International Journal of Pure and Applied Mathematics
Volume 118 No. 11 2018, 557-561
ISSN: 1311-8080 (printed version); ISSN: 1314-3395 (on-line version)
url: http://www.ijpam.eu
doi: 10.12732/ijpam.v118i11.71
Special Issue
ijpam.eu

DESIGN AND FABRICATION OF BLADELESS WINDMILL

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Abstract: At present India is stepping towards becoming a global super power. This implies that it is leading the list of developing countries in terms of economic development. Therefore the energy requirement of the country would increase in rapid rate. At present there is existing blade windmill to produce energy, but its capital cost, maintenance cost, friction loss is high. So in our project we are going to generate electricity by using BLADELESS WINDMILL. Bladeless wind generation uses radically a new approach of capturing wind energy. It works on principle that when wind is allowed to strike the column mast, it tends to vibrate and this vibrational energy is further converted to mechanical energy. The spring is provided inside mast which is connected to crank shaft. The vibration is transmitted to crankshaft which is then supplied to generator. It is an eco friendly project and it reduces the friction losses.

Keywords: Bladeless Windmill, Vortex Induced Vibrations. Spring

1. Introduction

In these days non renewable energy sources are gone to the depth of earth, so we can obviously produce energy by renewable energy sources. Wind energy has became a legitimate source of energy over the past few decades. The construction of bladeless windmill is quiet simple. The conical mast is pivoted vertically with the help of cylindrical rod which is held within roller bearing in such a way that it vibrate in one direction only. The portion below pivot is covered with help of metal sheet. The upper part of mast flutters in wind while crank shaft is connected to lower part.

Figure 1. Vortex windmill

This is a wind generator without blades. The main advantage of this underlies the absorption of energy through the vortices of a rigid member similar to an effect of aerodynamics.We are going to generate electricity by using the bladeless windmill. This wind mill will have no blades. It will generate electricity by using oscillation due to wind.

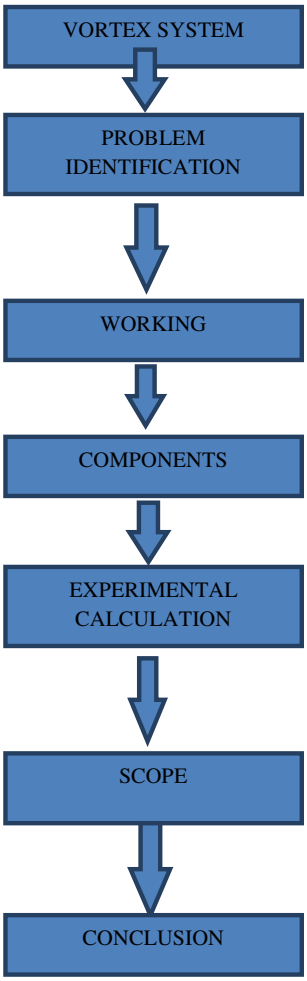
2. Problem Identification

The rate of wind power developed founds costly when compared to an existing wind mill. For these several invetigations need to be found out. Some of identifications are as follows:

- Higher capita expenditure in observed in erection and commisioning of a wind mill. Conventional windmill requires places where wind speed is more. Such places are limited. Hence windmills working on lesser wind speeds are need of the hour.
- The cost of manufacturing different parts of windmill is very high. A typical windmill will cost $3000-$8000 per kilowatt.
- So also the transportation of such huge parts is very costly and risky. If during transportation components get damaged then again cost increases.
- Designing of windmill blades is also a big task.
- The size of the assembled windmill is also very large. The conventional windmills occupy lots of space. The commercial turbines can be 160m high.
- Area of installation is 60 acres per megawatt of capacity of wind farms.
- Also they prove fatal to birds.
- They produce low frequency sound which is not good for human health.

3. Methodology

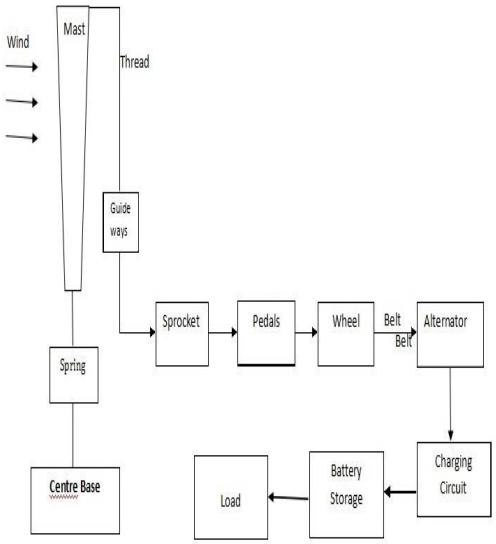
Methodology is the basic requirement for a project, because it defines the proper start and end condition of the works to be done. Proper planning and execution of the workflow decides the successful completion of the project. The methodology of this project is as follows.



3.1 Working Principle

The energy conversion happens in the mast, in which the wind strikes the column mast to vibrate. This vibration is converted into mechnical energy and then to electrical energy. When the wind impinges on the projected surface area of the mast from one specified direction, stream lines of the wind tend to depart and get sheared off. Further passage results into the formation of wind currents called vortices or eddies. When they are strong enough to overcome the internal resistance offered by the mechanism (crank shaft or direct linear alternator), the mast vibrates due to spring connected at outside surface of the mast. Then spring is connected to the foundation seat. The connecting rod is bound to transmit this vibration to the crank. The crank shaft can be connected to a generator further. We can also connect the lower end of the mast with the linear alternator directly.

Obviously, we can use a rectifier circuit to transform this A.C. current to D.C. current and charge a battery or connect it the load.



Component Selection

The bladeless windmill consists of the following components to fulfil the requirements of completing the operation of the machine.

Centre base
Spring
Mast
Crank Shaft
Flywheel
Belt
Alternator
Chain drive
Blower

Centre Base

Base is made up of the rigid iron angular structure. The base provides equidistant point for the position of the mast. It is capable of tolerating the mechanical stress acting on it. This provides the strong foundation to the mast and spring.

SPRING

Spring is mounted at the centre of the mast which provides the oscillation of the mast in any of the direction. Safe design consideration adopted for the spring, such that it takes the entire load of mast.

MAST

The rigid, osciillating part at the centre which has a conical shape forms the mast. The mast is made

lighter in weight to increse the oscillations and to reduce the stress due to inertia which transfers to the base.

Crank Shaft

The crank shaft is used to perform conversion between reciprocating motion and rotating motion. It is usually connected to flywheel.

Flywheel

The flywheel is provided to increase the low RPM at the input side to higher RPM at the generation. The flywheel is provided with the counter weight to increase the speed of the rotate of the generator and it helps to rotate for the longer time. The flywheel is rotated by placing it on the hub which is connected to the small sprocket. The larger sprocket is connected to the small sprocket of the flywheel through the chain.

Belt

The leather belt is used to drive the generator. The belt is connected to the pulley of the generator and the flywheel.

Alternator

The alternator is driven by the power wheel via the belt drive. The generator is design by using a ceiling fan stator which consists of 16 set of windings.. It is made to generate to electricity by replacing the metal rotor with a wooden rotor which comprises of Neodymium magnets.

Gear Drive

Gear drive helps in increasing the speed. The teeth are connected to the cycle hub and tightened and supported using a metallic frame. The compound chain drive is used to reduce the space required.

Blower

Blower is used to supply the artificial air required by the mast.

4. Experimental Calculation

Rack Setup:

Length=40cm;Width=2cm

Gear Wheel Setup:

Gear =16cm,8.5cm

Flywheel:

Radius=9cm, Depth=18cm

Full Setup:

Length=60cm,width=30cm, height=27cm

Mast:

Larger radius of the Mast, R1 =0.125m

Smaller radius of the Mast,R2 =0.0625m

Length of the Mast L =3m

Velocity of the wind, v=40 m/s

Projected area of mast exposed to wind

A= (R1 +R2) *3.00

= 0.5625 m^2

Force of the wind on the projected area,

F = ρ ×A×v 1 air

=1.225 × 0.5625× 11.12^2

=85.20 N

Table 1. Scope (Comparision Between Windmills)

PARAMETERS	CONVENTIONAL WINDMILL	BLADELESS WINDMILL
MODE OF OPERATION	It generates electric power with blades	It generates electricity without blades.
MODE OF GENERATION	It captures wind energy using Rotational motion of the blades.	It captures wind energy using "Vorticity"
STRUCTURE	The design is sturdy & there is high wear &tear.	The design is sturdy & there is minimal wear.
SAFETY	It is not safer for birds,that often suffer fromcollision with blades	It is also safer for birds,that often suffer from collision with blades
MAINTENANCE	It is not feasible to maintain, as it has highermaintenance cost	It is easy to maintain.
CONSTRUCTION	It has more moving parts	It has less moving parts
EFFICIENCY	It has high efficiency.	It has low efficiency.

5. 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, Vortex 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.

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