The two questions most commonly asked about a magneto are first, exactly what does it do in the engine, and second, just how does it do it. The magneto is solely for ignition. It provides a current of sufficiently high voltage (up to 17,000 volts in a Lawn-Boy engine) to cause a spark to jump the gap between the spark plug electrodes and ignite the compressed fuel vapor at exactly the moment when the piston reaches near the top of the compression stroke. And how does it accomplish this? Following the complete cycle of the production of a spark at the plug is about the simplest way to explain it.

Permanent magnets (cast into the flywheel) revolve around the rest of the magneto as the flywheel rotates. Magnetic flux around the magnets passes through the coil winding in the primary coil. This will induce a flow of current through the primary coil. The crankshaft also is rotating as the flywheel rotates. A cam on the crankshaft opens and closes breaker points. These breaker points, when closed, completes the circuit of the primary coil. When the cam opens these breaker points, the circuit of the primary coil is broken and the current ceases to flow. A condenser connected across the points prevents arcing and burning of the points. The condenser also absorbs (drains) current remaining in the primary circuit. A secondary coil is wrapped around the primary coil. The rapidly collapsing current in the primary coil induces a flow of current in the secondary coil of extremely high voltage. The more rapid the collapse, the higher the voltage. The secondary coil is connected directly to the spark plug through the high tension lead. It is the current with high voltage from the secondary coil which jumps the gap between the spark plug electrodes, causing the spark which ignites the fuel vapor in the combustion chamber. In a one-cylinder engine, this cycle is completed once for every rotation of the crankshaft.
IGNITION WIRING DIAGRAMS – D-400 SERIES

PRIMARY CIRCUIT
Current flow in the primary circuit is obtained from the flow of magnetic flux lines through the lamination assembly as the magnet sweeps past the ends (heels) of the coil laminations.

The circuit is completed through the closed breaker points and grounding.

SECONDARY CIRCUIT
The secondary coil is wound around the primary coil.

When the breaker points open, the current in the primary coil collapses. The collapsing magnetic field induces a flow of current through the secondary coil.

The current in the secondary coil is sufficient to jump the gap between the spark plug electrodes, causing the spark which ignites the compressed fuel mixture in the cylinder.

The secondary current is then dissipated through grounding at the magneto and grounding at the plug.

EASY TO SEE WHY IT IS NECESSARY TO HAVE:
1. CLEAN POINTS - dirty, pitted or corroded points will retard the flow of current in the primary coil because they make a poor electrical connection.

2. PROPERLY ADJUSTED POINTS - improperly adjusted points do not permit them to open at the right instant to interrupt the current at its peak. When you adjust the breaker point gap, you are "timing" the engine.

3. GOOD CONDENSER - a weak condenser can cause arcing across the breaker points and will not permit a rapid enough collapse of the flux in the primary coil to induce enough voltage in the secondary coil for a good spark.

4. CLEAN AND PROPERLY GAPPED SPARK PLUG - a dirty or improperly gapped plug cannot provide a good spark for ignition.

KNOWING THE PART EACH COMPONENT PLAYS IN PRODUCING IGNITION, IT'S
"D" 400 series engines have a twin spark ignition system. This system provides two different spark timings, one for starting and one for running. For starting, the spark-advance flyweight holds the cam in a position so that the igniting spark occurs at 6° of crankshaft rotation before the piston reaches the top of its upward travel. When the engine reaches approximately 1000 RPM, centrifugal force moves the flyweight out, rotating the cam to a position so that the igniting spark now occurs at 26° of crankshaft rotation before the piston reaches the top of its upward travel.

Push small end of spark, advance flyweight toward crankshaft. Hold tension of spring against crankshaft and return flyweight to original position. Allow smaller end of flyweight to drop down. Remove pin and spring.

Note: In reassembly, make sure the smaller end of the flyweight is on the keyway side of the crankshaft.

The assembly of the spark advance is correct when the small hair pin is horizontal to the flyweight and the spring loaded rod moves freely.

**BREAKER POINT ADJUSTMENT**

To check or adjust point gap, place spark advance cam only on crankshaft. Check and adjust points as described. See Breaker Point Adjustment on page 6-5.
COIL HEEL ADJUSTMENT

The air gap between the coil heels and the flywheel magnets is .010 inch. To check this gap or to reinstall a coil insert a strip of .010 inch non-metallic shim stock between the coil heels and the flywheel magnets.

NOTE

Use Lawn-Boy Air Gap Gauge Part No. 604659.

IGNITION PROBLEMS

Bad spark plug
Terminal missing from spark plug (high tension lead) cover
Lead wire pulled out of coil
Cracked insulation on lead wire
Poor condenser or coil

Burned or pitted breaker points
Worn breaker point fiber rubbing block
Poor connections
Frayed insulation on wires
Weak flywheel magnets
Spark advance assembly damaged or installed incorrectly

BREAKER POINT SPRING, TERMINALS
ASSEMBLY SEQUENCE

The correct assembly sequence on the condenser terminal is breaker arm spring next to condenser body, then the 2 terminal connectors secured by a nut. See illustration. Correct assembly provides the proper tension (pressure) on the breaker arm wear block and breaker cam. If the breaker arm spring is reassembled next to the nut or between terminals excessive pressure is applied to wear block resulting in incorrect point gap.

SHUT-OFF GROUND WIRE

When trouble shooting magneto problems make sure the shut-off ground wire terminals DO NOT touch the armature plate. If this happens, the electrical system will be permanently grounded. Also, the shut-off switch may become inoperative if dirt and grime collects between the shut-off switch screw and the shut-off blade. Insulation on ground wire should also be examined.

ASSEMBLY TIPS

When inserting the high tension lead wire, coat the end of the insulated portion with OMC Adhesive "M" Part No. 318535 for a water-proof connection. Twist lead wire into threaded coil casing as far as it will go. On early models only, bend clamp to secure high tension lead to coil.
MAGNETO ADJUSTMENTS

BREAKER POINT ADJUSTMENT
D-400 SERIES

To check point gap .020, rotate crankshaft until wear block is centered on lobe of cam. **MOVE CRANKSHAFT TOWARD CARBURETOR AND HOLD IN THAT POSITION.** Loosen breaker base screw, and place gauge between points. Pivot breaker base until gap is correct. Retighten breaker base screw and recheck gap to make sure breaker base has not shifted. Check breaker points every 40-50 hours for wear or pitted condition. Replace as required.

**NOTE**
When setting the breaker points, the top of the crankshaft should be held toward the carburetor to eliminate the effect of tolerance accumulations and wear. Remember, the feeler gauge must be clean. After correct setting, the breaker base screw must be secured tightly.

**CONDESER**

It is not necessary to replace a condenser every time the breaker points are replaced. Usually, the risk of condenser failure decreases as the condenser is used, and most condensers will last the life of the engine. However, if the condenser is thought to be the cause of an ignition problem, it must be checked for capacity, shortage or leakage and resistance.

The condenser should be heated to approximately 100 DEG. F. before testing. This will eliminate the possibility of the condenser checking okay when cold, but failing under normal operating conditions. For example, a leak will show up much better at high temperatures.

**NOTE**
Do Not Over Heat. The expansion may crack some of the insulation.
A simple method of heating a condenser is holding it in your hand for a few minutes or placing it in an oven with a thermometer control. The condenser clamp is the ground connection for the condenser and therefore, must be secured tightly.

**BURNED OR PITTED BREAKER POINTS -** Always replace badly burned or pitted points. Do not file points.

**WORN BREAKER POINT FIBER WEAR BLOCK** - Sometimes the fiber wear block which contacts the cam can wear down enough so that the breaker arm is shorted through the crankshaft. If this has happened, replace the breaker points. On later model Lawn-Boy engines, part of the breaker arm has been cut away to minimize the possibility of shorting.

**POOR CONNECTIONS** - Check wires for good connections, especially at condenser.
COIL
The magneto coil is seldom the cause of ignition trouble. Therefore, other possible causes should be checked thoroughly before the coil is examined. A simple method of testing the coil is by checking the spark gap on the spark plug or through the use of a spark plug tester. Ignition spark must be of sharp blue color and should jump at least 1/4-3/8 inches to ground consistently. This method of coil checking is not fool-proof and therefore, an approved coil tester is recommended in many cases. With this equipment a primary and secondary continuity check can be made as well as coil output and polarity.

IGNITION TESTING EQUIPMENT

IGNITION TESTING
Every servicing dealer should have a test unit on hand for checking coils and condensers. There are several good makes on the market.

The following test data covers only coils and condensers. The Lawn-Boy Capacitor Discharge (solid-state) Module cannot be checked with conventional test equipment. Voltage applied to it will most likely result in damage. Therefore, the best way to check it is to use a standard test spark plug and observe for sufficient spark, or compare it to a CD Module which is known to be good.

TEST SPARK PLUG
A simple but effective means for checking ignition spark may be obtained using Special Tool Part No. 426814.
SPARK PLUG -- D-400 AND D-600 SERIES

There are many different types of spark plugs intended for various applications and therefore, it is extremely important that the correct plug be used in an engine and torqued correctly. Correct torque is 12 to 15 ft lbs.

LAWN-BOY recommends the use of the Champion CJ-14 spark plug because of its ability to supply, continuously, a hot spark for uninterrupted combustion.

Plugs should be cleaned and gapped every 25 hours of operation.

SPARK PLUG ANALYSIS

Normal

Few combustion deposits present on plug. Electrodes not burned or eroded. Insulator tip color, brown to light tan. Insulator dry - providing engine was not excessively choked prior to plug removal.

ANALYSIS: Ignition and carburetor in good condition. Plug is correct heat range - clean and replace, or install new Champions of same heat range.

Wet Fouling

Insulator tip black. Damp oily film over firing end. Carbon layer over entire nose. Electrodes not worn.

ANALYSIS: (one or combination) Carburetor adjustment too rich. Weak ignition outputs. Air filter badly clogged. Wrong fuel mix (too much oil). Plug too cold for type of work. Hi-speed carburetor adjustment not set with engine under full cutting load.

Oxide Fouling

Electrodes not worn (may be covered with deposits). Insulator nose choked, splattered, or "peppered" with ash-like deposits. In extreme cases, deposits are thrown against and adhere to the side electrode. Flying deposits may also wedge between the electrodes momentarily or permanently shorting out the plug.

ANALYSIS: Excessive combustion chamber deposits. Clogged exhaust ports or muffler. Use of non-recommended oils. Wrong fuel mix.

Overheated

Electrodes burned. Insulator tip color, light grey or chalk white.

ANALYSIS: (one or combination) Carbon clogged exhaust ports or muffler. Dirty or clogged cylinder fins. Lean carburetor setting. Dull blade or heavy cutting causing engine overloading. Wrong spark plug heat range (too hot).

NOTE

Prior to installing a new plug always check plug gap. Plug gap is no longer pre-set at factory.

The correct gap for LAWN-BOY engines is:

D-400 SERIES ... .025"  D-600 SERIES ... .035"

NOTE

DO NOT CLEAN PLUG IN SAND BLASTER.

SERVICE BULLETIN REFERENCES