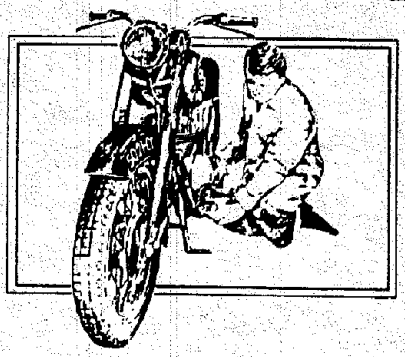
# SERVICE NOTES



## AMC HEAVYWEIGHT SINGLES

### AJS and Matchless expert KEN BRYANT on the popular plonkers.

☐ AMC heavyweight singles remained virtually unchanged from 1939-62, with few major modifications, and although intended mainly for 1950-62 models the following notes will generally suffice for all years. It is important to realise that in any kind of mechanical dabbling a modicum of common sense is the most valuable tool in the workshop. For instance, the haphazard replacement of every bush, bearing and piston will not magically transform your engine into a new one. Nor will it ever be capable of achieving standards higher than those applying when it was new.

If a part is 20 years old and half worn out, it should follow that it has another 20 years of life left in it, but very few people will ride their machines in the next 20 years as they have been ridden in the last 20. It is therefore worth giving some consideration as to whether it is really worth replacing those tried and tested parts, possibly of original manufacture, with the fragile crankpins, soft valve springs, out-of-centre bushes and guides and egg-shaped pistons, all of which faults, and many others, I have found in newly manufactured replacement parts. On the other hand, if you are going to pennypinch and believe that a valve grind and a tube of silicone gasket cement constitutes an overhaul, either leave it alone or sell it!

Selective assembly, common sense, workshop hygiene and correct tools and useage thereof, and patience are the keys to any successful mechanical work. These engines have few inherent faults. Those which exist can be lived with, and with proper care they are capable of long and reliable service. The engine is best worked upon out of the frame, but all work except splitting the crankcase can be done in situ.

With the engine out of the frame drained of oil and degreased and the plethora of AMC spacers and their locations noted, start by removing the nine bolts holding the rocker box, then lift it off. The rockers are assembled into the cover and give no trouble, being well lubricated and pretty solid. The rocker arms fit onto a splined shaft, spaced by a hard steel sleeve which runs in two bronze bushes, with an oil restricting felt washer between them. These suffer more from corrosion caused by dirty oil than from wear. To remove them, undo the nut on the inside of the shaft and *tap* out the shaft with a soft (brass or aluminium) drift. Check the sleeve for wear or corrosion. Replace the felts if they have gone hard. Check that the oilways are clear by squirting an oil can into the feed union. If you replace the felts use a tapered mandrel to spread them into place, otherwise the steel sleeve will tear them. Should it be necessary to replace the bushes removal and replacement is straightforward (warm it well) but do not drive them in too far as excessive end float here will cause an annoying clincking.

Check the valve rocker ends for wear; small amounts of wear can be stoned out. Later rocker arms have an oil groove machined into the metal to carry oil to the valve end. Check the mating surfaces for truth and also that the small 1/16in oil hole in the mating surface is not bunged up with jointing compound. Also check the oblong cover for cracks around the fixing holes. After 1949 the decompressor lever was fitted into the rocker box. Later ones have an 'O' ring seal fitted. Bad wear is seldom found here; wear on the decompressor arm is repaired by replacement.

Next, remove both pushrods – both are the same length (alloy head engines should not have steel pushrods in them); then the four head bolts – check these for waisting above the threads, caused by overtightening. Lift off the head. If force must be used, use a soft mallet and *tap* under the exhaust port. The pushrod tubes will probably come away with the head; pull them out and remove the rubber top seals from inside the head. Note the position of the thin steel rings; these are usually one of the parts lost by previous owners. Check the nine 1/16in BSF threads as there are usually one or two casualties here, either stripped threads or cracks across the holes caused by massive overtightening. Stripped threads can be helicoiled or have threaded inserts fitted. Gentle use of a countersink around these holes will help prevent oil leaks here. Also clean out as thoroughly as possible the bottoms of the holes. A 1/16in taper BSF tap is quite easy to obtain and will remove an amazing amount of gunge. This holds true of all tapped blind holes on all engines. Muck and oil in these holes will be forced out past the threads and will guarantee oil leaks at that point. Check the head bolt-holes for evidence of overtightening, and if necessary run a reamer or drill through to clear any collapsed metal. Use as wide a plain washer as possible here on reassembly.

Remove hairpin valve springs by hooking a finger in the coils and pulling up. Look for wear in the area where the top collar fits. Some is always apparent but will not prevent further use unless well ridged. If they are totally clapped, WD-type coil springs can be fitted, with attendant collars, and are relatively easily obtained. I have known pattern hairpin valve springs to be soft. The valves and guides give little trouble being well lubricated, unlike most other engines. Guides drift in and out *hot*. Late exhaust guides have circlip location. It is important that they protrude the correct height: 1/2in inlet and exhaust (1/2in and 7/16in before 1948). This is to stop the valve collar making contact on full lift. If the circlip type guides are fitted make sure the bottom spring plate has a corresponding recess to fit over the circlip. Remove the circlip before removing the guide. Genuine AMC valves were hard chromed on the valve stems (detected by the 'soapy' feel to them and the greyish colour) to overcome sticking problems encountered on iron heads. Count yourself lucky if you have some in serviceable condition, or look for them in old stock at autojumbles.

Use of V-blocks and a dial gauge will be beneficial on pattern guides as I have often found them to be eccentric, leading to problems when grinding-in or re-cutting (45° seats). Recut seats if necessary. Do not omit to align oil holes in the guides when refitting. Use an oil can to force oil through the oil regulating screw hole just above the inlet pushrod tunnel, as it is not unknown for the guides to be fitted without the oil holes in them. Check for blockage the 1/16in hole in the head which mates with the one in the rocker box. Set the control screw 1/4 turn out from shut. Repeat this operation for the exhaust guide oil feed and its exit.

Reassembly is straightforward enough, using the tool shown to fit the valve springs. Order of assembly is: valve in guide, bottom plate, top collar, two split cotters (taking care to locate them in the grooves on the valve), bottom loop spring on left, top on right. Lubricate everything well, preferably with an assembly compound such as Graphogen, especially under valve spring collar and valve stems.

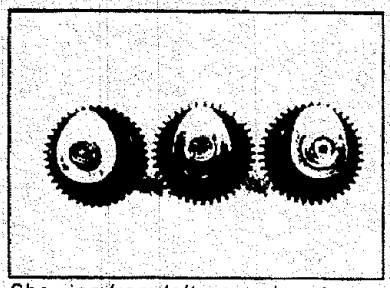
Carefully remove the cylinder (4 double hexagonal nuts) supporting the piston as it emerges. Mark the piston front (inside); split-skirt pistons should have the slot at the front. Remove one circlip, gently deburr the circlip groove, and then warm the piston and remove the gudgeon pin with a pin extractor or a hard push. Heat the piston well and it will not need force.

Now check the cylinder bore for wear or scuffing. Bad ridging or scoring means a rebore. If passed OK, check the rings for uniform contact and gaps. A suede-like appearance of the piston skirt coupled with shiny bits of metal embedded in it show use of multigrade oils. The piston skirt should ideally be a nice uniform matt grey at contact points, fore and aft, with no signs of siezure or scoring.

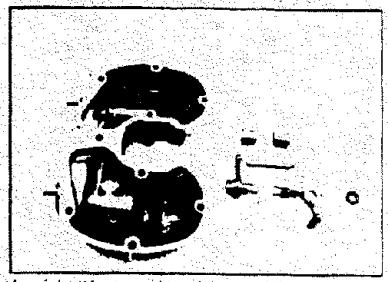
Original AMC pistons were wire-wound to control expansion rates, run on very low clearances (0.0001in) and were selectively assembled at the works. Little goes wrong with these although excessive wear can loosen the wire binding. Count yourself fortunate if you can find one of these or have one in good condition, for it is one of the reasons these engines are so mechanically quiet. Otherwise the cylinder will bore out in stages to +.060in. (.005 in non wirewound skirt clearance). It is not wise to use excessive compression ratios, especially on big-ends of non-AMC manufacture.

Undo the nut on the magneto chain sprocket and using an extractor, or extreme care, jar off the sprocket. Remove the five cheesehead screws and pull off – do not use screwdrivers – the timing chest cover. The cams will probably come off with it, so note if there are any shims fitted on the outer axles and their order. Next undo the 7/16 BSF x 26TPI left-hand nut, and the camshaft pinion can then be extracted. Don't use tyre levers or similar as they will damage both the teeth of the pinion and the bush housing. It is not strictly necessary to remove this pinion on post-'54 engines, but it is a wise precaution as it is possible to cause damage to the timing side bush when splitting the cases, if the pinion is left in situ.

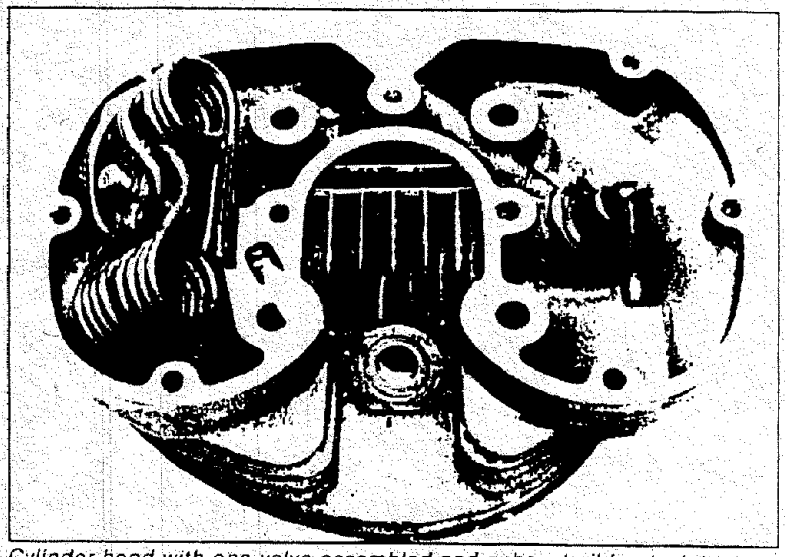
The timing gear gives no trouble under normal circumstances. If, however, there is heavy scuffing on the cam peaks, check that springs are not coil-bound or that the valve collars on hairpin springs are not hitting the top of the valve guides on full lift. Do this by turning the engine until each cam is at full lift and apply



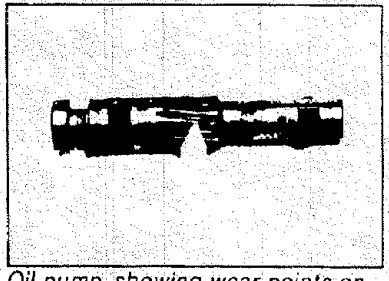
*Showing from left an early cam, an H cam and an SH scrambles cam.*



*Inside the rocker box, with one rocker in component form.*



*Cylinder head with one valve assembled and exhaust oil feed inlet arrowed.*



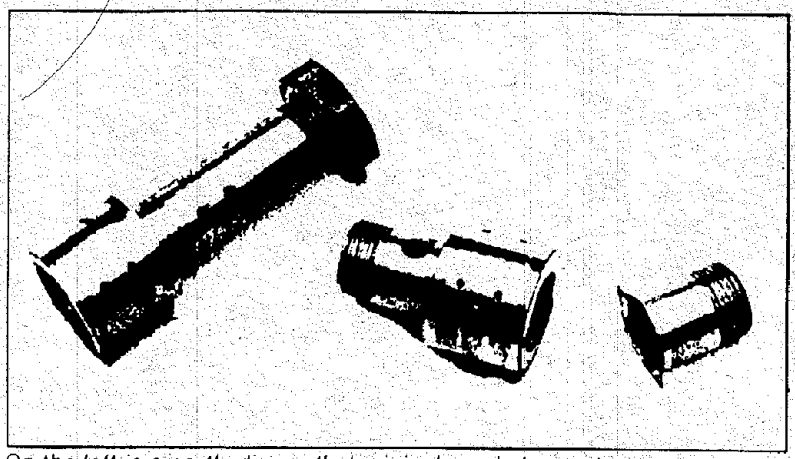
*Oil pump, showing wear points on teeth.*

*The various patterns of timing side bush, 1930-1962, earliest on the left.*

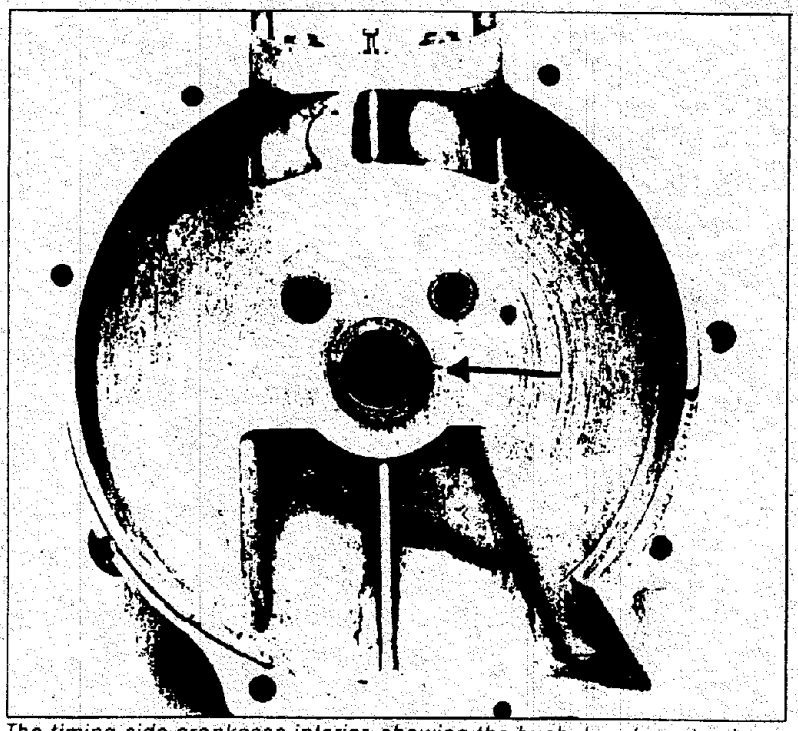
leverage on the rocker spindle nut to ensure there is movement. Check also the crankshaft pinion teeth for wear. A new one will help to quieten a noisy engine but if possible try to buy ex-WD stock as I have come across pattern pinions with the taper incorrectly bored. Cams can be marked on the lobes H or SH. The latter designates scramble cams.

Remove the oil pump locating pin, found just in front of the oil pipe unions. Check this item for wear on the plain portion. If any wear at all is apparent it is wise to replace it. 1948-on pins are larger and in two pieces and do not seem to suffer as much as the earlier ones. Remove the front pump plate (4 x 3BA cheesehead screws) and the rear (4 x 3BA bolts) when the oil pump can be pushed out from the front of the engine. Check the teeth on the pump for wear, usually caused by excessive endfloat of the flywheels. This pump was used from the early 1930s and although a few minor modifications were made to it, has proved totally reliable in use.

Check up and down movement of the timing side (t/s) shaft – little movement should be apparent – then removal of the two remaining crankcase bolts or studs should enable the crankcases to be parted. Lift the t/s off first, taking care not to damage the bush if the crankshaft pinion is left on. The drive side (d/s) may need gentle use of a soft mallet to



*On the left is a partly dismantled original crankpin; on the right, a pattern item.*



*The timing side crankcase interior, showing the bush dowel – note also damage to joint.*

drive the flywheels out. Don't let them drop if they are not to be split, as knocks will easily misalign them. Flywheels are marked to identify them – G3 and 16 for Matchless and AJS 350cc, and G8 and 18 for 500cc. It is not uncommon to find 350cc flywheels in a 500cc engine which could cause excessive vibration as they were balanced differently; also many 500cc engines have heavier flywheels.

With the crankcases thoroughly degreased again they can be heated and the drive side bearings removed. If they are hot enough the bearings will drop out of their own accord, so don't use force. Note the position of the spacer(s) between the bearings. While the d/s is cooling down, inspect the t/s half. Check the oil pump tunnel for scoring or damage. If damaged it can be bored out and bushed, but it needs considerable skill and toolroom equipment. Much more likely will be damage to the oilpipe union threads, especially the top one. These can be stripped or even have the corners broken off. There is no excuse for this kind of hamfistedness, which is too often found in the realm of d-i-y mechanics. Damage to this area can be repaired with care and expense. Threads are ⅛in BSP. Also check the 3BA holes at both ends of the oil pump housing for sheared screws or stripped threads. A stripped thread here can sometimes be overcome by use of a longer screw, otherwise use any appropriate repair technique (not fibreglass or self tapping screws!). Check the 3 x OBA tapped holes on the drive side crankcase as these are often stripped or oval, usually because someone has forced a wrongly threaded bolt in.

Remove the breather union and the small disc inside it, wash thoroughly and refit. After thoroughly cleansing in clean paraffin or similar the flywheels themselves can be examined; check for up and down play, with the crank pin at top and bottom of its circle. If any play or roughness is apparent then the flywheels will have to be split. This is a job for a specialist, as they need to be aligned to very fine limits. A well aligned and balanced set of flywheels is one of the keys to the sweet and reliable operation of any single cylinder engine, so any work here should be carried out by competent hands.

If the big-end is not too worn it can in some cases, be reclaimed by use of oversize rollers. This is particularly desirable if your engine has one of the two-piece AMC crankpins in it. Some pattern replacements have been known to break prematurely, and should be treated circumspectly. Original AMC pins were made in two parts – a hard outer track on a high tensile pin. Replacement pins are made up in one piece and are thus too rigid. It is claimed that the original design is at fault but this appears to me a flawed argument by reason of the fact that the replacement pins that break are not made in the same way as the original; and that an original pin in one of my own machines lasted for 20-odd years before it wore out. The replacement broke in 8,000 miles and destroyed a set of crankcases in the middle of France. I was not pleased about this! The AMC replacement of that is still there 8,000 miles on, so I have proved to my own satisfaction that original is best.

Other wear points to check here are the four splines for the shock absorber cam (up to 1956) on the driveside shaft. Wear here will give rise to a knocking sound on tickover, sometimes mistaken for big-end noise. Good quality replacements for these are obtainable from Russell Motors, Falcon Road, Battersea. The timing side shaft only wears after a considerable mileage or due to poor lubrication. Replacement of both shafts is straightforward, and if necessary should be undertaken when the big-end is attended to. The flywheels themselves are not prone to cracks, although the crankpin holes are sometimes found to be slack after several big-end renewals. Clean out all the compressed sludge from the nooks and crannies in the flywheels, using a scraper, or – only if *completely dismantled* – boiling in strong caustic solution (big end cage and some small ends are white metal). If the small end bush is replaced it will need reaming (⅞in + 0.00050/-0.00025).

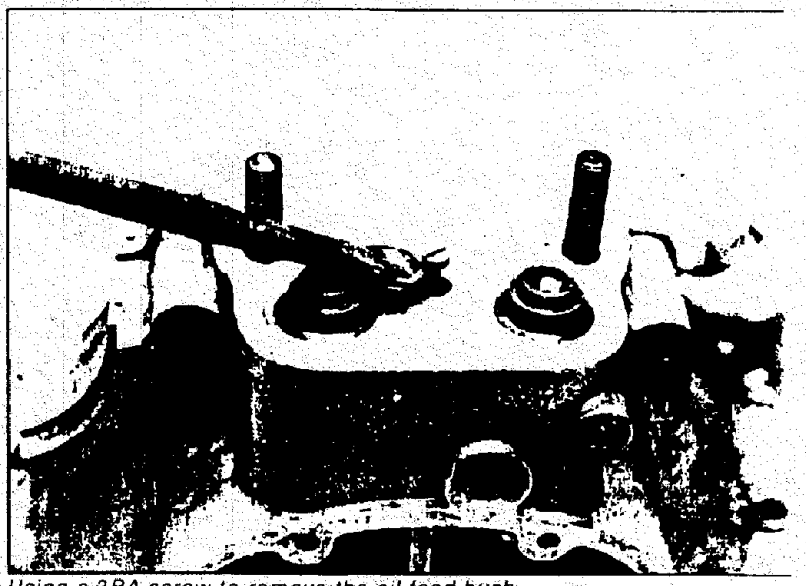
Having obtained all necessary replacements, renew both drive side ball bearings, plus spacers. To do this, heat

the crankcase half evenly until it spits back at you when you spit on it – and then drop the bearings into the case using no force, and with spacer(s) in the correct order. An old shaft will help to line it all up. 1955 and later engines used two different diameter bearings and one spacer. When the case is cool both bearings should revolve independently of each other and with no harshness or tightness. I have found FAG bearings to be of excellent quality. 1952-55 engines had the bore of the bearing housing machined to two different tolerances to enable the inner bearing to be tapped in or out to prevent end loading.

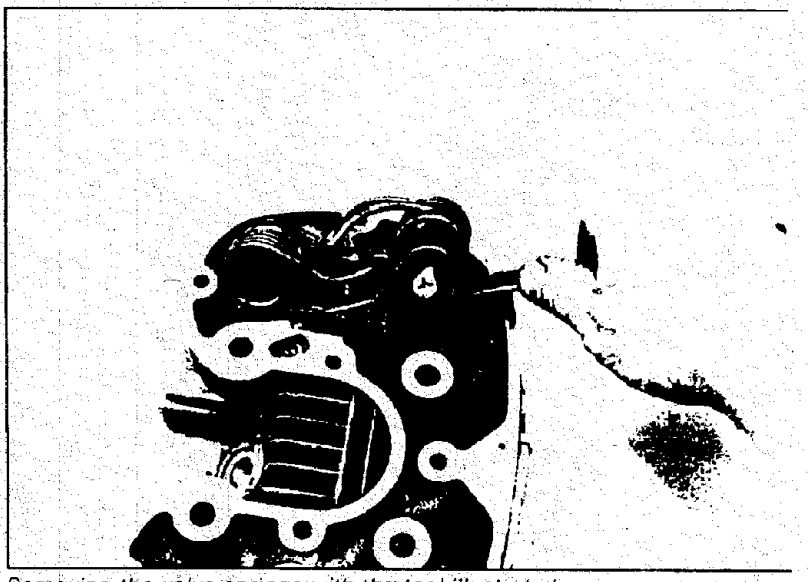
Various types of t/s bush have been used over the years, but only the later large one seems to have been made as a pattern spare. Russell Motors have some of the early double diameter small bush, and these can have the shoulder turned off to enable them to be used in early 40s and 30s engines. All of them are removed with heat and a double diameter drift, from the timing chest inwards. They will need care when replacing to ensure that they are correctly located. If not, the bush can contact the oil pump and cause considerable trouble. Large bushes are prevented from rotating by a dowel. Pattern bushes will need reaming, preferably line reaming. Use of a dial gauge and V-blocks can also be prudent, and I have found it advisable to check all pattern spares especially those which are supposed to be round or concentric.

Before reassembling the crankcase it is worthwhile fitting the cams and timing cover to the timing side case and checking the end float of the cams. Shim as necessary. Nil end float and a nice easy spin is required. End float will not harm, but will result in noise. Do not omit the gasket when measuring. Cam bushes seldom need replacing, though if they do, ex-WD stock is still relatively easily obtained and fits all engines; bushes are relieved at one end to facilitate fitting. the magneto drive bush is longer and has an oil retaining scroll at its outer end. Use a well fitting double-diameter drift and heat to replace; line ream to ½in +/- .0005in.

Tappet guides, unless subject to neglect, also run almost indefinitely. They can be removed by getting the crankcase very hot and gently drifting out, taking care not to damage the housing, or use the tool illustrated. (Russell Motors have some of these). Later versions of these had six slots for better oil drainage. On most engines you will see between the tappet guides a small tapped hole. This is a pressure relief valve and feed to the cylinder wall. It is trouble-free and needs no maintenance. To remove it, insert a 3BA screw and lever gently upwards, remove the spring and ball, wash in petrol and replace – the top of the long bush should be level with the bottom of the recess. If, however, as often is the case, you find that you have a cylinder barrel with no oil holes at the bottom of the bore wall, then it is prudent to block off this unit.



*Using a 3BA screw to remove the oil feed bush.*



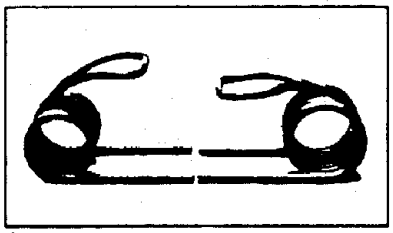
*Removing the valve springs with the tool illustrated.*

Now reassemble the crankcases and flywheels for a trial run, using 3 x 4½in bolts equidistant around the cases and check flywheel end float, which should be between .025in and .020in. Older engines with single diameter bushes have the end float adjusted by the simple expedient of tapping the bush in or out as required. On late engines you will probably be using a pattern bush, in which case face off the inner surface of the bush, or, more likely, you will have to make up spacers. Do not use thin steel shims. I use a bronze crankpin washer (trusty ex-WD stock) turned out to suit and then faced up to get the required end float. This has been in use for some time and shows no signs of falling to bits yet. Loctite it to the flywheel cheek.

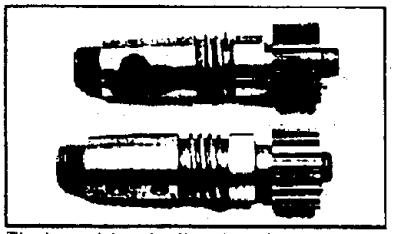
You should already have checked all the internal oilways for blockages and cleaned the muck out of the magnetic drain plug, and will now be ready to reassemble the crankcases. Use the aforementioned bolts and only Hylomar or Wellseal on the joints, never any kind of silicone jointing compound. Use Graphogen or a similar graphited assembly compound on friction surfaces, and oil everything liberally. The whole flywheel assembly should now revolve easily with no tight spots.

Next, fit the oil pump into its tunnel, well lubricated, jiggle it fore and aft to centralise the guide screw slot and screw in the guide pin using finger force only. If it doesn't go home easily move the pump slightly. Fit the two pump end covers with their gaskets, using only grease, and making sure that the feed

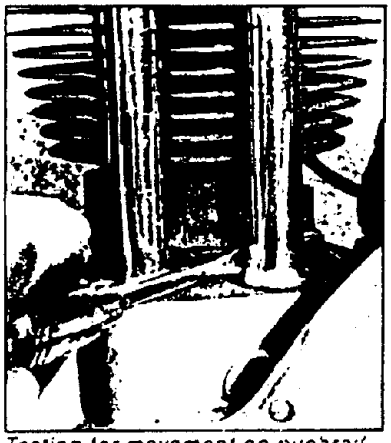
*An alternative method, and the sole method for hairpin springs on iron heads.*



*On the left a worn-out genuine valve spring: on the right a pattern spring 2,500 miles old.*



*Timing side shafts showing pattern crankshaft pinions – note they do not go fully home.*



*Testing for movement on pushrod tubes prior to final assembly.*

hole on the front cover is not obstructed; these plates may benefit from a gentle refacing on a flat surface. Check them carefully for cracks as old ones can fatigue. Check the flywheels for smooth rotation again.

Refit the piston and cylinder, preferably using a ring clamp, or extreme care if not. Use spring washers under the base nuts. Ring gaps should be .003in per inch of bore. Chrome top rings are beneficial if you can get them. Do not omit to glaze bust the bore. If the correct tool for this is not available, medium grade emery cloth will do the job, though not perfectly. Use Hylomar or Wellseal on the gasket, two gaskets if a compression plate is used. If you make your own gasket use .006in or similar as thicker paper may on occasions blow out at the base joint, especially if using a compression plate.

Fit the crankshaft pinion ensuring that the key is in place and do the nut up tight, making sure that the timing mark is not obscured (if it is leave it till later). Fit the cams and time the valves. Several methods of marking the wheels have been used but the basic system is the same with all cams. Turn the dot on the crankshaft pinion to 10 o'clock and fit the inlet cam, using appropriate mark; then turn the pinion forwards to 2 o'clock and fit the exhaust cam. Replace any shims as previously noted, then fit the timing chest cover and gasket, using compound or grease. It will be beneficial to countersink these threads a little. Note that on these engines you will need to turn the crank 360° to time the ignition, as the valve timing is not set up on the firing stroke as are most other engines. The ignition timing is most accurately done with the head off but you will have to fit the engine to the frame first.

Use a new set of rubber seals and assemble the pushrod top rubbers and washers and insert the pushrod tubes in the head. Fit new rubber seals over the tappet blocks. Stick them in place with a little jointing compound.

The cylinder head joint is made by a copper gasket. This can be annealed and reused (not 1940-47 copper/asbestos gaskets) if the stud holes are not oval. Sometimes, however, use of this gasket causes a small space between the inner flange of the cylinder and the head, resulting in carbon build up – not a good thing. If you have the time and inclination judicious and careful use of grinding paste will mate these surfaces.

Fit the head and pushrod tubes. The head will not seat directly onto the cylinder at first but may have to be pulled down against the pushrod tube seals. Tighten the head bolts gently and diagonally. Torque to 30ft/lbs, which will save having to retighten later. Lever the bottom of the pushrod tubes gently, if they move easily then the tubes are not tight enough and will leak. Remedy is to remove the head and fit another plain steel washer above the rubber seal. Lubricate the ends of the pushrods and drop into the tubes. They should locate themselves but check. You should already have checked them for truth, and have cleaned up if possible the (almost inevitably) mangled hexagons of the adjusters. Leave the locknuts finger tight.

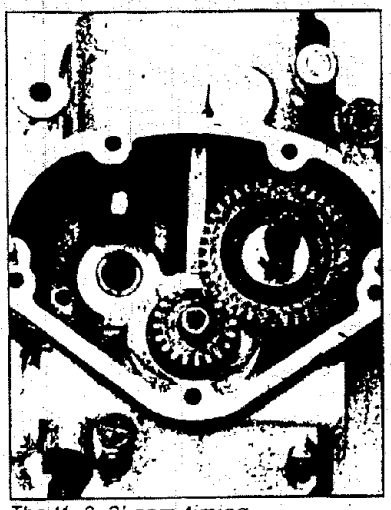
Use a new rocker box gasket, sealing with grease only, and carefully replace the rocker box. No valve end caps are used post -'48 unless it is necessary to reclaim worn valve ends, in which case the valves will need to be shortened by about 1/32 – 1/16in. If caps are used stick them on with a smear of oil. Bolt the rocker box down evenly and diagonally, (ensuring both valves are closed at the top dead centre), starting from the two middle ones which carry the head steady. Torque to 10ft/lbs.

With the engine on tdc firing stroke, set the tappet clearances to zero; that is, so that you cannot feel any up or down play but are able to spin the pushrod freely with a finger. If you have difficulty holding the bottom hex while securing the locknut, rotate the engine till the cam is at full lift and then tighten. Oil copiously, and replace the oblong cover with a new rubber seal and fibre washers under the acorn nuts and use fingers only, *not* pliers, on these.

Ignition should be timed to 1/16in btdc, full advance. Use an NGK B8ES for best starting and carburation. Also chuck the suppressor cap away on magneto ignition models, as they seriously weaken the sparks of magnetos, and use one of the older type rubber covers.

If an automatic advance mechanism is used on magneto models check it carefully for sluggish or sticky operation. They suffer more from bodgery than wear. Oil it with light oil and grease the chain lightly.

You will have wasted most of your efforts and expense if you refit a weak



*The '1, 2, 3' cam timing arrangement. Note also oil pump guide screw at bottom left, and damage to joint face caused by use of levers to extract the crankshaft pinion.*

magneto or worn carb after an overhaul so see to these first. It may seem elementary to state this but far too many people do.

When refitting the engine it is easier and safer to fit the oil pipes to the engine first, finger tight only, so avoiding any possibility of crossing threads. Beware of adjusting the valve lifter cable too tightly, and examine the bakelite carburettor insulation block for cracks. It may also be a sensible precaution thoroughly to scour out the oil tank if there is any sludginess evident.

Above all, do not ruin your handiwork by using multigrade oil of any make, these are killers in old engines. Use SAE30 winter and SAE40 or 50 in summer. These engines were designed to be run on such, and use of them will help to ensure long and reliable service.

**Some useful data**

*Cam timing specs*

*Up to 1948* used a straightforward dot and dash system.

*1949-50-51* used numbers 1 and 2 on both cams. Use 1 on Matchless, 2 on AJS, for both cams; this was because AJS engines had the magneto at the front of the engine.

*1952-53* All engines have magneto at front and the cams were marked 1 and 2, but the 2 mark is used on both engines.

*1954-55* Cams were marked H or HL and numbered 1, 2, 3.-On 350cc use 3 inlet, 2 exhaust, and number 2 inlet and exhaust on 500cc.

*1956-58* Use 3 inlet, 1 exhaust on 350cc; and on 500cc 2 inlet, 1 exhaust.

This, of course, presupposes you have the correct cams for the engine, as they will all interchange. If not, apply common sense and logic to sort it out.

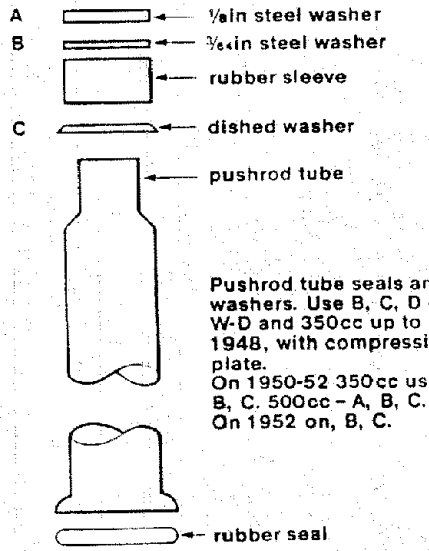
*Compression ratios* – 350cc : 6.5 to 1
– 500cc : 7.5 from 1956 (6.1 pre-1956)

*Flywheel runout* (given perfect circumstances) 0.001/.002in.

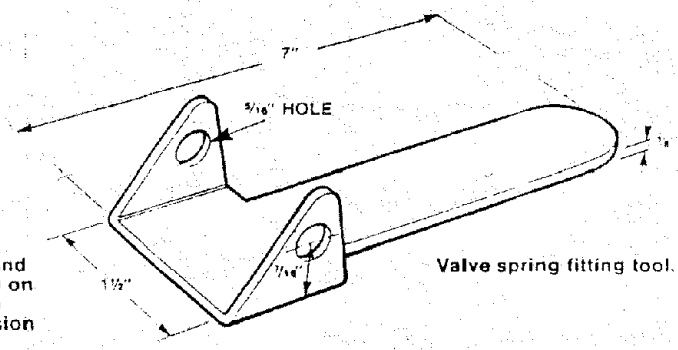
*Contact breaker gap:* magneto .012in; coil-ignition .015in.

*Ring gaps:* .006/8in new; max .030in.

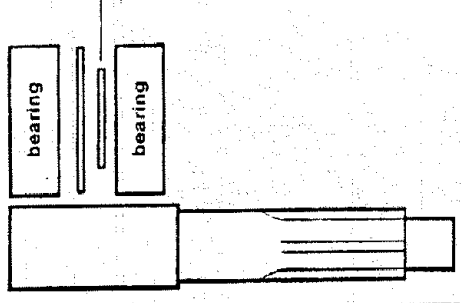
*Hairpin spring height* between the jaws 2in. Replace if less than 1 15/16in.



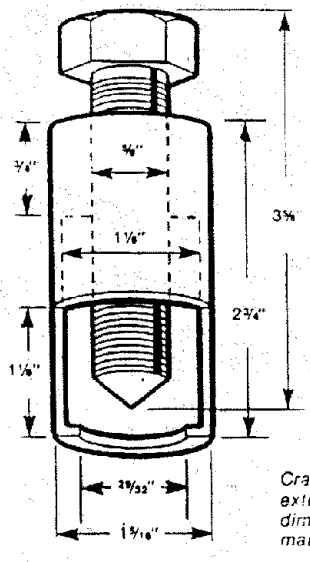

**Pushrod tube seals and washers. Use B, C, D on W-D and 350cc up to 1948, with compression plate.**
**On 1950-52 350cc use B, C. 500cc – A, B, C.**
**On 1952 on, B, C.**




**Valve spring fitting tool.**




**Arrangement of main bearings and spacers.**
**This spacer omitted on engines using one small and one large ball bearing on drive side, 1955 on.**




*Crankshaft pinion extractor, showing dimensions for manufacture.*