

THERE's little difference between the Moto-Guzzi V-twin engines. Fairly early types had a dynamo sitting on top of the main casing, and timing gears have given way to chain-drive in recent years. Apart from the automatic gearboxes all models are covered here.

Assuming your engine is still functioning, the best start is to drain the oil thoroughly when hot. This cuts out a lot of the mess when the casings are split. Another good bit of forward planning is to invite at least a couple of strong folk along to make sure things don't get dropped or crunched when the bike is separated from the engine. The Guzzi differs from most machines in that the bike is lifted off the engine by virtue of the detachable bottom frame tubes.

Before you get to this point, the work starts with the removal of the seat and tank, and disconnection of cables and wires between engine and bike. The alternator wires are pulled directly from the terminal block after removing the outer casing. Mark the block with the wire colour codes first.

Usual items like the exhaust pipes have to come off — plenty of penetrating oil on the pipe nuts and balance tube clamps will help — but the carbs can be left in place. The battery and holder, which bolts down on to

the gearbox, needs to come out, and the starter motor can be removed.

The next stage requires the bike to be lifted up and some hefty blocks of wood placed under the sump to get the back wheel off the ground. Don't use anything wobbly like bricks, and make sure it's standing firmly.

Remove the back wheel complete with drive hub after disconnecting the brake and four drive shaft flange bolts to the hub. Undo the clip retaining the rubber universal-joint rubber boot at the gearbox, and release the two fork pivot bolts. The right-hand pivot is covered with a screw plug, and has a slotted head. The joint simply slides off the splined gearbox shaft as the forks are removed.

Next, tie the clutch arm with wire to stop it swinging free once the engine is out, otherwise the small spring and the thrust roller assembly could get lost.

With the frame tubes and engine mounting bolts removed, the back of the bike can be lifted away from the engine unit. Lift the back of the frame on the front wheel until it can be swung clear of the engine. Ideally,

you should have one person at each end of the bike (or maybe two at the back end), and someone hovering around the engine to make sure nothing snags and the engine stays put as the bike is lifted. It's a simple operation, but if you want any details shown in pictures, check out the July issue which featured a clutch job on the vees.

Remove the six nuts holding the engine and

gearbox together — but before you remove the flywheel, a word of warning. The intermediate and pressure plates are normally clearly marked to show their assembled position, but the reference marks on the outer ring gear plate, flywheel and crank can be very faint. Mark the parts with a punch or paint as you go. The timing marks are sometimes made with a pencil! Make sure these are carefully scribed before they get rubbed out.

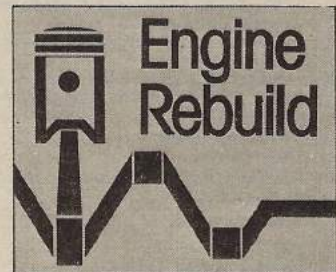
Before the flywheel comes off, you could make reassembly of the distributor easier by swinging it round to a firing mark and making a note of the points which are just opening (the right cylinder points have a red lead, and the left is green).

Mark the distributor position in relation to the casing, and it will be dead easy to settle the gear drive into the correct position later. Release the bolts evenly from the ring gear plate to release the clutch spring tension. Check parts as they are removed, especially the sliding teeth and the friction plates for wear and any signs of fretting. Bend back the locktabs and shock the six flywheel bolts undone.

Rocker gear

WORK AT the top end can start with the carbs and rocker gear — the carbs are "handed", by the way. The rocker shaft set bolts have to be removed and the shaft and rockers pulled off before all the head nuts can be reached. Swing each cylinder round to the firing point in turn to release the valve spring tension. Be careful to keep the individual rocker shims in the correct order.

Remove the pushrods, and clean and check all parts for wear on the working



Moto Guzzi V-twins

Moto-Guzzi offer everything, from long and low racers to sit-up California Freeway styling — and all with the same sensible shaft drive and leg-warming in-line V-twin. This month we show you how to pull one of these hefty vees apart — in our case the 850cc T3 model.

surfaces. We found a fault on the end of one of the pushrods, it was a hair-line crack around the edge of the rounded end of the steel insert. One gentle pull and it came away — just spotted in the nick of time! It would have been disastrous if this item had been reassembled without being spotted.

Undo the oil-feed banjo union bolts on the head. The complete pipe can be removed for cleaning. Check the sealing washers before reassembly, and remember the bolts are very easy to overtighten. There are two side nuts to release before the four main head nuts are removed. One is an ordinary nut in the spark plug recess, and the other is hidden by a 10mm. hex. socket plug. The socket sleeve nut below is also the same wrench size. Make sure the plug O-ring seals properly on reassembly, as this seals in the floor of the rocker housing.

After these nuts are removed, the main nuts can come off. The side nuts should be tightened after the main nuts have been torqued down diagonally during reassembly. Assemble the rockers temporarily with the pedestal to keep all the individual components together.

Slide the head off and check the valves as necessary. Most ordinary spring compressors will fit. Check the valve stems for wear ridges and galling on the surface, and play in the guides. Check that the valve seat faces are reasonably narrow and valves and seats are free from burning and pitting. Replace the valves if worn, and check the new valves in the guides. If there is still too much slack between valve and guide, the guide will have to be replaced and reamed to size to match the individual new valve. Get this done by an expert: the seats should be recut after fitting the guide. Valve springs

should ideally be replaced except when the engine has only done a low mileage.

Slide the barrels off carefully after removing the top O-rings from the studs. O-rings are also fitted at the base of the studs, and these should all be renewed. The same applies to the piston circlips if the old pistons are re-used.

Warm up the pistons to allow the gudgeon pins to be removed using either an extractor, or by carefully supporting the piston as the pin is knocked out with a soft drift and mallet.

Check the piston for wear generally, including wear in the piston ring grooves. Check for scoring or wear ridges on the gudgeon pin, and make sure there's no play when the pin is fitted in the little end clean and dry.

The barrels have chrome bores, so they don't wear as quickly as cast-iron, but when they are past the limit, they will have to be replaced. Keep each piston with the respective barrel. The pistons are marked with an arrow facing the exhaust side.

Big ends

BEFORE THE timing cover can be lifted, the alternator outer housing and rotor will have to be removed. This is held by three screws, and the rotor by a central bolt. Remove the long 5mm. hex. socket bolt in the centre of the rotor. The bolt is pulled out of the crankshaft, and then has to be unscrewed from the rotor, which is also threaded. The threaded portion in the end is to enable you to extract the rotor using a small piece of steel rod about 1½in long. The diameter of the rod has to be small enough to be able to push down the hole. The bolt is screwed

back into the rotor and tightened down on to the end of the rod to push the rotor off. The bolt won't stand too much tightening, so it should be *lightly* tapped on the end with a mallet to help jar the rotor off the taper as you tighten.

The timing cover and the sump pan can now be removed. Fourteen Allen bolts retain the timing cover, the longer bolts going at the bottom.

Once the sump pan has been removed, you must be careful not to rest the base of the engine flat on the bench, as the oil pickup pipe from the pump can get bent. When you need to stand the engine upright, a couple of pieces of wood under the base will do the trick.

Taking the rods out is simple if you've got a socket extension. For identification purposes, the left-hand rod has an oil splash hole facing upwards into the cylinder, and the right cylinder rod has a downward-facing hole. Later models are interchangeable, having a hole each side, but it's best to keep the rods in their respective positions anyway.

You should renew the big-end cap nuts, and the bolts, if you really want to play safe. Unless the big-end shells are perfect, these should be replaced. Of all the components in the engine, the rod caps are the most important to torque up accurately. The correct fitting of the caps is identified by a milled edge down one side.

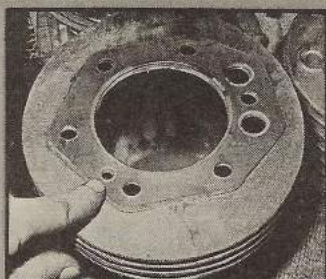
The crank is very strong, and it won't do any harm to wedge a piece of wood between the crank web and the inside of the casing to lock it up for removing the timing gear nuts. The crank gear nut is a special slotted item, and rather than using the special tool, you can either make your own



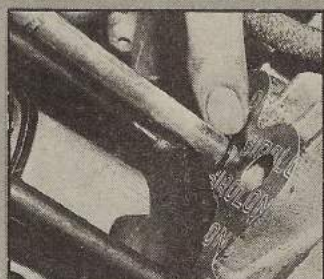
1 After splitting the gearbox from the engine, mark the flywheel components with paint or with a scribe — original marks can be very faint.



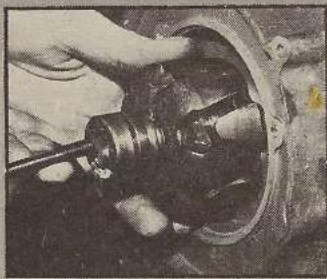
2 Not all the head nuts can be seen. The rocker pedestal has been removed for clarity to show the plug which covers the 10mm hex nut below.



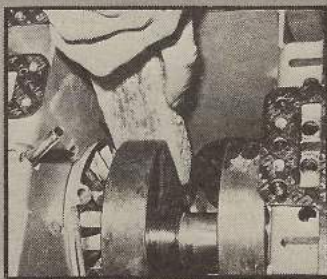
3 All gaskets should be renewed. Note here that the gaskets on the top, and at the bottom of the barrel can be fitted the wrong way and block hole.



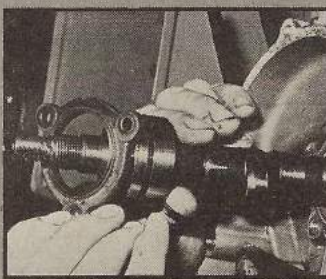
4 The cylinder studs are fitted with O rings at the base and also on top of the head under the rocker pedestal. These must be renewed.



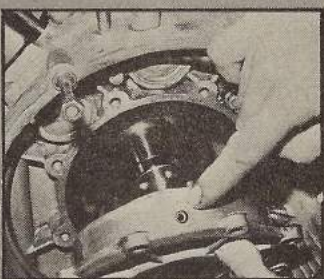
5 The long alternator rotor Allen bolt has to be unscrewed from the rotor as well as the crank. A small rod can be used under the bolt as an extractor.



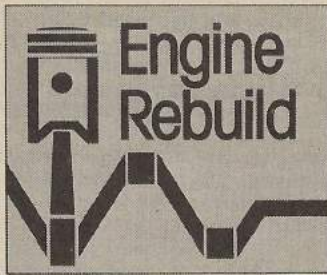
6 It's sufficient to hold the flywheel and shock the flywheel bolts loose, but the timing nuts will need a firm hold on the crank by wedging in wood.



7 Once the timing gears have been removed, the cam thrust plate can be taken off after checking end-float. Remove cam followers before sliding cam out.



8 It's absolutely essential to get the mating faces of the main bearing flanges clean and smooth before refitting. The crank comes out this side, note . . .



tubular spanner with a hacksaw and file using a piece of pipe (this can be hardened by heating and quenching), or *carefully* use a punch in the slots to drift it free. The ordinary nuts on the cam and oil pump sprockets will have to be removed to allow them to be pulled off the shafts with the chain. On the earlier gear-drive types, the cam gear also has to be removed to get at the camshaft thrust plate bolts.

The sprockets are clearly scribed with timing marks, but if timing gears are fitted with paint marks on the teeth, scribe marks before the gears are removed. Sprockets and gears are keyed on to straight shafts, and are not usually difficult to remove. The cam chain sprocket will take a two-legged puller if necessary, and the crank sprocket can be *very carefully* levered up. The gear-driven oil pump gear has a couple of threaded puller holes, but it isn't normally necessary to remove it, unlike the chain type, unless the pump has done a high mileage and needs to be inspected. The gear-type pumps are normally very reliable.

Once the timing sprockets have been removed, the chain can be replaced if worn, and the camshaft thrust plate can be

removed to allow the cam to be withdrawn. Check the tensioner pad for excessive wear and chunks out of the rubber. Remove the cam followers first and clean and inspect them. Any marks or pitting on the bearing surfaces means they're headed for the waste bin. Also, clean up the follower bores and insert them dry to check there is no undue play here.

Check the cam end-float first before removing the plate. Then remove the plate and check for undue wear, before pulling out the cam and checking all the bearing surfaces for scoring and possible wear flats on the lobes.

The crank should come out for inspection of the main bearings. This is removed, as mentioned, by undoing the retaining bolts from the rear flange. Again, check for undue end-float before removal. A puller is available if it is very sticky, but normally the crank simply needs tapping with a soft mallet on the other end. The flange must line up with the oil hole when replaced (see pic).

Once the whole engine is stripped down, the casings and the oilways can be cleaned out. Remove the cartridge filter in the sump pan (if fitted), and the strainer and relief valve. Clean these, and the oilways in the sump. Check the main bearings and journals. If excessive end-float has built up, the thrust face on the timing end of the crank and the main bearing should be checked.

Gearbox

THE BOX gives little trouble, being very strong with plenty of roller bearings in all the right places. Before you skip this section, there are a couple of points to mention.

First, the clutch centre needs to be removed so it can be used as a clutch plate alignment tool. This is held with the only other special nut, the same pattern as the crank timing gear, but unfortunately a different size.

The same comments apply for removal as the crank sprocket nut, but making up your own spanner is probably wiser here as the nut is recessed.

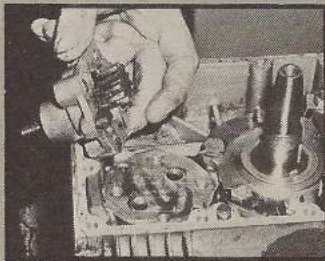
The shaft can be held by engaging top gear and using the drive shaft universal joint to hold the output shaft. Carefully hold this in a vice while you undo the clutch centre nut.

The other point which should be checked regardless of whether the gearbox is to be stripped, is the pivot pin on the clutch arm. This pin should be removed if it becomes corroded and stuck in the pivot holes. Leave penetrating oil to soak in if it is well crudded up, as the pivot posts on the end casing could get broken when trying to punch the pin out.

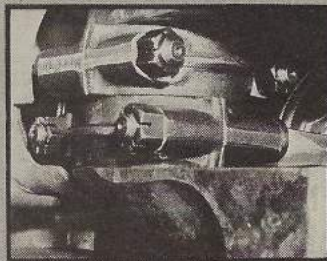
Clean up the pin and the holes, and reassemble with plenty of grease. Make sure the pin is kept greased during servicing, as one day it could save you removing the engine if the clutch pushrod seal gets leaky. It can only be replaced in situ if you can pull the pivot pin out easily.

If you are stripping the box, the first items to come off are the speedo drive just above the output shaft, and the detent spring and plunger under the gearbox breather union. The speedo drive has a small washer on the end: don't lose it!

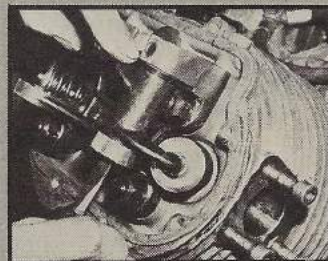
Carefully lever the locksleeve edges out of the output shaft splines with a small screwdriver to allow the 27mm retaining nut to be undone. There is a Guzzi service tool to fit the output splines as the nut is



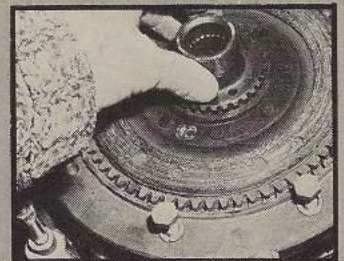
9 ... oil hole which lines up with the casing. Unless high mileages or damage has occurred, you can expect the pump to be pretty reliable.



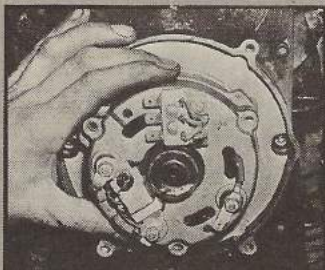
10 An easy way to smash up the barrel spigot is to get them mixed up — here you can clearly see the cut-away for the opposite big end nut.



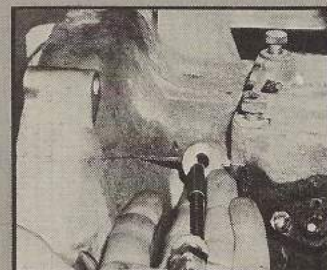
11 The rocker shaft has a slotted end to allow the shaft to be turned into the correct position for lining up the set screw hole in the top.



12 Check the friction plates for a minimum thickness of 7.5mm. Use the clutch centre from the gearbox to line up the plates in the flywheel.



17 There is now a modified position for the alternator casing, shown here with the terminal block at the top. Simply mount in the new position.



18 Gearbox stripdown begins with removing the breather union which hides the detent plunger and spring. Check the plunger and spring for wear.



19 Double thrust-race components form part of the 'mushroom' arrangement on the end of the single clutch pushrod which also holds the seal.



20 The speedo drive comes out next, watch out for the small washer on the end of the shaft. If it doesn't come out with it, check in the works.

undone, but you should find there is enough room to fit most ring spanners over the nut and then hold the shaft with the driveshaft joint by carefully clamping it in a vice or with a large adjustable spanner.

Just behind the nut is the speedo drive gear which is held in place on the shaft with a small ball bearing. This can be removed with a magnetised screwdriver, and the gear slid off.

Remove the end cover bolts, and with the box in neutral, tap around the end cover lightly with a hide mallet to break the gasket seal. With the gearbox on its side, you should be able to joggle the cover out complete with the selector drum, layshaft (output shaft), and main shaft. The clutch shaft, which is fitted with a large cush-drive spring, drives on to the mainshaft, and will normally stay in the box as the rest of the gears are withdrawn. If you do a job such as replacing the shift lever return spring, always remove the gears fully to ensure the mainshaft thrust roller is assembled into position, and that none of the rollers have fallen out.

The selector fork shaft can be pulled out of the cover and off the selector forks to allow these to be disengaged from the selector drum. The selector drum and shift lever assembly can now be withdrawn and laid out in order with the other components. Lay out the selector forks in order with the two gear shafts, and clean up the parts individually to inspect them for wear.

Shafts

ALL THE moving surfaces should be checked for wear, especially the fork and selector drum channels for wear ridges. The edges of the selector dogs should be

checked — in fact any wear in the selection which will limit proper engagement of gears. With a few drops of light oil on the various bearings after clearing, you can check them on the shafts for any signs of roughness or wear. Bearing outers in blind holes in the casings are best left to the dealer to remove with special tools. You may be lucky enough to get them to fall out with a bit of careful warming up on the casing with a blow-torch and tapping with a hide mallet, but normally they are stuck in with Loctite.

Excessive end-float is not usually a problem on the gearshafts, but if worn or damaged parts are replaced on the shafts, the assembled length of the lay and mainshafts should be checked between the inner faces of the bearings — at either end of the shafts. The mainshaft measurement is 6.579 in. (167.1 mm.) to 6.583 in. (167.2 mm.). Layshaft measurements should be from 5.697 in. (144.7 mm.) to 5.72 in. (145.2 mm.).

In both cases, the measurements can be obtained by adding or subtracting shims between end gears and the bearings at the clutch end of the shafts. The two shafts can be assembled in the box without the end cover to check whether the gears line up nicely.

Removing the gears from the shafts is no problem, the most important thing being to keep all parts in the correct order. The fifth gear on the mainshaft is held with a ring retained with a small spring-loaded catch pin in the shaft which has to be pressed down with a small screwdriver before the retaining ring can be removed.

New bearings should be assembled into the casing with a smear of green Loctite on the outer track.

Assembling the gears in the box is virtu-

ally reverse order stuff, but make sure the speedo drive shim on the shaft is returned to the correct position, and that the gear selector is in the neutral position (no gears engaged). Also make sure that the roller thrust bearing stays in place on the end of the main shaft.

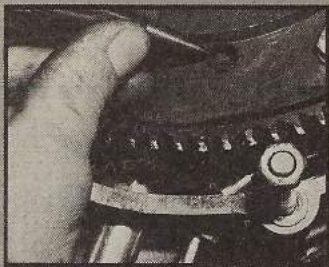
If the gear lever has been over-throwing in one direction and short on movement in the other, this can normally be remedied by loosening the locknut and moving the eccentric lever adjuster bolt just above the clutch arm pivot. With the box fully assembled, and the detent spring and plunger in place (make sure these are not worn), turn the input shaft and shift through the gears while adjusting the bolt to and fro until all the gears click nicely into place. As we said before, the box normally doesn't give much trouble, but this can sometimes give rise to mystery shifting faults which can't be traced to wear in the parts.

Reassembly

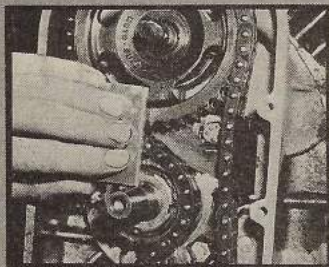
NO SWEAT if you've kept all the parts in order, but it could be embarrassing if the barrels are accidentally swapped. The respective cut-aways on the spigots are designed to clear the big end on the opposite rod. Another point to watch on the head and barrel gaskets is they can be assembled the wrong way round, which blocks off the oil return holes.

Starting at the bottom end, if a cartridge filter is fitted in the sump pan, this should only be lightly nipped up by hand.

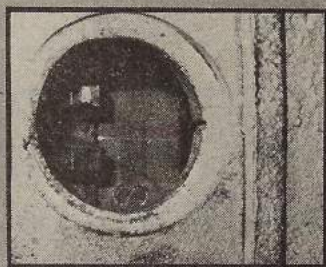
Fitting the timing gears/sprockets is straightforward. Sprockets can be popped loosely on to the shafts with the timing chain, with the scribe marks on the crank and cam sprockets facing each other. Move



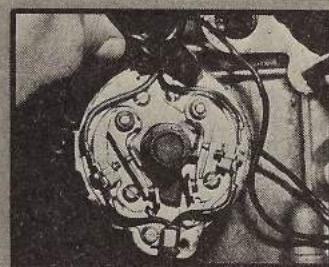
13 Before you start tightening down the ring gear plate, make sure the outer teeth of the intermediate plate line up with the teeth in the flywheel.



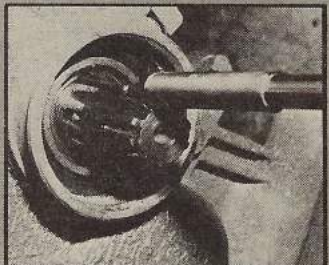
14 The scribed marks on the cam and crank sprocket must face each other and line up along the centre line of the shafts. Earlier gear-driven types have two ...



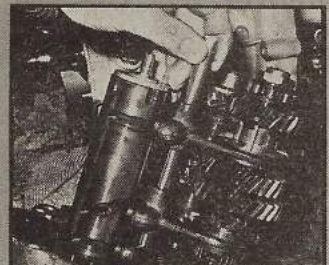
15 ... marks on the cam gear which line up either side of the crank gear mark. Timing marks are lined up with the line in the edge of the inspection hole.



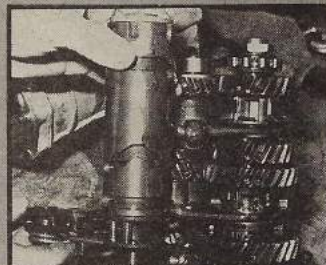
16 After timing up the right cylinder by moving the distributor body, the left cylinder points are timed by edging them round with a screwdriver.



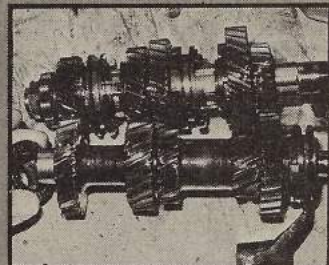
21 After removing the layshaft locknut, there's a tricky little operation of removing the steel ball which locks the speedo gear on the shaft.



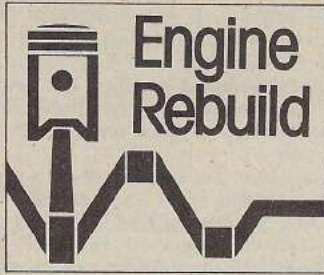
22 You may have to carefully wobble the end casing about to withdraw the gears. Stripping out the gears starts with sliding out the selector shaft.



23 Once this is out, the forks can be swung clear of the selector drum, and this, and the shift shaft lever can be pulled clear of the end casing.



24 Check all the surfaces which can wear on the gear change parts and renew as necessary. Make sure the roller thrust race stays in place when refitting.



the crank and the cam around until the key and the pin on the camshaft lines up, and push home. The scribe marks should be exactly in line on the two sprockets looking along the centre line of the shafts (see pic).

The same thing applies to the timing gears, but the camshaft gear has a mark on two teeth, and the single mark on the crank gear lines up between the two.

There is no external timing chain adjuster on the chain tensioner pad. You have to bend back the locktabs (replace if tatty), and loosen the bolts holding the plate on which the tensioner is mounted. You need a good pressure against the chain, and this is obtained by carefully levering the pad inwards with a flat lever between the nearby casing lug and the back of the pad, and tightening up the bolts.

If you don't get enough tension on the chain, you will soon know from the rattle when the bike is started, but this can be re-adjusted with the engine in the frame.

Torque up the flywheel bolts with new locktabs, and carefully assemble the clutch plates in the correct order and position, using the clutch centre to align.

Get the special nut good and tight on the gearbox clutch shaft, and carefully introduce the gearbox to the engine. The gearbox needs to be in gear so the clutch centre can be rotated by turning the output shaft to align the splines as the gearbox is pushed

on. Don't force it! If it doesn't slide on easily, pull the box away and re-check everything — you'll find it's handy having someone to help you offer up the gearbox at this stage.

Ignition timing

THE gearbox needs to be bolted up first to give you a reference mark to the flywheel in the inspection hole in the clutch housing.

The TDC mark on the flywheel for the right cylinder is marked 'D', and the TDC mark for the left cylinder is marked 'S'. If you marked the position of the distributor body at a firing point on one of the contacts, it will be simple enough to select the appropriate cylinder with the firing mark showing in the inspection hole and both valves closed. Slide the distributor into place so that the points are just opening when the body lines up with the mark you have made. You may have to try it in place a couple of times before you select the correct tooth position on the helical gear to bring it round to the correct position.

Whether you marked the position of the body or not, it's a fairly simple process, but when you are lining up the contacts to the just opening position initially, remember that the distributor cam rotates anticlockwise, so the cam must be approaching the heel from this direction — it's easy to make this mistake initially.

Once the distributor has been roughly lined up, and the points have been checked and gapped, setting the timing spot-on begins with the right cylinder, as the contacts for this cylinder are fixed to the base plate of the distributor. Bring the flywheel around until you can see the 'D' mark in the inspection hole, and then rotate clockwise past the first mark above the 'D' line. Go past about an inch and bring it back onto the firing mark. This will eliminate backlash. Back the slightly clamped distributor body

off in an anti-clockwise direction, and then bring it forward slowly till the points just open. If you overshoot slightly, back it off to make sure the points open when the distributor body is being turned clockwise to eliminate backlash.

Once this is set, go through the same process on the left cylinder, using the firing mark next to the 'S' line. The only difference in setting the timing here is that the distributor remains undisturbed and the points are gently eased round on the baseplate. Again, the points should just open when being eased in a clockwise direction. A final check should be made by rotating the flywheel slowly in an anti-clockwise direction to see whether the points open exactly on the firing marks.

Final setting up of the carbs when the engine is fully warmed up can be done the factory recommended way of disconnecting the plug lead from the cylinder not being checked, and setting the idle speed between 1,000 and 1,200 rpm. The mixture screw, which is towards the rear of the carb just above the float chamber, is normally adjusted within a range of 2 to 2½ turns out on the left cylinder, and 2 to 2¼ turns out on the right. Twiddle the screw until you have the fastest, smoothest idle, adjusting the idle speed as you go.

One last point about checking the gearbox oil level. This should be done with the bike tilted about 15 degrees to the right in order to fill with the correct quantity of oil when topping up. A piece of wood about an inch thick under the left side of the centre stand will do the trick.

Final clutch arm adjustment is pretty easy. Release the locknut and adjust the screw so the arm doesn't foul on its arc of movement, and make sure there is a little slack in the cable.

● Many thanks to Mick Walker Motorcycles of Norwich Road, Wisbech, for their help in the preparation of this article.

Engine data

Adjustments:

Plug: Champion N9Y..... .6mm (.023in)

Points:..... .37-.43mm (.014-.016in)

Static timing: First mark above 'S' or 'D' TDC mark on flywheel.

850T 8° BTDC

850T3..... 2° BTDC

LeMans 15° BTDC

Valve clearances 22mm (.009in) cold

Capacities:

Engine 3.5 litres (6.16 pints) SAE 10w/50 or 20w/50

Gearbox75 litres (1.32 pints) EP90

Torque figures:

Engine ft-lbs

Cylinder head nuts..... 32

Big end nuts..... 35

Flywheel bolts 30

Main bearing flanges..... 22

Ring gear plate 22

Gearbox

Output shaft nut..... 120

Clutch centre nut..... 55

	mm	in
Valve stem/guide clearance		
(inlet) .....	.013—.050	.0005—.0019
(exhaust) .....	.020—.057	.0008—.0022
Valve spring (outer) free		
length min.	52.5	2.06
Piston ring gap		
(compression).....	.030—.45	.012—.018
(scraper) .....	.025—.40	.010—.016
Ring clearance in groove.....	.030—.062	.001—.0024
Gudgeon pin clearance in		
little end .....	.021—.045	.001—.0017
Crankpin diameter.....	43.893	1.730
(late 850)	44.008	1.733
Regrind sizes: 10, 20 & 30 thou		
Big end bearing clearance .....	.050—.085	.0019—.0032
Rod side clearance.....	.030—.040	.0012—.0016
Flywheel mainshaft diameter ...	53.97	2.1248
Timing side mainshaft diameter	37.975	1.4951
Main bearing clearance.....	.030—.068	.0012—.0027
Regrind sizes: .2, .4 & .6mm		
Camshaft bearing clearance	.025—.066	.0098—.0022
Cam follower bore clearance ..	zero—.042	—.0016
Oversizes +.05 & +.10mm		
Oil pump gear/housing		
clearance max .....	.035	.0015
Min. clutch plate thickness.....	7.5	.2953