DISTRIBUTOR BASICS

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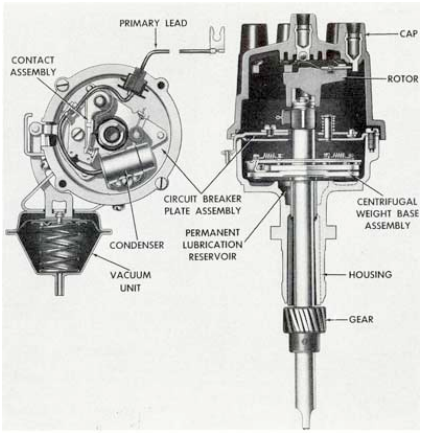
Until the implementation of engine control modules, an ignition distributor functioned as an engine's brain. It controls the build-up of electrical charge in the ignition coil, decides when precisely when to let that charge loose, and directs it to the correct cylinder. "Distributors" in the earliest years were of varying design, configuration and operation. But, by the mid- to late-1920s the design of distributors had matured to that most envision when the term is used. Later, there were further modifications as the industry began its transition to computers for engine control. This article focuses on the "common" distributor which is installed in the majority of today's collector cars.

A distributor consists of a housing, a drive shaft with breaker cam, a breaker plate with contact points and condenser, an advance mechanism, a rotor and a cap. See Figure 1 for an illustration of these components.

Figure 1



How a Distributor Works

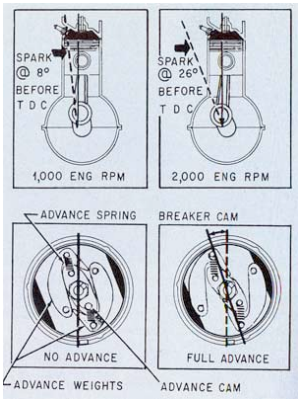
Rotation of the shaft and cam causes the breaker points to open close. Typically, the cam has the same number of lobes (high points) as there are cylinders. Some cars uses two sets of contact points that open and close alternately and these have only half as many lobes as cylinders. The contact points open and close once for each cylinder with every revolution of the breaker cam. As a result, the high voltage from the coil is delivered once for every two rotations of the crankshaft during its compression stroke.

When the points are closed, current flows in the primary circuit causing the build-up of a magnetic field in the ignition coil. When the points open, this current stops causing the magnetic field in the coil to collapse triggering a high voltage surge from the coil's secondary circuit which flows from the coil through the rotor and cap to the correct spark plug. The condenser acts to prevent burning of the contact points as the high voltage is released by the coil.

Timing of the release of electrical energy from the coil to the spark plugs must vary with engine speed. At idle, the spark must occur just before the piston reaches top dead center. As engine speed increases, the spark must occur earlier to give ample time to ignite and burn the charge for maximum power. Varying the advance of spark release is accomplished by centrifugal and vacuum means. Centrifugal advance is provided by two weights that move outward against

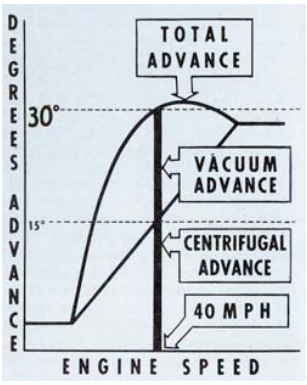
spring tension as engine speed increases. See Figure 2. This movement is transmitted to the breaker cam causing it to move ahead (advance) with respect to the distributor shaft. As a result, the points open earlier in the compression stroke at high speeds.

Figure 2



Under part throttle, a vacuum exists in the intake manifold. This limits the amount of fuel/air mixture admitted to the cylinder. To realize full power with this limited mixture the spark needs to be advanced from top dead center which is accomplished by the vacuum advance. It is a spring-loaded, airtight diaphragm connected to the breaker plate. Because the breaker plate is mounted on a bearing, it can turn inside the housing. The diaphragm is connected by a vacuum line to a port on the carburetor on the closed side of the throttle. As the throttle is opened, vacuum in the carburetor draws on the distributor vacuum diaphragm causing the breaker plate to advance. As the throttle opens wider, the manifold vacuum decreases reducing the draw on the diaphragm and at wide-open throttle there is no vacuum advance. The centrifugal and vacuum advance mechanisms operate in combination to provide the correct amount of advance depending upon engine speed as shown in Figure 3.

Figure 3



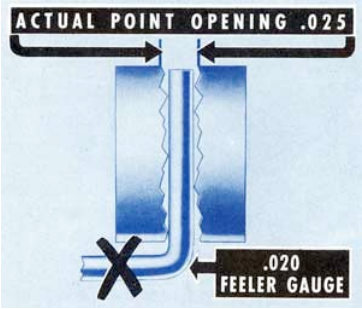
Possible Problems

The distributor is a relatively simple device, but many problems can compromise operation. For ease of starting and optimum performance, all distributor specifications should be as prescribed by the manufacturer in the shop manual. Some are installation related and some are caused by conditions within the distributor. Installation problems are three. Because distributor rotates at one-half the crankshaft speed, it is easy to install it 180 degrees out of phase with the crankshaft. Another installation problem is inserting the spark plug wires in the cap in incorrect positions, i.e., not in correct firing order. Finally, the initial timing of the distributor can be incorrect.

Condition problems fall into three categories: (1) primary circuit problems, (2) secondary circuit problems, and (3) timing problems. **Primary circuit** problems include defective leads, bad connections, and burned or open contact points that increase circuit resistance; points not properly adjusted; defective condenser; and grounded primary circuit. Figure 4 shows how pitted contact points can prevent correct setting of the point gap. **Secondary circuit** problems include high tension leakage

across the distributor cap or rotor and defective wiring or connections. **Timing** problems beyond idle are caused by defective vacuum advance or vacuum leaks; defective centrifugal advance, and wear in the distributor bushings or bearings, shaft, and drive gear.

Figure 4



Replacement of points, condenser, and rotor are typical, regular maintenance operations. All contact points in the cap need to be clean and bright and the interior of the cap clean. Problems with the distributor advance mechanisms do not need routine attention. However, old distributors (>30 years) or those with extensive use should, at minimum, be thoroughly inspected. In some cases, accumulation of oil and dirt can impair the centrifugal advance which can be corrected by simple cleaning. In other cases, replacement of parts, such as the advance weight springs, will be required. Vacuum units can also be compromised by impaired linkage in addition to age-weakened vacuum diaphragms. Finally, excess wear in the distributor shaft, its bushings or bearings and/or the drive gear will prevent accurate timing across the full engine speed range. Testing of distributors is best accomplished using a stroboscopic distributor tester which can simulate operation at a full range of engine speeds. Use of this device is also recommended following any mechanical repairs to ensure proper operation before installation in the engine. Specifications and how-to procedures are usually included in the applicable shop manual for a particular car.