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A PATH FOR HORIZING YOUR INNOVATIVE WORK

VELOZETA SIX STROKE ENGINE

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Abstract: The quest for an engine which having the same or more power with higher fuel efficiency than the existing ones has started before many years. As a result of all these researches a new engine concept is formed, which is a six stroke engine. Lot of research works are conducting on this topic nowadays and already six types of six stroke engines were discovered yet. Of these the recent developed three six stroke engines, i.e., Bearer head, Bruce crowers and Velozeta's are undergoing tremendous research works. During every cycle in a typical four stroke engine, piston moves up and down twice in the chamber, resulting in four total strokes and one of which is the power stroke that provides the torque to move the vehicle. But in a six stroke engine there are six strokes and out of these there are two power strokes. The automotive industry may soon be revolutionized by a new six-stroke design which adds a second power stroke, resulting in much more efficiency with less amount of pollution.

Keywords: Six stoke engine, Velozeta, power stroke and Otto or Diesel cycle.

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INTRODUCTION

The term six stroke engine describes two different approaches in the internal combustion engine, developed since the 1990s, to improve its efficiency and reduce emissions.

In the first approach, the engine captures the waste heat from the four stroke Otto cycle or Diesel cycle and uses it to get an additional power and exhaust stroke of the piston in the same cylinder. Designs either use steam or air as the working fluid for the additional power stroke. As well as extracting power, the additional stroke cools the engine and removes the need for a cooling system making the engine lighter and giving 40% increased efficiency over the normal Otto or Diesel Cycle. The pistons in this six stroke engine go up and down six times for each injection of fuel. These six stroke engines have 2 power strokes: one by fuel, one by steam or air. The currently notable six stroke engine designs in this class are the Crower's six stroke engine, invented by Bruce Crower of the U.S.A; the Bajulaz engine by the Bajulaz S A company, of Switzerland; and the Velozeta's Six-stroke engine built by the College of Engineering, at Trivandrum in India.

The second approach to the six stroke engine uses a second opposed piston in each cylinder which moves at half the cyclical rate of the main piston, thus giving six piston movements per cycle. Functionally, the second piston replaces the valve mechanism of a conventional engine and also it increases the compression ratio. The currently notable six stroke engine designs in this class include two designs developed independently: the Beare Head engine, invented by Australian farmer Malcolm Beare, and the German Charge pump, invented by Helmut Kottmann.

TYPES OF SIX STROKE ENGINE

A. Single piston designs

These designs use a single piston per cylinder, like a conventional two- or four-stroke engine. A secondary, non detonating fluid is injected into the chamber, and the leftover heat from combustion causes it to expand for a second power stroke followed by a second exhaust stroke.

A.1 Griffin six-stroke engine

Heated exhaust-jacketed external vaporizer, into which fuel was sprayed, was the main principle of working of griffin six stroke engines. The temperature was held around 550 °F, sufficient to vaporize the oil but not to break it down chemically. This fractional distillation

supported the use of heavy oil fuels, the unusable tars and asphalts separating out in the vaporizer.

A.2 Bajulaz six-stroke engine

The Bajulaz six-stroke engine is similar to a regular combustion engine in design. There are, however, modifications to the cylinder head, with two supplementary fixed capacity chambers: a combustion chamber and an air preheating chamber above each cylinder. The combustion chamber receives a charge of heated air from the cylinder; the injection of fuel begins an isochoric (constant-volume) burn which increases the thermal efficiency compared to a burn in the cylinder.

A.3 Velozeta six-stroke engine

In a Velozeta engine, fresh air is injected into the cylinder during the exhaust stroke, which expands by heat and therefore forces the piston down for an additional stroke. The valve overlaps have been removed and the two additional strokes using air injection provide for better gas scavenging.

A.4 NIYKADO Six Stroke Engine

This is the only engine that is categorized as a fully working prototype. The first prototype was developed in 2004, which used only two valves. The second prototype, developed in 2007, was an improved design using four valves.

A.5 Crower six-stroke engine

In a six-stroke engine prototyped in the United States by Bruce Crower, water is injected into the cylinder after the exhaust stroke and is instantly turned to steam, which expands and forces the piston down for an additional power stroke. Thus, waste heat that requires an air or water cooling system to discharge in most engines is captured and put to use driving the piston.

B. Opposed piston designs

These designs use two pistons per cylinder operating at different rates, with detonation occurring between the pistons.

B.1 Beare Head

The term "Six Stroke" was coined by the inventor of the Beare Head, Malcolm Beare. The technology combines a four stroke engine bottom end with an opposed piston in the cylinder

head working at half the cyclical rate of the bottom piston. Functionally, the second piston replaces the valve mechanism of a conventional engine.

B.2 M4+2

The M4+2 engines have much in common with the Beare Head engines, combining two opposed pistons in the same cylinder. One piston works at half the cyclical rate of the other, but while the main function of the second piston in a Beare Head engine is to replace the valve mechanism of a conventional four stroke engine, the M4+2 takes the principle one step further.

B.3 Piston charger engine

In this engine, similar in design to the Beare head, a "piston charger" replaces the valve system. Piston charger perform the work of charging the main cylinder and simultaneously it control the inlet and outlet opening which leads to no loss of air and fuel in the exhaust. In the main cylinder, combustion takes place every turn as in a two stroke engine and lubrication as in a four-stroke engine.

Fuel injection can take place in the piston charger, in the gas transfer channel or in the combustion chamber.

VELOZETA SIX STROKE ENGINE:-

Mechanical Engineering students of the college of Engineering in Trivandrum made this six stroke engine as a part of their B.Tech project. After the completion of the course they formed the company Velozeta with the help of state and central government. They have got the patent of this engine also.

In Velozeta's six stroke engine, a four-stroke Honda engine was experimentally altered to build the six stroke engine. The first four strokes of this engine are just like a conventional four stroke engine. The additional two strokes are for better scavenging and cooling of the engine which is provided by a secondary air induction system.

Figure1:-Velozeta six stroke engine

The engine shows 40% reduction in fuel consumption and dramatic reduction in pollution. Its specific power is not less than that of a four stroke petrol engine. The engine can run on almost any fuel, petrol and diesel to LPG. An altered engine shows a 65% reduction in CO pollution when compared with the four stroke engine that was used to develop the Six Stroke engine.

Engine parts modified:-

1) Camshaft / Crankshaft Sprockets

In the six stroke engine the crankshaft has 1080 degrees of rotation for 360 degree rotation of the camshaft per cycle. Hence their corresponding sprockets are having teeth in the ratio 3:1.In the original four stroke engine the teeth of the sprockets of the crankshaft and the Camshaft was in 2:1 ratio. The 34 teeth sprocket of the four stroke engine camshaft was replaced by a 42 teeth sprocket in the six stroke engine. The camshaft sprockets were also replaced from 17 teeth to 14 teeth to convert the four stroke engine into six stroke engine.

2) Cam lobes

In the six stroke engine the 360 degrees of the cam has been divided into 60 degrees among the six strokes. The valve provided at the exhaust has to be kept open during the fourth, fifth and the sixth stroke. The cam has been made double lobed in order to avoid the hitting of the exhaust valve with the piston head. The profiles of the exhaust and the inlet cams have been shown in the figure2.

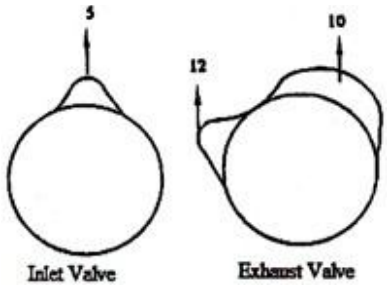

Figure2:- Cam Lobes

3) Valve Timing

The valve timing of the four stroke Honda engine has been changed. The inlet valve opening (IVO) is 0° at TDC, same as that of the four stroke Honda activa engine. Inlet valve closes (IVC) at 25° after BDC, same as that of the four stroke engine. Exhaust valve opens (EVO) 0° at BDC, which in the original engine was 25° before BDC. Velozeta reduced this 25° advanced opening of exhaust valve to extract maximum work per cycle. Exhaust valve closes 10 degree before TDC in order to prevent the loss of air fuel mixture through the exhaust valve.

4) Secondary Air Induction System

The secondary air induction system, supplies the air which is used during the fifth and sixth stroke. During the fifth stroke air from the air inlet valve is sucked into the cylinder through the secondary air induction line. During the sixth stroke, the air is removed through the air exhaust valve. The inlet valve and exhaust valve remains closed during these strokes.

WORKING OF VELOZETA SIX STROKE ENGINE:-

Different working strokes of a six stroke engine are:

1st stroke (suction stroke)

During the first stroke the inlet valve opens and air-fuel mixture from carburetor is sucked into the cylinder through the inlet valve and piston moves from TDC to BDC.

2nd stroke (compression stroke)

During the second stroke, piston moves from BDC to TDC, both the inlet valve and exhaust valve are closed and the air-fuel mixture is compressed. The compression ratio of the modified engine is same as that of the original four stroke Honda engine.

3rd stroke (1st power stroke)

During the third stroke, power is obtained from the engine by igniting the compressed air- fuel mixture using a spark plug. Both valves remain closed. Piston moves from TDC to BDC.

4th stroke (exhaust stroke)

During the fourth stroke, the exhaust valve opens to remove the burned gases from the engine cylinder. Piston moves from BDC to TDC.

5th stroke (2nd power stroke)

During the fifth stroke, the exhaust valve remains close and the air inlet valve open. Fresh air from the air inlet valve enters the cylinder through the secondary air induction system. Piston moves from TDC to BDC.

6th stroke (2nd exhaust stroke)

During the sixth stroke, the air exhaust valve remains open. The air sucked into the cylinder during the fifth stroke is removed to the atmosphere through the air exhaust valve. Piston moves from BDC to TDC and six stroke cycle is completed.

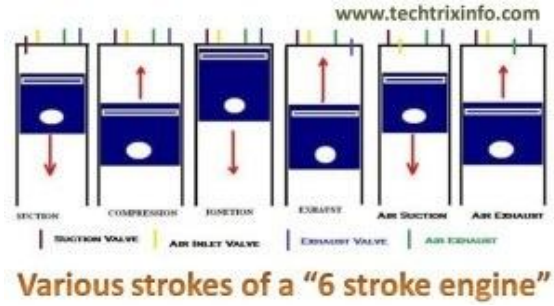

Figure3:- Working of Velozeta engine

Advantages of the Engine:

1. Reduction in fuel consumption.

2. Dramatic reduction in pollution normally up to 65%.

3. Better scavenging and more extraction of work per cycle.

4. Lower engine temperature - so, easy to maintain the optimum engine temperature level for better performance.

5. Less friction – so, less wear and tear .

6. The six-stroke engine does not require any basic modification to the existing engines. All technological experience and production methods remain unaltered.

7. Higher overall efficiency.

CONCLUSION:-

The six stroke engine modification promises dramatic reduction of pollution and fuel consumption of an internal combustion engine. The fuel efficiency of the engine can be increased and also the valve timing can be effectively arranged to extract more work per cycle. Better scavenging is possible as air intake occurs during the fifth stroke and the exhaust during the sixth stroke. Due to more air intake, the cooling system is improved. It enables lower engine temperature and therefore increases in the overall efficiency. This is a priority for the six-stroke engine. Reducing fuel on performance will reassessed the concept of automobile. An only improvement of the internal combustion engine is the ultimate solution, no wonder. Its adoption by the automobile industry would have a tremendous impact on the environment and world economy, assuming up to 40% reduction in the fuel consumption and 60% to 90% in polluting emissions, depending on the type of fuel being used

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