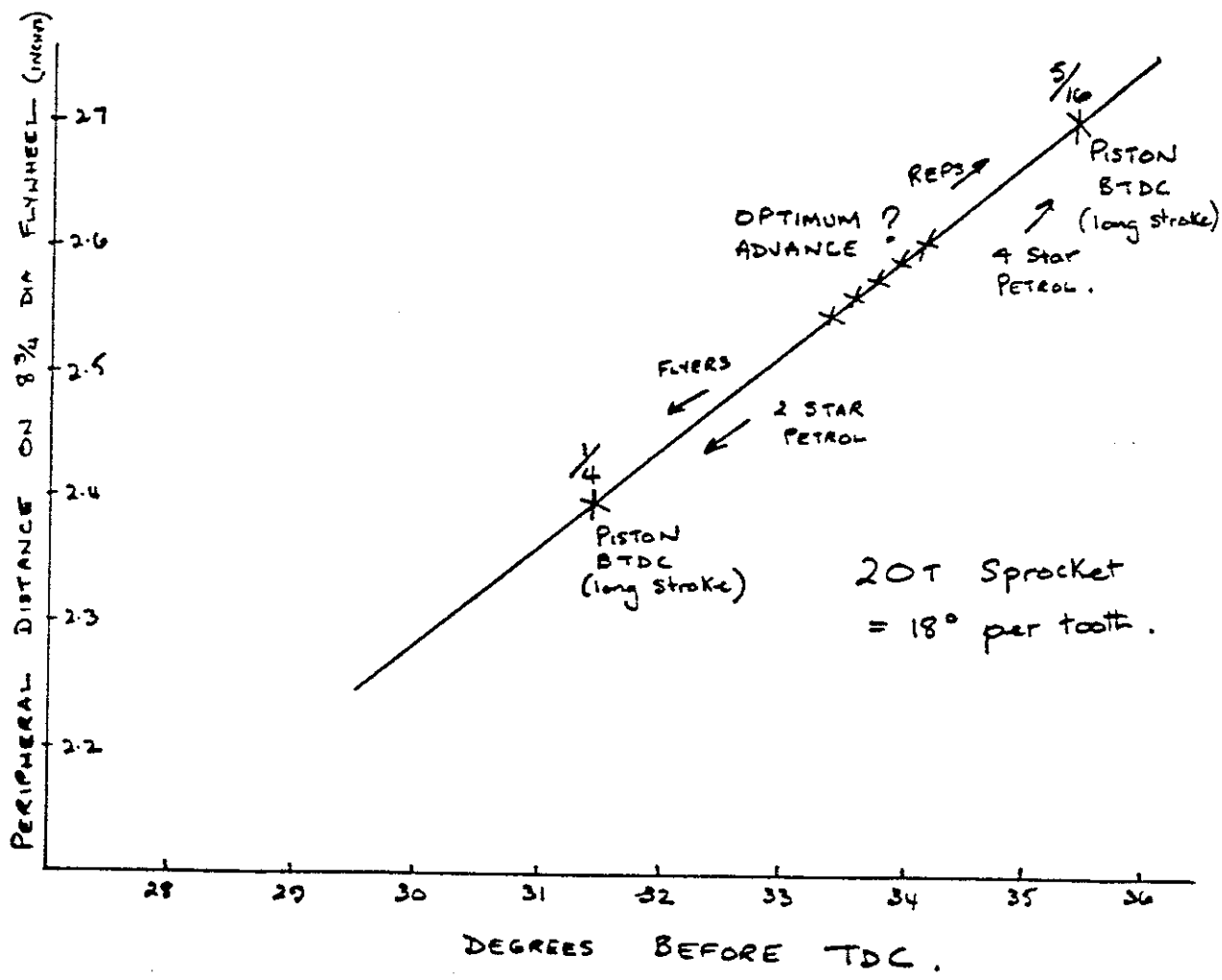
5.6 Ignition Timing



POTTY'S POINTS

Glyn Chambers

I have been asked by several members recently what is the correct ignition timing for a Scott.

The Book of the Scott is not much help—'points just fully open', 'just separated', 'fully retarded, top dead centre', or—'crankpin centre line in line with rear cylinder holding down bolt, fully retarded, points just separated', or again—'just before top dead centre, fully retarded. Pearson's book, Motorcycle Repair by A. St. J. Masters, gives five degrees advanced (must be wrong). Others have told me 5/16 inch or 34 degrees advanced.

Well, what is it? No one can give it exactly, there are so many variables: compression (the greater the compression the less advance wanted), piston and head shape, engine characteristics, and the fuel used.

Two-star fuel (low octane) is best for 99 per cent of all standard Scotts. The flame-retardent additives (mainly lead—now a dirty word) can actually slow down combustion, so that on four-star fuel you will need more advance than for two-star. My 'Sprint' does 90 mph-plus on two-star (certified). With two-star you also get less fouling of plugs and points, but don't try it in your high-compression motor-cycle or car engine—it might eat the pistons away.

The chart shows what I have found to be the optimum timing for most Scotts, and it also gives a peripheral measurement which you can make on engines with 8½ inches diameter. (Yes, I know longstroke and shortstroke engines will be slightly different, but not much.)

Timing the Scott is very easy but the first big shock you might get is from the magneto (or distributor), for to get accurate timing the spark must be evenly distributed and you will be very lucky if your mag. is as near as ±5 degrees on each side. This means that timing can vary as much as 10 degrees with a good magneto.

The point at which the spark is produced in a magneto is the moment that contact is *lost* between the points and is about the time that the maximum current is generated in the magneto or when the magnetic field is passing through the coils. To check the point at which the points open, use a half-thou shim, test meter, or fag paper, and check this against a simple home-made cardboard protractor or degree plate. You can use a bell or lamp and battery, but the contact breaker bolt must first be insulated by a paper cone.

Provided there is not excessive play in the bushes, distributors can be fixed easily by stoning one cam with care. Mags are harder to fix. First get the contact breaker to run as true as possible. Make sure that both tapers, male and female, are clean and true and that the keyway is good and does not 'ride up'. Make sure the bolt is not bent, and if this fails to get it to run true try a very gentle tap with a hammer and drift.

Now work on one cam ramp with a hand stone to get the distribution better. Racing and aircraft magnetos have far more accurate cams than standard motor-cycle magnetos. Don't worry if the contact breaker gaps vary from side to side; nominal gap is 12 thou. but 10-15 thou. is acceptable. Gaps more or less than this can affect the internal timing of the magneto (the relationship of contacts breaking to maximum magnetic flux).

Having done all this we can actually time the magneto to the engine by first finding T.D.C. (top dead centre) using a P.P.I. (piston position indicator). The P.P.I. can be a proper tool for the job or one made out of an old sparkplug and a bent bit of wire, old nail, or, in my case, a short pencil with nicks in it. Anything will do that can measure about one inch before and after T.D.C. There is too much dwell at T.D.C. for a dial guage to be accurate. You can even take off a transfer port and mark the position with a pencil about half down each way from approximate T.D.C.

Which ever method you use, mark the flywheel your distance each side of T.D.C. using a datum point (I use the base of the carb.). Half way between these two marks is the true T.D.C. Mark it.

Using the chart, measure a peripheral distance for the advance you require and, with the magneto locked at full advance, this is your timing. Repeat for the other cylinder and check by turning the engine over in a forward direction only.

THE GOOD SCOTTING GUIDE (Part four)

Brian Marshall

You will probably have noticed by now that this series of articles hasn't mentioned those peculiar two-speed machines that some of you are so fond of! There are various reasons for this, the main one being that I have no practical experience of running a two-speeder, even though I have owned 'basket-case' machines from the extremes of two-speeder production, namely a 1911 veteran and a very late example, a 1931 Sports Squirrel with four-point fixing crankcase.

Apart from this, I am inclined to the view that if you know nothing about them, you shouldn't really think about running one!

Seriously though, all sorts of people keep on telling me that I am missing out on something very special, and I am slowly coming to the conclusion that I really ought to think seriously about buying one. Perhaps in a few years time I will be in a position to write about them. Apart from the two-speed gear unit, I suppose that most other Scott knowledge will be applicable anyhow.

Enough of this rambling and back to the practical tips. This time the subject is ignition timing on magneto-equipped Scotts. The topic has been covered a few time in the past, but it is now several years since the last (and excellent) article by Glyn Chambers, so many newer members may find this of interest. In fact, the vast majority of Scotts are remarkably tolerant of ignition setting, but having it spot on does make quite a difference to starting, performance, slow running and so on. Generally speaking, running retarded has little harmful effect. The bike will just be gutless and maybe run rather hot. Running with too much advance, however, can be catastrophic. The resulting 'detonation' is not as obvious on a two-stroke like the Scott as it is on a four-stroke engine, particularly to those owners without a sympathetic ear for an engine in distress, or to those who wear a modern crash helmet, which muffles mechanical noise. I am convinced that many cases of crank breakage are due to the effects of detonation, and it can also hole pistons, particularly under racing conditions.

Reference to *The Book of the Scott*, and advice from other owners can be bewildering and misleading, and I am wary of any instruction which refer to setting the timing with the magneto on full retard. What is happening on full advance is of far more importance than a largely irrelevant full retard setting, and because so many magnetos have been modified over the years, you never know just how many degrees of advance are available from the lever. So I always set the timing with a fully advanced magneto.

The other important thing to remembers is that the more efficient your engine is, the *less* advance it needs. Very, very few engines are

now in 'standard' condition, what with rebores, proprietary pistons, modifications to porting, better petrol, and so on, the settings recommended in old Scott literature can be totally ignored!

Generally speaking, shortstroke Flyers, with their lower compression ratios, are happy at 5/16" Before Top Dead Centre, and longstroke Flyers, TT Reps and Sprint Specials at 1/4" B.T.D.C. (My very high compression Sprint Special is a hybrid longstroke/shortstroke engine, with ported pistons etc., and it requires only 3/16" B.T.D.C.).

I would not advise exceeding 5/16" B.T.D.C. on any engine. If your engine needs more than that to run properly, something is wrong and needs investigating.

On several occasions when I have been asked to set up the timing on an engine I have found that I was wasting my time because the magneto was clapped-out, so do make absolutely sure that it is spot on. I personally I am allergic to Lucas magnetos and much prefer B.T.H. and Bosch mags., but that is just my pet foible and I am sure that magneto specialists will disagree with me. Rotated by hand, on the bench, I like to see and hear a big blue cracking spark that will jump well over 1/4" and I am instantly suspicious of a magneto if it will only produce yellowish or inaudible sparks, especially if they won't jump a good gap. Another important point is to remember that a magneto sparks as the points are just beginning to separate, repeat, just beginning to separate.

The magneto must also produce its sparks at 180° apart, and worn slip rings or bent armature shafts, worn bearings etc., can play havoc with this requirement. If you find that the points gap is very different at each cam, or if it varies between revolutions, you have got a problem that is probably best entrusted to a mag. specialist.

If truth be known, even a good 180° twin mag. can be anything from 175° to 185° between firing points, and only aircraft or racing magnetos are much better.

Right, if you have got a good magneto, points gaps correctly set, and you know what setting you are after, the procedure is as follows:

1. Adjust magneto chain tension to a nicety, remembering that a too-tight chain will damage the magneto bearings. A slack chain won't do much harm, but it does retard the timing slightly.

2. Remove spark plugs. Trace the lead from No. 1 pick-up to its spark plug and bring the piston in that cylinder up to Top Dead Centre. This is most easily achieved with a pencil or wooden dowel down the plug hole, especially if a series of notches are cut into the pencil for visual reference.

A more accurate tool is a dial gauge with extension rod down the plug hole. You will inevitably lose accuracy at T.D.C. due to a small amount of 'dwell' as the piston stops and changes direction. This is even more noticeable in a worn engine. The technique to avoid the dwell problem is measure a given distance B.T.D.C. and exactly the same distance After T.D.C. True T.D.C. is then half way between those two points.

I then wedge the engine at T.D.C. with a little hard rubber sash window wedge between the flywheel and bottom union nut on the carburettor. (Recheck T.D.C. after positioning the wedge.) With a sharp centre punch I then mark the flywheel rim at a fixed reference point such as the straight transverse crankcase flange which runs each side of the induction stub. The wedge can then be removed; and now T.D.C.

can be instantly located at the roadside without any dismantling in the future.

The next step is to turn the flywheel BACKWARDS to the requisite point B.T.D.C. This can be measured down the plug hole, but a more accurate method is to measure an equivalent distance round the flywheel rim from your T.D.C. mark.

Unless your flywheel has been turned down by quite a bit it is safe to assume that it has a diameter of 8¾", and a little geometry can be applied, using the knowledge that 5/16" of advance equates to 34° of advance. To save you the mathematics, this is equivalent to a distance of approx. 2.7 inches on the periphery of the flywheel.

So, turn your flywheel *backwards* by 2.7 inches from T.D.C., mark it again with a centrepunch, and you now have what I consider to be maximum safe advance. The flywheel can also be marked at 2.4 inches from T.D.C. This equates to approx. ¼" of advance, and YOUR correct timing figure will be somewhere between these two points, at a point to be decided from your engine's characteristics and from experiment. Wedge your engine again, but this time at your new 'instant reference point for ignition timing'.

We now have to set the magneto at No. 1 firing point, remembering again that this is as the points are just beginning to separate. I personally do not separate the mag. sprocket from its taper as I consider that jarring it free does more harm than good to the armature shaft and bearings. I therefore disconnect the mag. chain instead, trying up the ends with wire so that they don;t drop out of reach.

With the magneto now 'free', turn it FORWARDS until No. 1 points just begin to separate. This can be easily judged by a piece of cigarette paper between the points. Very gently tug on the paper as the magneto is turned *forwards*, and the paper comes free just as the points open. The magneto can then be wedged at that setting with another of those little rubber wedges between the sprocket and the body of the mag.

Make absolutely sure that the mag. is on full advance during this procedure, and if necessary check that the advance/retard control cable adjustment is not restricting the movement of the cam-ring.

Practice this finding of the opening of the points a few times if necessary, and a pencil mark on the sprocket, lined up with a mark on the body of the mag. will soon show you if you are achieving the same point every time.

Once you are happy that both mag. and engine are wedged at the correct settings, just replace the mag. chain and that's it! (Don't forget to remove the wedges.)

It all sounds a bit complicated I know, but I think it is the safest method, and once the flywheel is marked it is very quick and easy.

If your engine doesn't to run now, and you get loud bangs in the exhaust, you have probably timed it 180° out, so just switch the plug leads round and you should have a runner!

Remember this is not an exact science like it is on a modern bike engine. Apart from any deficiencies in the magneto due to wear, your cranks may not necessarily be exactly 180° apart either, and just watch that mag. chain thrashing around too!

So the Good Scotting Rule No. 4 is:

GET YOUR IGNITION TIMING RIGHT, AND DON'T RUN WITH TOO MUCH ADVANCE.

JIM'S JOTTINGS

Jim Best

With regard to the letter headed 'Reverse Scotting' in the April issue of *Yowl*, the obvious reason for an engine running backwards during running or starting is over-advanced ignition timing. To have an engine with that amount of advance is asking for a broken crank. An engine ticking over at, say, 800 r.p.m. is asked, in a split second, to run in the opposite direction; it doesn't take any imagination to see the loading on the engine components and the poor old weak crankpins. The signs of over-advanced ignition are the tendency, already mentioned, for the engine to run in reverse and also for the kickstarter to kick back so violently that the kiskstarter pawl jumps out over the retaining spring.

I am amazed at the way our 'Bible', the *Book of the Scott*, explains the way to set the timing. It mentions things like seeing the piston at T.D.C., putting bits of wire down the plug hole, only checking the timing on one cylinder, and retarding the ignition. I don't run my Scotts with the ignition lever in the retarded position. After setting the timing with the lever retarded, how much advance would I be giving it when I advance the lever? It can't be the same on Lucas, Fellows, BTH and Bosch magnetos.

In timing the engine on one side and not checking the other cylinder, you are presuming that the cam ring lobes are at 180°, the points open the same amount, and the cranks are set at 180°. (I will explain this in an article I intend to write on Scott cranks.)

I have used the following procedure, as given to me by my father, to set the timing for the last 30-odd years and I have never had a broken crank or an engine running in reverse.

I have a plunger clock and I made an adapter out of an old sparking plug to hold the clock. The idea is to screw it into the plug hole to give the position of the piston. I fully advance the magneto and the set piston .350" before top dead centre. I insert a .0015" feeler gauge between the points, turn the magneto in the right direction until the feeler is just released, then push the sprocket on the taper and tighten. Then I check again to make sure that nothing has moved during tightening. Now I insert the clock in the opposite plug hole and check the timing on this side. It will not be the same, owing to the problems I mentioned earlier. It may be retarded, say .320", or advanced, say .380". If it is retarded, or at .350", that is all right; if it is advanced the sprocket will have to be removed and this cylinder set to .350". The most advance you can have is .350" on the more advanced cylinder.

A bit of time spent getting the timing right will save a lot of time replacing a broken crank.

More on Ignition Timing

Dear Tom,

May I belatedly join in the discussion on ignition timing. My very first bike was a 1937 500cc Squirrel, bought in 1957. It soon became clear that there was something wrong with the magneto, and an examination revealed that there were deep grooves in the slip ring. A new slip ring and brushes soon cured the problem, but that went the same way within about a month. Another one did the same thing. At this stage I decided to Araldite the grooves and everything was then smoothed off using strips of emery cloth. I only mention this because I seem to remember reading in these pages that it is something which should *not* be done. Well, it worked for me, and it was still working when an accident wrote off the bike and put me into hospital. Now, back to the timing. Brian Marshall's idea of not removing the mag sprocket is sound advice. I found that the problem was not getting it off, but getting it back on again without upsetting the timing. I have never timed any bike on full retard, and have always worked at 32 degrees for the Scotts, although I can't remember where I got this figure from.

So, the procedure is to find T.D.C. using your favourite method, and here again Brian's idea of marking the flywheel is excellent; my current bike, a 1947 Flying Squirrel has a chisel mark on the flywheel as a datum. Now reverse the engine through 32 degrees, either using a measurement of the flywheel, or by mounting a cardboard protractor on the mag sprocket. Remove the mag chain, adjust the mag to points just opening and fit the chain back on the nearest tooth. Now this will almost certainly move the armature one way or the other. You now bring the points back to just opening using the advance/retard lever and then mark the lever. At this stage I can't agree with Brian that the slack in the chain will correct bad timing. Using my current bike as an example, the mag sprocket has 20 teeth, therefore, if the timing is half a tooth out (the maximum), it would be mistimed by nine degrees, which is not insignificant. This brings me to the point made by Dave Thomas (October 1994) who states that the ignition lever position is not critical. Once the ignition is set correctly, I tend to agree with him. Again, using my own bike as an example. there seems to be about 15 degrees of movement of the cam ring. On a normal four-stroke twin, this would equate to 30 degrees of engine movement and would be about right. On our engines, of course, it only equates to 15 degrees and if some of this has been used up in getting the timing correct, then it doesn't leave much retardation for starting etc. Personally, I have never found this to be a problem.

I have to say that the above is based purely on my own bikes. Whether Scotts had special mags with extra advance/retard because they ran at engine speed, I don't know. Perhaps someone could enlighten me.

By the way, if there is anyone out there in the Louth, Lincolnshire, area, please make contact.

Tony Kitching,
Louth, Lincolnshire.