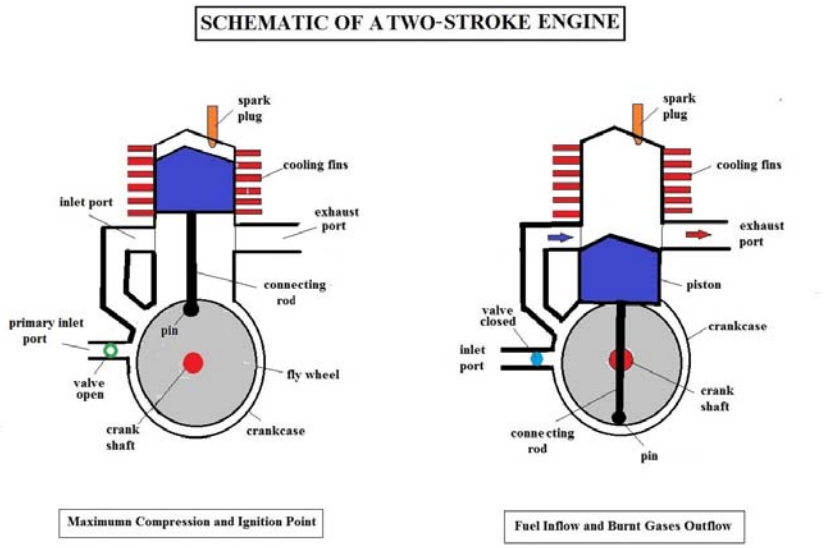
CHARACTERISTICS OF TWO-STROKE ENGINES

There are (after neglecting the Wankel type) two basic internal combustion engines using gasoline as its primary fuel. These are the Four-Stroke Otto Engine used mainly for automobile propulsion and the smaller Two-Stroke Clerk Engine used in lawn-movers, motor cycles, chain-saws, etc. Both types have advantages and disadvantages and have found their niche were they are most practical. We want here to discuss the properties of the lighter and air-cooled two-stroke (also referred to as two-cycle) engines with which most readers will be less familiar.

As the name implies, a two-stroke engine involves just one up and one down motion before repeating the cycle. We show a schematic of such an engine in the following figure-



It consists essentially of a cylinder in which a piston connected via a connecting rod connected by pin to a rotating flywheel attached to a rotating crank shaft. The figure shows the piston at its two extreme points. When the piston reaches its top point the compressed atomized fuel mixture is ignited by a spark plug. This produces a downward power stroke until the piston reaches the location of the inlet and outlet ports. At that point the burnt gas products are expelled through the exit port while at the same time a new fuel-air mixture enters the chamber through the inlet port from the crankcase driven by the higher pressure there because of the piston's prior downward motion. During the next part of the cycle the injected fuel is compressed as the piston again moves upward. When reaching the top the cycle repeats with the ignition of the compressed mixture. A typical compression ratio for these two cycle engines is about seven. The power output per engine weight will be larger than that for a four-cycle engine of the same weight but one pays for this by having some of the newly aerated fuel pass right out the exit port without first combusting. Part of this problem could be solved by the use of fuel injection which has at this point been used only sparingly in two-stroke engines because of the extra cost and weight. A distinct advantage of low powered two-stroke engines is that they can be air-cooled by the placement of a few cooling fins. For the higher powered four stroke engines (early VWs excepted) some form of water cooling is required to

handle the waste heat problem.You can find a short film indicating the position of the piston during the entire two-stroke cycle by going to-

http://www.animatedengines.com/twostroke.html

A careful study of this time-dependent behavior clearly suggests many improvements which could be made for such two stroke engines including –

(1)- fuel injection into the crank-case region

(2)- designing more efficient piston top surfaces and cylinder ends for better combustion and burnt product removal without also taking along some of the unburnt fuel

(3)- some form of swirl injection and product removal to take advantage of the difference in density of the injected fuel and the burnt products

(4)-multiple spark plugs to accelerate and enhance the combustion process

(5)- running of many identical two-cycle engines arranged radially (not unlike the P&W wasp airplane engines of the 1930s) and all connected to the same crank-shaft

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