

EXPERIMENT NO. 2

OBJECT

To study and sketch the model of S.I. Engine (4-Stroke Petrol)

EQUIPMENTS

Model of 4-stroke petrol engine (cut section)

CONSTRUCTIONAL DETAIL

4-stroke petrol engine consists of following main parts

- | | |
|------------------------------|--|
| 1. Cylinder | 13. Cam shaft |
| 2. Cylinder head | 14. Governor |
| 3. Piston | 15. Fuel pump |
| 4. Connecting rod | 16. Spark plug |
| 5. Crank shaft | 17. Carburetor |
| 6. Crank | 18. Valve operating mechanism |
| 7. Flywheel | (Tappet, push rod, rocker, valve spring) |
| 8. Big and small end bearing | |
| 9. Crank case | 19. Piston rings |
| 10. Piston rings | |
| 11. Intake valve | |
| 12. Outlet valve | |

WORKING PRINCIPLE

The petrol engine is also known as spark ignition engine or constant volume engine. In 4-stroke petrol engine, one cycle is completed in two revolution of crank shaft and four strokes of the piston. This type of engine is called four stroke engine. A 4-stroke petrol engine has suction compression, expansion and exhaust strokes for each operating cycle.

SUCTION STROKE

This stroke begins just before the piston reaches to top dead centre during its upward movement in cylinder. The suction stroke begins at about 10^0 - 20^0 before TDC. At this time inlet valve begins to open. As the inlet valve opens, piston goes past TDC and begins to move downward in cylinder, due to that low pressure is created in cylinder and air fuel mixture enters into the cylinder, suction, compression, expansion and exhaust strokes for each operating cycle.

COMPRESSION STROKE

In this stroke piston moves from B.D.C. to T.D.C. and compressed the air fuel mixture, because of compression temperature and pressure will be increased, at this time, both valves will be closed and ignition takes place with the help of spark plug.

EXPANSION STROKE OR POWER STROKE

After ignition burnt gases inside the cylinder expands and exerts the pressure on piston due to that piston again moves from T.D.C. to B.D.C. and power produced on crank shaft and flywheel gets movement by this stroke.

EXHAUST STROKE

Exhaust stroke occurs as the piston moves from BDC to TDC. The exhaust valve begins to open before the end of power stroke that is before BDC, as the piston moves up in cylinder, the combustion product are pushed out through the exhaust valve.

The cycle is completed, now the engine is ready to such the fresh air fuel mixture again.

DESCRIPTION OF THE PARTS

CYLINDER

Cylinder is a circular shaped container within which piston travels in reciprocating motion. Cylinder provides a cylindrical close space to allow movement to the piston, to admit and ignite the charge. Cylinders of a multi-cylinder engine are cast as a single block. The block is cast in one piece from grey cast iron or iron alloyed with other metals such as nickel or chromium. Some blocks are cast from Al. in case of water cooled engines it contains water jackets between outer and inner wall of the cylinder. In case of air cooled engines cooling fins are provided on the external surface of the cylinder.

CYLINDER HEAD

The part mounted on the cylinder is called cylinder head. It contains inlet and outlet valve seats and has a threaded hole to accommodate the spark plug in S.I. engines and fuel injector in C.I. engines. It is cast in one piece from alloyed iron. It provides the protection to the valves and piston by enclosing them.

PISTON

The gas force produced during power stroke acts on the piston. Piston reciprocates within the cylinder, and transmits the force exerted by expanding gases to crankshaft via connecting rod. It is designed as a metal cup. Pistons of engines are made of alloy steel aluminum alloy. The oil drain holes are provided for circulation of lubricating oil. A T slot is made to accommodate for thermal expansion of piston.

PISTON RINGS

Piston rings are provided to seal the space between the piston and cylinder wall on the upper part of the piston. These rings are called compression rings. In the lower part of the piston grooves are provided to install the oil rings. These oil rings scrapes off excess lubricating oil from the cylinder wall during the downward movement of the piston. Piston rings are usually alloy C.I. various coatings are used on compression rings. Soft substances like phosphate, graphite and iron oxide which rapidly are used to coat the rings.

CONNECTING ROD

Connecting rod transforms reciprocating motion of the piston into rotary motion of crank shaft. The material used for connecting rod ranges from plain carbon steel to high grade nickel alloys. The latter are used in heavy duty engines or where low weight is of importance. The connecting rod is drop forged and then machined and heat treated.

CRANKSHAFT

The crankshaft together with the connecting rod converts the power delivered to the piston by the burning gases from an up and down motion to a rotary motion. The crankshaft of an engine acts the power output shaft and also called engine shaft. The crankshaft is usually a one piece forging made of heat treated alloy steel

and machined in lathes and furnished by grinding to provide suitable journals for the connecting rod and main bearing.

CAMSHAFT

Camshaft consists of a number of cams on it. Each cam is meant to operate a valve at present timing. It controls the opening and closing of the inlet and outlet valves. It gets the movement from crankshaft through timing gears.

TIMING GEARS

Timing gears are a pair of gears of which one is mounted on crankshaft and the other at camshaft. The gear mounted on camshaft is 2 times larger in dia. than the other mounted on crankshaft. It means that the cam shaft has to rotate $\frac{1}{2}$ the speed of crankshaft. It is because a valve has to open and close once in every two revolution of crankshaft.

FLYWHEEL

It is mounted on crankshaft. It controls the fluctuation of speed. It absorbs excess energy during power stroke and provides it to the piston in other strokes.

SPARK PLUG

It is mounted on cylinder head and at the end of the compression stroke when the temperature and pressure increases, it provides a spark to ignite the compressed charge.

FUEL SYSTEM IN S.I. ENGINE

In the fuel flow system fuel filter are always provided to filter foreign particles. The fuel system of a car uses a fuel pump to lift fuel from the tank and supply the

same to the carburetor. Carburetor supplies air fuel mixture of appropriate strength and quantity to the engine cylinder according to the load requirement. Some modern cars have fuel injection system instead of carburetor which is called MPFI system.

VALVE OPERATING MECHANISM

The valve and valve operating mechanism of an I.C. engine admit at the right moment, fresh charge into the engine cylinders and exhaust the products of combustion into the atmosphere. There are two valves located at the cylinder head.

1. Inlet valve, 2. Outlet valve, these valves are opened and closed at the proper timings with the help of camshaft.

APPLICATIONS

4-stroke petrol engines are widely used in transportation as cars, motor cycles.

RESULT

The study and sketch of 4-stroke petrol engine is done.

DISCUSSION