

ICSD/45

DESIGN OF LIGHT GENERATING MECHANISM USING GRAVITY

Rasika Shelar

Department Mechanical, New Horizon Institute of Technology and Management, Thane,
India

Essha S. Shinde

Department Mechanical, New Horizon Institute of Technology and Management, Thane,
India

essha397@gmail.com

Charushila Sarate

Department Mechanical, New Horizon Institute of Technology and Management, Thane,
India

Sanjana Kulkarni

Department Mechanical, New Horizon Institute of Technology and Management, Thane,
India

Aakarshika Lal

Department Mechanical, New Horizon Institute of Technology and Management, Thane,
India

Abstract

The existing technologies that are used for generation of electricity work on the fundamental principle of converting mechanical energy into electrical output. The source of generating the mechanical output varies. Electricity generated from nuclear, thermal, wind, hydro are the most prominent sources used in present time for generating electricity. The concept proposed and discussed in this paper also fundamentally converts mechanical input to generate an electrical output to power an LED source. The major difference is that it uses gravity as an input. The mechanism operates on gravitational force which is converted into an electrical output that powers an LED source

Keywords: Renewable energy, gravitational field, gravitational potential

1. Introduction

According to the Paris climate agreement many countries are exploring alternative renewable routes for harnessing electricity, and limiting their carbon emission. The scope renewable sector provides is vast and promising as the phase of future however the technologies existing aren't feasible enough to extract their maximum potential. Proving to be less efficient than their non-renewable counterparts. Even though technological advancement might show an accelerated uptrend, in the renewable sector, there are still substantial regions around the world that predominantly survive on sources like biomass and fuels like kerosene to provide basic utilities. Statistical analysis have illustrated that over 713 million people in India and 706 million in

china followed by 575 million people in central and southern Africa formed one-third of the world's population that survived on off grid power generation sources. Even though solar technologies look promising that carries a massive disadvantage. Their output majorly depends on the climate and terrain. Another drawback is that the harnessed power has to be stored in battery. Batteries have a limited shelf life and once they have been utilised to their maximum potential usually ends up in landfills which is already a global environmental crises. It has been found that kerosene lamps have a predominant use in off grid regions and a majority of rural areas. These lamps pose a potent risk to the environment as well as to the human health. The lamps used in rural areas provide no safety, moreover 3percent of world's

CO₂ emissions. A significant source of black carbon the noxious fumes emitted by these dangerous lamps are equivalent to inhaling 40 packets of cigarettes, are solely responsible for intense local warming impact. It has been estimated that kerosene consumes 30 percent of the world's poorest population. Due to the above causes Mr Jim Reeves a pioneer behind gravity light explored an entirely new concept for generating electricity using gravity.

Just as in hydroelectricity where the potential energy of falling water generates electricity, the model he invented uses the potential energy of falling mass to generate electricity that powers an LED lamp. Gravity is the most fundamental forces available in nature and the most predominant force in universe. This force is best described using Newton's law of gravity that states this force is directly proportional to the product of the masses and inversely proportional to the square of the distance between them. According to Einstein this force was considered as a deformity in the space time fabric. In spite being deemed as the weakest of the four fundamental forces in nature its extent in the universe is infinite owing to the inverse relation of the distance parameter. On a macroscopic scale this force is responsible for the formation of the clusters of stars and planets owing to its attractive nature. And on a microscopic scale it is responsible for imparting weight to every matter existing on earth. This property is extensively utilised in the mechanism of generating light.

2. Concept

[1] Gravitational force is utilised to power an led my converting the potential energy stored in the masses into kinetic energy as the masses fall which later gets converted into an electrical output. The mechanism used to achieve this conversion is belt and pulley drive. [2] This design is based on similar principle of clocks with pendulum. There is an anomaly between the weights the clocks carry and the one that is used in this setup. [9] In this paper, a methodology has been designed which shows that gravitational energy can be amplified using perpetual motion mechanism. Thus, this transformed energy can be used as electrical energy. Perpetual motion is a motion that continues indefinitely without any external energy source in practice because of friction. The perpetual motion is an isolated system which violates the first and second law of thermodynamics. Despite the fact, perpetual motion device is physically impossible in terms of laws of physics. And thus, there are many ways to convert this gravitational energy into electric energy. This unit produces positive torque and reduces the negative torque by co-operating

with single directional arms. Further, the kinetic energy is converted into electric energy by transmitting it to a power generating unit. Thus, this power system is used to transmit the electric energy out. Buoyancy is an upward force exerted by fluid that opposes the weight of an immersed object in common, the pressure increases with the depth as a result of weight. Thus, an object submerged in a liquid experiences greater pressure at the bottom of the column than at the top. This pressure difference results into net force that tends to accelerate an object upwards. An object whose density is greater than the fluid in which it is submerged tends to sink. In the situation of fluid static, the net upward buoyancy force is equal to the fluid displaced by the body. [7] Russian Inventor, Mikhail Dmitriev to think about his gravity engine. He has clearly contrived an instrument whereby static gravitational force can be tackle to create helpful vitality. He has worked for a long time creating and testing gravity controlled gadgets and he has been extremely effective in his work. His different outlines depends on the standard of having weights appended to a haggles for those weights to be counterbalanced outwards when falling and balance inwards when rising. On account of the diverse lever arms included, that gives a drive irregularity which causes the wheel to pivot constantly and if the weights are of an impressive size, then the revolution is effective and can be utilized to produce electrical vitality.

3. Methodology

[1] The design proposed in this paper comprises of components; bicycle wheel, bicycle dynamo, gear train of a bicycle, chain, weights, and led light. The assembly includes a bicycle wheel that is used in conjunction with a generator shaft by means of a belt drive. The gear train is mounted on central shaft of bicycle wheel. The chain is mounted on gear train. Two weights are attached at the end of the chain one being responsible for power generation and the other offers dynamic balancing to the assembly, and restricts accelerated descend of the falling weights. The falling weights causes the gear sprocket to rotate which in turn causes the bicycle wheel to revolve as well. This motion of bicycle wheel is transmitted to shaft of bicycle dynamo whose rpm generates desirable electricity. The electricity generated is used to power an led. Thus the principle of this mechanism is the masses should descend as slowly as possible, increasing its time period as long as it is feasible, while the generator turns fast enough to provide the necessary electric output for an led .

[2] This mechanism makes use of a ballast material that stores the potential energy which is later converted by gravity as the weights slowly descent. This design differs from the previous one since the led in use is mounted on an adjustable lamp that can be hung from ceiling or supported in the wall. This paper mainly illustrates the advantages of using a synchronous motor for converting the gravitational energy into an electric output. The output though uses a led it can vary according to the requirement ranging from a battery to sound generating instrument. The coupling circuit contains rectifier, capacitor and an LED. The gear system comprises of smaller gears and larger gears. Larger gears control belt speed, movements, suspension motion. The smaller gears provide input to electric circuit.

[3] This set up consists of crank and pin arrangement bearing variable loads. Two pulleys are used in which the diameter of the upper puller is larger compared to the lower one. These are mounted on a vertical plane. A mini dc generator is connected to a flywheel through pinion. The flywheel offers dynamic balancing of load. The arrangement requires an initial force to overcome the inertia of the setup, once set in motion it would work on gravity. As the load from higher altitude falls to a lower level the load at the lower level gradually moves upward and the chain rotates for certain duration. A gravity conversion unit is used to convert gravity potential energy to kinetic energy.

The main purpose of designing this machine is to utilize the gravitational force and generate electricity that can power the bulbs, CLF, etc. there are different research papers and patents done for various ways to extract electricity and generating power. Pendulum is suspended with a weight and a hinged with spur gear about its equilibrium position. When pendulum is at static position a small push or pull is given and pendulum is displaced from its position. Due to this, gravitational force pulls the pendulum back to its initial position. Permanent magnetic generator is used for generating electricity by converting mechanical energy into electrical energy. There is no commutator and so no direct current can be produced. In this design, a rod is passed through centre of hollow sphere such that there is a symmetric view from all sides. Next a mass is attached to centre rod and a metal strip is attached away from centre rod. The mass is then locked at centre of rod. Now, a float along with mass is attached in such a way that when sphere is filled the mass does not sink and floats on it. As we look from above, there is a mass difference and imbalance in the system. This is created by gravitational force. Thus, power is generated due to gravitational force.

Since, the mass is in right hemisphere the buoyancy force is applied by the float. Thus, both gravity and buoyancy force causes the rotation. The setup consists of fixed wheel and load carrying wire which is mounted on a shaft. The load is then connected on the base of the overall structure. Limiting switch is connected to the bottom of the structure. Micro controller AT mega08 receives information from the limiting switch. It is also used to give the instructions to synchronous motor to rotate anticlockwise. At first, the load is mounted at top of the wheel and shaft is connected with DC generator. The generator generates electricity as the load comes down and touches the limiting switch. The circuit connected with the micro controller closes as soon as the load comes down and touches the limiting switch. An instruction is given to the synchronous motor to rotate. Electricity is generated because of the rotation of the synchronous motor. By using this method we can produce 60-70% of electricity without any manpower or any other resources.

4. Advantages

- One of the most featured advantages of using gravity to generate an electrical output is that this source is abundant in nature and does not vary according to climate or terrain.
- This advantage this mechanism offers is the materials are readily available and they cost less than their PV cells competitor.
- Gravity offers a stable and reliable output for power generation on a small scale.
- Led lamps are more efficient than an incandescent bulb providing more lumens per watt
- The main advantage of using this project is that the elimination of LED or CLF will be done for free of cost with the help of pendulum oscillation and gear mechanism.
- This mechanism can be easily incorporated in off grid regions because all it needs is any form of masses that is available easily around the place of installation.
- It provides flexibility and is user friendly. with no complex machine and heavy machinery
- It provides a higher conversion ratio[3]
- Can be connected in parallel to wind power and solar power generating systems to generate electricity
- By this method production of 60-70% of electricity without any manpower or any other resources is possible.

5. Design Components

Various design prototypes were analysed for the fabrication of model. the material selected for the design of frame is C40. The different components of the model are :

1. Sprocket
2. Pulley
3. Supporting rods
4. Shafts
5. Base
6. Chain
7. Weights

1. Sprocket

Various types of materials are available in the market for the manufacturing of sprocket. The sprocket utilised in the setup is the one used in bikes. Various types of sprocket include cast iron , plastic, steel, stainless steel. Cast iron sprocket is used in the model. Due to its frequent usage in daily products and its cost efficient advantage. On the sprocket a chain will be mounted that will support the required weight.

2. Wheel

The wheel used in the design of common bicycles used on a daily basis. The wheel is made from stainless steel and is used in conjunction with a smaller pulley. The wheel transmits the motion to the smaller pulley via a flat belt.

3. Supporting Rods

The main frame consists of two square rods each of 6 ft dimensions on which the entire mechanism is mounted. These rods are welded to the base frame. The base frame is of rectangular shape constructed from metal rods of square cross section. The individual shafts on which pulley and wheel are mounted are drilled into these supporting rods

4. Shafts

Two shafts of circular cross section are used made of C40 material. These shafts support pulley and wheel respectively, through their rotation motion gets transferred from wheel to pulley.

5. Base

The base supports the weight of the entire model. it is also made from C40 material rods of square cross section. It provides stability and sturdiness

6. Chain

The chain used is bicycle chain made of plain carbon steel, the one used in this model is nickel plated to prevent rust and for aesthetic appeal.

7. Weights

The weights used are metallic slabs of rectangular cross section each of 1kg

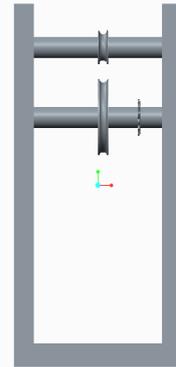


Fig 1.0

Front view of the set up. The pulley mounted on upper shaft and the wheel mounted on the lower shaft. Both the shafts are drilled into the two supporting rods.

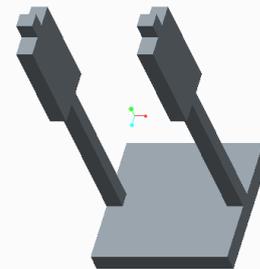


Fig 1.1

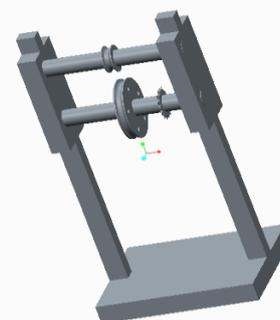


Fig1.2

The setup consists an additional sprocket attached to the lower pulley. On which a bicycle chain would be mounted. On which weights will be attached

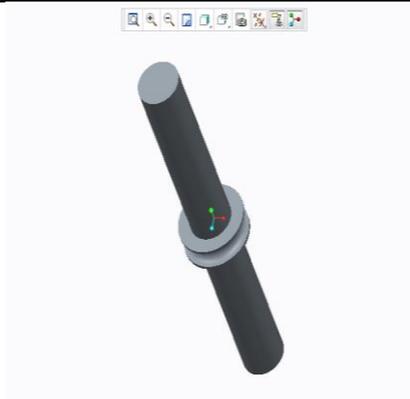


Fig1.3

The individual shaft on which pulley is mounted. It is of circular cross section.

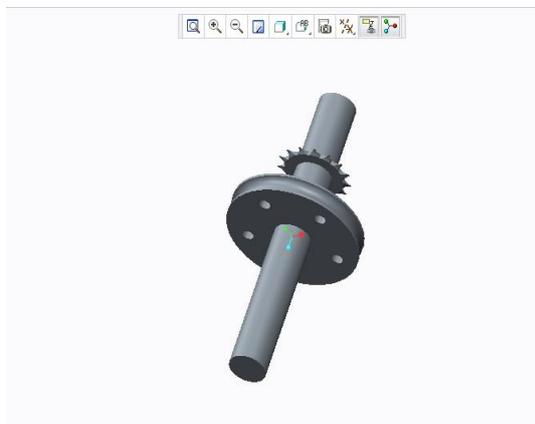


Fig 1.4

The individual shaft on which the pulley and sprocket is mounted.

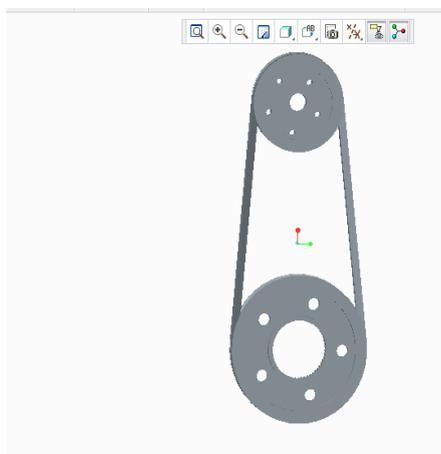


Fig 1.5

The side view of component. It consists of a pulley and wheel connected by a flat belt. Its main

function is transmission of motion in turn power from wheel to pulley. This gets later transferred to the synchronous motor.

6. Design requirements

The source that drives this mechanism is gravitational force. Therefore the major objective is to develop such a mechanism that would optimise this gravitational force which would result in a durable electrical output that would be sufficient to run an LED source. The principle behind the working of this mechanism is the height parameter. The setup efficiently makes use of this height by converting the potential energy of the weights into an electrical output with the help of a rotary mechanism. The design can be optimised to a larger extent if the time span is increased exponentially and it operates in a continuous cycle without stopping.

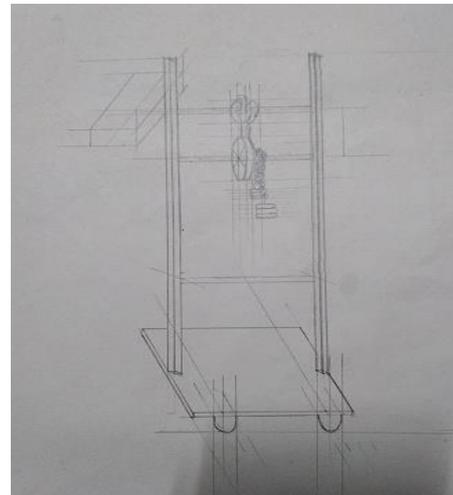


Fig 2.1

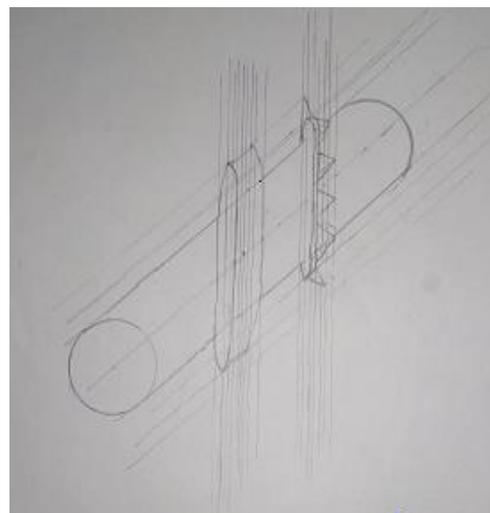


Fig 2.2

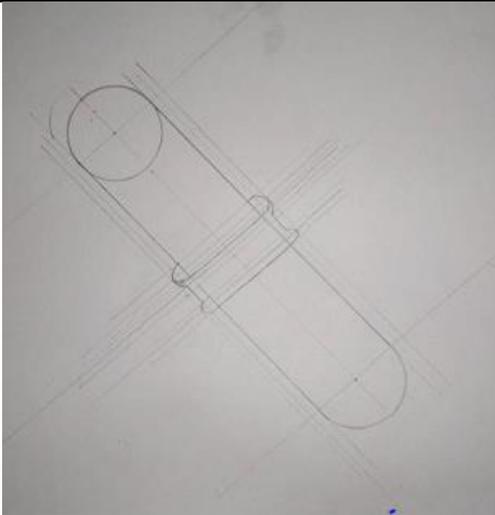


Fig 2.3

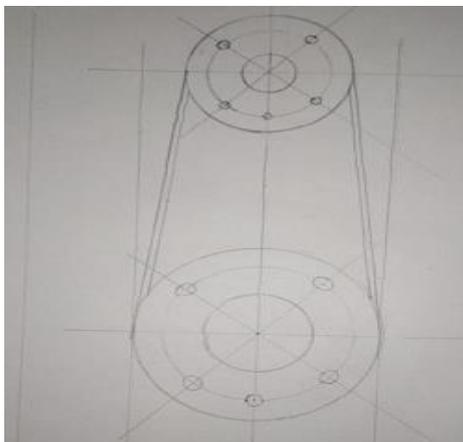


Fig 2.4

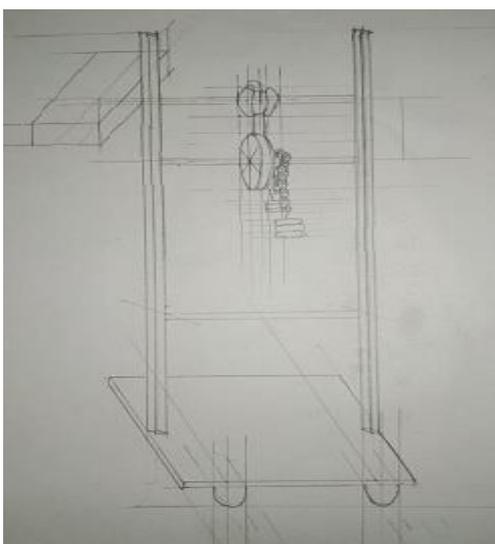


Fig 2.5

7. Modifications

As mentioned in the earlier segment the main objective is to increase the time span without affecting the cost. And to operate the mechanism in a loop ie it operates indefinitely without coming to rest. This is achieved with the help of a spring plunger arrangement. As the weights reach a predetermined level that are rewound to the starting point with the help of a spring. The spring force is calibrated to have a value equal to mgh at the time it reaches the ground level and is recoiled back to its original position because of the restoring force of the spring. And thus the cycle of operation starts again without affecting the electrical output. The main advantage of this concept is that it improves the efficiency.

8. Highlights of design concepts

The key feature of this design concept is that it provides a sturdy base, unaffected by vibrations caused by load or external factors. Another advantage this design offers is variable height. Since height is an integral factor for generation of power the mechanism can be adjusted to meet variable load demands. From maintenance point of view it proves to be highly cost efficient since the components do not require special attention or maintenance needs. Cost of installing the model is also very nominal. Through this prototype the purpose is to increase the running time of the pulley that will lead to increase of power output. Unlike other non-conventional sources of energy which requires complicated setup and auxiliary accessories or high maintenance of this mechanism provides an ingenious way to utilise the most fundamental and abundantly available source of energy.

Conclusion

It can be observed that gravity offers many advantages over the existing renewable technologies, however there has yet to be made provisions to make these mechanisms reversible, amplifying the electrical output even though it doesn't require storing the energy it can be added as a backup. This prototype aims at generating a continuous and stable electrical output at the same time providing a cheaper alternative to generating light. Variable height advantage can increase the time span according to load requirement. In a nutshell this light generating unit is extremely cost efficient and offers as an attractive solution to lighting problems in places where electricity is

scarce or negligent. This mechanism can also be set up in outdoor spaces and can provide as an emergency backup for a specified time period

9. Reference

- [1] Rakesh S Ambade, Roushan Prabhakar, Rupesh S Tayade, "Review on Gravity Power Generation", International Innovative Research in Science, Vol 3, issue 4, April 2014, PP1,2,3.
- [2] Pankaj Ghode, Ankit Jadhav, Kalpesh Gardi, SR Bhandari "Changing perspective: Gravity Light", IOSR Journal of Computer Engineering, e-ISSN: 2278-0661, P-ISSN:2278-8727, PP01-03
- [3] Pranit Parekh, Het Barot, Varun Terdal, Teeksha shanoj, "Design Analysis Working Of A Light Generating System Using Gravity", International Journal of Electrical Electronics and Data Communication, ISSN: 2320-2084, Vol 5, Issue-11, Nov 2017
- [4] Digvijay S Jadhav, Sagar N Hullule, Nitin N Jejurkar, "Gravity Power Generation", Vol 5, Issue No 03, March 2016
- [5] "Experimental verification using database model for power generation by gravity", International Journal Of Engineering Sciences and Management Research, ISSN 2349-6193
- [6] Mrs D Pushpalatha ME, M Satish, K Satishkumar, M Selvakumar, TVivek, " Gravity lighting system", International journal of current trends in engineering and research , Volume 3 Issue3, March 2017, pp108-113
- [7] Tamboli Nvaman V, Shaikh Usmanpasha A, MD Ali Hassan, Vahid Khan Liyaqat, Prof Iqbal Mansuri, "A Review on Gravity Power generation", International Journal of Advanced Research in Science Management and Technology", Volume 2, Issue 10, October 2016
- [8] Pramod Gorakh Ghayal, Prof R N Dehankar, "Experimental Verification using database model for power generation gravity machine", International Journal Of Engineering Science and Management Research, ISSN 2349-6193
- [9] R Rathish, S kamalakannan, G Karthi, M karthik , "Design and fabrication of gravity power generation", international journal of innovative research in science engineering and technology, Vol 3, Issue 3, March 2017
- [10] Yogesh Kudale, Devyani Padwal, Pradeep Kopnar, "Gravity driven electricity generating mechanism", International journal of engineering research and development, Volume 14, Issue 1, PP32-36
- [11] Huzaifa A Tinwala, Ankit G Patel, Prof Falgun Patel "power generation using gravity and buoyancy force", International journal of engineering research and technology, Vol 3, Issue 4, April 2014
- [12] Abhijitsinh V Makwana, Druv Patel, Darshan Patel, Henil Patel, Akhil Patel, "gravity lamp", International journal of engineering research and application", Vol 7 , Issue 2, February 2017