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POWER GENERATION FROM RAILWAY TRACK

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Abstract - *In this project, we generate power by energy harvesting arrangement from railway track for powering lighting and signaling apparatus in railway stations as well as track side equipments. Today there is a need of non-conventional energy system to our nation. The energy obtained from railway track is one such source because there is no need of any type of fuel in this energy generating arrangement as an input to generate the output in the form of electrical power. The mechanism includes components such as flap, rack and pinion, gears, freewheel, flywheel, DC generator, filter and boost circuits and battery. The main focus of this arrangement is the harvesting of large amount of power from railway track which can be used to power the track side infrastructures which has power rating up to 8 to 10 watts or more. As this energy production technique is simple ,cost effective ,non-conventional and non-polluting, it has wide scopes in the mere future .*

***Key Words*: Energy Harvesting, Energy, Infrastructure, Rail Road.**

1. INTRODUCTION

Railway transportation which includes commuter rail and metro plays an important role in the economy of our society as well as our everyday quality life. In order to create a bustling railway transportation system, it is essential that railway track-side equipment (signal lights, wireless communication monitoring devices, positive train control, etc.) are well maintained and operated. If the functioning of these railway-side track equipment can be done by using the energy harvested from these same tracks, its the best case imaginable. When train moves over the track, the track deflects vertically due to load exerted by the trains bogies. The vertical displacement of the track under the weight of a passing train can be connected to regenerative devices i.e. a vibration energy harvester. The generated power can be stored into the battery and used to power track-side equipments. Railroad energy harvesting doesn't have even trivial disturbance to atmosphere or rail-transportation system. The mechanical motion converter in our design presents a flywheel integrated along the output shaft. The flywheel is designed for maintain the generator speed close to optimal value. Thus the electrical generator will no longer operate at discontinuous speeds. Therefore energy production efficiency is slightly increased . The flywheel also enables the harvester to produce more continuous DC power output without using electrical converter component . This type of continual power output can be smoothly utilized. We can harvest large amount of energy from rail-track and this power can be employed in order to operate railway side-track equipments which has power ratings of about 8 to 10 watts or more. To accomplish this goal, an electromagnetic based harvester can be considered as the most effective .

It is observed that the need for electrical power is very high. We are assigned the responsibility to discover new ideas as well as techniques for power generation in order to meet this demand. Law of conservation of energy states ," Energy can neither be created nor be destroyed, but it can be transformed from one form to another". This technique of power generation thus provides us a way to transform vibrational energy lost to ground to electrical energy which is highly beneficial. It can be used to activate railway station equipments like light, fan, signal light etc. we can implement this proposed system at both railcar entry point as well as leaving point in the railway station.

We can set up this energy harvesting arrangement in different areas such as foot step at school as well as colleges ,speed breaker arrangements in highways etc for generation ways of electrical energy. Thus the power production rate is increased and demand at particular area can be fulfilled.

2. BLOCK DIAGRAM

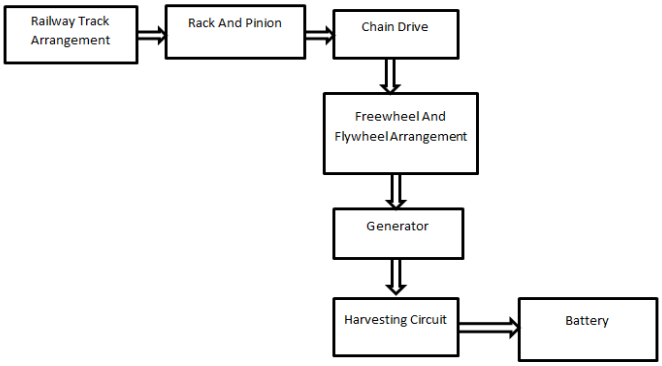

Fig.-1: Block Diagram of Power Generation from Railway Track

3. HARDWARE DESCRIPTION

3.1 Railway Track arrangement

A railroad or railway is a track where the vehicle travels over two parallel steel bars, called as rails. The rails support &

guide the wheel of the vehicles, which are traditionally either train or trams.

3.2 Rack and Pinion

Rack & pinion is a type of linear actuator that comprises a pair of gears which convert rotational motion in to linear motion.

3.3 Chain Drive

Chain drive is used for transmitting mechanical power from one place to another place. It is often used to convey power to the wheel of vehicle. The power is transmitted by roller chain, known as the chain drive.

3.4 Flywheel

A flywheel is a rotating mechanical device that is used to store rotational energy and also maintain the constant speed. Flywheels have moment of inertia and thus resist changes in rotational speed. The amount of energy stored in a flywheel is proportional to the square of its rotational speed. Energy is transferred to a flywheel by application of a torque to it, thereby increasing its rotational speed, and its stored energy.

3.5 Freewheel

In mechanical or automobile engineering a freewheel or overrunning clutch is a device in a transmission that disengages the driveshaft from the drive shaft rotate from the driven shaft when the driven shaft rotates faster than the driveshaft. An overdrive is sometimes mistakenly called as freewheel.

3.6 DC Generator

An electrical generator is a device that converts mechanical energy to electrical energy, generally using electromagnetic induction. The source of mechanical energy may be a reciprocating or turbine steam engine, water falling through a turbine or waterwheel, an internal combustion engine, a wind turbine, a hand crank, or any other source of mechanical energy.

3.7 Voltage Regulator

The function of voltage regulator is to provide a constant output voltage to a load connected in parallel with it in spite of the ripple in the supply voltage ot the variation in the load current. Voltage regulators are available in a variety of outputs like 5V,6V,9V,12V and 15V. Here we are using 8V LM 7808 V Voltage regulator IC.

3.8 Battery

To charge a battery from AC we need a step down transformer, rectifier, filtering circuit, regulator to maintain the constant voltage then we can give that voltage to the battery to charge it. If you have only DC voltage and charge the lead acid battery, we can do it by giving that DC voltage to a DC-DC voltage regulator and some extra circuitry before giving to the lead acid battery.

4. EXPERIMENTAL SETUP

Fig.-2 Experimental Setup of Generation of Power Using Railway Track

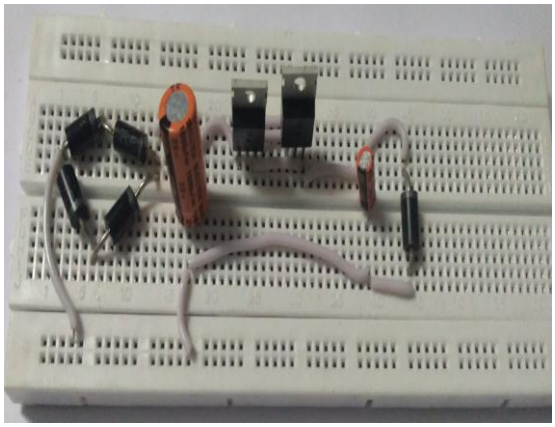

Fig.-*3* Harvesting Circuit

5. WORKING PROCEDURE

As the train passes over the railway track the load acts upon the flap placed over the track or the plant setup. It is then transmitted to rack and pinion arrangement as well as the chain sprocket arrangement. The reciprocating motion of the track is converted into rotary motion with the help of rack and pinion arrangement. The rotatory motion is then fed on to the gear drives which transfers this motion to the other shaft where chain sprocket and flywheel is mounted. The generator is coupled to freewheel placed in outer shaft .The flywheel performs two functions : stablize the rotation of outer shaft , increase the speed of shaft of generator coupled to it to optimum value . This speed which is sufficient to rotate the rotor of a generator is fed into the generator where an electro motive force is produced that generates electricity.

This electrical power produced can be stored to a battery after passing through filter as well as boost circuit. The generated power can be used for powering lighting as well as signaling equipments in railway station .It can also be transferred to grid which can be used to light rural areas. This will be a great boon for the rural villages too.

6. CONCLUSIONS

This project proposes a power generation technique from railway tracks. This type of power generation is found to be cheaper than many other alternatives and the model has less number of parts and the assembly would cost very less with all the components being readily available.

It is observed that the need for electrical power is very high nowadays and we are given the responsibility to discover cutting edge techniques which helps in the smooth ,efficient and effective generation of electric power . This is a non-conventional method which is cheap, cost effective and has no adverse effect on environment and can be used to provide power for lighting as well as signalling systems in railway stations. The energy harvested can also be transferred to a grid which can be used to activate lighting equipments in rural areas. By taking into account the advantages of this energy harvesting technique and the simplicity of manufacturing it and implementing it, this method can considered as one of the most effective non-conventional energy harvesting technique that can be implemented in the future. In a country like India where the railway network is widely spread ,this type of energy generation technique has immense potential.

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