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Design Calculation of Flywheel Free Energy Generating System with Motor-Generator

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Abstract
This study deals with the concept of free energy system and its generation using flywheel system. The energy storing capacity of flywheel is used to generate extra amount free energy. This extra energy is used to run the other electrical home appliances. It consists of A.C. motor of 1.5 horsepower capacity is used to drive a series of belt and pulley drive which form a gear-train and produces over double rpm at the shaft of an alternator. The intriguing thing about this system is that greater electrical output power can be obtained from the output of the alternator than appears to be drawn from the input motor. It is done with the help of gravity wheel. The gravity wheel or flywheel is coupled with the gear-train in order to produce more extra energy or free energy. The overall study is done with various parameters of flywheel to obtain the maximum free energy output (4.167 kW= 5kW) of the system.

Keywords: Free energy system, Flywheel, Gravity, Gear-train, Alternator

1. Introduction to Free Energy Generating System

There is electricity everywhere present in limitless quantities and can drive the world's equipment without the need for gas, coal or oil. Free energy means zero cost energy. Mechanical energy which drives windmill or Solar energy in solar cell which is converts into DC current other energies are obtained from wind power, water power and telluric power. Free energy generator is a process to generate these types of energy.

Free energy suppression is the notion that corporate energy interests intentionally suppress technologies that may provide energy at very low cost. Other remaining untouched forces of nature which are well familiar in the scientific literature include earth batteries, atmospheric electricity, telluric currents, and pressure system changes. The energy from perpetual motion is considered fantastical forces.

Free Energy generally means a method of drawing power without fuel to be burnt from the local environment. There are many different ways for doing this. These ways span many years and countries. The amount of power which can be obtained can be very high and the few kW needed to power a household are most definitely within the reach. Some of the methods which can be used as the free energy devices are as follows:

- Battery-Charging Pulsed Systems
- Moving Pulsed Systems
- Energy-Tapping Pulsed Systems
- Aerial Systems and Electrostatic Generators
- Motionless Pulsed Systems
- Fuel-less Motors
- Magnet Power
- Passive Systems
- Gravity-Powered Systems

2. Methodology

Flywheels are around for about thousands of years. The initial application is the potter's wheel. Perhaps the most commonly used application in recent years is in internal combustion engines. A flywheel is a simple form of mechanical energy storing device. Energy is stored by rotating disc to spin about its axis. This energy is proportional to its mass and the square of its rotational speed.

- Advances in magnetic bearings, power electronics, and flywheel materials coupled with integration of mechanisms have resulted in DC supply flywheel energy storage systems that can be used as a supplement or auxiliary to batteries in UPS systems.
- Introduction to Flywheel Energy Storage (Kinetic storages), also known as FES, are used in many technical fields. The flywheel rotors are coupled with an integral motor–generator that is contained in the housing .The motor-generator is used to store and then harness energy from the rotating flywheel. The use of flywheel power system can improve the overall life, replace batteries, regulate power frequency and provide a sustainable energy conversion.
- Flywheel energy storage systems (FES) are designed for regenerative braking applications, to supplement DC power in UPS (uninterruptible power system).Flywheel braking systems utilize a regenerative brake or KERS (Kinetic Energy Recovery System). Flywheel braking systems reduce power consumption in mobile cranes, rail transport, automobiles and in other significant load bearing rotary motors. Inertial mass is increase speed to a very high revolving speed and maintaining the energy in the system as rotational energy. The energy is transformed back by slowing down the flywheel. The available performance comes from Inertia effect and rotational speed.
- Flywheels are the primary load-bearing device inside flywheel power systems. The flywheel is commonly fabricated from steel or carbon fiber. Carbon fiber flywheels have a higher energy density due to the light weight and high strength. Steel , aluminum and composite rotors are an economical alternative to the carbon fiber rotor.
- The flywheel consists of a heavy circular disc fitted with a strong axle projecting on either side. The axle is mounted on ball bearings onto fixed supports. There is a small peg on the axle. One end of a cord is loosely looped around the peg and its other end carries the weight –hanger.

3. Main Features of Flywheel Used In Free Energy Generating System

A flywheel is a mechanical device specifically designed to efficiency store rotational energy. Flywheels resist changes in rotational speed by their moment of inertia. The amount of energy stored in a flywheel is proportional to the square of its rotational speed. The way to change a flywheel's stored energy is by increasing or decreasing its rotational speed applying a torque aligned with its axis of symmetry.

Flywheels are typically made of steel and rotate on conventional bearings; these are generally limited to a maximum revolution rate of a few thousand rpm. High energy density flywheels can be made of carbon fiber composites and employ magnetic bearings, enabling them to revolve at speed up to 60000 rpm (1 kHz). In Figure 1, (a) is conventional flywheel and (b) is modern automobile engine flywheel.

(a)

Fig .1 (a) Conventional flywheel (b) Modern automobile engine flywheel [1]

3.1 Applications of Flywheel

Flywheels are often used to provide continuous power output in systems where the energy source is not continuous. For example, a flywheel is used to smooth fast angular velocity fluctuations of the crankshaft in a reciprocating engine. In this case, a crankshaft flywheel stores energy when torque is exerted on it by a firing piston, and returns it to the piston to compress a fresh charge of air and fuel.

A flywheel may also be used to supply intermittent pulses of energy at power levels that exceed the abilities of its energy source. This is achieved by accumulating energy in the flywheel over a period of time, at a rate that is compatible with the energy source, and then releasing energy at a much higher rate over a relatively short time when it is needed. Flywheels are used in power hammers and riveting machines.

Flywheels can be used to control direction and oppose unwanted motions, gyroscope. Flywheels have a wide range of applications from gyroscope for instrumentation to ship stability and satellite stabilization (reaction wheel), to keep a toy spin spinning (friction motor), to stabilize magnetically levitated objects. Figure 2 shows the block diagram of basic components of flywheel storage system.

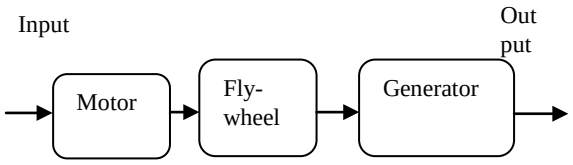


Fig .2 Basic components of Flywheel energy storage system

3.2 Advantages and Disadvantages of Flywheel

Flywheels are not affected by temperature changes as are chemical rechargeable batteries, nor do they suffer from memory effect. They are also less potentially damaging to the environment, being made of largely inert or benign materials. Another advantage of flywheels is that by a simple measurement of the rotation speed it is possible to know the exact amount of energy stored. However, use of flywheel accumulators is currently hampered by the danger of explosive shattering of the massive wheel due to overload.

One of the primary limits to flywheel design is the tensile strength of the material used for the rotor. Generally, the stronger the disc, the faster it may be spun, and the more energy the system can store. When the tensile strength of a flywheel is exceeded the flywheel will shatter, releasing all of its stored energy at once, this is commonly referred to as "flywheel explosion" since wheel fragments can reach kinetic energy comparable to that of a bullet. Consequently, traditional flywheel systems require strong containment vessels the total mass of the device.

When used in vehicles, flywheels also act as gyroscopes, since their angular momentum is typically of a similar order of magnitude as the forces acting on the moving vehicle. This property may be detrimental to the vehicle's handling characteristics while turning. On the other hand, this property could be utilized to keep the car balanced so as to keep it from rolling over during sharp turns. Conversely, the effect can be almost completely removed by mounting the flywheel within an appropriately applied set of gimbals, where the angular momentum is conserved without affecting the vehicle. A single gimbal, for instance, could free a car for the 360 degrees necessary for regular driving. However, for instance, driving up-hill would require a new gimbals mechanism with a new degree of freedom.

4. Components of Flywheel Energy Generating System

4.1 Pulley

A pulley is a wheel on an axel or shaft that is designed to support movement and change of direction of a taut cable. The supporting shells are called blocks. A pulley may also be called a sheave or drum and may have a groove or grooves between two flanges around its circumference. The drive element of a pulley system can be a rope, cable, belt or chain that runs over the pulley inside the groove or grooves. Figure 3 shows the simple of three grooves pulley but two grooves pulley is used in this designed system.

Fig .3 Three Grooves Pulley [3]

4.2 Belt Drive

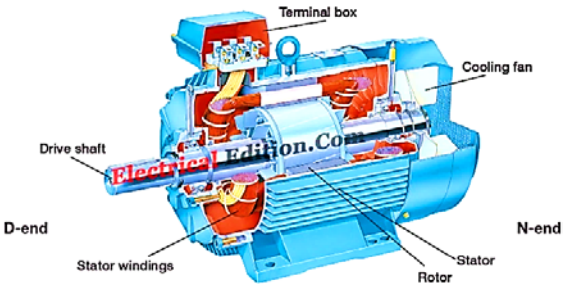
A belt drive is analogous to that of a chain drive, however a belt sheave may be smooth so that the mechanical advantage is approximately given by the ratio of the pitch diameter of the sheaves only, not fixed exactly by the ratio of the teeth as with gears and sprockets. In the case of a drum-style pulley, without a groove or flanges the pulley often is slightly convex to keep the flat belt centered. It is sometimes referred to a crowned pulley. Though once widely used on factory line shafts, this type of pulley is still found driving the rotating brush in upright vacuum cleaners, in belt sanders and band saws. Agricultural tractors build up to the early 1950s generally had a belt pulley for a flat belt. It has been replaced by other mechanisms with more flexibility in methods of use, such as power take-off and hydraulics.

Just as the diameter of determine a gear ratio and thus the speed increases or reductions and the mechanical advantage that they can deliver, the diameters of pulleys are a way to provide multiple drive ratios in a belt and pulley system that can be shifted as needed, just as a transmission provides this function with a gear train that can be shifted. V belt step pulleys are the most common way hat drill presses deliver a range of spindle speeds. Belt drive is shown in figure 4.

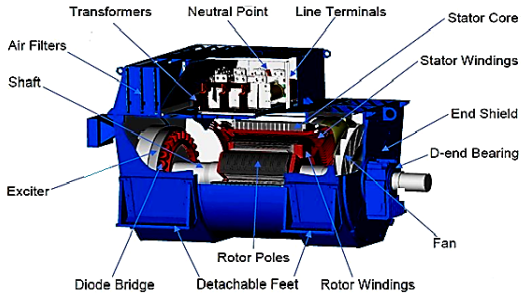
Fig .4 Belt drive [3]

4.3 Motor/Generator

Flywheels are complex constructions where energy is stored mechanically and transferred to and from the flywheel by the electrical machines such as motor and generator. The electrical machines should work as a motor to transfer electrical energy to the flywheel and as a generator to restore the energy stored into the flywheel. When acting as a motor, the electric energy supplied to the stator winding is converted into mechanical energy, increasing the speed of the flywheel. In generator mode, kinetic energy stored in the rotor is transformed into electrical energy. The motor/generator part has a large upgrade potential and its design is continuously improving.



(a)



(b)

Fig .5 An Example constructions of (a) Motor and (b) generator [2]

5. Calculation of Output and Efficiency of the Designed System

(i) Calculation of Total Output and Efficiency

For Motor,

Input voltage (system voltage) - 220 V

Rated voltage - 230 V

Rated rpm - 1500 rpm

Input current – 230 V →21.8 A (measured value)

220 V →?

$$= \frac{220 \times 21.8}{230}$$

= 20.85 A

Input current = 20.85 A

Input power → P =VI cos ɵ

$$= 220 \times 20.85 \times 0.8$$

P = 3669.6 W

Motor input = 3.7 kW

For Generator,

Output voltage - 250 V

Rated voltage - 300

Rated rpm - 1500 rpm

Output voltage – 300 V→ 5 kW

Output voltage – 250 V →?

$$= 5\ \text{kW} \times \frac{250\ \text{V}}{300\ \text{V}}$$

= 4166.67 W

= 4.167 kW

Alternator / Generator output = 4.167 kW

Shaft rpm = 750 rpm

$$\omega = \frac{2\pi N}{60} = \frac{2\pi \times 750}{60} = 78.54 \text{ rad/s}$$

Torque, T= P/ ω = (4166.67 W)/ (78.54)
= 53.05 N-m

Total Efficiency (η) = $\frac{\text{Total Alternator output obtained}}{\text{Total Motor Input given (kW)}}$

$$\eta = \frac{4166.67\ W}{3669.6\ W} \times 100\%$$

η = 0.113 %
η ~ 100%
η = 100%

Therefore, extra (100) % output is obtained from the system.

Calculations for Energy stored (kinetic energy) in Flywheel ,

$$E = \frac{mv^2}{2}, \qquad v = \frac{\pi DN}{60}$$

Where,
N = angular speed of flywheel (N-m)
v = velocity of flywheel (m/s)
E= kinetic energy stored in flywheel (Joules or kgm^2/s^2)
m = mass of flywheel (kg)
D = diameter of flywheel (m)

For this project,
D = 10.16 cm
= 10.16 × 10-2 m
= 0.1016 m
m = 185 kg
v = πDN/60
= (3.142×0.1016×750)/60
= 3.99 m/s
E = (mv^2)/2
= (185× 〖(3.99)〗 ^2)/2
= 1472.61 J or kg m^2/s^2
~ 1473 J or kg m^2/s^2

The specific values (calculated values) of energy stored (kinetic energy) in flywheel are shown in below Table 1.

Table .1 Energy Storage Data for Flywheel System

Mass (kg)	Angular speed (rpm)	Energy stored (J or kgm^2/s^2)
185 kg	750 rpm	1473 kgm^2/s^2
100 kg	405.41 rpm	232.63 kgm^2/s^2
200 kg	810.81 rpm	1861 kgm^2/s^2

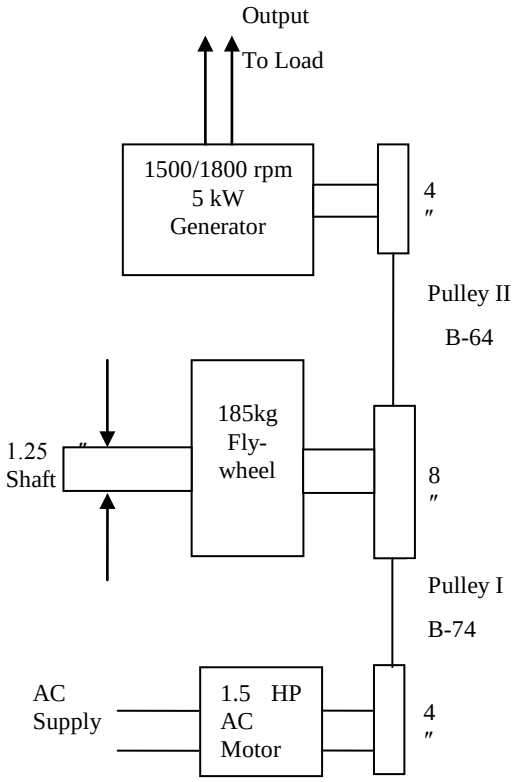


Fig.6 Layout of Designed Flywheel energy generating system

(a) (b) (c)

Figure .7.(a) The completely result of a designed system with 185 kg flywheel and 5 kW output generator (b) Testing with three loads (running 1 hp motor, electric drilling machine and cutting machine (c) Output voltages (250 V) of generator of the designed system .

4. Conclusions

Flywheels are one of the most promising technologies for replacing conventional lead acid batteries as energy storage systems for a variety of applications, including automobiles, economical rural electrification systems, and stand-alone, remote power units commonly used in the telecommunications industry.

A recent advance in the mechanical properties of composites has rekindled interest in using the inertia of a spinning wheel to store energy. The state of charge can easily be measured, since it is given by the rotational velocity. The first rotation of flywheel rotors is suitable for direct generation of high voltage.

It has obtained (100%) extra electrical output which is free energy from our project. The AC generator have produce (3.7) kW of electricity by using flywheel from (1.5) HP motor. The other main advantages of conventional free energy using flywheel is that it can generate without extra equipment. It can be used in various applications like electric fuel cars and increase the efficiency of traditional electrical equipment.

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