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WIND VENTILATOR ELECTRICITY GENERATOR

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Abstract - *This paper describes about the modified wind ventilator that can generate electricity. The system is new modification of the wind ventilator system is by adding the extra fins to help it to spin faster and more efficiently. Optimize design and performance of the system also discussed. Wind ventilation system is suitable to use for the low speed wind places. This system is containing the combination of the AC generator, wind ventilator, batteries and inverter. This system is also used with combination of wind ventilator and solar system. In wind ventilator system managed to produce 13 Vdc to 14 Vdc to charge the 12 Vdc batteries system. The operational concept of the system is the load will use the energy from the batteries that charged using wind ventilator. The observed performances of system are the voltage and current of the wind ventilator, batteries and the load.*

***Key Words*:** wind ventilator, wind energy, dynamo, battery, Charge controller, , LED lamp etc.

1. INTRODUCTION

Now a day the generation of electricity is more costly because of insufficient primary material like as coal, oil, etc. Hence to generate the electricity used in wind ventilator. The main function of free spinning wind ventilation is to provide fresh air in atmosphere and living area all year round 24 hours in one day in free of cost and it does not hazard to the environment. The extra function is produce electric energy from wind ventilator.

The wind ventilator capture the wind kinetic energy in a rotor consisting of one or many blades mechanically coupled to a generator. The ventilator is mounted on a buildings, workshop, institute, etc. to enhance the energy capture. The vertical-axis machine has been the standard in Denmark from the beginning of the wind power industry. Hence is called as Danish wind ventilator. The vertical-axis machine has the shape of a circular. It is used in the past because of its specific structural advantage. However, most modern wind turbines use a vertical-axis design.
The buildings, workshop allows access to stronger wind in sites with wind shear and placement on uneven land or in offshore locations and most of them are self-starting. At this time, it can be cheaper because of higher production volume. The disadvantages are it has difficulties operating near the ground and with turbulent winds because the blade bearing need smoother, more laminar wind flows. The wind ventilators blades are easily need a special installation procedure. It also has relatively cost of production, installation and transport compared to wind turbine. The turbines does not need to be pointed into the wind to be effective.

1.2 Objectives

1. To develop roof ventilator with DC generator for electricity generation.
2. The wind ventilation in barns is to replace impure air of respiratory products of combustion, and fumes arising from fluid and solid excreta, refuge, etc., with dust free pure and fresh air from outside.

2. Wind Ventilator

In this paper is interested to the second type that comprise of stationary part and rotational part. Stationary part is composed of base and fixed shaft and rotational part is composed of fan blades and bush that put on the fixed shaft on stationary part. In this system the principle of wind ventilator, when the air flow on the top of wind or the heat air that lifting to under the wind , it turns the wind ventilator. Ventilation rate is up to the speed and the size of wind ventilator. Figure 2.1 shows the construction of windventilator.

Fig 2.1 construction of wind ventilator

A literature review within a specific field or interest of research is one of the most essential activities in the process of research. This section acts as a platform for the whole research to support and define each action performed during analysis and experiment. Different books, research papers were studied to collect the basic information and design procedures according to standards. Research in the computer-aided punching process planning has been widely reported since the 1970s. The advantages of automated process planning are productivity improvements, cost reductions, and design automation.

1.Sirichai Dangeam This paper describe that the thailand is the country in the tropical zone. There are high humidity and warm weather all of year. Especially in Summer on April and May, Day time temperature may be increasing to 45 OC or 39-41 OC for the average temperature at noon all of the year. It effects to decreasing work efficiency of worker or damage product for some business. The results of the generator performance are at the no-load speed100 rpm, the generator voltage could be induced 52.3 V. At on-load, the generator could be supplied the load with the real power 1.15W. For the results after install the generator in the ventilator on the wind of a building to charge the12V battery, and the minimum wind speed for enough charging to battery is at 20 rpm.[1]

2. Chonmapat Torasaa*, Nichanant Sermsrib This paper describe that Wind energy is one types 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. Moreover, Thailand has promoted the studies of wind energy application to generate electricity. Nowadays, there is number of small and medium wind turbines used for electricity generation for buildings, houses and small communities. Since Thailand is located in the tropical climate, the buildings, houses and industrial facilities prefer installing roof ventilators to vent hot air out of the roof. Therefore, the author proposed the roof ventilator system equipped with a small direct current electric generator. A 18-watt DC generator was installed in 24-inch roof ventilator and carry around rotation of the generator by gear to the rotation axis of roof ventilator. The results of the study were found that roof ventilator would begin to generate a voltage of 0.2 - 0.3 volt at wind speed of 0.5 meters per second. When the

wind speed is higher than 2 meters per second, it would produce about 3.5 volts. However, when connecting the voltage produced by the generator to the DC Step-Up Converter, it was found the wind speed of 5 meters per second. DC generators can produce a voltage of 3 volts. With the DC Step-Up Converter, the voltage would increase to approximately 12 volts and can the current to 220 mA, which is sufficient level to work with light-emitting diode lamp. In sum, the system of roof ventilator with a small DC generator could be applied to generate electricity for various households. [2]

3. Ashvi Suresh, Basil Jacob,Lishana Fathima Sharaf, Gomathy S This paper describe that the 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 Wind top Turbine Ventilator (R.T.V). Wind top ventilators (RTV) generally used for ventilation purpose, can be used to extract wind power by suitably designing a generator to couple with it. 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 type sources are destroyable energy sources. Now all countries and associations are interested in the renewable energy sources. The solar ,wind ,water ,ocean waves can have important role in electricity production.[3]

4. I.Daut 1, C.Shatri 2 , M.Irwanto 2 , A.N.Syafawati 2 , S.S.Shema 2 This paper describe that the advantages of the HAWT are the blades are to the side of the turbine's center of gravity, helping stability. It also allows the angle of attack to be remotely adjusted gives greater control, so the turbine collects the maximum amount of wind energy. Tall tower allows access to stronger wind in sites with wind shear and placement on uneven land or in offshore locations and most of them are self-starting. At the same time, it can be cheaper because of higher production volume .In the past, some electric generators driven by a roof ventilator have been developed . For example, Daut et al. have reported a new modification of the roof ventilator generator system by adding the extra fins to rooftop ventilator turbine in order to help it to spin faster and more efficiently. In this design, the rubber belting was attached to the moving object of the roof ventilator. The AC generator is connected to the belting area by using a small plastic wheel. When the wind blows on the fins and generates enough drag forces, the roof ventilator will rotate. The plastic wheel of the AC generator and the moving roof ventilator will spin synchronously to generate electricity. However, the rubber belting has to rub against the wheel and will lead to friction that occurs at the belting/wheel interface causing energy loss and is hardly employed. Dangeam et al. used a RFPM (Radial Flux Permanent Magnet) generator for voltage generating. The system comprises of stationary part and rotational part. Stationary part is composed of base and fixed shaft. Rotational part is composed of fan blades and bush that put on the fixed shaft on stationary part. When the air flow on the top of roof or the heat air that lifting to under the roof, it turns the roof ventilator. Since the generator is directly mounted on the bottom of the shaft, it can prevent thermal convection .To overcome these issues for the rooftop ventilator generator, a small power generation system motivated by a coreless stator AFPM (Axial Flux Permanent Magnet) generator which is driven by the air ventilator has been proposed. AFPM machines are generally regarded as ideally suited whenever low speed is required, such as in direct-drive applications .Compared with other PM machine topologies, the AFPM designs have higher power densities. For a given magnet material and air-gap flux density, radial flux designs have higher rotor movement of inertia; the active weight of the AFPM machines is smaller. Furthermore the AFPM machines have many unique features. For being permanent magnet, they are usually more efficient. As field excitation losses are eliminated, reducing rotor loses significantly. Machine efficiency is thus greatly improved, and higher power density achieved. Also,

AFPM machines have thin mag- nets, so they are smaller than radial flux counterparts. AFPM machine size and shape are important features in applications where space is limited, so compatibility is crucial. The noise and vibration they produce are less than those of conventional machines. Their air gaps are planar and easily adjustable. Also, direction of main air-gap can be varied, so derivation of various discrete topologies is possible. These benefits give AFPM ma- chines advantages over conventional machines in various applications .In this work, the AFPM generator is assembled at the ventilator base. The system can be installed on the roof, bathroom intake, or at ventilated place to provide a spare source. When the ventilator rotates, the flux of the permanent magnet rotor part moves across the air gap and induces the e. m .f. AFPM machines with coreless stators are regarded as high efficiency and simplicity of construction and very low rotor losses for distributed power generation system. Because of the absence of core losses, a generator with this type of design can potentially be operated at a higher efficiency than conventional machines. Besides, the high compactness and disk- shaped profile make this type of machine particularly suitable for mechanical integration with ventilator. In this paper, a small power generation system motivated by a coreless stator AFPM generator has been de- signed and fabricated. This generator has two outer disk rotors and one coreless stator in between. Neodymium- Iron-Boron (Nd-Fe-B) rare-earth magnets produce the necessary excitation in the generator. These magnets are glued onto the two inner surfaces of rotor disks. After the preliminary design, and for precision study, a two-dimension model of the machine is analyzed using finite element method software. In addition, analytical results will be validated through a series of experiments to demonstrate the usefulness of the system.[4]

5. Ponnson Kaewtip1, Naebboon Hoonchareon2 This paper describe that a prototype of a magnetic levitation rooftop turbine ventilator (RTV) through redesigning a standard rooftop ventilator that is typically mounted upon rooftops of factories, constructed to wind micro generation system. By re-arranging positions of the rotor and the stator and integrating the magnetic levitation system to assisting support weight of turbine body, which can result in a very low starting torque so as to minimize the self starting speed (m/s). Thus, it could easily turn and be able to rotate in low-speed wind ambient. This can practically improve responsiveness to intermittent wind and its directional change. The testing apparatus was conducted with wind speeds from 0-14.0 m/s, incremented by 0.2 m/s each iteration, where the test results show that the RTV self-starts at a wind speed of 0.4 m/s and minimal charged speed was recorded at 95.8 RPM at a voltage of 12.07 VDC (activated charging voltage via battery bank of two 12 V, 100 A—in parallel connection) at 7.8 m/s. Then, it reaches ceiling voltage of 35.3 VDC and 0.51 ADC at turning approximately 119 RPM in which it produces power output 18 watts. At cut-out speed of 14.0 m/s and also rated output speed, the RTV optimizes the turning at 160.6 RPM while generating 1.02 ADC, in which it produces a maximum power output of 36 watts. For the modes of finance; ROI remarks at 6.21, payback period at 4.03 years, and cost per kWh is as low as 2 cents/kWh, assuming operating at average speed of 14.0 m/s all year long.[5]

6. N.A.Ahmed The author has been pioneering wind top ventilator research, design and performance studies for over a decade at the University of New South Wales in Australia forever a decade. Work on wind driven ventilators started at the University of New South Wales when Edmonds Products Australia Pty Ltd required testing of their ventilators designed to operate on wind tops of dwellings to meet a single regulatory requirement, that is can the ventilators withstand hurricane wind forces, that is wind forces of a minimum velocity of 215 km/ hr. The experiments were essentially in the form of ‘destructive used so that they could withstand the loads generated by high wind. Subsequent studies lead to the aerodynamic investigation of the performance of these ventilators. The major issue that were investigated involved the efficient operation of these ventilators in low speeds.[6]

7. N.Thavapriya1, P.Pandiyaraj2 This paper describes about the modified wind ventilator that can generate electricity after reviewing the techniques developed by various researchers. The new modification of the wind ventilator system is by adding the extra fins to help it to spin faster and more efficient. This system is suitable to use for the low speed wind places through Optimum design of the system. The system consists of DC generator, wind ventilator, solar charger, batteries and LED bulb. This paper is aimed to discuss the methods and techniques to generate electricity by wind top ventilators with suitable modifications. By revolution of the ventilator the alternator starts to rotate in the ratio of 1:15. So, that the power produced is directly proportional to the speed of the ventilator. The small setup boost converter is used to step up the voltage. [7]

8. Narin Watanakul This paper presents a small electrical power generation for low speed system. The power conversion (wind ventilator) of covert dc voltage to three-phase ac voltage system. The paper proposed two part system, the first part stage about power generate electricity with dc machines, the load will use the energy from the batteries (12V/5Ah) that charged using by wind ventilator. The second part, design 7-level cascade multi-level inverter (INV) topology by using separated dc sources form wind ventilation and batteries. The prototype two part system is built and tested in laboratory. The multi-level INV data collected by MATLAB simulation are used in comparison with the experimental results.[8]

9. Ming Chun Hsieh1, David King Jair2, Huann Ming Chou2 This paper presents a small power generation system motivated by a coreless stator AFPM (Axial Flux Permanent Magnet) generator which is driven by the rooftop ventilator. The generator consists of discs for the rotor and the stator geometry. The stator disc is sandwiched between two rotor discs and the magnets in the two opposite rotor discs may be placed N-S arrangements. Since there is no silicon steel inside the coils, we should eliminate the magnetic pulling force between the rotors and the stators. When the ventilator rotates, the flux of the permanent magnet rotors part move across the air gap and induces the emf in the coreless coils. After that, the ac voltage is rectified to dc voltage and finally charged to the 12 V 5 A hr battery for household appliances. To analyze the magnetic circuit, the finite element analysis was used to simulate the magnetic flux density in the AFPM generator. The test is operated in electrical machines laboratory and essentially to determine the characteristics of prototype generator. Based on the experiments, the results of the output voltage can achieve 103 V with no-load, and 20 V on 100 Ω resistive loads at the speed of 200 rpm. For the results after installing the generator on the roof of a building to charge the 12 V battery, the minimum wind speed for enough charging to battery is at 10 rpm. Furthermore, the prototyped of the generator is relatively small and cheap. After the fabrication and testing of the prototype, this system has been proved feasible for practical application.[9]

10. Anthony Lloyd & Jacob Michener This project aims to create a more compact and accessible renewable energy source using the Wind and Ventilation Turbine (WVT) Generator. The wind turbine provides ventilation while generating “clean” electricity using solar and kinetic energy. The electrical generation causes no functional losses to the ventilation as rising heat and passing wind turn the turbine, ventilating the house. Placing a generator beneath the spinning turbine allows for the transformation of mechanical motion into electrical energy. The system charges a battery, supplying recharging power into small standard electronics (i.e. cell phones, tablets, etc.) through a USB output.[10]

2.1 Methodology

To design the air wind ventilation ball to generate the electric current, the concept was designed to modify the ventilated ball with the diameter 24 inches to install the 18

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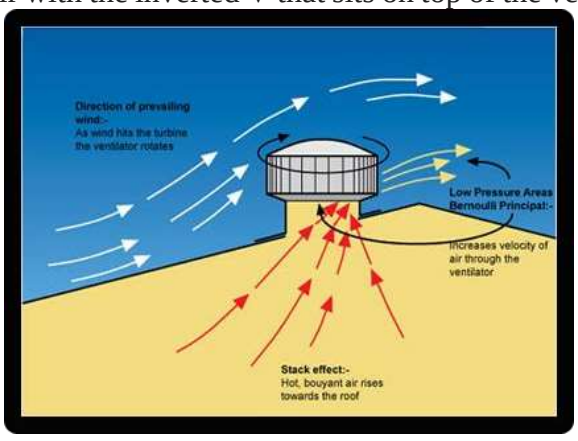
watts DC generator. This is the process and cheap expense is considered, and the DC generator will also not close the ventilated holes. For the purposes of the DC generator is connected to ventilated ball and also connects to external battery charger to supply the electric current for Light Emitting Diode (LED) lamp as shown in Figure 2.2.

2. WORKING OF WIND POWER

The vertical Wind Power is a turbine which has a rotating blade and installed in vertically. It is designed such a mannerso that is easily be mounted a platform. It can be installed near to the ground there is no need to build a high tower. It is easily catch the wind regardless of the winds direction. Vertical Wind Power it is type of wind power usually utilized in the urban and rural areas. This machine can be installed ina location closer to the ground and since it's vertically positioned, there is no need to point to blades the winds direction. Vertical wind generators produce electricity using the same principles as that of an ordinary and standard wind power generator. The blade is rotate when the wind blows by it. As soon as the blades start rotating, it will generate electricity which is stored to the battery for your daily consumption.

The concept of behind wind ventilator is that the turning blades will help force air out of the attic. Hot air is naturallyrises, so its attic air is heated above the ambient air temperature a vent will allow the less dense hot air to atmosphere. Commercial uses of wind ventilator often connect to large underside and are used to draw things such as smoke out of a building, workshop, institute etc. A domestic ventilator does not have this fan. A problem often city area with typical ridge vents is that they stop the rise ofthis hot air with the inverted V that sits on top of the vent toatmosphere.



3. CONCLUSIONS

- Induced voltage from generator is directly proportional to the speed of wind ventilator. In case of practical installation on the wind ventilator, voltage is induced lower than the measurement in laboratory because ofwind changing.
- In this study of adapt the air ventilationball to generate the electric current. It has been to study

the probability to use the small DC electric generator to install the ball by adapting, adding the elementfor electric current with least effect of the movement of the ventilation balls.

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