

2.4 Engine Overhaul

SPECIAL HINTS ON SCOTT ENGINES

By J. H. KELLY (*Scott Motors Ltd.*)

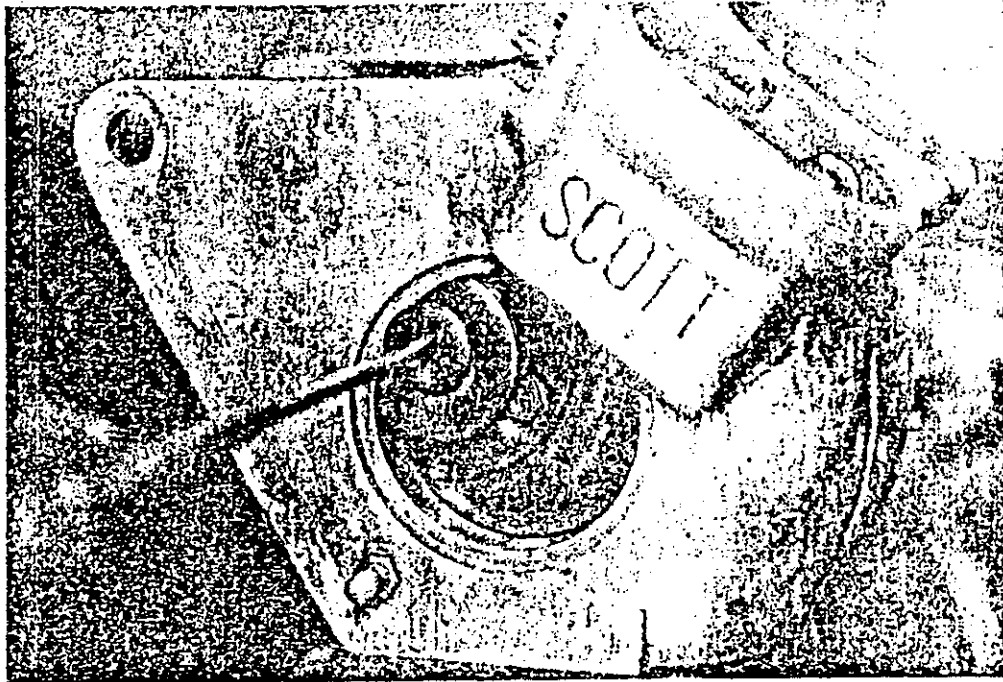


Fig. 1.—REMOVING THE CRANKPIN SCREW.

Note how the crankcase door flange is machined away to allow for crankpin screw removal.

TAKING DOWN A SCOTT ENGINE

FIRST, a timely warning: DON'T TAKE OFF THE WATERCOOLED HEAD FOR DECARBONISING—this is only a water jacket, and is distinct from the cylinder itself.

Removing the Cylinders

Drain water from radiator, take out plugs, radiator (gently please!), remove silencer, transfer covers, cylinder holding-down bolts, carburetter on Supers only (not essential, but allows more room), and on Supers right-hand exhaust port cover. Then lift off the cylinders.

If these are tight, replace plugs, engage gear, open throttle and turn

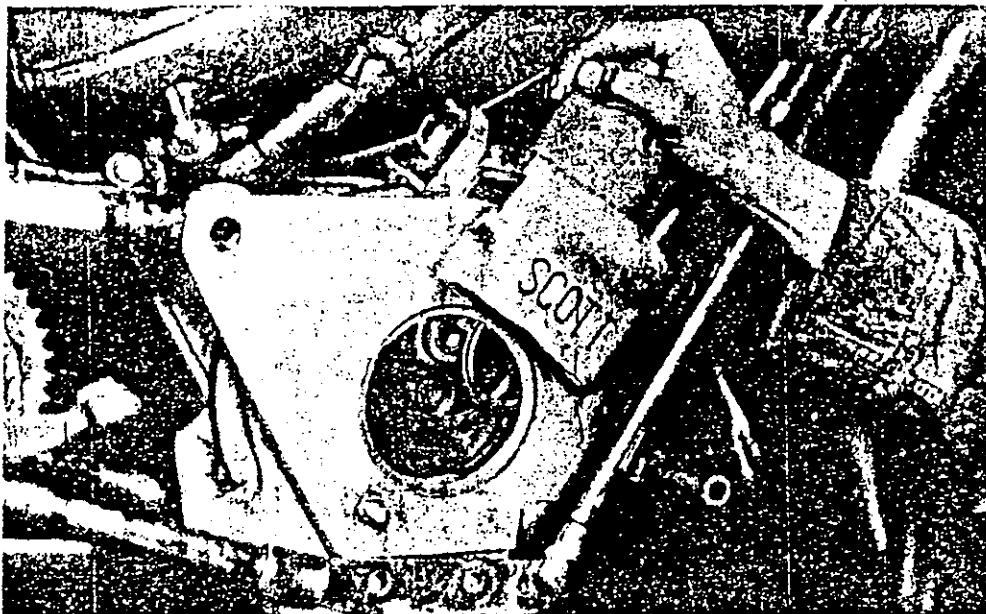


Fig. 2.—REMOVING PISTON AND ROD COMPLETE FROM CRANKCASE.

Note the right hand tilts the rod and the left hand turns flywheel backwards, thus drawing crankpin bush away from con rod.

back wheel *slowly*, until block moves up from the crankcase against compression.

Crankcase Doors

Having removed crankcase doors (on late Flyers and Replicas these must be removed *before* cylinder bolts can be taken out), remove crankpin screws, stamped right- and left-hand respectively, by using door strap as screwdriver. If these are tight, tap end of strap whilst in screw slot; failing that, tap gently with hammer and light punch. (On Supers and Flyers it will be noted that the crankcase door flange is machined away at one point to allow for removal of screw: it will only come away at this point—don't force.)

Pistons and Con Rods—Removal

Take out big-end rollers (COUNT THEM IN YOUR HAND—12 EACH SIDE), then turn flywheel to top of stroke—tilt con rod sideways, turn flywheel back slightly—i.e. taking crankpin bush "out of the con rod," piston and con rod come out together nicely.

All gudgeons (except very old type, split-pinned or lock ringed) tap out from the inside (i.e. flywheel side), and if piston bosses are at all worn, oversize gudgeons *must* be fitted, otherwise the old gudgeons will

FIG 3: NOTE!!! From Glyn Chambers.

If you do this a smashed crankcase cup will result. The flywheel must be supported!!!

SPECIAL HINTS ON SCOTT ENGINES

117

eventually float out, with unhappy results to the cylinder walls. (*Note.*—Oversize gudgeons, $\frac{1}{16}$ in oversize, are supplied by works and depot.)

Pistons and Con Rods—Adjustment and Repairs

If pistons show signs of having seized, ease off *lightly* with a very fine file, and if cylinders are marked, lap out with crocus powder and oil, but extreme care must be taken to ensure that the cylinders are washed perfectly free of powder afterwards. Don't use your own pistons for this job—beg, borrow, or steal an old one.

When trying pistons and rings in cylinders, put a small wad of paper in the head first, as in some cases it is possible to jam the piston rings if the piston is pushed too far up into the head.

If the rings show more than $\frac{1}{1000}$ gap, fit new ones (using only genuine Scott rings for the job: cheap rings mean loss of efficiency, and are false economy, anyhow).

Genuine Scott rings are supplied slightly oversize (circumference), and it may be necessary to file slightly to fit (incidentally, radial depth and width are dead right on these rings) inspect your gaps through the ports ;



Fig. 3.—REMOVING RIGHT-HAND CRANK.

Note centre bolt is slackened off a few turns, and a sharp blow drives out crank. WARNING: support crankcase on a block of wood first, and see that the crankpin bush on the under side registers with the crankcase cut away—otherwise the flange may get broken when the crank drops out.

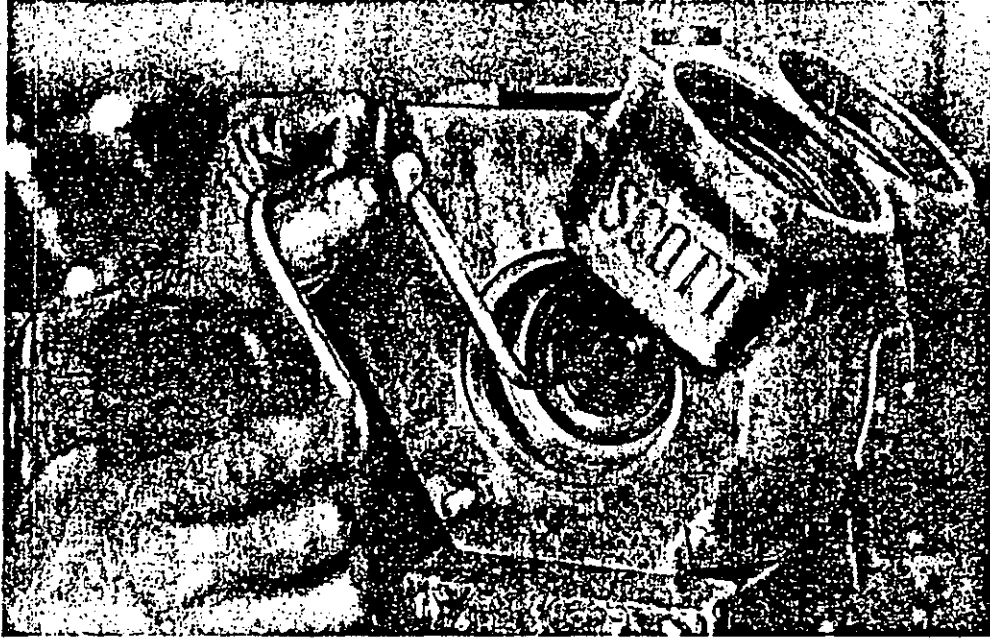


Fig. 4.—GRINDING IN PACKING GLANDS ON SCOTT ENGINE BEFORE REASSEMBLY.
The method is described in detail on page 123.

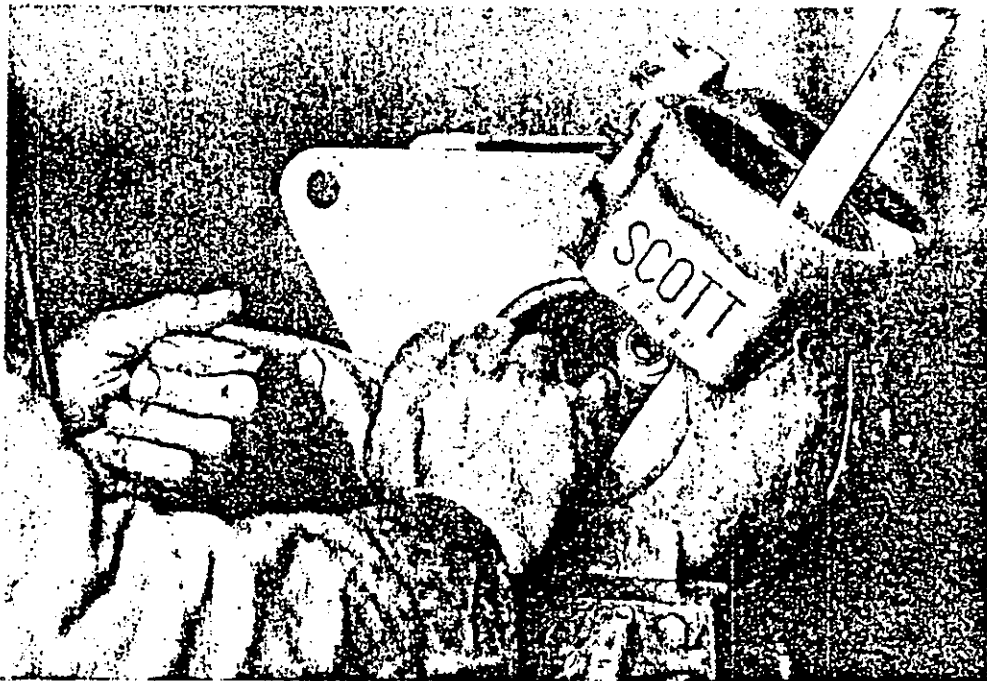


Fig. 5.—UNDOING LEFT-HAND THREADED NUT OF CRANKSHAFT BOLT.
Lay a tyre lever or strip of metal (NOT SHARP EDGES, PLEASE ! !) in crankcase as shown, and the crank pin bush will rest on it whilst nut is being slackened off.

and remember that old engines wear more at the middle than at the bottom of the stroke, and a ring tight at the bottom may be just right at the top; make due allowance for this, and fit each ring separately.

Clean ring grooves thoroughly, and roll rings round piston; don't have any "sticky" spots (a free ring is very necessary for a two-stroke and one tight ring spoils the whole performance), and if an old ring has been badly seized in, chamfer the piston ring groove edge very slightly.

Refitting Rings for Fast Work

For "fast" work rings should be fitted with a very small gap and lapped in with jewellers' rouge and oil. The same warning re cleaning your pistons and cylinders applies here.

Engines should be run carefully for fifty miles (a little oil in the petrol is advisable), and if fitted for fast work, one hundred miles.

Use an ordinary penknife or a Woolworth's scout-knife for removing carbon, clean all ports thoroughly, polish your pistons vigorously *on the top only* with metal polish (this will render your next decoke easier), and clean out the oil grooves, but do not polish the sides of the pistons.

Reassembling Pistons and Con Rods

When replacing con rods, put these back correctly. It is generally assumed that, as long as the small-end bush fixing screw is uppermost, all is well, but it isn't.

A small centre-punch mark will be seen on the side of the rod, at the

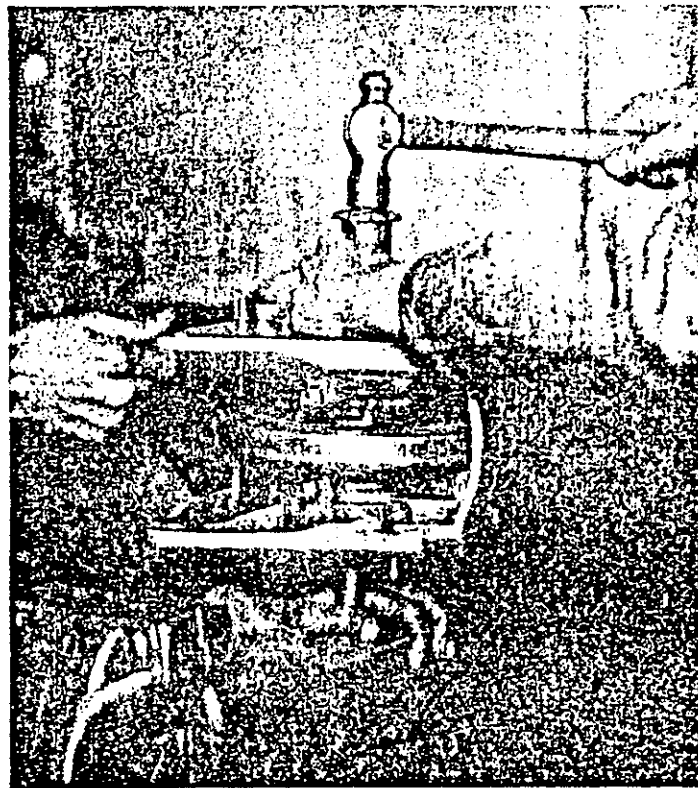


Fig. 6.—BUILDING UP CRANKSHAFT.

After the crank bolt has been screwed up, each crank should be driven into the flywheel, using a hammer and tubular punch.

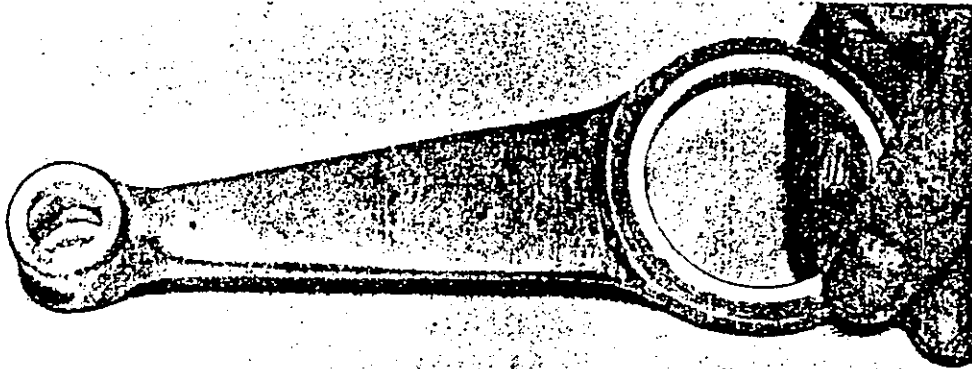


Fig. 7.—SHOWING CENTRE-PUNCH MARK ON CON ROD.
This side faces flywheel.

top, near the small end, and this should face the flywheel ; keep each rod to its own side of the engine, as they come out.

Watercooled Head

If this leaks badly, remove two locking rings and lift off the head ; clean the surfaces carefully, fit new rubber and c/a washers ; use Hermetite or Metalastine, allow to get tacky before putting on the head, tighten the head down evenly and *gently* (remember the head is very thin), and allow to stand for a few hours before filling with water.

It will be found that the head can be tightened a little more after a day or so's running.

Did you know this ?

The London Depot of Scott Motors, Ltd., will be pleased to lend a special spanner for these head nuts against a deposit of 10s. ; no charge is made for use and deposit is returned in full. The same facility is given in the case of a half-compression locking-ring tool, the deposit here being 5s.

Joints

Always use new packings, these are quite cheap.

All joints should be fitted dry, except base linen rings, on which you may use either seccotine or oil. Trim up transfer and induction washers to the ports, to ensure an even flow of gas.

Gauzes

These are fitted to most 596 engines and the early 486 and 532 models, but a little more speed and acceleration may be gained by their removal. If the engine spits badly with the gauzes out, replace them immediately.

Cylinder Bolts

When tightening down the cylinder holding-down bolts, do these diagonally; this relieves the "last bolt" of undue strain.

A Warning—leave the Skirts alone

Many Scott owners, no doubt intrigued by the usual press photos and descriptions of T.T. Scotts, or inspired by those weird and wonderful tuning hints so freely broadcast, have rushed blindly into the practice of cutting away the cylinder skirts below the cylinder transfer ports in order to gain a little more speed and acceleration.

Whilst it is more than likely that this end has been attained, the slow running has been practically destroyed—a little thought will explain why!

Now the T.T. Replica, of course, *is* cut away, BUT *the inlet and exhaust ports are altered accordingly* to balance up for the slow running. This part of the business is never mentioned by the "tuning expert."

Never meddle with these dangerous experiments; remember the Scott Works and the Depot are always only too willing to give advice on such points: they will be delighted to help you get the best out of your Scott.

HOW TO TAKE SCOTT ENGINE OUT OF FRAME

Having attended to the cylinders and pistons, it now remains to get the balance of the engine out of the frame, as follows:

Remove engine chains, (engine and/or magneto), four bottom $\frac{3}{8}$ -inch engine bolts and large top bolt, and lift assembly from frame.

In the Case of "Flyer" Models

Support crankcase with box or petrol can, remove chains, take out carburetter slides, disconnect clutch wire, remove three main engine bolts, taking out the *top* one last.

For 1928-31 Flyers take out *front* bolt first and

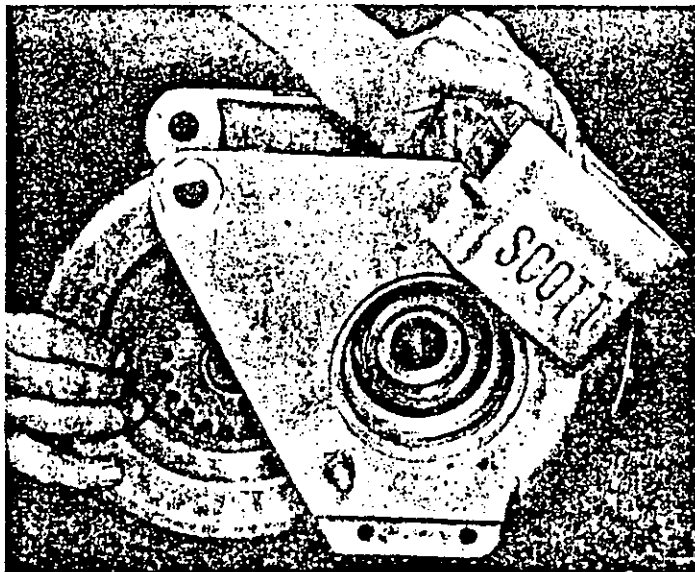


Fig. 8.—CORRECT WAY TO REPLACE FLYWHEEL.
Note fingers rest naturally in deep rim of flywheel.

remove front stand; when reassembling, put this bolt back first, *without* stand and washers, and after replacing other two bolts, take out front one again and replace stand and washers at your ease. This saves a lot of "juggling" with front stand.

REPLACING ENGINES (COMPLETE) IN FRAME

Super will go back into frame quite comfortably if the right-hand exhaust port cover is left off.

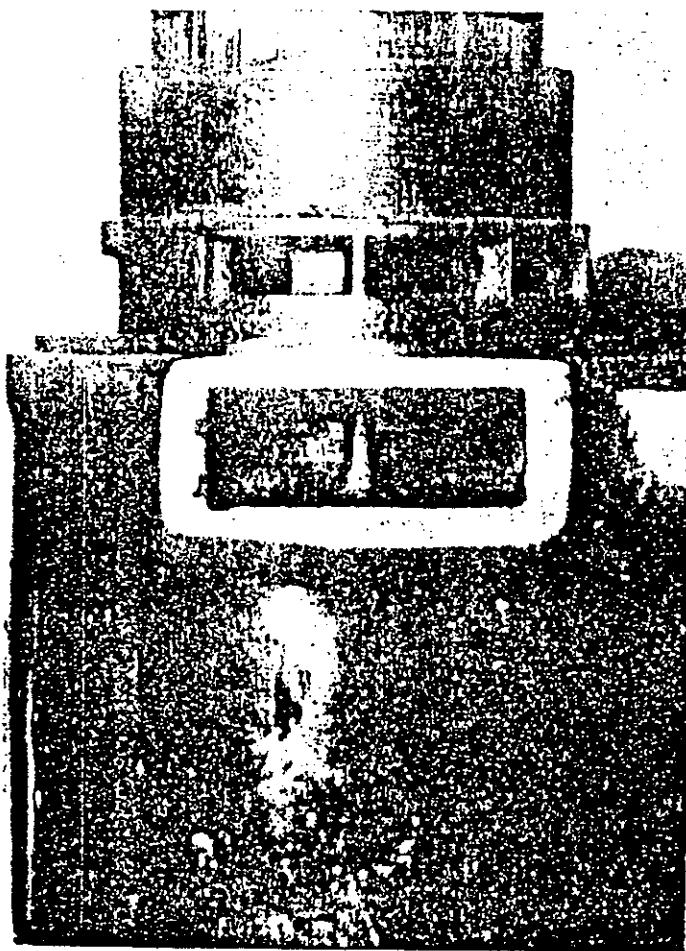


Fig. 9.—It is possible to examine the piston ring gap through transfer port.

connecting the gear chain, which will come out with the engine.

A Note on the Threespeed Super

In this particular job it is far simpler and easier to remove engine and gearbox on the undertray in one unit—but don't forget to remove the clutch wire first—so easily forgotten!

"Flyer" Models

These should be put in upside down and swung up into position (see Fig. 10), fitting front bolt (only) first (see note *re* 1928-31 Flyers above).

Incidentally, it is worth while taking out the gearbox at the same time on these models, as on removal of two gear tray bolts and nuts, sprocket housing complete, two underneath nuts to gearbox studs, the tray can be swung downwards and the whole gearbox dropped through the frame—an extra five minutes' work! This will also save dis-

DISMANTLING CRANKSHAFT

A delicate job, but quite straightforward. Proceed as follows : unscrew LEFT-hand nut in centre of right-hand crank, undo bolt on left-hand side a few turns (right-hand thread), a smart blow on the bolt head will dislodge crank ; bolt can then be unscrewed, releasing right-hand crank and rollers. (COUNT THEM—SUPERS 13, and FLYERS 15.)

The left-hand crank can then be removed by a steel bar passed through the flywheel, giving it a smart blow.

Take great care in replacing cranks ; a little grease (vaseline) will hold

the rollers in position (bed these down on the bearing by passing a piece of string round the outside of rollers, when in position, and tighten), replace packing gland (after grinding this in with a little *fine* valve-grinding paste or knife-powder, see Fig. 4) and be sure that the tongue of this engages with the keyway in the flywheel.

After the crank bolt is screwed up, each crank should be driven into the flywheel, using a hammer and tubular punch (three sharp blows only).



Fig. 10.—FLYER ENGINE READY TO SWING UP INTO FRAME.

Warning

Whenever hammering up a crank, the other one *must* be in position first and a solid mass brought to bear up against it, so that the force of the blow is not transferred to the crankcase cup.

Each crank must be knocked up in turn and crank bolt tightened a little, and cranks **MUST** be driven up solid to flywheel, otherwise the flywheel key may shear.

Always use a new crankshaft bolt and nut, as these tend to "stretch," and left-hand thread is invariably damaged.

When tightening up bolt and nut, don't overdo it ; the left-hand nut may need to be thinned down to clear the large hole roller plate. See

that the latter seats firmly on the crank, then check that it really clears the nut ; rivet the nut over lightly to prevent working loose.

When replacing flywheel, see that this is put back right, i.e. the fingers of the right hand fall naturally into the groove of the rim. *Flyers*, the thin sprocket will be on your right (magneto chain drive).

The sprockets usually last for years, but can be replaced for a few shillings, and are only riveted on to the flywheel. (20-tooth only supplied.)

If main bearings or cups are worn, the cranks and crankcase must be returned to the WORKS for new parts to be fitted, as these are not supplied separately.

Big Ends

If your bushes or rollers show signs of pitting or "scaling" they should be replaced. (Works and London depot will rebush or exchange rods and cranks for you at a reasonable charge.)

Don't waste your time or money on oversize rollers—rebushing is not expensive, and the Scott engine, as an engineering job, surely deserves a better fate than faking up big ends !! When you realise that explosion force does not wear the bushes *evenly*, you *must* see that the oversize rollers are altogether wrong !!

GENERAL NOTES ON SCOTT ENGINES

Air Leaks

These can generally be found by squirting petrol around the various joints ; pulling off each plug lead separately will instantly show which cylinder is weak, although a blown carburetter (induction pipe) washer may lead you badly astray (check this first) !

Intermittent firing or cutting out on one side may be due to cracked pick-ups (H.T.), but more elusive is the burnt contact-breaker points, or loosening of same ; early Lucas Magdynos are peculiarly sensitive on these points. Too wide a gap at the plug or magneto points is another cause.

Plugs for Scott Engines

A very debatable point this ! but a just golden rule. *If you are satisfied with your present plugs, DON'T change, stick to that type.* Apart from this, here are the recommended types.

GENERAL AND TOURING

Champion No. 13 (for 1929-31 Flyers, No. 7).

FAST TOURING

K.L.G. H.S. 3.

Lodge H.H. 1.

Champion Aero A (for 1927-8 Flyers and T.T. Replicas only).

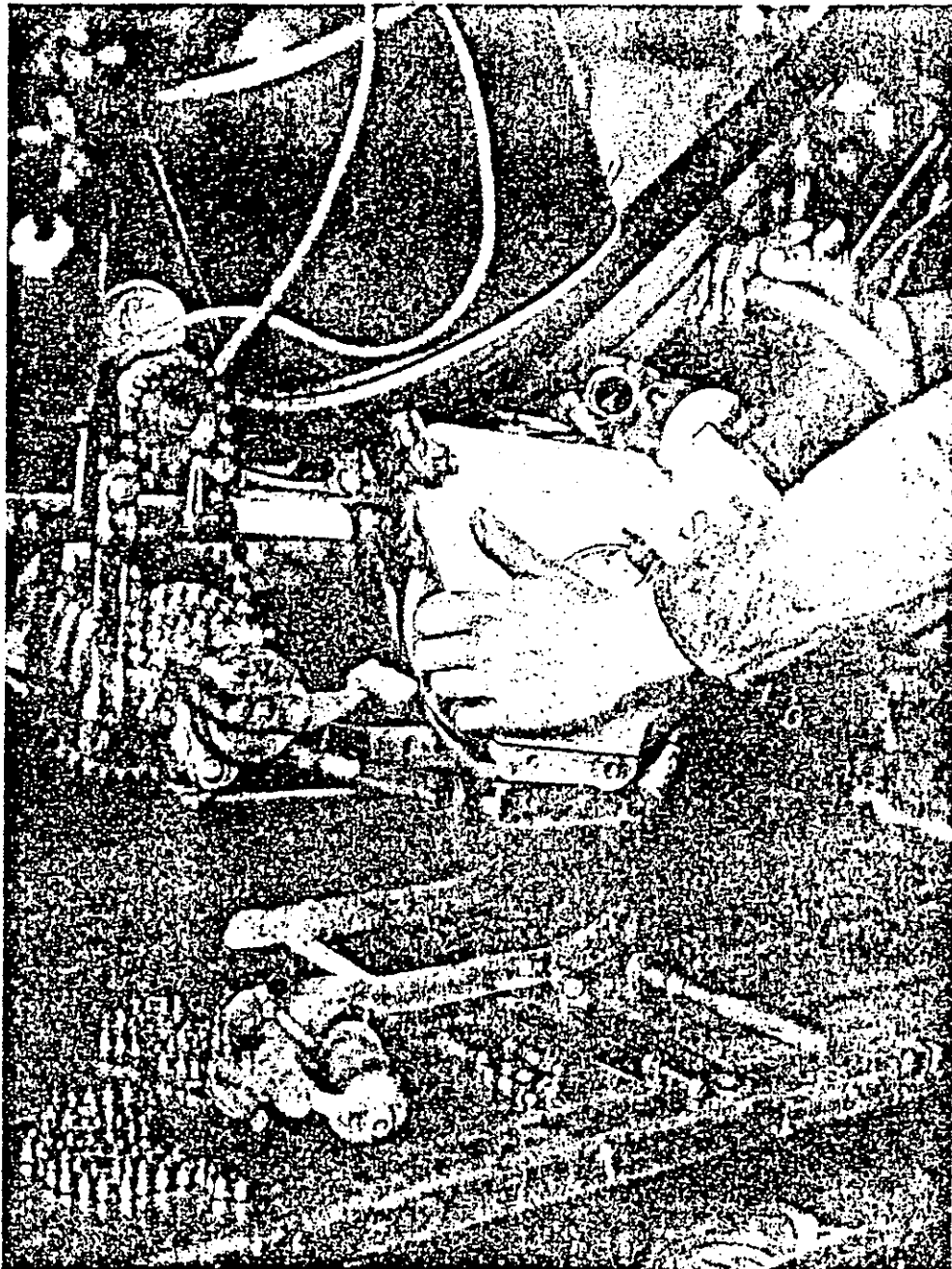


Fig. 11.—LIFTING SUPER ENGINE OUT OF FRAME.

RACING

K.L.G. 268 and Champion Aero A.

Warning

Plugs with a longer reach than $\frac{3}{4}$ inch must not be used ; damage to pistons is the penalty !

Timing

Take out plug, set piston at top of stroke, retard ignition lever fully, set contact-breaker points just fully opened. If you have timed off the wrong cylinder, this will be denoted by a backfire in the silencer ; it is then necessary to change over the plug leads.

Oil

Use Castrol XXL (or "runners up" Castrol XL, Duckhams' Adcol R.R.).

Petrol

Any good brand of No. 1 (OR BETTER STILL 50 per cent. petrol to 50 per cent. pure benzole). For T.T. Replicas, ethyl.

Decoke new engines, 1,500 miles ; afterwards, 2,000 to 4,000 miles, according to model.

Scott Radiator

Perished hoses and rubber pads for bolts should be renewed, and in the event of a new hose weeping, a few turns of insulation tape round the brass water pipes will cure this.

The water system should be flushed out occasionally with warm water and soda to remove any deposit.

To prevent freezing in cold weather add about a pint and a quarter of ordinary commercial glycerine to the radiator water. If you cannot get glycerine, empty the radiator by the drain tap in the cylinder, but make sure that it is empty, as if there is a rust deposit at the cylinder end it is quite likely that it will block up the drain tap.

For a small honeycomb leak, stop this up with a piece of chewing gum (*after* you have chewed it !)—this is quite a good tip, as you can get this anywhere on the road, where you probably could not get Plasticine. Have the leak repaired as soon as possible (corrosion sets in very quickly and spreads) by a skilled radiator repair man. **DON'T TACKLE IT YOURSELF.**

Silencers for Scott Machines

The Howarth silencer, fitted to Flyers, etc., is very prone to choke up after the oil pump has been set on the liberal side (such as a new machine

or rebores), and it is advisable to take this to pieces (three) and clean out thoroughly after 600 miles; easiest method is to burn it out over an ordinary gasring or blowlamp.

In any case, clean regularly every 1,000 miles.

For increased efficiency and to minimise back pressure, you may increase the small $\frac{1}{4}$ -inch hole at the end of the cone (inside portion) to about $\frac{3}{8}$ inch, and on the Flyers, which already have the expansion chamber at the front, the outer baffle of the inside part may be entirely removed, *but* this latter idea is not conducive to real silence, although careful driving (i.e. no hectic blinding in first or second gears!) will see you through.

Oil Pump Setting (Pilgrim)

Oil pump settings are usually a nightmare to the "new owner," and the "so many drops per minute" idea bewilders him more than ever, so we suggest the following as a more certain method.

On new (or rebored) engines, set the pump to give one drop of oil at every third pulsation at the "beak," i.e. one, two, then drop.

After running in, it can then be reduced to one drop at every fourth pulsation, i.e. one, two, three, then drop. (Or even less by that time, as obviously you will have got into the "swing" of things.)

The exhaust, of course, is a reliable guide—excessive blue smoke means too much, absence of smoke not enough.

A faint haze at low speeds (lift the half-compression lever momentarily and it should give an extra "puff") is fairly safe, but just remember that if you are too generous in adding oil to your petrol, you may be smoking profusely, but not getting enough oil to the mains and big ends via the oil pipes; so be very careful on this point.

A Useful Repair Hint

To replace worn engine chains, it is easier to attach new chain to old one and "follow on." If no old one is available, remove top engine eplates, smear first dozen links of chain with stiff grease and thread over engine sprocket (this allows the chain to cling to the teeth instead of "piling up" at the back of crankcase). In the case of 1931 Flyers and Supers, this greasing is not necessary, as a chain guide is now provided.

OTHER SCOTT FEATURES

The Scott Kick Starter, Twospeed and Threespeed Gearboxes, the Clutch, Chains and Cycle Parts will be dealt with in later articles.

SOME NOTES ON REBUILDING THE SCOTT ENGINE

by Tim Sharp.

One road tester for "Motor Cycling" described the Scott as possessing an "endless store of revs." What he really meant was that power increased roughly in proportion to revs, and had not flattened out by the time it was considered time to change gear, i.e. from 1,000 to 4,000 rpm. It is this characteristic which makes the Scott such a delight to ride, and makes any more than 3 gears totally unnecessary. This characteristic can be further developed during engine rebuilds by paying attention to the following points:-

1) Close fit of the piston skirt in the cylinder is essential to avoid gas leakage at low rpm. This is a most difficult thing to achieve because piston seizure will occur without warning if the clearance is insufficient, and Scott pistons do not expand uniformly. Probably the best way is to err slightly on the tight side and strip down to remove high spots at intervals during progressive running in. Silk pistons were made from low expansion alloy and were finished slightly oval, the idea being that they would be nearer circular at running temperature. I have built several oversize Scott engines using these pistons and close piston fits have been achieved without seizure problems.

2) Port the piston at the back so that the mixture in the crankcase has an easier and more direct route into the transfer port. On long stroke engines with six inlet ports the rear two have to be blanked off if this modification is carried out. Also the rear of the cylinder spigot has to be cut away to line up with the piston port at B.D.C. as in Replica cylinder blocks. Although this reduces the inlet port area it is still adequate, particularly if crankcase volume has been reduced to improve crankcase pumping efficiency.

3) Reduce the crankcase volume as much as possible by having close fitting doors. This can be achieved more effectively when there is nothing mounted on the crankcase doors and the big end screw can be thinned down to allow the doors to fit deeper into the crankcase. It is surprising how much volume can be saved here.

4) Fit larger transfer ports if these are still obtainable, (George Silk did make them some years ago) or remove the bridge from existing ones and seal the hole at each side with a fibre and a rubber washer. Although this increases crankcase volume it stores the charge close to the cylinder where it will be required. The Clubman Special of 1939 had a larger transfer port but those made by George Silk were larger still.

5) Do not alter port timings, these are already more than enough. I have had delightful engines using short stroke pistons in long stroke cylinders, where the extra $\frac{1}{16}$ inch piston top land height has reduced exhaust and transfer timing, and also of course increased the compression ratio.

6) I favour an exhaust system with an expansion box close to the cylinder as in the earliest Scotts. This gives a rapid drop in cylinder pressure and a quieter exhaust if a Burgess type silencer is also fitted. Some TT Scotts were fitted with this type of exhaust and I asked the late Frank Varey during question time after his talk to the Northern Section what the relative advantages of this type were. He said that low down power was increased at the expense of absolute top speed. At this time I was doing a lot of miles on my sidecar outfit four up and I could have done with a bit more at the bottom particularly with a close-ratio gearbox, so I set to and made my own. To my surprise this gave me more at the top end and less at the bottom! The reason for this is that the volume of the box is too great and next year I shall have one hopefully nearer the correct size.

7) Fit a larger carburettor. The standard $1\frac{1}{16}$ inch type 276 Amal instrument has too small a bore and $1\frac{3}{16}$ inch minimum is required. Furthermore on some of these instruments the top feed float chamber can limit the fuel flow at full throttle instead of the main jet and disastrous piston seizure can occur due to overheating from the ensuing weak mixture. It is noteworthy that the Clubman Special had a larger carburettor with twin float chambers probably for this reason. A final point on carburettors is that if a Monobloc or Concentric is fitted it is necessary to reduce the downdraught angle by fitting an adaptor. This also has the advantage of increasing the inlet track length.

These modifications need alter only marginally the original appearance of the Scott and for those who enjoy riding a Scott the delight of that "endless store of revs." can now be enjoyed with a capital D, and a 22 or even 23 tooth gearbox sprocket.

Tim Sharp.

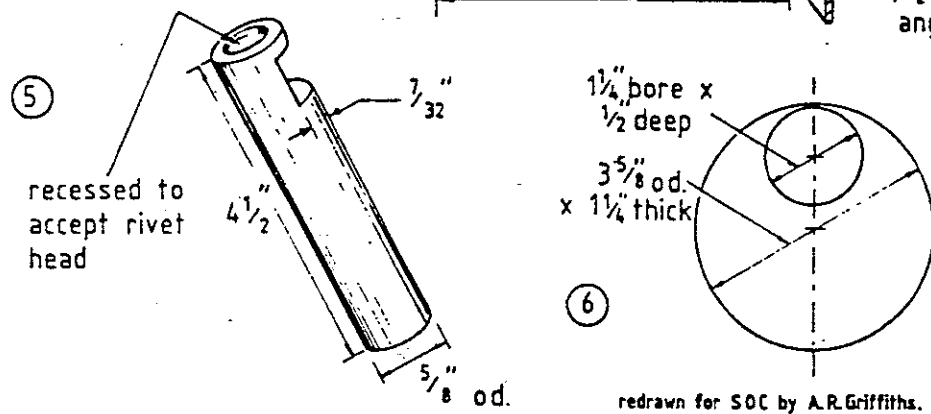
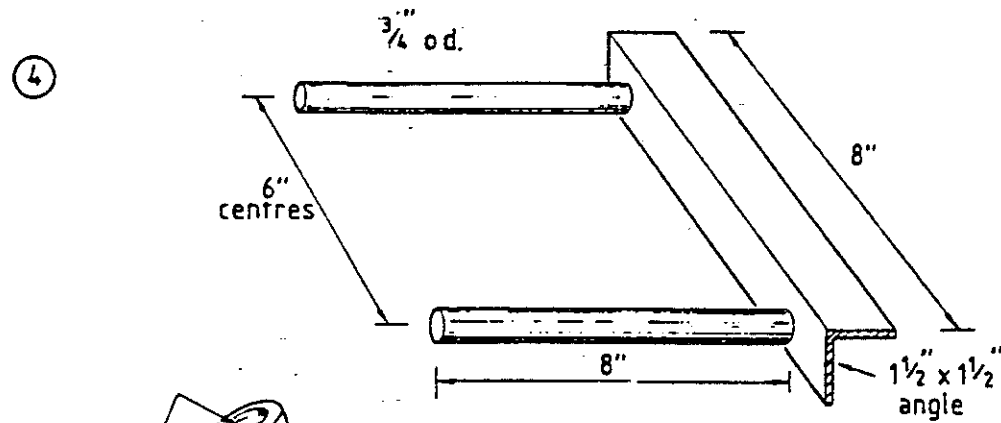
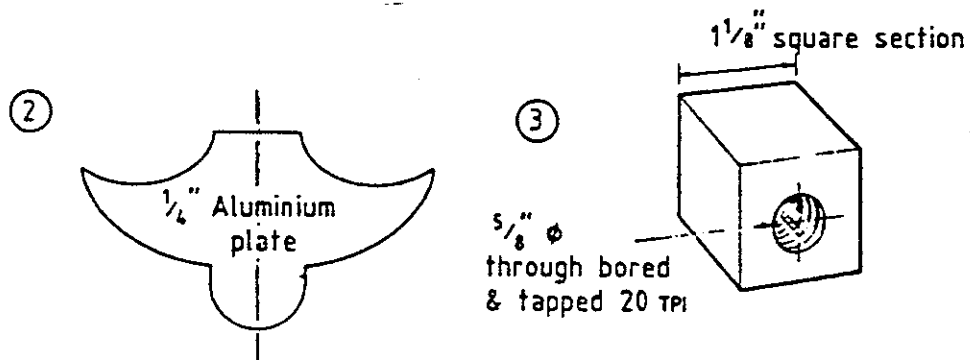
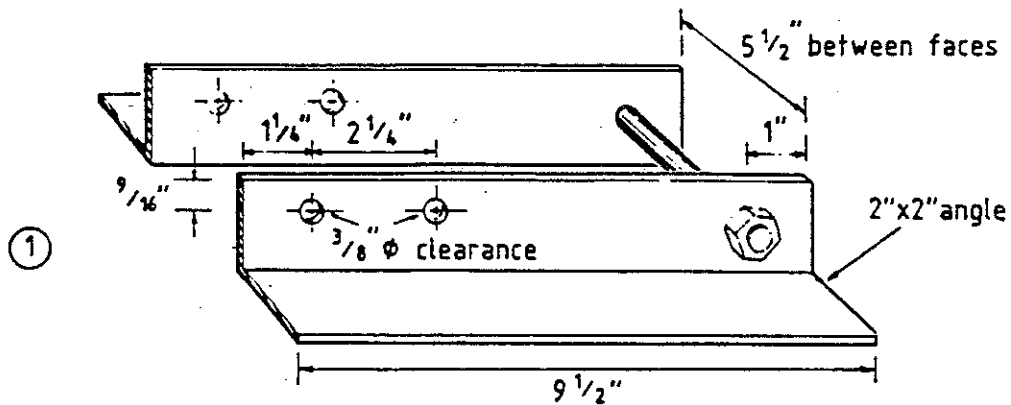
MAKING IT A LITTLE EASIER

Jack Frazer

However manageable and appropriate individual Scott components may be when assembled in their frame and ready for the road, there is no doubt that some of them present a problem when on the bench. Having, over the last few years, spent a considerable time with engines and two-speed gears of the 1923/25 era, this fact has become forcibly borne in upon me: engines will only lie on their sides and two-speed gears are the shape of nothing any way. Acting on the principle that if one has to do it once, one may well have to do it again, it appeared to me that a few simple jigs and special tools could prevent onset of aggro and, indeed, damage to ageing fingers. Hence the following which may be of interest to others.

1. This consists of two short lengths of 2" angle separated by a distance piece (5½") and through bolt. Each angle has two ¾" clearance holes to accept the engine bottom rail bolts. When this is bolted to the rebate at the bottom of the crank case, the engine will stand firmly in the normal position.
2. This comic shape (not to scale in the sketch: you will have to figure out for yourself) when cut out of ¼" aluminium plate and slipped into either crank chamber will effectively prevent crankshaft rotation to enable crank pin screws or the crankshaft drawbolt to be dealt with.
3. This is a cutting of 1¼" square BMS bored through and tapped ⅝" x 20 tpi. When held firmly in the vice this will accept either end of the two-speed gear hollow spindle, to enable assembly/adjustment/trial to proceed in an orderly fashion without damaging the threads or squeezing the spindle.
4. This consists of a cutting of 1½" angle with ¾" holes at 6" centres. Into these two holes are screwed two ¾" OD bars (corresponding to the frame rails), each shouldered to ¾" dia. and threaded at the ends to accept nuts. This gadget can be held by the angle in the vice, and the two-speed gear complete with supporting lugs assembled thereon for trial and adjustment.
5. This offset anvil made from ⅝" OD BMS may be held in a vice to facilitate closure of rivets securing chain wheels to two-speed gear drums, otherwise difficult to do neatly.
6. This is a hardwood block 1¼" thick, 3⅝" OD, with a recessed hole 1¼" ID x ½" deep cut at the periphery. This slips into the crank chamber and, when the whole issue is inverted on the bench, supports the crank for driving up its opposite number.

I have not thought it necessary to show the two or three peg or "C" spanners required, as anyone can make these up from ⅛" or ⅜" plate, but those setting up their lathes to produce securing rings for compression release valves or, indeed, for lock rings for "flat head" water jacket covers, may care to note that the threads involved are 24 tpi.



V16/10 June 1990

West Horsley
Surrey

Dear Brian,

In reading Den Bowman's letter about his 1929 works TT Scott where he mentioned the engine number as 29TT6.

About 3 years ago I restored the Scott which was prepared by the works for the 1930 Manx Grand Prix. The engine number is SP 29TT which was reputedly the spare engine for the 1929 TT entry. It is 498cc bored plus 30thou", the block has had some work done on the ports and is of a higher compression ratio. The crankcase had also been worked on and fortunately is not damaged. The machine finished 15th ridden by R. Stobart. Mavro also had an identical machine made at the same time both being fitted with his footchange gear selector which later became standard. They also had long tanks incorporating an oil tank at the rear. The frames were Sprint Specials with large diameter front brakes.

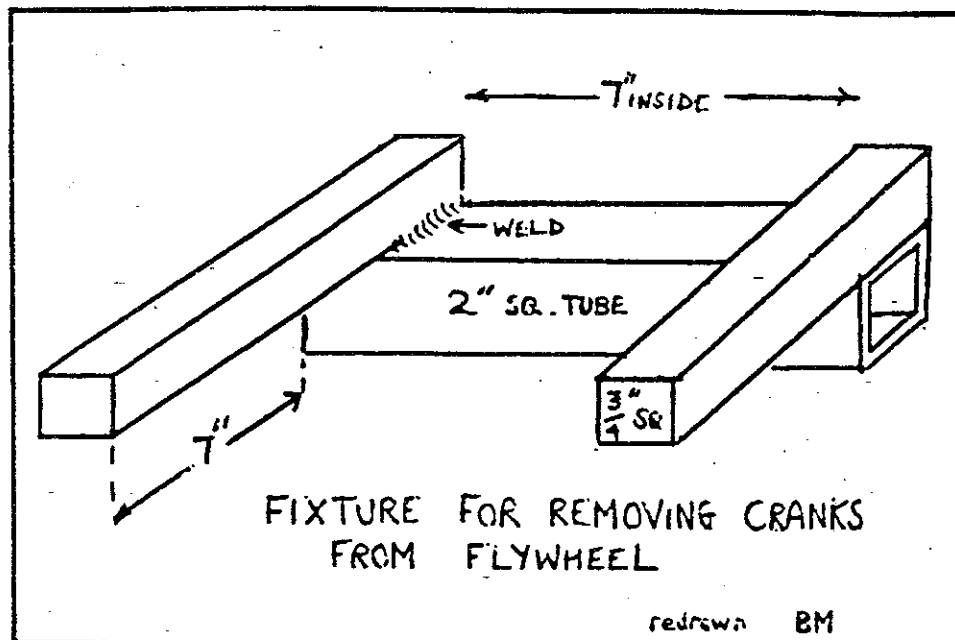
I am enclosing photos, showing Mavro's machines which might re-print in *Yowl*.

Also find enclosed a sketch of a fixture I made up to assist in the removal of the cranks from the tapers in the flywheel. It comprised two pieces of $\frac{3}{4}$ " square bar welded onto a piece of 2" square box section at 7 $\frac{1}{4}$ " centres. By clamping the box section in a substantial vice the two arms facing away from the bench allows the crankcase to be laid horizontally into the arms whereby the flywheel rests on the arms. A biscuit tin is then suspended under the lower side by pieces of wire to catch the crank and rollers when they are driven out. The above makes it a single handed operation.

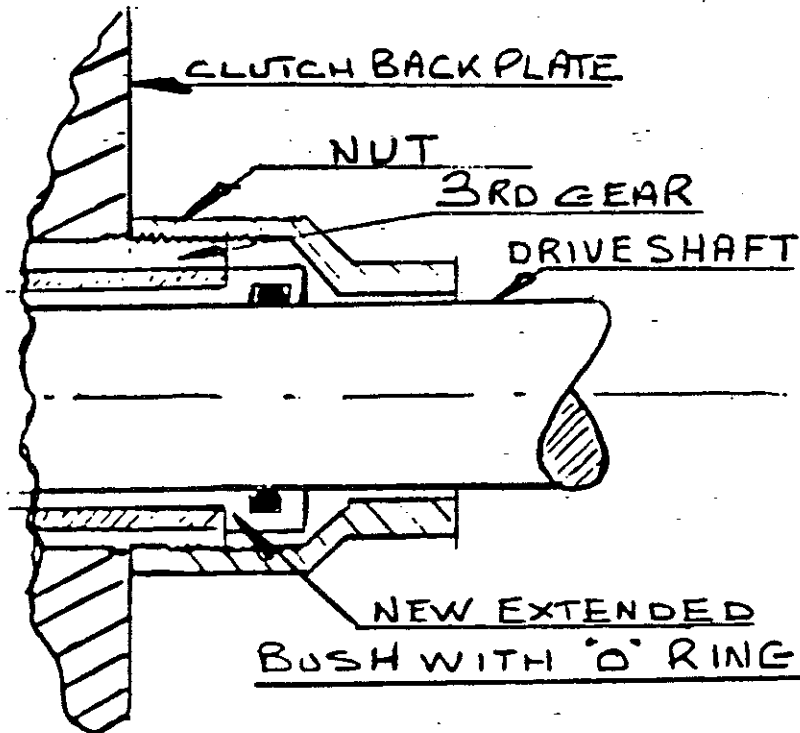
If appropriate you might like to print this in *Yowl* and I would be grateful if you could return the photos.

Enjoyed your last copy of *Yowl*.

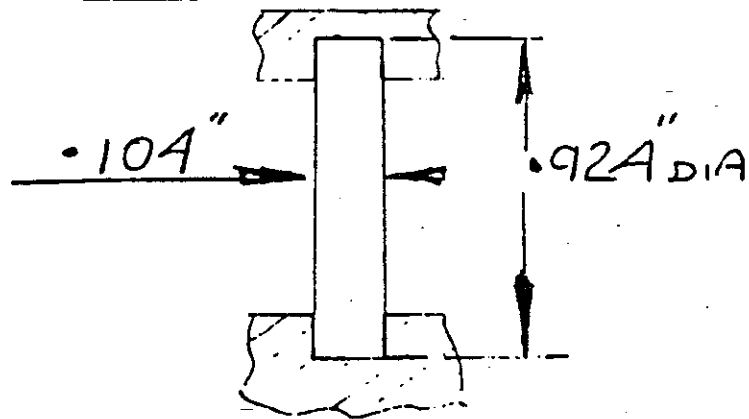
Yours sincerely — Charles Windsor



V1.8/4 June 1993



116 "O" RING GROOVE DETAIL



Ged Rumble's gearbox oil-seal details.

Wrinkles for the Wrinklies

Dear Editor,

I haven't any Scott lore to tell you about or any tales of the past or the unexpected, so if you'll bear with me, I'll tell you about the things I've been doing to my old girl in the last 12 months (a 1931 Flyer, not my very patient and understanding wife).

Christmas 1991 I did the crankcase oil-seal conversion (as in *Yowl*, Dec. 1991) — the best value-for-money job I've done on my bike. I've ridden over a thousand miles on runs and Sunday morning rides the long way round to the pub and not one drop of Silkolene Blood has been

spilt on car parks or my garage floor.

If you want all the oil that passes through the Pilgrim pump to end up round the engine's mains and big-ends, and not into the crankcase void, do the conversion. It costs very little, is very easy to do and, as I found, there is no need to take the crankcase out of the frame.

As standard, my bike had no chain-oiler, so I decided to fit a 'Scott-Oiler'. What a wonderful device it is! Only works when you chase the throttle, so oil is not dripping all the time and you don't have to remember to turn off taps at the end of a run.

With my mag chain driven from the clutch drum, I lubricate two chains in one go and I haven't had to adjust either in over 12 months. Can't be bad.

Do you look down at your radiator when bombing along and remember that Beach Boys' song 'Good Vibrations'? (No? Come off it. Most Scott owners are wrinkly enough to remember that.) Well, they're no good for our old Scott rads and I've sometimes wondered how mine hangs on in there. So I tried to ease the pain a little. I've replaced those semi-rigid linen/rubber hoses, that seem to get harder by the ride, with butyl washing-machine hoses. They are convoluted in the middle with enough plain either end to be cut to suit both top and bottom hose lengths. The plain section is only $\frac{7}{8}$ " bore, but will stretch very easily to fit the 1" dia. radiator and engine outlets. If you fancy trying these, ask your local washing-machine spares shop for pump-to-outlet hose for Indeset models L5/L6 pt. no. IND 160. They cost about £4.75 each. I rode all last year with them fitted to my bike — no problems and a lot less vibration as well.

I use thixotropic Shell Tivela Compound 'A' in my gearbox as recommended by Brian Marshall in *Yowl* some time ago, and very good it is in slowing down leaks. However, when fitting a set of close ratio gears, I decided to improve the seal situation a bit.

The drive shaft was badly worn, .010" at the worst. I had it hard chrome-plated then re-ground it back to size and to a very fine polished finish. I extended the new bush in the third gear by $\frac{5}{16}$ " in length into the clutch back-plate retaining nut and up to the root diameter of the spline on the third gear. I then grooved the bush extension internally to take a standard '116' O-ring. The fine finish on the shaft was essential to prevent abrasion of the O-ring and, fingers crossed, it seems to have cured that leak OK. The small amount of 'A' compound that leaks past the third gear bush lubricates the clutch thrust race just about right, so I've done nothing about that. But I'm thinking about it.

During last year I had a problem with spitting back through the carb. at normal running speeds. On the V.M.C.C. Midland Section Boxing Day Run things really came to a head. The old girl played up all the way to the Black Boy, on the run, and all the way home. My son was following in his 2CV, giving his grandad a morning run out to see the bikes. On arriving home he said: "Dad, every now and again flames were shooting out from between your legs". (Carburation, boys. Nothing to do with turkey and stuffing.) I had a head to head with the gurus at the next S.O.C. Midland Section meeting and the conclusion was: mixture. It was then I remembered I'd changed the needle jet; my original had fatigued and broken at the undercut between thread and hexagon.

My 596cc Flyer should have a standard needle jet — I'd fitted a 106 as a replacement. As my old jet has no number, I assume it's standard and I've silver-soldered it together, re-cut the thread and cleared the bore. On test the bike ran very well, so I assume the jet was the problem. Better buy a new one before my coddled job falls in half again.

At the same time I was also concerned that the ignition timing was contributing to this spitting back. My mag cam-ring was not at its best. One lift felt OK, the other at 180° plus or minus miles, and not very pronounced either. So off it went to Peter Smith in Dipton, Co. Durham, for a re-grind. I posted it on Saturday and fitted it back on the bike the following Wednesday. What super service! On return it looked, and was, a 'cock-on' job. The timing on both cylinders is now as close to being the same as it is ever likely to be. The engine is running more smoothly and starting very easily, hot or cold.

I've covered quite a few miles during a very dry February and March and all seems well now. In fact, the old girl is going great.

I started to pen this during the Christmas '92 break. It's now April '93, but I have, of course, been taking time out to massage the old girl in the garage.

Ged Rumble.

V9/1.2 July 1976

Penola. 5277,
South Australia.
8th March 1976.

THE EDITOR, YOWL

Dear Sir,

As you will be aware from various letters published in recent issues of your journal, I am restoring a 1936 Flying Squirrel which has been in the family for almost 40 years. The frame, wheels, mudguards etc. were stripped, renovated and painted several years ago. The gear-box and clutch had their turn about two years ago and the Magdyno and other minor parts were attended to last year.

I have now just assembled the engine and in doing so I acquired a "wrinkle" which I think may be worth passing on. The reason for the bike going out of use about fifteen years ago was inability to start it and when it was dismantled about three years ago it was found that one of the crankshaft seals had seized and become red-hot, probably due to the failure of the oil supply on that side. In those days the bike was not much used and could be idle for periods of five or six months or more which would account for the oil pump ceasing to function.

Fortunately I still had the mainbearing cups and seals which I had taken out of the engine just after the war, one set of which was in quite good order. As luck would have it, it was the one I needed so I swapped it for the burned-out one.

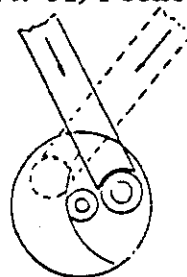
It was when I went to assemble the cranks that I found difficulty in getting the mainbearing rollers into the cups. I have forgotten how I did it years ago, but this time I used a device which is very simple and very, very effective.

I think everyone knows the wrinkle of using a strip of tin and a pair

Dear Brian,

In reply to Arthur Fogg's request for details on Tom Ward's special tools for working on Scotts (*This and That*, Yowl, April '91) I believe I can enlighten him on one of those items.

"You might like to know how we dismantle Scott cranks — all without any heavy business. We use a 1 inch x 1/4 inch flat bar of aluminium 8 inch long and recessed at the business end to fit crankpin. With this and a 3/4 lb hammer, we jar the crank first one way and then the other, repeatedly, and listen for the sound changing denoting that the crank is released."



This method was also listed as an alternative way of releasing the cranks from their taper in a step-by-step illustrated article on Scott overhauls in *Motor Cycling*, March 7th 1962. I too mentioned the tool and method in our Autumn issue of *Overhung Cranks*. However—a sharp response came from Eric Langton almost by return post, and I quote:-

"I was startled not to say shocked to read the advice on how to remove a Scott crank in the last newsletter. I have never broken a crank, but if I wanted to, I would put on my blue and white striped apron and lay into it with a 3/4 hammer just as described and if it came out in one piece I would not want to use it again. The repeated blows from a heavy hammer must be many, many times more destructive than anything those flimsy con-rods could inflict."

Food for thought?

As for the 'Guide rod' used when replacing the cylinder block, I would be delighted to hear about this marvellous device as well. My method has been to use six hands and three brains with the ever increasing use of expletives and corresponding volume being amplified to stem the rapidly diminishing co-ordination. At the critical moment, someone who shall be nameless, makes the smart remark. "Are we enjoying ourselves yet?" There must be a better way!

Best wishes — Neil Earnshaw.

Ed: I just don't know what to think of this method of crank removal. What happens to the Flywheel Key??

Is the flywheel clamped or wedged in some way? I can see that it would be easy to hold the flywheel of a two-speeder engine in a vice, but NOT so easy with a three-speeder (Flyer) engine. Even so it must be a pain to have to repeatedly slacken it off, turn the flywheel, tighten up, and then hammer in the opposite direction. Perhaps I am misunderstanding the technique?

To my mind the only danger of the conventional method is of the crank hurtling out of the crankcase and taking a piece of the thin and fragile lip of the door opening with it, simply because the crankpin is not lined up with the cutaway. All I do is stuff the crank chamber very tightly with a piece of clean rag. It stops the crank going too far, and also keeps all the rollers, gland, spring etc. from going A.W.O.L.

I have only ever replaced cylinder blocks on my own, without assistance, and I have never broken a ring. The size and shape of the 'chamfer' at the bottom of the bore seems to be important as it acts as a guide to centralise and precompress the rings. Certainly short stroke 596cc engines bored to plus 60 thou, are much more difficult, because there is not enough metal left to machine a chamfer! My method is to cut some half-inch wide strips of aluminium sheet (about 18g) which I use as piston ring clamps. These are well oiled and held in place with very tight rubber bands, adding bands for more tightness until the rings are flush with the piston sides. I set both pistons at the same height, wedge the flywheel with a wooden wedge in the bottom of the crankcase, oil the bores well, and just lower the block down into the crankcase. Hand pressure has always been enough. As soon as I can see that the rings have entered the cylinder I cut through the rubber bands and fish out the alloy strip. The only awkward bit is not overdoing the tightness of the rubber bands, because if you do the alloy strip is reluctant to slide over the rings as the cylinder pushes downwards. Let's hear YOUR special method! R.S.V.P.

THE SCOTT BIG END

Tim Sharp

Not a great deal has appeared in *Yowl* on this the Scott's Achille's heel and I hope my experiences on this subject during numerous engine rebuilds and over 50,000 miles of Scotting will prove useful to others.

I doubt if anybody will disagree with me when I say that all the moving parts of the Scott engine and gearbox are exceptionally reliable and have a long life with the exception of the big end bearings. It is true that piston seizure is fairly common but this is due to lubrication failure or insufficient clearances.

It is also true that all the parts of the Scott motor-cycle are robustly designed with the exception of the crankshafts.

Although this weakness is a serious handicap for those seeking to increase the power output of the Scott engine by raising peak revs above 4,500 rpm (e.g. Vintage racing), it is also a fact that the ordinary Scott rider very rarely reaches 4,000 rpm as this represents about 90 mph with a 21T final drive sprocket. Crankshaft failure is in fact a rare occurrence to the ordinary Scott rider but big end failure is not. I well remember Harry Langman saying that in his racing days he never had a problem with crankshafts breaking but he did have plenty of problems due to big end failure for which he usually blamed inadequate lubrication. It was for this reason that the crankshafts of the later longstroke engines were undercut to channel oil through the big end bearing. This of course weakened the crankshafts somewhat compared with the short stroke engines and the Super Squirrel engines but it was effective at getting oil to the big end.

What then can be done to make the big end last longer and also perhaps to be capable of greater loads?

Some years ago whilst rebuilding a Scott bottom end I found that the big end rollers were an exceptionally tight fit and had to be knocked into position with a hammer and piece of hard wood. Once the con-rods were assembled on to the cranks they had no lateral shake whatsoever. This engine subsequently gave a much higher mileage than usual before the rebushing of cranks and con rods again became necessary. I then began to look more closely at the bushes and race plates when dismantling engines that had done considerable service.

Firstly I noticed that without exception both the inner and outer race plates were worn where the holes were drilled to allow ingress of oil to the race tracks. The holes appeared to have become bevelled and this could only have been caused by the rollers twisting in service due to a too great lateral clearance on the big end bush. This twisting of the big end rollers must then obviously greatly increase skidding of the rollers instead of rolling and the bearing becomes somewhere between a roller bearing and a plain bearing but with far too little lubrication for sliding motion. This then generates heat and may result in a reduction in surface hardness of the bushes and rollers after which wear becomes very rapid indeed. The much greater life of the bearing where the rollers were a tight fit must have been due to the reduced tendency for rollers to twist out of line and cause skidding.

Secondly I noticed the familiar flaking of the race tracks at the positions of maximum load. This type of wear is made worse by running with too much ignition advance or too high a compression ratio. (Compression ratio should not be higher than 7:1 before part closure). It is also made worse by big end rollers skidding which can locally affect surface hardness, particularly if insufficient lubricant is present.

This type of wear is very seldom seen on the main bearings where the fluctuations in rotary speed are not present and of course neither is the tendency for rollers to skid.

The key to increasing big end life is therefore in reducing the tendency for rollers to skid and in providing the big end with more lubrication so that the skidding that does take place does not generate enough heat to destroy surface hardness or cause scuffing of the race tracks.

There are two further factors which affect big end life:—

1. Flexure of the overhung cranks causing the whole con-rod assembly to be out of line. This is greater at higher revolutions (crankshaft loading increases in relation to the square of the rpm), and is also dependent on the material from which the crank is made and the type of heat treatment. At touring speeds it is very small and although it must have some effect on big end life it is very difficult to say how much.

2. Oscillation or vibration of the con-rod at the small end. This also has the affect of putting the whole con-rod assembly out of line.

At certain speeds a quite violent side to side movement can be set up at the small end and I believe that this can result in a very considerable reduction in big end life.

Both these two factors result in the big end rollers being run on their edges which must encourage skidding and local overloading of the race tracks.

Reducing the tendency to skid

This is achieved first by making up a reduced lateral clearance big end bearing and secondly by eliminating vibration of the con-rod small end by making nylon spacers of the correct width to fit each side of the small end.

Minimum lateral clearance bearing

The usual dimensions of the crankpin bush are:—

O.D. 1.25in

I.D. 0.750in

Width 0.444in

Those of the con-rod big end bush are:—

I.D. 1.875in

O.D. Variable — interference fit in the rod and then ground to 1.875in I.D. after fitting.

The width of the con-rod big end bush is 0.372in — 0.373in.
The thickness of the inner race plate is 0.0625in (1/16in)
and we have:

—0.375in Roller
0.062in Race plate

0.437in Total
0.007in Clearance of rollers between race plates.

0.444in Width of big end bush.

This clearance .007in is too great to maintain accurate alignment of the rollers in the bearing. By using a crankpin bush of 0.44in the clearance of the rollers between the race plates is reduced to .003in with a resulting improvement in roller alignment.

Bushes of this width can be obtained by either reducing the standard bushes on a carborundum block or better by specifying the precise dimensions when having them made by Alpha bearings or whoever can undertake this type of work.

The distance between the inner and outer race plate of the bearing now becomes: —

0.440in Width of big end bush
0.062in Inner race plate

0.378in Distance between inner and outer race plate.

— and care must be taken to make sure that the con-rod has three or four thou' clearance between the race plates.

As previously mentioned the rollers should be a tight fit in the bearing and when fitting the con-rods to the crankpins it should be necessary to knock the last few rollers into position with a few light taps with a hammer and piece of hard wood. This may be contrary to theoretical recommendations on the assembly of ball races but in my experience any "lumpy" movement of the bearing disappears as soon as the engine warms up, presumably due to the high interference fit con-rod bush in the big end eye 'relaxing' a little at higher temperature. In fact it is not good to have too high an interference fit at this point because on reaching running temperature the bearing may not remain truly circular. For this reason con-rods reconditioned at the Shipley Works had the big end bushes locked by punching metal into keyways ground in the edges of the bush, rather than relying solely on high interference fit.

We must also consider the classic method of reducing skidding by using a lightweight aluminium cage to separate the rollers. This has been tried and I refer to an excellent article in *Yowl* February 67 by George Bennett.

I have no experience on the success or otherwise of using caged bearings on the Scott big end but I would think there are two disadvantages: —

(1) The load carrying capacity of the bearing is reduced because there are fewer rollers in the bearing and the rollers have to be narrower to allow room for the cage.

(2) The cage may suffer rapid wear if any flexure of the crankshaft occurs.

(to be continued)

THE SCOTT BIG-END (2)

T. Sharp

It is doubtful anyway if Scott engines run fast enough to benefit from caged bearings since all push rod Norton singles (and Vincents for that matter) managed with a crowded assembly.

Reducing small end vibration

As already mentioned, this is achieved by making up nylon rings of just the correct thickness to fit on the gudgeon pins at each side of the con-rod small ends. They have to be specially made for each engine since these dimensions are different for every engine. The technique is as follows:—

(1) Assemble the crankcase out of frame with a flywheel end float of no more than .010in and no less than .005in. A small end-float on the crankshaft reduces the wear on the flywheel by the packing gland tongues due to the "sawing effect" of the side to side motion. It is also necessary of course if we are to have minimum lateral clearance on the con-rod small ends. The correct crankshaft end float is obtained by shims behind the packing glands and I find it convenient to measure the end float using feeler gauges between the flywheel and the chain guide, knocking the crankshaft first one way and then the other using a heavy hide mallet.

(2) Having correctly assembled the crankcase the next stage is to assemble the con-rods on to the cranks as previously described and fit the pistons without rings to the small ends of the con-rods, finally placing the clinder block in position. (A simple matter without piston rings).

For those who use pistons parted at the rear the next stage of measurement is made more simple.

(3) We must now measure the clearance between the internal gudgeon pin bosses on the pistons and the con-rod small ends, so that accurate spacers can be made up. If the pistons have been ported at the rear access can be gained with feeler gauges through the transfer port, and measurement is simple. Where pistons have not been ported, the only way is to insert feeler gauges from underneath the piston gaining access through the crankcase door. A flashlight is necessary and very long feeler gauges are essential.

(4) Having determined how thick each spacer should be it is now necessary to produce these from nylon bar (nylon for its light weight) on the centre lathe. First bore a $\frac{1}{8}$ in hole down the centre and then part off the spacers at the correct dimension using the indexing on the lathe slides.

The engine can now be assembled with the spacers in position on the gudgeon pins.

Finally, to take the maximum advantage of this work we must improve lubrication. Much has been written on this subject, whether it be the Mavro system (May 63 or May 77) back to drip feeds (Glyn Chambers), double reduction Pilgrim pump mounted away from engine heat, or Pilgrims Progress by D. Avis October 65 and April 66.

All these systems are good and they are all improvements on the standard lubrication system but my favourite is the Loftytube system described in detail by W. (Lofty) Avis in two articles October 65 and April 66. For those who have not read the articles I will briefly describe my version of it.

It consists basically of applying the dry sump principle to a 2-stroke. I use the standard duplex Pilgrim Pump on the offside

crankcase door set to deliver one drip every other pulse when the engine is at running temperature. Normally this would result in an enormous smoke screen and rapidly oiled plugs. This is prevented by the fitting of low pressure one way valves (readily obtainable from compressed air specialists), in place of the crankcase drain plugs. These then take the surplus oil in the crankcases via a 2 into 1 junction to a single Pilgrim pump mounted on the nearside crankcase door and set at full stroke. This pump returns the oil to the oil tank via a rather crude filter which is in fact a bowl type fuel filter where any metal debris can settle out rather than by efficiently filtered. The system really does work, there are no smoke screens and well over double the amount of oil goes through the main bearings and big ends compared with any system where the oil has eventually to be burned. There is some dilution of the oil with petrol but this does not seem to matter.

To conclude my contribution, which I hope will stimulate some further correspondence, may I give a few facts about Silk pistons. After reading in a recent *Yowl* that John Hobley of Tees Tyne section had fitted a pair in his 2-speeder I decided to lash out thirty odd pounds and get a pair for myself.

The dimensions are as follows:—

Bore 76mm. (2.992in or 2-15/16in + .055in).

It would I think be possible to bore a detachable head longstroke block to this oversize but not a blind head longstroke block where there would be a danger of blowing the tops off the cylinders. Used in conjunction with longstroke crankshafts the capacity would be nearly 650c.c.

The distance from gudgeon pin centre to top land is identical to longstroke. i.e. 1/16in less than shortstroke. This is important because when short stroke pistons are used in long stroke engines the compression ratio is too high.

Unlike Scott pistons they are not turned circular but are three to four thou' greater in diameter at right angles to the gudgeon pin than they are paralld to the gudgeon pin.

Most important the weight at 380gms. each including pins and rings and unported is almost identical with a die-cast Hepolite piston I have for a 498c.c. engine!!

It is also very advisable to have the crankcase wells machined out to 3in diameter if anybody is contemplating fitting Silk pistons to a Scott.

Finally just to illustrate how much the crankshaft will take I must mention the superb performance put up by Ian Pearce at the October 78 Vintage meeting at Cadwell Park.

In the up to 1945 final and after he had been lying in third place behind two Triumph twins for eight laps he flew past Mick Broom on the back straight and held on during the final lap to win by a machine's length.

I crossed all my fingers for him and the crankshafts as he accelerated out of the hairpin and up the hill, noticeably holding 1st and 2nd gear much longer than on previous laps.

I do believe that Ian uses a standard Scott bottom end and I well remember Harry Langman once agreeing that the crankshaft was the Scott's weakness but "It is amazing just how much they will take" he said.

A CAGED ROLLER BEARING FOR THE BIG-END ON A SCOTT Part I

by *George Bennett*

On the normal Scott big-end, the rollers in the bearing are "crowded" and of large diameter, whilst the crankpin is weak and the crank disc flexible. These four factors contribute greatly to the failure of the big-end at high r.p.m. The following text deals with each factor in turn, highlighting the reasons for failure of each component.

(a) *Crowded Rollers.*

A bearing is said to have crowded rollers when there is no cage separating the individual rollers and these bear directly against each other. Although this type of arrangement possesses the advantage of having a large area of contact between the crankpin and the con-rod eye, the objection is that at high engine speeds centrifugal force tends to throw the rollers outwards from the crankshaft centre which increases the friction force between each roller, causing considerable wear (see fig. 1). There is a speed when the friction force is so high that the rollers lock and wear is very rapid.

(b) *Large Diameter Rollers.*

The speed at which the rollers will lock depends on the diameter of the rollers: the smaller the diameter, the higher the speed at which locking will occur. (This is due to the reduction of weight). But, unfortunately, small rollers rotate faster than large ones, causing more rapid wear, so this is not the complete answer.

(c) *Crank Pins and Crank Discs.*

Crank pins and crank discs have been known to break at high r.p.m. also, the rollers in the bearing wear at each end giving a "barrel" shaped roller, due to the disc deflection, (see fig. 2). The obvious solution to prevent deflection and/or breakage is to have thicker discs but, due to the compactness in the Scott design, this is impossible. However, a partial cure is to use narrower rollers, i.e. $\frac{1}{4}$ in. wide, as used in the main bearings, which have two effects:—

1. The centre-line of the rollers is brought closer to that of the crank disc which reduces the amount of overhang and hence there is less tendency for the crank disc to deflect.
2. Due to (1) the rollers do not wear so rapidly at each end.

Note—The overhang can be reduced even further by utilising narrower inner roller plates.

FITTING CAGED ROLLER BEARINGS.

By using the narrower rollers ($\frac{1}{4}$ in. wide) a cage may be fitted to the big end bearing. For my own use I have constructed a cage, from Dural bar, in the form of a complete ring with extensions to keep the rollers apart (see fig. 3). Incidentally, I reduced the number of rollers by two, to ten, to give sufficient room for the cage to be fitted.

The advantages of having a caged bearing are many and below I have listed some of them, in order of importance.

(a) A cage separates each roller from its neighbour and the centrifugal force set up due to motion is taken on the cage bar, instead of the neighbouring roller, which prevents inter-roller scuffing.

(b) A cage guides the rollers parallel to the direction of travel. In the standard big end, side plates guide the rollers but due to the clearances allowed, the rollers slew and wear is set up between the ends of the rollers and the side plates, causing the rollers to skid more easily.

Even at low speed the rollers in a crowded race can slew and cause wear, so a cage would be useful even here.

(c) By using duralumin for the cage and also by using narrower and less rollers, the weight of the roller assembly is greatly reduced. At high speed this is a big asset since, due to the oscillating motion of the con-rod swinging about

the gudgeon pin, the rollers speed up at T.D.C. and slow down at B.D.C. The forces causing skidding are found from the formula $\text{Force} = \frac{\text{weight}}{g} \times \text{acceleration}$, from which it can be seen that the lighter the rollers the lower the forces causing skidding and hence the life of the bearing is prolonged.

(d) Dural is a good bearing material, especially against steel, providing it is lubricated: therefore friction is again reduced in the bearing.

(e) Although the total bearing area of the caged rollers is less than that of the standard bearing, the "guidance" of the rollers should make the big end last much longer.

The foregoing are my reasons for fitting a caged big end bearing to my Scott. A batch of cages has been produced and several volunteers will be testing them in their engines. In part II, I will give details of how I produced the cages and of how to fit them to the engine. Any comments? Please write to *Towl*.

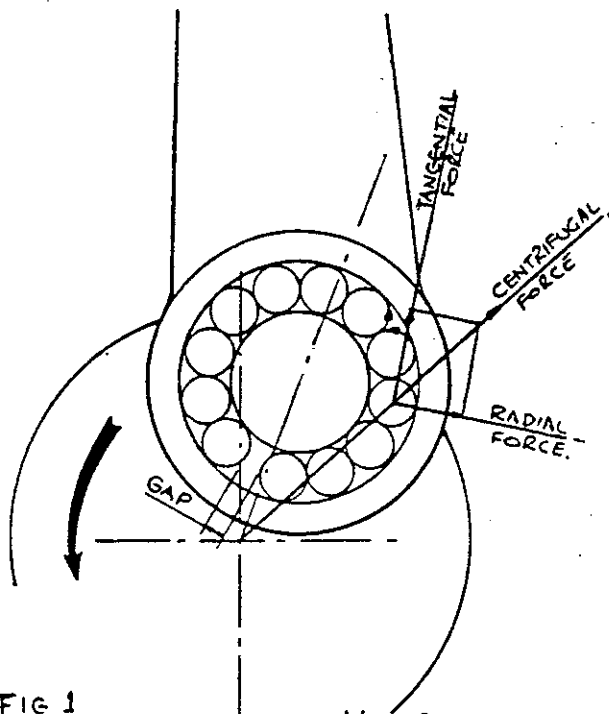


FIG 1
 $\text{CENTRIFUGAL FORCE} = \frac{W}{g} \times \omega^2 r$
 RADIAL FORCE TAKEN BY OUTER RACE,
 TANGENTIAL FORCE TAKEN BY NEXT ROLLER

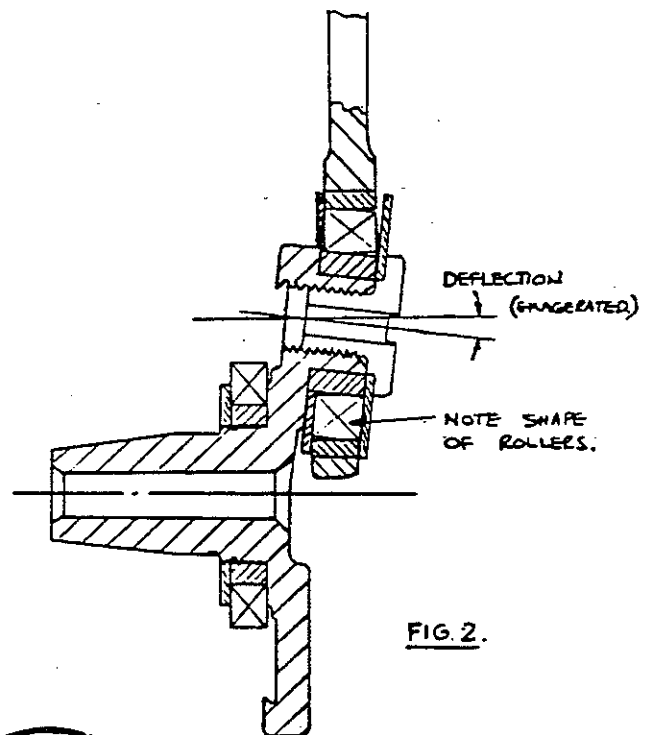


FIG. 2.

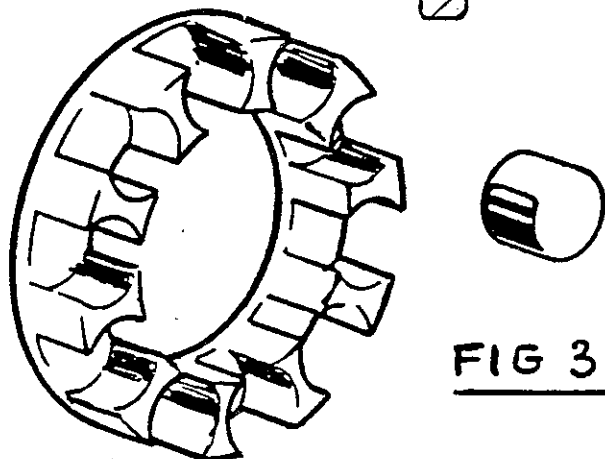


FIG 3.

V9/5 May 1975

POTTY COMMENTS

Detachable heads . . . that won't!

Firstly — why detach at all if not necessary? We managed with blind head blocks for years. A re-bore should be the only excuse, certainly not for decokes as gaskets are difficult to obtain.

However, if the head has to come off, the studs can be bored out (as someone mentioned in Jan '75 "Yowl") but there is on the market a tool for use on cars with the same problem. It's called a "corrosion cutter" and it is a thin tube with a cutting edge on one end, should be quite easy to make one. Use by hand power and tommy bar — not an electric drill!

Anyhow, to stop the same thing happening again:—

1. Increase the clearance on the hole, and
2. Replace studs with stainless steel ones.

Remember — 'Bars Leak' stops corrosion as well as leaks.

GLYN CHAMBERS

CYLINDER HEAD CORROSION V9/12 July 1976

This is caused by electrolytic or galvanic action between two different metals in bimetallic contact.

In effect, the alloy cylinder head and the steel cylinder bolts act as a battery, the presence of water aids this. It is actually a question of the voltage generated that controls the amount and rate of corrosion. Different materials act in different ways. In some cases one of the materials will corrode away completely whilst the other remains unmarked, whilst in others, both will corrode at the same rate more or less, and so on.

We went to a great deal of trouble and expense to have some stainless steel studs made, this cuts out the corrosion on the studs completely but unfortunately only reduces the high corrosion rate slightly on the alloy head.

The answer—Cadmium plate the studs. This cuts out 98% of all the corrosion, so will all who have bought studs, please RETURN THEM, SO WE CAN FINISH THE JOB OFF. All the studs in stock are being plated and we hope that this will not affect the price much. We should be able to sell a complete set of 16 plated stainless studs, 15 large and the special small hexagon nut, plus all the stainless washers for about £10.00 a set.

You couldn't get them made out of ordinary steel at that price. To make a 100% job of it, you have to:—

1. Use our special studs.
2. Open out the holes in the cylinder head very slightly.
3. Paint the holes with anti-corrosion paint or treatment.
4. Use an inhibitor in the water. (Bars Leak is just the job, and stops corrosion and leaks in the radiator.

Your cylinder head will now last forever!

Potty

CYLINDER HEAD CORROSION V10/12 Nov 1976

Ken Lack

I can offer another remedy to the cylinder block/head electrolytic action problem described by Glyn Chambers in the July Yowl: "Fernox".

"Fernox" is the liquid used to keep central heating systems free from corrosion. When I have used it in the Scott water cooling systems, the water has issued forth from the drain tap almost fit to drink.

Since it is supplied in half, or one-gallon containers, it would be logical and economical for a group to share one between them.

HOW TO FIX YOUR HEAD

Jim Ogden, Gordon, N.S.W., Australia.

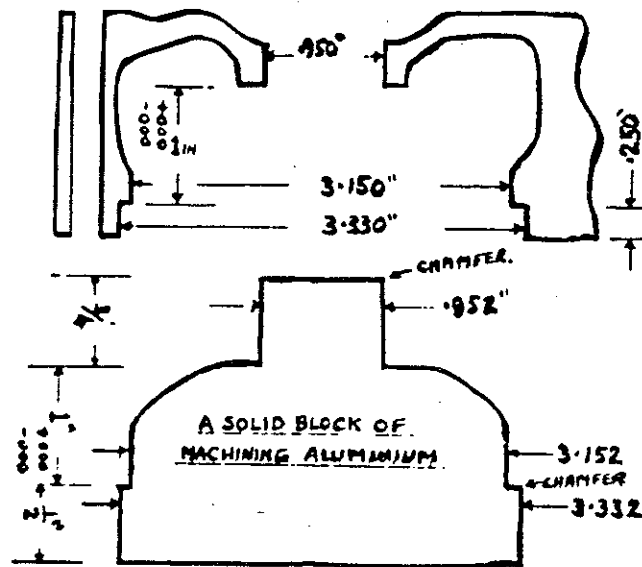
I should imagine that there are a lot of cylinder heads about, which have had the plug thread stripped at some time in the distant past, and which have been repaired by welding an insert of aluminium in place, or something similar which has fixed the spark plug thread perfectly, but somehow, mysteriously, the water still leaks into the combustion chamber.

Having been confronted with this problem at first hand, with not much chance of being able to buy a nice new cylinder head, a way of fixing the faulty head had to be found.

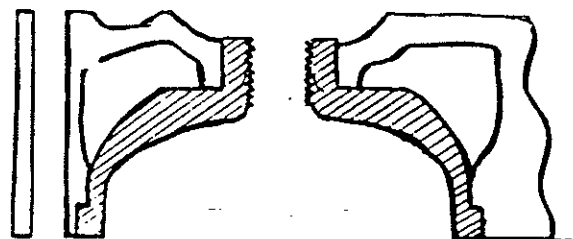
Fortunately I have the use of a lathe, and after much experimenting I stumbled upon what seems to be the complete answer.

This comprises replacing the complete combustion chamber, by turning out the cylinder head and fitting an insert turned from machining aluminium. With this system, water cannot leak into the combustion chamber and the head is just about as good as new.

In case any of you Scott owners' should have this problem, and decide to have a go, here are a few pointers which may help.



CYLINDER HEAD & INSERT.



INSERT IN POSITION 596cc ENGINE.

First, make a template of the combustion chamber shape, so that you know what shape to turn out of the insert, making all three sizes .002 inches bigger than the corresponding bore turned in the cylinder head, and put the insert in the cylinder head, mount the head on a substantial surface, put the insert into the freezer compartment of the refrigerator. When too cold to hold, heat the head with an oxy-torch or similar (be careful not to melt it) and the insert will then tap into place. Make sure it sits well down on the shoulder, and when cold, it is ready to turn the combustion chambers. The machining aluminium will polish up like a mirror with 1000 wet and dry.

Mine is going well with no sign of a water leak.

IMPROVEMENTS TO SCOTT CRANKSHAFT SEALS

The crankshaft metal-to-metal sealing glands on the Scott engine were a most ingenious design, and the porting arrangements appear originally to have been designed with the old drip-feed system in mind, utilising the periodic crankcase depressions.

However, with the Pilgrim pump system the behaviour of these glands is often erratic. A carefully assembled engine should perform satisfactorily as far as oiling is concerned, but all too often oil is lost into the void between the crankcase chambers, and although this lubricates the primary chain (unintentionally), the resultant mess, the variations in the proportion of the oil performing its primary function, and the variable effects of gas leakage past the glands on the engine slow running characteristics, are irritating to say the least.

During the past few years several owners have replaced these glands with modern oil seals, and have generally reported improved performance.

The writer is indebted to David Brierley for the basic information regarding this modification, and has applied it to the engine of a Flying Squirrel Sports machine, with very satisfying results so far.

Not only is the engine completely oiltight, but also the oil feed via the Pilgrim pump appears much more regular and it is much easier to maintain the recommended "faint blue haze". Additionally, the slow running is improved. Admittedly, the bike has covered only about 1000 miles since the modification, but so far the performance remains constant.

The modification entails the following work:-

Sleeving the crankshafts

A mild steel sleeve is fitted to the parallel diameters of the crankshafts, as shown in Fig. 1.

The dimensions of the sleeve are given in Fig.2.

The sleeves, a slide fit on the crankshaft, should be locked in place using Loctite, preferably, but not essentially, "Bearing Fit 631". This product permits removal at a later date, if sleeve replacement becomes necessary.

The surface of the sleeves, on which the oil seals will run, should be well polished after turning, down to 1200 grade wet and dry paper — used dry, as should the chamfers which provide the lead into the oil seals. Mild steel is selected for these sleeves because experience shows that this usually exhibits less wear than do harder steels running in oil seals. The reason for this is not fully understood, but it is possible that the softer mild steel "smears", thus avoiding surface break-up into tiny particles which, with the oil, would form a lap.

End Float and Thrust

The metal glands and springs having been discarded, it is necessary to make and fit thrust washers. Phosphor bronze or aluminium bronze appear to be suitable materials.

These thrust washers should be "floating", and the dimensions are giving in Fig.3.

Steel shim washers may be used between the rear face of the thrust washer and the retaining ring for the main bearing rollers, if it is necessary to adjust the end-float.

The end float should be .020 inches to .028 inches, so that there can be some crankshaft "bounce" to assist in providing lubrication to the oil seals.

Oil Seals

The outer element of the seals should be rubber coated rather than bare metal. The seals are pressed into the main bearing cups rear aperture,

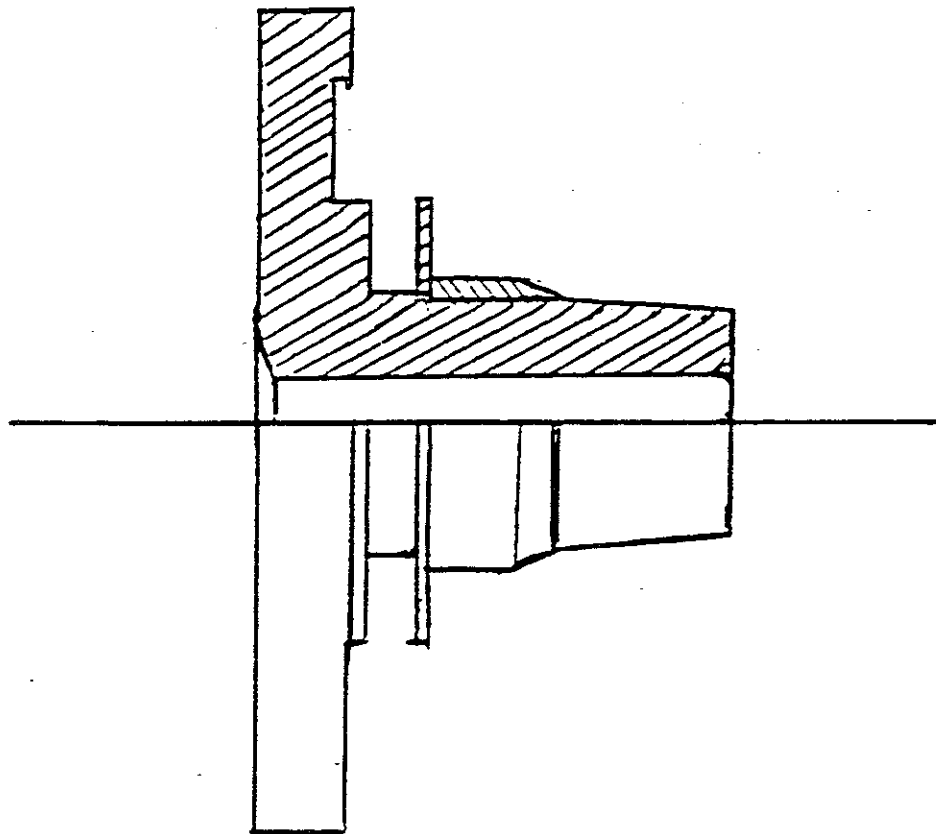


FIG. 1
CRANK/MAINSHAFT ASSY.
WITH SLEEVE FITTED.

and have dimensions as follows:-

Inside dia. $1\frac{1}{8}$ inch

Outside dia. $1\frac{1}{2}$ inch

Width $\frac{1}{4}$ inch

Suitable seals are:-

George Angus Part No. MT 1121501/4 — SE70

or Aeroquip Part No. M1 0751121/4 — SE70

Seals of this type have an interference fit of about .005 inches with the rear aperture of the main bearing cups. They should be pressed into the aperture, lip facing towards the cranks, using a drill press or similar to ensure squareness. The bearing cup aperture and the outer diameter of the seal should be smeared with an adhesive prior to pressing-in.

Assembly

The cranks and flywheel are assembled and "knocked up", in the normal way. Care should be taken to ensure that the mild steel sleeves, the bronze thrust washers and the oil seals are well lubricated with engine oil, before assembly.

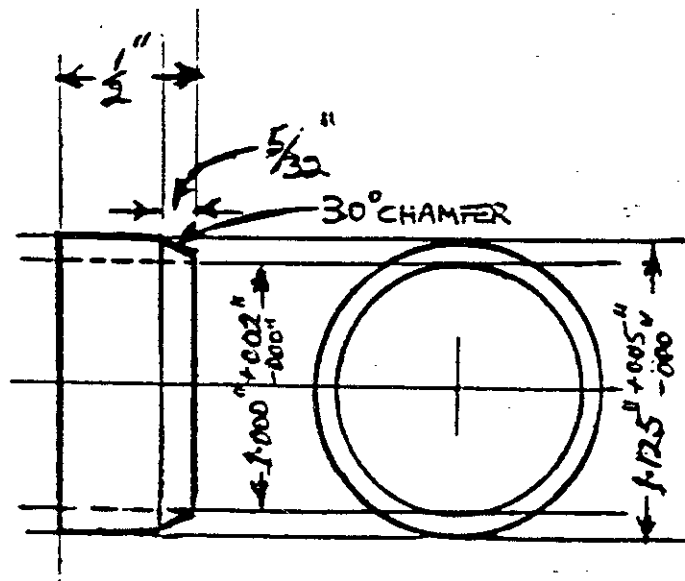


FIG. 2

MILD STEEL SLEEVE

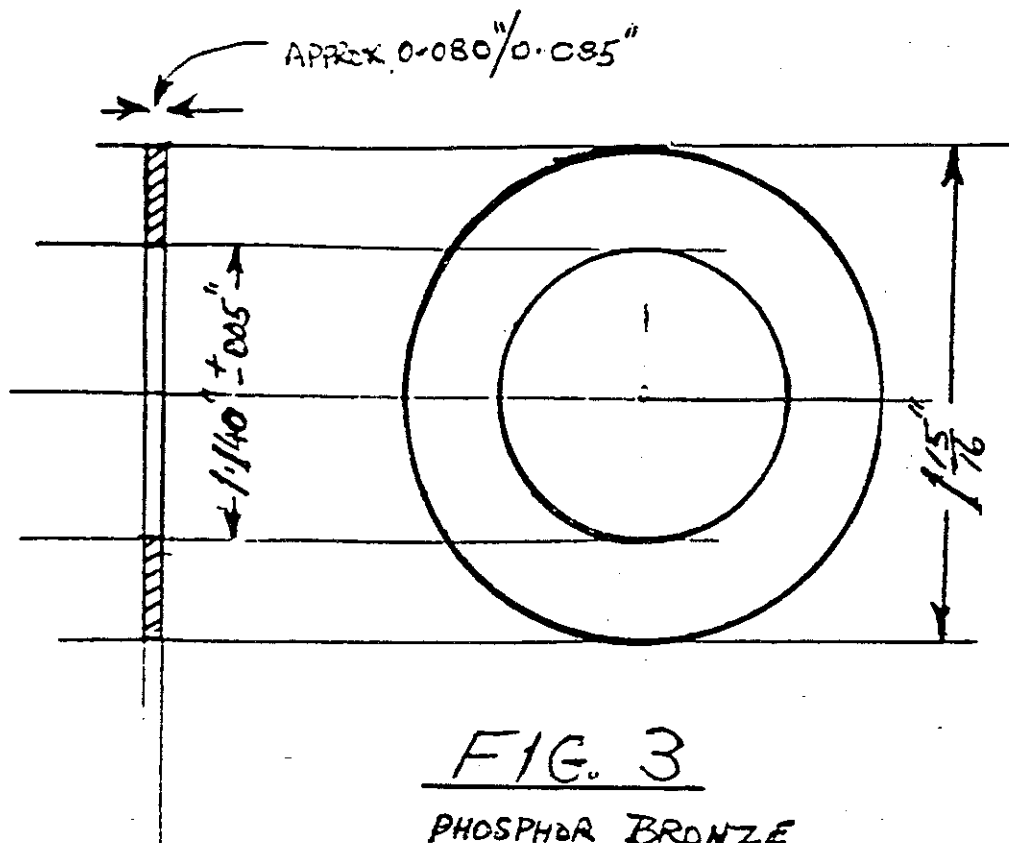


FIG. 3

PHOSPHOR BRONZE
FLOATING THRUST WASHER.

Lubrication

Tests so far indicate that oil reaches the crankcases satisfactorily and normally, despite the absence of porting. It is considered that the positive pressure, albeit small, which is developed by the Pilgrim pump is sufficient to ensure metered oil delivery to the main bearings, and in fact there appears to be improvement, as mentioned earlier.

The oil seals so far appear to be receiving adequate lubrication. At first sight one might think that on leaving the port in the bearing cup rear wall, the oil would be centrifuged outwards and thus starve the seals of lubrication. This appears not to be the case, and one theory holds that in centrifugal systems such as this, pressure differentials are set up and that these result in some of the fluid flowing inwards towards the centre. Obviously, the mechanism of such flows is complex. Perhaps this phenomenon contributes to the leakage into the crankcase which we often experience with the original metal sealing glands.

The only disadvantage so far recorded is that it becomes necessary separately to lubricate the primary chain! Silkolene Chain Lubricant aerosol is most effective; it need be applied only occasionally, and if used correctly, it does not "fling".

Both David Brierley and the writer will be stripping down our engines at some future dates, and will report on what we find. Meantime, details of experiences of other members with similar sealing systems would be useful to have, especially in regard to seal and thrust washer life.

Don Hewitt.

V17/8 Feb.1992

Slaithwaite,
Huddersfield.

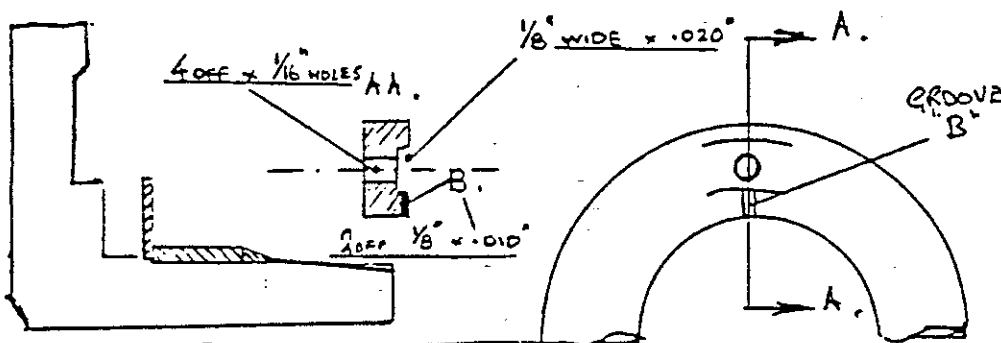
Dear Brian,

I refer to Mr Don Hewitt's article on crank seals. Perhaps if a groove is machined in the face of the "thrust washer" and say, four holes drilled through, the mains will be lubricated better, and a couple of grooves radial outwards will lubricate the seals (see 'B'). All very well you say, but what about back pressure!? An air line type non-return valve could be fitted to each side. The end float could then be reduced to say .012" min, thus reducing seal wear and also stress on other engine parts. I personally would bore the thrust washer to a 'fit' on the crank. This will stop it rattling about and accelerating wear. .005" clearance could soon become .010".

Happy Smoking,

'Mercury'.

N-T. SCALE.



AS PER FIG. 1
PAGE 237.

Improved Crankshaft Seals

Dear Editor,

The December 1991 issue of *Yowl* carried an article which I wrote describing improvements to Scott engine crankshaft seals, and I mentioned that I would report in due course on the progress of the new seals, with particular reference to wear.

I recently stripped down one of the two engine which I have modified in this way, a 498cc PZ unit, and which had run for about 1,500 miles or so. My findings were:

- (i) the crankshaft end-float had not altered,
- (ii) no wear was discernible on the mild steel sleeves fitted to the crankshafts, to the seals themselves, nor to the phosphor-bronze thrust washers,
- (iii) the flywheel and the cavity between the crankcases were completely oil-free,
- (iv) there was a nice and plentiful film of oil in all desirable places, including the main bearings, the big-end and little-end bearings.

David Brierley tells me that he has partially stripped an engine which he had modified similarly, and he found that the end-float had not altered, from which he concluded that the end-thrust washers had not worn. There has been no oil leakage into the flywheel cavity. David's only complaint is that the flywheel has gone rusty!

It seems that the modifications to the seals are well worth while. Not only is the annoyance of oil leakages eliminated, but so is the ingress of air *via* the crankshaft seals.

Another matter which may be of interest is that of the lubricant itself. During discussions with an acquaintance who, in addition to being one of the Castrol technical people, is a keen motor cyclist, knowledgeable on two-stroke engines, it was suggested that their 'Castrol Super TT 2-Stroke Motorcycle Oil' would be very suitable for the Scott engine.

This product contains a dispersant (probably one of the paraffin series) and this enables it to mix easily with the incoming fuel mist in the crankcase, which in turn promotes more complete combustion of the oil, with consequently reduced carbon deposits.

I have used this oil in one of my engines which has the crankshaft seals modifications, and it certainly does appear to perform well. Carbon deposits are greatly diminished. It has proved possible to reduce the amount of oil fed *via* the Pilgrim pump, and the exhaust is much cleaner — a very faint 'blue haze' indeed! Of course, part, but not all, of the permissible reduction in the oil feed is due to not having to provide an excess to compensate for the leakage past the seals.

This product is expensive at £3.99 per litre, but the reduced consumption helps in this respect.

It would be most useful to hear from other Club members of any experience which they have had with this product.

Don Hewitt,
Chislehurst,
Kent.

REGARDING PISTON SEIZURES

by The Technical Correspondent

Dear Mr. Mugleston,

I'm sorry to hear of your trouble but I'm afraid it's a pretty common story that you tell. The first thing to find out is whether the seizures are in fact due to lack of oil. A slight lack of clearance at the last rebore could result in persistent seizures whenever you take her over 55 to 60 for more than a minute or so. The trouble lies in the uneven heating of the front and rear of piston and cylinder, due to the exhaust and transfer being on opposite sides. The pistons expand to oval and bind up in the bores. After perhaps even one such seizure, the pistons can become permanently set oval at the skirt and bind in the bores even when cold. You do not say if one piston only seizes, or both and this restricts the scope of my diagnosis to some extent. I usually employ a process of lapping the pistons in whilst heated by a gas flame directed into the exhaust port. The pistons and bores are "eased" wherever greying of their surfaces shows contact is occurring, until the components remain free of binding even when smoking hot, (oil and "Bluebell" for lapping). The pistons are then no longer round when cold but are a perfect fit when at working temperature. After this treatment, I have a Scott which at last can be "hammered" and goes all the better for it. The trouble is that when starting from cold it has piston slap and appears a bit sluggish, just like some 4-strokes. The compressions however also resemble a 4-stroke, (when engine is hot you can stand on the kick-start).

If you strip your engine, check the pistons for circularity by entering them into the cylinders, inspecting the gap between skirt and bores. Ovality can be cured by a "re-distorting" process but it is too long a subject to go into just now. Filing them down is useless since the skirt clearance will then be excessive.

Piston overheating can also arise from retarded or overadvanced ignition, or burning of carbon deposits.

The oiling side of things has many aspects. Firstly, is oil being delivered to the pump? Secondly, is it getting to the engine? And thirdly, is it getting into the crankcase? I have previously discovered 1/8 ins. bore pipe being used for the pump feed (should be 1/2 ins. bore minimum) and oil tanks fouled with old congealed oil. Distorted and fractured corks in oil taps have also been the cause of oil starvation at the pump.

Lack of delivery to the engine, assuming that oil gets to the pump, can be due to a faulty pump (these get very tricky to set when worn) or due to an air-lock occurring. All air must be bled out of the feed pipe from the tank; (allow oil to leak out of the union for a minute or so before the pump connections are all tightened). Open up pump adjusters and run engine until the oil is delivered at sight feeds, without bubbles. Oil pressure in the engine feed pipes is below atmospheric when running at low speed since the "rotary valve" action of the "timed" drillings in the packing glands of the main bearings cause crankcase pressure fluctuations to actually suck in the oil. At high speeds however, this does not hold good and it is then that any leaky unions, or a weak oil pump, causes loss of oil feed; just when the poor old engine needs it most. The moral is - see that the pipes and joints are sound.

Having got the oil to the engine, the next question posed is as to whether it is getting in. If an engine has been run dreadfully short of oil, the packing glands in the main bearings are almost certain to be scored. They will not, therefore, provide a proper gas seal and will leak oil profusely into the chain compartment. The engine, of course, is not getting its share. A lot of oil dripping out of the engine compartment will tell its own story here.

The packing glands can be tested by removing the tank and engine casing top covers so that the sprockets may be observed. Arrange a lead lamp to get a good view. Put a piston at T.D.C., remove transfer cover and pour about 1/2 of a 1 lb. jar of paraffin into crankcase so as to submerge crank disc com-

pletely. Rock flywheel and look for tell-tale streaks of paraffin. A leak that allows only a dribble will affect carburation at low throttle settings but a steady drip will spoil the engine completely and cause loss of oil when running. Check out both sides.

Whilst on the subject of packing glands, these are very much left and right handed affairs. They *must* be correctly fitted. If swapped over L. to R. or if two the same are in an engine, trouble will definitely ensue. As previously explained, the holes are timed to register on crankcase suction, but if swapped over they will register on crankcase pressure. Usually no ill effects are observed until large amounts of throttle are used, whereupon the pump becomes airlocked by the back pressure (usually only on one side) and a seizure soon follows. This might well be your trouble. I am repeatedly finding it on machines which infuriated owners have eventually abandoned in disgust.

A fool-proof method of checking was described in the October *Towl*.

If the glands are reversed, a strip-down is the only answer. They can then be lapped-in with fine grinding paste, the end float adjusted, pistons checked etc., and a new start made.

I must emphasize also that a good conventional Pilgrim pump can supply oil perfectly OK for "Belting." It is its excessive delivery when in town and its fluctuations which make the present arrangement unsatisfactory. My old '28 Flyer never gave any trouble (except for the odd smokescreen) once her glands were put to rights and a new oil pump fitted. The pump was on the magneto platform of course; a '29 model I had later used to require the pump adjusting daily, according to the thermometer and barometer readings. That pump was on the crankcase door and it gets too hot down there on the engine.

I hope the foregoing helps a bit. When you come to do a stripdown, I have some handy "cartoon strip" service sheets now to hand that may help you. Send 2/6d. Postal Order to cover the photo-printing and postage if you should require one.

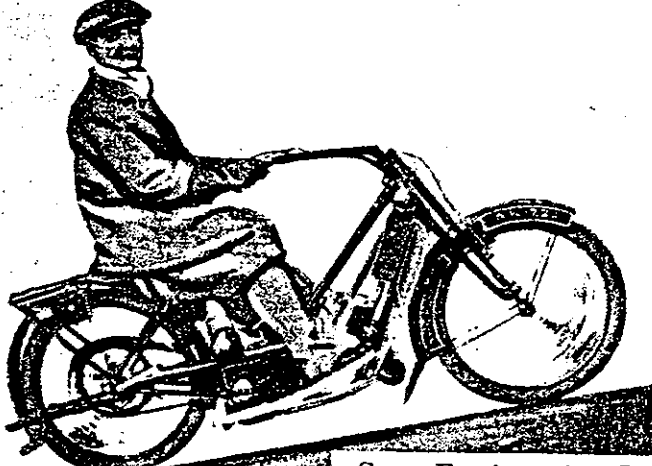
*These are now available from our new Membership Secretary :- Harry Beal, 25, Beeleigh Cross, Basildon, Essex.

MINE IS A 1914

SCOTT

TWO STROKE

WHAT'S YOURS ?



Scott Engineering Co.
LTD.
SALTAIRE, SHIPLEY, YORKS.
London Agents :-
GODFREY & APPELBERG LTD., 67, PORTLAND ST.

V6/1 Aug. 1968

SCOTT SERVICING.

(Or 'Do it yourself for beginners!').

by a *Veteran Victim*.

If in light hearted moments you can recall 'burnups' with Silent Sixes or Blue Princes (and we offer no prizes for guessing those makes) the following will have little interest for you. If you are old enough to know that a Harley Pea-shooter is not a new fangled schoolboy's missile launcher—you are too long in the tooth and cynical to receive any assistance from this article. No, it is indeed for the downy faced youth standing in his wide eyed innocence and lost in rapture and admiration before his Scott, whether half clapped or otherwise, blissfully unaware of the harm and havoc the dreaded bug 'Scottitis' will wreak on his system with the passing of the years. You would be well advised to stand back at the Jubilee Rally and study the gnarled and grizzled veteran victims of the scourge and its effects on the human mind and system as they struggle and straggle from one model to the next, glassy-eyed, mouthing "No that's not original". "Didn't fit that 'till '22" and other strange phrases.

If they ignore this warning and with the determination of youth decide to press on—then where to start?

If the internals of the Scott are just a mystery, then the Membership Secretary for the modest sum of one shilling PLUS postage, will forward two excellent exploded drawings which simplify things to such an extent that even the Editor can see which bit goes where.

You may be toying with the idea that at the time of overhauling to round off the picture with a spot of super tuning—well at this stage I would say 'forget it'. Put such thoughts firmly from your mind, unless of course you figure you are just the man to shew Harry Langman a thing or two. Why Harry? Well recall his words—"the performance of a two stroke engine is determined more by the original design and construction than any subsequent tuning!" First and last it is accurate workmanship that controls the results. You cannot tinker with a two-stroke like you can with a four-stroke".

In any case, Scott blocks are rare and scarcer than Vincents at a Midland Scott meeting.

I suppose the engine should be the first item and we can deal with the gear box and cycle parts later.

So having armed yourself with the exploded drawings offered, we will take the plunge. (Although the drawings offered for sale are of the 1939 Clubman Special engine, with the exception of the porting and the additional pump and cylinder wall oiling, it is more or less identical with engines fitted to duplex framed Scotts since 1927).

Even the earlier engines bear a resemblance and the drawings will simplify these, but I should add that in the earlier Super engines only thirteen rollers were for the main bearings as against fifteen in the Flying Squirrels. During 1927 wider bearings were employed but these can be distinguished by a slight swelling of the crankcase near the doors, instead of flush fitting as the narrow bearing earlier engines.

We will assume that having moved exhaust pipes, radiator, oil pipes cables or other items that can get caught round the neck as the engine is dropped out—not literally of course, otherwise Matt will be doing a booming trade in crankcases,) and the engine is now removed.

If you are satisfied that the gasket between the head and the cylinder block is in good condition then there is no need to struggle with the sixteen studs, should any difficulty be found, as decoking etc can be carried out with the head in place.

The block is held by four bolts, the heads of which protrude by the side of the Scott lettering cast in the crankcase, but before the block can be separated, the transfer port covers at the rear of the cylinder must be removed. The washer or gasket at the cylinder base, as also the transfer ports will require replacing, but no difficulty need be found in obtaining supplies of these, as there are several sources of supply.

The big-ends can be dismantled through the crankcase doors and withdrawn through the mouth. Drive the gudgeon pin from the centre of the engine. In some earlier engines, circlips were used but in later ones pads are employed.

Small end bushes can be renewed by even the most unmechanical minded, but if big ends are worn then renewal entails grinding so Aerco Jigs are the people.

If it is just a question of small end bushes which must be reamed after fitting to .625-.00075-.001, then remember to file the top of the new bush to fit the con-rod cutaway.

Big end bearings consist of twelve $\frac{3}{8}$ x $\frac{3}{8}$ ins. rollers running on a sleeve and held in place by drilled side plates.

Should it be necessary to separate the two half shafts from the central flywheel, it will be necessary to slacken the LEFT HAND threaded nut of the through bolt. Unscrew the nut a few turns, and a sharp blow on the head of the nut should dislodge the right hand crank, and after removal of the bolt and crank, pass a drift through the flywheel to remove the left hand crank.

REMEMBER TO SUPPORT EVERYTHING PROPERLY whilst carrying out these operations.

If the outer main bearing races require renewal, then again a job for Matt at Aerco Jigs.

If the rollers of the main bearings are "scuffed" in any way they should be renewed. Never change them over from right to left etc., and whilst dismantling ensure that none fall through into the crankcases.

The keyway in the cranks and flywheel must be sharply defined and if there is any wear in the groove, it should be fettled before reassembly.

The Pilgrim pump is driven by a slot in the extension plate and operates on the total loss system and expels shots of oil trapped by the reciprocating plungers. These are driven by a cross member keying into the mainshaft extension. The plungers rotate and because of the cams on the ends of the plungers are caused to reciprocate. The stroke of the plungers can be varied by adjusting the external adjusters. There are several kinds of these, which are the knurled wheels at the side of the pump. Some of these are numbered, but have no bearing on the adjustment other than a guide for setting. Screwing these in limit the movement of the plungers, hence less oil collected and forced out, whilst screwing outwards has the opposite effect. The pipes from the pump outlets are taken direct to the crankcase chambers and is directed to the main bearing. The oil is admitted through a hole in the packing gland and these register with the oil orifice. The intake of oil is timed to occur during the crankcase depression when the transfer port is closed. At this point oil not only passes on to the main bearing but improves crankcase compression by acting as a seal. The mist caused by shaft rotation lubricates the lower part of the cylinders and the big end via a drilling. Surplus oil drains to a well in the base of the crankcase which acts as a "splash" system when the engine is first started.

Oil should be SAE 50 for Summer or SAE 30 for Winter, though I have no doubt that we shall have other recommendations should this be read by seasoned Scotters.

On reassembly, (though perhaps before this, check the security of the sprockets that are rivetted to the flywheel and ensure that there is no looseness there,) after fitting together each main bearing assembly and crank and inserting the shafts into the keyway of the flywheel, working from the crankcase doors. After fitting the holding bolt test for end play which should be between .012 and .015 and is adjusted by shims between the screw collar and the face of the packing gland.

If the cylinder is badly worn — do not overlook "sleeving". There are several firms that will undertake this task.

"FLYWHEEL FAILINGS"

by 'Lofty' Aris

Of all the component parts of the Scott machine, probably the flywheel is the most neglected as far as technical information and overhaul instructions are concerned. After all, it's only a chunk of iron used to hold the cranks together and somewhere to hitch a sprocket; except for providing a bit of inertia it plays no part in the functioning of the engine. Why worry about it when there are fascinating things like pistons and gudgeons, rollers and cranks, compression ratios and port timings to play with?

The truth of the matter is that the flywheel and allied components are at the centre of the engine both in position and function. The writer recently "had a go" at a Scott motor for a disillusioned novice, who had acquired what appeared to be a quite nice machine for the princely sum of £12 10s. 0d. At that price he couldn't go wrong but in spite of a good carb. and mag. the engine ran like a nightmare; with the rad. filled with boiling water it needed a good tow to start it and even after several minutes warming up was still reluctant to keep going. It would spit viciously and frequently; power was next to nil but the vibration was terrifying. Even the novice, charged as he was with the elation that comes with just collecting the long anticipated object of desire, had not the nerve to complete the 10-mile journey to Southend. It was a sorry figure that dropped the boiling brute on the kerb and thoroughly skaken, physically, and spiritually, staggered up the few paces to the writer's front door with hardly the strength to lift the aluminium knocker (aluminium for low unsprung weight).

In spite of worn bores, scored pistons, slack small ends, excessive ring gaps, scuffed big ends and odd sized sparking plugs the engine emerged, like Cinderella, magically transformed at practically no expense. There was just no money left in the poor lad's kitty and the writer could not afford to finance an overhaul which could run into £25 or so. In spite of all the serious short-comings she was an easy starter, smooth at all speeds and with a fair turn of acceleration, albeit with a few rattles and a funny habit of dropping onto one pot just after starting. However, a few rev-ups soon shook off the plug, the water that had seeped through a leak in the cylinder head. Not a thoroughly satisfactory job, admittedly, but the intention was, not so much to restore his machine, but to restore his faith.

The main interest in this machine lies in the fact that it demonstrated uniquely how dependent the Scott motor is upon its Flywheel components to ensure satisfactory performance. Tracing the stages in this bottom half botch-up will illustrate the faults that can occur, their effects, cures, and possible prevention.

The first job was to test the crankcase for leaks as the vicious spitting and vibration suggested main bearing trouble, probably loose cranks. After an initial mechanical check over which did not reveal very much, the tank, carb., engine top plates and transfer-covers were removed and a small lead-light placed so as to illuminate the interior of the engine casting. The pistons were both positioned half-way up the stroke and a jam-jar of oily paraffin run into the L.H. crankcase, via. the lower transfer aperture. A few seconds later an oily streak appeared on the flywheel, indicating an indifferent seal at the packing gland to cup or cup to crankcase surfaces (could be a crack in the casting). The paraffin was drained via. the plug at the bottom of the crankcase and the R.H. crankcase tested in the same way. Now all was revealed, it being hardly possible to pour fast enough to equal the tremendous flood streaming out of the engine casting into the drip tray, previously placed beneath the machine in case of such an event. An immediate stripdown was the only course of action and what a story this revealed.

The most horrifying part was the condition of the R.H. main-bearing. The cup was purple and fearfully scored, particularly on the sealing face which was covered with radial cracks. The gland itself was conical instead of flat and

its spring had the appearance and the substance of a well-chewed boot-lace. The main-bearing bush on the crank was dead soft and so rolled and thickened that it had forced the locking ring; already as soft as solder, right off its threads. Miraculously the rollers seemed to be quite good although down to a "deep straw." The left hand assembly was reasonable except that the gland was badly scuffed. It was here that the probable clue to it all was found; the gland was stamped "R"! A close inspection of the remnants of its opposite number revealed a murky "L."

This one simple mistake of assembly must, over the many years, have been the basic cause of a large number of would-be enthusiasts being deconverted from Scotts back to four-strokes. The effect of this mistake is to cause the oil pump to suffer an air-lock from time to time since the oil holes in the glands will register with the oil ports in the cups on crank-case compression instead of suction. The resulting, unpredictable behaviour of the oil system is enough to deter the keenest type, especially when the fitting of a new pump brings no more than partial relief from the problem. The situation is not eased by the fact that the pump, as fitted, is subject to variations in adjustment when all else is correct. Advised of this last fact by "experts" the novice concludes that Scotts are just not for him and sells the machine before it costs him even more money. One often sees adverts for Scotts offered with complete engine over-haul, good tyres, etc. etc., for a very reasonable sum; the seller often not realizing that the basic cause of the previous ruination of his engine had been removed when it was overhauled by Tom Ward, Geoff Milnes or who-ever.

In any case of doubt the following check should be applied to the engine. Attach a connection to one of the oil inlet elbows, terminated in a piece of plastic tube that may be held in the mouth. Place that piston at the bottom of the stroke and rotate the flywheel slowly forward whilst attempting to blow into the tube. At about half way up the stroke the resistance should fall away as oil clears and it should be possible to hold the engine at this point and blow fairly freely into the pipe. Continue rotation and within a few degrees there should be a second hole registering. Just before top dead centre a further hole is to be found. If a wrong-handed gland is fitted the sequence of holes will be reversed and registering on the down stroke of the piston. A check should be also made on the other half of the engine, even if the first half is O.K.; two lefts or two rights is not unknown. Of course, old machines sometimes had different hole configurations, some only having one hole. Don't be misled by finding one hole, followed by two during the upstroke of the piston; this probably means that both glands and cranks are in the wrong side.

We will gloss over the entirely unethical process of extracting the mutilated crank-case cup and its replacement by one from a ruined Flyer. Sufficient it is, to say that we took a big chance and it came off. A set of soldered-on tabs of copper foil served to feed the oil to the crank and appeared to function O.K. Strictly speaking, cup replacement is a works job. The main-bearing bush was a happier task; replacement parts coming from the writers collection of fractured cranks that he accumulated during the period "B.C.P." (before compression-plate).

A spare packing-gland was discovered in the junk box but the driving tongue was worn slantwise. A touch on a grinder straightened this up, and the L.H. gland was given similar treatment. The result of the wear and grinding was a certain amount of back-lash in the drive of these components; not important really but a bit of headscratching about tidying up this point, without cost, gave birth to an idea which formed the basis of a modification that has been applied to several engines with great success.

The combined effects of heavy gland friction and generated heat had caused more than the usual amount of wear into the flywheel keyway by the gland tongues. It amounted to about 3/16 of an inch on the ravaged R.H. side. The combined effects of driving pressure, the sawing effect of the tongues as the

mainshaft bounces axially over the end-float and the absence of any lubrication at these points, will sometimes produce an eighth of an inch wear here on engines that have run for long periods, without bottom overhaul. Clearly, the tongues always sit in the slots they have cut and these are only just deep enough to prevent each gland being lifted as the flywheel drifts over towards it. The wear must be made good before an engine is re-assembled for there can be no guarantee that gland-lifting will not occur after things have been disturbed, even if it were not occurring before. Dealers will, of course, do a flywheel overhaul, some perhaps an exchange; but the process of making good is not an impossible task if the services of a first-class welder and a turner are available.

First of all, clean up the flywheel, especially the slot cut by the gland and inspect for the other troubles that are mentioned later. Next, make up a conical guard from thin sheet brass or aluminium to fit into the tapered portion of one side of the Flywheel. This keeps welding splash off the vital surfaces. Leave a gap opposite the key-way near the mouth of the taper. Using a small diameter rod and an electric arc set, a good man can fill in the groove without too much damage and leaving the minimum of surplus metal. All the flywheel welding can be done at one go; then starts the cleaning up. After removing welding flux, the keyway can be filed out using the original good areas as a guide. Use a good key as a test gauge and achieve a tap-in fit. Weld metal must now be removed from the counterbore which receives the packing-gland boss. The surfaces are non-critical here, but for appearances sake, a lathe job gives the best results. Not having access to a large machine at that time the writer used an endmill to chew off the spill-over and odd blobs of weld with every satisfaction.

Welding sometimes leads to flow of metal from the keyway onto the edge of the taper. The sharp edge of the keyway in a crank taper can be used as a tool for removing a small amount of metal, but in any case a suitable file must be used to finally take off the last thou or so. The crank can be used as a test gauge, since as long as it can wipe out the file marks, the metal is still proud. Patience is the key to it all.

The final process is one of grinding each crank into its own socket in the flywheel. Very little metal can be safely removed in this way since a lumpy patch in the flywheel could wear away a crank that was previously accurate. The process merely removes the irregularities in the surface caused by cold welding of the metal parts when in previous tight contact. By looking for a uniform grey surface after a little lapping, one can check that the mating of the tapers is satisfactory. A few scratches or machining marks are unimportant. Use a small quantity of fine grinding paste and work with light pressure over a few degrees each side of the correct position for assembly, lifting frequently. Wash off with paraffin before inspecting. A high spot can be taken down a thou or so by using an old crank and applying grinding compound at that point only. Grease the rest of the taper surfaces.

After a good mating has been attained comes the testing. Wash off the surfaces thoroughly and dry, fit a crank in position without a key and give a firm butt home with the palm. A good job will hold the weight of the flywheel until knocked or twisted. This is seldom so after lapping-in since the removal of metal by the crank leaves a minute step at the end of its reach. The easiest way out of this is to slightly increase the chamfer of the tip of the crank taper, using a grinder. Perhaps this perfection of fit is not absolutely essential but it's very reassuring. One thing that cannot be allowed is any "rock" of the crank when lightly fitted into the flywheel.

When reassembling the crankshaft the shims may need to be changed since the cranks will have both moved inward a fraction. Half a thou off cranks and flywheel each side is two thou in all. This becomes about 6 thou inward movement because of the surfaces being on a taper. If the end float was correct before, a thin shim may have to be removed. The usual complement is one thick, one thin per side. Aim for the minimum of 10-12 thou end-float when the cranks are lightly knocked home. Always test with the distance piece in position

at the top-rear engine mounting point. By keeping the end float small the sawing effect of the gland tongues is minimised. The end-float can be measured by using feelers to gauge the gap between the sprocket and the crankcase cup after levering the flywheel over as far as it will go with a screw-driver. The flywheel should then be levered toward the other side and the measurement repeated, the difference in gaugings being the end-float. Avoid gauging onto a rivet head which could be an unreliable surface to work to.

Another common fault exhibited by the flywheel in question was that it possessed 'fully floating' sprockets. Some attempt had obviously been made previously to cure the trouble because a brass shim had been inserted to take up wear. The trouble often starts by running the primary chain too tight, but the writer has had the trouble occur without this cause on new and reconditioned flywheels. The only certain cure is to get a welder to apply three spots of electric weld (4 on a 4 rivet flywheel) to join the sprocket to the flywheel boss. This does not draw the temper of the sprocket and ensures that the microscopic movement that starts the trouble simply cannot occur. The weld is not a substitute for the rivets, just a locking agent. If the sprocket has only a slight rotary movement, the weld treatment alone will do a good job. Should side play be present then the sprocket (or sprockets) must be removed and the flywheel bosses built up with electric weld. The services of a good turner now become necessary to recut the seatings. These need to be turned to provide a firm fit for the sprockets and should be true to the flywheel axis. The flywheel of course, has no actual centre so the trick is to insert the crank with its key. With the flywheel gripped in a large 4 jaw chuck, it is positioned whilst gauging onto the mainbearing track. The process must be repeated for flywheels carrying mag-drive sprocket. The writer does not know the tolerance allowed by the Works but recalls a sprocket he once acquired cheaply which was fitted to a flywheel re-conditioned as above to within .002 inches. When the whole machine was re-assembled it was found that the primary chain ran tight and slack. Assuming a worn chain was the cause, a new one was ordered and the machine put on the road. The whole thing felt nasty; there was a high frequency vibration at about 40, and below 30 the drive would snatch. At tick-over, the chain performed quite a fandango and the engine would not run smoothly. On fitting the new chain things were almost as bad but the slack and tight spots could now be aligned with points on the engine rotation. The whole job had to come down again and on checking, the sprocket was found to be 10 thou. off centre. A new one was got from the works and found to be 3 thou. off so the flywheel was set up again and the best of the six possible positions chosen from the sprocket. On assembly, the motor was as smooth as silk and two-stroking was remarkably good.

Scott sprockets are particularly long lived and maybe the original ones appear re-usable. Generally, this is not so because the centres are worn and the rivet holes elongated. The rivets therefore cannot hold them properly. This last point can probably be overlooked if the weld process is applied but the centres will have to be skimmed-out and the flywheel bosses machined to fit individually to them. If the sprockets are at all shaky, best buy new, since if fitted securely they will last out the machine.

One important aspect of a flywheel is its balance. On a Scott, the flywheel is purely an energy-storing device and incorporates no bob-weights as in most other engine designs. Being machined all over a fairly well balanced component is obtained automatically and in view of the rather fierce rocking couple present, a little "joggle" will go unnoticed. However, a word of warning based on an experience; beware of rusted flywheels, particularly if the rusting is more severe in one spot. The writer recently salvaged an old 1928 flywheel which was rusted at the bottom where the crankcase had been in a flood. The attraction was in its weight which was some 2 pounds heavier than standard. It was required for a special engine to haul a heavy side-car. Because of doubts about the balance, a set of rails were made up so that with cranks assembled the whole crank-

shaft could be rolled on the main-bearing tracks and thus tested complete. The results was a surprise indeed. Altogether, fourteen holes of 3/8 ins. diameter and averaging 7/16 ins. deep were required on the outer rim on the unrusted section before a balance was obtained. There is little doubt that this little lot would have been noticeable at 4,000 r.p.m. One peculiar point of interest was that the taper angle was very slightly greater and a lot of work was required using a broken crank, to get the late type cranks to fit properly. The original short-stroke components were O.K. and it would be interesting to know, via the Correspondence Columns in "Yowl" (to be launched under the Captaincy of Mr. Geoff Lee) whether others have also had this experience.

We revert now to the subject of modifying the crankshaft key. It all came about in an effort to avoid the backlash arising from wear of the gland tongues, the idea being to insert some kind of a shim on the trailing edges to take up the clearance. Since the drive does not normally reverse it is probably not worth while on this score but on worrying around the problem it was realised that if a heavy shim were applied to the key-way on the surface which drives the gland tongues any wear arising would be on the glands and the shim, both replaceable components. Experience had shown that 2 to 3 thou. per 1,000 miles is an expected rate of wear of the flywheel material providing the end-float is kept small. It was decided to go for .025 ins. shim and replace this every overhaul. The material employed was in fact the strip steel used around the packing cases. It comes in various thicknesses, is hardish but can still be cut and filed. Time has proved it to be fairly satisfactory, most of the wear occurring on the shim, which of course costs nothing.

The size of the shim is about 1/8 of an inch wide and runs the full width of the key-way in the flywheel, its ends covering the repaired surface where the gland tongues had previously been doing their worst. The presence of the shim prevents the key being inserted so a step must be milled along its appropriate edge to clear the shim. A problem arises in assembly and safe retention of the shim and this has been solved by soft-soldering the shim in place on the key and cleaning up the combination to make a good fit in the keyway. Cut the step to the exact depth, or slightly less than the shim requires, tin both items and sweat together, pressing shim well down as the solder hardens. If the shim is prepared slightly too wide and too long it can be filed to size afterwards, making a neat job and avoiding the need to position it accurately lengthwise. Anyone wishing to incorporate this modification where the gland tongues are not sufficiently worn away will have to grind them back. Do this on the other edges where the wear does not take place thus preserving the hardness on the driving edges where it is most needed. Make sure that the gland tongues slide easily into the key-way when laid in position on the flywheel and that the key is inserted with shim protecting the repaired spots in the key-way. It is reassuring to reflect that the modified area of the key is not a thrust face for the transmission of torque from cranks to flywheel and this may be one reason why it is possible to get away with soft soldering. To date, well over 50,000 miles of Scotting have been covered using engines incorporating this modification without any trouble on this score. The writer's own machine has done about 25,000 of these and is just starting on its third shim.

The final fact on flywheels is not, strictly, speaking any fault of the engine at all but rather of an overall machine design in which there is no provision for looking after that highly-stressed component, the primary chain. Racing machines can use one chain per race if necessary and since they do not have to enter a 'Concours' afterward, they can splash on plenty of oil. On touring machines, general cleanliness and economies on both oil and chains are both of great importance. A good deal of thought went into this one and since the ideal way of using the same oil over and over again was denied (because it required the total enclosure of each chain) it was decided that, if the same oil could be used to lubricate each chain in turn both oil consumption and messiness would be re-

duced. A good deal of oil-fouling in a Scott is caused by leakage past the packing glands on the mains. What if this oil could be used? There would be at least no extra cost, or mess! To accomplish this feat of thrift the "Dr. Scholls" lubricator was devised (so called because a piece of the famous Doctor's Orthopaedic felt was used for the prototype). It consists of a thin ring of absorbent material on the side of the primary sprocket and revolving with it, (one each side if a mag. chain is used). When the engine is assembled it just fills the space between sprocket and crankcase cup, the escaping oil being trapped by it. The outer edge is about the same diameter as the roots of the sprocket teeth and in service, the edges of the chain side plates squeeze into it. Oil is thus fed in where the plates overlap thus reaching the pins (or rivets)- the vital points. Lubrication inside and outside of the rollers is also provided.

How this oil is persuaded to pass to the rear chain must be covered in a future article devoted solely to the subject, our interest now must be confined to getting the flywheel rigged. The prototype has now been discarded after 5,000 miles but has worked well. A new primary chain was fitted at about the time of its installation and has done this mileage with one adjustment only and that consisting of one turn on the gear-box draw-bolt applied whilst the covers were off to allow for a touch-up on the clutch settings. This must be something of a record for a Scott; but to be quite fair, the oil feed was unavoidably somewhat generous. Leakage from the mains has been a problem since new cranks were fitted although there seems no reason for this. Using the "Loftylube" lubrication system the feed to the mains is stepped up to the equivalent of "1 in 1" at the pump; the leakage going up rather more than proportionally. A modification to the glands has now been incorporated and although no results are known yet, the lubricator ring has been re-designed to give greater efficiency in placement of the oil, anticipating that the leakage will be reduced.

The original was a ring, 1/16 ins. thick, cut from a block of the felt*. It comes 1/4 ins. thick and has a plastic backing which is retained. The inside diameter of the ring is the same as that of the sprocket and the outside diameter that of the valleys between the teeth. The flywheel rivets were drilled and tapped 8BA and 3/8 ins. deep at their centres. The holes were countersunk a bit deeper than heads of the 8BA x 1/4 ins. screws that are used. The ring was laid plastic side to the sprocket and a scriber used to prick through to find the holes. The countersunk screws were inserted and screwed firmly home, burying themselves in the felt. None have come loose, but the small size was chosen so that in case of mishap, they would easily disintegrate and could escape without dislodging the cup.

The new ring, as yet unproven (mileage to-date-25), was made from a flexible, black piece of horse-hide from an old wallet. A disc, the diameter of the sprocket, was laid in place and the fixing holes pricked through and the screws inserted. The leather was cut through against the valleys of the sprocket teeth using a small ball-pen hammer. The marked leather was now removed and the centre hole cut out. Next, the cuts already made by the valleys in the sprocket were joined up by cutting out "V" shaped pieces between them. The "V"s were about 1/4 ins. deep and went toward the centre, (not outward so as to follow the tooth contour). The pieces now projecting will come opposite the rivets, thus throwing oil out radially where it will do most good. These projections were made about 1/4 ins. wide at the tops and were given 3 or 4 radial slits, each about 3/16 ins. deep; the idea being to form a brush which would hold oil and only yield it up when squeezed by the chain sideplates. A load of theory perhaps; but once the idea catches on, everyone will have his own ideas and designs will be legion. The writer is convinced of one thing however; if a machine has any leakage out of the mains at all, a few turns of string wound into the gap will lubricate the chain quite effectively, but with no such absorbent medium the oil will never get *inside* the chain and this is the point where lubrication is vital.

*The prototype ring which ran this mileage was actually made from a 5 ins. x 4 ins. x 1/4 ins. slab of "Regaid" adhesive felt obtained from "Boots."