



In this article we are using a brand new 200cc engine casing, mainly when you buy these from suppliers they come just about totally bare, if you need to strip your engine, we will get round to an article on this, but for now you will have to read everything backwards to strip it!!



Some of the casting marks can still be found on the new engine cases, and even if you are using your one that you have just stripped, the first job will be to clean and inspect everything. Jizer, Gunk or some people even have their casings bead or vapour blasted, but what ever you choose, the casings are pretty soft alloy, don't get them sand blasted or similar as you will ruin them. Acid dipping has also been know to be done, but this can affect the casting, be careful.



Again finally checking all stub holes, a tap is being used here just to clean the thread



Points of wear on the casings are stud holes, where the mag housing goes in, bearing and crank housings, and check where the end plate bolts go in on the outside. The seat of the endplate and in particular the studs/holes need careful inspection. With all stud holes repaired, to do this time inserts are best, Wurth do make some very good ones, but they are expensive!



OK ready to start getting dirty? First of all, I always try to work as cleanly as possible, sure you will get dirty hands, but wash them often and carry on. Engine mounts are to be fitted first, for this we need heat, and a couple of suitable hammers. You can of course by a tool to fits these. Heat the casings up where the mounts go in.



The method I use when not using the special tool is to support the back of the casing with a large pound hammer, copper grease the mountings to help them slide in, then from the front knock the mountings in. Take note on the large mounts there are three holes in them, these holes should be pointing forwards.



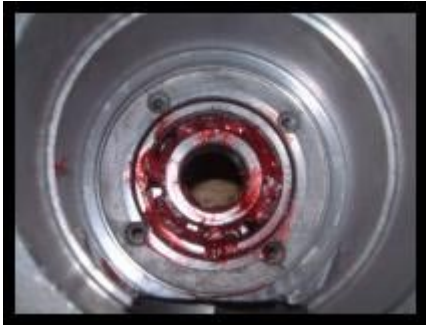
Now we have the mounts in, we are fitting the engine to a special tool, the engine case holder just to make our life easier when moving the casing around, again this is not needed but helps!



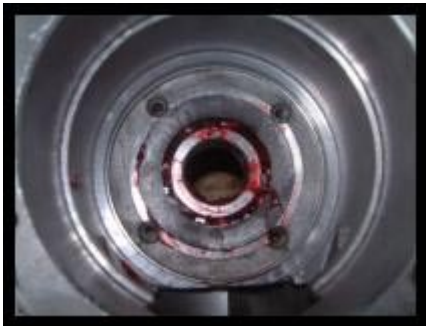
Here we are starting with the drive side bearing set up, shown are the parts needed to fit the bearing. Good quality grease, bearing, gasket, oil seal and plate, plus four retaining bolts.



There are three methods to fit the drive side bearing, heat the casing by means of blow torch or similar, freeze the bearing as it makes it shrink, or buy a bearing press tool. There are manufacturers of tools specifically for Lambretta, if your going to make a habit of doing these jobs they are well worth the expense. Using one of these methods, press the bearing into the engine casing, it does not matter which way round it goes, but it is important that it is pressed all the way home. You can check this by looking at it through the chain side of the casing, it should fit right up tight against its housing.



Once the bearing is pressed home, smear the balls of the bearings with high melting point grease,



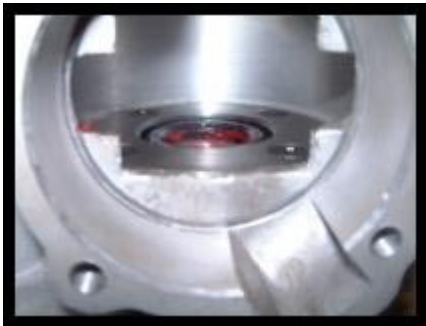
The round gasket is then fitted, some gaskets will not fit this housing perfectly, do not worry, just simply and carefully push the gasket edges into the housing with a flat screwdriver, just be careful when doing this.



Next we need to fit the oil seal to the plate, the picture here shows the correct way round it goes. The spring around the oil seal should face the the crank when it is finally assembled. Four new screws are used, it's always best to use new ones here as the old ones almost certainly will be damaged when removing them. New ones from most dealers will now be supplied as high tensile Allen key headed bolts, it is much easier to secure and do this type of screw. Lock-tite is always sensible on these bolts,



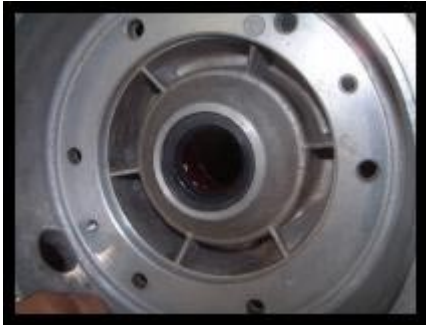
The plate is diagonally torque'd, this makes sure the plate sits down evenly, keep going around them until you are sure all four bolts are secured as tight as they can be, there is no torque setting for these bolts, but you should tighten them fully until they will turn no further.



With this picture you can see that the oil plate is fitted correctly, it is vital that the plate is secured fully home and is flush as in the picture. If the plate sits proud and is not secured correctly, your crank will rub against it and not turn correctly, damage will occur.



Place the mag or stator housing so that the inner part faces upwards. Now as with the drive side bearing you need to either heat the housing, keep the heat at the top of the housing. When heated, fit new seal carefully as the housing is hot! with spring facing towards you (it will end up facing into the crank when you have finished) Fit the L shaped cup washer next.



Now we need to fit the bearing, it comes in two halves, put the inner to one side as this must be fitted to the crankshaft. Either with your bearing tool or by using a socket or similar, make sure that what you use puts the pressure on the outer track, knock the bearing in position. Make sure it goes in square, tap it fully home. **Li SX and TV models, if you are using the original size of bearing (NU205) fit the spacer washer. GP models and machines using a GP crank with the larger bearing (NU2205) do not have or use this spacer.**



With the bearing in position, fit the last larger oil seal, again with the spring side facing you, towards the crank when assembled. A large circlips holds everything in place. Lightly pack the inner bearing with your grease as no oil gets here to lubricate it and it relies on this grease. With every thing finished your mag housing should look like this!



Preparing the new crank, if you are not re-fitting your old crank you will need to fit the mag side bearing inner track. The easiest way to do this is again heat the inner track. It will be easier the hotter you get the inner track, glowing red is OK, when it is suitable heated use your pliers to slip the track over the crank shaft. When you have this done, tap home around the whole inner track to make sure it is seated properly. Again, an special tool can be purchased to fit and remove the inner track, well worth it if you to do this kind of job often.



Fitting the crank, smear a little grease on the inner edge of the drive side oil seal, this helps the crank through, then by passing the shorter shaft through first, it is easier to get the crank at BDC, so the crank is at it's shortest. First smear a little grease on the drive side inner seal that we fitted earlier, a very slight coating is all that is needed. This helps the crank pass through it, less chance to nip the edge of the seal.



The crank should be pushed as far as possible by hand, rotating the crank slightly as you go, again to make sure you do not snag the edges of the oil seal.



Here we are using a special tool to pull the crank through, from the chain side position the space central on the bearing.



The front sprocket bolt is used to pull the crank through into position. If you do not have this special tool, fit the flywheel nut on the end of the crank, this stops you from damaging the thread on the crank, and using a rubber or nylon hammer, tap home the crank, again twisting as you go.



Here we can see again, the use of the tool to pull the crank through, we are also using a con rod holding tool to position the crank



Note how the crank is fully home now, flush to the drive side plate, but still turning freely.



Before you fit the mag housing that we have built, the first step is the gasket for the mag flange, this will only fit one way, make sure all the holes line up with the gasket

Fit the mag housing assembly, this should be a pretty good fit, wiggle it into position, if its a little tight, a rubber hammer hit evenly around the edges will tap it home. If you are using your original one, it will need cleaning to make it fit easier. Once the mag housing is just about home, three nuts on the studs secure this. Again in a diagonal pattern tighten this fully home. Finally check the crank still turns freely.



Now you have the mag fitted, we can turn our attentions to the front sprocket assembly



The dished washer goes on first, dished side down.



The drive sleeve has splines on it, in no special way other than to match these splines with the splines on the crank shaft, fit the sleeve.



The front sprocket goes next, the half moon part of it faces out towards you.



Next the bottom spring collar goes on, but before you fit the spring, place the top collar on.



In this picture you will see, where the oil way hole is on the drive sleeve, we have used a felt pen to make a mark directly opposite this. This will help us line every thing up when we come to secure it all down. Take this top sleeve back off now you have made this mark



Fit the spring on next, and put back on the top collar, lining up the pen mark you made with the whole as best you can. Tighten the whole assembly down now, a note should be made that we still have our conrod holding tool in position to secure everything. If you do not do this it will be impossible to fully tighten the front sprocket bolt. Once you are happy that every thing is aligned with your marks, tighten home fully the front sprocket bolt. When complete it is important you double check every thing is correct by hitting the front sprocket assembly with a hammer, if it sounds solid every thing is correct, if it sounds hollow, take it off and start again!



Fitting of the new barrel studs is easily done by the double nut method. By this we mean screw one of the head nuts on to the stud, then screw another directly after it, lock them together with two spanners. Now using one spanner, if you have locked the nuts together tightly simply screw the bolts down with the spanner. Again with two spanners un lock these nuts and move on to the next stud



Carry on fitting and four studs, ideally we are looking to get them all the same height as far as they will go in. Fit your cylinder base gasket now, it will only line up and fit properly one way round. **Top Tip** Vespa PX cylinder studs are ideal to use as they are slightly longer and will make sure you get enough thread of the stud into the engine casing.



Although we have fitted the cylinder and piston here, we are showing you this picture now for you to note the correct way round the piston goes, the arrows of the piston face to the exhaust port. The easiest way to fit the top end is to fit the piston and rings into the cylinder first. Fits both or all three rings (depending on your make of piston) on to your piston, making note as the rings have a cut out which fit into the peg on the piston one way only.



Compress the rings onto the piston while sliding into the barrel from the bottom, i.e. the top of the piston goes into the bottom of the barrel. Slide the piston up one ring at a time, each time making sure the ring has seated properly into the bore of the cylinder.



Slide the barrel on to the studs as in the picture above. Fit the small end bearing into the crank, it is a good idea to dip this in a little light oil or two stroke oil to aid in the first start up. Line the conrod and piston up so you can fit the gudgeon pin and tap through lightly with a rubber hammer. Fit both piston circlips, make sure they are fitted correctly by turning them in their grooves. If they do not turn easily or pop out, they were not seated correctly, try again.



slide the barrel fully down the studs, if you are using a dial gauge to set top dead centre (TDC) now is the time to skip to the stator and flywheel section so you can mark TDC.



The cylinder head and parts needed to fit, notice the one nut longer than any other, this is used to secure the cylinder head cowl. If you are using your old cylinder head, it will need to be flatted. To do this, simply use a piece of glass and sticky back sand paper, grinding disc is ideal. rotate the head within your hands using a twisting movement 1/4 of a turn for ten times. Carry one after each ten twists by turning the head 90 degrees and doing again, you should end up doing this four times.



First fit your head gasket, then place your head on top of this. The head should only fit on the studs one way, the spark plug hole should be facing the top left hand side.



Again in this picture take note of the long nut that excepts the cylinder cowl bolt, because we have the engine on a stand, it is upside down, so yours again with the engine the correct way up should be on the bottom left hand stud as you look directly at it.



Finally in a diagonal pattern, it is important you torque these nuts down, 20lbs is ideal, the Lambretta Home Workshops manual does state 15, but trust us 20 is better.



Carrying on at the top end, we are now going to fit our electric's. Here we are fitting an electronic kit, but roughly speaking the points and condenser stator are fitted in the same way.



The electronic stator, the main difference is the "black box" pick up, it is at the top of the stator with a white line on it. If you are using the points/condenser type stator, you will of course need to almost certainly fit new points and condenser, check the workshop section for this.



Thread the wiring from the stator through the hole at the top, taking note of the gap on the stator to allow the wires to sit into when fitted. Make sure you do not snag the wires when fitted, there is a plate to hold down the wiring that should be fitted to the top nut/bolt when securing the stator



I always recommend fitting the stator in a central position on the oval holes of the stator plate, unless of course you have marked the stator and housing before removal, this allows you to turn the stator either way to adjust the timing if needed. Just nip the nuts/bolts at this stage as you will almost certainly will need to move the stator around.



To secure the wiring, a gasket, two plates and a rubber grommet are used. The plates have a tapered side to them, after you have fitted the gasket to the engine casing, the first plate (they are the same) goes with the highest side in towards the engine, then the grommet, then the last plate with the raised part facing out. Secure the plates with two bolts, original ones were a screwdriver fit ment ones, for each of removal/fitting in the future you can use either Allen headed or spanner headed bolts.



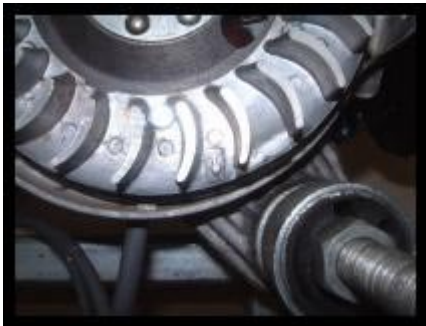
Finally before you fit the flywheel, just make sure none of the wiring is too high and will catch on the flywheel.



Next put the flywheel on, and tighten the flywheel nut, note it has left hand thread, it does not need to be particularly tight at this stage, just nip it up.



We are going to need to find TDC (Top Dead Centre) this is the point when the piston is in its highest point in its travel, up to the head. We are looking for when the piston will not go any further up, but not starting its travel downwards either. If you have a play, you will find a small point where the piston no longer moves. We are using a TDC tool, the outer part of it is used like a spark plug, simply screw it into the plug hole. It then has an inner rod, that you can rest on the top of the piston to give you better sight of its travel.



When you have found TDC, there is an arrow on the flywheel, we need to make a mark on the outer ring of the mag housing directly opposite this arrow. Using a bladed screwdriver and hammer, a gentle tap will be enough to cut a groove in the alloy. Take note again because of the holding tool our engine is upside down



Now using our dial gauge, we need to measure the firing point. Take the flywheel back off, line the arrow on the dial gauge, it is in position zero degrees, with the mark you made on the mag housing with your screw driver. To do this there is a hole in the centre of the gauge, place this over the shaft of the crank, and lightly fit the nut back on with your hand, this insure more accuracy.



Timing is before TDC on all models, so to mark the firing point you will need to go back towards the engine mount from the zero position. Timing for models is 23 degrees Li/TV/SX and 21 degrees for GP. The only other setting known at this time is the new Imola kits, which need to be set at 27 degrees. Again it is a good idea to make a second mark on the mag housing now with your hammer & screwdriver to show the firing point. This will save you if you need to set the timing up again having to go through this all the time.



Now this is where the points and electronic set ups differ. First I'll cover electronic, on the black box on the stator picture we showed earlier, we mentioned the white line. This white line needs to line up with two very small marks situated either side of a flywheel window, they are directly opposite each other in the same window.



What we need to do is make sure when the arrow of the flywheel is lined up with the mark you made for your firing point on the mag, that the two lines on the flywheel window are in a perfect line with the white line of the pick up box.



If you cannot get them to all align, this is when you need to move the stator around on its oval holes to achieve this position. When you have done so, timing is set.



To set a points system, follow the electronic instructions except. For this I use a battery and bulb & holder, attached one side of the bulb to an earth, the other to the battery, of which the other side of the battery wire goes to the green coming from the stator. Instead of lining the lines up, what we are looking for here is when you turn the flywheel to the firing mark, the bulb will become brighter when it reaches this mark exactly.

Too soon or too late, you will need to either adjust the points on the screw, this is done by undoing the screw, turning the bottom plate of the points slightly, and nip back up and try again. If you cannot get the light to brighten by adjusting the points base, again moving the stator on the oval holes and try again adjusting the points further.



When you have finally set the timing, make sure the stator plate retaining bolts or nuts are tightened, again using a torque wrench fit the flywheel and torque to 50lbs.



Job done, your top end is now complete, only thing left to do is fit the spark plug and cowlings. I always leave the cowlings until it is in the frame and every thing has been checked and the scooter is running. Just saves you time in case you got any thing wrong!



Turning our attentions to the rear end and gearbox of the scooter now, with the rear hub bearing and oil seal



Fit the oil seal into the bearing first, it should have the oil seal fitted into it with the springs facing into the crankcase.



You may need to heat the crank casing up to fit the rear hub bearing, some people prefer to freeze the bearing this makes it shrink. You can also of course use a bearing fitting tool for this job. Fit the bearing/seal into its recess in the crank case, it will only fit one way round, and it goes in from the brake shoe end. Pack with high melting point grease.



Here we have the parts to secure the bearing one thin shim plate, one thick but small retaining plate and four washers & nyloc nuts.



First slide the shim plate over the four studs, next the smaller but thicker plate, all held down with washers and nyloc nuts. Again do this up in a diagonal pattern, nice and tight. We have also while we are here, fitted the two rear brake shoe pivots, this end is now complete bar the brake set up.



Here we see all the parts needed to fit the main shaft. The gear selector, selector shaft and seals. Fit the gear selector first on GP models this is one complete unit which includes the outer arm. On earlier models the selector arm is separate to the shaft, you just need to fit the shaft at this stage.



The sliding dog should be fitted to the lay-shaft first, to do this insert the selector spring in the centre of the layshaft, and hold a ball bearing at each end of this spring. If you look at the sliding dog at the end with the ring on, it has two recess to make fitting this assembly together easier. The feet of the dog should be flush with the end of the shaft (this is first gear). -fit the shaft through the bearing and make sure the lugs on the gear selector wishbone locate into the sliding dog



Tap the lay-shaft home with a hide mallet. Place the rear hub cone washer onto the lay-shaft then a suitable distance piece (avoids messing with the rear hub). Place the rear hub washer and nut then tighten, we will tighten it properly later on. If you cannot find a suitable spacer, simply fit the rear hub and torque. In both cases this is done to set the gearbox up correctly.



With the lay shaft in position we can Finish off the brake now, here you can see all the parts needed for the job, your shoes, clips and operating levers and shaft.



Fit the operating cam through the hole in the engine casing, grease this when fitting as it is important for a good operating brake.



Next fit the brake arm, notice the position it is in, it needs to be some where like this for the brake to operate correctlty when you connect the cables up. The arm is held on to the shaft by a circlip.



We are now ready to fit the brake shoes, you will find it much easier to fit the return spring to the two brake shoes first, expand the shoes or the operating cam, and then place the holes of the shoes bystretchingg them apart, on to the pegs you fitted earlier.



Finally fit the retaining W clip, sometimes you will be supplied or have two circlips with plates, either way is fine, and it does not matter which method you use.



Job done, brake parts finished and fitted, if you had dirty hands while fitting brake parts, naughty you, just make sure all braking surfaces are clean and free of grease.



The "Xmas" tree gearcluster, separate gears, shims and bearings are now going to be fitted to make up the gearbox



Just near the selector arm, in the casing is a housing for the bottom Xmas tree gear cluster, in here goes the needle roller bearing.



On the bottom of the cluster is fitted a shim, the bottom is the widest part.



First into the casing goes the cluster, making sure the shim is still in position when fitted, simply pop the cluster into the needle roller,



On the top of the mainshaft, fit the top shim, it fits as in the picture just lay it on.



Next pop on the end plate roller bearing for the mainshaft, again just pop it in position



The first gear to go in is forth, this is the smallest gear of all. If you look at the gears carefully, second third and forth have a boss on them, a slightly raised part on one side. This is important as they go in a certain way. Forth gear fits with its highest boss towards you.



After you are happy with forth gear being put in, make sure that forth is level with its counter part gear on the cluster. Next in is third, again check the highest boss, this time the boss faces towards the rear hub. Again check and make sure the gears line up. If they do not, try another sized shim at this under the cluster at this stage



Second gear now goes in, the same way round as third gear, the highest boss faces in towards the rear hub. Again check the alignment as you go.



Notice first gear, you will see on the top face some teeth, these are for the kick-start to mate to when starting, again only fit this way round!



Fit the mainshaft shim now, if you are using a totally new gearbox, I would suggest a few shims, 2.0 2.2 & 2.4 should be fine. If you are using your original gearbox and casing, you should be OK with your old shim. If you are using new, fit the 2.2 first and then when can measure up.



Instead of the original stud and nut arrangement, it is much better to use high tensile steel bolts too secure the endplate. Make sure you get these from a Lambretta dealer as they need to be the correct length. Loctite is also used here to secure these bolts.



Remember the picture above and the shim, we will need it to check endplate float later on. With the new bearing fitted into the endplate, it is held in there by a circlip, fit the end plate, making sure it goes on nice and square. You will need to wiggle it to get the two shafts and bearings, plus all the studs and dowels to line up. Do all the nuts up at an even rate to pull the end plate down evenly, continue until tight.



Fit the outer part of the clutch housing, the spider only at this stage, we need to check every thing is tight and secure for measuring the endplate float. Fit the clutch holding tool to secure the mainshaft so it will not turn and into this just place the clutch spider on its splines,



Again when we fitted the brakes, make sure that either you have a spacer or the rear hub fitted and torque to 120lbs so we can start measuring.



Now we are ready to measure end plate float. This is done by measuring the gap between the shim on first gear to the inner face of the end plate. The gap we are looking for is between 0.07mm to 0.30mm, the use of thicker or thinner shims adjusts this gap.



Now when you are happy with gearbox operation you can continue to fit the rest of the end plate nuts or bolts. Secure evenly and nice and tight.



Fit the mainshaft shim washer, the Home Workshop Manual mentions that these shims align the chain, true they do, but unless you have the correct workshop tool for doing this dont worry as if you try to alter the measurments and you get it wrong, you will do more damage then good.



Parts needed to fit the chain, rear sprocket, chain and guides, clutch housing bush or bearing, and the clutch nut and tab washer



The chain guides, there are now many types of new top chain adjusters available, certainly on any tuned Lambretta, but even for the cost of them they are a good idea to use instead of the factory "normal" type. a) they last longer & b) these types are much less prone to breakages, hence aiding reliabilty.



Slip the chain around the rear sprocket, your front one will already have been fitted



Roughly position the bottom chain guide in place (and the top one if you are using the original style), lay the chain around the front sprocket with one hand while holding the rear sprocket with the chain around it in the other.



On some types of chain tensioner a stud is used to fix the guides, secure the bottom one first which does not move, then the top over that.



The top tensioner, is used to take up the slack in the chain, ideally your chain will not require too much adjustment, but to get the correct adjustment, push upwards on the adjuster to tension the chain. Nip the bolts up, then between the front sprocket and the tensioner, wiggle the chain up and down, you should have 1/2" play at most. Tighten fully the tensioner when you are happy with this.



If you have a look at this rear sprocket you will see it is solid. There are some that have a rivet section in them, these are two piece rear sprockets. Again for tuned and ideally all scooters, a solid non riveted type should be used. The rivets are not uncommon in breaking or allowing the two sections to come apart. Fit your center bush or bearings now, either two needle roller bearings or one brass bush, some prefer the brass type of bush.



Bath your clutch corks in the ST90 gearbox oil you will use, if you fit them dry without soaking them first, you run the risk of burning the plates out from the word go!



Fit the clutch spider into the rear sprocket, in just goes in on the bearings/bush. Notice the legs of the spider, the top edge is like a castle effect, then after this the shafts of the spider should be smooth, if yours has ruts or lumps it is worn, either file flat again or replace.



A tab washer locates on any one of the pins with it's eyellet, the clutch nut can then be tightened down by hand.



Fit the clutch holding tool, do not try to use screwdrivers or anything else to trap or jam this, damage will occur, these tools are very cheap and very neccessary.



Using the best socket and ratchet you have, simply get this nut as tight as you can, there is no torque setting other than really tight! Use a screwdriver and hammer to knock over one edge of the tab washer onto the nut, this is done to stop the nut coming un done.



The clutch springs, and here we are using a centre spring as well due to the tuned engine. When checking your clutch springs, you should stand all five up, they need to be all the same height.



To stop the springs from falling, especially if the engine is still in the scooter, simply dab one end of the spring in grease before fitting.



By dabbing the grease on one end of the spring, this can now be placed in its recess in the clutch spider, it will help to keep the spring in position



Carry on until all five are in place



Fit the clutch basket, again it has recess in it for the springs to sit in, plus the legs of the basket will need to align with the legs of the clutch spider. Onto this goes a clutch cork



After the first cork, put a steel plate on this, then cork etc



Carry on until the last part which is the steel top plate, this has a chamfered edge on it and is thicker than the other plates. GP top plates differ to all other models by being thicker.



Now we need to use the clutch compressor to compress the clutch basket and springs. .



When this is done you can slide the corks and plates down into the housing, they should slide down pretty freely with no interference.



Continue to compress so that the top plate is under the groove in the leg of the clutch spider. Now you can fit the clutch retaining circlip, where the two ends meet they should be placed so that both ends fit inside a leg.



All that remains now is to fit the chaincase side gasket, if you have a non GP/DL machine make sure the top clutch thimble is in position.



To assemble the kickstart mechanism, the shaft requires a bottom plate, a spring then the kick-start piston. In the side is a hole for the locating/locking pin. When this is assembled place the whole shaft through the chain casing. Fit the return spring, look carefully there are holes in the casing and shaft for each end to go. For GP machines only, fit the brass clutch operating bush in its housing.



Fit the clutch operating arm as shown, complete with return spring.



On the outside of the kickstart shaft fit the kick-start shim and retaining circlip.



Using a set of mole grips securely fixed to the kickstart shaft, you can now place the chaincase side on the engine.



This is done so you can use the grips to align the kickstart into position, as it needs to be wound back for tension and to seat properly.



Rear hub, shims and locking kit.



First put the thin shim washer in position, then the rear hub cone. The split on the cone should fit down the raised edge of the main shaft as shown in the picture.



Finally fit the rear hub on its splines and affix the nut. If you engine is in the frame put the engine into first gear and ask a friend to push down on the rear brake pedal as hard as they can. If not do the same, but use some thing suitable on the rear brake arm to lock the wheel. Tighten the rear hub as hard as you possibly can. Place the locking washer over the nut, check for alignment of the hole for the grub screw. You can turn the locking plate in three different positions, if it still does not align, again locking the rear wheel as mentioned, tighten until alignment takes place. Fit the allen key grub screw and tighten.

Here we have it, one fully rebuilt engine.

