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Development of Micropower Generation System using Rooftop Ventilator

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Abstract: *Wind energy is one of renewable energy and it does not cause pollution. Therefore, presently, there is the technological development of applying wind energy for the electricity generation. Wind energy is used to replace fossil energy such as oil and coal, causing environmental pollution. This paper presents the electric power generation by using Rooftop Turbine Ventilator (R.T.V). Rooftop ventilators (RTV) generally used for ventilation purpose, can be used to extract wind power by suitablydesigning a generator to couple with it. Rooftop Ventilators do notconsume any electrical power for its working. The paper discussesthe development of a power generation system using a typicalRTV. The paper emphasize on the materials and the constructionmethodology adopted for developing a Rooftop power producingsystem. As a test case, the RTV power generation system isdesigned to charge a battery and power up the LED lightingload connected to it. Speed of 150rpm. This type of Small scale power generationsystems are suitable to charge low power loads.*
Keywords: *Roof Top Ventilator, Light Emitting diode & Direct Current.*

I. Introduction

The demand of electricity is increasing day by day. To achieve that demand different renewable and non-renewable energy sources are used to produce electricity. In other side by using conventional energy source the pollution is increasing and this creates global warming .This typesources are destroyable energy sources. Now all countries and associations are interested in the renewable energy sources. The solar ,wind ,water ,ocean waves can haveimportant role in electricity production .But there are some problems created in the production of electric power generation like, high cost, difficulties in maintenance, space for plant installation and power distribution .India begin to develop a micro power station to improve such problems. India is in the tropical zone and havehigh humidity and warm weather present in all over the year, especially in march and April .The day temperature may be increasing to $43^{o}C$, so this increase in temperature is affected on the worker and this effect decreases the work efficiency of worker and also reduces the productivity of company. Because of high intensity of sunlight and high room temperature the ventilation system is used in workshops, industries or factory building .The rooftop ventilators work without using electricity. This technology is commonly usedon the roof in workshops, industrial buildingshouses. [Figure.1] The ventilator remove the hot air from building and maintain the normal temperature. Rooftop ventilator is design technically to work as a vertical spindle and it does not consume electric energy. The RTV rotates because of the wind in the surroundingor due to the internal hot air. This rotatory motion of the RTV can be utilized for producing electricity. This system is obtained by modifying a typical RTV into a Roof top ventilator generator. Thus the RTV Generator can be used for ventilation purpose and also for small scale power generation.

Figure.1.Roof Top Ventilator

II. Roof top ventilator

Rooftop ventilators are generally placed on the roofs of industries, workshops, ware houses etc.for ventilation. They do not want electricity for its working .Being an eco-friendly green product RTV helps in reducing the carbon footprint and aid in energy savings. They are maintenance free. They do not produce any noise during its operation. It suck hot air in summer and moisture laden air in winter from the interior of the buildings .Rooftop ventilators rotate under two principles. First is the air flows from high temperature area to low temperature area or from high pressure area to low pressure area. Second is due to the slight breeze in the surroundings. (Figure.2)

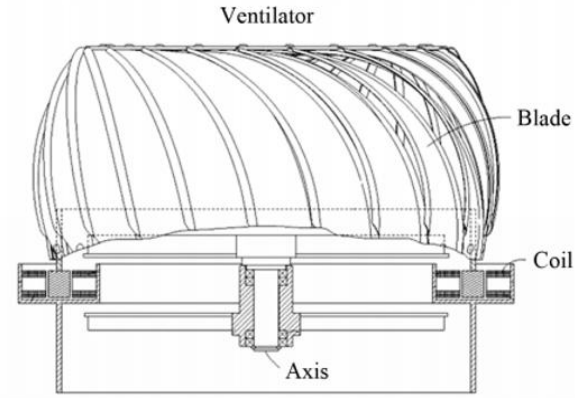


Figure.2. Main parts of RTV.

2.1Constructional specifications

A permanent magnet generator is developed to harness the wind power through RTV. Neodymium magnets are used as permanent magnets which is connected to the rotor frame .It consist of a generator. A typical ceiling fan stator wounded with 0.35 mm copper winding wires make the stator of the generator .Rotor are stator are bolted to the frame (figure 4).

Figure.4. Construction of RTV.

2.2Gear

It is used to transfer energy from RTV shaft to alternator shaft.Nylon gear is used here to reduce the weight .Gear tooth ratio obtained is 6:1 ,so we use 14 tooth for primary and 84 tooth for secondary .It helps to increase the speed.

2.3 Alternator

This is the main part of power generation system. It converts the mechanical energy of RTV system to electrical energy. The output of alternator selected is 12V.

2.4 Permanent Magnent

The main function of a magnet is energy conversion. In devices like generators, sensors etc.It is help to conversion of mechanical energy to electrical energy. Magnets are used in motors, actuators etc. to produce the magnetic field for the conversion of electrical energy into mechanical energy.

Four major types of permanent magnet materials are Neodymium or Neo Rare earth (*N dF eB*),Samarium Cobalt (*S mC o*), Hard Ferrites (*S r F e* 2 *O* 3) and AlNiCo magnets. Neodymium also called as NIB is an alloy of Neodymium, Iron and Boron, is the strongest of all permanent magnets with Curie temperature about 310◦C.

2.4Bearings

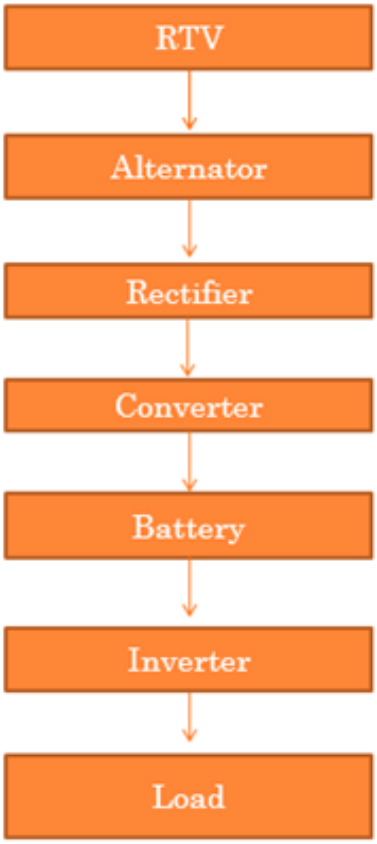
Rolling bearings are used in machines so as to support and locate the rotor and to transfer the load to motor frame from the shaft.The factors depending on the selection of bearings are speed, temperature and the working

temperature of the machine, environment type where it is implemented etc. Roller bearings in two numbers are used for the easy rotation of the rotor plate along with the rooftop ventilator. A bushed bearing is also used to fix the stator parts.

III. Power generation system

The RTV system consists of a Roof top ventilator coupled with the permanent magnet generator. The RTV generator is connect to a battery through a bridge rectifier. The load (LED) is connected to the battery. The winding and the rotating magnets constitute the stator and rotor of the generator.The roof top ventilator rotates due to internal hot air or due to the slight breezein the surroundings. The rotor rotates which produces a rotating magnetic field. According to Faradays Law of Electromagnetic Induction, a voltage is produced in the stator winding.

A bridge rectifier is used in this study for rectifying the generated AC voltage to DC,They have high rectification of 0.8 and a ripple factor of 0.5. The conduction of the diode gives a rippled DC at the output which is filtered to achieve DC Voltage. The rectified output is fed to the battery. The system is designed such that the load draws power from the battery charge by the RTV.



IV. Result Analysis

The maximum speed of ventilator is limited to 500rpm, there is mechanical vibrations at 500 rpm and above, which slightly affect the system stability.A RTV mounted on the roof, no such vibrations will occur at these low speed. A maximum voltage of 20 V DC is obtained at a ventilator speed of 500 rpm.

Sr.no	Speed(rpm)	Voltage(V)
1	300	12
2	282	10
3	200	9
4	175	7
5	170	5

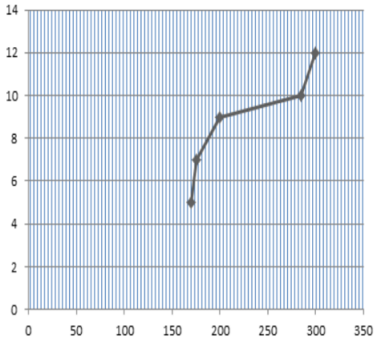


Figure.4. Voltage vs speed graph

V. Conclusion

The rooftop ventilator generate electricity from the wind energy. This system also remains the main function which is to provide air ventilation in house or factories. The low speed of the ac generator is one of the main factors to make this system perform in the right condition. It can produce up to 20Vac at the 500 rpm speed. The system create to charge the 20Vdc batteries system in the good and efficient condition. Induced voltage from generator is directly proportional to the speed of roof ventilator. In case of installation on the roof, voltage is induced lower than the measurement in lab because of wind speedchanging.

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