REVITALISE YOUR ROOTESMOBILE

Rootes Engine Strip-Down

Joss Joselyn describes the overhaul of the Rootes 1500 and 1725 used in various Humbers, Sunbeams and Hillmans.

When Hillman production resumed after the war the engine was a humble 1184cc side engine was a humble side valve four, replaced by an overhead valve version in 1954. From that point on this very conventional three main bearing engine was to become the mainstay of Rootes Group medium size production cars and for the Sunbeam Rapier and Hillman Minx Series I of 1955 the capacity rose to 1390cc, but the big news was an aluminium cylinder head and new camshaft for the Rapier. Development of the engine continued until 1965 by which time it was up to 1592cc. At this point the engine was revised with a new block to allow a new five-bearing crankshaft giving smoother running and allowing the capacity to be taken up to 1725cc with a cast iron or aluminium cylinder head. It could be said that the five main bearing engine was really a further stage in development rather than a completely new design and the overhaul procedures described here are largely applicable to the earlier engines.

There are basically two capacities of five bearing engine — 1496cc and 1725cc. The smaller engine was installed in the Hunter 1500 and the latter has a much wider application in the Humber Sceptre, Sunbeam Rapier, the old Sunbeam Alpine sports car as well as the numerous versions of the Hillman Hunter. The two engines are, however, very similar. The 1725 is basically 'square' — the bore diameter and stroke are nearly equal, while the 1500 has a shorter stroke, making the engine 'oversquare'.

The other major variation is that the 1725 engine is fitted with a cast iron head for the low compression versions and an alloy head for the high compression, high performance versions. The 1500 has a cast iron head for both high and low compression designs.

There are other differences where twin carburettors, for instance, are fitted or where the engine is inclined, as it is on later models, instead of being mounted vertically. It is possible, however, to cover the overhaul of all these together, considering only the two different cylinder heads separately.

To learn about rebuilding this range we visited engine overhaul specialists, Tipler Engineering, 636 Old Kent Road, London SE15, and the one they stripped and rebuilt for us was the inclined 1725 job with an aluminium head taken from a Hillman Hunter.

Tools you will need.

Set of A/F spanners or sockets • Engine lifting equipment • Soft faced mallet • Internal and external micrometers • Valve compressor • Valve grinding paste • Valve holder with a sucker • Feeler gauges • Torque wrench • Screwdriver • Complete gasket set • Piston ring clamp or compressor • Circlip pliers.

The method of engine removal is optional — the engine can be lifted out, leaving the gearbox in situ after supporting it or the engine and box can come out together and then be parted on the floor. The radiator has to come out to give working clearance and the bonnet is lifted off completely and stowed somewhere safe. The job is made easier if the bulk and the weight of the engine are reduced by taking off a number of ancillaries beforehand — starter, alternator, manifolding, carburettors, air cleaner, etc. If the car has an oil cooler, mark the unions at the filter mounting housing before disconnecting them so that they go back where they came from.

Ideally the engine is best worked on while resting on a bench although, if the work has to be done on the garage floor, there is no problem, except perhaps that of an aching back. It's a good idea to cover the area with a thick carpet of old newspapers both to protect the engine against damage and the floor from escaping oil.

You will also need a second area, either a table, corner of a bench or small area of floor on which the components can be laid out in order of dismantling. It is also a good idea to associate small parts —washers, nuts, bolts, spacers, tab washers, oil throwers and the like with the major components they secure or are assembled to. This can save a lot of sorting out later, when reassembling and, because this is unlikely to follow on dismantling immediately, anything you can do to remind yourself about the order of components and their assembly is definitely going to be useful.

Use little boxes, tins or other containers to keep all the bits in, labelling them if you like

and even drawing assembly diagrams. Check everything as you take it off so that you know if you need to buy any new bits and pieces — it could save you being held up on a Sunday afternoon when parts counters are all closed.

Most of the major stages of dismantling can be seen from the photographs. The work has been tackled in a reasonably logical sequence there but there is no need to stick slavishly to our sequence. It is a good idea to precede any dismantling work by washing the engine off with Gunk and a hosepipe — you can see what you're doing better and it makes working a lot more pleasant. It wasn't done in the photographs because all the parts, immediately after dismantling, went straight into a chemical cleansing bath.

Take the push-rod cover off the side of the engine at an early stage — this will enable you to disconnect the little central oil feed pipe to the rocker shaft, which in turn allows rocker assemblies to be unbolted and lifted off.

If you wish to note the ignition timing set-up on the distributor drive before dismantling, pull off the crankshaft pulley and take off the timing cover before dismantling the rocker shaft. Turn the engine over until the two timing marks on the crankshaft sprocket and camshaft sprocket line up. The position of the 'offset D' drive slot can then be noted while the engine has its valves 'rocking on No. 1' and 'firing on No. 4.' Alternatively the engine can be turned over until they are rocking on No. 4 and firing on No. 1 and then the position of the drive slot noted. The former will be found easier when re-building.

If you really do not know how much work you intend doing and if it all depends on measurement of wear, you will obviously give priority to getting the head and sump off. Lifting the head will enable an internal micrometer or bore gauge to be used to indicate bore wear and a visual inspection made for bore damage. Once the sump has gone, a big-end cap or two can be removed so that crankshaft journal wear can be measured.

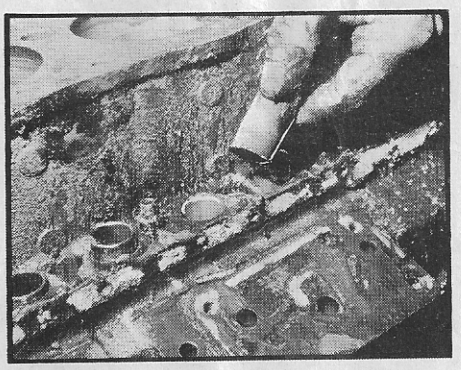
At this stage a decision can be reached about obtaining an exchange 'short motor'. This is the whole of the working guts of the engine — block, crankshaft, pistons and rods. Stripping it ready for exchange will mean only taking off the flywheel, head, sump, timing cover, oil pump and any odd studs like the two on top of the block on which the head is mounted.

If a 'short motor' is not considered the answer, dismantling will continue and great care should be taken to keep everything in order so the various components can go back in the same place. Lay everything out, starting with the rocker shafts, continuing with the push rods (pushed in sequence through a piece of card), cam followers and camshaft.

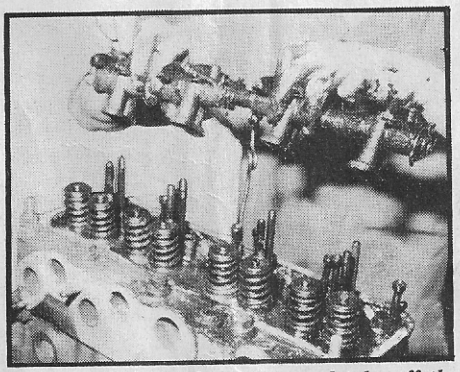
At the crankshaft end, it will be found that main bearing caps are numbered already but check the numbers and ensure you know which way round the caps fit — mark them to make sure.

Big end caps are not marked and so will have to be identified by blobs of paint or cutting into them the requisite number of 'nicks' with a file. Con rods also need marking both with a number and which side is 'front'.

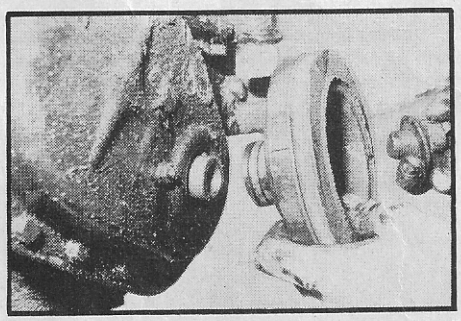
Once again lay everything out in order. Reassemble the big end caps on their rods and main bearing caps back onto the engine.



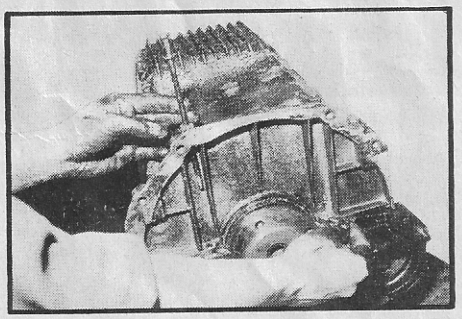
1 *The head is held by ten bolts and two nuts and studs — all 5/8in. A/F. Undo them in the reverse order to that shown in diagram. Take out the cam followers if you can. If they prove difficult because of suction, push them out from below later when the sump is off and engine inverted.*



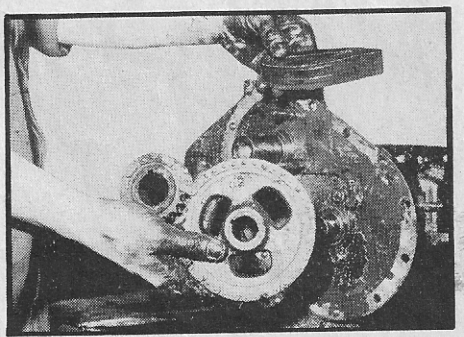
2 *Remove the rocker cover and take off the push rod cover on the side so that the little oil feed pipe to the rockers can be disconnected and removed. Alternatively it can be left connected to the rocker assembly and lifted off with it.*



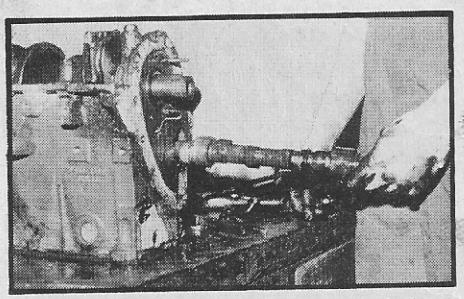
3 *With the engine on the bench, take off all the ancillary components — engine mountings, manifolds, petrol pump, distributor and the water pump. Undo and remove the crankshaft pulley bolt using a 1 1/8in. A/F socket and then use screwdrivers positioned each side of the pulley to lever it off.*



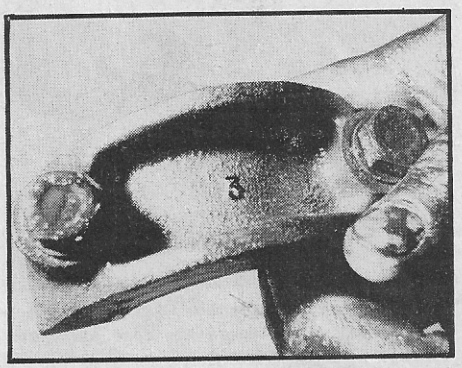
4 *Removing the alloy sump is the usual matter of a series of small bolts around the fixing flange, except at the rear end where a pair of long bolts are used. Shown also is a short bolt which someone had substituted in the past on this engine. Earlier engines had a pressed steel sump, a dust plate and bracing bars either side of the sump.*



5 *The timing cover is simply a matter of bolts and one central stud and nut. With the tab washer knocked back and the central securing bolt removed from the camshaft sprocket, the whole assembly can be levered off.*



6 *Follow this by undoing the camshaft thrust plate and pulling the shaft out.*



7 *The main bearing caps should already be marked — check the numbers are correct as you remove them.*

Rootes Hillman Engine Strip-Down

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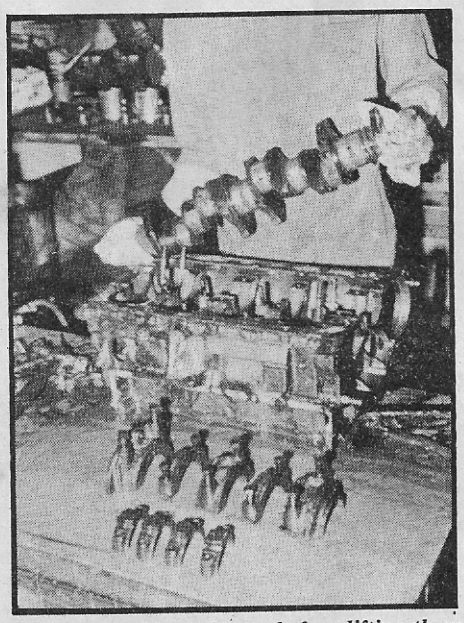
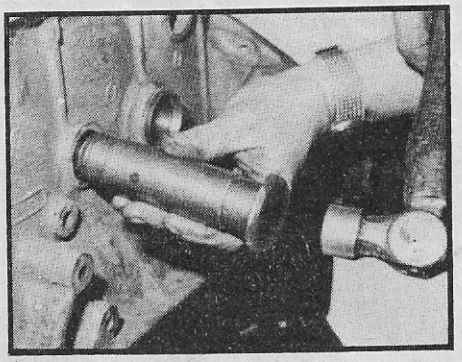
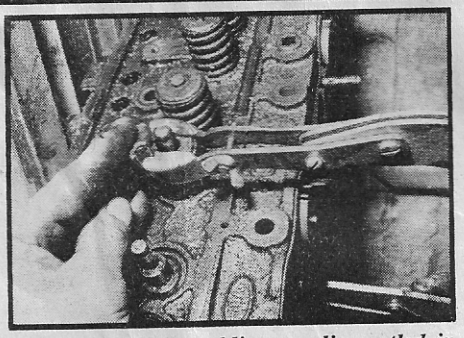


8 *Mark the big end caps before lifting them off so that they cannot be mixed up. Keep all the caps in order anyway and, once the crankshaft is out, the main bearing caps can go back into position loosely as a double precaution.*

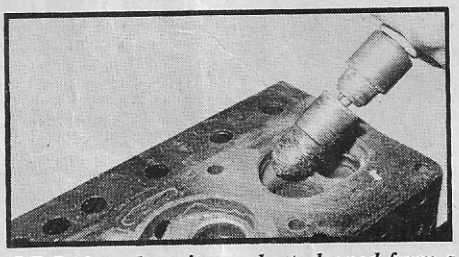
9 *As the con rods and pistons come out, mark the rods both for number and the front side to facilitate rebuilding.*



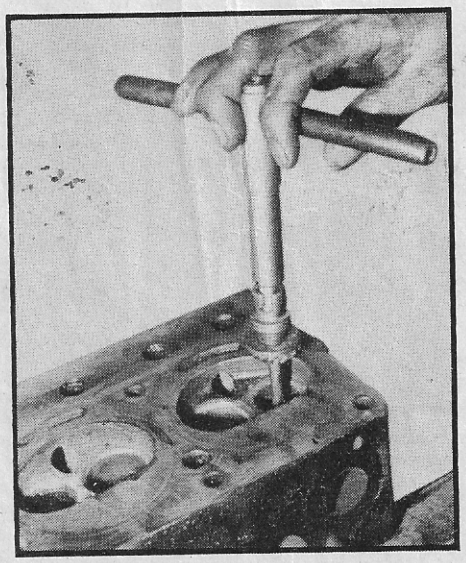
10 *It is always a good idea to knock a screwdriver through the core plugs and remove them — it will facilitate cleaning. Fit new ones by coating the housing with gasket cement and driving them in using a suitable drift.*



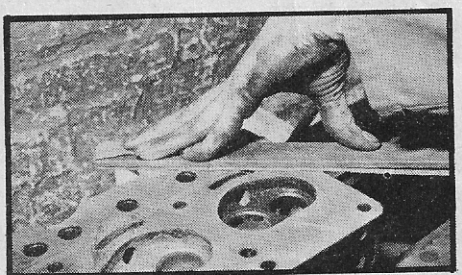
11 *The valve assemblies are dismantled in the usual way, using a valve spring compressor to squash the springs so that the little collets can be extracted.*



12 *Carbon deposits are best cleaned from a cast iron head using a rotary wire brush but remember with an alloy head to treat it somewhat more gently.*



13 *Valve seats are usually recut professionally using a power-driven rotary cutter. They can be cut however using a hand tool like the one shown here.*



14 *One method of removing carbon, etc. from the flat face of the head without gouging it is to wrap emery cloth round a flat file.*

MEASURING WEAR

This is a critical part of the overhaul and must be carried out from knowledge and with accuracy. You don't want to rebuild an engine with old badly worn parts and you don't want expensive machining carried out if it is unnecessary. As most DIY types won't have a micrometer, the best bet is likely to be to carry the block and crank down to the local overhaul expert and get him to measure it for you to advise. It will be cheaper, probably, than hiring a 'mike'.

If the bores are worn more than 0.008in., you've no real alternative to a rebore. With this engine, there is not a tremendous range of oversizes available — just +0.020in. and +0.030in. and then it will be a matter of asking the engine reconditioner to re-sleeve the block and bore it out back to standard again. With only two oversizes possible, it is unlikely there will be any trouble getting pistons to match but it is still a good idea, to save mistakes, to get them supplied by the same firm that does the rebore.

A new set of rings or perhaps a set of special oil control rings might be the answer if the bore wear is less than 0.005in. A better idea still could be to fit a set of PEP pistons, specially designed to expand and take up wear and ovality in old bores.

The critical wear figure on a crankshaft is usually found on the crankpins — big ends normally wear faster than mains. Wear in any journal, however, of more than 0.0015in. will mean either having the crankshaft reground down to the next undersize or exchanging it for a reconditioned one, depending on preference or the procedure usually employed by your local engine expert. The maximum undersize figure for this crankshaft is — 0.040in. and normally it is possible to have it reduced in 0.010in., 0.020in. or 0.030in. steps before this figure is reached.

If the maximum wear figure is less than 0.001in., you'll probably get away with simply fitting new shell bearings, although many people would consider it false economy not to have the crankshaft ground while the engine is stripped.

HEAD OVERHAUL

Overhaul procedures for the two heads — alloy and cast iron are not tremendously different; always remember, however, when working on an alloy head, to treat it that much more carefully to avoid damage.

Clean the encrusted carbon out of the combustion chambers using a rotary wire brush in the electric drill. It's a technique that is hardly likely to damage a cast iron head but exercise a lot of care with the alloy version. Rotary brushes with brass 'bristles' instead of steel can help here.

Get the carbon off the flat faces of both heads using a flat scraper but select a tool

Rootes Hillman Engine Strip-Down

that is made of something softer than the head metal — wood, plastic or perhaps brass.

It is best to work initially with the valves still in position — they will protect the seats from damage. Then remove them when the worst of the carbon has been scraped out. Use a normal universal valve spring compressor for this work and adopt the same policy with valves and springs as with all the other parts and keep them strictly in order.

What you do with the valves depends on their condition but they should all be cleaned up first. This is relatively easy with the inlet valves but the exhausts may involve more work. Mounting them in the vice and then attacking them with the wire brush in the drill is one way. Clamping a normal wire brush in the vice and spinning the valves in the drill chuck is another.

If the condition of the seats is very bad, a new set of exhaust valves may be the answer. Normal pitting, however, can be removed by getting the reconditioner to recut the valves on a machine.

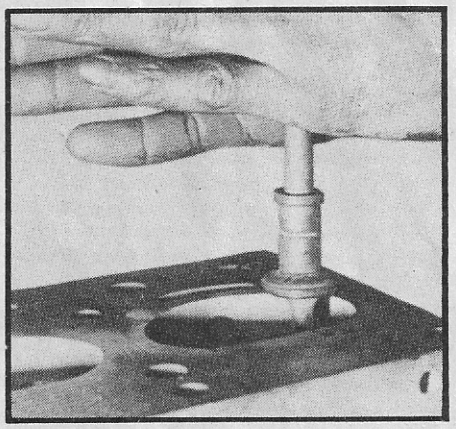
The seats in the head can usually be cleaned up by recutting with a stone or special angled cutter but if the seating has been 'hammered' or burnt and is badly damaged, it may be repaired by having an insert fitted.

Very light wear can be taken out by the normal lapping in process. Use the rubber sucker tool (seen in picture 15) and a reciprocating motion with the palms of the hands to rotate the valve in its seating. Apply a thin smear or grinding paste all round the seat and keep lapping until there is an unbroken matt light grey band around the complete periphery of the valve.

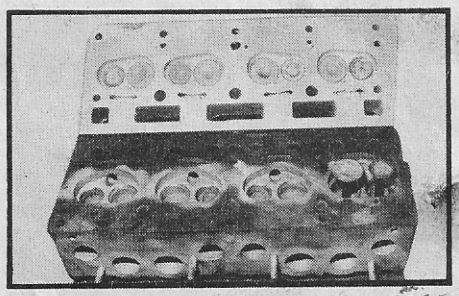
If the head has not been overhauled for a long time, a new set of valve springs would probably be a good idea. Note that they are different for the two heads. Remember also that valve head diameters are also different and the type of head must be specified when buying new ones.

Inspect the head for cracks and damage and consult your reconditioner if you find any. It is a good idea, particularly with the alloy head, to check for warping and, if necessary, have the head surface ground before refitting. Try a new valve stem in each guide to test for lateral play, indicating wear. If any significant play is discovered, new valve guides will be required. On a cast iron cylinder head it is a job you may be able to tackle yourself by drifting out the old ones and driving new ones in but one which is made a lot easier by the correct shouldered drifts which the professional reconditioner will have. On the alloy head the guides are sweated out and in, and it is not the sort of job an amateur should attempt.

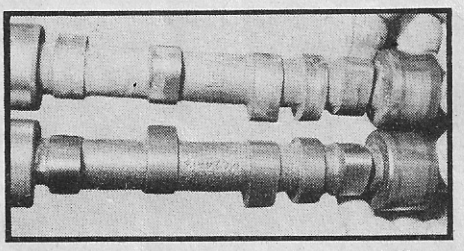
Reassembly of the valves to the head follows normal lines but there are slight differences between cast iron and alloy heads, principally that spring seating plates are used on alloy heads but not on cast iron. Seals are used inside the top collars and the new ones from the decoke gasket set should be installed. Use the valve spring compressor to refit the assemblies, ensuring that each valve stem is



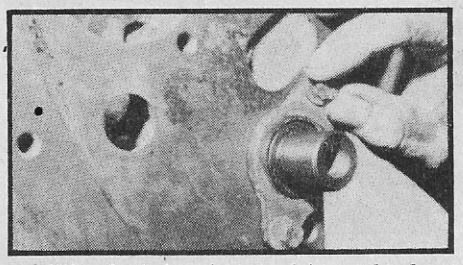
15 *Valves are lapped into their seats in the usual way, using grinding paste and a suction tool.*



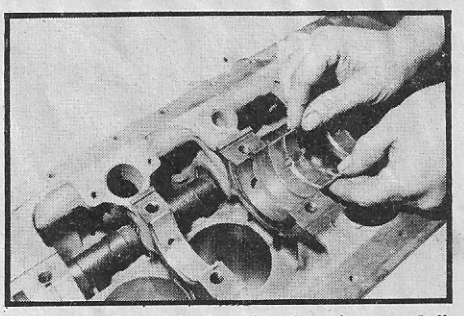
16 *Here are overhauled examples of both cast iron and alloy cylinder heads. Note the difference in combustion chamber shape and push-rod holes. The porting is also different.*



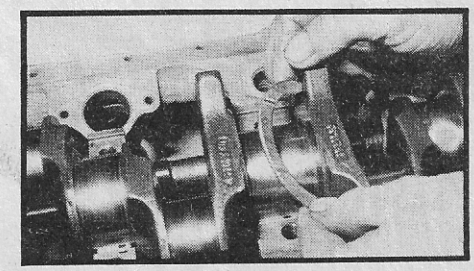
17 *There are several camshafts and if you are changing yours, make sure you get the right replacement. Here can be seen the vital difference between the cast iron head engine and the alloy head type. Both No. 1 lobes are aligned but look at Nos. 3 and 4!*



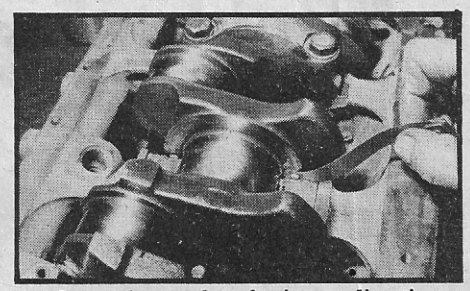
18 *Wipe both bearings and journals clean, lubricate with clean engine oil and insert camshaft, locking it in position with the thrust plate.*



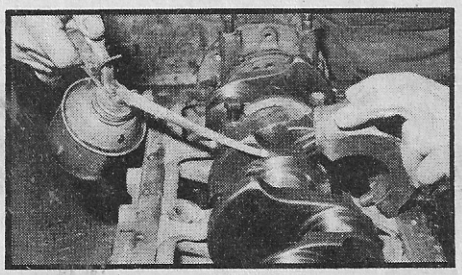
19 *Wipe the main bearing housings and fit the bearing shells. If the tab (keep) is correctly located into its recess, the oil holes will line up accurately.*



20 *With the crankshaft in position, the two thrust washers can be inserted, one each side of the centre main bearing. They go on the top side of the bearing only and are installed grooved side towards the web of the crankshaft.*



21 *Lever the crank as far in one direction as it will go and measure end float with feeler gauges, inserting them between thrust washer and web. End float should be between 0.002in. and 0.008in.*



22 *Lubricate the upper bearings before installing the crankshaft and the lower ones before fitting the caps (engine upside down). Torque each cap down one at a time and spin the crankshaft after each one to make sure it has not locked up — mixing the caps could have that result.*

Rootes Hillman Engine Strip-Down

(Continued)

lubricated with clean engine oil. Hit the top of each valve assembly after refitting to check that it is properly installed.

ASSEMBLY

For the work of assembly, you will need a clean corner of a bench or a covered and clean corner of the garage floor. Carry in your hand as you build the two essential aids — a clean rag and an oil can charged with new engine oil.

Start assembly with the camshaft and, if you're fitting a new one, make sure it matches the head, because the arrangement of valves on the cast iron and alloy heads is entirely different and, logically, so is the camshaft.

Most of the major points are shown in the photographs and described in the captions. As each main bearing is torqued down, spin the crank before tackling the next one to ensure it is not locking up. Torque settings are 55 lb/ft for the main bearing cap bolts and 29 lb/ft for the big end caps.

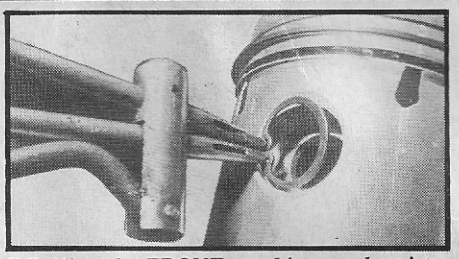
Getting everything in the right place and the right way round is important or the caps will lock up. Equally important is getting the con rod the right way round on the piston — with the word FRONT towards you, the oil squirt hole is on the left.

End float on the crankshaft should be between 0.002in. and 0.008in., preferably towards the lower limit. Adjustment is by means of oversize thrust washers which are available in standard size and +0.0025, +0.005 and +0.010in. If thrust washers are mixed, put the standard one to the front and the +0.0025 to the back and so on.

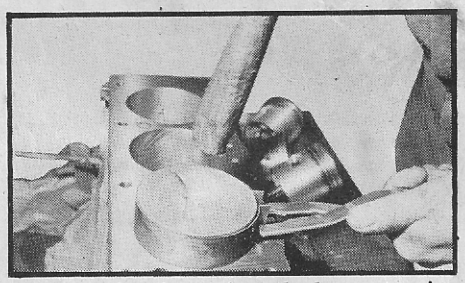
Timing gear assembly is covered in the photographs but don't forget the oil thrower! The reverse scroll oil thrower on the crankshaft pulley should be cleaned out and the timing cover correctly centred around the shank of the pulley. The special tool for this purpose is often unobtainable so feeler guages and patience will be required, otherwise a lot of oil will escape.

Inspect the cam followers before fitting them again. If they are dished, they will need regrinding (which is what Tiplers do with theirs) or replacement. If they are pitted, change the whole set. A Chrysler short motor has a plate fixed to the block detailing oversize or regrind dimensions including the cam follower bores. Oversize followers are available — make sure you get the correct ones! Ensure that the push rods go in the right way round — concave at the top and convex at the bottom.

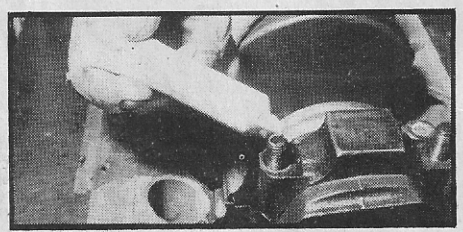
Two points where it pays to be particularly thorough with the Rootes engine in three or five bearing form are the oil pressure relief valve and the small valve in the pipe at the



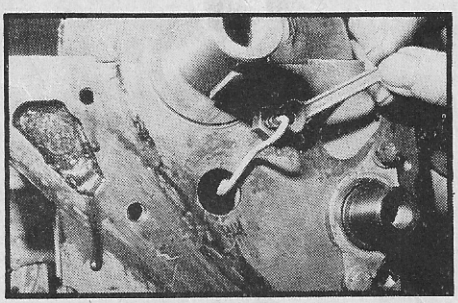
23 *Align the FRONT marking on the piston crown with the previously marked front on the con rod. If the pistons are warmed first, it will be easy to push the gudgeon pin into position. Lock it in place by carefully inserting the internal circlip and double checking that it locates in its groove.*

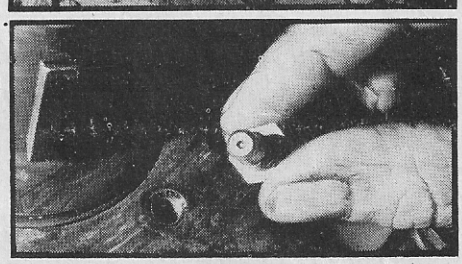


24 *Drop the pistons into the bores, turning the FRONT marking on the crowns to the front of the engine and then using a ring clamp and hammer haft to tap the piston home.*

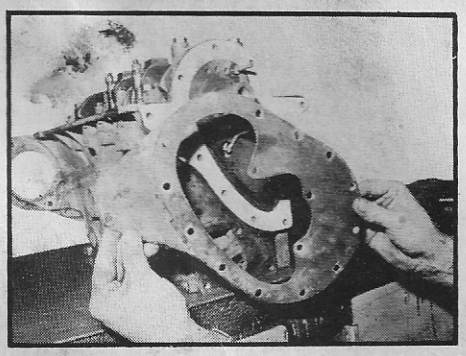


25 *Ensure the right big end cap is fitted and it is the right way round, coat the thread with Loctite and tighten the nuts to 29lb/ft.*

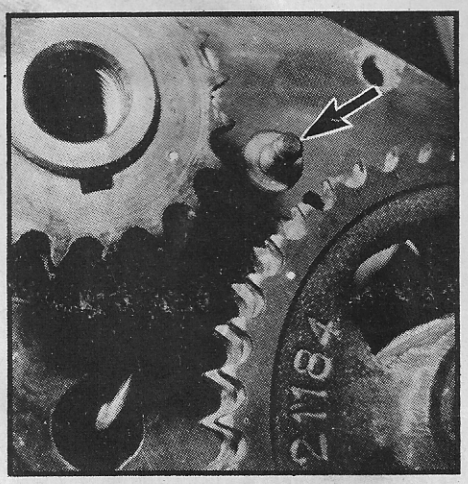




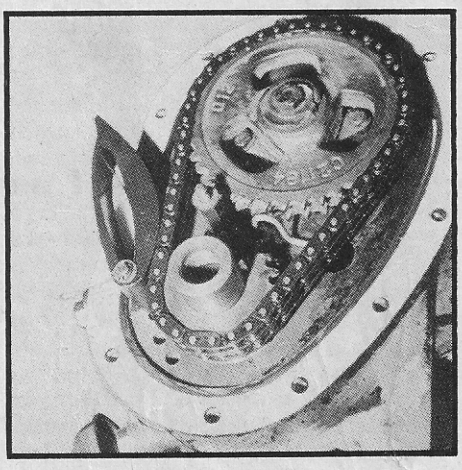
26 *This little pipe, threaded into the front face of the crankcase is the chain case oil pressure relief valve. Check, before fitting, that the tiny ball and spring actually are there — without them all oil pressure would be lost.*



27 *Stick the gasket into place carefully and fit the timing case backplate.*

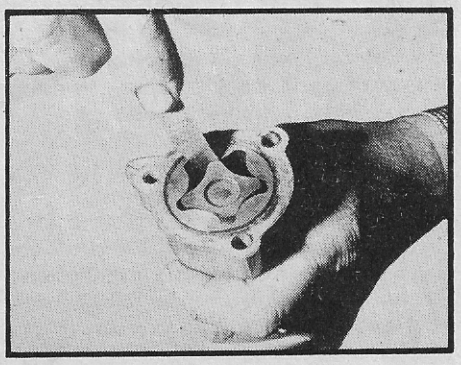


28 *Insert the stud with the threaded end which locates in the cover (arrowed) and locate both sprockets temporarily on their shafts, turning them until the two timing marks line up.*

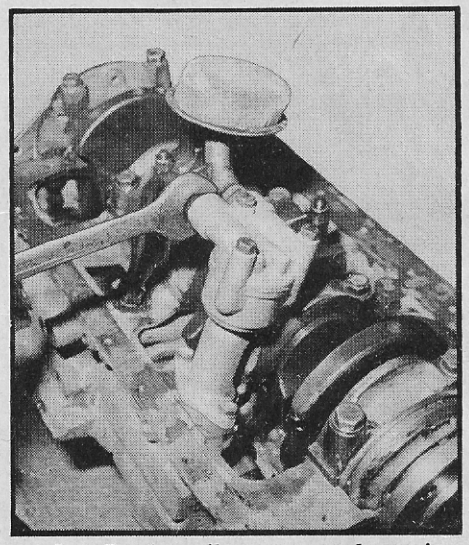


29 *The two sprockets are removed again, retaining their relative positions, and wrapped in a new duplex chain. Then they are tapped into position on their shafts as an assembly. The camshaft bolt is locked with its tab washer and the new tensioner block fixes on its spindle with a washer and spring clip. Another gasket goes on but do not fit the cover yet.*

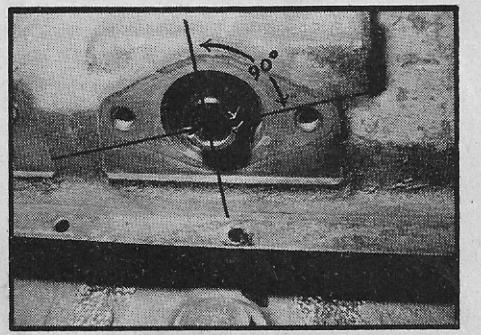
Rootes Hillman Engine Strip-Down



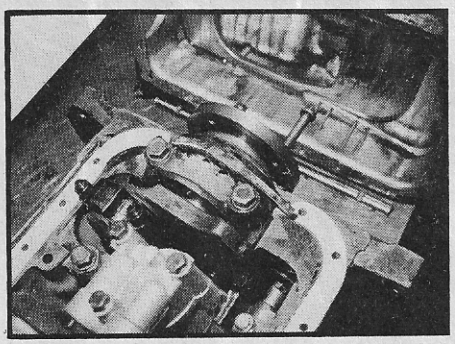
30 *Check the oil pump for wear, using feeler gauges and taking three measurements. First measure between the top of both lobes, as shown. Then insert feelers between outer rotor and covers and then finally lay a straight-edge across the pump body and measure the clearance between this and the rotors. The first dimension should be between 0.001in. and 0.006in., the second between 0.005in. and 0.008in. and the third between 0.001 and 0.003in. If any of these dimensions are exceeded, fit a new pump.*



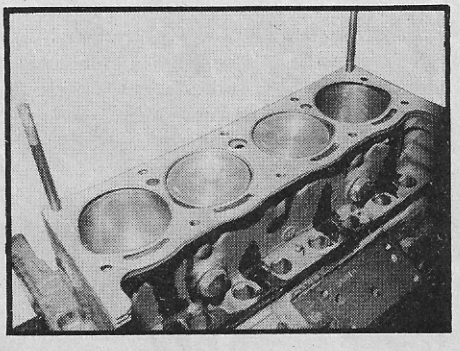
31 *Install the oil pump and strainer assembly but while doing so, ensure the timing wheel marks are still aligned. Then ensure when the oil pump drive teeth mesh with the camshaft that the offset 'D' of the distributor drive is correctly positioned.*



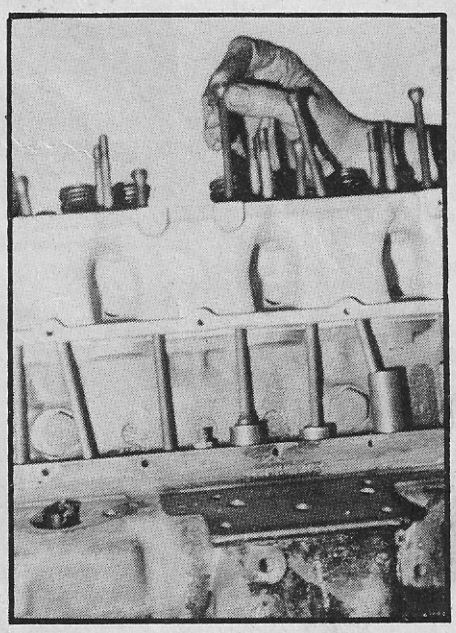
32 *Here is how the offset 'D' should look. The small sector is towards the bolt hole marked and a line bisecting the slots should go right through it. This will time the engine correctly on No. 4 cylinder firing.*



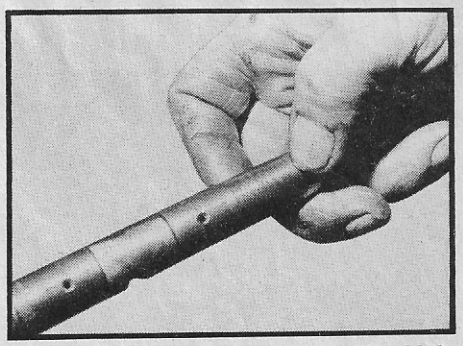
33 *Bearing cap seals are positioned in their grooves; they will be held properly by the pressure of the sump pan. A new (two-piece) gasket must also be used round the mounting flange.*



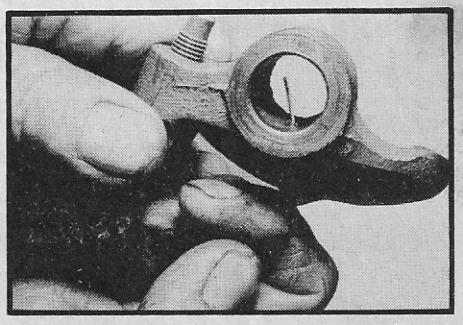
34 *Ensure you fit the right head gasket — those for cast iron head and alloy head are somewhat different. Tighten the head bolts and nuts progressively in the order shown in diagram on page 00. Finally torque them to 45 lb/ft.*



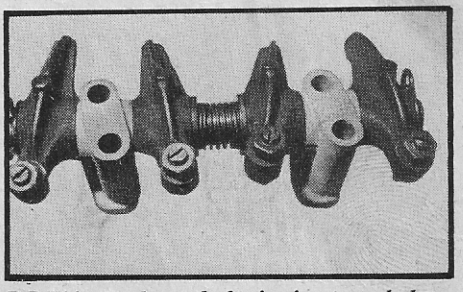
35 *Insert the cam followers and push rods. If the same ones are being refitted without any work, they should go back into the same positions from which they were removed.*



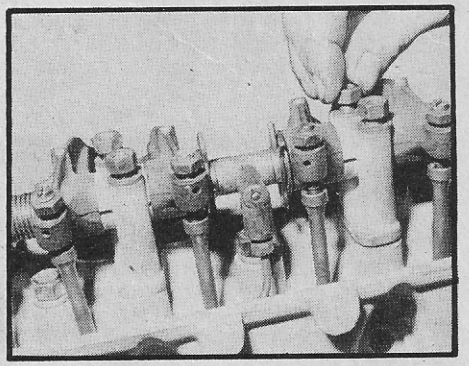
36 *A check of the rocker gear should be made as both shaft and rocker bushes can wear. A new shaft was fitted in this case.*



37 *Rocker pads were all re-surfaced and, as a last check, here the oil feed hole is being probed to ensure it is clear.*



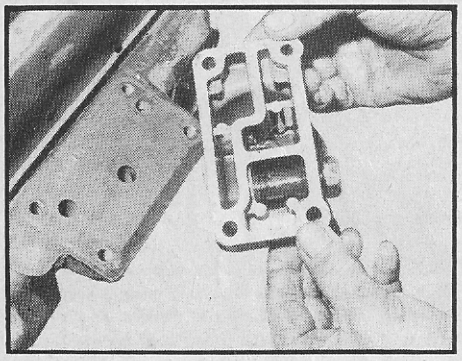
38 *This rocker shaft is in two halves. Here is one half assembled and ready to go back on the engine.*



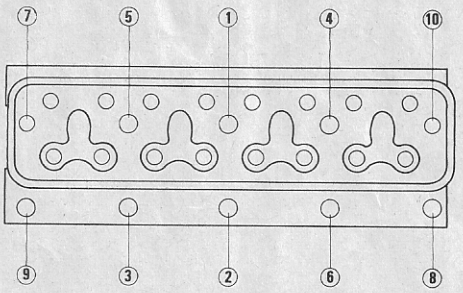
39 *The two halves are joined in the centre by the oil feed adaptor which must not be forgotten. Pedestal nuts, here finger tight, are eventually tightened to 11 lb/ft. Valve clearances are temporarily set cold — inlets to 0.012in. and exhaust to 0.014in.*

Rootes Hillman Engine Strip-Down

(Continued)



40 *It is generally reckoned best to change the oil pressure relief valve rather than to try and check it for wear. The housing is fitted with a new gasket, taking care to check it is the right way round. It is then turned over and bolted onto its housing. Cars with an oil cooler had a slightly different housing.*



Sequence for tightening head.

timing chest. Quite a few people doing home rebuilds on these engines have found that when the job is completed they still have poor oil pressure and these two valves are often the culprits. Apparently the oil pressure relief valve itself often only lasts 40,000 miles before allowing the oil pressure to wilt, so while the engine is in bits put in a new one.

Always fit new tab washers and new gaskets right through the rebuild.

If you are going to get full benefit from your rebuilt engine, overhaul or at least check as many of the ancillaries as possible — items like the fuel pump, carburettor, distributor and starter motor. Install new air filter and oil filter and remember to refill both the sump with oil and the radiator with coolant.

Remember, finally, if your rebuilt engine is going to last, drive gently for at least the first 300 miles and preferably the first thousand. Careful running in is essential to avoid early trouble with the engine and to ensure it has a long life before the next overhaul. □

NEXT MONTH

Overhauling the Jaguar XK engine with Paul Skilleter and Ron Beaty