Research Article

INCREASING THERMAL EFFICIENCY OF INTERNAL COMBUSTION ENGINE BY ECOFRIENDLY EXHAUST AND INLET VALVE SYSTEM

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ABSTRACT
As per the present technology of internal combustion engines, air enters in cylinder through air filter & carburetor. At the end of suction stroke, the inlet valve does not get closed immediately it takes about 40o after bottom dead center (BDC), during this period the entered mixture after hitting on piston & cylinder wall escapes to atmosphere through inlet valve, carburetor & Inlet side of Internal Combustion engine[1]. This leads to improper combustion due to inappropriate proportion of air & petrol. As per our research inlet valve is kept opened for 40 to 60 degrees to fill the cylinder as much as possible. But air is an elastic fluid, hence during this period instead of entering more Air-fuel mixture into cylinder, the Air-fuel mixture simply bounces on cylinder wall & piston top according to Newton's 3rd law wall & piston provides equal & opposite reaction (Kim *et al.,* 2008). The effect of this bounce back is to fill the cylinder insufficiently. Another effect is that Air-fuel mixture gets bounced which tends to change the Air fuel ratio. Also the inlet side pollution is increased (Jasak *et al.,* 1999). Due to above two reasons combustion remains incomplete & increases the Carbon-monoxide emission from Exhaust side. These effects as Bounce Back Loss After extensive study & research to get beneficial effects of these Bounce back loss he has developed Eco-Friendly Non Return Valve.

Keywords: Air Fuel Ratio, BDC, Carbon-monooxide, Elastic Fluid, Internal Combustion Engine, Suction Stroke

INTRODUCTION
As we know overall engine performance mainly depends on the proper combustion of air fuel mixture. Because of bounce back losses the ratio is not constant which leads to incomplete combustion (Kim *et al.,* 2008). The Eco Friendly Non Return Valve Minimize the effect and increases the efficiency of engine.
I) Principle
The device Eco-Friendly Non Return Valve is used to minimize bounce back losses of air fuel mixture (Unburned Hydrocarbon Particles) through carburetor inlet Unburned Hydrocarbon Particles may be of petrol or CNG the device is connected to inlet of Air Filter. The device is developed in nylon and PVC material.
II) Working Process
The device has Non-Return valve designed so as to allow airflow to inlet of air filter, but during the compression cycle of I.C. engine it does not allow Air-Fuel Mixture (unburned Hydro carbon) in reverse direction to atmosphere. The known traditional principle of I.C. Engine i.e. at the end of suction stroke, inlet valve of engine remains open for 40* to 60*. It has been kept open to take benefits of inertia, which allows more air fuel mixture to enter in engine cylinder after suction stroke is completed. But my research has placed following data. At the end of suction stroke, piston is at bottom dead centre (BDC). At the duration of valve opening after suction stroke air fuel mixture particles strikes on the crown of piston cylinder wall & piston top, action gets completed which gives equal & opposite reaction (Wenig *et al.,* 2010). This happening lets the air fuel mixture to bounce back to atmosphere through carburetor & air filter. Those are unburned hydrocarbons, which are dangerous atmospheric pollutants. My device minimizes the air pollution due to unburned HC.
The evaluation is made in following process:
1. The stick of analyzer is connected to air filter through an additional hole to filter air chamber.

Research Article

2. Engine is allowed to run at 1000,2000,3000,5000 rpm
3. Emission is then analyzed on infra red gas analyzer.
4. The Emission of Hc are collected without valve.
5. The Echo Friendly Non-Return Valve is connected to Inlet of Air Filter.
6. The Emissions of Hc are collected with valve at above state RPM respectively.
7. The stick of analyzer is connected to exhaust pipe and carbon monoxide readings are observed.
8. The Emission of Carbon monoxide are collected without valve at above state RPM respectively at the exhaust side.
9. The Emission of Carbon monoxide are collected with valve at above state RPM respectively at the exhaust side.

Evaluation is done by using following devices:

1. *Exhaust Gas Analyzer*: analyzer, Model TD 2040EGA 200 P, with an ability to measure potentially harmful emissions from petrol engines. Along with measuring the exhaust gases it also measures the engine speed (RPM) and can be used to replace a precision tachometer. Main features include: measurement of carbon monoxide (CO) in %; measurement of hydrocarbons (HC) in PPM; engine speed in RPM; easy to read bright red 1" LED display with an option to read either CO and HC or CO and RPM; diagnostic printer with customized printouts available as an option; due to this combined facility, the meter is ideal for checking and setting simultaneously air - fuel mixture ratio at different engine speeds. TD 2040/EGA 200 P meets all requirements specified by the Central MV Act, and is suitable for use at service stations and automobile workshops for pollution check on two stroke/four stroke petrol engines (Blizard and Keck, 1974).

2. *Engine Tachometer (PET-1000)*: The PET-1000 pulse tachometer can measure rpm of engine by bringing it close to plug cord of the engine. This is only 13 mm thick and can be put in pocket. The model PET-1000 is designed for engine models 2 stroke (1 and 2 cylinder), 4 stroke (1, 2 & 4 cylinder). An antenna lead is supplied to use if needed (Blizard and Keck, 1974).

3. *BAJAJ 100 cc 4 Stroke petrol* engine: Engine 4 Stroke, Single Cylinder, Air Cooled Cubic Capacity 99.35cc Max. Power 7.02 BHP @ 8500rpm.

RESULTS AND DISCUSSION
Results
Device tested on BAJAJ BOXER 4 stroke, 1 HP engine. The test conducted by Pollution Testing meter & RPM testing meter with & without the device where measure on inlet side of internal combustion engine and results tabulated as below.
Test Conducted On Exhaust side for Hydrocarbon and carbon Monoxide on Enfield (350 c.c) with and without valve At 120 rpm the % of Co reduction with valve is 8.3% while that at 2000 rpm is 19% Also Hc % reduction at 120 rpm is 28% while at 2000 rpm it is 82 % As now days two & four wheeler market is growing rapidly air pollution has become the major issue.

RPM of engine without device

RPM	CO%	HC(PPM)
1000	0.6	3550
2000	0.6	3410
3000	0.6	3430
5000	0.7	3220

RPM of engine with device

RPM	CO%	HC(PPM)
1000	0.0	60
2000	0.1	80
3000	0.1	160
5000	0.1	10

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As per present technology everyone knows that the air pollution due to vehicle is because of the emission from silencer, but due to this concept it is proved that the bounce back gases from carburetor side is also contributing in polluting the air.
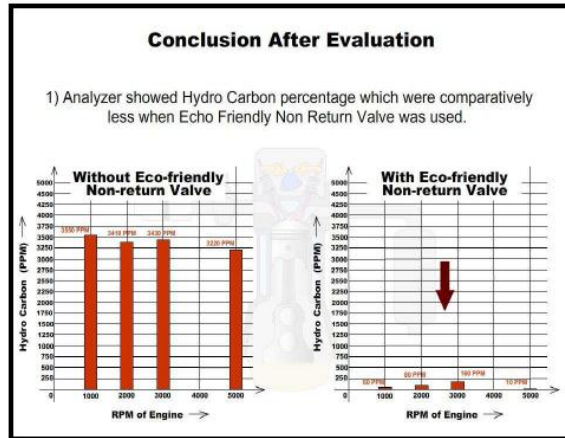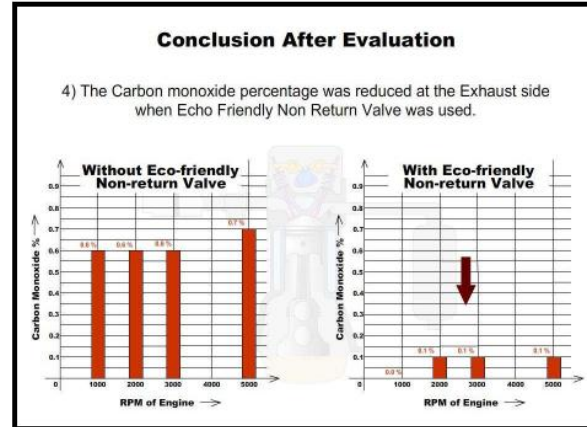

Figure 1

Figure 2

Conclusion

1. Analyzer showed Hydro Carbon percentage which was comparatively less when Echo Friendly Non Return Valve was used (figure 1).

2. Fuel Combustion was good hence there was increase in efficiency of engine.

3. It is seen that the concept of Ram effect develops bounce back losses which are removed by Echo Friendly Non Return Valve

4. The Carbon monoxide % was reduced at the exhaust side when Echo Friendly Non Return Valve was used (figure 2).

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