Hints and Tips - Coil Polarity

The Question:

Someone has written to me with a query about ignition coils asking which low-tension terminal (+ or -) on the coil should be connected to the distributor contacts on a positive earth car. All my coils are marked SW (ignition switch) and CB (contact breaker). There are various numbers on the base of the coils and also a letter, some are L, others R or LO.

Obviously somebody thought that polarity matters otherwise why mark the terminals at all? Are coils different for positive and negative earth cars or should positive earth cars connect the SW terminal to the distributor?

The real problem in this case is engine cutting out due to coil overheating, could this be caused by incorrect polarity?

The Answer

There is a good reason spark coils are wound the way they are. Positive and negative ground coils have their windings thrown (wound) in different directions in relationship to each other. Spark coils are always wound in such a manner so that the high tension connection on the coil goes negative when the distributor points open. This means that the rising potential at the spark plug is also negative. Why would one want an operating condition where the rising pulse from the spark coil is negative?

The center electrode in a spark plug runs hotter than its grounded electrode. Since electrons can be striped off of a hot electrode more readily than off of a cold electrode, the center electrode is always made the negative electrode. The result of this choice is that the arc across the spark plug electrodes can be initiated at a slightly lower potential when the center electrode is the negative electrode. (In this manner, thermionic emission aids in the establishment of the initial discharge.) As Pete observed, his vehicle will run with either a negative output or a positive output from the coil. I have operated my TD with the incorrect high tension polarity from the spark coil for over 20 years. So it requires a slightly higher potential to strike the arc - big deal. This polarity reversal occurred when I converted to negative ground so I could more conveniently install contemporary electronic devices. I never bother to fit the 'correct' negative ground spark coil.

After the arc (plasma) has been initiated, the circuity oscillates and the thermionic emission consideration becomes meaningless.

Conclusion -- The coil will work and your MG will run no matter what you do. If you want to be sure that you have the slightly more desirable initial negative output then pay close attention to the polarity of the primary connection. The primary terminal marked (-) must connect to the (-) terminal on the battery.

Best wishes, Carl Cederstrand

The Positive and The Negative

The policy of rotating spark plugs from top to bottom has been practiced by mechanics and pilots for many years. It is common knowledge in the industry that the bottom plugs are always the dirty ones and the top plugs are the clean ones. By periodically switching the plugs from top to bottom, you get a self-cleaning action from the engine whereby the dirty plug placed in the top is cleaned, while the clean plug replaced in the bottom gradually becomes dirty. Based on this cleaning action, a rotational time period must be established.
Due to the ever-increasing cost of aircraft maintenance and a desire to get the maximum service life from your spark plugs, the following information is offered on the effects of constant polarity and how to rotate plugs to get maximum service life.

The polarity of an electrical spark, either positive or negative, and its effects on spark plug electrode erosion has long been known, but has had little effect on spark plug life in the relatively low performance engines of the past. However, in the later, high performance, normally aspirated and turbocharged engines where cylinder temperature and pressure are much higher, the adverse effects of constant polarity are becoming more prevalent. As you can see in the picture comparing spark plug wear, when a spark plug is installed in a cylinder that is fired negative and is allowed to remain there for a long period of time, more erosion occurs on the center electrode than on the ground electrode, and when a spark plug is fired positive, more erosion occurs on the ground electrode than on the center electrode. From this we can see that a periodic exchange of spark plugs fired positive with those fired negative will result in even wear and longer spark plug service life.

To get a polarity change, as well as switching the plugs from top to bottom, the following rotational sequence is suggested. First, when removing the spark plugs from the engine, keep them in magneto sets. After the plugs have been serviced and are ready to be reinstalled in the engine, make the following plug exchange. For six cylinder engines, switch the plugs from the odd number cylinders with the plugs from the even numbered cylinders. For example, switch 1 with 6, 2 with 5, and 3 with 4. On four cylinder engines, you must switch 1 with 4, and 2 with 3. During the following operating period, each plug will be fired at reverse polarity to the former operating period. This will result in even spark plug wear and longer service life. This rotational procedure works equally well on all four and six cylinder Lycoming engines except four cylinder engines equipped with the single-unit dual magneto. This is a constant polarity magneto and the only benefit to be gained by rotating the plugs is the reduction of lead deposit built up on the spark plugs when a rotational time period is established and followed. Another exception occurs on a few four cylinder engines where one magneto will fire all of the top spark plugs and the other magneto will fire all of the bottom spark plugs. If the plugs are rotated as previously recommended, a polarity change will result but since the plugs do not get moved from top to bottom, no self-cleaning action by the engine will occur. This may result in the necessity to clean the bottom plugs at regular intervals as these are always the dirtiest. For those engines with magnetos which fire all top or bottom spark plugs the choice of rotating plugs to change polarity or to obtain bottom to top cleaning action must be made by the aircraft owner or the A & P mechanic.