Breaker Point Service - Pt II

A series on understanding, servicing and repairing the points and distributor

It has been called 'dwell angle' or 'cam' angle and we hear it referred to when we tune the car or adjust the points. Where is the 'dwell' and how do we set the angle?

The 'dwell' is not anything that we can see, nor is there a standard reference for all cars pertaining to the amount of dwell. The dwell is merely the period when the breaker points are closed. When the points are closed, they allow the coil to energize magnetically and store energy. When the points open, the stored energy is released as high voltage electricity through the rotor, cap, the high tension wires to the spark plugs. To properly understand the dwell or cam angle – and the terms are interchangeable – we have to take a more serious look at the ignition system of the car or truck.

The center shaft of the distributor has a number of ridges, or high spots on it, that number depending on, and generally coinciding with, the number of cylinders. Each full revolution of the center shaft is 360°, the number of degrees in a circle. Whether the engine is a four cylinder, 6 cylinder, 8, 12 or 16, the center shaft still rotates 360° in one full revolution. A four-cylinder engine has four high points on the center shaft, a six-cylinder engine has six high points, etc. In between each high point is a flat, or low spot. These too, match the number of cylinders. Each high point and low point affect one cylinder. So for each cylinder, the center shaft rotates a certain number of degrees – that is 360° divided by the number of cylinders: 90° for a 4-cylinder, 60° for a six cylinder and 45° for an eight cylinder. Within each range of degrees, the breaker points open and close once, so for a four-cylinder engine, one full revolution means the points open and close four times. The number of degrees that the points are closed for each cylinder is the dwell.

Now let's try to explain why the dwell is important and what happens during that 'dwell' period. For this though, we must leave the distributor and step back to examine the ignition coil as well.

The ignition system consists of a number of components – on some engines more than others, but for the standard single breaker point ignition, you will find the following: the coil, the distributor, spark plugs and a series of wires connecting everything.

The primary circuit – the high tension circuit - increases the voltage in the coil to thousands of volts. The secondary circuit goes from the coil to the breaker points. The breaker points are two segments: a movable segment and a fixed segment. The fixed segment is grounded and adjustable. The movable segment is always 'hot'; that is, there is a continuous flow of electricity to it. The movable segment is not adjustable. The only adjustments are from wear – wear at the movable point face and wear at the rubbing block or wear (weakening) of the tension spring. When that wear is excessive, the set of points both movable and fixed should be changed. If properly adjusted, and with everything else in good order, the points should last hundreds of thousands of openings and closings.

When the points are in the 'Open' position, there is not a complete circuit. When the points close, the current flows through the fixed segment to ground completing the circuit to ground. The points open and close a few hundred times per second, the actual number depending on the number of cylinders and the engine RPM. The points have to be closed long enough to build up the maximum magnetic flux in the ignition coil core.

Okay, here's where it gets a bit complicated.

The primary and secondary windings in the coil are connected by an iron core. That concentrates the magnetic field and greatly increases its efficiency. When the points are

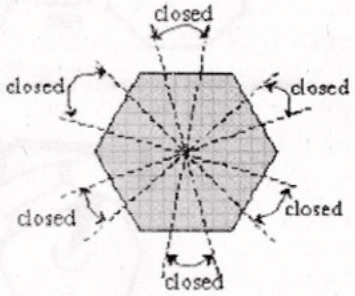
closed, there is a complete circuit, and current flows through the resistor, ignition coil and breaker points to ground. Even though the coil is grounded the instant the points close, current takes a little time to reach its highest value because it takes energy to make the magnetic field build up in the coil's primary winding, and that building field opposes the current flow from the battery. The magnetic field likes to maintain a constant strength, but as it nears its maximum strength, the rate of increase slows down so there is less opposition to current flow. Even though the field reaches its maximum strength in a few milliseconds, the fact that it does take some time means the movement of the lines of force cut across the secondary winding relatively slowly. We know from generator theory that it takes a magnetic field, a coil of wire, and movement between the two to induce a voltage into the coil. The secondary winding is the coil of wire. The building of the magnetic field is what creates the movement.

In the ignition coil, the secondary winding has thousands of loops, and a little voltage is induced into each one. Just as a generator is less efficient at low speeds and produces less voltage, the ignition coil is less efficient when the magnetic lines of force build and cut across the secondary winding slowly. A typical coil might produce about 300 volts from the secondary winding. That's not nearly enough to jump a spark plug's gap. The points have opened and current flow stops. Unlike when the magnetic field built up slowly and current flow reached maximum over a short period of time, here the open circuit forces current flow to stop instantly. The magnetic field collapses very rapidly. Since the magnetic lines of force are moving very fast, a very high voltage is induced in the secondary winding.
Credit to http://randysrepairshop.net/ *for the text in italics above.*

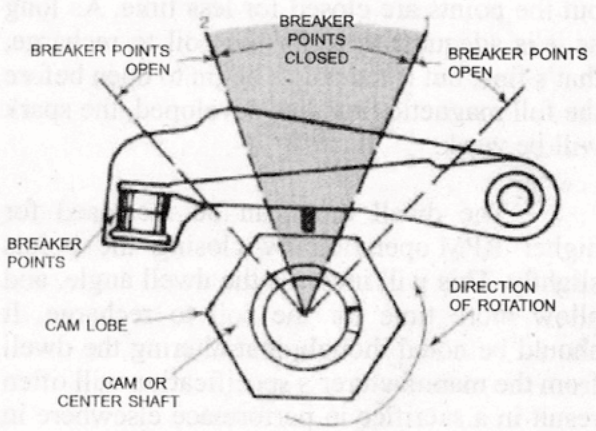
The (relatively) slow building of the magnetic field occurs during the period that the points are closed and the circuit is complete. As soon as the points open, the circuit is broken, and the magnetic field collapses extremely rapidly. As soon as the points again close, the field begins to rebuild and recharge the condenser, and continues to build for as long as the points are closed.

It is this closed period that is referred to as 'dwell.' If the dwell period is too short, the magnetic field doesn't get the chance to build to its maximum. If the dwell is too long, the points may not open enough to produce a hot enough spark.

Earlier we mentioned that the number of cylinders and the high points on the distributor shaft represent an angle of a complete circle. Let's use an 8-cylinder engine as an example. 360° (a full circle) divided by 8 (number of cylinder or high points on the distributor shaft) equals 45°. That 45° is measured from the time the points begin to open until they are just short of opening again. During this period, the points fully open, sparking and discharging the magnetic field, and then closing allowing the charge to rebuild. The recharge period – that is, the time that the points are closed – is the dwell. It is measured in a number of degrees; a portion of the 45° cycle. Normally the recharge period, the dwell (for an 8-cylinder engine), is roughly



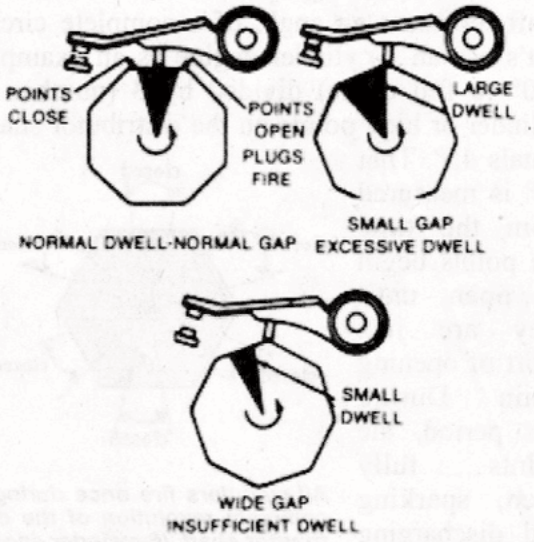
All cylinders fire once during a complete revolution of the distributor shaft. (6-cylinder engine shown.)



The angle of dwell is the portion of rotation when the breaker points are closed (shaded area.).

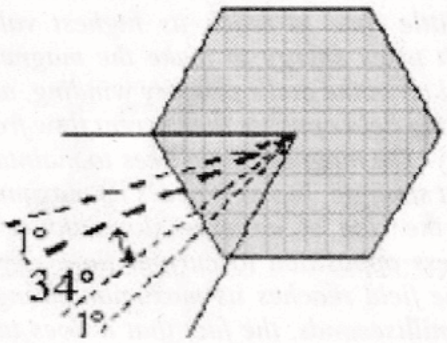
between 30° and 36°, BUT the dwell figure varies depending on the engine.

A Motors Manual (available from model year 1934 on) often lists the dwell or 'cam' angle in the tune-up specifications. The owner's manual or the service manual for the car may offer the cam angle. The dwell period can vary considerably between engines. Why is this? There is always that 45° cycle (for 8 cylinders) from opening through closed to opening again. Why then should the dwell be the same for all engines?



Let's add another factor into the mix: dwell time. The period of time of the dwell on an engine running at 1,500 revolutions per minute (RPMs) to considerably longer than an engine running at 3,000 RPMs, and longer than an engine running at 5,000 RPMs. The dwell or cam angle doesn't change at the higher RPM, but the points are closed for less time. As long as it is adequate time for the coil to recharge, that's fine, but if the points begin to open before the full magnetic field has developed, the spark will be weak.

The dwell time can be increased for higher RPM operation by closing the points slightly. This will increase the dwell angle, and allow more time for the coil to recharge. It should be noted though, that altering the dwell from the manufacturer's specification will often result in a sacrifice in performace elsewhere in the total RPM range. Increasing or descreasing the dwell angle by 2° will only result in a change of 1° in actual timing as shown in the illustration below.

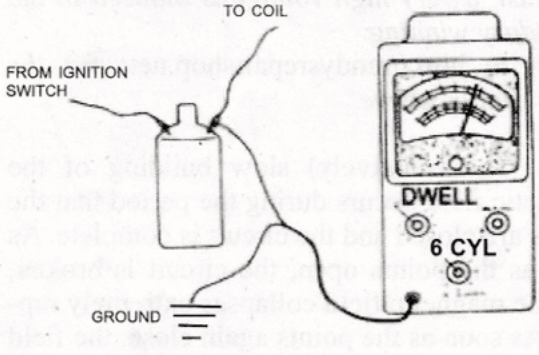


2° lower dwell means only 1° later firing time since it splits on both sides of the dwell angle.

SETTING THE DWELL

The dwell angle cannot be treated as an independent adjustment. It relies on the point gap. The point gap can be found in the same sources mentioned above: Motor's Manual, the owner's manual or the service manual. The article on points in last month's issue describes how the points are installed, dressed and adjusted.

With the points properly set, a dwell meter can be attached to the car and a cam angle/dwell angle reading read from the gauge. One wire from the meter attaches to ground and the other attaches to the distributor side of the coil (or to the terminal on the distributor where the coil connects.) Set the dials to 'Dwell' and to the correct number of cylinders. A positive ground battery may require switching of the meter's wires. If the dwell angle is too large, the point gap can be increased. If the dwell angle is too small, reducing the point gap will raise it. It



only takes a minute adjustment to the point gap to alter the dwell.

Dwell angle, point gap and the entire operation of the engine is dependent upon all parts being in good order. If the distributor is worn – the high points on the cam worn down, the center shaft bent, the bushing too loose or egg-shaped, the tension spring for the points or for the vacuum advance weights are worn or weak, or any one of a number of other problems, the adjustments that you make will not result in a predictable spark.

S.K.

NASH & LAFAYETTE

Year	Model Designation	Breaker Gap, Inch	Cam Angle, Degrees
1935	Lafayette 6.....3510	.020	38
	Advanced 6.....3520	.020	35
	Advanced 8.....3580	.017	28
1936	Lafayette 6.....3610	.020	38
	Ambassador 6.....3620	.017	28
	"400" Standard 6.....3640	.020	35
	"400" De Luxe 6.....3640A	.017	28
	Ambassador 8.....3680	.020	35
1937	Lafayette 6.....3710	.020	35
		.017	28
	Ambassador 6.....3720	.020	A

Chart compiled from Motor's Auto Repair Manual, 11th Edition, 1949 covering vehicles from 1935 to 1948.

. As mentioned, the dwell or cam angle is not a hard and fast figure. It cannot be assumed that the dwell angle for one six cylinder vehicle is applicable to another. The chart above is a compilation of data from the Motor's Manual for Nash-Lafayette. 1935 two six-sylinder engines were available: the Lafayette 6 and the Advanced 6. Despite both engines having the identical number of cylinders, and both being manufactured by Nash, the dwell angle varies by 3 degrees. The Lafayette 6 engine is an 'L' head engine, and the Advanced 6 is an overhead cam engine.

It is best to follow the manufacturer's specifications whenever possible, but engine wear and use can alter the specifications. By adjusting the points so that they open a fraction more or less will also reflect in the dwell angle, but may result in a better running engine.

S.K.