



DESIGN OF POWER GENERATION UNIT BY USING HUMAN EFFORT

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Abstract

Energy is the basic need for the development of the modern world. For meeting up the regular demand of energy we need to design a system that will produce electricity without destroying the nature. This paper attempts to show how man has been utilizing and optimizing kinetic energy. Researches show that the world has already had its enough shares of its energy resources. Fossil fuels pollute the environment. Nuclear energy requires careful handling of both raw as well as waste material. The focus now is shifting more and more towards the renewable sources of energy, which are essentially, non-polluting. This paper attempts to show how energy can be produced, stored and used by using human foot effort while walking over the plate.

The setup consists of elements such as spur gears, sprocket, chain, flywheel, battery. In this paper a permanent magnet D.C. generator is used thereby generating 12 Volt D.C. This D.C. voltage is stored to the lead 12-volt battery. Electricity stored in battery is used to activate the light, fan etc. and one can convert D.C. voltage to A.C. voltage as per application

Keyword: flywheel, Power Generation, Non-conventional Energy

I. Introduction

In today's fast moving world, energy demands and use is ever increasing. Energy is the primary and most universal measure of all kinds of works by human beings and nature. Everything what happens in the world is the expression of flow of energy in one of its forms. To cope with these

ever increasing energy demands one needs to devices, various machines those are capable to generate electricity. one such attempt is made in this paper work which is 'Design of Power Generation Unit by Using Human Effort'.

Energy in the form of electricity plays a very important role in the life of a normal man. Electricity is one of the greatest wonders of science. Next to man, it is the most important and revolutionary creation in this world of ours. It has practically revolutionized the world. Electricity is one of the most widely used forms of energy. Today our whole life style is dependent on electricity. With the increasing population the use of electric power is also increasing. But we know that the resources to generate electricity are limited, and this has lead to the energy crisis. During this scenario we need to generate electricity from the things used in day-to-day life.

'Design of Power Generation Unit by Using Human Effort' is specially planned to design and fabricate the conversion unit for utilizing the available unconventional energy source. That is tremendously available energy in low intensity with ample quantity can be utilized. The plate converts man power into rotation of flywheel. The rotation power is stored in flywheel & flywheel rotate D.C. generator that generate electricity. This generated Electricity can be used for different purpose such as lighting, household purpose, etc.

II. Principle

The principle of the electric power generation using human effort is very simple. It is based on the same principle as in the case of electricity

generation in case of hydroelectric power plant, thermal electric power plant, nuclear power plant, geothermal energy, wind energy, tidal energy etc. In all of the above power plant mechanical energy is converted into electrical energy . In this setup also mechanical energy is converted into electrical power using a D.C. generator. Here the forward motion of the rack is converted into the rotational motion, which in turn rotates the generator and generates electricity.

III. Components

The ‘Design of Power Generation Unit By Using Human Effort, Consists Of:-

1. Generator 12V 1A 1200 rpm

An electrical generator is a machine which converts mechanical energy (or power) into electrical energy (or power). The energy conversion is based on the principle of the production of dynamically (or motional) induced emf. Whenever a conductor cuts magnetic flux, dynamically induced emf is produced in it according to faraday’s Laws of Electromagnetic Induction. This emf causes a current to flow if the conductor circuit is closed. Hence, two basic essential parts of an electrical generator are a magnetic field and a conductor or conductors which can so move as to cut the flux. A motor and one or more generators, with their shafts mechanically coupled, used to convert an available power source to another desired frequency or voltage. The motor of the set is selected to operate from the available power supply the generators are designed to provide the desired output

No load	
Speed:	1200 RPM
Current :	1 A
Operating Range:	6 to 12 V

At Stall	
Torque:	2.7 KgfcM
Current:	26 A

At Max Efficiency	
Efficiency:	76%
Power:	43 W

Speed:	9800 RPM
Torque:	0.42 KgfcM
Current:	4.7 A

2. Shaft

A shaft is a rotating machine element which is used to transmit the power from one place to another. The power is delivered to the shaft by some tangential force and resultant force set up within the shaft permits the power to be transfer to various machine links up to the shaft. In order to transfers the power from one shaft to other various member such as pulleys, gears etc. are mounted on it. The shafts are usually cylindrical, but may be square or cross shaped in section. They are solid in cross-section but sometimes hollows shafts are also used. The material; used for the shafts has high strength, good machinability, low notch sensitivity factor, high wear resistant, good heat treatment etc. The stresses generally induced in the shaft are shear stresses, bending stress and stresses due to combined shear stress and bending stresses. Generally the shafts are manufactured by hot rolling and finished to size by cold drawing or turning and grinding.

3. Sprocket

This is a cycle chain sprocket. The chain sprocket is coupled with another generator shaft. The chain converts rotational power to pulling power, or pulling power to rotational power, by engaging with the sprocket. The sprocket looks like a gear but differs in three important ways:-

1. Sprockets have many engaging teeth; gears usually have only one or two
2. The teeth of a gear touch and slip against each other; there is basically no slippage in a sprocket.
3. The shape of the teeth is different in gears and sprockets.

Freewheel is the sprocket in which its inner mechanism work in other to produce clockwise positive motion to the flywheel forward motion flexible link counter clockwise freewheeling motion of possible link counter wheel freewheeling motion of wheel during reverse motion of link. The free wheel is provided with ratchet and pawl mechanism freewheeling mode.

In this mode upper and lower pawl presses oscillate but does not get locked in reached groove the spring and hence pawl get compressed due to anticlockwise at the outer tooth rim

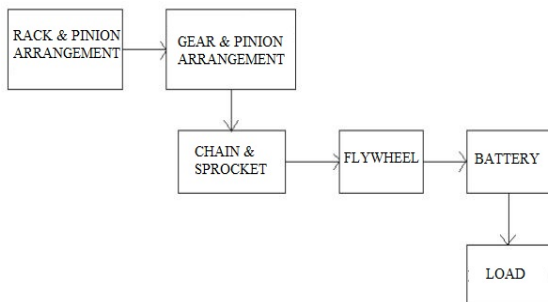
4. Flywheel

The flywheel is a mass, usually a metal weight, fitted to a rotating power transmission shaft or directly to the motor spindle. When power transmission shaft or directly to the motorist will not react as quickly as the same motor without a flywheel fitted, providing slower acceleration up to the voltage/ speed required. This is due to the motor having to work a little harder to start an extra weight of the flywheel moving and get it spinning once the flywheel is spinning at the desired speed it has an amount of stored kinetic energy in proportion to the speed and weight of the flywheel

5. Bearing

The ball and roller bearing consist of an inner at race which is mounted on the shaft or journal and an outer race which is carried by the bearing or casing. The ball bearing is used for light loads and the roller bearing as used for heavier loads. The bearing supports the shaft as the axle & holds as it in current position with respect to frame or casing. The bearing ensures free rotation of the shaft or axle with minimum friction. The bearing takes up the force getting on the shaft or the axle and transmits them to the frame or the casing. Since the rolling element & the race are subjected to high local stresses of varying magnitude with each revolution at the bearing, therefore the material at the rolling element (i.e. steel) should be at high quality, The ball bearing are generally made at high carbon chromium steel. The material at high both are balls and races are heat treated to give data hardness and toughness.

IV. Block Diagram:



V. Construction:

In this project work a working model is constructed using gear arrangement. This project model is made to generate at least, 12 volt DC of electricity. This will be sufficient enough to charge a battery of 12 volt. Rack and pinion arrangement is used to convert the human power into rotary motion of shaft. This shaft is connected to flywheel by using sprocket and freewheel gear, the flywheel is used as energy storing device. The flywheel is mounted on mild steel shaft Here the DC generator used for generating the electricity having capacity to generate at least 12 volt.

VI. Calculation

$$\text{Work Done} = F \times S$$

$$W = mg \times S$$

Where m- Mass

g- Acceleration due to gravity
 S- Displacement
 $W = 50 \times 9.81 \times 0.24 \text{ J}$
 $W = 117.72 \text{ J}$

Now we know that work done per second is power

$$\text{Power} = \frac{\text{Work Done}}{1 \text{ Sec}}$$

Therefore
 $\text{Power} = 117.72 \text{ W}$

Now Torque For the Pinion is given By

$$T = m \times g \times r$$

$$T = 50 \times 9.81 \times 0.026$$

$$T = 12.75 \text{ N.m}$$

Again we know that

$$\text{Power} = \frac{2\pi N_1 T}{60}$$

By this equation we can find out N1 for Pinion

$$117.72 = \frac{2 \times \pi \times N_1 \times 12.75}{60}$$

thus we gets

$N_1 = 88.17 \text{ RPM}$ Now we know that

$$\frac{N2}{N1} = \frac{T1}{T2}$$

Where

N1 – RPM of Pinion1

N2 – RPM of Gear1

T1 – Teeth of Pinion1 (13)

T2 – Teeth of Gear1 (48)

$$N2 = \frac{88.17 \times 48}{13}$$

$$N2 = 325.55 \text{ RPM}$$

Similarly

$$\frac{N3}{N2} = \frac{T2}{T3}$$

Where

N2- RPM of Sprocket

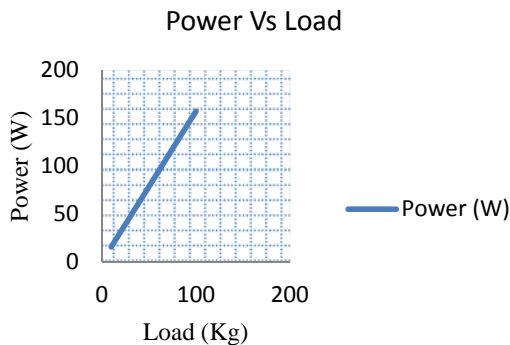
N3- RPM of Freewheel

T2- Teeth of Sprocket (48)

T3-Teeth of Freewheel (13)

$$N3 = \frac{325.55 \times 48}{13}$$

$$N3 = 1202.03 \text{ RPM}$$



VII. Working

When the paddle is pressed, the rack moves in forward direction, this results in rotational motion of pinion 1 thus gear 1 which is mounted on the same shaft rotates with the same RPM as that of pinion. Further the pinion 2 which is in mesh with gear 1 rotates, sprocket and pinion 2 mounted on the same shaft rotates with the same RPM.

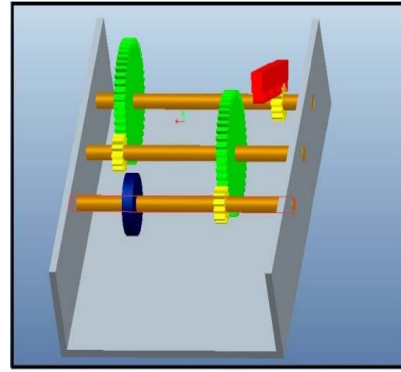


Fig. CAD Model

Sprocket is connected with freewheel and the freewheel, flywheel and D.C generator are mounted on same shaft by using this mechanism, we can convert mechanical energy into electrical energy.

VIII. Advantages

1. Generation of power without polluting the environment.
2. Simple construction, mature technology and easy maintenance as compared with Power Plants.
3. No fuel required thus fuel costs minimized.
4. No external source is needed for power generation
5. One time investment

IX. Applications

India is a country with high population, so if the project is installed at various sites of public areas like,

1. Colleges
2. Shopping Malls
3. Bus stand
4. Railway stations

X. Conclusion

As the conventional source are depleting very fast, then it's time to think of alternatives. We got to save the power gained from the conventional sources for efficient use. So this idea not only provides alternative but also adds to the economy of the country.. Now the time has come to put forward this type of innovative ideas, and also researches should be done to upgrade its implication. In future, if the flywheel speed control device and voltage protection devices are added with large generation process, it would be a model all over the world .After some

modification of the designed project, the efficiency of the whole system can be increased by increasing the capacity of the generator and applying more weight.

XI. References

- [1] Md.Saiful Islam, Syed Khalid Rahman, Jakeya sultana Jyoti, "Generation of Electricity Using Road Transport Pressure", International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 2, Issue 3, May 2013
- [2] Alok Kumar Singh, Deepak Singh, Madhawendra Kumar, Vijay Pandit, Prof.Surendra Agrawal, "Generation of Electricity through Speed BreakerMechanism", International Journal of Innovations In Engineering And Technology (IJIET), Vol.2 Issue 2, April 2013
- [3] Pranay Vijay Ashtankar, Pratik H. Bendle, Krunal Kene, Milind R. Kalbande, Pratik Makhe, Prof. S.M. Dhomne , "Road Power Generation (RPG) by Flip plate Mechanism", International Journal of Science, Engineering and Technology Research (IJSETR), Volume 3, Issue 3, March 2014
- [4] Shakun Srivastava, Ankit asthana, "produce electricity by the use of speed breakers," Journal of Engineering Research and Studies, Vol.2, No.1 April-Jun 2011.
- [5] R.S. Khurmi, J.K. Gupta, "Theory of Machines", S. Chand Publication, Delhi, 1 August 2005, pp. 382-479