

Portable on Run Power Source

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Introduction

The proposed device converts power from relative motion of air with respect to a vehicle on-run and uses the same to charge portable electronic devices.

Abstract

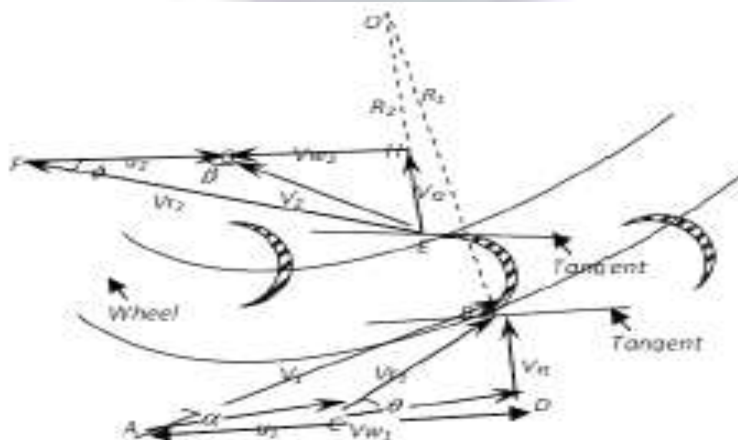
“Necessity is the mother of invention” goes the saying and this project is yet again making its true. This project is the result of very common need which almost every one of us would have felt. We all travel and discharging of mobile phone, iPods, other small portable devices often leave us in a wanting situation where we crave for a power source specially while we are inside trains and buses which either has no charging ports or if it does have then one needs to stand and wait in a long queue to get very small amount of power. Though Indian Railways have charging ports for the same but in reality most of them either do not function or one has to wait for hours to get a chance for charging. At the same time we do have a power source which is left unexplored and unused, but has the potential to solve the charging problem of almost every person travelling in Public buses and sleeper coaches of trains. The unexplored energy source is high relative velocity of air which flows at sides of the means of transportation we are travelling. It is proposed to use this relative velocity of air with respect to the vehicle as the power of source. The flow of air through a specially designed small “Axial Flow Reaction Propeller Vanes” create torque to rotate it like a shaft which by means of few gears feed the rotational mechanical power to a D.C Dynamo. This Dynamo generates power varying between two limits- ground level(zero volts) and high level(6V in the case of our model for charging mobile), a simple stabilizing circuit functions to provide constant charging voltage which the required device.

The physical base of whole device is a very strong permanent magnet which helps in sticking the whole apparatus on the side of vehicle’s ferrous body. So a person now just sticks the apparatus out of his window on the metal body of the vehicle and enjoys easily available power and never runs short of power making his journey pleasant.

Theory

The principle of working is based on laws of electromagnetic induction. 2Watts of power has to be developed by means of air flow. The following is the derivation of work done by the propeller in rotating the shaft which runs the D.C Dynamo when air at given velocity flows through it.

Derivation of Efficiency



Let,

R1= radius of wheel at the inlet of vane

R2= radius of wheel at the outlet of vane

ω = angular speed of the wheel

Tangential speed of vane at inlet = $u_1 = \omega R_1$

Tangential speed of vane at the outlet = $u_2 = \omega R_2$

The velocity triangles at inlet and outlet are drawn as shown in figure.

α and β are the angles between the absolute velocities of jet and vane at inlet and outlet respectively.

θ and ϕ are vane angles at inlet and outlet respectively.

The momentum of air striking a series of vanes per second at inlet is given by the mass of air striking per second and component of velocity flow at inlet.

$$M_1 = (\rho a V_1) \times (V_{w1})$$

(V_{w1} is the velocity component of flow at inlet along tangential direction)

Similarly, momentum of air striking a series of vanes per second at outlet is given by

$$M_2 = (\rho a V_1) \times (-V_{w2})$$

(V_{w2} is the velocity component of flow at outlet along tangential direction and negative because the velocity component is acting in the opposite direction.)

Angular momentum per second at inlet is given by the product of momentum of air at the inlet and its radial distance

$$= \rho a V_1 \times V_{w1} \times R_1$$

Angular momentum per second at the outlet is given by

$$= -\rho a V_1 \times V_{w2} \times R_2$$

Torque exerted by air on the wheel is given by impulse momentum theorem as the rate of change of angular momentum

$$T = (\rho a V_1 \times V_{w1} \times R_1) - (-\rho a V_1 \times V_{w2} \times R_2)$$

$$T = \rho a V_1 (V_{w1} R_1 + V_{w2} R_2)$$

Work done per second by the wheel is given by

$$WD/s = \text{torque} \times \text{angular velocity}$$

$$WD/s = \rho a V_1 (V_{w1} R_1 + V_{w2} R_2) \times \omega$$

$$WD/s = \rho a V_1 (V_{w1} R_1 \omega + V_{w2} R_2 \omega)$$

As $u_1 = \omega R_1$ and $u_2 = \omega R_2$, we can simplify the above equation as,

$$WD/s = \rho a V_1 (V_{w1} u_1 + V_{w2} u_2)$$

In the above case always the velocity of whirl at the outlet is given by both magnitude and direction as

$$V_{w2} = (V_{r2} \cos \phi - u_2)$$

If discharge is radial at the outlet the V_{w2} is zero and hence the equation reduces to,

$$WD/s = \rho a u_1 V_1 V_{w1}$$

$$KE/s = \frac{1}{2} \rho a V_1^3$$

Efficiency of the reaction propeller is given by,

$$\eta = \frac{\text{work done per second}}{\text{kinetic energy per second}}$$

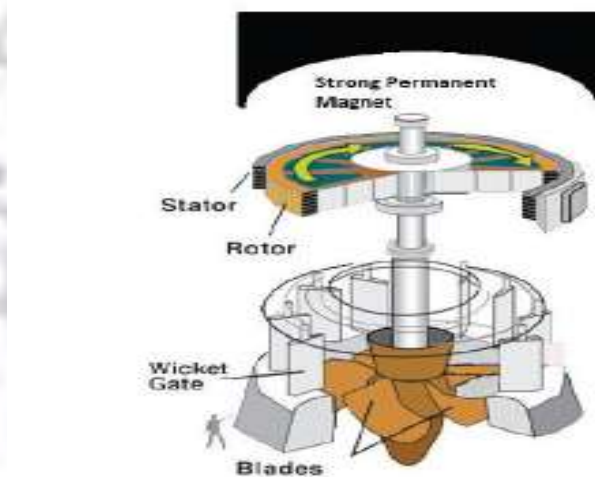
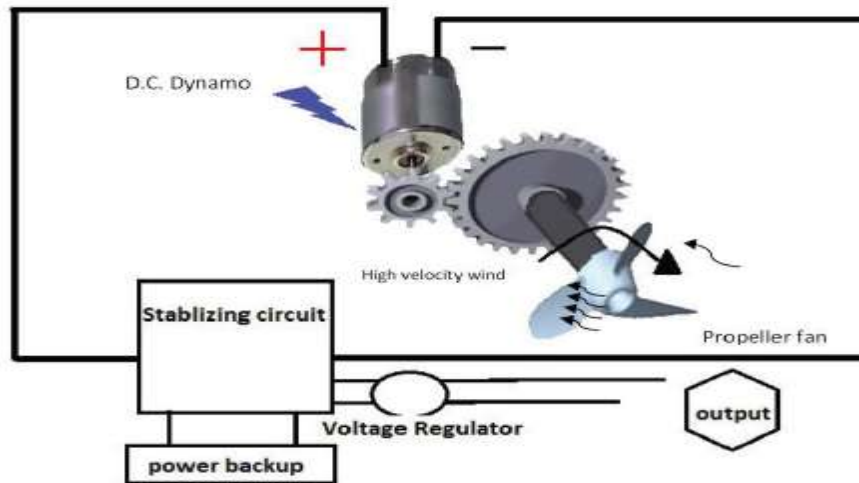
$$= \frac{\rho a V_1 (V_{w1} u_1 + V_{w2} u_2)}{\frac{1}{2} \rho a V_1^3}$$

$$\eta = \frac{2(V_{w1} u_1 + V_{w2} u_2)}{V_1^2}$$

WORKING

The flowing air develops enough torque to move the shaft of the D.C Dynamo, the DC current so generated is fed into the voltage stabilising circuit which also has a power back-up section feeding power to the circuit in case the power generated by the DC Dynamo is less than the required output circuit. The power back-up circuit consists of three A1 Size 2V lithium ion rechargeable batteries. The figure attached explains the total mechanism. The regulator can be used to vary the output as per the requirement to charge the mobile phones, iPods, Digital Cameras and even laptops. A very strong permanent magnet at the base of the whole closure make sure that the total apparatus sticks to the iron body of the vehicle we are in.

FIGURES AND DIAGRAMS



The complete model with sticking base magnet

BENEFITS

- [1]. The whole system is hundred percent practically applicable and would become every common man's requirement once it comes to existence.
- [2]. The system makes an individual independent of all his dependencies on the public bodies for providing his power needs while on move.
- [3]. It is 100% environment friendly and requires zero maintenance cost. Even the power produced is free of cost for the user.
- [4]. The increase in air drag in the vehicle is negligible as even larger amount of air drag is experienced by the vehicle due to windows so it does not affect the mileage of the vehicle or its efficiency.