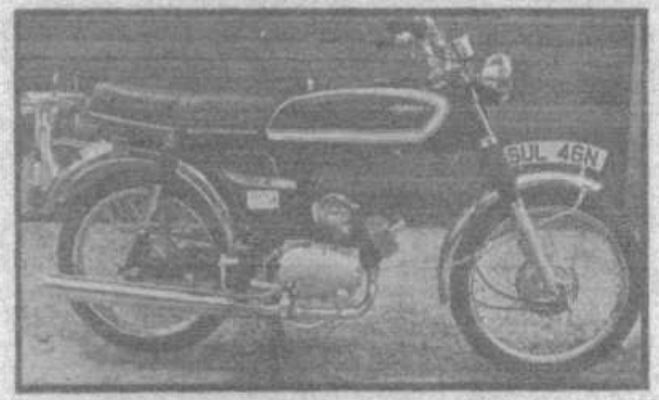
ENGINE REBUILD SERIES



YAMAHA FS1-E

THE CHANCES are, that this engine will be the first power unit that the average FS1E owner has ever taken apart.

For this reason let me state straight away that this feature cannot replace the workshop manual. What it can do is cover some of the points, in detail, that the manual writer, assuming some prior knowledge, would not bother with.

Thus, armed with both manual and this feature you should be able to tackle the FS1E engine.

There is no point in tackling this job armed with a couple of rusty spanners and a hammer. You must have some decent mm spanners, open-ended and ring, pliers, screwdrivers and some of the Yamaha special tools, plus, of course, a hammer but only a small one.

"Fools rush in" as the saying goes so before attacking the engine removal, start by giving the bike a thorough clean down removing all the road muck and grease that accumulates around the cylinder head and barrel. Only when the engine is nice and clean should you even think about removing it from the frame.

Start by running the engine for a couple of minutes, to warm up the gearbox oil, then when you drain it, the oil will flow that much more readily. With the gearbox drained the next task is to remove the exhaust system. You should use a special "C" spanner to remove the front pipe but you can probably get away with knocking it around with a large drift.

To gain access to the pedal drive chain you must first remove the cover, on the near-side. With the chain exposed search around the chain until you locate the spring link and remove it. You are now going to need a pair of circlip pliers to remove the pedal driven sprocket and its driving dogs, which are retained by a couple of "C" washers. Now remove the gear change pedal.

Some of the engine stripping is best done while the unit is still

1 Before you do anything else, make sure that you have drained the gearbox, the plug is located here.



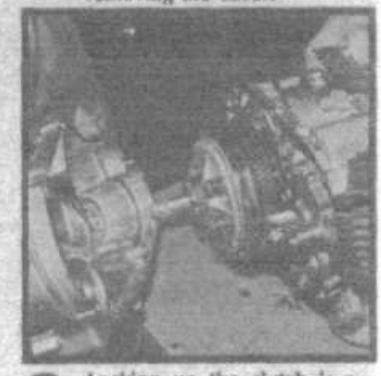
2 Four screws and the carb cover will lift off. To remove the carb you must first pull out the rubber . . .



3 . . . plug so that you can gain access to the carb inlet manifold clamp, located here. Remove petrol pipe.



4 Make sure that you have drained the oil before taking out the cover screws and removing the cover.



5 After removing the clutch cover a wise man will remove, and store, this inlet manifold sealing ring.



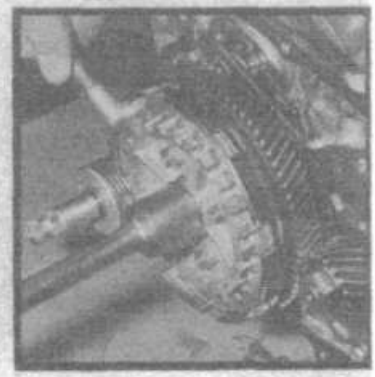
6 After removing the four centre screws the clutch pressure plate and friction plates are removed.



7 With the plates out of the way you can pull out the push rod from the centre. Don't forget this ball.



8 Locking up the clutch is a problem. Here a special tool is in use. See text for more details.



in the frame so that as you remove some of the ancillaries they can remain on the bike attached to their respective cables etc. Remove the screws from the nearside engine cover and lift it off. The small circular flywheel that you have now exposed is the engine's generator. You will have to lock the engine in order to remove the centre retaining nut. This can be done by putting the bike into gear and applying the rear brake.

Having unlocked the rotor you are going to need a special puller to extract it from the end of the crankshaft. This puller screws into the rotor and then the bolt down the centre of the puller locates against the end of the crankshaft and draws the rotor off the crank.

This will have exposed the generator coils. The complete assembly is removed as one and wired out of the way so that it remains on the bike, still attached to its wires. It's not a bad idea, at this stage, to remove the woodruff key from the end of the crankshaft, before it removes itself and gets lost. This can be done by tapping it out with a sharp, flat screwdriver.

On the other side of the engine the four screws retaining the carb cover are removed to reveal the engine's carb. This, in turn, can be removed by loosening the clamp at the inlet manifold through the hole in the front of the casing. Once the carb is unclamped it can be pulled off the inlet stub and wired to one side still attached to its cables. The air cleaner can be removed at this stage. Now disconnect the rear drive chain.

You are now ready to remove the engine from the frame. Start by removing the two upper mounting bolts and loosen, but do not remove, the footrest mounting bolt. Tip the engine forward and disconnect the neutral warning light switch. If you now pull out the footrest mounting bolt the engine will fall on your foot!

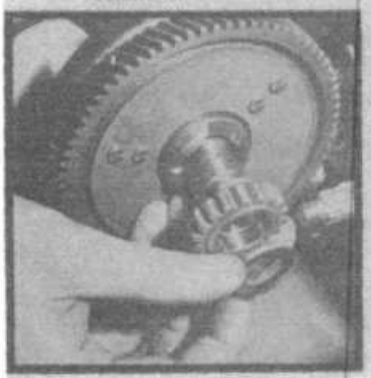
Now to begin the engine strip in earnest. Before the clutch cover can be tackled the kick-start must be removed so, after removing same, unscrew the seven screws holding the clutch cover and lift this off. These screws are not all the same length so note the positions of the screws as you remove them. If the cover is tight do not try to lever a screwdriver between the joint, you will only break the crankcase. Tap around the edge of the case with a soft mallet to break the joint, it will probably only be stuck with a gasket compound.

After removing the cover the next job is to strip the clutch. This is quite simple to do, just remove the four screws in the centre of the pressure plate and lift out the plates. Apart from the pressure plate there should be two friction plates with a steel one located between them. In the centre of the clutch inner drum there is a push rod that must be removed and a small steel ball located behind it. You will probably have to tip the engine up to shake this small ball free, don't lose it.

Your next problem is to unlock the big nut in the centre of the clutch. Knocking down the lock tab is no problem, your main headache is going to be holding the centre of the hub as you undo the nut. There is a special tool available, as seen in the pic, but you can probably get away with screwing two of the clutch bolts back into the hub and putting a bar across them. I say probably, because if the nut is very tight you stand a good chance of breaking the clutch hub. If you want to make a holding tool you can do so by welding, or bolting, a lever onto an old clutch plate.

With the nut undone you can remove the clutch assembly. If you noticed the clutch outer drum moving in relation to the driven gear don't worry, it's rubber mounted and is supposed to move. Note that the kickstart gear comes off with the clutch and check the order of the washers between the drums etc. You should have a steel and a thrust washer between the two drums and one thrust washer behind the kickstart gear.

9 Hiding behind the clutch drum is this kickstart gear. Note the washer that locates behind it.



10 After releasing the tension from the kickstart return spring, the drive gear is removed.



11 You will need circlip pliers to remove the kick-start idler. Note, there are two washers behind.



12 After removing the circlip from the gearchange shaft the complete assembly is pulled from the cases.



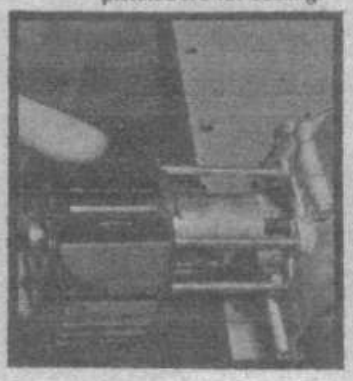
17 Once the flywheel is off the charging coils can be removed and left attached to their wires.



18 You can remove this woodruff key with a screwdriver, tapping it out from the front.



19 Four nuts and the head can be lifted off, followed by the barrel. Check piston/bore for seizing.



20 The piston circlips are of the wire type. You will distort them on removal. Always fit new ones.



Very carefully remove the end of the kickstart spring to de-tension it, take care not to lose any fingers (the ones on your hands), and remove the kickstart drive gear complete with spring. With your circlip pliers remove the clip holding the kickstart idler gear and remove the gear, note the flat and corrugated washers behind the gear.

If you are feeling lucky you can try your hand at removing the crankshaft drive gear. As there is no way of locking the engine, at the moment, you have to fit your ring spanner on the nut and try to shock the nut loose by hitting it with your hammer. When you have tried this, and it doesn't work, you just leave the job until later when you have stripped the top of the motor and are then in a position to lock the engine.

Around the other side of the engine locate and remove the gearchange shaft retaining circlip. With this out of the way you can then slide the shaft out as a complete assembly with the levers and arms still attached.

Now is the time to tackle the top end of the engine. Start by removing the four head bolts and lift off the cylinder head. If you want to re-use the gasket you can by heating it up, to soften it, and then letting it cool down.

The piston has a small arrow marked on the top of the crown and this should always face the front of the bike. The barrel can now be lifted off. If you are going to remove the rings at this stage make sure that you keep them in the right order and the right way up, ready for re-fitting.

To remove the piston from the rod you must first take out one of the circlips, these are the spring wire type and must always be renewed. You cannot remove them without distorting them to some extent, so you must always fit a new one.

In theory you should now be able to push out the gudgeon pin. If it is tight do not use extra force or the piston will be damaged. The answer to this particular problem is to warm the piston up, to expand it. I do not mean attack it with a blow lamp, a piece of rag soaked in hot water and wrapped around the piston will do the job. The small end bearing can then be slipped out of the connecting rod. This item seldom wears on this engine so you can probably re-use it.

If, at the earlier stage, you failed to unlock the engine drive nut from the end of the crankshaft now is the time to tackle it. Using a small wedge type tool under the small end of the con-rod you can lock up the engine in order to remove the nut (see pic).

If you do not have such a tool you can make one up from any flat, strong piece of steel. Do NOT put a screwdriver through the small end and wedge this across the mouth of the crankcase, you will only bend the connecting rod.

Moving to the off side of the motor remove the six cross head screws from the rotary valve cover, and remove the cover. The disc valve can now be lifted off. This may need a little persuading as it has been known to stick on the shaft. When refitting the disc the two dots on the face must line up with the drive pin in the shaft to keep the timing correct. If you cannot see the two dots don't panic; you are looking at the wrong side.

Moving to the back of the engine unhook the spring from the gearchange drum roller and unbolt the roller. Remove the neutral light indicator switch.

Before attempting to remove any of the screws holding the two crankcase halves together make up a card roughly the shape of the crankcase. The idea is to remove the screws and fit them into suitable holes in the card, corresponding to their position in the crankcase. This is the only way that you are going to make sure that they go back into their respective homes. There are twelve bolts in all and they come in six different lengths! You are now ready to split the crankcases.

For this operation you should use a special puller (as in the pic), which screws into the near

13 **Again, a circlip retains this pedal chain driven gear, it must be removed before the cover is lifted.**



14 **Lifting the cover reveals the flywheel generator; clutch operating mechanism remains in the cover.**



15 **After loosening off the nut, two "C" washers are removed before the gear can be unbolted.**



16 **After removing the nut and washers, this flywheel puller is needed.**



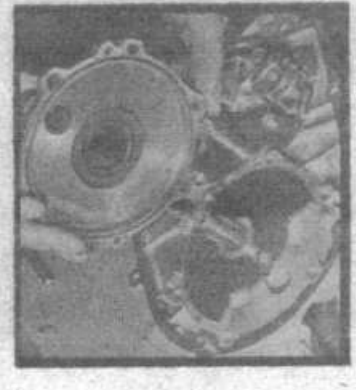
21 ***After removing the piston (see text) the small end just slides out. This bearing seldom wears out.***



22 **This forked tool is used when removing the drive gear nut and the generator flywheel.**



23 **Once the crankshaft drive gear has been removed the rotary disc valve cover can be unbolted.**



24 **The valve disc can then b slipped of the end of th crankshaft. Timing do are arrowed.**



side crankcase and presses the nose of the crankshaft out. If you do not have the puller, and cannot readily get one, you can separate the cases by holding the near side case and hitting the end of the crank with a soft mallet after the cases have been heated in an oven.

The idea is to expand the cases so that the bearings will become loose and the two halves of the crankcase will come apart easily. If you do not heat the cases you will have to hit the crankshaft end nose so hard you will probably knock it out of alignment.

The main bearing should stay in the crankcase but in practice it usually sticks to the crankshaft. The puller is now transferred to the other side. Before you can push out the crank you will have to remove the disc valve drive pin from the crankshaft.

This can be done with a nail punching it out from the other side. When refitting, the pin cannot be fitted the wrong way around putting the disc 180° out, because the hole is tapered.

The order for rebuilding the gears is clearly shown in the pic. Make sure that you check the gear change drum for any signs of wear, replace if at all suspect. The main wear points on the FS1E motor seem to be restricted to the barrel. It is not so much that it wears, it's just that some owners forget to put any oil in the fuel and the motor seizes up! The crankshaft is very strong and should really last the life of the bike. Always fit new oil seals into the crankcases as the engine's performance really depends on the crankcase acting as a pump. If the seals are less than one hundred per cent you will lose power.

The barrel, piston and exhaust pipe should be de-coked as a matter of course, making sure that the exhaust pipe and silencer are really clean. When putting the unit back together put plenty of oil on the main and big end bearing and around the piston.

Dave Walker

ENGINE DATA

Spark plug type	NGK B7HS
gap	6mm
Ignition timing	1.8mm BTDC
points gap	.30/35mm
Ring end gap	.15/.35mm
Clutch friction plate	3.5 to 3.2mm min.
Clutch spring length	34 to 33mm min.

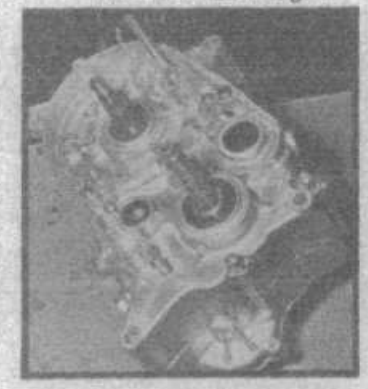
TORQUE SETTINGS

Cylinder head	7ft lb
Flywheel	42/50ft lb
Primary drive gear	42/60ft lb
Spark plug	20ft lb
Clutch boss	36/50ft lb
Drive spocket	50/70ft lb
Engine mounting bolts	15/20ft lb

25 After un-hooking the spring the positive gear selector mechanism can be removed.



26 You have to remove twelve screws to split the cases, but note they come in six different lengths.



27 If you are not going to use this special puller to separate the cases you must use heat (see text).



28 The main bearing, on the crankshaft, should remain attached to the crankcase but rarely does so.



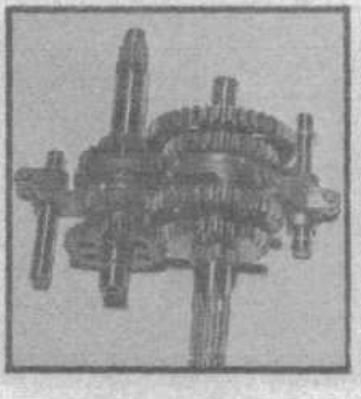
29 Before pressing out the crankshaft from the off side case remove disc valve drive pin.



30 Once the little drive pin has been shifted the crank can be pressed from the case with puller as here.



31 The gears just lift from the case. The order of assembly, with the selectors is as here.



32 On the gearchange drum look out for wear here, any play will be reflected in the gear shift action.

