Implementation of Supercharging on SI Engine using Naturally Rammed Air

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Abstract— Supercharger is a device introduced in two wheelers. The leading problem seen in the bikes nowadays is less mileage and high exhaust emissions. This problem can be overcome by the implementation of Supercharger in bikes. The main problem of the carburetor is it supplies more fuel at high speed, which is not at all required. The next problem is that the carburetor contains a venture, which is provided to increase the velocity of the air-fuel mixture, but this ultimately leads to decrease the pressure of the mixture and moreover also decreases the density of the air-fuel mixture. Because of the reduction in the density, the fuel in the combustion chamber does not burn properly and leads to reduce the mileage of the vehicle and also in addition increases the emission to great extent. These two disadvantages lead to reduce the efficiency and increase the emissions. This project aims to solve the inherent drawbacks of simple carburetor by increasing the amount of air supplied to the A/F mixture. We concluded that using supercharging along with biofuel has increased the efficiency of vehicle with reduction in emission.

Key words: Carburetor, Naturally Rammed Air, Supercharging, SI Engine

I. INTRODUCTION

One of the reasons for high exhaust emission and poor mileage in the vehicles is insufficient air in the mixture. Mostly simple carburetors are used in two wheelers where in a rich mixture is attained during high throttle opening. This problem is effectively solved in four wheeler by sophisticated techniques. However, these devices cannot be implemented in the two wheelers because of the space available and also because it is uneconomical. Two wheeler consists of a carburetor for the proper mixture of Air and fuel which is required by the engine to generate the power. The problem of low density of charge entering into the engine can be solved by supplying pressurized air to the flowing charge. This can be done by providing an air vent to the carburetor. According to the requirement and space availability a hole is drilled in the carburetor. The flow of pressurized air in the carburetor is supplied via U-tube

II. RESEARCH ELABORATION

The primary objectives of a carburetor are-

1) To achieve proper combustion of A/F mixture in the combustion chamber.
2) To increase the mileage of the vehicle.
3) To reduce emission of vehicle.
4) To reduce the harmful emissions from the exhaust of a S.I engine.
5) To provide an environment friendly fuel.

A. Objectives of Supercharging:

The objectives of supercharging are as follows:

1) To increase the power output for a given weight and bulk of the engine, which is important for the aircraft and marine engines where weight and space is of importance.
2) As the altitude increases, the density of air decreases and normal I.C. engine when operated at high altitude gives less power output due to decrease in density of intake air. Therefore to compensate the loss of power due to altitude of aircraft supercharging is done. There is 1% loss of power per 100m of altitude.
3) To generate the more power from existing engine.

B. Effects of Supercharging:

The effects of supercharging are as follows:

1) A supercharged engine has air supplied to it at a pressure and density higher than the atmosphere. This increases the volumetric efficiency.
2) The mechanical efficiency of supercharged engine is more than that of naturally aspired engine when both are running at the same speed.
3) The specific fuel consumption of a supercharged engine is less due to proper combustion achieved by better turbulence. For supercharged engine, chances of detonation increases due to higher pressure

III. RESULTS

The experiment was carried out on a 4-stroke single cylinder stationary engine and different parameters were measured by varying the input parameters. Following are the result tables of it-

A. Without Supercharging

Input Parameters				Measure Parameters					Output Parameters					
Expt. No	Fuel	Load	Speed (rpm)	H1 (mm)	H2 (mm)	V (Volt.)	I (amp)	Time For 5cc (sec)	Ma (kg/ hr.)	BP (K W)	TFC (kg/ hr.)	SFC (Kg/ kw hr.)	A/F RATIO	Break Thermal Eff.(%)
01.	Petrol	Low	Low	90	96	167	1.28	47.20	4.82	0.305	0.305	1	15.5: 1	8.78
02.	Petrol	High	Low	90	96	206	2.94	44.2	4.82	0.86	0.33	0.37	14.6: 1	22.88
03.	Petrol	Low	High	70	116	308	2.17	12.2	13.36	0.95	1.18	1.24	10.9: 1	7.06
04.	Petrol	High	High	70	116	270	4.01	15.6	13.36	1.54	0.92	0.59	14.06: 1	14.69
05.	Biofuel (90+10)	Low	Low	91	97	167	1.28	42.5	4.82	0.305	0.35	1.15	13.3: 1	8.14
06.	Biofuel (90+10)	High	Low	91	97	207	2.94	42.82	4.82	0.86	0.35	0.40	13.7: 1	22.97
07.	Biofuel (90+10)	Low	High	65	122	292	2.11	16.2	14.88	0.88	0.94	1.04	15.8: 1	8.75
08.	Biofuel (90+10)	High	High	73	116	268	3.98	17.2	12.92	1.52	0.87	0.55	14.68: 1	16.33
09.	Biofuel (80+20)	Low	Low	90	100	166	1.28	40.2	6.23	0.305	0.38	1.24	16.3: 1	7.60
10.	Biofuel (80+20)	High	Low	90	100	206	2.94	40.5	6.23	0.86	0.38	0.44	16.3: 1	21.44
11.	Biofuel (80+20)	Low	High	60	130	313	2.26	14.22	16.4	1.01	1.08	1.06	15.2: 1	8.85
12	Biofuel (80+20)	High	High	60	130	273	4.08	14.49	16.49	1.59	1.05	0.66	15.5: 1	14.34

Table 1: Without Supercharging

B. With Supercharging

Input Parameters			Measure Parameters							Output Parameters				
Expt. No	Fuel	Load	Speed (rpm)	H1 (mm)	H2 (mm)	V (Volt.)	I (amp)	Time for 5cc (sec)	Ma (kg/hr.)	BP (KW)	TFC (kg/hr.)	SFC (Kg/ Kw hr.)	A/F Ratio	Break thermal Eff. (%)
01.	Petrol	Low	Low	86	97	166	1.28	40.29	6.53	0.303	0.35	1.15	17.6 :1	7.60
02.	Petrol	High	Low	86	97	206	2.94	39.96	6.53	0.86	0.36	0.41	17.6 :1	20.97
03.	Petrol	Low	High	75	109	255	1.87	18.89	11.49	0.68	0.76	1.11	14.5 :1	7.85
04.	Petrol	High	High	76	109	247	3.64	19.77	11.49	1.28	0.72	0.56	15.3 :1	15.60
05.	Biofuel (90+10)	Low	Low	90	100	167	1.28	37.53	6.23	0.305	0.38	1.25	15.5 :1	7.50
06.	Biofuel (90+10)	High	Low	90	100	253	3.69	38.92	6.23	1.33	0.39	0.29	15.9 :1	31.88
07.	Biofuel (90+10)	Low	High	64	125	283	2.01	15.84	15.39	0.81	0.94	1.16	16.03: 1	8.05
08.	Biofuel (90+10)	High	High	64	125	263	3.91	16.80	15.39	1.47	0.89	0.60	16.9:1	15.4
09.	Biofuel (80+20)	Low	Low	90	100	167	1.28	38.56	6.23	0.305	0.40	1.30	15.5:1	7.22

10.	Biofuel (80+20)	High	Low	90	100	253	3.71	42.21	6.23	1.34	0.36	0.27	17.3:1	35.26
11.	Biofuel (80+20)	Low	High	62	125	295	2.10	14.44	15.64	0.88	1.05	1.20	14.6:1	7.93
12	Biofuel (80+20)	High	High	62	125	267	3.91	14.20	15.64	1.49	1.07	0.72	14.3:1	13.19

Table 2: With Supercharging

C. Exhaust Readings

1) Without Supercharging

Fuel	CO (%)	HC (ppm)	$C0_2$ (%)	O2 (%)	NOX (ppm)
Petrol	0.23	245	6.1	-0.1	46
Biofuel (90+10)	0.14	370	5.7	-0.1	66
Biofuel (80+20)	0.14	260	6.6	-0.1	54

Table 3: Without Supercharging

2) With Supercharging

Fuel	CO(%)	HC(ppm)	$C0_2$(%)	O_2(%)	NO_X(ppm)
Petrol	0.15	374	6	-0.1	79
Biofuel(90+10)	0.08	171	2.6	-0.1	26
Biofuel(80+20)	0.10	346	3.9	-0.1	41

Table 4: With Supercharging

IV. CONCLUSION

Due to increase of amount of air entering into system proper compression will occur

When proper combustion occurs amount of emission reduces.

Addition of bio-fuels provides a platform for alternative fuels which able to meet requirement of gasoline or conventional fuels.

Use of biofuel which are traditionally prepared can be use into internal combustion engine because of having similar properties as gasoline.

By providing such supercharger system to IC engine we can able to get proper amount of air-fuel mixture ration by providing extra amount of air into carburettor

As there is proper combustion in IC engine there's reduced amount of pollutants exhausted through manifold

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