International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Index Copernicus Value (2016): 79.57 | Impact Factor (2017): 7.296

Gravitational Power Plants using the Semi-Perpetual Motion Concept

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Abstract: ***In the past few years, energy sources have been depleting so that it will experience a shortage of fuel for electricity generation. Therefore, alternative energy sources are needed to produce electricity from renewable sources. One method that can be used as an electric energy plant is gravitational energy. The method has advantages over other energy sources because it does not require fuel and does not pollute the environment. Many models of gravitational power plants have been carried out by researchers, but some have not been successfully implemented due to several limitations. Including friction factors that cause loss of kinetic energy. In this study, a model of gravitational power plants was designed using a pair of spur gears mounted on a non-parallel shaft. The energies supply mechanism is then added to the system, which is called the semi-perpetual motion. The gravitational power plant engine model that is designed can produce shaft mechanical energy, although some improvements still need to be made to some component parameters. The model can be further developed so that the mechanical energy can be produced more efficiently.***

Keywords: Semi-Perpetual Motion, Spur Gear, Gravity

1. Introduction

Demand for electrical energy is increasing day by day because of the rapid growth in industrialization and modernization and has an impact on the effects of pollution and global warming. In line with these electrical energy needs, energy resources gradually decline at a high-level. In the past few years, energy sources will be depleted so that there will be a shortage of fuel (petroleum, coal, wood, water, etc.) for electricity generation, while renewable sources such as the sun, wind, biomass are only available for a certain duration during the day and night. Therefore, alternative energy sources are needed to produce electricity from renewable sources. One method that can be used as a generator of electrical energy is gravitational energy to meet energy needs at this time. Abundant gravitational energy is available and has advantages over other energy sources because it does not require fuel and does not pollute the environment. However, gravitational power plants produce electricity that is relatively small compared to other power plants, such as hydroelectric power plants. If a gravitational power plant can be realized, it can replace other electricity generation and will solve the problem of global warming and environmental pollution.

Gravitational power plants are termed perpetual motion. Perpetual Motion is defined as any movement that can be maintained without using an external energy source and its movement is continuous [4,5,9,16]. Much research has been done in developing various models prototypes to use the concept of perpetual motion. Research conducted shows that some studies failed and some succeeded.

Failure to develop the concept of perpetual motion is mainly influenced by friction factors [6,8,12]. Friction always occurs when the engine/system is running and tends to change the energy needed, increasing the temperature so as to reduce the rotation/speed of movement. Therefore, an external energy supply is needed to keep the engine/system moving. The mechanism of energy supply for this perpetual motion system has become a problem, so intensive research is needed so that the system in question can be realized.

2. Literature Survey

Some of the results of research on the perpetual motion that has been carried out, among others: Ahmed [2] designed a perpetual motion engine using two balls with different loads and connected to a balanced shaft, and mounted vertically to the generator system. Using the principle of imbalance, the two spheres move circularly in the ring platform, so that the shaft connected to the generator rotates and produces kinetic energy from the shaft. Ambade et.al [3] designed a perpetual motion system use the load variations on the crank and bearing pins mounted upright around the belt attached to the pulley. This system uses gravitational energy by converting potential gravitational energy into kinetic energy.

Chaudhari [7] designed a mechanism for perpetual motion with the composition of the crank and flywheel mounted on the same shaft. The system works when the ballast is at the top of the vertical axis in the initial 360° rotation. The energy added during the downward movement is friction. Furthermore, the rotation of the first shaft rotation is transmitted to the alternator through the drive transmission drive power to produce electrical energy. Gajbhiye et. al [9] uses a pendulum that is attached to the stem and connected with a free hinge to move as a system of perpetual motion. Both sides of the pendulum are fitted with a magnet. The connecting rod connected to the crank disc will rotate and change the back and forth movement from the pendulum to the player disc. Furthermore, the disc rotates the generator to produce electrical energy. Khan et. al [11] conduct an analysis of the perpetual motion system that uses magnets arranged in a circle on the edge of the plate, and a magnetic ring attached to plate center. This system is analyzed using theoretical calculations, followed by a simulation of PRO ENGINEER Wildfire 5.0. However, the system built cannot produce lasting movements.

Several models of perpetual motion have been carried out by researches. This shows that some of the results of the study

were not successful because of several limitations. Including friction factors that caused loss of rotational energy and the mechanism used to obtain energy was less specific than gravity in several aspects. However, among several models that have been made with a systematically regulated mechanism can convert kinetic energy into electrical energy.

In connection with the strengths and weaknesses identified from the models that have been made by previous researchers, in this study designed a gravitational power plants (perpetual motion) using spur gears mounted on a non-parallel shaft (vertical or horizontal direction). A supply energy mechanism is added to the system, called ***semi-perpetual motion***. The model designed expected can provide an alternative solution for improving various previous models so that the gravitational power plant can be realized to replace other electrical energy generators.

3. Researh Methods

This study uses experimental methods, by designing and manufacturing the perpetual motion machines, and then testing the machine's performance that has been made. The perpetual motion machine design planned is using the concept of gravity [1], which is when an object that has a mass (m) is placed on a higher surface, then the gravity of the object (g) will give a lower tensile force due to the influence of pressure [6]: P = F / A, where: P: Pressure (N / m²); F: Force = m.g (N); A: Cross-sectional area (m²).

Force is one of the energy source [6]. Force is something that causes a change of things. In physics, force is defined as any interaction that can cause an object with mass to experience changes in motion, either in the direction or geometric construction. Force has magnitude and direction, it is a vector quantity that denoted by the symbol of F [13]. There is a perpetual force, namely Gravity: W = F = m.g (Newton). For each action of force, there will always be forced reaction that is equal and opposite (Newton's III Law), with the formulation of $F_{AB} = - F_{BA}$. One of the factors that impede the perpetual motion engine is friction. Friction occurs due to the interaction of the surface of an object or two objects in contact [10]: Fg = μ x N; where: Fg: Friction force (N); μ: coefficient of friction; N: normal force (N). Therefore, in the planned perpetual motion engine, a mass enhancement system is added to reduce the friction effect.

The planned perpetual motion machine design is shown in Figure 1. The pair of spur gears with different diameters is used as the main component to produce the initial driving energy. The gear pair is set-up with a un-parallel shaft axis in a vertical/horizontal direction so that it is an imbalance condition (the center of the mass is not the axis as the axis of rotation). In the upper gear wheel, the springs pull is mounted towards the arm shaft to add tensile force. Force (F) that acts on the interrelated working pressure of the gear, with the influence of the gravitational force (g), and the position of the imbalance, causing the pair of gears to produce mechanical energy on the shaft. To increase the force, the system is designed with a mechanism of mass enhancement on the shaft/ arm of the drive gear, so that the force will be greater at the working pressure of the gear pair. This force is used as the initial driving energy of the gear pair to produce mechanical energy of the shaft. The addition of the external force is then termed ***semi-perpetual motion***.

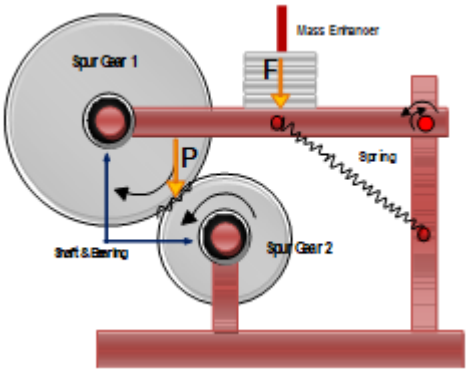

Figure 1: Design of Perpetual Motion Machine

4. Results and Discussion

Semi-perpetual motion machine design of the spur gear pairs to be tested is shown in Figure 2. Two spur gears are paired with the position of not the parallel axis, i.e. 45° slope in the vertical direction so that the gear pair is in an imbalance position. The diameter of the upper gear is 185 mm and the lower gear is 120 mm. The upper gear mass is also larger, as 35 kg (including arm and bearing).

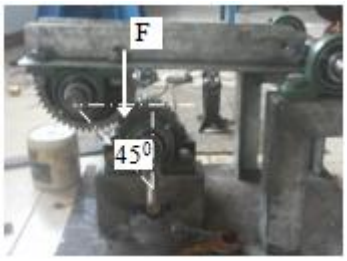

Figure 2: Semi-Perpetual Motion Model

The model uses the principle of gravity; the initial driver of the model is lifting the upper gear arm then provide a manual rotation. Put slowly to press down on the gear. The upper gear will give force through the pair of gears at the contact point. So that the tangential force occurs as the initial driving energy in the pair of gears, thus giving mechanical energy to the shaft. When a pair of gears rotates, a load is added to the arm to add style and pressure.

This system uses gravitational energy conversion that converts potential gravitational energy into kinetic energy. The kinetic energy or mechanical energy of the resulting shaft is passed to the pulley and belt, then to the generator to produce electrical energy. Tests were carried out with variations in load/mass enhancing loads, namely: 2,4,6,8 and 10 kg. The selection of mass loads is only a sample to test how much additional gear rotation needed for each load added.

4.1 Test Resuts

The perpetual motion machine models designed, show the following testing results:
For increasing mass of 2 kg.

Force: F= m.g

= (35+2) kg. 9,81 m/s^2 = 362,97 N

One round distance (L):
L = 2 . r . π
= 2. 92,5 mm. 3,14 = 0,581 m
Torque: T = F. L
= 362,97 N . 0,581 m = 210,89 J
Power: P = F . L / t
= 210,89 J / 65 sec. = 3,244 W

For masses of 4, 6, 8, 10 kg are summarized in Table 1.

Table 1: The model test results

No Testing	Mass of Ballast (kg)	Time (Second)	Power (Watt)
1	2	65	3,244
2	4	67	3,318
3	6	68	3,488
4	8	70	3,501
5	10	71	3,664

The tested model not yet functioning optimally gives kinetic energy due to friction factors. The longest gear rotation lasted 71 seconds when added 10 kg ballast mass. The thickness of the gears also greatly affects the process of shifting teeth to the next pair of teeth at the contact point. The model made is very dependent on the gravitational force through the supply of mass and pressure at the point of contact of the gears pair. Therefore, the gear thickness factor must be considered so as the moving gears process can take place as quickly as possible.

The forces act on the system is shown in Figure 3. The test results and force vectors are shown in Figure 4. The force of tangential (F_T) of the gear system is strongly influenced by Torque (T) which is related to the power (P) given to the system. In testing the system, the energies supply (P) is planned based on the strength given by the mass to gravity (F = m.a). If F = F_R (radial force), then is theoretically obtained:

$F_R = F = m.a \rightarrow m = 35$ kg.
= 35 kg. 9,8 (m/s^2) = 343 N

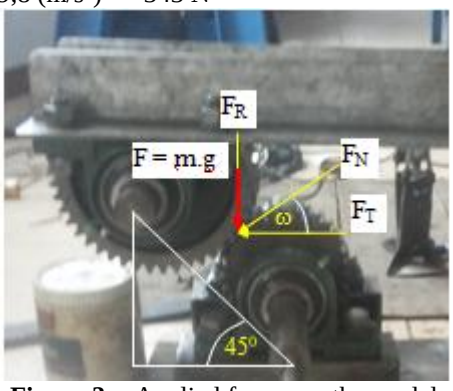

Figure 3: Applied forces on the model

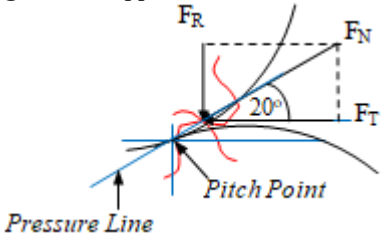

Figure 4: Force vector of the model

Tangential Force (F_T):
$F_T = \frac{F_R}{\tan \omega} = \frac{343\ N}{\tan 20^o} = 408$ (N)
Normal Force (F_N):
$F_N = \frac{F_R}{\cos \omega} = \frac{343\ N}{\cos 20^o} = 365$ (N)

Based on these results, obtained F_T = 408 N, F_N = 365 N whose value is greater than F_R = 343 N, then the large diameter gears at the top can provide centripetal force to the lower gear shaft to produce mechanical shaft energy. However, it must be noted that the tangential force is strongly affected by power and torque:

The distance of one round of gears (L) is:
L = 2 . r . π
= 2. 92,5 mm. 3,14 = 0,581 m
The rotation speed of the gear (v) to take the circumference (L) is:
v = n . 2 . r . π
$v = \frac{L}{t}$
= 0,581 m / 65 sec. = 0,0089 m/s

Gear rotation (n):
$n = \frac{v}{2\pi r}$
$= \frac{0{,}0089 m/s}{0{,}581\ m} = 0{,}919\ rpm$

Friction that occurs in a pair of straight gears is kinetic friction (f_k), then:
$f_k = \mu_k . F_N$
= 0,42. 365 (N)
= 153,3 N

The model "*free body*" diagram is shown in Figure 5.

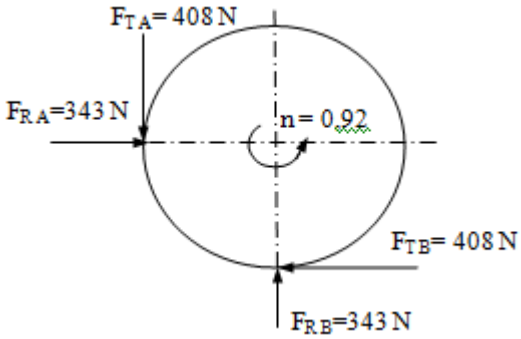

Figure 5: Free body diagram of the model

4.2 Discussion

Tests that have been carried out on both models use the simple concept of Newton Law (II), which is when an object experiences a force of F, it will accelerate (Newton's Second Law): F = m.a. Force can change the state of an object. Force is any form of interaction that can cause an object to experience mass changes in motion, both in the form of direction, and geometric construction. The test results show that the friction force is an obstacle, especially at the working pressure/ gear contact angle. Friction forces occur on the surface interactions of the gears of the two interrelated gears (locked teeth). The friction forces are strongly

influenced by the friction coefficient and normal force as 153,3 N.

The greater the coefficient of friction (μ), will be directly proportional to the magnitude of the friction force. In testing the system, the radial force is very dominant to the working pressure of the gear (contact points and contact angles) due to the influence of the mass and shaft unbalance. The position of the gear pair in an imbalance so that the teeth in contact cannot switch teeth as quickly as may be. When the gears are paired to starts the associated gear pair transition, the relatively large force in the radial direction or the direction of gravity arises. Due to the influence of the un-parallel shaft.

This shows that the model built still needs minor repairs, especially on gears thickness (e.g.: < 7 mm). This thickness results in the length of the contact point (Figure 6) between the paired gears. The gear rotation obtained to be converted into shaft mechanical energy is still very small, which is 0.919 rpm. The maximum power produced is 3,664 W when adding 10 kg of load, and the maximum time of gear rotation is 71 seconds, and after that, the engine loses its kinetic energy. This is influenced by the small normal force that also impacts on the smaller tangential force, which is 408 N.

Torque is also very influential in producing tangential forces to provide mechanical energy to the shaft. The main disadvantages of the model built are mainly influenced by the contact points size on the pair of gears. So that the force and pressure given are not able to supply gravitational energy continuously. Therefore, the contact point needs to be reduced by reducing the thickness of the gears.

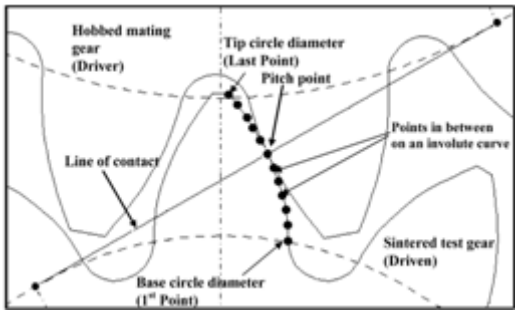

Figure 6: Pitch point of spurs gear

5. Conclusions

The perpetual motion machine model designed using a mechanical model can produce shaft mechanical energy with the help of gravitational energy. The model still needs some improvements to the gear component parameters. The designed model can produce the power of 3,664 W and 0,919 rpm on ballast mass of 10 kg. The model designed by providing a mass enhancement system can overcome problems in the development of a perpetual motion model. Therefore, it can be further developed so that it is more efficient in producing shaft mechanical energy. The gravitational energy is a renewable energy nowadays that can meet future energy needs. Gravitational energy is available on every surface of the earth, so it has a high potential to be used as a power generator on a large scale. This will give a beneficial impact to the social community and the economic situation. Gravitational power plants are free of any fuel and will reduce greenhouse gas emissions and climate change.

6. Acknowledgment

The author would like to thank and give the highest appreciation to the Directorate General of Strengthening Research and Development, Ministry of Research, Technology, and Higher Education of the Republic of Indonesia which has funded this research.

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