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Design and Analysis of Compressible fluid Engine

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***Abstract*— In present day the awareness among the people has been increased to reduce the use of the nonrenewable energy resource and emission control system. In this paper we design and analysis the compressible fluid, engine which runs based on the compressed pneumatic air stored in the storage tank. The compressible fluid air engine system consists of compressed air stored in the tank act as the fuel for the engine. The energy is given in the form of the compressed air for running the engine. During normal engine the exhaust air has emission or toxic gases like Knox, CO etc. By using the compressible fluid engine the emission is zero. Due to the use of atmospheric air in the inlet and exhaust gases. Thought some of the renewable energy resources like solar, biofuel, which are in the developing stages we focused on the compression based technology. Since the equipment which are used for the construction of the compressible fluid engine is easily available in the market and fabrication is quickly done.**

***Keywords*— Compressible fluid, engine, storage tank.**

I. INTRODUCTION

Declining resource of the fuel in the ground tends to search for new fuel and new design of the internal combustion engine. Nowadays the compressible fluid, engine research is done more in number. So we have decided to design and alter the existing model of the engine which is running on petrol. The four stroke engine which is running from the fossil fuel is taken to the examination and then the alternation is done in the new designed compressible fluid engine which is run by the compressible fluid. The fossil fuel consumption and then the emission of the unburnt fuel gases are getting reduced in this model. So the pollution and then natural, nonrenewable resource is kept for the further generation. After the construction of the pneumatic engine the test for the engine performance, power and mechanical efficiency, mean effective pressure are get calculated. First the design of the engine is done and then the basic analysis of the compressible fluid engine is made.

I. ENGINE DESIGN OF EXISTING INTERNAL COMBUSTION

The existing internal combustion engine is classified into two types based on the strokes. . In the two stroke engine the cycle will completed in two stroke of the piston or one revolution of the crankshaft. This one power stroke is obtained in each revolution of the crankshaft. In the four stroke engine is completed in four stroke of the piston or two revolutions of the crankshaft. This one power stroke is obtained in two revolutions of the crankshaft. Here we consider the design of the engine which is working under the four stroke process. The four stroke engine is valve operated and then the efficiency of four stroke engine is more when compared with the two stroke engine.

A. Suction stroke

Suction stroke is the initial stroke in the four stroke petrol engine. Here the piston is moved from the top dead center to bottom dead center. While moving the pressure inside the cylinder is getting reduced and become lower than the atmospheric pressure at this time the inlet valve gets opened and then the air fuel mixture is passed into the cylinder until the pressure in the cylinder and the atmosphere became same.

B. Compression stroke

In this compression stroke the piston is moving from the bottom dead center to the top dead center. During this process the air fuel mixture in the cylinder is get compressed and then pressure inside the cylinder get increased and this is placed near to spark plug. During this process both inlet and outlet of the engine is closed.

C. Expansion stroke

At the end of the compression stroke the air fuel mixture is ignited by the spark plug which is placed inside the cylinder. The burnt gases produced which drive the piston from top dead center to bottom dead center. The flywheel which is attached with engine shaft store energy during this stroke and supplies it during other stroke. Both valves are remaining closed during the operation of this stroke.

D. Exhaust stroke

After the expansion process the gases become useless, so the gases are collected and then made escaped through the exhaust valve to the atmosphere. Here the piston is moving from the bottom dead to top dead center and the exhaust gas are driven out of engine cylinders.

II. NEW ENGINE DESIGN OF AIR AS FUEL

In this compressible fluid engine the compressed air is stored in the storage tank which is acting as the fuel. The compressed air, which is stored in the tank is passed to the inlet port of the compressible fluid engine. When the inlet valve gets open stored air is passed into the cylinder where the stored energy is converted into mechanical energy. Then the pressure of the compressible fluid is getting reduced and passed out to atmosphere. This process is like steam engine working instead of steam compressible fluid that is air is used.

A. Expansion stroke:

In expansion stroke compressed air, which is stored in storage tank passes into the cylinder by opening the inlet valve. When the compressed air is entering into a cylinder the piston move from the top dead center to bottom dead center. The air entering with high pressure moves the piston in a downward direction and then the area of the cylinder is getting increased due to increase in area pressure drop takes place this helps the piston to move up in the exhaust stroke. By this movement the pressure energy is converted into mechanical energy. In this process the exhaust valve remains closed.

B. Exhaust stroke:

During this stroke the piston is moved from the bottom dead center to top dead center. This stroke starts when the piston starts moving from the bottom dead center. When the exhaust valve gets open the air in the cylinder is expelled to the atmosphere and the cycle gets continuous. The exhaust valve closes when the piston reached top dead center. At the end of the exhaust stroke some air will be trapped inside the clearance volume.

III. FABRICATION OF COMPRESSIBLE FLUID ENGINE:

The fabrication of the compressible fluid engine consists of designing the camshaft and valve timing. In normal four stroke petrol engine the camshaft consists of two cam which is used to control the inlet valve and outlet valve. The timing of the valve opening and closing are based on the stroke length and then the cylinder diameter. The timing valve and the cam shaft depend upon the fuel used for running the engine. For the compressible fluid engine the fuel used to run the engine is compressed air. So the camshaft and then timing valve should change when the ordinary camshaft is used, then the opening and closing of the valve get changed and the operation of the compressible fluid engine gets affected.

A. Camshaft of petrol engine:

The camshaft of petrol engine consist of two cam one is used for inlet valve control and another is used for outlet valve control. The cam which is used in normal four stroke petrol engine consist of rise, dwell 1, fall, dwell 2. In the inlet cam first rise is used to open the inlet valve and send the air fuel mixture into the cylinder. Dwell is used to hold the inlet valve as in position. Fall is used to close the inlet valve and stop the fuel entering into the cylinder. The second dwell is used to hold the inlet valve as in position. In the outlet cam the first rise is used to open the outlet valve and send the exhaust gas into the atmosphere. Dwell is used to hold the outlet valve as in position. Fall is used to close the outlet valve and stop the exhaust entering into the atmosphere. The second dwell is used to hold the outlet valve as in position.

B. Camshaft of compressible fluid engine:

The camshaft of petrol engine consist of two cam one is used for inlet valve control and another is used for outlet valve control. The cam which is used in compressible fluid engine consist of rise, fall. On the inlet cam rise is used to open the inlet valve of the compressible fluid engine and send the compressed air into the engine cylinder. when inlet cam fall it is used to close the inlet valve of the compressible fluid engine. On the outlet cam rise is used to open the outlet valve of the compressible fluid engine and send the expanded air into the atmosphere. At the outlet cam fall is used to close the outlet valve of the compressible fluid engine.

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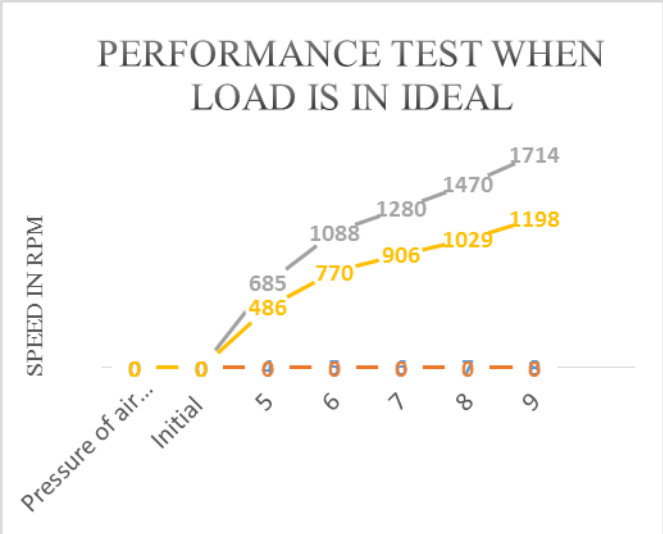
V. ANALYSIS OF COMPRESSIBLE FLUID ENGINE

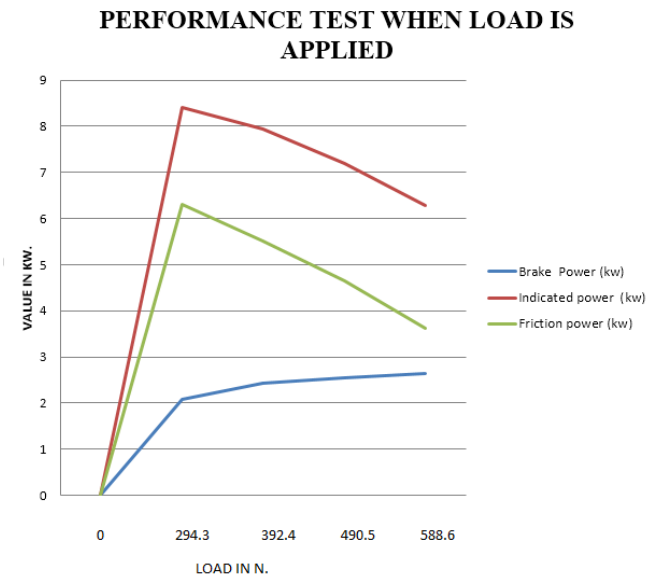
The Analysis of compressible fluid engine is done by doing the test on the compressible fluid engine which is fabricated by us. Analysis of the compressible fluid engine is done in two ways, they are one by changing the compressible fluid pressure and other by applying different load on constant pressure.

PERFORMANCE TEST ON COMPRESSIBLE FLUID ENGINE IN IDEAL LOAD:

S.No	Pressure of air stored in tank (bar)		Time (sec)	Engine speed (rpm)	Wheel speed (rpm)
	Initial	Finial			
1.	5	4	38	685	486
2.	6	5	35	1088	770
3.	7	6	33	1280	906
4.	8	7	32	1470	1029
5.	9	8	29	1714	1198



PERFORMANCE TEST WHEN LOAD APPLIED:



VI. CONCLUSION

The analysis of the compressible fluid in the engine is done and then the performance test and then efficiency is calculated. The construction of the compressible fluid engine can be done. The storage of the atmospheric air can be easily done using a compressor. By using this type of engine the fuel cost is reduced. Then maintenance of the engine are also less when compare to other type of engine.

REFERENCES

[1] Er. R.K. Rajput, "Air Compressors," in Thermal Engineering (SI units), ixth ed. India.

[2] S.Domkundwar, Dr C.P. Kothandaraman, A.V. Domkundwar, "Testing of IC engine, performance characteristic of IC engine" in A course in Thermal Engineering (with introduction nuclear & solar energy) (SIunits), V th ed. India.

[3] Yan Shi, Maolin Cai " Dimensionless Study on Output Flow Characteristics of Expansion Energy Used Pneumatic Pressure Booster", Journal of Dynamic System Measurement,and Control,vol.no.135,pp.021007-1-021007-8, March 2013.

[4] Wojciech SZOKA, Dariusz SZPICA "Adaptation of classic combustion engine to compressed air supply",acta mechanica automatic, vol 6no.1pp.68-73, 2012.

[5] Rahul Kumar, Anand M G "Simulation and construction of Single-stage reciprocating pneumatic transmission system Engine" International Journal of Science and Research Publicatio,vol.no.2,pp.1-6,Issue 7,July 2012.

[6] Franco Antony, P J Albert, Rimin P R, Rino Disney, Sooraj, Sreevalsan S Menon " Design and Development of Pneumatic Hybrid Vehicle (PHV)" , International Journal of Innovative Research in Science, Engineering and Technology, ISSN:2319-8753, vol.3,pp.13184-13191, Issue 6, June 2014.

[7] J P Yadav, Bharat Raj Singh, "Study and Fabrication of Compressed Air Engine" ,S-JPSET:ISSN 2229-7111,vol.no.2,issue1,2011.

[8] Dr. Maglub Al Nur, S.K.M.Asikul Islam , Debashish Saha and AashiqueAlam Rezwan "Modification of an Si Engine into a Compressed Air Engine to Work with Compressed Air or Gas", 6th International Mechanical Engineering Conference & 14th Annual Paper Meet (6IMEC&14APM), 28-29 September 2012.

[9] Prof. Kalpesh Chavda, Patel Manish D, Suthar Umang P, Patel Krunal V, "Study and Development of Compressed Air Engine-Single Cylinder: A Review Study", IJSRD - International Journal for Scientific Research & Development , ISSN: 2321-0613,Vol. 2, Issue 05, 2014.

[10] Chien-Jong Shih1, Chi-Nan Yeh and Ting-Hao Chang, "Experimental Optimization and Analysis of Intake and Exhaust Pipeline for Small Engine Motorcycle", Journal of Applied Science and Engineering, Vol. 15, No. 1, pp. 21-30, 2012.

[11] Mistry Manish K, Dr.Pravin P.Ratho2,Prof. Sorathiya Arvind S, "Study And Development Of Compressed Air Engine single Cylinder: A Review Study", International Journal of Advanced Engineering Technology, E-ISSN0976-3954, vol.no.3, Issue 1, 2012.

[12] Saurabh Pathak, Kontham Swetha, V.Sreedhar, V.S.V Prabhakar, "Compressed Air Vehicle: A Review", 4th IRF International Conference, ISBN: 978-93-82702-64-1 9th March-2014.