

How Do You Make Your T Go So Fast?

Part two: Thermodynamic

By Tom Carnegie

Henry Ford said that the top speed of Model T Fords was 45 miles per hour. A lot of them now days are hard pressed to achieve that speed. Sometimes after someone has taken a ride in my car, they will ask me: "How do you make your T go so fast?" My stock, off-the-cuff reply is that there are only two things to make a T go fast - compression and aspiration. This is essentially true, but is an oversimplification. There are really THREE things! The three things are: 1. Mechanical efficiency 2. Thermodynamic efficiency and 3. Volumetric efficiency. Last newsletter we talked about mechanical efficiency. This time we will talk about thermodynamic efficiency.

What are we talking about when we say mechanical, thermodynamic and volumetric efficiency? Efficiency is getting as much work done with as little energy (or fuel) spent as possible. Does this mean the best gas mileage possible? It can, but what we are looking for in the Montana 500 is the most power possible given the obvious limitations of the Model T motor. Mechanical efficiency (henceforth M.E.) deals with things such as friction, vibration and wind resistance. Thermodynamic efficiency (henceforth T.E.) deals with things that make the bang of the power stroke stronger. Volumetric efficiency (henceforth V.E.) deals with getting the biggest and best charge of fuel into the combustion chamber. When we say T.E. what might come to mind is temperature since the root word is thermo. Of course we are talking about heat. Specifically, getting the heat produced by the explosion of the fuel mixture to do as much as possible. When the combustion explosion takes place, a good deal of the energy produced is wasted or used inefficiently in one way or another. When we talk about V.E. next time we will talk about ways to maximize the amount of air-fuel mixture that we get into our combustion chamber. For this article, we will assume that we get the same volume of charge for every illustration. Let's assume that we take in exactly one pint of air-fuel mixture on every intake stroke. What can happen to this charge to keep us from getting the most bang for our buck? Let's start with factors outside of our engine.

Yes, it is true there are things that can lower T.E. that you have no control over. One is the quality of the air. Three major things can effect the air quality in regards to combustion. Number one: is atmospheric pressure. As the barometric pressure drops, the air becomes thinner thus it is able to hold less oxygen. Oxygen is the ingredient needed for combustion (besides fuel). Number two: is humidity. As the relative humidity rises, the air becomes less able to hold oxygen. Number three: is heat. As the air gets hotter it loses its ability to hold oxygen. That is why using Ford's carb air heater is a bad idea (from a Montana 500 viewpoint).

Once inside the engine the first thing under our control is air-fuel ratio. This is adjustable on the Model T. The reason it is adjustable is that the requirements for a perfect air-fuel ratio are not always the same. Normally in the Model T you would fine-tune this as you go down the road. In addition to mixing the fuel, one of the jobs of the carburetor is to atomize the fuel. The smaller the droplets of fuel, the more combined surface area they will have. More exposed surface area translates into better combustion. Of course we can't expect to have a good controlled mixture if we have air leaks in the manifold.

Once the properly mixed and atomized air-fuel mixture is into the cylinder, it is then squeezed. In general, the harder you can squeeze it the more power you will get from the explosion. I say "in general" because some factors like detonation may make this not true. Another factor for power is combustion chamber shape. Unfortunately, the Model T combustion chamber is not the best-designed thing in the world. Waukesha-Ricardo heads and Z-heads and the like have much better combustion chambers but are not allowed on the Montana 500, nor is modifying the original head.

Once our optimally mixed, atomized and squeezed mixture is in the combustion chamber it needs to be ignited. A well tuned ignition system including timer, coils, coil-box, wires and plugs are needed for this. If the coil fails to spark, or sparks weakly or the plug misfires the mixture may not be ignited. It could also be ignited at the wrong time - either before the piston has come up enough or after it has come up too far. There is a perfect time to ignite the mixture that is a function of engine speed and load. The faster the engine speed and the lighter the load, the faster the spark needs to be for maximum power. When running on mag the Model T has only two effective positions of spark advance. The coil is triggered by the waveform produced by the magneto. It is not continuously variable but rather goes in 22 1/2-degree "notches". The spark timing can vary from cylinder to cylinder as a result of coil settings. If the point gap is wider or the upper point drop is more or the point tension more, the coil could take longer to spark. This is why it is important to set your coils on a proper coil tester.

Once our optimally mixed, atomized and squeezed mixture is in the combustion chamber and ignited at the exact right time, where does the energy of this explosion go? The answer is that most of it goes right out the tail pipe and we can't really do a thing about it. Some of the energy goes into the cylinder walls where it is dissipated by the radiator or directly to the air. We can ameliorate this situation a little bit. When the cylinder walls are cold, heat that would otherwise be used to drive the piston, is absorbed. The way to slow this down is to have the cylinders run as hot as practical. Of course you don't want to get them so hot to where the lubrication is burned off or the pistons grow too big and seize, but in general hotter is better. On modern cars the temperature is raised using thermostats and pressure caps. On the Model T using the thermo-siphon system, the engine is usually going to be running just a few degrees short of the boiling point of your coolant. The easy way to raise the engine operating temperature is to raise the boiling point of your coolant, namely, add anti-freeze. Anti-freeze doesn't have the load carrying capacity of pure water, so that adding too much could allow your car to overheat in high stress situations such as pulling a long hill. You may have to experiment to find the optimum mixture. Also never run a water pump or a fan. A water pump defeats the thermo-siphon system and a fan is only needed for long periods of idling and speeds under seven miles per hour. Both of these items also rob power to turn them.

To re-cap: Adjust your carb well. Don't allow any intake leaks. Mill your head and block as much as is practical. Make sure that your ignition system from the mag forward is in top shape. Set your spark timing in the best spot. Run your engine as hot as possible without causing problems. This should help you to have a thermo-dynamically efficient engine. Next time is V.E. day.

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