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Production of Electricity and Pumping of Water Using Wind Mill

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Abstract: This paper gives the clear idea to overcome power cuts in agricultural areas by using the wind mill for production of electricity and water pumping system. Aero turbines convert wind energy into rotary mechanical energy. A mechanical interface, consisting of a step-up gear and a suitable coupling transmits the energy to an electrical generator and also consisting of reciprocating pump for pumping water from under ground level. In our project both production of electricity and pumping of water can be easily done. As gear is connected to the pinion which increases the speed, as the dynamo rotates, power is produced and the main shaft is connected to the pump which draws water from the ground level. The main theme of this paper is how to use the renewable energy in an effective manner by keeping the surrounding as clean as possible.

Keywords: wind mill; electricity; water pumping; agricultural areas

I. INTRODUCTION

The wind is a free, clean, and inexhaustible energy source. It has served mankind well for many centuries by propelling ships and driving wind turbines to produce electricity, grind grain and pump water. Now-a-days the worldwide society is going towards the renewable energy sources. Currently, all the countries are going towards the wind energy for the production of power as its minimum amount threats to the environment where the site is exactly located.

As India is one of the developing country and agriculture is the backbone of India. The population and the industries are increasing day by day. So, the demand for electricity is more for domestic and industrial purpose but we are lagging in the production of electricity. Due to this reason power cut is increasing in domestic and agricultural areas. In this paper we using the wind energy for the production of electricity and pumping of water, so once it is implemented the people are independent of power cut both for domestic and agricultural purpose.

The wind axis machine are classified into two types according to the axis of rotation of the rotor. They are horizontal axis machines and vertical axis machines.

Horizontal axis machines must able to rotate inside the wind to extract the power. Vertical axis machines can obtain power from all wind directions as it is rotating along with the wind direction.

A wind power is the process of producing electricity using wind energy. It converts kinetic energy into mechanical energy which is further converted into electrical energy. Wind farms produce clean energy, generate jobs and income in regional areas and have minimum environmental impacts, when appropriately located.

A wind pump is a type of windmill which is used for pumping water**.** Wind pumps were used to pump water since from 9th century. A top tower gear box and crankshaft convert the rotary motion into reciprocating strokes. It carries a rod to the pump cylinder below and sucks the water to the surface.

II. LITERATURE SURVEY

B.Shanthi Saravana et.al [1] paper suggests only the analysis of non-grid high power pumping system for irrigation to reduce the demand on grid and to improve the economy of Tamil Nadu Electricity board, only in the presence of power supplied by Tamil Nadu Govt.

R. Nolan Clark [2] proposed a wind-electric water pumping system that operates independent of the electric

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utility for rural domestic and livestock water. This cannot be implemented for large scale agriculture area.

Dr.V.Rajini et.al [3] gives the application of wind energy source to large scale desalination system analysis-Investigation of wind power potential in coastal areas of Tamil Nadu. This shows the coastal area people can use the wind energy instead of depending on the government electricity.

LI Dinglin et.al [4] proposed the economic analysis wind powered storage system for storing the water and produce power through water turbine. This is useful only during the peak loads but it not that much efficient as it needs more space for storing water. Reliability on this proposed system is minimum.

III METHODOLOGY

Here the method used in this paper is unique when compared to the other wind mill used for pumping water and power production. Henceforth the construction and working is described below.

A. Construction

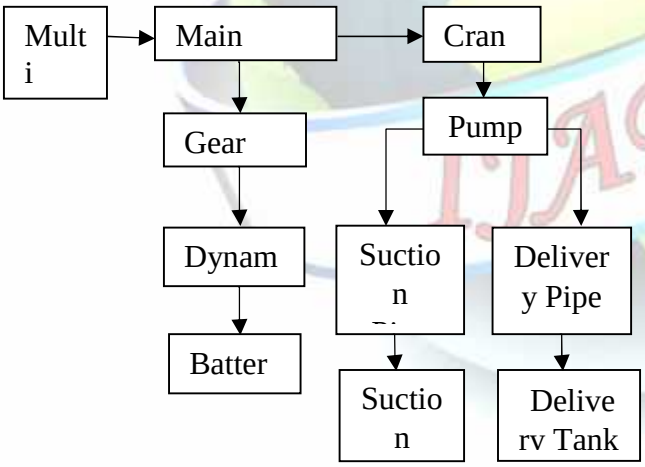

Fig. 1. Block diagram of the system

The wind mill consist of outer frame for total setup, two housing bearings, shaft, crank, pump, connecting rod, gear and pinion, dynamo, blade, and hub. The two housing bearing placed on the top of the frame and connected with frame using the bolt nut, and then the shaft is connected with the bearing the top of the frame. The shaft consist of flange, gear and crank. The gear from the shaft is connected to the pinion and then the pinion is connected to the dynamo. The crank at the one of the shaft is connected to the pump through the connecting rod, on the principle slider crank mechanism to achieve the reciprocating motion and the other end of the shaft is connected to the hub. The hub consist of the blade. It consist of totally six blades connected to the hub. The whole setup is assembled for the working purpose.

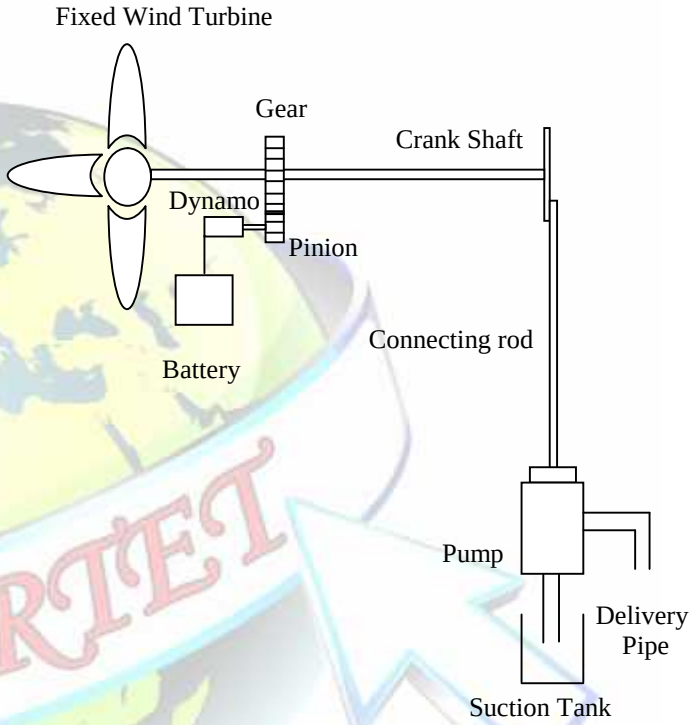

Fig. 2.Diagram of the setup

B. Working Principle

The figure shows the complete view of the experimental setup and the working principle of the power production system and water pumping system has been explained below in a detailed manner.

When the air strikes the blade, the blade captures the wind and it starts to rotate. When the shaft rotates along it, when gear is meshed with the pinion. As the pinion is connected to the dynamo, when the pinion rotates along with that dynamo

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Fig. 3.Front view of setup

also rotates and starts to produce the current for a considerable amount. The current is transferred to the 6v bulb and the bulb is blown.

Fig. 4.Light glowing due to power production

The pumping of water is done by using the rotation of the shaft. As the shaft is connected to the disc plate at the one end. The disc plate is connected using a connecting rod to the reciprocating pump. This works under the principle of slider crank mechanism where the rotary motion is converted into reciprocating motion. Here the plate is rotating, so that the piston rod moves in reciprocating motion. Hence the water is pumped from the ground.

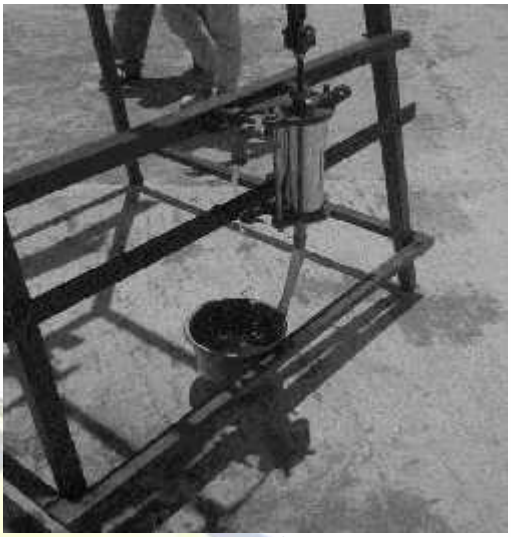

Fig. 5.Function of suction system

C. Economic Analysis

The economic analysis of this paper deals towards the lower economic cost. In this system power is not separately used for pumping the water, but it is taken directly from the wind mill through the shaft which is coupled to the pump. So that the power consumption of the pumping water is reduced completely. In addition to that power also produced using this system. So that it can be directly taken for the domestic purpose. Hence this system is more useful for your society.

D. Calculation

D.1 Speed Calculation

$$N_1 / N_2 = Z_1 / Z_2$$

$$45/N2=9/96$$

$$N2=486 \text{ rpm}$$

Where,

N_1=Speed of the blade shaft in rpm

N_2=Speed of the pinion shaft in rpm

Z_1= No of the teeth in gear

Z_2= No of the teeth in pinion

D.2 Power Calculation

$$\text{Power} = \frac{1}{2}\rho AV^3$$

$$P=1/2\times1.164\times0.6361\times125$$

$$P=46.27\text{watts}$$

$$P_{max}=0.595\times(46.27)$$

$$P_{max}=27.53\text{watts}$$

Where,

ρ=Density of air in kg/m^3

$\rho=\rho_e\times273/273+30$

$=1.273\times273/273+30$

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$=1.164kg/m^3$
A=Area of blade=$0.6361m^2$
V=Velocity of air=5m/s

D.3 Discharge Calculation

Q=Discharge in one revolution × No of revolution per seconds

$Q=A \times L \times N_1/60$

$Q=3.848\times10^{-3}\times0.07\times (45/60)$

$=2.0202\times10^{-4}m^3/s$

$=2.0202\times10^{-4}l/s$

Where,

D=Diameter of the cylinder in m
A=Cross section area of the cylinder in m^2
R=Radius of the crank=0.035m
N=Speed of the blade shaft in rpm
L=Length of the stroke=2r=0.070m
$N_1/60$=Number of revolution per second

IV CONCLUSION

By considering the various parameters of wind energy and wind water pump, it is noted that performance by combining both will get more advantage. As the pumping water can be stored in tanks, used for later purpose and current can be stored in batteries, used when it is necessary or send through gird lines for the domestic purpose. If necessary any one mode can used for pumping the water or production of electricity, so overflowing of water and current can be controlled. The global environment is changing day by day and becoming more polluted, by using renewable energy we can reduce it. So, the people and companies must focus on the renewable energy rather than non-renewable energy.

In this power production and water pumping depend upon the wind. So, that converting this into a hybrid method will give more advantage to this system (i.e.,) with the combination of wind and solar method. As solar energy is also a best source of renewable energy and power can be produced through it for pumping the water and for the electricity production.

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BIOGRAPHY

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