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ELECTRICITY GENERATION BY USING ROOF VENTILATOR

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ABSTRACT

Roof top ventilator is a metallic construction which is wind driven and it is installed on the roof of industries as well as machine shops, warehouse and it provide effective ventilation. Warm air becomes lighter and goes upward at the top of industries and it is expelled out through ventilator. At the same time fresh air also suck inside due to free spinning of roof ventilator. For this project we have proposed two models for generation of electricity. For the first model we have done calculations for design of drive shaft, selection of belt drive as well as selection of bearing. For second model we have done calculations for gear ratio and selection of gear. For the selection of gears we have used trial and error method i.e. firstly we have selected gears and then checked whether selected gears are safe or not.

Keywords: Generator, Roof top ventilator, Voltage, Wind power.

1. INTRODUCTION

We know that there are two types of energy resources used for generation of electricity. These are Renewable Energy sources and Non Renewable Energy sources. Non-renewable resources are those resources that use fossil fuels deposited over many centuries. It is found that there is significant reduction in these energy sources and many of the countries are experiencing fast degradation of these resources. The main non-renewable energy sources are Coal, Crude oil, Natural gas and there is another one which do not contain fossil fuel but comes into this category. That source is Nuclear energy.

Renewable energy sources include solar energy, Hydro-electric energy, Bioenergy, Geothermal energy, Tidal energy. These resources have many advantages over non-renewable energy sources. Renewable energy is considered as green and clean as it does not produce any harmful emissions and pollutants as like fossil fuels. Also these requires less maintenance. But there are several disadvantages of these resources. The Solar, Wind, Water, Tidal energy can play important role in production of electricity without affecting on environment. But the some problems arises in the production power generation like, high construction cost, difficulties in maintenance, space for plant installation and power distribution. Therefore in India, government has to develop small power stations to improve such problems.

One of the way to develop such type of small power station is effective use of Roof top ventilator to generate electricity. Roof top ventilator is name of mechanical equipment that runs on wind to provide fresh air in the industrial

sheds without running cost. It does not consumes any power units and no power connection is required. It works on principle of flywheel and ones it gets momentum it keeps on rotating. Ventilation is perfect method of replacing warm and humid air with fresh and clean breeze. The highly efficient roof top ventilator is naturally powered by wind and helps in keeping the machine shops and industries with fresh air. The workers not just can enjoy the benefits of the better air ventilation in the house, but also have extra electricity supply for small load appliances like radio, mobile phone charger, etc. The main component of the system is Generator. It will convert the kinetic energy of turbo ventilator into the electricity.

2. LITERATURE SURVEY

Mr. Karakavalasa Goutham and Siva Krishna [1] found that power can be generated in the form of low grade heat of 70-80^{0}C with 20^{0}C ambient temp by constructing a simple pool of salt water. From study it is found that the solar ponds made a tremendous progress in the last thirty years. So in their research paper they mainly reviews the basic principles of the solar pond and the problems encountered in its operation and its maintenance.

Miss. Autade Puja Padamnath, Mr. Londhe Ganesh Bhausaheb, Mr. Wagh Sagar Atmaram [2] have conducted research on electricity generation using roof top ventilation In this paper they have told about generating electricity from RTV. Generally RTV are used for ventilation purpose. A standard RV is typically mounted on rooftops of industry and factory. It does not consume electricity for its working. According to their research journal it can produce electricity for low wind speed. System can produce electricity without causing any kind of pollution. Wind energy is renewable source of energy; it can replace conventional or non-renewable sources of energy that cause pollution to the environment. According to their research we can use inverter to convert DC to AC and operate light load or for other applications.

Sambeet Mishra, Pratyasha Tripathy [3] studied that one can generate the thermal energy by concentrating and converting the direct solar radiation at medium/high temperature. The resulting thermal energy is then used in a thermodynamic cycle to produce electricity, by running a heat engine, which turns a generator to make electricity. According to them Photovoltaic and solar thermal technologies are two main ways of generating energy from the sun, which is considered the inexhaustible source of energy. PV converts sunlight directly into electricity whereas in solar thermal technology, heat from the sun's rays is concentrated to heat a fluid, whose steam powers a generator that produces electricity. They found that to get thermal energy five major varieties of solar thermal technologies used which are: 1] Parabolic Trough Solar Electric Generating System. 2] Central Receiver Power Plant. 3] Solar Chimney Power Plant. 4] Dish Sterling System. 5] Solar Pond Power Plant.

3. PROBLEM IDENTIFICATION

It is found that the electricity generation from energy sources like solar energy, tidal energy and some other sources have some disadvantages. For example energy harvesting from tidal energy requires construction of dam in sea which is very costlier. Also electricity generation though solar ponds requires regular maintenance because salt crystals forms after vaporization of water. Same thing happens in case energy harvesting from geothermal energy.

Therefore we have decided to develop a system which requires less area for assembly, having less maintenance and maintenance cost & no adverse effect on environment.

3.1. ISSUES

1. From various literature survey, it is found that the majority of research is concentrated on generation of electricity from tidal energy, wind mill, hydro power generation, but in case of roof top ventilator very few researches have conducted and the research results.
2. It is found that the cost required for the installation of other systems like hydroelectric power plant, wind mill turbine, tidal energy are very high as compare to RTV system and it is not possible to install these systems at every place.
3. It is found that the power output from all other sources is more as compare to RTV system but maintenance cost of these systems are very high.
4. At low speed of air flow there is no problem in electricity generation but more time required for charging of batteries.

4. OBJECTIVES

1. To select a roof ventilator of suitable diameter of hub, number of blades and area of blades.
2. To select gears and design a gear box system for transmission of motion from roof ventilator gear to generator gear.
3. To fabricate a metallic stand for assembling of roof – top ventilator and dc generator.

5. SELECTION OF COMPONENTS

Specifications of selected components are as follows.

Sr.No.	Components	Specification	Dimensions
1	Roof top ventilator	Diameter of hub	680mm
		Number of vanes	34 nos.
		Thickness of vanes	0.5mm
		Material	Aluminium
2	Drive shaft	Diameter	15mm
		Material	Carbon steel C40
3	Belt drive	Length	180mm
		Material	Rubber
4	Bearing	Inside Diameter	15mm
		Outside diameter	24mm
		Designation	61802
		Material	Chrome steel

Table 5.1: Selected Components and there specifications

Gear ratios for three pairs of gears are as follows.

Sr.No.	Gear	Gear Ratio
1	Gear1 and Gear2	0.1754
2	Gear3 and Gear4	0.2500
3	Gear5 and Gear6	0.2678

Table 5.2: Gear pairs and their ratios

8. RESULT

8.1. Observation Table:

Following table shows the output voltage of generator at different speeds of roof top ventilator by belt drive mechanism.

Sr.No.	Rotations of RTV	Output Voltage
1	30	0.92
2	50	0.98
3	100	1.86
4	150	2.35
5	175	2.60
6	200	3.16

Table8.1: Output voltage of generator by belt drive mechanism

8.2. Observation Table:

Following table shows the output voltage of generator at different speeds of roof top ventilator by gear drive mechanism. When ventilator starts rotating at 200 RPM, generator generates 10V voltage.

Sr.No.	Rotations of RTV	Output Voltage
1	30	2.51
2	50	3.83
3	100	7
4	150	9.20
5	175	9.54
6	200	10

Table8.2: Output voltage of generator by gear drive mechanism

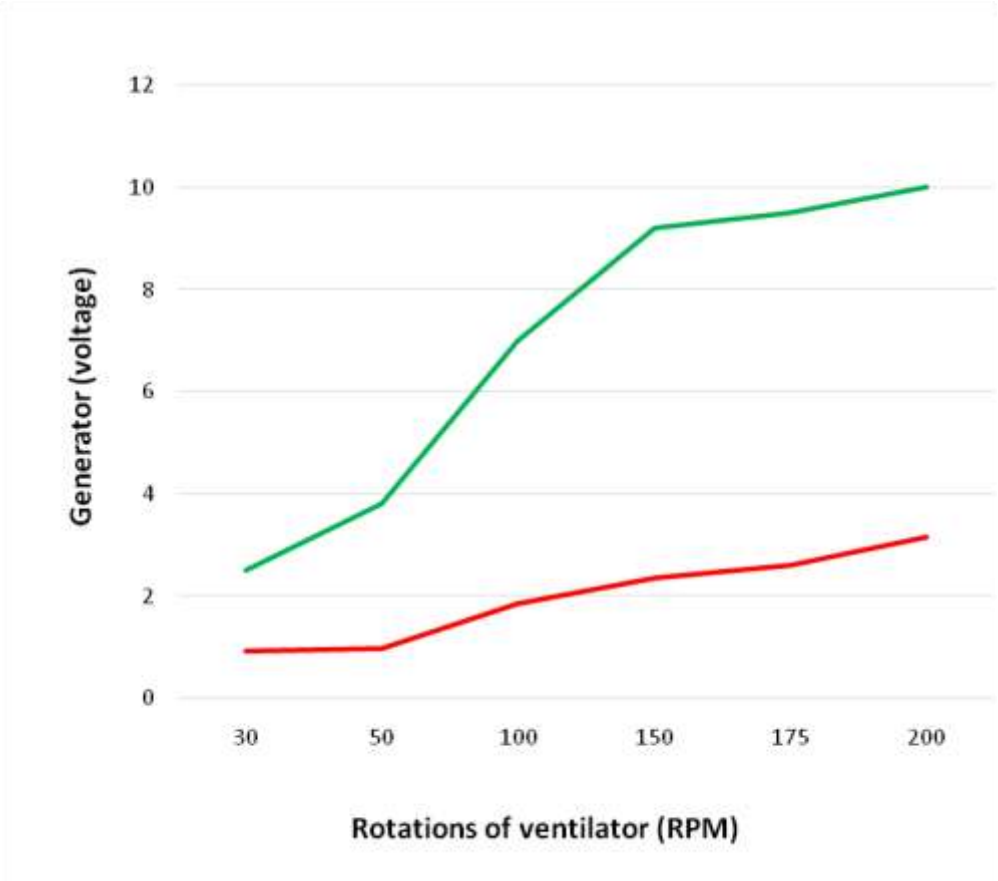

Fig.a.Graph showing combined output voltages of generator at different speeds of roof top ventilator.

In above graph, green line shows output voltage by gear drive mechanism and red line shows output voltage by belt drive mechanism. This graph shows that gear drive mechanism gives more output voltage as compare to belt drive mechanism.

10. CONCLUSION

This paper gives brief idea about generation of electricity using roof top ventilator. In this paper we have compared output values of voltages for both belt drive and gear drive mechanism. The result table shows that the output voltage is more for gear drive mechanism than that of belt drive mechanism. It is also found that gear drive mechanism is more compact as compare to belt drive mechanism.

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