ARIEL

C.W.WALLER

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PEARSON

ARIEL MOTOR CYCLES

Motor Cycle Maintenance and Repair Series

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ARIEL MOTOR CYCLES

A PRACTICAL GUIDE COVERING
ALL MODELS 1948–60

By
C. W. WALLER

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PREFACE TO THE SIXTH EDITION

THIS sixth edition of Ariel Motor Cycles gives a brief description of all models manufactured since 1948, and also full information for maintenance and adjustments. In the case of single-cylinder models, treatment covers all models from 1937. For the benefit of service agents and riders who prefer to undertake their own top or bottom overhauls, much useful information is given including technical date charts showing such essentials as inner and outer dimensional sizes of various working components.

Numerous illustrations of parts and exploded views are given, and reference to these should be made when the correct order of assembly is required.

The author desires to thank Ariel Motors Ltd. for their courtesy in giving permission to reproduce many factory-issued illustrations in this and previous editions, and the publishers also thank them for permission to use the Ariel Trade Mark as a cover design, although the book is in no way a factory-sponsored production.

C. W. W.

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For the 1953 season, the 4G Mk. II engine was introduced, and offered as an alternative to the Mk. I engine. For 1954, the Mk. II only was manufactured. The main differences were a four-pipe exhaust system, higher compression ratio and a redesigned cylinder-head. An S.U. Type M.C.2 carburetter was fitted to Mk. II models manufactured for 1954 and 1955; the fitment of this carburetter necessitated a new frame to clear the air intake.

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The Lubrication System

The lubrication system (Fig. 1) depends entirely on cleanliness, and on all 1000-c.c. models the oil tank and crankcase sump should be drained every 1000-1500 miles and thoroughly flushed with clean petrol. Refer to "Lubrication Recommendations" for correct grades of oil to use for 1000-c.c. models.

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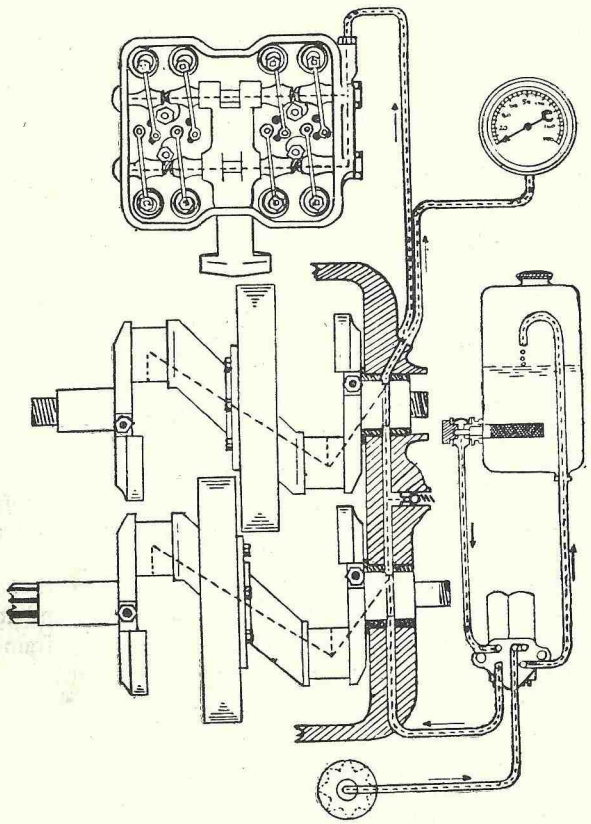

FIG. 1.—THE LUBRICATION SYSTEM.

Oil is drawn from the tank and passes through an oilway in the crankcase wall to the two main bearings and thence through the drilled crankshafts to the big-ends. A separate feed is taken to the rocker box and a connection made to the oil gauge. The oil drains down into the star-shaped filter in the sump and is then pumped back into the tank for further circulation.

functioning to full capacity and that the release valve is well sprung and seated. The oil pressure is controlled by a spring-loaded valve acting as a release when the pump produces a certain pressure limit. The release valve (Mk. I engines) is situated in the end of the front crankshaft on the timing side, and is accessible after removing the large hexagon cap in front of the chain cover. On Mk. II engines the oil-pressure release valve is incorporated in the oil-pump body. If a low oil pressure is recorded, the release valve should be removed, dismantled and thoroughly cleaned. The small coil spring may have weakened, and a new one should be fitted for retesting. Whilst the valve is removed it is advisable to clean out as far as possible the timing end of the hollow crankshaft.

Removing Oil Pump

Before refitting the timing-chain cover and joint washer, the complete oil pump should be removed for cleaning and checking (see Figs. 2 and 6). The Mk. I pump is situated in the timing-gear case and driven by a small spindle extension formed on the camshaft gear nut. To remove the pump it is only necessary to release the two hexagon nuts and lock-washers and gently prise off the fixed studs. Hold the pump between the vice jaws, but cover the two faces with a small thin guard of wood or fibre to prevent damage. Remove the pump base plugs or caps and expose the spring-loaded ball valves. Thoroughly wash out and examine the pump plungers and ball seatings for any sign of scoring or foreign matter.

Before reassembling, place the steel balls on their respective seatings and with the aid of a short steel bar and hammer give each ball a sharp tap. This has the effect of keeping the seating contours in relation to the balls. Before replacing the small coil springs, lightly stretch them to increase tension. Tighten both plugs securely and wipe the pump and crankcase pump faces and refit, but ensure that the pump washer is in good condition.

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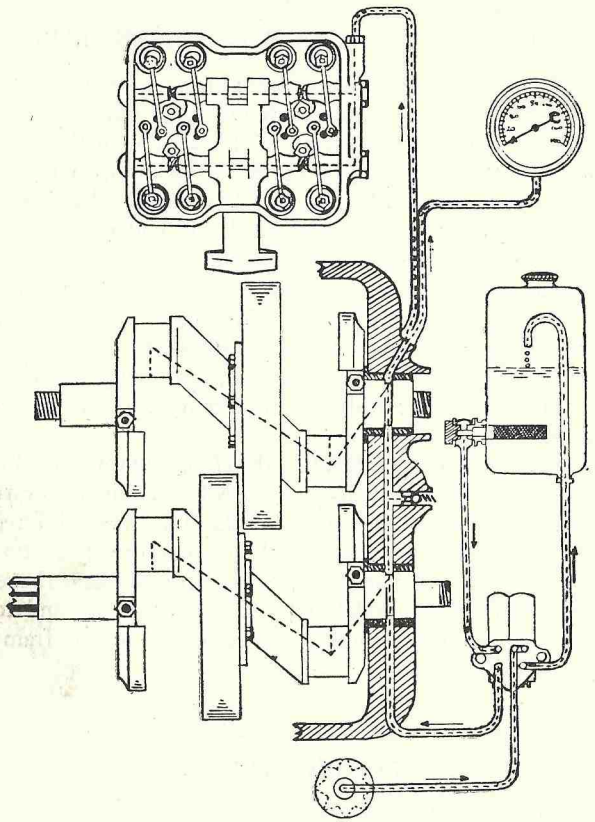

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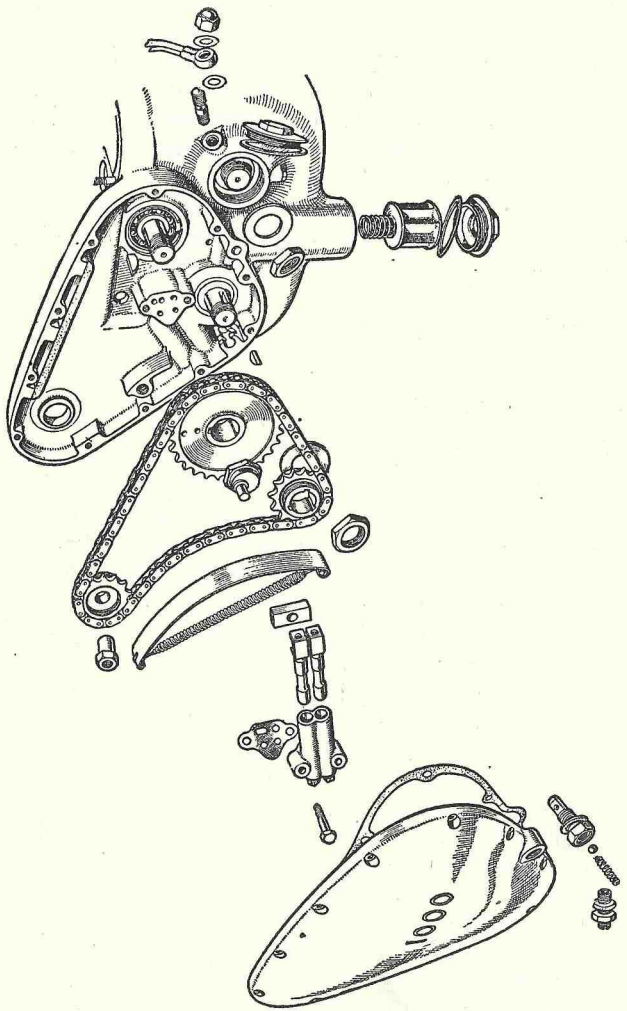


[*By courtesy of 'The Motor Cycle'.*

FIG. 2.—THE FOUR-CYLINDER TIMING GEAR AND OIL PUMP ARRANGEMENT (1948).
The chain drives the camshaft and Magdyno. Showing also oil filter and relief valve in timing case cover.

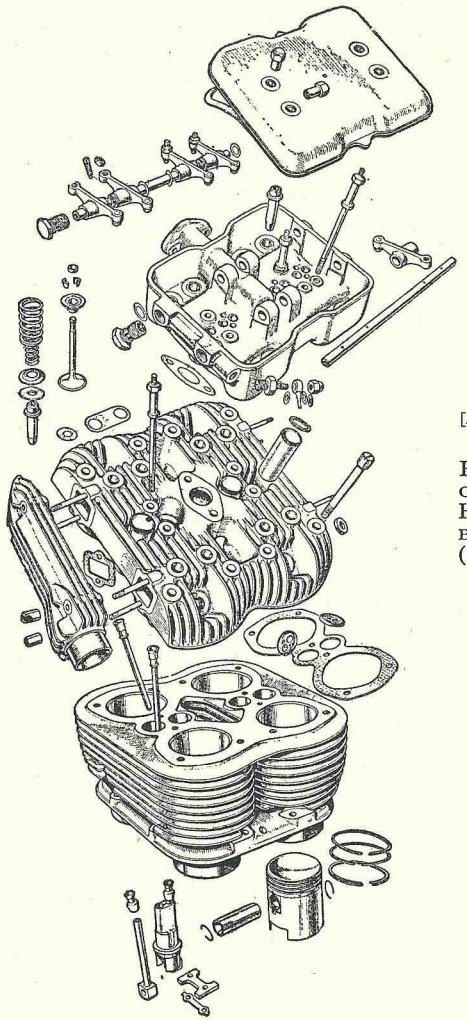
be allowed to wear to excess, or loss of movement and undue noise will occur. The oil-pressure valve should be occasionally removed and dismantled for cleaning, and the ball and spring treated in the same way as those of the oil pump.

To remove the Mk. II oil pump take off the three securing nuts and pull away the pump complete with spiral-driven gear. The sleeve nut securing the camshaft gear incorporates the other corresponding pump driving gear and is screwed on the end of the camshaft with a left-hand thread. The camshaft sprocket can be easily removed from the keyway by suitable leverage. It is well to note that although the rocker-box construction of the 1949–59 Models 4G varies considerably from that of the 1948 type, theoretically the lubrication is identical and the diagram (Fig. 1) is applicable to all 1000-c.c. models, irrespective of year of manufacture.

During the maintenance check take the opportunity to examine the timing chain, tensioner spring and blade, and, on the Mk. I and Mk II, the adjustable stop for the blade. The action of the stop is such that when adjusted to give approximately $\frac{1}{64}$ in. or $\frac{1}{32}$ in. clearance between it and the rear of the blade the chain cannot straighten out due to any chain snatch or irregularity which might be set up in the engine when running. Adjust the stop with engine cold and the timing chain in the tight position between sprocket. Tappet adjustment should be checked with the engine cold and set to give 0·001 in. clearance for all inlet and exhaust valves. Note that these settings are different from those recommended for the "cast-iron" 4G engine. Test each pair of valves for correct seating and the tappets for clearance by rotating the engine slowly to obtain full compression on each respective cylinder when both valves should be fully closed. A safe measure to adopt is to turn the engine slightly over the full stroke in order to clear fully any cam pressure on the pushrods and rockers. The rocker adjusters can be operated with the small special spanner supplied in the tool-kit; this is also used to securely tighten the lock-nuts.

DECARBONISATION

With a new engine recently run in, it is recommended that



[*By courtesy of "The Motor Cycle".*

FIG. 3.—THE FOUR-CYLINDER BLOCK, HEAD AND ROCKER-BOX ASSEMBLY (1948).

the cylinder-head be removed for examination and cleaning after 2000–3000 miles. After this, it is only necessary to repeat the operation every 8000–10,000 miles to maintain maximum efficiency.

Removing Cylinder-head (1948 Cast Iron)

The order of procedure in removing the cylinder-head complete with rocker box attached is a very simple one, and does not require any special tools or fitments. The petrol tank need not be removed. After detaching the carburetter, exhaust pipes and rocker-box cover, the twelve securing bolts are removed, and it is advisable first to take out the four extended centre bolts which pass through the rocker box. These are the bolts which carry the four rocker-box cover dome nuts. Prise up the head just enough to allow the eight push-rods to clear the top of the cylinder-block and withdraw them sideways. Support the head complete with rocker box and all fittings on the bench by placing it on two lengths of thick board strips to prevent the extended ends of the push-rods being damaged.

The rockers must be removed before attempting to dismantle further, and to do so the rocker spindles are withdrawn by detaching the hexagon cap nuts and pulling the spindles out by using one of the long centre head bolts, screwed $\frac{5}{16}$ in. × 26 T.P.I., into the exposed end of each spindle. Lay out, in correct order, on the bench, all rockers, distance washers, steel shims and push-rods, taking note that shims are fitted only to prevent rockers directly touching the aluminium spindle bearings.

Removing Cylinder-head (Mk. I)

For ease of operation the petrol tank should be raised or completely removed, as this leaves the procedure of dismantling the carburetter, rocker-box covers and oil pipe, etc., more easy and accessible. Next move the eight head-securing nuts from the clinder-block studs which pass upwards and through the holes in the head casting.

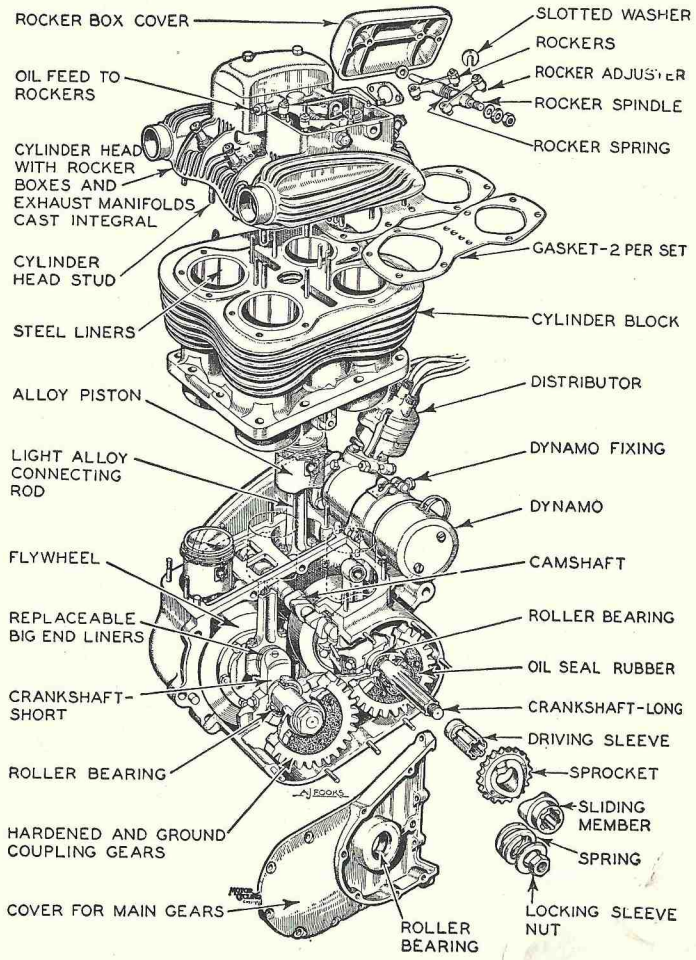


FIG. 4.—EXPLODED VIEW OF THE ARIEL 4G MK. I 1000-C.C. LIGHT-ALLOY ENGINE (1949–52).

Four nuts are located inside the rocker boxes and four outside. Next note that there are twelve more securing nuts located between the second and third cylinder-block fins, these being screwed to the studs fixed into the cylinder-head. Unscrew these nuts almost to the ends of the studs and lift the alloy cylinder-head far enough to allow a few thin strips of metal or spanner to be inserted to support the head whilst the twelve nuts are finally removed from between the fins.

Removing Cylinder-head (Mk. II)

Disconnect petrol pipe and remove petrol tank. Remove H.T. cables and sparking-plugs. Remove carburetter and disconnect rocker oil-feed pipe to cylinder-head. Remove the eight exhaust manifold securing nuts (four each side) and also the exhaust-pipe clamp bolts and silencer clip nuts. The manifolds, complete with pipes and silencers, can then be withdrawn.

With Solex Carburetter Fitted

Remove the induction manifold by unscrewing the three securing nuts and one retaining clamp. Next remove the long pillar nut which supports the clamp. Remove the eight securing nuts on the top outside edge of cylinder-head and one nut in the centre of the head now disclosed by the removal of the induction manifold.

With S.U. Carburetter Fitted

Remove the induction manifold after unscrewing the three nuts and washers. Next remove the eight securing nuts on the top outside edge of the cylinder-head and the two nuts on the centre of the head which have been disclosed by the removal of the induction manifold. Remove the four long hexagon-headed sleeve nuts and the four standard nuts, all of which are used to secure the four separate steel rocker-block assemblies. The remaining four head securing nuts are positioned between the first and second lower fins of the cylinder-block, and after removing these and the push-rods,

which should be suitably marked, the cylinder-head is free to be lifted and turned into a position where it can be withdrawn from under the frame lower tank tube.

Detaching Cylinder-head (All Models)

If any difficulty is experienced in loosening the cylinder-head from the block, try rotating the engine with the kick-starter, leaving the sparking-plugs in position to give full compression. The H.T. cables should be disconnected. This operation should have the effect of breaking the joint, which may be sealed tightly by the head gasket. Do not on any account attempt to prise up the head with metal tools, as the joint faces can be easily damaged. Pull out the push-rods and suitably mark each one to ensure that they can be replaced in the same order.

Unless a top overhaul is considered necessary, the cylinder-block need not be removed for decarbonisation, but all carbon can be cleaned from the piston tops after rotating the engine slowly in order to bring each piston to T.D.C. position as required. On 4G Mk. I light alloy models it is not necessary to remove the rockers unless wear is suspected, and then the operation is very simple and only necessitates removing the rocker-spindle end nuts on the outside of the box casting and then gently punching each spindle a short distance along the housings.

The slotted washers locating the spindles inside the rocker-box can now be removed and the spindles withdrawn. Before dismantling the rocker assembly, take note of the order of position of the respective springs and rocker thrust washers.

To dismantle the rockers on Mk. II models, the assemblies should be suitably marked before dismantling to ensure reassembly in the same order and positions. A close examination of one of the box assemblies should be made if it is decided or found necessary to remove the rockers and spindle from the steel box. Take note of the protruding boss on the side of each box and the formation of the rocker spindle which has the bearing surface form offset. The longer offset portion of the spindle fits into the extended boss side of the steel box.

If it is found necessary to remove a rocker spindle, special note should be taken of the order of assembly. To dismantle, first remove the two circlips from the grooved ends of the rocker spindle and drill out the brass dowel plug, which is cut from No. 10 gauge wire and locates the spindle by way of a groove cut on the side and in direct line with the block fixing holes.

The spindle must be pressed out of position. Take note of the rocker springs fitted to take up end float and also note the position of the oil-feed hole for the oil pipe of the small rubber joint washers. Reassembly of a rocker spindle is quite a straightforward matter providing the location is correct and the brass peg is refitted into the groove provided.

Some engines have been produced with the rocker or tappet adjusters fitted to the valve ends of the rockers, whereas later engines incorporate adjusters fitted to the push-rod ends of the rockers. The method of adjustment, however, is identical for both types. Do not on any account immerse a light alloy cylinder-head in any form of caustic solution to remove carbon, because although this is common practice with cast-iron heads and blocks, caustic soda solutions will very quickly entirely ruin any aluminium or allied alloy. Decarbonise the head with the aid of wire brushes and scrapers only, taking care not to damage valve seatings and guides. Valve seatings are formed in the light-alloy material by pressing in separate inserts manufactured from a high-expansion steel. No attempt should be made to replace the inserts unless equipped with suitable tools and knowledge of such procedure. Note also that the valve guides are not of the usual cast-iron type, being made up from bored bronze bar and securely held in position by the valve-spring pressure. In order to prevent damage to the alloy material through tightening sparking-plugs, bronze bush inserts are pressed into the head to receive any standard 14-mm. plug. Valves have heat-treated stem ends, and therefore the hardened end caps as used on the "cast-iron" Model 4G are not necessary.

Valve Removal

A valve-spring compressor to facilitate spring removal can be obtained, but the actual spring rate or load is very light, and

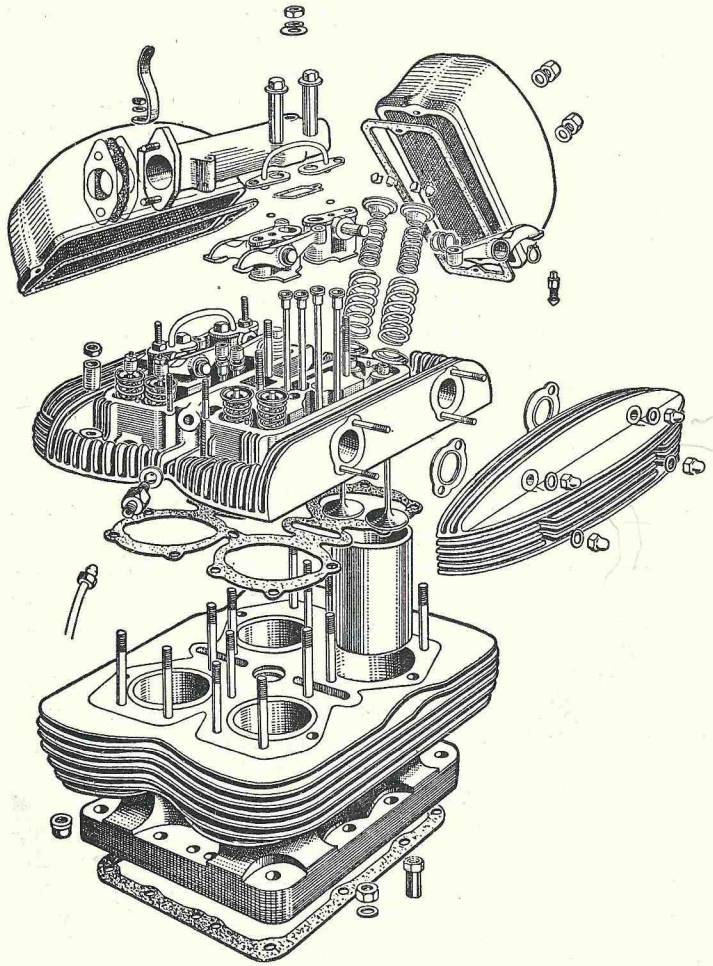


FIG. 5.—EXPLODED VIEW OF 1000-C.C. MK. II CYLINDER-HEAD AND BLOCK ASSEMBLY.

providing the valve heads are kept pressed into their seatings any simple improvised tool can be used.

Valves and Seats

Examine the hardened valve-stem end caps for wear (1948 models only); although these can be refaced, renewal is advisable if the pitting is deep. Each valve should be ground to its respective seating and not interchanged. Inlet valves are those with the stem undercut below the head and are the four inside ones numbered 2, 3, 6 and 7. Note that the large coil of the inner valve spring fits next to the collar with taper hole. The usual method is employed when grinding-in the valves, and here again no special tools are required.

Valve seatings should be examined for signs of pitting or "pocketing", and if it is found that a good ground angle cannot be obtained, the seating in the cylinder-head should be lightly recut with a seating-cutter tool of 45°, using a pilot-stem clearance fit in the valve guide. It may be necessary, at some period during the life of a valve, to reface it with the aid of the workshop refacing machine, but these operations are best carried out by a competent mechanic only.

Removing the Rocker Box (1948)

If an oil leakage is suspected at the rocker box and cylinder-head joint it is advisable at this stage to remove the box for examination and refacing if necessary. To remove the rocker box from the cylinder-head, with all rockers and valves already dismantled, the two nuts screwed on the two centre studs in the centre of the underside of the head should be removed. This will release the induction joint between the cylinder-head and rocker box. Next press or drive out, with a stepped or double-diameter drift punch, the valve guides, taking care to support the whole assembly firmly in the press or on the bench whilst operating. The rocker box is now parted from the head, and should be thoroughly cleaned and very lightly refaced on a flat surface-plate, using a little very fine emery paste or cloth. Check valve guides for internal ovality wear, and renew if this

is excessive. Reference to the data chart at the end of this chapter should be made for sizes.

Reassembling the Rocker Box (1948)

Refit the rocker box to the head after placing the new joint washers in position, but it is advisable to smear these with a little high-class jointing compound beforehand. Then refit and tighten up the two induction centre-stud nuts. Lightly coat the valve guides with compound and press into position with the shouldered portion inside the box. Reassemble all valves, rockers, push-rods, etc., not forgetting the eight valve end caps. If convenient leave the assembly of the head and box after refitting to set overnight before running the engine, and thus ensure a perfect oiltight joint. Make sure the cylinder-head gaskets, which are now of the copper and asbestos type, are in good condition and place on the cylinder-block so that all bolt holes are in line. When replacing head to block take care to screw down each holding bolt in turn very little at a time until quite tight. After running the engine for a short period try tightening each bolt in turn again. Refer to the data chart again for valve clearances and to Chapters VII and XI referring to carburetter and magneto adjustments.

Removing Cylinder-block

During the process of decarbonisation, if it is desired to examine the pistons, the cylinder can be removed by unscrewing the eight holding stud nuts and lifting the block clear. On cast-iron engines the two rear nuts, situated between the Magdyno and the cylinder-block, can be removed with a special spanner, made up from a length of hexagon steel bar and the cut-off end of an ordinary open-ended spanner welded on to one end of the bar at a right angle. The top of the hexagon can be turned with another spanner or wrench.

Pistons

To remove the pistons from the connecting-rods the circlips or lock rings must be prised out of their grooves with the

pointed end of an old screwdriver or scribing tool. If the gudgeon-pins are at all tight for any reason, they can be lightly driven out by supporting one side of the piston and using as a drift punch an old pin or bar of slightly smaller diameter. If the original pistons are to be refitted, mark them in correct order (see Fig. 10).

The pistons and cylinder-bores should be examined and checked for wear. Cylinder-block should be renewed or reground if bore wear exceeds 0·008 in., and pistons likewise renewed if bearing faces at the skirt have worn to increase the clearance 0·004 in. above standard. Piston-rings should be replaced if the gaps exceed 0·030 in. when tested in their respective bores.

Gudgeon-pins and Bearings

The gudgeon-pin small-end bushes can be removed with connecting-rods in position by using a form of draw bolt and bush made up from an old bush reduced slightly in diameter outside and pulled through the connecting-rod end by tightening the draw-bolt nut. New bushes can be inserted in the reverse way and hand reamed after fitting. Refer to data chart *re* sizes and clearances. When fitting the pistons and gudgeon-pins it is advisable to renew all circlips owing to loss of tension during removal.

Refitting the Cylinder-block

This is best carried out with assistance, but if single-handed, the engine should be rotated slowly until all pistons are at same level and two wood strips, 9 in. × $\frac{1}{4}$ in. × $\frac{7}{16}$ in., placed across the top of the crankcase to support the four pistons in a vertical position whilst lowering the block. Ensure that all ring gaps are staggered in relation to each other and the block is lowered very carefully whilst compressing each ring in turn as it enters the respective bores. The rings and bores should be smeared with clean oil before fitting. The easiest method is to use ring clips to hold the rings compressed while the cylinder-block is being replaced. See that the base

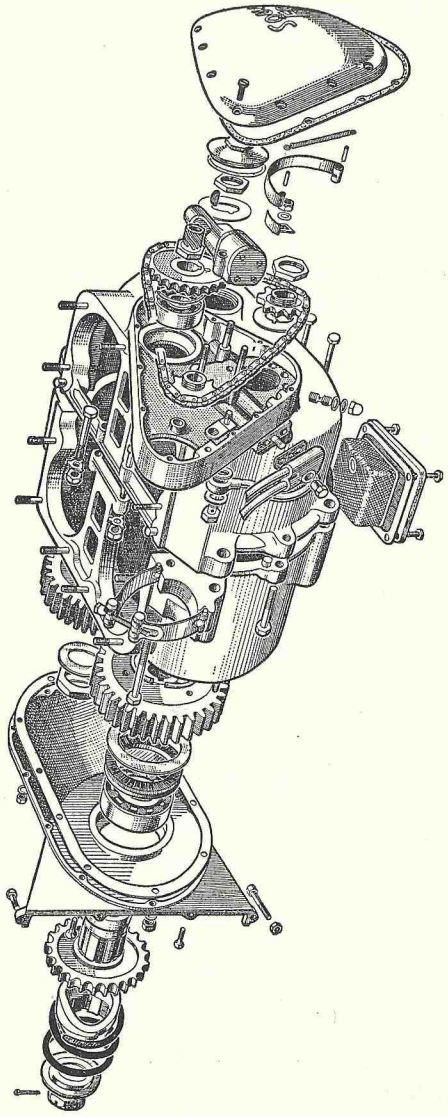


FIG. 6.—EXPLODED VIEW OF 1000-C.C. MK. II BOTTOM HALF.

washer is in good condition and that the cylinder is reassembled, (it can be reversed on some models) as originally fitted.

Refitting the Cylinder-head (Cast-iron and Mk. I)

After the head has been thoroughly cleaned and all valves correctly ground in to their respective seatings, a new gasket or joint washer should be prepared and placed in position on the top face of the cylinder-block, which should also have been thoroughly cleaned. Do not use jointing compound. Assuming now that the rockers and valves are all correctly assembled again, the head complete is ready for refitting. Replace the securing nuts between the fins of the block and position them immediately below the corresponding stud holes in the block face ready to receive the screwed ends of the studs when the cylinder-head is lowered into position. Insert the push-rods into the head and locate with each respective rocker arm before fitting the head, which when lowered into position will allow the ends of the studs to engage the securing nuts. Before attempting to screw on the nuts farther, lift the head approximately ½ in. and insert two metal strips or thin spanners to support it whilst screwing the nuts on a further few threads. Remove the strips and finally tighten all the nuts between the fins, and the eight (four, 1948) which bear against the top of the cylinder-head.

When tightening the head-securing nuts it is essential to screw down the nuts to almost full travel and then to finally tighten each in a cross-over action from corner to corner, etc., commencing with the eight centre ones. Always retighten the nuts after warming up the engine and again after approximately 100 miles running. The valve clearances should be set (see p. 41), and checked again after retightening the head-securing nuts.

Refitting the Cylinder-head (Mk. II)

See that the joint faces of the head and cylinder-block are perfectly clean and the joint washers in good condition. Do not use jointing compound. Check all cylinder-head

nuts on the studs to make sure the threads have not been damaged.

Place the cylinder-head in position and then insert the push-rods, taking care to correctly locate the lower ends in the tappet cups. Next replace the rocker-assembly blocks into each respective original position, at the same time noting that each rocker end is correctly located in the corresponding push-rod top end. Take care not to damage the small rocker oil-feed pipes connecting the rocker blocks. Reassemble all fixing bolts and nuts and then proceed to tighten these in two or three stages.

The order of tightening the nuts and sleeves is most important to ensure a perfect joint between the cylinder-head and block. Tighten in the order correct from 1 to 18 (see Fig. 10). Complete the assembly of the induction manifold pipe, taking care to fit a new oiled-paper joint washer at the port of entry.

Finally, assemble the carburetter, exhaust pipes with manifolds, and the controls. Adjust valve-tappet clearances to 0·006 in. Inlet and 0·008 in. Exhaust (cold). After the first 50 miles or so running on the road, retighten the cylinder-head nuts because the head washer settles a little with heat. This is particularly important if new head washer has been fitted, and should be repeated several times. Do not forget to check valve clearances, because they will be reduced as a result of any settling down of the head washer, also frequently check the head nuts.

DISMANTLING THE COMPLETE ENGINE

This is necessary only when the main or big-end bearings require renewal. Heavy oil consumption, loss of pressure and bearing knock indicate that wear is present in the bearings. The engine can be removed as a complete unit from the frame if so desired, and the first operation is to dismantle the primary chaincase, chain and clutch. Foot-rests also are removed, and after taking off the securing nut, the foot-rest should be given a sharp blow downwards with a hammer to loosen the taper fitting.

Removing the Engine-shaft Shock Absorber (1937–48)

The engine-shaft shock absorber is best dismantled with the engine still in the frame, and it is only necessary to release the tab or lock-washer between the two securing nuts and the assembly can be removed. For future reference the order of assembly is as follows: driving sprocket, sliding member, spring-retaining collar, spring, spring plate, hardened steel washer, lock-nut, tab washer and final lock-nut. This assembly is not adjustable, and lock-nuts are intended to be tightened to the fullest travel.

Removing the Engine-shaft Shock Absorber (1949–59)

After the clutch and outer primary-chain cover have been removed the shock-absorber assembly will be exposed, and it will be noted that the design of this has been changed from that of all previous 4G models. A two-cam sliding member and corresponding engine sprocket is fitted in place of the original three-cam type, thus giving a far more sensitive action to the transmission. A splined driving sleeve and sleeve-type nut is fitted in place of the early pattern tab washer and lock-nut device. Note the order of assembly, see exploded view of engine unit (Fig. 4) and also see when dismantling the exact location of the self-aligning—rubber and spring—oil seal. For the benefit of owners of 1948 1000-c.c. machines it is quite possible and permissible to fit the above-mentioned modified engine-shaft shock-absorber assembly complete, as well as the oil seal, to all existing units without any alteration to the splined shaft or coupling gear.

In order to prevent the shock-absorber sleeve-type locking nut becoming loose a small modification was introduced in 1952 and a slotted-type nut and split cotter pin fitted after drilling a No. 39 hole in the threaded end of the driving shaft at $\frac{11}{64}$ in. from the extreme end. Any previous 1949–51 Model 4G crankshaft can readily be modified by a drilling and then slotting the existing sleeve nut with a hacksaw.

Removing the Engine

Drain and remove the oil tank, battery and battery carrier.

Remove the rear engine plates and withdraw the gearbox after detaching the rear chain. Support the engine by placing suitable packing under the crankcase, and then remove the front engine plates. The complete crankcase can then be withdrawn from the frame.

Crankcase-bearing Oil Seal

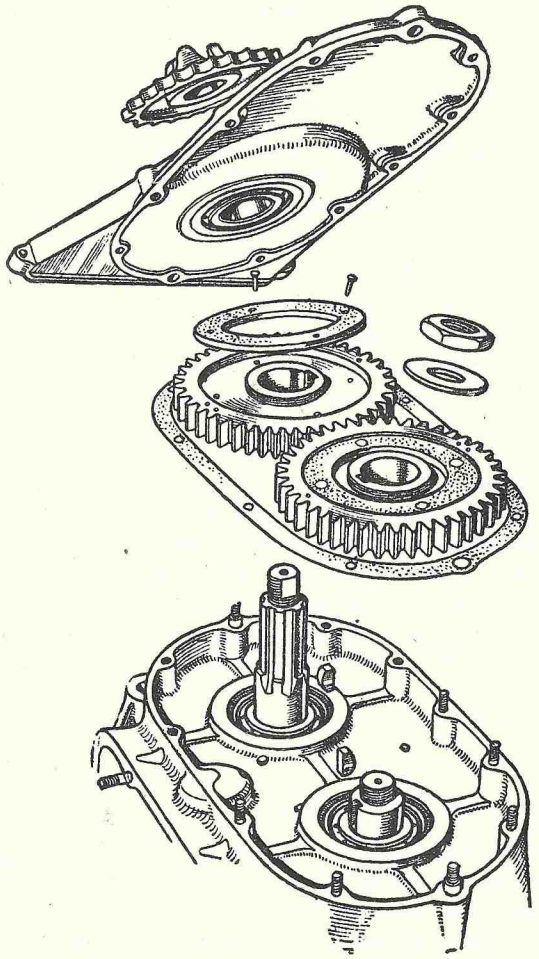
Due to wear of the driving-side crankcase roller bearing, it sometimes occurs that an excessive amount of oil enters the coupling gear housing and is subsequently forced through the outer bearing into the primary-chain case, causing leakage into the clutch housing.

Without completely dismantling the engine to renew roller bearings, a special self-adjusting oil seal can very easily be fitted between the bearing in the gear cover and the rear coupling gear. The seal can be obtained direct from the makers' Service Department, or from Ariel dealers, but it must be noted that this fitment is incorporated as standard on all 1948–59 models.

To fit, it will be necessary to remove the primary-chain cover and coupling-gear cover as illustrated in Fig. 7, and the seal is then placed over the splined driving shaft, but finally located on the extractor thread of the rear coupling gear.

Crankshaft Assembly Gears

Fix the assembly firmly on the bench and remove the crankshaft coupling-gear cover, taking care that the large roller bearing housed in same, and which has an inner race with a centre bore 0·001 in. smaller than those in the main crankcase, is marked for replacement in same order if not to be actually renewed. Remove the front crankshaft nut securing the coupling gear, and the gears are then ready for extraction. The makers can now supply a special set of crankshaft coupling-gear extractors, which also incorporate a fitment for reassembling the gears on each respective shaft. In the absence of the factory set, large screw-type extractors, of the same design as those in the tool-kit for magneto sprocket removal, can be machined up if desired. Reference to the data table



[*By courtesy of 'The Motor Cycle'.*

FIG. 7.—THE FOUR-CYLINDER CRANKSHAFT COUPLING GEARS.

The fibre discs on the gears prevent a metallic ringing noise and the gear cover forms the back plate of the primary chain case.

will give gears and shaft thread sizes. The coupling gears are a press fit on the straight shafts, which also incorporate standard-type steel keys. Note that the teeth on each coupling gear are marked with centre dots in two places for correct meshing, and either pair of such markings can be used,

providing the single marked gear meshes between the opposite two marked gears.

IMPORTANT NOTE

When refitting the gears, care should be taken to ensure the correct register of the two keys in their respective keyways, otherwise incorrect alignment will result.

Timing Gear (1948)

Removal of the timing gear entails the extraction of the oil pump, as previously described, and the withdrawal of the magneto, camshaft and crankshaft sprockets. The steel tensioner blade should be held down to reduce pressure on the chain whilst removing the three sprockets; a strong paper clip can be adapted for this purpose. The camshaft sprocket nut is left-hand thread. The mag. sprocket is a centre taper fit and the camshaft and crankshaft sprockets keyed and parallel. A steel oil-seal washer is fitted behind the rear crankshaft sprocket and front nut. Take note when reassembling to fit the camshaft sprocket with the raised centre boss inwards. Remove the Magdyno from the platform after removal of the hexagon fixing bolt underneath and the top securing strap. Lift the Magdyno to clear the base dowels and note the special joint rubber washer between the crankcase and the magneto end cover.

Timing Gear Mk. I–II (1949–56)

The timing gear layout is similar to that of the 1948 models, except the 6-volt Lucas dynamo is driven by a different type of sprocket from that previously fitted for driving the Magdyno unit. A fibre rubbing strip is not fitted inside the timing chest as on previous models, and is not necessary with the adjustable type tensioner. The crankshaft and dynamo sprockets can be removed with the aid of the small special extractor obtainable from Ariel dealers. The camshaft nut and oil-pump drive is left-hand thread, the sprocket being keyed to the same shaft and a tight push fit. No extractor is necessary for removing the camshaft sprocket, and only a very light leverage need be applied.

The oil pump and drive of the 1948 models should have a maximum clearance of 0·005 in. only between the rear face of the Dural sliding block of the oil pump and the front face of the camshaft nut. Any excess clearance at this point will cause a mechanical tapping noise to be set up whilst running; provision is made for thin packing shims to be fitted between the camshaft sprocket and the securing nut until clearance is correct. To ensure being able at any time to make a leakproof joint always keep a new oil-pump washer in reserve. The dynamo and distributor can be withdrawn as a complete unit after unscrewing the securing stud. See also "Electrical Equipment".

Timing Gear Mk. II (1957–59)

These engines are fitted with duplex timing chains and sprockets calibrated to operate the special dynamo-drive gearing, which ensures an early cut-in phase on the dyanmo charging circuit. The duplex-type sprockets are fitted by standard key practice, and for extraction purposes a bolt-type extractor tool is available at Ariel stockists. A screw-on extractor for removing the dynamo sprocket is also available.

Crankcase

After removing the screwed cap which plugs the timing-side main front bearing, the crankshaft nut and oil-seal washer can be detached. After the crankcase bolts securing the halves have been removed (including the two bridge bolts) the crankcase can be parted and the camshaft and crankshaft assembly withdrawn. The crankshaft timing-side plain bearings should be examined for wear and score marks, and if a clearance exceeding 0·004–0·005 in. is found the bearing should be replaced. To remove, gently warm up the crankcase surrounding the bearings, remove the grub screws or securing set pins and press out with a suitable mandrel or press tool. The bearing bushes, which are white-metal lined must be pressed into the interior of the half crankcase. New bushes supplied

by the makers require to be rebored after being pressed in owing to certain contraction, and a finished clearance of 0·001–0·005 in. should be allowed for crankshaft fit. Location of the oilways must be watched to ensure that the oil-feed holes are in line with the corresponding oil feed in the crankcase.

Excepting 1948 engine units, which are not fitted with securing pins or grub screw, when new bushes are fitted they will require drilling $\frac{13}{64}$ in. × $\frac{1}{8}$ in. deep to receive the pin or screw, but care must be taken not to exceed the depth of $\frac{1}{8}$ in., otherwise the white-metal lining may be pierced.

With the crankcase now dismantled, the timing-side half can be examined for any signs of a crack or fracture at the very important flange surrounding the magneto (1948) or dynamo (1949–59) sprocket hole. This flange acts as an oil-path or narrow trough, and all excess oil thrown up around the sprocket is drained away from the hole, where otherwise it would have a tendency to enter the armature housing. A broken flange should be patched by aluminium welding and cutting or filing a new groove. The coarse return or reverse thread on the back of the sprocket should just clear the hole in the crankcase, and the sprocket must be as near perfect centre as possible. Driving-side crankcase roller bearings have their outer lipped races pressed into the crankcase and held by circlips. The race housing is parallel bored. The lipped side of the race is located next to the circlip groove. Worn or pitted roller bearings should be replaced, and, when pressing in or out, slightly warm the crankcase housing to avoid scoring and subsequent slackness.

The Timing Chain (1948)

Examine the pivot ends of the steel tensioner blade and spring hooks, and if at all worn, renewal is advisable. A worn timing-chain fibre rubbing strip will create undue noise, especially at slow engine speeds. To remove the strip, the three securing rivets must be drilled countersunk and punched out. New rivets with the head well up in the fibre-strip must be firmly supported when riveting the ends into the

aluminium crank-case flange. Rapid fibre-strip wear is usually attributable to a worn timing chain or tensioner.

Camshaft Bearings

When the camshaft bush located in the drive-side crankcase requires replacement it can be withdrawn from the blind housing by warming the surrounding metal and inserting a tight-fitting reamer, which, when slowly turned and pulled, will extract the bush. The new bush must be drilled after fitting to correspond with the oil-feed hole in the housing.

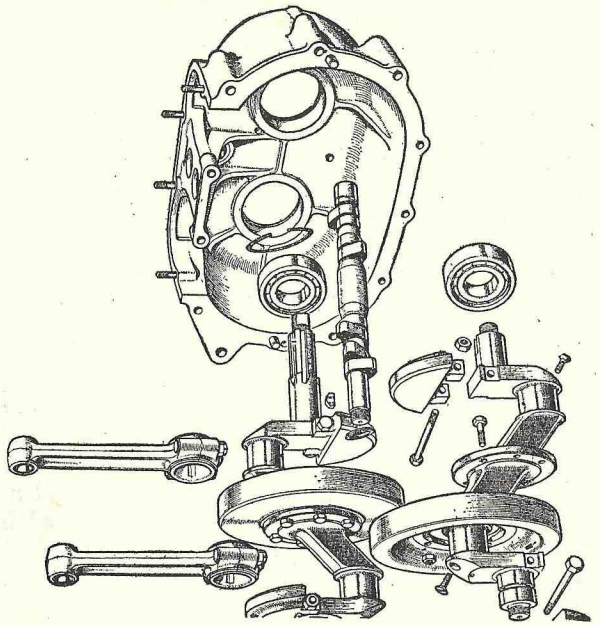
Tappets and Guides

Do not disturb these unless lengthy service and wear make it necessary to replace. Check, however, the four tappet guide blocks to ensure that these are a snug fit in the block and see that the guide-securing plates are perfectly flat and not distorted in any way. These plates should be refaced by rubbing down on a surface plate. Also check the two lock-washers, and when assembling securely tighten the securing nuts.

Connecting-rods (1948–55)

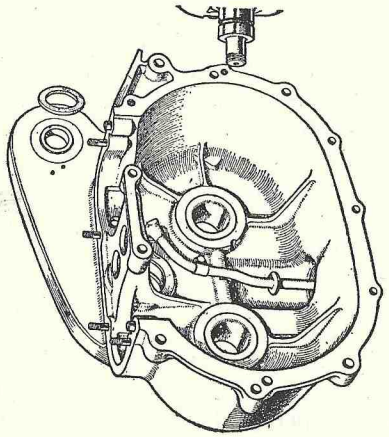
Commencing in 1948 engines were fitted with a modified type of rod incorporating a big-end bearing consisting of two separate loose-shell liners, white metalled. The liners are supplied in pairs when replacements are needed, and as they are all finished to determined standard sizes no special instructions are necessary relative to fitting, other than to ensure that location is correct when the rod is assembled to the crank journal. Each bearing should be tested for diametrical clearance due to wear, and if 0·003–0·004 in. is exceeded, new liners should be fitted. Worn journals can be reground by the makers or competent agents and under-sized bearings supplied to suit (—0·002 in.,—0·010 in.,—0·020 in.).

The original slotted-type big-end bearing securing nuts have been replaced with Simmonds Pinnacle lock-nuts which do not need cotter pins. It is permissible to use these nuts



[By courtesy of "The Motor Cycle".

FIG. 9.—THE FOUR-CYLINDER CRANKSHAFT ASSEMBLY (1948).



[By courtesy of "The Motor Cycle".

FIG. 8.—THE FOUR-CYLINDER TIMING SIDE CRANKCASE (1948).
Showing crankshaft plain bearings and oil return from sump filter.

again after removal, but for security reasons it is really advisable to replace the full set.

The connecting-rod is fitted with the Simmonds big-end nuts uppermost, and therefore it is possible to remove the nuts, bolts and bottom bearing caps with the crankcases in position in the frame of the cycle. To replace a big-end bearing (loose liners), it is only necessary to remove the cylinder-block and expose all big-end bearing nuts, etc. To prevent the nuts, bolts, etc., from dropping into the crankcase, it is advisable to place a cloth beneath each rod before dismantling. Before refitting the connecting-rods it is advisable to thoroughly clear out the crankshaft drilled oilways. Remove the screwed small plugs in each crankshaft, with a length of stiff wire scrape out all deposits of foreign matter and wash out with clean petrol. See that the big-end oil-feed hole in each crank journal is perfectly clear, and test with a $\frac{3}{32}$-in. drill.

REASSEMBLING

When reassembling the crankshafts and crankcases make quite sure that all joint faces are clean and a smear of good jointing compound applied. Do not omit to fit the oil-seal "steel thick plain" washers behind the crankshaft sprocket and the front shaft nut. When coupling gears and chain sprockets have been refitted the magneto and camshaft timing must be correctly set according to the data chart.

Valve Timing

Generally, it will be found that when the two holes on the camshaft sprocket are pointing downwards and in line with the timing mark on the crankshaft sprocket with No. 1 piston at T.D.C. correct valve timing will result.

The above method, however, cannot always be guaranteed to give an accurate 100 per cent setting, and with certain series of engine it is not possible to follow the markings at all. The makers' service mechanics always set valve timing by the

original method of inserting a fine-reading steel rule in the plug orifice of No. 1 cylinder and setting the piston at $\frac{3}{16}$ in. before T.D.C. This operation should be carried out before finally fitting the crankcase sprocket and chain.

With the piston correctly set, the camshaft should be turned by lightly positioning the sprocket until the inlet valve just commences to open. This is best determined by setting the valve-stem clearance at 0·002 in. only and sliding the rocker arm across the face of the valve end cap until "lift" is felt. After obtaining the correct setting of No. 1 inlet valve, it is then essential to offer up the small crankshaft sprocket on one of the three keyways provided and test the timing chain for easy meshing. This is a trial-and-error operation, and may entail trying all three key positions before the chain locates without "riding" sprocket teeth. When sprockets are fixed and tightened, adjust valve clearances to correct data setting, and as No. 1 cylinder timing is now correct Nos. 2, 3 and 4 will automatically follow through using an integral one-piece camshaft.

Magneto Timing (1948)

The ignition timing is set after bolting the Magdyno in position, and the most convenient cylinder to work on is No. 1 or right-hand front. Setting the piston at $\frac{5}{16}$ in. (1000-c.c.) before T.D.C. of the compression stroke with both valves closed will be correct with the control in the fully advanced position and the breaker points just opening.

At this setting the magneto sprocket, with the chain already in position over same, as well as over the camshaft and crank sprockets, should be tapped on with a box or tube spanner placed over the spindle. Finally, check the timing and tighten the armature nut.

Timing the Distributor (1948 Magdynamo)

This is best carried out by checking on No. 1 cylinder as for the magneto timings the setting of $\frac{5}{16}$ in. B.T.D.C. is the same for setting the rotor arm. The timing-indicator line on the rotor segment or blade should correspond with the line on the

aluminium base-plate of the distributor cover when all backlash has been taken up by turning the rotor by hand anti-clockwise. To alter the position of the rotor, this should be gently pulled off the steel adaptor carrying it, and the small centre fixing screw removed. The adaptor can then be prised upwards and reset in the desired position. The distributor spiral gears are driven by the dynamo gear by way of a separate detachable driving-dog.

If the dynamo is removed for cleaning or adjustment, take care not to turn the engine, otherwise the magneto rotor timing will be altered. To remove the vertical spiral distributor gear it is necessary first to unscrew the complete greaser, as the threaded shank of this acts as a safe location for the gear. Check the distributor cover for cranks or "tracking" (H.T. short-circuit) and, when the engine and oil tank are refitted into the frame, take care to ensure that the main H.T. cable from pick-up to distributor is not pinched between the tank, or H.T. leakage will occur at this point if ordinary rubber cable is used.

Timing the Distributor (1949–59) Coil Ignition

The timing is set with the contact breaker points just separating when the piston is at Top Dead Centre and the automatic advance and retard control is in the retarded position. Internal springs automatically hold the cam spindle in this position when the engine is stationary. If it is necessary to make any slight adjustment to the timing, it can be done by rotating the complete distributor head. Firstly loosen the securing clip bolt and rotate the head in a clockwise direction, that is, with the arrow marking, to retard, and in an anti-clockwise direction, or against the arrow to advance. Make a pencil mark on the outside of the distributor head, rotate in the required direction approx. $\frac{1}{8}$ in. and test.

Refitting the Engine to the Frame

No special instructions are necessary for refitting the engine and gearbox into the frame, except always loosely assemble the rear engine plates and gearbox in position first, finally

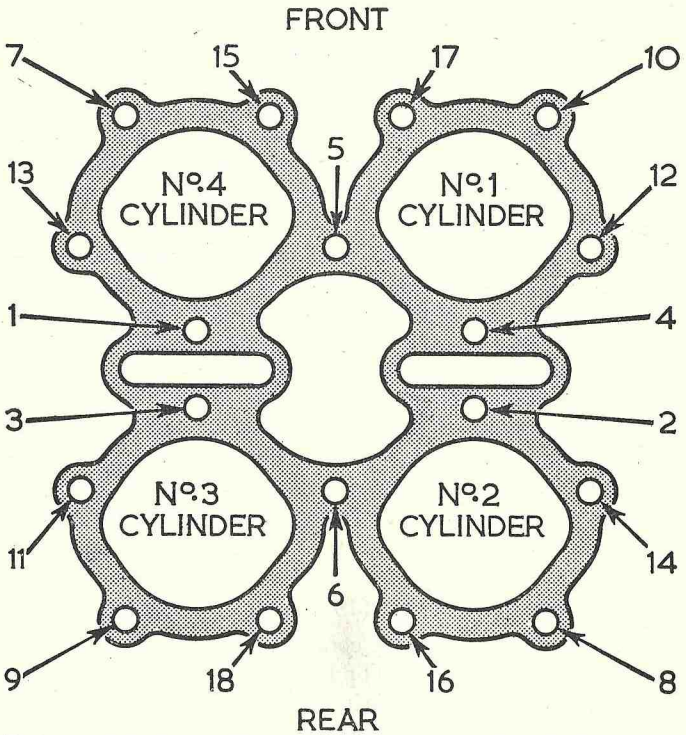


FIG. 10.—SEQUENCE OF TIGHTENING FOR 1000-C.C. MK. II CYLINDER-HEAD.
Also note the cylinder numbering arrangement.

positioning the front plates and tightening very securely all fixing bolts and nuts.

Note the order of firing is Nos. 1 2, 3 and 4 (see Fig. 10).

After running the engine for a short period with the rocker cover removed, check the oil pipe-line to rocker box to ensure that it is clear and oil is flowing through the hollow rocker spindles. In wet weather water is liable to flow on to the distributor cover and cause a short-circuit in the system, with subsequent misfiring. A suitable cover for the distributor can be made up with a piece of oiled silk or similar material and extended over the H.T. leads under the petrol tank. Good-

quality waterproofed and heavily insulated cables can be substituted for the soft rubber type supplied by the makers, with very lasting benefits.

Engine Over-oiling

Oiling-up on a Model 4G Mk. I may be due to excessive oil pressure in the rocker boxes, and modification can be carried out to rectify this by grinding a chamfer on each side of the top webs of the rockers (see Fig. 11). The idea is to prevent surplus oil from running straight down the rockers and on to the valve stems and guides and thence into the combustion chambers. By introducing the chamfer webs oil is diverted in the opposite direction and on to each push-rod, and then drained into the crankcase sump by way of the push-rod channels.

A modification to prevent over-oiling on a 1953–54 Mk. II is illustrated in Fig. 12. The sleeve is fitted, with the flange at the top, inside the inner valve spring to shroud the valve guide from the oil mist within the rocker box. This device, together with the redesigned valve guide, is completely effective in preventing too much lubricant running down between the valve and the valve guide. Parts are available to enable owners to carry out this modification.

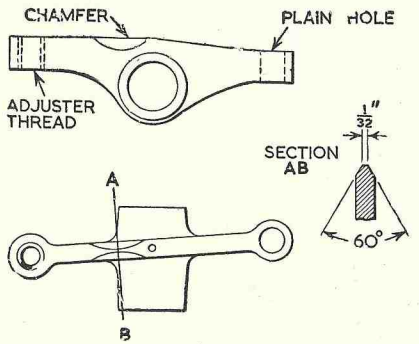


FIG. 11.—MODIFICATION TO 4G ROCKER.

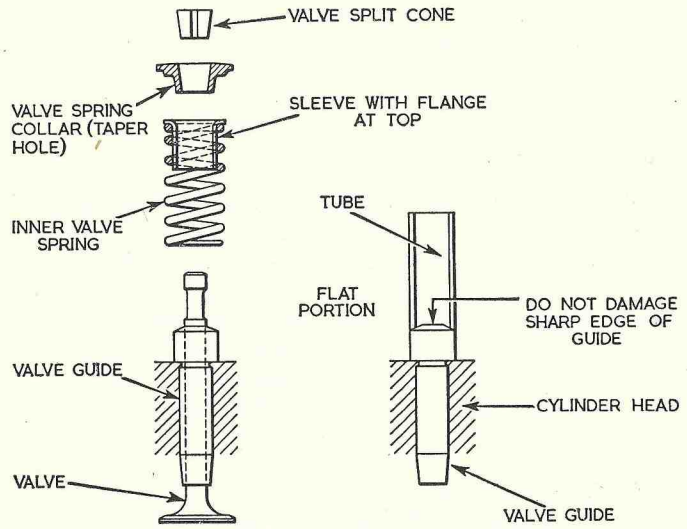


FIG. 12.—MODIFICATION TO 1000-C.C. MK. II VALVE GUIDE.
The shroud prevents excess oil from running down the guide.

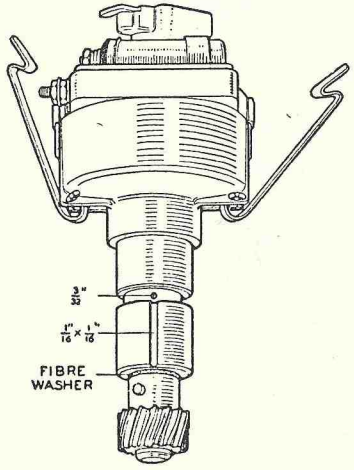


FIG. 13.—MODIFICATION TO 4G DISTRIBUTOR SHAFT.

Distributor Drain Slot

On some Models 4G Mk. I produced before July 1952 the contact points have occasionally become fouled by engine oil. If this trouble is experienced, the following remedy (Fig. 13) is recommended. Remove the contact-breaker base-plate and the driving dog and withdraw the distributor shaft and the action plate. Cut a groove $\frac{1}{16}$ in. wide × $\frac{1}{16}$ in. deep in the lower portion of the distributor shaft, underneath the condenser housing. Drill a $\frac{3}{32}$-in. hole through the shank at the bottom of the groove and at 90° to it. Remove all the swarf from the distributor body and the shank and reassemble the distributor. Ensure that the fibre washer is replaced and that the driving dog is securely locked to the shaft.

DATA TABLE
1948–59 1000-c.c. MODEL 4G

	Bore mm.	Stroke mm.	Capacity, c.c.	B.H.P.	Peak Revs.	Compression Ratio
Engine:						
4G 1948	65	75	997	36	58·00	5·8–1
4G Mk. I 1949–53	65	75	997	34·5	54·00	6·0–1
4G Mk. II 1953–59	65	75	997	40	56·00	6·7–1

Valve Timing:	
Inlet Valve Opens (B.T.D.C.)	$\frac{3}{16}$ in. or 25°.
Inlet Valve Closes (A.B.D.C.)	$\frac{1}{2}$ in. or 55°.
Exhaust Valve Opens (B.B.D.C.)	$\frac{11}{32}$ in. or 60°.
Exhaust Valve Closes (A.T.D.C.)	$\frac{1}{8}$ in. or 20°.
Ignition Timing:	
1937–48 4G	$\frac{5}{16}$ in. B.T.D.C. (adv.)
1949–59 4G	T.D.C. (ret.)
Valve Clearances: (With engine cold)	
Inlet Valve	0·006 in. — 1948 4G
Exhaust Valve	0·008 in. — 1948 4G
Inlet Valve	0·001 in. — 1949–53 4G Mk. I
Exhaust Valve	0·001 in. — 1949–53 4G Mk. I
Inlet Valve	0·006 in. — 1953–59 4G Mk. II
Exhaust Valve	0·008 in. — 1953–59 4G Mk. II

Piston-ring Gap:

1948	0·010–0·012 in.
1949–59	
Compression Rings	0·012–0·017 in.
Oil-control Rings	0·015–0·020 in.

Piston Clearance in Cylinder-bore:

Ring Land	1000-c.c. 1948	0·016–0·019 in.
	1000-c.c. 1949–59	0·020–0·023 in.
Below Rings	1000-c.c. 1948	0·004–0·006 in.
	1000-c.c. 1949–59	0·003–0·005 in.
Extreme Skirt	1000-c.c. 1948	0·002–0·004 in.
	1000-c.c. 1949–59	0·001–0·003 in.

Oil Pressure (Adjustable): approx. 40 lb./sq. in.
(Non-adjustable, 1949–59): 23–35 lb./sq. in.

Cylinder-bore 1000-c.c. 2·560 in.

Valve Head and Seating:
Angle 45°

Gudgeon-pin:
Diameter 0·6865 in. / 0·6862 in. (or $\frac{11}{16}$ in.—0·002 in.)

Small-end Bush:
Ream after fitting to 0·6868 in. / 0·6863 in. (or $\frac{11}{16}$ in. —0·001 in.)

Valve Stem:
(Clearance in guide (1948)):

Inlet	0·002 in.
Exhaust	0·003 in.

Valve Stems (1949–59):

Inlet, Diameter	0·311–0·312 in.
Exhaust, Diameter	0·309–0·310 in.

Valve Guides (1949–59):
Bore 0·313–0·314 in.

Rocker Arm:
Internal Bore 0·4995–0·5005 in.

Rocker Spindle:
Diameter 0·498–0·499 in.

Crankpin:
Diameter 1·3745–1·375 in.

Crankshaft, Plain Bearing End:
Diameter 1·2495–1·250 in.

Crankshaft Plain Bearing (White Metal):
Honed after fitting to 1·2515–1·252 in.

Camshaft Bush in Crankcase:
Ream after fitting to 0·874–0·875 in.

Camshaft (Bush End):
Diameter 0·8735–0·873 in.

Crankshaft Threads:

Thread for coupling gear extractor	$1\frac{3}{4}$ in. × 20 T.P.I.
Nut securing shock absorber	$\frac{11}{16}$ in. × 20 T.P.I.
Nut securing front coupling gear	$\frac{3}{4}$ in. × 20 T.P.I.
Nuts securing R.H. crankshafts	$\frac{3}{4}$ in. × 20 T.P.I.

Camshaft Nut $\frac{3}{4}$ in. × 20 T.P.I. left hand

Crankpin Oil-hole $\frac{1}{32}$ in.

Camshaft Ball Bearing:
Size $\frac{3}{4}$ in. × $1\frac{7}{8}$ in. × $\frac{9}{16}$ in.

Crankshaft Roller Bearing in Crankcase:
Two-lipped Type 1·125 in. × $2\frac{1}{2}$ in. × $\frac{5}{8}$ in. (2 off)

Crankshaft Roller Bearing in Gear Cover:
One-lipped Type 1·124 in. × $2\frac{1}{2}$ in. × $\frac{5}{8}$ in.

Contact-breaker Gap

Magneto	0·012 in.
Coil	0·014–0·016 in.

Sparking-Plug Gap

Magneto	0·015–0·018 in.
Coil	0·025 in.

Timing Chain (1948–56)	Endless $\frac{5}{8}$ in. × 67 pitches.
(1957–59)	Duplex 8mm. × 80 pitches.
Magdynamo (1937–48)	Lucas Type MNIE. 180°.
Distributor (1949–59)	Lucas Type DKX4A.
Carburetter	Solex 26 AH. (1948–53). S.U. MC. 2 (1954–59)
Gear Ratios	Refer to Chapter VI.

CHAPTER II

500 and 650-c.c. TWIN-CYLINDER ENGINES

THE 500-c.c. Models KG and KH were introduced for the 1948 season; basically similar, they differed in that the KH featured high-compression pistons, a polished cylinder-head and a slightly different carburetter. The two models were continued almost unchanged until 1953, when a newcomer, the all alloy KHA, was introduced, and the KG was dropped from the range. For 1954, one 500-c.c. twin-cylinder model only was offered; this was the KH with an alloy head and cast-iron barrel, since continued for the 1955–57 season.

For 1954, a new 650-c.c. twin-cylinder model was added to the Ariel range; this also was continued, with slight modifications, for 1955–59.

Construction—500-c.c. Engines

The 63 mm. bore × 80 mm. stroke vertical twin-cylinder engines utilise a one-piece forged-steel crankshaft carrying a bolted-on cast-iron flywheel and mounted on a roller bearing at the drive side and a white-metal-lined phosphor-bronze bearing at the timing side. The light-alloy connecting-rods, containing loose shell bearings at the split big-ends and bushed at the small-ends, are polished all over.

Two separate camshafts are employed, each serving a dual purpose by operating the respective inlet and exhaust tappets and also carrying the timing-chain sprockets with magneto- and dynamo-driven gears. The front or exhaust camshaft carries a chain sprocket to which is attached the dynamo-driving gear. On all 1948–50 and early series 1951 engines the dynamo-driving gear was manufactured from a special fabric material and attached to the chain sprocket by a "slipping-clutch" friction-drive arrangement. On the same series of engines the rear or inlet camshaft carried a chain sprocket, to

which was riveted another fabric gear for meshing with and driving the gear of the magneto. Attached to this gear is the automatic advance and retard mechanism. During 1951 the makers discarded fabric material for timing gears and introduced a "Millenite" iron gear for each camshaft. These soft-iron gears can be fitted to any existing twin-cylinder engine by direct riveting to the chain sprockets, but the "slipping-clutch" assembly must be entirely omitted. Special note must be made that the gears are not interchangeable, the front dynamo fibre or "Millenite" gear having 57 teeth, and the rear magneto 59 teeth.

Flat-base tappets operate in guides pressed into the cylinder-block and operate the overhead valves through short push-rods.

A worm machined on the inlet camshaft engages a skew gear at the top of a vertical shaft that drives the gear-type oil pump, situated in the crankcase sump.

Construction—650-c.c. Engine

This engine differs from the 500-c.c. models in having one camshaft only, that being gear driven; a worm gear integral with the crankshaft timing pinion operates a gear-type oil pump housed within the timing case. A chain connects a sprocket on the idler pinion with the dynamo sprocket.

Lubrication—All Twin-cylinder Models

Oil reaches the delivery side of the pump by gravity feed from a separate oil tank, and is then forced along internal oil-ways to the timing-side bearing in the crankcase. From this bearing, the oil, under pump pressure, enters the hollow crank-shaft and feeds the big-end bearings by way of suitably drilled holes in the two crank journals.

Oil pressure is kept constant on the 500-c.c. engines by a non-adjustable relief valve fitted into the end of the crankshaft on the timing side and designed to show a pressure on the gauge of approximately 25 lb./sq. in. with normal running. Oil pressure in the 650-c.c. engine is controlled at 50–60 lb./sq. in. by a release valve in the timing-side crankcase half.

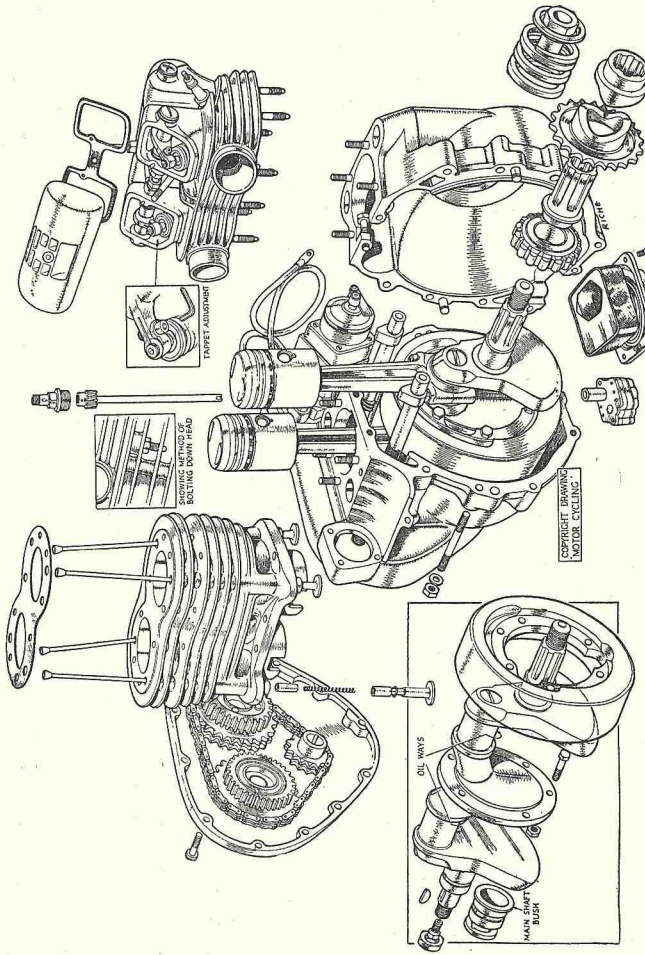


FIG. 14.—EXPLODED VIEW OF 500-C.C. TWIN-CYLINDER MODEL. ["*Motor Cycling*" *Copyright drawing.*

An external oil pipe-line is taken to the cylinder-head and rocker-box assembly and fed to the rocker spindles; the 500-c.c. engines are lubricated from the feed pump, whilst the 650-c.c. engine rocker feed is tapped from the scavange-pump return. From the cylinder-head the oil drops down inside the

push-rod channels—cast in with the cylinder-block—and into the main crankcase, thus thoroughly lubricating all tappets and camshafts. The 650-c.c. engine camshaft and tappets are further lubricated by a trough fed by the timing-case drain, and into which the cams dip. The amount of oil release into the crankcase is sufficient for the crankshaft and flywheel to throw upwards for splash lubrication of both pistons.

Two large-diameter holes in the timing-side crankcase also allow oil to be blown into the timing-gear case for lubricating the gears. A drain hole is provided in the timing-side half-case through which excess oil is passed back into the main-case sump, filter and return side of the pump to be subsequently returned to the oil tank.

Excess crankcase pressure in the 500-c.c. engines is released as oil mist via a light, spring-loaded, ball-valve breather situated immediately above the oil-pump driving spindle and to which is attached a union and copper pipe leading to the rear driving chain for slight extra lubrication purposes.

The 650-c.c. engine has a timed breather incorporated in the camshaft gear; the pressure is released, with its attendant oil mist, on to the rear chain.

MAINTENANCE

Maintenance adjustments apply chiefly to valve or rocker clearances, magneto, carburetter and the lubrication system.

Check the tappets every 500–600 miles, and drain and cleanse the oil tank, crankcase sump and filter every 1000 miles; 1500 miles is permissible between 650-c.c. engine-oil changes.

Lubrication System

The oil pump should not be removed unnecessarily during maintenance procedure, and providing the system is kept clean the pump should not fail to operate. A high oil-gauge reading may be recorded when the engine is cold, but this merely indicates that all is well, and that full delivery is taking place. If the oil-tank filler cap is removed whilst the engine is running, the action of the return side of the pump can be checked by observing the flow of oil into the tank.

Defects—500-c.c. Engine

Should the oil gauge, if fitted, not register, carefully check the following points: Make certain that the supply tank and the filter beneath the filler cap are clean and the oil level in the tank is correct. Check for leakage all oil-pipe connections to gauge and cylinder-head. Check the delivery and return pipe-line from the oil tank to crankcase, and ensure that no air leakage is present on the supply side. Test the oil-gauge pipe for clearance internally by inserting a length of fine wire.

If all is well with pipe-lines, etc., and engine running pressure is low or nil but oil is actually returning to the tank, then it might be assumed that there is an internal pressure leakage by way of the relief valve in the end of the crankcase. Check the valve by first removing the timing-gear cover, and then unscrew the valve body complete from the end of the shaft (see Fig. 14). Take out the split cotter pin, spring and steel ball from the valve body and cleanse in clean petrol and ensure that the steel ball makes good contact in the seating. If the original appears distorted or weakened fit a new spring and reassemble, but, before refitting the complete valve to the crankshaft, clean out from the hollow oil-way any residue of foreign matter which may have accumulated. If, after a re-test, no pressure is recorded, the pump can be removed for examination by taking off the crankcase sump plate, gauze filter and spring, and then removing the four securing screws and gently pulling the oil pump out of the crankcase housing.

Dismantle the pump, if it appears to be tight or locked, by unscrewing the pins securing the body sections and pulling them apart to expose the internal gear pinions. Check the condition of the pinions and spindle and wash thoroughly in petrol. Reassemble and ensure that the pump can be rotated freely by hand.

When fitting the pump back into the crankcase make sure to engage correctly the tongue and slot of the long driving shaft and short pump spindle before finally tightening the four securing screws. Prime the pump well with clean oil before fitting the bottom plate and testing.

Over-oiling

The 1956 model KH 500-c.c. Twin-Cylinder oil feed was excessive and caused considerable over-oiling in the cylinder-head. A conversion set consisting of a special oil-pipe assembly from the pressure side can be obtained from service agents, and together with the hollow stud fitted in the base of the crankcase, the correct flow of oil can be regulated.

Fitted in the hollow stud is a short piece of wire specially calibrated to allow just sufficient oil to pass at pressure into the feed pipe to rocker boxes.

Note that the oil-pipe union is secured with a dome nut, and if this is removed, take care not to lose the length of wire rod, otherwise excessive oil under pressure can pass to the top assembly. Note also that the oil gauge was omitted from the tank on all KH 1956 models.

Defects—650-c.c. Engine

Examine the oil lever in the tank. Examine oil-pipe connections from the tank to engine at four points for leakage. On the supply or delivery side (the front pipe) it may be drawing in air. Remove the pressure-control valve, which is located in the hexagon plug in front of the lower portion of the timing case. Thoroughly clean and ensure that the valve is free to operate, and is not obstructed in any way by the presence of small particles of foreign matter. If the return flow of oil to the tank should cease the cause might be traced to the failure of the anti-syphon ball valve in the crankcase sump. To correct this, remove the cover plate, and the ball valve will be seen located in the return oil pipe from the sump; insert a stiff piece of wire into the valve orifice, thus lifting the ball off its seating to free it.

The oil pump should be regarded as a complete assembly and not needlessly dismantled. The pump will rarely require any attention providing the lubrication system is kept clean. Therefore, only in the event of a total failure of the whole lubrication system or when the annual overhaul takes place should the pump be dismantled for examination and cleaning.

Tappet Adjustment—500-c.c. Engine

The four tappets (1948–49) are spring loaded (see Fig. 14) and adjustment of the recommended 0·002 in. clearance for the inlet and exhaust is carried out with the engine cold and valves closed. The 1950–56 models are fitted with integral tappets, which are not spring loaded. A modification to the cam form was introduced to early 1952 engines, and necessitated a revision of valve-tappet clearances. All engines commencing at and from the Serial Number TE 1258 and any other bearing the letter "C" after the engine number are fitted with modified camshafts, to which the following tappet-clearance instructions (engine cold) apply: inlet-valve clearance 0·005 in.; exhaust-valve clearance 0·008 in. When setting the inlet clearance, one inlet valve must be fully open whilst the other inlet-valve tappet is being adjusted to 0·005 in. When setting the exhaust-valve clearance one exhaust valve must be fully open whilst the other exhaust-valve tappet is being adjusted to 0·008 in. These clearances apply also to 1953–56 models.

To test for clearance each rocker arm should be lifted away from the valve stem by putting pressure on the spring tappet. With a rocker arm held thus a feeler gauge should be inserted and the clearance noted.

The 1948–50 and early series of 1951 models are fitted with rocker arms incorporating clamp pins to secure the rocker-adjusting screws, and the makers provided a small socket key in the kit for loosening the clamp and also for adjusting the rocker screw. Late 1951 and all 1952–56 models are fitted with rocker adjusters and ordinary lock-nuts, both operated by a small special flat spanner from the kit. After adjusting and finally checking the clearances, either the clamp screws or the lock-nuts should be very carefully tightened.

Tappet Adjustment—650-c.c. Engine

Valve clearances and adjustments should always be carried out when the engine is cold. The correct clearances for all inlet and exhaust valves should be 0·010 in. The rocker or tappet adjustment screws have squared ends for adjustment purposes, and a suitable spanner is provided in the tool-kit.

The screws are secured by lock-nuts. Always ensure that the lock-nuts are securely tightened. Valve end caps are not fitted, all valve stems being specially treated to prevent wear.

When adjusting tappet clearances it is essential to adopt the following procedure. Rotate the engine until one inlet valve is fully open and then adjust and check the clearance of the other inlet valve, which should now be fully closed with a clearance of 0·010 in. Use the 0·010 in. feeler gauge for accuracy when checking. Adopt similar action for adjustment of the opposite inlet valve by rotating the engine again until the valve which has been adjusted is wide open. Repeat exactly the same procedure for adjustment of the two exhaust valves.

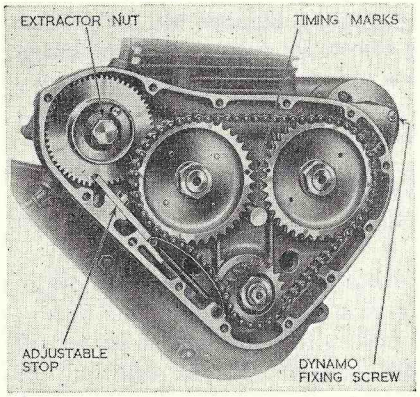


FIG. 15.—500-C.C. TWIN TIMING GEAR, SHOWING ADJUSTABLE STOP PLATE.

Timing-chain Tensioner—500-c.c. Twins

The timing gear and chain cover should be removed occasionally and the chain tensioner examined for clearance. There will be seen in position an adjustable stop plate (Fig. 15) with which the spring blade contacts with a buffer action. Wear or stretch of the timing chain will make adjustment of the stop plate necessary, and with the engine stationary and the chain in the tightest position—ascertained by rocking the timing gear slightly—the stop plate should be set to allow 0·010 in. clearance only between the plate end and the contacting end of the blade. To ensure quiet action of the timing

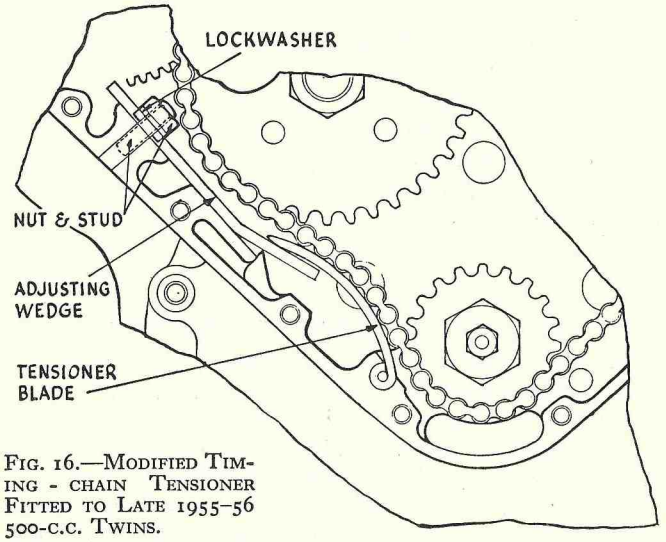


FIG. 16.—MODIFIED TIMING - CHAIN TENSIONER FITTED TO LATE 1955–56 500-C.C. TWINS.

gear do not allow excess clearance ever to set up, otherwise a loud metallic knock very similar to that caused by a badly adjusted tappet will occur, or it can even be mistaken for "piston slap".

A modified chain tensioner (Fig. 16) was introduced in June 1955, and may be fitted to any previous 500-c.c. twin. It consists of a hardened steel tensioner blade that is raised or lowered by an adjustable wedge secured by a nut and lock-washer to a stud in the timing case. Chain tension is increased by sliding the wedge upwards, and decreased by sliding it downwards. The chain should have approximately $\frac{1}{8}$ in. lift between the crankshaft sprocket and the exhaust-camshaft sprocket. To facilitate the insertion of the new tensioner into older models, tensioner blades supplied as modification sets are slotted to obviate the necessity to dismantle the timing gear.

DECARBONISATION

Whilst "running-in" a new or reconditioned engine, during which period excessive carbon and burnt-oil deposits are built

up within the cylinder-head combustion chambers, the head should be removed for cleaning and examination at approximately 2000–3000 miles.

With normal running after this first decarbonisation a further mileage of 8000–10,000 can be covered before dismantling the cylinder-head again. The twin-cylinder engines are very prone to "pinking" if allowed to carbonise, and the above mileage should not be exceeded during the periods.

Removing the Cylinder-head—500-c.c. Engine

Take off or raise and prop up the petrol tank for ease of operation after disconnecting the centre oil-gauge pipe.

Next remove the petrol pipe, or pipes on 1950–52 models, the oil pipe from crankcase to centre union on cylinder-head, then the carburetter, exhaust pipes and rocker-box covers.

Do not disturb the four-way oil-pipe assembly to the rocker spindles. Note on the 1948–52 models where the eight cylinder-head fixing nuts are located in between the second and third cylinder-block fins, and with a thin open-end set spanner release the nuts by five or six turns. Have in readiness two thin spanners for packing between the head and the top face of the cylinder-block when the head has been lifted sufficiently to allow the eight fixing studs to almost clear the second fin of the block. The nuts can then be finally released and allowed to settle between the fins. On 1953–56 models the cylinder block and head securing bolts are of the extended type located at the lower end in steel thimbles in the crankcase and screwing into bronze inserts in the cylinder head. Each securing bolt incorporates two hexagons brazed together out of relation thus allowing twelve spanner positions per revolution. This method of fixing and operating enables the tightening down of the head and block to be carried out without difficulty. Whilst the cylinder-head is being lifted, hold the four push-rods in position in their respective rockers until they are clear of the block, when the complete head can be withdrawn sideways. Withdraw the push-rods and mark them for identification purposes when reassembling.

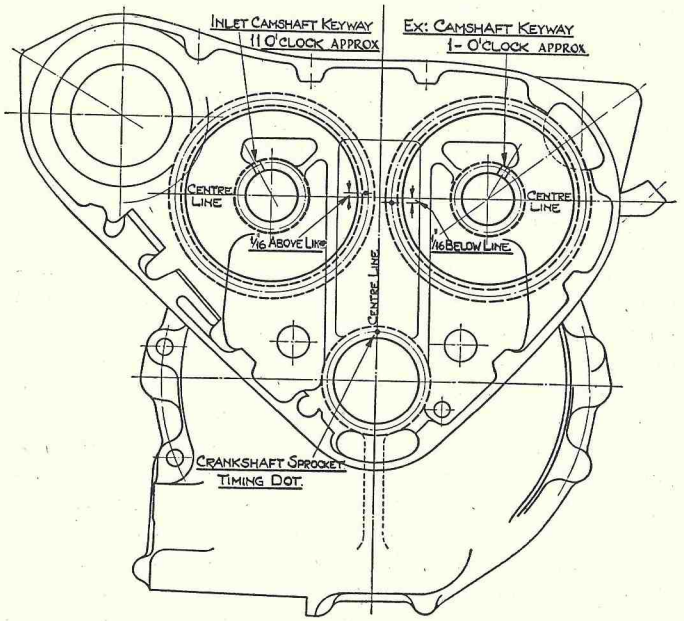


Fig. 17.—Valve-timing Marks on 500-c.c. Twins.

Removing the Cylinder-head—650-c.c. Engine

Raise the petrol tank, remove exhaust pipes, carburetter, petrol pipe, rocker covers, sparking-plugs and oil-pipe assembly from crankcase to rocker box. Remove the engine steady stays from the rocker-box end only. Releasing the stay fixing from the frame end will allow the stays to be pivoted away from the engine. Remove the four rocker-box securing bolts and the four nuts from the studs under the rocker box and finally the nut from the stud inside the rear cover aperture. Note that special "Shakeproof" washers are fitted under the outside bolt heads as well as under the four stud nuts. The rocker box can now be lifted off complete. The push-rods can now be lifted clear. Refer to Fig. 18 for the order of fitting, tightening and removing the head bolts.

Grinding the Valves

An O.H.V. valve-spring compressor, which can be purchased from any good-class accessory dealer, is essential for removing the four valves, which are secured with split cones. Mark all valves and fittings and replace them in the same order. Decarbonisation of the cylinder-head is carried out in the usual way by scraping or wire brushing, and grinding the valves into their respective seatings with a good-quality compound.

The four overhead rockers need not be removed from 500-c.c. engines for decarbonisation purposes, and they can be held away from the valve-stem ends in order to allow clearance for the forked or cup end of the compressor tool. Note that the separate hardened valve-stem end caps are not used on the twin-cylinder models; all stems being scientifically treated to withstand hard wear and tear. Do not attempt to replace the valves into the head until it is certain that all seatings are in perfect order and all trace of carbon has been removed and the combustion chambers and ports thoroughly washed. Have in readiness a replacement cylinder-head joint washer or gasket, because after one being disturbed it is sometimes difficult to obtain a good oil- and gas-tight joint by using an already compressed or distorted gasket. Both pistons can be brought to T.D.C. by a turn of the engine, and all carbon should be removed from the crowns by scraping. It is not necessary to remove the cylinder-block for a common decarbonisation, but if it is thought desirable to examine the pistons and rings, reference should be made to "Dismantling Complete Engine".

Refitting the Cylinder-head—500-c.c. Engine

After preparing the complete head for reassembly, and having ascertained that the head and block faces are perfectly clean, the new gasket should be placed in position, but without the use of jointing compound.

Note the exact position of the eight head nuts placed between the fins of the block, and observe that each head stud has a radius at the end to assist engagement with the corresponding nuts. Place the push-rods in position in the head, making quite sure that they can be located easily with the rocker arms, and lift the head into position and at the same time enter the

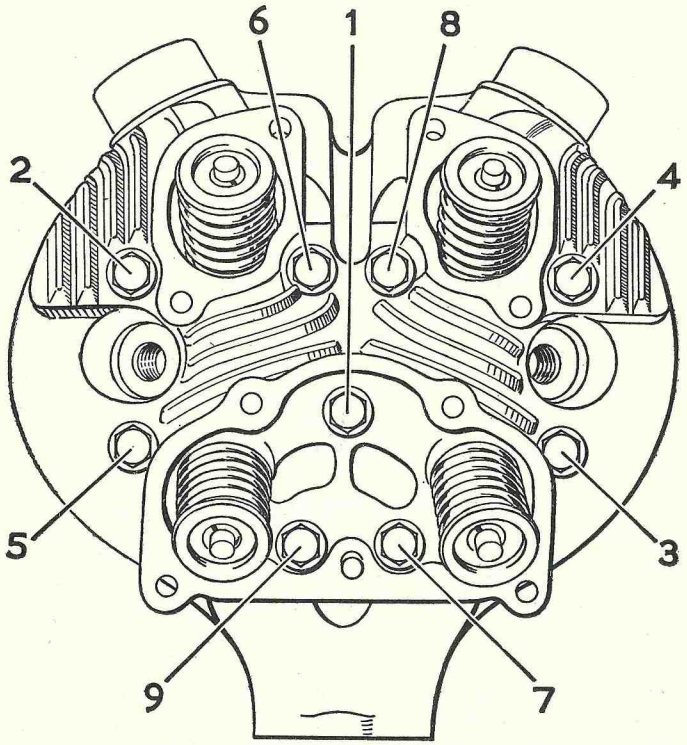


FIG. 18.—SEQUENCE OF TIGHTENING THE 650-C.C. TWIN-CYLINDER MODEL FH CYLINDER-HEAD.
The head should be released in the reverse order.

lower ends of the push-rods into their respective channels in the block. Replace the thin spanners or other suitable packing pieces on the cylinder-block face and lower the head to rest on them whilst engagement of the fixing studs and nuts is carried out. After turning the nuts two or three times on to the studs, remove the packings and tighten up equally.

Refitting the Cylinder-head—650-c.c. Engine

Position the cylinder-head gasket on the cylinder-block, and replace the cylinder-head. Tighten the head bolts, refer to Fig. 18 for the order of tightening down. Place the push-rods

into position and refit the rocker box. Reconnect the engine-steady stays and the oil pipe to the rocker box. Refit the sparking-plugs, exhaust pipes, carburetter, petrol pipe and petrol tank.

Final Adjustments

After each decarbonisation it is advisable before refitting the carburetter to dismantle it completely and wash out the jets and passages and examine and replace, if necessary, the two flange washers which are to be positioned one each side of the induction distance piece. Set the tappet clearances. Run the engine for a short period to warm it up, then again check and tighten the head-fixing nuts, and after the initial run on the road make a further check and again tighten if possible. Repeat the tightening process several times during the next 1000 miles until the new head gasket has been well "bedded down". Tappet adjustment should also be checked often.

DISMANTLING COMPLETE ENGINE

No hard-and-fast ruling can be given regarding the exact mileage to be covered before a complete engine overhaul is necessary. So much depends upon the type of service to which the machine has been subjected, but generally speaking, if run under normal conditions a well-maintained engine unit should not require a full overhaul at less than 20,000 miles.

To remove the engine from the frame it is not essential to take off the petrol tank unless it is desired to do so for ease of operation. After removing the exhaust pipes, carburetter, battery, oil tank and pipes, etc., the complete clutch, primary chaincase and engine shock absorber should be entirely dismantled. Refer to Chapter VI for instructions relative to dismantling the clutch. When the outer half of the chaincase is removed the engine-shaft shock absorber is exposed, and it will be noticed that this assembly is held in position by a locking sleeve nut.

The order of assembling should be observed at the time of dismantling, and is as follows:

(1) splined driving sleeve with crankcase oil seal next to roller bearing; (2) engine driving sprocket; (3) sliding member; (4) spring; (5) spring-retaining plate

(6) hardened washer
(7) sleeve locking nut } 500-c.c. engine;
(6) locking ring nut
(7) split cotter } 650-c.c. engine

After the chaincase, etc., has been taken away, remove all the engine-plate tie bolts, first taking the precaution to support the engine by placing a suitable packing block or box under the crankcase. The engine, now having been lifted clear, should be held securely in a bench vice or otherwise supported ready for removing the cylinder-head and cylinder-block. Dismantling the head has already been dealt with under "Decarbonisation".

Removing the Cylinder-block

Rotate the engine by turning the pistons to bottom dead centre, and then take off all cylinder-base securing nuts. As the 500-c.c. cylinder-block is reversible, take care to mark "Front" or "Rear" before removing. When lifting the block from the crankcase, be careful to see that the spring-loaded tappets, if fitted, do not foul the crankcase housings in which they operate, and also see that the pistons come away from their respective bores quite freely.

Removing the Tappets—500-c.c. Engine

If tappet wear is suspected, pull each one out of the cylinder-block and mark for reference when refitting. Each tappet stem, on 1948–49 models only, consists of two separate parts with a coil spring between, and is positioned in the channel of the block by a small circlip. Examine each circular tappet "foot" for wear and check stems and guides (see "Technical Data").

Removing the Tappets—650-c.c. Engine

The tappet assembly does not normally require attention, but if it is desired to dismantle and examine for any reason, proceed as follows: Remove the two outside set-screws and take out the two inlet tappets. Next remove the centre set-screw, taking note of the $\frac{3}{16}$-in.-diameter steel ball beneath it,

push out the grooved-tappet-retaining pin from the inside of the barrel and remove the exhaust tappets. The inlet and exhaust tappets are not interchangeable.

Servicing Cylinder-bore and Pistons

Carefully examine both cylinder-bores for wear or score markings. If piston "slap" has been suspected and the bores can be gauged to show wear, especially at the top of the stroke, exceeding 0·008 in., then a rebore is advisable. In any case, the practice of fitting a new piston to a worn bore is not recommended, and if the pistons show any signs of wear at a 20,000-mile overhaul, then the bore should be reground to 0·020 in. oversize and suitable pistons, complete with rings and pins, fitted.

Refer to "Technical Data" for piston clearances and ring gaps. The makers' recommendation for a maximum oversize is 0·040 in., but they undertake a standard of 0·020 in. only and supply pistons to suit. Gudgeon-pin circlips can be removed with a sharp-pointed scriber-type tool, and when once taken out should always be discarded and new, correctly-tensioned circlips fitted. Gudgeon-pin and small-end-bush clearances should not exceed 0·003 in.; the data chart gives correct sizes for checking purposes. Small-end bushes are a tight fit in the connecting-rods, but can be withdrawn by using a light press or an extractor made up from a draw bolt, nut and an old bush of lesser diameter. New bushes can be pressed or drawn in by the same method reversed and can then be reamed to size—always after fitting.

The pistons are removed, after heating, by supporting each one in turn on one side and then driving out the gudgeon-pin from the opposite side with a suitable short-length drift or punch, or an old gudgeon-pin ground to a smaller diameter. These should appear bright and present a uniform bearing surface where they rub on the cylinder-bore. Dark or burnt marks, particularly near the ends of the rings, indicate that gas is blowing past, causing loss of compression, and that the rings should be replaced. To check the piston-ring gaps insert each piston into its bore without rings and then place each ring independently in the cylinder-bore hard up against

the lower end or skirt of the piston. Measure the gaps with a feeler gauge. Rings should be perfectly free in the grooves with approximately 0·003 in. up-and-down movement when new. When fitting new rings the gap between the ends when tried in the cylinder-bore should not be less than 0·010 in. or more than 0·015 in. for the two top compression rings and 0·009 in. and 0·013 in. respectively for the bottom slotted-type scraper rings.

Removing Timing Gear and Oil Pump—500-c.c. Engine

The timing gears and chain must be removed before attempting to dismantle the crankcase, but before doing so the position of the timing marks—centre-punch dots—should be carefully recorded and so assist in obtaining a correct setting when reassembling. After taking away the tensioner device complete, the three sprocket-securing nuts are next removed from the two camshafts and crankshaft end. A special screwed or threaded type sprocket extractor and draw bolt is supplied by the makers for withdrawing the sprockets; but although it is advisable to use three of these to draw the sprockets off gradually and all together complete with endless chain in position, the operation can be carried out with one tool or even with the aid of the ordinary pattern puller as used in the car industry.

Check the timing chain, after cleaning, for stretch and wear by pulling on short sections of it and carefully noting the amount of slack between the links. After lengthy mileage renew the chain, and thus ensure a correct valve and ignition timing (see Fig. 15). When the sprockets are removed take note of any end play, packing shims in the recess of each timing gear, as these will perhaps be necessary again when reassembling. Note also the position of the hardened end-thrust washer on the crankshaft end, and also of the position behind this washer of any packing shims which may have been used to determine correct end play. The crankshaft and camshaft location for end play is dealt with under "Reassembly".

Magneto removal comes next, and is easily carried out by unscrewing the special extractor nut on the armature spindle;

this will withdraw the complete automatic advance and retard control unit. Examine this unit and ensure that the springs do not show signs of weakening or fracture. The makers supply control units complete, and it is not advisable to attempt any repair to them, except perhaps to renew a spring. The magneto (Lucas or B.T.H.) is located against the rear face of the crankcase timing chest by a flange and three fixing nuts, which are unscrewed for final removal of the unit.

Dynamo removal is carried out by releasing the securing strap and the nut close to the chain cover and sliding the unit out complete with the small steel driving gear attached.

Remove next the crankcase sump plate, filter and oil pump. Take off the crankcase pressure-release valve and pipe to rear chain. The crankcase halves are ready for parting after releasing all fixing studs and nuts and the two very important internal fixing bolts just below the top cylinder face of the crankcase.

Dismantling the Timing Gears—650-c.c. Engine

Remove the outer timing-gear cover. Note the position of the twelve fixing screws, which are of varying lengths. Detach the dynamo securing strap and rotate the dynamo in its housing in order to release the tension on the dynamo driving chain. Remove the large dynamo driving sprocket, which has a taper fixing and is secured by a lock-washer and nut. After loosening the nut an ordinary small workshop sprocket extractor can be used, but failing this the sprocket can be removed by giving a few light hammer and soft punch blows to the side of the centre taper boss. Withdraw the sprocket complete with chain. Take out the four deeply recessed fixing screws securing the inner timing cover and withdraw this from the crankcase face. The timed crankcase breather sleeve can remain in the cover, leaving the $\frac{1}{8}$-in. thick cork washer attached to the camshaft gear.

The automatic ignition timing device which is incorporated with the magneto driving gear can be removed by unscrewing anti-clockwise the self-extracting nut on the end of the magneto armature spindle. After the nut loosens it will almost immediately tighten again, and it is then that it commences to

withdraw the gear and timing device from the tapered magneto spindle.

Do not take the timing device to pieces or attempt to remove it from the gear-wheel. Remove the cork washer from the face of the camshaft gear and next take off the nut and lock-washer, and the gear can then be withdrawn from the keyed end of the camshaft in a similar manner to the dynamo driving sprocket. The idler gear complete with shaft can next be pulled away from the bushed crankcase. The oil pump is held in position by three nuts and washers which are removed before taking off the lock-nut (left-hand thread) and washers from the end of the crankshaft. As the oil pump is being withdrawn release the hexagon-headed worm gear, which also has a left-hand thread. The small timing pinion which is keyed to the crankshaft can be extracted using an ordinary workshop claw-type extractor tool.

Parting the Crankcase Halves

The crankcase can be parted by gently tapping with a workshop hide hammer or mallet, and the shaft and camshaft can be taken out.

The connecting-rods are removed by taking off the pinnacle-type nuts from the securing bolts and pulling the main part of the rods away. Note very carefully how the big-end shell liners are located, and mark the rods and end caps to ensure that they are replaced in the same order. Check the condition of the shell liners and crank journals, and if either journal registers ovality at all, it should be reground to a permissible 0·010 in. undersize and small-diameter liners fitted.

Big-end-bearing shell liners are replaceable in pairs only, and when new should register clearance of 0·005–0·001 in. when fitted to the rods and tried on the journals. Each complete rod assembly should show end clearance or float of approximately 0·020 in. Crankshaft internal oilways should be washed out with clean paraffin or petrol. Pass a stiff piece of wire through the holes to prove that all is well. All 1948–49 500-c.c. models incorporate crankshafts with a small oil-feed hole in each big-end journal, but to improve internal and piston lubrication, a modification in the form of a 0·010-in.-deep

groove surrounding the oil-feed holes in the crankpin journals was introduced in 1952. More oil is released under pressure by way of the grooves, thus ensuring a larger splash feed to the cylinder-bores. The sketch (Fig. 19) shows the position and dimensions of the modification which can be carried out to any twin-cylinder model manufactured in the years 1948–49.

The crankshaft timing-side plain bearing should be checked for wear—clearance when new between shaft and bush being 0·001 in., and permissible wear clearance being 0·003–0·004 in. Replacement plain bearings are supplied by the makers in a 0·010-in. undersize to allow for boring out to give the correct shaft clearance after fitting, or they can be obtained finished to a size giving 0·002–0·003 in. clearance, which allows for contraction after being pressed into the crankcase. Always check the bearing for clearance after fitting and ream or lightly hone to give the internal diameter the recommended 0·001 in. clearance. The crankcase plain-bush-type bearing is removed and fitted by the press method only.

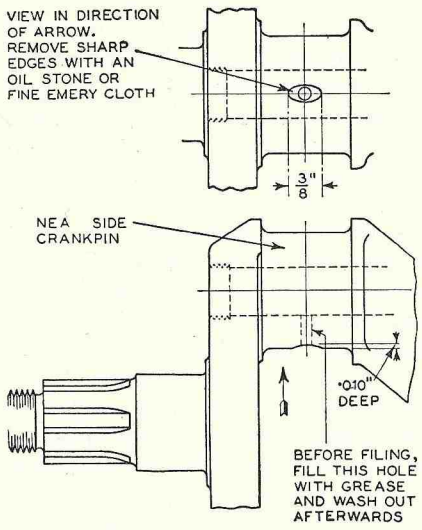


FIG. 19.—ILLUSTRATION SHOWS POSITION AND DIMENSIONS OF MODIFICATIONS TO OIL-FEED HOLES ON THE CRANKPIN JOURNALS OF 1948–49 MODELS.

The driving-side roller bearing should be replaced if showing wear, and the outer race can be pressed or drawn out after heating the case in boiling water or by a light flame application. The inner race can be driven off the shaft end with a soft punch tool or drift. The replacement inner race must be a tight fit on the shaft, and the bearing outer ring or race pressed into the crankcase housing lip side first.

REASSEMBLING THE ENGINE

Refitting the crankshaft with rods and camshaft is a very simple operation, and with all bearings and bushes very carefully checked and renewed as necessary, the work can proceed. When fitting the big-end bolts and nuts do not on any account attempt to slacken back the slotted nuts in order to allow the insertion of the split cotter pins. If any nut slot does not line up with a hole in the bolt when the nut is fully tightened file the face of the nut until the hole in the bolt and the nut correctly line up.

Rebuilding the Bottom Half—500-c.c. Engine

Fit the shafts and bolt up the crankcase, not forgetting the two pinch bolts at the top of the cases. The location of the crankshaft for end-play clearance is governed from the timing side by the main bush or bearing face, and before finally fitting the crankshaft gear care should be taken to ensure that the hardened thrust washer and the necessary packing shims are in position to give the recommended 0·002–0·004 in. end play. Also check the camshafts for end play—recommended 0·001–0·002 in. and regulated by the use of thin shims placed behind and in the recessed parts of the camshaft sprockets. After setting the crankshaft with connecting-rods at top-centre, the crank gear or sprocket key should be on the top-most position.

Rotate the two camshafts until the keys are set approximately at "11 o'clock" inlet and "1 o'clock" exhaust respectively (Fig. 17).

Place the timing chain over the three sprockets with the "Dot" markings almost opposite and then slide the sprockets

on to their shafts again, almost engaging the keys in this operation. The thrust washer and shims should previously have been positioned on the crankshaft.

Now strike an imaginary line through the centre of the camshaft sprockets and finally set these so that the "Dot" on the rear or inlet sprocket is $\frac{1}{16}$ in. above the centre line and the "Dot" on the front or exhaust sprockets is $\frac{1}{16}$ in. below the centre line.

Gently drive the sprockets on to the keyed shafts until the nuts can be started on the threads and finally tightened to force the sprockets home. Fit the timing-chain tensioner and adjust. To check the valve timing first adjust the valve tappet clearances to 0·002 in. and note:

The Inlet Valves open 15° or $\frac{1}{16}$ in. before T.D.C.
The Inlet Valves close 55° or $\frac{9}{16}$ in. after B.D.C.
The Exhaust Valves open 46° or $\frac{13}{32}$ in. before B.D.C.
The Exhaust Valves close 20° or $\frac{1}{8}$ in. after T.D.C.

After checking, readjust valve-tappet cold clearances, on modified cam-form models only, to:

Inlet valve, 0·005 in. (1·270 mm.).
Exhaust valve, 0·008 in. (2·032 mm.).

Refitting Magneto and Dynamo—500-c.c. Engine

The magneto and dynamo, both having been very carefully examined and adjusted as necessary (see "Electrical Equipment"), should now be refitted. Take note of the type of joint washers required between the magneto and dynamo flanges and the crankcase face, and renew as necessary.

When fitting the dynamo, and engaging the small toothed driven gear with the larger driver, check the clearance between the chain side links and rivets and the face of the small gear. If clearance is nil or close, put two flange washers in position, or better still use a special thick washer which can be obtained from the makers. A distinct metallic knock has been known to be set up in the engine unit due to the timing chain fouling the dynamo-driven gear face, and it is a very important point to watch when reassembling.

The magneto, driving gear and control assembly can next be

inserted, but should not be finally tightened up until the timing has been set after the cylinder-block and pistons have been fitted.

Rebuilding the Bottom Half—650-c.c. Engine

When reassembling the crankcase smear the joint faces with jointing compound to ensure an oiltight assembly and take care to refit all crankcase bolts, nuts and lock-washers securely. When refitting the big-end bolts and nuts do not on any account attempt to slacken back the slotted nuts in order to allow insertion of the split cotter pins. If any nut slot does not line up with a hole in the bolt when the nut is fully tightened file the face of the nut until the hole in the bolt and the nut correctly line up.

The timing pinion can be refitted by lightly driving it on to the keyed crankshaft with the concave side facing the crankcase. Follow with the plain steel washer. The oil pump is next refitted taking care to replace the joint washer and ensuring that the holes correspond. Fit the pump and the driving worm on together, taking note that the worm is left-hand threaded, and therefore care must be taken to prevent damage to the corresponding spiral gear on the oil-pump drive. The driving spiral worm is finally secured with the keyed washer and lock-nut. The camshaft pinion can be easily refitted on to the keyed camshaft by adopting the following precedure. Insert a long screwdriver or similar instrument into the top of the crankcase and hold it against one of the cams and the top case lug to prevent the camshaft from moving inward and displacing the key when fitting the camshaft gear pinion. The pinion is fitted with the breather driving stud outwards and finally secured by the special locking washer and nut.

The idler pinion is next fitted after rotating the engine to bring the timing dot on the small crankshaft pinion at the top to mesh with the corresponding dot on the idler pinion and also so that the line or dash timing mark on the camshaft pinions meshes with the corresponding line or dash mark on the idler pinion. The magneto is secured by two short bolts above and one long extension bolt below, with a thin paper

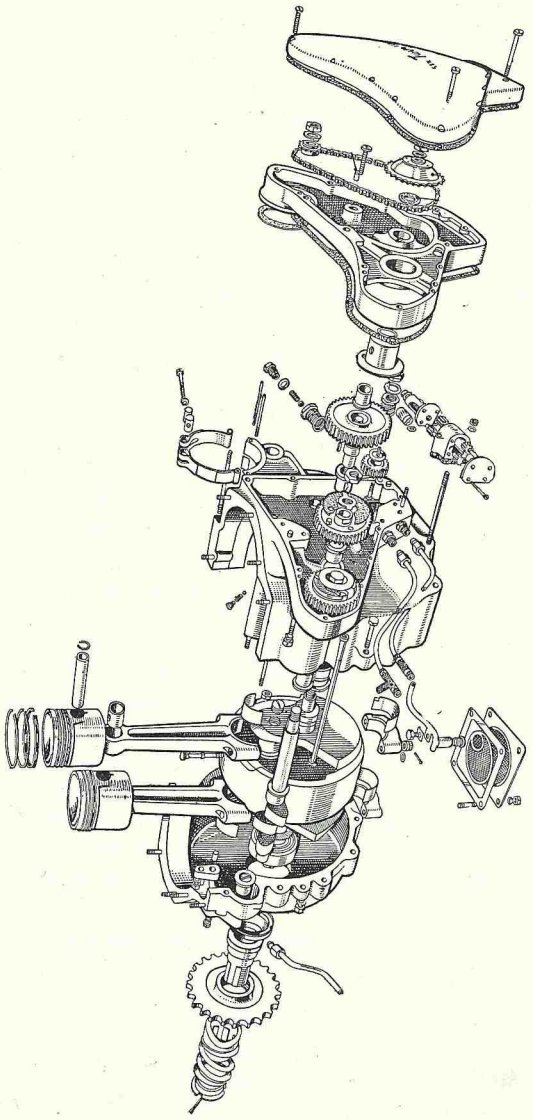


FIG. 20.—EXPLODED VIEW OF 650-C.C. TWIN-CYLINDER MODEL FH BOTTOM HALF.

joint washer fitted between the magneto and crankcase. The magneto driving-gear pinion complete with automatic ignition advance device should be placed in position on the armature spindle but the centre locking nut can at this stage be left loosely attached until the timing is completed.

Refit the mechanical breather on to the camshaft gear pinion, taking care to ensure that the cork washer is located correctly between the pinion and breather. Next smear the breather with engine oil. Place the paper joint washer in position on the inner face of the inner timing-gear cover after covering the joint surface with jointing compound. Place the inner gear cover in position and secure tightly with the fixing screws.

To refit the dynamo drive, first place the chain on the dynamo sprocket and then place the driving sprocket between the chain run (concave side of the sprocket facing inwards) with the timing-gear cover. Fit the driving sprocket on to the protruding shaft of the idler pinion and securely tighten in position with the lock-washer and nut. Next adjust the dynamo chain by rotating the dynamo in its cradle to give approximately $\frac{1}{8}-\frac{3}{16}$ in. up-and-down play on the chain, but not sufficient to allow the chain to foul the screw boss in the centre of the cover near which the chain runs. Secure the dynamo by means of the strap fixing.

Before fitting the outer timing-gear cover and joint washer, which should be prepared with jointing compound on the faces, insert approximately 4 oz. of a light-grade grease in the chain housing. The chain is not otherwise automatically lubricated.

Refitting the Cylinder-block (All Models)

Use a new base-joint washer in order to prevent oil leakage. The operation is very simple and best carried out with the pistons at lowest position of the stroke. Well smear the bores with clean oil and see that the pistons, rings and clearances are as per makers' specifications (see "Technical Data"). Use new circlips. Proceed with the fitting of the cylinder-head, etc., as previously mentioned under "Decarbonisation".

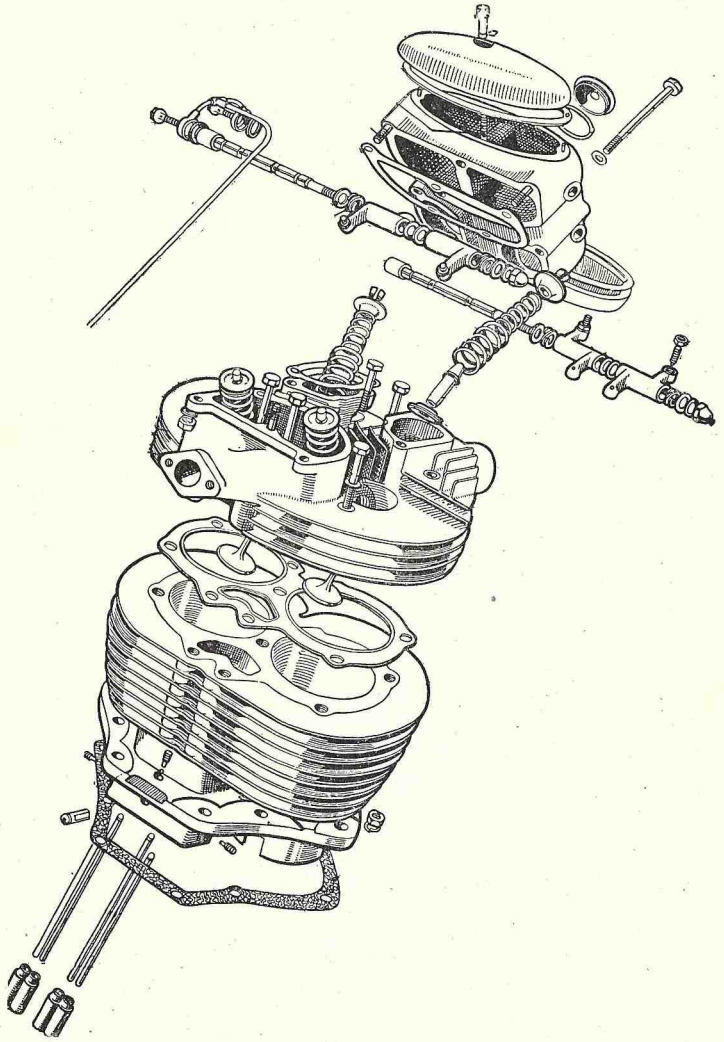


FIG. 21.—EXPLODED VIEW OF 650-C.C. TWIN-CYLINDER MODEL FH CYLINDER-HEAD AND BLOCK ASSEMBLY.

Ignition Timing—500-c.c. Engine

The magneto timing can now be set. First, very slowly turn the engine until the pistons are at the top of the stroke and then select the cylinder for timing, which is the one corresponding to the combustion chamber or cylinder-head with both valves closed after the compression stroke.

Rotate the engine forward again slightly and check the piston selected for timing with a thin rule or with a degree chart on the main shaft until it is set 4–8° or $\frac{1}{32}$ in. *after top dead centre.*

Rotate the magneto armature until the metal segment of the slip ring is visible and opposite the high-tension pick-up feeding the sparking-plug for the cylinder selected for timing. Gently rock the armature until the contact-breaker points are just about to open, and in this position very carefully tighten up the armature-spindle nut without altering the timing setting. The timing has been set with the control in the retarded position, but it is wise to now check same fully advanced. To do this it is necessary to turn by hand the spring-loaded control unit, and when at the full-travel position, which is full advance of the armature, the engine should be gently rotated backwards until the contact-breaker points just break at 30° or $\frac{1}{4}$ in. *before top dead centre.* This latter timing is recommended as being the one to use for the final setting, especially if any difference should arise between the two movements.

Ignition Timing—650-c.c. Engine

The standard ignition timing when 6·5–1 compression pistons are fitted is $\frac{11}{32}$ in. before top dead centre, with the automatic control held in the fully advanced position by turning the central bridge plate in an anti-clockwise (left-hand) direction. Before tightening the automatic control and magneto pinion centre nut, set the right-hand side piston at top dead centre of the compression stroke and with both valves closed. Slowly rotate the engine backwards and forwards to check exactly top dead centre. This can be done by engaging the top gear and turning the rear wheel by hand and by inserting a metal rod into the sparking-plug hole to enable the piston

to be "felt". Next rotate the engine again very slowly backwards until the piston has moved down the bore $\frac{11}{32}$ in., which is the position required before top dead centre. Next rotate by hand the magneto contact-breaker (turning it in its normal direction of rotation, *i.e.*, clockwise or right-hand) until the contact points are opposite the high-tension pick-up for the cylinder which is being timed. Now lightly drive the magneto gear and control unit on to the armature taper and tighten the central securing nut. Always check the ignition timing again before finally tightening the nut, as it is most important for the timing to be set accurately in order to obtain efficient engine performance.

Final Assembly

Before assembling the engine-shaft shock absorber (see p. 58) carefully fit the self-aligning rubber and spring-tensioned oil seal over the driving shaft and against the face of the crankcase; this prevents oil leakage from the case via the roller bearing into the primary chaincase. Well prime the oil pump with clean oil before reassembling (as pp. 49 and 50). To refit engine unit into the frame reverse the dismantling procedure. Apart from the engine unit, all information and data for single-cylinder models is applicable to twin-cylinder models.

DATA

498-c.c. Engine

Cylinder-bore : 63 mm.
Engine Stroke : 80 mm.
Cubic Capacity : 498 c.c.
Compression Ratio :
Standard L.C. Piston, 6·8–1.
H.C. Piston, 7·5–1.

Power Output : KG, 24 b.h.p. at 6,000 r.p.m. KH and KHA, 26 b.h.p. at 6,500 r.p.m.

Valve Timing (set with 0·002 in. clearance) all models.
I.V.O. 15° or $\frac{1}{16}$ in. before T.D.C.
I.V.C. 55° or $\frac{9}{16}$ in. after B.D.C.
E.V.O. 46° or $\frac{13}{32}$ in. before B.D.C.
E.V.C. 20° or $\frac{1}{8}$ in. after T.D.C.

Ignition Timing : Piston position before T.D.C., 30° or $\frac{1}{4}$ in., with automatic control in fully advanced position.

Piston Clearance (Standard and High Compression):
Ring Land, 0·0198–0·0223 in.
Below Rings, 0·0048–0·0063 in.
Extreme Skirt, 0·0028–0·0043 in.

Measurements taken at front and rear piston thrust bearing face. Pistons "ground cam oval", *i.e.*, 0·010 in. minus at gudgeon-pin boss sides.

Piston-rings :
Compression, 2·4803 in. O/dia. × 0·088–0·094 in. width × 0·063 in.–0·064 in. thick.
Oil Control, 2·4803 in. O/dia. × 0·085–0·091 in. width × 0·1245 in.–0·1255 in. thick.
Gaps, 0·008 in.–0·010 in.

Gudgeon-pin : Outside Diameter, 0·6862–0·6865 in.

S.E. Bush : Reamed after fitting, 0·6863–0·6868 in.

Valves : Stem Diameter.
Inlet, 0·311–0·312 in.
Exhaust, 0·309–0·310 in.

Valve Guides : Internal Bore, 0·313–0·314 in.

Tappets : Stem Diameter, 0·3145–0·342 in.

Tappet Guides : Internal Bore, 0·3425–0·3435 in.

Rockers : Internal Bore, 0·4995–0·5005 in.

Rocker Spindles : Bearing-Face Diameter, 0·498–0·499 in.

Camshaft Bushes :
Flanged Type. Timing Side, 0·874–0·875 in. Reamed after fitting.
Plain Type. Drive Side, 0·6255–0·6245 in. Reamed after fitting.

Camshafts :
Bearing Ends. Diameters, 0·623–0·624 in. and 0·873–0·8735 in.
End Threads, $\frac{11}{16}$ in. × 20 T.P.I.

Crankshaft Bush (Lines) : 1·2505–1·2510 in. Reamed after fitting.

Crankshaft :
Timing Side Bearing End. Diameter, 1·2495–1·250 in.
Drive Side Bearing End. Diameter, 1·125–1·1255 in.
B.E. Crankpin Journal. Diameter, 1·3745–1·375 in.
Thread. Driving End, $\frac{3}{4}$ in. × 20 T.P.I.
Thread. Timing End, $\frac{11}{16}$ in. × 20 T.P.I.

Crankcase Roller Bearing : Drive Side, MRJ $1\frac{1}{8}$ in. Lipped. Bush in crankcase for oil-pump driving shaft. Internal Bore, 0·3745 in.–0·3755 in. Reamed after fitting.

Timing Chain : 8mm. Pitch × 5 mm. Roller × 72 Pitches. (Endless.)

646-c.c. Engine

Cylinder bore: 70 mm.; engine stroke: 84 mm.; cubic capacity: 646 c.c.; compression ratio: 6.5.

Ignition Timing : $\frac{11}{32}$ in. (8.7 mm.) before T.D.C. maximum advance.

Valve Timing : I.V.O. 30° before T.D.C.
I.V.C. 70° after B.D.C.
E.V.O. 65° before B.D.C.
E.V.C. 25° after T.D.C.

Valve Clearance (cold): 0·010 in.

CHAPTER III

SINGLE-CYLINDER ENGINES
(Except the 200-c.c. Colt)

SIMPLICITY of design and makers' desire to incorporate the interchangeability of component parts has produced an engine which has a very marked degree of popularity with all Ariel owners. Many parts of the current-type engines allow almost obsolete models to be kept in service if adapted, and it is through this feature that any servicing and maintenance schedules can be applied to every Ariel single-cylinder engine produced since 1933. This text refers mainly to the current-type engine as fitted to all Ariel singles since 1938, when the first totally enclosed cylinder-head and rocker boxes were incorporated. The general remarks, however, can be applied to singles of all capacity except where specific points vary. The 1954–59 200-c.c. Model LH Colt is dealt with in Chapter IV.

MAINTENANCE
1938–59—All Models

Maintenance adjustments are of the usual type associated with all single-cylinder internal-combustion engines, and confined chiefly to the valve clearances, carburetter, Magdyno and lubrication system.

Lubrication

The dry-sump system, incorporating a dual-plunger oil pump driven by a small crank extension on the end of the cam spindle, forces oil direct to the big-end bearing by way of the flywheel gear-side mainshaft (Fig. 22).

Located in the right-hand or timing-side flywheel is the oil purifier, which is a tubular reservoir extending from the big-end to the outer rim of the flywheel where a cupped plug is fitted. Due to centrifugal action, all foreign matter in the oil

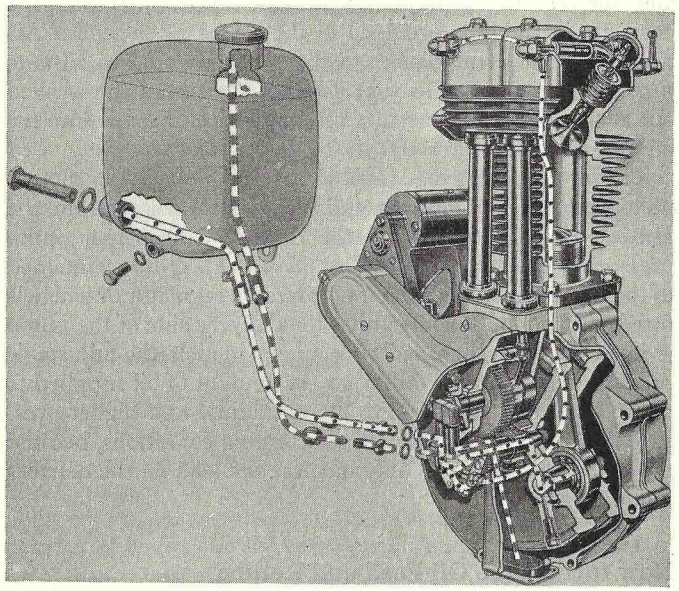


FIG. 22.—LUBRICATION SYSTEM INCORPORATED ON ALL SINGLE-CYLINDER MODELS (1933–59).
The white dotted line indicates the delivery line. Note that the timing-gear-case connections are reversed on 1952–59 models, except certain special competition models.

is passed towards the cuppled plug, where it is collected and retained until the cleaning-out process. It is recommended that this purifier be removed for cleansing every 4000–5000 miles, and is quite accessible after removing the crankcase sump filter or when the cylinder barrel is dismantled for top overhaul. If difficulty is experienced in removing the purifier plug with an ordinary tube or box spanner, give the hexagon head a hard blow with the hammer, which will have the effect of very slight stretching and loosening the thread. An inner tube was fitted in the cupped plug on some engines, but this is not now fitted and can always be discarded from former assemblies.

The Sump filter should always be washed out whilst removed,

and when refitting take care to locate the copper oil-return pipe correctly in the hole provided in the top of filter gauze. Always fit a new joint washer to the sump plate. *The oil-tank filter* on all models up to 1953 should be removed and washed out at the same time; when replacing ensure that the internal oil pipe is located correctly.

The oil-pressure gauge fitted to Ariel single-cylinder models up to 1950 does not indicate, and has no effect whatever on, the *amount* of oil pumped into the engine. The actual pump pressure is constant, and the supply of oil will be maintained to the big-end bearing even if no pressure regulator or gauge is fitted, providing, of course, that the delivery side of the pump is in order. On 1938 and subsequent models the adjustable pressure regulator will only vary the amount of oil supplied to the overhead rocker system. Do not adjust to a higher pressure than 10–15 lb. under normal running conditions, because the higher pressure will only increase the load on the delivery pump.

How to Test the Oil Feed and Return

To test the oil supply from the pump on all models up to 1941 which are fitted with a pressure regulator, remove the plug above this with the engine running, and oil will be pumped out of the plug-hole if the delivery pump is functioning correctly. The 1941 and 1951 single-cylinder engines are not fitted with the pressure regulator, and the oil supply can be tested by detaching the lower end of the oil pipe to rocker box, and with engine running oil should flow from the union stud. To test the oil return flow with engine running, remove the oil-tank filler cap and ascertain if oil first of all returns in a stream, and then in a regular flow of bubbles only, which is the correct condition of working.

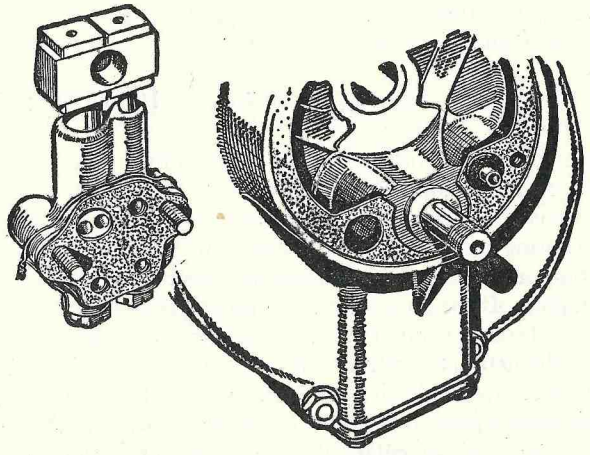
The 1941 and 1951 engines not fitted with the pressure adjustable regulator have incorporated instead a spring-loaded ball valve in the timing cover behind the oil pump. To clean this valve, remove the oil pump and with pliers pull out the steel plug, remove the ball and spring and wash in clean petrol. The plug is grooved on side-valve engines and acts as a

pressure release when engine is stopped and assists the zero action of the oil gauge.

On 1952–59 O.H.V. models the oil feed to rocker boxes is by a feed pipe, taken from the oil-return system prior to entry into the oil tank. No oil-pressure regulator or gauge is fitted, and maintenance is confined to cleansing of pipes and connections. On all models the *oil delivery* connection is the uppermost on the timing-gear case (see Fig. 22). On 1952–59 models, *except special competition machines*, the connections at the *tank end* only have been reversed, owing to the fitting of a new type tank.

Excessive Oil Consumption

This is usually associated with heavy smoke emanating from the exhaust system and may be due to the fact that the return side of the oil pump, fitted with the larger plunger, is not functioning to its full capacity. Foreign matter under the plunger ball valve will cause the pump to fail, and the only remedy is to remove the complete oil pump from the timing-gear case, dismantle and clean. Remove the magneto-chain



["*Motor Cycling*" *Copyright drawing.*

FIG. 23.—OIL PUMP WITH JOINT WASHER AND EXTRA 0·005-IN. WASHER AT RETURN OIL PIPE JOINT (ALL MODELS 1937–59).

cover and then the two pump securing screws. Remove both delivery and return base plugs in the pump body and expose the small coil springs and steel $\frac{7}{32}$-in. balls. Thoroughly clean and tap the balls gently into their respective seatings to ensure a good, clean fit. Examine the plungers for wear when fitted, and if excessive play is found renewal of pump body and plungers is advisable. See that the pump body is a good fit on the aluminium face of the gear cover and, if necessary, gently reface by rubbing down on a flat surface plate. Two paper joint washers can be fitted to a pump that is low on the face. Always ensure that the joint washer correctly registers with the holes in the pump and gear cover and that no overlap occurs.

When refitting the oil pump see that the duralumin operating block is replaced with the chamfered edge of the hole facing inwards. Remove the crankcase sump plate and gauze and test the oil-return pipe, which is a press fit in the housing, but if at any time a leak is suspected the pipe should be withdrawn, thinly "tinned" and replaced, or, better still, renewed. Any air leak between the timing cover and crankcase, at the point where the short copper oil-return pipe extends, must be prevented by fitting one or two 0·005-in. small circular paper washers, but this operation will entail removal of the magneto chain and sprockets.

Oil Pump and Timing-Gear Cover (1956–59 models only)

A modification was introduced in 1956 to prevent a failure of the oil pump through the ingress of foreign matter, both in the delivery and the return systems. On the delivery side an extra spring-loaded ball valve is fitted in the short feed pipe to the big-end bearing, just behind the pump, and secured by a small plug. If the plug is removed for any reason, note that the small coil spring is fitted first into the feed pipe, followed by the $\frac{3}{16}$-in. diameter steel ball and then the plug.

On the return side an extra spring-loaded ball valve is fitted in the timing-gear cover in the direct oil-return line. If the oil pump is removed an enlarged hole will be noticed in the timing cover just behind the pump into which is fitted a small coil spring, followed by a $\frac{7}{32}$-in. diameter ball. Take care not to lose the ball and spring when dismantling, for although the return pump will operate without these, there will not be the extra safeguard against failure.

Failure of the return oil pump will always be noticed by over-oiling on the delivery side with resultant excessive "smoking" from the exhaust.

Breather Valves

Breather valves consisting of elbow unions with a freely rotating steel ball in each have been fitted to all engines with the dry-sump system. Loss of oil through a breather valve may be caused through inefficiency in the oil return or if the union has not been screwed far enough into the timing-gear cover. See that the $\frac{1}{4}$-in. ball is in position. On all engines prior to 1941 it is held by a split ring, although free to float. All elbow unions fitted since 1941 are of the 90° type and only located at the back of the cover, the ball being held in position by a wire pin.

When refilling the *oil tank*—after washing-out every 1000 miles—do not fill beyond a level of 1 in. below the top of the return pipe and "top up" frequently to maintain this level.

Timing Chain

The Magdyno chain should be frequently checked for tension and adjusted to give $\frac{1}{4}$-in. approximately up-and-down lift. Test for wear, which is indicated by tight and loose positions when engine is rotated, and renew if necessary.

Adjusting Tappets

Tappet or valve-stem clearance should be checked and adjusted every 1000 miles. Correct clearance with engine cold is:

600-c.c. side-valve	Inlet 0·003 in.	Exhaust 0·006 in.
O.H.V. (up to 1953)	Inlet nil	Exhaust 0·002 in.
O.H.V. (1953–59)	Inlet 0·006 in.	Exhaust 0·008 in.

When adjusting tappets, set the piston at top dead centre with both valves closed and adjust with the tool-kit spanners provided for this purpose.

Adjusting Exhaust-valve Lifter

Exhaust-valve lifter adjustment is carried out when valves are closed; with the side-valve model the control cable is adjustable. Leave approximately $\frac{3}{16}$ in. or $\frac{1}{4}$ in. slack movement before the lifter actually commences to operate. The O.H.V. lifter arm must be adjusted to provide the slack movement, and this arm is fixed on a taper spindle. To loosen arm, undo the securing nut a few turns and with a light hammer give the nut face a sharp tap. Set the arm to the correct angle and retighten nut. The lifter spindle also comprises a small valve head with a seating similar to an engine valve, and if oil leakage is noticed at the spindle hole, remove the complete lifter, dismantle and grind-in the valve in the manner of engine valves. Also fit new cork gland-washer if leakage is severe.

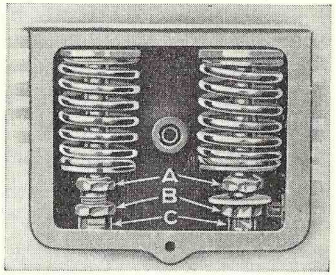


FIG. 24.—METHOD OF ADJUSTING VALVE-STEM CLEARANCE — ALL 1937–59 600-C.C. SIDE-VALVE MODELS.

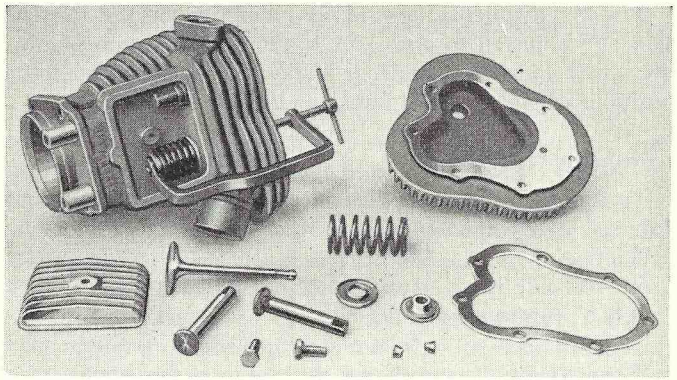


FIG. 25.—CYLINDER AND HEAD ASSEMBLY (1937–51 600-C.C. SIDE-VALVE).
Showing method of removing valves.

TOP OVERHAUL AND DECARBONISATION

The average single-cylinder engine is due for "top overhaul" at 3000–4000 miles' running. Symptoms indicating this are such as a falling-off in maximum speed and acceleration, loss of compression, undue mechanical noise and possibly excessive oil consumption.

Side-valve Engine

The side-valve cylinder can be removed without removing the petrol tank, but it is more convenient to dismantle the cylinder-head first. Ordinary kit spanners only are required to remove head bolts and base nuts, etc. After detaching the carburetter, exhaust pipe and exhaust-lifter cable, set the piston at B.D.C. —bottom dead centre—lift the cylinder up, tilting forwards and clear of the frame.

The 1952–59 VB models have a redesigned cylinder and valves and incorporate a light-alloy cylinder-head held by nine bolts or studs and nuts. The alloy head cannot be fitted to the 1936–51 cylinder.

Remove the valves by means of a valve-spring compressor tool, which can be obtained from most accessory dealers. The cylinder and *cast-iron* cylinder-head can be cleaned by immersion in a strong solution of caustic soda. Do not clean aluminium or light alloy with this solution.

Check valve guides for wear, and regard them as due for replacement if stem clearance of 0·008 in. inlet and 0·010 in. exhaust is exceeded. The side-valve tappet guides should not need replacement for at least 20,000 miles' service. All valve and tappet guides are a plain press fit, and can be removed and refitted by using a double-diameter drift tool.

Examine valve seatings, and if at all pitted or grooved beyond ordinary regrinding, a seating cutter of 45° should be lightly applied to recondition them. If valves do not require refacing they can be ground in to their respective seatings with the aid of ordinary grinding paste. No special tool for holding side valves is necessary whilst grinding. Lightly rub down the top face of cylinder and cylinder-head base on a flat surface plate, using fine emery paste or cloth, and prepare the joint gasket if in condition for refitting, but renewal is advisable.

The Piston

Removal of piston is carried out by first taking out the wire circlips retaining the gudgeon-pin. Use a pointed scribing tool to prise out the clips, and always replace with new if available. Support the piston on one side and drive out the gudgeon-pin from the other with a drift made up from an old pin or steel bar smaller in diameter. Clean piston after removing rings and check for wear in the cylinder-bore. Refer to data chart for clearances when new, and if these are exceeded by 0·008 or 0·010 in. a new cylinder or reboring and sleeving is advisable, but this is very unlikely at the first "top overhaul". Piston-rings should be renewed when the gap exceeds 0·025–0·030 in. measured in the bore.

All Ariel pistons are known as "oval ground", *i.e.* 0·010 in. is ground from each gudgeon-pin side of the piston. Therefore, all clearance measurements should be taken at the bearing faces front and rear. One type only of oversize piston is available at the Ariel factory, that of 0·020 in.

Gudgeon-pin and *small-end bush* clearances should not exceed 0·004–0·005 in. Oversize gudgeon-pins are not supplied by the makers, and when clearance is detected as above, it is advisable to replace the small-end bush. The bush can be removed during the "top overhaul", but this is best carried out when engine is completely dismantled, as a hand or power

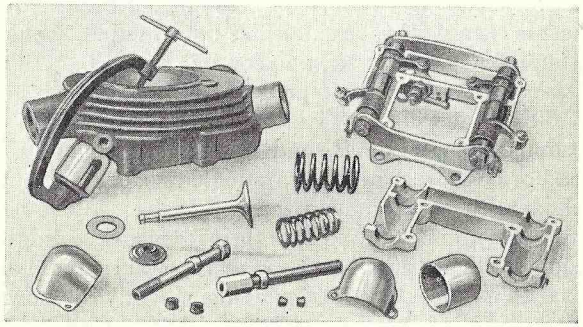


FIG. 26.—CYLINDER-HEAD AND ROCKER-BOX ASSEMBLY (1937 O.H.V.).
Showing method of removing valves.

press can then be used. To remove bush with flywheels in the crankcase, the draw-bolt-and-collar method can be used, and also for refitting new bush, which should be reamed to suit the gudgeon-pin after fitting.

Having completed the "top overhaul" bench work, the order of assembly is the reverse of dismantling and, apart from taking care to space correctly the piston-rings with gaps on opposite sides, the whole operation is fairly simple and straightforward. "Top overhaul" should include some first-aid attention to the Magdyno and carburetter as well as chain and other adjustments, all of which are covered in later chapters. Although the above text refers to the 1936–55 600-c.c. side-valve engine, the general principles can be applied to all side-valve units manufactured since 1932, when the detachable cylinder-head was first incorporated.

O.H.V. Engine "Top Overhaul"—250-c.c., 350-c.c. and 500-c.c. Models

The 1937 models were fitted with a cast-aluminium rocker box carrying the complete rocker gear. This box assembly can be removed from the engine without removing the petrol tank. Decarbonisation and removal of the cylinder barrel are carried out on similar lines to that of the side-valve model, and the same remarks regarding examination of the piston, etc., apply to all single-cylinder machines.

Removing Rocker Box of 1937 O.H.V. Models

Rotate engine to close both valves and remove the four rocker-plate bolts securing plate to cylinder-head. Lift rocker box complete and withdraw sideways. If the rockers show any undue end or side play the assembly should be dismantled and checked. The top half rocker box, when removed, will expose the rocker hardened spindles and distance collars, and, after noting the order of assembly, remove the spindles and check bearing surfaces for size and wear; also rocker arms. Only complete renewal of these parts will eliminate any undue mechanical noise caused by wear. Frequent application of the grease-gun to the special greaser nuts provided in the spindle ends will ensure very long wearing qualities of the assembly. The grease enters the hollow

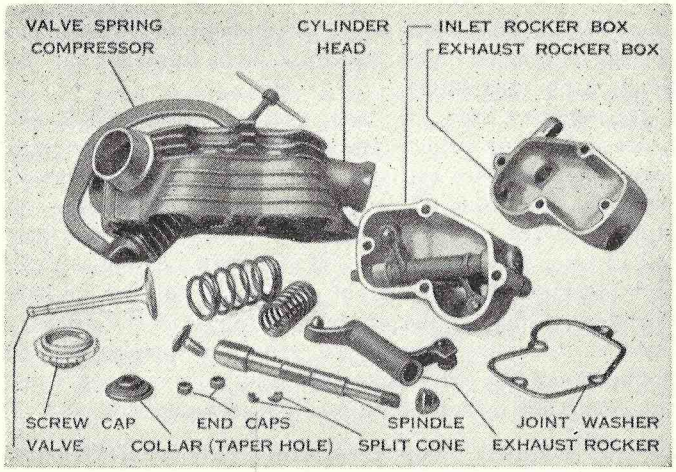


FIG. 27.—CYLINDER-HEAD AND ROCKER-BOX ASSEMBLY FOR 1938–59 SINGLE-CYLINDER O.H.V. MODELS.
Showing method of removing valves. The 1954–59 500-c.c. O.H.V. cylinder-heads are different externally, but the fittings are identical.

spindles and also the rocker ball ends where they fit into the top cup of the push-rods. Clean out the complete grease line and hole in the ball end. Note the position of all fibre and rubber oil-retaining washers at the push-rod cover ends and renew at every "top overhaul". Lift out the push-rods and check ball and cup ends for wear, and ensure that these are not loose on the rods.

Removing Rocker Boxes of all 1938–59 Single-cylinder Models

Remove the petrol tank to obtain easy access to the four bolts securing each rocker box to the head. Note the long bolt for fitting to the push-rod end of the box. To dismantle the rockers, remove the flat, large-headed screws from the left-hand end of spindles and the dome nuts securing oil-pipe assembly; the rocker spindles can then be pressed or driven out towards the left-hand side. Check position of distance washers, diameter of rocker spindles and bore of rockers.

When removing the cylinder-head take care not to drop the valve-stem hardened end caps. It is possible for these to pass down the push-rod covers and enter the valve timing chest, with serious results if the engine is run later.

Notes on Inspection

Decarbonisation, valve removal and piston examination are similar to the 1937 O.H.V. and side-valve models. Reference should be made to the data table beginning on page 95 when checking all working parts and bearings.

Do not interchange valves. Note that all inner valve springs are taper formation, the large end fitting next to cylinder-head. During "top overhaul" it is always advisable to check the connecting-rod big-end bearing for direct up-and-down play. After removing the barrel and piston, test the bearing for wear by pulling on the rod with the flywheels at the top as well as at the bottom of the stroke. A lift of 0·004–0·005 in. indicating wear is permissible, but if in excess of this, the engine should be regarded as due for a complete dismantling. The connecting-rod big-end should always register 0·010–0·012 in. side-float between the flywheels, but if $\frac{1}{8}$ in. is felt and measured up at the small-end, then bearing wear is indicated.

Refitting and Adjustments after Top Overhaul

General remarks applicable to all models side-valve and O.H.V. single-cylinder. If possible, always have ready a complete set of engine joint washers and gaskets. Always renew circlips when refitting gudgeon-pins. Fit piston same way round as when removed. When fitting cylinder barrel single-handed and no ring-compressor tool is available, always tilt the barrel over the piston-ring ends in turn first before attempting to enter the full ring. To obtain an accurate ignition setting, before fitting the cylinder-head, note piston position by placing a steel rule or bar across the top of barrel and measure exact distance B.T.D.C. required.

The 1937–51 single-cylinder O.H.V. models are not fitted with head-joint gaskets; the barrel and head should be ground in together by smearing a little valve-grinding compound on the faces and rotating the head on the barrel in the same way as when grinding in a valve.

All standard O.H.V. 1952–59 models are fitted with cylinder-head gaskets. Always refit the hardened valve end caps to O.H.V. models. Do not interchange push-rods and ensure that these are located properly in the cam-lever sockets. Adjust tappets with an extra clearance of 0·001–0·002 in. until valves have properly settled in after grinding and, after a few hundred miles' running, readjust to correct clearance. Tighten all holding-down bolts and nuts after warming the engine.

COMPLETE CRANKCASE ASSEMBLY OVERHAUL

Removing Engine from Frame as a Complete Assembly, all 1937 Models

The crankcase and primary chain oil-bath layout is common to the complete range of singles, with the exception of the 1939 250-c.c. models OG and OH. The latter were fitted with a lighter crankcase and oil-bath and a totally enclosed clutch, but apart from these requiring a little difference in method of dismantling, the general principle and covering remarks apply.

The petrol tank need not be removed. Dismantle carburetter and all control cables and remove battery and exhaust pipes. Drain and remove the oil tank complete with two pipes. Detach the foot-rests and rod and take note of the distance piece fitted between the rear engine plates. Except on the 1939 250-c.c., remove the clutch dome, complete clutch and the outer half of the primary chaincase. Refer to Chapter VI regarding clutch and gearbox dismantling.

Remove complete engine shock-absorber assembly held in position by two lock-nuts, and the driving sprocket, together with clutch chain-wheel and primary chain, can be withdrawn from off the shafts. Do not lose the clutch chain-wheel needle rollers. Remove rear portion of primary chaincase, battery carrier and bolt holding the rear mudguard bracket to engine plate. Support the engine underneath with suitable packing and release the gearbox adjuster. Remove the top gearbox fixing-bolt and release the tie-bolts which pass through the engine plates and crankcase lugs. Remove the two bolts holding the front engine plates to the frame as well as the two rear, and the engine unit can be lifted clear of the frame, but

complete with rear plates and Magdyno mounted on the plate platform.

With the engine securely held in a strong vice by clamping on one of the front crankcase lugs, the cylinder-head, rocker boxes and cylinder barrel should be removed as described under "Top Overhaul".

Removing the Magdyno and Timing Gear

Take off oil pump. Place a small steel protector cup over the oil-pump crank drive after removing sprocket securing nuts and, with extractor provided in the tool-kit by makers, pull off both sprockets complete with the endless driving chain. Remove small hexagon bolt holding magneto platform to the

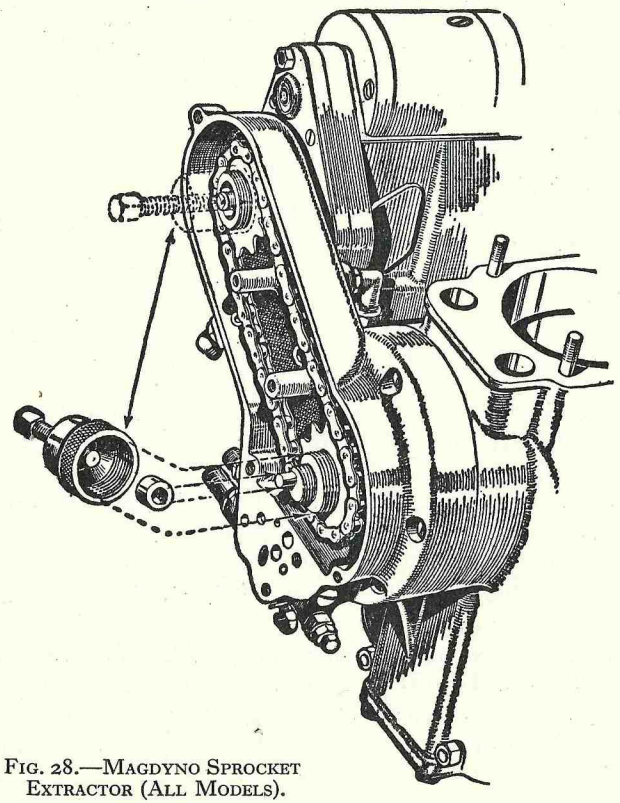


FIG. 28.—MAGDYNO SPROCKET EXTRACTOR (ALL MODELS).

chaincase and the three Magdyno-base fixing bolts located under the magneto platform.

Take note of the order of assembly of the felt washer and metal retainer at the joint between Magdyno end plate and the timing case. Rear engine plates can now be removed, and the timing-gear cover is ready to be detached by first removing the five securing screws. Whilst pulling the cover away from the crankcase, press on the camwheel spindle to retain the gear in position for checking purposes. Withdraw the camwheel and cam levers and pull off the timing pinion by first removing the securing nut, which has a left-hand thread. Note the small key and keyway in the spindle and pinion. The pinion is a tight fit on the spindle and can only be removed with the kit extractor. Note the correct way for refitting pinion is with the chamfered side facing inwards. Also note timing dots on pinion and camwheel, and when these are meshed together the valve timing is set correctly.

Cam Gear, all Models 1937–50

Cam levers are fitted with the oil-hole uppermost and the inlet lever placed in position first. Check faces for wear and renew if grooved.

Camshaft bushes in timing cover and crankcase should be checked for wear, and if excessive clearance is observed new bushes are advised. To remove a bush, gently warm up the aluminium cover or crankcase and press out with a suitable double-diameter drift or press tool, taking care to support the centre of the assembly. Press in the bush in the cover with the oil hole corresponding to that in the cover, and also note that this bush is grooved. The camshaft bush in the crankcase is grooved, but not drilled with an oil hole.

Ream bushes together by using a long pilot-type reamer and with the timing cover bolted to the half crankcase.

Cam-gear Assembly—500-c.c. Model VH; 350-c.c. Model NH (1951–59)

The Ariel cam gear used on all Hunter models since 1939, and employing two separate cams machined and ground from

the solid bar was superseded in 1951 by a single wide cam for operating the two cam levers, which were also modified. Unlike the earlier pattern levers, which were identical and interchangeable for either exhaust or inlet, the 1951 levers consist of a forked-type exhaust and plain-type inlet, the latter being fitted into the fork before being placed on the cam-lever spindle, with the inlet in the rear position nearest the induction.

The gear-wheel and small pinion on the flywheel spindle are both marked with timing dots as before, and it is impossible to set the valve timing incorrectly if these dots are intermeshed. The modified assembly can be fitted to all single-cylinder O.H.V. models produced since 1937, except special competition engines.

Taking Apart the Crankcase

Crankcase tie-bolts having been removed, place the assembly on the bench and gently drive the halves apart by tapping with a mallet or hide hammer inside the cylinder aperture. Tap out the flywheel assembly, but take note of hardened end-play washers which may be fitted to the mainshafts.

Removing Main Bearings

Crankcase bearings are known as an "interference fit", and can very easily be removed by warming the crankcase to allow for expansion and then striking each half face downwards on a flat, hard surface. Remove the securing bearing circlip before attempting to tap out and note position of the distance piece between the two drive-side bearings. Refer to data chart regarding correct type crankcase bearings and note that Model VH or Red Hunter is fitted with "roller" bearings extra to the usual "ball" type. Wash out all bearings in clean petrol and examine carefully the inner and outer races for any signs of pitting or scoring and renew if necessary. Warm crankcase again around bearing housings before pressing in new races.

Cam Lever Pin fit should be dead tight in crankcase. Check for wear; see data chart, p. 98. The pin can be removed by warming around the fixing boss and pulling out with suitable grips. Warm crankcase again before fitting new pin.

Overhauling Flywheel Assembly when Taper Crankpin is Fitted

The flywheel assembly incorporating a taper crankpin, common to all Ariel singles except 500-c.c. Red Hunters, can be dismantled without any very special apparatus and it is only necessary to remove first one of the crankpin nuts, right-hand thread, and if a suitable press is not available, place a hardwood wedge or taper chisel between the flywheels near the crankpin and give same a few sharp blows with the hammer to part the wheels. Check the crankpin centre race for pitting or wear, and if it is necessary to remove the pin from the other flywheel, it can be driven out with an ordinary punch or drift and hammer.

Fitting Oversize Rollers

The big-end bearing, comprising crankpin, outer race—which is a press fit in the connecting-rod—and a double row of hardened steel rollers, is supplied as a complete assembly, and the makers' recommendation is for this always to be renewed as such, and not in separate components. For convenience, however, a set of new rollers only can be fitted, either standard or up to 0·003-in. oversize. If it is possible to micrometer measure the original rollers, note that when new these are size $\frac{1}{4}$ in. × $\frac{1}{4}$ in. Therefore, if these register 0·002 in. wear, this will permit an up-and-down play in the connecting-rod of a minimum of 0·004 in. If oversize rollers are fitted, ascertain that when the complete bearing is made up, there is at least clearance between two rollers when a feeler gauge is inserted of 0·010 in. thickness. A big-end bearing without this circumference clearance will give trouble up to a point of serious overheating and subsequent seizure. When refitting a big-end bearing, check to see that there is a minimum of 0·0005-0·001 in. maximum up-and-down clearance.

When Parallel Crankpin is Fitted

The 500-c.c. Red Hunters are fitted with a parallel crankpin of 1 in. diameter, a double row of rollers which are caged

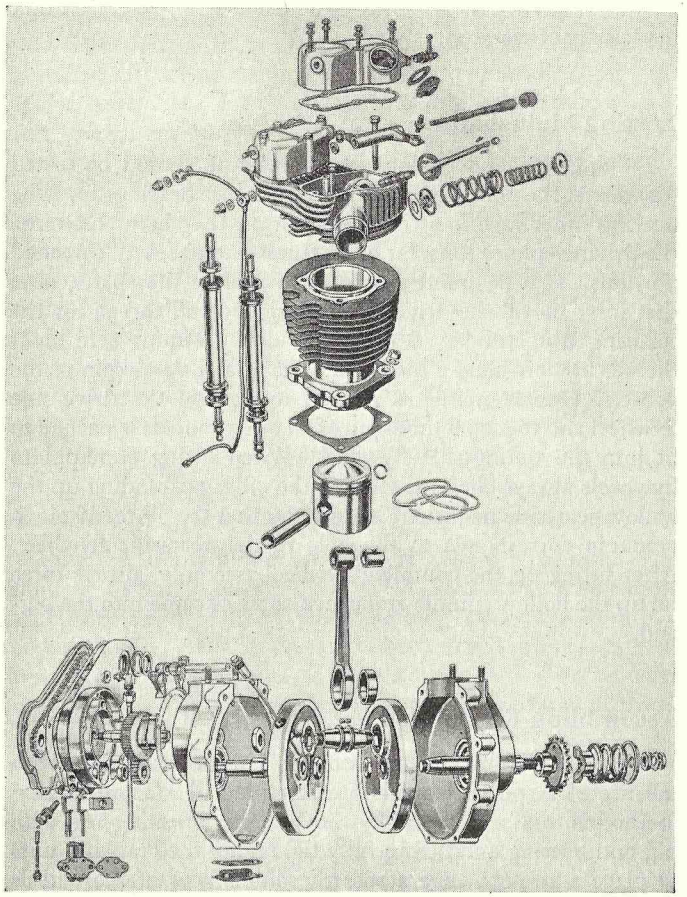


FIG. 29.—EXPLODED VIEW OF THE 1938–59 350-C.C. SINGLE-CYLINDER O.H.V. ENGINE ASSEMBLY.
The 1938–53 500-c.c. single-cylinder O.H.V. engine is very similar.

and an outer race pressed into the connecting-rod. To dismantle the flywheels it is advisable to press the crankpin out, but if no press is available, five or six short bolts and nuts can be inserted between the flywheels and the nuts unscrewed against one wheel with the bolts equally spaced. All

"Hunter" flywheels are built of polished steel, whereas other models are of cast iron.

Testing Mainshafts

Driving-side and timing-side mainshafts should be tested for wear at the points on which the crankcase bearings fit. The bearing inner race is a tight push-fit on the shaft. Examine the driving splines for wear or fractures and check all threaded portions. If it is found necessary to replace the shafts, note that for removal the drive-side is a right-hand thread for the securing nut and keyed on all models. Timing-side shaft threads are left-hand either end. The straight crankpin of the 500-c.c. Hunter model is pegged to fit into the drive-side flywheel and the taper crankpin of all other models is pegged to fit into the timing-side flywheel. When fitting crankpin to flywheels always check to see that the oilway extending up the hollow gear-side mainshaft is clear and that the oil-feed hole in crankpin corresponds to the hole in the gear-side flywheel. After fitting up the complete flywheel assembly, always force oil up the hollow spindle and check entry of same into the big-end.

Assembling Flywheels

Flywheel alignment after assembly is best carried out with the use of a special workshop assembling jig. The common method is to assemble the flywheels and connecting-rod with big-end bearing and before fully tightening the crankpin nuts to place a straight-edge across the outer faces of the wheels approximately at right angles to the crankpin. Tapping the wheels will bring both more or less in alignment, and the straight-edge test should show this to contact both flywheels evenly. Then, for a final check before tightening the crankpin nuts, the complete assembly should be set up between two lathe centres, and if a workshop clock-dial gauge is available, test each mainshaft for true running, which should not exceed 0·002 in. error through mal-alignment.

Refitting Crankcase

The crankcase halves should be thoroughly cleaned and smeared with a thin coating of good-quality jointing compound before assembly. Fit flywheels into one half-crankcase first and then offer up the opposite half. Insert two or three securing bolts and tighten. Check for end clearance or "float" in the cases, and if this exceeds 0·012 in. dismantle crankcases again and fit on either mainshaft a thin-gauge hardened end-play washer and re-check. The flywheel assembly must be located centrally in the crankcase and the end-play washers can be used to determine this. From 0·008–0·012 in. end-play is permissible. When finally tightening up crankcase tie-bolts, see that the top faces on which the cylinder barrel fits are perfectly even. Any irregularity present at this face will prevent the cylinder from correctly locating, and cause serious mal-alignment and oil leakage.

Reassembling Timing Gears

Refit the timing pinion on the spindle by driving same right home in the keyed position, and when the camwheel is inserted with the timing "dots" corresponding the valve timing is correct. After cam levers have been fitted prepare a new timing-cover joint washer to exact pattern, and also the extra 0·005 in. small circular washer for fitting to the short protruding copper oil-return pipe. Before assembling the timing-gear cover see that the oil-feed pipe which passes into the hollow mainshaft is fitted securely in the cover and is not damaged or out of alignment. This pipe is a light driving fit and, as described in a previous page, forms a housing for the pressure ball valve on all 1941 and subsequent models. Refit rear engine plates to crankcase, and bolt down the Magdyno on the platform, but leaving the securing bolts for finally tightening after the correct mag. chain tension has been applied. Fit the felt washer and steel retainer to the recess where the magneto armature enters the gear cover, and an extra Vellumoid or similar material circular washer over the armature spindle to prevent oil and crankcase pressure entering the magneto gear housing.

Fitting Magneto Drive

Timing-gear cover and chain sprockets with magneto chain in position are refitted and the nut on the camwheel holding the driving sprocket securely tightened. This is best carried out by using a tube spanner and giving the tommy bar a few final hard blows with the hammer. Do not tighten the nut securing the driven sprocket on the magneto spindle, but slide the magneto on the platform to give sufficient pressure to hold the felt washer and retainer and also to obtain correct chain tension. Tighten up magneto base bolts.

Retiming Ignition

Assuming that the piston and cylinder have already been refitted as described under "Top Overhaul", set the piston at required position of degrees before T.D.C. compression. Set ignition control to fully advanced position and contact-breaker points to just commencing to open. Note that the magneto rotates anti-clockwise from driving end when setting the breaker. With magneto armature and piston in relatively correct positions, place a tube spanner over the armature spindle against the sprocket to clear the nut, and give a few sharp blows with the hammer to tighten the sprocket on the taper. Securely tighten spindle nut and re-check the mag. timing.

Refit oil pump after checking as described under "Lubrication" (p. 76), and also deal with adjustments to carburetter and Magdyno, etc., as laid down in Chapters VII and XI.

Replacing Engine in the Frame

Ensure that all crankcase tie-bolts and engine-plate fixings are dead tight. Do not omit the foot-rest rod distance piece fitted between the rear engine plates. See that the shock-absorber assembly is fitted up correctly. The 1941–59 assembly incorporates an improved type of sliding member and engine sprocket and, as this is interchangeable with all previous types, it is advisable to fit it to any Ariel single-cylinder model whilst in the overhauling stages. Order of assembly is as follows:

(*a*) Plain distance collar next to crankcase bearing; (*b*) engine driving sprocket; (*c*) sliding member—no spring cup fitted to 1941–59 models; (*d*) shock-absorber spring; (*e*) spring plate—plain centre hole, not splined; (*f*) lock-nut; (*g*) tab or lock-washer; and (*h*) lock-nut.

See that a paper joint-washer is fitted at the foot-rest boss between the chaincase halves. This will prevent oil leakage. The gearbox lower swivel and top clamp bolt must be securely tightened; also ensure that the flat head of the clamp bolt is located in the D-shaped hole in the near-side rear engine plate.

Final Adjustments

Run the engine for a short period in order to ascertain that the lubrication system is in order, and remove the crankcase sump plate and filter gauze: to the oil-return pipe then exposed, attach a length of rubber tubing terminating in a glass jar containing clean engine oil. With the engine running, the oil-return pump should remove the oil from the jar and pass it into the oil tank. At the same time, the delivery flow can be tested by detaching the oil pipe to gauge union nut, also by noting the gravity fall of oil from the flywheels through the sump aperture.

DATA FOR 1937–59 SINGLE-CYLINDER ENGINES

Model.	Year.	Capacity.	Bore.	Stroke.	Compression Ratio.	Peak Revs.	B.H.P.
		c.c.	mm.	mm.			
VB, Side Valve.	1937–59	597	86·4	102	5·0—1	4400	15
VG, O.H.V.	1937–50	497	81·8	95	6·8—1	4600	22
VH (Red Hunter), O.H.V.	1937–59	497	81·8	95	6·01—1 or 7·5—1 H.C.	H.C. 6000	27
NH (Red Hunter), O.H.V.	1937–59	348	72	85	6·0—1 or 7·0—1 H.C.	H.C. 5800	17
NG, O.H.V.	1937–50	348	72	85	6·0—1	5000	13
OH (Red Hunter), O.H.V.	1939 only	249	61	85	7·0—1	6000	13
OG, O.H.V.	1939 only	249	61	85	6·0—1	5400	12
LG, O.H.V.	1937–38	249	61	85	6·0—1	5400	12
LH (Red Hunter), O.H.V.	1937–38	249	61	85	7·0—1	6000	13
W/NG (Military Model).	1940–45	349	72	85	6·5—1	—	—

Note.—Peak revs. on Hunter Models is with H.C. Pistons.

Valve Timing

Model.	Inlet Opens. Before T.D.C.*	Inlet Closes. After B.D.C.†	Exhaust Opens. Before B.D.C.†	Exhaust Closes. After T.D.C.*
VB. 1937–1959.	$\frac{5}{32}$ in. 22°	1 in. 70°	1 in. 70°	$\frac{7}{64}$ in. 25°
VG (except 1946-1950).	$\frac{1}{64}$ in. 5°	$\frac{13}{32}$ in. 55°	$\frac{11}{16}$ in. 60°	$\frac{5}{32}$ in. 20°
VG, 1946–1950.	$\frac{9}{64}$ in. 22°	$\frac{15}{16}$ in. 70°	$\frac{15}{16}$ in. 70°	$\frac{3}{32}$ in. 25°
VH all years except	$\frac{9}{64}$ in. 22°	$\frac{15}{16}$ in. 70°	$\frac{15}{16}$ in. 70°	$\frac{3}{32}$ in. 25°
NH 1951–1959.	$\frac{9}{64}$ in. 22°	$\frac{15}{16}$ in. 70°	$\frac{15}{16}$ in. 70°	$\frac{3}{32}$ in. 25°
VH 1951–1959.	26°	77°	70°	33°
NH 1951–1959	26°	77°	70°	33°
NG (except 1946-1950).	$\frac{1}{64}$ in. 5°	$\frac{13}{32}$ in. 55°	$\frac{11}{16}$ in. 60°	$\frac{5}{32}$ in. 20°
NG, 1946–1950.	$\frac{9}{64}$ in. 22°	$\frac{15}{16}$ in. 70°	$\frac{15}{16}$ in. 70°	$\frac{3}{32}$ in. 25°
LG, LH, 1938.	$\frac{9}{64}$ in. 22°	$\frac{15}{16}$ in. 70°	$\frac{15}{16}$ in. 70°	$\frac{3}{32}$ in. 25–
OG, 1939 only.	$\frac{1}{64}$ in. 5°	$\frac{19}{32}$ in. 55°	$\frac{11}{16}$ in. 60°	$\frac{5}{32}$ in. 20°
OH, 1939 only.	$\frac{9}{64}$ in. 22°	$\frac{15}{16}$ in. 70°	$\frac{15}{16}$ in. 70°	$\frac{3}{32}$ in. 25°
W/NG (Military Model).	5°	55°	60°	20°

* T.D.C. = Top Dead Centre. † B.D.C. = Bottom Dead Centre.

Note.—Owing to the makers fitting slightly different cam contours at times, variations to the above chart will be found on some models, but if cam gear and timing pinion is meshed to centre-dot markings valve timing will be correct.

Ignition Timing

(*Piston position before Top Dead Centre. Mag. control fully advanced.*

Model	Inch	
VH, NH, LH, OH. (All Hunter Models.)	Red $\frac{5}{8}$.	High speed.
	$\frac{1}{2}$.	Normal touring.
VB 1937–48	$\frac{5}{16}$.	
VB 1949–59	$\frac{1}{4}$.	
VG, LG, NG, OG	$\frac{3}{8}$.	$\frac{1}{2}$ with Hunter type cam assembly.
W/NG (Military Model)	$\frac{1}{2}$.	Before T.D.C.—control fully advanced.

Piston Clearance

Solid-skirt-type (Cast-iron Cylinder)

Standard Models.	Below Rings.	Extreme Skirt.
All 250-c.c.	0·007–0·008 in.	0·003–0·005 in.
All 350-c.c.	0·007–0·009 in.	0·003–0·005 in.
All 500-c.c.	0·005–0·007 in.	0·005–0·007 in.

Model "VB" 600-c.c. side valve

Ring Land, in.	Below Rings, in.	Extreme Skirt, in.
0·024–0·027	0·0075–0·0095	0·0045–0·0065

All 500-c.c. models with Light-alloy Cylinder Barrels and Solid-skirt-type Pistons

Ring Land, in.	Below Rings, in.	Extreme Skirt, in.
0·016–0·019	0·0035–0·0055	0·002–0·004

Split-skirt-type (Cast-iron Cylinder only)

Model (1952–59)	Ring Land, in.	Below Rings, in.	Extreme Skirt, in.
500-c.c. VH	0·022–0·019	0·0055–0·0035	0·004 –0·002
350-c.c. NH	0·023–0·020	0·004 –0·0025	0·0025–0·001

Measurements to be taken at front and rear piston-thrust bearing face. All pistons are "ground cam oval"—*i.e.*, 0·010 in. at gudgeon-pin boss sides.

Camshaft Bush

All O.H.V. and S.V. . . Ream after fitting to 0·750 in. diameter.

Camwheel Spindle

All O.H.V. . . . Diameter 0·7485–0·7480 in.

Oil Pump

All Models.*

Delivery plunger	Diameter 0·1870–0·1875 in.
Return plunger	Diameter 0·3745–0·3750 in.
Delivery pump bore	Diameter 0·1875–0·1880 in.
Return pump bore	Diameter 0·3750–0·3755 in.

* 1950–55 All Models, Delivery plunger, Diameter $\frac{1}{4}$ in.

Magneto Chain

All Models. . . . $\frac{1}{2}$-in. pitch × $\frac{1}{8}$-in. × 35 pitches. Endless type.

Engine Ball and Roller Bearings

Crankcase ball bearing (except Model VH).	Size 1 in. × $2\frac{1}{2}$ in. × $\frac{3}{4}$ in. for drive-side.
Crankcase ball bearing (except Model VH).	Size 1 in. × $2\frac{1}{4}$ in. × $\frac{5}{8}$ in. gear-side and drive-side.
Crankcase ball bearing VH.	Size 1 in. × $2\frac{1}{4}$ in. × $\frac{5}{8}$ in. drive-side next to roller bearing.
Crankcase roller bearing (Model VH only).	Size (lipped) 1 in. × $2\frac{1}{4}$ in. × $\frac{5}{8}$ in. for gear-side.
Crankcase roller bearing (VH only).	Size (non-lipped) 1 in. × $2\frac{1}{2}$ in. × $\frac{3}{4}$ in. for drive-side.
Big-end bearing (except Model VH).	Inclusive *taper* 1 in 6 crankpin. $\frac{1}{4}$ in. × $\frac{1}{4}$ in. rollers. $\frac{3}{4}$ in. × 20 T. crankpin nuts.
Big-end bearing (1937–55 Model VH).	1 in. parallel crankpin. $\frac{1}{4}$ in. × $\frac{1}{4}$ in. rollers in alloy cage. $\frac{3}{4}$ in. × 20 T. crankpin nuts.
Crankcase bearing distance collars.	(1) Next to flywheel, 0·165 in. width.
Crankcase bearing distance collars	(2) Between D.S. bearings except VH 0·285 in.

Crankcase bearing collars.	distance (3) Between D.S. bearings VH only 0·274 in.
Crankcase bearing sprocket collar.	and (4) Next to sprocket, 0·586 in.

GUDGEON-PIN

All Models.
O.H.V. and S.V. . . Diameter 0·8110–0·8115 in.

SMALL-END BUSH

O.H.V. and S.V. . . *Ream after* fitting to 0·8120–0·8125 in. diameter.

VALVES—*Stem Diameter*

Model.	Inlet	Exhaust.
All 250-c.c. . . .	0·311–0·312 in.	0·311 –0·312 in.*
All 350-c.c. . . .	0·311–0·312 in.	0·340 –0·341 in.*
All 500-c.c. O.H.V. . .	0·342–0·343 in.	0·3695–0·3705 in.*
600-c.c. S.V. . . .	0·311–0·312 in.	0·311 –0·312 in.*

* Valve-seating angle, all models, 45°.

VALVE GUIDES—*Internal Bore*

Model.	Inlet.	Exhaust.
All 250-c.c. . . .	0·313 –0·314 in.	0·313 –0·0314 in.
All 350-c.c. . . .	0·313 –0·314 in.	0·344 –0·345 in.
All 500-c.c. O.H.V. . .	0·344 –0·345 in.	0·374 –0·375 in.
600-c.c. S.V. . . .	0·3135–0·3145 in.	0·3135–0·3145 in.

TAPPET S.V.

600-c.c. S.V. . . . Diameter 0·499–0·500 in.

TAPPET GUIDE S.V.

600-c.c. S.V. . . . Internal Bore 0·5005–0·5015 in.

ROCKER SPINDLE

All O.H.V. 1937–55 . . Diameter 0·498–0·499 in.

ROCKER

All O.H.V. 1937–55 . . Internal Bore 0·500–0·501 in.

CAM LEVER PIN

All O.H.V. and S.V. . . Diameter 0·4890–0·4895 in.

CHAPTER IV

200-c.c. MODEL LH COLT (1954–59)

Engine Lubrication

THE engine lubrication system is of the dry-sump type, operated by a double-gear pump situated in the bottom of the crankcase. All oilways are internal except for the supply and return pipes from the tank. The oil flows through a filter in the tank to the supply portion of the pump, which delivers it past a pressure valve A (Fig. 30) to the crankshaft and the big-end bearing.

After lubricating the big-end and circulating through the engine in the form of mist, the oil drains through a filter in the bottom of the crankcase, from which it is drawn by the return portion of the pump past another ball valve C and delivered through the return pipe to the tank. To check the flow of oil in the lubricating system, remove the tank filler cap whilst the engine is running. Oil should be seen issuing from the return pipe to the crankcase.

Ball Valves

Incorrect seating of the ball valve A will allow oil to transfer from the tank to the engine whilst the machine is stationary. In this event unscrew the plug over the valve and remove spring and ball. Clean the ball and its seating and replace. If the ball valve C in the base of the pump should adhere to its seating, there will not be any return flow of oil to the tank. To correct this, remove the cover plate B, insert a piece of wire into the valve orifice and lift the ball off its seating to free it.

Tank-pressure Release

Any restriction in the press-release pipe in the oil tank will cause an increase in pressure inside it, and will result in leakage of oil at the filler. This can be rectified by inserting a

length of flexible wire into the pipe at its lower end (just in front of the rear mudguard) and pushing the wire right up the pipe, thus clearing any obstruction.

Filters

To remove the oil-tank filter for cleaning, unscrew the oil-pipe union at the bottom of the tank, when filter will come out with the plug.

The crankcase filter can be withdrawn after removing the cover plate B. The filters should be thoroughly washed in petrol and carefully dried before replacement.

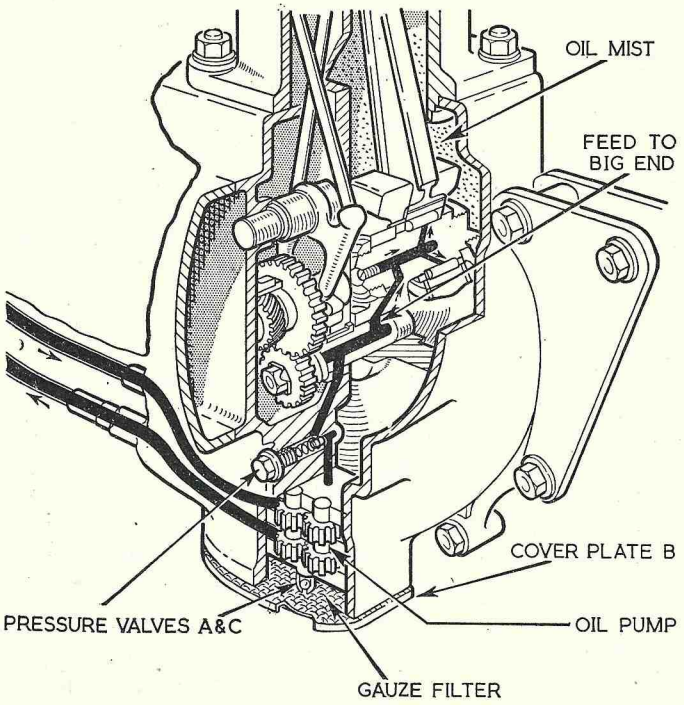


FIG. 30.—LUBRICATION SYSTEM OF THE 200-C.C. MODEL LH COLT.

Oil Tank

Inspect the level of oil at least once a week. It should never be allowed to fall below the level marked on the outside of the tank. When topping up do not fill the tank completely; leave about 1 in. margin between the oil and the top of the tank. If this precaution is not observed it is possible that oil will seep from the filler cap. Drain and refill the tank every 2000 miles.

Carburetter Air Cleaner

The air cleaner needs to be dismantled and cleaned every 1000–1500 miles. The filter element should be washed thoroughly in petrol, allowed to dry and then submerged in light engine oil for a few minutes. Allow the surplus oil to drain off, and reassemble.

Setting the Valve Clearances

Checking and adjustment of the valve clearances must always be carried out with a cold engine, when the amount of clearance for the valve should be 0·001 in. inlet valve and 0·002 in. exhaust valve. Commencing with Serial No. LA 201 (1955), the recommended clearances with the "R" ramp-type cam assembly are inlet valve 0·010 in. and exhaust valve 0·012 in.

One central bolt holds the rocker-box cover in position. Take care not to damage the gasket, as otherwise a new one will be required when reassembling, in order to prevent oil leakage. Remove the sparking-plug; this enables the engine to be turned easily by hand pressure on the kick-starter. Rotate the engine until the piston is at top dead centre on the compression stroke. This can be simply ascertained if a long piece of wire is inserted through the sparking-plug hole, so that the top of the piston can be felt. At the end of the compression stroke the valves will be closed, and slight movement of the engine backwards or forwards will not open either of the valves.

Apply a spanner to the flats on the adjusting screw. Hold it stationary in order to assist in the operation of releasing the lock-nut. Slacken the lock-nut with a tappet spanner. The

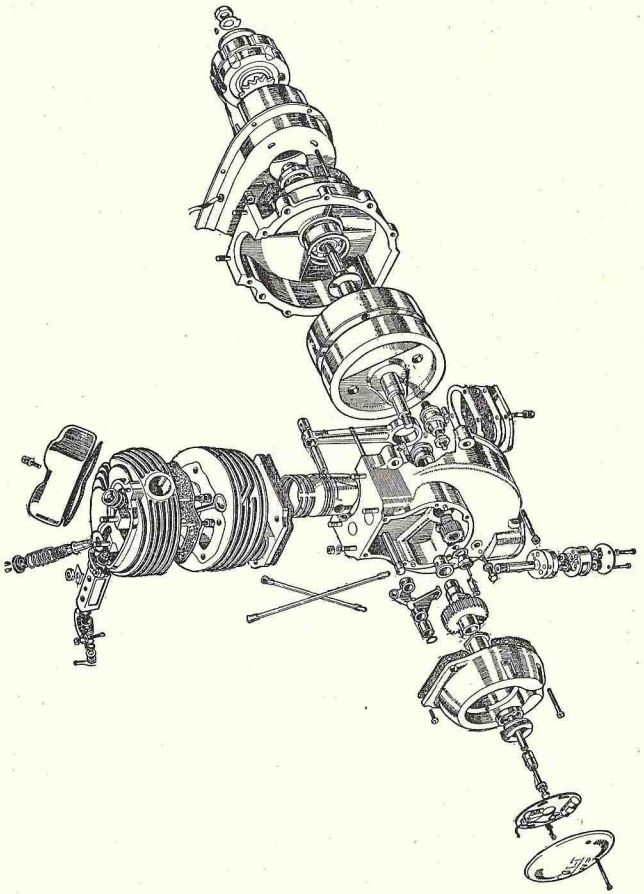


FIG. 31.—EXPLODED VIEW OF THE 200-C.C. MODEL LH COLT ENGINE.

operation should be carried out simultaneously with the previous one. Hold the lock-nut stationary and move the adjusting screw up or down until the space between the valve and the end of the rocker arm is only just sufficient for the feeler gauge to enter.

Retain the adjusting screw in the correct position and tighten the lock-nut securely against the rocker arm. Check the clearance to make certain it has not altered while tightening the nut. Replace the sparking-plug and the rocker-box cover, taking care not to damage the gasket.

When the engine warms up to its normal running temperature the clearances will be different from the figures given above, and for this reason the clearance must be set with the engine quite cold. Failure to observe this instruction may lead to difficult starting, poor performance, burnt valves, etc.

Clutch Adjustment

Check for correct clutch adjustment. This should be set to give approximately $\frac{1}{16}$ in. free movement between the internal operating arm and the end of the push-rod. This movement should be "felt" at the handlebar control lever, and minor or running adjustments carried out by means of the external cable adjuster on the handlebar end of the control cable. For clutch-assembly major adjustment see Chapter VI.

Contact Breaker

The contact gap should be adjusted to 0·012–0·015 in.

Remove the contact-breaker cover, which is also the Ariel Colt nameplate, and rotate the engine with the sparking-plug removed until the contact rocker-arm fibre heel is positioned on the centre of the operating cam. Loosen the lock-screw A (Fig. 32) and then turn the small cam screw B clockwise to widen the gap, or opposite rotation to narrow the gap. Finally check the gap with a feeler gauge and tighten the screw A. Note the position of the felt-pad lubricator. This should be soaked with a few drops of lubricating oil every 5000 miles, but take care not to over-oil, as there is a risk of the excess getting on to the contact points and causing trouble.

Ignition Timing

If for any reason it has been found necessary to remove the complete contact-breaker assembly and mounting plate, it will be essential to reset the ignition timing when replacing. The mounting plate is held in position by the two screws C and D (Fig. 32), and it will be noted that a limited range of adjustment is possible through the two slots in the plate into which are fitted the screws C and D. To set and adjust the ignition timing, first remove the sparking-plug to enable the engine to be rotated slowly by depressing the kick-starter by hand pressure. Next set the piston at $\frac{1}{16}$ in. before top dead centre at the end of the compression stroke with both valves fully closed. To check this position insert a length of stiff wire through the sparking-plug hole until the top of the piston is felt. Gently rotate the engine backwards and forwards to ascertain that the top centre is accurate, otherwise a true setting for the ignition timing will not be found.

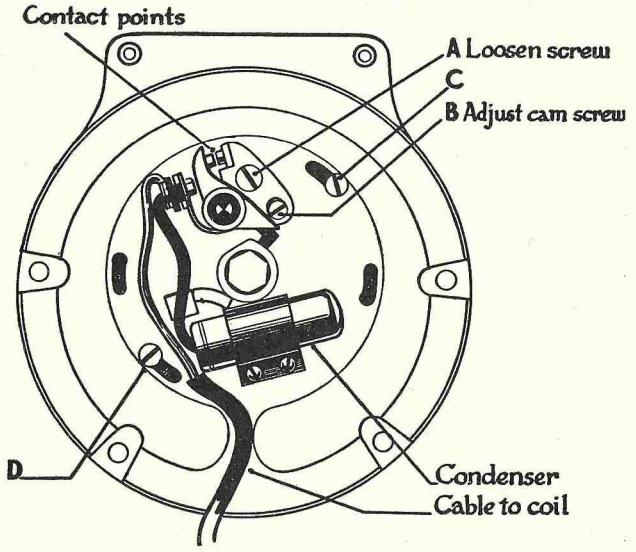


FIG. 32.—200-C.C. MODEL LH CONTACT-BREAKER ADJUSTMENT.

An easy method of "rocking" the piston to find top centre is by engaging top gear and rotating the rear wheel very slowly by hand. With the piston set correctly and the contact-breaker mounted into position, but with the fixing screws C and D loosened, turn the mounting plate through slot movement until the contact points are just opening. Tighten the screws C and D to lock in position. Finally, check the ignition timing, which should now be with the piston at $\frac{1}{16}$ in. before top dead centre contact points just opening control fully retarded. Note that when the engine is stationary the ignition timing is in the fully retarded position, because of the action of the automatically controlled advance and retard mechanism behind the contact-breaker mounting plate.

Valve Timing

The valve timing cannot become disturbed with normal running, therefore it is inadvisable to attempt to dismantle the timing gear and cam assembly except when the general overhaul is due. If, however, it does become necessary to examine the gear assembly, proceed in the following manner. First remove the Ariel Colt nameplate. Disconnect the cable lead from the contact-breaker to the coil. Remove the two screws securing the contact-breaker mounting plate (screws C and D, Fig. 32).

Next remove the long centre hexagon-headed bolt which secures the automatic advance and retard unit and driving sleeve.

The automatic unit is located on a keyed tapered shaft and, to remove, it is only necessary to improvise a very simple extractor by first inserting in the centre hole a $3\frac{1}{2}$ in. length of $\frac{3}{16}$ in. diameter rod. Next screw into the thread provided a $\frac{5}{16}$ in. B.S.C. 26 T.P.I. bolt, approximately $\frac{5}{8}$ in. long, and the advance unit will be forced off its taper.

Valve Timing Marks

Having exposed the cam gear and intermeshing timing pinion, note carefully the position of the two corresponding timing marks. Check to ensure that when the piston is at

top dead centre on the compression stroke (both valves closed) the two timing marks register together. Also note they register at every second revolution of the engine shaft.

The Automatic Advance Unit

Whilst this is dismantled examine the action of the governor controls and see that they work freely. Note that when the driving sleeve is engaged with the governor and is turned by hand to the advance position (weights fully extended outwards) and then released, the small coil springs withdraw the weights to the normal stationary position (fully retarded). Wipe the control clean and well lubricate with thin cycle oil.

Cylinder-head

After the machine has covered its first 250 miles when new or after decarbonising, check the tightness of the cylinder-head bolts. This is because the gasket tends to settle down after the initial clamping. To ensure even distribution of pressure with consequent freedom from distortion, tighten the nuts as indicated in Fig. 33.

The Sparking-Plug

The sparking-plug is of great importance in satisfactory

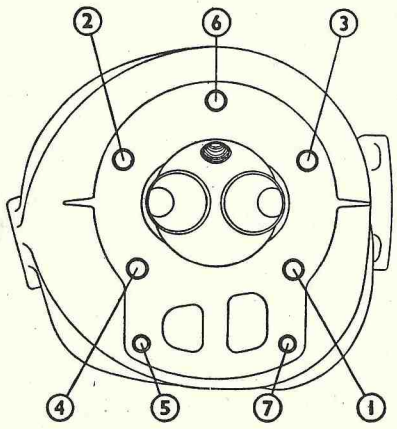


FIG. 33.—SEQUENCE OF TIGHTENING CYLINDER-HEAD ON 200-C.C. MODEL LH COLT.
The head should be released in the reverse order.

engine performance, and every care should be taken to fit the correct type when replacements are necessary. There is little to be gained by experimenting with different plugs, as the make and type originally fitted is best suited to the requirements of the motor. Remove the sparking-plug every 1000 miles for inspection. If the carburation is correct, the sparking-plug points should remain clean almost indefinitely. An over-rich mixture from the carburetter will, however, cause the formation of a sooty deposit on the points, and later on the plug end face. If such a deposit is found, clean it off carefully and check the carburetter settings. The continued use of leaded fuel may also eventually produce a deposit on the plug—this time of a greyish colour. A light deposit due to any of these causes can easily be cleaned off, but if it is allowed to accumulate, particularly inside the body, the plug may spark internally, with an adverse effect on engine performance—if, indeed, it does not stop the engine altogether. The plug should be cleaned and tested at regular intervals, and it is suggested that this service be performed at your garage on a special "Air Blast" service unit. If eventually the cleaning process fails to restore the plug to its original condition of efficiency it should be replaced by a new one.

When inspecting the plug, also check the gap between the points. This should be 0·020 in., and adjustment should be made by bending the side wire. Never attempt to move the centre electrode, and always use a special plug-gap tool.

When refitting the plug make sure that the copper washer is not defective in any way. If it has become worn and flattened, fit a new one to ensure a gastight joint. It is advisable to always well smear the plug threads with spirit graphite before fitting, and on no account overtighten any type of plug in the alloy head. Screw the plug down by hand as far as possible, then use a spanner for tightening only. Always use a tubular box spanner to avoid possible fracture of the insulator, and do not in any circumstances use an adjustable spanner. Paint splashes, accumulation of grime and dust, etc., on the top half of the insulator are often responsible for poor plug performance. The plug should be wiped frequently with a clean rag.

TRANSMISSION

Primary-chain Adjustment

Remove the chaincase filler cap: the chain can be seen through the orifice and its tension checked with the fingers. It is not necessary to move the outer half of the case. Located immediately below the gearbox on the right-hand side will be found two long hexagon-headed sleeve nuts and serrated washers. Loosen both sleeve nuts and washers, and the gearbox can be moved backwards and forwards as required until correct primary-chain tension is obtained. Rotate the engine slowly, and at intervals check the up-and-down movement mid-way between the sprockets, which should not exceed $\frac{1}{2}$ in. at the *tightest* point.

The gearbox nuts must be securely locked, otherwise the pull on the primary chain when the engine is running may cause the box to slide forward, thus slackening the chain. Note that after adjusting the front chain the rear chain also may need adjustment owing to the fact that the gearbox has been moved. The primary-chain tension should not exceed a total up-and-down movement of $\frac{1}{2}$ in.

Rear-chain Adjustment

The tension of the rear chain is modified by altering the position of the rear wheel. Set the machine on its stand. The wheel must be in its lowest position in the suspension unit for the purpose of this adjustment. The rear-brake adjuster (D, Fig. 34), must be slackened off, as otherwise the brake rod may prevent free movement of the wheel. The spindle nuts (E) must be released to ensure easy movement of the wheel spindle in the fork ends. The adjusters F should be tightened so that they are equal on both sides of the wheel so that the latter is kept in correct alignment in the frame. Retighten the wheel-spindle nuts E. Screw up the brake adjuster D until the rear brake operates with its normal efficiency.

The wheel alignment should be checked carefully. Any misalignment may cause excessive tyre and chain wear and uncomfortable steering. The rear-chain movement should

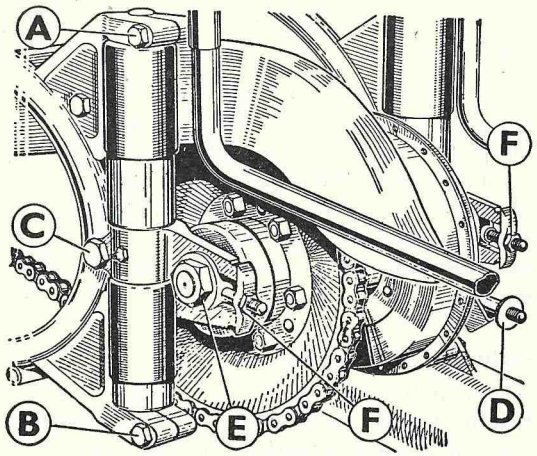


FIG. 34.—METHOD OF ADJUSTING THE REAR CHAIN ON THE 200-C.C. MODEL LH COLT.
(A) (B) (C) Pinch bolts. (D) Rear-brake adjuster. (E) Spindle nuts. (F) Chain adjusters.

not exceed $\frac{1}{2}$ in. with the wheel set at the lowest point in the suspension unit.

Chain Lubrication

Remove the rear chain periodically, clean it thoroughly in petrol or paraffin, and then gently warm in a mixture of grease and graphite. When cool, wipe off excess grease, clean the sprockets and replace the chain.

Remember, when replacing a chain fitted with a detachable connecting link, that the spring link must always be put on with the closed end facing the forward direction of travel of the chain (*i.e.* on the top run).

Gearbox Oil Level

Early series gearboxes were not fitted with a level plug. To check the oil level, remove the filler cap and insert a bent metal dip stick, upon which the correct level of oil should show at approximately 1 in. from the base. Top up as necessary. Later series gearboxes have a level plug on the front cover. The capacity is $\frac{1}{2}$ pint engine oil.

WHEELS

Front-wheel Removal

Dismantle the assembly in the following order. The brake cable must be uncoupled, first at the lever on the brake cover plate, and then unscrewed from the top. The wheel spindle is locked by a pinch bolt, which is fitted to the nearside fork leg only. It is only necessary to slacken the pinch bolt. To unscrew the wheel spindle apply a spanner to the spindle head. Note that the spindle has a left-hand thread and unscrews in a clockwise direction.

Front-wheel Replacement

Make certain that the stud on the brake cover plate fits properly into its socket, otherwise the brake will be inoperative. Before the pinch bolt is tightened the forks must be depressed sharply several times to enable the nearside fork leg to align itself on the spindle. If this precaution is not observed the leg may not be aligned properly, in which case it will not function correctly. Do not forget to tighten the bolt.

Front-wheel Bearings

The hub is fitted with cup and cone type bearings, and adjustment can be carried out in a satisfactory manner only when the wheel is removed from the forks.

To adjust, slacken the lock-nut (A, Fig. 35). Adjust the nut B, this should be tightened or loosened according to requirements, but note that it is most important that this nut is not over-tightened—the wheel must have just perceptible side play at the rim.

When this setting is obtained retighten the lock-nut A against the adjusting nut B, and finally recheck.

Rear-wheel Removal

In order to take out the rear wheel, unscrew the speedometer driving cable at the point of entry into the hub gearing. Disconnect the rear chain at its spring link and unwind it from the rear-wheel sprocket. Leave the chain in position on the

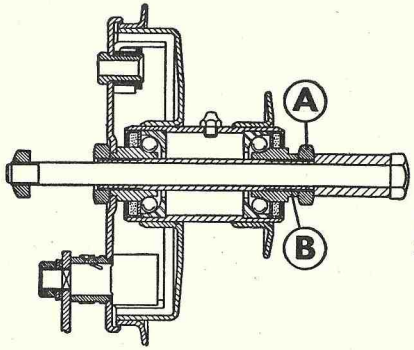


FIG. 35.—METHOD OF ADJUSTING 200-C.C. MODEL LH FRONT HUB.

(A) Locknut
(B) Adjusting nut.

gearbox sprocket. The rear-brake adjuster D (Fig. 34), on the end of the brake rod, should be unscrewed completely. The spindle nuts E need not be completely removed but slackened far enough to allow the wheel to be withdrawn.

Rear-wheel Bearings

The hub is fitted with ball bearings that require no adjustment.

Wheel Alignment

Whenever any adjustment has been made to the rear chain it is advisable to examine the wheel for alignment, since if this is incorrect the steering will be unsatisfactory and undue wear will take place on the sprockets, chains, tyre, etc. Check that the chain adjusters are firmly against their stops. This should, of course, be the normal condition after chain adjustment.

Apply a straight-edge along the sides of the wheels. A narrow plank is a suitable gauge, which should be applied at a point immediately below the silencer and kept in a horizontal position. It may be necessary to cut pieces from the straight-edge in order to clear other portions of the machine. With the front wheel set straight ahead the gauge should touch both wheels at two points.

SUSPENSION AND STEERING

Front Forks

If after considerable mileage the forks appear to develop excessive up-and-down movement, replenish the hydraulic system.

Remove the hexagon-headed cap at the top of each fork leg. Unscrew the drain plug at the bottom of each fork tube. Drain out the old oil. It will help this operation if the owner stands astride the machine, grasps the handlebars and oscillates the forks sharply up and down a few times. Replace the drain plugs. Add $\frac{1}{4}$ pint of oil to the top of each leg. Replace the hexagon-headed cap; these must be screwed down tightly, since they anchor the fork tube to the top yoke.

Note.—A quantity slightly in excess of the above amount will not be harmful, but on no account must the fork legs be filled right up to the top, or they will be unable to function.

Steering-head Adjustment

Raise the front wheel clear of the ground. Stand astride the front wheel and lift it while an assistant places a box underneath the crankcase. Remove the steering-head lock-nut, behind the speedometer, to reveal the adjusting sleeve. Slacken the pinch bolt. Release the fork yoke pinch bolts. These are located close to the point where the fork legs pass through the lower steering yoke and must be freed so that during adjustment of the steering-column the yoke can take up a new position on the fork legs. Turn the adjusting sleeve until all slackness (*i.e.*, up-and-down play) has been taken up. Check the adjustment. Make sure that the sleeve is not too tight, otherwise the steering will be stiff and the ball race may be damaged. Tighten all three pinch bolts and the steering-head lock-nut, and recheck the adjustment.

Rear Suspension

Under normal running conditions the rear suspension should not need any attention other than that of lubrication. If, however, it is decided to dismantle the assembly for any

reason, adopt the following sequence. Remove the rear wheel. Remove pinch bolts at the top and bottom of the suspension unit (A and B, Fig. 34). Tap the centre columns upwards with a hammer and soft punch and take them out through the top lugs. The spring units will slide sideways from between the top and bottom lugs and can be completely dismantled on the bench. If necessary the wheel-spindle brackets can be detached from the bearing sleeves after removal of the pinch bolts C.

Note.—The pinch bolts at A, B and C engage with notches in their respective sleeves, and particular attention must be paid to their correct position.

BRAKES

It is vitally important that the brakes are kept in good condition. For this reason do not over-lubricate the wheel bearings, and oil must not be used instead of grease in any circumstances. When washing the machine down, avoid playing the hose direct on the brakes, otherwise they will be ineffective until dried out. The brake cam spindles should be lubricated with oil every 1000 miles. Discretion must be exercised when lubricating to ensure that oil does not reach the brake lining. Neglecting to lubricate the spindles may make the brakes stiff to operate.

Front-brake Adjustment

The length of the brake cable can be altered at its lower end by means of a knurled thumb-nut on the cable stop.

Rear-brake Adjustment

Finger adjustment is provided at the end of the brake rod. Do not set the brakes too closely, since, particularly in the case of the front brake, its action may be too powerful. Any friction between lining and drum will obviously impair the machine's performance. In addition, if carried to extremes, the heat may melt the grease in the hubs, and this may find its way to the brake linings.

DECARBONISING THE ENGINE

Decarbonisation should be carried out only when the engine really needs it. The usual symptoms are an increased tendency to "pink" (a metallic knocking when under heavy load), due to the building up of carbon on top of the piston and inside the cylinder-head, a general falling-off of power, noticeable mainly on hills, and a tendency for the engine to run hotter than usual.

Preliminary Work

Remove the petrol tank. First turn off the petrol tap and detach the petrol pipe. The petrol tank itself is attached at the front to the steering-head lug and at the rear to the frame top tube, the latter fixing points being rubber mounted. Note the correct sequence of assembly for replacement purposes afterwards.

Unscrew the sparking-plug. Take off the carburetter by removing the flange bolts. By unscrewing the ring nut at the top of the carburetter mixing chamber the slides can be pulled right out and tied up to the top tube out of the way, while the main body of the instrument can be completely removed. The exhaust pipe is a push fit into the cylinder-head, and can be withdrawn when the bolts holding the exhaust system to the frame are released.

Dismantling for Top Overhaul

Undo the nut and bolt securing the engine steady stay to the cylinder-head. Remove the central bolt and take off the rocker box. Examine the gasket, and should there be any signs of oil leakage it should be replaced by a new one when reassembling. Set the piston at top dead centre on the compression stroke. In this position both valves will be closed and there will not therefore be any pressure on the rocker gear, due to the valve springs, during subsequent operations.

The cylinder-head nuts should be slackened in the reverse order to that shown in Fig. 33. They are located between the fins at the side of the barrel. If the head shows a tendency to stick, a few light taps with a wooden mallet under the exhaust

port will loosen it. Raise the head enough to enable the push-rods to be removed from the rocker ball pins and the push-rods themselves can then be taken out. Examine the cylinder-head gasket carefully for defects. If it is not sound and bright, but has black stained patches, these may indicate leakage of gas, and a new gasket should be obtained.

Place a wooden block which will fit inside the cylinder-head on the bench, and lay the head over the block with the valve heads resting on it; compress the valve springs until the split collets can be removed. When the collets are out the valve springs and top collar can be lifted out. Alternatively, a valve-removal tool can be employed.

Bring the piston to the top of its stroke and scrape off the carbon deposit with an old penknife or similar tool, taking care not to damage the piston crown. All traces of carbon must also be cleaned from the combustion chamber, the valve heads and the ports.

Removing Cylinder Barrel

Remove the nuts holding the barrel to the crankcase. The barrel itself is then removed by lifting it upwards and forwards with the piston set at the bottom of the stroke.

Examination of Valves

An examination of the seating of a valve will quickly reveal whether or not it requires regrinding. The same applies to the seating in the cylinder-head, although this tends to deteriorate much more slowly than that on the valve, and it is seldom that a valve requires grinding-in merely in order to restore the cylinder-head seating.

When the valves were ground-in originally the seatings on the valve and in the cylinder-head were smooth and continuous, and of uniform width all round their circumferences. The probability is that the inlet valve will have suffered very little and, indeed, the seat may still be smooth and continuous. If this is so, restore to the original condition with a very slight amount of grinding, using fine-grade paste.

The exhaust valve, on the other hand, may require more

attention. If the seating is merely discoloured, a little attention with grinding paste will soon rectify it, and this is all that should be necessary if the engine has been properly looked after and the valve is examined at reasonable intervals. If, however, the exhaust valve has become scaled or pitted, a considerable amount of grinding-in may be necessary and, in extreme cases, this operation may fail to restore the seating. A valve is not likely to deteriorate to this extent unless it has been abused by such things as continuous running without sufficient tappet clearance, or with an incorrect mixture from the carburetter, or late ignition timing (see previous pages for these respective items), or it may be the result of neglect in failing to regrind at reasonable intervals. If the exhaust valve is found to be in this condition do not attempt to grind it in, but return it for refacing. Similarly, if the seating in the cylinder-head is badly pitted, this should be returned for the seat to be recut. The importance of having proper workshop treatment in the event of excessive pitting or scaling is emphasised, for any attempt to rectify these by the use of grinding paste alone will only result in the removal of too much metal from the seat in the head, with consequent pocketing and its attendant adverse effect on performance.

Valve Grinding

Smear a small quantity of grinding compound over the face of the valve and return the valve to its seat. A valve-grinding tool can be obtained from any accessory agent. Note that a light spring inserted under the valve head greatly facilitates the grinding-in operation, allowing the valve to lift and be rotated to a new position periodically. The valve should be raised and turned to a new position after every few strokes. Grinding should be continued until the valve seat and face show a uniformly matt metallic surface all round. Grinding paste is often supplied in two grades, coarse and fine. For valves in good condition a small amount of grinding with fine grade should be sufficient. If the valves are in poor condition, however, but not bad enough to return to the factory, start with the coarse grade and finish off with the fine, being careful to remove all traces of the former before changing to the latter.

Thoroughly clean the valves, seatings and stems, and wipe out the ports before reassembling. It is a good idea to smear the valve stems lightly with engine oil before inserting them in their guides.

Valve Springs

After a considerable mileage it may be desirable to renew the valve springs, as these tend to lose their efficiency due to heat and other causes. This is more likely to occur in the case of the exhaust-valve spring, as it is also more heavily loaded, and a useful test when the springs are dismantled is to compare them for length. If they are of different lengths the shorter one should be replaced. If the springs are examined in this manner while decarbonising, and replaced if necessary, it will save dismantling specially for this purpose at a later date.

Valve Rockers

To remove the rockers, if this should be required for any reason, it is merely a case of withdrawing the split pins and unscrewing the nuts which locate the rockers in position. Careful note should be kept of the rocker assembly for replacement purposes, as the various washers must obviously be inserted in the correct order.

Pistons and Rings

It should be rarely necessary to remove the cylinder barrel since top overhaul, already described, usually suffices to keep the machine in first-class working condition. Unless the condition of the engine indicates that the piston rings or cylinder-bore require attention, the owner will be well advised not to disturb the barrel. Symptoms indicating faulty piston rings might include heavy oil consumption, poor compression (but only if the valves are in good order, otherwise they are much more likely to be the cause), and excessive piston slap when warm. This latter may be due to worn bores, which could be checked without removing the barrel if the piston is moved to bottom dead centre, thus exposing the bores for examination and measurement.

In order to examine the piston, etc., insert a pointed instrument, such as a screwdriver or the tang of a file, into the slot specially provided in the piston and lever one circlip out of its groove. The gudgeon-pin is a tight fit in the piston and it may be necessary to warm the latter, using a cloth which has been immersed in hot water, wrung out and wrapped around the piston. Support the piston on the side from which the circlip has been removed (to avoid strain on the connecting-rod) and tap out the gudgeon-pin from the opposite side, using a light hammer and a punch of suitable diameter. The piston will now be free, and the inside should be marked to enable it to be replaced the correct way round. Cover the crankcase with a cloth to prevent foreign matter falling into the case.

If the piston rings are stuck in their grooves they must be prised free and removed from the piston. This needs care, as the rings are brittle. All carbon deposit should be carefully scraped from the grooves and the inside edges of the rings. Any rings showing brown patches on the surface in contact with the cylinder should be replaced. Check the piston-ring gap. Insert each ring in turn into the cylinder, followed by the piston. The latter is pushed against each ring to make sure it is true in the bore. Withdraw the piston and check the gap, which should be 0·008–0·012 in. Fit new rings if the gap greatly exceeds the figure stated. It is advisable to check the gap of new rings in a similar manner before fitting, and if the gap is less than specified the ends of the rings should be carefully filed to the correct limit.

Refitting the Valves

Replace the valves into their respective ports, place the springs over the stems with the collar in position and, with the valve heads resting on a wooden block as before, compress the springs until the split collets can be inserted. A dab of grease on the inside of the collets will serve to hold them in position until the spring is released. Make quite sure that the collets are correctly located.

Reassembling the Engine

Before assembly all components should be thoroughly

washed in petrol and dried, and a supply of clean engine oil should be available. It is advisable to have a set of paper joint washers to hand, together with some jointing compound, and, as previously mentioned, a new cylinder-head gasket and rocker-box gasket should be obtained if considered necessary.

When the piston rings are refitted, warm the piston and replace on the connecting-rod, making sure that it is fitted the correct way round. Smear the gudgeon-pin with engine oil and tap into position while the piston is still warm, supporting the latter from the opposite side. Fit a new gudgeon-pin circlip; this must not on any account be omitted. Fit a new paper washer to the crankcase face, lightly smearing with jointing compound before doing so. Coat the bore of the cylinder barrel with engine oil and smear the piston similarly. Turn the piston rings so that the gaps are on the opposite sides of the piston. Rotate the engine until the crankshaft is a little past bottom dead centre and then, compressing the top piston ring with the finger, slide the cylinder barrel over the piston and top ring.

Each ring must be compressed in turn as the barrel is refitted, and care is necessary to avoid breaking the rings. Alternatively, the rings may be compressed into their grooves by means of a piston-ring compressor so that as soon as the piston enters the bore the clip will automatically be pushed off. Before bolting the cylinder barrel to the crankcase, make sure that both tappets are in their lowest position, otherwise the barrel may not seat properly due to the pressure of the valve springs. Screw up the base nuts lightly at first, and then tighten a quarter of a turn at a time, working in diagonal order.

The cylinder-head gasket should be renewed if there is any suspicion that it has been leaking. The cylinder-head nuts should be tightened in accordance with Fig. 33 after the push-rods have been fitted in position. Recheck the tightness of these nuts and bolts after 250 miles have been covered—particularly if a new head gasket has been fitted.

Before the head is bolted down, the push-rods should be inserted down their appropriate apertures. It should be noted that the rods are crossed and that the exhaust rod must be fitted first, the plain end fitting into the cup formed on the

rocker in the timing case and the cupped end fitting over the rocker ball end. Tapper clearances should now be carefully set. When the rocker cover is replaced, examine the gasket to make sure that it is in order, otherwise there may be oil leakage at this point.

Clean and adjust the sparking-plug and replace. Connect the H.T. lead. Refit the carburetter. The needle and slide must be inserted correctly in position before the ring nut is screwed down. Note that the flange washer must be in good condition, as otherwise there may be air leakage past it, which may cause difficult starting and poor engine performance. Refit the petrol pipe, petrol tank, exhaust system, etc.

CHAPTER V

250-c.c. LEADER AND ARROW MODELS

IN 1958 the makers of Ariel motor cycles produced a machine incorporating modern styling, built-in weather shielding, luggage accommodation, etc.

THE LEADER

This production was the result of careful study of extensive shielding or enclosure, whilst allowing easy access to the essential working parts for adjustment and maintenance. Several accessories not generally used on the orthodox motor cycle are available for fitting to the Leader, including flashing direction indicators, rear bumpers, pannier cases/bags, inspection lamp, neutral-gear indicator, clock, etc. Fully equipped, therefore, the Leader can aptly be described as an "enclosed utility roadster" whilst remaining in the motor cycle class.

A beam-type pressed steel frame is used to which is attached a trailing-link-type front fork, and pivoted rear fork.

Mounted on the top of the frame is the dual seat with a hinged upper portion which, when lifted, gives immediate access to the petrol-tank filler cap, tool compartment and battery.

The enclosure side panels are very easily removed to gain access to the carburetter, contact breaker, gearbox, and for chain and clutch adjustment. The complete tail of the enclosure can be hinged upwards when rear wheel removal is necessary.

THE ARROW

Basically the Leader and Arrow models are identical, the difference between them being relative to enclosure and general equipment only. The Arrow is described as a "stripped" version of the Leader and suited more to the requirements of the sports type of rider. All the information given here regarding maintenance and adjustment, unless otherwise stated, is relative and applicable to both models.

ENGINE

Engine Maintenance

Simplicity of design and construction of the engine enables an owner to continue to use the machine for very lengthy periods without attention other than to ensure that the correct ratio of petroil is maintained.

At approximately every 3000 miles it is advisable to check the ignition contact-breaker gap, and to lightly lubricate the centre operating cam by means of a few drops of thin oil on the felt pad provided in the breaker assembly.

To gain access to this on the Leader, remove the near-side left-hand enclosure panel which is attached to the body by 5 slotted-type fixing screws. The contact-breaker cover can then be removed.

After lubricating the felt pad, take care to clean away any surplus oil which might foul the contact points and cause uneven running due to misfiring. To check or adjust the contact gap to the correct setting of 0·015 in., first rotate the engine slowly until the centre cam raises one of the rocker arms to the full limit of opening, and then check the gap with a suitable gauge.

If adjustment is necessary, the short contact sleeve screw can be turned in the required direction to give the 0·015 in. clearance gap and then tightened.

Rotate the engine again slowly, raise the other rocker arm for checking or adjustment, and ensure that both breaker gaps are set accurately before replacing the cover (see Fig. 36).

DECARBONISATION

In keeping with general two-stroke principles it is advisable to decarbonise at approximately every 5000 miles running. To remove the two separate cylinder-heads it is necessary first to take out the sparking-plugs, then with a socket-type wrench or spanner remove the sleeve-type head securing nuts and gently raise each cylinder-head clear of the extended base-fixing studs. Take care not to damage the head-joint gaskets

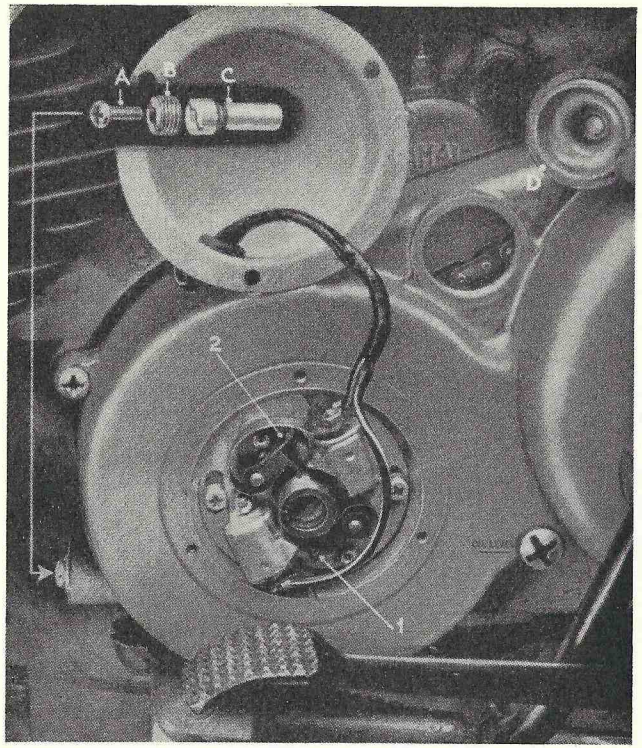


FIG. 36.—CONTACT BREAKER AND PRIMARY CHAIN ADJUSTER ON LEADER AND ARROW.
Contact breaker (1. L.H.-side cylinder, 2. R.H.-side cylinder). Primary chain adjuster (A. Plug screw. B. Stop plug. C. Nylon adjusting sleeve. D. Inspection cap).

as it is possible to use these again if replacements are not readily available. Refer to Fig. 37 and the reference numbers for identification and order of assembly of all parts relative to the top overhaul.

Take great care when removing carbon from the cylinder-heads and piston tops, as it is quite easy to score and damage the respective joint faces and surface metal. Also ascertain that the threads in the sparking-plug holes are clear of carbon, and likewise the threads of the plugs.

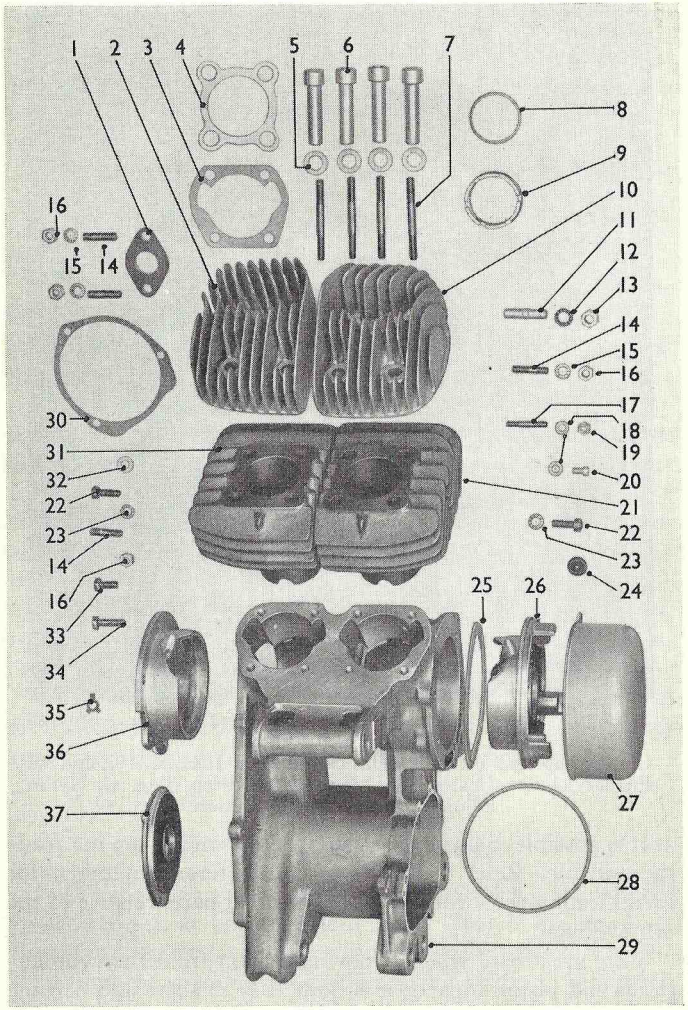


FIG. 37.—CYLINDERS, CRANKCASE AND FITTINGS ON LEADER AND ARROW MODELS.

KEY TO FIG. 37.

1. Carburetter-flange-joint washer.
2. Cylinder head (l.h. side).
3. Cylinder-base-joint washer.
4. Cylinder-head gasket.
5. Washer.
6. Cylinder-head sleeve nut.
7. Crankcase-cylinder stud.
8. Sealing washer.
9. Exhaust-pipe securing nut.
10. Cylinder head (r.h. side).
11. Footrest stud.
12. Shakeproof washer.
13. Nut for footrest-stud.
14. Carburetter-fixing stud.
15. Shakeproof washer.
16. Nut.
17. Alternator stud.
18. Plain washer.
19. Nut for alternator stud.
20. Screw for alternator cover.
21. Cylinder barrel (r.h. side).
22. Crankcase end-cover screw.
23. Shakeproof washer.
24. Alternator-cover grommet.
25. Crankcase-cover shim.
26. Crankcase end cover (r.h. side).
27. Alternator cover.
28. Alternator cover joint ring.
29. Crankcase complete with fixed fittings.
30. Oil-seal housing joint washer.
31. Cylinder barrel (l.h. side).
32. Plain washer.
33. End-cover bolt.
34. Oil-seal housing bolt.
35. Tab washer.
36. Crankcase end cover (l.h. side).
37. Oil-seal housing.

With the cylinder-heads removed, rotate the engine until each piston discloses the respective exhaust ports, when all carbon obstruction can be removed.

When replacing the cylinder-heads, screw down each sleeve nut a few turns in correct order until all are securely tightened. Always use a little graphite grease on plug threads to prevent seizure damage.

Removing Cylinder Barrels and Pistons

The makers advise removal of the cylinders at 10,000 miles' service, so following on after taking off the cylinder-heads as already described, both barrels can be raised to clear the long securing studs. The usual precautions should be taken to support the pistons when removing the barrels, and it is advisable to rotate the engine slowly to bring the pistons at the lowest limit of the stroke before actually lifting the cylinder-barrels clear.

Note the type of circlips fitted to retain the gudgeon-pins, and remove one only from each piston, using fine pin-nosed pliers or a suitable scriber tool for this purpose.

The gudgeon-pins are of the floating type and can be simply pushed out to allow piston removal. Mark each piston for position, and do not interchange.

Note that the tops of the pistons are stamped with an arrow

and the word FRONT. Take off the rings and remove all traces of carbon from inside the pistons, and ensure that the ring grooves also are thoroughly cleaned. If the same rings are to be refitted take care not to interchange positions.

To check the piston rings for wear, place these in the respective cylinder bores and test each gap with standard feeler gauges. The makers recommend fitting new rings with 0·008–0·010-in. gap, with a slight addition to allow for the size of the small locating peg. Oversize gudgeon-pins and small-end bushes are not available from the makers, and if at any time undue wear is noticed, these parts should be replaced with standard fittings.

Dismantling Crankshaft and Connecting-rod Assembly, etc.

The built-up crankshaft assembly should not be disturbed under any circumstances except if a serious failure occurs or if bearing wear is suspected after very extensive service.

It is not advisable even at this stage for the novice to attempt to undertake to dismantle the lower part of the engine unit, but for the more advanced owners and service mechanics, a study of Fig. 38 will be almost fully self-explanatory.

No extra special tools are required for dismantling, and those with a good workshop kit can readily undertake this job when and if necessary.

When dismantling, note the position on the crankshaft of the A.C. generator rotor, and do not leave this apart from the stator coil assembly for any length of time or the magnetic properties will be lost.

No maintenance or adjustment is possible to the generator, and in the case of failure, which is unlikely except after very lengthy service, it would be advisable to fit a replacement.

Ignition Timing

It is essential that the timing should be exactly the same for both cylinders, and the maker's recommended setting of 20° b.t.d.c. with the contact-breaker points just opening, must not be altered.

In order to assist with checking or setting the timing, and to ensure that the crankshaft assembly is in the right position for when the contact-breaker arm should just commence to open, the makers have provided for a simple method of check. Note that when the contact-breaker cover is removed, the top fixing screw hole in the crankcase is drilled right through.

A timing peg is supplied in the tool-kit for insertion into this hole, and by rotating the engine very slowly the peg can be pushed in to engage with another hole drilled in the engine flywheel. This is now the correct position for setting the contact arm to the point of just breaking. This check operation must be carried out for both cylinders, and the breaker gaps adjusted to 0·015 in. as previously described.

Primary Chaincase

It is necessary to remove the chaincase in order to gain access to the chain, clutch assembly, engine sprocket, etc. First, except on the "stripped" Arrow model, remove the side enclosure panels, and next the footrest and brake pedal. Note the position of the pedal lever which is fitted to a splined shaft. This must be removed before taking off the actual brake pedal.

Take out the three contact-breaker cover screws and detach the L.T. cables, taking note of the colour code for correct connecting. Remove the contact-breaker centre cam simply by loosening the fixing screw, but note the position of the small locating peg. Do not damage the oil seal. Refer to Figs. 38 and 39.

Before removing the oil-bath eight fixing screws, first release the chain-tensioner blade by taking out the primary chain adjuster. Refer to Fig. 36. The method for removal is to first take out the plug screw A and stop plug B. Then screw the plug A into the threaded sleeve C and pull it out. Take note of the oil-seal ring on the sleeve and correctly position when re-assembling.

Clutch Assembly

The clutch requires very little attention, but it is essential always to ensure that the correct clearance of $\frac{1}{16}$ in. is kept

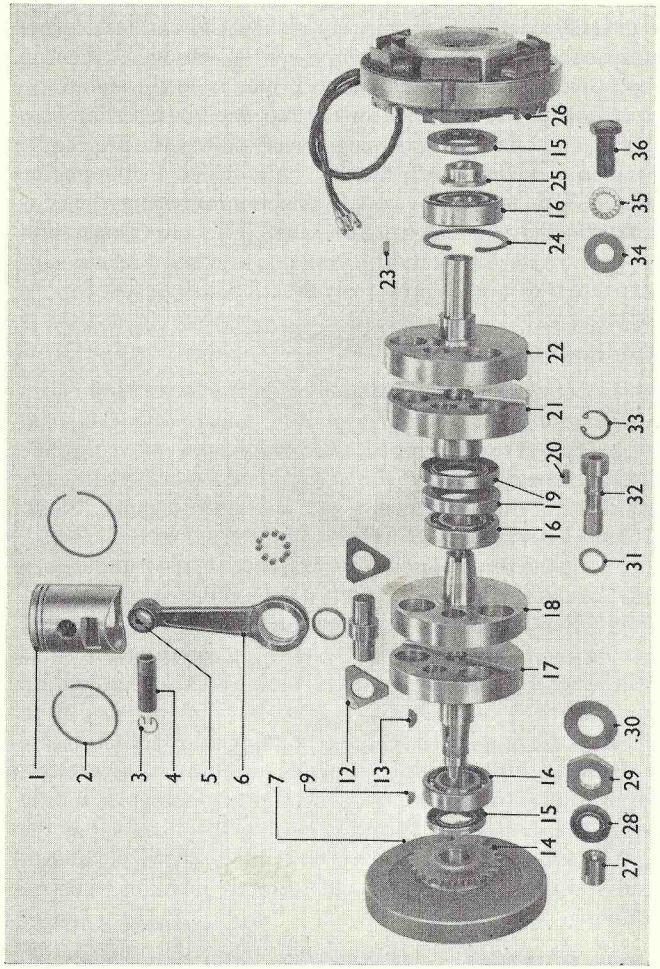


FIG. 38.—PISTON, CONNECTING-ROD AND CRANKSHAFT ASSEMBLY—LEADER AND ARROW.

KEY TO FIG. 38

1. Piston complete.
2. Piston ring.
3. Gudgeon-pin circlip.
4. Gudgeon-pin.
5. Small-end bush.
6. Connecting-rod complete.
7. Flywheel and sprocket.
9. Flywheel engine-sprocket key.
12. Crankpin thrust washer.
13. Engine-sprocket key.
14. Engine sprocket.
15. End-cover oil seal.
16. Crankcase ball bearing.
17. Crankshaft outer shaft (l.h. side).
18. Crankshaft inner shaft (l.h. side).
19. Crankcase oil seal.
20. Locking-bolt key.
21. Crankshaft inner shaft (r.h. side).
22. Crankshaft outer shaft (r.h. side).
23. Mainshaft rotor key.
24. Cover-bearing circlip (r.h. side).
25. Crankshaft collar (r.h. side).
26. Alternator complete.
27. Cam assembly (contact breaker).
28. Contact-breaker oil seal.
29. Engine-sprocket nut.
30. Engine-sprocket tab washer.
31. Crankshaft locking-bolt washer.
32. Inner-crankshaft locking bolt.
33. Locking-bolt circlip.
34. Rotor-bolt plain washer.
35. Rotor-bolt shakeproof washer.
36. Rotor bolt.

between the end of the push-rod and the short operating lever. Refer to Fig. 40 and note that after removing the cover plate B, the push-rod adjuster becomes readily accessible. To adjust for correct clearance, turn the screw A after releasing the lock-nut in the direction necessary to increase or decrease the gap until $\frac{1}{16}$-in. free movement is felt prior to clutch withdrawal. Also note that the clutch cable must have at least $\frac{1}{8}$-in. free movement before withdrawal is felt at the handlebar control, and for adjustment of this, a threaded sleeve is provided in the cable just near the gearbox.

The clutch springs, three in number, are held by sleeve-type nuts, but these are not of the adjustable pattern and must always be fully tightened. When dismantling the clutch take note of the shock-absorber assembly, and when refitting, replace the buffer rubbers with the thick sections to the left-hand side of the driving-member vanes, looking from the rear of the clutch centre. Refer again to Fig. 39 for order of assembly.

Primary-chain Adjustment

Unscrew the inspection filler cap D on the chaincase and lift the top run of the chain, taking note of the amount of slack movement. Rotate the engine slowly and check the chain lift in different positions. A lift of $\frac{5}{8}$ in. due to stretch or wear of the chain is the permissible limit, and adjustment should be carried out to allow for a minimum lift of $\frac{3}{8}$ in. with the chain

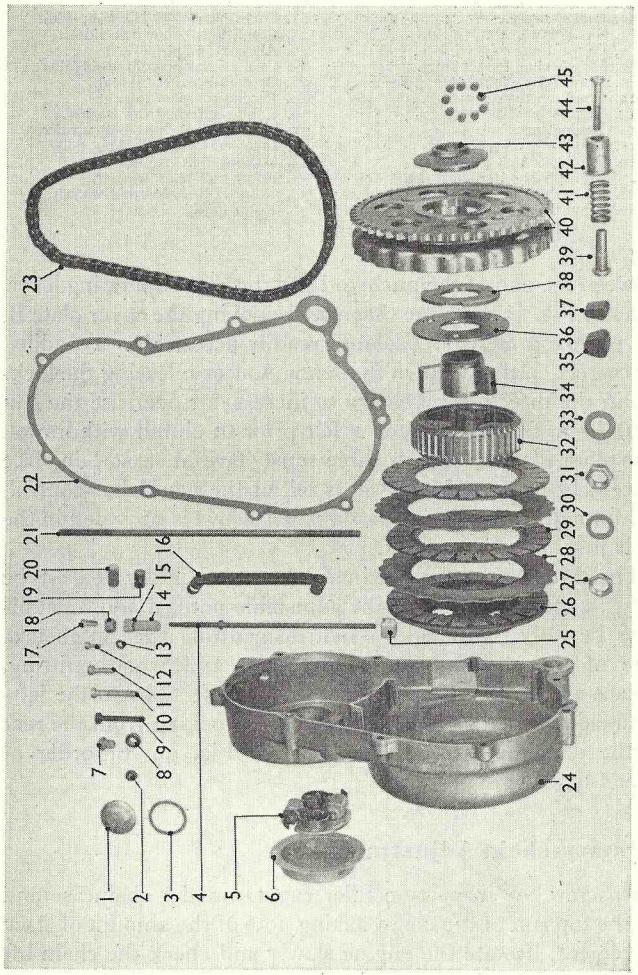


FIG. 39.—CONTACT BREAKER, CHAINCASE, CLUTCH AND FITTINGS—LEADER AND ARROW.

KEY TO FIG. 39

1. Outer chain-cover inspection cap.
2. Contact-breaker-cover grommet.
3. Inspection-cap washer.
4. Primary-chain adjusting rod.
5. Contact breaker complete.
6. Contact-breaker cover.
7. Outer chain-cover oil-level plug.
8. Oil-level plug washer.
9. Outer chain-cover drain-bolt.
10. Chain-cover screw (long).
11. Chain-cover screw (short).
12. Screw securing contact breaker.
13. Contact-breaker screw plain washer.
14. Adjuster sleeve for chain-tensioner adjusting-rod.
15. Oil-seal O-ring for sleeve.
16. Primary-chain tensioner blade.
17. Adjuster locking-plug screw.
18. Tensioner locking plug.
19. Tensioner-blade trunnion.
20. Felt plug in crankcase for rear-chain lubrication.
21. Clutch push-rod.
22. Chain-cover joint washer.
23. Primary chain.
24. Outer chain-cover.
25. Chain-adjuster saddle nut.
26. Clutch-spring plate complete with liners.
27. Clutch lock-nut.
28. Clutch driving plate.
29. Clutch plate and liners.
30. Clutch lockwasher.
31. Clutch nut.
32. Clutch centre.
33. Clutch-nut washer.
34. Clutch-centre vane.
35. Cush drive rubber (large).
36. Clutch-centre end plate.
37. Cush drive rubber (small).
38. Thrust and locating washer.
39. Clutch spring nut.
40. Clutch chainwheel complete.
41. Clutch spring.
42. Clutch-spring cap.
43. Clutch thrust washer.
44. Clutch-spring bolt.
45. Clutch-chainwheel roller-bearing.

at the tightest position. Take out the small screwed plugs A and B and rotate the slotted adjusting screw C clockwise to tighten the chain, and anti-clockwise to slacken. Check for lift as previously described and replace both plugs.

Refer to Fig. 39 for identification of components.

Gearbox Assembly

Maintenance is confined to lubrication only, and reference to Fig. 40 shows location of oil filler, level, and drain plug. The gear assembly is housed in unit with the engine, and no attempt should be made to disturb the internal parts except after very extensive service, when some wear and tear becomes apparent. At this stage, the same remarks as previously applied to the engine-crankshaft assembly, apply again to the gearbox, and for the benefit of those experienced and service mechanics, reference should be made to Figs. 41 and 42 for identification of parts and correct order of assembly.

FRONT FORK AND STEERING ASSEMBLY

No adjustment is required to the actual fork assembly, and maintenance is confined to lubrication only. Reference to the lubrication chart (see page 142) will outline the essential points.

As the assembly is more or less fully enclosed, again for the benefit of those desiring to view the internal parts. Fig. 43 will clearly identify all components and the order of assembly.

Steering Adjustment—Leader

The steering head should be tested frequently for any undue slackness which can occur at the point of bearing control, and which is fully adjustable.

Two head lock-nuts are located on the top assembly, and access to these for the purpose of adjustment is by way of the locker on the top of the enclosed frame.

When adjustment is to be carried out, first place the machine on the centre stand, with also a suitable box support under the crankcase, high enough to allow the front wheel to clear the ground. Next take out the bolt securing the handlebar stem and raise the bar from the splined steering column. Remove the two nuts from the steering-lock housing and take out this housing complete with lock-nut. Next raise the steering-head lock proper, and with two suitable spanners adjust the steering-head bearing control until these bearings appear to be just free but with no actual lift or play.

Replace all parts previously removed and re-test with the front wheel on the ground. The head bearings are of the common cup-and-cone type, and should be repacked with grease after lengthy service, proceeding as above when dismantling.

Steering Adjustment—Arrow

The actual method of bearing adjustment is similar to that for the Leader, but on the Arrow, in order to gain access to the head-lock-nuts, it is necessary to first remove the headlamp and tool-box. Next remove two front bolts from the inside of the front enclosure, slacken off the lower four screws to enable this to be raised enough to expose the steering head lock-nuts.

WHEELS

Front Wheel (Lubrication, Maintenance and Removal)

The two front hub bearings are of the single row ball-journal type and therefore non-adjustable. These should be repacked

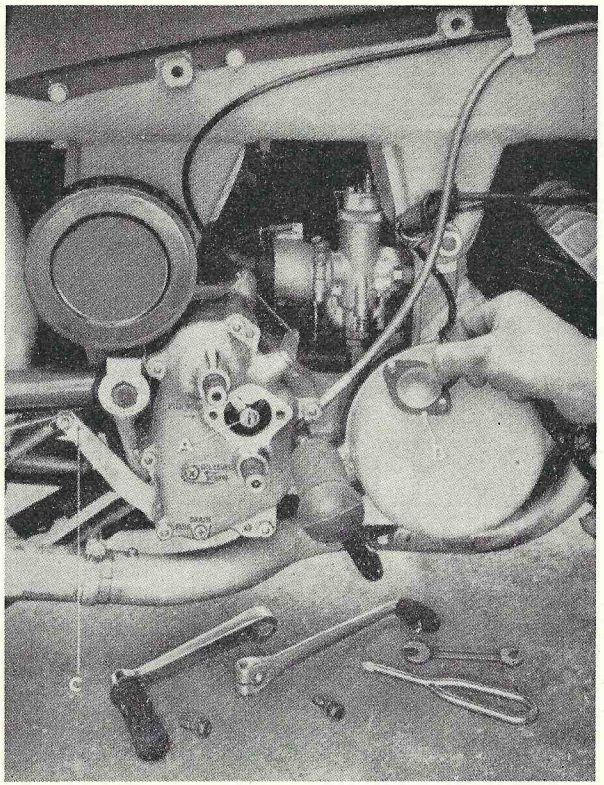


FIG. 40.—GEARBOX UNIT ON LEADER AND ARROW.
A. Adjusting screw. B. Cover plate. C. Brake lever.

with grease at approximately every 5000–6000 miles after removing all original matter. To remove the wheel for hub lubrication, first support the machine on the centre stand and expose the hub-spindle ends by taking off the cover plates from both sides. Refer to Fig. 44.

Release the brake cable from the operating arm on the circular brake plate, and take out the bolt at the front end of the brake-anchorage bar. Take note of the location of the two special-type washers which cover the pivot-arm bearing.

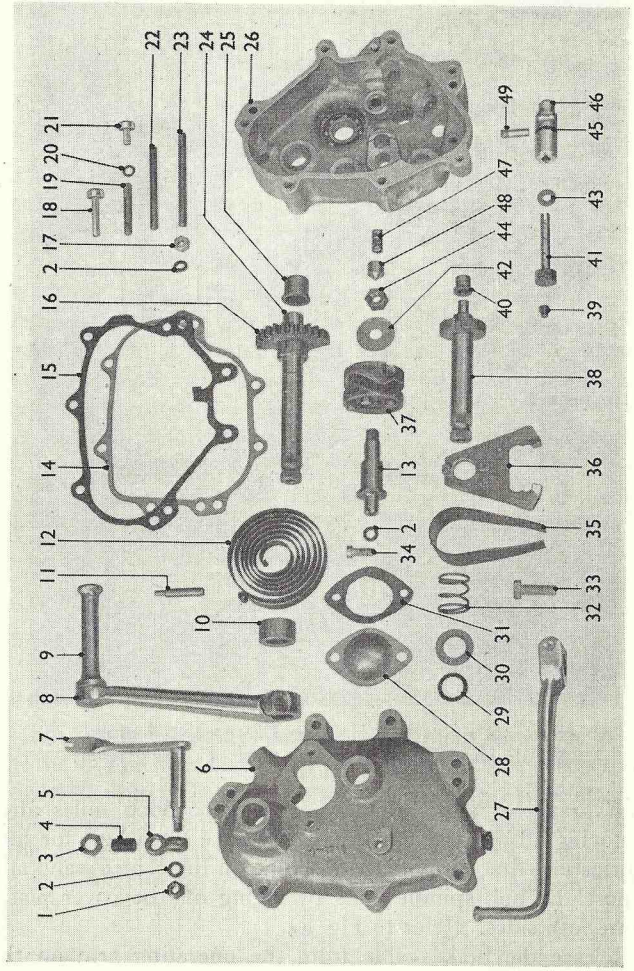


FIG. 41.—KICK-STARTER CASE AND FOOT-GEAR CONTROL—LEADER AND ARROW.

KEY TO FIG. 41

1. Nut securing inner-clutch operating lever.
2. Spring washer.
3. Adjusting-screw lock-nut.
4. Adjusting screw and ball.
5. Inner-clutch operating lever.
6. Kick-starter case cover.
7. Clutch operating lever and spindle.
8. Kick-starter lever.
9. Kick-starter lever pedal.
10. Kick-starter spindle distance collar.
11. Kick-starter spring pin.
12. Kick-stater spring.
13. Cam spindle.
14. Joint washer between k/s case and gearbox.
15. Joint washer for k/s case cover.
16. Kick-starter quadrant.
17. Nut for gearbox-cover studs.
18. Screw, k/s case cover—k/s case to gearbox.
19. Stud, k/s case to k/s case cover.
20. Oil-level plug washer.
21. Oil-level plug.
22. Dowel, gearbox—k/s case covers.
23. Stud, gearbox—k/s case covers.
24. Kick-starter spindle.
25. Kick-starter spindle bush.
26. Kick-starter case.
27. Foot-change lever.
28. Clutch-adjuster cover.
29. Oil-seal ring.
30. Oil-seal washer.
31. Joint washer for cover.
32. Quadrant-spindle spring.
33. Kick-starter lever bolt.
34. Adjuster-cover screw.
35. Quadrant return spring.
36. Quadrant and peg.
37. Gear-change cam.
38. Quadrant spindle.
39. Speedometer-spindle thrust button.
40. Quadrant spindle bush (inner).
41. Speedometer spindle.
42. Cam-spindle washer.
43. Speedometer-spindle thrust washer.
44. Cam-spindle nut.
45. Speedometer-spindle bush oil-seal.
46. Speedometer spindle bush.
47. Cam plunger spring.
48. Cam plunger.
49. Grub screw securing speedometer-spindle bush.

This bearing should be cleaned and lightly smeared with grease. Next slightly compress the fork-damper units and keep them in this position by pushing two $\frac{1}{4}$-in. diameter bars, one at each side, through the holes in the fork legs to engage with corresponding holes in the fork-suspension levers or links. Refer to Fig. 43. Next unscrew the hub-spindle nut, slacken off the pinch bolt on the opposite end, and pull out the spindle.

After cleaning, lubricating, etc., replace the wheel, leaving the damper units compressed until the spindle and all parts are finally tightened.

Front Brake

The makers record that the first series of machines produced were fitted with the well-known front-brake fulcrum-type adjuster. The usual method for adjustment of this type is for the square end of the fulcrum to be turned clockwise until the brake-shoe lining just touches the drum, then to turn it in the opposite direction 4 or 5 notches only. Finally, complete normal adjustment with the sleeve adjuster for the cable.

On later series of machines not using the fulcrum fitting, adjustment is made by using the cable adjuster until this is unscrewed to the limit of travel, and then reset back again,

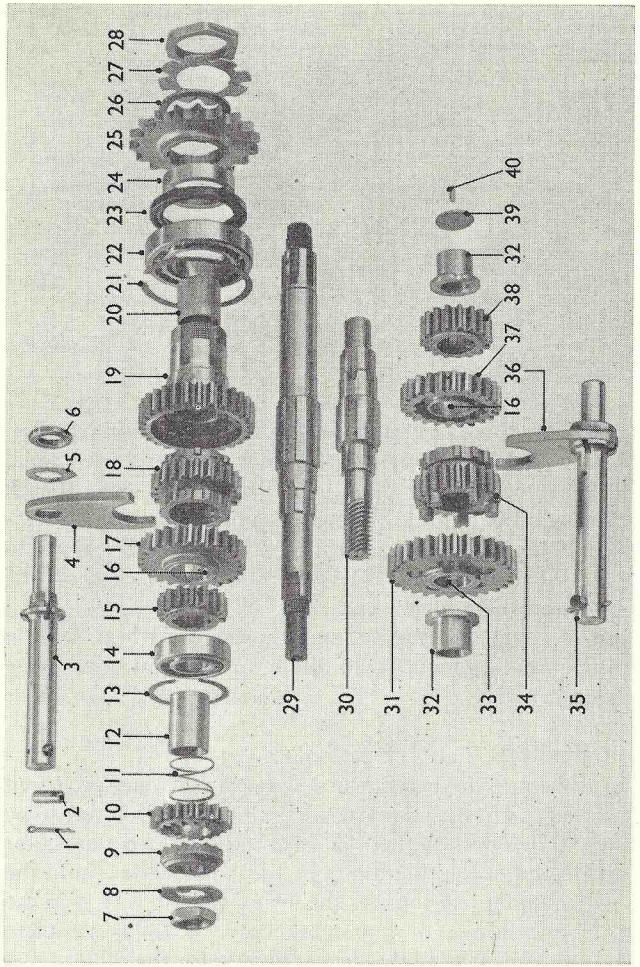


FIG. 42.—GEARBOX ASSEMBLY—LEADER AND ARROW MODELS.

KEY TO FIG. 42

1. Dowel split pin.
2. Selector-spindle dowel.
3. Mainshaft selector fork spindle.
4. Mainshaft selector fork.
5. Washer.
6. Mainshaft selector-spindle nut.
7. Mainshaft nut.
8. Mainshaft-nut lockwasher.
9. Driving ratchet.
10. Ratchet pinion.
11. Ratchet-pinion spring.
12. Ratchet-pinion bush.
13. Bearing retaining pin.
14. Ball race.
15. Mainshaft first gear.
16. Mainshaft third-gear bush.
17. Mainshaft third gear and bush.
18. Mainshaft second gear.
19. Driving gear and bush.
20. Driving-gear bush.
21. Circlip.
22. Ball bearing.
23. Driving-gear oil seal.
24. Sprocket-spacing collar.
25. Driving sprocket.
26. Driving-gear nut distance washer.
27. Driving-gear nut lockwasher.
28. Driving-gear nut.
29. Mainshaft.
30. Layshaft.
31. Layshaft first gear and bush.
32. Layshaft bush.
33. Layshaft first-gear bush.
34. Layshaft third gear.
35. Layshaft selector fork (complete).
36. Layshaft selector fork.
37. Layshaft second gear and bush.
38. Layshaft pinion.
39. Crankcase-layshaft washer.
40. Layshaft-bush dowel.

and the brake-lever arm on the anchor plate also reset by moving it on to the next serration.

Always use the cable adjuster for final setting.

Rear Wheel (Lubrication, Maintenance and Removal)

The rear hub and chain wheel are fitted with ball journal bearings similar to those in the front wheel and are non-adjustable. The same remarks relating to the front hub for lubrication apply to the rear, and to remove the wheel (which is of the Q.D. type) the method is as follows, and does not necessitate disturbing the chaincase, chain or driving sprocket. Refer to Fig. 45.

Close to the rear-hub spindle nut there is a rubber plug or cover on the chaincase, which when removed will expose a hole through which the three wheel-securing nuts can be withdrawn after unscrewing. Take off the adjusting nut from the brake rod, and also the nut securing the brake-anchor arm to the circular brake plate.

Next take off the wheel spindle nut and pull out the spindle. Note the loose distance-piece situated between the rear-fork end and the brake plate which when removed will enable the three wheel fixing studs to clear and allow the wheel to be withdrawn. On the LEADER model the rear portion of the body tail-cover assembly can be hinged upwards to allow clearance for the wheel, whilst on the ARROW model it is only necessary to lean the machine over to the left-hand side for easy wheel removal. After attention to the wheel, refit it into the fork end and ensure

that the three securing nuts and spindle fixing are all thoroughly tightened.

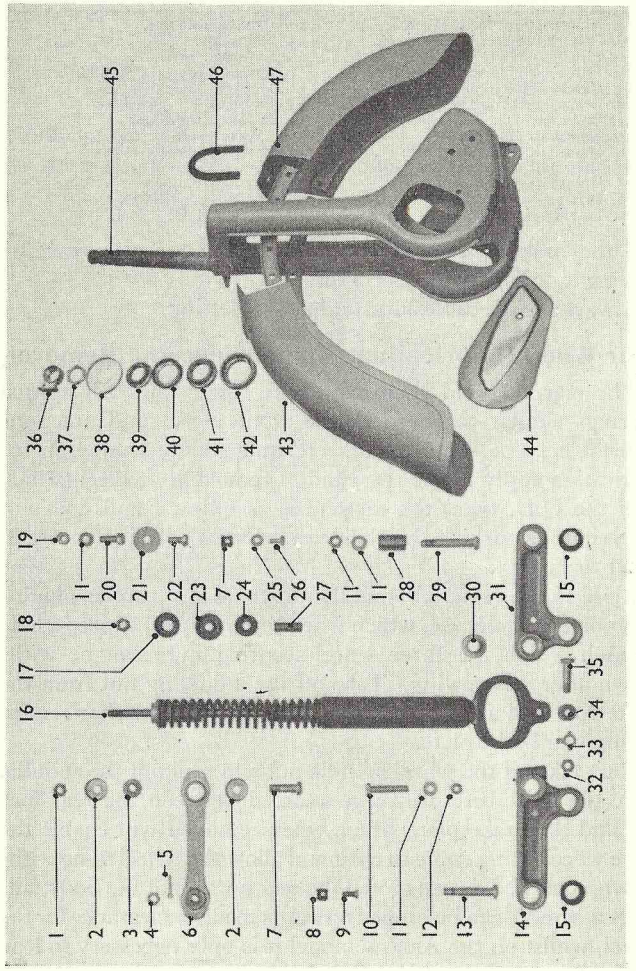


FIG. 43.—FRONT FORK AND MUDGUARD ASSEMBLY—LEADER AND ARROW MODELS.

KEY TO FIG. 43

1. Nut for anchor-bar bolt.
2. Anchor-bar dust cover.
3. Anchor-bar ball and bush.
4. Slotted nut for anchor-bar bolt.
5. Slotted-nut split pin.
6. Anchor bar complete with ball and bush.
6. Anchor bar complete with ball and bush.
7. Anchor-bar securing bolt.
8. Nut for cover-plate screw.
9. Cover-plate screw.
10. Suspension-lever pinch bolt (l.h. side).
11. Plain washer.
12. Nut for pinch bolt.
13. Suspension-lever pivot bolt (l.h. side).
14. Suspension lever (l.h. side).
15. Suspension-lever bush.
16. Damper unit complete.
17. Damper-top centre cap.
18. Damper nut.
19. Nut for mudgard bolt.
20. Bolt, mudguard crown—leading section.
21. Plain washer.
22. Bolt for mudguard trailing section.
23. Damper-top outer cap.
24. Damper-top rubber.
25. Plain washer.
26. Bolt, mudguard to fork bracket.
27. Damper—top distance tube.
28. Bearing distance piece (long).
29. Suspension-lever pivot bolt (r.h. side).
30. Suspension-lever distance piece (r.h.-side).
31. Front-suspension lever (r.h. side).
32. Nut for fork-end bolt.
33. Tab washer for fork-end bolt.
34. Bearing distance piece (short).
35. Bolt for fork-end.
36. Handlebar lock.
37. Steering-column nut.
38. Steering-head race dust cover.
39. Steering-head ball-race cone.
40. Frame-head lug ball-race.
41. Bottom steering-head cone.
42. Ball race bottom frame-head lug.
43. Rear section, front mudguard.
44. Front-fork cover plate (r.h. side).
45. Steering column and fork-leg assembly.
46. Rubber moulding.
47. Front section mudguard.

Rear Chain Adjustment and Lubrication

Lubrication is automatically carried out by a supply of oil from the primary chaincase, the level of which should be frequently checked. To check or adjust the rear chain, first remove the large rubber inspection plug from the face of the chaincase, and check the lift or slackness of the chain when the machine is supported on the centre stand.

When correctly adjusted the chain should give a permissible lift on the top run in the lightest positions of $1\frac{1}{4}$–$1\frac{1}{2}$ in. The chain-adjuster bolts are situated in the fork ends and should be carefully set after loosening the wheel spindle nut. Take the usual precaution when adjusting the rear chain to ensure that wheel alignment is correct.

SILENCERS

The silencers are of the built-up type and can be dismantled for cleaning purposes. To dismantle the interior baffle assembly, unscrew the domed securing nut and end cover and gently extract the baffles, leaving the centre rod in position. It is essential with this type of silencer to thoroughly clean by scraping and brushing the baffle assembly frequently, in order to ensure engine efficiency, and being a relatively easy operation, a convenient time for this is when engine decarbonisation is carried out.

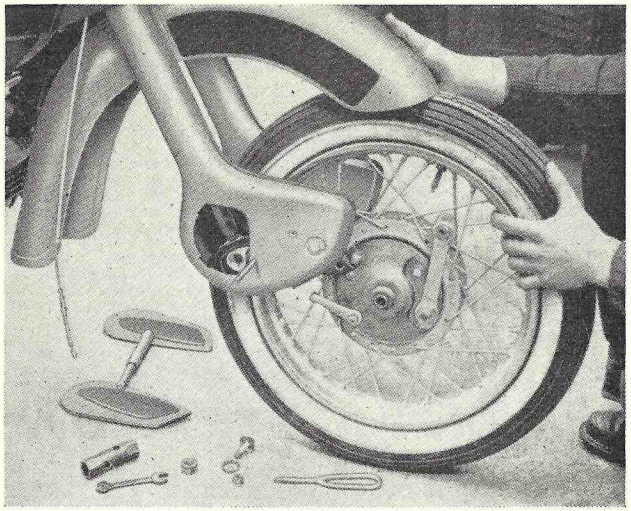


FIG. 44.—(*above*) FRONT-WHEEL REMOVAL ON LEADER AND ARROW.

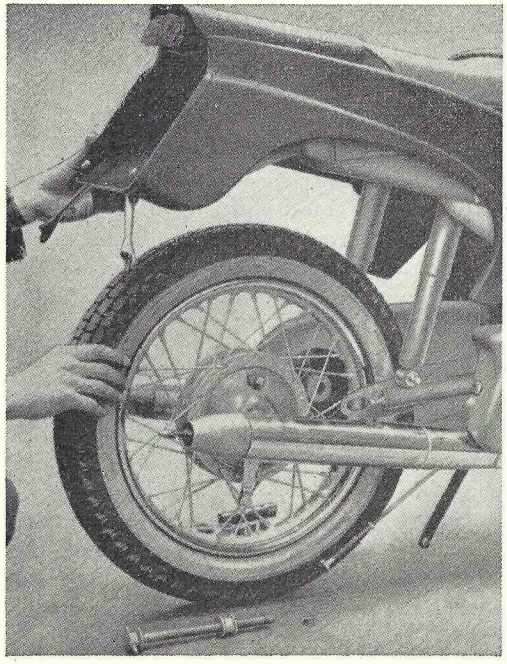


FIG. 45.—REAR-WHEEL REMOVAL ON LEADER AND ARROW.

ELECTRICAL FITTINGS

Apart from the usual battery topping-up, no adjustment can be made to the generator or rectifier, and maintenance therefore is confined solely to keeping the various fittings clear of oil and foreign matter. See wiring diagrams, pages 215–224, 230, 231.

FRAME AND FITTINGS

The Leader and Arrow frames consist chiefly of a main top beam suitably designed to house the steering-head cups, petrol tank and other minor attachments. In the case of accidental damage to the frame, this should be regarded as a service repair or exchange, and owing to the nature of construction only special jigs and tools should be used to ensure true alignment.

RECOMMENDED MAINTENANCE PERIODS LEADER AND ARROW

(*See Fig. 46 on next page*)

A. Control levers, cables, etc. *Weekly :* A few drops of cycle oil.

B. Petrol tank. See chart below.

C. Battery. *Weekly :* Check electrolite level and top up if necessary. *Every 2500 miles :* Clean and check terminals.

D. Front and rear hubs and front anchor bar. *Every 1000 miles :* Check wheel-spindle nuts. *Every 5000 miles :* Remove existing grease, clean and repack.

E. Front and rear brake-cam spindle. *Every 2500 miles :* Grease sparingly.

F. Brake-pedal spindle and centre stand. *Every 1000 miles :* Grease.

G. Gearbox. *Weekly :* Check level and top up if necessary.

H. Contact-breaker wick. *Every 2500 miles :* A few drops of engine oil on felt pad.

J. Primary chaincase. *Every 1000 miles :* Check level and top up if necessary.

K. Brake-plate bush, nipple in front spindle. *Every 1000 miles :* Grease sparingly.

L. Front links. *Every 1000 miles :* Grease.

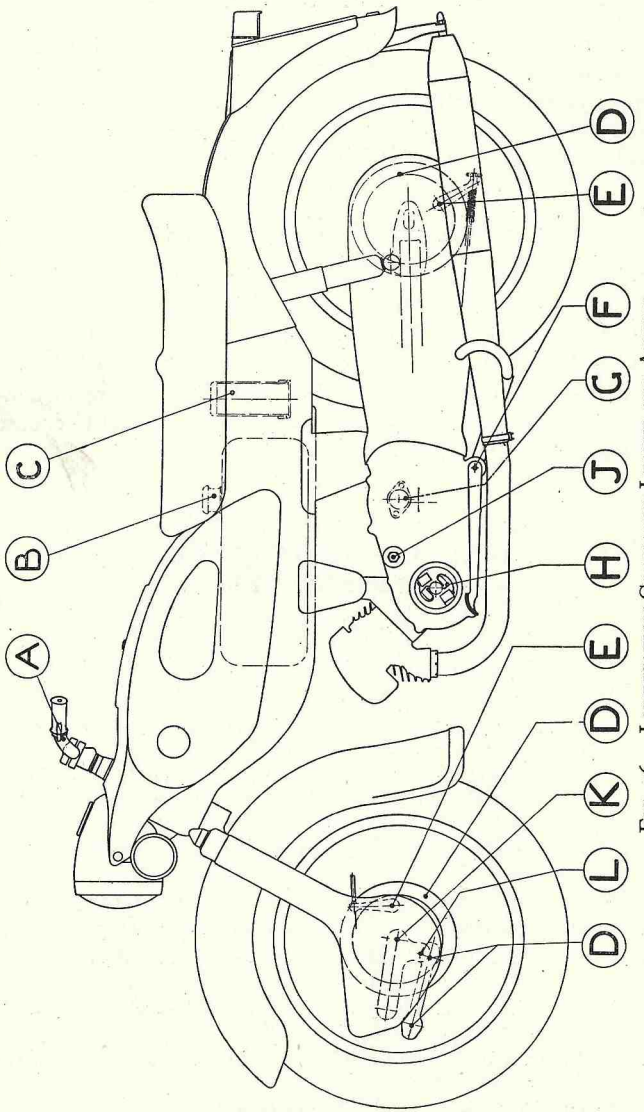


FIG. 46.—LUBRICATION CHART FOR LEADER AND ARROW.

RECOMMENDED LUBRICANTS
LEADER AND ARROW

Item	Quantity	Wakefield	Esso	Mobiloil	Shell	B.P.
Engine B petroil mixture	*See below for details	Castrol Two-stroke Oil Ratio 20–1 4 measures per gallon	Esso Two-stroke Motor Oil Ratio 20–1 4 measures per gallon	Mobilmix TT Ratio 20–1 4 measures per gallon	2T Mixture or 2T Two-stroke oil	B.P. Zoom or Energol Two-stroke oil
Gearbox	1 pint	Castrol XL	Essolube 30	Mobiloil A	Shell X-100-30	Energol 30
Primary chain-case	¾ pint	Castrolite	Esso Extra Motor Oil 20W30	Mobiloil Arctic	Shell X100 20/20W	Energol 20W
Front and rear hubs — Grease points	See Owners' Guide	Castrolease LM	Esso Multi purpose grease H	Mobil-grease MP	Retinax A	Energrease L2

* Petrol—oil ratio, 25–1. Use 3 tank-cap measures per gallon unless otherwise stated.

Note.—The 20–1 ratio is necessary only when it is desired to use one of the quick-mix lubricants recommended.

DATA FOR LEADER AND ARROW TWIN-CYLINDER MODELS

249-c.c. Engine

Cylinder-bore : 54mm.

Engine Stroke : 54 mm.

Cubic Capacity : 249 c.c.

Compression Ratio : 8·25:1.

B.H.P. : 16 at 6,400 r.p.m.

Ignition Timing :
Piston position b.t.d.c., 20°, or 0·080 in.

Clutch:
Wet type, 3 friction plates, with transmission shock absorber in clutch hub.

Carburetter:
Amal Monobloc, with cold starting device; air filter and silencer; choke size $\frac{7}{8}$ in.; main jet 170; pilot jet 30; needle jet 105; needle position 3, throttle size $3\frac{1}{2}$.

Gearbox:
Ratios—First 19:1; second 11:1; third 7·8:1, fourth 5·9:1. 1,000 engine r.p.m. in top gear = 11 m.p.h.

Primary Drive:
Endless roller chain, $\frac{3}{8}$-in. pitch, 0·225 in. wide, 70 links enclosed in alloy oil batch; oil capacity $\frac{3}{4}$pt. SAE20.

Secondary Drive:
Roller chain, $\frac{1}{2}$-in. pitch, 0·305 in. wide, 113 links enclosed in chaincase, automatically lubricated.

Sprocket Sizes:
Engine shaft, 22 teeth; chain clutch wheel, 50 teeth; gearbox, 18 teeth; rear wheel, 47 teeth.

Fuel Tank Capacity: 2·3 galls.

Electrical Equipment—Lucas:
AC Generator, 50-watt type R.M. 13/15.
Battery, 13-amp type ML9E, 6 volt.
Rectifier, type F.S.X.1501.
Headlamp, Pre-focus light unit, 6-in. dia., main bulb 24/30 watt double filament, pilot bulb 3 watt.
Rear lamp: Stop-tail bulb, 18–3 watt double filament.
Electric horn: H.F. type, 1849.
Ignition: Two separate coils, oil-filled type M.A.6.
Contact breaker: Gap, 0·014–0·016 in.
Sparking plugs: Lodge, 2HLN or Champion N3.

Lubrication: Petroil.

Fuel-tank Capacity: 2·3 galls.

Front Wheel:
Rim size, WM2–16.
Spokes, 36.
Tyre size, 3·25 by 16, ribbed type.
Hub, light alloy, full width.
Brake size, 6-in. dia., $1\frac{1}{8}$ in. wide.

Rear Wheel:
Rim size, WM2–16.
Spokes, 36.
Tyre size, 3·25 by 16, studded.
Hub, light alloy, full width.
Brake size, 6-in. dia., $1\frac{1}{8}$ in. wide.
Quickly detachable pull-out spindle.

Tyre Pressures:
Front, 18 lb. per sq. in.
Rear (solo), 22 lb. per sq. in.
Rear (with pillion), 28 lb. per sq. in.

CHAPTER VI

GEARBOX AND CLUTCH ASSEMBLIES (Except 250-c.c. Leader and Arrow Models)

THE Burman 4-speed gearbox incorporating a fully-enclosed positive foot-change mechanism has been fitted to the complete range of Ariel motor cycles since 1937. All 1937–51 single-cylinder models, 1949–51 twin-cylinder models and 1937–51 1000-c.c. models are fitted with the heavyweight BA type gearbox.

In 1952 the Burman GB type was introduced, this unit being of an entirely different design except for the main clutch details which remain and are fully interchangeable with the BA and CP types.

The 250-c.c. and 1948 twin-cylinder models are fitted with the lighter CP type, with one exception, this being the 1939 250-c.c., which is fitted with the Burman H lightweight type, now obsolete. The BA and CP gearboxes are identical in every detail as far as the type of construction is concerned, and maintenance and overhaul notes are applicable to both.

Maintenance—BA and CP Types

All clutch-spring adjusting screws should be screwed down only just sufficient to allow the end coil of each spring to be visible when sighted across the face of the centre outer spring plate. Tightening the screws too far will have the effect of compressing the springs beyond a free working limit, and will thus render the withdrawal action very stiff and heavy. The correct adjustment is for the spring plate to disengage equally. If the tool-kit special clutch screwdriver is not available, an ordinary driver, wide enough to be filed out U-shape, is suitable for adjustment purposes.

The clutch-cable adjuster should be set to allow the outside operating lever to have sufficient throw or travel, otherwise clutch "drag" and gear "crash" will result. Adjust the

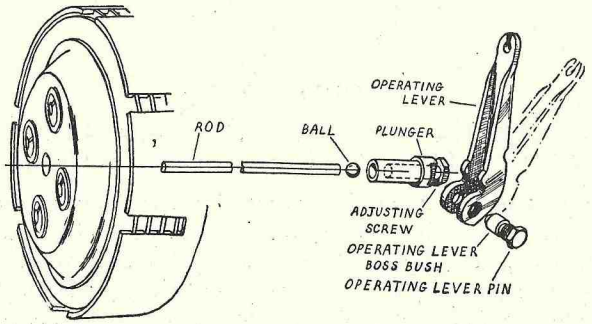


FIG. 47.—CLUTCH-WITHDRAWAL ADJUSTMENT.
Fitted with CP and BA gearboxes on all 1937–51 models.

operating lever plunger to give $\frac{1}{64}$ in. clearance between the thrust points. Frequently check this adjustment by testing the feel of the handlebar control lever and by pulling and pressing on the operating lever to ensure that no actual direct pressure is applied to the push-rod when the clutch is normally engaged. Other than an occasional tightening-up of all visible securing bolts and nuts and lubricating the gearbox main assembly and the kick-starter and foot-change mechanism, no other maintenance can be applied. "Top up" the gearbox occasionally with the makers' recommended brand of grease or oil and grease mixture and also apply the grease-gun to the various nipples if fitted to the kick-starter case and cover.

The gearbox can be considered due for complete dismantling if *gears disengage* whilst under load. This can be due to a weak pawl spring inside the main casing or to wear on the pawl and ratchet of the foot-change mechanism. A worn main driving-gear ball bearing, worn driving-gear bushes or operating forks, as well as main pinions worn taper, will all cause gear "jump".

Maintenance—GB Type

The clutch-operating arm or lever is situated within the gearbox end casing, and adjustment is carried out by turning the small cover plate held by two screws on the face of the end

cover. Located in this plate is the adjusting sleeve nut, which screws on to the threaded part of the operating arm. The arm should be set to give up to $\frac{3}{16}$ in. free movement; this can be tested after removing the oil-filler plug. After correctly setting the operating arm take up all the unnecessary slack in the clutch-control cable by unscrewing the cable adjuster on the top of the main gear case end cover (single- and twin-cylinder models) or by the mid-way cable adjuster (four-cylinder models).

Engine oil grade SAE 50 or 60 is recommended for lubrication; a filler cap and an oil-level plug are provided on the kick-starter end casing. The oil level should be checked every 1000 miles and "topped up" as necessary.

DISMANTLING COMPLETE GEARBOX

Removing gearbox from frame of all models 1937–55 single-cylinder, 1948–59 twin cylinder and all the 1937–59 1000-c.c., excepting the 1939 250-c.c., is carried out as follows:

Remove Clutch Assembly

Dismantle clutch by first removing the spring-retaining screws with the special kit screwdriver, and the spring plate and all clutch plates, corked or fabric and plain, can be withdrawn. Note order of assembly, the first plate to be fitted being plain, then a fabric or cork plate, then alternate plain plates and, finally, a plain plate before the spring plate carrying spring cups and springs. The mainshaft end nut secures the clutch body and requires removal with a large, heavy-duty type spanner. Difficulty may be found in removing this, and if the top gear is engaged and the rear brake applied this will help to keep the shaft from revolving.

An Easily Made Service Tool

A very useful tool for holding the clutch case from turning with the shaft can be made up by obtaining an old clutch plain plate and welding to it a steel flat strip suitably bent to allow the plate to be inserted in the case and the strip portion to

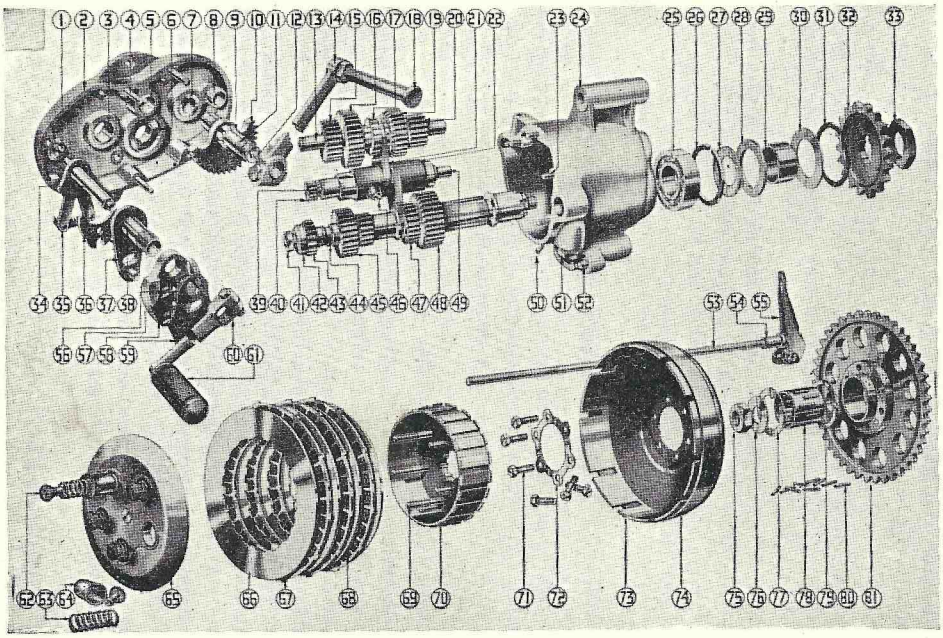


FIG. 48.—EXPLODED VIEW OF GEARBOX ASSEMBLY—BURMAN MODELS CP AND BA.
For all Ariel models 1937–51.

KEY TO FIG. 48

1. Sector spindle bush.
2. Gearbox cover (inner).
3. Camshaft bush (K.S. case).
4. Gearbox cover stud.
5. Layshaft spindle bush.
6. Mainshaft bearing.
7. K.S. spindle bush (inner).
8. K.S. stop peg rubber.
9. K.S. spindle.
10. K.S. quadrant.
11. K.S. spindle.
12. K.S. spindle grease nipple.
13. Layshaft spindle.
14. K.S. lever.
15. Third gear, layshaft.
16. First gear, layshaft.
17. Layshaft clutch.
18. K.S. lever pedal.
19. Second gear, layshaft.
20. Layshaft small gear.
21. Operating fork (layshaft).
22. Operating fork (mainshaft).
23. Gearbox stud.
24. Gearbox shell.
25. Driving gear bearing.
26. Bearing retaining ring.
27. Driving gear inner washer (lipped).
28. Driving gear felt washer.
29. Driving sprocket spacing collar.
30. Driving gear outer washer (flat).
31. Driving gear locating ring (split).
32. Driving sprocket.
33. Driving gear nut .
34. Sector spindle.
35. Gear sector, quadrant and ratchet assembly.
36. Pawl.
37. Control quadrant.
38. Ratchet sleeve.
39. Camshaft rollers.
40. Pinion formed on camshaft.
41. Ratchet nut.
42. Driving ratchet.
43. Ratchet pinion.
44. Ratchet pinion spring.
45. Third gear mainshaft.
46. Operating peg.
47. Mainshaft sliding gear.
48. Driving gear.
49. Camshaft.
50. Gearbox grease nipple.
51. Gearbox filler plug.
52. Gearbox adjustment peg.
53. Clutch operating rod.
54. Clutch operating plunger.
55. Clutch operating lever.
56. Main spring.
57. Pawl spring.
58. Spring box.
59. Cover plate for spring box.
60. Foot control lever.
61. Foot control lever rubber.
62. Clutch spring adjusting nut.
63. Clutch spring.
64. Clutch spring cup.
65. Spring plate.
66. Clutch plain plate.
67. Clutch plate fitted fabric inserts.
68. Fabric insert.
69. Clutch spring stud.
70. Clutch centre.
71. Chain wheel centre bolt.
72. Chain wheel centre tab washer.
73. Clutch case.
74. Clutch-case band.
75. Mainshaft nut, clutch end.
76. Mainshaft nut plain washer.
77. Thrust washer (keyed).
78. Needle roller cage.
79. Thrust washer (plain).
80. Needle roller.
81. Chain wheel.

engage with the foot-rest or the floor. A heavy blow on the tommy bar of the tube spanner will usually loosen the nut. Many later-type models have a special lock-washer fitted behind the nut. The clutch splined centre can now be pulled off quite easily. Examine all splines on which the plain plates slide and remove with a fine file any rough or worn edges. Withdraw the clutch push-rod from the mainshaft and examine for end wear. The ends are hardened to ensure long wearing. The outer clutch body is next removed by knocking back the ears on the chain-wheel centre tab-washer and unscrewing the six securing pins. Examine the slots in the clutch body, and if worn or stepped too badly to reface the body should be replaced.

The Clutch Chain-wheel

This can be removed only by taking off the outer half of the primary chaincase, detaching the chain and sliding the chain-wheel complete with centre sleeve and hardened needle rollers off the end of the mainshaft. Note that the rollers are not fixed into the cage, and ensure when refitting these that they are kept in position and lubricated by an application of grease. A plain thrust-washer is fitted behind the needle roller cage and a keyed washer in front with the key portion located in one of the short splines on the end of the mainshaft.

Removing the Gearbox

Take off the oil-tank and battery carrier to give greater accessibility to the top and bottom clamping and swivel bolts. Loosen all rear engine plate bolts and the gearbox adjuster and allow the plates sufficient slackness to enable the gearbox to be lifted out towards the offside. Clamp the gearbox in a vice by way of the bottom swivel lug and remove the nuts securing the outer end-cover, which can then be pulled away complete with the kick-starter and foot-change mechanism.

Dismantling—BA and CP Types

Unscrew the hexagon nut on the end of the mainshaft and take off the kick-starter driving ratchet, ratchet pinion, distance

sleeve and short coil spring. These parts require checking for wear, together with the kick-starter quadrant which was removed with the outer end-cover. If the first few teeth of the quadrant are "burred", these should be ground down to give a clean engaging action with the ratchet, but a new part is, of course, advisable. Remove the inner half gear-cover from the main casing, taking note of the twelve hardened rollers which form the bearing for the gearbox camshaft. Since 1941 many gearboxes have been fitted with a phosphor-bronze bush in place of the roller-type race. Next remove the slotted screwed plug at the base of the main casing and pull out the pawl spring. Pull out the mainshaft from the clutch side and then remove as a complete assembly the layshaft with gears and operating forks.

Inspecting Internals for Wear

Internal pinions and operating forks should be carefully examined, also layshaft spindle and mainshaft. Check for wear on the fork operating faces and renew if at all grooved. Note the order of assembly on the camshaft and that the longer of the two forks is for operating the sliding-gear clutch on the layshaft. If the gearbox has been long in service it is advisable to check both the layshaft and mainshaft spindles between lathe centres and using a clock-dial gauge. If either shaft is bent in excess of 0·005 in., a renewal is advised. Burman gear pinions are not case-hardened, but being made from oil-toughened nickel-chrome steel, are hard enough to give strength and wearing quality without the risk of frequent fracture.

Test the shafts in their respective bearings or bushes and note that a clearance wear of 0·005–0·007 in. is permissible before renewal. The driving gear and sprocket, having been left in position in the gearbox shell, should be tested for clearance, both internally and externally, and renewed if the centre bushes show a clearance exceeding 0·006–0·007 in. when tested with the mainshaft inserted.

Driving-gear Bushes

Two are fitted with a centre space for grease deposit between

the two and are a tight press fit and require reaming after fitting to give a shaft clearance of at least 0·0015–0·002 in. To remove the driving gear from the casing the sprocket large lock-nut must be unscrewed. Some models have a special lock-washer securing the nut, whilst others incorporate the system of punching the inner edge of the nut into one or more of the splines of the driving-gear shank. To hold the gear and sprocket from turning, a very useful tool can be made up and used as follows. Obtain a scrap mainshaft and grind two flats on the thick end which carries the clutch race. Fix this shaft in the vice by gripping the flats. Take the mainshaft sliding gear and place on the splined shaft with the large pinion uppermost. Next invert the gearbox case over the shaft and engage the sliding-gear pinion with the driving gear. The nut can now be unscrewed and the driving gear pushed into the case for removal.

Gearbox Oil Seal

With a seal fitted it is advisable to use as a lubricant a fifty-fifty mixture of oil and grease. The oil-seal can be incorporated on any BA or CP gearbox. The seal fits, with a thin steel gland washer on either side, immediately behind but after fitting the driving-gear bearing (see Part No. 25, Fig. 48).

Check the Main Ball Bearing and Bushes

The driving-gear ball bearing is easily pressed out of the housing after removal of the circlip and dust-cover. Wash out the bearing and check inner and outer races for pitting and wear. If bearing shows any sign of wear and "shake" renewal is advised. A worn bearing will cause gears to jump out as well as making undue noise.

The layshaft spindle bush and camshaft bush fitted into the gearbox case should be examined. These bushes have a flanged-face fitting and are pressed into position. If the camshaft bush flange is worn the shaft can take up a floating action due to excessive end-play, and as the operating forks are located on the shaft this float will readily cause the forks to over-travel with the sliding gears and disengage them whilst

under load. A temporary repair can be effected by placing a hardened shim or washer on the end of the camshaft to compensate for the worn flange, taking care to leave at least 0·001–0·002 in. end-play. After ensuring that all gear pinions and shafts are in good condition for further service, preparation should be made for reassembling the main gearbox.

Dismantling—GB Type

Removing the kick-starter case end cover enables examination to be made of the internal clutch-operating lever and plunger and also exposes the complete kick-starter and foot-change mechanisms, as well as the speedometer spiral gear device.

Before removing the end cover take out the oil-drain plug and allow all oil to drain off. Release the clutch-cable adjuster sufficiently to allow the inner wire and nipple to be detached from the inner operating lever. Take off the nut securing the gear indicator cap and small coil spring enclosed on the end of the foot-change cam-barrel spindle. Unscrew the six cheese-headed screws which secure the outer kick-starter cover to the inner kick-starter case, noting carefully the position of the three different lengths of screws used. Draw the cover forward approximately $\frac{1}{2}$ in., taking care to hold securely the kick-starter crank and pedal in the vertical position. Tie the kick-starter crank to the foot-change lever in order to prevent the kick-starter spring from unwinding.

The kick-starter end cover can now be fully removed complete with kick-starter quadrant and spring and also part of the foot-change operating assembly.

Note the position of the main return spring for the foot-change control quadrant. This is a large U-shaped flat steel spring working together with the cam cylinder. After removing the kick-starter outer cover, take off the mainshaft end nut, kick-starter driving ratchet and pinion and the small coil spring and sleeve for pinion.

Next dismantle the gear-selector spindle split pins and take out the foot-change cam cylinder together with the spring plunger, which it will be noticed makes contact with the

various indentations on the face of the cylinder. Take out the clutch-operating plunger and the operating lever, which will still be attached to the kick-starter case outer cover. Also note the position of the small steel ball between clutch rod and plunger. Remove the four cheese-headed screws securing the inner kick-starter case to the main gearbox shell, noting the position of the two different lengths of screws, and withdraw the case, leaving the internal gear assembly, etc., in position in the main housing or shell.

It is possible to remove the kick-starter rear half-case complete with the internal gear assembly, selector forks, etc., all left in position, by taking off the complete clutch as previously described but also removing the splined driving sleeve fitted to the clutch end of the mainshaft. Without dismantling the kick-starter ratchet pinion assembly the four securing screws are taken out, and the rear half-case can be pulled away with gear assembly attached. This method is the most satisfactory way of making a close-up examination of the gear assembly.

After dismantling the kick-starter cover and case with the gear assembly attached as previously described, it will be noticed that the main driving-gear ball bearing, rear sprocket and oil seal will be left in position in the gearbox shell or main case. To remove these, secure the sprocket to prevent rotation and unscrew the large nut locking the sprocket to the driving-gear sleeve. Note the special lock-washer fitted behind the nut and also the order of assembly of the ball bearing, oil seal and retaining washers.

The driving gear will now push through into the gearbox base, and the ball bearing, which is a press fit in the shell housing, can be driven out after removing the gland oil seal, etc.

Reference to the exploded view (Fig. 49) should be made when dismantling and reassembling, and the correct order of gear assembly, number and titles, carefully noted. When refitting the foot-change cam assembly, place in position the ball-ended plunger and small coil spring so that the ball end engages with any one of the indentations on the rear face of the cam cylinder.

After fitting any necessary replacement parts and cleansing,

the cover can be replaced by reversing the procedure, taking care to replace the paper joint washer and tightening all screws before refilling the case with oil. Be sure to replace correctly the small coil spring and gear-indicator cap and nut.

Reassembling—BA and CP Types

This is really a reversal of the dismantling operation. Note the correct order of the driving-gear ball bearing, retaining rings, felt washer, etc. Insert driving gear, fit sprocket and lock-nut and ensure that this is dead tight. If no special lock-washer is used, lock the sprocket nut in position by centre punching.

Make up into a complete sub-assembly the mainshaft gears, layshaft assembly, camshaft and operating forks, and insert this into the gearbox case, locating the layshaft and camshaft spindles in their respective bushings. Note the position of the camshaft pawl before refitting the pawl spring and plug. Insert the mainshaft from the driving-side and pass it through the mainshaft sliding gear. Fit on the shaft end the remaining third mainshaft gear. Next place the twelve camshaft hardened rollers (where fitted) in the shaft groove, which has previously been well smeared with grease, and fit the gearbox inner cover, after ensuring the bushes and mainshaft ball bearing are in good condition. Refit kick-starter ratchet assembly and tighten mainshaft and nut. Test mainshaft for end-play which should be $\frac{1}{64}$–$\frac{1}{32}$ in. If end-play is excessive, this can be reduced by fitting a slightly longer ratchet pinion steel bush on which the kick-starter pinion and small coil spring fit. Another method for reducing end-play is to countersink the inner face of the shaft nut to allow it to project over the shoulder on the shaft end and so push the ratchet further along the shaft.

The foot gear-change mechanism is of the positive type and allows only one gear at a time to be engaged by one movement only of the pedal either way. Apart from accidental damage, the only parts requiring replacement due to wear and tear over a long period are the two main coil springs and the two pawl coil springs positioned in the alloy spring-box, and the ratchet and quadrant pawl.

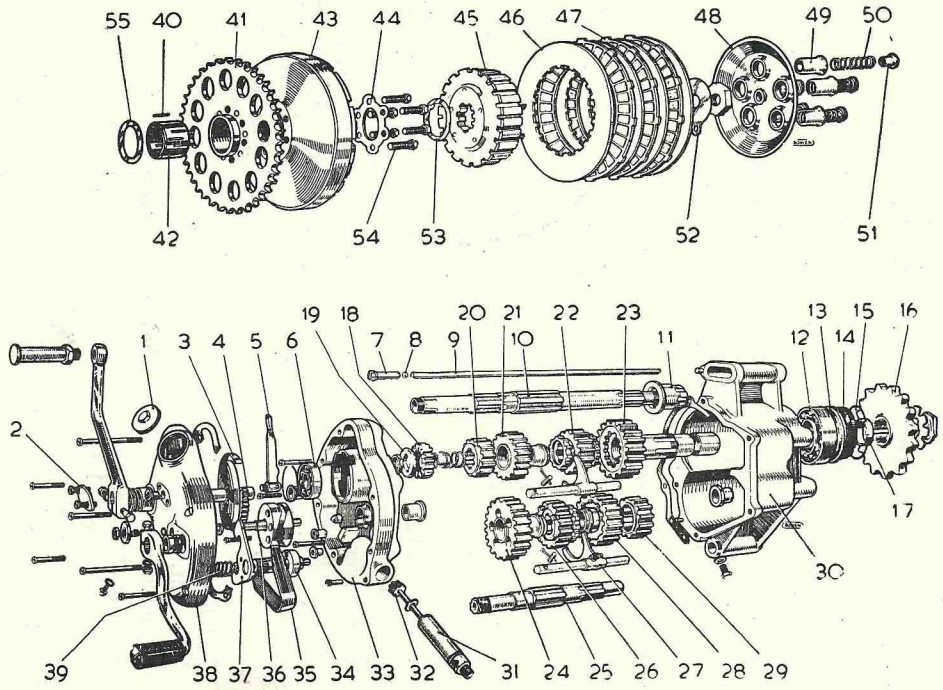


FIG. 49.—EXPLODED VIEW OF GB GEARBOX AND CLUTCH ASSEMBLY.

KEY TO FIG. 49.

EXPLODED VIEW OF GB GEARBOX AND CLUTCH ASSEMBLY

1. Gearbox filler plug.
2. Clutch-adjusting sleeve cap.
3. Kick-starter spring.
4. Kick-starter quadrant.
5. Clutch-operating lever.
6. Mainshaft ball bearing.
7. Clutch-operating plunger.
8. Clutch-operating plunger ball.
9. Clutch-operating rod.
10. Mainshaft.
11. Mainshaft sleeve.
12. Driving-gear bearing.
13. Driving-gear oil-seal housing.
14. Driving-gear oil seal.
15. Bearing-retaining ring.
16. Driving sprocket 19T.
17. Sprocket spacing (4G only).
18. Kick-starter ratchet pinion.
19. Kick-starter driving ratchet.
20. First-gear mainshaft 17T.
21. Third-gear mainshaft 25T.
22. Second-gear mainshaft 22T.
23. Driving-gear with bush 28T.
24. First-gear layshaft 29T.
25. Layshaft.
26. Third-gear layshaft 21T.
27. Selector fork assembly.
28. Second-gear layshaft 24T.
29. Layshaft pinion 18T.
30. Gearbox shell.
31. Speedometer spindle bush.
32. Speedometer spindle.
33. Kick-starter case.
34. Foot-change quadrant spindle.
35. Main spring for foot-change.
36. Foot-change cam assembly.
37. Foot-change quadrant.
38. Kick-starter case cover.
39. Foot-change secondary spring.
40. Clutch needle rollers 12.
41. Clutch chain-wheel 44T.
42. Needle roller cage.
43. Clutch case.
44. Chain-wheel set pin lock washer.
45. Clutch centre.
46. Clutch plate plain.
47. Clutch plate with inserts.
48. Clutch-spring plate.
49. Clutch-spring cup.
50. Clutch spring.
51. Clutch-spring adjusting nut.
52. Mainshaft nut lock washer.
53. Thrust washer, outer.
54. Chain-wheel set pin.
55. Thrust washer, inner.

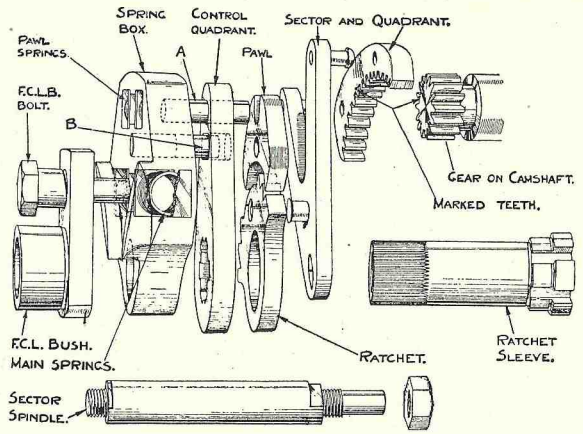


Fig. 50.—Exploded View of the Foot Gear-change Mechanism (BA and CP Type).

Where to Look for Wear

The ratchet and pawl should be closely examined for any sign of wear at the engaging points and, although a temporary repair can be made by "stoning" up, these parts should be replaced if they appear to be unduly worn. Check the tightness of the three rivets securing the ratchet and quadrant to the sector. Any slackness of this assembly will cause trouble in gear engagement, and resultant jumping out of mesh will occur.

Timing Must be Checked

Note that when actually fitting the foot-change assembly the quadrant and small gear pinion on the camshaft must be correctly "timed" or meshed, otherwise incorrect positioning of gears will result. The quadrant and pinion are marked with distinctive timing dots, and these must be intermeshed when the gears are in the netrual position before finally bolting up the outer gearbox end cover.

The Kick-starter

The quadrant and ratchet having been examined or replaced, attention should be given to the kick-starter lever return spring. Ensure that the spring is strong enough to return the lever and pedal to the vertical position after being depressed. A weak spring can have its tension increased by rewinding a further one or two turns. Do not wind the spring up solid, but only sufficient to throw the lever and pedal sharply to the normal vertical position. The inner end of the spring fits into one of the slots on the kick-starter shaft immediately behind the quadrant, and the outer end to a peg provided in the gearbox cover. The correct way for fitting the spring is for it to be located on the shaft with the coils running clockwise from the centre. If fitted the reverse way, the pedal will be thrown to the lowest position instead of to the top of the stroke. The end cover as well as, of course, the main gearbox case should be nearly filled with any of the makers' recommended brands of grease.

Refit the end cover and install the complete gearbox back in the frame. The operation is again simply a reversal of dismantling, and reference should be made to the text describing the clutch assembly before finally replacing the oil-bath chaincase and clutch cover. Points to watch after a gearbox has been overhauled are chiefly connected with lubrication and clutch adjustment.

Speedometer Drive

Where a speedometer spiral drive is incorporated in the gearbox, ensure that the spirals of the layshaft spindle and the short speedometer drive are kept in good condition by adequate lubrication. It is a good plan to remove the lower end of the speedometer cable and occasionally insert a little thick oil in the spindle housing.

Cork or Fabric Clutch

The gearbox manufacturers recommend that for ordinary touring, traffic work, road and sprint racing, cork is by far the

best material, but for grass or sand racing, freak trials and scrambles, fabric is recommended.

Cork possesses greater gripping power and is not affected by oil or water and being slightly elastic takes up the drive in a smooth, progressive manner. It will not, however, stand continued slipping, as it is liable to burn and char. Fabric does not grip so well as cork and, when fitted, a stronger set of clutch springs must be employed. Fabric will slip if exposed to oil or water and is very fierce on taking up the load due to its hardness and incompressibility.

GEARBOX AND CLUTCH ASSEMBLY
200-c.c. LH Colt Model

Lubrication

The Burman four-speed gearbox Type GB30 is fully oil lubricated, the correct capacity being $\frac{1}{2}$ pint. On the first series of Colt motor cycles manufactured, no oil-level-indicating plugs were fitted, but if a stiff wire or spoke is inserted at an angle through the oil filler cap H (Fig. 52) on the gearbox end cover the oil level should indicate at approximately a 1-in. or 25-mm. mark on the wire. Later series gearboxes have an oil-level plug J incorporated on the front cover. Every 2000 miles remove the drain plug K, drain oil and refill.

Gearbox Mechanism

The internal gear mechanism cannot be adjusted in any way, and no attention is necessary other than lubrication. If for any reason at all the mechanism calls for dismantling, this should be undertaken only by those with expert mechanical knowledge. Reference, however, to the exploded view (Fig. 51) will assist with the order of assembly.

Clutch Adjustment

Adjustment is rarely necessary, although a frequent check should be made to ensure that there is always at least $\frac{1}{16}$ in. free movement between the internal clutch-operating lever and

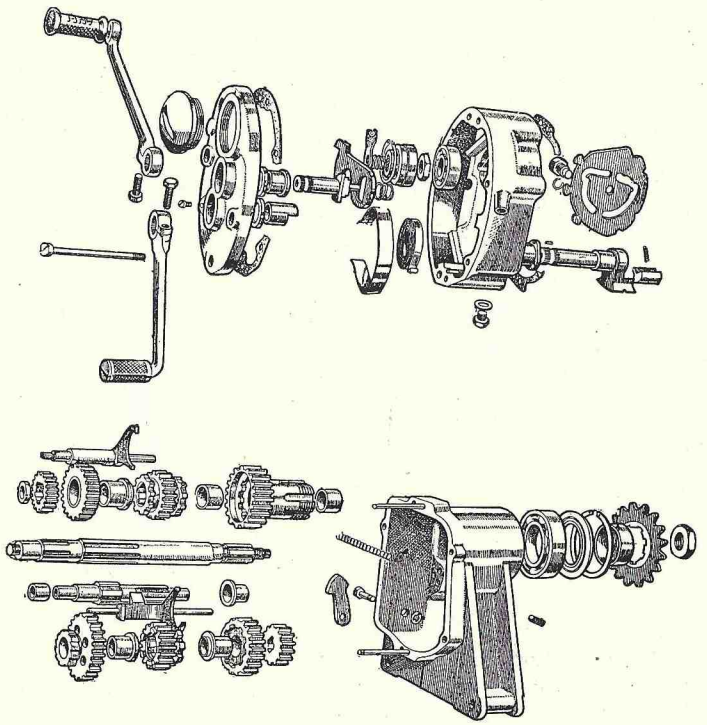


FIG. 51.—EXPLODED VIEW OF THE GB30 GEARBOX FITTED TO THE 200-C.C. MODEL LH COLT.

the end of the push-rod. Reference to Fig. 52 will show the actual layout of the clutch and the three-point adjustment. Note the position of the operating lever E located within the end case. This is normally set at approximately 15° (one o'clock) from the vertical position, but do not unnecessarily alter this, or some difficulty may be experienced in finding a satisfactory operating angle. Use the control cable adjuster F for normal running adjustment and to maintain the necessary $\frac{1}{16}$ in. clearance previously mentioned. If, due to cable stretch, sufficient adjustment cannot be obtained, further provision for adjustment is provided by means of the screw and

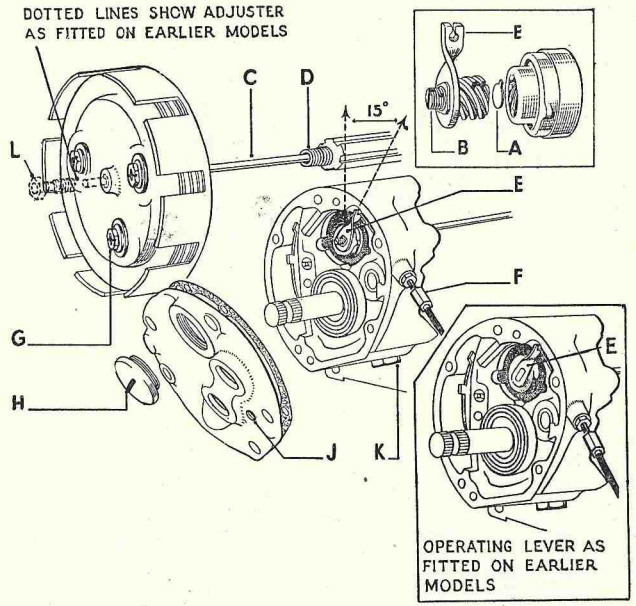


FIG. 52.—CLUTCH ADJUSTMENT ON 200-C.C. MODEL LH COLT.

(A) Thrust plate. (B) Screw. (C) Operating rod. (D) Mainshaft. (E) Operating lever. (F) Control-cable adjuster. (G) Clutch-spring locknuts. (H) Oil-filler cap. (J) Oil-level plug. (K) Drain plug. (L) Locknut.

lock-nut L and B in the centre of the clutch spring plate. Loosen the lock-nut L and turn the screw B clockwise (right-hand) to reduce operating-rod C clearance, and anti-clockwise (left-hand) to increase clearance. Note the action of the operating rod passing through the hollow mainshaft D.

All models with Engine Number higher than LA 1265 are fitted with clutch adjustment at the kick-starter end of the internal clutch-operating lever. If the mechanism is dismantled at any time be very careful to replace the hardened steel thrust plate A in its correct position, otherwise damage can be caused to the end of push-rod C.

GEARBOX AND CLUTCH DATA

Motor Cycle Model	Gearbox Type.	Clutch Type.	Driving Sprocket.
1937–51—Single-cyl. 250-c.c. and 350-c.c. except 1939 250-c.c.	CP1	2 cork plates 3 plain plates	⅝ in. × ⅜ in. 18T.
1937–51—Single-cyl. 500-c.c. O.H.V. and 600-c.c. S.V.	BA1	3 cork plates 4 plain plates	⅝ in. × ⅜ in. 19T.
1937–51—4-cyl. 1000-c.c.	BA2	3 cork plates 4 plain plates	⅝ in. × ⅜ in. 19T.
1948—Twin-cyl.	CP1	3 cork plates 4 plain plates	⅝ in. × ⅜ in. 18T.
1949–51—Twin-cyl.	BA1	3 cork plates 4 plain plates	⅝ in. × ⅜ in. 19T.
1952–59—NH.	GB5	2 cork plates 3 plain plates	⅝ in. × ⅜ in. 19T.
1952–59—VH, VHA, KH, KHA and VB.	GB6	3 cork plates 4 plain plates	⅝ in. × ⅜ in. 19T.
1952–59—4G.	GB7	3 cork plates 4 plain plates	⅝ in. × ⅜ in. 19T.
1954–59—LH.	GB30	2 cork plates 3 plain plates	½ in. × 0·305 in. 17T.
1954–59—FH.	GB33	3 Klingerit plates 4 plain plates	⅝ in. × ⅜ in. 19T.

Clutch chainwheel = ½ × 0·305 in. × 44T., except 1954–59 FH with 42T. clutch chainwheel.

GEAR RATIOS CP AND BA

Model.	Engine Sprocket.	Top Gear.	3rd.	2nd.	1st.
1937–51—250-c.c. and 350-c.c., except 1939 250-c.c.	Solo 20T.	5·7	7·3	10·1	15·3
	19T.	6·0	7·7	10·6	16·1
	18T.	6·4	8·2	11·2	17·0
	17T.	6·8	8·7	11·9	18·0
1937–51—500-c.c. O.H.V. and 600-c.c. S.V.	Solo 23T.	4·7	6·0	8·0	12·6
	21T.	5·2	6·5	8·6	13·9
	Side-car and optionals 20T.	5·4	6·8	8·8	14·5
	19T.	5·7	7·2	9·7	15·3
	18T.	6·0	7·6	10·0	16·2
	17T.	6·4	8·0	10·6	17·2
1937–51—1000-c.c. 4-cyl.	Solo 25T.	4·3	5·5	7·4	11·6
	24T.	4·5	5·7	7·7	12·1
	23T.	4·7	6·0	8·0	12·6
	23T.	5·6	7·2	9·9	15·0
	Side-car 22T.	5·9	7·5	10·3	15·7
1948—Twin-cyl. KG and KH.	Solo 23T.	5·0	6·4	8·8	13·3
	Side-car 19T.	6·0	7·7	10·6	16·1
1949–59—KG and KH.	Solo 21T.	5·20	6·65	9·15	13·85
	Side-car 19T.	5·75	7·40	10·15	15·40

Gear Ratios GB

Model.	Engine Sprocket.	Top Gear.	3rd.	2nd.	1st.
NH.	19T.	5·72	7·50	9·72	15·15
LH.	17T.	7·00	8·50	11·60	17·50
VH and VHA.	Solo 23T.	4·74	6·20	8·05	12·55
	Side-car 19T.	5·72	7·50	9·72	15·15
VB.	Solo 22T.	4·95	6·47	8·42	13·10
	Side-car 19T.	5·72	7·50	9·72	15·15
KH and KHA.	Solo 21T.	5·18	6·77	8·81	13·72
	Side-car 19T.	5·72	7·50	9·72	15·15
FH.	Solo 24T.	4·35	5·70	7·40	11·55
	Side-car 22T.	4·95	6·45	8·40	13·10
4G (1952).	Solo 24T.	4·5	5·88	7·65	11·92
	Side-car 22T.	4·95	6·47	8·42	13·10
4G (1953–54).	Solo 26T.	4·18	5·46	7·10	11·07
	Side-car 23T.	4·74	6·20	8·05	12·55
4G (1955–59).	Solo 25T.	4·35	5·70	7·40	11·55
	Side-car 22T.	4·95	6·47	8·42	13·10

Wide Ratios GB

Engine Sprocket.	Top Gear.	3rd.	2nd.	1st.
17T	6·50	9·45	13·05	20·00
18T	6·00	8·95	12·30	18·70
19T	5·75	8·45	11·50	17·90

Gear Box Ball Bearings

All Years.	Mainshaft Ball Bearing.	Driving Gear Ball Bearing.
Type BA	Size 52 mm. × 20 mm. × 15 mm.	Size 72 mm. × 1½ in. × 17 mm.
Type CP	Size 40 mm. × 17 mm. × 12 mm.	Size 62 mm. × 1 $\frac{9}{32}$ in. × 16 mm.
Type GB	Size 52 mm. × 20 mm. × 15 mm.	Size 72 mm. × 1½ in. × 17 mm.

CHAINS

Primary Chain Adjustment.—Slacken off pivot and clamp bolts, and rotate nut on draw bolt to swing box about pivot bolt. Adjust until chain has approx. $\frac{3}{8}$ in. up-and-down movement midway between sprockets at tightest point.

Rear Chain Adjustment (*Rigid Frame, Fixed Rear Wheel*).—Slacken off two rear-wheel spindle nuts and loosen nut securing brake anchor bar to brake plate; then adjust by turning screw adjusters by an equal amount. Chain movement, approx. $\frac{5}{8}$ in. Adjust rear brake if necessary.

Rear Chain Adjustment (*Plunger-type Frame with Fixed Rear Wheel*) 1937–39.—Slacken off two hub spindle nuts and rotate adjusting cams in required direction. Each side of wheel must be equally adjusted to ensure correct alignment. 1950–55 models have adjuster bolts and lock-nuts, see page 204.

Rear Chain Adjustment (*Plunger-type Frame with Detachable Rear Wheel*) 1937–39.—Slacken off spindle nut on brake side and sleeve nut on offside. Sleeve nut is centre hexagon, inner hexagon being adjusting cam. 1950–59 models have adjuster bolts and lock-nuts, see page 204.

Chain Adjustment (*Pivoted-rear-fork Frame*).—Place the machine on the centre stand and slacken the rear spindle units and the chain-adjuster lock-nuts. Turn the chain adjusters until, with the damper units fully extended, the chain has a total up-and-down movement of between 1¼ and 1½ in. The chain will then have the normal $\frac{5}{8}$ in. movement when the rider is astride the machine.

Rear Chain Lubrication is by means of needle valve in primary chain case (just behind clutch dome); this controls overflow to rear chain. Obtain correct setting by trial on road; turn clockwise to decrease supply.

Driving Chain Wear.—A permissible stretch of $\frac{1}{8}$ in. per foot of chain is allowed before replacement is considered necessary.

CHAPTER VII

CARBURETTERS

THE needle-jet-type carburetter (Amal) is fitted to all Ariel single-cylinder and twin-cylinder engines, and reference should be made to the data chart in this chapter regarding the different models for relatively different cubic capacity engines. Maintenance of the carburetter is normally confined to detaching and washing out the float chamber, checking and tightening the fixing flange, top and bottom mixing chamber ring and nut and periodically making pilot and throttle stop adjustments. Tuning of the Amal "Monobloc" carburetter fitted to 1955–59 models is identical with that of the earlier type carburetter.

Adjustments and Tuning—Amal Carburetter

The Pilot Air Screw.—If screwed in clockwise this reduces the air supply and richens the slow-running mixtures; turning anti-clockwise weakens the mixture.

The Throttle Stop screw.—This screw should be so set as to just open the throttle valve sufficiently to keep the engine running slowly with the control lever in the fully closed position. Regulate the pilot screw and throttle stop to enable the engine to "tick over" with an even beat. Too rich a mixture will cause erratic running, and a very weak mixture will cause "spitting back" or even failure to run at all. Slow-running adjustment is a question of trial and error, and experiments must be made with the settings in conjunction with the ignition-control lever in various positions.

The Throttle Valve.—The cut-away of the valve or slide controls the mixture between $\frac{1}{8}$ and $\frac{1}{4}$ throttle position.

Acceleration is governed by the cut-away to a very marked degree, especially when opening up from a partially closed or closed throttle position. The larger the cut-away the weaker the mixture and vice versa.

The Jet Needle also has a considerable influence on acceleration and petrol consumption. The needle groove position

determines the mixture through the $\frac{1}{4}$ to $\frac{3}{4}$ range of throttle opening. Fitting the needle in the centre groove gives a general satisfactory setting, but if a weaker mixture is desired, the needle must be lowered by fitting the fixing clip in a groove nearer the needle top. A richer mixture is obtained by using a lower groove for needle fixing.

The Main Jet is calibrated and stamped with its size number. The smaller the number, the weaker the mixture, and vice versa. The main jet does not normally vary the mixture below the $\frac{3}{4}$ throttle opening unless the needle jet is considerably worn. Trial and error experiments again are necessary when fitting different sizes of main jets, but, generally speaking, the jet size should be that to produce maximum power and speed with the throttle and the air valve fully opened.

AMAL CARBURETTER DATA

Model.	Year.	Amal. Type.	Main Jet.	Pilot Jet.	Throttle Valve.	Needle Jet.
FH	1954	276	170	—	6/4	Std.
FH	1955	376/12	240	25	376/3½	0·106
HS	1954	10TT9	380	—	6	0·109
KG	1948–52	276	140	—	6/3	0·107
KH	1948–52	276	150	—	6/3	0·107
KHA	1953	276	150	—	6/3	0·107
KH	1954	276	150	—	6/3	0·107
KH	1955–59	376/7	200	30	376/3½	0·106
LG	1937–38	275	110	—	5/4	—
LH	1954	275	75	—	5/3	Std.
LH	1955	375/5	90	25	375/3½	0·105
NH	1937–54	276	150	—	6/4	0·107
NH	1955–59	376/8	200	25	376/3½	0·106
OG	1939 only	275	110	—	5/3	—
OH						
VB	1937–54	276	160	—	6/4	Std.
VB	1955–59	376/13	220	30	376/5	0·106
VG	1937–50	276	170	—	6/4	Std.
VH	1937–54	289	200	—	29/3–4	Std.
VH	1955–59	376/11	200	30	376/3½	0·106
Leader and Arrow	1958–60	375/33	170	30	3½	105

Needle Jet size 0·106 is standard *on "Monobloc" carburetters* and is not usually stamped with the size.

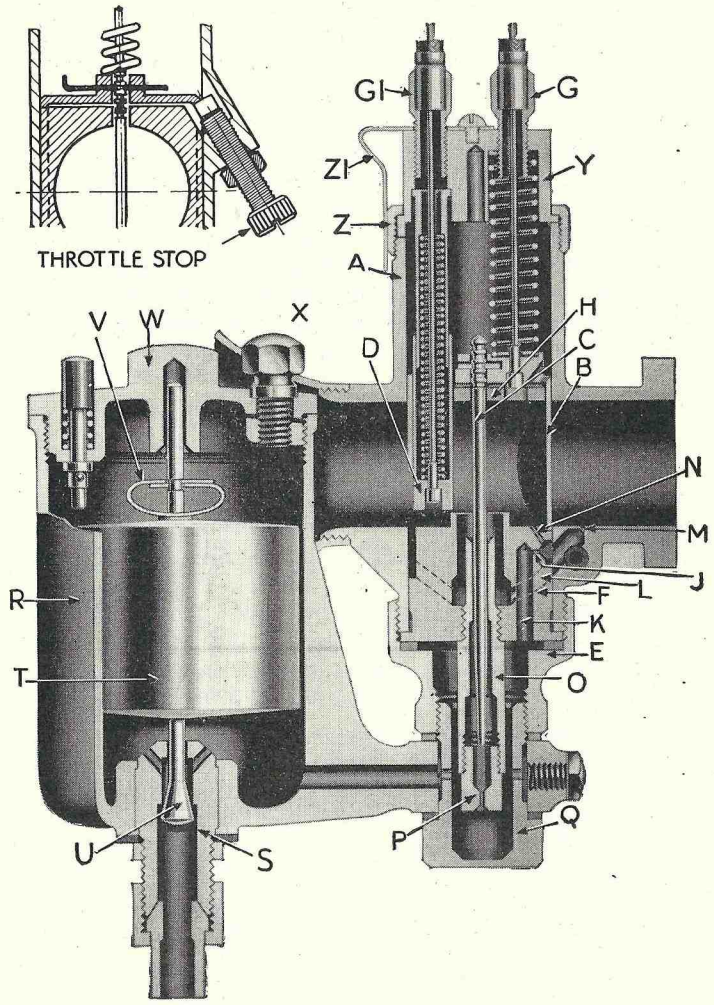


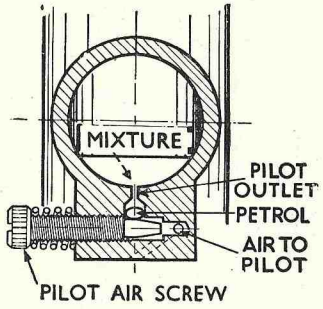
FIG. 53.—SECTIONED ILLUSTRATION OF THE AMAL NEEDLE JET CARBURETTER, FOR SINGLE- AND TWIN-CYLINDER MODELS.

KEY TO FIG. 53

Air and throttle valves are in the closed position.

A. Mixing chamber.
B. Throttle valve.
C. Throttle needle.
D. Air Valve.
E. Mixing chamber union nut.
F. Jet Block.
G. Throttle valve cable adjuster.
G1. Air valve cable adjuster.
H. Jet block barrel.
J. Pilot hole.
K. Pilot feed hole.
L. Pilot air hole.
M. Pilot outlet.
N. By-pass.
O. Needle jet.
P. Main jet.
Q. Holding bolt.
R. Float chamber.
S. Needle seating.
T. Float.
U. Needle valve.
V. Spring clip.
W. Float chamber top.
X. Float chamber lock screw.
Y. Mixing chamber cap.
Z. Knurled ring.
Z1. Spring.

FIG. 54.—SHOWING SIDE VIEW OF THE AIR INLET.



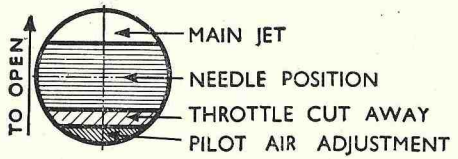


FIG. 55.—SHOWING THE RANGE AND SEQUENCE OF ADJUSTMENTS OF THE AMAL CARBURETTER.

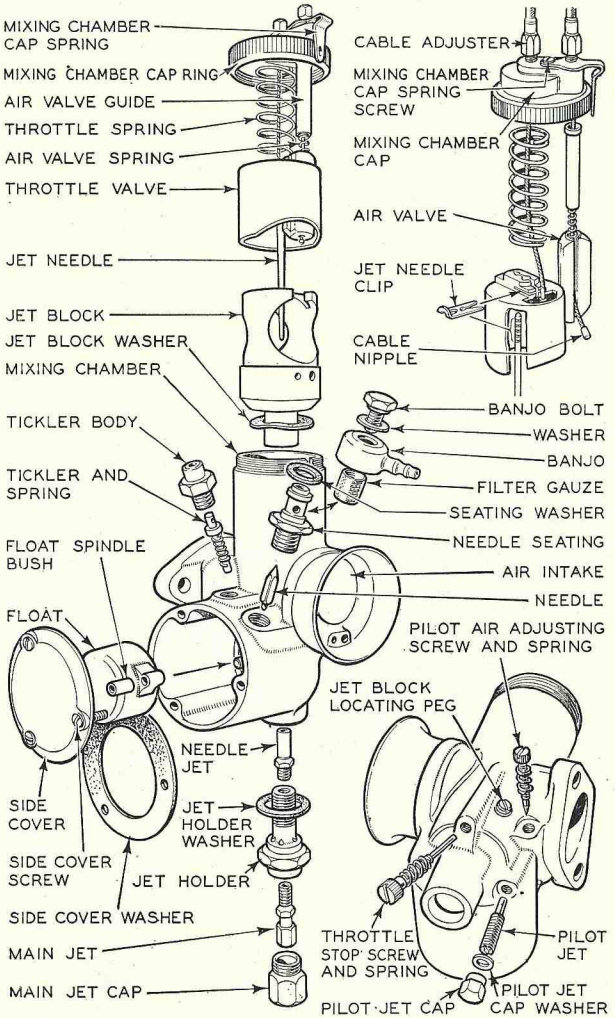


FIG. 56.—EXPLODED VIEW OF THE AMAL "MONOBLOC" CARBURETTER FITTED TO THE 1955–59 MODELS, EXCEPT 4-CYLINDER AND 1960 LEADER AND ARROW 250.

SOLEX CARBURETTER

The Solex carburetter is fitted to the 1937–53 1000-c.c. models.

Type 26 *FHDT Assembly* 12 (600-c.c., 1938–39).

Choke Tube	20
Main Jet	100 × 58
Pilot Jet	055
Well	50443/L1
Jet cap	19 × 140 × 2
Needle Valve	2

Type 26 *FHDT Assembly* 12 (1000-c.c., all 1937 and 1938 engines up to No. DD8587).

Choke Tube	23
Main Jet	115 × 58
Pilot Jet	055
Well	50443/L1
Jet Cap	19 × 140 × 2
Needle Valve	2

Type 26 *AHD Assembly* 22 (1000-c.c., 1938–52).

Choke Tube	23
Main Jet	120
Air-correction Jet	150
Pilot Jet	070
G.A. Jet	3
G.S. Jet	100
Jet Cap	51861/L2
Needle Valve	2

Type 26 *AHD Assembly* 22 (1000-c.c., 1953 only).

Choke Tube	23
Main Jet	120
Air Correction Jet	170
Pilot Jet	060
G.A. Jet	3
G.S. Jet	100
Jet Cap	51861/L2
Needle Valve	2
Well	5·1

Air Strangler Type (26FHDT)

The slow-running adjustment is carried out by turning the screw which is spring loaded on the throttle lever of the carburetter and should be set for "tick-over" commencing with the throttle control closed. The slow-running mixture is regulated with the other spring-loaded screw situated near the carburetter fixing flange. Turning this screw clockwise weakens the mixture and anti-clockwise gives a rich slow-running mixture. Correct position can be determined only by trial and error in the attempt to obtain a smooth running engine. The standard settings can be altered to suit climatic conditions and altitudes. To improve petrol consumption a size smaller main and pilot jet can be tried. The main jet first number indicates the actual jet hole calibration, and the second number refers to the correction holes. Alternative main jet sizes are variable in numbers of five. For example—100 × 5, 115 × 58, 110 × 58.

Bi-starter Type (26AHD)

Slow-running adjustment is the same as for the air-strangler-type carburetter. Different sizes of main, pilot and air-correction jets can be experimented with, and a No. 65 pilot jet will probably improve fuel consumption without sacrificing performance. The main jet controls mixture at cruising speeds and acceleration, and a No. 115 or 110 can be tried relative to consumption of fuel.

The Air-correction Jet

Compensates the higher-speed mixture. To weaken this mixture a larger correction jet is fitted, and vice versa. Therefore, if a smaller main jet is fitted it will probably be found necessary to fit a smaller correction jet to balance the mixture at higher speeds.

High-altitude Setting

Where a Solex carburetter operates at 3000 ft. and over above sea-level, it will be necessary to employ a different jet setting to that of our British standard. The makers have a general recommendation, which is to reduce the main jet a half size for 3000 ft., with a maximum reduction of one size for altitudes over 6000 ft. The higher the altitude, the smaller the main jet is the ruling, and it may be necessary to increase the size of the air-correction jet, but to reduce the pilot jet.

S.U. CARBURETTER, TYPE MC2

(*Fitted to 4G models commencing Engine No. PL.*101.1954)

Adjustment and Tuning

The S.U. carburetter is of the automatically expanding choke type in which the cross-sectional area of the air passage, and the effective orifice of the jet, is variable.

The choice of the needle, which governs the effective orifice of the jet, is settled for a particular engine only after considerable testing, both on the engine test bed and later on road test, and it is not, therefore, a common requirement that the needle type should be changed from the maker's original specification.

If any doubt arises as to the correctness of the type fitted, this can be checked by first removing the suction chamber and then slackening the side needle screw, when the needle can be pulled out and its marking checked. The identifying letters *GN* may be rolled around the shank or stamped on the flat end of the shank.

When detaching the suction chamber and piston unit from the main instrument (necessary when checking or changing the needle) it will be necessary, owing to lack of headroom, to lift the two units, that is the chamber and the inner piston, together as one, away from the carburetter body, and this will call for a certain amount of care and manual dexterity, as after the two side screws have been removed the suction chamber can be lifted only a limited amount; then one hand is required to raise the suction piston upwards inside the chamber against the mild load of the inner compression spring, whilst the second hand steadies the suction chamber, after which the complete unit can be moved sideways clear of the main instrument—great care must be taken, however, to see that the jet

needle is not bent in the process. When refitting the suction chamber and piston the procedure is, of course, reversed, and the piston should be held as high up as possible inside the suction chamber whilst the whole unit is carefully guided into the position bore and jet in the main body.

It should be noted that where some alteration to mixture strength is required, it is the needle alone that is changed, the jet size (0·090 in.) remaining constant throughout a given range of carburetters.

When reinserting the needle, the normal setting is with the shoulder (or junction between the straight part of the tapered working section of the needle and its shank) just flush with the bottom of the piston-rod into which it is inserted. This normal setting should only be changed by inserting the needle, say, a further $\frac{1}{32}$ in. farther in, if the position of the jet-adjusting nut for normal running needs to be lower than three full turns downwards from its topmost possible position.

After checking, if this is considered necessary, the type of needle fitted, tuning of the carburetter is necessarily confined to correct idling adjustment. This operation should be attempted only after the engine has attained normal running temperature, and is carried out by means of the throttle-stop screw (2, Fig. 58), which governs the amount of throttle opening for idling, and the jet-stop nut (18), which gives an enriching effect when screwed downwards, and a weakening effect when screwed upwards.

A correct idling mixture gives an even beat with a colourless exhaust—too rich a mixture gives a trace of black in the exhaust with a rhythmical or regular misfire—too weak a mixture gives a splashy, irregular type of misfire with a marked tendency to stop when only partially warm.

A second check on the correctness of the mixture strength may be made by unscrewing the hexagon-headed 2 B.A. plug screw (29, Fig. 58), immediately under the air intake (set in an angular position), and then with the engine idling a thin wire nail or similar type of metal rod is carefully pushed upwards until it lifts the suction piston, then any amount of manual lift over $\frac{1}{32}$ in. should cause the engine to stop from weakness of mixture, and therefore, this setting can be taken as correct;

if, on the other hand, a lift of approximately $\frac{1}{16}$ in. causes the engine to gain speed, then the mixture strength is too rich and should be suitably weakened off.

Defects in Operation

In the case of unsatisfactory engine performance, before making any alterations to the carburetter setting, a general check should be made on the ignition system, valves and valve guides in the engine, also the gas tightness of both induction-pipe and carburetter-flange joints.

If, however, the engine and ignition are found to be faultless, the following points should be checked on the carburetter.

Sticking of Piston.—The symptoms here are either stalling and a refusal of the engine to run slowly or, alternatively, lack of power accompanied by excessive fuel consumption. This defect is easily detectable. The piston should rest, when the engine is not running, upon the bridge (28, Fig. 58). When raised by means of a rod inserted through the 2 B.A. hole under the air intake, as previously described, to its highest position against the appreciable resistance of the piston, and then released, it should drop freely, and strike the bridge sharply and distinctly. If it becomes prematurely arrested in its downward movement, or if it appears unduly reluctant to break away from its position of rest on the bridge when an attempt is made to raise it from this position, the jet should be lowered by means of the enrichment mechanism and the test repeated.

If the previous symptoms persist it can be assumed either that the enlarged diameter of the piston is making contact with the bore of the suction chamber or that the piston-rod is not sliding freely within its bush. If, on the other hand, sticking has been eliminated by the act of dropping the jet, the indication is that contact and friction are taking place between the jet and the needle.

Rectification should be conducted as follows, according to the diagnosis.

Dirt or Contact Between the Piston and Suction Chamber, or Sticking of the Piston-rod in its Bush.—Remove the suction

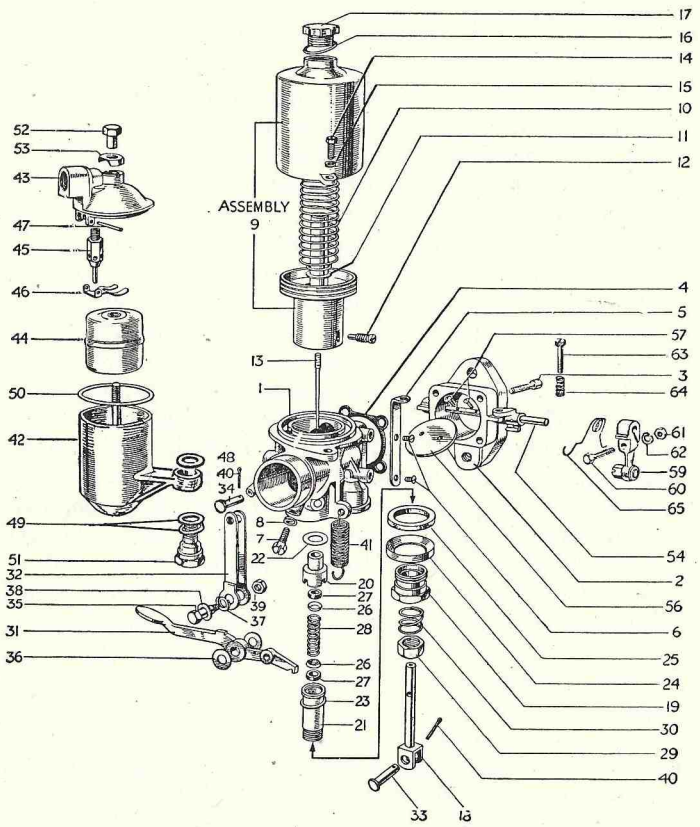


FIG. 57.—EXPLODED VIEW OF S.U. CARBURETTER TYPE MC2.

KEY TO FIG. 57.

1. Body.
2. Throttle barrel adaptor.
3. Screw.
4. Gasket.
5. Throttle cable abutment.
6. Screw.
7. 2 B.A. plug screw.
8. Washer.
9. Suction chamber.
10. Piston spring.
11. Thrust washer.
12. Needle screw.
13. Jet needle.
14. Screw.
15. Spring washer.
16. Oil-cap washer.
17. Oil cap.
18. Jet.
19. Jet screw.
20. Jet top half bearing.
21. Jet bottom half bearing.
22. Copper washer.
23. Copper washer.
24. Brass sealing ring.
25. Cork sealing ring.
26. Brass gland washer.
27. Cork gland washer.
28. Spring.
29. Adjusting nut.
30. Spring.
31. Jet lever.
32. Jet link.
33. Long pivot pin.
34. Short pivot pin.
35. Bolt.
36. Fibre washer.
37. Spring washer.
38. Washer.
39. Nut.
40. Split pin.
41. Return spring.
42. Float chamber.
43. Float-chamber lid.
44. Float.
45. Float needle and seat.
46. Hinged lever.
47. Hinge pin.
48. Fibre washer.
49. Washers, 2-fibre, 1-brass.
50. Float chamber lid washer.
51. Holding bolt.
52. Float-chamber lid nut.
53. Brass cap.
54. Spindle throttle.
56. Throttle disc.
57. Screw.
59. Throttle lever.
60. Bolt.
61. Nut.
62. Washer.
63. Adjusting screw.
64. Adjusting-screw lock spring.
65. Lever return spring.

chamber, withdraw the piston and thoroughly clean both parts with petrol and a clean cloth. Apply a few drops of light oil to the piston-rod, preferably diluted with paraffin if any signs of rust or corrosion are noticed on the rod. Replace the piston in the suction chamber and test for rotational and sliding freedom. Any direct local contact between these two parts, attributable to some indentation of the suction chamber, may be rectified by carefully removing any high spots which may show up on the suction-chamber bore by means of a hand scraper. On no account should any attempt be made to enlarge generally the bore of the suction chamber, or to reduce the diameter of the enlarged part of the piston, as the maintenance of a limited clearance between these parts is absolutely essential.

Lubrication

Each month remove the plastic octagonal oil cap from the top of the suction chamber and feed a few drops of thin machine oil into the orifice. When the oil cap has been replaced, ensure it is well tightened. An air leak occurring at this point would upset the automatic operation of the piston in the suction chamber and cause faulty carburation. If the oil cap is lost, it must be replaced by another grey cap, *without* a vent hole.

Eccentricity of Jet and Needle.—Re-centring of the jet in relation to the needle will be necessary should the jet have become laterally displaced in service due to inadequate tightening of the locking screw (15, Fig. 58), or any other cause. This operation will, of course, also be necessary if the jet and its associated parts have been removed for any reason. It may also be necessary after the removal and replacement of a needle. The procedure for the re-centring of the jet is as follows.

The jet stop nut (18, Fig. 58) should first be screwed upwards to its fullest extent, the jet head then being raised to contact it so that the jet assumes its highest possible position. The locking screw (15) should now be loosened just sufficiently

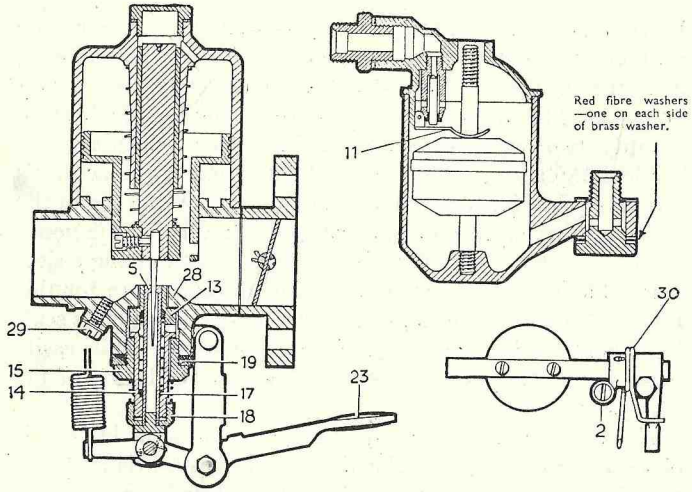


FIG. 58.—SECTIONAL VIEWS OF S.U. CARBURETTER, TYPE MC2.

2. Throttle stop screw.
5. Jet.
11. Float chamber hinged fork lever.
13. Jet bearing, top half.
14. Jet bearing, bottom half.
15. Jet locking screw.
17. Jet gland washer.
18. Jet stop nut.
19. Locking screw washer.
23. Jet lever.
28. Bridge.
29. Plug screw.
30. Throttle return spring.

to release the jet and jet-bush assembly (5), (13), (14), etc., and permit this to be moved laterally.

A moderate side loading applied to the lower protruding part of the lower jet bush (14, Fig. 58) will indicate whether or not the assembly has been sufficiently freed. The piston should now be raised, and, maintaining the jet in its hightest position, the piston should be allowed to drop. This will cause the needle to be driven fully into the jet mouth, and thus bring about the required centralisation. The locking screw should now be tightened and the jet returned to its former position. Should any indication of contact between the needle and the jet persist, which may sometimes occur due to further displacement of the assembly on finally tightening the locking screw, this must again be slacked off and the operation repeated.

Flooding or Leakage

Flooding from Float-chamber or Mouth of Jet.—Flooding may occur due to a punctured and petrol-laden float or to dirt

between the float-chamber needle valve and its seating. To remedy either defect, the float-chamber lid should be removed, and the necessary cleaning, float replacement or repair effected. The needle and seating-unit number is T2; to identify, two ring grooves are machined around the seating.

Flooding also may occur if the original manufacturer's setting of the hinged fork lever (11, Fig. 58), in the top of the float chamber has been disturbed, possibly causing the petrol level to be higher than normal, this higher level giving a slow petrol bleed over the jet bridge. The setting figure for this fork is that with the fork pressing the needle home in its seating, then a $\frac{3}{8}$-in.-diameter test bar should just slide easily between the curve of the fork and the circular facing of the float-lid casting.

Leakage from Bottom of Jet.—If persistent slow leakage is observed in the neighbourhood of the jet head, it is probable that the jet-gland washer (17, Fig. 58) and its lower counterpart, together with the locking-screw washer (19), require replacement. The jet lever (23) should first be detached from the jet head, the locking screw (15) removed, and the entire jet and jet-bush assembly withdrawn. On reassembly great care should be taken to replace all parts in their correct situations, as shown in the diagram. Re-centring of the jet, as previously described, will, of course, be necessary after this operation.

Air Filter

The air filter should not be disconnected to increase the maximum speed of the machine; removal of the filter will impair the general performance of the engine. As the carburetter is exposed to road dust and other foreign matter if the air filter is not connected, there is a possibility that the freedom of the piston in the suction chamber will be interfered with.

CHAPTER VIII

FRONT FORKS AND STEERING ASSEMBLY

THE girder-type front-fork assembly fitted to all models up to 1946 is entirely obsolete and spare parts are no longer available. However, any 1937–46 model can be converted, and a complete telescopic-fork assembly supplied by Ariel stockists is easily adapted to suit the original frame head lug without any machining operation. But it is essential to use with the conversion a 1947–59 complete front wheel with all fittings and mudguard.

TELESCOPIC FRONT FORK WITH HYDRAULIC CONTROL

(Except 200-Colt and 250 Leader Models)

The telescopic fork assembly was first fitted as standard to all 1947 Ariels.

Maintenance and Adjustments

This is confined solely to periodical tightening of all nuts and bolts. Once the fork tubes have been filled with $\frac{1}{2}$ pint of oil of the recommended grade for each fork leg no "topping up" is required. To test the correct oil-level with the machine unladen in a perfectly upright position, remove the two top plated hexagon plugs and insert a dip stick. The level should be 17–18 in. below the top face of the handlebars bracket for all normal running, but if it is desired to improve the damping effect, a higher level can be used. Auxiliary coil springs are fitted to each fork leg and are supplied in two grades —light (yellow spot) for solo use and heavy (red spot) for side-car work.

Exchanging springs may be carried out without any special

tools, except for the use of the hexagon socket key supplied by the makers in the tool-kit. Remove the front stand, mudguard and wheel. Remove the two top plated plugs and loosen the sunken hexagon pinch-bolts in the crown bracket. Each lower fork-tube cover assembly can now be pulled out from below. If the tube is tight, open the split of the crown bracket R (Fig. 59) slightly with a taper wedge and replace top plugs, but only screwing down a few threads. Give the plugs a sharp blow with a mallet and the tubes will slide downwards. Take off the coil springs, replace and then proceed to fit up in the reverse way to dismantling. Before fitting the coil springs ensure that they are well packed with thick grease, otherwise there is a tendency for a dry spring to "chatter" against the outer covers.

Dismantling

After very lengthy service or damage, it may be necessary to dismantle completely the fork assembly. This is best carried out by first removing the whole assembly from the steering-head of the frame. Remove damper knob and column lock-nut Y (see Fig. 59). Lift off handlebar bracket and speedometer mounting if fitted. Remove other column lock-nuts L and M and note position of the self-adjusting spring plate which automatically adjusts the steering-head ball races. The steering-column and crown carrying the complete fork assembly can now be withdrawn downwards. Take care not to lose the steel balls from the head races.

After removing coil springs as previously described, continue dismantling by unscrewing the sleeve S locating the special oil-seal. A service tube spanner supplied by the makers is essential for this operation. A stiff wire circlip T securing the top bush U is next removed, and whilst holding the main tube in the jaws of a vice, suitably protected with soft clamps, tap gently with a mallet or hide hammer on the end of the sliding tube V and the bottom bush W will drive out the top bush U. The main fork tube can now be removed complete with the lower bush, which is secured with a sleeve nut. To remove bottom outer cover, detach the three short screws X

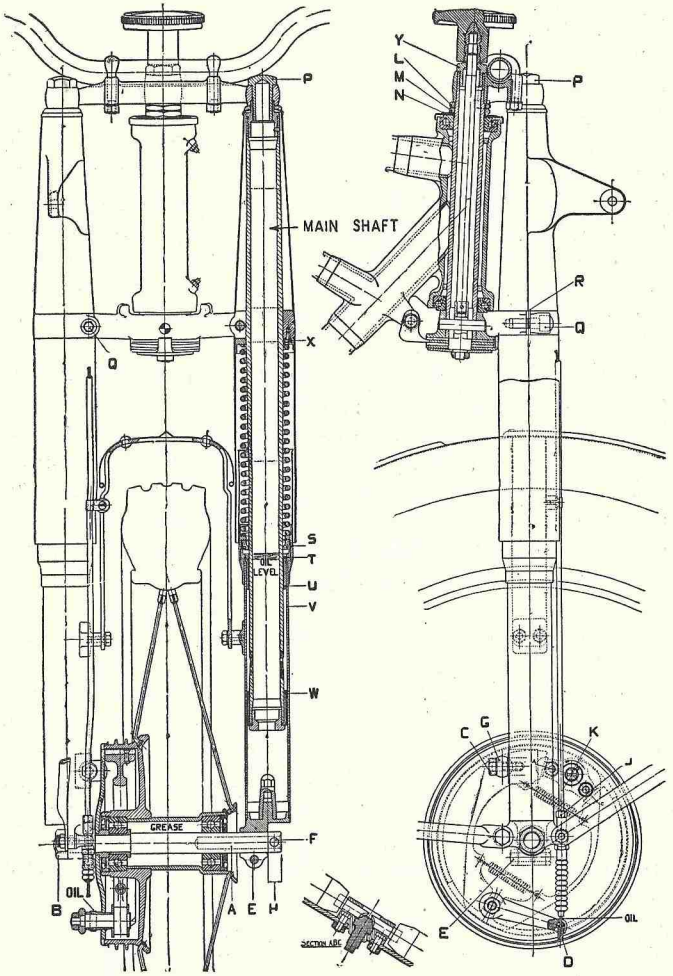


FIG. 59.—THE 1947–55 ARIEL TELESCOPIC FORK WITH HYDRAULIC CONTROL. THE 1952–55 SPEEDOMETER MOUNTING IS NOT SHOWN.

(A) Front-hub spindle exposed. (B) Hub-spindle nut. (C) Brake-plate anchor bolt. (D) Cable nipple. (E) Pinch bolt. (F) Hub spindle. (G) Lug locating anchor bolt. (H) Fork-end lug. (J) Cable stop. (K) Brake-adjusting screw. (L) (M) Locknuts. (N) Spring diaphragm. (P) Plug. (Q) Pinch bolt. (R) Split crown. (S) Sleeve. (T) Circlip. (U) Top bush. (V) Sliding tube. (W) Bottom bush. (X) Bottom outer-cover fixing screws.

with a long screwdriver. The top cover can be lifted clear after removing the handlebar bracket, with which is incorporated the speedometer mounting on certain 1950 and on all 1951–55 models.

The main inner fork-leg tubes are turned from high-tensile manganese-carbon steel, tested to 45 tons/sq. in., and if at all damaged are extremely difficult to reset without special tools and jigs. When reassembling the telescopic fork, ensure that all parts are thoroughly cleansed, especially the white-metal-covered top and bottom bushes, oil-seals, etc. Foreign matter will prevent the sliding and damper action from working effectively.

If the white-metal bushes appear worn or scored these should be replaced and no attempt made to re-metal them. The 1949–55 models are fitted with special bronze bushes which entirely supersede the 1947–48 pattern, but are interchangeable throughout the complete range. The self-adjusting oil-seals, which have, when new, internal diameters of $\frac{1}{16}$ in. less than the outer diameter of the main tubes, should be replaced after very long service.

Reassembly

First replace the outer covers, leaving handlebar bracket and lock-nuts loose. Slide the oil-seals and the housings S over the main leg tubes and also the top bushes U, Fig. 59. Next insert the bottom bushes W in the sliding tubes V. Secure each main tube between the protected vice jaws and place a split tube or sleeve over the tube so that it makes contact with the end of the vice jaws on one side and the top bush U on the other.

Tap the end of the sliding tube V to force right home the bush U. Refit circlips T and screw up the sleeves S securely. Insert the main tube assembly into the crown and handlebar bracket, loosely tighten the top plugs P and finally tighten the nut Y below the steering-damper knob. Tighten plugs P and lastly the two pinch-bolts in the steering-crown. Remove plugs P again and refill to correct level with recommended grade of oil.

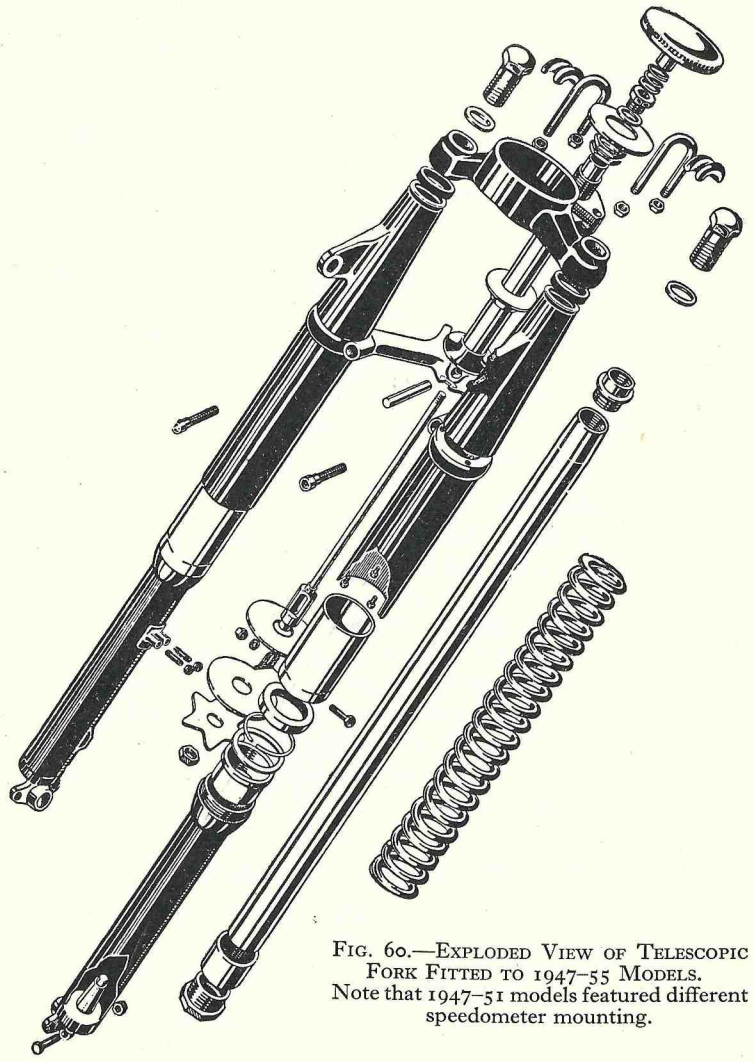


FIG. 60.—EXPLODED VIEW OF TELESCOPIC FORK FITTED TO 1947–55 MODELS.
Note that 1947–51 models featured different speedometer mounting.

Head Races

Repack top and bottom head races with grease and refit to frame, taking note of the self-adjusting layout. Between the two column lock-nuts L and M and the ball-race dust cover, a spring diaphragm N is located. The spring action of this automatically adjusts the head races against wear to a certain degree. After lengthy service, however, clearance may develop in the head races and spanner adjustment is essential.

Support the front of the machine by placing a block under the engine to allow the wheel to clear the ground. Slacken off the top column lock-nut L and screw down the bottom nut M until all clearance is taken up. Then further tighten the nut one-sixth of a turn. Hold the nut securely and tighten the top lock-nut L. Test the steering carefully, and if any roughness is felt, worn or pitted races and steel balls are probably the cause. Instructions regarding replacement of head races will be found in Chapter X.

Steering-damper

The lower end of the damper rod is secured by a parallel steel peg driven into and through the crown at the base of the steering-column. The peg also passes through the brass trunnion piece connected to the end of the rod. To dismantle the complete damper, punch out the parallel peg, unscrew damper knob and remove the small damper-plate anchorage bolt and nut. The whole assembly can then be withdrawn. After very lengthy service the friction fabric disc may require renewal, otherwise no replacement should be necessary except in case of damage.

TELESCOPIC-FORK ASSEMBLY DATA

Special tools necessary for dismantling and assembling consist of:

1. T type tube spanner for sleeve S carrying oil-seal on main tube.
2. Hexagon socket key for pinch-bolt marked Q.
3. Split sleeve for main tube and bush assembly. (Obtainable from makers and agents.)

Top and bottom white-metalled bushes obtainable only from makers and agents.

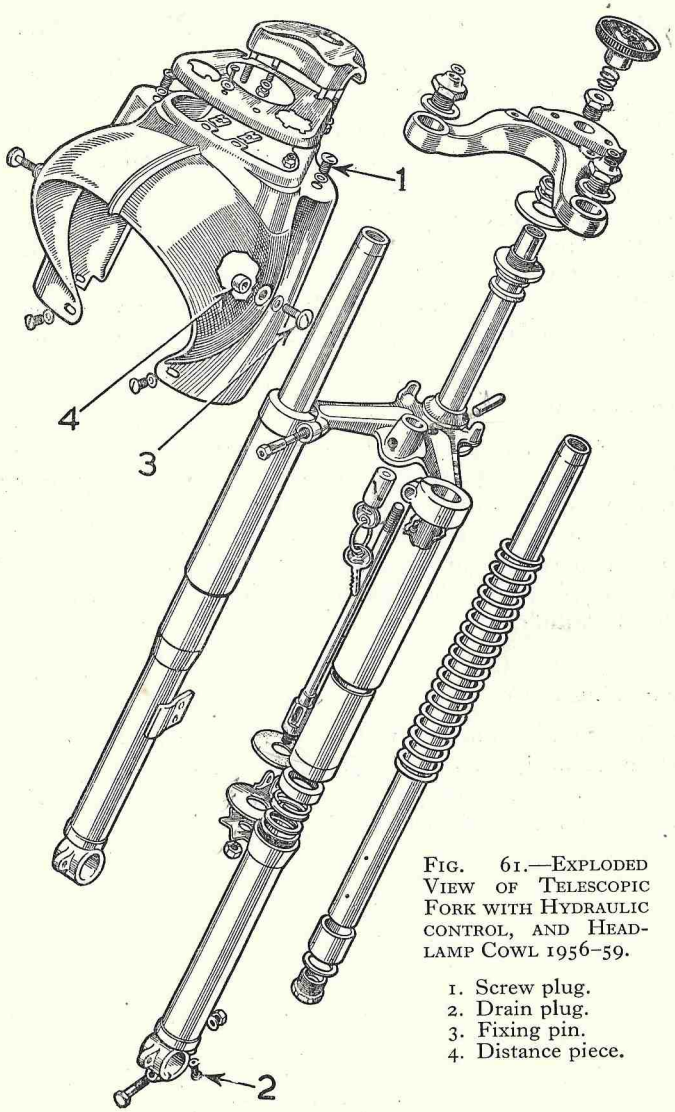


FIG. 61.—EXPLODED VIEW OF TELESCOPIC FORK WITH HYDRAULIC CONTROL, AND HEADLAMP COWL 1956–59.

1. Screw plug.
2. Drain plug.
3. Fixing pin.
4. Distance piece.

1956–59 ASSEMBLY WITH HEADLAMP COWL

The construction of this assembly is very similar to the 1947–55 type with the addition of a lamp cowl and steering lock. An oil-drain plug is fitted to each leg, and it is therefore possible to drain and measure the exact quantity of lubricant. The correct amount of oil for each respective leg is approximately one-third of a pint or nearest equivalent, 7 fluid oz.

To drain the fork legs (see Fig. 61) remove the screw plugs (1) from the top of each leg. Next remove the drain plugs (2) at the base of each tube and check the amount of oil removed. Never over-fill the forks or the hydraulic action will be retarded.

Headlamp

The main and pilot bulbs are positioned within the main lamp body which must be withdrawn forwards out of the cowl when these bulbs are to be removed for replacement.

The handlebars should first be turned fully to the right. Next remove the two fixing pins (3, Fig. 61) and note the two distance pieces (4) which fall away. The complete lamp can now be withdrawn.

Steering Lock

This lock is located in the base of the steering-head lug and is a press-fit, secured by a small grub screw.

To remove the lock, punch out the screw and drive out the lock body with a soft metal drift.

CHAPTER IX

WHEELS, HUBS AND BRAKES

Front Wheel and Brake (1947–55 Telescopic-fork Assembly Type)—All models except 200-c.c. Colt and 250-c.c. Leader

THE construction of the front hub for this assembly only is similar to that of the detachable rear wheel fitted to 1937–39 models when specially ordered from the makers. Instead of the taper roller bearings as fitted to the front hub of all previous Ariel models, the 1947–55 hub includes two single-row ball journal bearings pressed into the centre shell. Special rubber sealing washers are used to cover the bearings when fitted to prevent ingress of foreign matter.

The front brake is identical with all previous types, except that the adjustment is carried out by the fulcrum instead of the usual milled, round adjusting nut on the brake rod. Maintenance consists only of lubrication of the hub bearings, brake cable and cable nipple. The bearings are not adjustable. To lubricate, remove the hub spindle by unscrewing the end nut on the brake side and loosen the pinch-bolt on the offside fork end. The hub spindle can now be withdrawn by using a tommy bar passed through the hole in the spindle end and pulling and twisting the spindle right out. Every 4000–5000 miles insert about a teaspoonful of thin grease into the hub through the spindle hole. Adjustment for brake-lining wear is made by turning clockwise the square-headed fulcrum attached to the brake plate. The brake-cable stop is adjusted to take up any initial stretch of the cable, and should not be used otherwise.

Removal of Hub Ball Bearings

Both bearings are a tight fit in the hub shell and can be removed only by first unscrewing the locking rings on either

side, and, with a soft punch tool inserted through the shell and driven up against the abutment at the back of each bearing, driving it out. When fitting new ball journals, which must be pressed or driven in, ensure that care is taken to apply pressure or driving load to the outer race only. Any pressure applied to the centre race will cause undue stress on the actual bearing surfaces and steel balls. When refitting the locking rings and rubber sealing washers to this hub, take care that the ring does not lock up solid the inner race of the bearing, otherwise the driven wheel will force the race to rotate on the spindle and form a groove, with resultant excessive shake and clearance. Note that the brake-side ball bearing is fitted with a centre steel sleeve for spindle reduction. The sleeve and bearing is supplied by the makers of the motor cycle assembled ready for fitting, and riders are advised not to interfere with it.

Rear Wheel and Brake with Fixed Wheel and Rigid Frame (1936 onwards, all Models)

To take off the wheel, remove wing nut on brake rod, disconnect chain, uncouple front end of brake anchor bar, slacken spindle nuts, and lift hinged portion of guard and pull out wheel.

To remove the brake, after removing wheel, undo brake-plate lock-nut and remove brake plate complete with shoes and then pull off the shoes. Lightly grease the brake cam spindle, fulcrum adjustment wedge and spindles. Examine the brake linings for wear and, if necessary, fit new linings or replacement shoes and linings. If new linings are fitted, see that they are riveted down so that they lie in close contact with the shoe. Also see that the rivet heads are countersunk in the lining and that the foot of the rivet is carefully punched over.

Removal of Bearings and Adjustment

First take out the wheel and remove the brake plate as described above. Screw off the two thin adjusting and locking nuts, G and H (Fig. 62) and tap out the spindle towards the brake-drum side. Prise off the two dirt-excluding covers; these will probably be damaged and, therefore, require re-

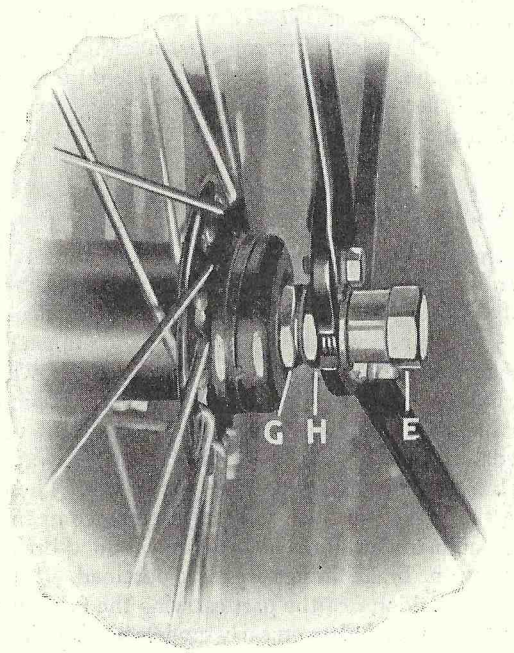


FIG. 62.—WHEEL-BEARING ADJUSTMENT.
(E) Outer spindle nut. (G) Inner-cone adjusting nut. (H) Outer locknut.

placement. The inner races, rollers and cages of the taper roller bearings will drop out complete.

The outer races are pressed into the hub and should not be removed needlessly. Each race bears against an abutment washer in the hub tube. Remove the race by driving out with a drift placed through the hub and bearing up against the back of the abutment washer. Examine the track of the outer race. The inner race-track cannot easily be seen, as it is masked by the rollers and roller cage. However, wash in petrol, examine as well as possible, and also examine the taper rollers and the cage. If any parts are worn or damaged replace the whole bearing assembly.

When the wheel has been refitted to the frame, slacken the outer spindle nut E on side opposite brake drum; hold inner

cone-adjusting nut G and loosen outer lock-nut H. Adjust inner nut, and then, still holding this inner nut, tighten the lock-nut and the outer spindle nut. When the bearing is correctly adjusted there must be just the slightest slack as measured at the rim.

Brake Adjustment

All normal brake adjustment must be made by rotating the square-ended fulcrum screw situated in the brake plate diametrically opposite the brake-lever bearing (Fig. 63). Turn clockwise to compensate for wear. The hand adjuster on the rear end of the brake rod must be slackened off whilst the fulcrum adjustment is made. When the fulcrum spindle will turn no further, retighten the hand adjusting nut until the brake pedal has only a trace of idle movement. Always adjust the rear brake by means of the fulcrum adjuster. The thumb-screw on the brake rod must only be used to compensate for rear-chain adjustment. This is important if good braking and even wear on the brake linings are to be obtained.

The wedge holder, *i.e.*, the part carrying the fulcrum screw, is riveted to the brake plate on early models but is bolted to the plate on later machines. Bolts, not studs, cast-in to the wedge holder, are used. Therefore, do not try to unscrew the bolts from the holder. Simply unscrew the nuts outside the brake plate and withdraw the holder. Put shakeproof washers under the nuts when replacing. The hub should be packed with grease during assembly, or grease may be pumped in via the grease nipple after the bearings have been assembled, but before the brake plate is fitted. Spin the wheel a few times, holding by the spindle, and wipe off any surplus grease which works out past the bearings.

Detachable Rear Wheel

A quick detachable rear wheel was first introduced in 1936, fitted to certain models only, and discontinued during the 1939 season. This type of wheel is carried on a hollow spindle and has two single-row ball journal bearings in the hub, and a

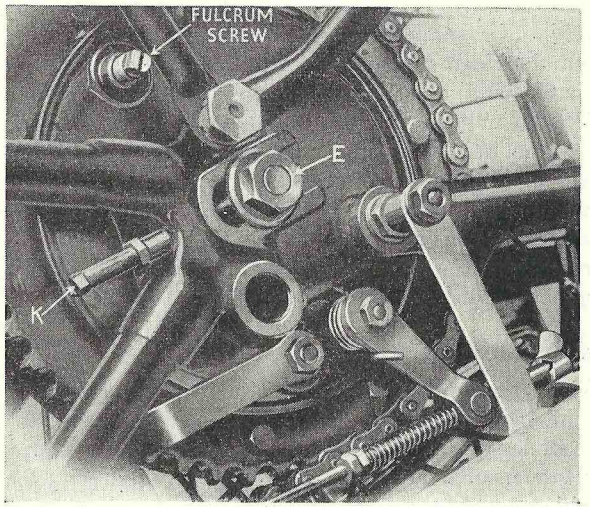


FIG. 63.—REAR BRAKE ADJUSTMENT.
(E) Hub-spindle nut. (K) Rear chain adjuster.

similar bearing in the brake-drum centre. The brake drum and sprocket are located on a fixed spindle bolted to the near-side fork end, and construction, maintenance and lubrication are identical with the drum and brake assembly of the fixed wheel.

One ball bearing of the single-row journal type is fitted to the brake drum—pressed into position with a metal grease-retaining washer either side and finally secured with a flat circlip. The bearing can be removed for replacement purposes by removing circlip and retaining-washer and punching out with an offset tool. When fitting new bearing apply pressure only to the outer race. The two hub bearings are treated in the same way as the brake type, with the exception that they are finally secured by lock-nuts and a circlip. Note position of hub-spindle distance collars and fork-end sleeve when reassembling the wheel into the frame.

A detachable rear wheel was again introduced for 1950 models, and this was similar to the previous wheel except for the lay-out of the hub spindle and distance pieces. The wheel

hub is fitted with only one ball bearing instead of two as previously, and a similar bearing is fitted to the brake-drum centre.

Hub bearings of any description, provided with correct lubrication and adjustment where possible, should give a useful service of from 30,000 to 40,000 miles. To determine whether ball journal bearings require replacement, the wheel should be tested for "shake" when fitted to the frame, and rim play should not exceed $\frac{1}{8}$ in. Taper roller bearings as fitted to non-detachable wheels and being adjustable, do not show "play" so readily, but when wear takes place it usually sets up a roughness through pitting of the rollers and outer race.

Brake Adjustment

Where the Ariel fulcrum adjustment is incorporated, this fitment, being of car design, allows the brake linings to bear more or less evenly over the whole length of the fabric and therefore ensures far longer life than when fitted with the rod or cable control only.

Brake-operating cams can be stoned or ground if slightly grooved, but replacement is advisable if badly worn. Brake drums, if seriously scored, should be replaced, but where the braking surface is not deeply marked, the drum interior can be cleaned up on the lathe and the linings slightly packed with thin shim steel to compensate. Very thin grease should never be used for hub lubrication, as this has a tendency to work through and saturate brake linings as well as leaving the bearings to dry off frequently.

Fixed Rear Wheel with Pivoted Rear Suspension (1954–55)

To remove the rear wheel support the machine on the centre stand. Remove brake cable from operating lever. Disconnect rear chain. Remove securing bolt from end of brake anchor bar. Release hub-spindle nuts, remove the two bolts securing the dual stays to the rear guard, also the four bolts securing the rear end of the mudguard. Detach the two rear-lamp "snap" connectors inside the guard and the rear end of the mudguard can be removed, thus facilitating easy removal of the complete wheel.

Removal of Brake

After removing wheel undo brake-plate lock-nut and remove brake plate complete with shoes. Pull off shoes. Lightly grease the brake cam spindle and the fulcrum adjustment wedge and spindles.

Examine the brake linings for wear and, if necessary, fit new linings or replacement shoes and linings. If new linings are fitted see that they are riveted down so that they lie in close contact with the shoe. Also see that the rivet heads are countersunk in the lining and that the foot of the rivet is carefully punched over.

Removal of Bearings

First take out the wheel and remove the brake plate. Remove the ball bearing screwed locking nut (right-hand side) and tap the hub spindle towards the brake-drum side. The two hub ball bearings are a press fit in the hub tube, and can be removed by driving out with a drift from either side.

The ball bearings should be packed with grease before assembly, and afterwards during service at every 1000 miles a small quantity should be pumped into the hub by way of the grease nipple provided.

Detachable Rear Wheel with Pivoted Rear Suspension (1954–55)

To remove the detachable rear wheel, support the machine on the centre stand and remove the rear portion of the mudguard. Next remove the five wheel nuts securing the hub to the brake drum, and then unscrew and withdraw the large centre spindle bolt. Note the position of the loose distance collar between the hub hollow spindle and the right-hand fork end and tap this away. Pull the wheel to the side clear of the five driving studs, leaving the complete brake drum with sprocket and rear chain in position. The wheel is replaced by reversing the procedure, and care should be taken to ensure that the centre spindle and the five nuts are securely tightened.

Brake Removal

The brake drum and chain sprocket are carried on a fixed spindle clamped in the nearside or left-hand rear fork end of the frame, and operate through the medium of a single journal ball bearing. To remove the brake-drum assembly it is generally most convenient first to take out the detachable wheel, but the wheel with drum assembly can be removed as a complete unit if desired. Before attempting to remove the brake-drum assembly it will be necessary to disconnect the brake cable and driving chain. Take off the brake-plate lock-nut, and the plate complete with brake shoes, etc., can be withdrawn from the drum.

Before reassembling lightly grease the brake cam and fulcrum-adjustment device; also brake-cam spindle and joints. Take note of the position and arrangement of distance pieces for fork-end fixing and also note that the brake plate is prevented from rotating by a machined lug on the frame stirrup arm H (Figs. 68 and 69) engaging with a slot in the brake plate.

Removal of Bearings

One journal ball bearing ($\frac{3}{4}$ in. bore) is fitted to the detachable wheel hub and one similar (1 in. bore) to the brake-drum assembly.

To remove the wheel ball bearing, unscrew the right-hand side brass locking ring, bearing collar and rubber grease retainer, and the bearing can then be driven out with a soft punch or drift from the left-hand or inner side of the hub. Reverse the procedure for refitting and well pack the bearing with grease. To remove the ball bearing from the brake-drum assembly, first take out the brake plate and then lift out the cork washer on the hub side. Next remove the large flat spring-steel circlip and steel pressing, and the short centre spindle can then be driven out from the brake side complete with ball bearing. Note how the bearing is held in position on the spindle by a wire circlip, which must be removed before finally driving off the bearing. When replacing the bearing in the housing always well pack with grease.

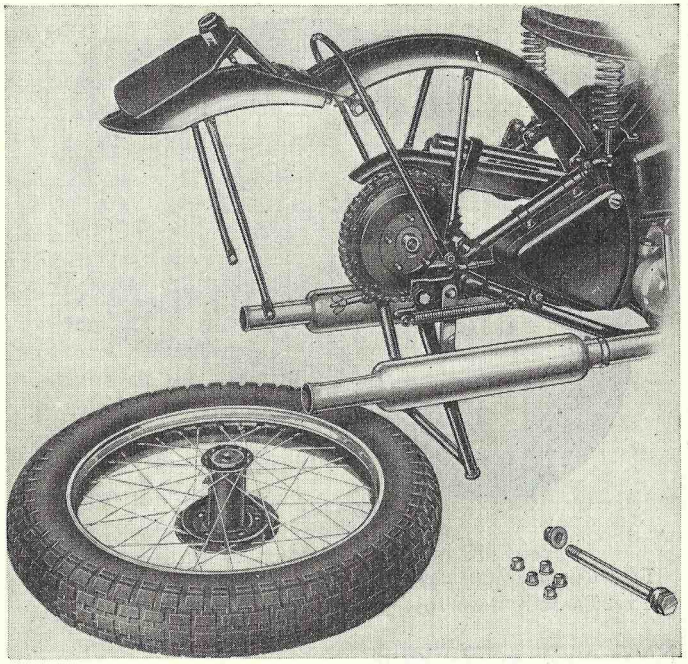


FIG. 64.—1950 DETACHABLE REAR WHEEL SHOWN WITH RIGID FRAME AND 1939–49–50 HINGED-TYPE REAR MUDGUARD.

Brake Adjustment—Pivoted Rear Suspension

All normal brake adjustment should be carried out by means of the fulcrum arrangement. The square-ended screw situated in the brake plate must be turned clockwise to compensate for wear on the brake linings. Use the brake-cable adjuster only to take up the slack in the flexible brake cable and to assist position the brake foot pedal to give just a trace of idle movement. A special fulcrum-adjuster spanner is provided in the tool-kit. Set the adjustable brake-pedal stop to give the pedal the most satisfactory riding position to suit the individual rider and tighten the lock-nut.

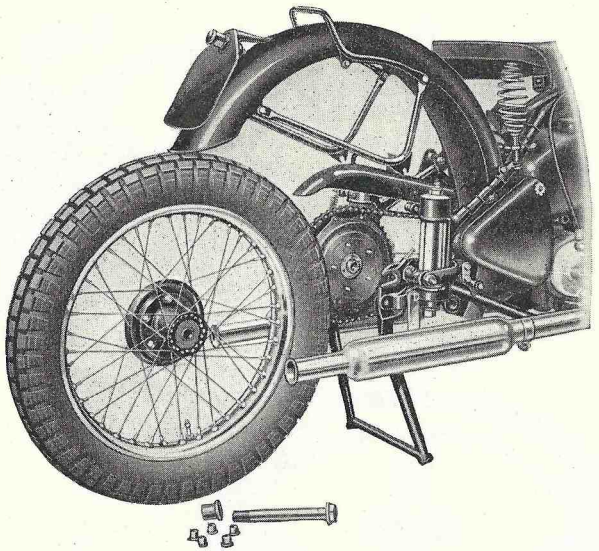


FIG. 65.—DETACHABLE REAR WHEEL SHOWN WITH PLUNGER TYPE FRAME AND THE 1951–52-TYPE REAR MUDGUARD AND STAYS.

Notes on Wheel Building

1948–59 1000-c.c. and 1939 600-c.c. models are fitted with the rear portion of the frame offset to the near or left-hand side in order to accommodate the overhung portion of the transmission, and to compensate and position the rear wheel rim centrally in relation to the top frame tube and front rim, the rear wheel is built out of centre to the permissible allowance of $\frac{1}{4}$ in. The rim is "dished" over towards the right-hand or offside. Double diameter or butted spokes are fitted to the brake side of all wheels. If spoke breakage occurs, it is advisable to replace the complete side or set.

FULL-WIDTH HUBS

1956–59 (all models except 200-c.c. Colt and 250-c.c. Leader)

Full width hubs were fitted to front and rear wheels of single

and twin cylinder models in 1956, except to the rear wheel of the 1000-c.c. Model 4G with plunger-type spring frame.

Removing Front Wheel from 1956–59 Telescopic Fork Assembly

With the machine supported on front and rear stands, proceed as follows:

Remove the front-brake cable from the stop lug. Detach the right-hand mudguard stay and brake-plate anchor strap.

Release the pinch bolt at the extreme bottom end of the left-hand fork leg (see Fig. 61). Remove the large hub spindle nut on the brake-plate side. Push a suitable tommy bar into the hole at the end of the hub spindle and rotate it in both directions, at the same time pulling the spindle outwards. This now leaves the complete wheel free for removal.

Removing Rear Wheel and Brake—1956–59

Support the machine on centre stand. Remove the fixing bolt from the anchor bar of brake plate.

Note the slot in the cable adjuster on the brake plate and turn the adjuster and lock-nut to allow the inner-cable wire to be removed.

Remove the rubber plug which is situated just below the left-hand hub-spindle end, and in the plug hole, after turning the wheel slowly, can be seen each of four wheel-securing nuts. These can be removed with a tube spanner by way of the rubber plug hole.

Next remove the large hub-spindle bolt, seat and mudguard bolts, etc., and withdraw the complete wheel with brake, but leaving the rear chain sprocket and short fixed spindle in position.

Removal of Rear Brake and Attachments

First take off the brake plate complete with fitments (see Fig. 67). Slacken off the brake adjusting fulcrum to allow the brake shoes to be drawn away, but take care to note the location and action of the two shoe springs and one cam return spring. Also note the fitting of the cam spindle and greaser nipple.

Removing the Rear-hub Ball Bearing

First remove the lock-plate and felt washer to expose the screwed locking ring (r.h. thread) which can be drifted round and out, leaving the single-row-type ball bearing to be driven out from the opposite side. Do not disturb the inner circlip.

When reassembling the bearing, pack it well with grease, and also during further service at approximately every 5000 miles. No grease nipple is fitted, so insert grease by hand through the right-hand side of the hub tube.

Removing Chain Sprocket and Ball Bearing

Remove rear chain cover and chain, referring to Fig. 67. Release the fixed spindle lock-nut and distance pieces, noting the order of assembly, when the sprocket assembly can be withdrawn from the frame fork end.

Remove the loose spindle, take off the dust cover or plate and the ball bearing will be exposed and can be drifted out from the opposite side. Reassembly is simple after packing the bearing well with grease.

Replacing Rear Wheel in Frame

A special hint is given for easy engagement of the thread when replacing the rear-wheel-hub spindle bolt. Release the left-hand nut sufficiently to allow the short fixed spindle to "float", when the long spindle bolt can then pick up the thread correctly. Tighten thoroughly both bolt and nut on each side.

Brake cable and fulcrum adjustment is as described for the front wheel assembly.

Brake Linings for Full-Width Hubs

Care should be taken when replacing brake linings, as those used by the makers of the motor cycles concerned are of very special wear-resisting material, and it is advisable to contact Ariel service agents for the exchange of brake shoes already lined.

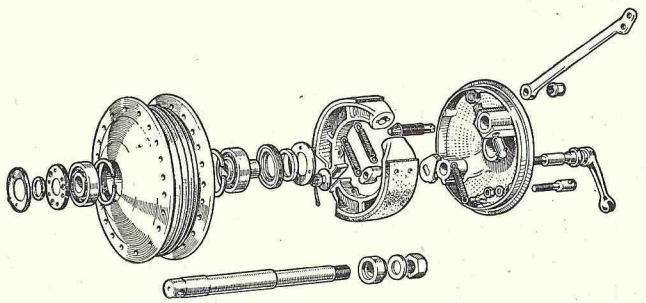


FIG. 66.—EXPLODED VIEW OF FRONT-WHEEL HUB ASSEMBLY—1956–59.

Removal of Front-brake Plate and Attachments

With front wheel removed, the brake plate with shoes is easily taken off. To remove the brake shoes from the plate, first fully unscrew the adjusting fulcrum to release the spring tension and the shoes can then be pulled off.

Removing the two Front-hub Ball Bearings

Unscrew the bearing locking rings on both sides (both are r.h. thread) and note the location of the felt grease-retainers. The two single-row-type ball bearings can now

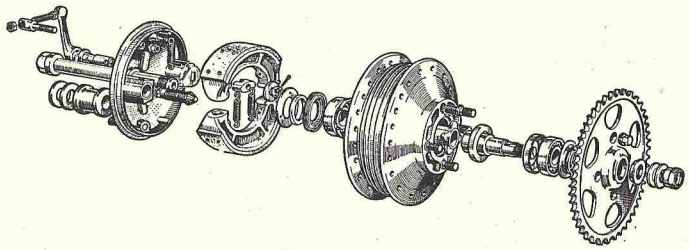


FIG. 67.—EXPLODED VIEW OF REAR-WHEEL HUB ASSEMBLY 1956–59.

be driven or pressed out from each respective side. It is not necessary to remove the inner distance circlips (see Fig. 66).

Hub-bearing Lubrication

When reassembling the bearings, pack these with grease, and also during further service at approximately every 5000 miles. No grease nipple is fitted, so it is always necessary to remove the wheel and unscrew the bearing locking rings to repack with lubricant.

Front-brake Adjustment

Next to the handlebar brake lever is fitted a knurled adjuster ring to be used for maintaining cable tension.

Adjustment to compensate for brake-lining wear is carried out by screwing in the square-ended cam or fulcrum. When adjusting this fulcrum, first release the cable adjuster and then the fulcrum screw until the linings just touch the brake-drum surface. See that the wheel is free to rotate before readjusting the cable with the knurled screw, and ensure that there is just a trace of free movement in the cable.

CHAPTER X

RIGID AND SPRING FRAMES
(Except Colt, Leader and Arrow models)

Rigid Frame

Apart from occasional lubrication of the steering-head bearings and the general tightening of all bolts, studs and nuts, no maintenance or repairs are necessary. In the case of a frame being damaged by accident, the average motor cyclist is advised to send it to the makers for repair. Special building jigs and fixtures are necessary to ensure that the frame is in perfect alignment, and the makers, with full knowledge of the type of tubing incorporated, can best determine when and where heat should be applied for the final setting process.

Head Races

These races or caps are hardened and ground and are a tight press- or driving-fit in the frame-head lug. Pitted or worn cups should be replaced, because perfect steering depends upon the condition and adjustment of the head races and steel balls. It is advisable to replace the balls if suspected at any time of being chipped or worn. The races or cups can be removed from the head lug by driving out from opposite ends, using an offset punch or drift long enough to pass through the length of the lug. New races can be inserted by press action or, if a press is not available, place a hard-wood block on the race and drive them in squarely.

Plunger Type Frame

Keep the assembly well lubricated and all working parts will give exceptionally long service. Replacements are not necessary for at least 40,000–50,000 miles. Ensure that the stirrup arm H is adjusted by screwing up the square-headed bolt G after loosening the lock-nut (see Fig. 68). Do not overtighten or the sliding action will be suppressed. Keep the connecting-link bolts tight.

Wear in the link-spindle bushes and stirrup-arm bushes after long service is remedied only by replacements.

Chain Adjustment

1937–49 *Models.*—Adjustment is carried out by independent operation of the separate cams fitted against the rear fork ends of the stirrup arms H (see Fig. 68).

1950–59 *Models.*—The stirrup arms H are fitted with adjuster bolts P and lock-nuts Q, and adjustment is similar to that for wheels fitted to rigid-type frames (see Fig. 69).

Dismantling Plunger Type Frame Attachment

This is best carried out by removing the rear wheel; support the machine by placing a suitable block or box under the engine.

Remove the dome nut under the assembly which screws on to the end of the centre bolt K. Pull out centre bolt K and top collar N. This collar is not threaded. The remainder of the centre assembly, consisting of the main coil spring, the slider B, the guide tube A, collar D, dust tubes L and M, bottom recoil spring and the thick base packing piece, can all be lifted out quite simply.

Remove the pivot pin G from the wheel side of the stirrup and take out link spindles and links I. Thoroughly examine the slider bushes C and renew if showing wear when tested on the guide tube A and spindle K. The bushes are a press-fit and should be reamed after fitting to correct size. See frame data on p. 208. Also test the pivot-arm bush E on spindle G and renew if worn. This bush is also a press-fit.

The connecting-link spindle bushes except on 1952 models are of the graphite compounded self-lubricating type, but should be tested for ovality wear and pressed out for renewal if necessary.

Lubrication Modification 1952 Models

The main slider tube bolt marked K (Fig. 68, 69) is not drilled or fitted with a grease nipple, but full lubrication of the sliding mechanism is provided by way of the nipple fitted to the slider boss marked E. This plain-type bolt should not be fitted to previous models. Greaser-headed bolts are also

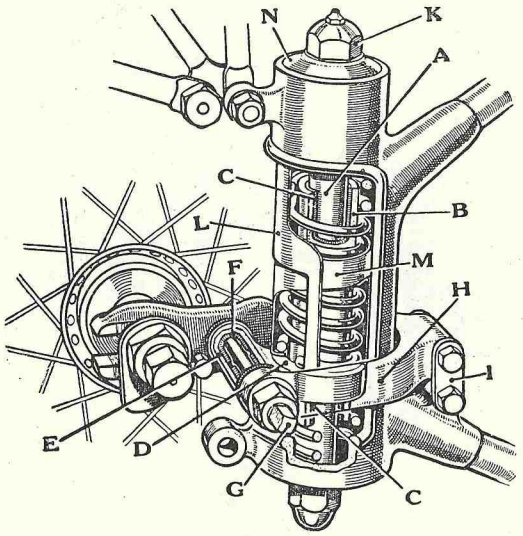


FIG. 68.—SECTION OF PLUNGER TYPE FRAME ARRANGEMENT (1939–49).
See text for reference to letters.

fitted to the connecting links, these being interchangeable with previous types.

Reassembly

Fit the dust-excluding tube L into the main cylinder from the top with the cut-away portion facing backwards. Next place in position the thick base packing-piece and the short, flat section recoil spring. Next place in position the slider B, locating same with the short extension below the collar D. Above the collar fit the dust tube M and the main coil compression spring. Assemble the top collar N on to bolt K, followed with the guide tube A, and pass this sub-assembly down through the slider B until the end of bolt K projects through the base of the main cylindrical lug. Screw on the bottom dome nut and thoroughly tighten. In order to save unnecessary work with the grease-gun, it is a good plan to pack well with grease the interior assembly before fitting into position.

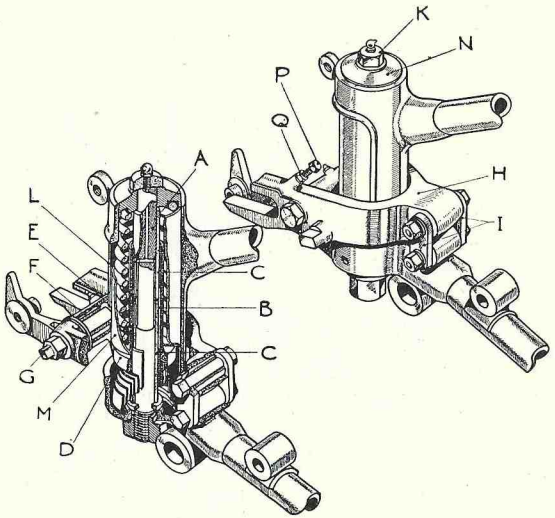


FIG. 69.—SECTION OF PLUNGER TYPE FRAME ATTACHMENT. 1950–54 AND 1955–59 4G MODELS ONLY.
See text for reference to letters.

If the spring attachment appears to "bottom" whilst the machine is being used on rough roads, it is a sign of main coil-spring weakness. Stronger springs are fitted to the Square Four model and can also be incorporated in the attachment of any single-cylinder machine if desired.

The head lug and ball races of the plunger type frame are identical with those of the rigid type and the same maintenance and service treatise therefore applies. A damaged frame should always be returned to the makers for repair and correct alignment.

Pivoted Rear Fork Frame—1954–59 models except 4G and 1954 VB

The "swinging-arm" or pivoted rear assembly (Fig. 70) is mounted to the main frame section by means of a fixed pivot spindle passing through two robust rubber bushings pressed into a welded cross tube.

The rear-suspension damper units incorporate flexible coil

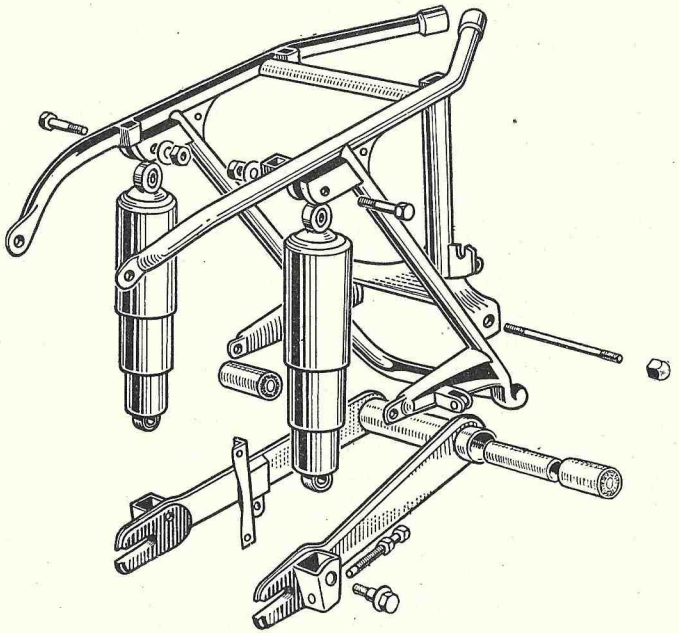


FIG. 70.—ARIEL PIVOTED REAR SUSPENSION FITTED TO 1954–59 MODELS, EXCEPT 4G and 1954 VB

springs to carry the weight of the rider and pillion passenger and the hydraulic damping device caters for all additional loading due to road shocks. Built-in lugs are provided on the frame for side-car attachment at five points. The damper units are detachable and are supplied in two graded types for solo or side-car use.

The damper units are sealed and do not require "topping up". After lengthy service the rubber mounting bushes may require renewal, these being easily removed by the ordinary workshop press method.

Petrol Tank, 1956–59 (except for 4G, Colt, Leader and Arrow)

Previous to 1956 all petrol tanks were of the four-fixing-bolt type, secured to suitable lugs on the frame top tube.

The 1956 tank is secured to the top frame tube by one bolt only and easily removed for the purpose of decarbonisation.

To remove the tank, take out the two small fixing screws from the front end of the polished strip on the top of the tank and lift off the strip. The tank-fixing bolt is located in the centre recess, and by removing the nut ($\frac{3}{8}$ in. × 26 T.P.I.) with a suitable tube spanner, the tank can be lifted from the frame. Note the position of the steel distance tube and washers. The bolt is self-aligning; note the method of location in the frame. Note also the position of the four rubber base washers and ensure that when refitting, these are correctly located in the recesses in the tank base.

DATA ON FRAMES

PLUNGER TYPE FRAME.

Sliding member bush (4 off). Ream after fitting to
0·8745 in. } diameter.
0·8755 in. }

Stirrup arm bush (4 off). Ream after fitting to
0·625 in. } diameter.
0·6245 in. }

Connecting-link bolt bush (4 off). Ream after fitting to
0·625 in. } diameter.
0·6245 in. }

Main spring top 0·296 in. diameter wire.

Main spring top 0·312 in. diameter wire 4G 1000-c.c.

FRAME INTERCHANGEABILITY

RIGID FRAME.

The single-cylinder rigid frame is interchangeable with every model 500-c.c., 350-c.c. and 250-c.c. produced in 1936 and subsequent, excepting the 1939 250-c.c. lightweight models. All engine and gearbox fixing plates, frame bolts, etc., are likewise identical.

PLUNGER TYPE FRAME (SINGLE-CYLINDER).

The spring-wheel frame, first manufactured in 1939, can be fitted to all 1936–53 models, excepting the 1939 lightweight 250-c.c. Engine plates, etc., are identical.

PLUNGER TYPE FRAME (FOUR-CYLINDER).

The spring-wheel frame (four-cylinder type) can be fitted only to the 1948–59 Square Four 1000-c.c. Note that 1954–59 Mk. II engines cannot be accommodated in earlier frames.

RIGID AND PLUNGER TYPE FRAME (TWIN-CYLINDER).

Frames for twin-cylinder models can be fitted only to the 1948–53 machines, and are not interchangeable with any other model.

PIVOTED REAR FORK FRAME.

This frame is not interchangeable with pre-1954 models.

CHAPTER XI

ELECTRICAL EQUIPMENT

THE Lucas Magdyno has been fitted to nearly all Ariel motor cycles since 1931. In 1937 the Lucas face-type cam contact-breaker was introduced for single-cylinder models, together with the automatic voltage control type dynamo (2-brush). The single-cylinder magneto drive of the well-known "slipping clutch" type was first introduced in 1937 and is fitted to all 500 and 600-c.c. single-cylinder models.

All 1948 four-cylinder models are fitted with the early ring-cam contact-breaker and fixed gear drive. The slipping-clutch drive cannot be adapted to this type Magdyno. Four-cylinder-type dynamos are of the A.V.C. type, and have been fitted to all 1000-c.c. models. The 1948–57 twin-cylinder models are fitted with either Lucas or B.T.H. magnetos and separate Lucas dynamos. Both magnetos are fitted with the ring-cam and pivot-rocker-arm-type contact-breaker. The 1949–59 1000-c.c. models are fitted with Lucas 70 W. dynamo and coil ignition system (see Technical Data at end of chapter). The 200-c.c. Model LH Colt, fitted with Wipac electrical equipment, is dealt with on pp. 228–231.

LUCAS EQUIPMENT

Lubrication

The Magdyno driving gears and housing are packed with H.M.P. (high-melting-point) grease when the unit is new, and this is sufficient for at least 20,000 miles' service. A small quantity of grease can, however, be inserted into the gear housing after withdrawing the dynamo. Armature bearings require further attention only during complete over haul.

The contact-breaker cam of the ring type is lubricated by a

short piece of felt located in the ring housing. In a small hole of the cam ring is fitted a small wick which absorbs oil from the felt and keeps a minute film of lubricant on the face of the cam ring.

Every 5000 miles withdraw the ring and soak the felt with several drops of thin machine oil. Having removed the contact-breaker to gain access to the ring, it is advisable to lubricate the breaker-arm pivot bearing. Turn aside the locating spring, prise the rocker arm off its pivot and smear a small quantity of petroleum jelly on the bearing. The face-cam type is lubricated by a wick contained in a screw behind

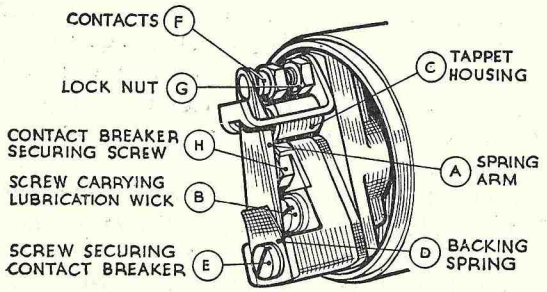


FIG. 71.—THE FACE-CAM TYPE OF CONTACT-BREAKER.

the moving contact spring blade. Remove the blade and wick screw and thoroughly soak wick in oil. At the same time pull out the hard fibre composition tappet which operates the moving blade and lightly smear with thin oil. Failure of contact arm or blade to open can usually be traced to the tappet having seized in its guide through lack of lubrication.

The commutator end of the dynamo armature spindle runs in a plain bush or bearing surrounded by a felt ring. To lubricate the bearing the felt must be kept soaked in thin machine oil, inserted by way of the ball valve in the dynamo end-cover. Several drops of oil should be forced in every 2000 miles to ensure good service of this bearing. As with the magneto portion, the main dynamo ball bearings are packed with grease when new and subsequently at each complete overhaul.

Adjustments

Contact-breakers should be examined for correct setting of contact points at least every 2000 miles or at any time if difficult starting or poor performance is experienced.

Rotate the engine until the contacts are fully opened and insert the feeler gauge attached to the magneto spanner (0·012 in. thick) between the two points. Loosen the contact-screw lock-nut and adjust the screw until the gauge just slides between the points and retighten lock-nut. Points can be cleaned and refaced squarely by using a very fine magneto file or carborundum stone. When replacing the contact-breaker of the ring-cam type, be sure to see that the projecting keyed portion engages with the keyway cut in the armature spindle. Do not overtighten the centre hexagon-headed securing pin.

The H.T. pick-up should be periodically removed and the carbon brush and spring examined and wiped with petrol. See that the brush and spring are free to slide in the holder. With the pick-up removed, clean the armature slip-ring surface and track by inserting a clean cloth and pressing on the ring whilst the engine is slowly rotated by hand. Examine the pick-up holder carefully for any signs of "tracking" or cracks; if the H.T. lead is perished renewal is essential.

Testing Dynamo (Automatic-voltage-control Type)

If no reading is obtained on the ammeter, the dynamo may be tested for generating as follows. Check to ensure that the dynamo and A.V.C. regulator are correctly connected. Remove cables from dyno terminals D and F and connect the terminals with a short length of cable wire. Start engine and set to run at a low throttle idling speed. Connect the positive lead of an ordinary moving-coil voltmeter (zero–10 volts type) to one of the dynamo terminals and connect the negative lead to any clean bare earthing-point on the dynamo body or engine. Note that the voltmeter connections are reversed on machines equipped with positive earth return.

Gently increase the engine speed and the voltmeter reading should rise without fluctuation. If no reading is indicated, do not rev. engine to obtain a reading, but check the brush

assembly. Ensure that the brush cover band is not touching one of the brush housings. If only a low reading is registered of, say, ½ volt, the field winding may be defective, whereas if a reading of 1½–2 volts is obtained the armature winding may be at fault. Never allow the voltmeter reading to exceed 12 volts. To examine armature commutator and brush assembly, remove the cover band. Pull back the brush springs and ensure that the carbon brushes are free in the guides by pulling gently on the flexible connections. If brushes are slow in action or sticking in their guides, remove them and polish lightly with a smooth file or fine emery cloth. Worn brushes that do not bear on the commutator should be replaced. Clean the commutator by holding a petrol-soaked cloth against it and turn engine over slowly by hand. Retest the dynamo, and if no reading is obtained the complete unit should be replaced with a new or serviced armature. If the dynamo is in good order, connect up the cables in correct original order and test by running engine again. No reading on ammeter will now indicate a break in cable leads.

Commutator

In good condition a commutator will be smooth and free from pitted or burnt spots. If requiring attention, use a thin strip of very fine glass-paper—not emery cloth—and polish whilst rotating armature between centres.

Dynamo Voltage-regulator Unit

Only after very long periods of service will it be found necessary to remove the protecting cover and clean the contacts, and even this operation should not be undertaken if the unit is functioning correctly.

Plugs

Detachable plugs should be dismantled and cleaned with a wire brush and petrol, and the electrodes set to a gap of 0·015–0·018 in.

ELECTRICAL SERVICE NOTES AND TEST DATA

Ariel 498-c.c. Twins

The electrical equipment is the *Lucas 6-volt with negative earth return*, except 1951–57 models, which have positive earth return.

Dynamo.—Lucas two-pole ventilated design; compensated voltage control; anti-clockwise rotation viewed from driving end. Crossed connections will cause serious damage to the regulator. Connect lead with *yellow identity tag* to main terminal, and *green-and-black tracer cable* to field terminal.

Test Data.—Dynamo cold: Cutting-in speed, 1200–1400 r.p.m. at 7·0 dynamo volts. Output, 5·0 amps at 1800–2000 r.p.m. at 7·0 dynamo volts, taken on 1·4-ohm resistance load without regulator. (Resistance must be able to carry 7·5 amps. without overheating.) Brush tension, 10–15 oz. Field resistance, 3·1–3·3 ohms.

Magneto.—Lucas K2F AC53, B.T.H.—KC2 or Form W4 (LM). Anti-clockwise rotation viewed from driving end. Contact-breaker gap 0·012–0·015 in. Condenser capacity 0·1–0·14 microfarad.

Test Data.—Centrifugal advance commences at 630–720 r.p.m. and gives maximum advance of 15°–18° at 1075 r.p.m.

Control Box.—Lucas MCR L-2. Houses cut-out and dynamo voltage regulator.

Test Data.—(*a*) Cut-out. Cut-in voltage, 6·3–6·7 volts; drop-off voltage, 4·5–5·0 volts.

(*b*) Regulator. Setting at 10° C. (50° F.), 7·8–8·2 volts; setting at 20° C. (68° F.), 7·8–8·2 volts; setting at 30° C. (86° F.) 7·7–8·15 volts; setting at 40° C. (104° F.), 7·6–8·1 volts.

Horn.—High-frequency type. Current consumption, 4 amps. (approximate).

Battery.—Capacity, 12 amp. hour, at 10 hour rate.

Ariel 4G, 1000-c.c., Models 1949–59

The electrical equipment is the *Lucas 6-volt with positive earth return.*

Dynamo.—See 498-c.c. models.

Test Data.—Dynamo cold: Cutting-in speed 1000–1150 r.p.m. at 6·5 dynamo volts. Output 10·0 amps. at 1700–1850 r.p.m. at 7·0 dynamo volts, taken on 0·7-ohm resistance load without regulator. (Resistance must be able to carry 15 amps. without overheating.) Brush tension 16–18 oz. Field resistance 2·6–2·8 ohms.

Distributor.—Anti-clockwise rotation viewed from driving end. Contact-breaker gap, 0·010–0·012 in. Contact-breaker spring tension, 20–24 oz. measured at the contacts. Condenser capacity, 0·2 microfarad.

Test Data.—Centrifugal advance commences at 200–350 r.p.m. (distributor) and gives maximum advance of 21°–23° at 2300 r.p.m.

Ignition Coil.—Current consumption: 1·6 amps. (approximate) running; 3·5–4·0 amps. (approximate) stall.

The coil moulding must be kept clean.

Control Box.—See 498-c.c. models.

Horn.—See 498-c.c. models.

Battery.—See 498-c.c. models, except certain series of 1951–52 models and all 1953–55 models, which are fitted with 20-amp.-hour type.

Ariel Single-cylinder Models 1937–59

The equipment is the *Lucas 6-volt with negative earth return* excepting 1951–55 models with positive earth return.

Dynamo.—See 498-c.c. models.

Test Data.—See 498-c.c. models.

Magneto.—Anti-clockwise rotation viewed from driving end. Contact-breaker gap, 0·010–0·012 in. Condenser capacity, 0·13–0·15 microfarad.

Control Box.—See 498-c.c. models.

Horn.—See 498-c.c. models.

Battery.—See 498-c.c. models.

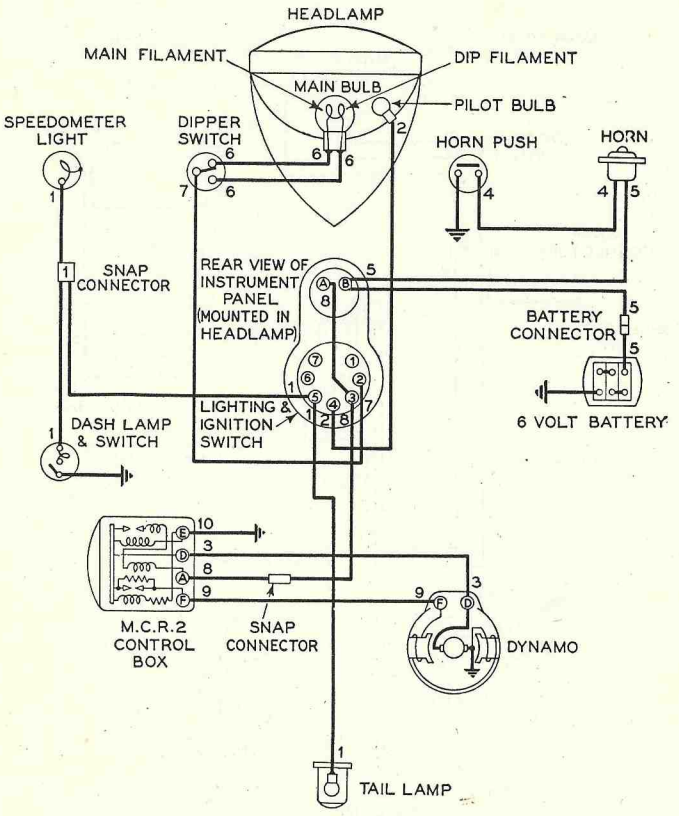
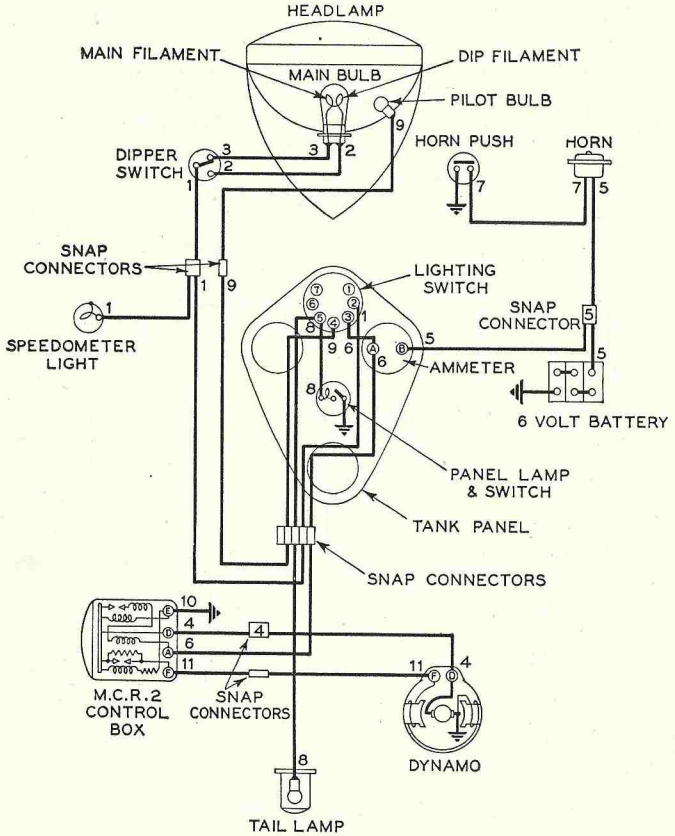


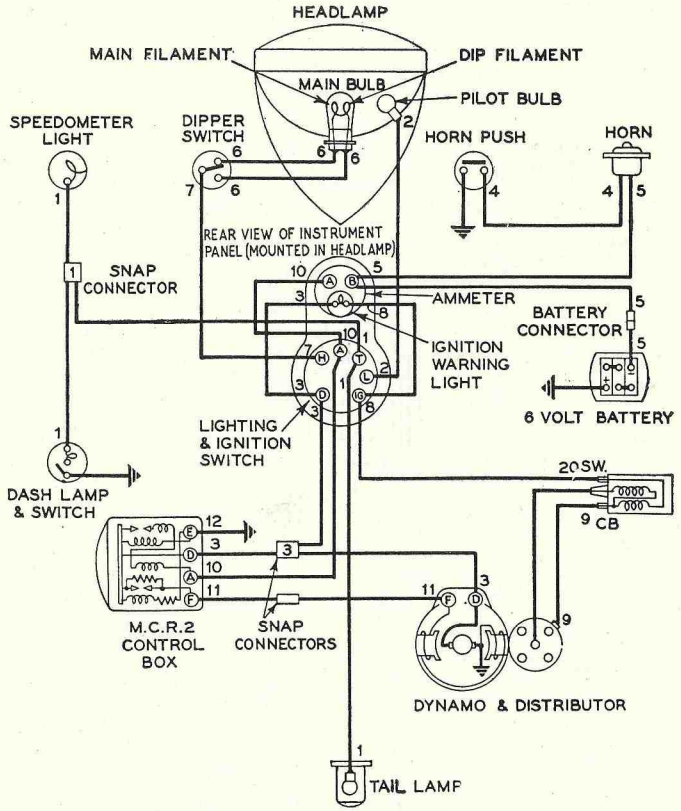
FIG. 72.—WIRING DIAGRAM ARIEL 500-C.C. TWIN-CYLINDER MODELS KG AND KH, 1948–49.



KEY TO CABLE COLOURS

1 BLUE	7 BROWN WITH BLACK
2 BLUE WITH RED	8 RED
3 BLUE WITH WHITE	9 RED WITH BLACK
4 YELLOW	10 BLACK
5 BROWN	11 BLACK WITH GREEN
6 BROWN WITH WHITE	

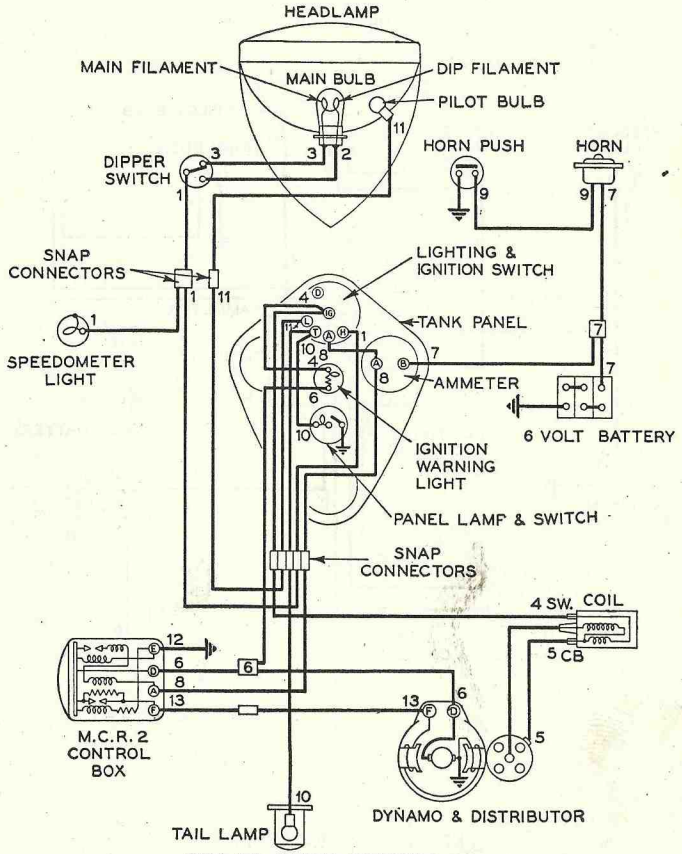
FIG. 73.—WIRING DIAGRAM ARIEL 500-C.C. TWIN-CYLINDER MODELS KG AND KH, 1950.



KEY TO CABLE COLOURS

1 RED	7 BLUE & WHITE
2 RED & BLACK	8 WHITE
3 YELLOW	9 WHITE & BROWN
4 YELLOW & PURPLE	10 WHITE & PURPLE
5 YELLOW & BLACK	11 GREEN & BLACK
6 BLUE	12 BLACK

FIG. 74.—WIRING DIAGRAM ARIEL 1000-C.C. SQUARE FOUR, 1949 AND 1951–52 (NOT 1950).



KEY TO CABLE COLOURS

1 BLUE	6 YELLOW	11 RED WITH BLACK
2 BLUE WITH RED	7 BROWN	12 BLACK
3 BLUE WITH WHITE	8 BROWN WITH WHITE	13 BLACK WITH GREEN
4 WHITE	9 BROWN WITH BLACK	
5 WHITE WITH BLACK	10 RED	

FIG. 75.—WIRING DIAGRAM ARIEL 1000-C.C. SQUARE FOUR, 1950 MODELS ONLY (COIL IGNITION).

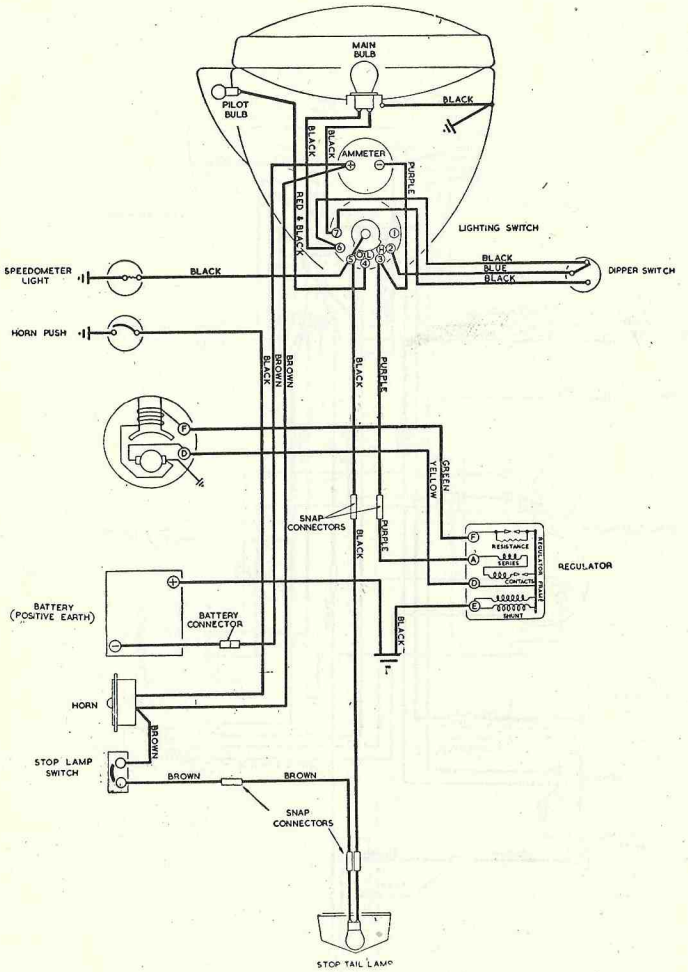


FIG. 76.—WIRING DIAGRAM ARIEL SINGLE-CYLINDER AND TWIN-CYLINDER MODELS 1951–59.

Note that 1951–52 models were not fitted with a stop lamp, and that 1954–55 models had maroon wiring from switch terminal No. 5. Additionally, the horn and stop-lamp leads on 1954–55 models were taken from the battery negative terminal, instead of the ammeter positive terminal.

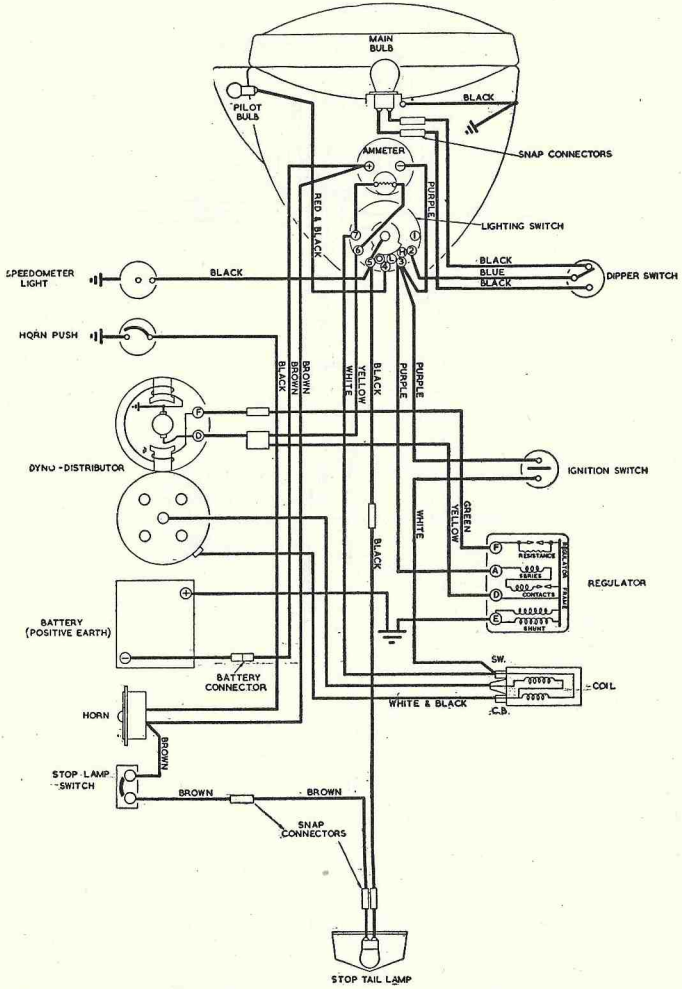


FIG. 77.—WIRING DIAGRAM FOR ARIEL 1000-C.C. SQUARE FOUR, 1953.

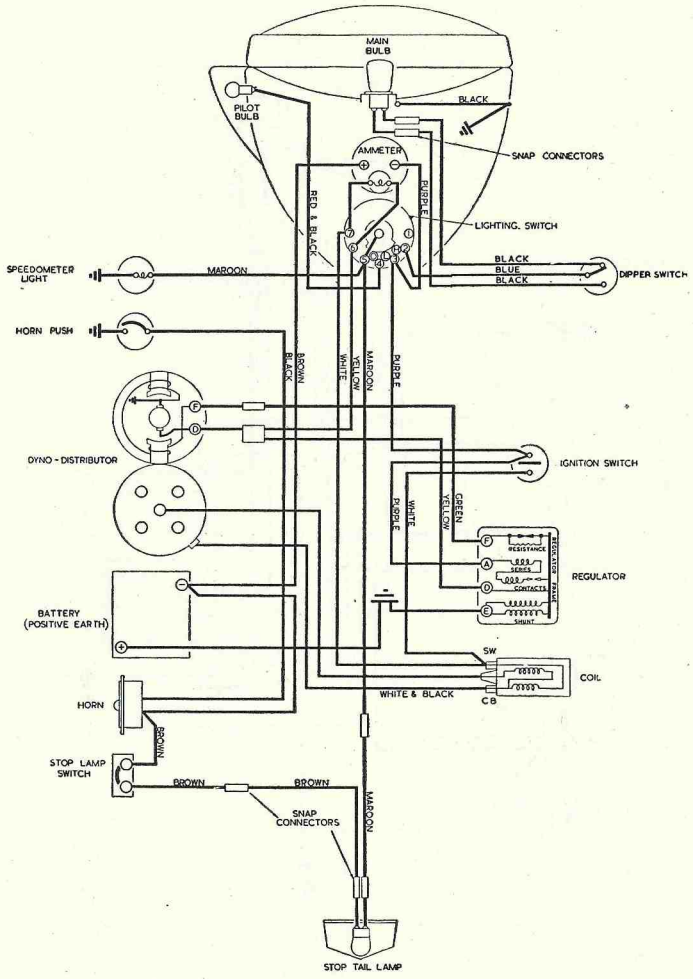


FIG. 78.—WIRING DIAGRAM FOR ARIEL 1000-C.C. SQUARE FOUR, 1954–55.

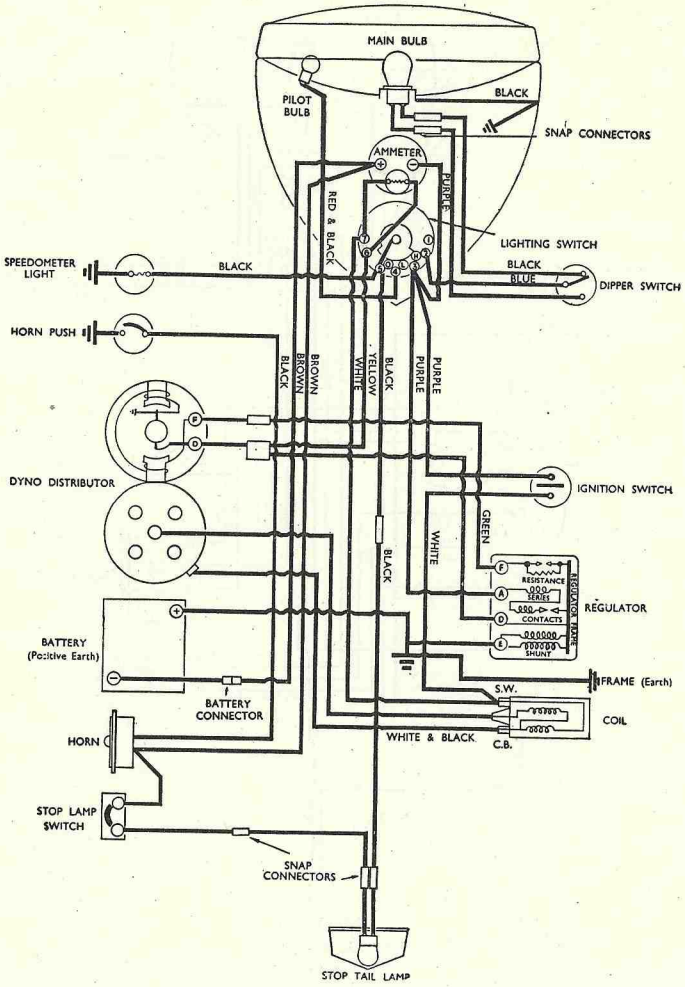


FIG. 79.—WIRING DIAGRAM FOR ARIEL 1000-C.C. SQUARE FOUR, 1956–59.

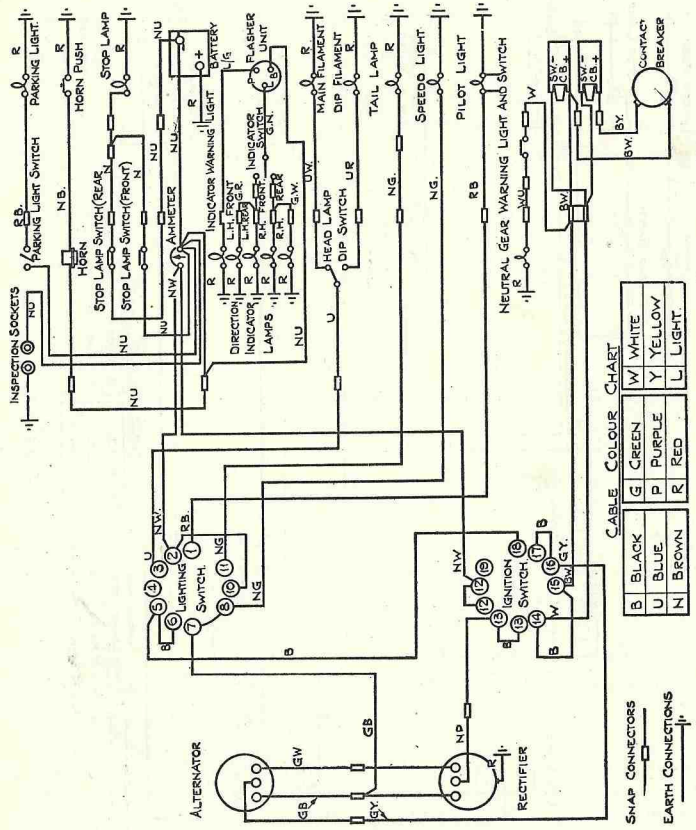


FIG. 80.—WIRING DIAGRAM FOR 250-C.C. LEADER, 1958–59.

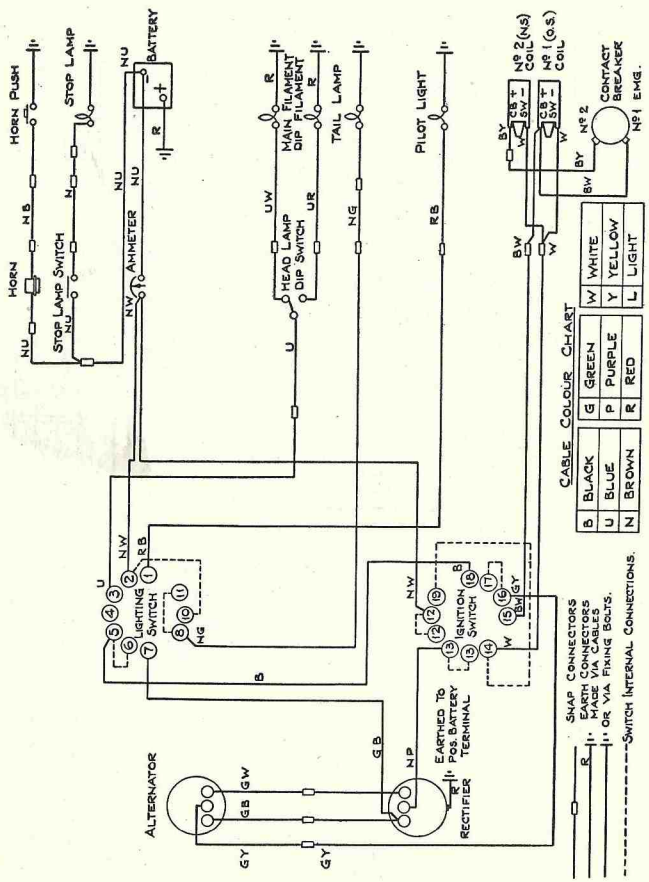


FIG. 81.—WIRING DIAGRAM FOR ARIEL 250-C.C. ARROW, 1958–59.

MAGDYNO OVERHAUL

The following instructions are applicable to the Lucas type MOI single-cylinder Magdyno, incorporating the slipping clutch drive, but the general layout and treatment can be considered relative to all models for both single- and four-cylinder machines.

Magneto

Remove the dynamo and take off the driving-end cover (see Fig. 82). To dismantle the slipping-clutch-type drive, a small tool is necessary to hold the large gear whilst the securing nut is unscrewed.

This locking tool simply consists of a length of mild steel $\frac{1}{4}$-in-dia. rod bent to a flat U, the ends being cut short with their centres $3\frac{3}{16}$ in. apart. One end is fitted into the hole in the large gear-wheel, and the other is pushed into the hole in the top of the casting through which the dynamo fixing stud is located.

Removing Magneto Armature.—Refer to Fig. 82. Remove contact-breaker assembly and cam. Unscrew cable stop of timing control and remove control plunger. Next remove pick-up complete and small earthing screw and brush from side of magneto body. Unscrew small end-cover screws, earthing terminal and pillar from end plate and take off the plate together with shims. Armature can now be withdrawn.

Magneto Armature Ball Bearings.—If worn and needing renewal, the bearings can be removed from the armature shaft with a bearing extractor, and an L-shaped tool used to remove the outer races from the housing.

Testing Magneto Armature.—If no apparatus is available a rough check of the armature windings can be made by means of a 2-volt battery and ammeter as follows:

Screw the contact-breaker fixing pin into the armature shaft. Connect one terminal of battery to this with the ammeter in series. Connect the other battery terminal to the metal body of the armature. The current taken by the primary winding should be approximately 4 amperes. Check the armature secondary winding by connecting one end of length of H.T. cable to the brass insert of the slip ring and hold the other end a short distance from the armature core. The lead from the battery which was first attached to the core should be now flashed quickly on and off the core, and a spark should occur between the H.T. cable end and the core. Failure to produce a spark indicates a fault either in the windings or condenser, and the complete armature should be replaced with a new one.

Magneto Assembly.—After thoroughly cleaning all parts, proceed to refit the magneto portion by first fitting the replacement ball bearings if these were found necessary.

The ball inner races and cages can be fitted to the armature shaft by means of a hand press, and the outer races or journals can be fitted to the housing by using a mandrel or double-diameter press tool. Note the special serrated fibre cup washer fitted behind the journal; this prevents current passing through and damaging the bearings. See that the armature tunnel is perfectly clean. Refit the armature, and repack the ball bearings with H.M.P. grease. The armature should freely rotate by hand, but no end play must be present. Adjust by adding or removing shims under contact-breaker housing end plate. Note that the cam is fitted with raised cam profile facing outwards. After ensuring that the hard fibre operating tappet is lubricated and free to slide, refit contact-breaker assembly. Adjust contact screw to correct gap 0·010–0·012 in.

Testing Slipping Clutch Drive.—Assemble driving gear, preventing armature rotating when tightening nut by using the U-shaped tool previously described. When assembled, check the tension setting of the clutch as follows:

Lock the driving gear to prevent it turning and with a suitable 12-in. spanner locked to the spindle a pull should be applied through an ordinary spring balance. The clutch should slip when the load is 4–10 lb./ft. Set by slackening or tightening the nut.

Pack driving-gear housing with H.M.P. grease and refit end cover with the jointing washer correctly located. Refit earth screw and brush.

Twin- and four-cylinder-type Magnetos.—Before removing the armature from these types, take out the safety spark gap earth screw from under the slip ring in the base of the magneto body or the slip-ring insulated housing will be badly damaged when the armature is withdrawn.

Dynamo

A plain porous bronze bearing is fitted to the commutator end of the dynamo shaft and a ball journal bearing to the driving end. If, when tested for wear with the armature in position, side movement of the shaft exceeds 0·015 in., then replacement of the bearings is advisable. The plain bush is a light press fit in the end bracket, and must be removed and replaced by using a suitable shouldered mandrel. The new porous bush should be allowed to stand for 24 hours in thin lubricating oil and, when fitted, see that the felt oil ring is located in the groove between the bush and the housing.

Clean the ball-bearing housing, and after packing the replacement bearing with H.M.P. grease, press home by equal pressure on the outer journal.

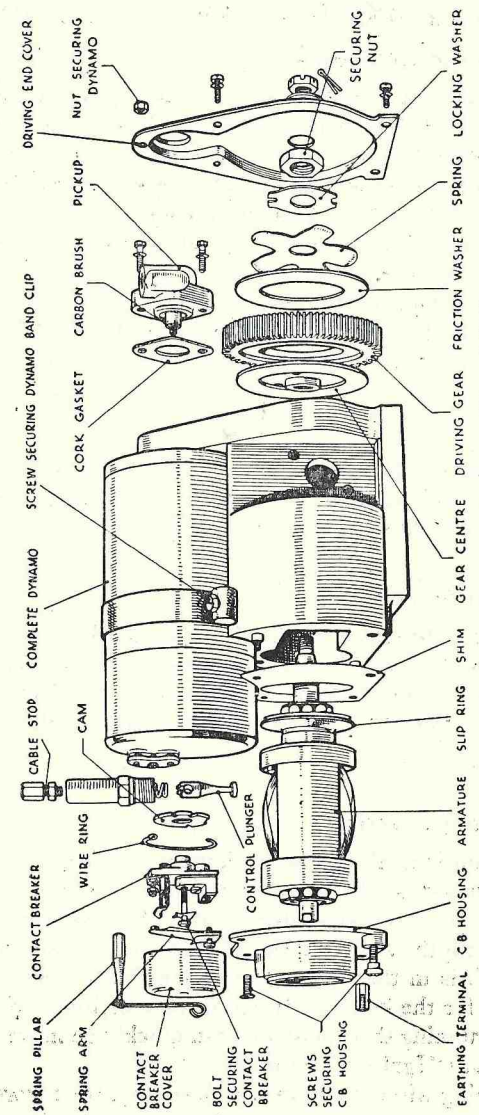


FIG. 82.—EXPLODED VIEW OF MAGDYNO (TYPE MOI).

WIPAC EQUIPMENT—200-c.c. COLT ONLY

Alternator and Rectifier

The rotor comprises six high-grade cast anisotropic magnets with laminated pole pieces. It is self-keeping, and may be removed from the stator without any loss of magnetism.

The laminated stator has six salient poles, each of which is wound with a coil of enamelled copper wire. These are vacuum impregnated with a special varnish to make them resistant to harmful effects of heat, oil and petrol.

It is important not to obstruct the air flow to the rectifier. Provided the leads are securely attached to the rectifier, no service or adjustment should be required.

Battery

Important.—The positive terminal of the battery must always be connected to earth. Reversal of the battery leads will cause serious damage to the equipment.

Contact-breaker

The contact-breaker points (Fig. 32) should be maintained with a gap of between 0·012 and 0·015 in. when fully opened. Incorporated with the unit is a felt pad for lubrication of the cam. This should be fed with a few drops of oil every 5000 miles.

Emergency Starting

Provision is made in the equipment whereby the machine can be started in the event of the failure of the battery or rectifier. It is not desirable to run the machine for long periods with the switch in the "Emergency" position. When the switch is in the "Emergency" position a small charge is provided for the battery. It will usually be found after a few minutes running that the switch can quickly be moved over to the ordinary "Ignition" position.

If running without a battery is necessary, the NEGATIVE lead *must* be connected to an earthed point on the frame of the machine and the ignition key turned to the "EMG." position.

In these circumstances the lights and horn are inoperative.

Note.—Failure to EARTH *the* NEGATIVE battery lead will result in serious damage to the ignition and the rectifier.

Important.—If the battery leads are disconnected for any reason take care that they are reconnected with the *Positive* + *to Earth.* Reversal of the leads will cause serious damage to the rectifier.

Battery Charging Rate

Some Colt models were fitted with a switch assembly designed to introduce a low battery charging rate. To maintain full battery capacity and balance input with output a slight modification is necessary. Remove the complete switch from the lamp to expose a $2\frac{1}{4}$-in. length of Systoflex-covered cable connected between No. 12 of the lighting switch, or top bank of terminals, and No. 5 of the ignition switch or bottom bank of terminals. Removing the connection will allow the full generator charge to pass to the battery.

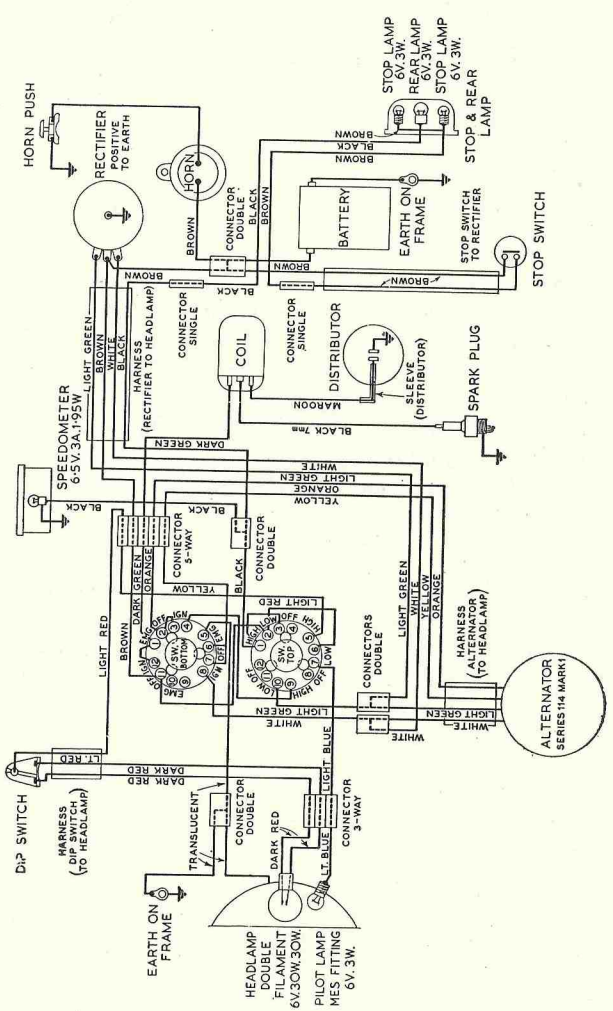


FIG. 83.—WIRING DIAGRAM FOR SERIES "A" 200-C.C. MODEL LH COLT.

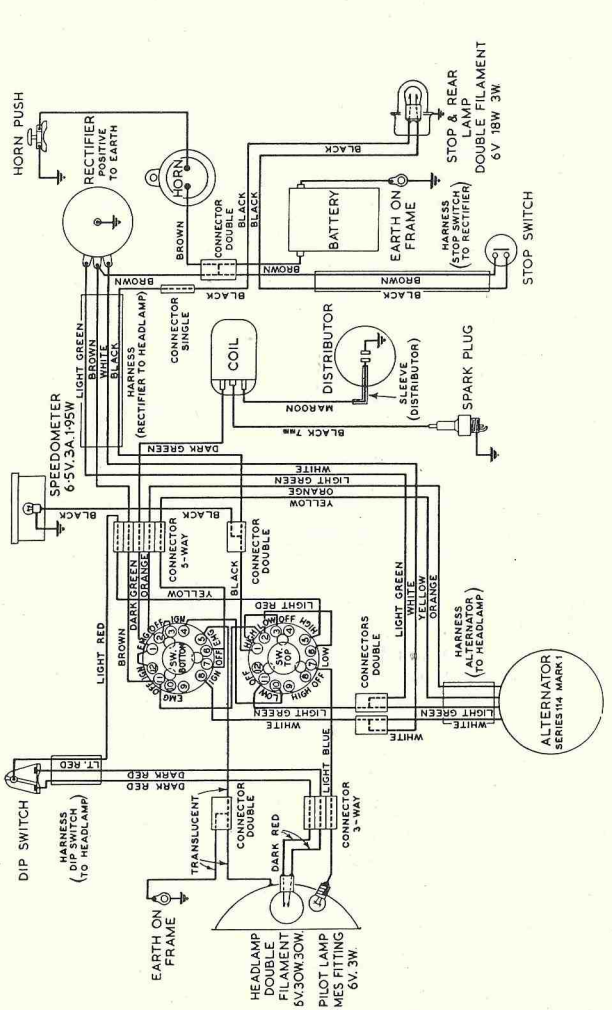


FIG. 84.—WIRING DIAGRAM FOR SERIES "B" 200-C.C. MODEL LH COLT.

APPENDIX

LUBRICATION RECOMMENDATIONS

ENGINE, 4 CYL., IN SUMMER: Castrol "XXL"; Essolube 50; Shell X100–40; Mobiloil "BB". WINTER: Castrol "XL"; Essolube 30; Shell X100–20; Mobiloil "A".

ENGINE, SINGLE CYL., IN SUMMER: Castrol "Grand Prix"; Essolube 50; Shell X100–40; Mobiloil "D". WINTER: Castrol "XXL"; Essolube 40; Shell X100–30; Mobiloil "BB".

ENGINE, TWIN CYL., IN SUMMER: Shell X100–40; Mobiloil "BB"; Castrol "XXL"; Essolube 50; Energol S.A.E. 40. WINTER: Shell X100–30; Mobiloil "A"; Castrol "XL"; Essolube 40; Energol S.A.E. 30.

"BA"/"CP" GEARBOX: Castrolease Medium; Esso Grease; Shell Retinax "CD"; Mobilgrease No. 2. Or a 50/50 engine oil and grease mixture when oil seal fitted.

"GB" GEARBOX: Engine Oil only S.A.E. 50/60.

OIL-BATH CHAINCASE AND REAR CHAIN: Engine oil.

WHEEL HUBS: Castrolease Heavy; Esso Grease; Shell Retinax "RB"; Mobil Hub Grease.

GENERAL GREASING: Castrolease "CL"; Esso Grease; Shell Retinax "CD"; Mobilgrease No. 2.

TELESCOPIC FORKS—NORMAL CONDITIONS: Castrol "XL"; Essolube 30; Shell X100–30; Mobiloil "A". ARCTIC CONDITIONS: Castrolite; Essolube 20; Shell X100–20; Mobiloil Arctic.

VARIATIONS FOR 200-C.C. MODEL LH COLT ONLY. Engine, Chaincase and Rear Chain: SUMMER S.A.E. 50; WINTER S.A.E. 30; GEARBOX S.A.E. 50.

See page 143 for recommended lubricants for 250-c.c. Leader and Arrow models.

SPARKING-PLUG RECOMMENDATIONS

Champion Plugs for Ariel Models

		Type
197–c.c.	LH Colt	N5
347–c.c.	NH Red Hunter to 1955	L7
347–c.c.	NH Hunter, 1956–59	N5
497–c.c.	VH Red Hunter to 1952	L7
497–c.c.	VH Red Hunter to 1959	N5
497–c.c.	KH Red Hunter Twin-cylinder to 1952	L7
498–c.c.	KH Red Hunter, 1953–57	N5
498–c.c.	KHA Twin-cylinder with alloy head	N5
498–c.c.	KG Fieldmaster	N5
598–c.c.	SV Model VB, 1937–51	L10
598–c.c.	SV Model VB, 1952–54	N8
598–c.c.	SV with alloy head, Model VB, 1955–59	N5
646–c.c.	FH Huntmaster Twin to 1959	L7
997–c.c.	Square Four to 1952	L7
997–c.c.	Square Four 4G, 1953–57–59	N5
250–c.c.	Leader and Arrow, 1958–60	N3

Lodge Plugs for Ariel Models

197–c.c.	LH Colt	HLN
347–c.c.	NH Red Hunter to 1955	HN or H14
347–c.c.	NH Hunter, 1956–59	HLN
497–c.c.	VH Red Hunter to 1952	CN or C14
497–c.c.	VH Red Hunter, 1953–59	HLN
497–c.c.	KH Red Hunter Twin-cylinder to 1952	CN or C14
498–c.c.	KH Red Hunter, 1953–57	HLN
498–c.c.	KHA Twin-cylinder with alloy head	HLN
498–c.c.	KG Fieldmaster	HLN
598–c.c.	SV, 1937–51	CN or C14
598–c.c.	SV, 1952–54	CLNH or CB14
598–c.c.	SV with alloy head, Model VB, 1955–59	HLN
646–c.c.–	FH Huntmaster Twin to 1959	HN or H14
997–c.c.	Square Four to 1952	CN or C14
997–c.c.	Square Four 4G, 1953–57–59	HLN
250–c.c.	Leader and Arrow, 1958–60	2HLN

INDEX

Rocker Spindle:
Diameter . . . 0·498–0·499 in.

Crankpin:
Diameter . . . 1·3745–1·375 in.

Crankshaft, Plain Bearing End:
Diameter . . . 1·2495–1·250 in.

Crankshaft Plain Bearing (White Metal):
Honed after fitting to . 1·2515–1·252 in.

Camshaft Bush in Crankcase:
Ream after fitting to . 0·874–0·875 in.

Camshaft (Bush End):
Diameter . . . 0·8735–0·873 in.

Crankshaft Threads:
Thread for coupling gear extractor . . . $1\frac{3}{4}$ in. × 20 T.P.I.
Nut securing shock absorber. . . . $\frac{11}{16}$ in. × 20 T.P.I.
Nut securing front coupling gear . . . . $\frac{3}{4}$ in. × 20 T.P.I.
Nuts securing R.H. crankshafts . . . . $\frac{3}{4}$ in. × 20 T.P.I.

Camshaft Nut . . . $\frac{3}{4}$ in. × 20 T.P.I. left hand

Crankpin Oil-hole . . $\frac{1}{32}$ in.

Camshaft Ball Bearing:
Size . . . . $\frac{3}{4}$ in. × $1\frac{7}{8}$ in. × $\frac{9}{16}$ in.

Crankshaft Roller Bearing in Crankcase:
Two-lipped Type . . 1·125 in. × $2\frac{1}{2}$ in. × $\frac{5}{8}$ in. (2 off)

Crankshaft Roller Bearing in Gear Cover:
One-lipped Type . . 1·124 in. × $2\frac{1}{2}$ in. × $\frac{5}{8}$ in.

Contact-breaker Gap . . Magneto 0·012 in.
Coil 0·014–0·016 in.

Sparking-Plug Gap . . Magneto 0·015–0·018 in.
Coil 0·025 in.

JET SIZE 0.090"

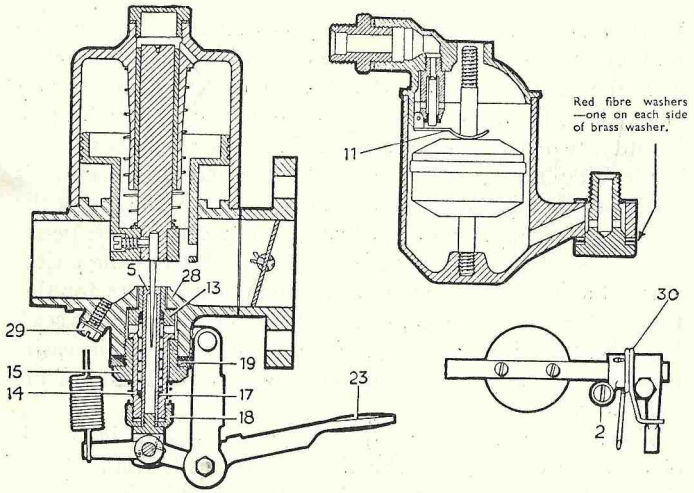


FIG. 58.—SECTIONAL VIEWS OF S.U. CARBURETTER, TYPE MC2.

2. Throttle stop screw.
5. Jet.
11. Float chamber hinged fork lever.
13. Jet bearing, top half.
14. Jet bearing, bottom half.
15. Jet locking screw.
17. Jet gland washer.
18. Jet stop nut.
19. Locking screw washer.
23. Jet lever.
28. Bridge.
29. Plug screw.
30. Throttle return spring.

to release the jet and jet-bush assembly (5), (13), (14), etc., and permit this to be moved laterally.

A moderate side loading applied to the lower protruding part of the lower jet bush (14, Fig. 58) will indicate whether or not the assembly has been sufficiently freed. The piston should now be raised, and, maintaining the jet in its hightest position, the piston should be allowed to drop. This will cause the needle to be driven fully into the jet mouth, and thus bring about the required centralisation. The locking screw should now be tightened and the jet returned to its former position. Should any indication of contact between the needle and the jet persist, which may sometimes occur due to further displacement of the assembly on finally tightening the locking screw, this must again be slacked off and the operation repeated.

Flooding or Leakage

Flooding from Float-chamber or Mouth of Jet.—Flooding may occur due to a punctured and petrol-laden float or to dirt