

Power Generation from Speed Breakers by Air Compression Method

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Abstract - Electricity is the most necessary form of the energy. We cannot even imagine our life without electricity. Consumption of the electricity is increase day by day. Nowadays most of the electricity is generated by conventional fossil fuels, eventually the conventional power sources will get depleted by the next few decades. This paper is about to use nonconventional energy source for power generation. Here we generate energy by air compression. All the setup is place under speed breaker when vehicle passing from speed breaker it generates electricity. Main benefit of this method is here we use wasted energy for power generation.

I. INTRODUCTION

Electricity is the most convenient and versatile form of energy. It has high demand therefore; its growing rate is faster than other forms of energy. Electricity plays a crucial role in industrial and agricultural sectors .The consumption of electricity indicates productivity and growth of the country. Therefore, power development has been given high-priority in development programme.This is an innovative and useful concept of Generating Electricity from Speed breakers; however it is a one more step ahead to improve the current situation of electricity.

Current situations in India

The present power position in INDIA is alarming as there are major power shortages in almost all states of the country leading to crippling of industries and hundreds of thousands of people losing jobs and a heavy loss of production.

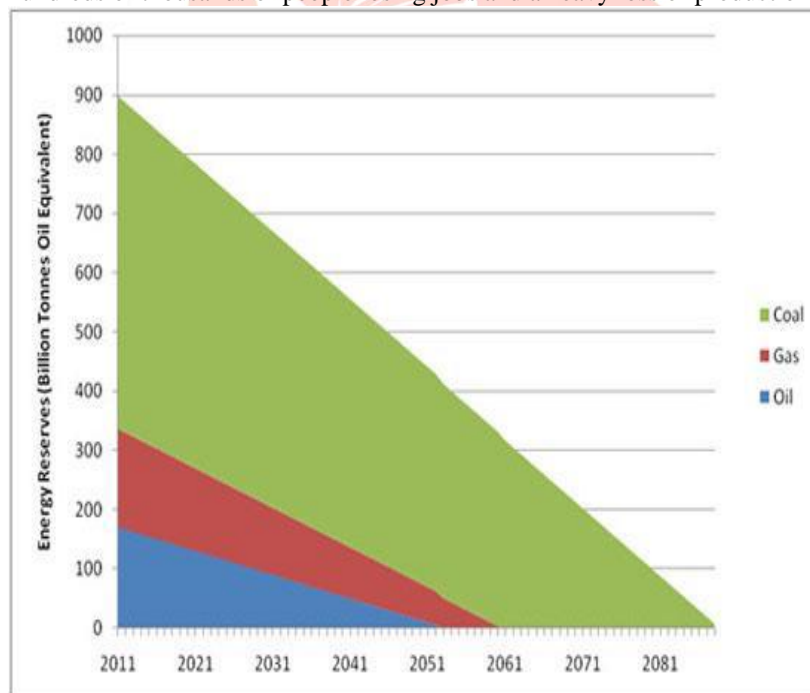


Fig.1 Energy resources

The availability of regular conventional fossil fuels will be the main sources for power generation. Eventually the conventional power sources will get depleted by the next few decades.

Therefore, we have to find some approximate, alternative, new sources for the power generation, which is not depleted by the very few years. Another major problem is pollution.

About the paper

Conservation of energy is become very easy nowadays. It is an attractive technology for optimal use of available sources. This project is attempted to show how energy can be tapped at commonly used road-speed breakers.

The number of vehicles passing over the speed breaker is increasing day by day. There is possibility of tapping the energy and generating power by making the speed breaker as a power generation unit.

In this project we fixed air compression pump along with speed breakers. When the vehicles passing from speed breaker the pump compress the air and with use of these compressed air turbine can rotate. The turbine is directly connected with the alternator/dynamo from which we get electrical output.

II. LITERATURE REVIEW

Firstly, South African electrical crisis has made them implemented this method to light up small villages of the highway. The idea is basic physics, to convert the kinetic energy into electrical energy that gone wasted when the vehicle runs over speed-breaker. Since then, a lot has been done in this field.

An amateur innovator in Guwahati has developed a simple contraption that can generate power when a vehicle passes over a speed breaker. **Kanak Gogoi**, a small time business-man, has developed a mechanism to generate power by converting the potential energy generated by a vehicle going up on a speed breaker in to kinetic energy. The innovation has caught the eyes of the Indian institute of technology (IIT), Guwahati, which will fund a pilot project to generate electricity from speed breaker.

Electric vehicle charging station at a McDonald's in Cary, N.C., a Burger King franchise in New Jersey said it would be testing speed bumps that harness kinetic energy in the locations busy drive-thru lane.

If the kinetic energy generated by moving vehicles was captured by New Energy Technology's Motion Power speed bumps twice per day, then it could produce enough electricity to power over half a million homes each day, according to company officials. "More than 150,000 cars drive through our Hillside store alone each year, and I think it would be great to capture the wasted kinetic energy of these hundreds of thousands of cars to generate clean electricity," said Andrew Paterno. Paterno and his business partner, Michael Wallstein own and operate twelve Burger Kings in the New York Metro area.

III. ALTERNATIVE METHODS

The generation of electricity using the vehicle weight and speed can considers as an input. The possible six different mechanisms are given below:

A) Crank-shaft mechanism. B) Roller mechanism. C) Rack and pinion mechanism.
D) Piezoelectric mechanism. E) Hydraulic mechanism. F) Air compression mechanism.

Here we are using Air compression mechanism

In this method when vehicle pass from the speed breaker the piston of the pump is goes down and air is compressed. The following figure shows air compression mechanism.

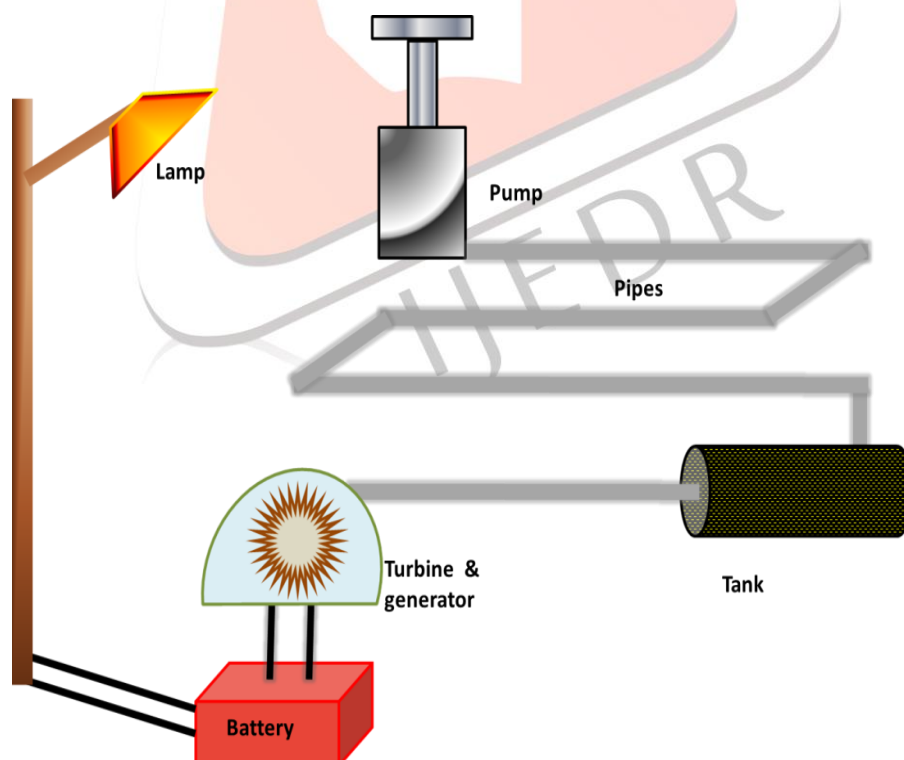


Fig.2 The schematic diagram

This compressed air has some velocity so we can use it to rotate turbine. The tank is provided for the more compression and storage of air it is not necessary if a force by the pump is very high. The exhaust air goes to turbine which is connected with the alternator or any type of electric generator so we can generate electricity. This method is needed less maintenance and also low cost, here absence of any other rotational parts reduces losses.

The reason for select this method is, it is applicable for constructing speed breakers which can generate electricity. The cost of construction is less and efficiency is high, the main problem in other mechanisms is constant output because there is only one way

to store energy is battery. In this mechanism storage of air is also possible, so it can give constant output for longer period of time than any other mechanism.

IV. BLOCK DIAGRAM

This system generates power by a vehicle passing through speed breaker. This arrangement consists of speed breaker assembly, cylinder and piston arrangement, wind turbine, Generator and Stabilizing Unit with battery for storing the generated output.

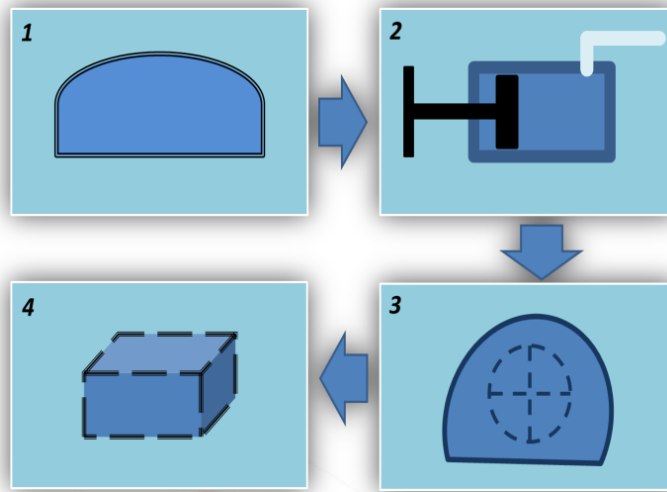


Fig.3 Block Diagram

- (1) Speed breaker assembly. (2) Air compression mechanism (cylinder, piston, air).
- (3) Turbine coupled with generator. (4) Battery for storage.

V. OUTPUT POWER AND LOSSES

The following equation is used to represent the kinetic energy (KE) of an object.

$$K.E. = \frac{1}{2} mv^2$$

i.e., **m** = mass of object. **v** = speed of object.

This equation reveals that the kinetic energy of an object is directly proportional to the square of its speed.

Here, **m**= mass of the air and **V**= velocity of the air.

The following figure shows the dimensions of a prototype in cm, to carry out theoretical calculations.

Height of cylinder = 15.5 cm, Radius = 3.25 cm, Total Height = 15.5 – 4.0 = 11.5 cm, Volume = 350 cc (4 pump = 1400 cc)

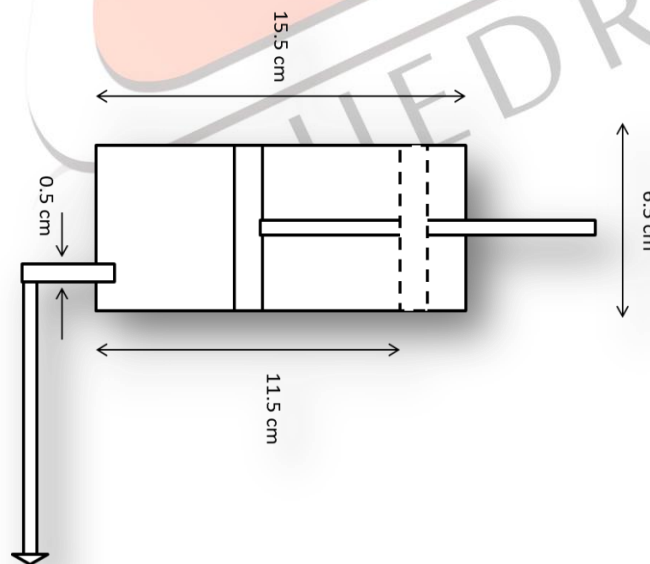


Fig.4 Dimensions of a prototype in cm

To calculate **M**:

Mass of the fluid is given by the product of density of the fluid and volume of the cylinder, i.e.

$$M = \text{density of air in kg/m}^3 * \text{volume of cylinder in m}^3$$

$$= 1.165 * \text{volume of cylinder}$$

$$= 1.165 * (350) = 0000.40775 \text{ kg}$$



Fig.5 Final speed breaker model

5.1 Generator selection

The selection of generator and turbine is a very important part in this project, as our project is based on the air compression mechanism so that generator should be capable of generate enough power with the kinetic energy of air. In the selection of generator part we found many types of different generators and learn that how to use in different applications. We use many types of methods with different types of generators and observe the performance.

5.1.1 –AC synchronous motor

A synchronous motor is electrically identical with an alternator or AC generator. In fact, a given synchronous machine may be used, at least theoretically, as an alternator. When driven mechanically or as a motor, when driven electrically in the case of dc machines.

Here we are going to use AC synchronous motor as generator; it is so easy that we can easily use the AC synchronous motor as a generator and it can give better power output.

It is not happen in all kind of AC synchronous motor, if motor requires excitation then it cannot produce power only with the rotation of shaft.

With the help of this type of generator we found 110 volt output voltage.



Fig.6 Output voltage

5.2 Expected losses in this arrangement

The springs attached to a pump are pressed when the vehicle is passing, after that the opposition force brings all system to its original position. This creates some losses.

There is also a losses take place due to joints, the pumps are connected in parallel so that the T connections are provided to joint all the pumps, this arrangement is also necessary because the pumps cannot be in series connection, input/output connections are more complicated.

For this mechanism we can neglect the losses because here we use wasted energy. If we neglect all the losses this mechanism is fully efficient, eco-friendly and free electricity generating mechanism.

5.3 Comparison

Table.1 Comparison

	Roller mechanism	Crank shaft mechanism	Rack and pinion mechanism	Air compression mechanism
Construction	Very easy	Hard	Very hard	Easy

Maintenance	Very high	High	High	Low
Current scope of system	None	Yes	Yes	Yes
Adjustable	Yes	No	No	Yes

VI. MERITS & DEMERITS

Merits:

- **Eco – friendly:** In this mechanism no pollution is created.
- **No fuel used:** In power plants there is fossil fuel is used i.e. coal, diesel, gas, etc. but in this mechanism no fuel is used.
- **Maintenance:** Less maintenance is required for this system. The main advantage of this mechanism is there is no any rotational parts like crank shaft mechanism and rack and pinion mechanism also no gear is required. So, it requires less maintenance.
- **Operation:** Operation is very easy and simple to understand so less operating staff is require. There is also no need of 24 hour observation.
- **Adjustable:** Here we can also use adjustable speed bumps so it can easily move and transport to any location, so that site selection problem is not so much important.
- **Cost:** Running cost is free because there is no fuel is used, and also less installation cost is require, less maintenance cost, so all over cost is less.
- Energy available all year around.

Demerits:

- It cannot give constant power output and It cannot use in less traffic areas.

VII. APPLICATIONS

- 1) To provide electricity in villages near to highway, to fed power directly to smart grid.
- 2) In street lights, Tollbooths, Traffic signals.
- 3) It can be placed in commercial building i.e. theatre, shopping mole, public/private parking etc. where use for light bulbs.
- 4) As a charging station for electric vehicle.

VIII. CONCLUSION

This paper describes generation of electricity from speed breakers, the kinetic and potential energy. The power generated is not constant but it is a small step to produce energy from speed breaker it is not just alternative but effective use of wasted energy. From the observations as compression is increased high power can be generated. It is a small level power generation but if it is used in proper way then we can generate larger amount of power. Now it's time to put forte these types of innovative ideas and researches should have been done to upgrade their implication.

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REFERENCES

- [1] Power plant engineering by A.K.Raja, AmitPrakashShrivastava, Manish Dwiwedi. [New age international publisher].
- [2] www.downtoearth.org.in/node/6080.
- [3] Fairley's- Speed bumps ahead for electric-vehicle charging by, Spectrum, IEEE Publication Year: 2010, IEEE Journals & Magazines.
- [4] Website of International Energy Agency (IEA), world energy outlook.
- [5] ShakunSrivastava, AnkitAsthana -"produce electricity by the use of speed breakers," Journal of Engineering Research and Studies, Vol.2, No.1 April-Jun 2011.
- [6] International Journal of Scientific & Engineering Research, Volume 4, Issue 6, June-2013, ISSN 2229-5518.
- [7] International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 2, Issue 2, March 2013.
- [8] International Journal of Advance Research in Science and Engineering IJARSE, Vol. No.2, Issue No. 2, February, 2013.
- [9] Aswathaman.V, Priyadharshini M., "International Journal of Recent Research and Review," Vol. I, ISSN 2277-8322, March 2012.
- [10] <http://www.scribd.com/doc/29409954/POWER-GENERATION-USING-SPEED-BREAKERS>, retrieved on 22-02-2012.
- [11] Jackson, W.D. - liquid metal faraday type MHD generators, IEEE on 1963, volume: 82, issue: 69.
- [12] <http://www.SciRP.org/journal/sgre>.
- [13] wikipedia.org;(for some equipment)http://en.wikipedia.org/wiki/Balance_springforpneumatic_motor_image_from_google.co.in

[14] www.energetica-international.com

[15] GreenstudentU.com

