

### 9.3 Tuning Notes and Data

## TUNING HINTS AND TIPS FOR SCOTT POWER-PLUS MODELS

*This article, originally published by The Scott Motor Cycle Co., was kindly forwarded to us by George Reeves.*

The Scott Power-Plus Engine although suitable for touring and general work, is actually of a racing type and further tuning for speed or special events amounts to little more than careful attention to details.

It is, of course, essential that the engine should be in perfect mechanical condition, and if any doubt exists, it should be thoroughly overhauled, and examined in accordance with the very complete general instructions given in the "Book of the Scott".

As a guide to what work is likely to be necessary in such an overhaul, and to avoid the risk of any of the work having to be done over again, it is advisable that the various tests be carried out for crankcase compression, air leaks, etc before dismantling.

### Engine

During this overhaul the Engine should not only be cleared of carbon, but every internal part should be polished scrupulously clean, and should be carefully polished with a smooth file or scraped, but on no account should the contours of the ports, etc., be interfered with.

Assuming that the pistons are a good fit, they should be closely examined for high spots (or small bright patches), which can with advantage be eased with a very smooth file.

Special attention should be given to the sides of the piston deflectors, which should not bear on the cylinder walls.

Piston rings should be an easy fit in their grooves and should be replaced if a gap of more than .015 exists or there are indications of uneven wear at any point on the circumference.

If trouble is experienced with rings sticking in their grooves, they can be eased slightly on the upper face by rubbing with very fine emery on a surface plate: also the edges of the piston ring grooves can be very slightly bevelled with a smooth file, but this should not be necessary unless the pistons have been seized and the metal spread.

Needless to say, all bearings should be in perfect condition, and connecting rods dead true before assembling, and great care should be exercised to avoid any side pressure on the connecting rod when replacing the cylinders.

The half compression valves should be thoroughly tested for compression holding, and if there is the slightest trace of leakage they must be renewed. Leakage between the valve and the cylinder can be cured by using a copper washer at this joint.

When assembling the Engine pay particular care to the correct register of packings or jointing washers for the carburettor, transfer ports and exhaust manifold; these, of course, should not protrude beyond the faces on which they seat, whilst the faces themselves should be in perfect register.

Transfer Port Gauzes are not fitted to Power-Plus Engines.

### Carburettor: Three-jet Binks Amal

Assuming that it is perfectly clean and the throttle slide or bore of the mixing chamber not worn, the only attention concerns the jets.

The standard jet sizes for petrol, Benzol mixture or ordinary commercial fuels are as follows:—

	596cc	498cc
Pilot (nearest Engine)	36	36
Centre (compensating)	50	50
Main (furthest from Engine)	120	110

The usual racing jet sizes are (for both 498cc and 596cc):—

Pilot	35.
Centre	50.
Main	120.
Usual jets with P.M.S.2. fuel:—	
Pilot	50.
Centre	70.
Main	170 or 180.

No alteration should be made to the length of jets or to the shaping of the throttle slide. If it is suspected that these have been tampered with correct replacements should be obtained from the makers.

The above jets although generally considered the best, are not necessarily the most suitable in every case after an engine has had considerable use, or to suit special circumstances. The most accurate can therefore only be found by experience. In doing this the air lever can be disregarded except for starting purposes when it should be closed, and to obtain maximum speed, jet sizes should be increased until no further advantage can be noticed, or until a tendency to four-stroking sets in, which must, of course, be avoided.

The Pilot jet is only in action at very small throttle openings, whilst the centre jet does not come into action until the throttle is more than three-quarters open.

Correct carburation at low and medium speeds with a tendency to four-stroke only at full throttle therefore indicates too large a centre jet, whereas pronounced knocking or lack of power at slightly less than three-quarters throttle, with the sudden disappearance of these symptoms after three-quarters throttle suggests the need of a larger main jet.

### **Fuel**

It should be remembered, however, that the Power-Plus Engine has a very high compression ratio, approximately 7 to 1 and therefore has an unavoidable tendency to pre-ignition or knocking under certain circumstances.

Larger jets may reduce this, but will not necessarily increase the power output, and to obtain the best results it is highly advisable, if not an actual necessity, to use special fuels such as Ethyl or a mixture of Racing Shell and No. 1 spirit (the latter in proportions found best by experiment — probably about 1-3). If obtainable P.M.S.2. fuel is of still further advantage for special work. If a Benzol mixture is preferred, the ordinary commercial mixtures will be found little better than No. 1 spirit, and the following proportions are advised:—

Pure Benzol and Aviation petrol in equal quantities.

The fitting of Twin Floats to the Carburetter (as on "Sprint Specials") has no effect on the normal performance, but avoids the risk of starving during violent or sustained acceleration.

### **Magneto Timing**

The normal timing is the same as standard with other models (fully described in the "Book of the Scott"), but a trifle faster timing may occasionally be of advantage, provided the machine is very carefully handled, otherwise damage to bearings etc., is almost certain to result. The Power-Plus engine is very sensitive to the ignition control, and this should be used continuously to suit varying conditions.

### **Sparking Plugs for Racing Work**

K.L.G. 356 Plugs are most suitable, but care should be taken to avoid oiling up, as they are very susceptible to this except at full throttle. A good plug for general high speed touring work is the Champion Aero, or alternatively Lodge H.1.

To avoid oiling up when using special racing plugs the engine should be warmed up first on a low temperature type such as the Champion No. 7. For sprint racing, where a quick get-away is essential, it is also a good tip to remove the crankcase doors beforehand, and extract any excess oil from the wells.

### **Starting**

To make a quick start, the Carburetter should be liberally flooded if the engine is cold, but not if the engine is hot. In the latter case, the petrol should have been left turned off until the very moment of starting.

For a running start, second gear should be engaged and both the half compression and clutch lifted together. Drop the clutch lever first and hold the half compression until the engine fires, when the clutch should be momentarily released to enable the "revs" to pick up.

An instant change is then made into low gear. Usually, the air lever should be closed for starting and the throttle opened only just enough to obtain maximum suction.

With the engine hot, however, it may be better to leave the air lever open. The ignition should be at least three-quarters retarded for starting, but quickly advanced as soon as the engine fires.

### Lubrication

For racing use only Castrol R. The approximate oil setting with the Pilgrim Duplex Pump is, for long distance racing, 20 drops per minute in each side when the engine is running at moderate speed on the stand.

The machine should be tried out over a half-mile stretch and the crankcase oil level inspected. The setting is correct when this level is just below top of oil well at bottom of crankcase.

Castrol XXL is quite suitable for fast touring, but for sustained speed, it does not provide the same margin of safety against momentary seizure.

The very best oil setting can only be found by experiment, and the safest guide is the presence of smoke from the exhaust, which should be noticeable when opening up suddenly after decelerating, or when operating the magneto cut-out at medium speeds. If the auxiliary cylinder wall lubrication system is fitted, this should be used on all occasions when the engine is pulling abnormally hard and in consequence, the pump setting can be a trifle less.

When cylinder wall oiling is not employed a little mineral Castrol XXL added to the petrol and, of course, thoroughly mixed, is an added safeguard. About  $\frac{1}{4}$  pint per gallon is ample.

### Exhaust System

The T.T. Replica Exhaust System is considerably more efficient than the touring type at maximum "revs".

If silencers must be used, their internal baffles must be dispensed with if possible, or failing that the centre hole at the rear end considerably enlarged. If an open exhaust can be used, the standard T.T. Replica pipe can be shortened slightly with advantage, the best length being 23 ins.

### Chain Lubrication

For touring only use the chain oilers occasionally as necessary.

For Racing chain oilers should be so adjusted that they can be left on continuously, except when standing.

An excess of oil on the primary chain, should, however, be avoided as it might lead to clutch slip.

### Gear Ratios

A range of gear ratios is available to suit all conditions, driving sprockets from 16T to 22T being obtainable.

The following is a guide to the most useful driving sprockets:—

*For Touring:*

498 c.c. — 19T.

596 c.c. — 20T.

*For Maximum Speed on level Road:*

498 c.c. — 20T.

596 c.c. — 21T.

*For Maximum Speed on Sand:*

498 c.c. — 18T.

596 c.c. — 20T.

For other conditions, the best can only be found by experiment.

### General Hints

Adjust brakes accurately and see that they do not rub when "off".

Avoid over tightening wheel bearings.

Do not over-fill hubs with grease, as excess may impair the efficiency of the brakes.

Find by careful experiment the most suitable tyre pressures and maintain them, and on Sprint Specials adjust shock absorbers to suit conditions.

Go over nuts and bolts, etc, regularly, and pay special attention to such vital parts as rear brake torque anchor bolt, steering damper anchor, gearbox operating arm nuts, etc.

When using sparking plugs of a type that will not stand oil, do not attempt to run slowly for long, but, if you must, then keep opening up the engine momentarily, which will reduce the risk of oiling up.

**R.P.M. AND M.P.H.***by P. G. Taylor.*

I am sure that all of us realise that given one of the above, the other can be found from a few simple sums. When converting one to the other for a range of speeds, a graph would be helpful. As an example of this, a graph might be drawn of engine R.P.M. to a base of speed in M.P.H. for a known overall gear ratio. Or supposing that you know the peak output of your engine ; which, in my case is 5,000 R.P.M. then to convert to M.P.H. a second useful graph could be plotted enabling gear ratios to be selected for a specific job.

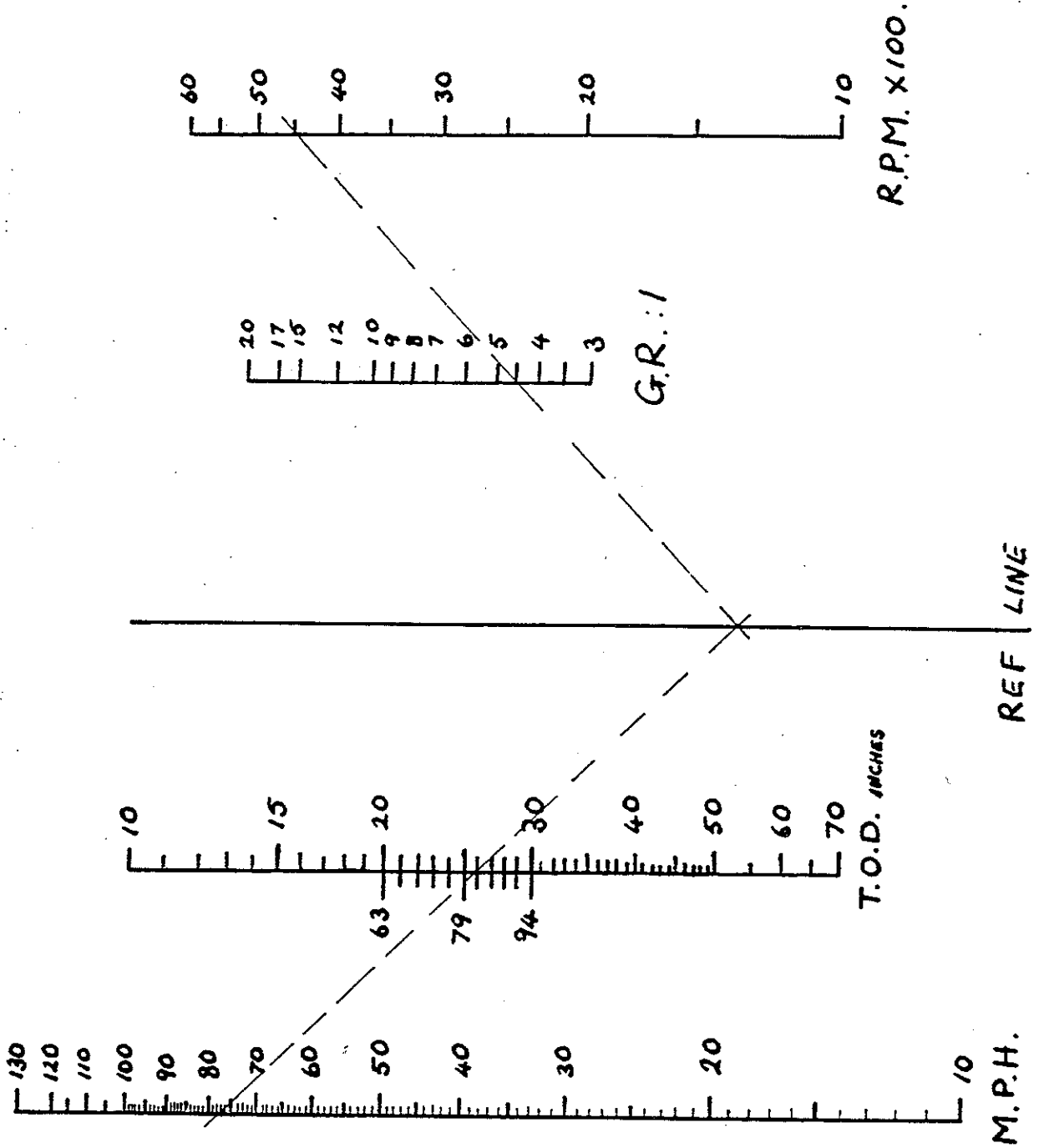
$$\text{M.P.H.} = \frac{\text{R.P.M.} \times \text{T.D.} \times 60}{\text{G.R.} \times 36 \times 1760} \text{ e.g. hill climbs, sprinting, road racing etc.}$$

Now for those fiends who like to change wheels, tyres, and generally mix up the factors that affect the resulting M.P.H. I have drawn a nomogram for the four variables. These being gear ratio, R.P.M. and M.P.H. and tyre diameter. I have also given tyre circumference over the most useful range, so that tyre wear can be taken into account.

This nomogram is really two graphs presented as one and is easy to read. The middle line is used in this instance as a reference line, but might be employed as the back axle R.P.M. on a car. Now to use the nomogram, first measure, with a piece of string or tape measure, the diameter or circumference of the rear tyre. Then place a rule on the nomogram to line up with the tyre circumference the speed you are interested in, e.g. your estimated maximum at present and also intersect the reference line, making a note of this point on that line. Transferring the rule to the other half of the nomogram and picking up the point on the reference line, gear ratio, R.P.M. can be selected to suit a particular engine, be it for sprinting, racing, or just normal touring. The dotted line shows an example of an engine turning over at 4,500 pulling a 4½ :1 G.R. with a tyre diameter of 26 ins. (3.50 × 19) returning a speed of 77 M.P.H. Given any three of the four variables, the fourth can be found in this way.

Probably the most useful aspect of the nomogram to the ordinary rider is in showing the maximum safe top speed in each gear, thus avoiding over-revving the engine, especially when "running in".

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Ed. Note.

Following the death of Rupert Draper, Brian Marshall offered the following article, sent to him around 1970, by way of a tribute. Note that the second section, titled 'Scott Peculiarities', does not apply to Scotts in general, but to a particular racing machine owned by Reg. Phillips.

### **HOW TO TUNE A SCOTT**

*Dedicated to Scott fanatics, who require a high performance out of the ordinary Flyer engine.*

**Compiled by: T.L. HATCH, R. DRAPER and R.G. PHILLIPS.**

*The machine must be stripped, every part thoroughly cleaned, Hub bearings well washed with petrol, dried, and packed with the best grease, as per instruction book which is easily obtainable from Scotts.*

#### **GEARBOX**

*Highgrade oil must be used, Castrol R is the most suitable. (This oil retains its viscosity better than mineral oils.)*

#### **REDUCING WEIGHT**

*As far as possible, remove unnecessary bits and pieces, such as lugs, heavy mudguard stays, etc. A certain amount of drilling can be done to the frame itself. Magneto platform, and the lower frame members and mag sprocket, all these items may be lightened. Fit a smaller saddle; this, apart from improving your riding position, will reduce weight. (Cut the weight down, without weakening the outfit.)*

#### **ENGINE**

*The main essentials in building the engine are — perfect bearings, bores and piston rings. The rings should have NO up and down movement, but must be perfectly free in the grooves. The piston ring gap can, in some instances, be reduced.*

*Shorten the induction stroke by smoothing down the rounded portion near the transfer port i.e. on the inside, using a file to straighten this from transfer to sump. Finally polish and smooth all surfaces inside the crankcase, increase and polish transfer ducts, extend to bolt. Wooden or aluminium blocks can be employed between cylinder block and crankcase. This will help the scavenging a lot. these blocks must be placed at the inlet ports, and be streamered, to conform with the contour of the induction ports.*

*A high compression can be achieved by grinding down the cylinder head  $\frac{1}{32}$ ". Great care must be taken, otherwise a bad seating will result between head gasket and cylinder.*

*If the compression is high 2 hot plugs must be fitted — M100 or M80 for racing — M50 for touring.*

*Transfer ports should have perfectly smooth contours, and streamlined to the block and crankcase, mated as one.*

*Streamline the cylinder bridges, without removing bearing surface.*

### MAGNETO.

Set the magneto points as close together as possible, consistent with even firing on both cyls. Use good high tension leads, make sure that the mag. is waterproof.

### GENERAL POINTS.

Set the mag. timing to suit your particular engine. Normally the setting is, handlebar lever fully retarded, piston top dead centre, mag. points just about to break. (It's a trial and error business). Make sure the carburation is correct; this again takes time and a liberal supply of jets are required.

Normally jet size 200 is suitable for high speed work. For ordinary touring a jet size 170 is generally suitable.

On Flyer & Replica engines file out  $\frac{1}{16}$ " from the intake side of piston skirt, this will increase volume in transfer.

### OILING SYSTEM.

Two oil pumps give the best results, for racing, one is sufficient for touring. Mobil 'E' oil is recommended, or Castrol 'R'.

To complete the ideal, fit 27x3 front and 26x350 rear tyres.

The above must be taken as a guide.

### COOLING.

The liquid system is quite good, provided the overflow pipe is clear and not damaged.

A good suggestion follows, take it or leave it; The main bearings are often overlooked, and do get hot. Here is the tip:- at the front of the Crankcase cut out two holes, say 1" (inch) by threequarters; make certain that the holes are on each side of the mains, i.e. cut out of the crankcase shell. The holes can be dustproofed by covering with fine gauze.

If you are lucky, and can get the following, then you have the world's best—

1 — A twin float racing carb. 2 — A square type B.T.H. magneto. 4-speed gearbox and foot change — detachable cylinder head, and finally a short wheelbase frame; a 1928 type is ideal.

For racing, Exhaust Pipe 17" long.

- (1). Before setting points on Magneto or for that matter prior to setting the magneto timing, the following must be observed — adjust the Magneto chain to the correct tension — a slack chain retards motor.
- (2). Adjust the make-and-break gap before either advancing the magneto timing and or retarding — perfect timing can only be obtained if the above points are carried out.

\* \* \* \*

The above notes are applicable for DPZ 498cc Scott, and are merely a guide.

The following para is from my own notes:

$\frac{1}{32}$ " off head — then use normal gasket.

Binks  $1\frac{1}{16}$ " Bore Carb — jet 140 (small circuit).

Binks  $1\frac{1}{16}$ " Bore Carb — jet 160 or 170 (Airfield).

Amal Carb.  $1\frac{1}{16}$ " Bore — jet 220.

$\frac{1}{32}$ " off inlet side of piston skirt.

Lengthen ducts & polish Crankcase, polish transfer passage & round off.



### SCOTT PECULIARITIES & HOW TO OBVIATE.

To start your machine — merely turn on petrol, and after a few moments start up — do not leave petrol taps on when machine is standing, flooding carb. is not required at any time.

Oil Tank (under saddle). Leave tap in on position at all times.

Oil Tank (small, in petrol tank. There is an oil lead into bell of Carb. — this is merely introduced as a 'power saver' when actually racing the model, do not use when touring or plugs will oil up.

Oil Pilgrim Pump, this is set for liberal oiling for fast touring and can be increased slightly for racing.

Chain Oiler. Can be used when required, do not over lubricate the chain, too much oil may get into the clutch.

If there is any difficulty in starting, inspect plugs (KLG, M100 or M80 are good for racing & fast touring) if you suspect too much oil in crankcase unscrew 'Bungs' (one at each side) and drain off oil. Do not be afraid to rev the engine.

Gears. The model is fitted with a close ratio gearbox, and at present your gears are (21 tooth sprocket) 4.18 T.G. Ratios, 5 1/2 M.G. 7.38 L.G. The sprocket is fitted with an outrigger, and can be easily changed for smaller: sprockets can be obtained to suit 'circuits', the sprocket now fitted is ideal for 100 mile races and, or airfield events.

Carburettors. The one fitted is 1 1/2" bore and again is suitable for any events, long or short distance (gearing is the most important factor).

General. For touring purposes, a small main jet can be used say 120 or 110 (I can supply). I have a standard Amal needle type carb. If you require for touring.

When racing: after practice stop motor by means of cut-out switch on handlebar, then turn off petrol, this ensures that there is a charge of gas in the crankcase and motor will start immediately.

At the start (racing). Turn on petrol just before flag drops and you will be first away, open air lever about halfway or, if motor is warm, open wide before starting: if engine is cold, open air halfway for suction.

Decarbonising. Drain off water and remove Radiator — then loosen off cylinder head (sixteen nuts) pistons can be scraped, also head — finally polishing.

Exhaust Pipe. This should be cleaned out periodically also exhaust ports, otherwise loss of power will result. Extra Oil may be used when racing (or suitable upper cylinder lubricant) used in the petrol, you can't over-oil a Scott, provided that the plugs stand up to it.

Use correct Plugs at all times, and always turn petrol off when stationary; the petrol level is very high; inspect gearbox for oil level, always make sure there is plenty of water in the Radiator.

Please write me any time you have trouble.

**Reg Phillips.**

Wishing you good 'Scotting' for 1953.

The section of this article beginning 'Scott Peculiarities' relates to a particular machine sold by Reg Phillips in 1953, and passed on with the machine to assist the new owner. This turned out to be my 1929 TT Replica VT 2770, now in the hands of Alan Whitehead.

**B.M.**

### Low Speed Torque

Dear Mr. Wess,

Among Brian Marshall's very helpful articles are references to increasing low speed torque by lengthening the inlet tract, so I have tried a cheap and easy conversion on WW 9819 a 498cc Flyer of 1929 vintage. Although performance in general was good, low speed torque was rather lacking, prompting a change four years ago from close to post-1934 medium ratios, which of course then shifted the problem from struggling to get away quickly at busy roundabouts to that of overcoming the gap between second and top when going uphill. The bike is fitted with original expansion box and absorption silencer (ex-Wartburg car!) and a 19-tooth sprocket.

I made an extension to move my carb away from the crankcase, while retaining the same angle of draught, so that there are no float chamber problems. This consists of two flanges (hand-made — hacksaw and file) with a piece of oval tube welded between (old car exhaust pipe squashed in the vice!). Overall length is  $2\frac{3}{8}$ " as any more would cause the throttle cable to be too sharply bent where it leaves the carb top. The air cable is bent, but this does not matter as it is seldom used — see below. I also fitted a 1" jet block instead of the standard  $1\frac{1}{16}$ ".

Results are good — it is now almost impossible to stall the engine on take-off, no matter what you do with the clutch, and with the ignition part-retarded it pulls like a side-valve Ariel I once had. Top gear pulling is much improved, and hills can now be climbed in top that formerly needed second. Top speed must have been reduced, but over 60 mph is easily available, and I never go over 50 anyway. It is an easy job and cost me £2 for the welding, as I already had the jet block, and is easily removable if required.

I have done over 2,000 miles with the longer inlet pipe, and recommend it. It would be quite feasible to revert to close ratios, in fact.

Two other points which may be of interest. I have used extended nose plugs for over 4,000 miles now (NGK BP6ES) and recommend them so long as you have the necessary clearance. They stay cleaner longer and give a 'crisper' performance and, I think, easier starting.

Secondly, if anyone has trouble starting from cold, may I suggest my 'magic cork' system? Get a cork (not rubber) bung for a fermentation jar, with a central hole to take the tube of the air lock. You will have to reduce the external diameter to fit the carb bell mouth. When putting the bike away for more than a few days, put the bung in the carb mouth at tickover with thumb or finger over the hole. This will stop the engine and leave the crankcases full of vapour; with the bung still in place, flood liberally, ignoring the air lever, and one or two kicks should start it even after ten to 14 days. Remove slowly by hand as soon as the engine fires. It is worth using for a restart after even two or three months, as it gives a super-rich mixture compared with use of the air slide.

**Ted Jemmett,  
Petworth, West Sussex.**

## HOW TO TUNE A SCOTT

'Tim' Wood

(from *Motor Cycling*, November 29, 1922)

The tuning of a Scott motor cycle is not by any means difficult, although some riders appear so to consider it. A few hints, however, should be of assistance to the lesser experienced of Scott owners.

I will deal with the cycle parts of the machine first. For maximum comfort and efficiency of the spring forks the front tyre should not be inflated too hard. Even when moderately soft there is no fear of the cover rolling off the rim, owing to the 650 mm. by 65 mm. rim used, the bead of this being much deeper than those of English measurement. As regards lubrication of the forks, I find that one injection full of oil down each sliding member once a month is quite sufficient. Occasionally the spring cap should be lifted with a screw-driver and the stem lubricated.

The head ball races are packed with grease and need no attention. If, when using a sidecar, you find that the front wheel wobbles, tighten the head locking ring. This will be found to be an effective cure. The front brake can be used without fear of the shoes jamming in the spokes, for even if it should twist they will come quite clear. The rear brake is sometimes ineffective in wet weather, but it can be made very good by fitting a flattened  $\frac{1}{2}$  in. annealed copper tube over the rubber pad and securing it at each end of the shoe by a small screw. Bedded, water will not then affect it.

Chain adjustment is all important. The high-gear chain should be set right, and the low chain left in whatever tension the gear alignment brings it. If the low-gear chain be then too tight it is due, in all probability to the fact that a 46 tooth sprocket is fitted. A sprocket of different size will equalize the tension.

It may sometimes be found that the gears slip, but that this slip can be cured by continual pressure on the pedal. If this be so, adjustment is necessary. This adjustment is quite simple if it be borne in mind that the friction produced between the inner and outer quick thread drums is the sole means of holding the gear in engagement. The actual method is as follows: To make the pedal go farther down in high, fit a washer on the thrust rod; to make the pedal go farther down in low, extract a washer. The gears should be lubricated by half a pumpful of oil every 30 miles. If the driving sprocket is being changed, the lock ring should be loosened or tightened only when the gear bolt is in position and tight. For speed work all chains should be on the slack side.

Turning now to the engine, it is well-known that with a two-stroke the chief points necessary for efficiency are: (1) Good cylinder compression; (2) good crankcase compression; (3) freeness. Cylinder compression is all-important, for if defective it also upsets the crankcase compression. If the compression be doubted the rings should be inspected, especially on the underside. The joint made here is as essential as that between the ring and the cylinder wall. There should be a continuous bright face along the bottom side of each ring groove.

### **Restoring Crankcase Compression**

It is not often that trouble with crankcase compression is experienced, but if this is found to be the case it can be made perfect by fitting good washers on the doors and cylinders. Freeness develops as the engine is run-in — about 1,000 miles is usually ample for the process.

The pistons should weigh exactly the same, and should bed to the cylinders evenly all round. For speed work they should be cleaned both inside and outside. I do not advise any alteration of the height of width of the ports. The top, bottom and sides can with advantage be polished, and the bridge pieces filed to some semblance of the streamline. The sharp edges of the inlet ports may be rounded off.

When refitting the cylinders, a coating of Seccotine should cover all washers, as this protects them against any action of petrol, oil or benzole. Gold size is useless here, for petrol attacks it, but it is good for cylinder head joints. Generally speaking, the gauzes can be omitted for speed work and retained for reliability trials and ordinary touring.

### **Sprint Tuning**

For hill-climbs and speed trials I advise a short, straight-through exhaust pipe, and an Amac carburettor, with the inlet tube removed, and jet not bigger than a 35. The correct gear ratio is of great importance, and this should be adjusted to suit the course, so that when all out the engine can attain a speed of approximately 3,600 revolutions per minute. The magneto should be timed so that the points are fully open when the spark is retarded and the piston is at top dead centre.

I recommend Wakefield's Castrol C or XL for ordinary running and Castrol R for racing. Slight leaks of oil from the main bearings can usually be cured by clipping down the pump plunger and allowing the engine to suck all oil. This can easily be done if the gland nuts on both the pump plunger and the regulator screws be kept tight. The drips, once set, need not be altered.

*(My thanks to David Frank for this article. Ed.)*