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Heat Extraction from Chimney and Pollution Control

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Abstract: *Diesel power invitably finds a very important role in the development of the plant's economy and technical growth. Inspite of their high thermal efficiency, one cannot ignore the fact about the effect of their exhaust, in the atmosphere. It is a well-known fact that the toxic gases emitted in diesel engines are less than the engines. Due to high cost of petrol, diesel engines are more in use. Anticipating the use of diesel engines, even more in the near future; this system developed can be used to control the toxic gases and control temperature coming out of the diesel engines. Also we used the heat from this gases to increases the temperature of water and used this water for inlet to boiler. Which can help to boiler to increase efficiency and save the power to heat the water. These toxic gases are harmful not only to the atmosphere, but also to the human & animal race. Objective of this project is to design & fabricate a simple system, where the toxic levels are controlled through chemical reaction to more agreeable level. Also we used the heat from this gases to increases the temperature of water.*

Key Words*: efficiency, plant's economy, temperature of water*

1. INTRODUCTION

Diesel engines are playing a vital role in Road and sea transport, Agriculture, mining and many other industries. Considering the available fuel resources and the present technological development, Diesel fuel is evidently indispensable. In general, the consumption of fuel is an index for finding out the economic strength of any country. In spite, we cannot ignore the harmful effects of the large mass of the burnt gases, which erodes the purity of our environment everyday.It is especially so, in most developed countries like USA and EUOPE. While, constant research is going on to reduce the toxic content of diesel exhaust and use of that that exhaust to heat a water and use this water at many applications. The diesel power packs find the ever increasing applications and demand. This project is an attempt to reduce the toxic content and temperature of diesel exhaust, before it is emitted to the atmosphere. And use this heat for heat a water. This system can be safely used for diesel and petrol power packs which could be used in inflammable atmospheres, such as refineries, chemicals processing industries, open cost mines and other confined areas, which demands the need for diesel and petrol power packs.

Also A wind turbine is a mechanical device which is rotated by the wind to generate electricity. It is also called as wind generator. There are two types of wind turbines. They are wind generator and wind mill. Wind mill is either used to grind grain or to pump water. There are two types of wind turbine based on axis of rotation. They are horizontal axis wind turbine and vertical axis wind turbine. The smaller turbines are simple in application like battery charging while bigger turbines are used for commercial power production. The most successful wind turbine is horizontal axis wind turbine as it is best suited for higher wind speeds at high altitude. The best examples for vertical axis wind turbine are the Gyro mill (straight blades) and the Savonius(scoops type). A vertical axis wind turbine does not need to be pointed towards the wind because of its vertical shaft. It adjusts itself towards the direction of the wind. The most efficient means of getting electrical energy is horizontal axis type.The components used are Silencer of Royal Enfield 350cc classic vehicle**,** Vertical Axis rotor commonly known Vertical Axis Wind rotor and two numbers of clutch bearings.

Keywords: exhaust heat extraction, reduced temperature of exhaust, silencer

2. LITERATURE REVIEW

Vikas Kachare1 , Venkatesh Kannan[1]] Instantly, a like pollution has become a greatest threat in the world. It is important from the public health point of view, because Polluted air causes physical ill effects. Increasing toxic pollutant in the air has focused the world's attention on the need of reducing it. The main pollutants contribute by automobiles are carbon monoxide, unburned hydrocarbon, oxides of nitrogen and Lead. Aqua silencer is used to reduce harmful pollutants and noise levels. Since water is used in this silencer it has been named as Aqua silencer. Aqua silencer is cheaper, effective and easy to install. In this review paper the complete focus was given on the study about the use of aqua silencer enhances the reduction of noise and toxic emission and all the various applications. There is tremendous progress in the field of reduction of toxic emission but still there is scope of further advancement in this

field. By using perforated plates the fuel consumption remains same as conventional system. By using water as a medium the sound can be lowered and also by using activated charcoal in water we can control the toxic emission to a greater level.

In aqua silencer the water contamination is found to be negligible. It gives smokeless and pollution free emission and also it is less expensive. It can be used for vehicles and also can be used in industries.

B.Bhubesh, R.K.Sathiendran, [2] This paper presents the power production by means of exhaust gases (from silencer) normally from two wheelers (bikes), cars, buses, trucks. The spark Ignition and Compression Ignition engines usingpetrol and diesel as their fuel produce waste gas in the form of air. The flow or velocity which comes outafter the final stroke is considered to have sufficient thrust to rotate the vertical axis rotor. In attempt of that idea a vertical axis rotor which suits well into the bike silencer is made and here what i use is silencer of Royal Enfield 350CC Classic vehicle. The flow or velocity of exhaust gas automatically rotates the vertical axis rotor. The vertical axis rotor is coupled to dynamo so that mechanical rotations can be converted into electrical energy. The electrical energy is then used for mobile

Shweta B. Said1, Sonali P. Wagh [3] Day by day the Air pollution is goes on increasing. The main source of the pollution is Exhaust from automobiles and industries. Hence to reduce these pollutants from Exhaust of Engine a new technology is introduced called Aqua silencer. An Aqua silencer is a device used to filter the pollutants produced from automobiles such as CO, UBHC, NOx and Lead. It uses the charcoal layer, perforated tube and water for its working. Due to water, the noise is also gets reduced than open environment. Because of this it get named as AQUA SILENCER.

Akhil Anil Kumar, [4] had observed that the aqua silencer is successfully effective in reducing emission of gases from the engine exhaust. By using water as a medium, the sound levels have been reduced and by using activated charcoal in water, it produces almost pollution-free and smokeless emission and is also cheap considering long term use. The aqua silencer's performance is almost equivalent to the conventional silencer. It can be widely used in industrial engines and with a little improvisation, in heavy weight vehicles. This project analyzed the smoke content of the exhaust gas before and after treatment and it was found that there is a considerable reduction in the emission as pointed out by the test results.

3. IMPORTANT COMPONENT

3.1 CHIMNEY WITH WATER JACKET INSIDE:

In this type of chimney, there are 4 to 5 perforated plates are installed. The perforated plate consists of different diameters. The purpose of providing different diameter holes is to break up gas mass to form smaller gas bubbles. The perforated plateof different diameter is shown in Generally 4 sets of holes are drilled on the perforated plate. After passing through perforated plate it goes through a layer of activated charcoal is provided and further a glass wool and felt filter covers it.

The whole unit is then placed in a water container. A small opening is provided at the end of the container to remove the exhaust gases and a drain plug is provided at the bottom of the container for periodically cleaning of the container. Also a filler plug is mounted at the top of the container. At the inlet of the exhaust pipe a non-return valve is provided which prevents the back flow of gases and water as well.

3.2 PUMP:

The pumping of water is a basic and practical technique, far more practical than scooping it up with one's hands or lifting it in a hand-held bucket. This is true whether the water is drawn from a fresh source, moved to a needed location, purified, or used for irrigation, washing, or sewage treatment, or for evacuating water from an undesirable location. Regardless of the outcome, the energy required to pump water is an extremely demanding component of water consumption. All other processes depend or benefit either from water descending from a higher elevation or some pressurized plumbing system.

3.3 STORAGE TANK:

A hot water storage tank (also called a hot water tank, thermal storage tank, hot water thermal storage unit, heat storage tank and hot water cylinder) is a water tank used for storing hot water for space heating or domestic use. Water is a convenient heat storage medium because it has a high specific heat capacity. This means, compared to other substances, it can store more heat per unit of weight. Water is non-toxic and low cost.An efficiently insulated tank can retain stored heat for days, reducing fuel costs.[1] Hot water tanks may have a built-in gas or oil burner system electric immersion heaters Some types use an external heat exchanger such as a central heating system or heated water from another energy source. The most typical, in the domestic context, is a fossil-fuel burner, electric immersion elements, or a district heating scheme.[2] Water heaters for washing, bathing, or laundry have thermostat controls to regulate the temperature, in the range of 40 to 60 °C (104 to 140 °F), and are connected to the domestic cold water supply.

3.4 FLOW CONTROL VALVE:

Flow measurement is the quantification of bulk flui movement. Flow can be measured in a variety of ways. Positive-displacement flow meters accumulate a fixed volume of fluid and then count the number of times the volume is filled to measure flow. Other flow measurement methods rely on forces produced by the flowing stream as it overcomes a known constriction, to indirectly calculate flow. Flow may be measured by measuring the velocity of fluid over a known area. For liquids, various units are used depending upon the application and industry, but might include gallons (U.S. or imperial) per minute, liters per second, bushels per minute or, when describing river flows, cumecs (cubic metres per second) or acre-feet per day. In oceanography a common unit to measure volume transport (volume of water transported by a current for example) is a sverdrup (Sv) equivalent to 10^6 m^3/s.

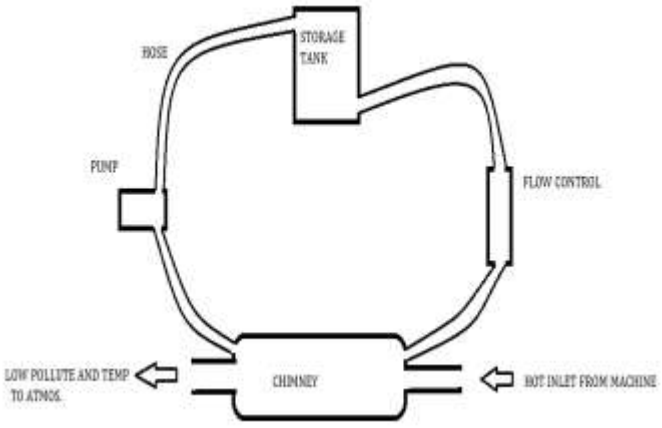
3.5 HOSES:

A hose is a flexible hollow tube designed to carry fluids from one location to another. Hoses are also sometimes called pipes (the word pipe usually refers to a rigid tube, whereas a hose is usually a flexible one), or more generally tubing. The shape of a hose is usually cylindrical (having a circular cross section Hose design is based on a combination of application and performance. Common factors are size, pressure rating, weight, length, straight hose or coilhose, and chemical compatibility.Hoses are made from one or a combination of many different materials. Applications mostly use nylon, polyurethane, polyethylene PVC, or synthetic or natural rubbers, based on the environment and pressure rating needed. In recent years, hoses can also be manufactured from special grades of polyethylene (LDPE and especially LLDPE). Other hose materials include PTFE (Teflon), stainless steel and other metals.

3.6 COPPER COIL WITH WATER FLOW INSIDE

Copper tubing is most often used for supply of hot and cold tap water, and as refrigerant line in HVAC systems. There are two basic types of copper tubing, soft copper and rigid copper. Copper tubing is joined using flare connection, compression

4. WORKING AND BLOCK DIAGRAM



A heat exchanger is a device that is used to transfer thermal energy (enthalpy) between two or more fluids, between a solid surface and a fluid, or between solid particulates and a fluid, at different temperatures and in thermal contact. In heat exchangers, there are usually no external heat and work interactions. Typical applications involve heating or cooling of a fluid stream of concern and evaporation or condensation of single- or multicomponent fluid streams. In other applications, the objective may be to recover or reject heat, or sterilize, pasteurize, fractionate, distill, concentrate, crystallize, or control a process fluid. In a few heat exchangers, the fluids exchanging heat are in direct contact. In most heat exchangers, heat transfer between fluids takes place through a separating wall or into and out of a wall in a transient manner. In many heat exchangers, the fluids are separated by a heat transfer surface, and ideally they do not mix or leak. Such exchangers are referred to as direct transfer type, or simply recuperators. In contrast, exchangers in which there is intermittent heat exchange between the hot and cold fluids—via thermal energy storage and release through the exchanger surface or matrix— are referred to as indirect transfer type, or simply regenerators. Such exchangers usually have fluid leakage from one fluid stream to the other, due to pressure differences and matrix rotation/valve switching. Common examples of heat exchangers are shell-andtube exchangers, automobile radiators, condensers, evaporators, air preheaters, and cooling towers. If no phase change occurs in any of the fluids in the exchanger, it is sometimes referred to as a sensible heat exchanger. There could be internal thermal energy sources in the exchangers, such as in electric heaters and nuclear fuel

elements. Combustion and chemical reaction may take place within the exchanger, such as in boilers, fired heaters, and fluidized-bed exchangers. Mechanical devices may be used in some exchangers such as in scraped surface exchangers, agitated vessels, and stirred tank reactors. Heat transfer in the separating wall of a recuperator generally takes place.

And all this circulation of water is done by the pump and water is continually heating

5. IMPORTANT CALCULATIONS

Engine data: **Hero Honda Splendor**

Bore (D) = 50 mm

Stroke (L) = 49.5 mm

No. Cylinders (n) = 1

Engine power (P) = 6.15kw (8.36ps) @ 8000rpm

Max. RPM (N) = 8500 rpm

Allowable back pressure for muffler = Not available (in H2O)

Transmission Loss Noise target (muffler) = 30 dB.

STEP 2: TARGET FREQUENCIES

To find fundamental frequency

Cylinder Firing Rate (CFR):

CFR to be calculated as per the equation –2,

CFR =8000/120 = 66.66

Engine firing rate (EFR):

EFR to be calculated as per the equation –3,

EFR= NO. OF CYL. X Cylinder firing rate (Eq-3)

EFR = 1*66.66=66.66Hz

STEP 3: MUFFLER VOLUME CALCULATION

Swept volume (Vs): $(\pi \times d^2 \times L)/4$

$= (3.14 \times 50^2 \times 49.5)/4$

= 97193.022 x 10^-6 Lit.

Volume to be consider for calculation

Volume = (No. of cylinders) x Vs = (1) x 0.09714375 Lit = 0.0971930

As no. of cyl = 1 for hero splendor.

Silencer Volume =Factor X ConsiderVolume

= 25 x 0.0971930 liters.

= **2.42982556** ***Lit***

Assumed Factor =25

Silencer Volume: Volume of silencer must be factor of at least 12 to 25 times the volume considered.

Volume can be adjusted depending on the space constraint.

STEP 4: INTERNAL CONFIGURATION OF MUFFLER AND CONCEPT DESIGN

Diameter of muffler calculated as:

$V_m = (\pi/4) \times d^2 \times L$

$2429825.5568\ mm^3 = (3.14/4) \times D^2 \times 0.350$

D=94.01mm OR

D=94 mm……..Diameter of muffler

Here, we take L= 350 mm after studying various muffler lengths of similar engine mufflers and overall space available on a motorcycle for mounting of a muffler and hence we select the same length.

Step 5: TAIL PIPE DESIGN:

Generally Tail Pipe Diameter and shape is taken the same as selected by OEM or manufacturer for lesser flow resistance and optimum flow characteristics.

Hence,

Tail Pipe Diameter: 23.48mm.

6. CONCLUSIONS

1. Hence we increase the temperature of water by using hot exhaust of engine.
2. We control global warming.

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