THE CONCEPT OF MAG-DRIVE POWER TRANSMISSION USING MAGNETIC ENERGY

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ABSTRACT

The Law of Conservation of Energy has stated that energy can neither be created nor destroyed, but the energy can be converted from one form to another form. Besides, the law also stated conserved energy loss over time, which means the energy loss in every second. Energy conservation is efforts made to consume lesser energy, while increase the efficiency of converted energy or reduce the amount of services used. In this project, magnetic-drive (magnetic energy transmission) was used as power transmission method instead of using belt drive and chain drive. In theoretical, magnetic energy provides no friction when it is used to convert to another form of energy. To test out the efficiency of this power transmission method easily, DC motor generator was used. The recorded results were based on the output of DC motor generator. Then, different numbers of permanent magnet was used to test out the driven and driver disk. The most stable output power transmission of magnetic-drive was 9 small magnets in both drive and driven disks. Both disks’ magnets were built to repulse each other at 90 degrees. All the material used in this experiment were insulated (except electrical and electronic devices), to avoid the charge in conductor which may cause by the change of magnetic field.

Keywords: magnetic energy transmission, magnet, power transmission, conservation of energy

1. INTRODUCTION

Energy conservation is a part of the concept of eco-sufficiency. It can reduce the uses of energy consumption, while increase the environmental quality, national security, personal financial security and higher savings (Zehner, 2011). It is at the top of the sustainable energy hierarchy (Dawson, 2015). It also lowers energy costs by preventing future resource depletion (Alliance, 2012).

Magnetism is a non-contact force. When two magnets are closing each other, one magnet will attract or repel to another magnet. The amazing part is, the magnets repel each other with a
distance, an “invisible” force try to keep them far away. This called as magnetic field. There are North pole and South pole at the end of the magnet. Whether a magnet is break into two pieces, it still contains two poles, only magnetic strength is affected. The magnets attract when two different poles are nearby, while it repels each other when same poles are nearby.

Next, fiction law stated that kinetic energy converts to thermal energy when two surfaces in contact and move relative to each other. Magnetic energy is a way to overcome this problem. Magnets repel each other with an invisible distance, which means no contact between them. Thus, magnetic drive power transmission method may produce more efficiency than chain drive and belt drive. In this paper, the objectives were to:

(i) To fabricate Mag-drive (power transmission by using magnetic energy);
(ii) To design lab experimental sheets for testing purposes; and
(iii) To analyze the efficiency of Mag-drive.

2. EXPERIMENTS

The law of conservation of energy stated that energy can neither be created nor destroyed. There was the only way to get energy, it transformed from one form to another form. In this experiment, magnetic energy was used for transmitted energy. The mechanical energy which was transmitted by magnetic energy was then converted to electrical energy, by using a DC generator.

Several experiments had been conducted. The first experiment is conducted with a very simple construction project, which may explain the used of magnets can extend the ending time of moving object. The first experiment was built using two CDs, upside down designed, which installed on an axel. 8 Neodymium magnets were used to install on each CDs, with 45 degrees angle and 1cm distance facing to another magnet.

The second experiment was conducted. The design of project in second experiment was quite different to the first experiment. The project was designed as internal layer and outer layer. The magnets at both layers were facing to each other with 90 degrees. The internal layer had 4 magnets, while outer layer had 6 magnets. This experiment was to show different design and different angle of magnets facing may cause different result.

The third experiment was conducted to show the energy conversion from magnetic energy to mechanical energy, and mechanical energy converted to electrical energy by using a DC generator. This construction of project in this experiment was more complicated compared to the first experiment. When the magnetic energy converted to mechanical energy, the starting energy was transmitted by using power transmission mechanism (chain drive), which from a bigger sprocket (driver gear) to a smaller sprocket (driven gear). Then, the DC generator connected to the driven gear with a shaft, to generate electrical energy.

The fourth experiment was conducted where the design was included solar panel as potential energy, to supply the electrical energy to DC motor. This construction performed two ways of energy conversion, which was from solar energy to electrical energy, electrical energy to mechanical energy; while another energy conversion was from mechanical energy to mechanical energy which was using the magnetic energy as way transmitted energy, mechanical energy to electrical energy. The last output of electrical energy was stored up in a
super capacitor, which for future used (charge USB electronic devices) or continued this energy conversion. Figure 1 showed the design prototype of the experiment apparatuses and the description of each component were detailed out in Table 1.

Figure 1: Design prototype of the experiments of energy conservation using the concept of magnetic and solar energy
Table 1: Description of each component in the project

<table>
<thead>
<tr>
<th>Component</th>
<th>Function</th>
</tr>
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<tbody>
<tr>
<td>Handy box</td>
<td>To store all the component inside the box, except the solar panel was screwed on the top of the box.</td>
</tr>
<tr>
<td>Solar panel</td>
<td>The only component placed outside the box, to collect sunlight and convert it into electrical energy (potential energy). The electrical energy was stored inside a battery for future used.</td>
</tr>
<tr>
<td>Perspex protection box</td>
<td>To cover the rotating disks and prevent the user from danger. The rotating disks may cause hazard if RPM too fast.</td>
</tr>
<tr>
<td>3D printed disks</td>
<td>The disks readied fix number of small magnet holes and big magnet holes. The angles of each hole were precise than man work.</td>
</tr>
<tr>
<td>Motors</td>
<td>Two motors were used in the system. One motor use as driver to drive the driver disk while another one converted into generator to generate electricity.</td>
</tr>
<tr>
<td>Spare part box</td>
<td>To store extra magnets for future experiment used.</td>
</tr>
<tr>
<td>Circuit box</td>
<td>To keep all the cable, electrical component inside this box. There’re toggle switch, rocker switch, variable resistor and digital volt meter on the top of box.</td>
</tr>
<tr>
<td>Toggle switch</td>
<td>To switch either solar panel charging battery circuit or battery ran a motor.</td>
</tr>
<tr>
<td>Rocker switch</td>
<td>To switch either Turn ON or Turn OFF the output.</td>
</tr>
<tr>
<td>Digital volt meter</td>
<td>To display the output voltage of generator.</td>
</tr>
<tr>
<td>Analog amp meter</td>
<td>To display the output current of generator.</td>
</tr>
<tr>
<td>Battery</td>
<td>To store the solar panel electrical energy for future used.</td>
</tr>
<tr>
<td>Output USB female port</td>
<td>To plug-in another male USB port for charging electronic devices.</td>
</tr>
</tbody>
</table>

2.1 Steps to Set-up the Mag-Drive System
Step 1: Charging battery

a) Connect the solar panel connector
b) Place the whole system under sunlight
c) Face the solar panel to the sunlight

Step 2: Install magnets in the 3D printed disk

a) Remove the screw of steel linker
b) Remove the Perspex protection box
c) Remove the 3D printed disk from motor and generator shaft
d) Choose the size and number of magnets for mag-drive experiment, the magnets can get it from spare part box
e) Refer to steps of assembly 3D printed disk to learn the correct way of assembly 3D printed disk
f) Install both disk on the shaft to try out an experiment
g) Remember install the Perspex protection box before starting the system

Step 3: Connect battery to the system

a) Run this system under shade
b) Connect the battery to whole system with battery connector

c) Beware the variable resistor, switch the variable resistor to maximum resistance before connect battery to the system

**Step 4.1: Circuit control**

Function of the components:

- **Toggle switch** = Switch either solar panel charge battery mode or battery active motor mode
- **Rocker switch** = Either switch ON or switch OFF the output circuit
- **Variable resistor** = Motor speed controller
- **Digital volt meter** = Show the output voltage, the circuit consume about 1.5V, so the estimated output voltage is the meter showed voltage plus 1.5V

a) Switch the toggle switch battery active motor mode from solar panel charge battery mode

b) Slowly control the variable resistor to reduce the resistance, the motor will increase the speed when resistance drop gradually

c) Reduce the resistance gradually, until the digital volt meter show “2.5 V” or above

d) Switch the rocker switch to “I” to switch ON the output charging circuit
**Step 4.2**: Circuit control (amp meter reading)

a) This analog amp meter shows the generated ampere

b) This analog amp meter was installed beside the circuit box

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**Step 5**: Generated electrical energy by mag-drive

a) Connect an USB electronic device for active or charging purpose

b) Attention to the electronic device’s ampere needed to active/charge

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**3. RESULTS AND DISCUSSION**

The results of the calculation of Mag-drive in electrical power field were related to the electrical energy that collected by volt meter and amp meter.

**Graph 1: RPM Efficiency of Mag-drive**
From Graph 1, it showed the different RPM of motor and generator with same generated voltage by generator. The table showed some efficiency lost in Mag-drive, the RPM of generator was less than motor RPM all the time. From the estimated calculation, the efficiency of Mag-drive was about 84.58%, which means it lost 15.42% efficiency. This result was tested out by using 9 small magnets at drive disk and 9 small magnets at driven disk.

RPM Efficiency of Mag-drive,

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RPM\ Efficiency = \frac{\sum_{\text{Generator}} \text{RPM} \times 100}{\sum_{\text{Motor}} \text{RPM}}
\]

\[
RPM\ Efficiency = \frac{344 + 834 + 1432}{422 + 995 + 1669} \times 100\%
\]

\[
RPM\ Efficiency = 84.58\%
\]
From Graph 2, it showed the electrical energy that generated by 12V DC motor. With higher RPM, the generator generated more electrical voltage. The generated voltage increased gradually from 100 RPM to 500 RPM. The generated voltage increased rapidly from 600 RPM to 900 RPM, while increased slowly from 900 RPM to 1400 RPM.

3.1 Energy Efficiency

Efficiency is the (often measurable) ability to avoid wasting materials, energy, efforts, money, and time in doing something or in producing a desired result. In a more general sense, it is the ability to do things well, successfully, and without waste. In more mathematical or scientific terms, it is a measure of the extent to which input is well used for an intended task or function (output). It often specifically comprises the capability of a specific application of effort to produce a specific outcome with a minimum amount or quantity of waste, expense, or unnecessary effort. Efficiency, of course, refers to very different inputs and outputs in different fields and industries.
Graph 3 showed the graph of Efficiency versus Disk RPM. The result showed the higher the Disk RPM, the higher the efficiency of Mag-drive. With this, Mag-drive is highly recommended for high RPM application.

4. CONCLUSION

Magnetic energy can be used as a type of mechanical energy transmission (Mag-drive). This transmission method provided a very good advantage, which is zero friction between two disks. Since permanent magnets have its own strength, which played the same role of teeth of the sprocket. With different angle and magnetic strength, it also affected the efficiency, and increase the efficiency of the mag-drive when both conditions are perfectly match and suitable. Mag-drive contains high efficiency in energy transmission, and suitable for high RPM power transmission.

The Mag-drive is suitable for high RPM power transmission. Also, the light weight gives a huge advantage in application which can reduce the inertia of a moving object. Other power transmission method application such as chain drive and belt drive can be replaced by Mag-drive. Other example is the Mag-drive bike where the replacement of Mag-drive bike design concept can avoid the risk of loose chain.

REFERENCES

