Power Generation By Using See Saw Mechanism

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Abstract : "Power generation using see-saw mechanism" uses the energy which gets wasted during the clutch operation. This project generates the electricity by using the energy stored in the wheel.

If clutch pedal is not pressed then engine shaft and wheel shaft both are coupled. In this state motion is transferred from engine to the wheel. But when the clutch pedal is pressed, the engine shaft and wheel shaft will get disengaged. Hence no motion will be transferred. But during this state wheel of the vehicle have momentum and energy is stored in it which is not utilized nowadays. A large amount of electricity can be generated by using a certain mechanism. So, this project deals with the generation of electricity during clutch operation.

In this project we have used a dc motor as an engine to provide the motion to the wheel. And we have made a arrangement such that the pulley which is attached to the wheel shaft will engaged with the dynamo during the clutch being operated. This dynamo will used the energy gain by the wheel and will generate electricity. In this project the components used are as follows : transformer, rectifier, shaft, pulley,Wheel, DC motor, rope drive, bearings, dynamo, multimeter, wire, welding device etc… Here the name see-saw mechanism is given because the arrangement we have used is of the shape of see-saw game played by the children.

This project will help in increasing the life of brake shoes as the see- saw mechanism also produces braking effect. Also this will increase the efficiency of engine by removing the alternator which is used for starting of the vehicle.

I. INTRODUCTION

Clutch is a very important part of the transmission system of the automobile. Clutch is used to transfer the power produced by the engine to the wheel. A clutch is a member used to connect a driving shaft so that the driven shaft may be started or stopped at will, without stopping the driving shaft. The use of clutch is mostly found in automobiles. A little consideration will show that in order to change gears or to stop the vehicles, it is required that the driven shaft should stop, but the engine should continue to run. It is therefore, necessary that the driven shaft should be disengaged from the driving shaft. The engagement and disengagement of the shafts is obtained by means of a clutch which is operated by a lever.

Power generation using see-saw mechanism" uses the energy which gets wasted during the clutch operation. This project generates the electricity by using the energy stored in the wheel. If clutch pedal is not pressed then engine shaft and wheel shaft both are coupled. In this state motion is transferred from engine to the wheel. But when the clutch pedal is pressed, the engine shaft and wheel shaft will get disengaged. Hence no motion will be transferred. But during this state wheel of the vehicle have momentum and energy is stored in it which is not utilized nowadays. A large amount of electricity can be generated by using a certain mechanism. So, this project deals with the generation of electricity during clutch operation.

II. MECHANICAL COMPONENTS

1. Wheel
2. Self-constructed 1 feet seesaw bend
3. 8mm iron rode
4. 2 pulleys 3 inch
5. 2 pulley 2 inch
6. Ball Bearing
7. Bearing stand
8. Foot pad as clutch
9. Spring for foot pad
10. Rubber/ thread built

WHEEL

Motion will be transferred to the wheel with the help of motor. Wheel is mounted on the shaft which also carries two pulleys.

PULLEY

The pulleys are used to transmit power from one shaft to another by means of flat belts, V-belts or ropes. Since the velocity ratio is the inverse ratio of the diameters of driving and driven pulleys, therefore the pulley diameters should be carefully selected in order to have a desired velocity ratio. The pulleys must be in perfect alignment in order to allow the belt to travel in a line normal to the pulleyfaces. The pulleys may be made of cast iron, cast steel or pressed steel, wood and paper. The cast materials should have good friction and wear characteristics. The pulleys made of pressed steel are

lighter than cast pulleys, but in many cases they have lower friction and may produce excessive wear

Rope drives

The belts or*ropes are used to transmit power from one shaft to another by means of pulleys which rotate at the same speed or at different speeds. The amount of power transmitted depends upon the following factors:

1. The velocity of the belt.

2. The tension under which the belt is placed on the pulleys.

3. The arc of contact between the belt and the smaller pulley.

4. The conditions under which the belt is used

Shaft

A shaft is a rotating machine element which is used to transmit power from one place to another. The power is delivered to the shaft by some tangential force and the resultant torque (or twisting moment) set up within the shaft permits the power to be transferred to various machines linked up to the shaft. In order to transfer the power from one shaft to another, the various members such as pulleys, gears etc., are mounted on it. These members along with the forces exerted upon them causes the shaft to bending. In other words, we may say that a shaft is used for the transmission of torque and bending moment. The various members are mounted on the shaft by means of keys or splines.

BEARINGS

The bearing makes many of the machines we use every day possible. Without bearings, we would be constantly replacing parts that wore out from friction. In this article, we'll learn how bearings work, look at some different kinds of bearings and explain their common uses, and explore some other interesting uses of bearings.

Multi meter

A multi meter or a multi tester, also known as a volt/ohm meter or VOM, is an electronic measuring instrument that combines several measurement functions in one unit. A typical multi meter may include features such as the ability to measure voltage, current and resistance. There are two categories of multi meters; analog multi meters and digital multi meters (often abbreviated DMM or DVOM.)

Dynamo

A dynamo, originally another name for an electrical generator, now means a generator that produces direct current with the use of a commutator. Dynamos were the first electrical generators capable of delivering power for industry, and the foundation upon which many other later electric-power conversion devices were based, including the electric motor, the alternating-current alternator, and the rotary converter. They are rarely used for power generation now because of the dominance of alternating current, the disadvantages of the commutator, and the ease of converting alternating to direct current using solid state methods.

Power Supply

In alternating current the electron flow is alternate, i.e. the electron flow increases to maximum in one direction, decreases back to zero. It then increases in the other direction and then decreases to zero again. Direct current flows in one direction only. Rectifier converts alternating current to flow in one direction only. When the anode of the diode is positive with respect to its cathode, it is forward biased, allowing current to flow. But when its anode is negative with respect to the cathode, it is reverse biased and does not allow current to flow. This unidirectional property of the diode is useful for rectification. A single diode arranged back-to-back might allow the electrons to flow during positive half cycles only and suppress the negative half cycles. Double diodes arranged back-to-back might act as full wave rectifiers as they may allow the electron flow during both positive and negative half cycles. Four diodes can be arranged to make a full wave bridge rectifier. Different types of filter circuits are used to smooth out the pulsations in amplitude of the output voltage from a rectifier. The property of capacitor to oppose any change in the voltage applied across them by storing energy in the electric field of the capacitor and of inductors to oppose any change in the current flowing through them by storing energy in the magnetic field of coil may be utilized. To remove pulsation of the direct current obtained from the rectifier, different types of combination of capacitor, inductors and resistors may be also be used to increase to action of filtering.

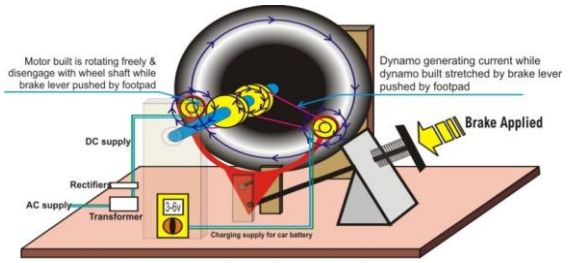
Rectification

Rectification is a process of rendering an alternating current or voltage into a unidirectional one. The component used for rectification is called ‘Rectifier’. A rectifier permits current to flow only during the positive half cycles of the applied AC voltage by eliminating the negative half cycles or alternations of the applied AC voltage. Thus pulsating DC is obtained. To obtain smooth DC power, additional filter circuits are required.

Transformer

A transformer is an electrical device that transfers energy from one circuitto another by magnetic coupling with no moving parts. A transformer comprises two or more coupled windings, or a single tapped winding and, in most cases, a magnetic coreto concentrate magnetic flux. A changing currentin one winding creates a time-varying magnetic flux in the core, which induces a voltage in the other windings. Michael Faradaybuilt the first transformer, although he used it only to demonstrate

the principle ofelectromagnetic induction and did not foresee the use to which it would eventually be put.



Complete Module

DESIGN & CALCULATIONS

Specification of DC Motor

Rotation, N=1500 rpm

Voltage, V= 12 V

Current, I=1.5 amp

Therefore, Power generated, P=V x I

=12 x 1.5=18 Watt

So, The Torque produced, T = (P x 60 x 1000)/ (2x 3.14 x N)

= (18 x 60 x 1000)/ (2 x 3.14 x 1500)

= 115 N mm

Shaft Design

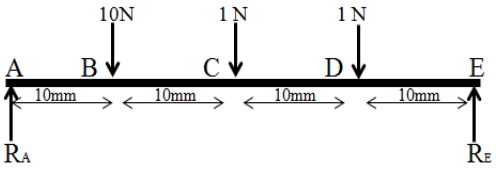
We have fixed the length of the shaft, l = 40mm

Number of wheels = 01 (at position B as shown in the figure)

Number of pulleys = 02 (at position C & D as shown in the figure)

Weight of the wheel = 1 Kg

Weight of the pulleys= 0.1 Kg



Reaction at point A

RA= 8.25 N

Reaction at point B

RB = 3.75

Now, Bending Moment

At point A, B.M. = 0 N mm

At point B, B.M. = 82.5 N mm

At point C, B.M. = 65 N mm

At point D, B.M. = 37.5 N mm

At point E, B.M. = 0 N mm

We find that Maximum Bending Moment is at point B

And Maximum Bending Moment, M = 82.5 N mm

For safe Design of Shaft

Torque Induced, TI ≤ TA, and Torque allowed (1)

We know that

Torque Induced, TI= $\sqrt{(T^2 + M^2)} = \sqrt{((115)^2 + (82.5)^2)}$ = 141.53 N mm (2)

And

Torque Allowed,TA= (3.14 x ţ x d^3) / (16) (3)

From equation (1), (2) and (3), we have got

Diameter of shaft, d ≥ 3 mm

Therefore, we have taken diameter of the shaft taken is, d = 5mm

GEAR RATIO SPECIFICATION:

Velocity ratio in case of dynamo is 1:80

It increases the speed to very high level and increases the input velocity to the dynamo shaft.

The transformer which acts as a power supplier .it steps down 220 V potential to 12V potential.

This step down transformer also analogous like gear which helps in interfering the velocity ratio of the shaft.

SPRING DESIGN:

Average service spring is used here with mean coil diameter of 1 cm.

Made up of 0.67 to 0.70 % carbons.

Up to 2.15 mm diameter allowable shear stress taken is525 MPA for average service spring

Modulus of rigidity (G): 80 knn/m^2

Modulus of Elasticity (E): 210 kN/mm^2

FROM TABLE we have taken the value of coil diameter and spring diameter

Spring diameter: 0.25mm

Mean spring diameter: 1 cm

Rope design

V = (3.14*d*N)/60

N = 1500 rpm

V = 3.14*0.5mm*1500/60

V =40mm /sec

Centrifugal tension Tc =mv^2

1*(40)^2 = 1.6N

Maximum tension in the rope allowed T= 3 N

T 1 = T- Tc = (3-1.6) N = 1.4 N

On calculating no. of ropes we get N = 8 ropes

Voltage calculation at step down transformer : 4.44fNaB

Output V = 12 V

Self-constructed see saw bend of diameter = 18 cm

DIMENSIONS

COMPONENT	DIMENSION
WHEEL DIAMETER	40 cm
PULLEY(WHEEL SHAFT)	7.5 cm
PULLEY(MOTOR)	5 cm
SHAFT LENGTH	40 cm
SHAFT DIA	0.5 cm
SPRING(MEAN DIA)	1 cm

CONCLUSION

- On providing power input of 0.551 KW, 22.2 volt electric potential is produced by using power of 15.4 watt which would have been wasted during clutch operation.
- This project will help in increasing the life of brake shoes as the see- saw mechanism also produces braking effect.
- Also this will increase the efficiency of engine by removing the alternator which is used for starting of the vehicle.

LIMITATIONS

This project have little limitations also as

- It will work efficiently only in those areas where we have to operate clutch more i.e. in crowded areas.
- Excessive use of clutch will lead to the damage of clutch plate also

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