Rambling on about Ignition – Batteries for Model Engine Ignition

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Since Cabin Fever 2007, I have become aware of how much confusion there is about electrical ignition and how it actually works. This is the first in a series of articles that are a mix of personal experience, technical background and how the ignition parts work and interact. Most people involved with engines large or small know much of this but often there is a gap that ties the whole sequence together.

Several months ago, I had battery problems and that seems like a good place to begin. I charged my 4 NiMh (Nickel Metal Hydride) D size batteries that I have been using for my engine ignition for several years. They worked great while checking the wiring and setting the timing on a new engine. Suddenly strange things started to happen, the coil buzzed and the Hall sensor seemed not to be operating correctly. By time I go to starting the engine two cells were gone. They were many years old so I replaced them with Duracell Alkaline D batteries fresh from the hurricane supply box. I had 6 volts instead of 4.8 and new batteries, so there should be no ignition problems.

I was working around the engine during a short run, my arm hit the top of the spark plug, and there was just a mild tingle. So I went looking and found the great new batteries drop to under 4 volts when the coil is on. Next, I decided to look at it with an oscilloscope and the battery voltage drops to under 4 volts as soon as it is turned on. About a minute later, it is at 3.8 volts.

I did some research about batteries.

Alkaline D batteries are for loads of under 2 amps and have a short circuit current of 3 amps. This is not very exciting if your coil needs 4.5 amps like the automotive coil I was using.

Old fashion Carbon Zinc D batteries are for loads of under 4 amps and have a short circuit current of 8 amps. These would run my coil at full current.

Rechargeable NiCd Nickel Cadmium D batteries are for loads of under 30 amps and have a short circuit current of 100 amps. These are almost a perfect battery.

Rechargeable NiMh Nickel Metal Hydride D batteries are also for loads of under 30 amps and also have a short circuit current of 100 amps. These are also almost a perfect battery and a lot less toxic than NiCd.

When I went looking for new batteries I found good old lead acid gel batteries are the most cost effective and they have high load currents like the other rechargables. Discussing my problems with other engine builders, I found the majority of they use lead acid batteries.

I got a sealed lead acid battery 6 volt and 5 amp-hour ratings. The new lead acid battery with the auto coil caused some increase in engine performance. The voltage only dropped about 0.2 volts when the coil was on and all was good. The battery I got was for loads of under 15 amps and has a short circuit current of 75 amps.

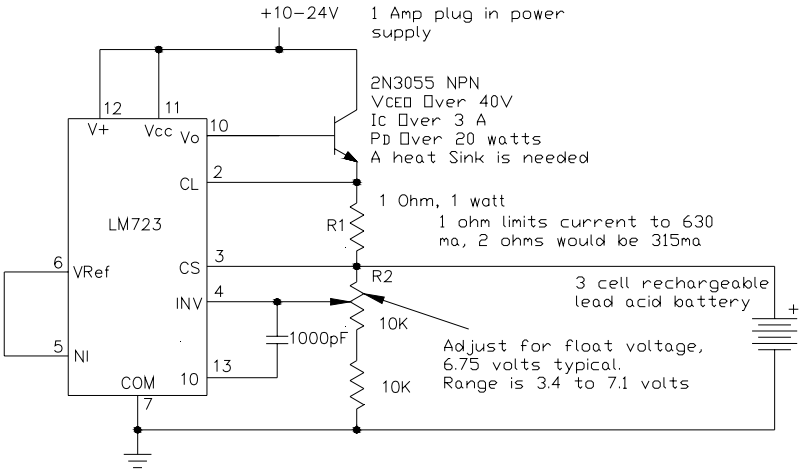
Long ago, I had a Volkswagen with 6 volt ignition, so I have a battery charger. I set it to 6 volts and 1 amp maximum and hooked it up. A few hours later, I notice the battery is blown up like a balloon and whistling. I took it back to the store, they promptly told me I overcharged it and I should get a new one and a better charger. It turns out these new sealed lead acid batteries have no vent and often have internal pressures up to 100PSI. The gas produced while charging is stored in the fiber glass plate separators and later reabsorbed during the discharge cycle. Older Gel lead acid or liquid lead acid batteries all have a vent to prevent over pressure and are more tolerant of overcharging.

I called the battery manufacture and spoke with an engineer. Lead acid batteries like everything else have data sheets and maximum current recommendations for longer battery

life. There is a 2 step approach to charging lead acid batteries and few cheap chargers (much less my 30 year old one) do both.

First, there is constant current charging which is fast and does the bulk of the charge process. The data sheet recommends the maximum charge rate, usually 5-10% of the amp-hour value. Next comes a constant voltage "float" which tops off the charge at the batteries ideal charged voltage which is 6.75 volts for a 6 volt battery at room temperature.

The charger at the battery store was nearly $40 and did not Indicate on its blister package how it controlled the charging. From the battery data sheet, I had the voltages and currents needed so why not just make one. The circuit is based on a LM723 voltage regulator integrated circuit, a power transistor and an old 12 volt power cube. It is fully adjustable and can be used with any rechargables batteries. The LM723 initially operated in constant current mode and the current is set by resistor R1. The 1 ohm resistor will set the maximum charge rate at 630ma. When the battery is sufficiently charged the current decreases and the regulated voltage set by potentiometer R2 floats the battery voltage. The battery I have recommends charging at 2.25 volts per cell or 6.75 volts. This circuit can be adjusted for float voltages from 3.55 to 7.15 volts.



This circuit will begin bulk charging at 630ma the current limit setting until the battery voltage approaches the float voltage. As the float voltage approaches the current is reduced and when the battery voltage equals the float voltage charging stops.

For maximum battery life, over 4 years, never let the charge go under 40% and never allow overcharging.