NEWSLETTER

Carb Heat

Hot Air and Flying Rumours

Vol 29 No. 7

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July-August 1999

Countdown to Oshkosh

Inside:

Next Meeting:
Saturday July 17, 1999 10:00 AM
EAA245 Chapter Hangar, Carp Airport

Presentation by our very own
Dick Moore
Workshop Tool usage

My trip out to Calgary and Penticton meant I missed our June meeting. I understand that close to 30 members attended the Oshkosh briefing. Thanks to Dick Moore for an excellent job filling in during my absence.

While I flew commercial to Calgary, I drove the Trans Canada highway to Penticton and return. This drive never ceases to amaze me with its endless beauty; a stunning new vista with virtually every bend in the road. As I drove through the mountains I found myself imagining the flight I was unable to complete back in 1993. While the weather when we arrived in Calgary was wet, it steadily improved, and on this occasion, a successful passage by light plane was definitely possible.

My wife fell in love with Penticton, so I guess it goes on the list of potential retirement locales, although I am not as sure, as it would be difficult to leave so many friends behind, no matter how attractive the locale.

Flyin Breakfast August 7/8

A reminder that our annual flyin breakfast, headed up by **Stan Acres** is scheduled **for Sunday August 8th**. I am sure Stan can count on your support for **the setup on Saturday August 7th**, as well as the event on Sunday.

Canada Day July 1st

Our annual display at the National Aviation museum was a big success this year. **Curtis Hillier** and his dedicated band of workers manned the inside display table. A special thank you to all who helped in this area.

Russell Holmes planned to display his Kitfox on its trailer, but where weather did him in last year; this year it was a recalcitrant trailer hitch. Next year, I expect to see Russ flying in.

The outside display of aircraft include Luc's RV-6, Wolfgang Weichert's RV-6; Dale Lamport's RV-6A, a beautiful RV-4 from Brampton owned by a good friend, Keith Fletcher, as well as Jim Laing's CH-200 C-GUPY which retains the registration of the Volksplane he donated to the museum. Congratulations Jim on completing your test flight period. It was good to see Dale and Kathy Lamport assisting as they did last year; even though they are not chapter members.

Arrow Scrapbook Available

Camped right in front of the Avro Arrow display at the Museum was **Peter Zuuring**, director of the **Arrow Alliance** who had talked to us about his research on the true fate of the Avro Arrow last September.

Peter's long awaited **Arrow Scrapbook**, which handsomely documents the findings of his more than fourteen months of research was on sale. Ken MacKenzie, Lars Eif, and I were quick to purchase our own autographed copies. For our $40.00 we got a fascinating 265 page look inside a National dream and ultimate tragedy. I highly recommend this book to all who have any interest in the Avro Arrow.

Oshkosh Thoughts

With less than three weeks left until the annual pilgrimage to Oshkosh, it looks like I will be making my last cross country in an RV-6 for a while. The goal is to find a buyer for Luc's beautiful mount who is prepared to pay in genuine American greenbacks. I will certainly miss flying such a versatile machine. On the positive side, I have decided to make a real attempt to rebuild my Lancair 235; so hopefully I won't have to drive to Oshkosh for more than a year or so. It seems much harder to find the energy after a long day at work, than in the past, but the motivation should be strong. Wish me luck.

This last flight promises to be like old times with Nigel Field in his Varieze, and Francois Marquis in his gorgeous Ferrari red Lancair 235 joining me along with a recently completed Velocity from Embrun. Now if I could just find a light weight, portable air conditioner for the tent; it promises to be a real scorcher this year.

Saturday July. 17th Meeting

Our next meeting continues our Summer Saturday series at our chapter clubhouse at Carp Airport. The topic will be **Workshop Tool usage**. **Dick Moore**, our operations director will be demonstrating the use of our new **Finger Brake** and outlining important aspects of using the **Lathe** and or **Milling** machine. This will be of particular interest to current or potential full members.

Note that there will not be a meeting in August due to the Flyin Breakfast on August 8th.

On **September 16th** we will resume our normal third Thursday at the National Aviation Museum, Bush Theatre meetings.

Gary

Mag Check
by *Mike Busch*

This article originally appeared in the May 1999 issue of Cessna Pilots Association Magazine.

Magnetos are frequently-neglected items, probably because they're so reliable and our engines have an "extra" one. But mags need regular maintenance, and the consequences of neglect can be devastating. AVweb's Mike Busch explains how mags work, what preventive maintenance they require, what can go wrong with them, and what to do about it.

My recently-completed annual inspection of my Cessna T310R included a considerable amount of scheduled maintenance work, as well as several significant unscheduled items (i.e., nasty surprises). One of the scheduled maintenance items this year was 500-hour magneto maintenance, which is a relatively significant item on a twin because there are four mags to do.

Many owners aren't aware (and an alarming number of A&Ps conveniently forget) that both Bendix (TCM) and Slick (Unison) mags need a minor tune-up every 100 hours and a major disassembly inspection, cleaning, lubrication and adjustment every 500 hours. The 500-hour major maintenance is frequently neglected, and it's not unusual to see an engine reach TBO without the mags ever having been removed. The fact that mags can continue to function in the face of such neglect is a testament to their inherent reliability.

As we'll discuss shortly, mag performance deteriorates significantly if this routine maintenance isn't done. This usually shows up as hard starting, high-altitude misfire, and/or general deterioration of engine efficiency. Occasionally, the result is much more serious (e.g., deafening silence).

What Makes 'Em Tick?

A magneto is a self-contained ignition system that converts mechanical rotation into high-voltage pulses that are used to fire the spark plugs, and does so without the need for external power from a battery or electrical system. For years, magnetos have been the ignition system of choice for aircraft engines because they continue to function perfectly even in the face of a total electrical failure.

The Rotor

The term "magneto" comes from the permanent magnet rotor which is spun by the engine's accessory gearing. In a four-cylinder engine, the rotor turns at engine RPM -- in a six-cylinder engine, it turns 1.5 times crankshaft speed. This magnetized rotor, together with the primary winding of the magneto's coil, function as a specialized alternator which generates alternating current flow in the primary as the rotor turns. Each full rotation of the rotor induces two waves of electric current in the primary coil, of opposite polarity.

The amount of energy generated in the primary coil winding is a function of how rapidly the magnetic field across the primary changes. This varies with two things: how strong the rotor's magnet is, and how fast it turns. Big mags (like the Bendix S-1200) generate more energy than do little ones (like the Slick 6300 or the Bendix D-3000 dual-mag) because their rotors have bigger, more powerful magnets.

As a mag gets older, its rotor gradually loses magnetism, so its ability to generate energy weakens. Fortunately, the rotor can be re-magnetized and this is typically done at major overhaul of the mag. Equally important as the strength of the rotor's magnetism is its rotation speed. Like any alternator, mags generate their maximum energy when turning at full operating speed, and put out a lot less energy at slow RPMs (such as idle).

The Coil and Breaker Points

The primary winding of the coil consists of 200 turns or so of heavy-gauge copper wire wound around a laminated iron armature. One end of the coil is permanently grounded to the case of the magneto, while the other end is connected to a set of cam-operated breaker points similar to those used in automotive distributors in the pre-electronic-ignition era. Normally, the breaker points are closed, grounding both ends of the primary coil and allowing current induced by the rotor magnet to flow continuously around and around the coil. This current flow produces a powerful magnetic field in the coil's iron core.

At the moment of ignition, the magneto's cam opens the breaker points, interrupting the flow of current in the primary coil winding, and causing the magnetic field in the coil's core to collapse quite suddenly. The collapse of the core's magnetic field induces a large voltage spike in the primary, which may be as high as 200 or 300 volts. Now, that's enough voltage to give you a nasty jolt if you grabbed a hold of the magneto's low-tension terminal while the engine was running, but it's not even close to enough voltage to jump the gap of a spark plug. That's where the coil's secondary winding comes in.

The secondary winding of the coil consists of a very large number of turns of very fine magnet wire -- perhaps 20,000 or so wound around the same core as the primary. One end of the secondary winding is grounded, while the other end is hooked to the high-tension terminal of the coil. The two coil windings act as a special sort of step-up transformer. Since the secondary winding has something like 100 times as many turns as the primary, the 200- to 300-volt spike produced in the primary when the breaker points open induces a voltage 100 times as large in the secondary: 20,000 to 30,000 volts. Now that is enough to produce a nice, hot spark!

The Capacitor

One little fly in this ointment has to do with what happens at the breaker points at the moment they're opened by the cam. Since the points are being opened by mechanical action of the cam, it's obvious that the process of point opening isn't exactly instantaneous. During the first microseconds that the cam is opening the points, they're still so close together than the 200-volt spike in the primary coil winding can arc across them.

Such arcing at the breaker points is a Bad Thing for two reasons. First, arcing causes a tiny amount of metal transfer from one breaker point to the other, and if left unchecked would cause the points to erode and pit quite quickly. Second, arcing causes the magnetic field in the coil to collapse more slowly, resulting in a lower voltage induced in the secondary, and therefore a weaker spark at the plugs.

To solve these two problem, mags are equipped with a capacitor connected across the breaker points. Here's how it works. At the moment of point opening, the initial voltage spike charges the capacitor for 50 microseconds or so instead of arcing across barely-separated breaker points. By the time the capacitor is charged, the cam has separated the points far enough that the 200- or 300-volt spike in the primary coil cannot jump the gap.

The result is a nice, predictable waveform and much longer-lasting points.

The size of the capacitor is critical. If it's too small, arcing won't be effectively suppressed. On the other hand, if it's too large, the coil's field will collapse so slowly that the magneto's voltage output will be seriously reduced.

The Distributor

The high-voltage pulses produced by the secondary winding of the coil must be directed to the spark plug of each cylinder in sequence. The magneto accomplishes this by means of a mechanical distributor. The high-tension lead of the coil is connected to a rotating wiper electrode on a large distributor gear that turns at half crankshaft speed inside the mag's distributor block, passing in close proximity to individual electrodes connected to the four or six or eight spark plug lead wires.

The distributor block is made of insulating (dielectric) material capable of withstanding tens of thousands of volts. It is essential that the inside of the distributor block remain scrupulously clean and dry. The slightest bit of contamination -- moisture, oil, or dirt can impair the dielectric properties of the block and allow internal arc-over between distributor block terminals, causing engine misfire...particularly at high altitudes. Once such arc-over occurs, it tends to leave a carbonized track in its wake, facilitating subsequent arc-over events.

The P-Lead

The "P-lead" is a wire that runs from the ungrounded end of the magneto coil's primary winding to the cockpit ignition switch. (The "P" stands for "primary.") Its purpose is to allow the ignition switch to disable the magneto by grounding the hot side of the primary. As long as the P-lead is grounded through the ignition switch, the breaker points are unable to interrupt the primary current flow, making the mag incapable of generating a spark.

The P-lead is normally a 16-gauge shielded wire, with the shield grounded to the magneto case. Shielding of the P-lead is essential, because an unshielded P-lead acts as an antenna that radiates the ignition pulses generated by the magneto and creates interference with aircraft radios.

Broken P-leads are a frequent problem, since the lead is exposed to engine heat and vibration and air blast. A broken P-lead center conductor results in a dangerous "hot mag" condition in which the ignition switch is unable to shut off the magneto. A broken P-lead shield usually causes radio interference which disappears when he particular mag is shut off with the ignition switch.

Mag Tune-Up

Tuning up the magnetos for optimum performance involves two sets of adjustments: internal timing (point gap and E-gap) and external timing (or "timing the mag to the engine"). The internal adjustments require that the mags be removed from the engine and opened up, and should be performed at least every 500 hours of operation. External timing is performed with the mags mounted to the engine, and should be checked every 100 hours or at annual inspection.

Internal Mag Timing

There are two internal adjustments that must be set correctly for a magneto to operate properly: point gap and "E-gap."

The point gap should be set first. To do this, the drive shaft of the magneto is rotated to the position at which the cam has opened the breaker points to the maximum extent. Then the point gap is measured with an ordinary wire-type feeler gauge. The points are then adjusted until for the specified gap (normally about .018 inch for Bendix mags).

Once the point gap is correct, the "E-gap" can be set. First, rotate the rotor slowly until you can feel a "magnetic detent." This is known as the "neutral position" of the rotor. Now, with a timing light ("buzz box") attached across the breaker points, rotate the magneto until the points just start to open. The number of degrees of rotation from neutral to point opening is called the "E-gap" and needs to be set to a specified value (e.g., 10 degrees +/- 2) so that the points open exactly when magnetic field induced in the coil by the rotor is at its maximum. On the big Bendix S-1200 and dual Bendix D-2000/3000 mags, this adjustment is made by loosening the screw that attaches the cam to the rotor shaft, and rotating the cam until the "E-gap" is correct. Other magneto models have non-adjustable cams, so the "E-gap" adjustment is made by adjusting the breaker points. These adjustments are essential to ensure that the magneto is able to generate enough energy to produce a hot spark. If the "E-gap" drifts out of limits, the mag will continue to work but the spark it produces will be weak.

External Mag Timing

Once these internal adjustments have been made, the magnetoes must be mounted on the engine and ignition timing set correctly. To do this, one of the spark plugs in the #1 cylinder is removed and the crankshaft rotated until the #1 piston is at top-dead-center position. Once this TDC position is established, the crankshaft is rotated to the specified firing position (typically 20° before TDC).

Using an ignition timing light ("buzz box"), each magneto is adjusted so that its breaker points open precisely at this desired firing position. The adjustment is made by loosening the two magneto base clamps and rotating the entire magneto on the engine mounting pad until the points just start to open (as shown by the timing light connected to the mag's P-lead terminal). The base clamps are tightened and the timing is re-checked.

External timing is critical to proper engine operation. It should be within a degree or so of spec, and should be re-checked every 100 hours.

Bumping The Mag

When ignition timing is checked routinely at 100-hour or annual inspection, it's not unusual to find that it has drifted off-spec by a degree or two. The drift can be in either direction. Wear on the rubbing block causes the points to open later, retarding ignition timing. Erosion of the breaker points themselves (due to arcing, etc.) causes the points to open earlier, advancing the timing.

The usual procedure is to loosen the magneto hold-down clamps and to "bump" the mag a little bit to bring the timing back to specifications. This procedure is fine so far as it goes. The problem comes when mechanics fail to keep track of how far the magneto timing has been "bumped" in the course of successive inspection intervals. You see, the same factors that cause the external timing to drift (rubbing block wear and point erosion) also cause the magneto's internal timing to drift away from the correct E-gap, which degrades the quality of the spark that the mag produces.

So, while it's certainly okay to bump the mag timing by one or two or even three degrees to correct timing drift, drift beyond that should be considered a "red flag" that it's time to pull the mag and re-adjust the internal timing. Naturally, unless you keep track of each time you bump the mag timing, you have no way of knowing the cumulative amount of timing drift that has occurred since the E-gap was last set. (One more reason for including more detail in your maintenance log entries.)

Getting Started

Once the engine is running, a properly-adjusted magneto does a fine job of providing the required ignition. Starting the engine is another matter altogether.

There are two major obstacles to starting a magneto-ignition engine. For one thing, our electric starters crank the engine at very low speed typically 10 to 20 RPM. But, a magneto is not capable of generating enough energy to fire a spark plug at less than, say, 150 RPM (referred to as the mag's "coming in speed"), and even at that speed, the spark would be marginal at best.

Then there's the problem of timing. Magneto-ignition aircraft engines have fixed ignition timing, typically at something like 20° BTDC (before top-dead-center). This setting is a compromise between takeoff and cruise (where we'd really like the ignition timing to be advanced even more) and idle (which would be a lot smoother if the timing was retarded). But there's no way that an engine is going to start with ignition timing like this. If you crank an engine at 20 RPM and a spark plug fires 20° before the corresponding piston reaches the top of its compression stroke, the engine will backfire, guaranteed.

So, to have a prayer of getting our engine started, we need to do two things: (1) figure out a way to coax the magneto into generating enough energy to fire the spark plugs at slow cranking speeds, and (2) figure out a way to retard the spark enough to ensure that the engine won't backfire during cranking.

Two rather different methods are commonly used to accomplish these things -- one mechanical, and the other electrical. Which you use depends on what kind of airplane you fly. Most Cessna singles use the mechanical method (impulse coupling), while most Cessna twins and many Beech Bonanzas use the electrical method (retard breaker).

Impulse Coupling

The impulse coupling is an extraordinarily clever mechanical solution to the starting problem. It's a mechanism that's contained within a hub that attaches to the magneto's drive shaft and is driven in turn by the engine. Here's how it works.

When the starter cranks the engine, a spring-loaded flyweight in the magneto drive hub catches on a stationary stop pin mounted on the magneto case. This stops the magneto shaft from turning further. As the engine continues to turn, an impulse spring in the hub is wound up for 25° to 35° of engine rotation (the "lag angle") until a drive lug on the coupling body trips the flyweight, disengaging it from the stop pin. At this point, the wound-up impulse spring "snaps" the magneto through its firing position at a speed much faster than cranking speed.

This has precisely the two effects desired: the ignition timing is retarded (by lag angle of the coupling), and the magneto rotor is turned fast enough to generate a decent spark. Neat trick, eh?

Once the engine starts, centrifugal force causes the spring-loaded flyweights in the impulse coupling to retract so that they no longer catch on the stop pin. When this happens, the engine drives the magneto directly and timing returns to its normal setting of 20° BTDC or whatever.

It's easy to tell whether or not your engine uses impulse couplings. If you hear a loud "snap" when you pull the prop through by hand, and if you hear "snap snap snap" just before your engine stops at shutdown, then you have impulse couplings.

Some installations provide an impulse coupling on both magnetos. Others use an impulse coupling on only one mag, and employ an ignition switch that grounds out the P-lead of the non-impulse mag during the start.

Because impulse couplings have moving parts, they need to be disassembled and inspected carefully during each 500-hour magneto maintenance cycle. In addition, there have been a lot of Airworthiness Directives against impulse couplings in recent years -- both Bendix and Slick -- and these have to be taken very seriously. An impulse coupling failure in-flight can result in total engine failure, and some failure modes can cause parts of the impulse coupling to drop into the engine gearbox, causing catastrophic destruction of the engine. So be sure your impulse couplings are not worn excessively and that all applicable ADs are complied with.

Retard Breaker

An alternative solution to the starting problem is the retard-breaker magneto. This was first pioneered by Bendix in its "Shower Of Sparks" system, but nowadays both Bendix and Slick make retard-breaker mags.

As the name implies, the retard-breaker mag makes use of a second set of breaker points to generate a spark at retarded ignition timing during engine start. Generally, only the left mag has the extra breaker points, and starting is done with the right mag disabled in this scheme.

While the extra set of points solves the problem of retarding the spark for starting, the fact remains that the magneto is still turning too slowly to generate the energy required to fire a spark plug. To deal with this problem, aircraft battery power is converted into pulses by a starting vibrator -- basically, a little electric buzzer -- and those pulses are fed to the magneto coil's primary winding via the P-lead, inducing high-voltage pulses in the secondary winding that do contain sufficient energy to fire the spark plug.

This scheme has some advantages. It eliminates the mechanical risks associated with worn impulse couplings. It also produces easier starting because the spark plug fires a dozen times or so during each ignition event, rather than just once. (Hence, the "Shower Of Sparks" trademark that Bendix uses for this system.) Finally, it saves a little weight.

There is one big disadvantage of the retard-breaker ignition system, however: You can't start the engine with a dead battery. Don't bother trying to hand-prop a twin Cessna unless you're simply looking for a new and different kind of aerobic workout.

SlickSTART

In 1997, Unison Industries introduced a product called SlickSTART, which is really a solid-state replacement for the old starting vibrator used in the retard-breaker system. Interestingly enough, however, Unison got the SlickSTART approved for use with both TCM/Bendix mags as well as their own Slick mags, and also got approval for use with impulse-coupling-equipped mags as well as the retard-breaker kind. In fact, just about the only engines that the SlickSTART is not approved for are those that use the Bendix D-2000 or D-3000 dual magneto.

The SlickSTART produces a much hotter spark for starting than either a starting vibrator or impulse coupling, and is far better at firing carbon-fouled plugs. (Note that nothing can help if the plugs are lead-fouled, other than removing and cleaning the plugs.)

Is it worth retrofitting your engine with the new SlickSTART system? If your engine is hard to start or you operate in frigid temperatures, it's an excellent idea. On the other hand, if you're not having any problems with starting, there's probably no reason to make the change.

Flying High

Starting is one phase of operation that is especially challenging to the magneto ignition system. Flying at high altitudes is another, particularly when we're talking about turbocharged engines and flight-level flying.

When a magneto generates a high-voltage pulse, we want that pulse to create a spark inside the cylinder by jumping the air gap between the electrodes of the spark plug. What we don't want to happen is for the spark to occur anywhere else -- such as inside the magneto distributor block, or inside one of the ignition harness wires, or between the ignition harness wire and a nearby piece of the engine, etc. Such an undesirable spark is called an "arc-over" and results in what we call "misfire."

To ensure that the spark occurs where we want it to occur, we must make sure that the spark plug represents "the path of least resistance" for the high-voltage pulse generated by the magneto. If we set our spark plug electrode gap to 0.018 inch, for example, and make sure that any place else in the ignition system that the spark could jump is a whole lot bigger than 0.018 inch, then we can be pretty certain that the spark will occur at the spark plug electrodes.

Here's the problem: Air is a pretty good electrical insulator, but its insulating capability (dielectric constant) varies with pressure. The higher the pressure of the air, the better it insulates -- the lower the pressure, the easier it is for electricity to pass through it (in what we call a spark).

High-Altitude Misfire

Imagine a turbocharged airplane departing a sea level airport. At the moment of ignition, the air pressure in the vicinity of the spark plug electrodes is quite high (since it has just been compressed by the piston), so it's a pretty good insulator. The air pressure inside the magneto is outside ambient, which is considerably lower, so that air isn't nearly as good an insulator. But the air gaps inside the magneto are at least several tenths of an inch wide, a great deal longer than the spark plug gap. So the spark plug gap is the path of least resistance and that's where the spark occurs.

Now suppose this airplane starts climbing up to a cruising altitude up in the flight levels. The air in the vicinity of the spark plug remains at high pressure, thanks to the compressive effects of the turbocharger and the compression stroke of the piston. But the air pressure inside the magneto decreases with altitude, making it easier and easier for arc-over to occur there. At some altitude, the breakdown voltage inside the magneto becomes lower than at the spark plug electrodes, and "high-altitude misfire" begins to occur. Let me tell you from firsthand experience that this will really get your attention!

If you ever experience high-altitude misfire in flight, the first thing you should do is throttle back. This will reduce the combustion-chamber pressure in the vicinity of the spark plug electrodes, and make it easier for the spark to occur where it's supposed to occur. Your next move should be to descend to a lower altitude, thereby increasing the air pressure inside the magneto and thereby raising the breakdown voltage.

When you get back on the ground, you should probably have a mechanic open up the mags and inspect the inside of the distributor blocks for carbon tracking. Such conductive deposits produced by previous arc-over events can make it much easier for subsequent arc-overs to occur, and should be cleaned off.

Preventing Misfire

There are basically two fundamental strategies for preventing such high-altitude misfire: make it easier for the spark to occur where it's supposed to, or make it harder for it to occur where it's not.

One obvious way to make it easier for the spark to occur where it's supposed to (at the spark plug electrodes) is to tighten up the spark plug gap. The specs say that a RHB32E spark plug should be gapped to between 0.016 and 0.019 inch. I gap mine to 0.016 inch to gain increased margin against high-altitude misfire. Of course, the gaps increase as the spark plugs wear, so it's important to clean and re-gap the plugs on a regular basis: at least every 100 hours, and perhaps even every 50 hours if you have a history of high-altitude misfire.

Many operators who fly regularly at high altitude prefer to use fine-wire spark plugs instead of the usual massive-electrode type. Fine-wire plugs are more than twice as expensive, but they tend to hold their gaps much longer, so part of their cost is offset by less frequent plug maintenance. Fine-wire plugs also last a good deal longer than do massives.

How can you make it harder for arc-over to occur inside the magneto? There are two ways. One is to use magnetos that are as physically large as possible, reducing the chance of internal arc-over between the widely-spaced electrodes. For example, the huge TCM/Bendix S6-1200 mags that I use on my airplane have distributor block electrodes that are spaced 1.2 inches apart, so they're much more resistant to high-altitude misfire than the smaller Slick 6300 mags that are also approved for my engines.

The other way to minimize the chance of arc-over is to pressurize the mags by pumping bleed air from the turbocharger into them. RAM Aircraft, for example, fits pressurized Slick mags on all its TSIO-520 engines. For really high altitudes, a pressurized version of the big Bendix S-1200 mag -- the S-1250 -- is available, and used by RAM on their GTSO-520 engines used on the Cessna 404 and 421.

Pressurized mags are a mixed blessing, however. Although the pressurization is an effective way to eliminate the high-altitude misfire problem, it also creates a new problem -- internal contamination of the magneto -- particularly when flying through moisture (rain or clouds). As a result, pressurized mags need to be opened up and cleaned a lot more frequently than do non-pressurized ones. In fact, Slick Service Bulletin SB1-88A recommends a teardown and internal inspection of pressurized mags every 100 hours (compared with 500 hours for non-pressurized mags).

The smaller Slick pressurized mags also do not produce nearly as energetic a spark as do the big TCM/Bendix S-1200s. While they certainly produce an adequate spark, they have less margin for misadjustment (E-gap drift, etc.).

If you do have pressurized mags installed, make sure they receive frequent maintenance, and change the filter in the magneto pressurization line often. TCM has an improved large green pressurization line filter (p/n 653386) that is more effective than the small, clear ones at removing moisture from the pressurization air before it reaches the magneto. RAM Aircraft also sells an improved filter. Both of these filters provide a sump and drain line for moisure.

Putting It All Together

Every 100 hours or annual, check ignition timing (i.e., external timing) with a magneto timing light. If the timing has drifted off by more than a degree, "bump" the mag to return the timing to specifications. Keep track of how far the timing has been "bumped" at each inspection, and in which direction. Cumulative "bumping" of more than about three degrees is good reason to remove the mags from the engine and readjust the internal timing, even if the normal 500-hour maintenance interval hasn't yet arrived.

Every 500 hours, remove the mags from the engine for major maintenance. For TCM/Bendix mags, it's easy enough to perform the 500-hour inspection and adjustment procedure locally, and replace the wear-prone parts (points, carbon brush, and distributor block). For Slick mags, consider simply exchanging the mags at 500 hours for reconditioned units from Unison. (Slick tends to discourage field maintenance of their mags by setting parts prices high and offering very reasonable prices for overhauled-exchange units.) If your engine uses impulse couplings, be sure to inspect them very carefully for excessive wear, and make sure all ADs have been complied with.

If hard-starting is a problem, consider installing the SlickSTART solid-state unit, which will work with almost any installation except for the TCM/Bendix dual-mag.

If you fly at high altitudes (especially if turbocharged), you need to take extra precautions to prevent high-altitude misfire. Clean and gap your plugs frequently (every 50 to 100 hours) and keep the gaps at the low end of the allowable range. Consider using fine-wire spark plugs. For high-altitude operations, you should be using either the big TCM/Bendix S-1200 mags, or pressurized Slicks with the big green TCM or RAM line filters to keep moisture out of the mags.

For even more information about magnetoes, I recommend John Schwaner's book "The Magneto Ignition System."

Classifieds

Place your ads by phone with Charles Gregoire @ 828-7493 or e-mail to cbg@nortelnetworks.com
Deadline is first of the month.
Ads will run for three months with a renewal option of two more months.

Irving Slone is looking for someone to accompany him in a Pietenpol to assist in flying it to Oshkosh this coming summer. Oshkosh 99 is featuring the 70th anniversary of the Pietenpol. A large turnout of Pietenpols is expected, (20 so far) and will be parked together in the showplane area. A multi-media presentation on the legendary designer and his aircraft will be presented at the theatre of the woods. If interested call Irving Slone at
722-0359 (res) or 230-2100 (office) 03/99

A limited number of WearCheck engine oil analysis (SOAP) kits at $28 each. Price includes analysis for 17 wear elements, additives and contaminents, percent fuel dilution, water concentration and diagnostic recommendation, plus debris examination (if present). SOAP has been used for at least 30 years and is the most widely accepted method of internal engine health monitoring and can often pinpoint impending engine failure.
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Cessna 140 engine baffles $50.00
MS24566-4B pulley NEW $8.00ea.,
Large HF radio (ex Otter), good ham project $25.00, Large Radar Screen (possible coffee table???) $25.00, Beech 18 oil cooler, new (possible rad??) $50.00, 6 Gal. J-3 wing Tanks (2) $200.00, Box of VW engine Parts (possible 1/2 vw project) $50.00, New autopilot , 12 volt trim servos and stuff $25.00, Air Path and Pioneer 3 1/8 compass cores $75.00/ea, Shark Fin pitot tube 24volt, new in box $25.00, Beaver U/L Lotus float rigging (spreader bars, etc.) $25.00, Continental prop. spacer (O.E.M. alum) $50.00
Tim Robinson 613-824-5044 03/98
75714.2136@compuserve.com

McCauley Metal Prop, 70-38 for a continental A65 or C85.
Jim Robinson 613-830-4317 01/98

Garry's Parts Bin

50 ft. 1/8" galvanized aircraft control cable, 7x19, MIL-W83420D
Dynafocal engine mount
Wheel pants $100.00
Oil, break-in, 12 litres, Shell, Esso
Wing Tip Nav Lights
NACA air inlets
Elevator trim assembly
Primer
Valves, Fuel selector
Valve, Parking brake
Accelerometer (G-meter) 2.25 inch
Oil cooler - Continental 6cyl.
CHT guage and probe
Lycoming, Accesory case, dual take-off adapter for hydraulic and vacuum pumps.
Piston rings for Continental E-185 or O-470.
Light weight starter & bracket for Lycoming O320 or O360.
two Lycoming engine-driven fuel pumps $50.00 each

Control wheel yoke assembly from Piper Tomahawk

Engine, VW 1600cc completely rebuilt
Garry Fancy (613)-836-2829 01/98

Articles Wanted

I am always interested in receiving submissions for this, your Newsletter. You may bring articles to the monthly meetings or mail information to the post office box or send me an e-mail attachment at:
cbg@nortelnetworks.com 01/98

EAA Chapter 245 Membership Application

NEW:___ RENEWAL:___ DATE:__/__/__
EAA NUMBER:......................
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OTHER:____________________________

Annual Dues: January 1st to December 31st. (porated after March31st for new members/subscribers).
Associate Member ____: $30.00 Newsletter plus Chapter facilities
Full Member: ____: $55.00 Newsletter, hangar, workshop, tiedowns
Newsletter subscriber ____: $30.00 Newsletter
Note Associate and full members must also be members of EAA's parent body in Oshkosh WI, USA

Make cheque payable to:
EAA Chapter 245 (Ottawa)
Mail to - P.O. Box 24149, 300 Eagleson Road, Kanata, Ontario, K2M 2C3