

GENERATION OF ELECTRICITY BY CRANK MECHANISM METHOD IN RAILWAY TRACK

Abhinav Raj^{1*}, Ashish Verma¹, Himanshu Joshi¹,
Mitra Gupta¹, Jiyaul Mustafa²

¹B.Tech Students, School of Mechanical Engg, Galgotias University, Greater Noida, India

⁵Assistant Professor, School of Mechanical Engg, Galgotias University, Greater Noida, India

ABSTRACT

Renewable source of energy has its own importance as it is important for sustainable development. It is important to establish some new techniques so that energy must be conserved. These new techniques should promote sustainable energy including renewable energy source to improve energy efficiency. This paper explains how to tap energy and led to the production of electricity. Generation of electricity through railway tracks is one of the most recent electricity generation concepts. In this system, as the train passes over railway tracks, a load occurs and the spring interconnected with metal track gets compressed. Due to this, a motion starts in rack and pinion mechanism and chain drive. This motion when passed through flywheel, rectifier and DC motor leads to the generation of electricity. This proposed system can result in heavy production of electricity and is a great renewable source of energy. For becoming materially rich and prosperous, a human being needs to consume more and more energy and this renewable source of energy is the best source of energy that we get in day to day life.

KEYWORDS: Crank Mechanism, Chain Drive, Electricity, Rectifier.

I INTRODUCTION

Indian Railway is a state owned national transporter, responsible for rail transport in India. It operates both long distance and suburban rail systems. It ran on average 13,313 passenger trains daily in 2015-16. Railway is not limited to means of communication but could be answer of new type of electricity generation [1-9].

The main purpose of this paper is to generate electricity without disturbing the ecosystem. Generation of electricity through railway track is one of the most recent electricity generation concepts. This device is engineered as a practical and useful alternative energy technology for generating clean electricity from the trains passing through railway tracks. Once fully optimized and installed, engineers anticipate that devices may be used to augment or replace conventional electrical supplies for powering lights at station or halts which will reduce the chances of accident.

Bharthi et al. [1] suggested that generation of electricity using high wind pressure generated by fast moving vehicles channeling the induced wind in the direction of the wind turbine. It was converting the energy of the wind into mechanical energy by using wind turbine and converting the mechanical energy into electrical energy by using a generating device. S. Jagdale et al. [2] were explained an innovative and new method of generating energy in a fast moving vehicle (especially train). The wind energy produced by trains is wasted and can be utilized for generation of electricity. Kinetic energy of the wind which is created is used to generate electricity. Ramanathan et al. [3] suggested about hybrid power generation and automatic railway gate control. They deal the trends in the growth of renewable in India and establishes diffusion model as a basis for setting target. The diffusion model is fitted to the past trends for wind, small hydro and solar water heating and is used to establish future targets. The wind energy potential has been estimated as 45,000MW assuming 1% of land availability for power generation in the potential areas.

N. Fatima and J. Mustafa [4] were suggested about production of electricity by method of Road power generation. Road Power Generation (RPG) is one of the most recent power generation concepts. This device converts the kinetic energy of the vehicles into electric energy by installing moving plate on the road, it takes the stroke motion of the vehicles and converts it to the rotary motion by crank mechanism and it generates the electricity. Chaitanya and Gowtham [5] were told about 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. 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. Sujata M. Tupe et al. [6] were explained the method of generating energy through moving train by using windmill. The method for generating electricity is by tapping wind pressure generated by moving train through windmill. The turbine converts wind energy into mechanical energy and this mechanical energy is converted into electrical energy.

II. SCOPE OF THE PAPER

There are almost 14,300 trains operating daily on 67,000 route kilometers of railway in India. This technique would be capable of producing power in almost 500 to 1000 megawatt (MW) of power in India alone. More use of renewable source of energy will lead to sustainable development. A survey states that over 100 of halts in Bihar and Uttar Pradesh do not have any facility of lighting at night due to which passengers face difficulties in boarding [3-7]. Supply of electricity in villages is very low. Hence, more research and development is needed in this field. 'Generation of electricity by crank mechanism method in railway track' is a method with which electricity will be produced in a very efficient manner. With the continuous passing of train, the generation of electricity will take place and will eradicate the problem of darkness at small stations or halts.

III METHODOLOGY

There are following steps used for generation of electricity by crank mechanism method through railway tracks given below:

3.1 Materials Required

In this section, there are various materials used for generation of electricity through railway track. The main equipment used is as follows: metal railway track, helical spring, rack and pinion mechanism, chain drive, flywheel, gears, and DC generator.

3.2 Working Principle

Railway track electricity generation is a system designed to generate electricity by the load applied by trains on track. It converts mechanical energy into electrical energy. As the train passes through the railway track, a load is applied on the track due to which the helical spring present below it gets compressed and provides a motion to rack and pinion mechanism. From there, the motion is transferred to chain drive. The motion mixes with stored energy of flywheel and passes through rectifier. Through gears, it reaches to DC generator. A reading can be taken on multimeter showing generation of electricity.

3.3 Procedure

In the process of generating electricity, first of all, a load is applied on railway track. Due to this loading, helical spring gets compressed. A motion is generated between rack and pinion mechanism and chain drive starts rotating. Flywheel used to store energy starts working and motion is transferred to rectifier. Through gear, motion is passed onto DC generator, thus generating electricity. A flow chart showing generation of electricity through railway track is shown in Fig.1. A similar power generation system constructed by Delhi Metro Railway Corporation is shown in Fig.2.

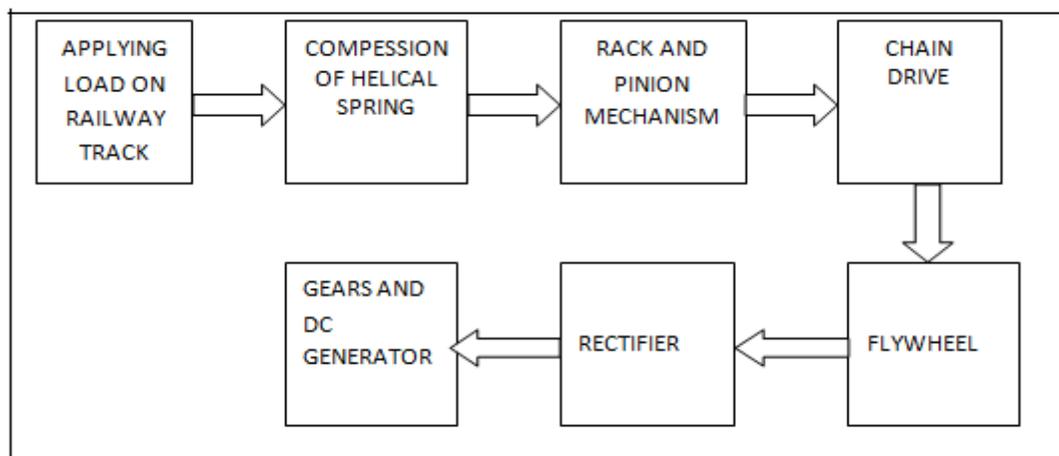


Fig.1. Block Diagram of Generation of Electricity through Railway Track



Fig. 2. Working construction in Delhi Metro Rail Track for Generation of Power [5]

IV . ADVANTAGES

- (i) A very cheap method of generating electricity.
- (ii) One time installation charges.
- (iii) Useful for isolated station and halts where problem related to lighting still exist.
- (iv) Less noise is produced.
- (v) The units have minimum visual impact on their surrounding environment.

V . CONCLUSION

Generation of electricity by crank mechanism method in railway track is an alternate source of energy. It uses the load of train exerted to railway tracks to produce electricity. It converts mechanical form of energy into electrical energy. This proposed system is highly useful for coming generation of power in India. With one time installation of equipments, it will provide electrical energy for a long period of time in a very efficient manner and at very low cost. More the number of trains pass over the system, more the generation of electricity.

In future, we can also generate electricity from vibrations on sleepers beneath the railway tracks with the proper usage of piezoelectric crystals. This can be used in nearby railway stations for working of various electrical appliances. The energy created will be at cheaper rate and will be pollutant free.

VI. ACKNOWLEDGEMENT

We are highly thankful to our guide Mr. Jiyaul Mustafa, Assistant Professor, Department of Mechanical Engineering, Galgotias University, Greater Noida, India, for guiding us to get through the bottleneck encountered during the work.

REFERENCES

- [1] S.Bharathi, G.Balaji and M.M. Kumar, A Method for Generating Electricity by FastMoving Vehicles, *International Journal of Computer Network and Security*, 4(15),2016.
- [2] S. Jagdale, K. Deshmukh, A. Patil, and H. Sonawane, Production of Electricity By Fast Moving Vehicles (Especially Trains), *International Journal of Electrical, Electronics And Data Communication*,4(11),2016
- [3] M.Ramanathan, S.Santhosh, M.Prabu, R.Yuvaraj, and C.Pazhanimuthu, Hybrid Power Generation and Automatic Railway Gate Control, *International Journal for Research in Applied Science & Engineering Technology (IJRASET)*,3(4), 2015.
- [4] Noor Fatima and Jiyaul Mustafa, Production of Electricity by the method of Road Power Generation, *International Journal of Advances in Electrical and Electronics Engineering*,1(1)2012,9-14.
- [5] P.B.Chaitanya and G.Gowtham, Electricity through Train, *IOSR Journal of Electrical and Electronics Engineering*, 10(1),2015.
- [6] S.M.Tupe,D.P.Chavan,C.P.Avhad, and A.K.Pathak, Power Generation through Wind created by Moving Train,*International Journal of Advances in Electrical and Electronics Engineering*,2(2),2016.
- [7] Nelson, C. A., Platt, S.R, Albrecht, and D., Kamarajugadda, V., and Fateh, M., Power harvesting for railroad track health monitoring using piezoelectric and inductive devices, *Proceedings of the SPIE*,1,2008, 69280R-69280R-9.
- [8] Hansen, S. E., Pourghodrat, A., Nelson, C. A., and Fateh, M., On-track testing of a power harvesting device for railroad track health, *Proceeding of the SPIE*, Vol.7, 2010.
- [9] John J wang, G.P Penamalli and Lei Zuo, Electromagnetic Energy Harvesting from Train Induced Railway Track Vibrations, *IEEE*, (7) 2012, .29-34.
- [10]H.Abramarich, E.Harash, Milogram, and Amit, Azilay, Power Harvesting from railways; apparatus, system and method , *US patent 7812508*, 2008.