

# Review on Power Charging Unit using Rotary Leverage System

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**Abstract** - Power crisis has always been a serious issue in India. There has been development in the power sector recently, yet it has not been able to meet societal requirements. Current scenario demands replacement of fossil fuels by renewable energy. Development in the field of renewable energy has been poor until now. The concept of flywheel energy storage has gained popularity in recent years. But the technology has not been harnessed effectively in power sector. In this paper we will be doing a detailed analysis on the concept of gravity power generation, flywheel, rotary leverage assembly and its application as a power charging unit.

## 1. INTRODUCTION

The rotary leverage system consists of a first order lever having an effort arm and a load arm. This lever is mounted through its fulcrum in a frictionless manner such that the oscillations produced generates energy efficiently and reliably. A weighted body is fitted to the extreme end of the effort arm and is positioned opposite to the end of the load arm. The effort arm along with its weighted body is made to oscillate at 90 degrees. Due to moment of inertia and gravitational energy, the load arm which is connected to a power receiver assembly is rotated which generates energy.

Rotary leverage system can be used to generate energy that not only runs the system continuously but also produce energy which can be used for various applications. The energy that is generated by the rotary leverage system can be stored in a flywheel. The main advantage of a flywheel is that it stores the energy that is produced in excess and releases it when the input energy is lower than required. The flywheel stores the energy and discharges it slowly to the DC generator which produces the output power.

## 2. LITERATURE SURVEY

### 1. Principle and Working of Gravity Power Generation Mechanism.

In this paper gravitational energy is used to obtain free energy. Initial force is required to rotate the wheel. Gravity causes the weights to come down which causes weights in the lower end to move up causing rotation of the wheel. The key advantages of this method are, gravity being a constant source of energy, location or site selection

becomes easy, small investment is required and it is eco-friendly. Although, the efficiency of this system is low.[1]

### 2. Energy Storage Technologies for High Power Applications.

This paper discusses, the recent developments of energy storage technologies for high power applications i.e. supercapacitors, SMES, flywheel and lithium-ion batteries. It provides comparative analysis. Flywheel used as the energy storage device has some advantages. Although power density of the flywheel is very high, cost per unit power is very low. Also, energy density is relatively low.[2]

### 3. Pulse Wheel/Flywheel; Contributing New Science for Unbounding Efficiency, to the Era of Physics

This paper proved mathematically that the efficiency of the system can be more than 100% by using flywheel. It can replace IC engines and can be used as an eco-friendly alternative. Due to the use of the pulse wheel/flywheel, the efficiency of the mechanism exceeds 100%. Since it uses a simple mechanism it proves advantageous. Also, the mechanism is very simple. And it is cheap to manufacture. But the system used is bulky. [3]

### 4. Analysis of Flywheel.

This paper gives a detailed study of a flywheel as an inertial energy storage device. Usage of cast iron and S-glass epoxy flywheel in machines which serve as a reservoir to store energy when the supply of energy is more than the requirement is emphasized here. The main advantage of a flywheel is that it stores energy when supply energy is more than required energy, and releases the stored energy when output energy is lesser than required energy. The main drawback of this is that a flywheel can only be used to store energy, not to produce it.[4]

### 5. Pneumatic Regenerative Braking System for Bicycle.

In this paper, a system is developed in which the energy that is lost when the brake of the bicycle is applied is converted to useful energy. This system stores kinetic energy which is produced due to heat, friction, etc, in the form of compressed air using flywheel technology. The energy stored in the flywheel when the brake is applied is

converted to electricity with the help of an alternator which is attached to it. The advantage of this system is that it has a high rate of energy recovery and there is minimum wastage of energy. Though this is something that is highly advantageous, the disadvantages overpower them. The main drawback is that the weight of the system is too high due to which more energy is required to run the whole system. And the energy obtained cannot be made use where required.[5]

#### 6. Wireless Flywheel-based Fast Charging station (WFFCS).

In this paper we study a technology that facilitates static and in-motion charging of electric vehicles using flywheel energy storage (FES) systems and wireless power transfer (WPT). Flywheel based fast charging station (FFCS) and wireless power transfer (WPT) systems are presented separately. The FFCS consists of FES which makes use of permanent magnet synchronous machines which acts as a motor and a generator. In WPT, time-varying magnetic field is used to transfer power over large air gaps to energize more than one load. Though this system has high power capacity, short access time, long lifetime, low maintenance effort, wireless means of transferring power and is environment friendly, it has low efficiency and needs high transmission frequency which poses as a big challenge for power electronics components.[6]

#### 7. Flywheel Energy Storage with Built-in Supercapacitors

This proposed system is an amalgam of the Flywheel energy storage system with super capacitors to enhance the dynamic response and has an insignificant effect on weight and size. The super capacitors are positioned in the rotating disc. This increases the energy storage as it can store both kinetic and electric energy. CATIA and ABAQUS are used for analysis and MATLAB or Simulink is used for simulation. The drawback is, by adding super capacitors, the energy storage capacity will reduce for low speed systems.[7]

#### 8. Flywheel energy storage systems: a conceptual study, design, and applications in modern power systems

This paper gives a conceptual study on the use of Permanent Magnetic Bearings and Superconducting magnetic bearings in the flywheel energy storage system and how this can benefit in the improvement of the power quality of the system. The key advantages are that it has a long-life span and has a pollution free operation with maximum storage system. The main disadvantage is that it has high manufacturing cost.[8]

#### 9. Flywheel Energy Storage (FSS): Exploring Alternative Use Case

This paper proves that a flywheel energy system can store and discharge electrical energy quickly. For this, a scalable flywheel prototype was made with an efficiency of 16.9%.

Also, real time electricity pricing data analysis was done to show that customers can save about \$500 per month from a 100kW flywheel system. This paper also provides a detailed comparative analysis to why chemical batteries are not preferred.[9]

#### 10. Conventional free energy using flywheel

In this paper we study that the free energy is generated using Flywheel. Input motor is of 0.370 kW. Output at alternator is greater than the capacity of motor 0.45 kW (21% more). The paper gives the detail of designing accessories of Flywheel parts such as Pulley, shaft, bearings and Belt drive. The key advantages are that they are environmentally friendly, non-hazardous and easy to maintain. The drawback is that the weight of the flywheel is excessive and there are no wide selections for DC motor and alternator. [10]

#### 11. Development of superconducting magnetic bearing for 300 kW flywheel energy storage system.

In this paper we study about the electrical energy which is stored as kinetic energy in heavy weight flywheel. Work in the paper is stabilize power output of solar plant of 1 MW. System uses a superconducting magnetic bearing. There is no mechanical contact with the flywheel rotor. System can charge and discharge a 300kW PV panel. Evaluation tests are carried out. The key advantages are that the new technology of using superconducting magnetic material. Rotor is of carbon fibre reinforced plastic, new technology. Long duration load tests 24 times heat tests. The disadvantage consists of expensive laborious cooling procedure. [11]

#### 12. Dual voltage/Power system by battery/Flywheel configuration.

The paper gives a combining Battery and Flywheel can give high power and high energy. Paper shows modelling of series and parallel combination of Battery and Flywheel in MATLAB/Simulink. Synchronous motor is used as load and schemes are tested for the same load power. The positive outcome is that there is low Energy consumption by parallel connection. Less variation in flywheel speed. The drawback is that the parallel connection requires two energy sources. Number of switching devices are more in series type.[12]

## 4. CONCLUSION

Thus, considering all the advantages and disadvantages of the reviewed papers, a conclusion can be made that an effective usage of an assembly with a rotary leverage system and a flywheel energy storage system can have an efficiency more than 100% by using the principle of gravity power generation mechanism. This system can have a wide scope of applications owing to the power crisis.

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