FABRICATION OF BLADELESS WINDMILL

A PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

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INTERNAL EXAMINER **EXTERNAL EXAMINER**

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ABSTRACT

India is now pursuing its goal of becoming an all-encompassing powerhouse. This suggests that in terms of economic development, it is at the top of the list of developing nations. As a result, the nation's energy requirement will rise quickly. The current energy generating methods are less cost-effective and environmentally unfriendly. The purpose in this days non-renewable energy sources are gone to depth of the earth, so we can obviously energy produce by renewable energy sources. There are used blade windmills to produce energy produces, but it's having cost is very high and many disadvantages like as capital cost, maintenance cost, running cost, friction loss etc. So by this project, we are going to generate electricity by using the bladeless windmill. It is a radically new approach to capturing wind energy. The device captures the energy of vortices, 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, may enter into resonance with the lateral forces of the wind, and even collapse. There is a classic academic example of the Tacoma Narrows Bridge. The bladeless windmill will generate electricity by help of oscillation or vibrations produced due to the wind. Here electricity can be generated by using piezoelectric material. There will be no blades and no rotation, so friction loss will be low and it is eco-friendly.

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CHAPTER 1

INTRODUCTION

Over the last few decades, larger, more effective designs have generated ever-increasing amounts of electricity, making wind power a credible source of energy. Turbine growth may have reached its ceiling despite the sector seeing a record 6,730 billion in world wide investment in 2014. When compared to traditional turbines, bladeless generators will produce power for 40% less money. Due to the size of the parts, transportation is becoming more difficult with each generation. Blades and tower tones’ pieces frequently needs specialized vehicles and straight, broad roadways. Moreover, wind turbines are heavy. Towers used to support gearboxes and generators can be 100 meters in height and weigh more than 100 tons.

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.

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.

1.1 VORTEX BLADELESS

Wind energy is one of the most cleanly and reliable source of renewable energy. Bladeless Wind Turbine uses a radically new approach to capturing wind energy. Our device captures the energy of Vorticity, an aerodynamic effect that hasplagued 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, may enter into resonance with the lateral forces of the wind, and even collapse. There is a classic academic example of the Tacoma Narrows Bridge, which collapsed three months after its inauguration because of the Vortex shedding effect as well as effects of flattering and galloping. Instead of avoiding these aerodynamic instabilities our technology maximizes the resulting oscillation and captures that energy. Naturally, the design of such device is completely different from a traditional turbine. Instead of the usual tower, nacelle and blades, our device has a fixed mast, a power generator and a hollow, lightweight and semirigid fiberglass cylinder on top. 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.

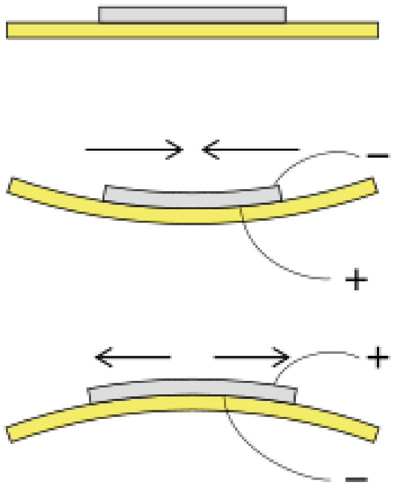
The kinetic energy of the oscillating cylinder is converted to electricity through piezo electric chips.

1.1 PIEZOELECTRICITY

Piezoelectricity (/ˌpiːzoʊ-, ˌpiːtsoʊ-, paɪˌiːzoʊ-/, US: /piˌeɪzoʊ-, piˌeɪtsoʊ-/)[1] is the electric charge that accumulates in certain solid materials—such as crystals, certain ceramics, and biological matter such as bone, DNA, and various proteins—in response to applied mechanical stress.[2] The word *piezoelectricity* means electricity resulting from pressure and latent heat. It is derived from Ancient Greek πιέζω (piézō) 'to squeeze or press', and ἤλεκτρον (ḗlektron) 'amber' (an ancient source of electric current).[3][4]

The piezoelectric effect results from the linear electromechanical interaction between the mechanical and electrical states in crystalline materials with no inversion symmetry.[5] The piezoelectric effect is a reversible process: materials exhibiting the piezoelectric effect also exhibit the reverse piezoelectric effect, the internal generation of a mechanical strain resulting from an applied electric field. For example, lead zirconate titanate crystals will generate measurable piezoelectricity when their static structure is deformed by about 0.1% of the original dimension. Conversely, those same crystals will change about 0.1% of their static dimension when an external electric field is applied. The inverse piezoelectric effect is used in the production of ultrasound waves.[6]

French physicists Jacques and Pierre Curie discovered piezoelectricity in 1880.[7] The piezoelectric effect has been exploited in many useful applications, including the production and detection of sound, piezoelectric inkjet printing, generation of high voltage electricity, as a clock generator in electronic devices, in microbalances, to drive an ultrasonic nozzle, and in ultrafine focusing of optical assemblies. It forms the basis for scanning probe microscopes that resolve images at the scale of atoms. It is used in the pickups of some electronically amplified guitars and as triggers in most modern electronic drums.[8][9] The piezoelectric effect also finds everyday uses, such as generating sparks to ignite gas cooking and heating devices, torches, and cigarette lighters.



1.2 PEIZOELECTRIC EFFECT

The nature of the piezoelectric effect is closely related to the occurrence of electric dipole moments in solids. The latter may either be induced for ions on crystal lattice sites with asymmetric charge surroundings (as in $BaTiO_3$ and PZTs) or may directly be carried by molecular groups (as in cane sugar). The dipole density or polarization (dimensionality $[C \cdot m/m^3]$) may easily be calculated for crystals by summing up the dipole moments per volume of the crystallographic unit cell. As every dipole is a vector, the dipole density P is a vector field. Dipoles near each other tend to be aligned in regions called Weiss domains. The domains are usually randomly oriented, but can be aligned using the process of *poling* (not the same as magnetic poling), a process by which a strong electric field is applied across the material, usually at elevated temperatures. Not all piezoelectric materials can be poled.[17]

Of decisive importance for the piezoelectric effect is the change of polarization P when applying a mechanical stress. This might either be caused by a reconfiguration of the dipole-inducing surrounding or by re-orientation of molecular dipole moments under the influence of the external stress. Piezoelectricity may then manifest in a variation of the polarization strength, its direction or both, with the details depending on: 1. the orientation of P within the crystal; 2. crystal symmetry; and 3. the applied mechanical stress.

The change in P appears as a variation of surface charge density upon the crystal faces, i.e. as a variation of the electric field extending between the faces caused by a change in dipole density in the bulk. For example, a 1 cm^3 cube of quartz with 2 kN (500 lbf) of correctly applied force can produce a voltage of 12500 V. Piezoelectric materials also show the opposite effect, called the converse piezoelectric effect, where the application of an electrical field creates mechanical deformation in the crystal.

CHAPTER 2

LITERATURE SURVEY

- Antonio Barrero-Gil et al :Extracting energy from Vortex Induced Vibrations: A parametric study; Universidad politecnica de Madrid, Plaza Cardinal Cisneros 3, E-28040 Madrid, Svain; in this he studied that Hence, Vortex- Induced Vibrations (VIVs) of a circular cylinder are analysed as a potential source for energy harvesting. To this end, VIV is described by a one- degree-offreedom model where fluid forces are introduced from experimental data from forced vibration tests. The influence of some influencing parameters, like the mass ratio m* or the mechanical damping C in the energy conversation factor is investigated. The analysis reveals that:
- The maximum efficiency r/M presents a maximum;
- The range of reduced velocities with significant efficiency is mainlygoverned by nf, and
- It seems that encouraging high efficiency values can be achieved for high Reynolds numbers.

- Robert Correa, Eric Cremer Wind harvesting via Vortex induced vibration; BJS- WD14; in this he studied that; There is a need for renewable energy source s to be more feasible. The purpose of this project is to develop a compact device that is able to harvest wind energy and transform it into electrical energy using the concept of vortex shedding. When calibrated correctly, the vortex shedding will induce resonant oscillation.
- Study of Vortex Induced vibrations for Harvesting Energy IJIRST- International Journal for Innovative Research in Science and Technology

- Today, 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. Hence its energy requirement is going to increase manifold in the coming decades. To meet its energy requirement, coal cannot be the primary source of energy. This is because coal is depleting very fast. It is estimated that within few decades coal will get exhausted. The next clean choice of energy is solar power, but due to its lower concentration per unit area, it is very costly. 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.

2.1 THEORETICAL AND TECHNICAL BASIS FOR THE OPTIMIZATION OF WIND ENERGY PLANTS 2017

The work contains an analytical review of modern means of wind power, based on different physical principles. Considered as widespread wind installations with a horizontal-axial configuration, a variety of vertical-axial installations with the Darrieus Rotor, with differential drag, with adjustable blades, and innovative designs for bladeless wind turbines. Also, modern methods and possibilities for scaling and optimal regulation of wind farms are considered. Mathematical models for the interaction of airflow with blades of collinear and orthogonal plants have been developed, and methods for optimal regulation have been identified that increase the energy efficiency of installations.

- Future emerging technologies in the wind power sector: A Europea perspective 2019 Roland Schmehl.
- This paper represents an expert view from Europe of future emerging technologies within the wind energy sector considering their potential, challenges, applications and technology readiness and how they might evolve in the coming years. These technologies were identified as originating primarily from the academic sector, some start-up companies and a few larger industrial entities. The following areas were considered:

airborne wind energy, offshore floating concepts, smart rotors, windinduced energy harvesting devices, blade tip-mounted rotors, unconventional power transmission systems, multi-rotor turbines, alternative support structures, modular high voltage direct current generators, innovative blade manufacturing techniques, diffuseraugmented turbines and small turbine technologies.

2.2 VORTEX BLADELESS TURBINE GYRO E-GENERATOR IJESRT Journal

Vortex-Bladeless is a Spanish SME whose objective is to develop a new concept of wind turbine without blades called Vortex or vorticity wind turbine. This design represents a new paradigm in wind energy and aims to eliminate or reduce many of the existing problems in conventional generators. The bladeless vortex turbine is one such concept that uses the principle of aero-elasticity and thereby the variations produced by it to generate electricity. Project work will include the design and development of a vortex wind bladeless turbine and a gyro-action based e-generator to be coupled to it to generate the electricity.

2.3 WIND POWER

Wind power is the use of wind energy to generate useful work. Historically, wind power was used by sails, windmills and windpumps, but today it is mostly used to generate electricity. This article deals mostly with wind power for electricity generation. Today, wind power is almost completely generated with wind turbines, generally grouped into wind farms and connected to the electrical grid.

In 2021, wind supplied over 1800 TWh of electricity, which was over 6% of world electricity and about 2% of world energy. With about 100 GW added during 2021, mostly in China and the United States, global installed wind power capacity exceeded 800 GW. To help meet the Paris Agreement goals to limit climate change, analysts say it should expand much faster - by over 1% of electricity generation per year.

Wind power is considered a sustainable, renewable energy source, and has a much smaller impact on the environment compared to burning fossil fuels. Wind power is variable, so it needs energy storage or other dispatchable generation energy sources to attain a reliable supply of electricity. Landbased (onshore) wind farms have a greater visual impact on the landscape than most other power stations per energy produced.

Wind farms sited offshore have less visual impact and have higher capacity factors, although they are generally more expensive. Offshore wind power currently has a share of about 10% of new installations.

Wind power is one of the lowest-cost electricity sources per unit of energy produced. In many locations, new onshore wind farms are cheaper than new coal or gas plants.

Regions in the higher northern and southern latitudes have the highest potential for wind power. In most regions, wind power generation is higher in nighttime, and in winter.

2.1 WIND POWER

Through wind resource assessment, it is possible to estimate wind power potential globally, by country or region, or for a specific site. The Global Wind Atlas provided by the Technical University of Denmark in partnership with the World Bank provides a global assessment of wind power potential. [13][15][16] Unlike 'static' wind resource atlases which average estimates of wind speed and power density across multiple years, tools such as Renewables. Ninja provide time-varying simulations of wind speed and power output from different wind turbine models at an hourly resolution. More detailed, site-specific assessments of wind resource potential can be obtained from specialist commercial providers, and many of the larger wind developers have in-house modeling capabilities.

The total amount of economically extractable power available from the wind is considerably more than present human power use from all sources. [18] The strength of wind varies, and an average value for a given location does not alone indicate the amount of energy a wind turbine could produce there.

CHAPTER 3

COMPONENTS

- SQUARE TUBE
- WEIGHT KG

- 6202 BEARING

- SWINGING MOTION

- PIEZOELECTRIC

3.1 PIEZOELECTRIC SENSOR

A piezoelectric sensor is a device that uses the piezoelectric effect to measure changes in pressure, acceleration, temperature, strain, or force by converting them to an electrical charge. The prefix *piezo-* is Greek for 'press' or 'squeeze'.[1] Piezoelectric sensors are versatile tools for the measurement of various processes.[2] They are used for quality assurance, process control, and for research and development in many industries.

Pierre Curie discovered the piezoelectric effect in 1880, but only in the 1950s did manufacturers begin to use the piezoelectric effect in industrial sensing applications. Since then, this measuring principle has been increasingly used, and has become a mature technology with excellent inherent reliability.

They have been successfully used in various applications, such as in medical, aerospace, nuclear instrumentation, and as a tilt sensor in consumer electronics or a pressure sensor in the touch pads of mobile phones. In the automotive industry, piezoelectric elements are used to monitor combustion when developing internal combustion engines. The sensors are either directly mounted into additional holes into the cylinder head or the spark/glow plug is equipped with a built-in miniature piezoelectric sensor.

The rise of piezoelectric technology is directly related to a set of inherent advantages. The high modulus of elasticity of many piezoelectric materials is comparable to that of many metals and goes up to 10^6 N/m^2. Even though piezoelectric sensors are electromechanical systems that react to compression, the sensing elements show almost zero deflection. This gives piezoelectric sensors ruggedness, an extremely high natural frequency and an excellent linearity over a wide amplitude range.

Additionally, piezoelectric technology is insensitive to electromagnetic fields and radiation, enabling measurements under harsh conditions. Some materials used (especially gallium phosphate or tourmaline) are extremely stable at high temperatures, enabling sensors to have a working range of up to 1000 °C. Tourmaline shows pyroelectricity in addition to the piezoelectric effect; this is the ability to generate an electrical signal when the temperature of the crystal changes.

3.1 PIEZOELECTRIC SENSOR

One disadvantage of piezoelectric sensors is that they cannot be used for truly static measurements. A static force results in a fixed amount of charge on the piezoelectric material. In conventional readout electronics, imperfect insulating materials and reduction in internal sensor resistance causes a constant loss of electrons and yields a decreasing signal. Elevated temperatures cause an additional drop in internal resistance and sensitivity. The main effect on the piezoelectric effect is that with increasing pressure loads and temperature, the sensitivity reduces due to twin formation. While quartz sensors must be cooled during measurements at temperatures above 300 °C, special types of crystals like

$GaPO_4$ gallium phosphate show no twin formation up to the melting point of the material itself.

However, it is not true that piezoelectric sensors can only be used for very fast processes or at ambient conditions. In fact, numerous piezoelectric applications produce quasi-static measurements, and other applications work in temperatures higher than 500 °C.

Piezoelectric sensors can also be used to determine aromas in the air by simultaneously measuring resonance and capacitance. Computer controlled electronics vastly increase the range of potential applications for piezoelectric sensors.

Piezoelectric sensors are also seen in nature. The collagen in bone is piezoelectric, and is thought by some to act as a biological force sensor. Piezoelectricity has also been shown in the collagen of soft tissue such as the Achilles tendon, aortic walls, and heart valves.

3.2 SQUARE TUBE

3.2 SQUARE TUBE

Square and rectangular tubing is also known as HSS (hollow structural steel). A hollow structural section (HSS) is a type of metal profile with a hollow cross section. The term is used predominantly in the United States, or other countries which follow US construction or engineering terminology.

HSS members can be circular, square, or rectangular sections, although other shapes such as elliptical are also available. HSS is only composed of structural steel per code.

HSS is sometimes mistakenly referenced as hollow structural steel. Rectangular and square HSS are also commonly called tube steel or box section. Circular HSS are sometimes mistakenly called steel pipe, although true steel pipe is actually dimensioned and classed differently from HSS. (HSS dimensions are based on exterior dimensions of the profile; pipes are also manufactured to an exterior tolerance, albeit to a different standard.)

The corners of HSS are heavily rounded, having a radius which is approximately twice the wall thickness. The wall thickness is uniform around the section.

In the UK, or other countries which follow British construction or engineering terminology, the term HSS is not used. Rather, the three basic shapes are referenced as CHS, SHS, and RHS, being circular, square, and rectangular hollow sections. Typically, these designations will also relate to metric sizes, thus the dimensions and tolerances differ slightly from HSS.

HSS, especially rectangular sections, are commonly used in welded steel frames where members experience loading in multiple directions. Square and circular HSS have very efficient shapes for this multiple-axis loading as they have uniform geometry along two or more cross-sectional axes, and thus uniform strength characteristics. This makes them good choices for columns. They also have excellent resistance to torsion.

HSS can also be used as beams, although wide flange or I-beam shapes are in many cases a more efficient structural shape for this application. However, the HSS has superior resistance to lateral torsional buckling.

The flat square surfaces of rectangular HSS can ease construction, and they are sometimes preferred for architectural aesthetics in exposed structures, although elliptical HSS are becoming more popular in exposed structures for the same aesthetic reasons.

In the recent past, HSS was commonly available in mild steel, such as A500 grade B. Today, HSS is commonly available in mild steel, A500 grade C. Other steel grades available for HSS are A847 (weathering steel), A1065 (large sections up to 50 inch sq made with SAW process), and recently approved A1085 (higher strength, tighter tolerances than A500).

3.3 WEIGHT KG

3.3 WEIGHT KG

The kilogram (also kilogramme) is the base unit of mass in the International System of Units (SI), having the unit symbol kg. It is a widely used measure in science, engineering and commerce worldwide, and is often simply called a kilo colloquially. It means 'one thousand grams'.

The kilogram is defined in terms of the second and the metre, both of which are based on fundamental physical constants. This allows a properly equipped metrology laboratory to calibrate a mass measurement instrument such as a Kibble balance as the primary standard to determine an exact kilogram mass.[

In science and engineering, the weight of an object is the force acting on the object due to acceleration or gravity.

Some standard textbooks[4] define weight as a vector quantity, the gravitational force acting on the object. Others define weight as a scalar quantity, the magnitude of the gravitational force. Yet othersdefine it as the magnitude of the reaction force exerted on a body by mechanisms that counteract the effects of gravity: the weight is the quantity that is measured by, for example, a spring scale. Thus, in a state of free fall, the weight would be zero. In this sense of weight, terrestrial objects can be weightless: ignoring air resistance, the famous apple falling from the tree, on its way to meet the ground near Isaac Newton, would be weightless.

The unit of measurement for weight is that of force, which in the International System of Units (SI) is the newton. For example, an object with a mass of one kilogram has a weight of about 9.8 newtons on the surface of the Earth, and about one-sixth as much on the Moon. Although weight and mass are scientifically distinct quantities, the terms are often confused with each other in everyday use (e.g. comparing and converting force weight in pounds to mass in kilograms and vice versa).

Further complications in elucidating the various concepts of weight have to do with the theory of relativity according to which gravity is modeled as a consequence of the curvature of spacetime. In the teaching community, a considerable debate has existed for over half a century on how to define weight for their students. The current situation is that a multiple set of concepts co-exist and find use in their various contexts.

3.4 6202 BEARING

3.4 6202 BEARING

A ball bearing is a type of rolling-element bearing that uses balls to maintain the separation between the bearing races.

The purpose of a ball bearing is to reduce rotational friction and support radial and axial loads. It achieves this by using at least two races to contain the balls and transmit the loads through the balls. In most applications, one race is stationary and the other is attached to the rotating assembly (e.g., a hub or shaft). As one of the bearing races rotates it causes the balls to rotate as well. Because the balls are rolling they have a much lower coefficient of friction than if two flat surfaces were sliding against each other.

Ball bearings tend to have lower load capacity for their size than other kinds of rolling-element bearings due to the smaller contact area between the balls and races. However, they can tolerate some misalignment of the inner and outer races.

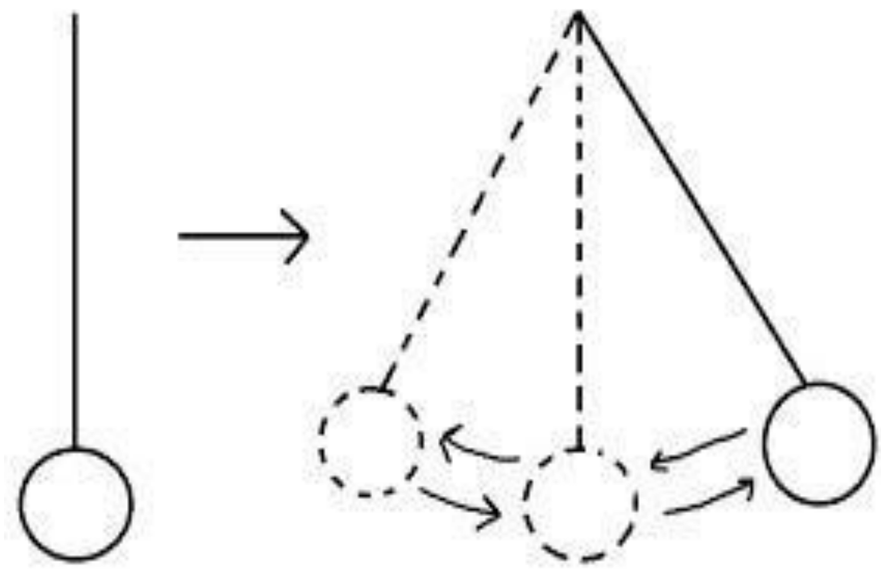
A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts. Most bearings facilitate the desired motion by minimizing friction. Bearings are classified broadly according to the type of operation, the motions allowed, or to the directions of the loads (forces) applied to the parts.

Rotary bearings hold rotating components such as shafts or axles within mechanical systems, and transfer axial and radial loads from the source of the load to the structure supporting it. The simplest form of bearing, the plain bearing, consists of a shaft rotating in a hole. Lubrication is used to reduce friction. Lubricants come in different forms, including liquids, solids, and gases. The choice of lubricant depends on the specific application, and factors such as temperature, load, and speed. In the ball bearing and roller bearing, to reduce sliding friction, rolling elements such as rollers or balls with a circular cross-section are located between the races or journals of the bearing assembly. A wide variety of bearing designs exists to allow the demands of the application to be correctly met for maximum efficiency, reliability, durability and performance.

The term "bearing" is derived from the verb "to bear";[1] a bearing being a machine element that allows one part to bear (i.e., to support) another. The simplest bearings are bearing surfaces, cut or formed into a part, with varying degrees of control over the form, size, roughness, and location of the surface. Other bearings are separate devices installed into a machine or machine part.

The most sophisticated bearings for the most demanding applications are very precise components; their manufacture requires some of the highest standards of current technology.

3.5 SWINGING MOTION

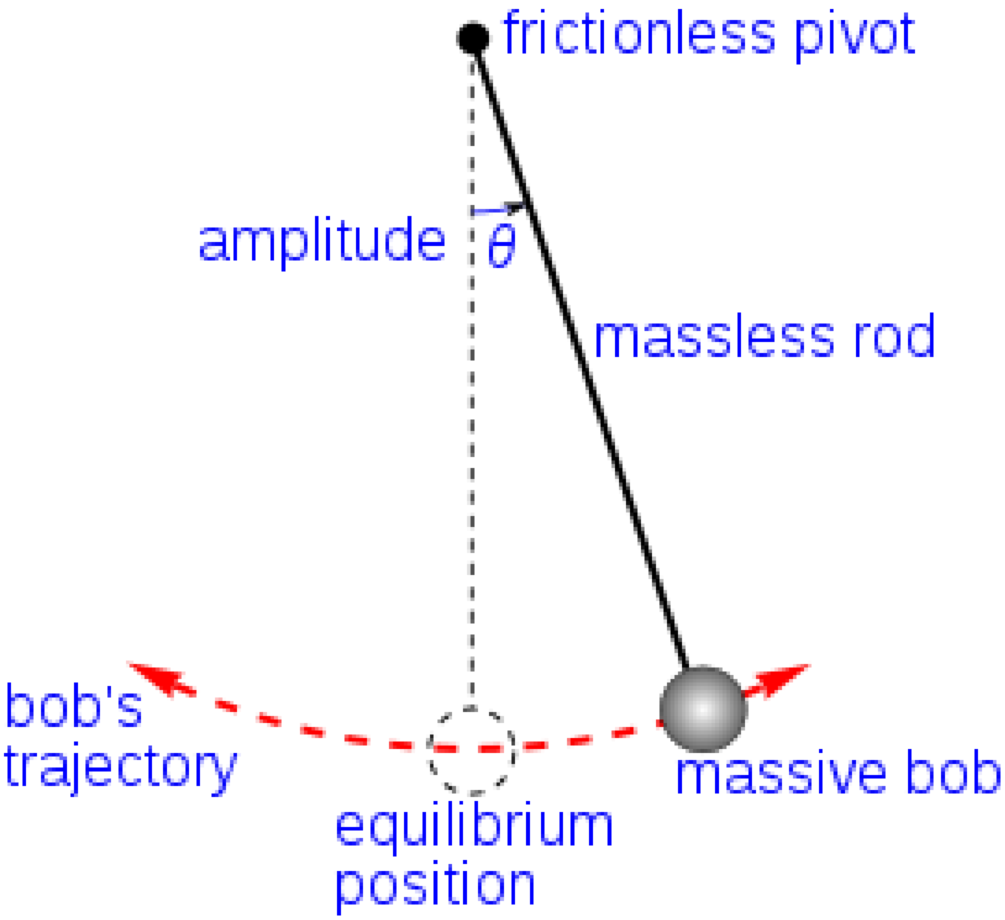


3.5 SWINGING MOTION

A pendulum is a weight suspended from a pivot so that it can swing freely. When a pendulum is displaced sideways from its resting, equilibrium position, it is subject to a restoring force due to gravity that will accelerate it back toward the equilibrium position. When released, the restoring force acting on the pendulum's mass causes it to oscillate about the equilibrium position, swinging back and forth. The time for one complete cycle, a left swing and a right swing, is called the period. The period depends on the length of the pendulum and also to a slight degree on the amplitude, the width of the pendulum's swing.

The regular motion of pendulums was used for timekeeping and was the world's most accurate timekeeping technology until the 1930s. The pendulum clock invented by Christiaan Huygens in 1656 became the world's standard timekeeper, used in homes and offices for 270 years, and achieved accuracy of about one second per year before it was superseded as a time standard by the quartz clock in the 1930s.

Pendulums are also used in scientific instruments such as accelerometers and seismometers. Historically they were used as gravimeters to measure the acceleration of gravity in geo-physical surveys, and even as a standard of length. The word pendulum is new Latin, from the Latin pendulus, meaning hanging.



3.6 PENDULUM

The period of swing of a simple gravity pendulum depends on its length, the local strength of gravity, and to a small extent on the maximum angle that the pendulum swings away from vertical, θ_0, called the amplitude.[8] It is independent of the mass of the bob. If the amplitude is limited to small swings,[Note 1] the period T of a simple pendulum, the time taken for a complete cycle, is:[9]

Where is the length of the pendulum and is the local acceleration of gravity.

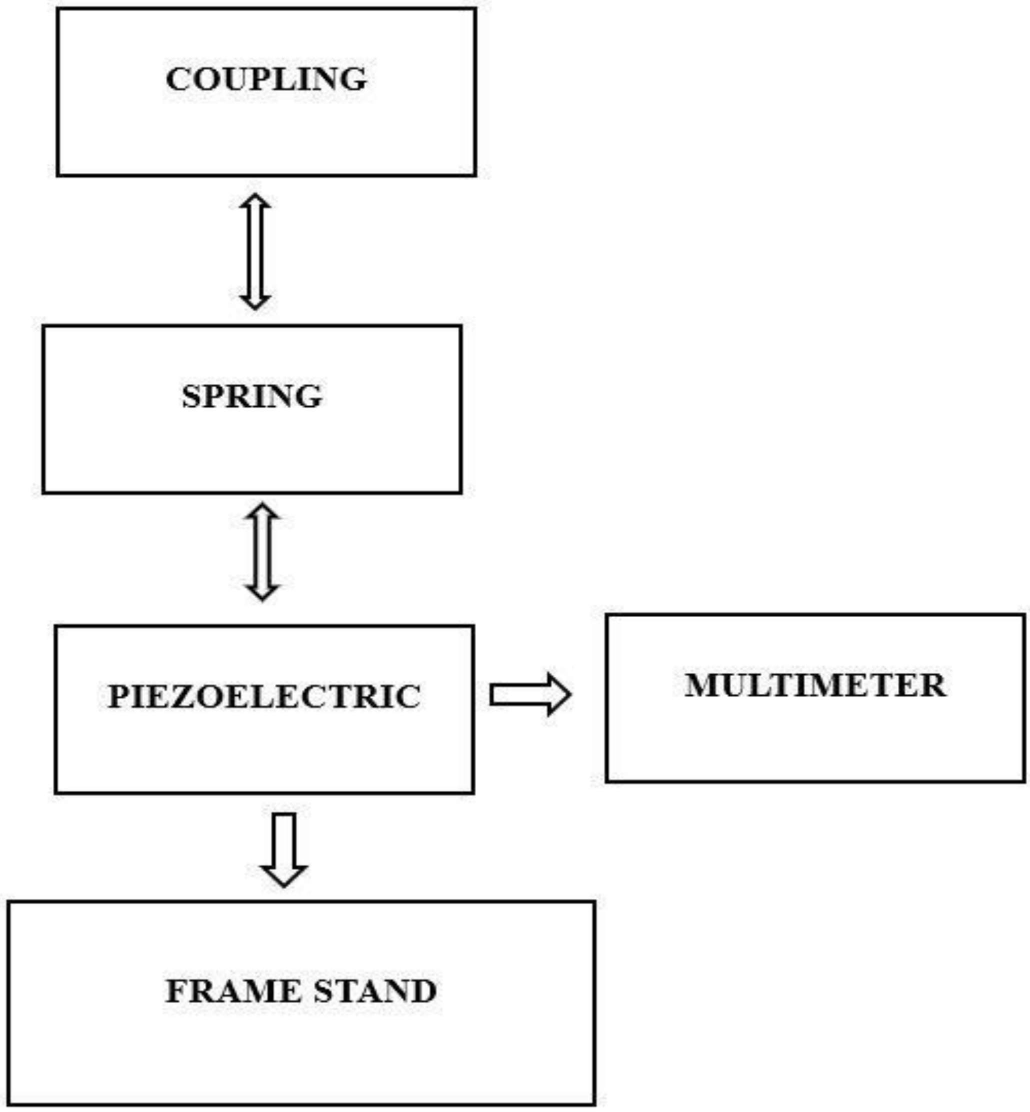
For small swings the period of swing is approximately the same for different size swings: that is, the period is independent of amplitude. This property, called isochronism, is the reason pendulums are so useful for timekeeping.

Successive swings of the pendulum, even if changing in amplitude, take the same amount of time.

For larger amplitudes, the period increases gradually with amplitude so it is longer than given by equation (1). For example, at an amplitude of $\theta_0 = 0.4$ radians (23°) it is 1% larger than given by (1). The period increases asymptotically (to infinity) as θ_0 approaches π radians (180°), because the value $\theta_0 = \pi$ is an unstable equilibrium point for the pendulum.

CHAPTER 4

BLOCK DIAGRAM



4.1 BLOCK DIAGRAM

4.1 WIND ENERGY INPUT

The wind energy is the input of the bladeless windmill system. The wind flows into the system, and its energy is captured by the bladeless windmill.

4.2 COUPLING

The coupling connects the wind energy input to the spring system. The coupling is designed to transfer the kinetic energy of the wind to the spring system in a controlled manner.

4.3 SPRING SYSTEM

The spring system is an essential component of the bladeless windmill. It is responsible for absorbing the kinetic energy of the wind and converting it into mechanical energy. The spring system consists of one or more springs that are carefully designed to provide the desired amount of energy transfer.

4.4 PIEZOELECTRIC TRANSDUCER

The piezoelectric transducer is a device that converts mechanical energy into electrical energy. It is attached to the spring system and generates an electric charge when the spring is compressed or stretched.

4.5 MULTIMETER

The multimeter is used to measure the electrical energy generated by the piezoelectric transducer. It provides information about the amount of energy produced and the efficiency of the system.

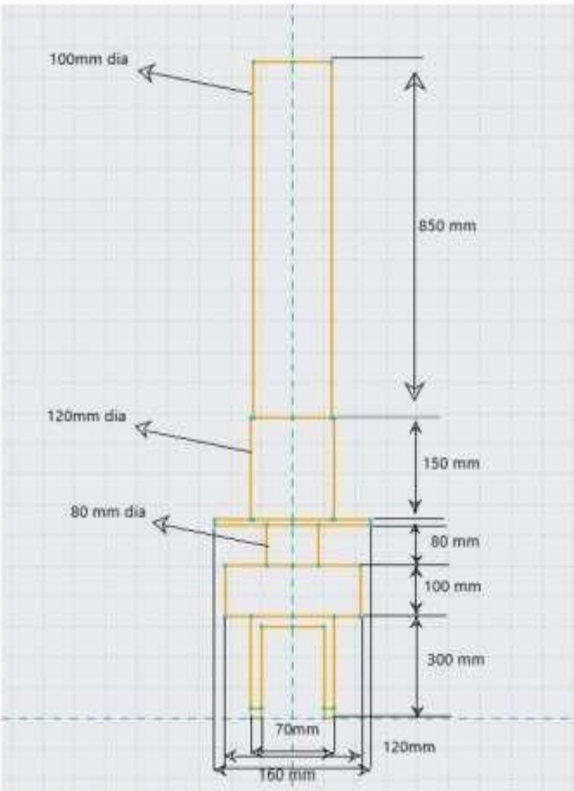
4.6 FRAMESTAND

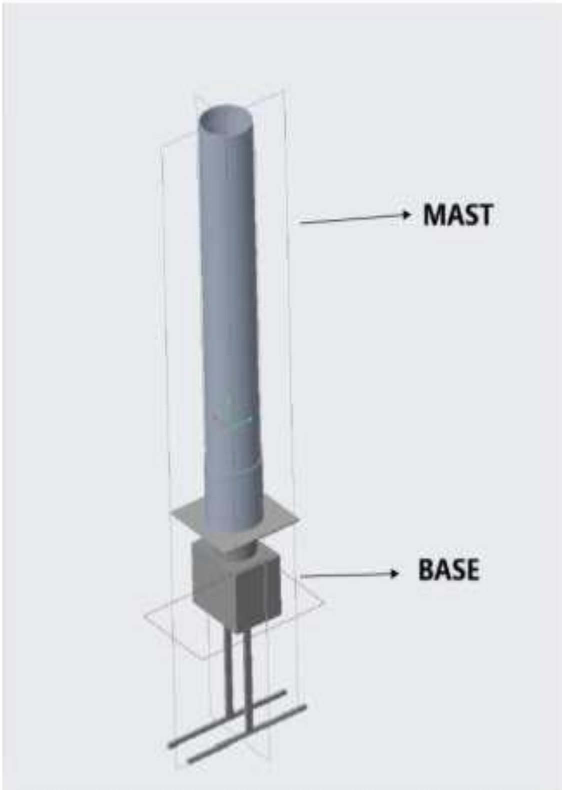
The framestand is the support structure for the bladeless windmill. It holds the spring system and the piezoelectric transducer in place and provides stability to the system. The framestand is usually made of strong and durable materials to withstand the forces generated by the wind.

Overall, the bladeless windmill system captures the kinetic energy of the wind using a coupling mechanism, which transfers the energy to a spring system. The spring system converts the mechanical energy into electrical energy using a piezoelectric transducer, and the multimeter measures the amount of electrical energy produced. The framestand provides the necessary support and stability to the system.

CHAPTER 5

DESIGN AND CALULATION





5.1 2D DIAGRAM **5.2 3D DESIGN**

5.1 POWER PRODUCED IN PEIZOELECTRIC TRANSDUCER

Output voltage of piezoelectric crystal can be calculated by using formula;

$$\mathbf{V = P \times g \times t}$$

Where,

P is the pressure applied in N/(sq.m)
g is the sensitivity of the material (40pc/N)
t is the thickness of the material
V is output voltage

5.2 Surface area of mast exposed to wind,

Diameter of the Mast, D = 100 mm
Length of the Mast, L = 1000 mm

S = (1/2)*3.14*D*L

= (1/2)*3.14*100*1000

= 157000 sq.mm

5.3 Force of the wind on the projected area,

$$\mathbf{F = \rho \times A \times v}$$

Where,

P is the air density(1.225kg/cu.m)
A is the surface area of mast exposed to wind

V is the Velocity of the wind

CHAPTER 6

PROJECT IMAGES

6.1 TOP VIEW

A piezoelectric bladeless windmill is a type of wind energy generator that does not have traditional rotating blades. Instead, it uses the piezoelectric effect to generate electricity. The top view of a piezoelectric bladeless windmill would typically show a cylindrical or conical structure with a series of vertical fins or vanes arranged in a circular pattern.

6.2 SIDE VIEW

The vanes are made of a piezoelectric material, such as quartz or lead zirconate titanate (PZT), that generates an electric charge when subjected to mechanical stress. As wind flows past the vanes, it causes them to vibrate and deform, which generates an electric charge in the piezoelectric material.

The electric charge is then collected and stored in a battery or capacitor for later use. The absence of rotating blades makes the piezoelectric bladeless windmill a more efficient and silent alternative to traditional wind turbines.

In summary, the top view of a piezoelectric bladeless windmill would show a circular array of vertical vanes made of piezoelectric material that generate electricity through the piezoelectric effect when subjected to wind-induced vibrations.

6.2 SIDE VIEW

A side view of a piezoelectric bladeless windmill would typically show a cylindrical or conical structure with vertical vanes arranged in a circular pattern around the axis of the cylinder or cone. The vanes are made of a piezoelectric material, such as quartz or PZT, and are attached to the central axis of the structure.

As wind flows past the vanes, it causes them to vibrate and deform, generating an electric charge in the piezoelectric material. This electric charge is then collected and stored in a battery or capacitor for later use.

In some designs, the vanes may be tapered, with a wider base and narrower tip. This allows the vanes to have a more efficient response to wind forces, as well as reducing the overall size and weight of the windmill.

The structure supporting the vanes may also include a housing to protect the electronic components and the piezoelectric material from the weather and environmental factors.

Overall, the side view of a piezoelectric bladeless windmill shows a relatively simple structure that is compact, lightweight, and efficient at converting wind energy into electrical energy.

CHAPTER 7

RESULT AND OUTPUT

7.1 MULTIMETER OUTPUT

The output of a piezoelectric bladeless windmill can be measured using a multimeter, which is a versatile electronic instrument that can measure various electrical parameters, including voltage, current, and resistance.

The output of a piezoelectric bladeless windmill is typically an AC voltage, which is generated by the piezoelectric material when it is subjected to mechanical stress by the wind-induced vibrations of the vanes. The output voltage of the windmill depends on various factors, including the wind speed, the number of vanes, the size and shape of the vanes, and the type and quality of the piezoelectric material used.

To measure the output voltage of a piezoelectric bladeless windmill using a multimeter, you can set the multimeter to measure AC voltage and connect the probes to the output leads of the windmill. The output voltage can then be read on the multimeter display.

It's important to note that the output voltage of a piezoelectric bladeless windmill can be relatively low compared to other types of wind turbines, especially at low wind speeds. Therefore, multiple windmills may need to be connected in series or parallel to achieve the desired output voltage and power. Additionally, the output voltage may need to be conditioned and regulated before it can be used to power electrical devices.

7.2 LIGHT OUTPUT

The light output of a piezoelectric bladeless windmill depends on several factors, such as the amount of electrical energy generated, the efficiency of the electrical components and the light source used, and the operating conditions of the windmill.

The electrical energy generated by a piezoelectric bladeless windmill is typically low compared to other types of wind turbines, especially at low wind speeds. Therefore, the light output of the windmill may also be relatively low. Additionally, the piezoelectric material used in the windmill may have limited efficiency and may not be able to convert all the mechanical energy from the wind into electrical energy.

To increase the light output of a piezoelectric bladeless windmill, multiple windmills can be connected in parallel or in series, or the electrical energy generated can be stored in a battery or capacitor and then used to power a more efficient light source, such as an LED.

Overall, the light output of a piezoelectric bladeless windmill may not be suitable for large-scale lighting applications, but it can still be useful for small-scale or off-grid lighting solutions, especially in areas with low wind speeds or limited access to electricity.

Piezoelectric bladeless windmills, also known as Vortex Induced Vibrations (VIV) windmills, use a cylinder or cone-shaped structure to generate power from the wind. As the wind passes over the structure, it creates a vortex that causes the structure to vibrate, which can be converted into electricity using piezoelectric materials.

The output and efficiency of piezoelectric bladeless windmills depend on several factors, such as the shape and size of the structure, wind speed, and the quality of the piezoelectric materials used. In general, piezoelectric bladeless windmills are not as efficient as traditional wind turbines, but they have several advantages, including:

Lower noise levels: Since they do not have any blades, piezoelectric bladeless windmills generate less noise than traditional wind turbines.

Lower maintenance: Bladeless windmills have fewer moving parts and, therefore, require less maintenance than traditional wind turbines.

Lower cost: Bladeless windmills can be cheaper to manufacture and install than traditional wind turbines, especially in areas with low wind speeds.

Despite their advantages, piezoelectric bladeless windmills are still in the experimental stage, and their output and efficiency need further research and development. However, they have the potential to become an alternative to traditional wind turbines in certain applications, such as small-scale power generation or in areas with low wind speeds.

CHAPTER 8

ADVANTAGES

- Ancoring and foundation requirements are reduced significantly compared to regular turbines, easing installation.
- Very lightweight and have their gravity centres close to the ground.
- Pollution free.
- Corrosion and cavitation is less.
- Vortex bladeless wind-driven generator prototype produces electricity with very few moving parts, on a very small footprint, and in almost complete silence.
- They do not disturb animals and allow birds and bats to simply avoid them when flying due to their simple design and very swept area.
- Bladeless turbines can be used both on and off the grid, and they can also be used in hybrid wind-solar systems.
- Bladeless wind turbines generate electricity for 40% less money as compared to traditional wind turbines.
- There are only a few moving parts in bladeless wind turbines. They not only help to reduce noise, but they also do not pose a threat to birds

DISADVANATGES

- This technology is in development phase and requires huge stakes by investors.
- The Major problem faced by this windmill is that it requires a starting torque.
- The output power depends directly on the height of the mast.
- Electrical power generation affected by environmental changes.
- Electricity generation is influenced by changes in the atmosphere. Oscillation control systems must follow the mast's usual frequency and vibration reliability.

- Depending on the desired outcomes, the mast height can be increased. So, a disadvantage of such wind turbines is that their initial cost is higher than the operating cost of a bladeless wind turbine.

APPLICATIONS

Bladeless wind energy can be used in a variety of industries and applications, including marine off- grid systems, industrial applications, remote telemetry and mobile base stations for houses, schools and farms.

● Bladeless energy for agriculture: Remote power systems are needed more and more in the world of farming.

● Bladeless energy for telecoms: with more and more mobile communication and Broadband technology being deployed in rural and remote areas, providing power for the Transmission equipment can be a problem.

● Bladeless wind energy for off-grid lighting: small scale bladeless wind turbine generators are ideal for providing efficient and reliable lighting in off-grid locations.

● The bladeless energy generates free renewable energy which can be stored in battery, illuminated when it gets dark.

● Streets, playgrounds, parks and car parks are good examples to name a few.

● Bladeless energy can also be utilized for Rail signalling: large parts of rail network lack convenient mains electricity.

● Bladeless wind power generators can be installed near railway signals to supply power to the signalling systems.

CHAPTER 9

CONCLUSION

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. Hence we have to spread this concept because only renewable energy can survive the world in coming future and in that wind energy is efficient option.

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 places 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 states of India because of it is environment friendly as well as seeking available amount of non – renewable energy sources.

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