DEVLOPMENT OF SPEED BREAKER DEVICE FOR GENERATION OF COMPRESSED AIR BY USING SPRING SUSPENSION

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ABSTRACT

On roads, speed breakers provided to control the speed of traffic in rushed areas. The potential energy in terms of weight of vehicle is loss on speed breaker can be utilized for useful purposes. In this project we are collecting the compressed air and store this air in the tank as non-conventional method by simply driving the vehicle. Non-conventional energy system is very essential at this time to our nation. Compressed air production using vehicle suspensor needs no fuel input power to produce the output of the air. For this project the conversion of the force energy in to air. The control mechanism carries the air cylinder (vehicle suspension), quick exhaust valve, Non-return valve and spring arrangement. We have discussed the various applications and further extension also. Whenever the vehicle is allowed to pass over the speed breaker dome, it gets pressed downwards. As the helical compression springs are attached to the dome, they get compressed which is attached to the bottom of the dome, moves down in reciprocating motion and to store the compressed air in receiver and to utilize the useful Work. The men which are come on the path are applying the impact force or thrust on the projected mechanism. This impact pressure energy can be utilized to operate the piston and make the compressed air. This source of power can be used at the offices, colleges or Hotels and most likely by the High-way rescue Hospitals operating system. Also by accumulating this low intensity

Keywords*: -* *speed breaker, spring, and double acting piston cylinder and air tank*

1. INTRODUCTION

The increasing traffic and number speed breakers on roads motivate to manufacture an innovative device which can channelize the energy of vehicles that is wasted on speed breakers to some useful work. In this practical manufacturing processes and steps of speed breaker device for generation of compressed are described which can be used to generate compresses air on highways in remote areas. We put our machine underground of road exactly

below speed barker, the helical compression spring is used for Suspension Purpose. In the speed breaker system the speed breaker is made up of mild steel strips. The dome is also made of mild steel sheets. Dome of speed breaker is welded with the frame. The spring is connected to the rod of the double acting cylinder. The welding is used in fabricating the device is shielded metal arc welding by using the flux coated electrode. The block diagram as shown in Fig.1 depicts the complete process of application of speed breaker device for generation of compressed air. The device was installed in the road as shown and vehicles (motor cycles and cars) were allowed to pass over the device. The weight of vehicles presses the dome of breaker which compress the spring which is connected to rod reciprocating in cylinder and the air is generated and stored in the air tank. The air stored in the air tank can be utilized for many purposes e.g. repair of punctured tubes.

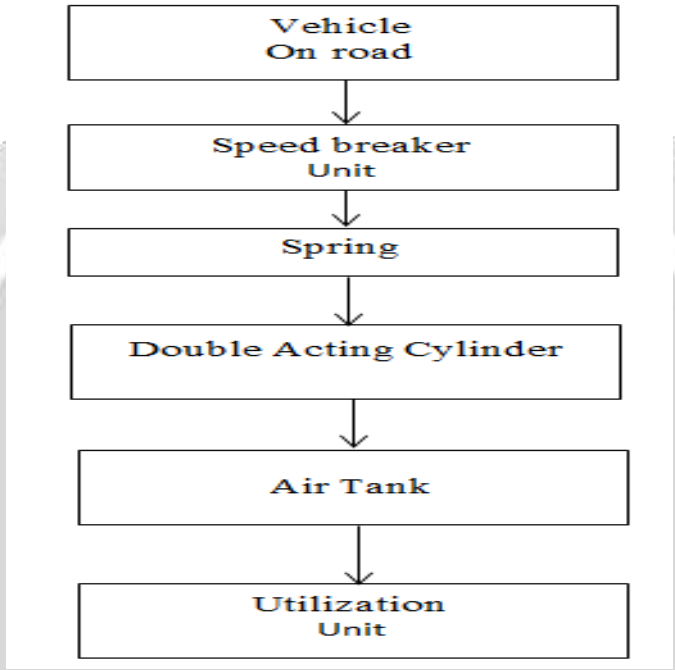

Fig-1.Block Diagram Representing Generation and Utilization of Compressed Air

2. OBJECTIVE

- Energy loss on speed breakers can be utilized for useful purposes.
- Development of a speed breaker device
- Simple mechanism is used to generate and store compressed air that can be further used for desired purpose.

3. LITERATURE REVIEW

3.1 Research Paper

S.Vigneswari1, V.Vinodhini (2014), "Compressed Air Production Using Vehicle Suspension" in this paper Non-conventional energy system is very essential at this time to our nation. Compressed air Production using vehicle suspensor needs no fuel input power to produce the output of the air. For this project the conversion of the force energy in to air. The control mechanism carries the air cylinder (vehicle suspensor), quick exhaust valve, and Non-return valve and spring arrangement. We have discussed the various applications and further extension also. The initial cost of this arrangement is high.

Dave Jaymin J. (2015), "Power Generation from Speed Breakers by Air Compression Method", 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.

Mr. Amol Sheshrao Fawade (2015), "Air Compression and Electricity Generation by Using Speed Breaker with Rack And Pinion Mechanism" The growth of any nation depends on utilization of energy and this paper helps for that. It is successfully produced electricity and compressed air by using speed breaker. This electricity can store in battery in day time and we can use it in night time for high way illumination, signal system on road, tollbooth or any other useful work. And compressed air can use for cleaning purpose in tollbooth and refilling of air in tires. This paper helps for conservation of natural resources.

3.2 Conclusion on Review Paper

In the last two to three years, a variety of models of Speed Breaker device are made for generation by using different types of mechanism. All the reviewed papers showed need of the electricity generation by using speed breaker, its working, performance characteristics, Types depends on the applications. Many more papers consist of design iterations for the better performance. Some papers are having both methods for finding out the best model from number of models. Spring mechanism and rack and pinion mechanism is also discussed in some paper.

3.3 Research Gap

After studying all above research papers it is observed that study on generation of Compressed Air by Suspension system is very less. Generation of electricity by using rack and pinion mechanism is more. Manufacturing steps of this device are very complicated and specific manufacturing facilities are required, therefore simple and without specific manufacturing facilities we are developed speed breaker device for generation of compressed air by using helical compression spring.

3. DESCRIPTION OF EQUIPMENTS

Fig-2.Double Acting Reciprocating Cylinder

Diameter : Ø40mm
Length : L 230mm
Pressure : 0.05-0.85 Mpa

Fig-3.Hose Pipe

Diameter : 6mm
Working Pressure: 3.7 Bar At (23 C
Burst Pressure : 15 Bar At (23 ^{0}C)
Temperature : -40 To 70 C

Fig-3.Non Return Valve

4. DESIGN AND CALCULATION

4.1 Air Tank Cylinder

Material Size **:** Ø180mm X 350mm
Material **:** Mild Steel
Weight **:** 3kg.
Quantity **:** 1

Table-1.Air Tank Manufacturing

Sr. No.	Operation	Machine	Time
1	Cutting the material 170mm X 250mm	Power hack Saw	60 Minute
2	Turning the Both side On lathe	Lathe	30 Minute
3	Drill the Upper side Of 8mm	Drill	10 Minute

Fig-6.Air Tank

4.2 Base Frame

Material Size **:** 690mm X 340mm X 560mm
Material **:** Cast Iron
Weight **:** 20kg.
Quantity **:** 1

Table-2.Base Frame Manufacturing

Sr. No.	Operation	Machine	Time
1	Cutting the material as our required size.	Power hack Saw	50 Minute
2	Make Welding	Welding	120 Minute

4.3 Dome

Material Size **:** 4000mm X 300mm
Material **:** Mild Steel
Weight **:** 2kg.
Quantity **:** 1

Table-3.Dome Manufacturing

Sr. No.	Operation	Machine	Time
1	Cutting the material 390mm X 280mm	Power hack Saw	60 Minute

Fig-7.Dome

4.4 Spring Design

1. Concept of Spring Design

The design of a new spring involves the following considerations;

a) Space into which the spring must fit and operate.
b) Values of working forces and deflections.
c) Accuracy and reliability needed.
d) Tolerances and permissible variations in specifications.
e) Environmental conditions such as temperature, presence of a corrosive atmosphere.
f) Cost and qualities needed.

On the basis of these factors material is to be selected and specify suitable values for the wire size, the number of turns, the coil diameter and the free length, type of ends and the spring rate needed to satisfy working force deflection requirements. The primary design constraints are that the wire size should be commercially available and that the stress at the solid length be no longer greater than the torsion yield strength.

Let,

F = axial load (N)
L_S = Solid length (mm)
n' = total number of coils or turn
n = number of active coil
d = wire diameter (mm)
D = mean diameter of coil (mm)
L_F = Free length (mm)
C = spring index = D/d
K = spring stiffness
G = Modulus of rigidity for the spring material
τ = Max. Shear stress induced in the wire (N/mm2)
p = Pitch (mm)
δ = Deflection of the spring

K_w = Wahl factor

Table-4.Specifications and material of helical compression spring

Sr. No.	Specification	Value
1	Material grade	IS 4454 Grade II
2	Ultimate Tensile Strength	1440 Mpa
3	Wire Diameter (d)	4.5 mm
4	Mean Diameter of Coil (D)	40 mm
5	Free Length (L_F)	195 mm
6	Young's Modulus	2×10^5 Mpa
7	Modulus of Rigidity	80×10^3 Mpa
8	End type	Closed and Ground
9	Number of active coils (n)	12
10	Total Number of Coils (n')= n+2	14

2. Calculations

a) solid length (L_S) = (n+2) d = (12+2) 4.5

= 6.3mm

b) Spring index (C) = D/d = 40/4.5

= 8.89

C is in between 6 to 9 so it is suitable for cyclic loading. Also it is suitable for manufacturing.

c) Provision of Guide

Free Length / Mean Coil Diameter = 195/40

= 4.87

As, Free Length / Mean Coil Diameter > 2.6 the guide is required for this spring according to thumb rule. Here the guide is provided so design is safe. These all above calculations are common for all types of springs design in this present work report.

d) Spring stiffness (k) = $Gd^4 / 8D^3n$ N/mm

= $80 \times 10^3 \times 4.5^4 / 8 \times 40^3 \times 12$

= 5.34 N/mm

e) Deflection (δ) = F / k (assume F = 300N)

= 300 / 5.34

= 56.17mm

f) Calculated shear stress (τ)

$$\tau = \frac{8*F*C}{\pi d^2}$$

$$\tau = \frac{8*300*8.89}{\pi*4.5^2}$$

τ = 335.38 N/mm^2 **< given shear stress, so design is safe.**

5. WORKING

When the vehicle (load) passes over the curved shape metal sheet i.e. dome, it goes down due to the load of vehicle. This assembly pushes down to the spring. This curved dome is connected spring and this spring is connected to cylinder rod. This quick action (movement of piston downward) compresses air and stored in the air cylinder (tank). When the vehicle goes away from the speed breaker, the dome along with piston moves up quickly due to the action of spring allows air intake into the compressor cylinder (suction stroke). These steps are repeated with the successive passing of vehicles. The frequent up and down movement of spring compression (attached with speed breaker dome) complete the intake and exhaust strokes of the repeatedly. These repeated cycles will be possible with busy roads will store a good amount of pressurized air in the air cylinder that can be further utilized for useful purposes.

Fig-9.Set Up of Speed Breaker Device For generation of Compressed Air by Using Spring Suspension System

6. ADVANTAGES AND DISADVANTAGES

6.1Advantages

1. No fuel is required for its operation.
2. Uninterrupted power generation during day and night.
3. Easy for maintenance.
4. Non-polluting energy sources.
5. Multipurpose.

6.2 Disadvantages

1. It cannot give constant output.
2. It cannot use in less traffic areas.

7. APPLICATIONS

1. It can use the refilling in tyres.

2. It is used in cleaning purpose.
3. It is also used in malls.
4. Hospitals.
5. Industrial purpose.

8. CONCLUSION

This speed breaker device is 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. As tests show frequent movement of vehicles over it generates enough air (80 cc of atmospheric air is pushed up into the air tank connected with the device, per cycle of suction and exhaust strokes) for commercial utilization. This compressed atmospheric air finds applications where pressurized air is required e.g. repairing puncture of the tube of tyre, cleaning of machines with steam of pressurized air. Frequent passing of vehicles is ensured by increasing traffic on highways.

9. FUTURE SCOPE

There is always some future scope for any research work. For this particular work, it may be possible to reduce the weight of suspension system .The modification in the suspension system will improve the straight line stability. It is further suggested that use of multiple air compressors attached with the same speed breaker would lead to improvement in the efficiency of the device.

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