

Regenerative Suspension System

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Abstract: The conventional vehicle suspension dissipates the mechanical energy i.e. potential and kinetic energy. In spring potential energy is stored and kinetic energy is wasted. The aim of paper is this wasted energy is compressed by using single acting cylinder by proper arrangement. The main aim of this paper is the compressed air production using vehicle suspension is given to the air conditioning system. The pushing power is converted into compressed air energy by proper arrangement. The pneumatic single acting cylinder is used for this project to compress the air. The output air from the pneumatic cylinder is collected through quick exhaust valve and non return valve and this compressed air stored inside the storage tank. After this research we concluded in car there is a lot of fuel burn only for working of A.C. while driving the car. If A.C. will run on other system rather than fuel then there is lot of fuel save in car hence the efficiency of car will also increases.

Keyword: Suspension system, Single acting cylinder, non-return valve, storage tank, heat exchanger.

1. INTRODUCTION

In the new age of electrical vehicle, everything has to be rethought. After one hundred years, people will laugh at today's hybrid and pure electric vehicle rather in the way we laugh at motor vehicle from 1880 that looked like something dragged along by a horse because that was starting point. Inside and out, today's vehicle almost look almost the same as what we went before.

The function of vehicle suspension system is to support the weight of the vehicle body, to isolate the vehicle chassis form road disturbances, to enable the wheels to hold the road surface. Two main elements in suspension systems are spring and damper. The damper is designed to dissipate vibration energy into the heat to attenuate the vibration which is transmitted from road excitation. However, the dissipated heat is from fuel or electrical power. In hybrid vehicle recapture some of the energy usually lost in braking system but the dissipation of vibration energy by shock absorbers in the vehicle suspension remains untapped.

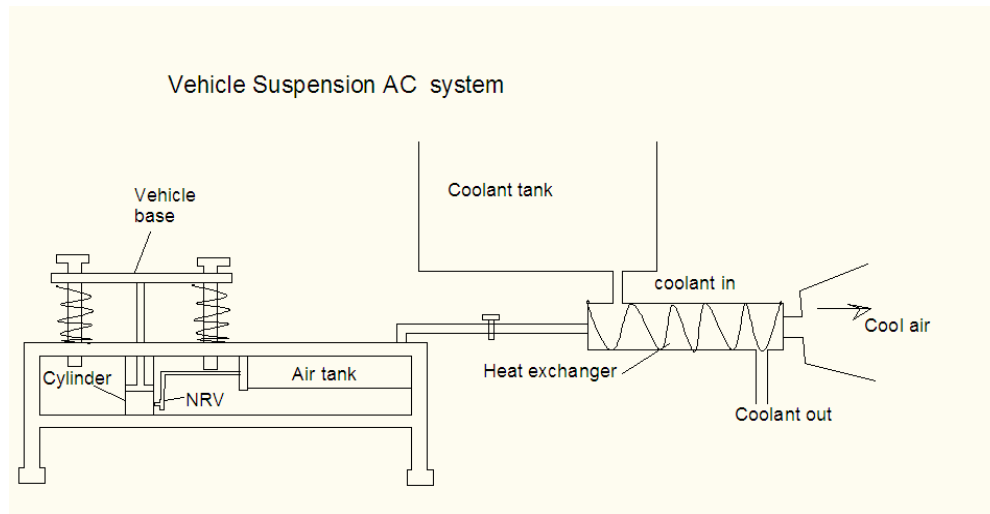
In the past, we pay little attention to energy loss of vehicle suspension. However, how much energy dissipated by the shock absorber of vehicle suspension? According to reference [6], only 10-20% the fuel energy is used for vehicle mobility.

The linear motion of suspension system is also use for compress the air by using piston cylinder arrangement. By using this compress air we can run A.C. system in the car and save fuel.

“Energy in motion when it is suddenly applied with a sort of obstacle means according to Newton's law for every action there is an equal and opposite reaction. Utilisation of this reaction is the basic reason behind the selection of this project work.”

2. OBJECTIVES OF PAPER

- a. To recover waste energy of suspension system.
- b. To save fuel which is burn for working of A.C
- c. To run A.C. on waste energy of suspension system.
- d. To increase the average of vehicle.

Development of the vehicle suspension system:**Fig. Layout of vehicle suspension A.C. system****Working-**

When vehicle is run on the rough or bumpy road surface then suspension spring continuously move up and down. We attach piston to the vehicle frame because of linear motion of piston, high pressure air comes out from cylinder. This high pressure air provides to air tank. In air tank high pressurized air is stored and when we want to turn on A.C. system this high pressurized air send to the heat exchanger by using knob. Low temperature coolant i.e. water (3.24°C) pass through the heat exchanger and also high temperature air pass through the heat exchanger by using knob (pipe). Here heat exchange occurs and air temperature becomes 15°C - 30°C which is further send at the required place which is to be cooled.

Main components of system and its working-

- a. Spring
- b. Piston cylinder arrangement
- c. Non return valve
- d. Storage tank
- e. Heat exchanger

a. Spring :-

When vehicle is running on a bumpy or rough road surface, then shocks and vibrations transmitted to persons, which is very uncomfortable that's why we use shock absorber to absorb shocks and vibrations to become comfort. Shock absorber is nothing but a spring.

b. Piston cylinder arrangement: -

It is use for compress the air to generate pressurised air. It consists of a cylinder barrel inside which a tight fitting piston can move to and fro. The piston rod comes out of the cylinder which can be attached to the component to which the motion is to be transmitted.

c. Non return valve: - A non-return valve allows a medium to flow in only one direction. The flow through the non-return valve causes a relatively large pressure drop, which has to be taken into account when designing the system. non return valve also works quick exhaust valve.

There are different types of non-return valves, such as

1. Spring loaded

2. Swing type
3. Clapper type valve

d. Storage tank: -Air tank is made up of mild steel. A hole is drilled at the upper side and threading is done to keep the pressure gauge and then fix two ends using welding and make input and output air connection. All pressurize air come in tank from various cylinder pipes connection. The use of storage tank to store pressurize compressed air and supply this pressurize air for various use when required.

Technical specification:-

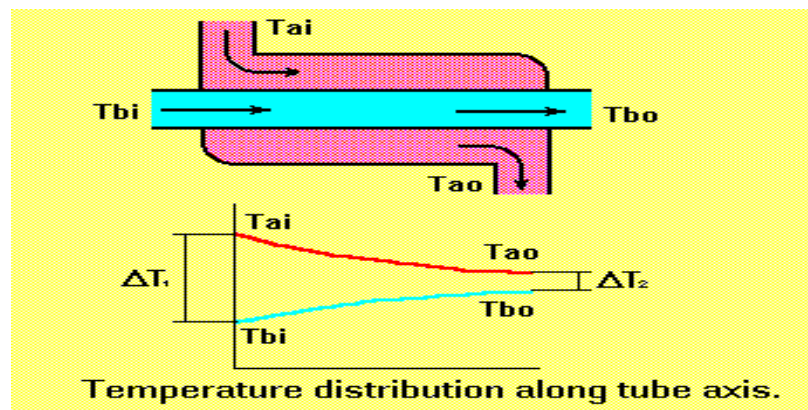
Parameters	Dimension
Internal diameter	176 mm
Outer diameter	180 mm
Length	350 mm
Maximum pressure	4 bar
Volumetric capacity	$0.8906.41 \times 10^3 \text{ mm}^3$

e. Heat exchanger: - It is used to exchange the heat between two medium in which heat transfer is takes place from high temperature to low temperature and maintain the temperature at mean temperature.

There are two main types of shell and tube heat exchanger

1. Parallel flow heat exchanger
2. Counter flow heat exchanger

We are using parallel flow shell and single tube heat exchanger in our project.



3. CONCLUSION

This project is made with pre planning, that it provides flexibility in operation.

This project 'regenerative suspension system' is designed with the hope that it is very much economical and help full to all vehicles to produce the compressed air. This project helped us to know the periodic steps in completing a project work. Thus we have completed the project successfully.

It has been a great experience while completing our project we come across lot many practical knowledge as well as experience. We had an opportunity to learn how project are been done. We received a lot of practical experience while working on this project as well as got enough freedom to our ideas for the improvement in our assigned project and check whether ideas are fruitful.

Therefore the design must be as perfect as possible and special attention is given during each manufacturing activity.

We paid special attention during each & every manufacturing process that was carried out. In the manufacturing we come to know how theoretical aspects are implemented in actual practice, we got to learn about different manufacturing processes, welding, gear, cutting etc.

4. FURTHER MODIFICATION AND FUTURE SCOPE

- 1) We can use screw compressor instead of piston & cylinder arrangement.
- 2) By using plus tube mechanism air can be used for Refrigeration & AC system.
- 3) More capacity tanks mounted to store large amount of air.
- 4) Safety valve can be used for safety of air tank.

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