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FABRICATION OF BLADELESS WIND TURBINE

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Abstract:
It is a new approach in the field of engineering to harness energy from wind. Where in traditional methods we use large blades for the conversion of wind energy into useful mechanical - electrical energy. The problem we have encountered from this approach is, it occupies large amount of space. So the moto of our project is to overcome the problems encountered by using traditional method and to make a device which is capable of producing energy and minimum/effective use of available resources. The device captures the energy of vortices, an aerodynamic effect that has plagued structural engineers and architects for ages (vortex shedding effect). As the air strikes the structure flow changes and generates a cyclical pattern of vortices. At the point at which forces are strong enough the entire cylindrical structure will start to oscillate/revolute, we use the swinging action of device to produce energy. The entire setup consists of a cylindrical shaped GI sheet cylindrical structure, piezo electric crystals base, supporting base, universal coupling, inverter setup and voltmeter. Wind turbines with blade have some major drawbacks so in order remove these types of drawbacks and to increase the capacity of the wind turbines the idea of bladeless wind turbine emerges. When it comes to working as we already know that the oscillating/revolute action is used to produce energy which means as a cylindrical section oscillates, the entire weight of device falls on to the piezo electric crystals which produces piezo electric effect. This is nothing but emission of electrons. In other words, tiny bit of voltage or electric city.

I. INTRODUCTION

Renewable energy is generally obtained from non-conventional sources like wind, solar, geothermal, ocean currents etc. These sources are called as renewable energy sources because these are abundant in nature and can be used for over and over again. Considering the adverse impact created by the conventional energy sources like polluting the environment and disturbing the eco life every organization or government entity wants to move towards renewable sources. Due to change in approach, we can see high demand for non-conventional power generation. This popularity has been increased by the cutting-edge research and break through in technology that has been introduces so far. Here in India, we 31% of our energy consumption from renewable sources. There is a capacity of about 1, 95,000 MW non-conventional energy in India. 31 % of it is the form of solar energy, 30% in ocean and geo-thermal, 26 % in biomass and 10 % in wind energy. This presentation focusses on bladeless wind turbines occupies 30% area of conventional generator and produces significant and notable energy production. Impact on birds will decrease significantly because blades are completely eliminated. maintenance cost will be decreased automatically due to less moving parts so we can observe significant cost reduction.

II. PROBLEM IDENTIFICATION

- Wind turbines with blades occupies large space.
- Cost of manufacturing is very high.
- Maintenance cost is very expensive.
- Wind mill size is very huge
- Ratio between power produced and area occupied is very less.
- Creates huge impact on birds and human health.

III. LITERATURE REVIEW

The previous research work description as follows. The devices capture the energy of vorticity, an aerodynamic effect that has plagued structural engineers and architects for ages (vortex shedding effect). As the wind bypasses a fixed structure, its flow changes and generates a cyclical pattern of vortices. once these forces are strong enough, the fixed structure starts oscillating. Instead of avoiding these aerodynamic instabilities our design maximizes the resulting oscillation and captures that energy. India is having fifth largest installed wind power capacity in the world. As the

regions with high wind speed are limited, the installation of conventional windmill is limited. Windmills that would provide safe, quiet, simple, affordable and work on lesser. Wind speeds are need of the hour. The Bladeless Windmill is such a concept which works on the phenomenon of vortex shedding to capture the energy produced.

The Vortex wind turbine has a straw shaped bladeless design. The turbine is designed to harness energy by exploiting the aerodynamic effect vorticity. The vortex uses the vibrations caused by vorticity in conjunction with a base of repelling magnets to generate electricity. The device in theory should have low maintenance costs because there are very few moving parts. The turbines can be placed closer together than conventional turbines are totally silent and cost less to manufacture. Vortex is also no danger to birds.

IV. DESIGN

Let's consider a structure called Cylinder.

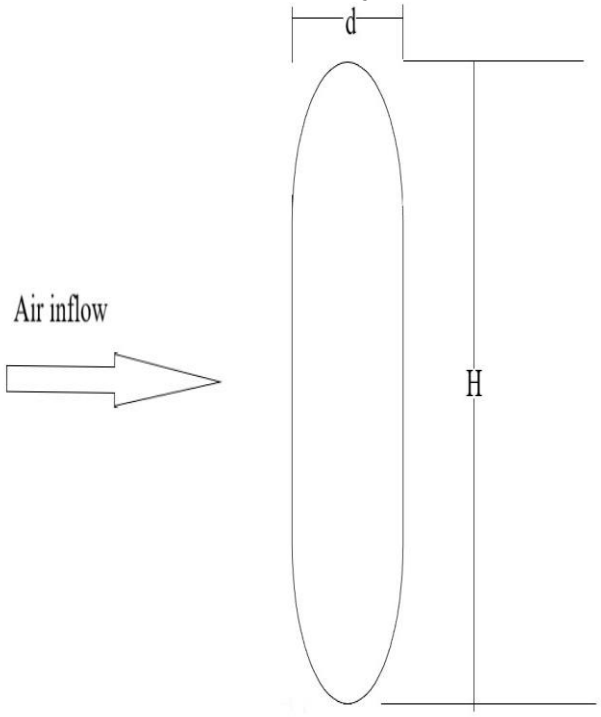


Figure.1. Tapered cylindrical structure

Considering the notations
as, d=diameter of
cylinder
H=height of the cylinder
U= Air velocity,
Now, we know Reynolds Number (Re)
Re= (UD)/ν
And Strouhal Number (St)
St= (fsD)/L
Reynolds Number distinguishes the flow of fluid as Laminar or turbulent. So, we are targeting Re values 300<Re<3*105 for better frequency of vibration.
Now for Reynolds number to be 300<Re<3*105, Strouhal Number should be 0.2 or 0.198
St = 0.2 15
length as H=112cm total length
d=125mm
height of stand=32.5cm
length of stand=50cm
Diameter of piezo electric base (Dmax)=60cm
Diameter of piezo electric base (Dmin)=20cm
Total height of device=152cm

V. WORKING DESIGN

A. BLOCK DIAGRAM

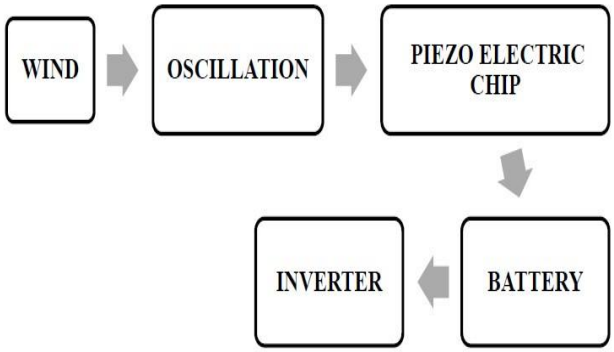


Figure.2. block diagram

As the air strikes the structure flow changes and generates a cyclical pattern of vortices. At the point at which forces are strong enough the entire cylindrical structure will start to oscillate/revolute, we use the swinging action of device to produce energy. The entire setup consists of a cylindrical shaped GI sheet cylindrical structure, piezo electric crystals base, supporting base, universal coupling, inverter setup and voltmeter. When it comes to working as we already know that the oscillating/revolute action is used to produce energy which means as a conical section oscillates, the entire weight of device falls on to the piezo electric crystals which produces piezo electric effect. This is nothing but emission of electrons. In other words, tiny bit of voltage or electric city. Our project is eco-friendly and helpful to environment.

B. COMPONENTS AND ITS DESCRIPTION

- Piezo electric material
- Volt meter

- Mast
- Universal joint
- Battery
- Inverter
- Stand

Piezo electric material:

In **PIEZOELECTRICITY** the term" piezo" stands for pressure or stress. Thus, **piezoelectricity** is defined as "Electricity generated by application of mechanical stress or tension" and the materials that exhibit this property comes under the category of **piezoelectric materials**. The credit for the discovery of these materials goes to **Sir Jacques Curie (1856–1941)** and **Pierre Curie (1859–1906)**. While experimenting with certain crystalline minerals like quartz, cane sugar, etc… they found that application of force or tension on these materials generated voltages of opposite polarities with magnitudes propositional to the applied load. This phenomenon was named as **Direct Piezo effect**.

Volt Meter:

A voltmeter measures voltages usually calibrated in volts, millivolts (0.001 volt), or kilovolts (1,000 volts). In order to measure a device's voltage, a voltmeter is connected in parallel to a device. This setup is important as objects in parallel usually tend to experience the same potential difference. It is connected in parallel with the circuit mainly because the same voltage drop occurs across it.

A voltmeter also has high internal resistance. This is done mainly because it is used in measuring the potential difference between the two points of the circuit. As such the current of the measuring device remains the same. In other words, the high resistance of the voltmeter will impede the flow of current through it. This allows the device to take correct readings of the voltage.

Mast:

The outer cylinder is designed to be largely 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 GI sheet. Instead of the usual tower, nacelle and blades, our device has only a mast made of lightweight materials over a base. This reduces the usage of raw materials and the need for a deeper foundation.

Universal Joint:

If any bend angle is shared equally between the two universal joints, then the two joints will cancel out velocity oscillations so that the final output shaft has a constant velocity. However, the oscillation of the intermediate shaft will cause vibrations and supports are required to maintain the equal angles.

Universal joints have been extensively used in vehicle drivetrains — but are being replaced by constant velocity

joints. Universal joints are now rarely used to transmit power to the front wheels of vehicles, except for some heavy-duty off-road vehicles. They remain widely used for drive shafts, although constant velocity joints are even starting to be used for these applications. Universal joints also have many other uses in mechanical control systems and industrial machinery. Universal joints allow large angles between shafts. For slight misalignment between shafts, a flexible coupling can be an alternative to a universal joint.

Battery:

Lead acid batteries used in the RV and Marine Industries usually consist of two 6-volt batteries in series, or a single 12-volt battery. These batteries are constructed of several single cells connected in series each cell produces approximately 2.1 volts. A six-volt battery has three single cells, which when fully charged produce an output voltage of 6.3 volts. A twelve-volt battery has six single cells in series producing a fully charged output voltage of 12.6 volts. A battery cell consists of two lead plates a positive plate covered with a paste of lead dioxide and a negative made of sponge lead, with an insulating material (separator) in between. The plates are enclosed in a plastic battery case and then submersed in an electrolyte consisting of water and sulfuric acid.

Inverter:

A **power inverter**, **inverter** or **invertor** is a power electronic device or circuitry that changes direct current (DC) to alternating current (AC). The resulting AC frequency obtained depends on the particular device employed. Inverters do the opposite of "converters" which were originally large electromechanical devices converting AC to DC.

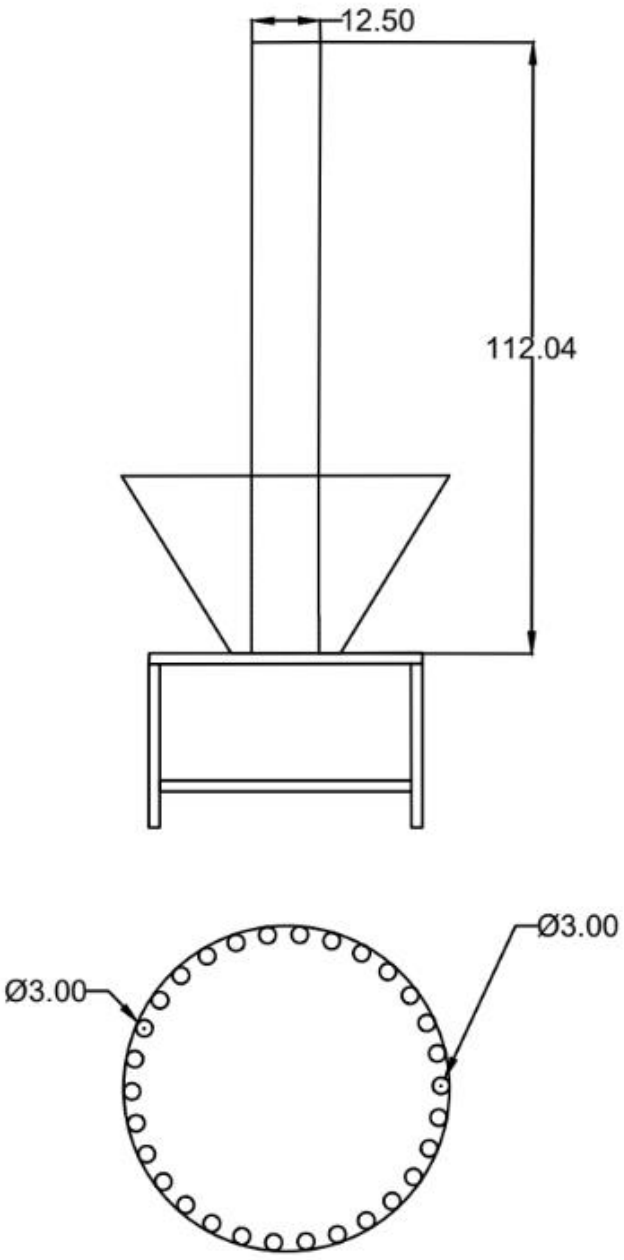
The input voltage, output voltage and frequency, and overall power handling depend on the design of the specific device or circuitry. The inverter does not produce any power; the power is provided by the DC source.

A power inverter can be entirely electronic or may be a combination of mechanical effects (such as a rotary apparatus) and electronic circuitry. **Static inverters** do not use moving parts in the conversion process.

Stand:

Stand is a supporting structure which holds cylindrical element and piezo electric base. It is made of iron and dimensions are 30*30 cm^2. The main purpose of stand is to stood the entire structure rigid and firm. As the structure oscillates in circular fashion it will helps to manage device from collapsing and moreover it creates room for circuits and wiring.

VI. FINAL DESIGN



Final design

VII. IMPLEMENTATION

- Sea shore
- On highways sides
- Hilly areas

➢ Roof top

EXPERIMENTATION & MAKING

DESIGNING

- Turning idea into a CAD design converting parameters into line diagram.
- Change units to centimetres in CAD start drawing.
- Selecting suitable layers and notify dimensions
- After completion of designing convert the DWG format of drawing into PDF using printing option.
- Take printout and proceed to next stage operations.

METAL CUTTING

- Check the GI sheet and iron metal are with required properties.
- Mark the dimensions and perform cutting operations using snips and metal cutter
- Make sure that exact dimensions are reflected while performing cutting operation. Follow all safety measures wear glows and goggles.

FABRICATION (WELDING)

- Cut the iron pieces into required dimensions as mentioned in CAD drawing.
- Weld the iron metal together using ARC welding.
- After completion of fabrication remove the unnecessary chips and debris using brushes.
- Polish the parts if necessary.

FABRICATION (BRAZING)

- The main difference between welding and brazing is operating temperature and flux used.
- Brazing is used to make GI sheet into cylindrical structure also known as mast.
- By using brazing, we connect mast to universal coupling.
- Join the all required parts according to dimensions.

TAKING READINGS

- After assembly process completed note down the reading.
- Readings are taken in order as time for one revolution voltage generated and current generated.
- We need minimum wind speed of 15 km/hr to generate power so we take readings by rotating mast by using any other external force.
- Readings are taken at 10 sec, 8 sec, 7 sec and 6 sec of a complete full rotation.
- Power is calculated by using formula P=V*I. Readings are taken into a table.

. RESULTS

➢ Bladeless wind turbine generates power at very low wind speed when compared to traditional wind turbines.

➢ Our project is just a prototype model and it will produce only small amount of current from the piezo-electric chips i.e., about 4-8 volts. The amount of power produced depends on number of piezo materials used.

➢ The vertical mast made of GI sheet will revolve at lower wind speed of about 15 km/s

Sno	Time for 1 Rev	Voltage(v)	Current(i)	P= V x I
1	10 Seconds	846mv	150ma	1.26 watt
2	8 Seconds	1269mv	170ma	2.15 watt
3	7 Seconds	1692mv	190ma	3.21 watt
4	6 Seconds	2115mv	210ma	4.44 watt

IX. ADVANTAGES AND DISADVANTAGES

A. ADVANTAGES

- Friction loss will be negligible due to less moving parts.
- This wind turbine produces less noise.
- Impact on birds will decrease because of no blades.
- Implement cost of this windmill is 48% less than the normal windmill.
- Maintenance cost will decrease dramatically.

B. DISADVANTAGES

- Less production of power compared to blade wind turbine.
- Electrical power generation affected by environmental changes.

X. CONCLUSION

The bladeless wind generation system configuration has been considered and the obtained results appear to be very encouraging, even though they are based on simulations and model taken from the literature, which certainly can give only approximate description of involved dynamics. Tapping the wind for renewable energy using new approaches is gaining momentum in the recent years. 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. Our device captures the energy of vorticity, an aerodynamic effect that has plagued structural engineers and architects for ages (vortex shedding effect). As the wind bypasses a fixed structure, its flow changes and generates a cyclical pattern of vortices. Overall, the project has been a success with all of the project requirements achieved. As the wind energy is powerful and consistent, the usage of conventional wind turbine for utilizing the wind energy in lesser area and cost is not possible. Hence bladeless wind energy helps us to achieve these criteria. This project has three main advantages: Utilizing less area, Generation of high power, Economical. In summary, the generation of electricity is made possible by the small structure of bladeless turbine. Highly efficient power is generated. This project will satisfy the need of continuous generation of electricity. The overall project uses less space area hence highly economical for the rural electrification of India.

XI. FUTURE SCOPE

- Since most of states of India has many villages where there is still very less amount of available electricity distribution. So, at that place's establishment of this type of bladeless wind turbine will help them to avail electricity as well as job for family persons.
- It must be established in every state of India because of it is environment friendly as well as seeking available amount of non – renewable energy sources.

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