LAVERDA

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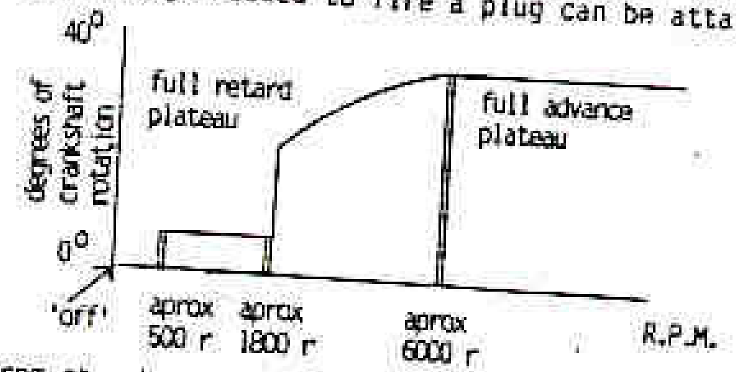
IGNITION TUNING ON LAVERDA ENGINES USING BOSCH TRANSISTOR IGNITION

The basic problem with all the models using the Bosch ignition system is accurate matching of all the parameters of the two or three entirely seperate ignition systems on the machine.

The obvious part is that as the ignition trigger passes the impulse (or pick-up) a minute voltage is generated and 'triggers' the amplifierto produce the spark. However this in itself would not provide any means of advancing the spark. Inside the ignition amplifier is a circuit which senses the 'rise time' of the 'triggering' voltage and at a preset level starts to advance the spark. The advance 'curve' is a straight line,up which levels out, (see diagrams)and the amplifier 'knows' the engine speed (and hence the amount of advance necessary) by sensing the voltage and the 'rise time' of that voltage in order to release the spark at the correct point along the advance curve for the r.p.m. at that instant. Quite a simple task for a transistor circuit which can perform this function much more accurately than the mechanical (centrifugal bob-weights) system it replaces. The other advantages being the superfast switching time of transistors allowing the voltage in the ignition coil(s) longer time to build up, and because of the very fast rise time possible with this system, there is much less chance of any short circuilts on the H.T. circuit (fouled plug, over-rich mixture, wet plug caps and leads etc.) draining off the energy before the very high voltage needed to fire a plug can be attained.



A TYPICAL ADVANCE CURVE
(for no particular engine)

A

From the above diagram it is obvious that at 500 rpm the ignition point climbs onto its fully retarded plateau (say 6° BTDC) from its non running (off) position. Now,when the engine rpm rises, the rise time of the voltage (from the pick-up) and the voltage level itself also rises until it reaches the predetermined level and so 'tells the amplifier to start the climb up toward full advance (1800 rpm on diagram A).

As the rpm rises so the amplifier carries on advancing the spark until (at 6,000 revs on diagram A), it levels off again and will continue to provide the spark at the same time right on up to maximum rpm. (Above 6,000 rpm all engines have a natural tendency to, in effect advance due to the extra 'swirl' of the fuel-air mixture and the speed at which the flame front travels through the mixture.

This simple system becomes a problem when 2 or more seperate systems are incorporated in one engine. Obviously all the seperate ignition systems must advance absolutely together to ensure that the ignition timing is the same on each cylinder at all times.

There are several methods that can be employed to ensure this and the one you use would depend on the equipment you have at your desposal. The obvious way would be to measure the pulse voltage from each pick-up and to adjust one or more of the following parameters (which all have an effect on the ignition firing point and/or the start of the climb along the advance curve); to ensure that each pick-up produces the same voltage at a particular engine speed.

The adjustable variables may include (depending on the model):-

1. The air gap between the pick-up and the trigger.
2. The position of the pick-up back plate itself.
3. The angle of the pick-up in relation to the trigger and
4. The relative positions of the pick-ups to one another.

There are also several other 'variables' which we will come to later!!

Use of a stroboscope is ideal for checking the final full advance point, and it is also possible to check that the two or more cylinders start to advance at the same engine rpm. However, because of the surge in the rpm that occurs when one amplifier advances it is likely to 'pull' the other amplifier systems up onto their respective curves and give a false impression of matching accuracy. Checking the full advance point of each cylinder against one another has similar draw backs because of the fact the 'leading' cylinder will level off on its 'full advance plateau'.

This levelling off of the advance curves has been taken as 'the big triple smoothing out as it cameon cam'. Although there is obviously a cam effect it is very much exaggerated by the fact that the ignition timing is finally the same on all three cylinders as the trailing amplifier(s) catch up!!

B

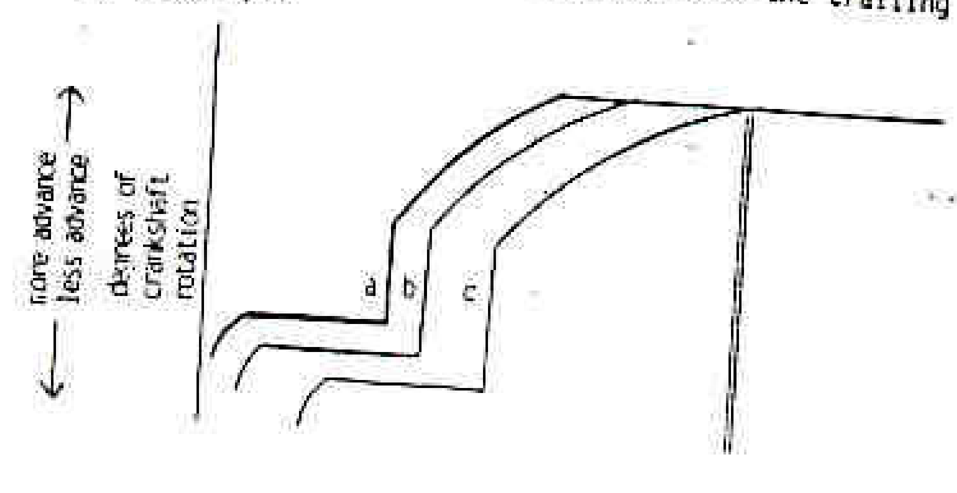


Diagram B is intended only to illustrate the theoretical curves. As will be seen, the positions of these curves along the 'rpm' axis is dependant on the culminative effects of several variables. There is an 'overlap' of effects in that each particular variable will have, to a greater or lesser extent, an effect on this curve.

From diagram B it can be seen that cylinder A will start its curve around 1,000 rpm whilst cylinders B and C follow at 1,600 and 2,500 respectively. For any given engine rpm you could have each cylinder firing at a differen point B.T.D.C. up till just above 6,000 rpm. When it all levels out.

This difference in ignition timing has been and is the root cause of several Laverda 'problems' including vibration on all models (500's + all triples) (ii) Flat spots (iii) Poor pick-up from low rpm (iv) General Lack of performance (v) Erratic tick-over on all models - even Montjuics!!

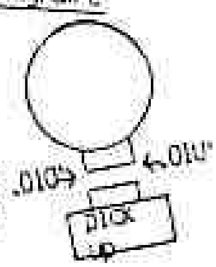
Fortunately, because of the consistency in Bosch ignition components, there is a relatively simple way to ensure accurate matching of all aspects of ignition timing on machines using more than one pick-up and amplifier system, without recourse to expensive test equipment.

Taking a 120° triple as an example:-

1. Ensure a correct T.D.C. on left cylinder.

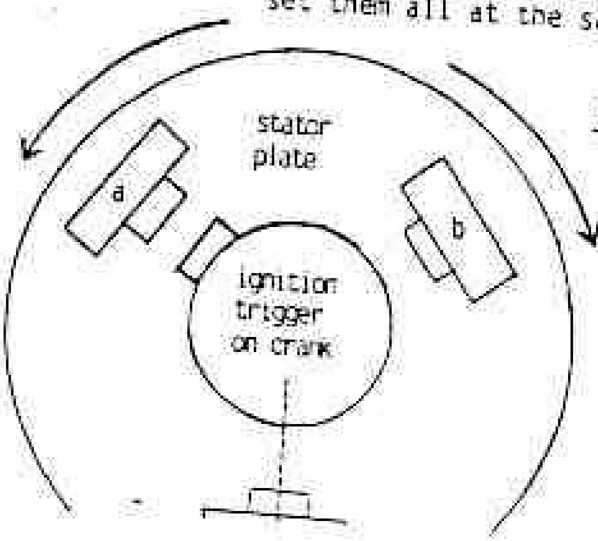
2. Set the air gap on the left pick-up to say 10 thou (or manufactures recommendation) and ensure that it is dead square on to the trigger by checking the gap from both sides rather than along the length of the trigger (see diagram C).

Diagram C



3. Run engine on strobe to check FINAL full advance point for left cylinder (move backplate to adjust if necessary) keep gap correct.

4. Having established correct orientation of the back plate, check (by whatever means you prefer) that all the pick-ups are at 120° to one another. A convenient method is with a divider (from a school geometry kit!) placed on the tip of the raised lines in the middle of the pick-ups to ensure that the pick-ups are all equidistant from one another and hence at 120° to one another, and set them all at the same air gap ACCURATELY.



120° Ignition on late triples (Diagram D)

a, b + c are the impulse generators or pick ups. The pick-ups can be moved in and out on 'Axis A', they will also pivot slightly in their mounts. The whole plate moves for major adjustment.

a = left
b = right
c = centre

The start of the climb onto the advance curve is dependant mainly on the air gap between pick-up and trigger. The closer the gap, the earlier the start up the advance curve. Very small changes in the air gap will have pronounced effects on the ignition advance curve. (With some amplifiers, 2 thou could make 400 revs difference to the start of the curve.

Applying this to all models several tuning tricks become possible, such as moving the advance surge up or down the rev range to suit a particular rider or riding condition (a slightly later rise would suit someone who spent a lot of time 'pottering' in town traffic, whilst a slightly earlier rise would help 'pull' the engine through the awkward change from pilot to main circuits on bikes used for more spirited riding. Montjuics will tick over at 800 rpm if both cylinders are timed right (the problem being one cylinder dropping off its full retard plateau at low revs and stopping the engine).

Even early 180^0 triples can be drastically improved by matching the air gaps on both pick-ups - consider the slight movement on the stator plate and the approximate 8 thou diametric clearance on the starter case bolts and it is obvious that careful matching of the two gaps can easily be achieved and, bearing in mind that a differential of just 2 thou can make 400 + rpm difference to the advancing point, it is well worth the effort involved.