

# Air Brake System using the Application of Exhaust Gas in IC Engines

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## ABSTRACT

In this braking system, exhaust gas from the IC engines is used to operate air brake in the automobiles. Air brake is most used braking system in vehicles. In the proposed model, instead of air brake, exhaust gas is used to operate the brake lever.

Exhaust gas from engine is stored in a specially designed pneumatic tank. This exhaust gas pressure is used to operate the pneumatic cylinder and brake lever. Filters are used to remove the impurities from the exhaust gas, and then it is allowed to store in the tank. Pressure relief valve is used achieve specific pressure in tank and helps to avoid damage in tank as well as in engine.

Two stoke petrol engine is used in the proposed exhaust gas braking system. Petrol engine is chosen because it produces less impurity in exhaust than diesel engines. This study can also be extended for diesel engines also with suitable design.

**KEY WORDS:** Petrol Engine, 2 Stroke, Air Brake, Exhaust Gas.

## 1. INTRODUCTION

The braking load of vehicles increases quickly so that the primary brake system is easily overloaded and can be damaged by overheating, possibly resulting in brake failure. Modern vehicles are equipped with hybrid system in order to preserve the non-renewable energy sources (Chengqun Qiu, 2016).

Vehicles operating in the hills, mountains will use the brakes frequently and leads to reduction in the average fuel economy and performance. Road hazards are taking place due to the failure in the braking system. Diesel engines have high thermal efficiency due to their higher compression ratios. The high compression ratio produces the high temperatures which is used for auto-ignition, and this makes the engine discharge less thermal energy in the exhaust (Ming Zheng, 2004).

During deceleration vehicle kinetic energy is stored and used as regenerative braking system. Regenerative braking improves the fuel economy as it uses the vehicle kinetic energy. In urban driving conditions about one third to one half of heat energy is released to atmosphere during the conventional braking (Chen Lv, 2015). Brakes are used to decelerate the vehicles in the hills and stop the vehicles. It is the field where continuous improvement and development is required. One of the examples is hand brake. Which is a essential system in the field of automobiles (Mohd Razmi Ishak, 2016).

The function of the hand brake is to stop the car in emergency situations and also in parking conditions. In case failure in the primary braking system then hand brake can be engaged to stop the vehicles. This proposed exhaust gas braking system has primary air brake function and also exhaust gas braking also. During emergency situations exhaust gas braking will be helpful to stop the vehicles.

## 2. MATERIALS AND METHODS

Two stroke engines completes the full cycle in every two stroke movement of the piston. Where as in four stroke engine piston travels four strokes. Stroke length represents the distance covered when piston moves from top to bottom dead centre or bottom to top. In the proposed model two stroke petrol engine is used. Fuel tank is shown in the figure.1.



**Figure.1. Fuel Tank**

Two stroke engines have high power too weight ratio and less moving parts. It is also lighter compared to the four stroke engines. Comparing to the cost two stroke engines are cheaper. Hence two stroke engine is used in the proposed model.



**Figure.2. 2 stroke petrol Engine**

Figure.2, represents the two stroke petrol engine used in the experiment. Pneumatic cylinder is used to operate the brake lever (Figure.3).



**Figure.3. Pneumatic cylinder**

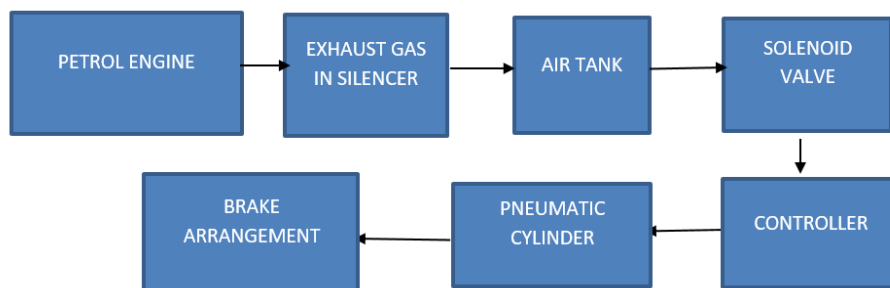
A solenoid valve is used to actuate the pneumatic cylinder at required time interval. Solenoid valve is operated by means of electrical signal.

**Control timer circuit:** Main purpose to timer circuit is to actuate the solenoid valve at regular interval of time to achieve proper lubrication at the desired interval.

### 3. EXPERIMENTAL PROCEDURE

The two stroke petrol engine is connected to the wheels in which exhaust gas braking is attached. Pressure tank is used to store the exhaust gas under required pressure. The braking speed is varied by adjusting the valve is called flow control valve.

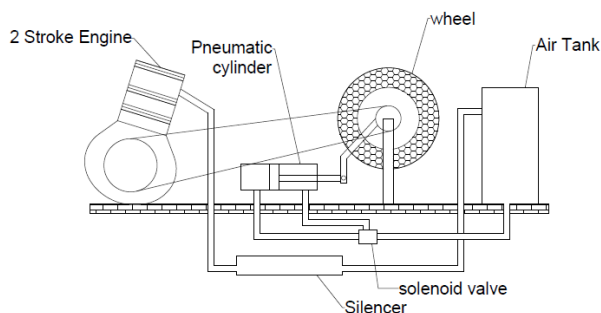
Solenoid valve is used to operate the pneumatic cylinder which actuates the brake lever of the wheels. The flow chart of the experiment is given in the figure.4.



**Figure.4. working flow chart**

During the operation of the engine, the exhaust gas is stored in the pressure tank. If the pressure of the tank exceeds certain limit then pressure relief valve will open. It is used to maintain the required pressure in the pressure tank. When the brake is applied, control circuit detects the signal and operates the solenoid valve. Exhaust gas stored in the pressure tank is used to actuate the pneumatic cylinder.

End of the actuator is connected to the brake lever. When pneumatic cylinder is actuated, brake lever is operated and applies the brake to the wheels. Brake pad is connected to the cam mechanism. Lever turns the cam, thus opening of brake shoe is obtained. Brake lever will come to the original position when it is not required. DCV is used to retract the pneumatic cylinder when not required. Figure 5 shows the complete experimental setup of exhaust gas braking system.



**Figure.5. Experimental Setup**

#### 4. CONCLUSION

Exhaust gas pressure is used to apply the brake and experiment is done with two stroke petrol engine. For Diesel engine, impurities are high in the exhaust gas. Hence, for diesel engines suitable filters and methods is required.

This brake uses exhaust gas pressure, thus it improves the efficiency of the engine compared to default air brake system.

It helps in filtering the toxic impurities from the exhaust gas using the air filter and thereby reducing the atmospheric pollution.

Study can be further extended for the diesel engines with suitable methodology.

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