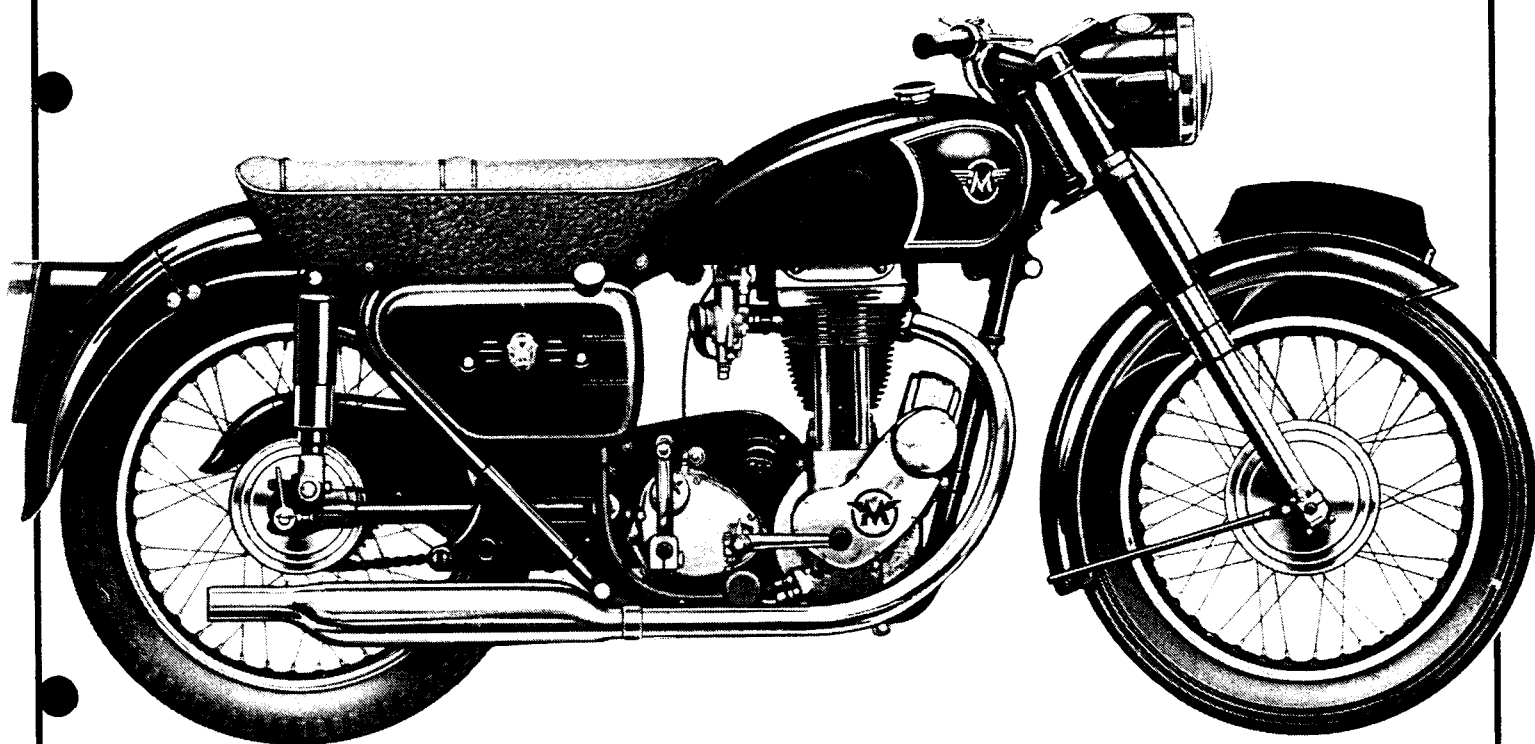


THE 'CLASSIC MECHANICS' STRIPDOWN

# 1954 Matchless G3LS

Ken de Groome strips the long stroke 350 AMC engine



**A** COMMON problem facing those carrying out a *cosmetic* restoration on an AMC single is that many earlier parts will fit and function but not look quite right.

The problem when rebuilding an AMC single engine is virtually the opposite. Many bits and pieces tend to look similar and even fit but they will definitely not function properly. I will not attempt, in this strip rebuild of a 1954 G3LS, to give a detailed account of all the variations, but will try to highlight the sort of thing to look out for.

It is possible to carry out a number of operations with the engine still in the frame but if the top-end needs an overhaul,

chances are the bottom end will be pretty tired as well. On this basis (at least on an engine with no positive history) I always carry out the complete strip away from the chassis.

Removing the engine from the frame is quite straightforward, but watch out for the three OBA screws which retain the chaincase (two BA spanner is required despite OBA thread) and also be very careful with the oil-feed return pipe unions on the crankcase, in particular the top one. It is very easy to break the casting if you are a little 'ham-fisted' with the spanner.

It is also a good plan to remove the rocker oil-feed pipe before removing the

engine from the chassis for which a  $\frac{3}{8}$ " AF spanner is required at the lower end.

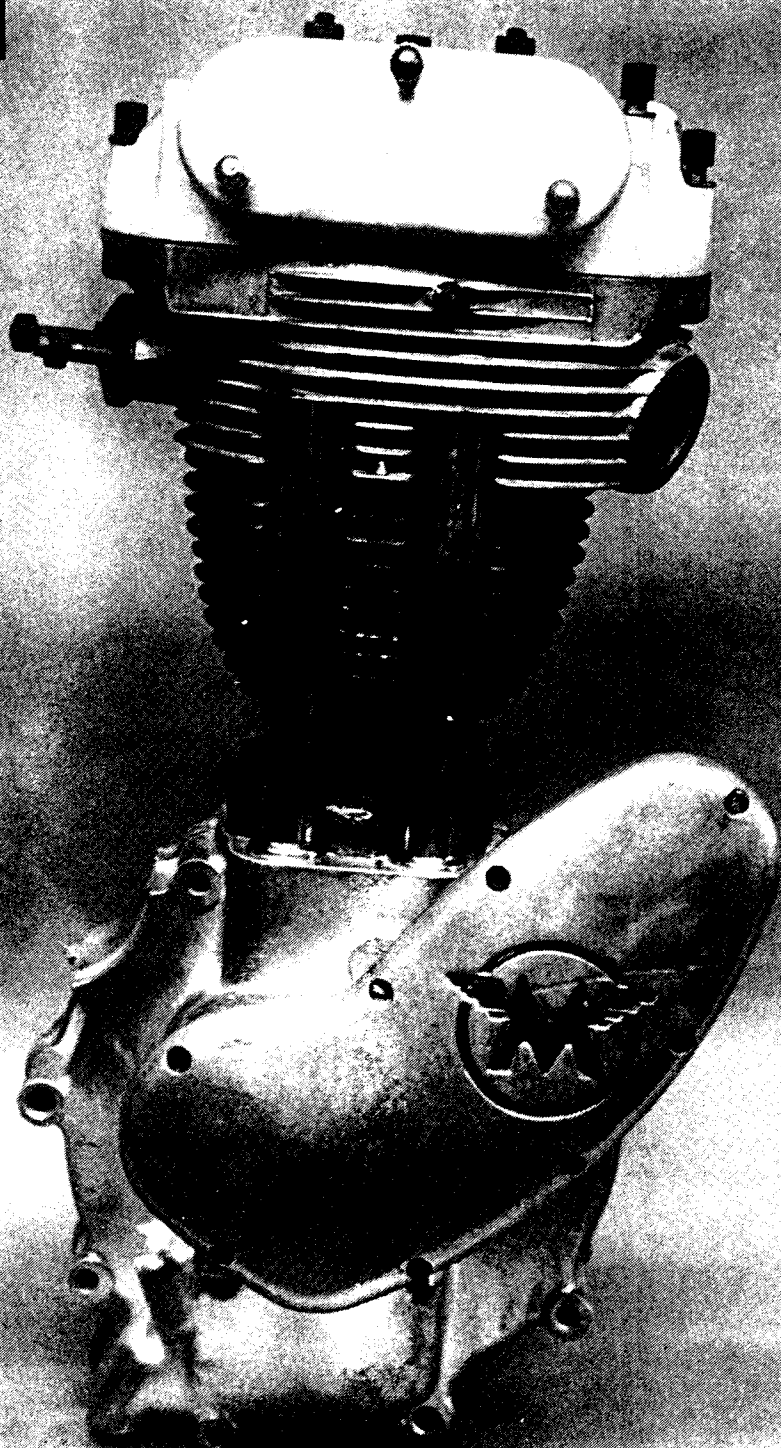
While most of the stripping is done using Whitworth sized spanners, there are a few 'oddies' which I shall point out as we go along.

- Having removed engine from its chassis, you should end up with something that looks a bit like **pic one**. This engine came to me 'as seen' and minus its magneto but I will cover magneto sprocket removal later so don't panic yet if you can't get yours off!

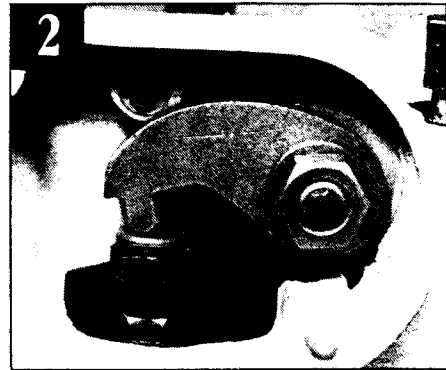
- Give the motor a good clean and then remove the sparking plug, followed by the three knurled nuts retaining the rocker inspection cover (2BA), then rotate the

• This article, though covering in particular a 1954 Matchless G3LS, should be useful to anyone rebuilding any alloy headed, long-stroke, AMC engine, 500cc or 350cc. A normal workshop manual should be used in conjunction with the article.

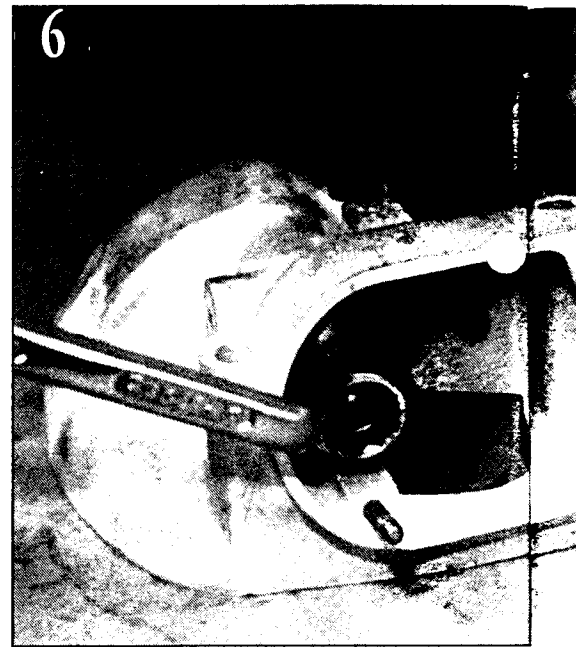
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crankshaft to get the engine at about TDC on the compression stroke. The object of doing this is to remove any valve-spring pressure when removing the rocker-box. If your engine won't turn over because of a seizure or something, then slacken off the tappet adjusters as far as possible (**pic two**).

- Undo the nine rocker-box retaining bolts a little at a time until it is possible to rotate all the washers then remove them all completely and remove the rocker-box, noting that the centre bolt is slightly longer than the two either side of it.

- With the rocker-box off, check it carefully for cracks around the bolt holes – these are quite common, largely through over-tightening (I tighten them to 18ft lbs).

- Wear points in the rocker gear to watch out for are in **pic three** where each rocker bares against its respective valve. If the wear is slight it can be stoned smooth. If not, replacement is required otherwise it will not be possible to reset the valve clearances later. Other wear points are in **pic four** where the valve lifter bears against the exhaust rocker – as much as  $\frac{1}{32}$ " wear is permissible here, but certainly no more. The rocker-spindle bushes rarely wear to any significant degree, but the hardened sleeves (**pic five**) do wear quite badly over a long period of time.

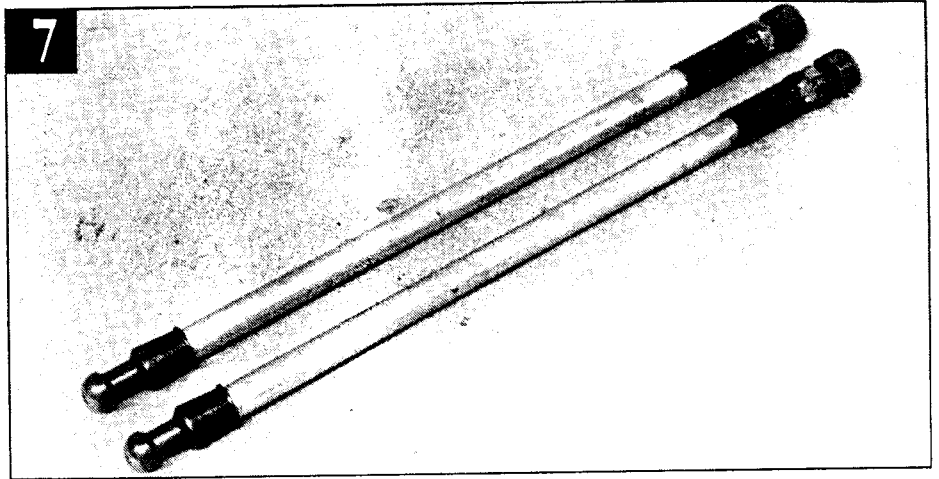
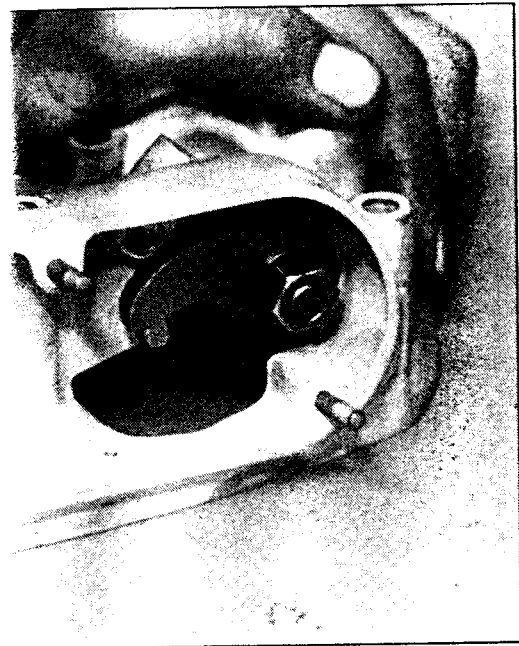
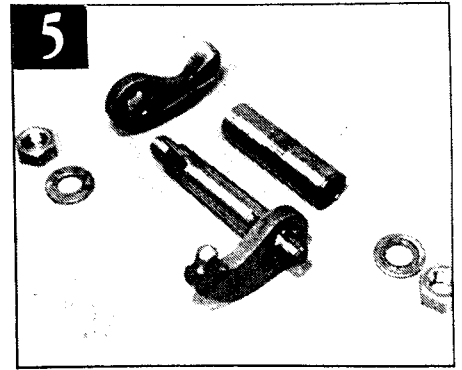
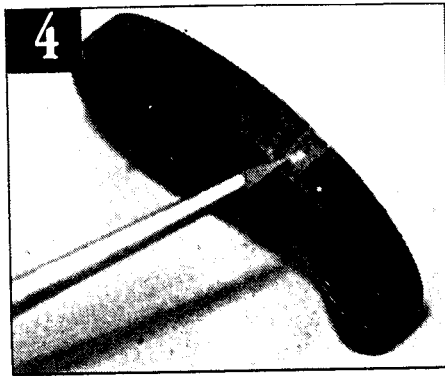
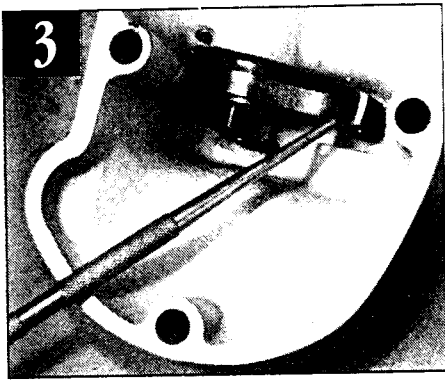
- To dismantle the rocker-gear, first slacken off the outer two nuts (**pic six**) a little, then with an open ended spanner, undo the

inner ones. It is then possible with just a little levering to pull the whole lot apart. If you found that you didn't use much effort in undoing the outer two nuts, then check the splines at both ends of the spindles for twist, the slightest sign of it warrants new spindles. When re-assembling, fit the valve-end rocker to each spindle first and tighten up the nut on each until about a half to one complete thread shows through at the end. Then attach the outermost rockers with their respective nuts and washers. Tighten up the outer nuts to around 35ft lbs, the inner nuts will now also be tight as a result of doing this.

- I always throw away the little felts between the bushes and try to forget that they ever existed as they don't do very much and just aren't worth fiddling around with.

- If the rockers are now tight, try tapping (quite hard) the outer ends of the rocker spindles – this is usually enough to shift the outer bush in a little and provide the required end-float. Aim at getting around 3-4 thou of end float. Much more than about 10 thou and it will start to clatter, harmless but irritating.

- The pushrods (**pic seven**) in any alloy-headed AMC single should be made from alloy with steel end fittings. If your pushrods are made of steel throughout, then the engine will produce quite a loud tappet noise when it warms up so they are best changed for the correct item. It is fairly rare for these pushrods to get bent, but



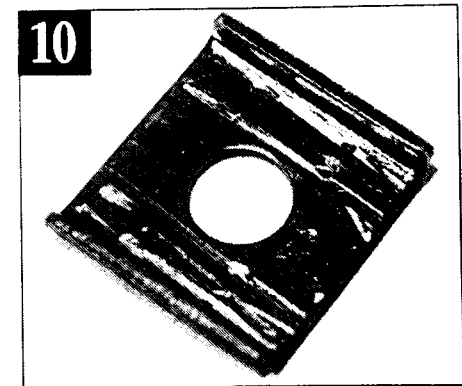
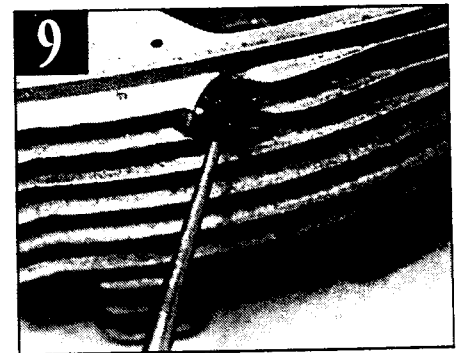
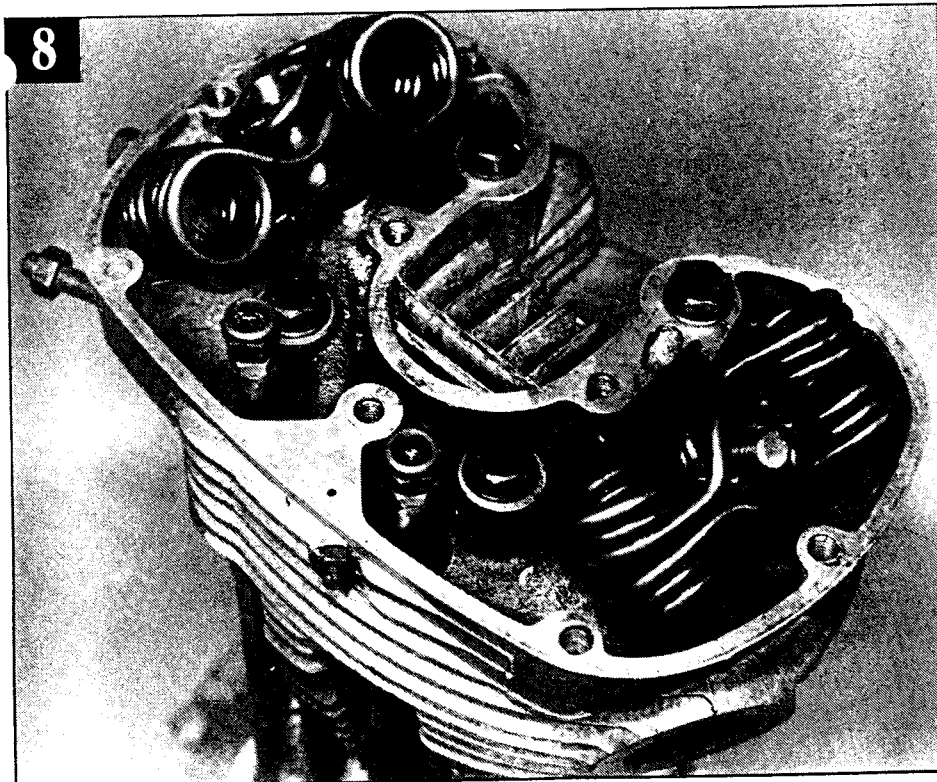
check anyway. Much more common is that the pressed-on end fittings come loose, if yours is loose, then clean them in a suitable

solvent and 'Loctite' them on.

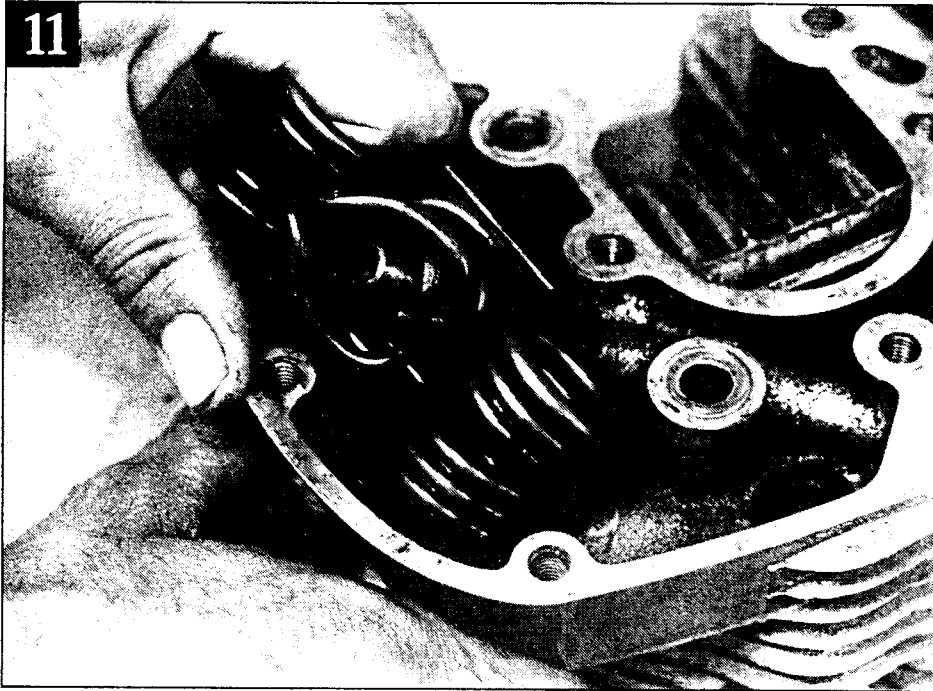
• Cylinder head removal is straightforward, just follow the same procedure as was used when removing the rocker-box bolts. Check the nine  $\frac{5}{16}$ " BSF threads and their bosses (pic eight). These are often stripped and/or cracked but can be repaired. If the threads appear serviceable, run a  $\frac{1}{4}$ " drill carefully down each hole followed by, if you have one, a  $\frac{5}{16}$ " BSF tap. The purpose

of this is to remove any old jointing compound, etc. so if you are having your head bead-blasted, use the drill and tap *after* blasting. It will then ensure that the holes are free of grit.

• The inlet valve oil control screw (pic nine) requires a  $\frac{3}{8}$ " AF spanner to slacken it off. Remove the screw adjuster and thoroughly clean the hole behind, especially if the head has been blasted



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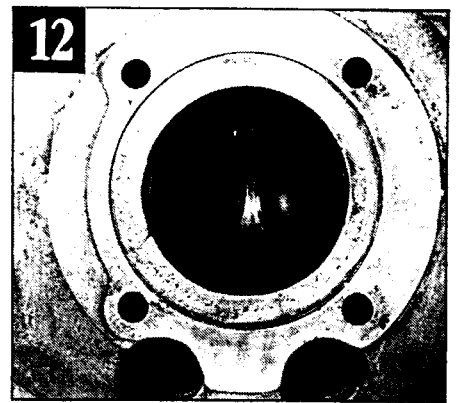


clean. When refitting the oil-control screw, screw it all the way in and then out just half a turn. Thirty five ft lbs should be used when refitting the four  $\frac{5}{8}$ " BSF cylinder-head bolts. Tighten them a little at a time and work in a diagonal pattern.

- A lot of people get puzzled as to how to get the hairpin valve-springs in and out. It is possible to buy two different types of valve spring compressor for them – a half-

moon shaped one if the lower spring ends slide into a block, and a pressed steel 'scoop' affair for the later tray-type as illustrated in pic 10. Providing that you are reasonably strong (and careful) it is possible to remove and replace the later type by inserting an index finger through the coils (pic 11) and either pulling or pushing as required. It is quite easy but keep the elastoplast handy!

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- The valves in this engine were quite 'pocketted' (pic 12) but as shown, are just about acceptable. Look carefully at both valve seats to see if they have moved within the head casting or are cracked – most problems seem to concern 350cc inlet seats and 500cc exhaust seats. If any of the above problems show up, then either find another head or get a new seat fitted. Fitting new seats to AMC heads is a bit tricky as they are cast-in during manufacture and quite a large hole has to be machined in the head to take a new seat (pic 13).

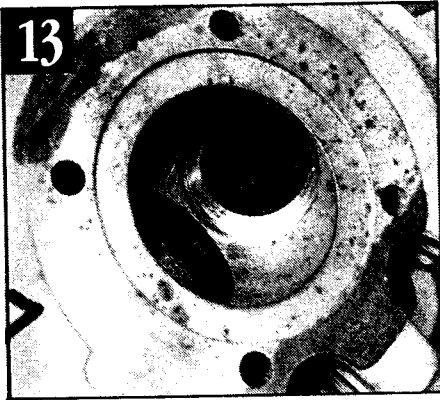
- The valve springs fitted to this engine were of the wrong type – they belong to a 'lightweight'. The correct type are shown to the left (pic 14). Note the different number of coils in each. The bottom spring trays tend to get badly worn in these motors but it does not seem to matter very much, at

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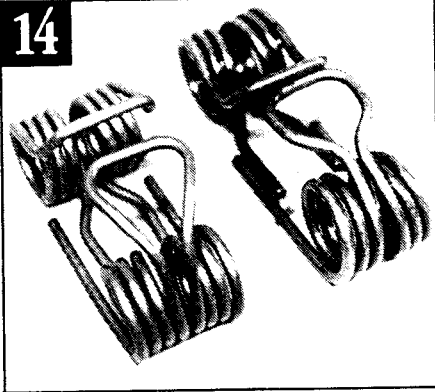


least not for the road-going work. If they happen to be pitted with rust, then it is as well to replace them. The pitting quickly wears away at the spring prongs.

- The top spring collars (pic 15) in this engine were satisfactory, but check at the point indicated and if much wear is apparent, buy some new ones. If a collar breaks, a valve is almost certain to drop in. Likewise, look at the springs where these collars bear, more than 8-10 thou warrants replacement.

- The cylinder barrel is the next item to be removed – but first, if it is still attached, remove the head gasket (pic 16) carefully as it can be annealed and re-used if so desired.

- Release the four cylinder base nuts ( $\frac{3}{8}$ " cycle). On a 500 motor, you will probably have to use an open-ended spanner but on a 350, it is possible to use a ring, which is preferable as these nuts are often quite



tight. If, after removing the nuts, trouble is encountered in removing the barrel from the crankcase, try a few *gentle side-ways* taps with a *soft faced* mallet. Still won't come off? Right, put the piston at bottom dead centre, then fill the cylinder with a clean rag. Now bolt the head back on with a couple of bolts, then turn the engine over with a spanner on the crankshaft and with a little wiggling to and fro, the barrel should now lift off.

- Slackening the top two crankcase studs rarely makes much difference in releasing the barrel on these motors, owing to the large clearance between the barrel and crankcase mouth. If you don't plan on stripping the bottom-end, lift the cylinder a little way (pic 17) and place a clean rag around the crankcase mouth to catch any broken rings, etc. Otherwise just lift clear of the piston, being careful not to let the conrod

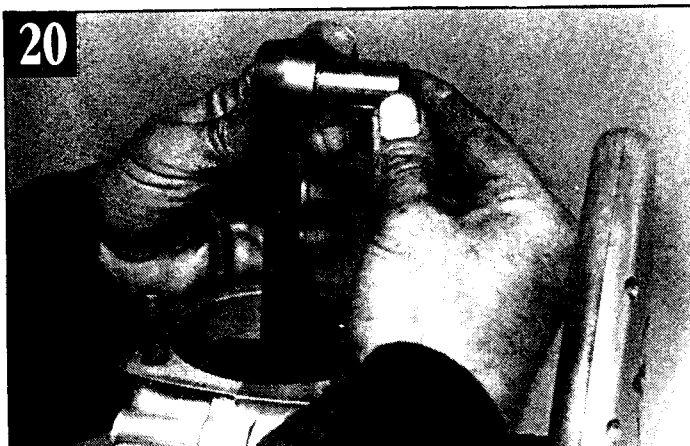
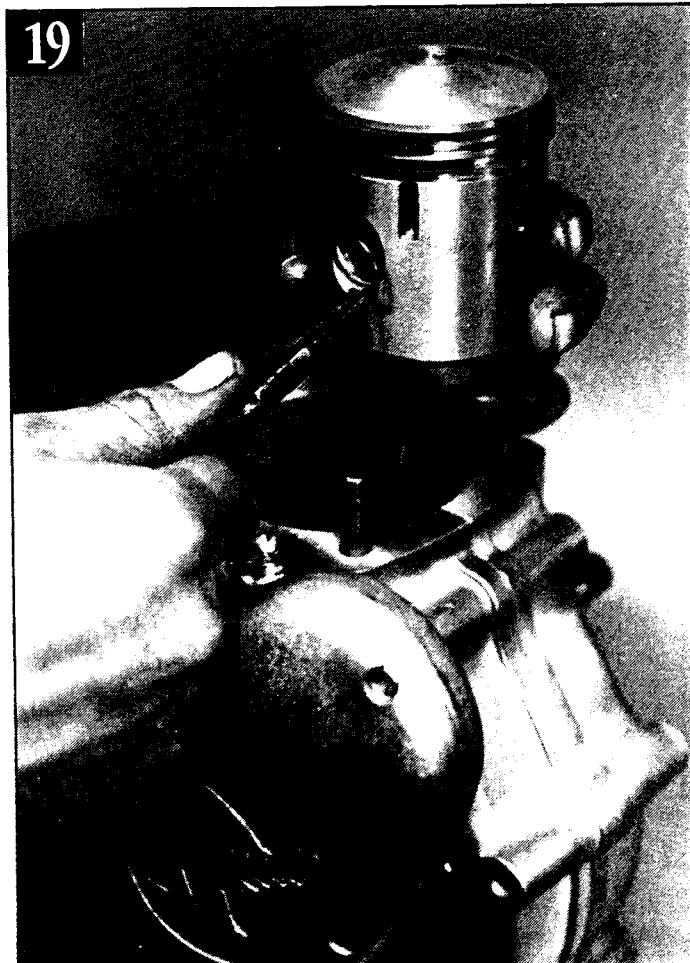
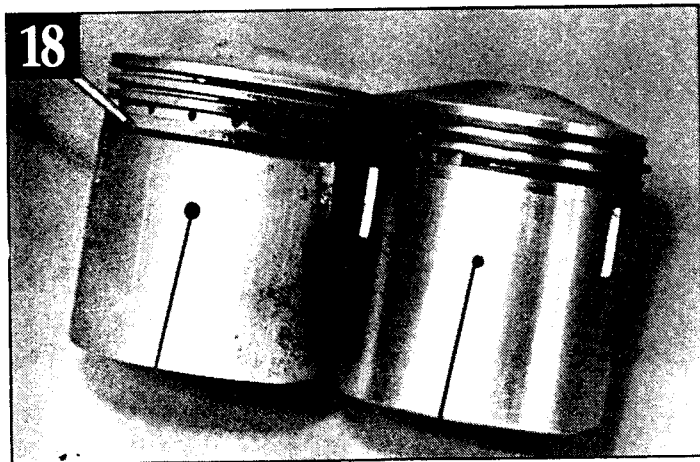


or piston bang to one side as it is removed.

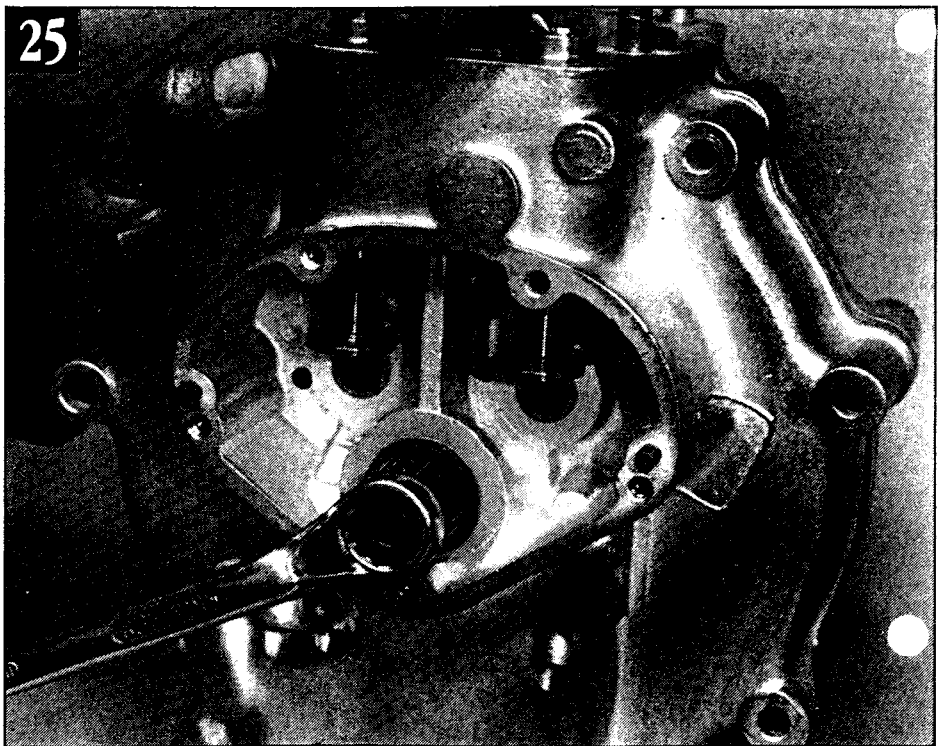
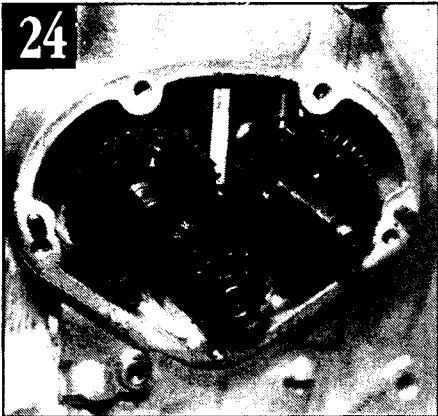
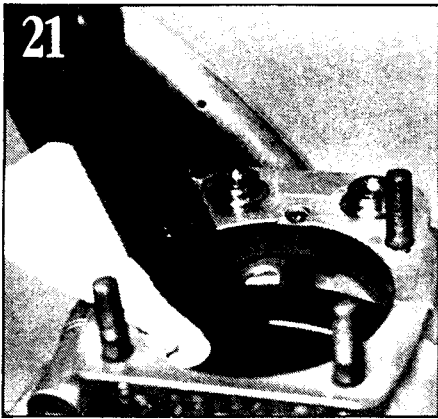
- If the bore is worn much more than around eight thou, then it is going to need a rebore. If it is within limits, then at least have it 'glaze-busted' to help bed things back in again.

- A word of warning if you re-assemble with a different piston but retain the original bore. As your bore may have a ridge at the top (even a fraction of a thou matters in this case) make sure that the top ring on your replacement piston will not foul this ridge. If the ring is only a fraction higher than the old one, then put an extra gasket under the barrel (or a thin metal shim) cut to shape). If the difference is more than slight, then have the ridge removed from the bore. The top ring will probably break if you don't do this.

- On the subject of pistons, the pattern ones currently available tend to have one of







three faults (or possibly all). These are: (1) the skirt is not the correct shape, probably owing to the casting settling; (2) the slot which runs more or less vertically up one face does not always quite reach the hole at the top on the inside; (3) the slot which runs around the piston (pic 18) is for some reason left unmachined, which makes nonsense of the two slots cast either side of the gudgeon-pin holes.

- If you are fitting one of these pistons, be prepared to run it in for probably about double the normal mileage expected. Before inspecting the piston in any great detail, it is as well to remove it from the conrod. A proper pair of circlip pliers (pic 19) should be used for removing the circlips. These circlips should be replaced with new items as a matter of course. If the pin is tight to remove, warm the piston up a little with rag soaked in hot water (a gas blowlamp can be used, but be careful not to overheat the piston).

- The small end bearing in these motors is rarely worn enough to warrant replacement. It should, however, be checked. Wipe both the bush and the gudgeon pin free of oil, then, if the pin is inserted as pic 20, it should be possible to just rock it. Now oil the bush and try again, if you can no longer rock the pin about, it is just right.

- The normal method of checking a big-end bearing in most engines is to grasp the conrod and try and move it up and down. However, on an AMC single, it is safe to say that if the rod can be rocked from side to side in an arc, then the bearing is in need of attention. Should you decide to have the big-end changed, I would strongly suggest that you take it (or send it) to a specialist as the sleeve in the rod will almost certainly require honing out once fitted.

- On early engines, you will notice an oilway on the top of the crankcases between the tappet guides (pic 21). This is to feed oil to the cylinder wall barrel. On any post-1947 engine, this oilway can be ignored. I usually block it up with a 3BA screw which conveniently just happens to be the same as used to hold the front oil pump end cap on. If you do this (and it is a good way of eliminating a potential leak) make sure that the screwhead is just below flush with the crankcase mouth. No Loctite is needed as the barrel will stop it going anywhere. It should be noted that this oilway was deleted around 1955.

- Before doing any more unbolting, have a look at the drive side. Is the narrow engine sprocket spacer still on the shaft? (pic 22). If so, remove it now, they get lost pretty regularly. Should your spacer be missing or if the engine has a dubious history, then be careful: these spacers come in at least four different thicknesses. Check with a straight edge against the sprockets when re-assembling.

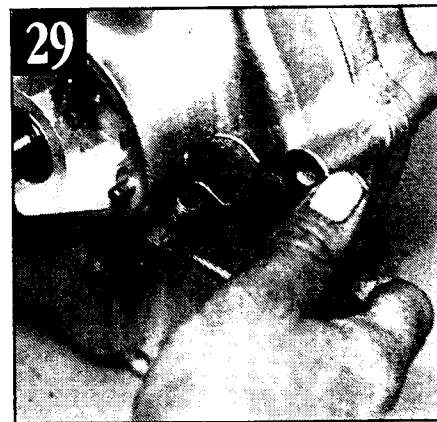
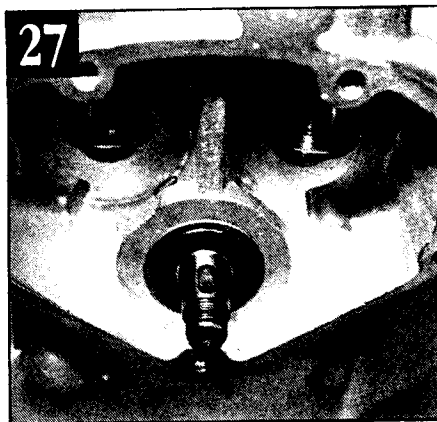
- To remove the magneto-drive sprockets, place a round bar, preferably 7/8" diameter, through the small-end to stop the crank rotating (a spanner on the drive-side shaft will do if you cannot find a suitable piece of bar). Assuming that your magneto is still attached, first release the nut holding the sprocket to the magneto, followed by the one on the camshaft (pic 23).

- Now release all the studs, nuts, spacers and engine plates which fix the magneto to the cases. It should now be possible to tilt the magneto and hook the chain off the top sprocket. To release the lower sprocket, it is unfortunately necessary to resort to levering. Use a large type lever or something similar between the timing case and the sprocket. A puller can be used to remove the sprocket from the magneto once the chain is away from it, but there is not enough room for a puller on the bottom sprocket, hence the use of a lever. If done with care, no problems will arise as a result. I have been doing it this way for over 24 years and never damaged anything.

- Once these sprockets are out of the way, grope about in the grease and you will find five 1/4" BSF cheese-headed screws (unless someone has changed them for 'unbrako' types in which case, expect at least one to be stripped through overtightening). Removing these five screws will enable you to remove the inner timing cover, it may need a gentle tap here and there to release it from its two locating dowels.

- To remove the two cams (pic 24), assuming that they didn't just fall out anyway, push them both in hard up against the rear cam bushes and rotate the engine until each lobe is at the top, or thereabouts and remove them. *Do not* on any account turn the engine over with either cam half in/half out, it is possible to do a lot of damage to the crankcase if you do.

- On a post-1953 engine, i.e. one with a large timing side bush, the crankshaft can be removed from the cases without removing the crankshaft pinion. I personally prefer to remove it at this stage, however, as it



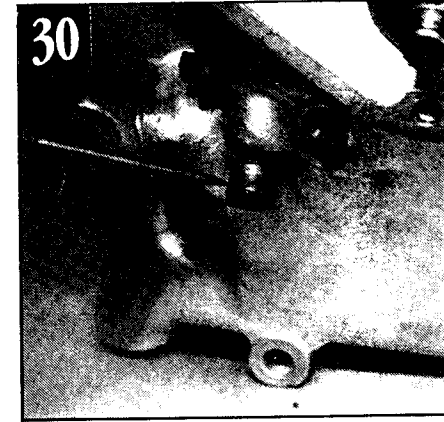
when trying to undo the nut retaining it.

- This pinion nut has a *left-handed* thread and is the only one of this type on the engine (pic 25). Once the nut is removed, it will be necessary to use a special puller to remove the pinion itself (pic 26). If it is very tight, then tighten the puller up as much as you dare, then tap the end with a hammer (not a mallet in this case) and it should pop off revealing a small key (pic 27) in the shaft.

- If trouble is encountered in removing this key, then just leave it where it is, if a new timing side axle is needed, a new key can be bought at the same time. Next, using a 4BA spanner, undo the four 3BA bolts retaining the oil-pump rear-end cap (pic 28), then using a screwdriver, remove the four 3BA screws at the front of the pump (pic 29) and remove that end-plate also.

- **NOTE:** If your valve-gear happens to be very worn out and appears devoid of any oil, it is worth checking to make sure that your front end-cap oilway lines up with the oilway in the crankcase. It is just possible someone may have fitted an end-cap off a pre-war 'V' twin which looks outwardly the same but is internally different.

- Using preferably a socket or a ring spanner, remove the oil pump guide pin (pic 30). Be careful when re-fitting this pin to make sure that it engages with the slot in the oil pump, and also because it has rather a fine thread (3/8" x 26 TPI) for something which is being screwed into aluminium. Should it prove a little difficult to remove the pump (pic 31), try rotating the engine a little and it should slide out quite easily. If it won't come out and you are sure that you have removed everything mentioned, then go no further with the stripdown. Take the

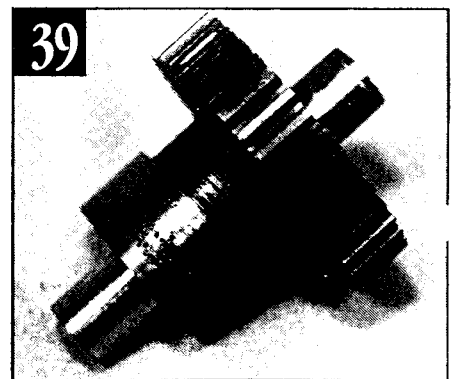
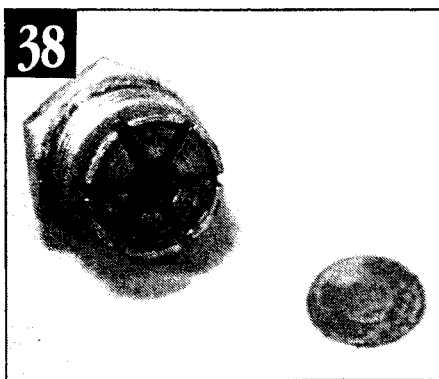
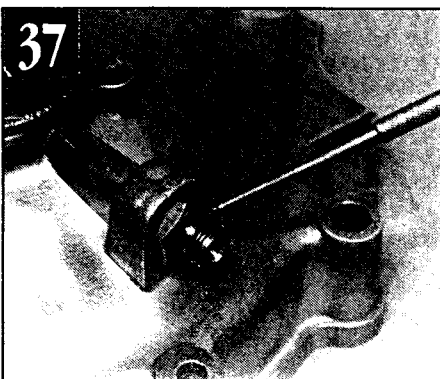
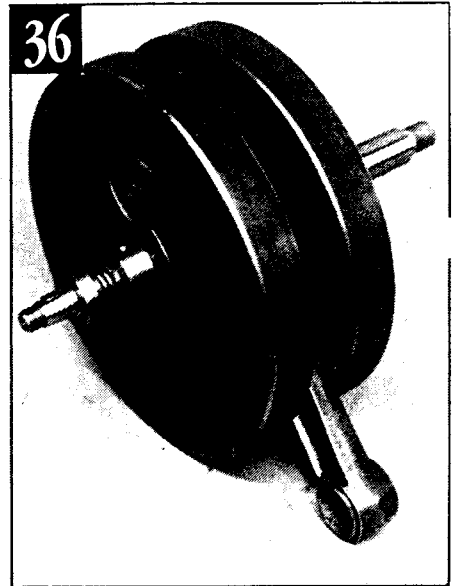
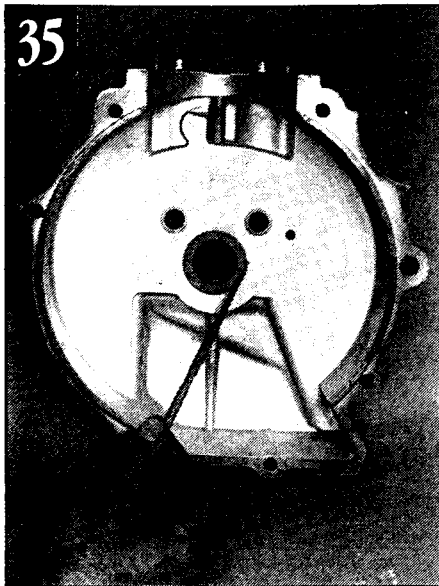
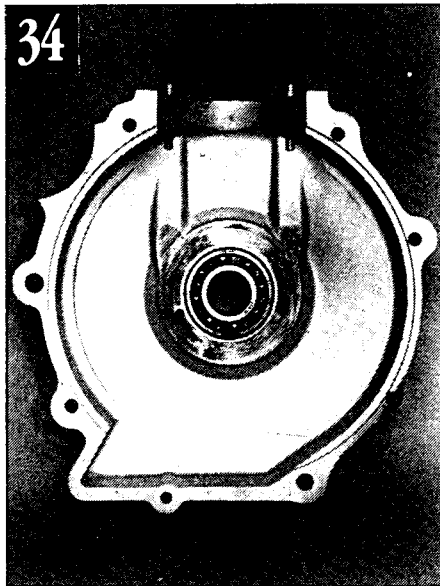
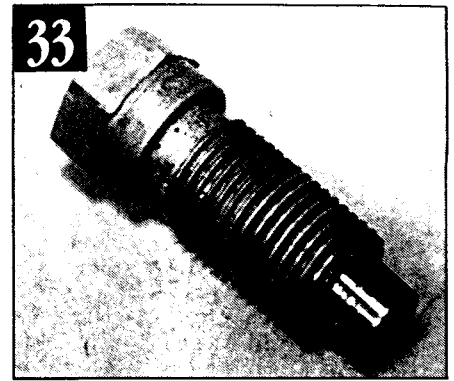
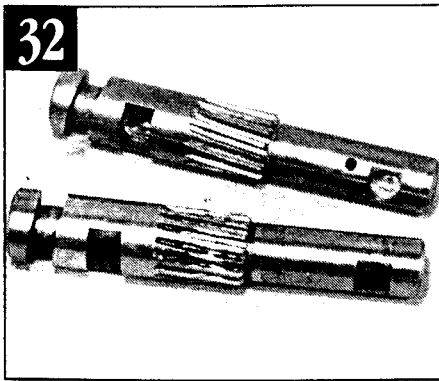
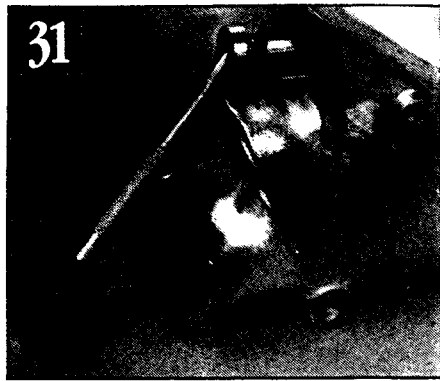


experience in performing miracles and you just might get a usable crankcase assembly back. Whatever you do, *do not* try to get the crank out of the cases without first removing the pump, you will end up with so much scrap. The teeth on this oil-pump only tends to wear after a considerable mileage. If the teeth on your pump are as worn as those of the lower pump (pic 32), then a new one should be fitted.

- If the new pump has '2S' stamped on one end, it will fit OK. Do be careful though that you do not get sold a pump for a lightweight. This looks very similar to the heavyweight '2S' pump but the two milled flats with holes in them are at around 180° to each other. Yours should look like the one at the top of pic 32.

- The other item which wears related to the oil-pump is the guide pin (pic 33). Pull the pin out of its threaded outer, when it will be possible to see if the part which engages with the pump has worn. If in doubt, buy a new one as wear here can cause all manner of mysterious goings-on with the lubrication system.

- At this stage, all that is left to do to split the cases is to remove the two remaining studs which are probably still in the cases and then gently pull them apart. It sometimes happens that the drive side case will not let go of the crankshaft. If this happens in your case, and a little tapping with a soft-faced mallet does nothing, then heat the case up evenly with a gas blow-torch. It is then quite likely that the two ball-races (pic 34) will come away with the crank instead of staying put in the cases as they should do. In this event, a puller will be needed to get the bearings off the shaft. If on the other hand, one or both bearings



used, then Loctite will probably be needed to hold them in the cases on re-assembly.

- Between these bearings will be found one or more spacers. If your engine has two different sizes of ball race, then you should only have one spacer: two bearings of similar dimensions, and you should have two spacers (the smallest one goes in first when assembling).

- If you have any doubt about the condition of the timing-side bush, then either get a second opinion, and or replace it as this bush is vital to lubrication system of the engine and must be line-reamed after fitting. These bushes were located, when fitted by the factory and most repair shops, by a small peg (pic 35). This can fall out if not properly fitted so be extra careful; I personally use a 2BA grub-screw to locate the bearings that I fit, and find this to be more secure.

- Points to watch for with the crank assembly (pic 36), apart from the usual possibility of a worn big-end are: damaged oil pump drive teeth; wear on either axle where the bearings run or locate; badly worn splines on the drive side shaft. One other thing I come across quite often is *bent* drive shafts which makes it almost impossible to true-up the crank, so be prepared to pay for a new one when having a new big-end fitted.

- On the outside of the drive-side crankcase will be found the engine breather (pic 37). Undo this and inside will be found a small disc of hard steel (pic 38). It is worth replacing this disc if it shows any signs of corrosion. Wear does not seem to matter too much providing it is not too extreme. When re-fitting, stick the disc into the body with a little grease to keep it in place whilst tightening up.

- Going back now to the valve-gear, it is not uncommon to find a little corrosion on the cams, caused usually, by condensation on short runs (pic 39). If it is restricted to the base circle as shown, it will not matter. If, however, the corrosion (or wear) extends up the lobes of the cams, then replacement or repair is called for, otherwise the cam followers will be quickly worn away. The feet of the cam followers, incidentally, should be at least  $\frac{1}{16}$ " thick, any less than this and they are liable to break-up.

- Should you decide on an alternative pair of cams, then if your engine is 1954 or later, you should be looking for a pair with an 'H' stamped on them FIG 40. If you find a pair with 'R', 'SH', 'CI' or 'CE' stamped on them, then seek advice before trying to fit them. All manner of things can happen if certain precautions are not taken.