

## **TECHNICAL TIPS – “Wench With a Wrench”**

**By Gail Wagner – Midstate Miata Club of NY**

### **ZOOM-ZOOM 101 - HOW DOES AN ENGINE WORK?**

If you're like most drivers (except us motor head-nut cases ☺), your understanding of how a car engine works is put the gas in, there's some kind of a min-explosion and you go forward after stepping on the gas pedal. Inquiring minds may want to know more details so here's a very brief explanation, as simple as I can make it, for how a car engine goes zoom-zoom.

#### A Little History

Wheels are 5,500 years old but the cars we drive today arrived on the scene in 1885! That's when German engineer Karl Benz (1844-1929), the father of Mercedes Benz, attached a small gasoline engine to a three-wheel cart and made the first primitive gas-powered vehicle. Although Benz developed the auto, another German engineer, Nikolas Otto (1832-1891) was more important as he invented the gasoline engine in the first place about 20 years earlier! Thanks, Guys!

#### Pump You Up

Think of your car engine, an internal combustion engine, as a big air pump because that's exactly what it is. Gasoline, pistons and spark plugs facilitate pumping air through the engine to generate power. The energy to get the “pump” pumping is generated by mixing air with fuel and setting that concoction on fire. ☺

More specifically, if you want to get technical: the internal combustion engine is a heat engine in that it converts energy from the heat of burning gasoline into mechanical work, or torque, which is applied to the wheels to make the car move.

#### Air Apparent

It all begins with the air outside your car. Air is filtered by the engine's air filter then immediately mixed with fuel either through a carburetor (in older vehicles) or a fuel injection system. That mix of fuel and air is then sent to the intake manifold which routes it to the cylinder head.

#### Cylinders and Pistons (not John ☺ )

The cylinder head acts as a kind of gatekeeper between the intake and the combustion chambers (cylinders). As you know, our Miatas have four combustion chambers/four cylinders but there can be 2, 4, 6, and 8 – even up to 12 cylinders thank you Enzo)! By the way, more cylinders = more power. If all chambers ignited their air-fuel mixture at once, the engine wouldn't run very smoothly or generate much power.

Individual cylinders are offset from each other and evenly spaced so that the combustion strokes of the pistons within the cylinders do not occur simultaneously and so that the engine is as balanced and smooth-running as possible. The cylinders are super-strong metal and sealed shut but open and close at one end like a bicycle pump. For this “pump” to work smoothly and efficiently, delivery of fuel/air mixture and the spark that causes the explosion of ignition have to be timed out just right.

### Valves

For combustion to happen, you need some valves and they need to open at just the right moment. In a car engine, the valves are part of the cylinder head at the top of each cylinder and they are opened and closed quickly by the rotation of the oblong lobes of the camshaft to push the valves open. When the intake valve opens, a cylinder is filled with a fuel mixture of air and gasoline waiting to be ignited by a spark from the distributor.

### Distributor

As it implies, now you need something to distribute the spark to the combustion chamber. The camshaft and distributor are partners connected by gears so that the distributor knows when cylinder needs a spark to ignite the fuel/air mixture.

When the intake valve is closed and the air-fuel mixture is compressed by the downward motion of the piston, the distributor sends a spark through a spark plug wire (or coil-pack in newer Miatas) to the spark plug. This creates a spark inside the cylinder which in turn causes thousands of tiny controlled explosions occurring each minute.

### And The Wheels Go Round and Round

This combustion explosion causes expanding compressed gases to force the piston inside the cylinder against the crankshaft resulting in its rotation. This rotation spins the transmission, which spins the driveshaft, which spins the wheels. By the way, at highway speeds, the crankshaft, a constantly turning axle, will be spinning at a rate of about 3,000 rpm’s (revolutions per minute).

### Let It All Hang Out (the back)

When the combustion stroke in the cylinder reaches the bottom dead center, the exhaust valves open to allow spent combustion gases to get pumped out of the engine as the piston comes up again. These valves let out the remains of the burned fuel mixture routing them through the exhaust system and filtering them out along the way via the catalytic converter, etc. When the exhaust is expelled out the back of your tailpipe, the exhaust valves close at top dead center and the whole process starts over again.

### Not All Engines Are Created Equal

As you must know, engines come in many shapes and sizes. Most auto engines cylinders are arranged in a straight line such as an “inline-four”, “straight 8” or combination of two banks of cylinders in a V as in V-6 (1950’s) or a V-8 (1920’s).

Engines are also classified by their size or “displacement” which is the combined volume of an engine’s cylinder, i.e., 1.8 liter, 2.0 liter, etc.

So now you know. No matter what kind of engine, as long as it’s an internal combustion kind, the basics of how it works is the same.

Don’t worry; there won’t be a pop-quiz tomorrow. ☺



2002 NB Mazda MX5 DOHC 4-cylinder engine

Take care of your Miata and it will take care of you.

Zoom Zoom Safely!

*Gail*

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