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Hydraulic Speed Breaker Power Generator

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Abstract
It is very well known fact that vehicles run with very much high speed on the roads due to which many accidents take place and to reduce these accidents it can be seen by us that speed breakers are placed on the roads and highways. And Due to which a lot of energy got wasted .As there are many available models for generation of power through the speed breakers but the power is not so sufficient for any specific purpose this paper attempts to show the new technique of power generation. Earlier many complicated mechanisms were introduced which were not efficient. The model introduced in the paper is more efficient and a specific desired purpose can easily be fulfilled by this, even the total amount of electricity required for a small village can be easily generated through this model. The combination of hydraulic press and crank lever mechanism is used here to generate electricity. This paper is all about the generation of energy with a new and more efficient method.

Keywords – Speed breaker, hydraulic press, transfer of force, turbine, crank and lever mechanism (beam engine), dynamo

I.   Introduction

On June 7, 1906, The New York Times reported on an early implementation of what might be considered speed bumps in the U.S. town of Chatham, New Jersey, which planned to raise its crosswalks five inches above the road level: "This scheme of stopping automobile speeding has been discussed by different municipalities, but Chatham was the first place to put it in practice".

According to statistics provided by the Ministry of road Transport & Highways, in India the lengths of national highway till year 2012 was 76,818 km and 15-20(on average) highways are there in each state. In year 2002, 58.8 million and in 2004, 72.7 million vehicles were playing on Indian roads. The annual rate of growth of motor vehicle population in India has been almost 10 percent during the last decade. [4][5][6] There is tremendous vehicular growth in India year by year .On Road these vehicles waste tremendous amount of energy due to speed breakers, the increasing traffic and number of speed breakers on roads motivate to manufacture an innovative device which can channelize the energy of vehicles that is wasting on speed breakers to some useful work.

Many models were introduced according to condition. After each generation the efficiency of model increased and the limitations diminished. Different-different models have variant designs, with use of gears, belts, dynamos etc with different application at different places has introduced. Each model was invented due to limitations of previous one. The few models are mentioned below

A.   **Use chain drive mechanism**
B.   **Use of rack and pinion system**

C.   **Direct use of load to generate compressed air**
D.   **Use of pressure through lever mechanism** [3]

All the models earlier made were not so efficient to generate sufficient amount of energy which was the most common limitation with all. The model introduced in this paper is very much efficient .As it is well known fact that the hydraulic press provides more force output on supplying low valued force input. So here the force or weight of vehicle will provide the Input and the hydraulic press will increase the force.

The Hydraulic press mechanism is used to transmit force from one point to another with the help of an incompressible working fluid and further the work will transmitted by the crank and lever mechanism (beam engine).

1.   **Description of Units**
This is very much efficient technology .It contains three units
  ➢   Hydraulic press
  ➢   Crank lever Mechanism (Beam Engine)
  ➢   Dynamo + Electricity reservoir

1.1 Hydraulic Press
Hydraulic press is a device which is used for lifting a heavy or large load by the application of a comparatively much smaller force than is required to lift the load mechanically or manually.

The force applied on the plunger may be small when compared to the weight placed on the ram. Also, the area of the plunger is small when compared to area of the ram. But the pressure acting

on the plunger (due to the application of force "F" on the plunger), and the ram is same (Pascal's Law). It is the area on which the pressure is acting that makes the difference. This makes a small force applied on the plunger able to lift heavy loads placed on the ram. (Refer fig.1)

Let, W = weight to be lifted, F = force applied on the plunger, A = area of the ram, "a" = area of the plunger, P = pressure intensity produced by force F.

Fig.1

We know that pressure P = Force / Area of plunger P = F/a As per the Pascal's Law, this pressure P, due to the force acting on the plunger, is equally acting on all parts of the hydraulic system. So this same pressure acts on the ram too. So,

Pressure P = W/A.

W/A = F/a

So, W = A/a* F.

But mechanical advantage (M.A.) can be defined as "the ratio of weight lifted to the force acting on the plunger."

So M.A = W/F. [1]

So, equating both the pressures, as they have to be equal From above expression it can be said that the intensity of output force will increase and hence it would be easy to drive the big turbines.

Now as the hydraulic press is providing a to and fro motion so here it is important to convert this motion into rotator motion for this a crank lever system is to be provide.

1.2 Crank Lever Mechanism

A crank is an arm attached at right angles to a rotating shaft by which reciprocating motion is imparted to or received from the shaft. It is used to convert circular motion into reciprocating motion, or vice-versa. The arm may be a bent portion of the shaft, or a separate arm or disk attached to it. Attached to the end of the crank by a pivot is a rod, usually called a connecting rod. The end of the rod attached to the crank moves in a circular motion, while the other end is usually constrained to move in a linear sliding motion (refer fig.2)

The term often refers to a human-powered crank which is used to manually turn an axle, as in

a bicycle crank set or a brace drill. In this case a person's arm or leg serves as the connecting rod, applying reciprocating force to the crank. There is usually a bar perpendicular to the other end of the arm, often with a freely rotatable handle or pedal attached.
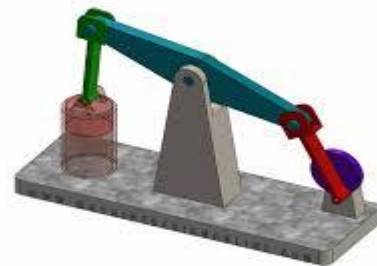

Fig.2

The rotator motion gained is transferred directly to the dynamo so as to create the electricity as the force is high the torque also will be high and so the power created by the dynamo will be high.[6][7]

1.3 Dynamo

A dynamo is an electricity generator that produces direct current with the use of a commutator. The dynamo uses rotating coils of wire and magnetic fields to convert mechanical rotation into a pulsing direct electric current through Faraday's law of induction. (Refer fig.) A dynamo machine consists of a stationary structure, called the stator, which provides a constant magnetic field, and a set of rotating windings called the armature which turn within that field. The motion of the wire within the magnetic field causes the field to push on the electrons in the metal, creating an electric current in the wire. On small machines the constant magnetic field may be provided by one or more permanent magnets; larger machines have the constant magnetic field provided by one or more electromagnets, which are usually called field coils .[7] the electricity created by this dynamo can be stored in batteries and can be further used according to requirement.
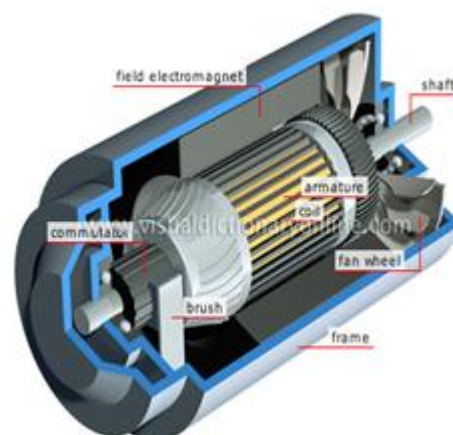

Fig.3

II. Details of the construction of energy transmitter

(Refer fig. 4 and fig. 5)

In this system the speed breaker may be made by cast iron, so that on applying high force on the speed breaker it will not break. The dome of speed breaker is welded with rod (1) which is placed parallel to it and the length of that is same to that of the dome so the whole surface can transmit force to a single point, and at the both ends of rod two supports with compression springs are to be connected so that the system will get reciprocating motion. The rod (parallel to dome i.e. rod (1)) connected to a another rod (named as Rod (2)) at its centre which is perpendicular to it; the rod (2) is connected to a plunger or a piston, which is placed in cylinder (1) , the cylinder is connected to the one end of box whose area is varying, now on other end a bigger cylinder (2) is connected which is having large cross sectional area then cylinder (1) a ram slides into it which is connected to rod (3) , a incompressible fluid is filled from plunger of cylinder(1) to the ram of cylinder(2) .Rod(3) which is connected to the ram will transmit motion to the lever and finally from lever to crank rod of dynamo. A similar assembly of compression spring as with plunger is connected to the ram for it's up and down motion. When no motion is transmitting at that time there will be no contact between Rod (3) and the rod (rod (4)) of the lever. A rigid support (kind of stopper) is connected above the ram as shown in figure 4 to stop the extra motion of the ram or the system. The road will act as stopper for the plunger.

The half assembly (i.e. hydraulic press) is to be fitted in the highway and half on land near to the road (i.e. crank lever mechanism and dynamo) and only curved shape dome is to be placed on the surface of road which will act as speed breaker, the dome shape is to be made in such a way so that whenever any vehicle will pass through it will do up and down motion. Hydraulic press is under the land surface and the dynamo is placed over the land to the side of the road .now, dynamo may connect to a reservoir of electricity and the electricity further can be use.

Here the rod (1) is connected in such a way that it will do up and down motion. A spring system is connected to the Rod (1) which will support the system for the up and down motion. Here fly wheel is attached with the crank rod to store the mechanical energy.

The dome shaped speed breaker is to be made in such a way that there is a split section at its centre with breadth of 10cm in speed breaker of total breadth 20cm which will do up and down motion. This section is named above as rod (1).

III. Working

When the vehicle (load) passes over the curved shape metal sheet (i.e. dome), its central half part will go down due to the load of vehicle, and simultaneously the load will compress the both springs and the rod (1), this curved dome and rod (1) is connected with the plunger via Connecting rod i.e. rod (2) the load transmitted to the working fluid, and from fluid to the ram. This ram will drive the lever and, lever will drive the crank rod and turbine. Here with the low load we can drive the big turbines (Dynamo) or the combination of small turbines, by the application of hydraulic press as mentioned above.

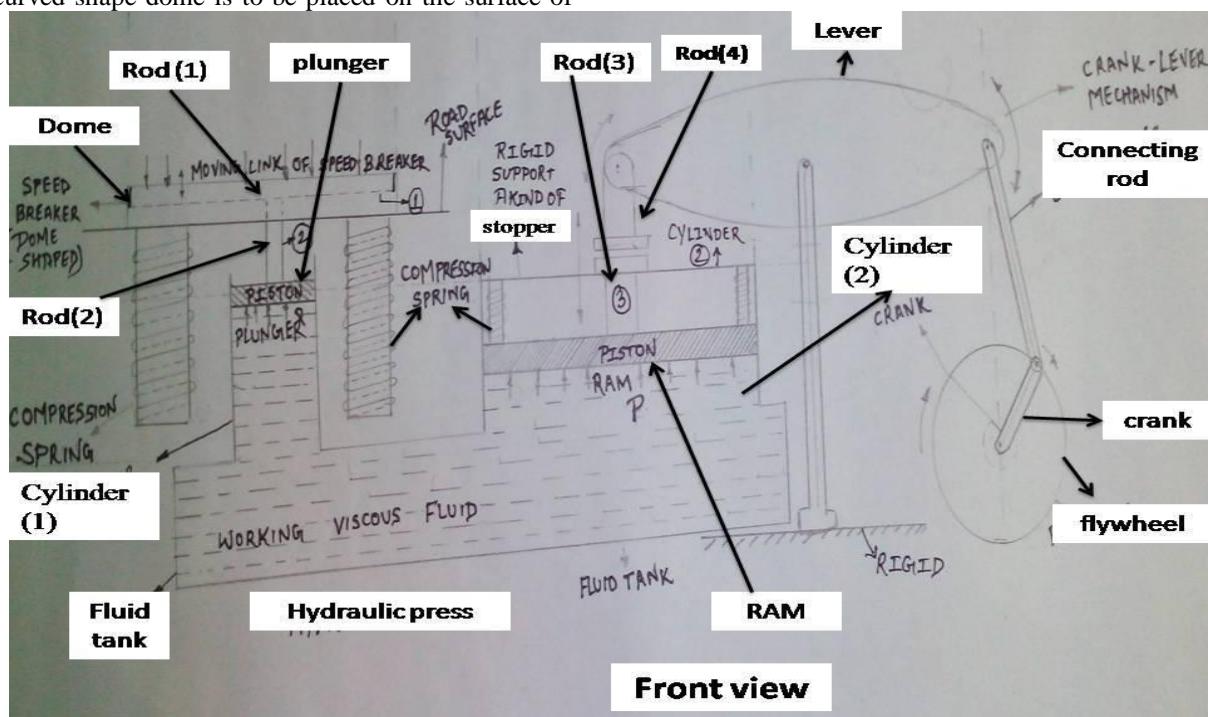As here the contact between the Ram and the lever is of short time it can be said that due to
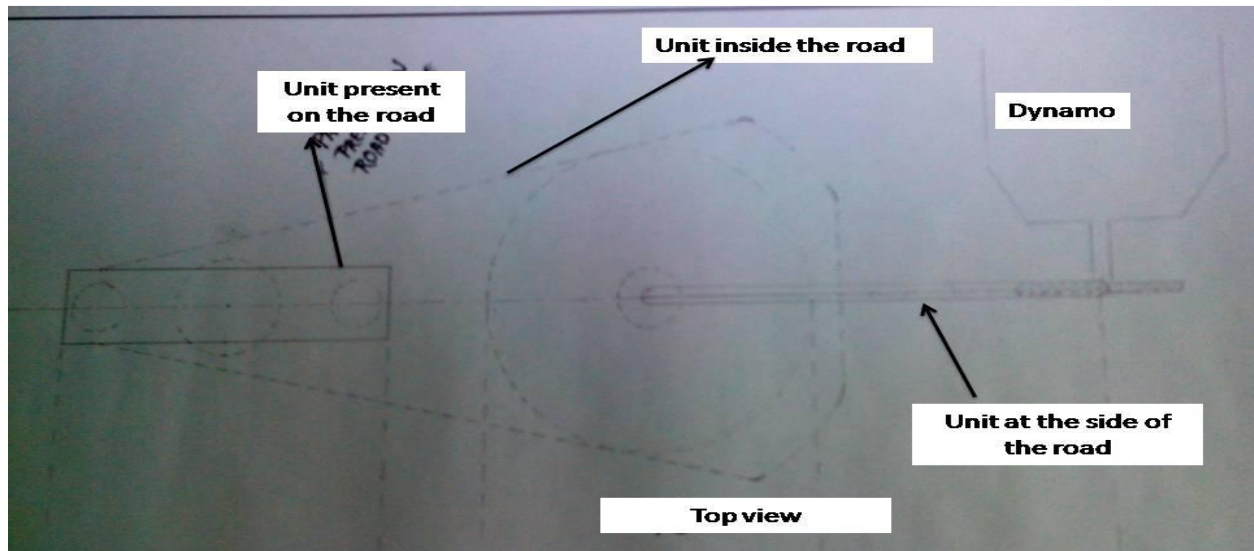

Fig.4

Fig.5

Application of Impact load the intensity of load will increase and hence will support the process.

The complete process of application of speed breaker device for generation of electricity is explained in block diagram (refer fig.6). The device was installed in the road and vehicles (motor cycles and cars) were allowed to pass over the device. The weight of vehicles presses the dome of speed breaker which presses plunger of System quickly, the electricity is generated as a result is stored in the reservoir.
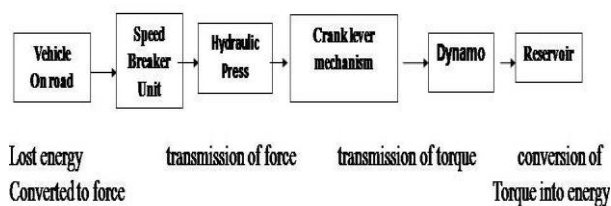
Block diagram of the force transmission and energy generation

Fig.6

IV. Energy Estimation

When the vehicle moves over the speed breaker, speed breaker reduces its speed. As these breakers have a little height it increases its potential energy. Let A vehicle's mass is 1,000kg passes over the system it pushes the damper to a depth of 10 cm it can produce approximate force of 9,800 N in plunger an If the area of ram is three times that of plunger then the total force gained by the Beam Engine or crank lever mechanism will be 29400 N i.e. three times that of force in plunger. Due to high value of force high torque may be achieved and hence a large size dynamo can be run, so from a single speed breaker on a busy highway, where about 100 vehicles pass every minute, about more than 3 kilowatt of electricity can be produced every single minute. Through this kind of speed breaker two purposes may be fulfilled
1. Reduction of accidents (due to high speed of vehicles)
2. Generation of power

V. CONCLUSION

The amount of electricity consumed in one night by all the street lights around Chennai city (India) is equal to consumption of electricity in a remote village for one month and 14 days [2], so if this kind of few speed breakers will be used by government on such busy streets then the problem of electricity may be solved .This speed breaker device will proved to be very useful in utilization of energy of vehicles lost on speed breakers. The manufacturing steps of this device are very simple, and very specific manufacturing facilities are not needed. The electricity generated by this device can be used for street lights of highway, or it may utilize by the people of village for the irrigation of crops or for their home appliances. Energy is the most important thing for development of any country so this will help a lot for development of country It is further suggested that combination of 5-6 speed breaker together can be placed in sequence for more production of energy and after every 2 km of distance on highways a device can be placed so as to get more and more power.

The only limitation of speed breaker is that for different type of vehicle (two wheeler, four wheeler, six wheeler or eight wheelers) different

assemblies have to be made as all are in different load categories.

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