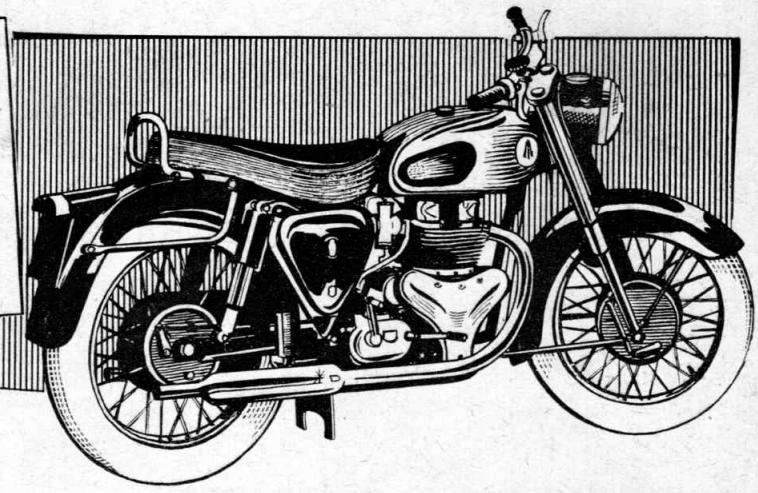
Overhauling BSA A-Type Vertical Twin Engines



The Main Features Discussed With Details of the Lubrication System, Valve Clearances and Ignition Timing

By BENCH TESTER

IT is always something of a debating point among enthusiasts whether the vertical-twin (or parallel-twin) four-stroke engine is not the ideal power unit for motor cycles in the medium-capacity range. The type of engine certainly has a great deal to offer: balance at least equal to, and usually rather better than, that of a single cylinder—with the advantage of lower inertia loadings; a smoother torque than the single; equal firing strokes—as against the vee-twin engine with out-of-phase firing; accessibility generally as good as the single or vee-twin; compactness superior to the vee-twin; and bulk little more than that of a single.

The vertical-twin engine may be thought perhaps to make its appeal chiefly to the experienced, practical, somewhat "hard-headed" rider who requires a "multi" but who would hesitate before the complication of a four with more numerous components—and the technical problems involved in layout and installation: four small cylinders across the frame with orthodox transmission; four cylinders in line with the frame in conjunction with shaft drive; flat four arrangements with cylinders projecting either side or laying fore-and-aft; or types with geared crankshafts.

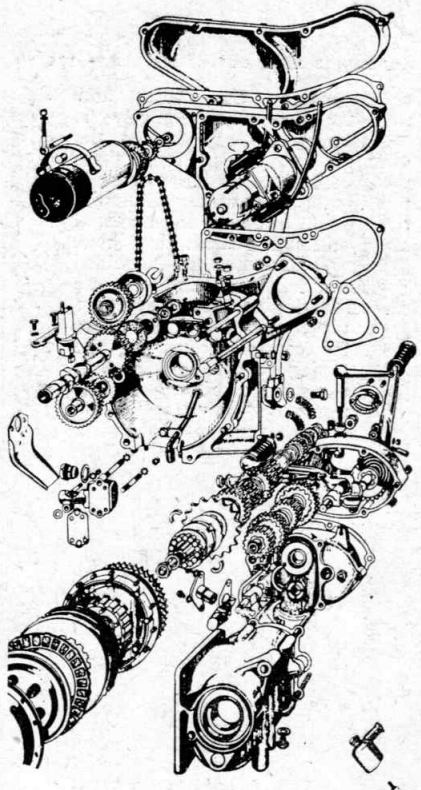
But however good a basic layout, equally important in final analysis are close attention to detail design, quality of materials used, reliable backing for spares and service—for these decide whether a design will continue and, as in the case of the B.S.A. A-type, be developed according to demands for increased power and speed.

Main Features

Main features of these engines can be seen from the illustrations. The "structural" components are split crankcases, deeply finned monobloc cylinders, detachable cylinder heads and rocker boxes. The crankshafts are single-piece forgings with bolted-on central flywheels—and, consequently, the big-ends of the connecting rods are split and bolted-up type. Pistons carry three rings, and gudgeon pins are fully floating, circlip-located in the pistons. Operation of the inclined valves in the one-piece cylinder heads is from a single gear-driven camshaft, through tappets and push rods to the overhead rockers. Double valve springs restrain "valve float" to high revolutions—the A7 engine "peaking" at about 5,700 r.p.m.

Sprockets transmit drive from the crankshafts through two-lobe cam shock absorbers, which permit maximum rotational movement with even thrust and moderate increase in spring pressure—thus ensuring smooth drive and take-up. Sprockets and chains are also employed for dynamo drives.

Figs. 1 and 2 show engine and gearbox components up to engine No. ZA7-11192. Fig. 3 illustrates the 650 c.c. engine and the 500 c.c. engine after No. AA7-101; and Figs. 4 and 5 depict models



A7 and A10 swinging arm frame.

Principal data follows:

A7 standard	5/16 in. before T.D.C.
A7 Star Twin, A7 Shooting Star	3/8 in. before T.D.C.
A10 Golden Flash	11/32 in. before T.D.C.
A10 Super Flash, A10 Road Rocket	3/8 in. before T.D.C.

All settings with ignition fully advanced.

Lubrication System

Lubrication of the A-type engine is on the dry-sump principle with a separate oil tank. A double gear pump situated in the bottom of the timing case deals with supply and return flows through internal oilways and the pipes shown in Fig. 6, which indicates the pressure release pipe, the filter, the oil supply pipe, and the oil return pipe.

Oil flows from the tank through the filter to the pressure or feed pump which then forces it via an automatic valve to the main bearing on the timing side, from which the feed goes through the hollow crankshaft to the big-end bearings. The pressure relief valve on the right of Fig. 6 maintains pressure at 50 to 60 lb. at the big-ends, and operates to allow surplus oil to flow into the bottom of the timing case.

Having lubricated the bearings and big-ends and been flung and squeezed out as droplets and spray, oil circulates in the engine as mist, then drains through a filter in the bottom of the crankcase, and passes by a non-return valve to the return side of the pump, which delivers it through the return pipe to the tank.

Oil flow in the lubrication system can be checked with the engine running. The filler cap should be removed, when oil should be seen flowing from the return pipe. Should the pressure release pipe in the tank become restricted, pressure will build up in the tank

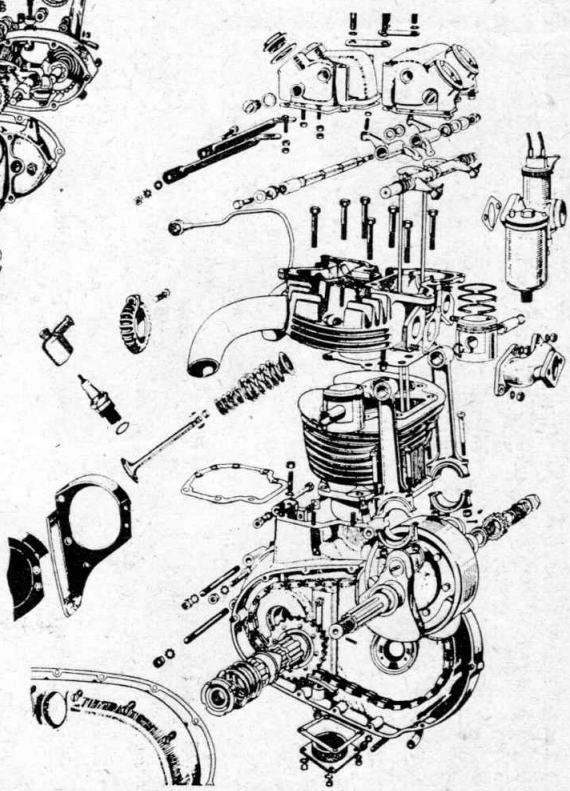


Fig. 1 and Fig. 2.—A7 engine and gearbox details, up to Engine No. ZA7—11192.

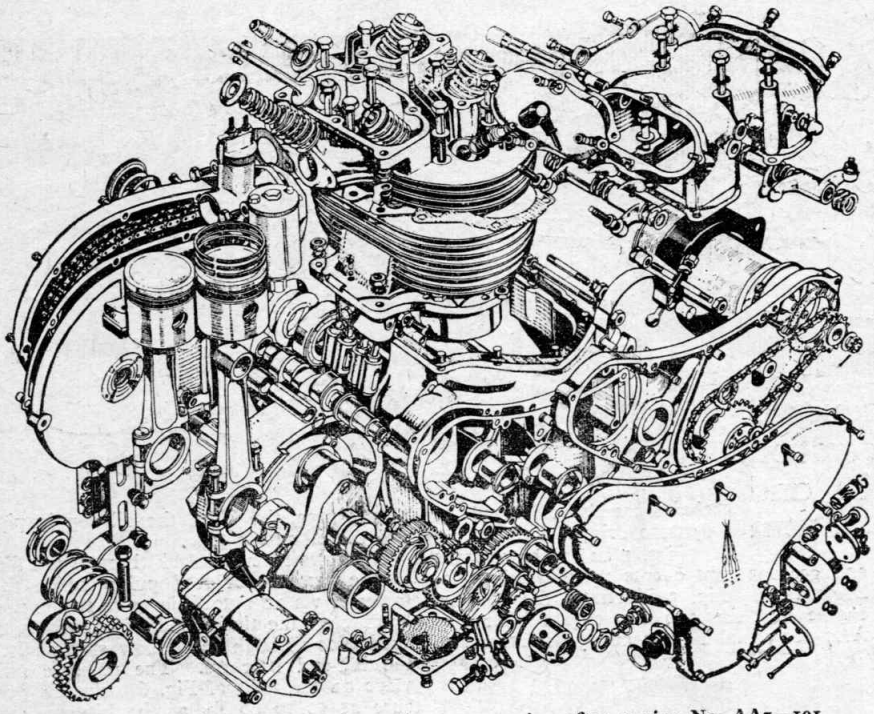


Fig. 3.—Details of 650 c.c. engine and 500 c.c. engine after engine No. AA7—101.

and the result is likely to be leakage at the filler cap. The remedy is to run a piece of flexible wire into the outer end of the pipe to free the obstruction.

Modifications

A modification was made to the lubrication system of A7 engines after No. AA7-101, and to the lubrication system of A10 engines after No. ZA10-4712, giving an additional supply of oil to the cylinders. On these engines, the excess flow from the pressure release valve is fed through drilled ways to the camshaft trough, and from there is directed on to the cylinder walls. At the same time, the timing gear receives an increased supply through a small bleed hole.

Fig. 7 illustrates the modified system and flow and indicates the oil supply pipe, the oil return pipe, and the bleed hole for controlled flow to the timing gears. In Fig. 8 is shown the oilway to the return or "scavenge" pump which returns oil to the tank.

Valve rocker lubrication has also undergone changes. Before engine No. XA7-450, oil mist from the crankcase is employed for lubrication of all rockers and valves. From this engine number, however, and before YA7-3402, oil is fed to the exhaust rocker spindle only. Thereafter, oil is fed to both inlet and exhaust rockers on all A7 and A10 engines, with mist and splash lubricating other parts of the valve gear. Supply to the rocker box is from a union where the oil return pipe couples to the tank.

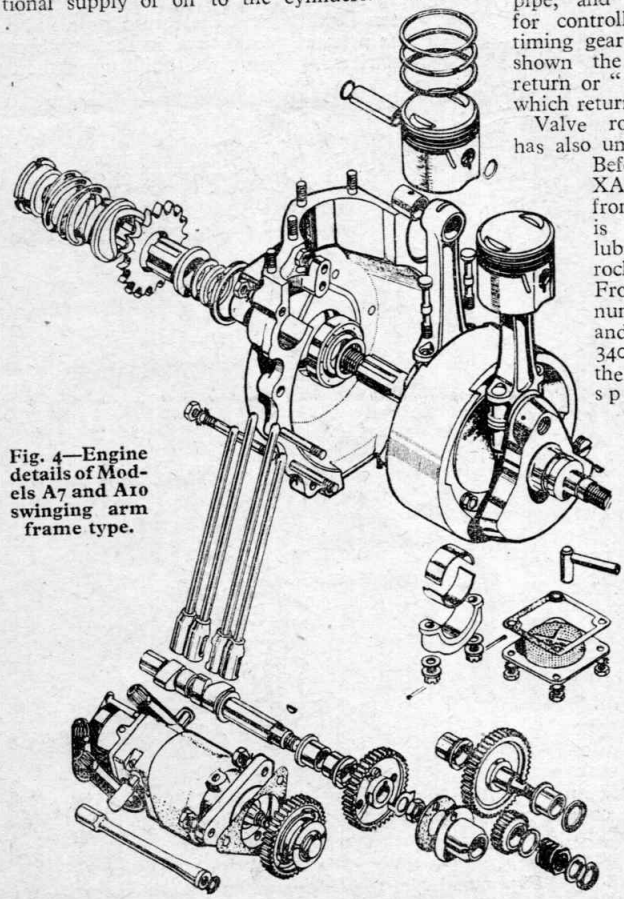


Fig. 4—Engine details of Models A7 and A10 swinging arm frame type.

Service Attentions

For new or overhauled engines, oil should be drained at 250 miles, then at 500 miles, and afterwards at 2,000 miles, the normally recommended period. The process is best performed after a run while the engine is hot—removing the drain plug and banjo with filter from the bottom of the oil tank, and the drain plug and cover with filter at the bottom of the crankcase. Parts should be washed in petrol and allowed to dry before refitting.

On swinging arm models, there is a different construction—though flow of oil is the same. A hexagon nut on the side of the tank can be unscrewed for access to the filter, and there is no necessity to disturb the oil pipes.

While draining the oil is a good time to remove and clean the pressure release valve, Fig. 6, since any defect with this, such as wear, or small pieces of foreign matter preventing it seating properly, could result in a reduced supply of oil to the big-end bearings—and possibly rapid wear or failure. The whole valve may be removed for cleaning in petrol; and both threaded parts must be pulled tight when refitting. The valve is "pre-set" by the length and strength of the spring. This should not be altered—but in case of doubt renewed.

Valve Clearances

Checking and setting valve clearances must be done with engines cold. On early examples, a screwed cap, Fig. 9, must be removed with a flat box spanner or other suitable tool, for access to the adjusting screw and locknut of each rocker. The small plug must be taken out to admit a feeler gauge for testing.

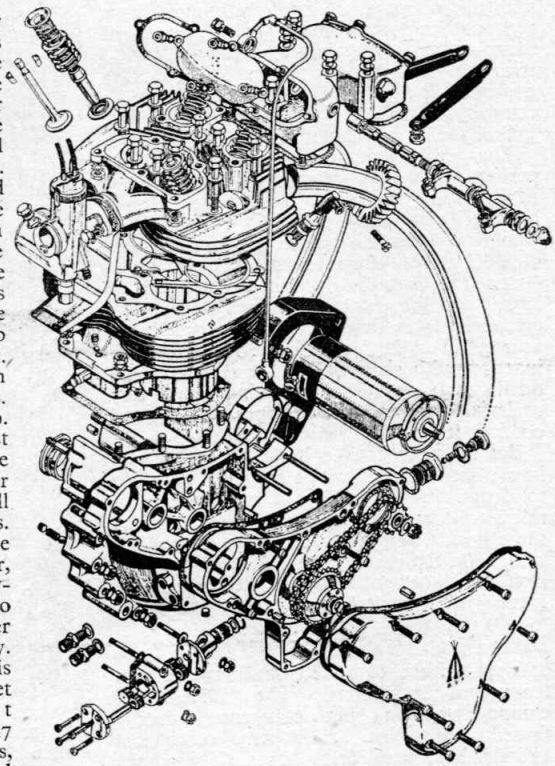


Fig. 5—Further engine details of Models A7 and A10.

Removal of sparking plugs is advised, as it enables the engine to be turned over with the minimum of effort, and several revolutions are generally necessary. On later engines, a cover, as shown in Fig. 10, can be removed front and back of the cylinder head for clearance adjustment; and in the case of A10 and swinging arm models, it is necessary to remove the petrol tank and take off the pipes and the strap beneath the tank connecting the two portions.

The special cams with gentle "ramps" to reduce noise in the gear demand care in positioning the engine before valve clearances can be checked or set. If a setting is made

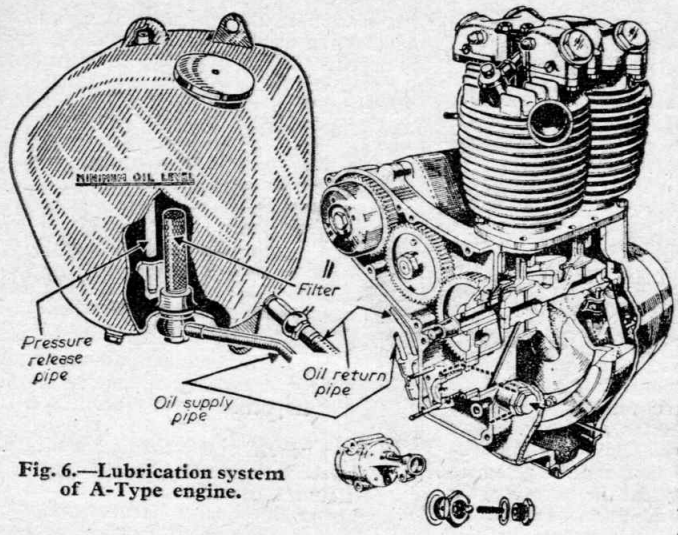


Fig. 6.—Lubrication system of A-Type engine.

partly up a ramp, clearance will be other than correct. To ensure each cam is right away from the tappet (which will then be resting as it should on the back of the cam), the "cross-over" method of positioning is employed. That is, each inlet valve is checked and set for clearance when the other inlet valve is fully open; and the same is done for each exhaust valve, which is also checked and set while the other is fully open.

Correct clearances are important both to avoid burning of valve faces and/or seatings, and at the same time to keep down noise and wear of the gear. The following are the maker's recommendations:

	Inlet	Exhaust
All A7 engines up to No. XA7-601	.003 in.	.003 in.
All A7 engines from No. XA7-601 to No. ZA7-11192	.015 in.	.015 in.
A10 engines and A7 engines after No. AA7-101 ...	.010 in.	.010 in.
A10 Super Flash	.008 in.	.010 in.
A7 Shooting Star	.008 in.	.012 in.
A10 Road Rocket	.008 in.	.008 in.

Ignition Timing

It is not usual for the ignition timing to slip in normal use, but a check can easily be made. Timing alters slightly with variation in the gap setting of the contact points, which should be kept at .010in. to .012in. A larger gap will advance the timing, while a smaller one will retard it—which characteristic is common to all ignition systems of motor cycles and cars. Hence, correct gap clearance is important both from electrical and from timing points of view.

To check timing after setting contact points to gap, the sparking plugs should be removed, and the gear-side piston brought to T.D.C., employing a rod to "feel" on the crown. Following this, the rod can be marked for T.D.C., and also for the advance position before T.D.C. to which the piston must be brought on the compression stroke.

To obtain the compression stroke, a finger or thumb can be held in the sparking plug hole while the engine is turned until compression indicates the piston is ascending on the compression stroke. Then the rod can be used to bring the piston to correct position. The contact breaker should be in the fully advanced position, with the points just commencing to break, as in Fig. 11, where the gap is shown as .002in.

If the timing is incorrect, the following is the re-setting procedure, with the piston in the given position. The timing cover is removed and the bolt unscrewed which holds the driving pinion—this bringing the self-extracting pinion from its taper. The contact breaker is turned clockwise until the points are just breaking with the heel of the rocker arm on the bottom cam. The automatic advance mechanism is wedged as shown in the fully advanced position; and the pinion bolt is tightened with the contact breaker held in position. A final check should be made taking the engine through two revolutions to the firing point again.

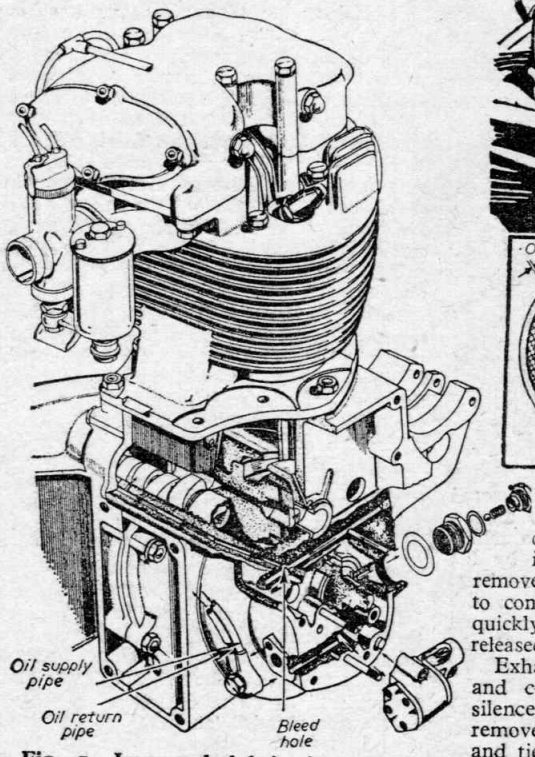


Fig. 7.—Improved lubrication system of later models.

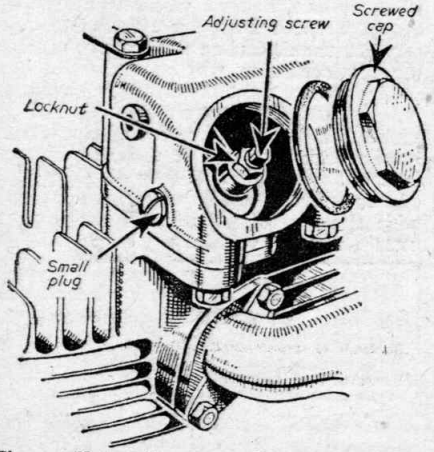


Fig. 9.—Valve clearance adjustment on early type engines.

Engine Removal

Removal of engine and gear units as in Figs. 1 and 2 (models with rigid and plunger type frames) commences with the petrol tank, which is secured by bolts at the steering head and seat lug. With a tank-mounted speedometer, the strainer bolt should be released, the instrument drawn out, the knurled nut unscrewed, and the light cable disconnected. On some models, there is a metal strap below the tank to remove; or the saddle nose bolt may have to come out. On other models, tanks are quickly detachable—pipes, as always, released.

Exhaust pipes push into the port recesses, and come away by removing bolts and silencers. Finned port collars need not be removed. The carburetter can be detached and tied to the rear of the frame, and tie-rods released from the front rocker boxes.

(To be continued)

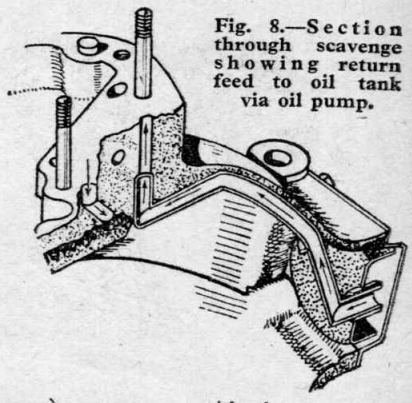


Fig. 8.—Section through scavenge showing return feed to oil tank via oil pump.

Fig. 11.—Contact breaker setting.

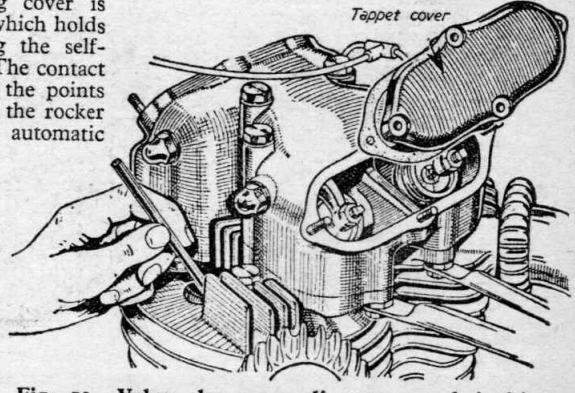


Fig. 10.—Valve clearance adjustment and ignition checking on later engines.

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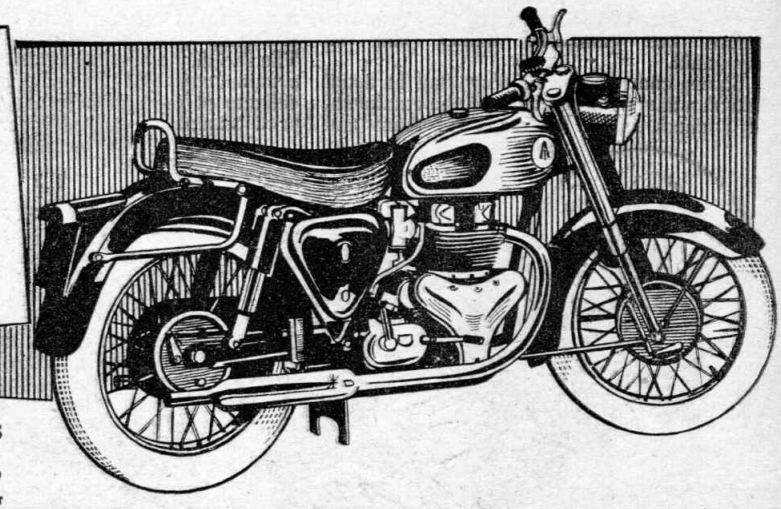

No. 2.—This Concluding Article Deals with Engine Dismantling and Assembly, Big Ends and Crankpins and Regrinding Dimensions

By BENCH TESTER

THE oil tank, Fig. 6 (August issue), is drained, and the pipes are removed —the rocker supply pipe, however, being left attached to the engine.

Then the rear chain is removed, followed by the engine front bolt passing through the dynamo cover and a frame distance piece, which usually falls when the bolt is taken out. Bolts holding the dynamo cover are removed, noting the plain washer on each between the cover and the crankcase —to be replaced on assembly.

At the rear there are three holding bolts, two below the gearbox, one behind the magneto: while the chain guard has two bolts which must be removed—one on the primary chain casing, the other on the stay —for the guard to be withdrawn. The bottom chain guard of rigid frame models, and the oil tank breather pipe clip then follow. The clutch cable should be detached, then there remains only the speedometer cable.

The unit can be removed from the offside, an assistant levering it up in the frame for it to be lifted out on to a strong box.

Engine Dismantling

In dismantling, the crankcase, timing, crankshaft, etc., will be more likely to give concern than the upper portion of the engine—though the cylinder head bolts should be released a little at a time to avoid strain.

On rigid and plunger frame models, Figs. 1 and 2 (August issue), the foot change lever is removed and screws taken out of the timing cover (at bottom, five on A7 and four on A10 being the longest—and three near dynamo the shortest). Oil should be caught as the cover is removed.

Releasing the strap on the dynamo and twisting this loosens the chain; then the sprocket nut and washer are removed, and the sprocket tapped free with hammer, and drift, and finally detached with the chain. Removing screws and the inner cover then exposes the timing gears—the camshaft gear carrying the crankcase breather and a cork washer $\frac{1}{8}$in. thick between gear and breather, which should be removed. The ignition automatic advance gear is self-extracting, and unscrewing the holding nut brings it off the taper.

With the holding nut and washer released from the camshaft gear, this can be drawn with the tool shown in Fig. 12, also employed for the crankshaft pinion on all engines after ZA7-1400, AA7-101 and all A10 engines. This is service tool 61-3256.

The idler gear comes away complete with shaft. Then three nuts and washers holding the oil pump are removed. Locknut and washers are undone from the crankshaft, as the pump is withdrawn, releasing the hexagon-headed worm gear. Both locknut and worm gear have left-hand threads. Following this, the crankshaft pinion is removed with the service tool; or on early models it can be prised off with a small lever—with care for the crankcase. Then can be removed the oil pressure release valve, and if a composition washer has been used below this valve it should be renewed on assembly. The timing gear with markings appears in Fig. 13.

When three nuts are removed, the magneto can be detached, and when twelve setscrews for the primary chain cover are released, it can be taken off. Note should be made of the screws for replacing correctly. Twelve bolts and nuts hold the clutch cover, and if removing the cover from the clutch body damages the jointing washer, it must be renewed.

The clutch spring adjusting nuts should be removed with springs and cups; then the plate removed and the mainshaft nut—clearing the locking washer. Removal of the plate assembly should await removal of the cush drive, taking out the split pin and unscrewing the slotted nut. Both assemblies then come together with chain, not losing any of the (18) clutch rollers. The thrust plate is drawn along the splined shaft, and the halved abutment ring removed from the rear. Then are removed two (four on early A7) bolts to release the gearbox.

The tappet guide fixing plate is detached, then the crankcase bolts are slackened, and the halves are separated, tapping at the front and rear with a soft mallet. On A7 models, nuts and washers must be left on one side of the studs between the gearbox flange, as they cannot be fitted with the crankcase assembled. If not detached earlier, the

	A7	A7 S.T.	A7	A7 S.T.	A10
	Up to Engine No. ZA7-11192	Twin Carb.	On and after Engine No. AA7-101	On and after Engine No. AA7S-101	
Bore	62 mm.	62 mm.	66 mm.	66 mm.	70 mm.
Stroke	82 mm.	82 mm.	72.6 mm.	72.6 mm.	84 mm.
Capacity	495 c.c.	495 c.c.	497 c.c.	497 c.c.	646 c.c.
Compression Ratio	6.6–1	7–1	6.6–1	7.25–1	6.5–1
Inlet valve opens before T.D.C.	24 deg.	24 deg.	30 deg.	42 deg.	30 deg.
Closes after B.D.C.	65 deg.	65 deg.	70 deg.	62 deg.	70 deg.
Exhaust valve opens before B.D.C.	60 deg.	60 deg.	65 deg.	67 deg.	65 deg.
Closes after T.D.C.	21.5 deg.	21.5 deg.	25 deg.	37 deg.	25 deg.
Contact points gap	.010in. to .012in.	.010in. to .012in.	.010in. to .012in.	.010in. to .012in.	.010in. to .012in.
Sparking plug gap	.018in. to .020in.	.018in. to .020in.	.018in. to .020in.	.018in. to .020in.	.018in. to .020in.
Sparking plug type	L.10S	L.10S	L.10S	L.10S	L.10S
Carburetter jet	—	110	—	—	—
With air cleaner	140	—	140	160	170

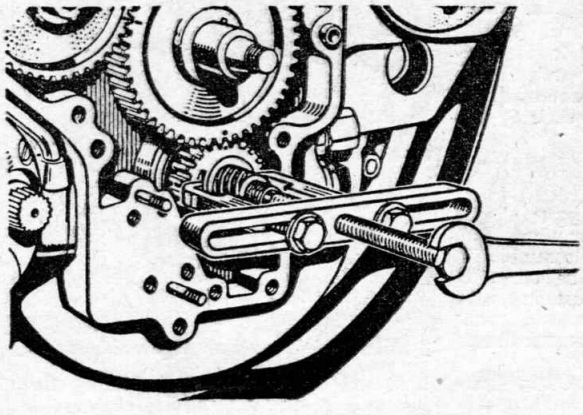

Fig. 12.—Drawing timing pinion.

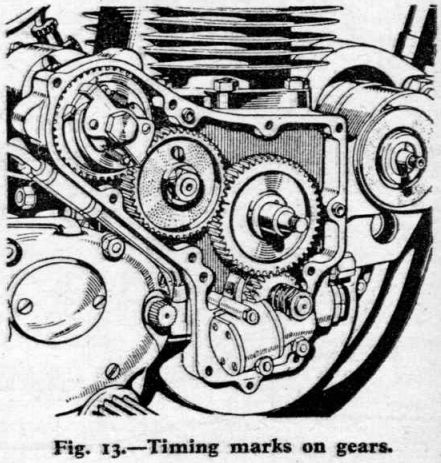

Fig. 13.—Timing marks on gears.

sump plate and filter must be removed before the crankcase halves can be separated.

Shims controlling end play may be fitted between the main bearing and the crankweb, so a check should be made for them and

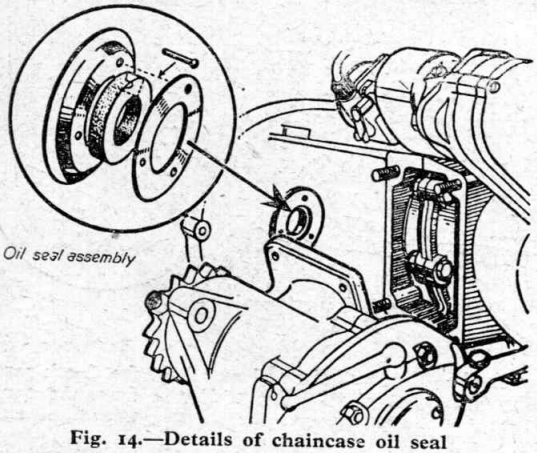

Fig. 14.—Details of chaincase oil seal

their number. If the drive side A7 ball race or the A10 roller race is worn, it can be pressed to the inside of the case, after warming the latter in hot water or oil. A steel washer should be noted between the race and the case, acting as an oil seal. A similar expanding and pressing procedure removes the timing side white metal bearing; and a service tool (No. 61-3159) draws out the camshaft blind bush.

On A7 engines, tappets are in the crankcase, and the exhaust double tappet block comes away when the halves are separated. A service tool (No. 61-3069), will remove the inlet tappet guides.

On A10 engines and A7 after No. AA7-101, the tappets are in the cylinder block. With two setscrews removed, the inlet tappets can be withdrawn; then removal of a setscrew with 3/16in. ball allows the guide pin to be pushed out and the tappets withdrawn. They are not interchangeable.

No attempt should be made to disturb the suction pipe from sump to pump, as it is cemented in the case. Neither must the small grub screw be disturbed near the main (plain) bearing. There is a ball valve behind it. The chain tensioner and adjuster need not be removed unless a new case is being fitted.

Big-Ends and Crankpins

Before the big-end bolts are taken out, note should be made of the way the connecting rods are fitted and if the left-side one is drilled to improve lubrication of the cylinder bore. No mistake can ordinarily be made with the bearing shells as they fit only one way, but the drilled shell must go to the drilled connecting rod when this is fitted.

Removable plugs in the crankshaft provide for cleaning out sludge, using a wire and squirting paraffin through, followed by an air-blast, or leaving to drain. Cleaning thoroughly is, of course, important after a crankshaft has been reground, as described later. The bolted-on flywheel should only be removed when a new crankshaft is being fitted.

In most reciprocating engines, and particularly in high-powered i.c. engines, the big-ends and crankpins are the most heavily loaded bearing surfaces. Ample lubrication is important as well as good fit. In the case of the A-type engines, with wear of the bearings there is a tendency to general "roughness," and the condition can develop until a distinct knock is noticeable.

Normally, if overall wear of the crankpins exceeds .002in.. as checked by micrometer, regrinding of the crankshaft is desirable, with undersize bearing shells for the big-ends. The B.S.A. Motor Cycle Service Department provides reground and rebushed units against delivery of worn parts received for attention; or if crankshafts can be ground locally, new undersize bearing shells can be supplied.

Regrinding Dimensions

On A7 engines No. XA7-101 to XA7-600, the crankpins are larger diameter than those of later models, and only one regrinding is possible. This brings the crankpins down to the original standard size of the later engines; and it is necessary to fit connecting rods (67-228) and standard bearing shells (67-226), which numbers must be quoted when ordering. The regrind diameter for the crankpins is 1.4600in. to 1.4595in., joining to the faces each side by a radius of .065in. to .060in. Each crankweb should be lightly marked —.040in. to indicate the undersize.

On A7 engines No. XA7-601 and onwards, and on A10 engines, three regrinds can be undertaken as follows, and in all instances the crankpin diameters must join to the faces each side by a radius .065in. to .060in.

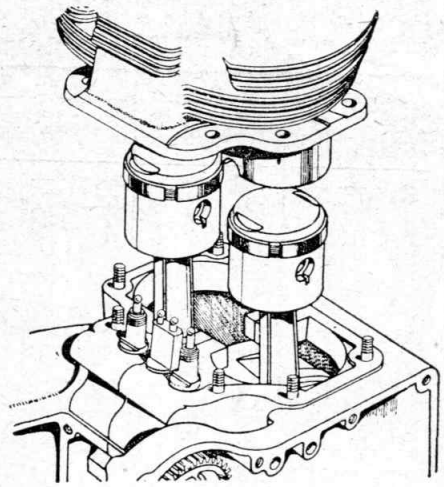

Fig. 15.—Replacing cylinder block.

First regrind: crankpins reduced to 1.4500in. to 1.4495in.; webs marked—.010in. bearing shells (67-226) marked .010in. undersize fitted.

Second regrind: crankpins reduced to 1.4400in. to 1.4395in.; webs marked—.020in.; bearing shells marked .020in. undersize fitted.

Third regrind: crankpins reduced to 1.4300in. to 1.4295in.; webs marked—.030in.; bearing shells marked .030in. undersize fitted.

On engines which have the left side connecting rod drilled to improve cylinder lubrication, one bearing shell 67-226 will be needed, and one drilled bearing shell 67-320 for this connecting rod.

Clearance Data

A thorough cleaning of all parts should precede any close examination for wear—and, of course, in preparation for assembly in which all precautions should be taken to exclude particles of ordinary dust and road grit, and that from grinding wheels, metal fragments, and other foreign matter found in workshops.

As important items directly affecting performance and running, attention will probably be given first to pistons and rings. Piston ring gaps should be checked—as always—with the rings well down in the cylinders and squared up properly. They should be .013in. for plain compression rings, and .011in. for oil control rings. Sideplay in grooves, which is important to reduce oil pumping, should be .002in. to .004in., as can be verified by feeler gauges. Piston clearances at the bottom of skirts, where too much clearance could result in piston slap, should be .003in. to .005in.

Other parts should be as follows: overhead rocker arm .4995in. to .5005in.; inlet valve guide .313in. to .314in.; exhaust valve guide .313in. to .314in.; inlet and exhaust tappet guides (A7 engines only up to No. ZA7 11192) .3125in. to .3135in.; camshaft bush .7485in. to .7495in.; idler pinion shaft bushes .7485in. to .7495in.; crankshaft bush, timing side, 1.375in. to 1.3745in.; gudgeon pin bush, A7 .6881in. to .6878in., A10 .7506in. to .7503in.

Engine Assembly

In assembly, bearing surfaces like main bearings, big-ends, gudgeon pins, pistons, rings, camshaft, tappets, valve stems, etc., should all be smeared with oil; and some should be applied to gear teeth and chains and sprockets, so that initial revolutions distribute the oil evenly, and all parts are well lubricated before the engine commences to run. Piston ring gaps should be located round the circumference, well out of line to obviate direct blow-by.

A new oil seal assembly to the chain case, Fig. 14, is fitted by placing the composition seal (part 67-1242) round end outwards into the crankcase bore, and fixing two steel plates by three rivets—with care for the soft aluminium during the riveting. The larger plate (part 67-1241) goes inside, and the smaller (part 67-1243) outside.

For fitting bearings and bushes into the crankcase halves, these should be warmed in hot water or oil. Then the bearings are pressed in carefully with support arranged to avoid damage. The steel oil seal washer should not be omitted from the driving side. It goes in before the bearing. If the camshaft and idler pinion bushes have been removed, these are also pressed in; and a phosphor-bronze bush is inserted in the inner cover for the outer end of the idler spindle.

Following fitting of new bushes, and new main bearing, reaming is required, preferably using the service tools to maintain alignment and correct dimensions. For this work, the crankcase halves are bolted together, and the inner cover is fitted. Afterwards, taken apart, they must be thoroughly cleaned.

No fitting is required to big-end bearings. Observation should be made of the oil feed hole and appropriate shell bearing for the left side connecting rod on engines having the supplementary oil supply to the cylinder.

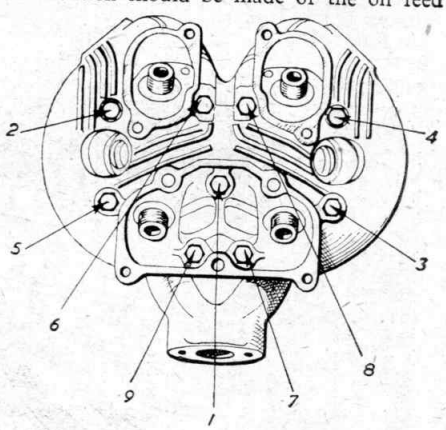

Fig. 16.—Head bolt tightening order.

Big-end bolts have been of two types. On early engines, they are B.S.F. 22 T.P.I., and should be tightened to a torque of 10lb. ft. On later engines, they are C.E.I. 26 T.P.I., and should be tightened to 8½lb. ft. These later type bolts can be fitted, complete with nuts, to early engines. The bolts must not be over-tightened, and nuts must not be eased back to bring split pin holes into line. Instead, they should be removed and carefully filed on the faces to pull up to the next slot, admitting the split pins at correct tightening torque.

Crankshaft endplay is adjusted by shims, and any removed in dismantling must be replaced—on the driving side. On A7 engines, endplay before tightening the sprocket should be .005in. to .010in., and this is taken up in the tightening. On A10 engines, the endplay is not taken up by tightening the sprocket, and should remain at .005in.

For fitting the crankcase, the crankshaft should be supported on a block with a hole for the mainshaft, with the driving side upwards. This half of the crankcase is then placed over the crankshaft, the whole assembly turned the other way up, and the camshaft inserted. On A7 engines, the twin tappet block is fitted with the oil hole towards the gearbox. Then the crankshaft faces are smeared with jointing compound, and the timing side of the case fitted and bolted up. Bolts should have shakeproof washers; the top inside two have locking washers. A steel rule can be used across the crankcase mouth to verify alignment, and across the milled flats of the inlet tappet blocks on A7 engines. The camshaft must spin freely, any tightness suggesting malalignment needing attention.

The push-fit breather pipe is cemented into the driving side casing behind the primary chain case, security at the lower end being a clip. The sump plate filter can be fitted, a paper jointing washer between it and the case, and the suction pipe from the pump passing through the hole in the gauze. Oil tank pipes can be bolted using jointing compound, and the relief valve fitted.

Dynamo straps and cover plate can be attached, and the tappet block securing plate replaced on A7 engines. The gearbox can be mounted, securing firmly, and noting for some models a fibre or Hallite washer used between the two units, since this must not be omitted.

Concave side inwards, the keyed timing pinion goes on the crankshaft, then a plain steel washer. For mounting the pump, the thick washer should be replaced with the holes matching, and a round fibre washer. Pump and driving worm slide on together, the left-hand-threaded worm being turned anti-clockwise—and finally secured by a keyed washer and nut. The outside edge of this washer is then turned for security.

With the key fitted, and holding the camshaft from moving inwards, using a screwdriver against a cam, the camshaft gear is fitted with the breather operating stud outwards. The nut and special locking washer follow.

Timing

The idler gear is inserted with the dot mark to the dot mark on the crankshaft pinion, and the dash mark to the similar mark on the camshaft gear, as in Fig. 13. The magneto goes on with a paper washer between it and the crankcase, and the gear with automatic advance is fitted loosely for timing to be done later in the manner already described.

The dynamo is placed in position, and the face of the inner timing cover smeared with jointing compound, and a paper jointing washer placed on the inner side of the inner cover. The crankcase breather should be fitted to the camshaft gear, a cork washer between the gear and the breather and, smeared with oil. With the cover fitted, endplay on the breather should be checked—and corrected if necessary by a thicker washer.

Cylinder and Head

Pistons should be fitted to the connecting rods, correct way round; and on A10 engines, tappets are replaced. The paper joint washer for cylinder base should be fitted to the crankcase, and pistons brought to T.D.C. Piston ring compressing tools facilitate fitting the cylinder block, as in Fig. 15, and are removed when the rings have entered the cylinders. The tools are 61-3061 for A7; 61-3334 after engine No. A7-101; and 61-3262 for A10.

The cylinder block should be bolted down, push rods entered, the magneto timed, and the dynamo chain and driving sprocket fitted—this last with a cork washer between it and the case. The dynamo chain should have ⅛in. to 3/16in. play for easy running—not sufficient to foul the boss in the casing. The outer cover is fitted with a jointing washer and compound.

After grinding in, valves can be fitted with springs, collars and collets; and with the gasket in position, the head can be fitted. Head bolts are replaced, also nuts on the inverted studs at the rear of A7 heads. Bolts should be tightened evenly, working diagonally, leaving the central inclined bolt to last. It is essential to go round the bolts tightening a little a a time until fully secure. Fig. 16 shows the tightening order for engines fitted to swinging arm frames.

The push rods must be down to the tappets before the rocker boxes are fitted; and a special tool is available for push rod location on A7 engines after AA7-101, and A10 engines. This is tool 67-9114. Care is required in fitting the rocker boxes, easing down the holding studs, and checking valve springs and collars are clear, otherwise valve stems may be bent. The boxes should be firmly seated without force before holding bolts are pulled tight. Valve clearances may then be set, and covers fitted.

The remainder of the assembly should follow straightforwardly from the dismantling procedure. The driving chain tensioner should be set so there is ½in. total up-and-down movement at the tightest position on the chain.

CATALOGUES RECEIVED

Cure-C-Cure Catalogue

A NEW trade catalogue of the Cure-C-Cure tyre and tube repair process is being issued by the manufacturers, Romac Industries, Ltd., The Hyde, Hendon, London, N.W.9. This booklet covers the entire Cure-C-Cure range for commercial, agricultural, motor, motor cycle, scooter, moped and cycle tyres. The range has been extended to cover many new sizes and types of patch and also valves, tyre plasters, etc., and these the catalogue fully itemises.

The Tabulator

THE British Tabulating Machine Co., Ltd., 70, North Row, London, W.1, this year celebrates its golden jubilee and the company's external house journal *The Tabulator* attains its majority.

To mark the occasion a special jubilee issue of *The Tabulator* has been produced, containing the story of the birth and growth of the company and present and future electronic machine development.

The publication is attractively produced, and is extensively illustrated with line and wash drawings and with photographs.

Park Lines Catalogues

A NEW edition of Park Lines' catalogue of portable buildings and kindred outdoor equipment is now available. It extends to 60 pages and includes details of many garages supplied by Park Lines, together with greenhouses, garden seats, incubators, power tools, etc. Of special interest to motorists are the details of the erection service offered by this firm.

Copies of the catalogue are obtainable free from Park Lines Ltd., 717-719, Seven Sisters Road, Tottenham, London, N.15.

By Road to Austria

THE A.A. has this year published a companion to its three booklets of routes through France to the Riviera, to the Costa Brava and to Switzerland.

It is entitled "Routes to Austria." Outward and return journeys via the Rhine, the Black Forest and Switzerland are included. Town plans, tables of meteorological readings and descriptive notes on the chief resorts and other places of interest are also incorporated.

This 68-page booklet is available free to members from any A.A. office.

Converting Garage Doors

THERE are many advantages of the "over-the-top" type of door for garages and other buildings. The door opens and closes easily; there is no interference with floor space; side walls are not blocked up; the door is not affected by inclement weather. (See Page 263.)

These doors can be fitted to existing buildings. Some hints for converting hinged doors to the "over-the-top" type are outlined in a new leaflet published by Coburn Engineers Ltd., Coburn Works, Peasmarsh, Guildford, Surrey.