Spark Plug Encyclopedia Article

Spark Plug

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In 1769, the first self-powered carriage was produced by Nicholas-Joseph Cugnot, a French military engineer. The machine's power was steam-generated and required so much cumbersome equipment that it was unmanageable and inefficient. It quickly became obvious that a more effective machine had to be developed. John Barber was the first to act on the theory of using a combination of highly condensed air and fuel to drive these self-powered carriages. He used matches and candles to produce the spark necessary to ignite the fuel and create the drive force. He patented his gas turbine in 1791.

It was not until 1860, however, that Frenchman, Jean-Joseph-Étienne Lenoir developed the earliest version of the internal combustion engine that used an electrical spark from a spark plug to ignite an air-fuel mixture. Lenoir's spark plug consisted of a hollow brass bolt, porcelain, and two platinum wires. Later, in 1885, Lenoir refined his spark plug, and the later version closely resembles what is used today.

Timing of combustion is controlled by the ignition system, but the spark plug's task is to produce the spark. Voltage from the ignition system ionizes (removes electrons from) air molecules around the electrodes of the spark plug. The voltage concentrates along a sharp edge of the electrode, causing a spark to arc across the electrode and ignite the exposed fuel. Sparking wears away the edges of the electrodes, so spark plugs have to be replaced periodically.

Modifications to spark plug design have been part of the search for internal combustion engines that burn leaner air-fuel mixtures and run cleaner. Metal alloys improve thermal conductivity; gold-palladium, copper-core and platinum-tipped plugs are claimed by spark plug makers to be more durable and to fire more reliably. The shape and exposure of the electrode improves combustion efficiency, and the two-pronged side electrode has been proven to improve fuel economy and engine performance. Specialized plugs like the Halo Disc are made of tungsten, nickel, and iron and have specialized insulators, electrodes, and inductors to minimize fouling, quenching, and electromagnetic interference. Such design features account for the wide assortment of spark plugs on the market.