



ISSN: 2319-5967

ISO 9001:2008 Certified

International Journal of Engineering Science and Innovative Technology (IJESIT)

Volume 3, Issue 4, July 2014

# Suspension less, Displacement based, Road Power Generation System (RPGS)

N.Ravi Sankar Varma<sup>1</sup>, Y.Sandeep<sup>2</sup>, P.Prudhvi Raju<sup>3</sup>, M.SRINADH<sup>4</sup>, Ch.Bhanu Prakash<sup>5</sup>  
<sup>1,2,3,4</sup> Students, <sup>5</sup>Asst.Prof Mechanical Engineering Dept, Vishnu Institute of Technology

*Abstract— Electricity turned to be a basic need in this modern world. We need to achieve a state where we get 24x7 electric supply without injuring and polluting the nature. Several attempts were already made in catching the Excess Energy in moving vehicles. This paper unveils a new mechanism, which works without suspension system, thus overcoming the major setback in the rest Road Power Generation Systems (RPGS). This paper also shows different attempts made by our team in building RPGS, Case Study, Calculations and future plans.*

**Index Terms — Excess Energy, Suspension, Mechanism, Road Power Generation System.**

## I. INTRODUCTION

At present, World Electricity Generation is at stake. It is in deficit and 1.4 billion don't even have access to electricity. Despite 42% electricity is generated by coal, 20% by natural gas, this somehow harms nature. At this point, India alone needs to install 400GW of Electricity Plants to meet its demand. So there is need of generating Electricity in eco-friendly way using renewable sources. One of such renewable sources is excess energy of moving vehicles. Several attempts are being made on this for a decade. Every attempt except Pezio-mat had to use suspension in the system to return the link displaced by the vehicle to its original state. There are certain setbacks using the suspension system, which are jotted below. So our Project overcomes these setbacks and also increases the Vehicle excess energy catchment area. By altering the plate lengths and angles this project can be used at various places like normal roads, Speed Breakers, Zebra crossings, Railway Gates, Toll Gates etc.

**Excess Energy in Vehicles:** When a man is moving on his vehicle, the vehicle's engine needs to propel both the man weight and vehicle weight. In many vehicles we observe the vehicle weight is very high [1]. For example, think of a case where a mere 70 kg man travelling in a 2500 kg Mahindra Scorpio. So here the engine needs to put extra effort, other than taking man, which we call excess energy.

## II. LITERATURE REVIEW

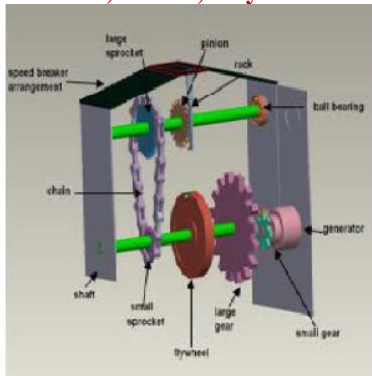
This concept of using Vehicle excess energy for Electricity Generation started on South African Speed Breakers a decade ago. In India this was modeled for the first time in Guwahati by amateur innovator Kanak Gogoi. This caught the eyes of IIT Guwahati. Later this model is funded and is recommended to Assam Government.

Around the world this concept is made into models using different mechanism. Some of them are [3]

1. Roller Mechanism
2. Rack and Pinion Mechanism
3. Air-Piston Mechanism
4. Hydraulic Mechanism
5. By Bicycle pedal mechanism
6. By using cams



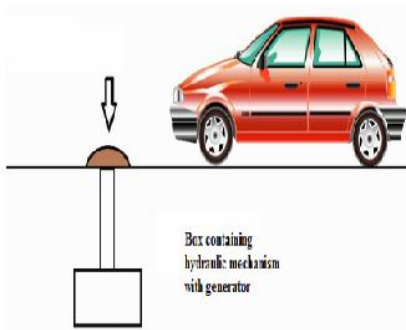
Roller Mechanism



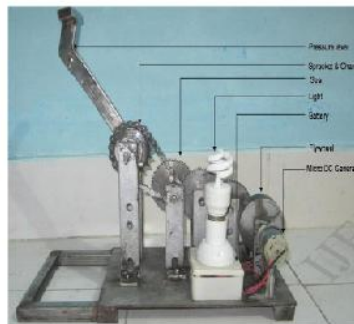
Rack and Pinion Mechanism



Air-Piston Mechanism



Hydraulic Mechanism



By Bicycle pedal mechanism



By using cams

Fig 1. Different Mechanisms used in various Road Power Generation Systems [3]

We also made 2 models on this concept and did calculations. Those models are explained here.

**A. Generation of electricity from speed breakers using Sewing machine Mechanism (RPGS-1)**

Here in this model, when vehicle passes by the foot pedal the side wheel rotates and this is further geared for generating high RPM, thus generating Electricity.

**B. Energy Tile (RPGS\_2)**

Here, when someone steps on the tile, the downward displacement in the tile is converted into rotation in shaft, which when connected to a dynamo generates Electricity.

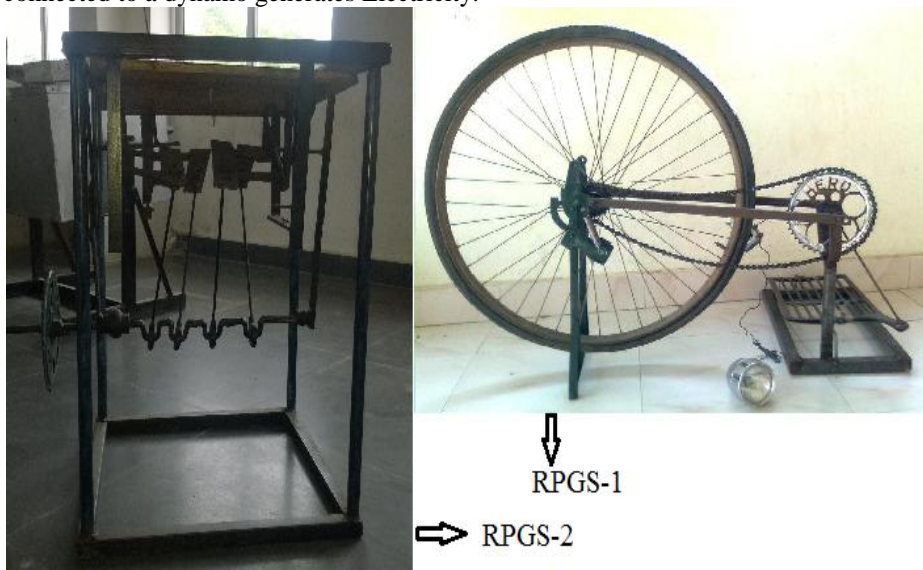


Fig 2. Our previous Attempts: RPGS-2, RPGS-1



ISSN: 2319-5967

ISO 9001:2008 Certified

International Journal of Engineering Science and Innovative Technology (IJESIT)

Volume 3, Issue 4, July 2014

### III. A REPLACEMENT TO SUSPENSION SYSTEM

Despite the concept of generating power from Excess weight of Vehicles being innovative, practically many setbacks arise due to suspension. They are

1. Abrupt kick back to the Vehicle.
2. Damage to the Vehicle.
3. Reduced life to the Project.
4. Reduced area of Application (Springs used for heavy vehicles are different to that of light weight ones).

So in our model RPGS-3 we overcame this by introducing a new concept, an alternate for suspension

#### *Powered Return Stroke with negative Displacement*

On using this innovative concept developed by us, the return stroke powered by the vehicle itself provides the negative displacement, which sets the Project to its original position.

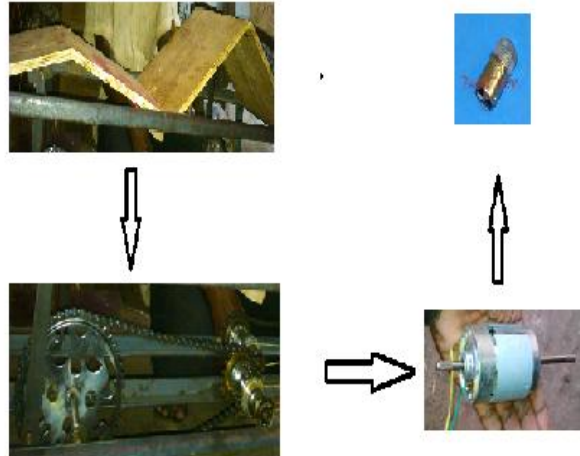
Despite, overcoming all the drawbacks mentioned above, this also provides two extra features

1. Powers the Dynamo in the same Direction as that of forward stroke.
2. Makes the project Symmetrical (Vehicle can move in any direction).
3. Energy can be tapped from any vehicle.

### IV. PROPOSED SYSTEM



**Our Team Presenting the Project**



**Flow Chart of RPGS-3**

The diagram symbolizes the four plates on the frame resting in a particular order. When vehicle passes by this they alter their positions and come back to the original position. This movement in the plates is caught by the mechanism beneath. The connecting link absorbs the energy from the four plates, this is absorbed by the connecting rod, and this connecting rod operated the sprocket wheel to move by a certain angle. This sprocket wheel allows other sprocket wheel to take more turn via a chain link. The small sprocket wheel is connected to a dynamo, which when operated in a certain speed (rpm), the bulb glows. The glowing bulb indicates generation of power.

### V. COMPONENTS USED

S.No	Components	Specifications	Details	Quantity
1	Dynamo	6 Poles 12 Volts	Usha Table Fan DC Motor	1
2	Chain	70 cm	Cycle Chain	2

3	Sprocket Wheels	20,7.5 cm	Cycle Sprocket Wheels	2+2
4	Connecting Rod	20cm*1.5cm*5mm	MS Plate	2
5	Bearings	1cm Dia	Ceiling Fan Bearings	8
6	Shaft	6mm dia	MS Rod	4
7	Light	2.5 Watt	Torch Light	1



.5 Watt Torch Light Bulb



1 cm Dia Ceiling Fan Bearing



6 Poles 12Volts  
Usha Table Fan DC Motor



7.5cm Dia Bicycle Rear Wheel  
Sprocket Wheel



Mild Steel Connecting Rod



Mechanism Beneath



20cm Dia Bicycle Main Sprocket Wheel



Mild Steel Frame

Fig 3: Components used in RPGS-3

## VI. ASSEMBLY

The complete description of the parts is given above and coming to the construction details of the parts. First, we have to prepare the frame with dimensions 30x80 in centimeters and the height of the frame is 40 centimeters and the supporting frame is placed at the height of 30 centimeters from the top and after the frame construction is completed then we have to go to the plates. The plates of length and width of 25x29 in centimeters are to be taken. These are made by wooden plates. In this way with same dimensions we have to make four plates. After doing that, we linked the plates in a pair with the help of door coupling. Then the linked pair of plates is placed on the frame. When these are placed on the frame a certain height is obtained because the length of the four plates is more than the length of the frame. Then coming to the connecting rod, one end of the connecting rod is fixed to the plates and the other end of the connecting rod is fixed to the spur gear wheels. The big spur gear wheel and the small spur gear wheel are separated by a distance and these two are connected with the help of a chain. By this construction when the plates move the small spur gear rotates 2-3 times with the help of whole construction. From the small spur gear wheel it is connected to the shaft by means of pulley. The shaft is connected to the dynamo. So with the help of the small spur gear wheel the shaft also rotates and with the help of this electricity is generated with the help of dynamo



ISSN: 2319-5967

ISO 9001:2008 Certified

International Journal of Engineering Science and Innovative Technology (IJESIT)

Volume 3, Issue 4, July 2014

and the generation of electricity is shown by connecting a bulb to the dynamo and when the shaft rotates the bulb glows. This is the assembly of the Road power Generation system (RPGS)

### VII. MODEL CALCULATIONS

#### Mechanical Calculations

An object of 10Kg passed over the RPGS at 5.4 Kmph.  
The Length of RPGS is 1.5 m.  
The Vertical displacement in the model is 10 cm  
So, the time taken by the Vehicle to cross RPGS can be calculating

$$5.4 \text{ Kmph} = 5.4 \times (5 \div 18) \text{ m/s} = 1.5 \text{ m/s}$$

$$\text{Speed} = \text{distance} \div \text{time}$$

$$1.5 = 1.5 \div t$$

$$\text{Therefore time (t)} = 1 \text{ sec}$$

$$\text{Work Done (W)} = \text{Force (F)} \times \text{Displacement}$$

$$\text{Force (F)} = mg = 10 \times 9.81 = 98.10 \text{ N}$$

$$\text{Displacement} = 0.1\text{m}$$

$$\text{Therefore W} = 9.81 \text{ Joules}$$

$$\text{Power (P)} = \text{Work done (W)} \div \text{Time (t)}$$

$$W = 9.81 \text{ Joules}$$

$$\text{Time} = 1 \text{ Sec}$$

$$\text{Therefore P} = 9.81 \text{ watts}$$

#### Electrical Calculations

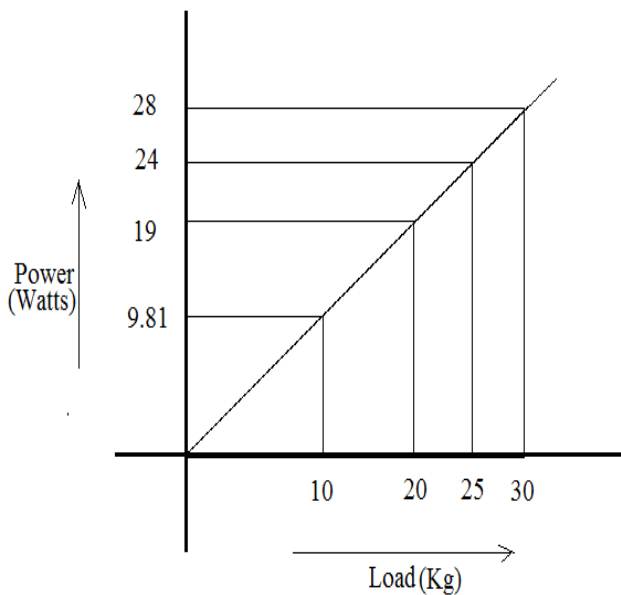
When the above conditions are maintained at the RPGS it is observed by a multi meter

$$\text{Voltage Generated (V)} = 2\text{V}$$

$$\text{Current Generated (i)} = 2\text{A}$$

$$\text{As Electrical Power (P)} = V \times I = 2 \times 2 = 4 \text{ Watts}$$

Therefore the efficiency of the Dynamo is found out to be  $4/9.81$ ,  
i.e 40% efficient.



S.No	Load	Power Generated
1	10kg	9.81 watts
2	20kg	19 watts
3	25 kg	24 watts
4	30 kg	28 watts



ISSN: 2319-5967

ISO 9001:2008 Certified

International Journal of Engineering Science and Innovative Technology (IJESIT)

Volume 3, Issue 4, July 2014

### VIII. COST

S.No	Component	Quantity	Cost/Quantity	Total Cost
1	Plates	4	Rs.50/-	Rs.200/-
2	Frame	1	Rs.2000/-	Rs.2000/-
3	Connecting Link	2	Rs.20/-	Rs.40/-
4	Connecting Rod	2	Rs.50/-	Rs.100
5	Sprocket Wheels	4	Rs.100/-	Rs.400/-
6	Chain	2	Rs.100/-	Rs.200/-
7	Bearing	8	Rs.20/-	Rs.160/-
8	Pulley	2	Rs.30/-	Rs.60/-
9	DC Fan Motor	1	Rs.600/-	Rs.600/-
10	Bulb	1	Rs.20/-	Rs.20/-
11	Wiring Charge	-	Rs.20/-	Rs.20/-
	<b>Total</b>			<b>Rs.3800</b>

### IX. CASE STUDY

Let us assume a 1000Kg Vehicle (1tonne) is passing over the RPGS at 27 Kmph .

It would catch 4905Watts of Mechanical Power. But as the Dynamo is only 40% efficient it can generate 1962 Watts of Electrical Power.

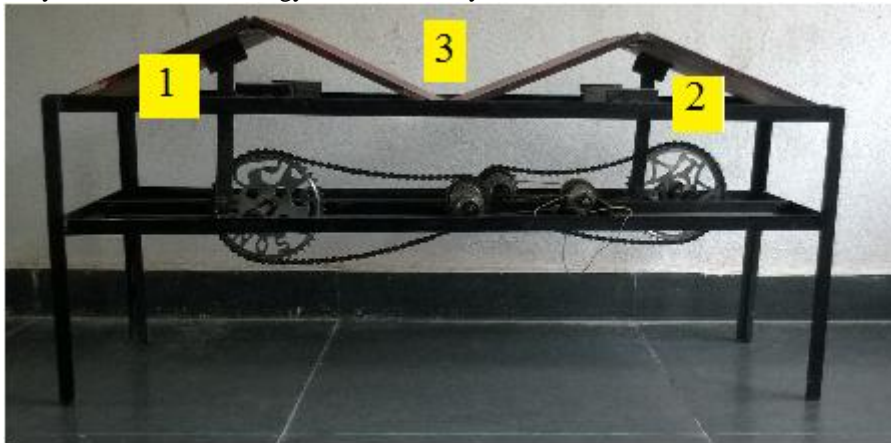
On a Heavy traffic road let us assume 30 vehicles passing by the RPGS per minute. So1800 per hour.

Therefore 3531.6 Kw-H of Electricity is produced.

So this means that the erection of 1000 RPGSs in traffic areas would equate to that of a typical Steam Power plant running on coal generating nearly 3500 MW of power, without harming the Mother Nature.

### X. FURTHER IMPROVEMENTS

We are planning to improvise this model by adding a new powering unit, at the sliding joint shown in the picture. In our present project only 1,2 are powering units, which are linked with Dynamo. We are in a plan to link the 3<sup>rd</sup> point also to the dynamo to convert energy more efficiently.



RPGS-3

### XI. CONCLUSION

This method being economical and user-friendly with robust linkages, promises dependable output for usage. The Suspension-less, Negative-Displacement type RPGS made by us will overcome certain drawbacks in this method and makes it real-time workable project. This even adds to the economy of the country by utilizing the growing traffic and population. This helps reaching our aim to be a power sufficient country.

### XII. AWARDS

1. Selected for Inovationeer'12 Event at Andhra University and complemented by the then Dep.CM of State D. Raja Narasimha.



**ISSN: 2319-5967**

**ISO 9001:2008 Certified**

**International Journal of Engineering Science and Innovative Technology (IJESIT)**

**Volume 3, Issue 4, July 2014**

2. Won Best Model Award at Nipuna'12 organized by ISTE chapter in SRKR Engineering College.
3. Runner up at VALIANT'12 in VIT, Bhimavaram.

#### **REFERENCES**

- [1] Mukherjee.D Chakrabarti.S, 2005, Fundamentals of renewable energy systems, New Age international limited publishers, New Delhi.
- [2] Sharma.P.C, 2003, Non-conventional power plants, Public printing service, New Delhi.
- [3] "A Review: Comparison of Different mechanisms used for Electricity Generation at Speed Breakers", MJRET vol.1, 2014.
- [4] "Production of electricity by the method of road power generation", IJAEEE, 2010.
- [5] "Every speed breaker is now a source of power", IPCBEE vol.1, 2011.