

Exhaust Emission Reduction in Two-Wheeler by Pre Heating Method

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ABSTRACT

The attempt has been made in this research to use preheating of exhaust gas is given to input of ignition in Two/Four stroke engine to increase the efficiency. Our foremost aim of selecting this research is to increase efficiency. It is also beneficial with regard to economic considerations and engine efficiency. A method and system for preheating internal combustion engine fuel to an optimum temperature before introducing the fuel into carburetion system. The two wheeler engine is an internal combustion engine. It is a device, which converts the thermal heat energy from the exhaust and converts it to air preheat. Also the atmospheric air is fixed over the silencer for intake the hot air to the carburetor. The concept of increasing the fuel efficiency of a petrol engine in this research is to pre-heat the intake air which is flowing through the carburetor. The humidity in the atmospheric air effects the petrol vaporization in the carburetor. Therefore, by pre-heating the inlet air to the carburetor for a considerable amount, the vaporization can be easier and in turn complete combustion is achieved.

Keywords: Heat exchanger, pre-heater etc

1. INTRODUCTION

The concept of increasing the fuel efficiency of a petrol engine in this project, is to pre-heat the intake air which is flowing through the carburetor. The humidity in the atmospheric air affects the petrol vaporization in the carburetor. Therefore, by pre-heating the inlet air to the carburetor for a considerable amount, the vaporization can be ease and in turn complete combustion is achieved. Moreover by reducing the water vapour to the engine, the steam formation in the engine can be reduced pitting of the engine cylinder, piston and exhaust pipe.

The pre-heating of inlet air to the engine can be achieved by fixing a heat exchanger inside the exhaust pipe. The atmospheric air is sucked through the heat exchanger to the carburetor. The air which is flowing though the heat exchanger gets heated by the engine exhaust gas. This reduces the water vapour in the inlet air and the temperature of the air is raised. The temperature raise causes complete combustion in the engine and it is also more suitable for warming up the engine in cold conditions. The output of the engine exhaust gas is given to the input of the ignition system, so that the proper ignition is occurred. In this case, the efficiency of the engine is also increased.

The exhaust gas is given to the heating chamber as shown in figure. The exhaust hot air is used to pre-heat the input air into the ignition system. So far this type of system has not been introduced in two wheelers. So this may be very useful to two wheelers without any complication and maintenance. But the air pre-heater design depends on the exhaust pipe fitted to the particular two wheeler engine.

The design is simple, cheap and does not give any trouble to the engine. The output of the engine exhaust gas is given to the input of the ignition system, so that the proper ignition is occurred. In this case, the efficiency of the engine is also increased. This system can be used in all type of petrol engine two wheelers and also can be used in small petrol engines used in various industries.

2. EXPERIMENTAL SETUP

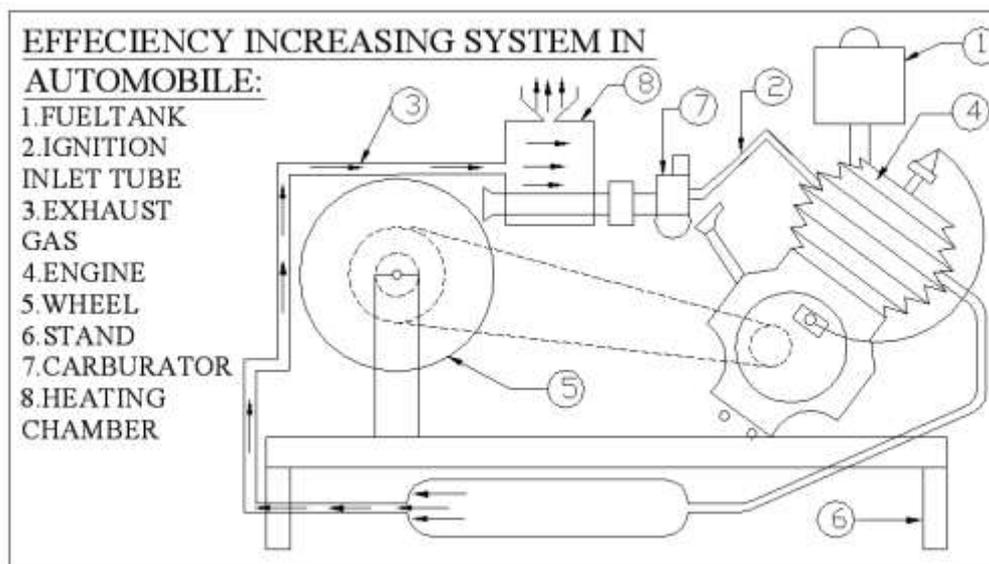


Fig- 1 : Preheat system used in vehicle

CONSTRUCTION AND WORKING PRINCIPLE

3. Construction:

The heat exchanger is located in the engine exhaust pipe. The exhaust pipe consists of a muffler and stay plates etc. The heat exchanger is made up of 18 SWG M.S. plate. The inner tube is inserted tightly on the muffler tube. A spiral baffle plate arrangement is made in between the two concentric tubes so as to make a spiral path to the incoming air. So that the heat transfer to the air can be increased. Moreover the air is flowing in counter direction to the exhaust gas; thereby effective heat transfer can be achieved.

The heat exchanger inlet is fitted with a pre-filter. The outlet is connected to a by-pass mechanism through a hose pipe. The by-pass mechanism is connected to the carburetor intake. The temperature of the air entering to the carburetor can be maintained constant for a particular degree centigrade. When the temperature of air is increased above the predetermined valve the thermal relay opens the butterfly valve (4- wheeler Application) and allows the atmospheric air to mix with the heater air from the heat exchanger. So the hot air is diluted with atmospheric air and reducing the temperature. Thereby the temperature of the hot air to the carburetor can be maintained at a particular level an adjustable screw which is used to pre-test the thermal relay for the required temperature.

3.1 Temperature Measuring Instrument Set-Up:

A milli Voltmeter is used to measure the temperature at various points, i.e., temperature of air at inlet & outlet of air pre-heater. The readings can be noted by the deflection of the pointer in milli-voltmeter. One end of thermocouple is connected to the milli-voltmeter while the other end is connected at required points on exhaust tube to measure the temperatures. The thermo couple wires are perfectly insulated by glass fiber sleeves.

3.2 Working:

The high pressure gas exiting the cylinder initially flows in the form of wave front as all the disturbances in fluids do. The exhaust gas pushes its way into pipe which is already occupied by gas from previous cycle, pushing that gas ahead and causing a wave front. Once the gas ahead flow itself stops, the wave continues on bypassing the energy to the next gas downstream and so on at the end of pipe. If this wave encounters any change in cross section or temperature it reflect a portion of its strength in opposite direction of its travel. The basic principle is described in wave dynamics. A heat chamber makes use of this

phenomenon by varying its diameter (cross section) and length to cause the reflection to arrive back in the cylinder at the desired time in the cycle. An approximation of a heat chamber in operation. It does a good job illustrating the positive portion of the exhaust pulse, however the several errors in this cycle: The exhaust gas would not go all the way through pipe in the 1 cycle. Neither does it show the suction wave generated by the diverging section. The fresh mixture drawn into header pipe.

Therefore in this method output of the exhaust gas is given to the input of ignition system with the help of heat exchanger so that proper ignition occurs. The exhaust gas is given to the heating chamber. And atmospheric air is heated with the help of heat exchanger. Therefore proper combustion of the fuel occurred and particulate matter reduces at the exhaust. Due to preheating the steam formation and pitting inside engine cylinder also reduced.

4. COMPONENTS OF SYSTEM:

4.1 Muffler:

A muffler (silencer in British English, or back box in Irish English) is a device for reducing the amount of noise emitted by the exhaust of an internal combustion engine. Mufflers are installed within the exhaust system of most internal combustion engines, although the muffler is not designed to serve any primary exhaust function. The muffler is engineered as an acoustic soundproofing device designed to reduce the loudness of the sound pressure created by the engine by way of acoustic quieting. The majority of the sound pressure produced by the engine is emanated out of the vehicle using the same piping used by the silent exhaust gases absorbed by a series of passages and chambers lined with roving fiberglass insulation and/or resonating chambers harmonically tuned to cause destructive interference wherein opposite sound waves cancel each other out. An unavoidable side effect of muffler use is an increase of back pressure which decreases engine efficiency. This is because the engine exhaust must share the same complex exit pathway built inside the muffler as the sound pressure that the muffler is designed to mitigate.

Some Vehicle owner remove or install an after market muffler when engine tuning in order to increase power output or reduce fuel consumption because of economic environmental concern, recreational pursuit such as motorsport and hypermiling and/or for personal aesthetic acoustical preferences. Although the legality of altering a motor vehicle's OEM exhaust system varies by jurisdiction, in most developed parts of the world, modification of a vehicle's exhaust system is usually highly regulated if not strictly prohibited.

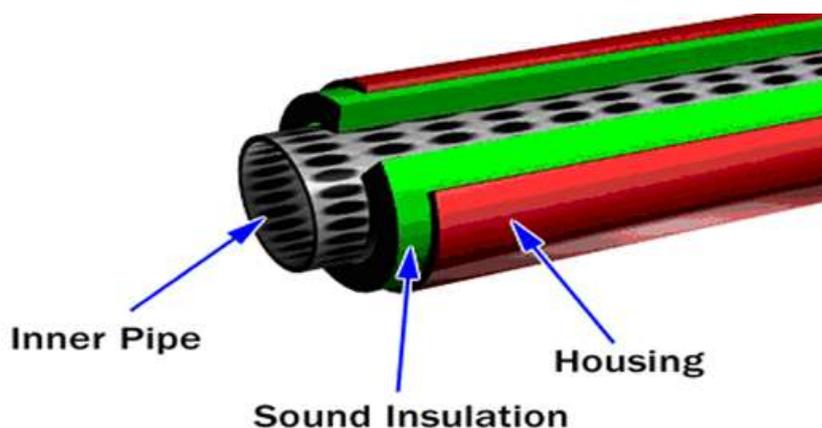


Fig.3.6 Muffler cut section

4.2 Heat Exchanger:

Heat exchangers are equipment that transfers heat from one medium to another.

E.g. From to cold water, from hot steam to cold water, from hot gas to cold water,

From hot water or unsaturated hot water steam to cool air.

A heat exchanger is a component that allows the transfer of heat from one fluid(liquid or gas) to another fluid. Reasons for heat transfer include the following:

1. To heat a cooler fluid by means of a hotter fluid
2. To reduce the temperature of a hot fluid by means of a cooler fluid
3. To boil a liquid by means of a hotter fluid
4. To condense a gaseous fluid by means of a cooler fluid
5. To boil a liquid while condensing a hotter gaseous fluid .Regardless of the function the heat exchanger fulfils, in order to transfer heat the fluids involved must be at different temperatures and they must come into thermal contact. Heat can flow only from the hotter to the cooler fluid.

4.2.1 Types:

Although heat exchangers come in every shape and size imaginable, the construction of most heat exchangers falls into one of two categories:

1. Tube and shell heat exchanger
2. Plate exchanger

According to types of flow it is divided into three categories:

1. Parallel Flow
2. Counter Flow
3. Cross Flow

4.3 Air Filter

A particulate air filter is a device composed of fibrous materials which removes solid particulates such as dust, pollen, mould, and bacteria from the air. A chemical air filter consists of an absorbent or catalyst for the removal of airborne molecular contaminants such as volatile organic compounds or ozone. Air filters are used in applications where air quality is important, notably in building ventilation systems and in engines. Some buildings, as well as aircraft and other man-made environments (e.g., satellites and space shuttles) use foam, pleated paper, or spun fiberglass filter elements. Another method, air ionisers, use fibers or elements with a static electric charge, which attract dust particles. The air intakes of internal combustion engines and compressors tend to use either paper, foam, or cotton filters



Fig.3.10 Engine Air Filter Clean and Dirty Side

5. DESIGN OF AIR-PREHEATER

5.1 Selection of Materials

The first problem is selecting suitable materials to serve the design purpose. The material should also be locally available. It should be best studied and also cheap in cost. The materials for baffle plates and tubes shall be decided first. Baffle plates and tubes should have very good thermal conductivity. It should also be resistant to chemical corrosion as well as erosion. Some of the materials that can be considered are copper, brass, aluminum and steel.

5.2 Final Material Selected:

Considering the merits of both the metals, steel is best suited for the purpose. But galvanized iron can be chosen as it is available in tube lengths in any diameter and to any required length. Also galvanized iron has very good corrosion resistance property. Further its cost is less and it can be welded to G.I sheet or steel sheet.

6. Conclusion:

This work adventured by us is the one that can be used for both preheating and efficiency. Even though it is complicated to convert to gas in four stroke engine, we have entered into this project. We have done the project with simple in construction by lower expenses. This is one of the advantageous project conserving the cost and scarcity of preheating. The compression ratio of the engine is from the efficiency which we have avoided for the reason that if we suit the engine for it will not work with preheating. Road test and load test had been carried out for testing the condition of engine with efficiency and compared with preheating.

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