International Journal of Engineering Research And Management (IJERM)
ISSN : 2349- 2058, Volume-02, Issue-03, March 2015

A REVIEW ON 4 STROKE ENGINE

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Abstract— **Today, internal combustion engines in cars, trucks, motorcycles, aircraft, construction machinery and many others, most commonly use a four-stroke cycle. The four strokes refer to intake, compression, combustion (power), and exhaust strokes that occur during two crankshaft rotations per working cycle of the gasoline engine and diesel engine. The cycle begins at Top Dead Center (TDC), when the piston is farthest away from the axis of the crankshaft. A stroke refers to the full travel of the piston from [1] Top Dead Center (TDC) to Bottom Dead Center (BDC). (See Dead centre.)**

1. INTAKE stroke: On the intake or induction stroke of the piston , the piston descends from the top of the cylinder to the bottom of the cylinder, reducing the pressure inside the cylinder. A mixture of fuel and air is forced by atmospheric (or greater) pressure into the cylinder through the intake port. The intakevalve(s) then close.

2. COMPRESSION stroke: With both intake and exhaust valves closed, the piston returns to the top of the cylinder compressing the fuel-air mixture. This is known as the compression stroke.

3. POWER stroke.: While the piston is close to Top Dead Center, the compressed air–fuel mixture is ignited, usually by a spark plug (for a gasoline or Otto cycle engine) or by the heat and pressure of compression (for a diesel cycle or compression ignition engine). The resulting massive pressure from thecombustion of the compressed fuel-air mixture drives the piston back down toward bottom dead center with tremendous force. This is known as the powerstroke, which is the main source of the engine's torque and power.

4. EXHAUST stroke.: During the exhaust stroke, the piston once again returns to top dead center while the exhaust valve is open. This action evacuates the products of combustion from the cylinder by pushing the spent fuel-air mixture through the exhaust valve(s).

I. INTRODUCTION

Perhaps the most well known engine type in the world, the automotive four-stroke engine has become the power plant of choice for today's consumers due to its greater efficiency and cost effectiveness over alternate reciprocating engines. The story of the internal combustion engine began in 1680 with a Dutch physicist, Christian Huygens, who conceptually designed an engine fueled by gun powder. However, the first internal combustion engine was actually built by a Sweetish inventor by the name of Francios Isaac de Rivaz in 1807. Through the combustion of a hydrogen and oxygen mixture, his engine, with some difficulty, powered a crudely constructed automobile. As the years went on, other inventors modified the design to be fueled by anything from gasoline to coal. The next greatest leap came in 1862 when a French engineer, Alphonse Beau de Rochas, designed and patented the first four-stroke engine. In 1864 an Austrian engineer, Siegfried Marcus, build the first gasoline powered vehicle, which was comprised of a cart and a one cylinder engine. But the biggest break through came in 1876 when Nikolaus August Otto invented the first successful four-stroke engine, aptly nick-naming 13 the four-stroke cycle the "Otto Cycle."

Manuscript received March 21, 2015

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II. MULTI-MODE 2-STROKE/4-STROKE INTERNAL COMBUSTION ENGINE

In a multi-mode, 2-stroke/4-stroke internal combustion engine operation, by switching the engine stroke from 4-stroke operation to 2-stroke operation so that the combustion frequency is doubled, doubling of the engine power is achieved even at the same work output per cycle. In order to meet the demand of extremely high power, the engine operates in 4-stroke boosted SI operation transitioned from 2-stroke HCCI operation at pre-set level of power and crank speed requirements. [2] By combining the multi-stroke (2-stroke HCCI and 4-strokeHCCI) and multi-mode operation (2-stroke HCCI and 4-stroke boosted SI operation), full load range and overall high efficiency with minimal NOx emission are achieved.

III. LUBRICATING SYSTEM FOR FOUR-STROKE-CYCLE ENGINE

Disclosed is a lubricating system for lubricating moving parts in a crank case of a four-stroke-cycle engine. The lubricating system comprises an oil tank for holding oil, an oil passage connected to the oil tank and an engine crank chamber, an oil supply means for supplying fine particles of oil held in the oil tank to the moving parts in the crank chamber via the oil passage, and an oil removing means for removing the fine particles of oil applied to the moving parts in the crank chamber, from the crank chamber without forming oil accumulation. To supply the fine particles of oil to the moving parts in the crank chamber, the oil of a liquid form is thrown to impinge against the moving parts in the crank chamber or is mixed with a gas entering the crank chamber. To remove the oil from the crank chamber without forming oil accumulation, the oil supplied to the moving parts is led up into the combustion chamber through the piston, or is returned into the oil tank with a pressure produced by reciprocation of the piston. The oil led into the crank chamber is in a form of fine particles, and therefore can easily be removed from the crank chamber without forming any oil accumulation.

IV. APPARATUS TO CONVERT A FOUR-STROKE INTERNAL COMBUSTION ENGINE TO A TWO-STROKE PNEUMATICALLY POWERED ENGINE

An apparatus to convert a four-stroke internal combustion engine to a [5] two-stroke pneumatically powered engine. An air compressor is driven using the rotation of the crankshaft and compressed air is delivered through a supply line to at least one holding tank. A supply line delivers compressed air from the tank through a regulator, which controls the pressure and volume, to the pneumatic distributor. A plurality of high pressure hoses finally communicates the compressed air to the cylinders of the engine via the spark plug orifices. The pneumatic distributor has a rotor which opens gate valves to supply compressed air to the cylinders wherein the pistons are at top dead center, making every downstroke a power stroke. The modified dual-lobed camshaft operates the exhaust valves so that every upstroke of a piston is an exhaust stroke and exhaust freely escapes through the exhaust manifold.

V. FOUR STROKE ENGINE WITH COOLING SYSTEM

A four stroke internal combustion engine having cooling system for cooling the engine is disclosed. The cooling system includes a closed loop cooling system for cooling at least a portion of the engine. [3] The cooling system also includes an open loop cooling system for cooling at least a portion of the engine. The open loop cooling system uses coolant from an external source (e.g., a body of water) to cool the engine.

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VII. PROCESS FOR CONTROLLING SELF-IGNITION IN A 4-STROKE ENGINE

The present invention is a process for [6] controlling self-ignition in a four-stroke engine comprising variable control of the opening and the closing of the intake and exhaust in the combustion chamber as a function of the engine load. At partial load the invention performs (a) prolonged retention of burned gases in the combustion chamber, and (b) a fresh gas intake period which overall follows the retention period, in order to minimize mixing of the fresh gases with the [7] burned gases and to control the amount of burned gases retained in the combustion chamber.

VIII. BALANCING ARRANGEMENT IN 8-CYLINDER, 4-STROKEENGINES

In an arrangement for improving the mass balancing of the valve operating mechanism of an 8-cylinder, 4-stroke internal combustion engine with two rows of cylinders, which are disposed in V-shaped fashion and which have at least one camshaft 20, 22 with valve cams for operating the valves, a linearly movable balancing mass 32, 34 is assigned to at least one camshaft of each row of cylinders. The balancing masses are moved by balancing cams 40, 42 on these camshafts in opposite directions against the force of springs. The centers of gravity of the balancing masses move along straight lines 44, 46, which cross in the longitudinal central L of the internal combustion engine and lie symmetrically to this plane.

IX. FOUR-STROKE FREE PISTON ENGINE

A free piston engine utilizes a shuttle frame external to combustion chambers to rigidly link shuttle parts reciprocating along a centerline. [4] If the shuttle parts are spaced apart along the centerline, the shuttle frame may be struts extending from the shuttle parts and linked by rods. Alternatively the shuttle parts are within a tubular shuttle frame that forms part of the combustion chamber boundary. If one shuttle part is arranged around the other with both centered about the centerline, the shuttle frame may include an annular plate between a cylindrical inner shuttle part and an annular outer shuttle part. Alternatively the shuttle frame may include an inner tube with a cylindrical inner shuttle part within the inner tube, and an outer tube with an annular outer shuttle part arranged between the inner and the outer tubes so that the shuttle frame forms part of the combustion chamber boundary.

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