DESIGN AND FABRICATION OF FRICTIONLESS STRENGTH TECHNOLOGY THE USAGE OF FLYWHEEL FOR ELECTRIC CARS

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ABSTRACT

Strength Garage Structures (ESSs) play a very critical position in latest years. Flywheel is one of the oldest strength storage devices and it has several advantages. Magnetic flywheel storage machine is upgraded version of FESS. It improves performance of strength generation. Frictionless strength generation is eco-friendly as well as has longer lifestyles due to no put on and tear at some point of production. The precept of energy era of the gadget is based on Faraday's law of caused emf.

Keyword: Frictionless energy, Electric vehicle, Energy storage system, Flywheel.

1. INTRODUCTION

Kinetic power healing machine KPRS is a gadget for convalescing the transferring automobiles kinetic power under braking and additionally to transform the usual loss in kinetic strength into benefit in kinetic electricity. Here we use mechanical kinetic electricity okay. Energy healing machine through flywheel to save the energy which is usually lost in the course of breaking and we use it to help propel the rider while beginning. Generally, in gift situation the power constituted of the bicycle with the aid of the usage of dynamo. In this association there is a few quantities of friction, so there may be lack of strength but we're trying to generate the electricity without use of dynamo which is frictionless. We can use the coil and neodymium magnet to generate the electricity.

2. LITERATURE REVIEW

Flywheel is one of the oldest strength storage devices. M. Mousavi G, Faramarz Faraji, Abbas Majazi and Kamal Al-Haddad researched on a comprehensive review of flywheel electricity storage gadget era. On this observation they have got evaluated the significance of flywheel in energy garage system (ESS) and additionally flywheel electricity storage shape theory consists of flywheel, motor, rotor bearing and strength digital interface. It additionally involves the FESS utility research like Fess in electric powered automobile, in railway, wind energy device, hybrid electricity technology machine, in space, in marine and additionally in electricity networks. It also evaluates the blessings and downsides of flywheel strength storage device. Standard scientist said the significance of flywheel in energy storage system.

Chung-Neng Huang and Yui-Sung Chen said efficiency development of magnetic flywheel over easy flywheel of their researched named as study on layout of magnetic flywheel control performance development of fuel cells used in automobile. This study refers that efficiency of magnetic flywheel is increased via 27. 3% over easy flywheel in fuel cell ouput. This development is possible only because of the residences of magnetic flywheel together with high

energy density, excessive-speed charging capacity and coffee loss. On these studies they've used lithium-ion battery in magnetic flywheel gadget (MFS).

Michael A. conteh and Emmanuel C. Nsofor did observe on journal of applied studies and era Composite flywheel fabric layout for excessive-speed strength garage. They've analysed residences of flywheel together with low density, low modulus and high electricity composite materials for high-velocity electricity garage. On this research, they did evaluate flywheel pressure analysis, electricity density of flywheel and composite fabric houses. They have concluded as a way to reap high power density a look for higher energy, decrease modulus and lower density for consistent pressure portion is needed. Also study tested outperformance as compared to the boron/epoxy-graphite/epoxy mixture.

Elisa Isotahdon et al, did studies look at on journal of alloys and compounds named as characterization of the microstructure and corrosion performance of Ce-alloyed Nd-Fe-B magnet. They studied neodymium magnet is important for growth in overall performance of ESS. In these studies, we get recognized approximately the microstructure and chemical residences of neodymium magnet. In addition, they stated that Ce-alloyed neodymium magnet, Ce is used to boom corrosion resistance property of magnet. In quick it increases existence span of neodymium magnet. This alloyed Ce can make large distinction in corrosion resistance homes of neodymium magnet. Its miles viable to replace Ce for Co for alloying. That they had additionally tested microstructure distinction among both alloyed neodymium magnets.

The look at on magazine of energy conversion and management named impact of energy-regenerative braking on electric powered automobile battery thermal control and manipulate approach primarily based on simulation investigation is accomplished by means of Jingying Huang, Datong Qin and Zhiyuan Peng. The main problem of re-generative braking is that temperature upward push in battery due to braking. This problem is solved via the usage of fuzzy logic simulations. They have got said that better regenerative braking ratio, better temperature upward thrust in battery so need to alter RB ratio to govern thermal management of battery in electric powered car. In addition, they reviewed numerous simulations for thermal management of battery on these studies.

In observe, there's scope for frictionless power technology with help of magnetic flywheel, regenerative braking and neodymium magnet. Magnetic flywheel in preference to easy flywheel, Ce alloyed neodymium magnet and lithium-ion battery are assembled to produce contactless electricity power. In design amount of strength produced is stored into battery and used each time favoured in electric car.

3. METHODOLOGY AND DESIGN

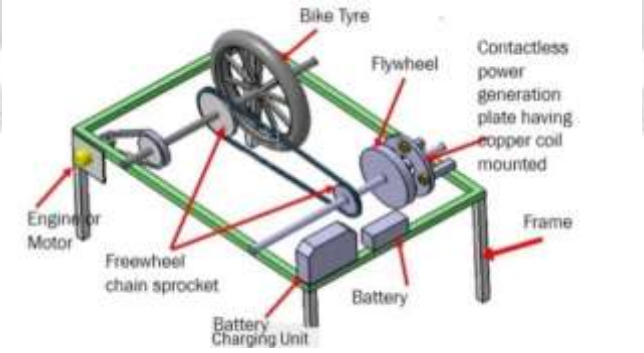


Fig. 1. Experimental setup

In layout, the flywheel, copper wire and neodymium magnet are major element of gadget. The Flywheel is used for the power storage device along with copper wire which is used to transfer electric powered flux to the gadget and neodymium magnet for magnetic flux. The wheel that is connected to the pulley mounted on the equal shaft and its diameter is much less than the wheel diameter because of which it's pace of rotation could be accelerated. On some other shaft linked to the pulley is having the meeting of flywheel and copper magnet-coil arrangement. Flywheel will shop the kinetic electricity at the same time as wheel is in walking circumstance and could release the k.E while the brake is applied on the wheel. So the use of flywheel presents such kind of electricity which help to run the cycle

by using less green electricity. Copper magnet will start rotating shaft and coil is consistent. So right here variable e.m.f is comprised of magnet and coil arrangement. With the aid of this way electricity can be generated and saved into battery.

Power generation:

While designing a generator, it's far vital to have a company draw close of the simple laws that govern its overall performance. As a way to induce a voltage in a twine a nearby converting magnetic area need to exist. The voltage induced now not simplest relies upon on the magnitude of the sphere density however also at the coil region. The relationship between the region and subject density is called flux (Φ). The way wherein this flux varies in time relies upon on the generator layout. The axial flux generator uses the changing magnetic flux to produce a voltage. The voltage produced through each coil can be calculated the use of Faraday's law of induction:

$$v = -N\frac{d\phi}{dt}$$

Time varying magnetic flux:

An important component is that the greater the trade in magnetic area the more they brought about voltage. Translating this to the development of a wind turbine is that the greater the speed of the wind the more the fee of exchange in the magnetic field and therefore extra voltage may be produced. Faraday determined that the brought about voltage was now not simplest proportional to the rate of exchange in the magnetic area but it's also proportional to the location of the magnetic subject. This vicinity without delay pertains to the size of each coil in a generator or the location of a coil. Growing the size of every coil will proportionally growth the voltage output. A time period referred to as the magnetic flux is formulated from the dot made from the region and the magnetic area density in a uniform subject.

$$\textbf{Flux} = \Phi = BA\cos\theta$$

In most cases a uniform magnetic discipline cannot be produced so the flux is calculated by using the vital of the magnetic area with recognize to the place.

$$\Phi B = \int B\, dA$$

A close approximation of the caused voltage may be taken the usage of the dot product.

Coil design:

The quantity of windings in line with coil produces a layout task. The greater windings will growth the voltage produced through every coil but in turn it will also increase the scale of every coil. So that it will reduce the dimensions of each coil a cord with an extra length gauge can be utilized. Again, every other mission is provided, the smaller the twine turns into the much less modern-day will flow before the twine starts off evolved to warmness up due to the multiplied resistance of a small cord. Each certainly one of our coils has a measured resistance of forty Ω; a smaller gage wire would similarly lessen this resistance. In this design we have choose to sandwich the coils between the two magnets. This design will growth the field density significantly improving the voltage output.

N-52 grade NdFeB magnet:

The magnets used on this layout is N-52 grade NdFeB magnets. The flux density of such magnet is 2100 Gauss and this is indicated by way of the inexperienced glow of mild inside the discern beneath.

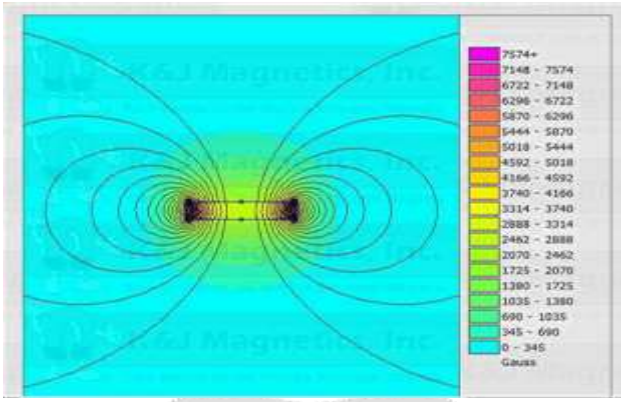


Fig 3: Flux density NdFeB magnet

The website for the everlasting magnets (N52) furnished the specifications which can be required to make this calculation as seen in desk

Table -1: Specifications

Max. Energy Product ^{BH}(MAX)	Residual Flux Density ^{BR}(MAX)	Coercive Force ^{H}C	Outer Diameter ^{D}O	Inner Diameter ^{D}I	Thickness H
33-52 MGOe	11.7-12.1 KGs	>11.0 Koe	40 mm	20 mm	5 mm

Data Reduction:

1.Belt drive transmission:

Motor RPM =1440 (standard motor)

Motor pulley Diameter (Input) = 75mm

Large pulley Diameter (output) = 85mm

Centre Distance = 250mm

Output Rpm = To find

Formula:

$$\frac{\textbf{RPM of motor}}{\textbf{RPM of shaft 1}} = \frac{\textbf{Diameter of shaft pulley}}{\textbf{Diameter of Motor pulley}}$$

1440/RPM of shaft 1= 85/75

RPM of shaft 1= 1270.58

RPM of shaft 1= N2 = 1270.58

2. Chain drive transmission:

The rpm of the output belt drive will be the input rpm of the chain drive mechanism thus,

Large sprocket RPM = 1270

Large Sprocket diameter = 120mm

Small Sprocket diameter = 80mm

Large sprocket teeth (input) =22

Small sprocket teeth (output) =14

Centre Distance = 400mm

Chain length= 1000mm

RPM of Shaft 1 / No of teeth on larger pulley/

RPM of shaft 2 = No of teeth on smaller pulley

1270/RPM output = 22/14

RPM output = 808

Thus, the input speed i.e,1440 RPM is converted to 808 RPM to the flywheel with the help of a belt drive and chain drive. Thus, the magnet will also start to rotate with the same speed as of the flywheel.

3. Equivalent torque applied on primary shaft

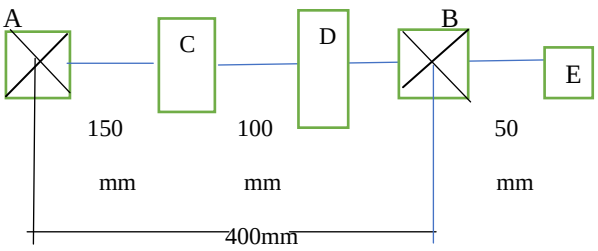
Power transmitted by shaft

$P=2\pi NT/60$

$P=2\pi\times1270\times T/60\times1000$

T = 3.76 Nm

Bearing	Pully (Wp)	Sprocket (Ws)	Tire (Wt)
2N	1.5N	5N	



Taking moment at point A,

RB x 400 + (RA × 0) = (150 × 2) + (1.5 × 250) + (5 × 450)

RB =7.31N

RA + RB = Total load

RA = Total load - RB

RA = (2 +1.5 +5) – 7.31

RA = 1.19N

4. Calculation of maximum B.M:

MA= 0Nm

MC = RA X 150 = 1.19X150

MC =178.5 N mm

MD =1.19X250 – 2 X 100

MD = 97.5Nmm

MB= 1.19 x 400- 2 x 150 -15 x50

MB= 101 N mm

ME = 0

Maximum bending moment at point C= 178.5 N mm = 0.178 Nm

Combine Twisting and Bending

$$Teq = \sqrt{[T^2 + M^2]}$$

$$= \sqrt{3.76^2 + .178^2}$$

$$= \sqrt{14.161} \quad Nm$$

Teq = **3.76 Nm**

As we know that,

$$Teq = (\prod \times D^3 \times \tau) / 16$$

Where,

τ = Shear Stress

$$\tau = (16 \times Teq) / (\prod \times 0.02^3)$$

τ = **2.3949 N/mm2**

For steel,

Allowable shear stress 60 N/mm2 ≥ τ.

Hence our design is safe.

5. Equivalent torque applied on secondary shaft

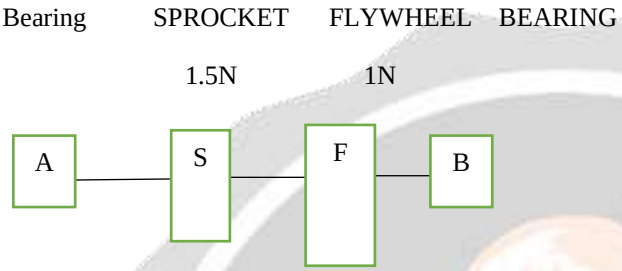
The power available for shaft 2 is same.

Power transmitted by shaft,

$P=2\pi NT/60$

$P=2\pi\times808\times T/60\times1000$

T = 5.912 Nm



Taking moment about point A,

RB x 400 + (RA × 0) = (1.5 × 250) + (1 ×300)

400 RB = 675 N

RB= 1.68 N

RA + RB= Total load

RA = Total load - RB

RA = (1.5+1) – 1.68

RA = 0.81 N

Calculation of maximum B.M: -

MA= 0Nm

MS = RA X 250 = 0.81 X 150

MS =200.5 N mm

MF =0.81 X 300 – 1.5 X 50

MF= 168 N mm

MB= 0 N mm

Maximum bending moment at point

S= 200.5 N mm = 0.2005 Nm

Combine Twisting and Bending

Teq = $\sqrt{[T^2 + M^2]} = \sqrt{5.912^2 + .2005}$

Teq = 5.915 Nm

As we know that,

Teq = (Π × D3×Ƭ) / 16

Ƭ = (16 × Teq)/ (Π × 0.023)

Ƭ = (16 × 5915)/ (Π × 0.023)

Ƭ = 3.76 N/mm2

For steel, Allowable shear stress

=60 N/mm2 ≥ 3.76N/mm2

Hence design is safe.

4. RESULT

The device association generates energy without any friction with flywheel and it can be utilized within the most quantity. The voltage output taken from the meeting is totally dependent on the rpm of the wheels so voltage is fluctuating so a battery is used to offer a regular electricity deliver to charging automobile or appliance. A battery related to the generator meeting is continuously charged while shaft actions. The end result of this test is primarily based on trial-and-errors approach. So, with the help of iteration technique, the output voltage from design is same to twelve V.

5. CONCLUSION

It is eco-friendly clean electricity production from the waste. Under the dynamic operating situations, the magnetic flywheel system satisfactorily reaches requirement for the EV gadget. Also, it will help in lessen stress on non-renewable resources like petrol, diesel and kerosene. It will make our nation a step beforehand in eco-friendly electricity manufacturing.

REFERENCES

1. S. M. Mousavi G, F aramarz Faraji, Abbas Majazi, Kamal Al-Haddad A complete assessment of flywheel strength storage device journal on renewable and sustainable energy review sixty-seven (2017) 477-490
2. Elisa Isotahdon, Elina Huttunen-Saarivirta, Veli-Tapani Kuokkala Characterization of the microstructure and corrosion performance of Ce-alloyed Nd-Fe-B magnets on magazine of alloys and compounds 692 (2017) a hundred ninety-197
3. Michel A Conteh, Emmanuel C. Nsofor Composite flywheel material design of high-speed power garage on journal of carried out research and generation 14 (2016) 184-190
4. Chung–Neng Huang, Yui-Sung Chen design of magnetic flywheel control for performance improvement of fuel cells used in vehicles journal on strength (2016) 1-13
5. Jingying Huang, Datong Qin, Zhiyuan Peng effect of power-regenerative braking on electric automobile battery thermal control and control method primarily based on simulation research on magazine of energy conversion and management one zero five (2015) 1157-1165.