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TRAIN AXLE POWER GENERATION

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ABSTRACT

This project aims at production of electricity by using the concept of the rotation of secondary shaft due to the primary railway axle caused by the moving train by using an electrical power generation system. This device could be placed along railway bogies or locomotive axles. An electrical power generation system comprises a variable capacitor and a power source. The magnetic coupling here by used will transfer power from locomotive axle to the generator shaft without contact that will implies no contact / friction load on railway locomotive shaft. That will beneficial for power generation without altering or damaging ongoing system.

Index Terms – Wiper Motor, magnet , Frame, Wheel, battery etc.

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I. INTRODUCTION

Now days, electricity has become a need of every single human, demand of electricity increasing day by day. This new generation needs lots of electrical power for their different operations. Due to this many sources are wasted and exhausted in a large amount. There are various ways to generate electricity. The human bio-energy being wasted if it can be made possible for utilization it will be very useful energy sources. The human waste foot energy is being used to produce electricity this would be a great evolution in electricity generation. The average human can take 3,000 - 5,000 steps a day.

The main objective is to build a power generation system such that it can contribute to the present power generation system as the need of energy is growing day by day. The generated power is eco-friendly as well as inexhaustible means the power can be generated as long as the railways are in function. This can be achieved by utilizing the energy resources along the railway tracks i.e., by utilizing the mechanical energy supplied by both wind gusts from train as well as mechanical energy supplied by the train when it is in motion. The proposed technique relates generally to generating electricity and, more particularly, to a method and a system for generating electricity along a railroad track. Many known railroad systems employ a variety of wayside equipment alongside the railroad tracks.

Within a network, railroad tracks often span rural and unpopulated areas, and as such, providing power to wayside equipment in remote locations may be a challenging and costly task. At least some known railroad systems run power lines into remote areas to power wayside equipment. However, depending on the location, such power systems may be expensive to install and to maintain. Unfortunately, traditional automated devices generally obtain operating power from an external power source, which is not generally available in remote areas. That is, the automated device receives operating power that is generated at a remote location and that is delivered over a power grid, and coupling the grid to the device can be a costly proposition, especially in remote areas. In certain instance, local power sources, such as batteries, have been employed. In any event, even if a local or external power source is provided, these power sources may not provide a cost effective mechanism for producing sufficient levels of power for operation of the automated testing devices. Therefore, there is need for a system and method for improving electric power generation with respect to rail systems.

A magnetic coupling uses permanent magnets to transmit torque between an input and output shaft without mechanical contact. Torque densities comparable with mechanical gears can be achieved with an efficiency >95% at full load and with much higher part load efficiencies than a mechanical gear. For higher power ratings a magnetic gear will be smaller, lighter and lower cost than a mechanical

gear. Since there is no mechanical contact between the moving parts there is no wear and lubrication is not required. Magnetic gears inherently protect against overloads by harmlessly slipping if an overload torque is applied, and automatically and safely re-engaging when the fault torque is removed. provides a unique ability to convert an applied mechanical train into an electrical potential or vice versa. Our project includes how to utilize the energy which is wasted, creates pollution to the environment. The sound energy of the moving train wheels which is nothing but pollution can be converted into electrical energy with the help of train axle power generation.

II. LITERATURE SURVEY

1) Electricity through Train Paidimukkula Bhanu Chaitanya1, Gedda Gowtham2

This paper aims at production of electricity by using the concept of the rotation of wind turbine due to the wind caused by the moving train and also by using an electrical power generation system. As anyone living near railway tracks will tell you, speeding trains generate quite a bit of wind as they whoosh past. The idea is to design a wind turbine that can be installed between the sleepers on a track, and as the train passes overhead, the wind drives a turbine to generate electricity. This device could be placed along railway or subway lines, and make good use of an otherwise wasted resource. An electrical power generation system comprises a variable capacitor and a power source. The power source is used in the form of a generator to prime the variable capacitor that effectively multiplies the priming energy of the power source by extracting energy from the passing vehicle. By alternately priming the variable capacitor using charge from the power source and discharging it at a later time in a cyclic manner to change the capacitance, a significantly large amount of electrical energy is produced due to change in capacitance.

2) A Unique Step towards Generation of Electricity via New Methodology Itika Tandon1, Alok Kumar2

In this paper we are representing the methodology of electrical power generation using human footstep. This is about how we can generate electricity using human's waste foot energy and applications for the same. When human walk in surroundings some force exerts on surface this force can be used to generate electricity. The idea of converting pressurize weight energy into the electrical energy is possible by piezo-electric crystal. The power generating floors can be a major application if we use piezoelectric crystals as an energy converting material. The piezo-electric crystals have crystalline structure and ability to convert the mechanical energy (stress and strain) into the electrical energy. Whenever there is some vibrations, stress or straining force is exert by foot on floor then these crystals evenly converts it into electric power which can be used for charging devices viz laptop, mobiles, electronic devices etc. In this paper, we are discussed about applications and generation of electricity in the area of power harvesting.

III. PROBLEM STATEMENT

- Design and develop a prototype model of showing the concept of railway electricity power generation through magnetic coupling which will show the working of application of electricity production by motor generator on secondary shaft coupled using non-contact magnetic coupling with prime mover axle shaft of railway locomotive or bogie.
- Also fabricate the model of the same which will show the working desired by it using a 12 volt motor generator by using its driving energy from main axle of railway bogie through a magnetic coupling designed using permanent magnets.

IV. PROPOSED SYSTEM

The system used its driving energy through an input electric motor which drives a shaft to show the rotational motion of the railway axle. The wheel is provided to show the working of railway wheel which also stores the inertia energy of shaft which drives the system. In between the shaft a permanent magnetic coupling is provided which will transfer through rotational energy from driving shaft to the DC motor generator shaft.

This coupling uses the disc coupling formed by two discs on whos circumfrrence of it the permannet magnets are placed. The magnets emplies the toeque force onto eact other by magnetic force of attraction and by thus when driving shaft is rotated by motor simultaneously the generator shaft also starts moving due to magnetic coupling.

By thus we provide rotational motion to the DC motor generator which will convert the rotational mechanical energy into electrical energy. Which is indiacted by a LED which glows when elecrticty is produced by generator motor.

The whole construction is done on a base frame fabricated using L angle mild steel channel. The magnetic disc coupling are also formed using mild steel circular plates and permanent magnets are placed on periphery of it. The motors are placed at ends of shaft and fitted to base frame.

V. DESIGN AND CALCULATION

DESIGN

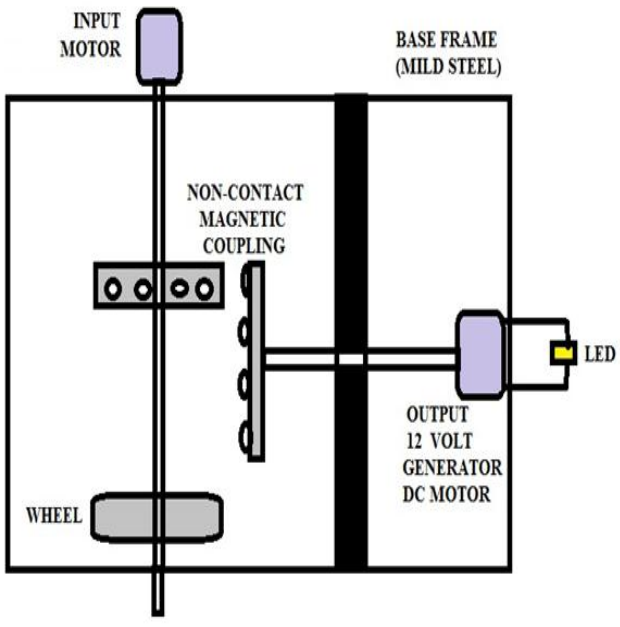


Fig. Block Diagram

DESIGN

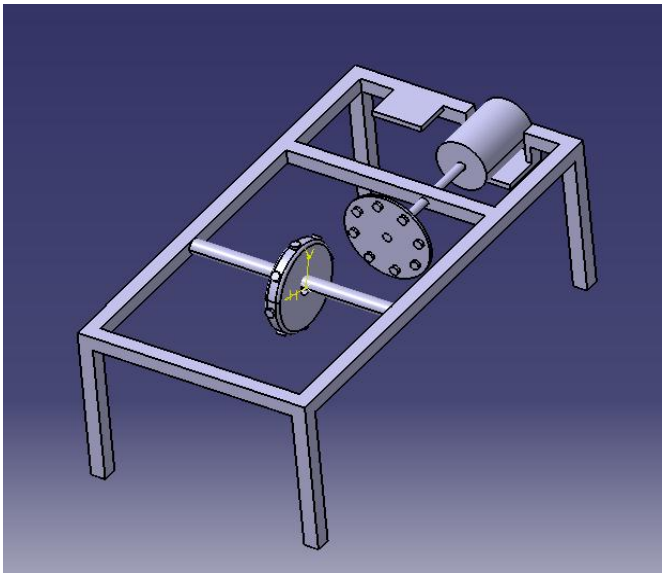


Fig. Cad design of train axle power generation on Catia

CALCULATION

Design of Frame:

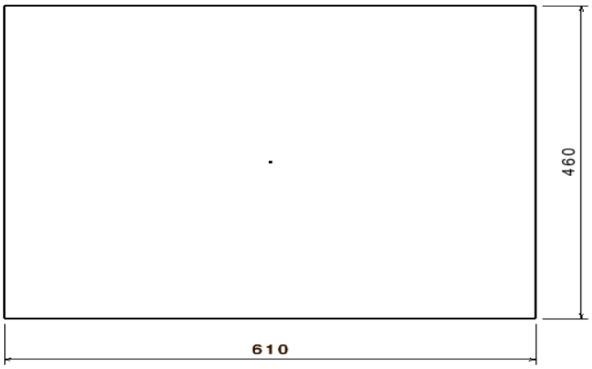


Figure 5.1.1: Frame

Frame design for safety FOR 20*20*3 L angle mild steel channel

b = 20 mm, d= 20 mm, t = 3 mm.

Consider the maximum load on the frame to be10 kg.

Max. Bending moment = force*perpendicular distance

= 10*9.81*305

M = 29920.5Nmm

We know,

M / I = σb / y

M = Bending moment

I = Moment of Inertia about axis of bending that is; *Ixx*

y = Distance of the layer at which the bending stress is consider

(We take always the maximum value of *y*, that is, distance of extreme fiber from N.A.)

E = Modulus of elasticity of beam material.

I = bd3 /12

= 20*20^3 / 12

I = 13333.333 mm4

σb = My / I

= 29920.5*10 /13333.333

σb =22.44N /mm2

The allowable shear stress for material is σallow = Syt / fos

Where Syt = yield stress = 210 MPa = 210 N/mm2

And fos is factor of safety = 2

So σallow= 210/2 = 105 MPa = 105 N/mm2

Comparing above we get,

σb<σallow i.e 22.44< 105 N/mm 2

So design is safe.

Motor selection for wheels

Given

Diameter for SHAFT=15 mm

Weight on SYSTEM is=10 kg

Torque required for motor

Torque=force*RADIUS OF SHAFT

=10 *9.81*7.5

=735.75 Nmm

=0.73575Nm

=7.3575kgcm

So torque required for seeder motor is =25 kgcm

Therefore we are selecting motor with 25kgcm torque.

Power output of DC motor is =voltage *current

=12*0.8

=9.6 watt

Power=2*pi*N*torque/60

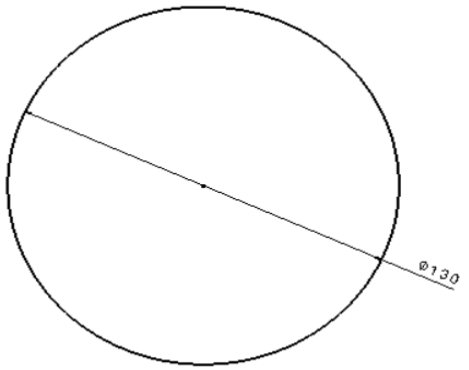
9.6=2*pi*N*7.3 /60

N=12.55 rpm =20rpm

But RPM is 10,20,30,55

So we will select RPM OF 30.

Design of disc



- $\frac{M}{I} = \frac{\sigma b}{y}$ **……(1)**

Bending moment(M)=force *perpendicular distance

=10*9.81*65

Bending moment(M)=6376.5Nmm

- **I=** $\frac{(M(R^2))}{4}$

$= \frac{(10*9.81(65^2))}{4}$

=103618.125mm4

- Y= $\frac{130}{2}$

=65

Therefore above value use in equation no(1).

$\frac{6376.5}{103618.125} = \frac{\sigma b}{65}$

Therefore, σ_b=4Nmm

σb<σallow i.e 4< 105 N/mm 2

Hence design is safe.

VI. CONCLUSION

There are many places which use electricity and thus those places are responsible for not proper usage of electricity. The ability to transmit power without contact whilst continuing to transmit mechanical power from one to the other makes these couplings ideal for applications where prevention of cross contamination is essential. A lot of energy is being used for various purposes and no one actually has a count of how it is wasted. One such huge form of energy is Electricity. Electricity is generated from various sources and is been used for various activities. There is no regulatory body which is concerned about the wastage of Electricity.

We are using the principle of magnetism which transmits the rotational mechanical energy of first shaft in equivalent rotational energy of second shaft. Which can be converted into electrical by generator and can be stored in batteries and used whenever and wherever required. We can use this electrical power as a free service in railways like water service, lighting, HVAC (heating ventilation and air conditioning).

ACKNOWLEDGEMENT

An acknowledgement section may be presented after the conclusion, if desired

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