2581-4575
International Journal For Recent Developments in Science & Technology
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A Peer Reviewed Research Journal

Fabrication of spring coil suspension system and generation of electric power using it

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Abstract: A spring is an elastic object used to store mechanical energy and it can be twist, pulled (or) stretched by some force and can return to their original shape when the force is released. While applying the load the Mechanical energy is converted into Electrical energy with the help of Rack and Pinion Mechanism. In this Mechanism, when the Springs Compresses and the rack moves in the direction as springs and the pinion attached to the rack will rotate the shaft which is attached to the dynamo and generates the Electrical energy. The present work attempts to analyze the amount of power we can generate from the energy stored in the springs of the suspension of a vehicle and how this energy is varied for vehicle to vehicle of different class and also to analyze by what amount the power generated is varied based on the no of dynamos used.

Keywords: coil springs, primary suspension system, modeling, static analysis.

I. INTRODUCTION

A basic suspension system consists of the parts springs, axles, shock absorbers, arms rods and ball joints. The spring is the flexible component of the suspension. The suspension system of a vehicle refers to the group of mechanical components that connect the wheels to the frame or body. A great deal of engineering effort has gone into the design of suspension systems because of an unending effort to improve vehicle ride and handling along with passenger safety and comfort. In the horse and buggy days, the suspension system consisted merely of a beam (axle) that extended across the width of the vehicle. In the front, the wheels were mounted to the axle ends and the axle was rotated at the center to provide steering. The early automobiles used the one-piece axle design but instead of being rotated at the center, it was fix-mounted to the vehicle through springs to provide the cushioning of shock loads from road inaccuracies. The wheels were rotationally-mounted at the axle ends to provide steering.

A coil spring is made from a single length of special wire, which is heated and wound on a former, to produce the required shape. The load carrying ability of the spring depends on the diameter of the wire, the overall diameter of the spring, its shape, and the spacing of the coils. Normally, helical spring failure occur due to high cyclic fatigue in which the induced stress should remain below the yield strength level and also with poor material properties.

II. NEED FOR NON-CONVENTIONAL ENERGY

Fuel deposit in the will soon deplete by the end of 2020Fuel scarcity will be maximum. Country like India may not have the chance to use petroleum products. Keeping this dangerous situation in mind we tried to make use of non-pollutant The buzzards of nuclear electric-

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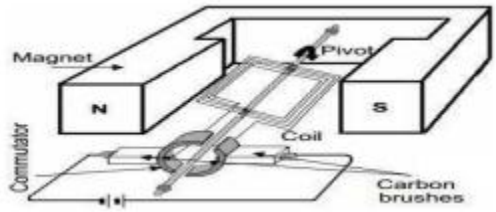
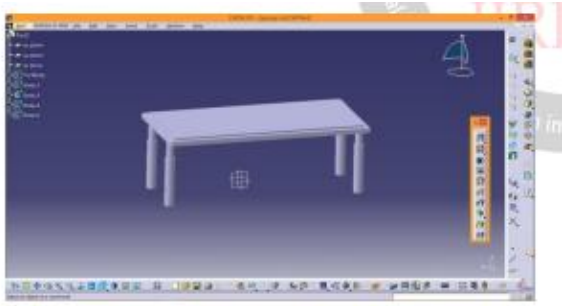
stations are only to will. Now electric power beamed directly by micro-wave for orbiting satellite. Solar power stations (s.p.s) provide a cost-effective solution even though work on solar photo voltaic and solar thermo electric energy sources has been extensively pursued by many countries. Earth based solar stations suffer certain basic limitations. It is not possible to consider such systems and meeting continuous uninterrupted concentrated base load electric power requirements. Energy plays an important role in the material, social and cultural life of mankind. The energy needs are increasing day by day. This is the result of population growth and increase in the standard of living which is directly proportional to energy consumption. As we know that mankind will be never lacking in energy. Today, it is liquid fluid, tomorrow it may be uranium with

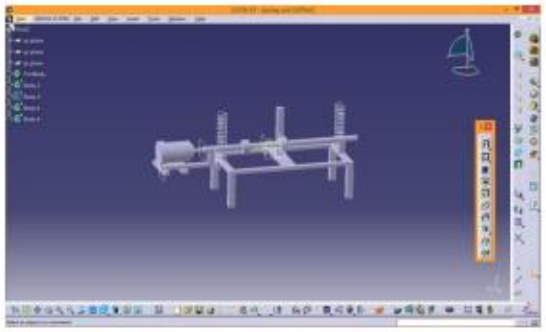
an element of risk. Risk exists where ever there is human activity and production of energy. Just as the supply of fossil fuel is finite thus there will be the supply of uranium. Perhaps, uranium would be exhausted quickly if it is used on a large scale.

III. WORKING PRINCIPLE The mechanical energy absorbed by the springs is converted into the electrical energy with the help of Dynamometer. The Dynamometer works on the principle of electromagnetic induction, where the current carrying conductor is placed in a magnetic field and emf is generated which generates electrical energy.



The to and fro motion of the suspension is converted into rotary motion with the help of rack and pinion mechanism. In this mechanism the linear force exerted by the spring is used to rotate the shaft with the help of a rack and pinion gear mechanism. The dynamo attached to this shaft is rotated whenever the shaft is rotated, based on the principle of electromagnetic induction the dynamo generates electrical power for every cycle. In general dynamo generates power for only one direction of rotation, if the shaft rotates in other direction, then the dynamo does not generate energy. In order to generate the energy on both the cycles the dynamos are arranged in





such a way that it generates power for both positive and negative half cycles so that we can generate the power on both the cycles. The power generated by the dynamo is directly proportional to the no of revolution of the rotating shaft. If the no of revolutions increases the power developed by the dynamo will also be increased and similarly if the no of revolutions is less the power generated will also be less. IV. DRAWINGS & FIGURES The base part of the model is designed using CATIA V5 in part modeling with square tube of 1000mm in length

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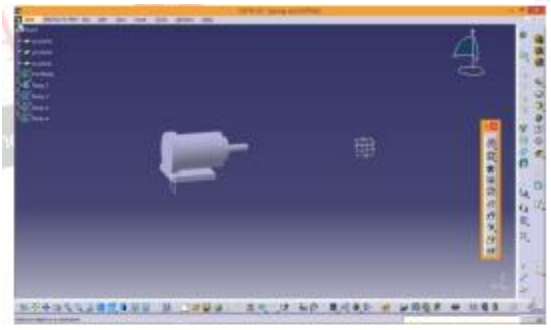
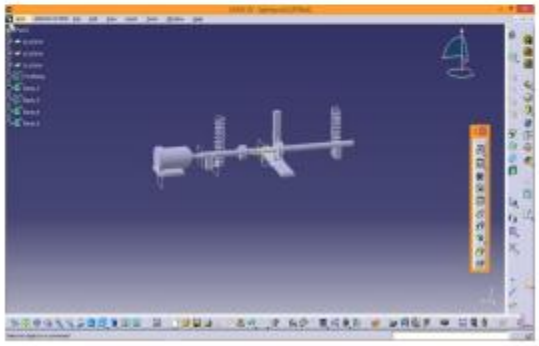
and 200 mm in width and then a bar is attached to the square tube to hold the dynamo and a thick sheet is added on the top surface of the base. Now the dynamo is designed by with the required dimensions. In the next body we now designed a the springs of 11 coils with a outer dimeter of 56.49mm and length of 152mm which is similar to the coil springs of a vehicle. And the shaft attached to the dynamo. At the center of the shaft we design the rack with module of 1.5mm and with a diamete of 72 mm similarly pinion is created with a diameter 72 mm with module of 1.5mm. Now in the next body we create a rectangular solid bar for applying load on the springs with a dimensions of 10000mm of length and 200 mm of width.Now in the assembly model we assemble all the the bodies in the topdown approach starting from the base square tube restraining all the degrees of freedom and then we assemble the load bar on the base and removing all the degrees of freedom except in linear direction and now we assemble the dynamo and the coil springs along with the shaft on the surface of the basetube.





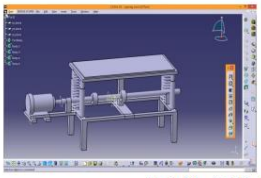


Fig:By Using Catia Design And Acutal Machine Assembly

V. CALCULATIONS & RESULTS

Speed	READING 1 (V)	READING 2 (V)	READING 3 3 (V)	READING 4 (V)	READING 5 (V)
Dynamo 10 rpm	0.11	0.13	0.15	0.14	0.13
Dynamo 60 rpm	0.64	0.65	0.61	0.62	0.62
Dynamo 100 rpm	1.2	1.25	1.19	1.3	1.35
Dynamo 3550 rpm	2.3	3.2	3.8	3.1	3.4

FOR 10rpm Dynamo:

- (For a load of 25kg) Avg power output= (0.11+0.13+0.15+0.15+0.13)/5 =0.13V FOR 60rpm Dynamo:
- (For a load of 25kg) Avg power output= (0.64+0.65+0.61+0.62+0.62)/5 = 0.62V FOR 100rpm Dynamo:
- (For a load of 25kg) Avg power output= (1.2+1.25+1.19+1.3+1.35)/5 =1.25V FOR 3550rpm Dynamo:
- (For a load of 25kg) Avg power output= (2.3+3.2+3.8+3.1+3.4)/5 = 3.16V

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	10rpm	60rpm	100rpm	3550rpm
Experimental	0.13V	0.62V	1.25V	3.16V
Theoretical	0.719V	1.2327V	1.027V	12.76 V

Theoretical Calculations:

S.No	RPM	Torque(N-M)
1.	10	0.6867
2.	60	0.1962
3.	100	0.0981
4.	3550	0.0343

VI. CONCLUSION & FUTURE SCOPE

The fuel used in automobiles is also consumed for rotating the alternator to charge the battery, this consumption is found to be 4% of total consumption. By newly designed suspension, regeneration system presently using alternator is detached from the engine and attached to the suspension system. The advantage of this concept is energy storage system is possible using "BESS system" and even fully drained battery is charged by ultra-capacitor using high frequency charge controller system. vehicles, milk trucks, fire brigade trucks and also those having high requirement of electricity inside it. From result graph we are observed that for a small amount of vibration of vehicle, we get the maximum voltage and current.

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