National Conference on Information, Communication and Energy Systems and Technologies - 2019
© 2019 IJSRSET | Volume 5 | Issue 7 | Print ISSN : 2395-1990 | Online ISSN : 2394-4099

Electricity Generation using Propeller Shaft of Vehicle

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ABSTRACT

A vehicle such as a large truck can generate electricity for operating a hybrid engine or recharging batteries by use of an electricity generating driveshaft. The electricity generating driveshaft is comprised of a magnetized driveshaft which acts as a rotor, and a series of copper wire coils surrounding the magnetized driveshaft which acts as a stator in an electrical generator. As the magnetized driveshaft spins as a result of power from the hybrid engine, an electrical field is created which is captured by the copper wire coils and used to power the hybrid engine or recharge a super capacitor or batteries of vehicle.

I. INTRODUCTION

The field of the invention disclosed here in is an article of manufacture and method for generating electricity from the rotating driveshaft of a motor vehicle and using the driveshaft to slow the vehicle to a stop. Vehicles have been powered by a variety of sources over the years. Before the invention of the internal combustion engine, vehicles were powered by animals, wind, and manpower. Since the abuse of the internal combustion engine, vehicles have been fuelled by gasoline, diesel oil, natural gas, ethanol and combinations of ethanol and gasoline. These fuels are expensive to use, difficult to obtain and transport and are becoming increasingly scarce. In response to these problems with the so called 'fossil fuels', vehicles are being powered by all electric motors or hybrid combinations of electric/gasoline or electric/diesel fuel engines. The use of electric motors or electric/fossil fuel hybrid engines is hindered by the difficulty of providing electricity to power the electric motor or the electric portion of the hybrid engine. Electric engines receive energy from batteries. However, the batteries are heavy decreasing the efficiency of the electric motor. The batteries also have limited storage capacity thereby decreasing the range of the vehicle driven by an electric motor. Moreover, stations to recharge the batteries are few limiting the usefulness of electric vehicles. Electrical generators have been in use for many years in different applications. This is possible due to the principle of electromagnetism. As this electrical energy is produced, the generator will cause electric current to flow through an external circuit. Typically, generators are made up of an arrangement of magnets, copper winding and a rotor, which ultimately produce electricity from mechanical power. This concept of electromagnetism can be applied to vehicles, or virtually anything that utilizes a drive axle or drive shaft.

II. PARTS AND MATERIALS

Table 1. Parts and Materials

Sr. No.	Parts	Material
1	Frame	Mild Steel
2	Wooden Sheet	Wood
3	Shaft	Steel

4	Coil	Copper Coils
5	Battery	STD
6	Bearings P204	STD
7	Motor	STD
8	Disc Magnets	Neodymium
9	Screw Nut Bolt M6	STD
10	Pulley	Mild Steel
11	Belt	STD

III. WORKING

- When the propeller shaft is rotating at high speeds, the disc magnets also rotates with its axis.
- When the magnet spins, the magnetic field around the top and bottom of the coil constantly changes between a north and a south pole.
- This rotational movement of the magnetic field results in an alternating emf being induced into the coil as defined by Faraday's law of electromagnetic inductions
- Copper coils generates 10 to 30 AC volt, by using AC to DC Converter circuit, we can convert it to DC and charge the batteries.
- Further by using this power we run the hybrid vehicles or electric vehicles.

IV. DESIGN

1.Shaft:

Figure 4.1. Shaft

Material-Mild Steel (M.S.)
S_{yt}=Yield Strength=170MPa
S_{ut}=Ultimate tensile strength=290MPa
..... (Ref. Table 2.5 in Machine Design by R.S. Khurmi & J.K. Gupta)
Torque=20Kg.cm=20*9.81*10=1962N.mm
Speed=100rpm
Weight of 8 magnets=1kg
(maximum weight value, weight considered as per available magnets with supplier of magnets. i.e. 18mm dia. and thickness 3mm)

Consider Self-Weight of Shaft=5kg
Total weight=W=6kg=6*9.81=58.86N
K_b=combined shock & fatigue factor for bending=1.5
K_t=combined shock & fatigue factor for torsion=1.25
…….. (Ref. Table 4.2 in Machine Design by V.B. Bhandari)
Applying A.S.M.E. Code,
τ_{per}=Permissible stress
$\tau_{per}=0.3*S_{yt}=0.3*170=51MPa$
$\tau_{per}=0.18*S_{ut}=0.18*290=52.2MPa$
Selecting τ_{per} whichever is minimum
…… (Ref. Page no.226 from Machine Design by V.B. Bhandari)
τ_{per}=51MPa (selected)

Considering effect of key-way reduces this value by 25%,
$\tau_{per}=0.75*51=38.25MPa$

Maximum bending moment of simply supported shaft carrying central load,

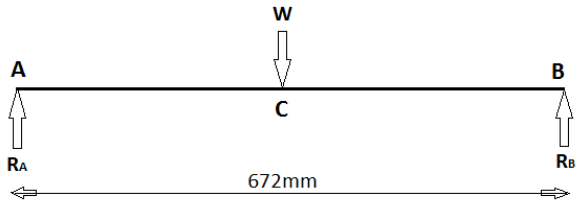

Figure 4.2. Vertical loading diagram of shaft

$$Mc = \frac{WL}{4}$$

Mc = (58.86*672)/4=26369. 28N.mm =9888

We know that, the equivalent twisting moment,

$$Te=\sqrt{(Kb*Mc)\ ^2+\ (Kt*T)\ ^2}$$

$$Te=\sqrt{(1.5*26369.28)\ ^2+\ (1.25*1962)\ ^2}$$

Te= Under root of ((1.5*9888)^2+(1.25*1962)^2)

Te=15034.105 Nmm

Therefore,

We also know that, equivalent twisting moment,

$$Te=\frac{\pi}{16}*\text{Tper}*d^3$$

Putting values,

15034.105= (3.14/16) *38.25*d^3

d=12.60 mm

factor of safety is selected=1.5

d=1.5*12.60 = 18.9mm =19 mm,

The standard size of shaft available nearby to 19 is 20mm

Therefore, shaft diameter(d) we considered as 20mm.

2.Motor:

Figure 4.3. Motor

Speed=N= 1440 rpm

Torque = 20 Kg-cm =20*9.81*10^-2

=1.962 N-m

Angular Velocity =ω= (2*π*N)/ (60) = (2*π*1440)/ (60)

=150.796 rad/sec

Power =P = T*ω =1.962*150.796

=295.862 watt

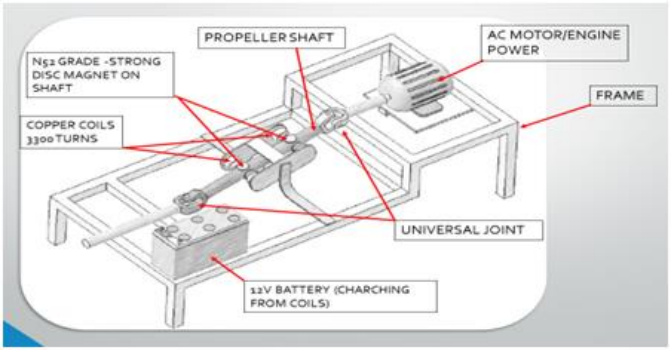

Figure 4.4. Proposed Working Setup

V. RESULTS AND DISCUSSION

1. Save energy:

Propeller shaft is used as energy source in this project due to rotary energy is directly converted to electrical energy & store in battery.

2. Reduce friction:

Dynamo mechanism or regenerative braking system not used in this project coils & magnet concept to generate electricity frictionless.

3. No air & environment pollution:

No fuel is required to run this project due to which no exhaust of pollutants take place.

4. Easy power generation:

As the vehicle is running the power generation takes place by itself and no need of extra efforts to generate power.

5. Low cost:

Main constrain a low-cost device middle class or small-scale industries or society can use it with the vehicles.

VI. CONCLUSION

Electrical generators have been in use for many years in different applications. The general definition of generator is a device that converts mechanical energy into electrical energy. This is possible due to the principle of electromagnetism. In generator powered by a diesel engine, the mechanical energy is provided

from the chemical energy that stems from the combustion of diesel fuel by the engine. This mechanical energy provided to the generator is eventually converted into electrical power based on the principle of electromagnetic induction. As the magnetic field is changed, a current is produced through the conductor within the generator.

VII. REFERENCES

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