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AN EXPERIMENTAL STUDY OF GENERATION OF ELECTRICITY USING SPEED BREAKER

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ABSTRACT

One of the most crippling problems of India is lack of electricity. Expanding electrification and scaling up electricity services is critical to both the economic and social development of India. The current state of electricity services across India can be said to be acute, if not in a crisis mode. In the present work an attempt is to be made to fabricate a ramp, by which we can utilize the kinetic energy in power generation. The goal of this study is to propose a setup for power generation which can be used in metropolitan cities as a speed breaker (ramp) so that when the vehicle passes over the ramp, the kinetics energy developed can be converted in the power generation. This provides a starting point for utilities in developing countries to better plan and to overcome from the existing electricity problem up to some extent**.**

KEY WORDS: Kinetic Energy, Speed Breaker (Ramp), Electricity.

INTRODUCTION

Electricity supply in India has been lagging in terms of service (measured by hours of supply) as well as penetration. Only 31% of the rural households have access to electricity, and the supply suffers from frequent power cuts and high fluctuations in voltage and frequency, with so-called blackouts and brownouts [1, 2].

Erratic and insufficient electricity supply has long been a serious obstacle to higher economic growth in India. In 2002, power generation capacity stood at 120,000 MW which is far below peak demand,[3,4] notwithstanding that total electricity generated rose from 290 TWh to over 500 TWh between 1990 and 2000/2001. Of this generated electricity, thermal capacity accounts for 71 percent, hydropower for 25 percent, nuclear energy for 3 percent and wind energy for 1 percent.[5] (Fossile fuels are not used to generate electricity).

The standard of Living and industrialization leap up the pressure on the conventional sources of power. Depletion of conventional sources becomes a problem in present world. And ever rising cost of conventional fuel may be major impediment in economic and social growth of third world nations. All the developing and developed nations are searching for new and newer sources of energy and its efficient use. Moving towards modernization, luxuries become necessities which lead the people towards the need

of personal vehicle thus contributing to the substantially increased traffic density. This increased traffic density can be utilized for generation of Electricity by using an innovative Technique.

In the present work an attempt has been made to fabricate a ramp, by which we can utilize the energy in power generation. This may further be used in battery charging.The efficiency of our machine is very less. It is seems a very small number but if we think in terms of number of vehicles and time it will be a huge amount of energy saved. This type of ramp is best suited for the places where the speed breaker is a necessity. The places like Toll bridges and vehicle parking stands are best for its utilization.

Experimental Setup

An iron roller is fixed on a wooden ramp on which vehicle passes. As vehicle passes over it, it starts moving. A linkage is provided which transfer the motion to a DC motor for electricity generation. All parts are described in detail on their respective places.

FRONT VIEW

LEFT SIDE VIEW

Fig 1: Experimental Setup Main Parts Their Specifications

Table 1: Specifications of Wooden Ramp

Sr. No.	Parts	Dimensions(mm)
1	Wooden board	480 * 250
2	Platform	245*120
3	Thickness of board	18
*Platform inclined at 15 degree from ground from both sides		

Table 2: Specifications of Metal Roller

S. no.	Parts	Dimensions(mm)
1	Outside diameter of metal roller	140
2	Inside diameter of metal roller	130
3	Length of roller	305
4	Diameter of shaft	30
5	Thickness of metal strip	5
6	No. of metal strip	16

Table 3: **Specifications of Chain and Sprocket Mechanism**

Sr. no.	Part	Dimensions (mm)
1	Diameter of Driving Sprocket	120
2	Diameter of Driven Sprocket	70
3	Length of Chain	800
4	Pitch of the Chain	10

Table 4: Specifications of Pulley and Belt

Sr. no.	Parts	Dimensions (mm)
1	Diameter of Driving Pulley	200
2	Diameter of Driven Pulley	55
3	Length of Belt	1425

RESULTS AND DISCUSSIONS

An experimental setup is fabricated as shown in fig 1. Table 1 to table 4 shows the specifications of various parts which are used to fabricate the setup. As the vehicle passes over the ramp, there‘s is a surface contact between vehicle tires and roller, which will tend to rotate the roller, it is free to rotate as it is supported on bearings which are mounted on T-shape supports which are bolted to wooden base.

Mathematical Model

w_1 = Angular Speed of Vehicle Tire (rad/sec)

w_2 = Angular Speed of Roller (rad/sec)

d_1 = Diameter of Tire (mm)

d_2 = Diameter of Roller (mm)

v = Velocity of Vehicle (m/sec)

I = Moment of Inertia of Roller (pipe)

Do = Outside Diameter of Roller (mm)

Di = Inside Diameter of Roller (mm)

V = Voltage (volts)

I = Current (Ampere)

T = Time (seconds)

R = Rotational Kinetic Energy of Roller (Joules)

E = Electrical Energy (Joules)

And $v=r*w$ (1)

Moment of Inertia of Roller, $I= (3.14*(d_o^4-d_i^4)) / 64$ (2)

Rotational Kinetic Energy of Roller= $(I*w_2*w_2) / 2$ (3)

Electrical energy= V*I*t. (4)

Efficiency=Electrical Energy / Rotational Kinetic Energy (5)

Table 5: Summary of Experiments Carried Out on Mechanical Apparatus.

Serial No.	Velocity of vehicle (m/sec)	Angular speed of vehicle tire(rad./sec)	Angular speed of roller (rad./sec)	Rotational kinetic energy (Joules)
1	2.78	0.00926	0.0336	4541
2	3.32	0.01108	0.0401	6469
3	4.155	0.0138	0.0503	10057

Table 6: Summary of Experiments Carried out on Electrical Apparatus

Serial No.	Rotational kinetic energy of roller(J)	Voltage (volts)	Current (ampere)	Time (seconds)	Electrical energy(J)	Efficiency (percent)
1	4541	5	0.8	4	16	0.4
2	6469	5.5	1	4	22	0.45
3	10057	6.4	1.2	4	31	0.48

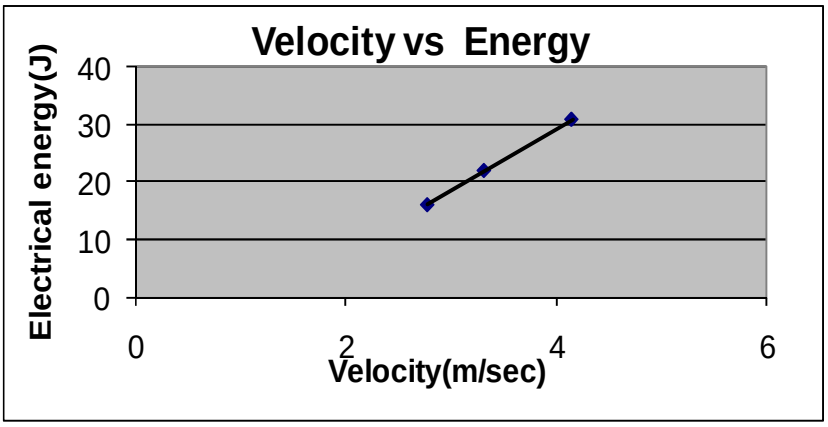

Fig2 : Electrical Energy V/S Velocity of Vehicle Ove the Ramp

Table 5 indicates the results of mechanical apparatus when the vehicle is passing over the ramp. Angular speed and corresponding rotational energy is calculated using equation no. 2 and equation no. 3.Table 6 indicates the results of electrical apparatus which shows the electrical energy (E) corresponding to the rotational kinetic energy(R). Fig 2 indicates that as the velocity of vehicle increases, electrical energy also increases linearly. It is also evident from table 6 that the efficiency is very low but it is also noteworthy that above showed results is the outcome when only one vehicle is passing over the ramp. In actual practice number of vehicle will pass over the ramp so consequently the efficiency will increase.

CONCLUSIONS

It can be concluded that, electricity is generated using the setup. It is observed that on moving a vehicle over the roller speeds varying from 10-15 km/hr, And in this region 5-7 volts is being produced. Speed Vs energy plot shows that energy produced is directly proportional to speed but there will be a limit of Mechanical Instruments.

The efficiency of air set ups is about 0.4 to 0.5%, which seems a very small value but if we see it in terms of numbers of vehicles passed per unit time, there will be huge amount of energy saved.

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