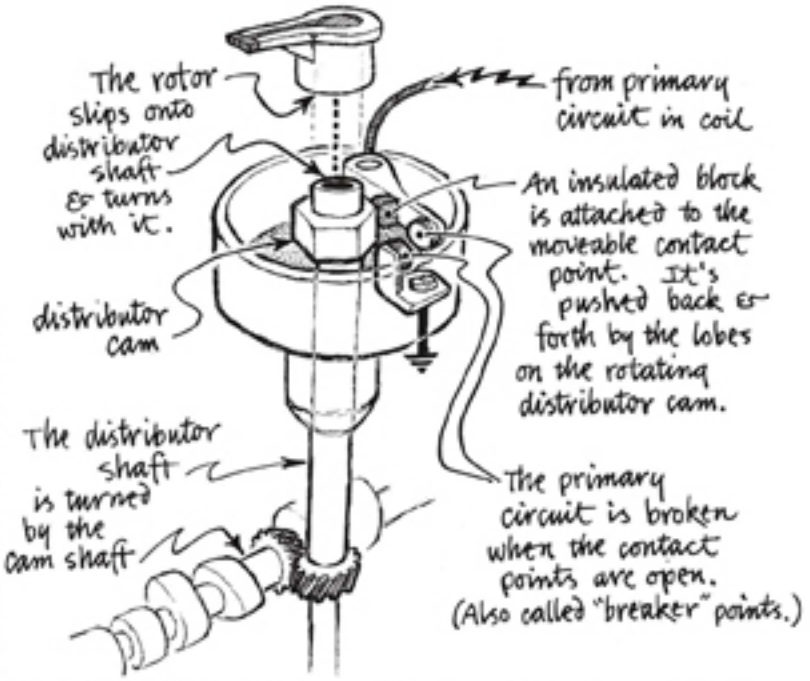


ILLUSTRATION COURTESY OF PATRICK LOFTHOUSE

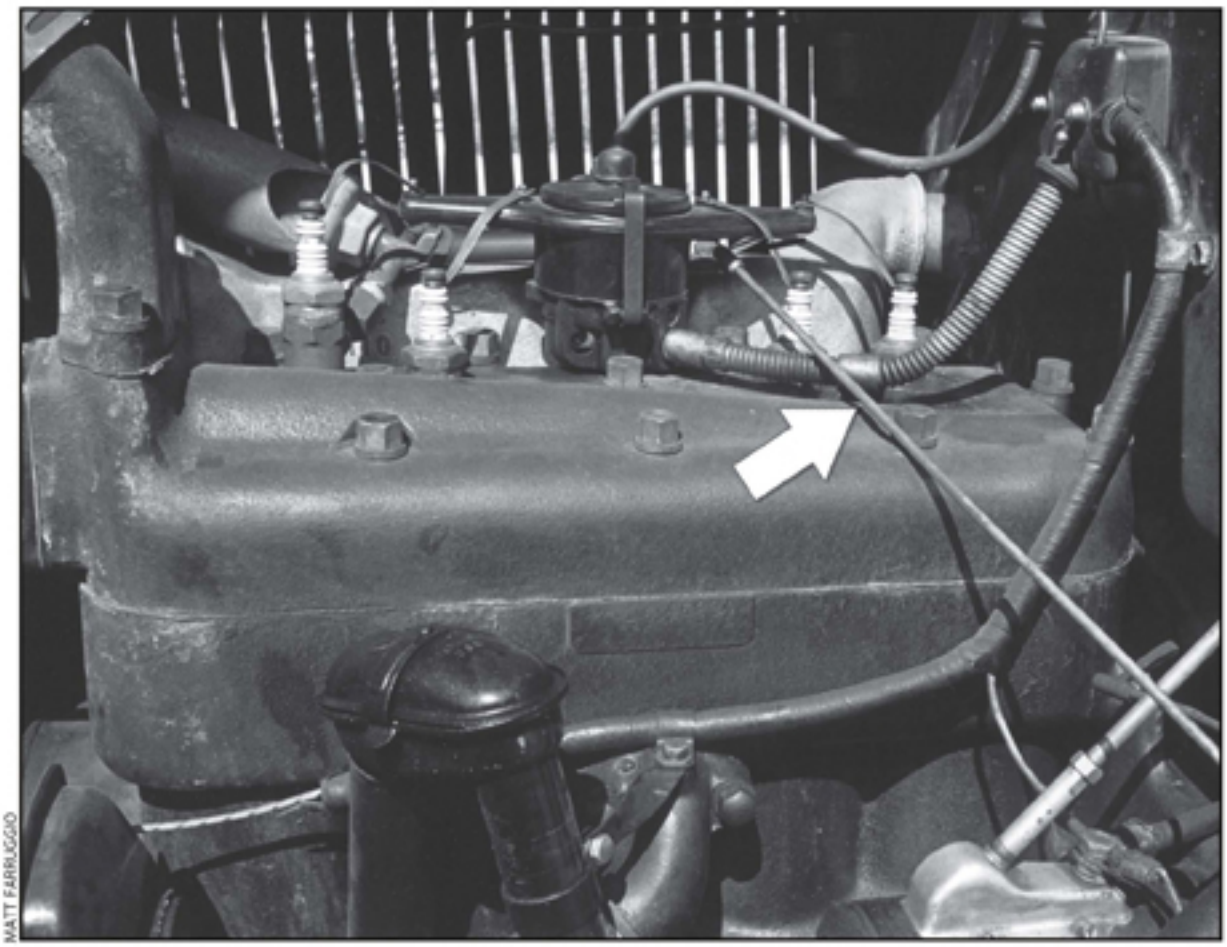
Fig. 18-2 Basic distributor. *The switch that turns the spark on and off is known as the* **breaker points** *(as in circuit breaker). When the points touch, low-voltage (12V) electricity crosses and signals the release of high-energy electricity from the coil. The coil electricity enters the top center of the distributor to the top of the rotor. Spark then jumps across, from the rotor to a contact for a spark plug on the rotor cap (not shown). In this drawing, the distributor is sending spark to a six-cylinder engine; that's why the distributor* **cam** *has six sides.*

and constantly adjust timing. Now distributors and their functions have largely been taken over by the vehicle computer, using sophisticated sensors and rapid feedback on many actual engine conditions.

MAKING TIMING CHANGES

I am going to start by showing you how to handle the basic timing changes with mechanical distributors, and then follow up with more modern methods of ignition timing and their modifications. Even the most basic system can be upgraded with new aftermarket ignition products.

In general, what we want to do when converting to alcohol is to start the spark firing much earlier than we would with gasoline. This has many advantages. Gasoline burns in a very narrow range of air/fuel mixtures that, of course, change rapidly as fuel is consumed during the explosion in the engine. This means that, in most cases, gasoline must be ignited just as the piston reaches the top of the cylinder, or just a very short time before. If the spark is fired too early, gasoline will combust abnormally and cause engine-damaging pinging, as well as waste a lot of its energy as partially combusted fuel.



MATT FARRUGGIO

Fig. 18-3 Model A "digital" distributor. *The distributor is the black device on top of the center of the engine. Look closely, and you'll see the copper straps lead from it to the top of each spark plug. The rod going down and to the right (see arrow), through the firewall, was attached by a linkage to the spark advance level on the steering column. Digital? Yes, you used the digits on your left hand to adjust the timing.*

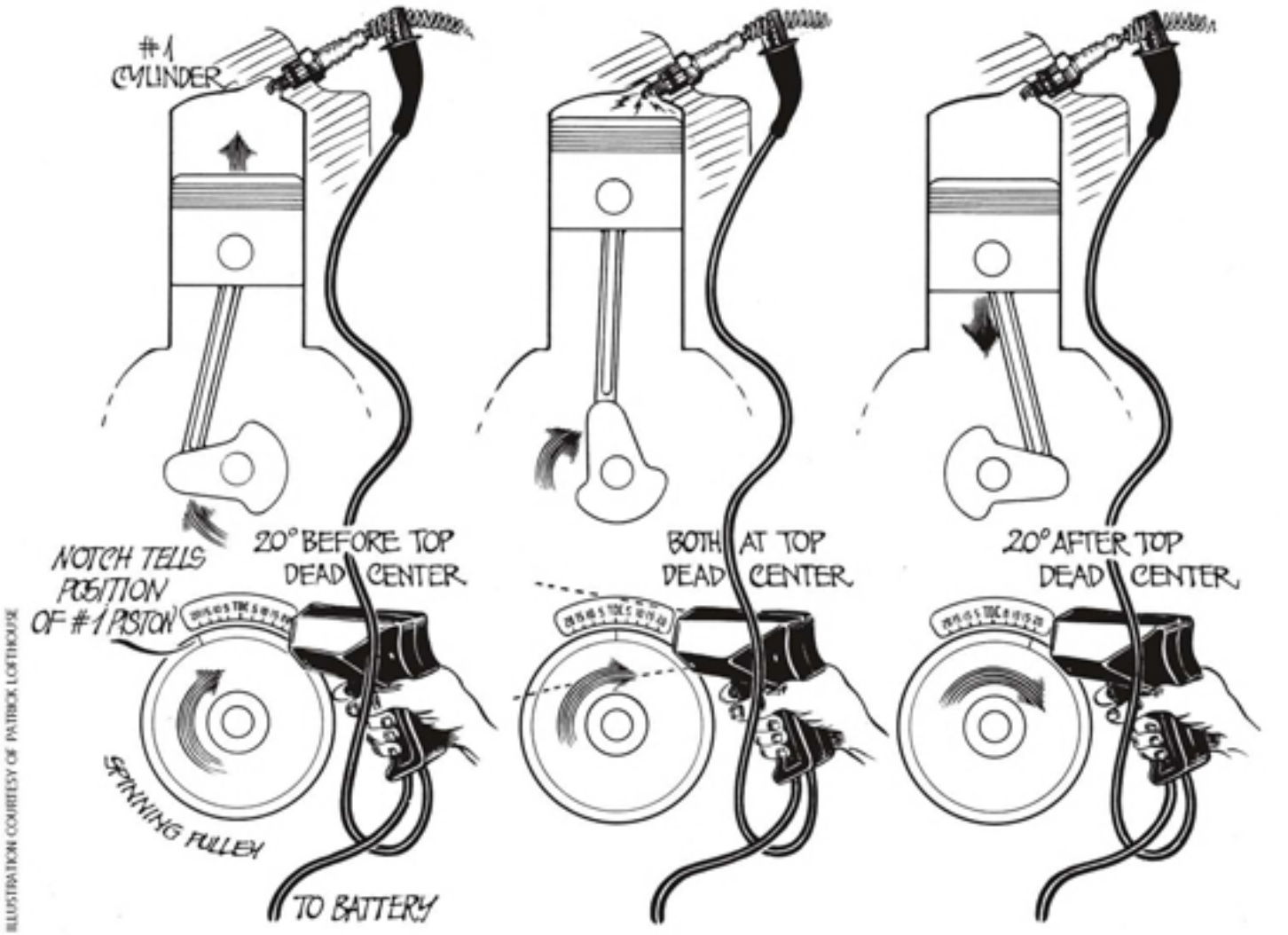


ILLUSTRATION COURTESY OF PATRICK LOFTHOUSE

Fig. 18-4 Ignition timing. *Using a timing light—which shines on a scale each time the #1 sparkplug fires—tells you when in the cycle the spark ignition is timed. When the piston is at the very top of its stroke, it's at top dead center. Fired while the piston is still traveling up is before top dead center. Fired after the piston is on its way back down is after top dead center.*

Mechanical Systems

When the piston is at the top of its compression stroke, that is considered 0° or top dead center, so the piston and connecting rod are pointing straight up. The connecting rod angles one way before it reaches the top and angles the other way on its way back down. Its angle is measured in degrees from top dead center.

Older gasoline-powered cars had a very narrow range of acceptable timing settings—0 to 8° **before top dead center (BTDC)**. This produced peak cylinder pressures at about 12–14° after top dead center.

With gasoline, you can't deviate from ideal specifications by more than one to three degrees; if the timing varies any more than that, a gasoline engine will run terribly, if at all. Alcohol is much more forgiving. If you aren't on optimal timing for alcohol, you may notice only a slight drop in mileage or perhaps a little trouble starting. In many cases, alcohol operates at a range of initial timing settings from 0 to 25° BTDC at idle.

Ignition timing controls the point in time when spark plugs are ignited to fire your mixture in the cylinder. Since it isn't possible to see the plug fire in the cylinder, you need a **timing light**, which flashes like a strobe every time your #1 spark plug fires. Shine this strobe light on the fan belt pulley or the **harmonic balancer** in the area adjacent to the timing plate. The timing plate is numbered a few degrees on either side of zero. The strobe light illuminates the spinning fan pulley every time that first plug fires, so you'll be able to see where the timing mark on the pulley aligns with the marks on the block-mounted plate.

To change the position of the timing mark to a specified number for your tune-up, loosen the hold-down bolt at the distributor's base and turn the whole distributor slightly, either clockwise or counterclockwise (see Figure 18-5). One direction advances the timing (firing earlier), and the other retards it (firing later). Once you've lined up the mark where you want it, tighten the hold-down bolt.

ILLUSTRATION COURTESY OF PATRICK LOFTHOUSE

Fig. 18-5 Adjusting the timing. *Loosen the hold-down device and rotate the whole distributor counterclockwise (usually) to advance, clockwise to retard, the timing.*

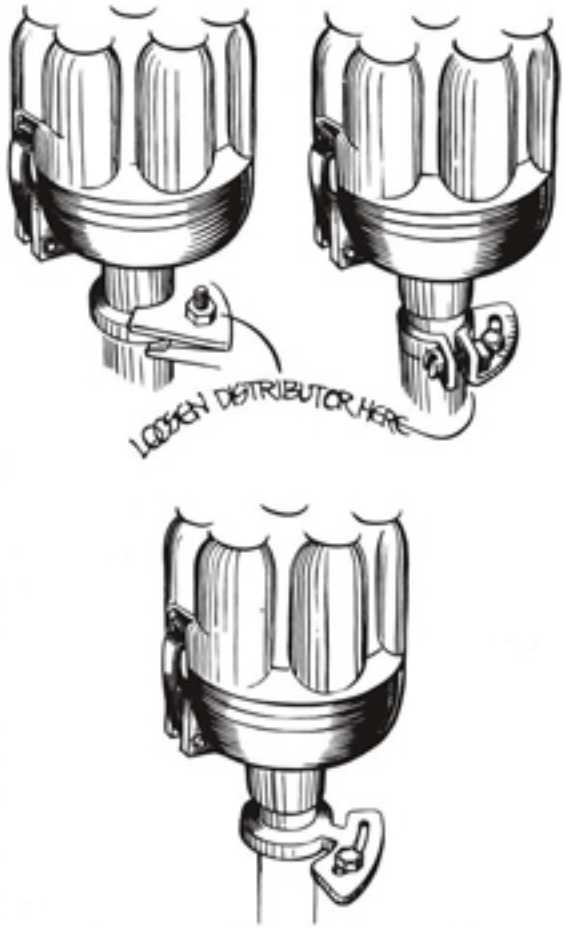


ILLUSTRATION COURTESY OF PATRICK LOFTHOUSE

Fig. 18-6 Various distributor hold-down brackets. *Different manufacturers use different methods to hold the distributor in place once the timing is set.*

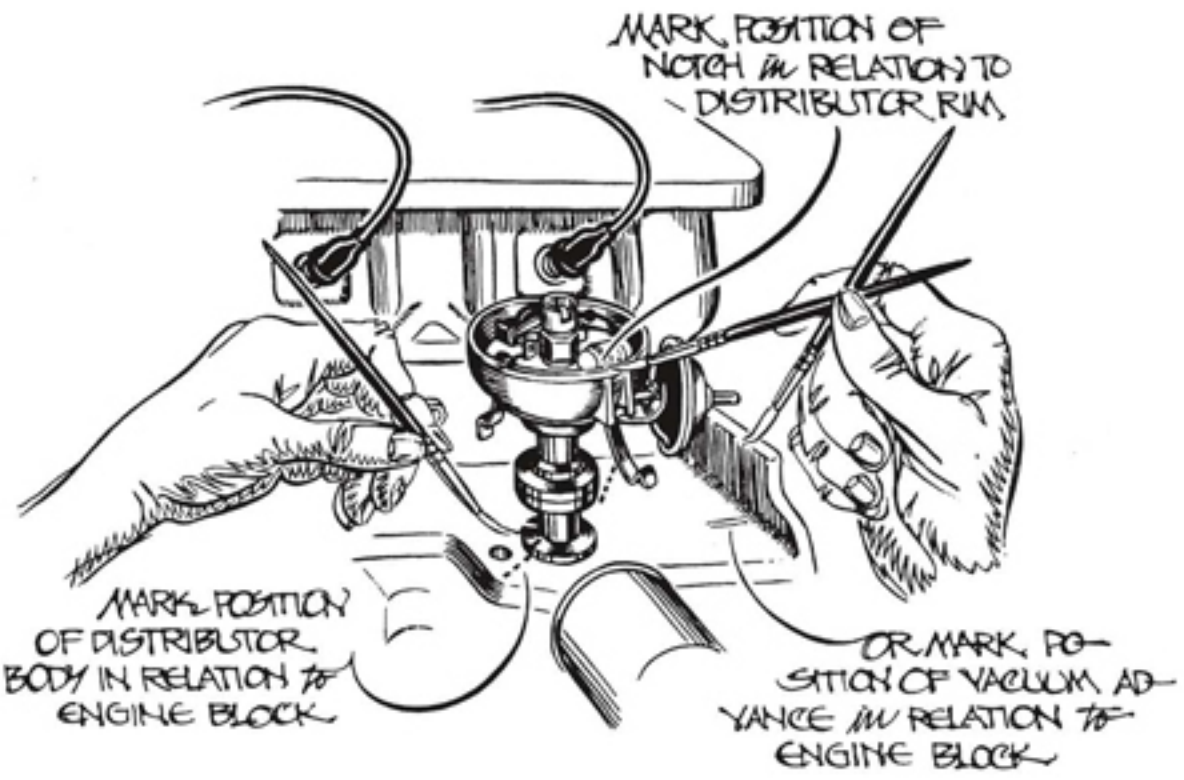


ILLUSTRATION COURTESY OF PATRICK LOFTHOUSE

Fig. 18-7 Keeping things straight. *Use any of these marking methods to indicate the proper setting for gasoline and for alcohol.*

DAVID BLUME

Fig. 18-8 Aftermarket knock detector. *This meter and the microphone below it can be used to determine the best settings for an aftermarket ignition-timing device. Once you've got your best average settings for gasoline and alcohol, you don't need this any more and can lend it to someone else in your fuel co-op.*

Your timing plate may not have enough marks to measure how much you want to advance your timing for alcohol. A **timing tape** (available at speed shops) may be appropriate for anticipating correct timing. It's a metallic or paper tape with markings up to 360 degrees, calibrated for the diameter of the balancer or pulley on your engine. You attach it with adhesive to the balancer or pulley. Read the tape against the zero mark on your timing plate.

If you lack a timing tape, you can set your present timing mark at point zero and, using the timing gauge on the engine as a degree ruler, paint a new mark on the pulley at 10° BTDC. Rotate the pulley until the new 10° mark is on zero, and mark off another 10° from which you can work. You can use either mark to get you into the ballpark, and then use the marks on the timing plate for more exact readings between 10 and 30°.

To determine the proper alcohol timing exactly, start by gradually advancing the timing to 15° at idle without the vacuum advance. Reconect and test-drive at normal speeds. To disconnect the vacuum advance, remove the vacuum hose from the distributor and plug the hose with a pencil or bolt.

If your vehicle misfires, pings, or loses power when it gets up to 65 or 70 mph, you've advanced the timing too far. The idea is to keep advancing the timing (at idle) a degree or two at a time, until you hit the exact point at which you begin to lose power, or misfire while accelerating to high speeds. When this happens, back up the timing a minimum of two degrees from the point at which you first heard the misfire (inaudible misfiring occurs a degree or two before you can sense it).

There are electronic gauges that use a **knock sensor** to listen to the engine and signal you with sound and/or lights when you begin to have inaudible pinging. This sensor is a microphone that can hear inaudible knocking (preignition). If you are part of a co-op, this should be one of the community tools to lend when first converting to alcohol.

The higher your vehicle's compression, the less ignition advance is required. This is because flame propagation is more rapid when the fuel mixture is compressed and turbulence is enhanced. For example, cars with 8.5 to 1 compression ratios typically require 15 to 25° initial timing advance. You may go as high as 50 to 60° overall timing advance during the accelerating cycle, due to vacuum advance. Vehicles with turbocharged or supercharged engines, high-energy ignition, multispark ignition, or some types of newer precombustion spark plugs, need even less overall advance.

On some cars, in order to advance timing 15 to 20°, you have to loosen the distributor hold-down bolt, and remove it along with the hold-down plate to free up the entire distributor. A slight counterclockwise twisting motion allows you to lift it out and replace it one drive-tooth back, counter-rotational from the direction the rotor spins (most rotors spin clockwise). This gives you an automatic adjustment of 10° or so, depending on the number of teeth on your distributor drive gear (see Figure 18-1). Make sure you mark the distributor plate and engine block so that you know

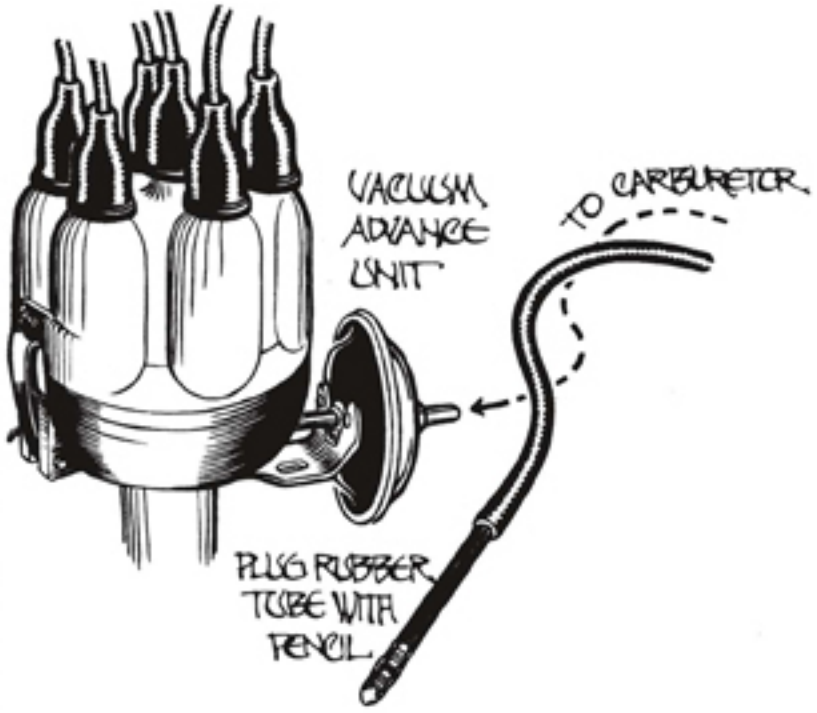


ILLUSTRATION COURTESY OF PATRICK LOFTHOUSE

Fig. 18-9 Deactivating the vacuum advance. *When setting timing at idle, you must deactivate the vacuum advance to get an accurate reading. Be sure to plug the hose, or you'll be creating a giant vacuum leak.*