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Review On Wind Power Generation Through Running Trains

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ABSTRACT

This paper brings new possibility of production of electricity by using the concept of rotation of wind turbine due to wind caused by running trains. This device could be placed along railway or subway lines, & make good use of an otherwise wasted resource. This paper deals with design & development of wind turbine system with the concept of generation of electricity as an auxiliary source in the train. This will help to cut down the usage of non-renewable sources which is on verge of extension & the entire process is non- polluting.

Keywords: wind energy, wind turbine, railway train, electricity.

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I. INTRODUCTION

Today's civilization will be forced to develop alternative energy source. Our current rate of fossil fuel usage will lead to energy crises in this century. In order to avoid energy crises many companies in the energy industry are inventing new ways of extracting energy from renewable resources.Wind energy is basically the kinetic energy of moving wind. It is renewable source & thus having far reaching economic value. The use of wind energy as an auxiliary source of energy is the at most need of modern society. Wind energy is harnessed by wind turbines which may be horizontal axis turbine or vertical axis turbine.

Objective

The main objective is to develop a technique relates generally to electricity generation system along rail road track with the aim of contributing to present power generation system as a need of energy is growing continuously.

Easy availability of wind induced by moving trains have high wind pressure generated in moving vehicles. These are independent of seasonal winds having variation in wind speed & direction and that too neither at all times & not having necessary forces to operate wind mill to generate electricity it can lead to reduction in global concern of greenhouse emissions.

II. LITERATURE REVIEW

Typically, a number of researches on renewable energy, such as wind, photovoltaic generation, etc. are actively encouraged. Wind towers are usually built together on wind farms. Wind power is growing at the rate of 21% annually, with a worldwide installed capacity of 238 GW in 2009, and is widely used in Europe, Asia, and the United States.

The fixed wind power generation system in use are dependent on wind force and direction of wind but it difficult for availability of air throughout the year i.e. there is immense need of generating electricity due to forced wind i.e. moving train, airplane. This is available throughout the year with immense speed.

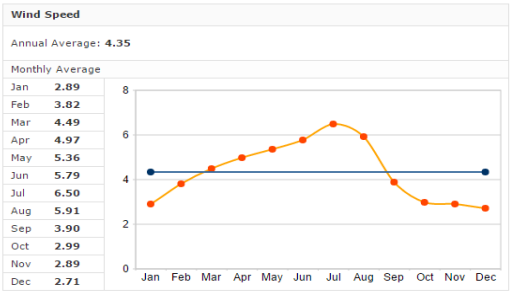

Fig.1. Average wind speed

Fossil fuels sources burn hydrocarbon fuels, which leads to decomposition of plants and animals. There are 3 main types of fossil fuels: coal, petroleum & natural gas. Another fossil fuel, liquefied petroleum gas (LPG), is derived from the production of natural gas. Heat of burning fossil fuel is used directly either for space heating or process heating, or converted into mechanical energy for vehicles, industrial processes, or electrical power generation.

Greenhouse gas emission result from fossil fuel-based electricity generation. Recently governments subsidize fossil fuels by an estimated
$500 billion a year

The power generation system can be configured to generate electric power through movements of the rail. The technique gives an electric power co-generation system for use with rail network.

Currently, the saving energy methods of rail transportations are mainly concentrated about how to carry out the regeneration braking energy.

Concept

Box wind power generator basically new concept of non-conventional energy generation. This inversion relates to generating electricity by pressurized wind by fast moving vehicle channelling the induced wind in the direction of wind turbine. A fast moving vehicle compresses air in front of it, pushes air towards sides i.e. creating vacuum at its rear & move forward.

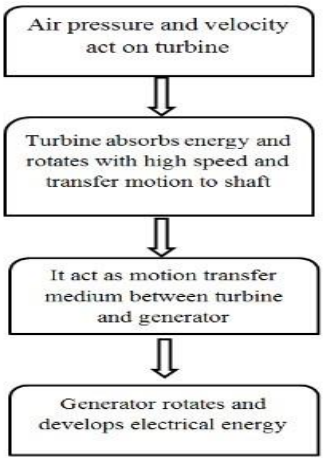

Fig. 2. Flow chat if inversion

There are two primary principle by which energy can be extracted from the wind. This is possible through creation of either lift or drag force. Drag forces provide the most obvious mean of propulsion, this being the forces felt by person exposed to wind. Lift is most effective mean of propulsion. Lift is primary due to physical

phenomena known as Bernoulli's law.

When wind density increases, pressure increases & such pressurized air comes directly in contact with surface. So need a new design of turbine to capture wind energy produced by moving train.As running trains with high speed generate huge wind flow and this flow of wind is used to drive wind turbine to generate electricity by installing the device between the sleepers on track, and as train passes overhead, the wind drives the turbine. This power generation system utilizes the kinetic energy created by the wind flow induced by running train can be effectively used to generate power on large scale.

Fig.3. Device between the sleepers on track

Bernoulli's Principle: Bernoulli's Principle states that an increase in speed of fluid occurs simultaneously with decrease in pressure or decrease in potential energy of fluid. Bernoulli's Principle is be derived from the principle of conversion of energy. It applies to various form of fluid flow, result in various Bernoulli's equation, There are different form of equation for different type of flow.

Incompressible Flow Equation :

$$\frac{v^2}{2} + gz + \frac{p}{\rho} = \text{constant} \qquad \text{...eq}^{\text{n}}\ 1$$

where:

v is speed at a point on a streamline, g is the acceleration due to gravity,

z is the elevation of the point,

p is the pressure at the chosen point, and

ρ is the density of the fluid at all points in the fluid.

An electrical power generation system comprises a dynamo, multimeter & a power source. During the input phase, turbine transmits motion to shaft, transmits

rotation against dynamo(which works on farady's law of magnatism), connected against multimeter(which measures energy output.), bearing.

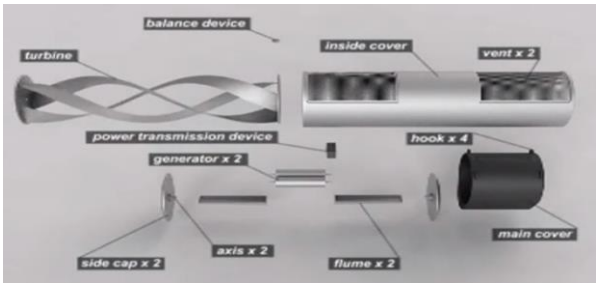

Fig.4. Construction **Detail**

Dynamo:A dynamo is actually magnetos that produce alternating current 12V. Dynamos saturate beyond a certain voltage to avoid overvoltage or protect lamps.

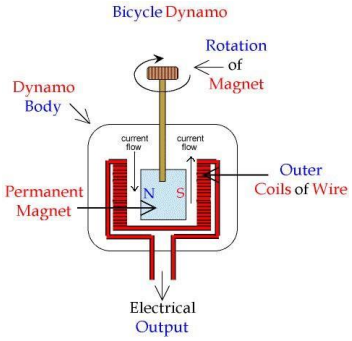

Fig.5, Dynamo current flow

Dynamos are generally limited to about 3W of output power, although the 12V dynamo can produce 6W of speed. A bottle dynamo is likely to slip, if run twice the normal power, a hub dynamo is more efficient.Good dynamo can achieve efficiencies up to 70% under 5W of output is delivered to produce 3W of electricity & provide good light output at low speed.

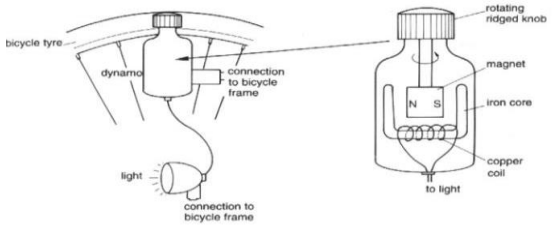

Fig.6. Dynamo constriction

- **Faraday's law of electromagnetism**

Faraday's law is a basic law of electromagnetism predicting how a magnetic field will interact with an electric circuit to produce an electromotive force (EMF)—a phenomenon called electromagnetic induction

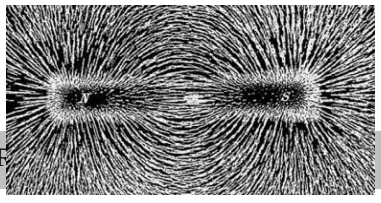

Fig.7. Magnetic Flux

A bar magnet has north and South Pole. If it is placed under a sheet of paper and iron filings are sprinkled over the top of the paper, these iron filings will arrange themselves into a pattern of lines that link the north pole with the south pole of the magnet (see diagram 1) These lines show the magnetic field around the magnet.

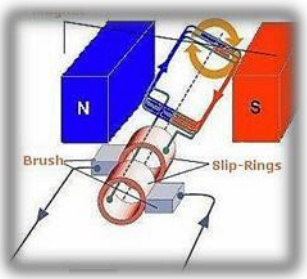

Fig.8. Construction Of Generator

In above diagram, the coil of wire is rotating in a clockwise direction, when the coil of wire is in vertical position. The voltage is greatest because the coil is passing through the strongest part of the magnetic field. At this stage the current flows from left to right, out through terminal, through the globe, and back into terminal. When the coil of wire is in the horizontal position, no electricity is produced because the coil does not cut the magnetic field, and no current flows. When the coil of wire is in the vertical position again the voltage is at its maximum, however the current flows in the opposite direction from right to left direction, out through terminal, through the globe, and back into terminal.

Ball bearings: A **ball bearing** is a type of rolling-element bearing that uses balls to maintain the separation between the bearing races.

The purpose of ball bearing is to minimize rotational friction & support radial and axial load. It achieves this by using at least two races one race is stationary and the other is attached to the rotating assembly. As one of the bearing races rotates it will cause the balls to rotate. Because the balls are rolling, they have a much lower coefficient of friction than that of two surfaces sliding against each other.

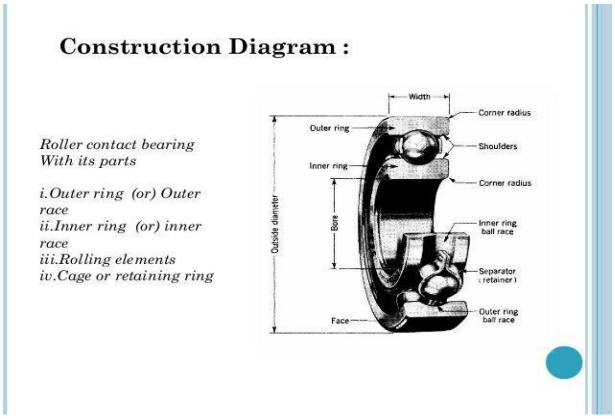

Fig.9. Diagram of ball bearing

Turbine is a mechanical device that extracts energy from a fluid and converts it into work as output. A turbine is a rotor assembly, which having shaft with blades attached.A device that can harness the wind created by running trains as they pass the turbine overhead with speed. This wind turbine power generator device is installed between railroad ties and placed half-underground so as to not interface with normal train operation. When train passes overhead, the large wind flow spins the turbine inside the device to generate electricity. When such a pressurized wind comes in contact with turbine, it need an immense requirement of new design of turbine, so as to capture maximum wind energy produced by moving train.It's almost using helix form of turbine blade in different ways. This turbine is coupled to shaft to transfer the motion.

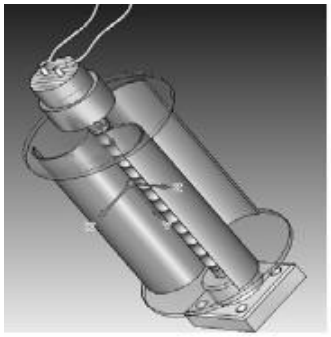

Fig.10. Turbine diagram

Shaft: A **shaft** is a rotating machine element, usually circular in cross section, which is used to transmit power from one part to another, or from a machine which produces power to a machine which absorbs power.The material normally used is mild steel, when high Strength is required, an alloy steel i.e. nickel, nickel-chromium etc. are used. Shaft are generally formed by hot rolling & finished to size by cold drawing or turning & grinding.

Fig.11. Mechanical shaft

Equations:

KINATIC ENERGY OF WIND

$K.E = 1/2mv^2$ Where,
m= mass
v= wind speed

Energy & power

Electrical energy in kwh. Energy =force * distance Power = Energy/Time

POWER ,KW
$P = 0.5 * \rho * V^3 * A$ Where,
p=power watt
ρ=Density of air, kg/m^3 V=wind speed m/s A=swept area, m^2

Average wind speed $= \sum fj * vj$
Power area $= 0.5 * \rho * \sum fj * vj^3$

Height Analysis: Power=torque*rpm
Variable rpm=(m_a*c_p)

Generator Size:
A kwh=cf*gs*8760 Where,
A kwh=Annual energy production

Cf=Capacity factor (efficiency

Gs=Generator size(rated power)kw 8760#of hours in a yr.

CONCLUSION

Best way to recover waste energy by the generating power which is primary need of metro cities.By using of this technology with low initial investment we can generate more power The technology is expected to reduce carbon emissions and also help to country to improve its economic power. Generated Power can easily transferred to local areas.It can be easily maintained by using sensors

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