ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Fabrication of Vertical Axis Wind Mill Pump

G.S.Rajasekhar Reddy
Final year Student,
Department of Mechanical Engineering,
VITS College of Engineering,
Sontyam, Visakhapatna.

N.Govind, M.Tech
Final year Student,
Department of Mechanical Engineering,
VITS College of Engineering,
Sontyam, Visakhapatna.

D.Chandra Sekhar
Assistant Professor,
Department of Mechanical Engineering,
VITS College of Engineering,
Sontyam, Visakhapatna.

Kunal Hansda
Final year Student,
Department of Mechanical Engineering,
VITS College of Engineering,
Sontyam, Visakhapatna.

ABSTRACT:

Since time immemorial, the main source of energy has been coal, oil, natural gas, nuclear energy, wood and coal. However, all these sources are limited and are the main cause of pollution and this has led to development and more focus on sustainable energy supply with minimum pollution effects. Hence research and analysis has shown that wind energy, solar energy and biomass are the most prominent solutions to the above problems because they are eco-friendly and readily available in nature. Wind energy can be generated using windmills that provide mechanical energy that is used directly on machinery e.g. water pump and grinder; or wind turbines that provide electrical energy. The main objective of our project was to design a windmill and therefore our scope will be limited to a windmill for water pumping water.

Windmills are classified into two main types based on the axis about which they rotate. Horizontal axis has the main rotor shaft running horizontally and if the rotor must be oriented in the direction of the wind, a wind vane is coupled with a servomotor. Vertical axis has the main rotor shaft running vertically; the rotor assembly can have two or more blades depending on the desired solidity. During the design analysis of the windmill , the following pertinent design parameters were obtained: swept area of the rotor 0.64 m2, free stream velocity 5 m/s, tip speed ratio 0.18, radius of rotation 2.41 m, high drag coefficient 1.4, low drag coefficient 0.413, angular speed of rotor assembly 0.448 rad/s , inertia of rotor assembly 439.4 kgm2 , aerodynamic power 90.923 W, power dissipated by rotating components 44.121 W and net mechanical power available 46.803 W.This vertical windmill was locally made using the local materials, skills and tools. The durability and reliability of the windmill was censured by using quality and chemical resistant materials. The designed windmill has a very good starting torque performance with its operating characteristics independent of the wind direction. The design is simple and the construction/fabrication technology required is less sophisticated. This makes it suitable for small scale application in wind energy conversion to mechanical energy, especially in remote areas with better wind regimes and it can also be coupled to a hybrid system to alternate between a system for electricity generation or used as a water pump. It is recommended amongst other things that the windmill should be tested to check any defects in the static structural strength design calculations and to reveal any unusual effect which may lead to unexpected failure.

KEY WORDS:

Vertical axis wind turbine blades (VAWT), pulleys, bevel gears, rope, pump, ball bearings.

INTRODUCTION:

Water is the primary source of life for mankind and one of the most basic necessities for rural

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

development. Most of the rural areas of Ethiopia do not have access to potable water. Are some regions of the country access potable water is available through use of manual pumping and Diesel engine. In this research, wind water pump is designed to supply drinking water. The is particularly attractive for use at remote sites where electric power is not available and maintenance is difficult to provide. A common multi-bladed wind pump usefully pumps with about 4%–8% of the annual wind power passing through the area it sweeps. This lower conversion is due to poor load matching between wind rotors and fixed-stroke piston pumps.

LITERATURE REVIEW:

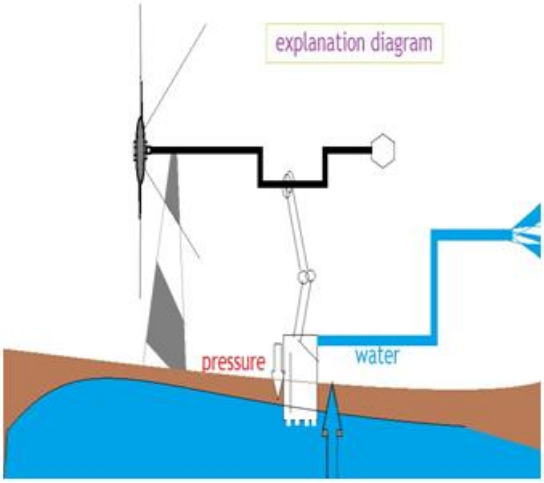
1. The American windmill, or wind engine, was invented by Daniel Halla day in 1854 and was used mostly for lifting water from wells. Larger versions were also used for tasks such as sawing wood, chopping hay, and shelling and grinding grain.

2. In early California and some other states, the windmill was part of a self-contained domestic water system which included a hand-dug well and a wooden water tower supporting a redwood tank enclosed by wooden siding known as a tank house. They feature a large number of blades, so they turn slowly with considerable torque in low winds and are self-regulating in high winds.

3. A tower-top gearbox and crankshaft convert the rotary motion into reciprocating strokes carried downward through a rod to the pump cylinder below. Such mills pumped water and powered feed mills saw mills, and agricultural machinery.

4.InAustralia,theGriffithBrothersat Toowoomba manuf actured windmills from 1876, with the trade name Southern Cross Windmills in use from 1903. These became an icon of the Australian rural sector by utilizing the water of the Great Artesian Basin

DESIGN AND FABRICATION OF VERTICAL AXIS WIND MILL:



WORKING PRINCIPLE:

Welding:

Welding is the most economical and efficient way to join metals permanently. It is the only way of joining two or more pieces of metal to make them act as a single piece. Welding is vital to our economy. It is often said that over 50% of the gross national product of the U.S.A. is related to welding in one way or another. Welding ranks high among industrial processes and involves more sciences and variables than those involved in any other industrial process

Cutting:

We used hand cutting machine to cut acrylic sheet with the help of abrasive cutting wheel Abrasive particles are brittle, and fracture after some amount of use, creating new sharp edges that will again perform Abrasive materials have two properties: high hardness, and high friability. Friability means that the more abrasion.

Fixing:

In this outer fabrication process we had done the acrylic plastic sheet into required dimension pieces according to our design after that it fixed to the chassis with the help of nuts and bolts the arrangement is done with all our requirements.

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Maintenance, repair and operations (MRO) or maintenance, repair, and overhaul involves fixing any sort of mechanical, plumbing or electrical device should it become out of order or broken (known as repair, unscheduled, or casualty maintenance). It also includes performing routine actions which keep the device in working order (known as scheduled maintenance) or prevent trouble from arising (preventive maintenance). MRO may be defined as, "All actions which have the objective of retaining or restoring an item in or to a state in which it can perform its required function. The actions include the combination of all technical and corresponding administrative, managerial, and supervision actions.

Finishing:

After all arrangements like painting, cutting, welding and fixing . we had given the outer body shape and model as shown below the fig

PARTS AND ITS WORKING:

Ball bearings:

In general, there are the following two designs: Linear motion bearing-carriage systems and Telescope linear motion bearings. Linear motion bearings are not only used in machine tools and in robots, but are also found more and more in the automotive and carriage building sector as well as in medical technology, like in X-ray machines and in the electrical industry. Requirements on linear motion bearings are just as various as the different kinds of application are within these sectors.

When it comes to handling and automation or to transport systems the most important aspect is speed, which also means productiveness and at the same time low power demand. In the machine tool sector the most important aspects are stiffness and easy running. The choice of the correct type of guidance depends on conditions like load, speed, stroke and acceleration as well as on influential factors such as temperature, lubrication, vibration, servicing and installation. Constant quality controls that are integrated within the manufacturing process ensure the consistently high quality level of all our products. Detailed information on different bearing designs as well as on the choice of the correct bearing type and its safe integration into individual constructions are listed in our corresponding product catalogues. For a complete overview of these catalogues please review the last page of this brochure. Due to our extensive product range and to the worldwide support of our customers on site by our service and technical departments we are able to create specific and economic rolling bearing solutions, in cooperation with our customers, for their individual bearing applications.

Bevel gear:

Bevel gears are gears where the axes of the two shafts intersect and the tooth-bearing faces of the gears themselves are conically shaped. Bevel gears are most often mounted on shafts that are 90 degrees apart, but can be designed to work at other angles as well. The pitch surface of bevel gears is a cone. Straight bevel gears have conical pitch surface and teeth are straight and tapering towards apex.

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Spiral bevel gears have curved teeth at an angle allowing tooth contact to be gradual and smooth. Zero bevel gears are very similar to a bevel gear only exception is the teeth are curved: the ends of each tooth are coplanar with the axis, but the middle of each tooth is swept circumferentially around the gear. Zero bevel gears can be thought of as spiral bevel gears, which also have curved teeth, but with a spiral angle of zero, so the ends of the teeth align with the axis.

Belt and pulley:

A belt and pulley system is characterized by two or more pulleys in common to a belt. This allows for mechanical power, torque, and speed to be transmitted across axles. If the pulleys are of differing diameters, a mechanical advantage is realized. A belt drive is analogous to that of a chain drive, however a belt sheave may be smooth (devoid of discrete interlocking members as would be found on a chain sprocket, spur gear, or timing belt) so that the mechanical advantage is approximately given by the ratio of the pitch diameter of the sheaves only, not fixed exactly by the ratio of teeth as with gears and sprockets. In this case the block and tackle is said to be "rove to advantage. Diagram shows that now three rope parts support the load W which means the tension in the rope is W/3.

Wind mill multi bladed:

A common multi-bladed wind pump usefully pumps with about 4%–8% of the annual wind power passing through the area it sweeps this lower conversion is due to poor load matching between wind rotors and fixed-stroke piston pumps.

Pump:

In the below fig pump is connected by bevel gar connecting rod to pump the water from the dip. Pumping systems are typically designed to support the needs of other systems, such as process fluids

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

transfer, heat transfer, and the distribution of water and wastewater.

Fabrication:

To size a wind pump for irrigation purposes will usually require an estimate to be made of the week by week or month by month average output. One method for making such an estimate is to combine data on the known performance of the wind pump at various hourly average wind speeds with data from a wind velocity distribution histogram (or numerical information on the number of hours in the month that the wind blows within pre-defined speed "bins").

Which gives the expected output of a windpump in various wind speeds, and the statistical average number of hours that the wind blows within each speed range, (or speed "bin" is the favoured jargon). Hence, the total output for each speed bin is obtained by multiplying the output per hour at that speed and the number of hours at which that speed is likely to recur. By adding together the output for each speed bin we arrive at the total annual output.

The importance of doing this monthly is that quite often the least windy month will have a mean wind speed of only around 60 to 70% of the annual mean wind speed, so the available wind energy in the least windy month can be as little as 20% of what can be expected for a mean wind speed equal to the annual average wind speed.

Therefore if annual averages are used, a considerable margin of safety is necessary to allow for "least windy month" conditions, (assuming irrigation water is needed in the least windy month or in a month with a mean wind speed below the annual average.

RESULT & CONCLUSION:

In villages these wind mill is used for pumping of water when there is no power supply easy to use and pump the water from easily without ant power and coming to future scope by keeping solar panels to rotate the wind mill we can pump easily where no power consumption is required to pump the water.The ease of construction and design modification of the vertical Windmill pump meant that the system is well suited for technological transfer to rural-based community groups or organizations working in developing countries, and at the end of the learning period, the rural people would have sufficient skills to enable them to continue with the maintenance and further innovation on the design.Although it is capital intensive, these technologies will be one of the most cost effective renewable energy wind pumps in terms of the cost per water pumped in very low wind regimes.

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

FUTURE EXTENSION:

- It can used for regenerative system by using solar panels we can produce electricity.
- We can produce easy electricity output.

REFERENCES:

1. Vertical Axis Wind Turbines : Darrieus Wind Turbine, Gorlov Helical Turbine, Vertical Axis Wind Turbine, Savonius Wind Turbine, Pacwind (2010) Windmills and Wind Motors: How to Build and Run Them. By F. E. Powell.

2. Power with Nature Second Edition: Alternative Energy Solutions for Homeowners Updated by Rew A. Ewing.This is one of the more readable texts on renewable energy. Ewing writes in a folksy, informal manner, and readers will find his hands-on primer worthwhile. Loaded with practical information to help almost anyone gain better understanding of using and living with renewable energy.

3. Gipe, P. (1993). Wind Power for Homes and Business: Renewable Energy for the 1990s and Beyond. Post Mills, VT: Chelsea Green Publishing Company.

4. Fraenkel, P. (1986). Water Pumping Devices: A Handbook for Users and Choosers. By arrangement with the Food and Agriculture Organization of the United Nations (UNFAO). IT Publications Ltd.

5. A..D. Spera, Wind turbine technology, ASME press, London, 1994.

6. G. Boyle, Renewable energy, power for a sustainable future, Oxford University Press, Oxford, England, 2004.

7. T.Ackerman, Wind energy technology and current status, a review, Elsevier science , 2000.

8. G.M. Goselin, A review of wind energy technologies, Renewable and sustainable energy reviews, Vol. 11, 2007.

9. Prehn Morten Sùrensen, Learning curve: how is new energy technology costs reduced over time, Report of an IEA Workshop, International Energy Agency, Paris , 1997 .

10.P.K.Chands,S.V.Tokekar,Expert-based maintenance: a study of its effectiveness, IEEE Trans Reliab , 1998.

11. E. Hau, Wind Turbines, fundamentals, technologies, application, economics, Springer-verlag Berlin Heidelberg, 2000.

12. G. Boyle, Renewable energy, power for a sustainable future, Oxford University Press, Oxford, England, 2004.

13. M. Hansen, Aerodynamics of wind turbines, James & James, London, 2000.

14 .Wind Energy Explained: theory, design and application" (Manwell, McGowan, Rogers)