

An Electricity-Generating Device Based on Speed Breakers Near Toll Plazas

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Abstract

On roads, speed breakers are provided to regulate the speed of traffic in cities near toll plazas. The potential energy that is lost when a vehicle's weight hits a speed breaker can be put to good use. This paper describes the P.E. of such a type of energy available on roads and its utilization for electricity in toll plazas for performing various tasks. The stages of development of a speed breaker device are described, as is that the mechanism to generate electricity using a DC Hydro Generator and store compressed air with the help of a piston cylinder compressor arrangement. Whenever the vehicle is allowed to skip the speed breaker dome, it gets pressed downwards. because the springs are attached to the dome. With the assistance of the piston cylinder arrangement, the rack is attached to the connecting rod of the cylinder, therefore the downward stroke of the rack can be used for air compression in the reservoir with the help of the piston cylinder arrangement. Simultaneously, a reciprocating piston cylinder arrangement compresses the air and stores it within the reservoir. After that, the compressed air goes to the DC Hydro Generator, which converts the high air into electricity. And now, this generated electricity is employed for various purposes in the toll plaza.

Key Words: Speed Breaker, Piston, Motor, Generator, Pressure, Compressor.

1. INTRODUCTION

In the recent decades, electrical energy has become a necessity for all human beings. The amount of electricity needed is growing daily. However, the resources available for electricity generation are scarce, and this is what has led to the current energy crisis. The rising demand for electricity leads to a decrease in the use of conventional resources for power generation and an increase in the emissions of pollutants. Consideration of renewable or non-conventional energy sources that are eco-friendly to the environment is urgently needed. Renewable energy technologies are commonly employed to generate electricity in order to reduce greenhouse gas emissions. Electricity is regularly produced using solar and wind energy.

On the road, vehicles waste a fantastic amount of energy on speed breakers, where there's a necessity to provide speed breakers to manage the speed of the vehicles near Toll Plaza. The annual rate of growth of automobiles in India has been

almost 20 percent during the last decade. There's tremendous vehicular growth year by year. Manufacturers of cutting-edge gadgets that can redirect the energy of moving vehicles that is squandered on speed breakers to productive work are motivated by the growing traffic and number of speed breakers on the highways. In this Practical manufacturing processes and steps of a speed breaker device for the generation of compressed air are described, which can be used to generate compressed air on the road near toll plazas in cities. The reciprocating air compressor is used for pressurized air generation, taking advantage of design simplicity. These are the most common kinds of compressors found in various applications. This paper supported the principle of the reciprocating air compressor, in which the compressor compresses the air by reducing the volume of air that has been isolated. We put our machine underground, exactly below the speed breaker. The highest piston rod is brought up to the level of the horizontal surface. When vehicles advance, the rack will be pushed down. The piston is reciprocating within the cylinder. The piston and cylinder arrangement convert reciprocating motion to air compression. The second part is specially planned to style and fabricate the conversion unit to utilize the available unconventional energy source. That's because tremendously available energy in low intensity with ample quantity is often utilized. Then this compressed air then goes to the DC Hydro Generator, which converts the high-pressure air into electricity. And this generated electricity is used in various applications in toll plazas in cities.

1.1 System Block Diagram

The diagram of electricity generation and air compression by using a speed breaker is shown in the figure.1.1. the primary part is air compression by using a speed breaker, which is shown within the figure and the second part is electricity generation. It indicates electricity generation and air compression occur when a vehicle passes over a speed breaker. With the assistance of the Block Diagram, one can easily understand the mechanism behind the identical.

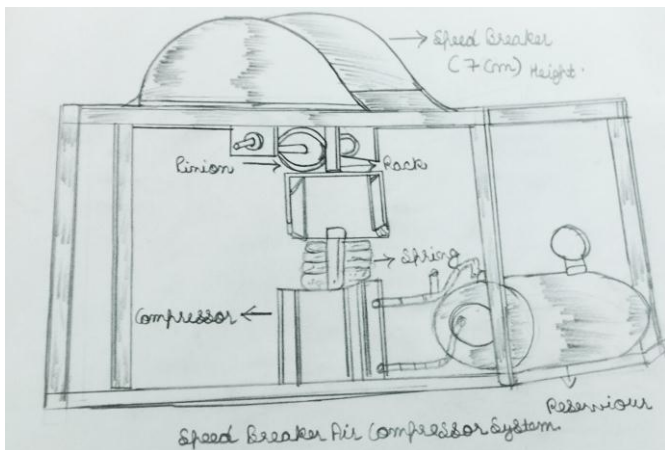


Figure : Speed Breaker Air Compressor System Design.

2. Working Principle

It works on the principle of reciprocating compressor during which compressor compresses the air by reducing the amount of air that has been isolated. The first crucial factor in this case is how we obtain reciprocating motion which is prime input within the system for that we use weight of moving vehicles that run on roads. These machine unit kept underground of road exactly below speed breaker, the very best of piston rod is bring up to level of road surface. When vehicles advance speed breaker it'll be pushed down so rack move downward and rack is jointed to piston rod so the piston is reciprocating within the cylinder. The configuration of the piston and cylinder produces air compression from reciprocating motion. Now during the dome shaped part press stroke, the air that has previously been introduced is being compressed while the piston moves in either an upward or downward motion. As a result of air being compressed in the small area, or "confined space," air pressure increases. more amount of air packed within the low volume created by the piston's sweeping motion inside the cylinder. The principal parts of kinetically operated reciprocating compressor are same as that for the I.C. Engine. Delivery and inlet valves They operate automatically and are spring-loaded. The pressure differential that is formed on each side and the spring that is included to close the valve at its seat cause them to open and close.

There are two strokes in Working. Suction strokes, Delivering Stroke The piston descends downward during the suction stroke, causing the pressure inside the cylinder to drop below that of the surrounding air. During the entire stroke, the intake value opens and ambient air is drawn within. The piston travels inward during the delivery stroke as the air in the cylinder is compressed. Compression continues while the inlet and delivery are both closed. The pressure rises above the receiver pressure at the conclusion of compression strokes. When the delivery valve's spring force is overcome by the high-pressure air, the air is expelled into the receiver tank.

3. Working Of Turbine And Generator

This device—a rotary motor—can work by instantly transforming a pressurized or elevated supply source into torque output. It does it very successfully by employing a revolving flow as opposed to a linear flow. Your supply source pushes against the turbine's inner rotor, which has blades, rotating it. Then, this revolving turbine is connected to the DC Hydro Generator, which converts the mechanical energy into electrical energy.

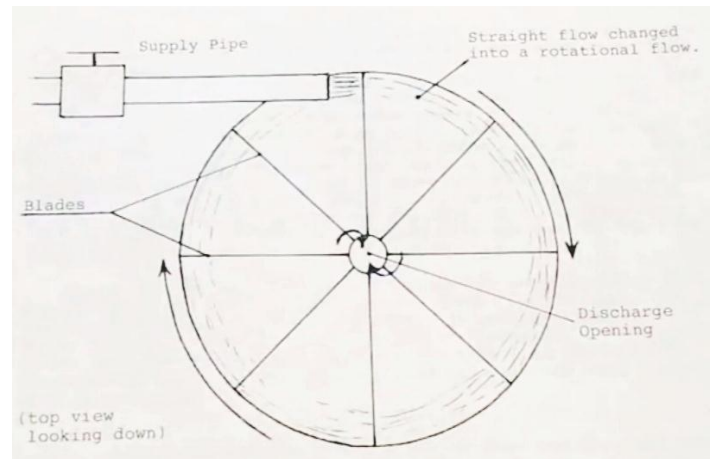


Figure : Rotatory Turbine Due To Air Pressure

4. Compressed Air

Compressed air a aggregate of all gases contained inside the surroundings. throughout this paper compressed air is stated a gasoline whilst it is used as a fluid medium. The unlimited deliver of air and consequently the ease of compression make compressed gasoline the most broadly used fluid for pneumatic device despite the fact that moisture and stable debris must be away from the air it does no longer require the giant distillation or separation manner required in the production of other gases. compressed fuel has maximum of the desired houses and characteristics of a fuel for pneumatic device. it is nonpoisonous and non - flammable but does include oxygen, which helps combustion .one of the maximum unwanted features of compressed air as a fluid medium for pneumatic systems is moisture content. The environment includes varying quantity of moisture in vapor from. changes in the temperature of compressed air will cause condensation of moisture within the pneumatic system. This condensed moisture is regularly very dangerous to the machine, because it increases corrosion, dilutes lubricants, and have to freeze in strains and compressed air lines to minimize or do away with moisture in systems wherein moisture might go to pot gadget overall performance. The supply of compressed air at the desired volume and strain is providing by an air compressor. the conventional form of compressor could be of the multi degree, reciprocating piston kind (displacement of sometime the diver need to bring with him a delivery of

respiratory gasoline, commonly compressed fuel. one cylinder compressor capable of charging a scuba cylinder to 300bar could have compression ratio of three hundred:1 it'd require big production and use significant energy to power it. To simplify the compressor, improve efficiency and reduce power necessities manufacturers use a multi-level arrangement. the following theoretical instance is a three-degree (3 cylinders) compressor with a compression ratio of 1: nine or 1:7 according to degree. this is able to provide us an output stress of 441bar in practice compressor manufactures may additionally installation 4 or greater tiers use distinctive compressor ratios to attain the desired output strain and will arrange for the air to be cooled because it passes from one stage to some other. [5] the amount of fuel contained within a diving cylinder may be calculated using Boyle's law e.g.: A 10-liter cylinder charged to 200bar consists of 2000 liters. Notes that the amount of air that a cylinder will preserve whilst charged to its running pressure is known as its working strain is known as its loose air capability i.e., if discharged to air stress the extent to which the compressed air could amplify. the size of compressor will depend on the favored responsibility. A scuba cylinder of 12-liter operating ability and 240 bar operating stress will preserve 2880 liters when charged. A 2 cfm (60 l/min) portable compressor will take over. forty-five mins to fill the cylinder from empty. it is apparent that a gadget with this sort of sluggish shipping would be vain for the duration of a dive middle. whilst air is compressed great warmth is generated. If no try is formed to cool it, the air will contain all of the warm temperature generated. Air, which incorporates all of the warmth in this way, is alleged to have gone through adiabatic compression (sometimes termed isentropic).

5. Dc Generator

The generator's primary job is to convert mechanical input energy into electrical output energy. The fundamental building block of a generator is a strong field magnet between whose poles a suitable conductor, typically in the form of a coil (armature), is rotated. The whirling wire coil breaks the magnetic lines of force, which causes current to flow through the wire. The mechanical energy of rotation is accordingly transformed into an electric powered present day inside the armature. gift Day mills work on the principles described by English physicist Michael Faraday in 1830. Electromotive pressure is evolved in a conductor while it's miles away moved in a magnetic field. The generator that The power that powers the lights on a bicycle is an instance of an alternator, that is, it produces alternating current (AC). A Direct current is generated by a generator using a commutator. Generators were the first electrical The electric motor is a gadget, able to hand over electricity for enterprise, and the foundation upon which many different later electric strength conversion gadgets have been based, which include the electric motor, the alternating-current

alternator, and the rotary converter. they may be hardly ever used for energy generation now due to the dominance of alternating modern, the dangers of the commentator, and the ease of changing alternating to direct modern-day the usage of stable nation methods.

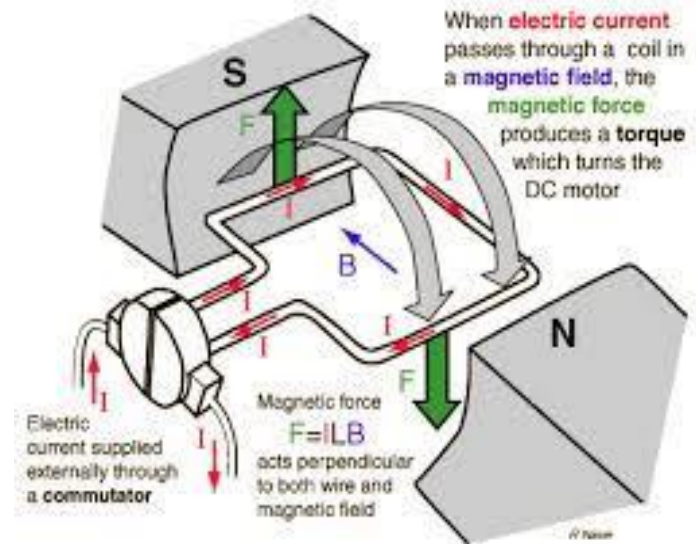


Figure: Dc Generator

6. Mathematical Calculation

Height of speed breaker = 7 cm

Work done=Force x Displacement

But Here, Force = Weight of the Body =650 Kg x 9.81

= 6370 N

Distance traveled by the body = Height of the speed brake =7 cm

Output power = Work done/Sec

= (6370 x 0.07)/60 = 7.43166 W

The power developed for 1 vehicle passing over the speed breaker arrangement for one minute is 7.43166 W,

Power developed for 60 minutes (1 hour) = 7.43166 x60

=445.899

Power developed for 24 hours = 445.899 x 24

=10.701 KW

7. Advantages

1. It doesn't need any fuel to run.
2. Uninterrupted production of electricity day and night.
3. Compared to typical power generation equipment, it is inexpensive.
4. Renewable energy sources.
5. Save Water
6. Simple to maintain

8. Conclusion

Any country's development depends on how well its energy is used, and this study can help. By using a speed limiter, it is successfully produced electricity and compressed air. This electricity can be stored in batteries during the day and used for toll plaza, signal systems on roads, high-way lights, and other beneficial tasks at night. Additionally, compressed air can be used to fill tyres with air and clean toll plaza. This essay promotes the protection of natural resources.

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