating circular raft on a lake and the other one presented by British Patent No. 25,234 dated Dec. 1894 consisting of sail boats floating and traveling thru a concrete circular channel - the boat being a continuous ring structure with the same diameter as the concrete water channel and acting as pulley that drives the power chain. These two prior arts, being a revolving circular structure, has the same defects and deficiencies as the aforementioned Sixth (6th) prior art by Rutler under France Patent No. 2523220 in which I have listed 7 impediments in page 7 hereof preventing commercial use of these circualar designs.

Summary of the subject invention:

The "UNITED SAIL WINDMILL" is designed to solve all the aforementioned problems or impediments encountered preventing the large scale commercial use of the aforementioned prior arts, and further intends to accomplish the functions of the crises creating "OIL" and/or the dangerous expensive nuclear energy in the poor nations. This newly invented windmill is designed to have as much wind contact as may be desired and intends to work even during the violent weather when the energy is abundant which is to be stored in the form of compressed air in large underground tunnels. The compressed air will, in turn, drive the electric generator to an extended time even after the windmills (in consortium) had stopped working as the wind stops. it is also designed to be easily constructed by the ordinary man out of low cost materials that are already available.

There are ELEVEN (11) inventions being applied for Patent Rights under this presentation, namely: (1.) "UNITED SAIL WINDMILL TYPE-1"; (2.) "SUSPENSION HOLDER FOR A RUNNING CHAIN HAVING VERTICAL BAR LOADS"; (3.) "LIGHT WEIGHT CABLE CHAIN"; (4.) "UNITED SAIL WINDMILL TYPE-2"; (5.) "UNITED SAIL WINDMILL TYPE-3"; (6.) "ROLLER PULLEY WITH GEAR-LOCK RUNNING ON/OFF A SUSPENDED CABLE RAIL"; (7.) "CABLE RAIL SWITCH

ON/OFF CONNECTOR"; (8.) "CABLE RAIL INTERMEDIARY SUSPENSION SUPPORT"; (9.) "UNITED SAIL WINDMILL TYPE-4"; (10.) "UNITED SAIL WINDMILL TYPE-5"; (11.) "UNITED SAIL WINDMILL TYPE-6".

How these presented inventions solve the aforementioned problems of the referred prior arts:

1. The "UNITED SAIL WINDMILL TYPE-1, TYPE-2, TYPE-3, TYPE-4, TYPE-5, and TYPE-6 all solve the maximization of wind contact by making the wind sails as large as desired and attaching as many sails as desired in the maner as shown in the drawings thereby operating the windmills in a very large commercial scale is very easily attainable. By using these large windmills in the production of compressed air, it will be very easy for these windmills to work in a consortium by interconnecting their compressed air pipe lines to a common depository air tank (in the form of underground tunnel or a series of tunnels thru a mountain) in order to be able to drive a large electric power plant;

2. The herein presented inventions No. 2, No. 3, No. 6, No. 7, and No. 8 are the most important components that brought about the possibilities of expanding the different types of the "United Sail Windmill" into very large windmills as may be desired because they make the windmill work and stand rigid against the strong winds thereby allowing the construction of a very long span transverse to the general direction of the wind, hence, a very powerful windmill;

3. By constructing a large windmill floating on the ocean as illustrated by invention No. 10 - United Sail Windmill Type-5 -- in the form of sail boats in a long single line formation tugging a long common cable/chain, a large portion of the ocean which is free can be converted into a wind farm. In case of violent weather these boats will be submerged underwater and then refloated after the hurricane is gone. Thru this method, maximum benefit from the wind over the unlimited ocean is made possible.

4. The low cost of construction with a resulting high power production attracts the investors to go into a large commercial scale of operation. The high wind-contact/cost ratio provided by these new inventions is the only deciding factor for a large scale use of these new designs.

Brief Description of the Drawings:

FIG. 1 is a schematic perspective view of the invention No. 1 -- "UNITED SAIL WINDMILL TYPE-1" showing the arrangement of at least Twenty (20) large wind sails, the power chain, the terminal gears, and the support structures. It is a long line of parading wind sails, transverse to the wind in one direction, that turn around a terminal gear at one end of the loop then make another long line of parading sails in the opposit direction (may be one or more miles long), then turn again at the other terminal gear at the opposit end to make a closed loop. Each wind sail is suspended in mid-air by a horizontal power chain at the top and by another horizontal power chain at the bottom that move horizontally at the same speed by driving the upper and the lower terminal gear which are synchronized and locked to each other by a long vertical axil that carries the power take-off gear and which is held in place by a strong structural bearing. Since there are intermidiary supports for the power chain to hold it in place, as shown in the drawings, the power chain will not sway side ward nor be overloaded, and this permits the construction of a very long and very large windmill of this kind even one or three miles or more miles accross a windy valley carrying one thousand or more sails in the system.

FIG. 2 is a schematic perspective view of the terminal gear of the "UNITED SAIL WINDMILL TYPE-1" in an enlarged detail drawing showing in detail the low cost of construction and synchronization of the two large diameter wheel gears, the construction of the sails and how the sails are carried by the power chains. The long radius of the terminal wheel gears allows the construction of a wider sail resulting to a large wind contact as shown.

FIG. 3 is a schematic perspective view of the mid-section of the "UNITED SAIL WINDMILL TYPE-1" showing in detail the construction of the invention No. 2 -- "SUSPENSION HOLDER FOR A RUNNING CHAIN HAVING VERTICAL BAR LOADS" -- one type holding in place the upper power chain and another type holding in place the lower power chain. The whole weight of the sail and the chain rests on the lower suspension holder so as not to introduce wear-and-tear upon the upper

chain. This figure also shows in detail the construction of invention No. 3 -- " LIGHT WEIGHT CABLE CHAIN". The long tooth gear lock of the suspension holder is very necessary to prevent the power chain from getting out of the rollers during violent weather yet it allows the vertical mast of the sail to pass thru.

FIG. 4 is a schematic perspective view of the terminal gear and the power station of the "UNITED SAIL WINDMILL TYPE-2" showing in detail the construction of the invention No. 4 in the form of a double story windmill similar to the said Type-1 but this Type-2 is suspended high in mid-air by means of the power chain which is in turn suspended by tall structures (wood poles or steel towers) thru the terminal gears and by intermidiate supports such as the herein invention No. 2 -- the "Suspension holder for a running chain having vertical loads". This figure also shows how the energy from the upper level windmill and the energy from the lower level windmill is transmitted to a vertical drive shaft or bar. It also demonstrate how the vertical weight of the power chain is carried or supported by the terminal gears. The terminal gears may be tilted to the slope of the power chain to prevent friction wear on the chain.

FIG. 5 is a schematic perspective view of invention No. 5 -- the "UNITED SAIL WINDMILL TYPE-3" a long line of several sails suspended high in mid-air similar to the said Type-2 windmill but this Type-3 is supported all along its horizontal length by means of a fixed high tension Cable Rail along the upper power chain and by another Cable Rail along the lower power chain. Also shown is a roller pulley with a long toothed Gear Lock (invention No. 6) that carry the sail on the Cable Rail. The long toothed Gear Lock prevents the sail from being derailed during violent weather. Also shown are new designs of cable rail switch on/off which allows the gear lock to pass thru, and the mid-air intermediate support for the cable rail that allows the gear lock to pass thru also. These are invention No. 7 and invention No. 8 respectively.

FIG. 6 is a schematic perspective view of invention No. 9 -- the "UNITED SAIL WINDMILL TYPE-4 which is a long line of several sails similar to the herein aforementioned windmill Type-1, but in

this Type-4 all the sails are running on an elongated (a mile or more) closed loop Rail Road Track and there is only one Power Chain being tugged along the rail track by the wind sails on trolley. Also shown are the three synchronized Power Terminal Gears at each end loop of of the rail track which are directly anchored to the ground.

FIG. 7 is a schematic perspective view of the invention No. 10 "UNITED SAIL WINDMILL TYPE-5" which is similar to the herein windmill Type-4, but in this Type-5 each wind sail is carried by a Sail Boat and the whole windmill is constructed floating on water surface (lake, sea or ocean) forming a long parade of sail Boats (a mile or more) in one direction, turn around on the terminal gears at the end loop, then make another long parade of Sail Boats in the opposit direction and turn around at the opposit terminal to make a closed loop. also shown is a barge anchored to the sea bed which carry the terminal gears and serves as power terminal station. For safety purposes this whole boat windmill system will be deflated to submerge under water during violent weather and then will be refloated by compressed air after the hurricane is gone.

FIG. 8 is a schematic perspective view of the invention No. 11 "UNITED SAIL WINDMILL TYPE-6" which is similar to the aforementioned windmill Type-1 in mechanism, but in this Type-6 the axil of the synchronized terminal gear wheels are horizontal and the wind sails are carried up and down by the pair of closed loop Power Chain. The wind sails spread up agianst the wind when they turn up above the Power Chain and then they close without resistance to the wind when they turn down below the Power Chain. This is an inclined windmill. The front terminal gear is in lower elevation or anchored close to the ground while the rear terminal gear is at higher elevation or mounted on top of a high structure so that each of the wind sails is fully blown up by the wind. This type of windmill is adoptable on sloping grounds (beaches and hill sides) that face the wind. It works on direct wind, oblique, and reverse winds. On the reverse wind the sails will spread up against the wind when they are under the chain.

DESCRIPTION OF THE PREFERRED EMBODIMENTS:

FIG. 1 and FIG. 2 illustrate and embodiment of the invention No.1 named as "UNITED SAIL WINDMILL TYPE-1" which is moved and/or energized by wind that blows from any direction. As the wind blows the sail 100 resist or deflects the wind thereby exerting effort thru the control string11 and thru the sail mast 110 upon the upper and the lower power chain 101 in a counter-clock-wise direction. As the power chain moves, it turns the terminal power gear 102 (upper & lower) in a counter-clockwise direction too. As the Power Gear 102 turns the vertical axil 105 which holds and synchronizes the movements of the upper and lower Power Gear, will also turn the Power Take-Off Gear 114. The vertical axil 105 is held in place at the top by the structural support (with bearings) 103, and held in place at the bottom by structural footing (with bearings) 106 anchored to the ground. The structural support 103 is held in place by tall standing structures 104 (wood poles, steel poles, or steel towers) which is in turn held standing rigid by guys (rope, chain,wire, or tension bars) 108. To relax the Power Chain from too much vertical loads, it is carried by intermidiary rollers support 107 at several points along the span at the bottom chain sitted on footing 106. To prevent the upper chain from swaying left or right due to the horizontal transverse force of the wind, the lateral support 109 is designed to hold the upper chain 101 in place. The lateral support 109 is suspended, at several point along the span of the chain, in mid-air by strong wire rope 108 thru tall structures 104 which are in turn anchored to the ground by anchore block 112. The Power Take-Off Gear 114 can in turn drive an air compressor which deposit compressed air to a large cental reservoir that supplies continuous energy.

FIG. 3 illustrates an embodiment of the invention No. 2 named "SUSPENSION-HOLDER FOR A RUNNING CHAIN HAVING VERTICAL BAR LOADS" the function of which is to hold the power chain 101 in place while said chain is running with the ability to prevent vertical and lateral movements of said chain at the same time allowing the vertical mast of the sails to pass thru said holder. As the Power Chain 101 carrying the sail by the vertical mast 110 moves thru said holder,

the roller 119 together with the long toothed gear lock will be rotating. Every tooth of the lock gear 118, having been constructed like an inclined plane, will be sliding under the said chain producing a lifting effect on the chain 101 at the same time the vertical bar 110 (sail mast) passes freely between the teeth of the lock gear 118 (long tooth gear). Another best mood of carrying out this Suspension Holder is to make the lifting lock gear 118 stay tilted 30 degrees in order to give the Power Chain/101 a good saddle ride on the long toothed gear 118 to prevent friction wear between the long toothed gear 118 upon the power chian 101. In this mood, the mast 110 being vertical, the axis of rollers 119 & 120 are also tilted 30 degrees to the right, roller 120 will be an upright 30 degree cone while roller 119 will be an inverted 30 degree cone, and frame 121 will be tilted 30 degrees up to the left. The roller 120 keeps on pressing the power chain 101 against the roller 119 so that the chain 101 will be forced to ride at the base of the long toothed lock gear 118. Another chain holder is the one holding the lower chain 101 at the bottom of the sail 100. This holder is an ordinary but deep pulley that exert uplift support and lateral support to the lower power chain. To prevent the chain from getting out of the pulley during violent weather,the lock gear 118 is intalled over the chain 101. Said lock gear 118 is freely rotating horizontally on top of the lips of the roller pulley 107 when the mast passes-by in which case the chain 101 is enclosed but the vertical mast 110 is allowed to pass thru over the roller pulley 107.

FIG. 3 also illustrate the imbodiment of the invention No. 3-- "LIGHT WEIGHT CABLE CHAIN" which is in the form of two parallel cable ropes 101 (made of steel or nylon strands) joined together to form a chain by means of short bars 116 (made of nylon tubes or metal tubes) attached perpendicular to the ropes 101 -- one rope clamped to one end of said short bar 116 and the other rope clamped to the other end of said bar 116. The length of said bar depends upon the thickness of the terminal gear 102. The distancing of said bar 116 depends upon the distancing of the teeth of the terminal gear 102. The bar 116 is clamped very tight to the rope 101 be means of the bolt 138 which passed thru the center of the rope 101. This type of chain is very much stronger in tension stress than any other type of chain of its

equal weight. The ideal chain for a windmill specially the type herein must be made as light as possible.

FIG. 4 illustrates an embodiment of the invention No. 4 named "UNITED SAIL WINDMILL TYPE-2" which works in the same principle as the aforementioned windmill Type-1 Fig. 1 except that it is made into a double story windmill and it is elevated high in mid-air in order to get the benefits from the higher speed winds. In this Type-2 windmill, the terminal gears 102 are smaller than those of the Type-1 but there are two gears for each chain at each terminal. Said terminal gears 102 are made to be far appart as shown in the drawings to make the return trip of the sails stay far away from the forward line in order that the return sails will get more benefits from the wind. This Type-2 windmill most importantly emphasizes the possibility of maximizing wind contact at the least cost of construction using a limited land space, using very tall support structures 128 & 129 to build a multistory or multi-level windmill. To build this type-2 windmill, the Type-1 windmill will be elevated high to the mid-air by means of the steel tower 129, the tower arms 128, the terminal gear bearing holder 122, the terminal gear synchronizing chain 125, the energy transmitter chain 126 with the corresponding transmitter gears 123 & 124, and the central drive shaft 127 that receives the power from the different levels of windmill and drives the power take-off gear 114. With the use of Suspension Holder 107 & 121 as illustrated in FIG. 3 the span of this multi-level windmill can be two or more miles long or as long as desired, and the sails can be made as large as desired.

FIG. 5 illustrates an embodiment of the invention No. 5 named "UNITIDE SAIL WINDMILL TYPE-3" which is the same high elevation multi-level windmill as the aforementioned Type-2 windmill, except that the whole weight of the sail and the power chain is carried throughout the span by a suspension high tension Cable Rail 132 which is keepped in place elevated high in mid-air by means of tall posts or steel towers. With the use of intermidiate suspension support 137 at several points along the span to support the Cable Rail, it will be possible to construct a very long span (two or more miles long or as long as

may be desired) of windmill of this type across mountain passes or over the valley. The presence of the Cable Rail 132 relaxes or relieves the Power Chain 101 from the vertical weight of the sails 100 -- a condition giving the chane to use a smaller and lighter Power chain 101 with a smaller and lighter Terminal Gears as illustrated in this figure.

This FIG. 5 also illustrates an embodiment of the invention No. 6 named "ROLLER PULLEY WITH LOCK RUNNING ON/OFF A SUSPENDED CABLE RAIL" which is an ordinary roller pulley 133 with deep groove adotable to the size of the cable rail and its joints, attached to the top end of the sail mast 110 in line with the uppoer power chain 101 and the other roller pulley 133 is attached to the lower end of the sail mast 110 in line with the lower power chain 101 -- each pulley rolling on the upper and the lower Cable Rail 132 respectively. To prevent the ruller pulley 133 from being derailed during violent weather, the long toothed Lock Gear 134 is incorporated by attaching it to the sail mast using said mast as its axil, fixed just touching the lips of the roller pulley 133 enclosing the Cable Rail 132 in between the roller pulley 133 and the Lock Gear 134.

This FIG. 5 also illustrates an embodiment of the invention No. 7 named "CABLE RAIL SWITCH ON/OF CONNECTOR" which brings out the opportunity to cut off the cable rail 132 at the terminal to allow the roller pulley 133 get off the rail 132 and to permit the roller pulley 133 to make a turn around the Terminal Gear 102. Said connector 135 is a strong steel plate able to hold the Cable Rail in place with special windows 136 in correct size and spacing in straight line just below the Cable Rail 132 to allow the free passage of the Lock Gear 134. Said connector 135 also allows the free entry of the roller pulley 133 and the Lock Gear 134 into the cable rail 132 after the turn around. There is no need to install a cable rail along the terminal loop because it is a very short span and the terminal gears /can 102 be tilted to align with the slope of the power chain 101.

This FIG. 5 further illustrates an embodiment of the invention No. 8 named as "CABLE RAIL INTERMIDIARY SUSPENSION SUPPORT" which brings about the opportunity to expand the windmill on cable rail into a very long line (a mile or more) by supporting the cable rail at several points along its span length. Said suspension support 137 is a strong plate that holds the cable rail 132 in place

and support it laterally and vertically. Said plate 137 is provided with special windows 136 in correct sizes and spacing in straight line just below the cable rail 132 to allow the free passage of the Lock Gear 134. Said intermidiate support plate 137 is suspended in mid-air by guy ropes 108 tied to tall structures 104 or 129.

FIG. 6 illustrates an embodiment of the invention No. 9 named "UNITED SAIL WINDMILL TYPE-4" which has the same principle as the herein aforementioned windmill Type-1 (several large sails tugging a common power chain) except for the following new special features and in the best mood it is carried out, to wit:

1. All the wind sails 100 are each carried by a trolley car that rolls on a very long (two or more miles) elongated closed loop rail road track 140 transvers to the wind forming a long parade of large sails in one direction and another long line parade of large sails in the opposit direction;
2. Only one closed loop power chain 101 with the same length as the inner rail track is used to gather all the energies from the sails 100;
3. Each of the Sails is carried by a separate triangular trolley car 146 with its wheels 141 & 142 lock or hooked to the rails 140 to prevent overturning;
4. There are three terminal gears 102 installed in triangular formation at each end of the loop to receive the energy from the power chain 101;
5. The rail (in the form of flat bar metal or timber bar) 140 is elevated from the ground by the support structures 143 & 144 in order to give chance for the lower wheels 142 to do a hook grip at the bottom of the rail 140.

As the wind blows, the sail 100 pushes upon the mast 110 at the same time pulls the succeeding mast 110 thru the control rope 111. The mast 110 in turn pushes or pulls the structural braces 145 transmitting the force to the structures of the car 146 making the wheels 141 start rolling on the rail track 140 while the wheel 142 prevents the overturning of the trolley car 146 by pressing against the bottom of the rail track 140. As the car 146 moves forward, it pulls the rope 148 which in turn tugs the power chain 101. The power chain 101 turns the terminal gears 102 which drives the synchronizing chain

125 which joints the forces of the three terminal gears 102 in order to distribute the great force of the chain to more tansvers bars 116 of the chain 101 that are in contact with the terminal gears 102. The center terminal gear drives the power take-off gear 114. Rope 147 holds high the sails thru bearing 131 that allows the sail to turn around the mast 110.

FIG. 7 illustrates an embodiment of the invention No. 10 named "UNITED SAIL WINDMILL TYPE-5" which has the same principle and of similar construction as the aforementioned windmill Type-4 except for the following special features, to wit:

1. The whole windmill system is floating on water (sea or lake, or on the ocean);
2. Each of the wind sails 100 is carried by a separate boat 154 on which the mast 110 is erected and forms a very long line of parading sails out on the ocean;
3. The terminal gears 102, in triangular formation, are installed on top of a floating barg 153 which is held in place by anchor blocks 112 thru guy rope 108.

As the wind blows the sail 100 exerts force on the boat 154 to a direction opposit to where the wind is deflected. As the sail 100 tends to overturn the boat 154, the counter weight 151 moves to the opposit side of the boat thru a small rail by action of a rope being pulled by the sail 100. As the boat 154 moves forward, it tugs the Power Chain 101 by the tug rope 148. The boats 154 turn around at the terminal by the action of the Power Chain 101 upon the front tug rope 148 which pulls the boat 154 to where the power chain 101 is going. The fender plate 152 prevents the boats 154 from getting over into the other side of the power chain 101, at the same time prevents the boat 154 from being blown sideward by the wind resulting to an unnecessary stress to the power chain 101. Strat braces 145 keeps the mast 110 stay erect rigidly. Bridge 154 carry the whole weight of the mast 110 and keep the float 150 stay together in the form of an "H" frame. Bearing 131 carry the whole weight of the sail 100 thru string 147 and allows the sail 100 to revolve around the mast 110. There are two barg 153 in the system -- one barg at each end of the loop that serves as power terminal station, carrying the

terminal gears 102, 114, 125, and other station accessories. This barg 153 is anchored to the ocean floor by means of heavy block 112 thru rope 108. Control rope 111 holds the sail to face against the wind, which has guaged springs that will relax the sail 100 when the force of the wind becomes excessively strong, but tries to adjust the sail 100 to be fully facing the wind when the speed is very low. In the event of a violent weather, the boat loaters 150 and the barg 153 will be deflated to submerge the whole system under water to scape distruction by strong winds and haeavy water waves. When the hurricane is gone, the whole system will be refloated again by means of compressed air. This type of windmill is expandable as much as the open ocean by installing intermidiary horizontal supports at several points along the span of the power chain 101 in the form of a deep groove roller pulley with lock gear similar to parts 107 & 118 shown in Fig. 3 which will be mounted on floating floating rafts anchored to the ocean floor.

Fig. 8 illustrates an embodiment of the invention No.11 named "UNITED SAIL WINDMILL TYPE-6" which has similar principle and construction as the aforementioned windmill Type-1 except for the following special and additional features, to wit:

1. The axil 105 of the terminal gears 102 are horizontal;
2. The sails 100 & 200 are blown up and spread open by the wind upon turning up and ride on top of the pair of Power Chain 101.
3. The sail 100 carries with it additional sails 200 that flip out open on each side of sail 100 and another 3rd sail 200 that flip out open down ward at the bottom of sail 100 between the power chain 101 to maximize blockade against the wind for more energy benefits;
4. The whole system is an inclined line where the front terminal gear 102 is at a low elevation while the rear terminal gear 102 is at a much higher elevation using a much taller post 103 or at the top of the hill so that every sail faces the wind fully and directly for maximum benefits.

As the wind blows all the sails 100 & 200 that are on top of the power chain will spread up wide open and move the chain 101 to the rear and turn the terminal gears 102 which in turn drives the axil

105 which turns the power take-off 114. As the sails turn down at the rear terminal and go under the power chain, they flip closed and relax to the wind forces. Guy bar 108 makes the structures stand up rigidly. Bar 110 is the sail mast in horizontal position which holds all the four sails at one point. Part 111 is the guy rope that makes the sail stand rigid against the wind, which has a control spring that is able to relax the sails when the wind is excessive. The ground foundation 113 hold the post 103 in place. Several windmills of this type-6 may be constructed adjacent and side-by-side to each other using the structural posts 103 as common post for every adjacent windmill, while the axil 105 can be made continuously long axil common to all succeeding side-by-side windmills. In the construction of several adjacent windmills of this type, the axil 105 may be preferably cut and discontinuous to provide clear space for the bottom sail 200 so that same can be constructed to be a wider and longer sail and to save axil materials. The only axil needed will be the axil holding the right terminal gear 102 of the first windmill at the same holding the left terminal gear 102 of the next adjacent windmill on the right, and so on. In this preferred mood, maximunm wind contact at least cost of energy convertion can be attained.

What I claim for which protection by a patent is sought are defined as follows:

1. A "United Sail Windmill Type-1" that converts the energy of the wind into mechanical energy for the production of consumable energy in the form of compressed air, electricity, and hydrogen gas fuel, comprising:

A plurality of wind sails made of light thin metal sheets or strong light cloth/fabrics joined togetner and fastened to a light strong frame to form a large rectangular face capable of stopping the wind blowing at 40 mph by installing a wire or string grid reinforcement across each face of the said sail;

A vertical mast in the form of a strong light pipe that carry each said sail in erect position thru bearing connectors, which is securely connected vertically to the upper power chain by its upper end and to the lower power chain by its lower end -- said upper and lower end of the mast are made very strong because they serve also as driving teeth of the power chain;

A strong control rope with guaged spring attached to the power chain to hold said sails against the wind thru its upper and lower corners farthest from the mast, and to relax the sails when the force of the wind is too excessive;

A pair of strong chain herein named as "Power Chain" specially constructed to be similar to a timing chain to be able to drive the transverse teeth of the terminal gear wheels, which is a closed circuit or loop with a length corresponding to the desired power capacity that can accomodate as much sails as desired, and which is operatively connected to the terminal gear wheels located at each end of the windmill at a horizontal loop position, and which hold the said sails thru said masts in mid-air forming a very long (one mile or more) line of parading sails transverse to the wind in one direction and another very long (same length) line of parading sails in the opoosit direction making a turn around at each of the two end loops of the windmill thru the terminal gears;

A pair of gear wheels locked together by a long strong steel vertical pipe as axil, herein named as "Terminal Gear", which holds rigidly the power chain in place at one end of the windmill and

at the other end by another pair of gear wheels of the same kind to receive the energy from the power chain;

Said axil carry and drives a power take-off gear at its lower section below the terminal gear;

A footing bearing at the lower end of the said axil to carry the whele weight of the terminal gear and to provide lateral support at the base of said axil;

A lateral support bearing structure at the upper end of said axil to provide lateral support in three directions to make the terminal gear stand erect rigidly against the horizontal forces exerted on it by the power chain;

A tall structure in the form of wood poles or steel poles, or steel towers with guy wires, erected some 30 degrees to the right behind the terminal gears and another one erected some 30 degrees to the left behind the said terminal gears, which suspend in mid-air said lateral support bearing structure that support the said axils;

Said Terminal Gear wheels are made to have long radius in the form of tie steel round bars (similar to bicycle wheels to make it light enough) to create a wide space between the said wheels for the wide sails to pass thru;

A roller pulley sitting on a footing thru which the lower power chain passes thru and which carry the weight of the power chain including the weight of the sails at intermidiate points along its length to provide vetical and lateral support to the lower power chain to prevent excessive sagging and overloading of the whole system;

A long toothed lock gear installed on top of the said support roller pulley that rotates horizontally to cover the lips of the roller pulley to prevent the power chain from getting out of the said support pulley during violent weather but at the same time allows the lower part of the mast to pass thru between the long teeth of said lock gear;

A suspension holder installed at intermidiate points along the span length of the upper power chain to provide lateral and vertical supprt to the upper power chain specially during violent weather and to remove overload from said chain permitting expan-

sion to a very long and very large windmill, as illustrated in FIG. 1, FIG. 2, & FIG. 3;

An air compressor, of any type, operatively connected to the power take-off gear of the said windmill, that will effectively produce any amount of compressed air that will be able to drive a gas turbine and/or pneumatic mchaines;

An Air tank of any material installed above the ground or underground, or a series of large tunnels under the mountain or under the sea, that are connected to the said compressors by means of air pipes, to serve as central depository of compressed air produced by several windmills in the vicinity;

An electric generator driven by a gas turbine of appropriate size connected to the said air tank/reservoir by air pipes, to convert said compressed air energy into electric energy;

An electrolyzing machine connected to said electric generator to convert the electric energy into hydrogen gas fuel;

A gas compressor of any type connected to the electrolyzing machine to compress the said hydrogen gas fuel;

A gas tank/reservoir to serve as storage for the said compressed hydrogen gas fuel for future consumption.

2. A "Suspension Holder for a Running Chain Having Vertical Bar Loads" that provides lateral and vertical support to a running chain that carry loads thru a vertical bar or rope attached to said chain, comprising:

A pair of cylindrical or conical rollers, one of which is about six inches in diameter but 50% less in diameter than the other, having equal length/hight, arranged in tandem with the space between them just enough to let said chain to pass thru;

Said conical rollers, if used, may be of 30 degree cone, arranged in tandem with the smaller cone inverted, both axils tilted 30 degrees to the right if the smaller cone roller is on the right side making the gap between said rollers trully vertical for the vertical mast to pass thru;

Said rollers may be made of hard rubber, plastic, or steel;

A long toothed gear, herein named as "Lock Gear", with teeth three (3) times longer than the gap between said rollers spaced equal

or a little bit larger than the diameter of the said vertical sail mast;

Said Lock Gear is integrated with and fixed at the bottom of said smaller roller at an elevation just touching the bottom of the larger roller so that the long teeth of said lock gear will just be sweeping the bottom of the said larger roller;

A stong steel frame that house or hold the said rollers and said lock gear together in place;

A strong rope or steel bar attached to each end of said roller frame housing connected to a post or tall structure to suspend said Suspension Holder in mid-air.

3. A "Light Weight Cable Chain" that can serve as power chain that can carry and absorb the weights and energies of the sails, which is made up of light and less materials but strong enough, comprising:

A pair of rope or cable, made of nylon strings or steel strands, integrated together by means of short transverse bars made of nylon or metal pipes;

Said short transverse bars are provided with jaws at both ends that will bite/grip to said rope by crimping and tightening the connector bolts that penetrates thru the said rope as shown in FIG. 3 of the drawings;

Said short transverse bars may be molded togetner with said nylon cable direct from the oven.

4. A "United Sail Windmill Type-2" that converts the energy of the wind into mechanical energy for the production of consumable energy in the form of compressed air, electricity, and hydrogen gas fuel, comprising:

A plurality of wind sails similar or the same as that of the said windmill Type-1, installed or connected to the system in the same maner as in windmill Type-1;

All parts, components and structural acessories that completes the said windmill Type-1, including those parts and/or components described in Claim-2 and in Claim-3, excœpt for the special features that the horizontal line of sails are constructed into

two or more levels or stories by using two or more pairs of closed loop power chains, high support structures (posts or towers), and that the terminal gears are of smaller diamters;

At each terminal end of said windmill there are two turn corners, each corner having one independent/separate terminal gear for each and every level of power chain, each gear being a composition of two plates (made of plastic, rubber, or metal) of equal diameter of base but the lower plate has longer teeth so that it will carry the vertical weight of the said power chain, while the upper plate absorbs the energy from the said power chain, said lower plate of the terminal gear at the lower power chain has no gear teeth because the bottom tip of the sail mast does not cross it;

A synchronizing gear, of smaller diameter, integrated with each terminal gear, each connected to the next turn corner by a synchronizing for every level of power chain;

An axil with bearing for every terminal gear fastened rigidly to the support arms of the steel tower, said axil is cut clear near the face of each gear to allow the large sail be able to pass thru freely between the upper gear and the lower gear past beyond the line of the axils;

Said upper terminal gear of the lower sail level and the lower terminal gear of the upper sail level are integrated together by a single short axil with bearing which is in turn fastened rigidly to the middle support arms of the steel tower;

A power transmitter gear attached to the axil of each terminal gear at the right turn corner of the windmill to transmit the energy to the central drive shaft which collects the energies from the different stories/levels of the windmill by means of a chain similar to the power chain, as illustrated by FIG. 4.

5. A "United Sail Windmill Type-3" that converts the energy of the wind into mechanical energy for the production of consumable energy in the form of compressed air, electricity, and hydrogen gas fuel, comprising:

All the parts, components, structural accessories, and method of construction of a multi-level windmill, that completes the afore-

mentioned windmill Type-2 in Claim-4 except for some changes and/or additions enumerated herein below;

A suspension cable rail parallel to and 1 to 3 inches close to each power chain, which is a high tension steel or nylon rope, suspended or held in place by a tall post or steel tower separate from the support structure of the main body of the windmill, provided with a switch on/off plate connector at the turn corner terminal gear to allow the roller to get on or off the said rail, to provide complete support to the sails and power chain;

A roller pulley attached to each end of the sail mast at the point where the power chain is also connected, which rolls on the said cable rail as the sail moves on tugging the power chain;

A Lock Gear attached to the mast just below and sweeping the lower lips of the said roller pulley, using the mast as its axil, with the teeth long enough such that there are two (2) teeth covering the cable rail at a time, in order to prevent said roller pulley and the sails from being derailed during violent weather, as described in Claim-6 hereof;

An intermidiary lateral support and vertical support to the Cable Rail along its free length, in the form of a horizontally suspended steel plate carrying a vertical plate post that holds the cable rail from below -- said plate post when carrying the upper cable rail will be curved to assume the form of a fishing hook because its suspension support will be above the said cable rail;

Said plate posts have windows in appropriate size and spacing to allow the lock gear to pass thru, as in accordance with Claim-8;

A Power Chain reduced in size in the form of a single strand nylon with pre-cast ball knots that serve as driving gear, or in the form of a single steel wire rope to which short steel bars are attached by clamps to serve as gear as can be seen in FIG. 5.

6. A "Roller Pulley with Lock Running on/off a Suspended Cable Rail" that cannot be derailed during violent weather while carrying a sail running on a wire rail, comprising:

A roller pulley with deep groove that fits on the rail, bolted to a vertical bar or the sail mast, which turns freely on a bearing strong enough to carry the weight of the sail;

A short bar brace connected to the power chain at one end and to

the outer end of the axil of the pulley forming a triangle in order to prevent the roller pulley from twisting or lagging behind on the cable rail as the sail moves forward;

A Lock Gear with long teeth in appropriate spacing to cover the cable rail with two teeth at a time, attached to the sail mast just below and sweeping the lips of the ruller pulley by using the sail mast as its axil, which is able to pass thru the vertical support of the cable rail, as illustrated in FIG. 5.

7. A "Cable Rail Switch on/off Connector" that provides complete support to the cable rail, allows the roller pulley to get on or off said rail, allows said Lock Gear to pass thru it, comprising:

A steel plate thick and wide enough corresponding to the size of the cable rail, with a wide slot at the middle of the upper side deep enough to permit the roller pulley and its lock gear to pass thru to exit or to enter the cable rail;

Said steel plate connector is provided with windows of appropriate sizes and spacing at the upper side edge towards its end where the roller pulley passes, which windows the long teeth of the lock gear will fit into in rolling out to exit off and/or to get on the said cable rail;

A strong steel pipe with inner diameter just enough to accomodate the cable rail, or a steel clamp with bolt that will bite or make a strong grip on the cable rail, welded to each of the upper side edge towards both ends of said plate connector, with its end facing the roller pulley tapered to rmove a heavy hump against the roller pulley;

A screw knot or grip wedge to hold the cable rail strands against one end of said strong pipe holder opposit the cable rail.

8. An "Intermidiary Suspension Support for Cable Rail" that provides lateral and vertical support to the cable rail along its free span length to prevent it from swaying sidewise due to wind forces and to relieve it from vertical loads for purposes of expanding the windmill to a very long span and large scale, comprising:

A horizontal steel plate thick and wide enough to have the required

strength, perpendicular to the said cable rail, carrying a vertical plate post along its center line parallel to the said cable rail, provided with sling bars attached to its four corners thru which it is suspended in mid-air by steel cable rope;

Said vertical plate post is provided with windows of appropriate sizes and spacing corresponding to and fitting to the long teeth of the said lock gear, which is directly clamped to and carry the said cable rail from below;

Said vertical plate post (in the case of the upper cable rail where the said horizontal plate is above the cable rail),where it is needed, assumes a form of a vertical uplift hook that hangs under the said horizontal plate, makes a curve under said cable rail and below the Lock Gear to provide a clearance for the passing structures - such as the sail mast, the roller pulley, and the Lock Gear.

9. A "United Sail Windmill Type-4" that converts the energy of the wind into mechanical energy for the production of consumable energy in the form of compressed air, electricity, and hydrogen gas fuel, comprising:

All parts, components, and structural accessories that complete the said Windmill Type-1 except for some changes and/or major additions, which are succeedingly enumerated below;

A long (one or more miles) double rail road track in the form of a steel flat bar or timber bar elevated one or more feet above the ground with its wide faces vertical and its side edges on top and bottom (are provided with steel lining in case rail is timber), that is parallel with and about fifty (50) feet from another rail road track of the same kind in the opposit direction and with which it makes a closed loop, as exemplified by the attached drawing FIG. 6;

Said rail may be in the form of a four (4) flanged beam the cross-section of which is in the form of a CROSS, the purpose of which is to reduce friction by building a special formation of several wheels in group that act on said rail in all possible directions of bearing pressures installed at each corner of said carriage car or trolley car that carry the sail;

A plurality of rectangular or triangular carriage car or trolley cars constructed out of structural beams, which has wheel in the form of deep grooved roller pulleys or a group of wheels in special formation that bite on the sail track bar (top & bottom of rail) making an anchor effect to prevent overturning due to action by the wind, that carry the wind sails by rolling along the rail track making a merry-go-round on the said closed loop rail road track;

A sail mast that is erected on and carried by the said trolley car thru its middle or directly riding on one of the said carriage wheels, supported to stay rigidly vertical by two slant struts resting on the opposit corners of the said trolley, which completely supports the sail in all directions of the wind, allowing the sail to be flipping to the left or to the right thru the support connector bearings;

A complete loop chain of the same length as the inner rail track which is carried and tugged by the said carriage cars by means of another short chain tied to one or two corners of said carriage cars;

A group of two or three terminal gears installed horizontally in triangular formation at each of the two terminal end loops of the said rail road track thru which the said power chain makes a bite to transmit the energy of the sails to the gears and thru which the carriage cars make a turn around;

A closed loop synchronizing chain that interlinks the said group of terminal gears to effect concentration of mechanical energy into the power take-off gear from the other terminal gears;

A concrete footing or any rigid structure that holds in place and completely supports each of the said terminal gears in an appropriate formation;

A plurality of horizontal tie bars held rigid on top of a pair of posts anchored to the ground, perpendicular to the said rails, equally spaced along the rails, that holds the rail in place rigidly at an elevation of at least One (1) foot above the ground.

10. A "United Sail Windmill Type-5" that converts the energy of the wind into mechanical energy for the production of consumable energy in the form of compressed air, electricity, and hydrogen gas fuel, comprising:

All parts, components, and structural accessories that complete the said Windmill Type-4 and in the same formation and arrangement of sails as in Type-4 except for some changes and/or major additions, which are succeedingly enumerated below;

A carriage boat (without a channel track or a rail track) of any appropriate size (may be as large as an ocean going vessel) in the form of an "H" frame floating on water or rolling on snow or rolling on flat grounds thru its wheels at its four corners, that carry and completely support the said wind sail thru a mast erected at the center of said boat and thru guy ropes that hold the sail against the wind as it flips to the left and to the right;

A plurality of said boats tied to and tugging a closed loop power chain forming a long line (2 miles or more) of parading sails in one direction transverse or oblique to the wind, parallel to and at least 50 feet away from another line of the same kind moving in the opposit direction to which it makes a closed loop as exemplified by the accompanying drawing FIG. 7;

A mast held rigidly vertical by means of two struts mounted on one side of said boat along side of the power chain forming a triangular pyramid with the said mast;

A heavy counter weight that keeps transfering to either side of said boat thru a transvers rail on the boat along its center bridge -- said movement is effected by the flipping of the sail to the left or to the right thru a complete loop string and pulley mechanism -- to counter balance the overturning moment by the sail on the opposit side of the boat;

A Fender Plate attached to the front and rear side of the boat facing said power chain, extending down 5 feet below water surface to prevent the said boat from moving over the said power chain and to prevent the said boat from being blown sideward by the strong winds;

Said boats are built to be submersible to hide underwater when ever the whole windmill system is threaten by violent weather conditions, and then refloated again by injecting compressed air into the said boat after the destructive weather is over or the wind has come into within working limits;

A power terminal barge at each end of said power chian loop in the form of a pentagon or triangular flat deck which carry the said terminal gears, the compressors, other equipment, and to house the operating personnel;

Said barge is anchored to the sea bed by heavy rocks or concrete blocks thru guy ropes in three directions that tends to stretch the power chain to both ends of its loop;

Said barge is made to be submersible to hide underwater whenever the whole windmill system is threaten by violent weather conditions, and then refloated again by injecting compressed air into it after the destructive weather is over or the wind has come back to within working limits;

A floating intermidiate support to the said power chain at an interval of every other three boats, in the form of a deep roller pulley with lock gear similar to Part No. 107 & 118 that support the bottom power chain of the said windmill Type-1, carried by a four (4) peice raft which is connected by strut to another raft that supports the opposit power chain, which assembly floats between the said power chain and anchored to the sea bed by ropes to hold the power chain in place and in correct alignment against the horizontal force of the wind;

A compressed air pipe running underwater to deliver the produced energy in the form of compressed air to the central reservoir or to any central power plant at sea or on the land.

11. A "United Sail Windmill Type-6" that converts the energy of the wind into mechainical energy for the production of consumable energy in the form of compressed air, electricity, and hydrogen gas fuel, comprising:

All the parts, components, and structural accessories that complete the said windmill Type-1 and in the same formation as the said Windmill Type-1 except for some changes and/or major additions which are succeedingly enumerated below;

A pair of inclined closed loop Power Chain that makes a vertical turn, parallel to and at least 20 feet from each other;

A pair of erect terminal gears that hold and completely support the power chain at each end loop of said chain;

A horizontal axil that holds, synchronizes, and completely supports the pair of terminal gears at end loop of the chain; which may be alternatively in the form of a short axil for every single terminal gear to provide a wider space for the sail to pass thru;

A pair of short posts erected firm on the ground with guy wires, spaced at least 25 feet from each other, that carry the axil of said terminal gears at the front end of said looped chain facing the wind, high enough to make the sail below the said chain clear the ground on its return trip;

A pair of tall posts erected firm on the ground with guy wires, spaced at least 25 feet from each other, that carry the axil of said terminal gears at the rear end of said looped power chain facing away from the wind, located at least 70 feet away from from the front posts;

Said front posts may be alternatively erected at the foot of the hill while the said rear posts erected on top of the hill for the purpose of making the whole windmill system an inclined structure on the beach slope or on the hillside slope;

A horizontal sail mast connected to and transvers to said pair of of power chain at least 20 feet apart along the length of said chain, which carry a folding sail;

A framed sail that open or spread upward when blown by the wind riding on top of said horizontal mast, herein named "main sail";

A framed sail that open or spread downward when blown by the wind hanging below and from said horizontal mast;

A framed sail that open or spread sideward attached at each side of said main sail, which uses the side frame of the main sail as its mast;

A control rope attached to each corner of said folding sails to make the sails face rigidly against the wind while on top of the power chain but allows the sails to fold closed when traveling against the wind;

An intermidiate support to the said power chain placed at every 50 feet along its length in the form of a long-tooth gear that fits into the said power chain carried by a correspondingly tall structure in order to prevent the said power chain from sagging down too much and to relieve the said power chain from too much vertical load specially when the windmill system is constructed into a very long line of parading wind sails;

Steel springs of appropriate strength are installed in the said folding sail assemblies to assist it to fold closed after turning down and move against the wind;

Steel springs of appropriate strength are also installed in the said control ropes of the sails in order to automatically relax said sails when the wind becomes excessively strong but the windmill will still be working to take advantage of the abundance of energy;

A power take-off gear operatively attached to the axil of the lower front terminal gear, to drive the compressor and/or other machineries.

12. A plurality of said large windmills working in consortium to supply compressed air to a central reservoir (may be a series of underground tunnels) to run a large power plant, or to run a large irrigation pump, factory machineries, and other pneumatic machines.

FIG. 1

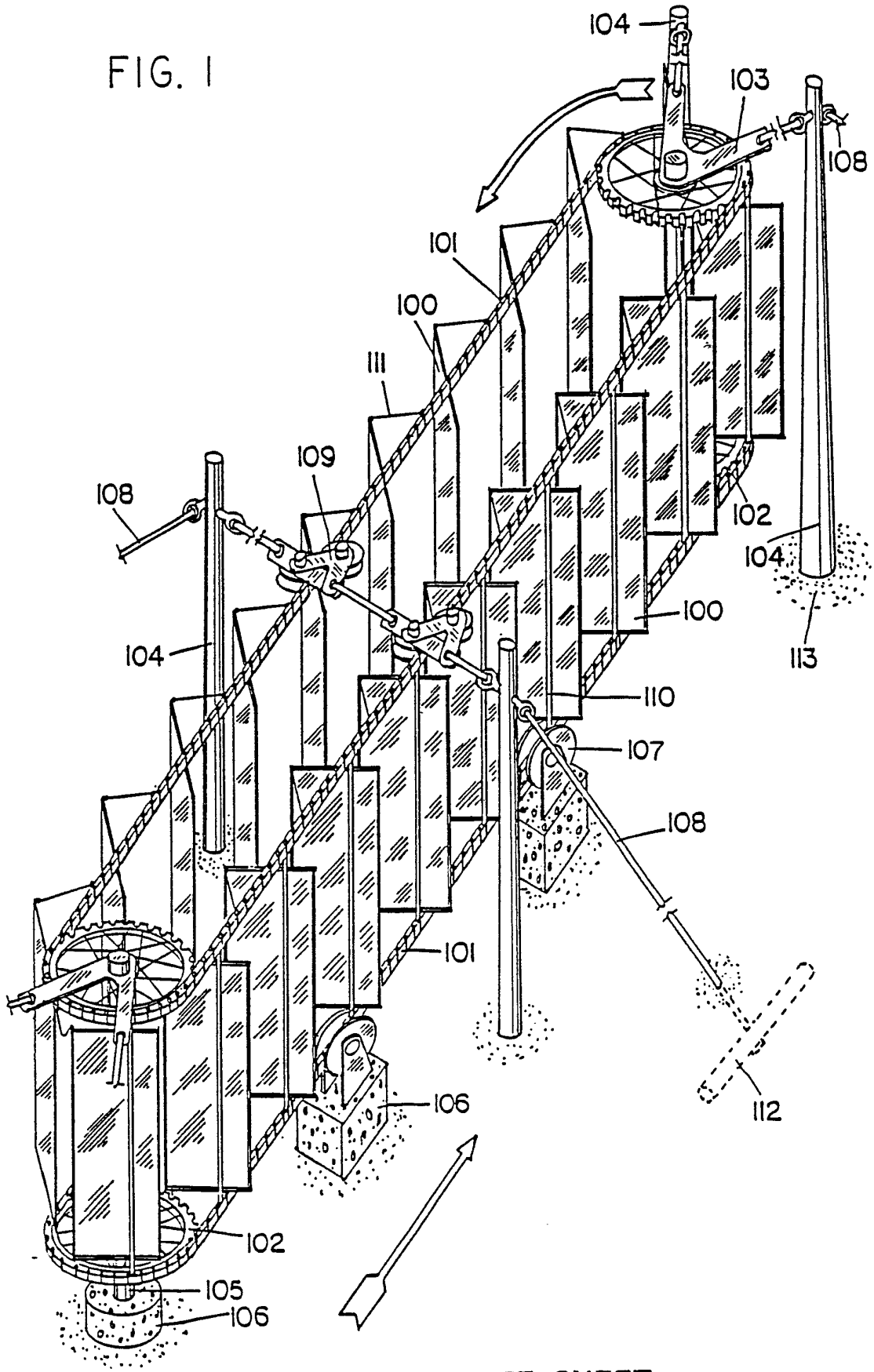
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FIG. 2

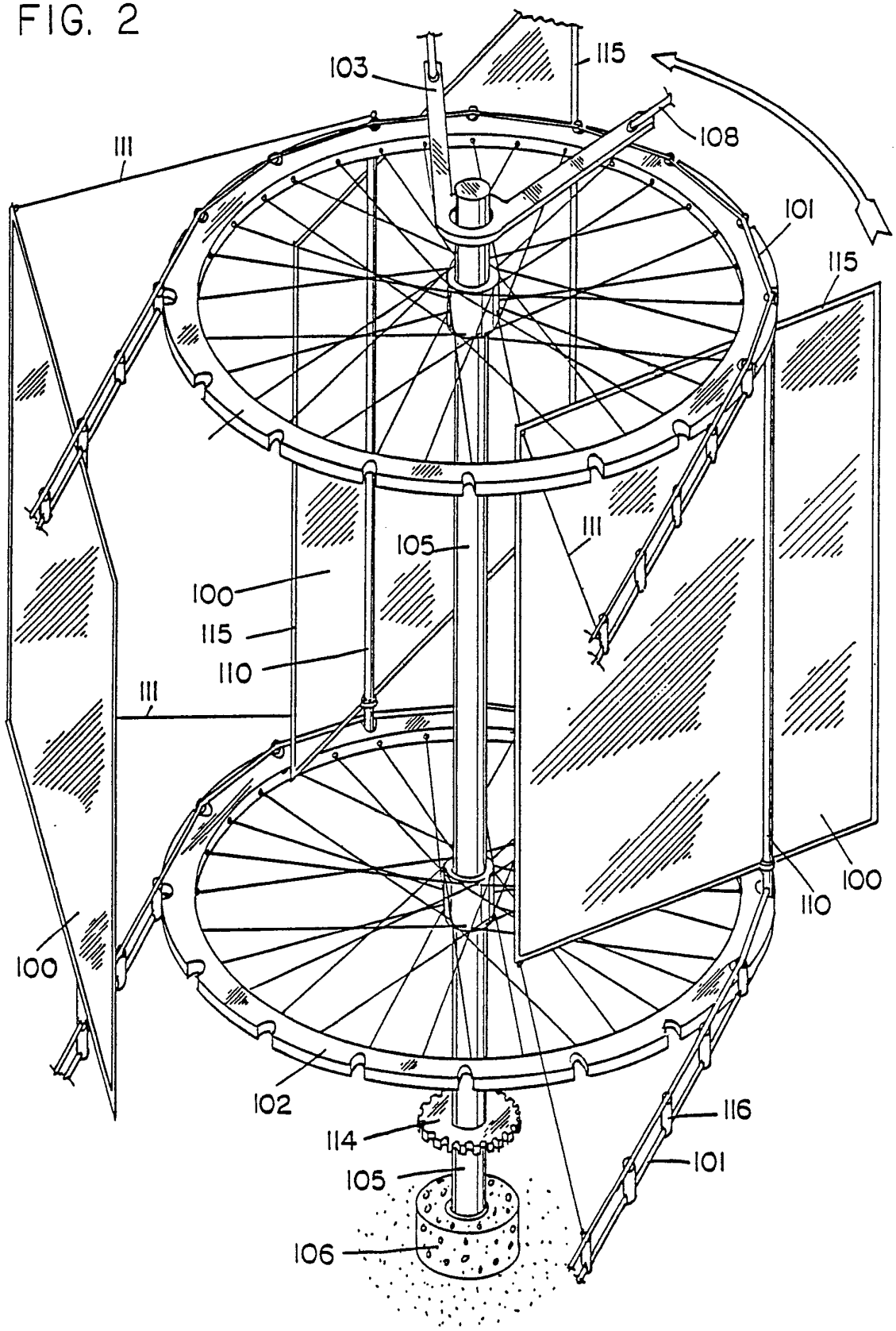
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FIG. 3

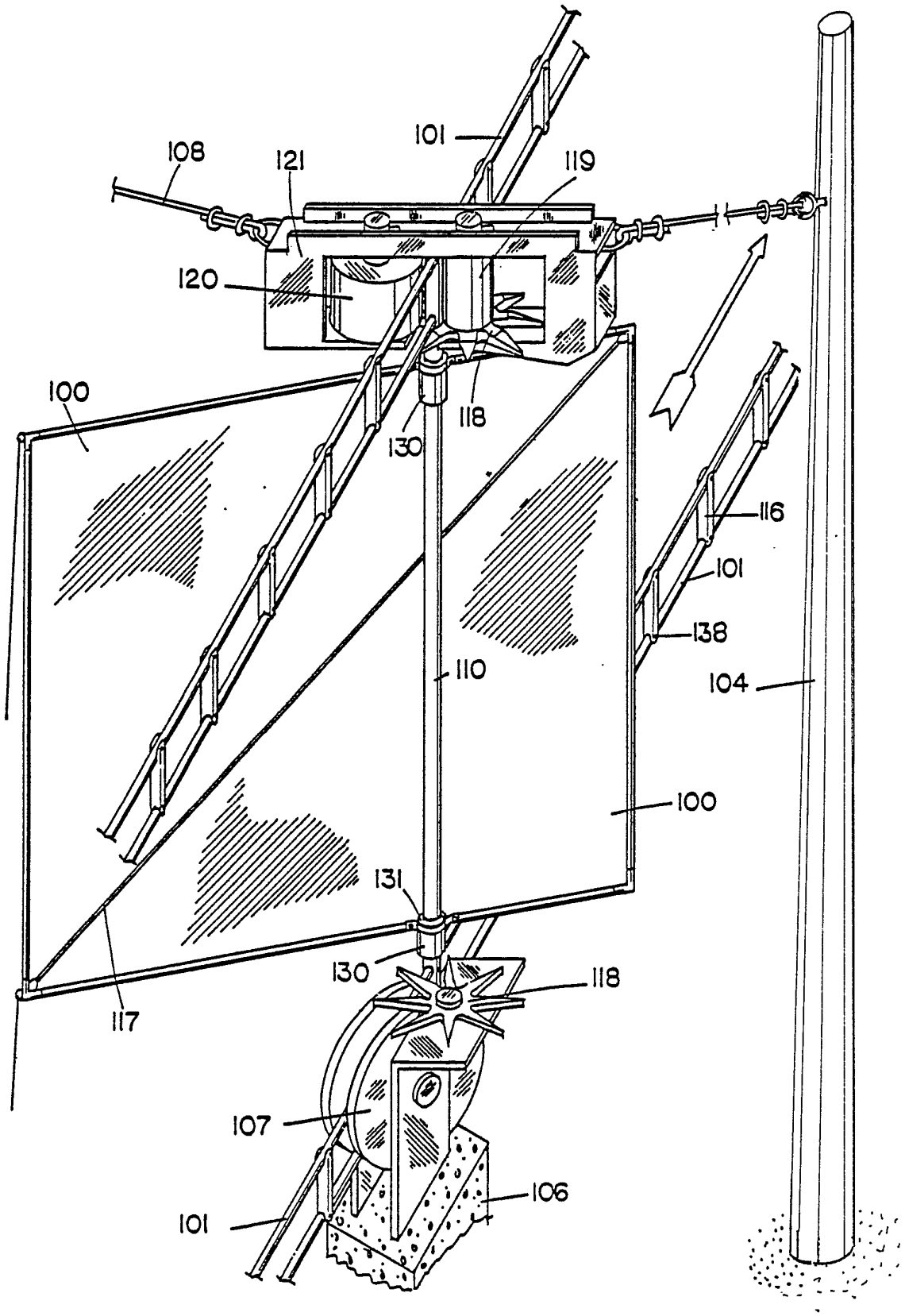
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FIG. 3A

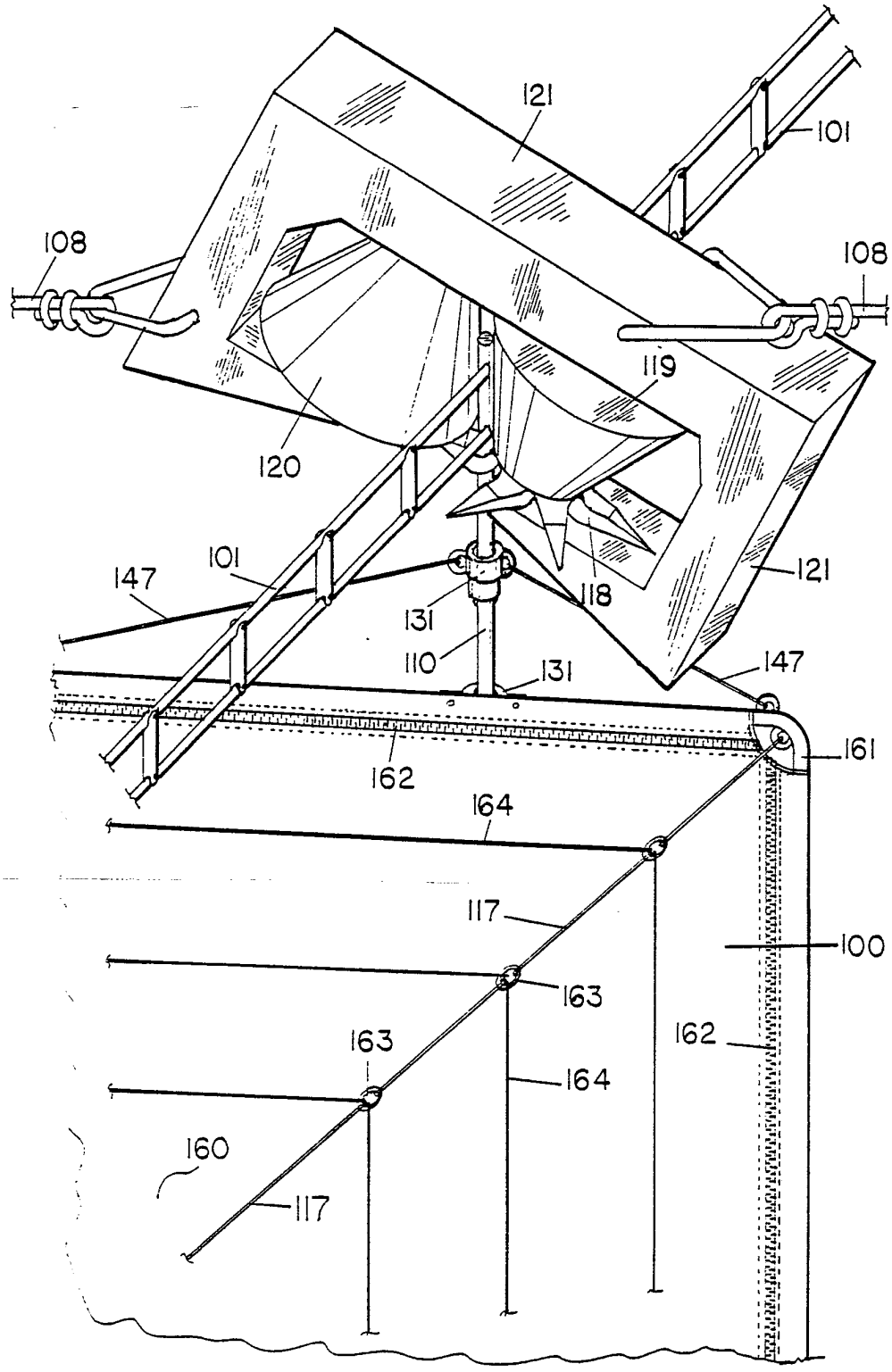
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FIG. 4

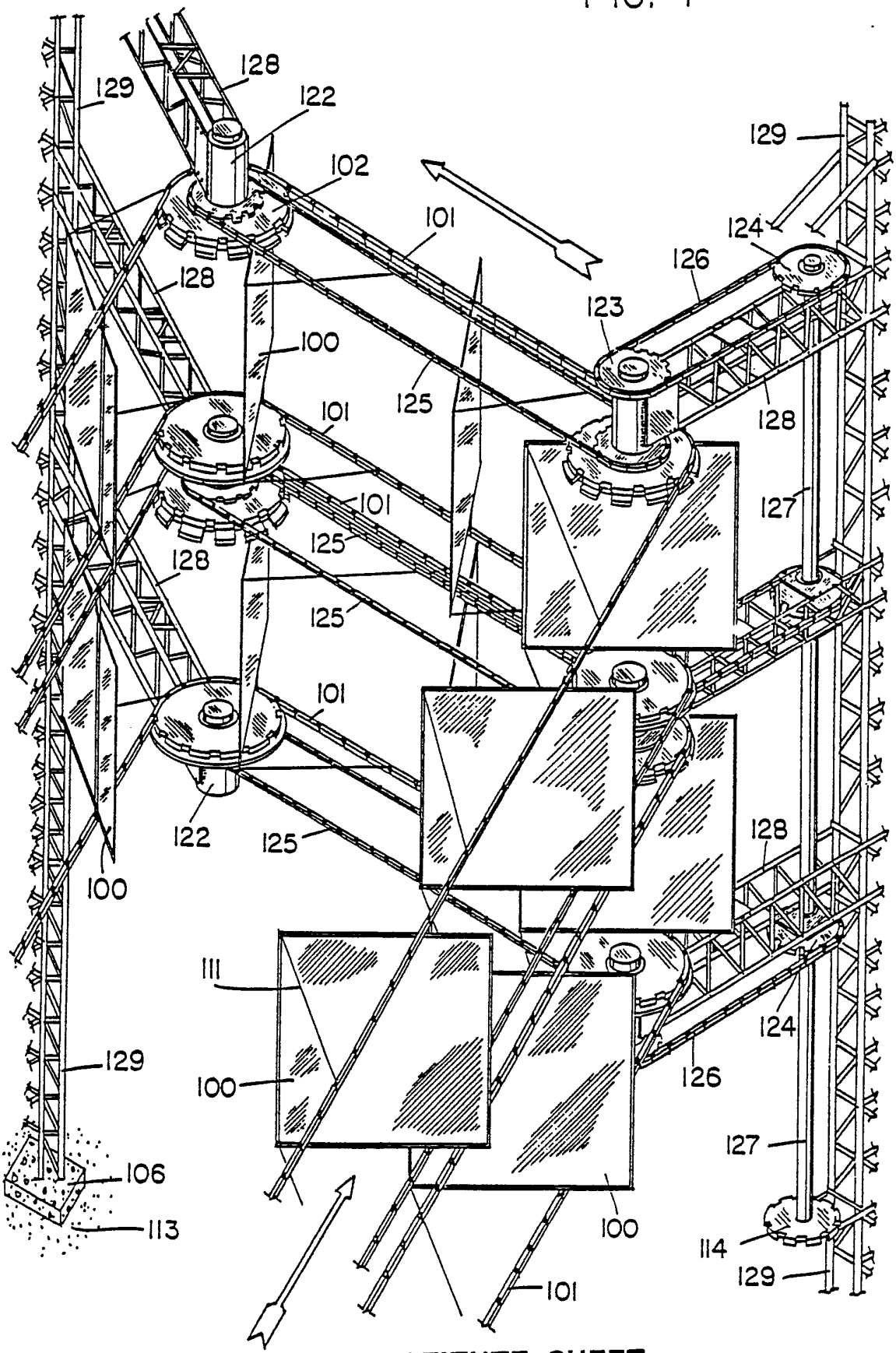
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FIG. 5

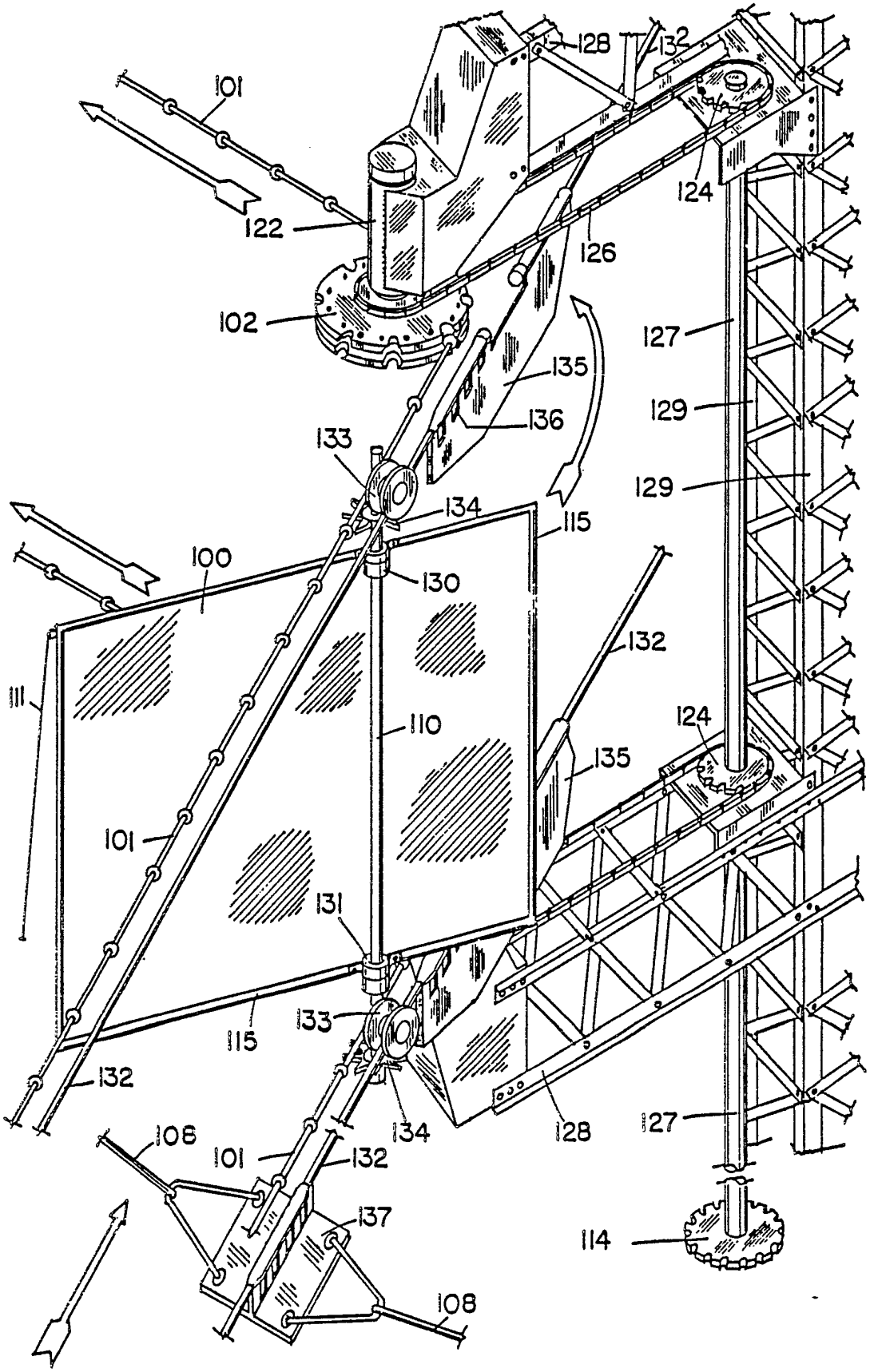
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FIG. 6

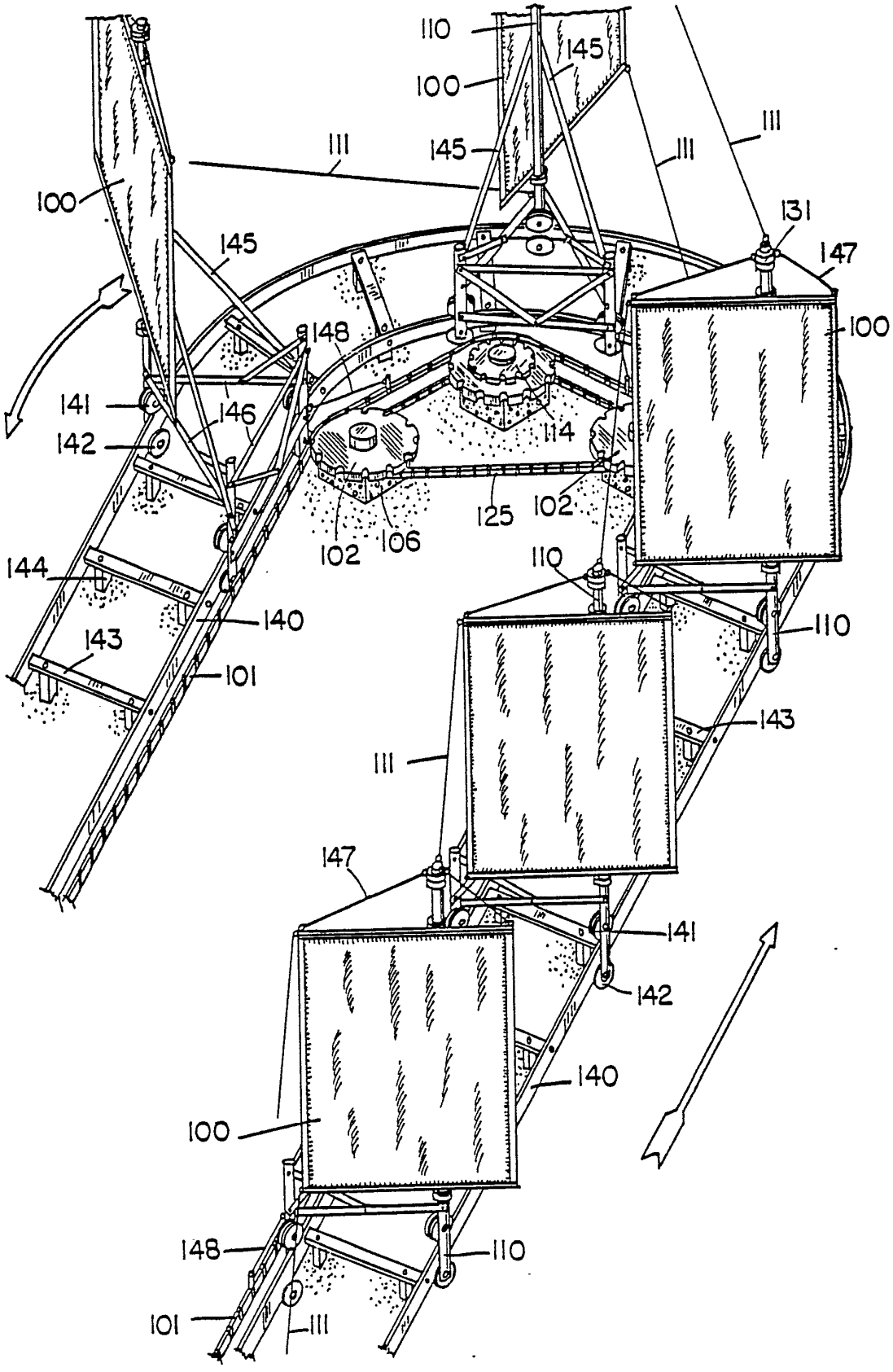
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FIG. 7

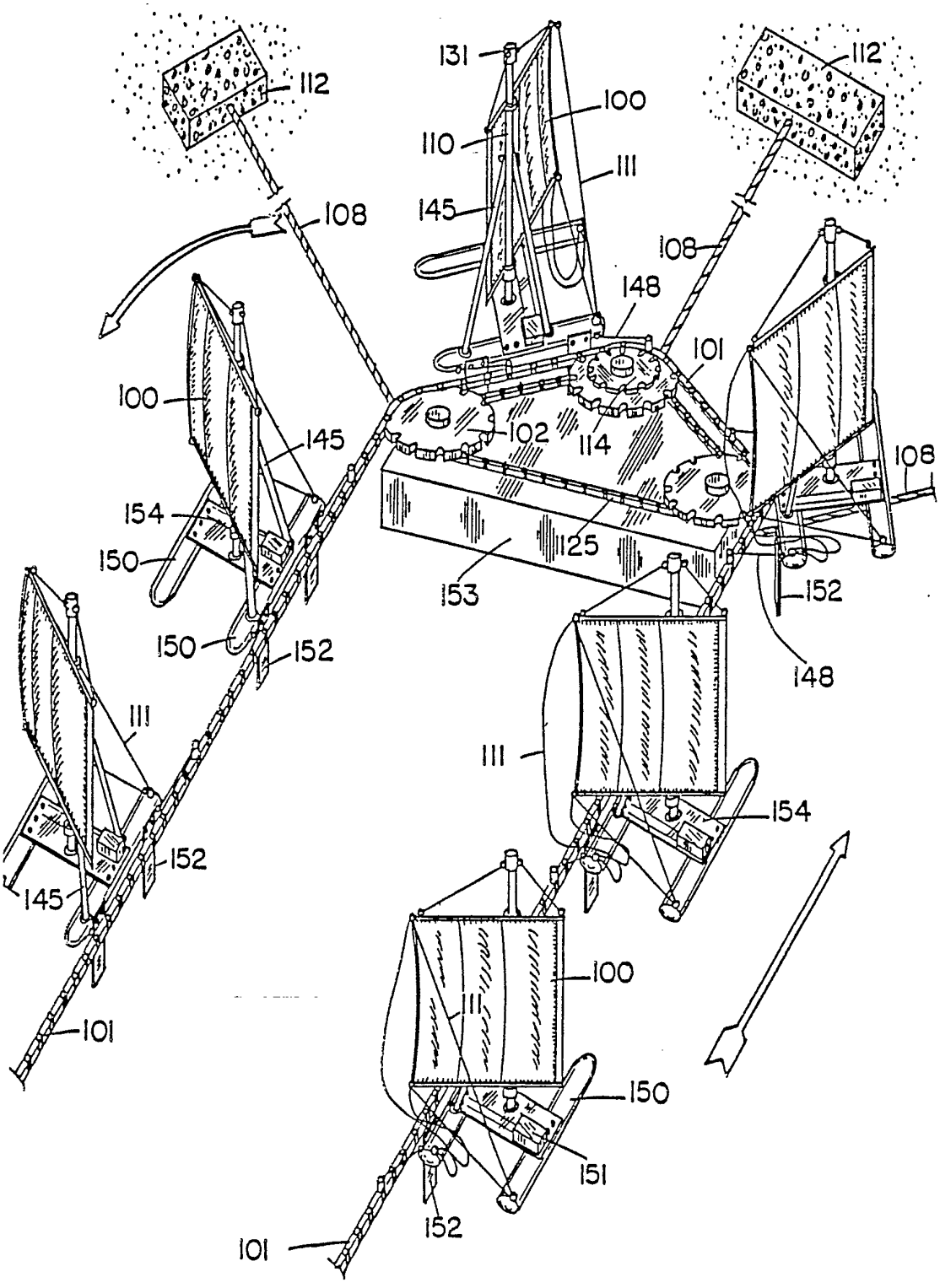
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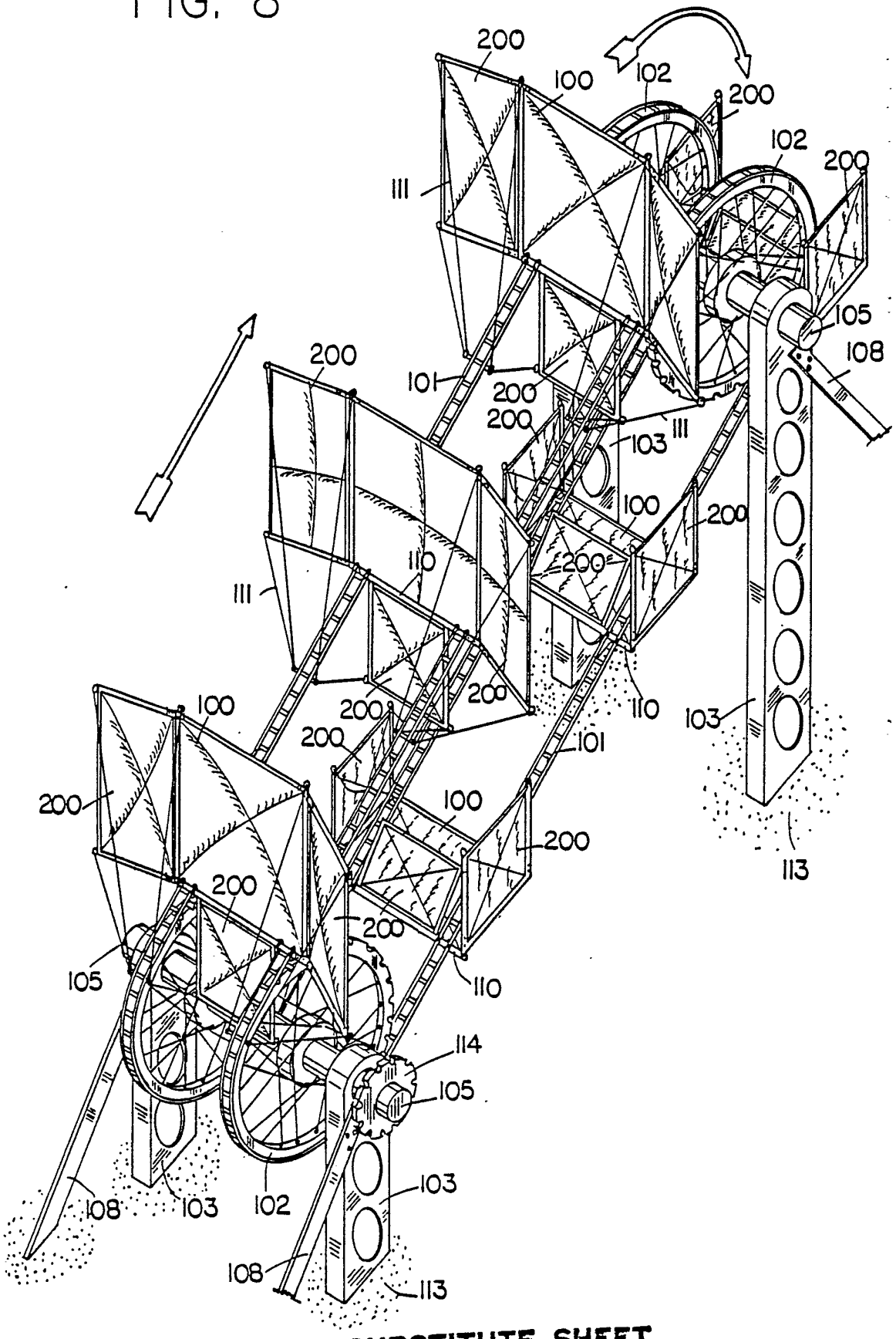
FIG. 8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INTERNATIONAL SEARCH REPORT

International Application No PCT/US86/00063

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

INT. CL.[4] F03D 5/02, F03D 9/02
U.S. CL. 290/55 416/8

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
U.S.	290/44,55 416/7, 8, 85, 119, 240A, D16.6 60/398

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
Y	US, A, 443,641, Published 30 December 1890, EASTMAN	1-5, 9, 11
Y	US, A, 4,302,684, Published 24 November 1981, GOGINS	1-5, 9, 11
Y	GB, A, 1,588,600, Published 29 April 1981, BLACKMAN	1-5, 9, 11
Y	US, A, 4,184,084, Published 15 January 1980, CREHORE	1, 4, 5, 9-11
Y	US, A, 4,309,006, Published 5 January 1982, BISCOMB	1, 4, 5, 9-11
Y	US, A, 3,730,643, Published 1 May 1973, DAVISON	6-9
Y	US, A, 4,052,134, Published 4 October 1977 RUMSEY	10
Y	GB, A, 25,234, Published 29 December 1894, FLUX	10

* Special categories of cited documents: [15]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [2]
2 April 1986	17 APR 1986
International Searching Authority [1]	**Signature of Authorized Officer [20]**
ISA/US	W.E. Duncanson, Jr.

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

X	US, A, 3,996,741, Published 14 December, 1976 HERBERG	12

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE [10]

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers ....., because they relate to subject matter [12] not required to be searched by this Authority, namely:

2. ☐ Claim numbers ....., because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out [13], specifically:

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING [11]

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.