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Operating Slider Crank Mechanism by Wind Energy

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Abstract – Energy is the requirement for every sector i.e., agriculture, transport, domestic, commercial etc, raising prices of oil and gas at present and future lead to concerns about the security of energy supply need to sustain our economic growth. Increased use of fossil fuel result in environmental problems both locally & globally. Because of this reasons, there is need to sustainable path of energy development. Promotion of energy conversion &use of renewable energy source and twin plants of suitable energy. India has a variety of renewable energy source, such as biomass, solar, wind etc.

Wind energy is a indirect form of solar energy. About 1% of total solar radiation that reach earth is converted into energy of wind.

By using the turbine blades, shaft, mechanism (belt or chain or gear), dynamo, supported stands can generate the electricity by wind.

With the use of this energy is stored in batteries and is used to run the slider crank mechanism which is a source of engine.

Index Terms – Energy, Oil, Gas, Security, Fossil Fuel, Economic.

1. INTRODUCTION

HISTORY OF WIND ENERGY

The renewable energy sources prevalent in the roller areas of developing countries of solar radiation and solar heat, wind energy, falling water and biomass. Geothermal, tidal ocean thermal and wave energies are also renewable, but they are very site-specific. The discussion in this report is confined to wind energy.

In1979, certain Danish producers of windturbine power,including bonus,Vestas,kuriant,andnordtank started to produce wind turbines.The turbines were supposed to generate electrical power by tapping and processing wind energy.The period marked the start of the developing process of the motor wind power industry.withinanextermely short period of time (around 2 years),capacity ratings of these turbines shot up from the low beginning rating(between 20 kw to 30kw for every turbine).

2.1 WHERE DOES WIND ENERGY COME FROM?

All renewable energy (except tidal and geo-thermal power), and even the energy in fossil fuels, ultimately comes from the sun. the sun radiates 174,423, 000,000, 000kwhr of energy to the earth per hour. About 1-2% of the energy coming from the sun is converted in to wind energy. That is about 50 to 100 times more than energy converted in to biomass by all plants on earth.

2.2 THE ENERGY IN THE WIND: AIR DENSITY AND ROTOR AREA:

A wind turbine obtains its power input by converted the force of the wind in to toque (turning force) acting on the rotor blades. The blade of energy which the wind transfers to the rotor depends on the density of the air, the rotor area, and the wind speed. The cartoon shows how a cylindrical slice of air 1mtr thick moves through the 1, 500 m2 rotor of time typical 600KW wind turbine. With a 43m rotor diameter each cylinder actually weighs 1.9 tons, i.e. 1500times 1.25kg

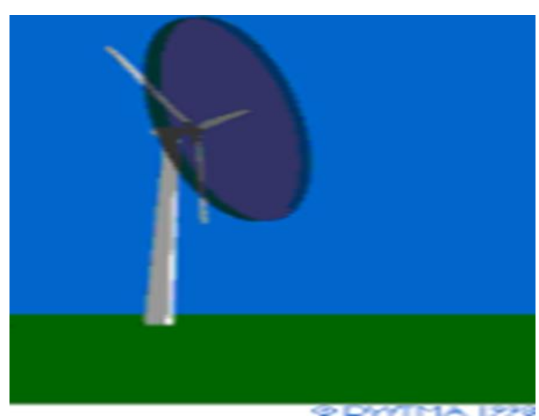


Fig 1: Density of Air

2.3 POWER OF THE WIND FORMULA

The power of the wind passing perpendicularly through a circular area is :

P=1/2ρv3πr2

Where,

P=The power of wind measured in W(watts)

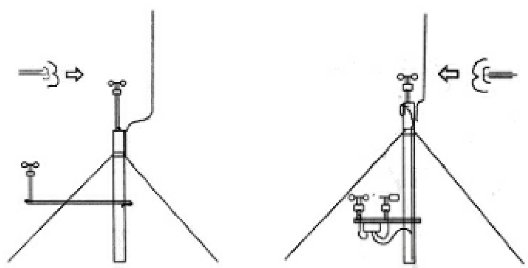
ρ=The density of dry air =1.225 measured in kg/m3

V= The velocity of the wind measured in m/sec.

Π = 3.1415926535……….

R =the radius of the rotor measured in m.

2.4 WIND SPEED MEASUREMENT IN PRACTICE:



The best way of measuring wind speeds at a prospective wind turbine site is fit an anemometer to the top of the mast which has the same hight as the expected hub height of the wind turbine to the used. This way one avoids the uncertainty involved in re calculation the wind speed to different height. By fitting the anemometer to the top of the mast one minimizes thredisterbanes of the air flows from the mast it self. If anemometers are placed on the side of the mast it is essential to place them in the previling wind direction order to minimize the wind share from the tower.

3.1 Wind Conditions

Looking at nature itself is usually an excellent writ% to finding a suitable wind turbine site. If there are trees and shrubs in the area, you may get a good clue about the prevailing wind direction, as you do in the picture to the left. If you move along a rugged coastline, you may also notice that centuries of erosion have worked in one particular direction. Meteorology data, ideally in terms of a wind rose calculated over 30 years is probably your best guide, but these data are rarely collected directly at your site, and here are many reasons to be careful about the use of meteorology data, as we explain in the next section. If there are already wind turbines in the area, their production results are excellent guide to local wind conditions.

3.2 Grid Connection

Obviously, large wind turbines have to be connected to the electrical grid. For smaller projects, it is therefore essential to be reasonably close to a 10-30 kilo volt power line if the costs of extending the electrical grid are not to be prohibitively high. (It matters a lot who has to pay for the Ower line extension, of course). The generators in large, modern wind turbines generally produce electricity at 690 volts.A transformer located next to the turbine, or inside the turbine tower, converts the electricity to high voltage (usually 10-30 kilovolts).

3.3 Grid Reinforcement

The electrical grid near the wind turbine(s) should be able to receive the electricity coming from the turbine. If there are already many turbines connected to the grid, the grid may need reinforcement, i.e. a larger cable, perhaps connected closer to a higher voltage transformer station. Read the section on Electrical grid issues for further information.

3.4 Soil Conditions

Both the feasibility of building foundations of the turbines, and road construction to reach the site with heavy trucks must be taken into account with any wind turbine project.

3.5 wind turbine site selection:

Wind is the fuel that drives a wind turbine. A wind mill needs to be placed where the wind is; puttingit on too short a tower is like installing solar photovolatic panels in the shade. Neither will work very wel. Not just any wind will do, a wind turbine needs air that moves uniformly in the same direction. The rotor cannot extract from turbulent wind, and the constantly changing wind direction due to turbulence causes excessive wear and premature failure of your turbine. This means that you want to place your turbine high enough to catch strong winds, and above turbulent air. Since the tower price goes up quickly with height there is al limit to what is practical and affordable. This section is intended to help you decide what tower heights works best.

4.1 BASIC LOAD CONSIDERATION

Whether you are building wind turbines or helicopters, you have to take the strength, the dynamic behavior, and the fatigue properties of your materials and the entire assembly into consideration.

Extreme Loads (Forces):

Fatigue Load (Forces):

Wind turbines are subject to fluctuating winds, and hence fluctuating forces. This is particularly the case if they are located in a very turbulent wind climate. Components which are subject to repeated bending, such as rotor blades, may eventually develop cracks which ultimately may make the component break. Metal fatigue is a well known problem in many industries. Metal is therefore generally not favored as a material for rotor blades. When designing a wind turbine it is extremely important to calculate in advance how the different components will vibrate, both individually, and jointly. It is also important to calculate the forces involved in each bending or stretching of a component. This is the subject of structural dynamics, where physicists have developed mathematical computer models that analyze the behavior of an entire wind turbine. These models are used by wind turbine manufacturers to design their machines safely.

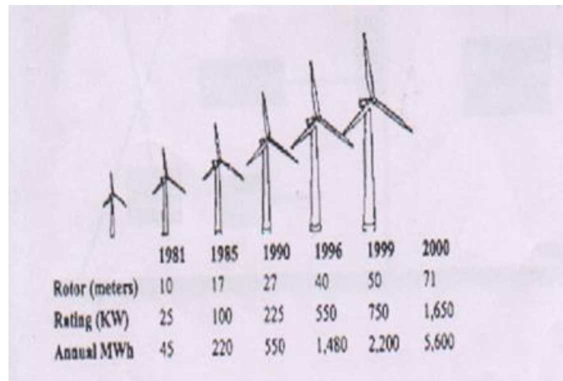
Structural Dynamics:

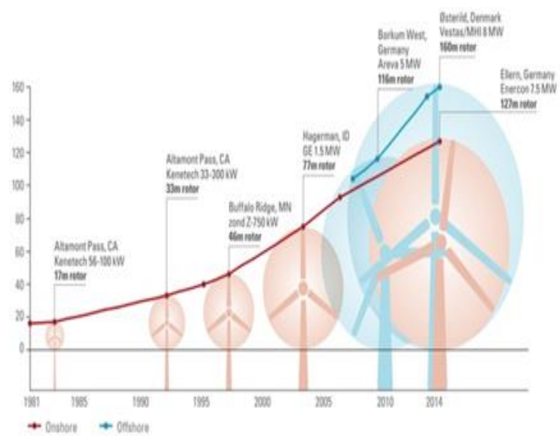
An example – A 50 meter tall wind turbine tower will have a tendency to swing back and forth, say, every three seconds. The frequency with which the tower oscillates back and forth is also known as the Eigen frequency of the tower. The Eigen frequency depends on both the height of the tower, the thickness of its walls, the type of steel, and the weight of the tower, the rotor will push slightly less against the tower. If the rotor turns with a rotational speed such that a rotor blade passes the tower each time the tower is in one of it extreme positions, then the rotor blade may either dampen or amplify (reinforce) the oscillations of the tower. The rotor blades themselves are also flexible, and may have a tendency to vibrate, say, once per second. As you can see, it is very important to know the Eigen frequencies of each component in order to design a safe turbine that does not oscillate out of control.

4.2 Wind Turbine : Horizontal or Vertical Axis Machines?

Horizontal axis

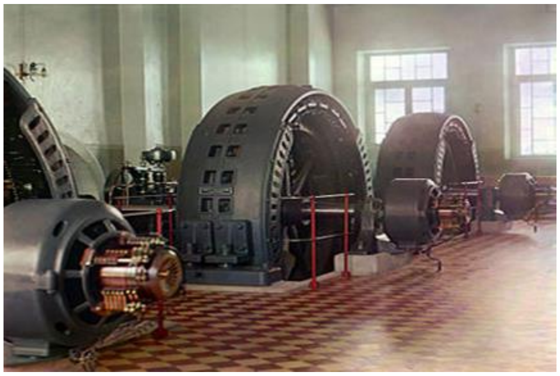
Components of a horizontal axis wind turbines (gearbox, rotor shaft and brake assembly) being lifted into position. Horizontal – Axis wind turbines (HAWT) have the main rotor shaft and electrical generator at the top of a tower, and must be pointed into the wind. Small turbines are pointed by a simple wind vane, while large turbines generally use a wind sensor coupled with a servo motor. Most have a gearbox, which turns the slow rotation of the blades into a quicker that is more suitable to drive an electrical generator. Since a tower produces turbulence behind it, the turbines is usually pointed upwind, of the tower. Turbine blades are made stiff to prevent the blades from being pushed into the tower by high winds. Additionally, the blades are placed a considerable distance in front of the tower and are sometimes tilted forward into the wind a small amount. Downwind machines have been built, despite the problem of turbulence (mast wake), because they don't need an additional mechanism for keeping them in line with the wind, and because in high winds the blades can be allowed to bend which reduces their swept area and thus their wind resistance. Since cyclic (that is repetitive) turbulence may lead to fatigue failures most HAWTs are upwind machines. Wind turbines vary in size. This chart depicts a variety of historical turbine sizes and the amount of electricity they are each capable of generating.

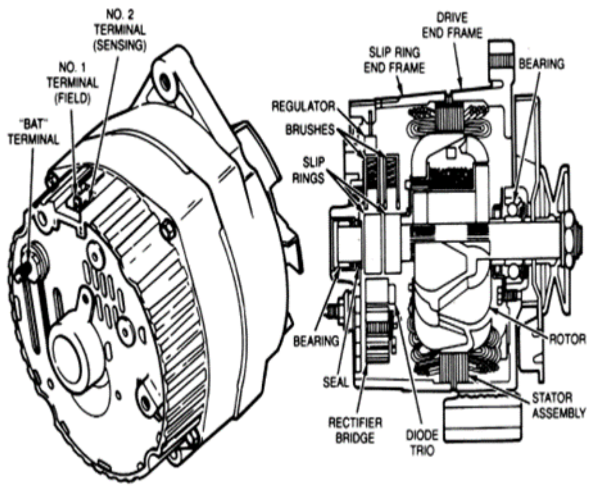




5.1 ALTERNATOR

An alternator is an electrical generator that converts mechanical energy to electrical energy in the form of alternating current.[2] For reasons of cost and simplicity, most alternators use a rotating magnetic field with a stationary armature.[3] Occasionally, alinear alternator or a rotating armature with a stationary magnetic field is used. In principle, any AC electricalgenerator can be called an alternator, but usually the term refers to small rotating machines driven by automotive and other internal combustion engines. An alternator that uses a permanent magnet for its magnetic field is called amagneto. Alternators in power stations driven by steam turbines are called turbo-alternators. Large 50 or 60 Hz three phase alternators in power plants generate most of the world's electric power, which is distributed by electric power grids.[4]





5.2 Principle of operation

A conductor moving relative to a magnetic field develops an electromotive force (EMF) in it (Faraday's Law). This emf reverses its polarity when it moves under magnetic poles of opposite polarity. Typically, a rotating magnet, called the rotor turns within a stationary set of conductors wound in coils on an iron core, called the stator. The field cuts across the conductors, generating an induced EMF (electromotive force), as the mechanical input causes the rotor to turn.

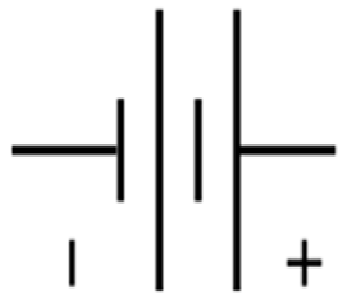
The rotating magnetic field induces an AC voltage in the stator windings. Since the currents in the stator windings vary in step with the position of the rotor, an alternator is a synchronous generator.[3]

The rotor's magnetic field may be produced by permanent magnets, or by a field coil electromagnet. Automotive alternators use a rotor winding which allows control of the alternator's generated voltage by varying the current in the rotor field winding. Permanent magnet machines avoid the loss due to magnetizing current in the rotor, but are restricted in size, due to the cost of the magnet material. Since the permanent magnet field is constant, the terminal voltage varies directly with the speed of the generator. Brushless AC generators are usually larger than those used in automotive applications.

6.1- BATTERY

An electric battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, smartphones, and electric cars.[1] When a battery is supplying electric power, its positive terminal is

Primary (single-use or "disposable") batteries are used once and discarded; the electrode materials are irreversibly changed during discharge. Common examples are the alkalinebattery used forflashlights and a multitude of portable electronic devices. Secondary(rechargeable) batteries can be discharged and recharged multiple times using mains power from a wall socket; the original composition of the electrodes can be restored by reverse current. Examples include the lead-acid batteries used in vehicles and lithium-ion batteries used for portable electronics such as laptopsand smartphones.



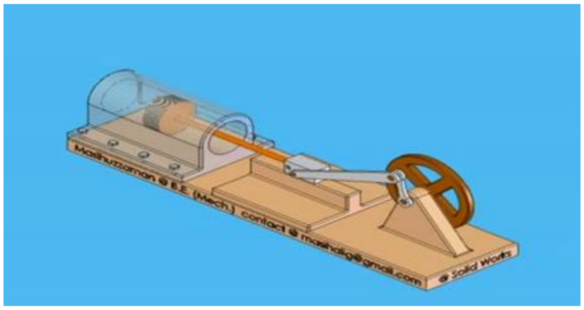
7.1- INTRODUCTION

The Slider-crank mechanism is used to transform rotational motion into translational motion by means of a rotating driving beam, a connection rod and a sliding body. In the present example, a flexible body is used for the connection rod. The sliding mass is not allowed to rotate and three revolute joints are used to connect the bodies. While each body has six degrees of freedom in space, the kinematical conditions lead to one degree of freedom for the whole system.

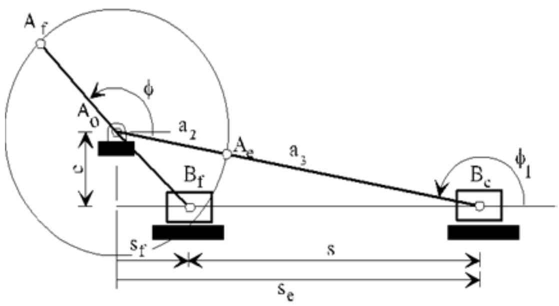
8.2 -Operation:

Inversion of slider crank mechanisms produce ordinary a whitework quick return mechanism.

A slider crank mechanism converts circular motion of the crank into linear motion of the slider. In order for the crank to rotate fully the condition L> R+E must be satisfied where R is the crank length, L is the length of the link connecting crank and slider and E is the offset of slider . A slider crank is a RRRP type of mechanism i.e. It has three revolute joints and 1 prismatic joint. The total distance covered by the slider between its two extreme positions is called the path length. Kinematic inversion of slier crank mechanisms produce ordinary a white work quick return mechanism.



Advantages:



- By using this mechanism ,with the use of fuel we can run the vehicles
- With the use this mechanism we can compresses the gases
- We can collect water in both(left &right)directions by the inlet &outlet values by the suction &compression operations .

Disadvantages:

- Continuous using of this piston will decrease in diameter.
- Without using the lubricants parts will be damage.

CONCLUSIONS

From the report we studied that wind has a lot of potential in it and if properly harnessed then it can help solve the energy crises in the world. The study of wind turbine and its characteristics showed that how it can be properly designed and used to get the maximum output. The power electronic circuitries have helped the concept of wind power a lot. Without them this concept would have been too expensive and far-fetched. With the thyristors and converters being used not only the operations have been smoothened but also the efficiency has been increased to a great extent. From the voltage stability analysis it was showed that how a doubly fed induction generator has superior characteristics than a simple induction generator. This report also showed the integration of wind farms with the transmission grid and the problems associated with it and the probable solutions that can be applied to solve them and have a better performance.

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