Modeling The Magnet Electric Power Planning As The Alternative Energy

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***Abstract*— Neodymium magnets are permanent magnets, which have high strength. Magnets can exert a force push or repel as powerful motor. The method in this study through the stages in the preparation of materials and research tools. Magnet is used N42 grade neodymium magnet with a diameter of 12.5 mm, thickness 1.5 mm thick composed of six pieces so that the whole 9 mm. In the attached magnet stator magnets are 48 pieces divided in 2 rows with the north pole facing into, and the magnet attached dictator a divided by 44 pieces also in the second row with the north pole facing out. The position of the stator magnet attached at an angle of 25° facing perpendicular magnetic rotor with 5 mm distance between the poles. Houses magnet drilled at an angle of 25° as deep as 9 mm, to install as many as 40 holes magnet is divided into 2 rows aligned with the row spacing of 15 mm. The results obtained by the occurrence of a failure in the magnetic shield systems to reduce the magnetic field, so it has been done in the selection of formulation shield Co-netic AA-Alloy, with the hypothesis magnet motor will work with power of 0.173 kW, torque of 1.81 Nm and motor rotation speed of 911 *rpm*.**

Keywords*— *Magnet Neodymium, energy, power, torque, rotation speed

1. Introduction

1.1 Background

Electrical energy demand in Indonesia is needed, and the government should subsidize the operation so that the community can be met. In Indonesia is still very lacking supplies of energy resources, so that frequent electric power crisis that occurs mainly remote and isolated areas. Magnetic power generator is one of the ideas of alternative energy development, to maximize the potential energy that can be used as well as the fuel and mining. A large investment, but operating costs are very small, a power advantage is. By utilizing the energy of the magnetic poles repel without additional charge at each operation. Achievement of the preservation of nature can also be maintained as independent power against the pollution.

1.2 Objectives of Research

This magnetic power is assumed to be working optimally, without limitation too focused on the potential energy required in its performance, because it relies on magnets repel force used. The power plant is expected to be helpful in terms of saving of minerals that are getting reduced due to excessive use of energy needed to obtain. The plant also preserve nature a clean, safe and comfortable without pollution, waste, noise, and other adverse effects.

In the village is not like the city of the electrical energy needs could be met, in villages sometimes do not work as a result electricity is not an unqualified company to always supply the electricity provider, so the policy was taken as a precaution. In anticipation long before the current energy crisis is to use water and wind. As the potential energy that can not be discharged, but the conditions and other support remains a limitation, not always where there is a large flow of water and there was always a strong wind pressure velocity, so this step can only be done in certain areas only, differently to magnets that can perform operations without the need to worry about where that does not support. In addressing these conditions, the researchers wanted to test the specimens will be obtained and the values of the necessary steps in planning a magnetic power generator. So that the future results of this study are expected to greatly help both in terms of science, the economy, and especially in the field of energy.

2. Magnetic

Neodymium magnet made from an alloy of neodymium, iron, and boron to form Nd2Fe14B tetragonal crystalline structure has a very high magneto crystalline uniaxial anisotropy (HA ~ 7 tesla). These compounds provide the potential to have high coercivity (resistance to be demagnetized). This compound also has a high saturation magnetization (JS ~ 1.6 Tesla or 16 kg). Therefore, the maximum energy density comparable to Js2 magnetic phase has the potential to store a large amount of magnetic energy (~ 512 kJ/m3 BHmax or 64 MG · Oe). Unit poles in the system are MKS Ampere meter, symbol m and q as well as for electrical charge. If at any point we place a power pole m 'of magnetic thin and long, while at another point as far as r of m' well we put m a power pole the interaction style both poles are:

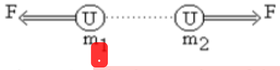

Figure 1 : The interaction of the two poles Style

$$F = \frac{\mu_0}{4\pi}\frac{m\,m'}{r^2} \tag{1}$$

Where:
F = force of attraction / repel force in newton

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R = distance in meters

m_1 and m_2 strong magnetic poles in Ampere-meter.

μ_0 = permeability of vacuum.

Value $\frac{4\pi}{\mu_0} = 10^7$ Wb/A.m

(2)

This formula is the same as the interaction of two electric charge formula proposed by Coulomb.

If B is the magnetic induction wire cutting, the force experienced by the wire is F = 2 π I B r, if 2πr is the length of the wire windings. Flow of radius r there with the induction field of $B = \mu_0 I/2r$, so that the power poles U m experiencing a force of F = m B'

$$F = \frac{m\, \mu_0\, I}{2\, r} \tag{3}$$

Both styles in the last equation is the interaction force between the poles of a magnet with current N on the circuit, so that:

$$2\, \pi\, I\, B\, r = \frac{m\, \mu_0\, I}{2\, r} \tag{4}$$

or

$$B = \frac{\mu_0\, m}{4\, \pi\, r^2} \tag{5}$$

Magnetic induction is induced by the magnetic poles of the magnet poles so far r. Comparison of magnetic induction B with permeability of vacuum μ_0 $H = B / \mu_0$, $\mu_0 = 12{,}5 \times 10^{-7}$. Called the magnetic intensity of the room is empty, so the intensity of the generated magnetic pole strength *m* to *r* point extent of the poles are:

$$H = \frac{1}{4\, \pi}\ \frac{m}{r^2} \tag{6}$$

If B is measured dalan Wb/m2 unit, the magnetic intensity H in Amp/m. Comparison between the power poles with cross-sectional area is called the power of the magnetization, as well as the charge per unit area is called the charge density.

$$J = \frac{m}{A} \tag{7}$$

Known as magnetic flux (Φ_B), which is the result of the projection of the magnetic field in all extents, penetrate. Magnetic field flux (Φ_B) that penetrates the area $d\vec{S}$ is zero. This is due to a net magnetic charge magnetic dipole is zero so the number of lines entering the B value as the path out of the area it. This means the overall magnetic field magnetic flux is:

$$\Phi = B\, .\, A \tag{8}$$

Where:

Φ = magnetic flux

A = area (surface) copy

B = strong magnetic field or magnetic

2.1 Style That Works On Portable Power Magnet Motor Mechanism

2.1.1 Rotation Kinematics

In Motion Straight subject, we know some scale, such as velocity, displacement and acceleration. Called angle because the rotational motion of each particle on a rigid body moving in a circle and take a certain angle. Quantities are also called angular velocity, angular acceleration and angular displacement.

When the disc rotates, each part of the disc moving at a different pace. Point near the axis (S), moving more slowly than the point located at the edge of the disc, however, because the rate of each point alias every part of the disc is different. However, when a point located on the edge of doing a full rotation, then the point near the axis also did a full turn. If discs do one lap, then all parts of the disc that also did one round.

2.1.2 Displacement Angle

In rotational motion, the easiest way is to measure angles using radians. Radian can be expressed in degrees, and vice versa. A full circle = 360º. Arc length around the circle = 2 π r. Thus:

$$\theta = \frac{l}{r} = \frac{2\pi r}{r} = 2\pi r \text{ rad} \tag{9}$$

To help demonstrate the change in the position of rotational motion, set an imaginary line as a reference point to see the change in location of the position. When the disc rotates, a point which at first coincides with the reference line moves through an angle θ l along the arc so far. A point is said to do the rounds as far as one radian if the length l = length r. In other words, if l = r, then θ = 1 radian. Mathematically, the angle θ is expressed as follows (in radians):

$$\theta = \frac{l}{r} \tag{10}$$

where:

r = radius,

l = length of arc

θ = Angular displacment

2.1.3 Corner speed

If speed is the ratio of the displacement and the lapse of time, it is the ratio of the angular velocity and the angular displacement interval.

2.1.4 Average angle speed

The position angle is measured from the reference line. At the time t_1, part the wheels are marked with dotted lines in the position so far θ_1 from reference line. At time t_2, the wheels are marked with dotted lines in the position of the reference line as far θ_2 from line. Difference between θ_2 and θ_1 an angular displacement *(* $\Delta\theta$ *)*. Mathematically average angular velocity is expressed as follows:

$$\omega = \frac{\theta_2 - \theta_1}{t_2 - t_1} = \frac{\Delta\theta}{\Delta t} \tag{11}$$

Where:

ω = angular velocity

t = time taken

$\Delta\theta$ = delta theta or angular displacement

Δt = time interval or period

2.1.5 Average acceleration angle

Mathematically, the average angular acceleration is defined as follows:

$$a = \frac{\omega_2 - \omega_1}{t_2 - t_1} = \frac{\Delta\omega}{\Delta t} \tag{12}$$

where :

a = average angular acceleration

ω_2 = final angular velocity

ω_1 = initial angular velocity

2.1.6 Frequency

The equation that connects between the frequency and the angular velocity is described as follows:

$$\omega = \frac{2\pi}{\Delta t} \tag{13}$$

Because $\Delta t = 1/f$, the angular velocity equation can be written as:

$$\omega = 2\pi f \text{ or } f = \frac{\omega}{2\pi} \tag{14}$$

where

f = frequency (hertz)

2.1.7 Period

The period is the time it takes to do one lap

$$\Delta t = \frac{1}{f} = \frac{1}{\omega/_{2\pi}} = \frac{2\pi}{\omega} \tag{15}$$

2.1.8 Relations between Linear Speed and Velocity Angle

When the disc rotates during the time interval Δt , the point of A cover corner as far as $\Delta\theta$, along the arc Δl . A point linear velocity direction given by the arrow to the end. Large linear velocity is:

$$v = \frac{\Delta l}{\Delta t} \tag{16}$$

because $\theta = \frac{l}{r} \rightarrow l = r\theta$, then the above equation can be written as:

$$v = \frac{\Delta l}{\Delta t} = r\,\frac{\Delta\theta}{\Delta t} = r\omega \tag{17}$$

The following equation expressing the relation between the tangential acceleration with angular acceleration.

$$a = \frac{v_2 - v_1}{t_2 - t_1} = \frac{\Delta v}{\Delta t} = r\,\frac{\Delta\omega}{\Delta t} = ra \tag{18}$$

2.1.9 Torque or moment of force

Newton's Second Law, that a body can move straight to a certain acceleration when given style. Changes in velocity = acceleration. The greater the force applied, the greater the acceleration of motion of an object. Mathematically, the relationship between torque to angular acceleration expressed as follows:

$$a \propto Fr \propto \tau \tag{19}$$

description :

α = acceleration angle

$\propto$ = comparable

F = force

r = radius

τ = torque

Big torque

Torque is the product of the force F and sleeve style l. Mathematically, the torque is formulated as follows:

$$\tau = Fl \rightarrow l = r \sin\theta = r F \sin\theta \tag{20}$$

description :

τ = torque and moment of force

F = force

L = sleeve style

3. Research methodology

The magnets used are grade N42 neodymium magnets with a diameter of 25.4 mm, 25.4 mm thick. In the magnet rotor magnet mounted as many as 30 pieces, 1 row with the north pole facing into, and the magnet-attached distator as many as 34 pieces, 1 row with the north pole facing out. The position of the stator magnet attached at an angle of 25 °, facing perpendicular magnetic rotor. Planned home magnet rotor has a diameter of 360 mm with a thickness of 35.4 mm made that does not have an influence on the magnetic field, in order to eliminate the influence of the resistance in the future as well as other effects.

Hold the magnet or drilled with a variety of angles, to attach the magnet by 30 holes divided into rows of slits. Similarly to the stator magnet, only differentiated diameter, number of holes and the drill angle holes to adjust the rotor magnet. In the process works, rotor positioned at the beginning of the side, will be shifted towards the position of the stator, which is supported by a retaining bolt as well as sliding sab.

After shifting toward rotor stator, rotor magnet is in or distator, will face each other and provide a repulsive force refused to move the stator is connected to the shaft. Varied angles before seen performance comparisons occur. In a shift towards rotor stator hub is planned to be a component of slip, with the rotary system as well as on the clutch was still attached to the stator grinding machines hand.

3.1 Test tools

The shape and construction of the test apparatus is shown in the following figure:

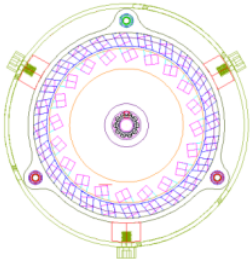

Fig 2 instrument testing looks ahead

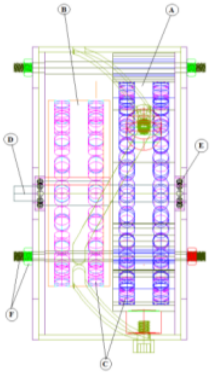

Fig 3 instrument testing looks aside

A: The house magnet stator, B: House magnet rotor, C: Magnet, D: Axis, E: Bearing / bearings, F: Bolts and nuts retaining

4. Analysis and Discussion

Has been taken into account and planned for portable power magnet motors of performance, torque, rpm, power up component-supporting components, but on the ground the motor may not work as expected, with the review that the components of the magnetic material made of teflon, with a diameter of holes made of 12.5 mm with a depth of 9 mm, with a total hole / hold as many as 40 pieces in 2 rows of rotor, and the composition of each magnet is attached at an angle of 25 ° right upright faces in 48 holes in 2 rows on the stator, the distance between 5 mm, and the north pole is a pole of mutual dealing.

4.1 Calculation of Magnetic Shielding And Planning

4.1.1 Calculation Results:

magnetic data
Magnetic induction (B) = 0.1599 Wb/m2 = 1599 Gauss
Strong magnetic field (m) = 39.978 amp.m
The intensity of the magnetic
(H) = 127920 amp/m = 1606.6315 Oersted
Magnetic flux (Φ) = 1.962 Wb
Magnet diameter (d) = 12.5 mm = 0.49213 in
data Shield
Co-netic AA-Alloy
The maximum magnetic induction (Bmax) = 7500 Gauss
Magnetic coercivity (Hc) = 0.015 Oersted
Netic S3-6 Alloy
The maximum magnetic induction (Bmax) = 21 000 Gauss
Magnetic coercivity (Hc) = 1.0 Oersted

4.1.2 Magnet Shield Plan.

Based on the data above, the calculated thickness and damping material owned by comparing material Co-*netic* AA-Alloy and Alloy *netic* S3-6, so it can be selected to suit the needs. Planning With Material Co-*netic* AA-Alloy

Counting thick magnetic shield (t) can be found by the equation:

$$t = \frac{1{,}25 \cdot d \cdot H}{B_{max}} \tag{21}$$

Having acquired a thick shield, the shield can be searched damping (A) by a magnetic force, by the equation:

$$A = \frac{\mu \cdot t}{d} \tag{22}$$

Magnetic flux density is obtained by comparing the style of the magnetic field has shield calculated by the equation:

$$B = \frac{H}{A} \tag{23}$$

From the calculation results obtained:
Shielding Co-*netic* AA-Alloy
Shield thickness (t) 0.13 in, the damping rate (A) 36189.63 and the remaining influence of magnetic force intensity (B) 0.044 gauss.
Netic shield S3-6-Alloy
Shield thickness (t) in 0.047, the level of attenuation (A) 147.08 and the residual effect of the intensity of the magnetic force (B) 10.92 gauss. It can be concluded that material suitable for use on portable power magnet motors is the shield of the type Co-*netic* AA-Alloy, due to the influence of a magnetic shield once fitted are assumed to reduce the magnetic force very well, but the thickness of the field size on the market only in 0014, in 0020, 0.025 in, 0.030 in, 0.040 in, 0.050 in and 0.062 in, so based on the information stretcher, whichever is the thickest in the 0.062 to take into account the damping rate of return.

Planning with Co-*netic* material Alloy AA-size 0.062 in

Measured values for the remaining influence of the intensity of the magnetic force is small enough so that the magnets on the rotor and stator are expected to work optimally as desired. Because of the reduced resistance force, although of little value, still the necessity of calculating whether these changes are affecting the performance of the rotor and the stator, the returns obtained by the calculation of the force experienced.

4.1.3 Calculation of Influence Remaining Prisoners Of Style Magnet

Consider the case that occurred due to force prisoners so that the rotor cannot rotate or does not move, which means that the force between repulsion and prisoners alike than or equal to zero. It can be concluded that the calculation can then be calculated on the basis of the failure.

Calculating the effect of magnetic force prisoners obtained from the equation:

$$F_{working} = m \times B_{working} \tag{24}$$

$$F_{resistance} = m \times B_{resistance} \tag{25}$$

$$F = F_{working} - F_{resistance} \tag{26}$$

5. conclusion

From the measurement results based on the equations and literature obtained in simulation planning power magnet has specification power (P) 0173 kw, torque (τ) 1.81 Nm, rotation speed (n) 911 rpm. For the election to choose the magnetic shield material that has a high level of permeability to obtain maximum damping, but the thickness and material used in the planning should be adapted to the product in the market, as well as in the selection of the bearing, in order to facilitate the work. In this plan still need measurements of the magnet to be used that will be very helpful if you are using an accurate measuring tool, especially in the calculation of static magnets. On subsequent research, it is necessary variation to variable angle position magnet mounted on the rotor, so the comparison of power, torque and rpm of the angle formed can be seen clearly performance.

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