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BLADELESS WIND TURBINE

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ABSTRACT:

In present situation, India is one of the top growing economies. The various sectors contributing to this, need electricity for its functioning. Non- renewable resources being depleted day by day, importance is given to develop power from renewable sources of energy like wind, solar, hydro energy etc.The aim of this project is to utilize wind power to its maximum potential to generate electricity. The region of high speed wind is limited and the area required for installation of conventional windmill is high due to the wake effect. Research is done to find new innovative methods that can operate under optimum wind conditions, under less area by minimizing wake effect and provide an efficient output.One such technology is Bladeless turbine that provides a quiet, safe, simple and efficient alternative to the conventional bladed turbines. Bladeless turbine is not actually a turbine, since it does not rotate. This new approach captures wind energy based on the phenomenon of aeroelastic resonance. Harnessing energy from the vortexes, a process called vortex shedding or Vortex Street.This causes the device to oscillate with little movement which is perfect to be placed anywhere without lubricants and without disturbing wildlife.

1) INTRODUCTION:

Wind power has become a legitimate source of energy over the past few decades as larger, more efficient turbine designs have produced ever-increasing amounts of power. Bladeless turbines will generate electricity for 40 percent lesser in cost compared with conventional wind turbines. In conventional wind power generation transportation is increasingly challenging because of the size of the components: individual blades and tower sections often require specialized trucks and straight, wide roads. Today’s wind turbines are also incredibly top heavy. Generators and gearboxes sitting on support towers 100 meters off the ground can weigh more than 100 tons. As the weight and height of turbines increase, the materials costs of wider, stronger support towers, as well as the cost of maintaining components housed so far from the ground, are cutting into the efficiency benefits of larger turbines. The alternative energy industry has repeatedly tried to solve these issues to no avail. But this latest entry promises a radically different type of wind turbine: a bladeless cylinder that oscillates or vibrates. The Bladeless Turbine harness vorticity, the spinning motion of air or other fluids. When wind passes one of the cylindrical turbines, it shears off the downwind side of the cylinder in a spinning whirlpool or vortex. That vortex then exerts force on the cylinder, causing it to vibrate. The kinetic energy of the oscillating cylinder is converted to electricity through a linear generator similar to those used to harness wave energy. It consists of a conical cylinder fixed vertically with an elastic rod. The cylinder oscillates in the wind, which then generates electricity through a system of coils and magnets. The outer conical cylinder is designed to be substantially rigid and has the ability to vibrate, remaining anchored to the bottom rod. The top of the cylinder is unconstrained and has the maximum amplitude of the oscillation. The structure is built using resins reinforced with carbon and/or glass fibre, materials used in conventional wind turbine blades.

2) MATERIAL SELECTION:

The selection of a material for a particular application is governed by the working condition to which it will be subjected, ease of Manufacturing and the cost considerations, pure metals find few applications in pure condition and secondly, they generally have poor strength in pure form. Various desired and special properties can be achieved by addition of different material to form alloys. Alloy comprises of a base metal and one or more alloying elements. The typical properties associated with working condition are tenacity elasticity toughness and hardness, toughness and typical properties associated with manufacturing process is ductility, malleability and plasticity. The designer selects the materials of construction for his product based on several criteria such as its cost, the desirable properties that it should possess, its availability, the preferred manufacturing processes that are to be employed, etc. The overall economy is influenced by all these factors. In special cases, essentiality and /or urgency of the need for the product can supersede the economic considerations.

3) METHODOLOGY:

The main principle behind this project is the conversion of linear oscillation of mast to rotational motion. As the mast is subjected to wind energy, it tends to oscillate due to the vortices formed around the structure of the mast, which can be converted to rotational force to generate electricity. In the bladeless wind system configuration, the mast is fixed with respect to the ground and the rib structure at the top of the mast comprising of thread arrangement is used for pulling the threads attached to it. Energy is obtained by continuously oscillation of the mast. The mast utilizes wind power to pull the threads along with the chain attached to the sprockets which drive the shaft which intern rotates the alternator to generate power.

4) DESIGN:

The design of the bladeless wind turbine is performed by commercial computer aided design (CAD) software. First, the individual parts of the bladeless turbine are created separately, and then all the parts are assembled together, for obtaining the proper and conceptual design of the bladeless wind turbine.

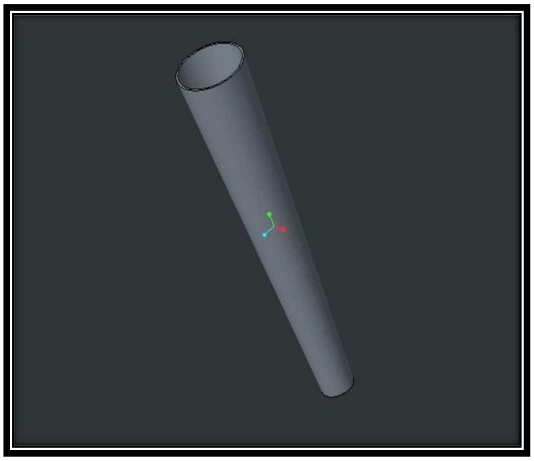
Fig 4.1: Design of PVC Mast

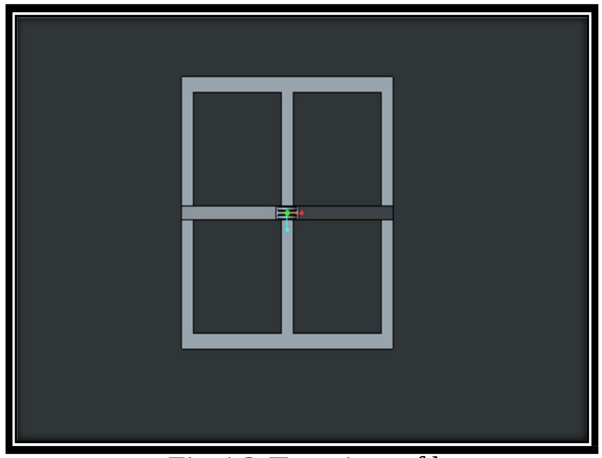
Fig 4.2:Top view of base

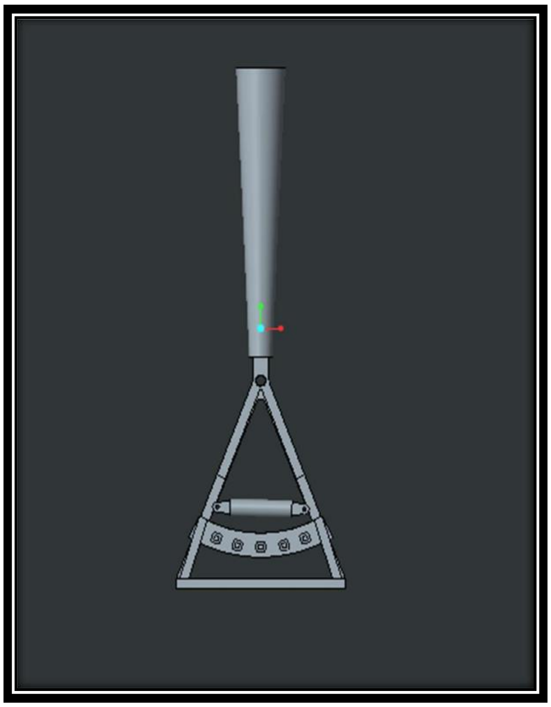
Fig 4.3: Front view of BWT

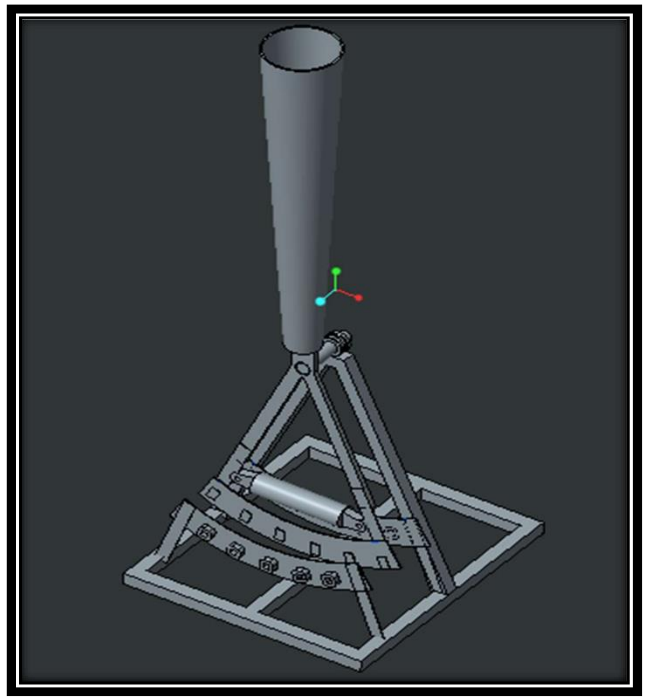
Fig 4.4: Isometric view of BWT

5) CONSTRUCTION:

The base of the turbine is made up of cast iron. The whole length of the cast iron is divided into our required size. The cast iron for base is divided into small pieces by the help of cutting machine. It has four parts of length which is welded together to attain a strong base. The base is made up of cast iron due to its strong durability property, since the device is introduced in the open atmospheric conditions, so that it does not get rusted.Thus the required base is obtained. Also the base should be stable to obtain a perfect oscillation movement of the pendulum without any interference. At the top of the base, i.e. at the top of the inverted 'V' shape a flat surface is made with the welding of cast iron. At this flat surface, two ball bearings are placed and welded at the gap of 3.5 inch between them. They are placed simultaneously one after the other. Here, we chose a ball bearing of outer diameter 2.5 inches and inner diameter of 1.5 inches. Two bearings are used to utilize maximum smooth rotary motion of the shaft and to withstand the weight of the PVC mast and magnets. Another part of cast iron is welded at the top of the base which is in the shape of the inverted 'V'. Next the shaft which is responsible for the oscillation movement is introduced. Next, the glass fiber which is made to oscillate, is placed with neodymium magnets on both sides of the glass fiber. Neodymium magnets are of different sizes, the size of the magnet which we chose for our project is 1×1.5 inch. Then this whole oscillating setup is hanged by penetrating the bearing inside the shaft placed at the top of the base. For making the PVC mast to oscillate like a simple pendulum, center of gravity should act at the center of the object. So a weight balancer is fixed at the bottom of the inverted 'V' notch (which is hanged for proper oscillation).

6) WORKING:

The construction of pendulum for bladeless wind generator plays an important consideration of this study as well as the application of Faraday's Law in cutting the maximum flux when pendulum moves sideways across the face area of the coils to induce voltage. Figure 4.5 shows the front view schematic diagram of the arc pendulum where six coil groups are constructed on both sides and the sliding arc shaped pendulum with neodymium magnets swings back and forth. So, when the oscillation movement happens, the magnetic field in the middle is cut through. The PVC mast which was fixed at the bearing, which was welded to inverted V notch, in which the weight balancer is fitted, balances the weight of the mast and neodymium magnets equally and produces proper oscillations, which helps the coils to induce proper voltage, with the oscillation of neodymium magnets. For this type of construction, the cutting of magnetic field is maximized since the arc pendulum covers the entire face area of the coil groups. The stator on the sides of the pendulum is a coil that has 220 turns each. The coils are placed in such a way that the fibre glass attached with the coils does not disturb or collide with the oscillating glass fibre pendulum. The bladeless wind generator produces induced voltage by cutting the magnetic flux between coils and magnets while swinging. However, the limitation was the weight of its body; as such, constructing a mast size would cause difficulty in its swinging action but most area under coil face can be covered for higher induced voltage. In line with this observation, a smaller mast size was designed and constructed so it can move freely on that portion of coil group's face area as it swings back and forth.

Fig 6.1: Bladeless wind Turbine

7) TESTING:

7.1 Selection of Location for Testing:

(i) Sea Shore:

First, the device is tested at sea shore. Then the device is set up and is ready for experiment. Wind speed is checked and measured and noted down in the table. Then the voltage is noted with the help of multimeter. This procedure is repeated for several times and noted in the table. Then the device is carried to another place for testing.

S.No.	Wind Speed (m/s)	Voltage(V)	Ampere(I)	Power (P)
1.	6.2	0.178	0.0037	0.0007
2.	6.6	0.168	0.0038	0.0006
3.	7.2	0.163	0.0036	0.0006
4.	6.5	0.170	0.0039	0.0005
5.	6.3	0.175	0.0037	0.0007

Table 7.1: Experiment readings at sea shore

(ii) Highways:

Now the device is tested at highways. Then the device is set up and is ready for experiment. Wind speed is checked and measured and noted down in the table. Then the voltage is noted with the help of multimeter. This procedure is repeated for several times and noted in the table. Then the device is carried to another place for testing.

S.No.	Wind Speed (m/s)	Voltage(V)	Ampere(I)	Power (P)
1.	4.5	0.200	0.0040	0.0008
2.	5.8	0.181	0.0032	0.0005
3.	4.9	0.190	0.0039	0.0007
4.	5.9	0.179	0.0034	0.0006
5.	5.3	0.185	0.0033	0.0006

Table 7.2: Experiment readings at Highways

(iii) Residential environment:

Finally, the device is tested at our residential environment. Then the device is set up and is ready for experiment. Wind speed is checked and measured and noted down in the table. Then the voltage is noted with the help of multimeter. This procedure is repeated for several times and noted in the table. Then the final readings are noted.

S.No.	Wind Speed (m/s)	Voltage(V)	Ampere(I)	Power (P)
1.	3.2	0.251	0.0053	0.0013
2.	2.5	0.290	0.0079	0.0022
3.	3.5	0.241	0.0046	0.0011
4.	3.7	0.222	0.0040	0.0008
5.	2.8	0.272	0.0065	0.0017

Table 7.3: Experiment readings at Residential area

8) FUTURE SCOPE:

From above information it is clear that the Bladeless turbine wind generator is the best option for electricity generation using wind power due to its various advantages. The country like India which having more rural population and condition suitable for wind generation through bladeless wind turbine is the best solution. It will help to increase percentage of renewable energy for electrical power generation and provides electrically as well as economically efficient power to the consumers. Here it can be mounted to a roof and be very efficient and practical. A home owner would be able to extract free clean energy thus experiencing a reduction in their utility cost and also contribute to the “Green Energy” awareness that is increasingly gaining popularity. Problem with bladeless wind turbine is that it’s initial cost is high but once it get implemented then it’s operational cost is very less since it compensates initial cost. Another problem is, awareness about this concept. This concept having very less awareness among the world hence research and development of this concept is very slow. Hence have to spread this concept because only renewable energy can survive the world in coming future and in that wind energy is efficient option .

9) CONCLUSION:

Wind energy holds the potential to be the world’s primary source of energy. The papers conclude that the vortex windmill is one of the greatest wind energy generation system .The generation system is useful for each and every individuals as well as residential, small scale industries. The problems with cost efficiency and the negative side effects that the modern wind turbine has an attempt to compensate for these problems, bladeless wind turbine is less expensive. In summary, the generation of electricity is made possible by the small structure of bladeless turbine. Efficient power is generated. This project will satisfy the need of continuous generation of electricity. The overall project uses less space area . The purpose of this paper is to provide some fundamental results on the bladeless wind system and serve as stepping stones for the future development of bladeless wind power generating system. The forces that is beneficial or useful to generate power in bladeless are different from those in conventional horizontal axial wind turbines.

10) RESULTS:

Table 7.1 shows the data from arc shaped pendulum exposed to actual wind speed, taken during the day time at sea shore side and maximum wind speed for each hour was recorded. The maximum voltage produced by the coils in the sea shore side was 0.178 volts, with a wind speed of 6.2 m/s. Table 7.2 shows the data from arc shaped pendulum exposed to actual wind speed, taken during the day time at highways and maximum wind speed for each hour was recorded. The maximum voltage produced by the coils in the highways was 0.200 volts, with a wind speed of 4.5 m/s. Table 7.3 shows the data from arc shaped pendulum exposed to actual wind speed, taken during the day time at sea shore side and maximum wind speed for each hour was recorded. The maximum voltage produced by the coils in the residential environment was 0.290 volts, with a wind speed of 2.5 m/s. Similarly, data gathered from tables 7.1 to 7.3 reveal that arc shaped pendulum got more voltage when there was less wind speed and less frequency in oscillations of the pendulum. Information from those gathered data further reveals that bladeless wind turbine arc shaped pendulum type is more capable of generating higher voltages at a slower wind speed.

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