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Power Generation Using Windflow due to Locomotive

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Abstract: **This paper aims at production of electricity by using wind energy which is created due to the motion of train. A turbine has a rotor with blades attached to it. When the wind strikes theblades they start moving, mechanical energy is produced, this mechanical energy is then converted into electrical energy this is achieved by using dynamo (22V, 100mA) .The electricity produced will run the various loads connected to the train cabin. The excess power is stored in battery for further use. The entire process is non- polluting.**

I. INTRODUCTION

As the need of the power/electricity is increasing day by day and natural resources are exhausting so power generation, using renewable sources is essential. At present there are many ways to generate electricity but these p wer generation techniques result in pollution. Renewable primary sources of energy are wind, sun and water (tidal waves). Wind presents a vast source of renewable energy. Wind energy is in fact an indirect form of solar energy.

The main objective of the invention is to provide a method and a system for generating electricity by the ignored kinetic energy of the loco. When train moves with some speed, tremendous amount of air opposes it, our invention aims to provide electricity by using this ignored air.

Any locomotive such as train when in motion produces wind currents along the direction opposite of its motion which can be utilized to rotate the shaft of generator. Wind or air in motion contains the kinetic energy which is converted into mechanical power by means of wind turbine which is connected to a generator for producing electricity. Thus power produced can provide the electricity to the various loads connected inside the train Such as fans and lights etc. The results show that this new technology could provide an different types of applications .Some major factors about this work have been studied and practically designed and tested. This process does not involve any sophisticated mechanism and ensures complete safety.

II. METHODOLOGY

Fig. 1

A. *Wind flow*

As our project is based on generation of power using the wind flow experienced by the locomotive, we take a dc motor to check how much output it generates while increasing the speed of vehicle which contrary increases the wind in opposite direction. We obtain the following observations with different speed. Observations are shown in TABLE I.

TABLE I

Speed Km/Hr	Voltage Generated
20	8
30	13
40	19.45
50	20
60	28

Also, an LED 3Watt bulb glows at speed of 50km/hr with its highest luminance. To demonstrate the wind flow in model, we use the dc motor of rating 24V/1500rpm with fan attached to it which gives the wind with velocity 32.2m/sec when 12V is supplied. This is checked with an anemometer.

B. Power generation:

When the air incident on the blades of the generator. It rotates the rotor of dc generator to create mechanical rotation. This mechanical energy is converted into electrical energy by making use of dc motor of rating 24V/1500rpm to work as generator. A DC generator produces direct power. Generators produce electrical power, base on fundamental principle of Faraday's law. According to this law, when a conductor moves in a magnetic field it cuts magnetic lines of force, which induces an emf in the conductor. The magnitude of this induced emf depends upon the rate of change of flux (magnetic line force) linkage with the conductor. This emf causes a current to flow if the conductor circuit is closed. When air having velocity 32.2m/sec rotate the rotor it generates about 15V dc voltage. This generated voltage is directly given to the load or it will be stored in the rechargeable battery.

C. Sensor circuit:

This circuit senses the light in surrounding and accordingly illuminate or switch off the lights in compartment of the train. The sensor act as an auto switching system, we can control unnecessary power consumptions during day time and also helps in reduction of manpower.LDR is used as a light sensor which changes its resistance according to the intensity of light.

III. WORKING

Now we have airflow of velocity 32.2m/sec, this wind rotates the blades of the generator then it produces voltage across it. The dc dynamos (22V, 100 mA) are installed in front of the engine as well as on the upper part of the doors of bogie. The blades of the dynamos get activated as soon as train moves, and are efficiently able to convert the mechanical motion of the blades into electricity which is obtained at their output terminals. If the wind is properly directed towards the wind turbine blades, maximum electricity may be generated.

The generated voltage is displayed through multimeter and LCD display using AVR. Then the generated voltage is supplied to the load i.e. bulbs in compartment through sensor circuit. LDR in sensor circuit detects the surrounding light and changes its internal resistance. Circuit is designed such that, it connects the load to the generated output only when the surrounding is dark. This arrangement helps the passengers and drivers when the train passes through tunnel and also helps in power consumption during day time. When the loads are switched off, the whole power is stored n battery.

According to power formula,

$$\text{Power} = \tfrac{1}{2} * \rho * c_p * \pi * l^2 * r^3$$

Where, ρ = air density =1.25 kg/m^3

c_p =Power coefficient=0.3 to 0.4

r =Velocity of air m/sec

l = Length of blade in meter

We are using blades of length 23mm. Power calculated is

$$\text{Power} = \tfrac{1}{2} * 1.25 * 0.3 * \pi * 0.023^2 * 32.2^3$$

Power = 10.40 Watt

II. RESULT

We generate the voltage of around 15V from the wind flow of 32.2m/sec.

IV. ADVANTAGES

The energy crisis is the today's major problem; Train requires power in MW for its operations, this method is a way to generate Power required for bogies without relying lot on main supply which further reduces the electricity bill. This process of power generation is totally pollution free. Although, generated power is stored in batteries to use power anywhere required. The same concept is also can be apply on any moving vehicle.

V. FUTURE SCOPE

In the future there will be a large number of small generators connected to the distribution networks, small systems that can be combined with management and storage energy systems in order to improve the operation of distribution systems. From an environmental point of view the system is considered clean, reliable, and secure. If efficient planning and an optimum operation of the hardware will achieve, it will be possible for this model to play a greater role in the future, contributing to energy efficiency improvement, reduction in distribution cost, and improvement in power quality. Hence, railway networks such as metros of big cities like Mumbai, New Delhi etc can be effectively used for implementation of this project.

VI. CONCLUSIONS

In this project the availability of wind energy for generation of electricity through small turbines is a key factor which decides the effectiveness of the entire project. In this work, the conversion of kinetic energy into electrical energy was studied. The possibility to produce electrical energy with different speed of train has been studied.

Also, it is found that the minimum effective loco speed is 40 Km/hr, this means that all the locos going over the system can be able to produce the energy. With this method, the whole loco can be supplied with electricity for lighting, fans etc. The technology is expected to contribute to save environment as it helps to reduce pollution and also helps the government in saving fuel. Thus this paper proposes an effective means of harnessing the wind energy by moving the train. When implemented it will meet up the power requirements for future generation.

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