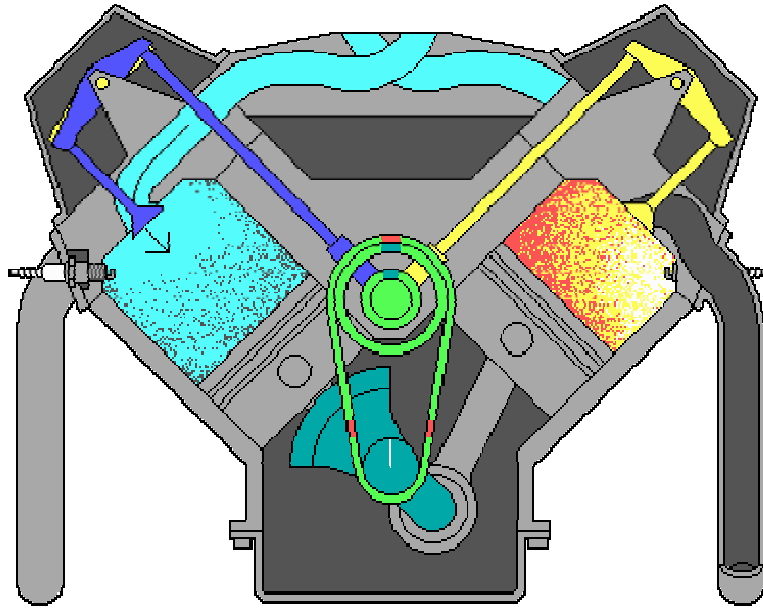


V-8 Engine Operation



Below is an overview of a V-8 engine

Cutaway of the V-8 Engine

This diagram shows the flow of fuel and exhaust within a V8 engine. It shows the timing chain (driven by the crankshaft) drives the camshaft, which opens the valves. Fuel enters the cylinders via the intake manifold. The spark-caused explosions force the pistons down. Rotation of the crank forces the pistons back up, which expels the exhaust.

The Engine's Lubrication System

This animation shows the route taken by the oil within an engine. The oil pump draws oil from the oil pan, then forces it through the filter, into the crankshaft passage, through the connecting rods to the pistons and rings. Oil is pushed through the lifters and pushrods, and covers the rocker arms. It then flows back down into the pan to complete the cycle.

The Piston, Rings, and Wrist Pin

The piston converts the potential energy of the fuel, into the kinetic energy that turns the crankshaft. The piston is a cylindrical shaped hollow part that moves up and down inside the engine's cylinder. It has grooves around its perimeter near the top where rings are placed. The piston fits snugly in the cylinder. The piston rings are used to ensure a snug "air tight" fit.

The piston requires four strokes (two up and two down) to do its job. The first is the intake stroke. This is a downward stroke to fill the cylinder with a fuel and air

mixture. The second is an upward stroke to compress the mixture. Right before the piston reaches its maximum height in the cylinder, the spark plug fires and ignites the fuel. This action causes the piston to make its third stroke (downward). The third stroke is the power stroke; it is this stroke that powers the engine. On the fourth stroke, the burned gases are sent out through the exhaust system.

The wrist pin connects the piston to the connecting rod. The connecting rod comes up through the bottom of the piston. The wrist pin is inserted into a hole (about half way up) that goes through the side of the piston, where it is attached to the connecting rod.

Pistons are made of aluminum, because it is light and a good heat conductor. Pistons perform several functions. Pistons transmit the driving force of combustion to the crankshaft. This causes the crankshaft to rotate. The piston also acts as a moveable gas-tight plug that keeps the combustion in the cylinder. The piston acts as a bearing for the small end of the connecting-rod. Its toughest job is to get rid of some of the heat from combustion, and send it elsewhere.

The piston head or "crown" is the top surface against which the explosive force is exerted. It may be flat, concave, convex or any one of a great variety of shapes to promote turbulence or help control combustion. In some, a narrow groove is cut into the piston above the top ring to serve as a "heat dam" to reduce the amount of heat reaching the top ring.

Timing Chain/belt

The automobile engine uses a metal timing chain, or a flexible toothed timing belt to rotate the camshaft. The timing chain/belt is driven by the crankshaft. The timing chain, or timing belt is used to "time" the opening and closing of the valves. The camshaft rotates once for every two rotations of the crankshaft.

The Cylinder Head

The cylinder head is the metal part of the engine that encloses and covers the cylinders. Bolted on to the top of the block, the cylinder head contains combustion chambers, water jackets and valves (in overhead-valve engines). The head gasket seals the passages within the head-block connection, and seals the cylinders as well.

Henry Ford sold his first production car, a 2-cylinder Model A, on July 23, 1903.

Push Rods

Push Rods attach the valve lifter to the rocker arm. Through their centers, oil is pumped to lubricate the valves and rocker arms.

Flywheel

The flywheel is a fairly large wheel that is connected to the crankshaft. It provides the momentum to keep the crankshaft turning without the application of power. It does this by storing some of the energy generated during the power stroke. Then it

uses some of this energy to drive the crankshaft, connecting rods and pistons during the three idle strokes of the 4-stroke cycle. This makes for a smooth engine speed. The flywheel forms one surface of the clutch and is the base for the ring gear.

Harmonic Balancer (Vibration Damper)

The harmonic balancer, or vibration damper, is a device connected to the crankshaft to lessen the torsional vibration. When the cylinders fire, power gets transmitted through the crankshaft. The front of the crankshaft takes the brunt of this power, so it often moves before the rear of the crankshaft. This causes a twisting motion. Then, when the power is removed from the front, the halfway twisted shaft unwinds and snaps back in the opposite direction. Although this unwinding process is quite small, it causes "torsional vibration." To prevent this vibration, a harmonic balancer is attached to the front part of the crankshaft that's causing all the trouble. The balancer is made of two pieces connected by rubber plugs, spring loaded friction discs, or both.

When the power from the cylinder hits the front of the crankshaft, it tries to twist the heavy part of the damper, but ends up twisting the rubber or discs connecting the two parts of the damper. The front of the crank can't speed up as much with the damper attached; the force is used to twist the rubber and speed up the damper wheel. This keeps the crankshaft operation calm.

Crankshaft

The crankshaft converts the up and down (reciprocating) motion of the pistons into a turning (rotary) motion. It provides the turning motion for the wheels. It works much like the pedals of a bicycle, converting up-down motion into rotational motion.

The crankshaft is usually either alloy steel or cast iron. The crankshaft is connected to the pistons by the connecting-rods.

Some parts of the shaft do not move up and down; they rotate in the stationary main bearings. These parts are known as journals. There are usually three journals in a four cylinder engine.

Main Bearings

The crankshaft is held in place by a series of main bearings. The largest number of main bearings a crankshaft can have is one more than the number of cylinders, but it can have one less bearing than the number of cylinders.

Not only do the bearings support the crankshaft, but one bearing must control the forward-backward movement of the crankshaft. This bearing rubs against a ground surface of the main journal, and is called the "thrust bearing."

Connecting Rod

The connecting rod links the piston to the crankshaft. The upper end has a hole in it for the piston wrist pin and the lower end (big end) attaches to the crankshaft.

Connecting rods are usually made of alloy steel, although some are made of aluminum.

Connecting Rod Bearings

Connecting rod bearings are inserts that fit into the connecting rod's lower end and ride on the journals of the crankshaft.

Oil Pump

The oil pump is used to force pressurized oil to the various parts of the engine.

Gear and rotary pumps are the most common types of pumps. The gear pump consists of a driven spur gear and a driving gear that is attached to a shaft driven by the camshaft. The two gears are the same size and fit snugly in the pump body. Oil is carried from the inlet to the delivery side of the pump by the opposite teeth of both gears. Here it is forced into the delivery pipe. It can't flow back, because the space between the meshing gear teeth is too tight.

The rotary pump is driven by the camshaft. The inner rotor is shaped like a cross with rounded points that fit into the star shape of the outer rotor. The inner rotor is driven by a shaft turned by the camshaft. When it turns, its rounded points "walk" around the star shaped outer rotor and force the oil out to the delivery pipe.

Piston Motion/Bicycle

The pistons in your engine's cylinder are similar to your legs when you ride a bicycle. Think of your legs as pistons; they go up and down on the pedals, providing power. The pedals are like the connecting rods; they are "attached" to your legs. The pedals are attached to the bicycle crank, which is like the crank shaft, because it turns the wheels.

To reverse this, the pistons (legs) are attached to the connecting rods (pedals) which are attached to the crankshaft (bicycle crank). The power from the combustion in the cylinders powers the piston to push the connecting rods to turn the crankshaft.

The bicycle played a large part in the process of inventing the automobile; in fact, in 1896, the first car that Henry Ford produced was even called a "Quadricycle."

Engine Placement

Mid-engine sports coupes have the engine mounted in front of the rear axle. Passenger space is limited to two people. Concentrating the weight in the center of the car improves handling.

The conventional sports coupe's engine is in the front of the car, driving either the front or rear wheels. This layout reduces production costs, but luggage space and rear seat room are sacrificed for the sporty styling.

Vans have engines located in either the front or the rear. Contemporary sedans have the engine in the front driving the front or rear axle.

Cylinder

A cylinder is a round hole through the block, bored to receive a piston. All automobile engines, whether water-cooled or air-cooled, four cycle or two cycle, have more than one cylinder. These multiple cylinders are arranged in-line, opposed, or in a V. Engines for other purposes, such as aviation, are arranged in other assorted forms.

The first four cylinder engine with a sliding transmission was in the 1907 Buick.

Oil Seals

Oil seals are rubber and metal composite items. They are generally mounted at the end of shafts. They are used to keep fluids, such as oil, transmission fluid, and power steering fluid inside the object they are sealing. These seals flex to hold a tight fit around the shaft that comes out of the housing, and don't allow any fluid to pass. Oil seals are common points of leakage and can usually be replaced fairly inexpensively. However, the placement of some seals make them very difficult to access, which makes for a hefty labor charge!

Engine Oil Dip Stick

The engine oil dip stick is a long metal rod that goes into the oil sump. The purpose of the dip stick is to check how much oil is in the engine.

The dip stick is held in a tube; the end of the tube extends into the oil sump. It has measurement markings on it. If you pull it out, you can see whether you have enough oil, or whether you need more by the level of oil on the markings.

Oil Filler Cap

The oil filler cap is a plastic or metal cap that covers an opening into the valve cover. It allows you to add oil when the dipstick indicates that you need it. Some cars have the crankcase vented through the filler cap. Oil which is added through the filler passes down through openings in the head into the oil sump at the bottom of the engine.

Oil Filter

Oil filters are placed in the engine's oil system to strain dirt and abrasive materials out of the oil.

The oil filter cannot remove things that dilute the oil, such as gasoline and acids. Removing the solid material does help cut down on the possibility of acids forming. Removing the "grit" reduces the wear on the engine parts.

Modern passenger car engines use the "full flow" type of oil filters. With this type of filter, all of the oil passes through the filter before it reaches the engine bearings. If

a filter becomes clogged, a bypass valve allows oil to continue to reach the bearings. The most common type of oil filter is a cartridge type. Oil filters are disposable; at prescribed intervals, this filter is removed, replaced and thrown away. Most states now require that oil filters be drained completely before disposal, which adds to the cost of an oil change, but helps to reduce pollution.

Oil Passages

Within the engine is a variety of pathways for oil to be sent to moving parts. These pathways are designed to deliver the same pressure of fresh lubricating oil to all parts. If the pathways become clogged, the affected parts will lock together. This usually destroys parts that are not lubricated, and often ruins the entire engine.

The oil passages are cleverly drilled into the connecting parts of the engine, which allows the highly mobile ones (like the pistons) to have ample lubrication. Originating at the oil pump, they flow through all of the major components of the engine. In the case of the pistons and rods, the passages are designed to open each time the holes in the crankshaft and rods align.

Oil Pan

At the bottom of the crankcase is the container containing the lifeblood of the engine. Usually constructed of thin steel, it collects the oil as it flows down from the sides of the crankcase. The pan is shaped into a deeper section, where the oil pump is located. At the bottom of the pan is the drain plug, which is used to drain the oil. The plug is often made with a magnet in it, which collects metal fragments from the oil.

Serpentine Belts

A recent development is the serpentine belt, so named because they wind around all of the pulleys driven by the crankshaft pulley. This design saves space, but if it breaks, everything it drives comes to a stop.