Wind Mill Operated Water Pump

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Abstract- *The main energy sources like coal, oil, natural gas, nuclear energy, wood are limited and are the main cause of pollution and this has led to drastic effects on environment. The imminent exhaustion of fossil energy sources lead to spreading global warming, expanding greenhouse effect , higher need of energy, less availability of power supplies. So it motivates us to focus on sustainable energy supply with minimum pollution effects like wind energy, solar energy. These renewable energy sources are eco-friendly and easily available.*

Pumping the water is fine where electricity is supplied. When the electricity distribution grid does not extend into rural areas, alternative power sources must be employed. In these scenarios, labor must be utilized, supplemented by diesel or gasoline engines if the fuel is available. The best choices are solar cells or windmills, which have not been widely exploited.

Using windmills as electric pumping systems is a developing technology that joins highly reliable small wind turbines and traditional electric centrifugal pumps to deliver a cost-effective alternative to using a fossil fuel pumping system for a community's water supply.

Windmills utilize the power of the wind to generate electricity or pump water, using air in the earth's atmosphere. The windmill's turbine blades capture the energy from the wind and turn it into mechanical energy to drive the water pump.

The main objective of our project was to design a windmill operated water pump which will be efficient for agricuture, irrigation purpose in rural area.

Keywords- renewable energy resources, fossil energy, Wind mill, turbine blades, water pump, technology, efficient

I. INTRODUCTION

Water pumping is very important, most basic wide-spread energy needs in rural areas of the world. It has been found that more than half the world's rural population does not have approach to clean water supply [1]. . Due to limited availability of power supplies or resources some alternate form of energy has to be used to supply water from the source to a point of consumption. Wind energy is an important source of renewable energy that can be used for pumping water in remote locations. In areas with modest wind resources, windmill generated electric pumping systems can provide a cost-effective alternative to small diesel pumps for both drinking water and small plot irrigation.

Among the renewable energy resources, the generation of electrical energy & mechanical energy by wind mills has emerged as a feasible and cost-effective option. Wind mills utilize energy from the wind to produce electricity. A typical system in a disclosed site could easily generate more power than household lamps and other use of electrical appliances [2]

The wind axis machines 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.

The basis of wind-electric water pumping technology has been the introduction of high-reliability small wind turbines that can operate for years without maintenance. The wide blades on a water pumping windmill are designed for low start-up wind speeds and slow-speed operation.

1.1 Objective

- To built up small scale wind mill operated water pump & to stud feasibility of it.
- To reduce weight and cost.
- To design & develop water pump which will cope up with ordinary pump.
- Operate a water pump with less noise, maintenance
- Make cheap and simple installation

1.2 Need

- Growing awareness of rising levels of greenhouse gases
- Global warming, pollution, acid rain,
- Increasing prices of fossil fuels
- Limited power supplies.
- Increasing dependency on renewable energy than non renewable source of energy

1.3 Scope of Project

- Wind energy for running specific application like water pump
- Wind energy can be used for electricity or power generation
- Efficiency or power output of pump can be improved by optimizing blade parameters such as blade thickness, blade length, blade profile, number of blades etc.
- drinking water and small plot irrigation
- Mechanical mechanisms located on top of a wooden tower.

II. 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.

2.1. Construction:

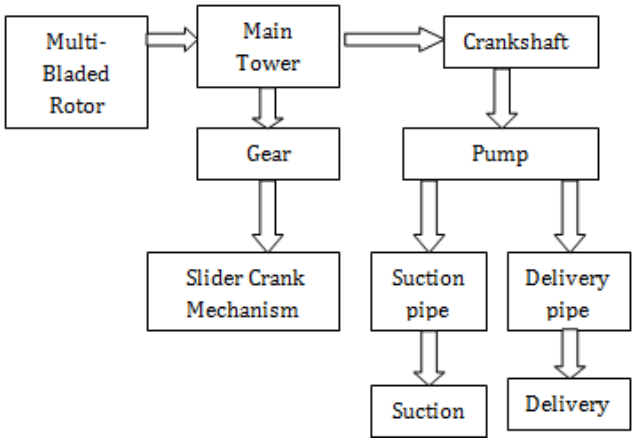

Chart 2.1.1: Methodology of Windmill water pump

- The wind mill operated water pump consist of outer frame for total setup, two housing bearings, shaft, crank, pump, connecting rod, gear and pinion, 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 consists of flange, gear and crank. The gear from the shaft is connected to the pinion.
- 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 consists of the blade. It consists of totally six blades connected to the hub. The whole setup is assembled for the working purpose.

2.2 Concept of Project

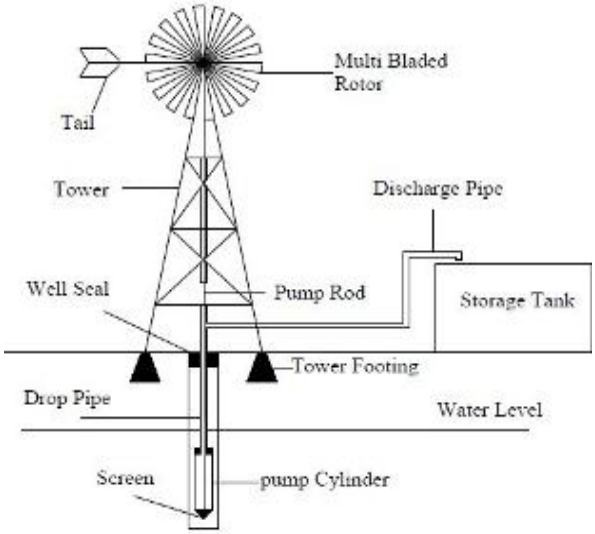

Fig 2.1.2: Working of Windmill operated water pump

- A water pumping windmill is simple, and efficient. The blades of the windmill wheel catch the wind, which turns the rotor.
- The wheel assembly is attached to a hub assembly, which drives a geared mechanism that converts the rotary motion to an up-and-down motion.
- This motion drives a pump rod, up and down inside of a pipe in the well.
- A cylinder with a sealed plunger going up and down inside forces the water up the pipe.
- Each upstroke pulls water into the cylinder, while on the downstroke, a check valve in the bottom keeps the water from being pushed out, so the water is forced up the pipe with the next upstroke.
- The amount of water a windmill can pump is controlled by the size of the pump cylinder, the elevation to which the water needs to be pumped, the size of the blades, and how windy it is where the windmill is installed.

III. MATERIAL SELECTION

The efficiency of a wind mill changes thus for good output it is important to check material and its properties. Blade is manufactured from different materials such as steel, aluminum, wood, fiber, carbon fiber, polypropylene plastic
For our project fibre material is used for windmill rotor blades due to its good properties like process-ability, recyclability, and weld-ability.

IV. MANUFACTURING

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4.1 Blade

Blade length is proportional to the swept area. Larger blades have a greater swept area and thus catch more wind. Because of this, they may also have more torque.

Fig 4.1: Windmill rotor blades

4.2 Crankshaft

Crankshaft should have high strength, rigidity and toughness due to these requirements; they are manufactured by casting and forging production techniques. Crankshaft is connected between the turbine blade and connecting rod. With the rotation of turbine blade, mechanical motion is obtained which is transmitted to the crankshaft producing rotary motion of connecting rod with piston in the pumping assembly.

Fig 4.2: Crankshaft

4.3 Connecting Rod

Connecting rod is long slender component between crankshaft and piston assembly. Mechanical motion obtained from the crankshaft is transmitted via connecting rod for the reciprocation of piston rod in pumping assembly.

Fig 4.3: Connecting Rod

4.4 Slider-Crank Mechanism

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.

Fig 4.4: Slider-Crank Mechanism

4.5 Pedestal Bearing

Pedestal is used to provide support for a rotating shaft with the help of compatible bearings & various accessories. Housing material for a pillow block is typically made of cast iron or cast steel.

Fig 4.4: Pedestal Bearing

4.6 Water Pump

Pump convert mechanical energy into hydraulic energy to lift and discharge water from low level to high level. In our project reciprocating piston pump is used. Wind energy is transmitted to pump by using crankshaft,bevel gears,slider-crank mechanism.

When considering a suitable pump, the flow rate is important. The flow rate is the amount of water that the pump

will deliver. The other factor is the head. This is the height through which the pump will raise the water. Both of these are related in that increasing the head will decrease the delivered flow.

Fig 4.6: Water Pump

V. WIND MILL OPERATED WATER PUMP

When piston moves from top dead centre to bottom dead centre pressure of water increased above atmospheric pressure at the end water is discharged through pipe. Due to pump is single acting reciprocating pump thus there is alternate flow of water in the delivery pipe.

Fig 5.1: Windmill Water Pump

VI. RESULT

Sr No	Wind velocity(m/s)	Water Discharged(ml)	Head(m)
1	2.68	3.8	0.4
2	3.55	4.6	1.2
3	4.63	5.4	2.7
4	5.86	6.8	3.4
5	6.42	7.5	4.8

VII. 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
- 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
- This project explains the mechanism to utilise the renewable energy as first option.
- Suiable for irrigation, farm,home and community water supply, Excellent for filling lakes, reservoirs and tanks. All mechanical design is simple and efficient. It is perfect solution for providing a lifetime of free water.

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