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PREFACE TO THE FIFTH EDITION

THE fifth edition has been extensively revised to fully cover all single-cylinder A.J.S. models produced from 1945.

The 350-c.c. is known as Model 16M or, in the case of a spring-frame machine, 16MS. Similarly, the 500-c.c is described as Model 18M or 18MS. The first two figures in the engine number (stamped on the drive-side crankcase) indicates the year of manufacture; thus, engine number 48/16MS/0000 indicates a 1948 spring-frame 350-c.c. model.

The makers of these machines have incorporated many basic design details from the Army type model, which has a world-wide reputation for efficiency and reliability.

The numerous modifications made are described in seasonal order, to serve as a guide to enable owners of early models to incorporate them in their machines, where it is possible.

Many engine features on the post-war models are identical to the pre-war models; thus the technical details given for the later models apply also to machines produced from 1938 up to 1939.

How to improve the engine efficiency is described in Chapter VIII, the treatment of the subject being on a practical basis, without theoretical reference. A chapter is devoted to Trials and Scrambles models, which are not covered by the maker's handbook.

The author wishes to thank Associated Motor Cycles Ltd. and Joseph Lucas Ltd. for co-operation and permission to reproduce their illustrations.

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F. W. NEILL

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CHAPTER I

FAULT LOCATION AND ENGINE SERVICING

WHEN any particular engine fault develops, the cause should be investigated systematically, and, before deciding to fit expensive replacements, which may prove to be unnecessary, a careful study of the information which follows on the various engine noises that are likely to develop should first be made.

Do not rely entirely on the advice given by the so-called expert, who does not have to foot the bill for unnecessary replacements. For example, camshaft end-float is invariably associated with small-end wear; thus it will often be found that after replacing the small-end bush and gudgeon-pin, noise due to camshaft end-float will still prevail.

Engine noises and when and how they occur are detailed to assist owners to locate the source, and also to avoid unnecessary expense in fitting new parts without just reason.

Where instruments for measuring engine parts are available and when an engine overhaul is contemplated, parts should be measured and checked against the sizes given in the technical data at the end of the book before new parts are used.

Locating the Source of Noise

Owners of A.J.S. models are strongly advised against the practice of using parts that are not made by the A.M.C. Company. There is no economy in using replacements of this kind, which can cause a serious engine failure.

Some owners concentrate on engine maintenance and overlook important frame, fork and gearbox parts. When an unusual noise develops, its cause should be investigated as soon as possible, otherwise expensive damage can occur. For instance, the exhaust pipe or silencer may become detached with the machine in motion.

When it is difficult to locate the source of any particular noise, let the machine coast downhill, with the engine shut off, and in neutral. A variety of noises may be audible, due to the rear chain fouling the chain guard, brake shoes rubbing on the brake plate, gearbox bearing noise, squeaks in the suspension. These are the most likely noises and are not always audible with the engine under load.

Excessive Oil Consumption

If oil consumption increases progressively after considerable mileage, check piston-ring gap. The normal gap is 0·003-0·004 in. for each 1 in. bore size. Should cylinder wear exceed 0·008 in. rebore the cylinder and use an oversize piston.

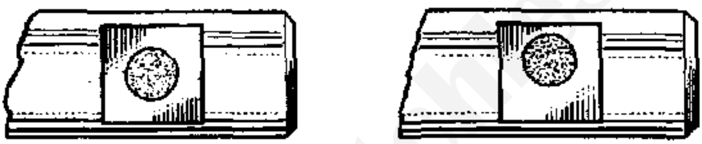


FIG. 1.—OIL-PUMP PLUNGER MODIFICATION FOR 1947-48 MODELS.

Pistons of dimensions +0·020 in. and +0·040 in. only are supplied. A chromed-top compression ring is recommended to minimise cylinder wear.

When this fault occurs and when rings and bore are unworn, check the valve guides for wear.

On engines with number before 9310 (350-c.c.) and 8765 (500-c.c.) an improved type of tappet guide can be used, which has an increased number of oil drain slots. After driving fast for a long distance, oil can pile up in the push-rod cover tubes, swamping the cylinder-head and guides. The oil will then enter combustion chamber and increase oil consumption. On 1947-48 models this can also cause the exhaust valve to stick in the guide, due to excessive carbon on valve stem and guide.

Oil supply to the top of the engine can be reduced by a modification to the oil-pump plunger (see Fig. 1), which is made by the makers.

Incorrect setting of the regulating screw controlling the oil supply to the inlet guide will increase oil consumption, normal setting 1/2 turn open from fully closed position.

If Engine Smokes Excessively on Starting

This fault is most likely to occur on engines that have covered considerable mileage or where the oil-plunger housing in the crankcase is either scored or worn, allowing oil to seep into the crankcase whilst the engine is stationary. To check, record the oil level in the tank with a dip-stick at night and check again on following day. If level has fallen seepage has occurred,

To remedy, send timing half of crankcase to the makers for a bush to be fitted in the plunger housing.

Bad scavenging of the sump will have the same effect, and may be due either to an air leak between the rear pump end cap and crankcase or an obstruction in the oil-way from the sump to the oil pump.

To check, remove the oil-pump plunger and the drain plug from the sump. A stiff piece of wire inserted through the plug hole in the crankcase and through the oil-way in the crankcase may dislodge foreign matter, such as a piece of broken piston ring, etc.

As a preliminary test, take out the oil filter and note if the oil return increases on running the engine. A choked oil filter will restrict the oil return.

Damaged or Worn Teeth on Pump Plunger

A slight amount of teeth marking is normal after considerable mileage. If the teeth are badly damaged on the plunger all round, this can only be due to overload caused by the guide pin not being properly located in the plunger groove and bearing on the plain diameter of the plunger. If the wear is excessive in one part of the plunger, restriction on either the feed or return side of the oil system is responsible.

The cause must be investigated and rectified before replacing the plunger. This can be due to:

(*a*) Obstruction in rocker feed passage, gasket incorrectly fitted.

(*b*) Obstruction in rocker-box oil-ways.

(*c*) Choked big-end feed (which is the most likely cause) due to foreign matter, or crankpin incorrectly located in flywheel, restricting oil feed.

After overhaul, when new parts have been fitted, use an old small-end hush placed on the timing-side axle, then squirt oil through the hole drilled in this bush. The oil should emerge each side of the connecting-rod if the feed passage is correct.

Oil Supply Fails to Rocker Box

Check the oil pump guide pin for wear on the extreme end. This may curtail the plunger travel.

When investigating oiling trouble after overhaul, verify that the correct type of oil-pump plunger and also timing-side axle has been fitted. For models after 1946 the plunger can be identified by the number " 2S " stamped on it.

Cylinder-wall Feed

This requires no attention and does not affect oil consumption, as commonly supposed. The arrangement is not incorporated in the 1956-type engines.

Crankcase Release Valve

This is a flap valve mounted on the drive side of the crankcase, behind the front chaincase. A slight oil discharge on starting, which ceases when the machine is in motion, is of no consequence. If the valve is dismantled, use a little grease on the serrated seat to hold the steel diaphragm in position during assembly.

Curing Oil Leaks

The engines are usually free from oil leaks. If the engine is taken down, a gasket set for renewals should be available on assembly. Should oil leakage occur from the push-rod cover tubes, test for rigidity. If it is possible to move the tubes slightly, use a thin steel washer, 3/64 in. thick, on the reduced end of the push-rod tubes to create additional pressure on the sealing rubbers. Avoid using gaskets not of A.M.C. manufacture, as these are unsuitable.

Oil leaks from the cylinder base can be due either to base nuts not being evenly tightened or a deformed cylinder-base gasket.

When fitting a new gasket, all broken pieces of the old gasket must be removed from the crankcase face, particularly round the base studs, also from the cylinder-base face. Apply jointing compound on the cylinder only and stick the gasket to it. Do not use jointing compound on the crankcase face.

Oil Leaks From Cap on Timing-gear Cover

A new metal cap, which is inexpensive, is required to rectify an oil leak from this point. The old cap can be removed by piercing a small hole in it so that it can be levered out with a sharp-pointed tang of a file.

Clean away all traces of oil in the cap recess, apply jointing compound on the outside diameter of the new cap and tap it home squarely. Do not run the engine until the jointing compound has bad time to set.

Wear on Valve Spring and Collar

Engines made before 1954 can be modified to overcome this trouble by the following procedure:

(1) Increase the diameter of the oil hole drilled in the box for the exhaust rocker in the rocker box to 3/16 in. diameter.

(2) Fit a metering plug, obtainable from the makers, Part No. 018890 (insert small hole end first). This alteration will cut down the oil supply to the exhaust valve, which is already generous, and at the same time force more oil to the inlet rocker and valve end, reducing wear on springs and collar.

(3) Fit two new rockers for valve ends with oil groove machined in side of rocker (Part Nos. 022136, 022137).

If so desired, 1952-type valve springs with open-tray-type seat can be fitted on earlier models using this type of valve spring.

Wear on Valve Ends and Rockers

This trouble is most likely to be associated with models made before 1954. The modification regarding wear on valve springs will also eliminate this wear.

To avoid expense in fitting new valves when wear takes place on valve ends, the original valves can be made serviceable by reducing the rocker end of the valve by 3/32 in. and using hardened valve-end caps used up to 1948 to restore the valve to its normal length. If the rockers for the valves are worn as a result of oil shortage, new ones will be required to maintain correct rocker adjustment.

Exhaust Valve Sluggish or Seizes in the Guide

If the engine misfires, or cuts out, accompanied with a mechanical clatter, after driving hard, the exhaust valve is the cause.

Engines with iron cylinder-heads are more prone to this trouble, which is due to a formation of carbon on the valve stem and in the valve guides, caused either by excessive oil or over-lubrication to the exhaust valve and guide. On engines made before 1949 a hole is drilled in the well cast in the rocker box, which registers with an oil passage in the cylinder-head supplying oil by gravity. This supply, which is already generous, should be restricted to prevent a re-occurrence.

A standard metering plug (Part No. 018890) obtainable from the makers, can be fitted into the hole drilled in the well for the rocker box. Insert the plug with the small hole downwards. Alternatively, use an aluminium plug with a slight fiat filed on it and insert this plug into the hole in the cylinder-head which registers with the oil-feed hole in the rocker box. The exhaust valve must be taken out (see " Decarbonising the Engine ", page 26), and all traces of burnt oil or carbon removed from the valve stem, and most important of all, from inside the valve guide, A narrow strip of emery cloth, together with a tommy bar, introduced into the guides can be used effectively. Ensure that no abrasive, or loose carbon, is lodged in the valve-guide oil hole.

If a complete engine overhaul is contemplated and if the engine number is before 9310 (350-c.c.) or 8765 (500-c.c.) change the tappet guide for the new type with six slots. This will prevent oil accumulating in the push-rod tubes and swamping the cylinder-head, causing over-lubrication and heavy oil consumption.

Valve Guides Loose in Cylinder-head

This can occur only on engines fitted with alloy-type cylinder-heads, and is usually connected with the exhaust-valve guide only. Scuffing by movement of the guide will tend to enlarge the hole in the cylinder-head.

Alternatively, if this guide is driven out without preheating the cylinder-head the same effect will take place.

To remedy, an improved type of guide (Part No. 022208), which uses a circlip to prevent the guide from moving, should be fitted and can be interchanged.

In cases where the guide is a very loose fit a copper deposit should be made on the outside diameter of the guide to increase its effective size and close up the interference fit.

It is rare for the inlet guide to be similarly affected, but if so, the same treatment should be applied. Alloy cylinder-heads *must* be heated when fitting or removing valve guides.

Wear on Camshaft

If the apex of cams are worn or bruised, the reason should be investigated before replacements are fitted. Should damage or undue wear take place on **the** apex or peak of the cams, this can only mean that undue pressure occurs on the cams when the valve is at full lift.

In the case of engines fitted with coil-type valve springs the springs may be of a type not made by A.M.C, which become coil bound, or close up solid when the valve is at full lift.

To check valve motion, rotate the engine until the valve is at full lift. Then apply a box key on the rocker-axle nut

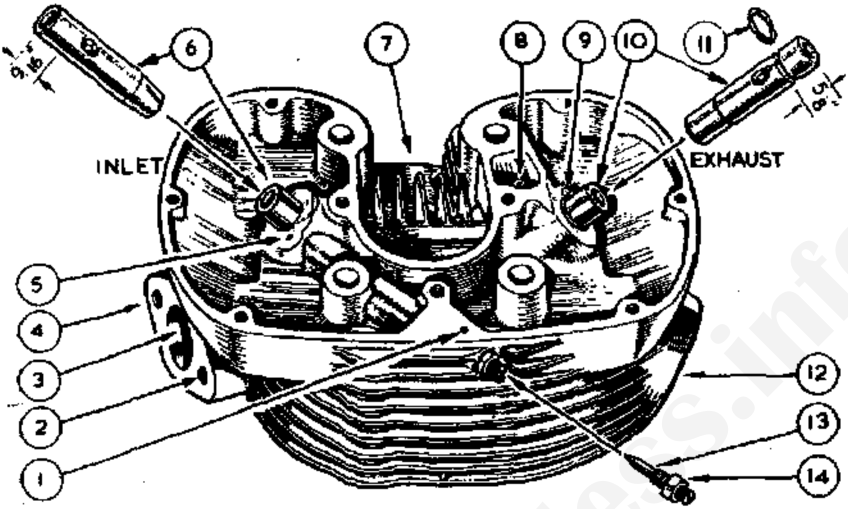


FIG. 2.—THE LIGHT ALLOY CYLINDER-HEAD.

The dimensions shown on the valve guides indicate the amount of guide standing proud when the guide is correctly inserted.

1. Oil feed to inlet valve.
2. and 4. Carburetter mounting stud holes.
3. Inlet port.
5. Inlet-valve spring seat dowel hole.
6. Inlet-valve guide.
7. Sparking-plug hole.
8. Oil feed to exhaust valve.
9. Exhaust-valve spring seal dowel hole.
10. Exhaust-valve guide.
11. Exhaust-valve-guide circlip.
12. Exhaust port.
13. Inlet-valve oil-feed adjusting screw.
14. Locking-nut for 13.

and endeavour to open the valve a little farther. If no movement is apparent the valve springs are closing up solid, and this is responsible for cam wear.

To remedy, fit A.M.C. valve springs, or ascertain that the valve-guide protrusion is not in excess of the specified length (see Technical Data at the end of this book).

On old engines a badly worn or damaged tappet foot will damage the cams. With engines using hair-pin valve springs contact with the valve-spring collar and valve guide can only be associated with this fault.

Removing Valve Guides (All O.H.V. Engines)

All guides are a force fit in the head, and a suitable drift, or hand press if available, is required for removal.

First, remove alt traces of burnt oil or carbon on the exposed end of guide with emery cloth. With the head supported, the guides are driven, or pressed, out and down into the port.

When dealing with alloy-type heads, first ascertain if a circlip is fitted, if so, this must be taken away for exhaust-guide removal. This type of guide was introduced for the 1955 season and can be fitted to any alloy-type head, providing a new-type valve-spring seat is used. Alternatively, form a recess in spring seat to clear the radius of the circlip. To remove the circlip tap the guide upwards, from inside the exhaust port, sufficiently for the circlip to be removed, then deal with this guide as previously described.

It is important that alloy heads must be uniformly heated before removing or refitting valve guides. If this process is omitted, " scuffing " on the guide diameter in the head will occur, causing the guide to become a loose fit.

Refitting Valve Guides

To ensure that the guide is started squarely, pass the valve through the guide hole, holding the valve with the fingers of one hand firmly against the head seating. With the valve firmly held, put the guide on the valve stem and press down hard to start the guide evenly and square, with the oil hole correctly aligned (see Fig. 2).

The head can be heated if necessary and the guide pressed home. For protrusion length, see Technical Data at the end of this book.

Bent Push-rods

The information given under " Wear on Camshaft " also applies to trouble of this nature.

ENGINE NOISES

It should be mentioned that A.J.S. machines are manufactured with a high degree of mechanical silence. No manufacturer can produce an engine that will be devoid of mechanical noise throughout the whole period of the machine's life.

In consequence, if a noise develops after considerable use, this does not necessarily indicate that the engine is worn out or that undue wear has taken place.

During use noises in some form or other will inevitably become manifest, which are audible only on account of the high degree of mechanical silence for which these models are noted.

It follows that, if mechanical silence is to be maintained, replacement of certain parts is inevitable. This does not mean, however, that without such replacement, the engine efficiency or reliability will be impaired.

Big-end Rattle

After considerable mileage a rattle may develop, which is audible only when the engine is running light or not under load. The same noise will also be audible when the machine is rotating the engine, i.e., on a down gradient.

This noise can occur when the accumulated clearance of the crankpin, rollers and big-end liner reach a clearance of 0·0015 in. which is microscopical. The noise is audible only on account of the quiet valve gear used. The machine can be used for a further 5,000-10,000 miles without attention, but if the noise creates irritation, then this slight movement must be taken up.

In most cases a new set of big-end rollers will suffice, providing that the roller track on the crankpin or the big-end liner is not damaged.

Piston Slap

This engine noise, which is audible when the engine is under load or upon changing into a high gear, is entirely due to clearance between the piston and the cylinder.

On engines that have considerable mileage a rebore and oversize piston is the only remedy.

The use of the wire-wound piston undoubtedly reduces piston noise by reason of the close clearance permissible with this type of piston. This is, with new parts, 0·001 in. This type of piston was introduced in 1948, after considerable experimental work with prolonged road tests under exacting conditions.

Construction of the piston is shown in Fig. 3, which illustrates the five turns of high-tensile steel wire used to control expansion. A Y-type alloy is used, with a tin-plated finish to minimise seizure. The shape is both oval and taper in

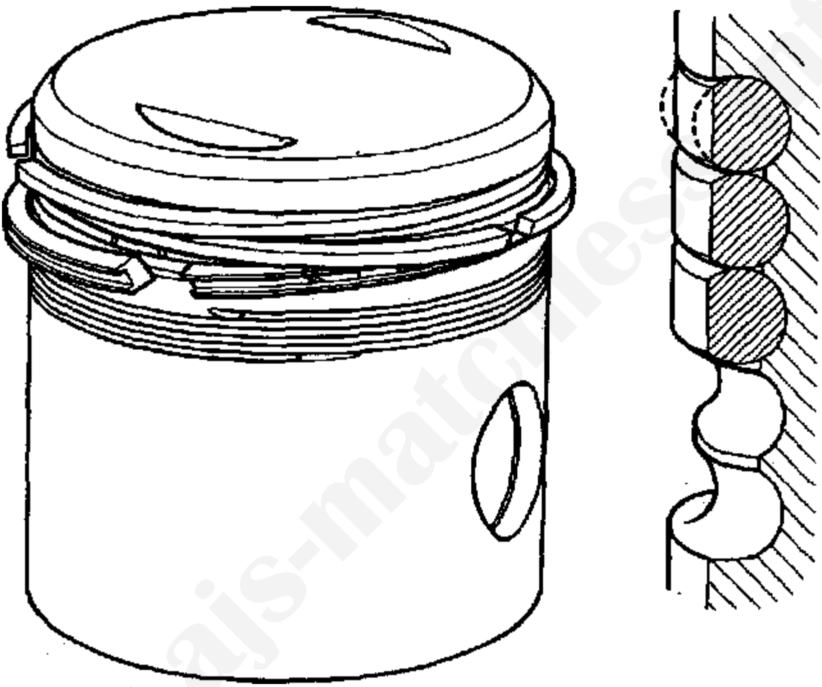


FIG. 3.—WIREWOUND CLOSE-FITTING PISTON.

Note the five turns of high-tensile steel wire used to control expansion.

section, with the maximum around the gudgeon-pin bosses where the expansion is greatest. Therefore discoloration at these places is of no consequence. Owing to the close clearance used, matching of pistons and cylinders is carried out at the factory, before assembly.

In addition, both cylinder and pistons are checked on a fluid gauge, with the dual purpose of avoiding manual errors and to ensure accuracy.

Owners of machines made before 1947 can use this type of piston, providing that the short-type connecting-rod is fitted at the same time.

A table of tolerances with symbols stamped on both the cylinder-base flange and piston crown is shown in the Technical Data at the end of the book.

Engine noise due to piston slap will become inaudible when the ignition is retarded, and is not associated with a worn small-end bearing.

Noise in Camshaft End-float

This is usually indicated by a " clacking " noise when the engine is running at slow speeds, and disappears as engine speed increases. This is due to end-float of the camshaft (which drives the magneto) between the crankcase and timing cover. As the tappet is offset to the cam, this causes an oscillating movement of the cam, which is responsible for the noise.

The origin of this noise can be proved, by running the engine with the magneto chaincase cover removed until the noise develops, which will cease when pressure is applied on end of the shaft driving the lower magneto sprocket. A piece of wood or screwdriver handle can be used for this purpose.

To remedy, remove the magneto drive and timing-gear cover, and then fit a 0·005-in. shim washer over the cam-wheel shaft, which will take up the play and stop the noise.

Timing-gear Noise

This may be due to backlash between the cam wheels and the small timing-gear pinion. The use of a new small pinion is first recommended, before incurring unnecessary expense in other replacements.

On old engines a worn timing-side axle bush or cam wheel bushes will cause backlash, but it is rare for the cam wheel bushes to have undue, or premature, wear. The fact of inserting the cam into the bush and testing for rock is no guide as to wear, because of the short bush used.

Backlash between the camshaft which drives the magneto and the small pinion can be detected as follows. Remove the magneto chain cover and run the engine at idling speed to produce the noise which, if due to backlash, will become inaudible if the wooden handle of a screwdriver or similar tool is pressed down on the top run of the magneto drive chain. This load will damp down the backlash, thus proving that the noise is associated between these two parts.

Noise in Rocker Box

Should a clicking noise develop in the region of the rocker box, on models fitted with hair-pin valve springs, this can be due to a distorted spring making contact with the rocker box. A similar noise will also occur if one or both rocker arms are making contact with the valve spring. The spring will be marked with a slight groove.

To correct, grind a slight radius on the rocker at the point where contact takes place.

When dealing with a distorted valve spring, try the effect of changing its position, which may have the desired result.

Excessive end-play between the rockers and bearings for rocker axles can be taken up by removing the rocker with its shaft. Then tap out one of the bushes to the required amount so that no end-play exists, the rockers being free to move when the axle nut is tightened.

The two brass plugs in rocker box behind the rocker arms are metering plugs, and should not be disturbed or the aperture increased.

Flywheel End-float

The flywheel assembly on all models is pulled towards the engine sprocket by the shock-absorber spring. If the flywheels can be moved sideways by hand, and with the shock absorber assembled, this can be due only to the ball-races on the driving-side shaft being loosely fitting in the crankcase. This fault should be corrected promptly, to prevent further damage to the crankcase.

The cause of this occurrence is due to foreign matter entering the ball-races, temporarily locking the inner and outer member of the ball-race, which then rotates in the crankcase. If both ball-races are unworn or undamaged the outer members of each race can be copper plated to increase the effective diameter and close up the interference fit. Both ball tracks must be masked with large steel washers before this process is carried out.

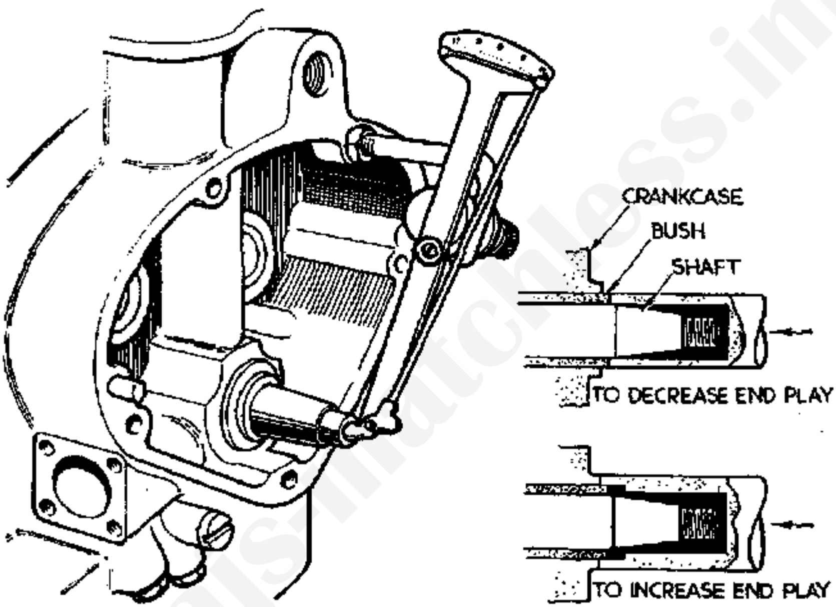


FIG. 4.—METHOD OF CHECKING AMOUNT OF MOVEMENT BETWEEN FLYWHEELS AND CRANKCASE.

As an alternative, the crankcase half can be returned to the makers, who will knurl the bearing housing to close up the interference fit.

The crankcase should be uniformly heated to extract or refit these bearings. Wear on the two spacing washers between the bearing is also due to the same cause.

With the shock-absorber spring removed, it is possible to move the flywheels sideways, the normal end-float is between 0·020 in. and 0·025 in. (Fig. 4 shows the method of measuring end-float.)

To prevent end loading the ball bearings after fitting, the inner race (flywheel end) should be tapped gently away from the outer race until both inner members are free to rotate individually.

Engines issued in the latter part of the 1952 season and on subsequent models have two dissimilar diameters in the ball-race housing. The outer race nearest the sprocket is a close interference fit and the outer race is a slight interference fit, which will facilitate bearing adjustment as previously described.

After fitting the later-type two-diameter timing-side bush check for end-float. If below the specified amount, face back the bush until this is achieved.

ENGINE SERVICING

When to Decarbonise

There is no fixed or known distance that the engine should cover before decarbonising. With the advent of high-octane fuels now available the necessity for this work is not now so frequent. The need for this decarbonising is usually indicated by a fall off in engine performance, together with an increase in petrol consumption.

There is, however, a risk of damage to the exhaust valve, and possibly the exhaust-valve seating in the cylinder-head, if the engine is used for a long mileage before decarbonising.

This is brought about by separation of additives in the fuel, which become impinged on either the valve or head seating. On combustion, the flame in the combustion chamber is forced through the small gap caused by the valve being held off its seat, when burning will inevitably take place. A closely adjusted exhaust-valve push rod will have the same effect,

It is in the owner's interest to check compression from time to time after long mileage has been covered. This check must be made with the throttle wide open, otherwise the cylinder will not be charged, and there is nothing to compress if the throttle is closed or partially open.

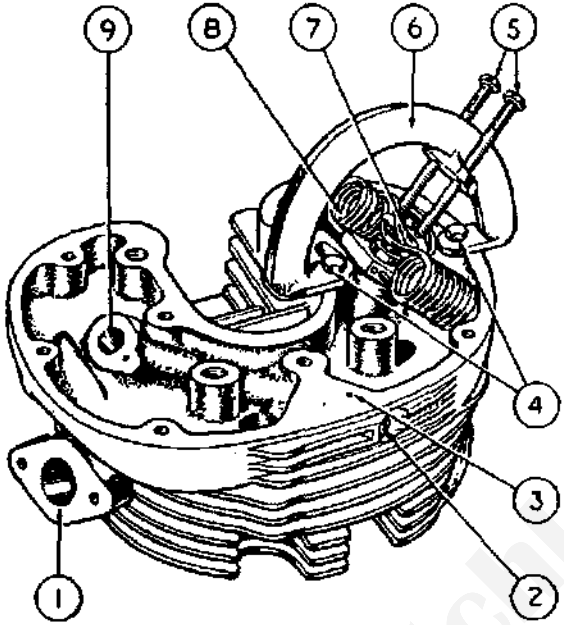


FIG. 5.—SPECIAL TOOL FOR VALVE-SPRING REMOVAL.

1. Inlet port.
2. Oil-regulating screw.
3. Inlet-guide oil-feed passage.
4. Bolts fixing compressor to head.
5. Spring-compressing bolts.
6. Spring tool body.
7. Valve-spring collar.
8. Valve springs.
9. Valve-guide aperture.

Decarbonising the Engine

A gasket set and valve-spring tool are required before commencing work. Proceed by removing the petrol tank, exhaust pipe with silencer attached, the high-tension cable and sparking-plug. Take out the throttle and air slides and protect them with a piece of clean rag. Tie these slides to the frame top tube to prevent damage. Next remove the cylinder-head steady, if fitted, then the rocker-box oil pipe, using two spanners on both the union and union nut to stop the union moving when the nut is released. Disconnect the valve-lifter cable, if fitted, to the rocker box.

Unscrew all bolts fixing the rocker box to the cylinder-head and remove, with the exception of the two bolts below the frame rail. The rocker box can now be tilted and moved to the right side, when the push rods can be extracted. Identify these rods for location, they will interchange, but it is best to replace them in the original position.

The four cylinder-head bolts are next removed, when the cylinder-head with push-rod tubes attached can be taken away. Draw out, in turn, each push-rod cover tube and watch for two thin steel dished washers, which may be fitted over these tubes.

With the cylinder-head on the bench, both valves can be checked to decide if grinding is necessary by wiping dry the combustion chamber, then nearly filling each port with petrol in turn. If the petrol does not seep past the valve seat after standing for a short while, the seating must be in order. It is also worthwhile making this check after valve grinding.

A gas-tight joint between the valve and its seating is all that is required, and if petrol does not seep past the valve a gas-tight joint will be ensured.

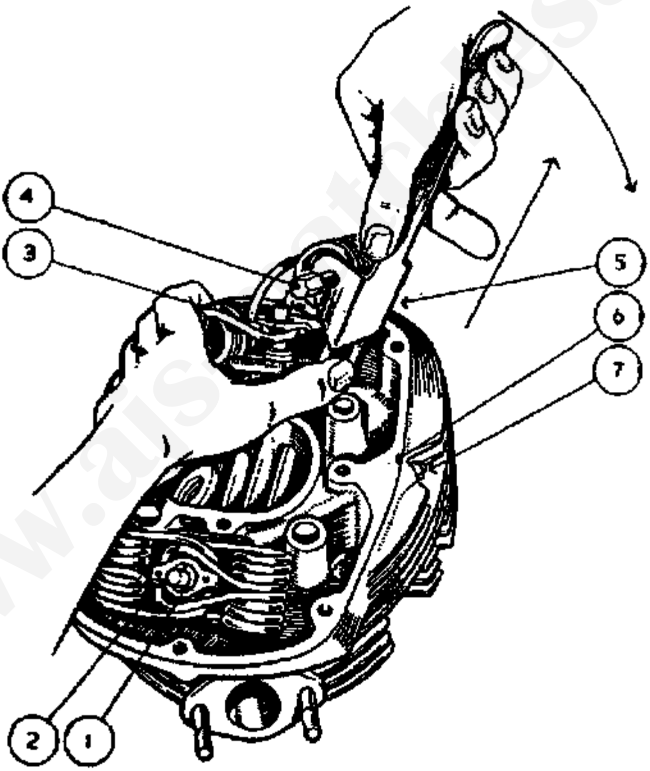


FIG. 6.—ALTERNATIVE TYPE OF TOOL TO THAT SHOWN IN FIG. 5 FOR VALVE-SPRING REMOVAL.

1. Valve collet.
2. and 3. Spring collar.
4. Fulcrum bolt.
5. Spring compressor.
6. Oil passage from rocker box.
7. Oil-regulating screw.

If the valves have to be removed, first remove all traces of carbon in the sphere of the head, with a tool such as a 6-in. steel rule, before the valves are taken out. This will prevent particles of carbon lodging in the ports, which is difficult to extract unless a compressed-air line is. available.

Valve Grinding

Two types of valve-spring tools are shown in Figs. 5 and 6 for use on engines fitted with hair-pin valve springs. Coil-type springs can be removed with a spring compressor such as is made by Messrs. Terrys. With both valves removed, the small amount of carbon round the valve seats can now be dislodged.

Avoid unnecessary valve grinding for, on alloy-type heads, the valve seats are not replaceable. If the exhaust valve is burnt or badly pitted it should be reseated by a dealer with suitable equipment; the seat angle is 45°. A piece of rubber tubing slipped over the valve end will serve as a tool to grind the valve to its seat. Do not use a rotary motion during this process, which will make continuous lines on the valve, turn the valve 180° each way until a matt surface is seen on the valve and seat.

Avoid handling the valve with grinding paste on the finger and thumb as the paste can get into the guide and set up a lapping process when the engine is first run on reassembly. After grinding and removing all traces of grinding compound, pass a piece of fluff-proof rag through both guides. Squirt oil through both oil passages, apply oil on both valve stems and reassemble both valves. The head can now be placed aside.

It is not advisable to disturb the piston rings unless absolutely necessary. Springing the rings open to clear the ring slots will distort them, particularly if pieces of tin or sheet foil are used for this purpose,

Removing Loose Carbon

If the cylinder barrel is not to be removed, rotate the engine until the piston is on top dead centre, then with the use of the tool previously described, carbon formed on the piston crown can be removed. During this process particles of carbon will collect in the recess formed between the piston top lands and the barrel.

To remove, set the engine with the piston about 1 in. down the barrel. Press some grease into the recess between the piston and barrel, turn the engine past top dead centre and down the cylinder again to the extent of 1 in. A ring of grease will be formed in the cylinder barrel, with particles of carbon adhering to it, which can be wiped off. Repeat this process to ensure all loose carbon is removed.

Replacing the Cylinder-head

The cylinder-head can now be replaced in the following manner. Fit new sealing rubbers in the push-rod cover-tube apertures with the metal washers on each side of the sealing rubbers, then insert both tubes in the head. If new rubber seals are not fitted, some jointing compound on the reduced ends of both cover tubes will tend to prevent oil leakage.

Engines fitted with a solid head gasket can use the original gasket, if it is annealed before fitting by heating until the gasket is cherry red, when it should Be plunged quickly into cold water to make the metal ductile.

If this gasket is damaged or if there is ovality in its bolt holes, this means that the gasket has been leaking. In this case, it should be discarded.

Care should be exercised when fitting the gasket into position, ensuring that it is correctly located, as it might move when the head is replaced.

Before attempting to tighten the cylinder-head bolts, turn the engine to top dead centre of the firing stroke (i.e., both tappets down) and tighten the four bolts diagonally. In factory service a torque spanner set to 36-40 ft.Ib. is used for this purpose.

Whilst it is essential that these bolts are tight, over-tightening, particularly in the case of alloy-head engines, can stretch these bolts or possibly break them if undue force is used. Great care must therefore be taken when replacing alloy-type cylinder heads.

Refitting Rocker Box

A new rocker-box gasket is recommended. On engines made before 1949 this can be incorrectly fitted in reverse. This seals the oil passage in the cylinder-head, which lubricates the inlet valve. Squirt oil on the valve ends, insert the centre bolts in the rocker box and offer up both push rods, engaged with the rocker arms. Check the position of the engine, as if one or both tappets are lifted strain will be imposed on the rocker box during the process of retightening the fixing bolts.

Replace the components in the reverse order to that given for removal. In the case of the exhaust pipe, this should be cleaned, particularly underneath, using a chrome cleaner.

With an alloy head, if the exhaust pipe is not a good fit in the port, a rattle can occur when the engine is hot, due to movement of the pipe, which is sometimes difficult to detect.

To remedy, a steel drift, shaped like a carrot, can be driven into the top end of the pipe, making it slightly bell-mouthed and a closer fit when it is replaced.

Cleaning the Carburetter

Dismantle the carburetter completely. To clean out the float chamber, if the choke or brass jet block is difficult to remove use a piece of suitable wood on the top end of the block and tap the end of the wood lightly and gently, to avoid distorting the block, which will make it useless. Clean out the small hole drilled in the brass jet block or choke (see Fig. 20) and also the hole drilled diagonally in the mixing chamber, which is equally important as the pilot jet (see page 57).

The flange on the mixing chamber may be buckled. In order to check this, place a straight-edge or steel rule on the flange when, if held up to the light, distortion can readily be seen. A piece of emery paper on a sheet of glass will serve as a surface plate so that the flange can be rubbed down until it is perfectly flat, preventing an air leak. On carburetters that are not fitted with a Hycar ring it is essential to use a thin paper gasket on this joint, as a thick one will cause the carburetter flange to bend when the two stud nuts are tightened.

When the carburetter has been reassembled, work the throttle several times, making sure the slide does not stick or is sluggish, due to a distorted mixing chamber, before the petrol tank is replaced.

Push-rod Adjustment

It is most important that any moving part of the engine should not be replaced dry. Apply oil to both push-rod ends before making this adjustment.

As quietening curves are used on both cam flanks, correct push-rod adjustment can be effected only with the engine properly positioned. These curves are slight ramps, designed to close up rocker clearance slowly when the valve is lifted, with the same effect when the valve closes. Therefore, both tappets must be on the base circle of the cams to be clear of these ramps. This position is when the piston is on the top dead centre of the firing stroke.

On engines with *iron head,* adjust the push rods when the engine is cold, so that there is no appreciable up-and-down movement in both push rods, the rods being just free to rotate with the fingers. *With an alloy-type cylinder-head,* run the engine until it is reasonably warm, to offset expansion, and make the adjustment in the same manner as with an iron head.

The use of a test tank is worthwhile. This may consist of a quart oil tin, with a union soldered in the bottom to accommodate a petrol pipe, and attached to one of the frame tank rails. The engine can be run for a short while, to settle down, when it may be necessary to reset the push rods and re-tighten the rocker-box bolts before the petrol tank is refitted. Do not overtighten the nuts on the rocker cover.

Refitting the Petrol Tank

Before refitting the tank, make sure that the cylinder-head steady nuts are very firmly tightened. Look underneath the tank for evidence of rocker-box oil pipe fouling, and set this pipe as required.

Ensure that there is no dirt in either of the petrol-tap recesses. Arrange the control cables on the frame tube neatly and then refit the tank. Do not forget to wire the petrol-tank bolts, which should not be unduly tightened, to allow the tank to flex slightly.

Checking Ignition Timing

This is an important setting, and should be carefully carried out. With high-octane fuels it is possible to run with excessive ignition advance without audible detonation or " pinking ", which must have an adverse effect on bearings, particularly the big-end assembly. Therefore, the maker's recommended setting should be used.

An alteration in the contact point gap affects the ignition timing. *Increasing* the gap advances the timing, and, conversely, *closing* the gap retards this setting. It is important to set the contact points to have a gap of 0·012 in. before checking or setting the magneto timing. Proceed by removing the rocker-box cover, sparking-plug and contact-breaker cover. Turn the engine until the inlet valve opens, then closes; check piston position by inserting a piece of old wheel spoke, or something similar, through the sparking-plug hole. Hold the wire as vertical as possible, and if top gear is engaged the rear wheel can be rocked to and fro, when the wire will rise and fall as the piston passes the top-dead-centre position. When the wire is at the highest point of its movement the piston is then on top dead centre.

Make a mark on the wire to register with the seat on the cylinder-head for the sparking-plug. Take out the wire and make a further mark ½ in. *higher* up the wire, which is the maximum advance recommended. Have available a piece of cigarette paper which is inserted between the contact points, fully advance the ignition control lever, or if an auto-advance unit is fitted, make a small wooden wedge to jam the unit in this position. Put the wire through the plug hole, again as vertical as possible, turn the engine *backwards* until the *higher* of the two marks on the wire register with the plug seat, when the contact points should be just about to separate. A light pull on the paper will indicate exactly when the points separate.

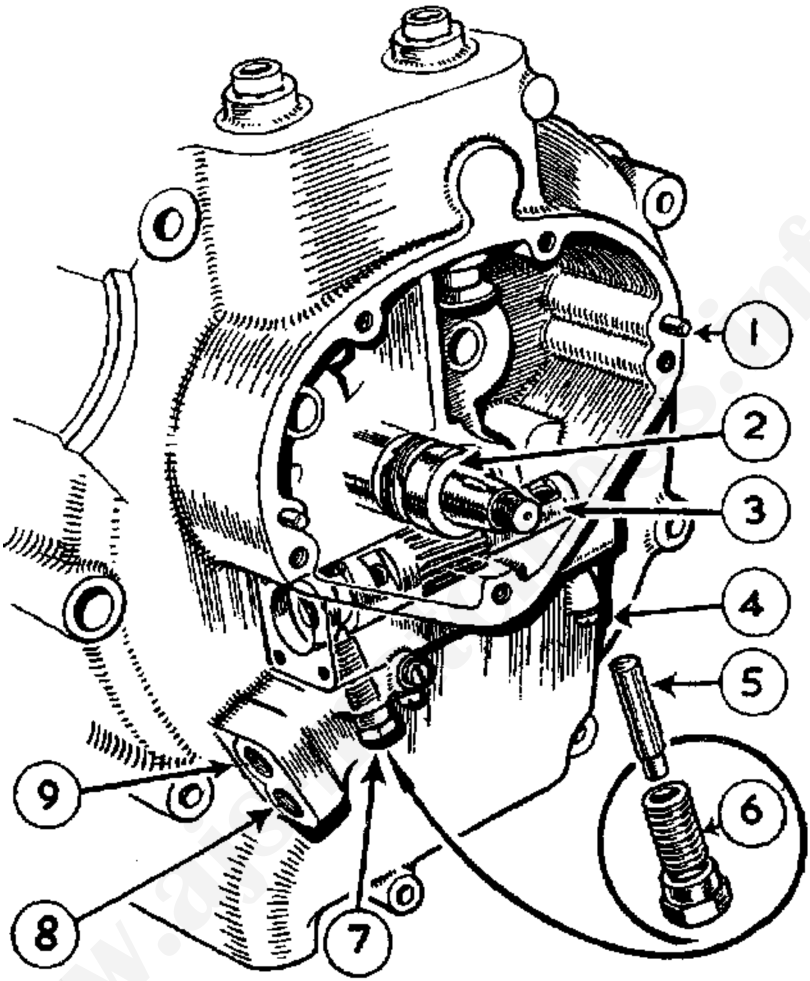


FIG. 7.—ROTATING OIL-PUMP PLUNGER.

Inset shows the guide screw which registers in the plunger profiled groove, thereby providing the reciprocating movement.

1. Dowel peg, locating timing-gear cover.
2. Timing-side flywheel axle with integral gear for driving oil-pump plunger.
3. Oil-pump plunger.
4. Screw (one of three).
5. Guide pin.
6. Screwed body for guide pin.
7. Guide pin in position engaged in profiled cam groove of plunger.
8. Tapped hole (for oil-feed pipe to pump).
9. Tapped hole (for pipe returning oil to oil tank).

Setting Ignition Timing

If the magneto timing has been disturbed, it is best to leave the sprocket on the camshaft loose.

To remove this sprocket with drive assembled, unscrew the fixing nut a few turns then with use of a tyre lever, with one end bent at right angles, placed behind the sprocket, it can be levered off. If the sprocket proves stubborn to remove, maintain pressure and tap the shaft end lightly, the jar in doing this will release the sprocket. Details given for checking this setting are used for resetting.

Note that the nut securing auto-advance units is self-extracting and the assembly will be withdrawn from the armature shaft as the nut is unscrewed,

Lubrication System

The oil pump on both late 1939 models and also models subsequent to 1946 are practically identical as regards design. The pump has only one moving part—the double-diameter plunger. The plunger is rotated by worm gear on the timing-side flywheel axle, the pump action is created by a reciprocating movement, due to the guide pin operating in a profiled groove cut in the larger diameter of the plunger. Numerous cases are known where the oil pump has been damaged—and in some cases the crankcase as well—by inexpert attention due to incorrectly locating the pump guide pin (see Fig. 7). No other attention to this part of the engine is needed except to check the guide-pin sleeve for tightness.

Oil Filters

Up to 1956 a close-grained felt filter was used in the oil tank to separate foreign matter during the passage of oil from the sump to the tank.

A magnetic filter is used in place of the fabric type on the 1956-57 engines. A metal gauze or strainer is fitted to the oil-feed pipe to prevent rag particles or pieces of fluff entering the feed side of the oiling system.

Cleaning the Filter

After engine overhauls, and after the first 500 miles the oil should be changed and the filter cleaned at the same time. Once the interior of the engine is clean, it is not essential to clean the filter at frequent intervals, in which case the mileage for the next cleaning should be between 5,000 and 6,000 miles.

After draining the oil tank, the engine must be run for several minutes before oil is seen emerging from the spout in the oil tank. If this compartment is filled with oil its return will be accelerated.

PERIODICAL MAINTENANCE

DAILY. Inspect and check oil circulation.

WEEKLY. Check oil level in tank. Check tyre pressures.

EVERY 500 MILES. Check gearbox oil level, 1948-57 models. Check front chaincase oil level. Check the battery for electrolyte level (see instructions in battery lid) and avoid overfilling.

EVERY 1,000 MILES. Add 2 oz. grease to gearbox—models 1938-47. Top up oil-type gearbox if required. Grease rear chain (see List of Lubricants, page 165). Grease hub bearing lightly. Grease brake-expander lever. Grease steering-head bearings. Grease brake pedal. Oil moving parts, such as rear-stand bolts when fitted. Oil control cable revolving nipples. Oil brake-lever clevis pin. Oil control cable when nipples are fitted.

EVERY 5,000 MILES. Change engine oil. Clean oil-tank filter. Check steering-head bearings. Check push-rod adjustment.

EVERY 10,000 MILES. Have magneto and dynamo serviced by Lucas Service Depot

CHAPTER II

ENGINE OVERHAUL

THE information given in this chapter covers the complete dismantling, overhaul and reassembly of the engine. Certain changes have been made on engines produced since 1947, and for the benefit of the readers, these have been summarised in tabular form on pages 38 and 39.

If a complete engine overhaul is contemplated, and to ensure that the work can proceed smoothly and without delay, some thought should be given as to the equipment that is likely to be required. If workshop facilities are available no difficulty should be experienced if the dismantling and assembly are carried out methodically and without undue haste. Whilst it is only natural to endeavour to complete the work as quickly as possible, " rushing the job " can lead to disappointment and delay. Cleanliness in work is vital, the bench, tools and equipment must be free from road grit or abrasive.

A table of spanner sizes is given in Chapter IX and also a list of special tools. In addition, it is necessary to have a valve-spring compressor, plenty of clean rag, a clean paint-brush (to apply oil to engine parts), a petrol and oil squirt, grinding paste, jointing compound, i.e., " Wellseal " and a Spare Parts list. A metal tray made from perforated zinc is most useful to wash small parts, when immersed in paraffin.

DISMANTLING THE ENGINE

Start by following the instructions given for decarbonising the engine (see page 26), but leave the cylinder attached to the crankcase. Remove the battery. Place a tray under the chaincase to catch oil when the outer portion is removed.

Removing the Engine

The dynamo chain is endless and is removed, together with the engine sprocket, to be dealt with later.

Straighten the lock-washer, prise out the circlip from the nut for the dynamo sprocket, apply a spanner on the two flats

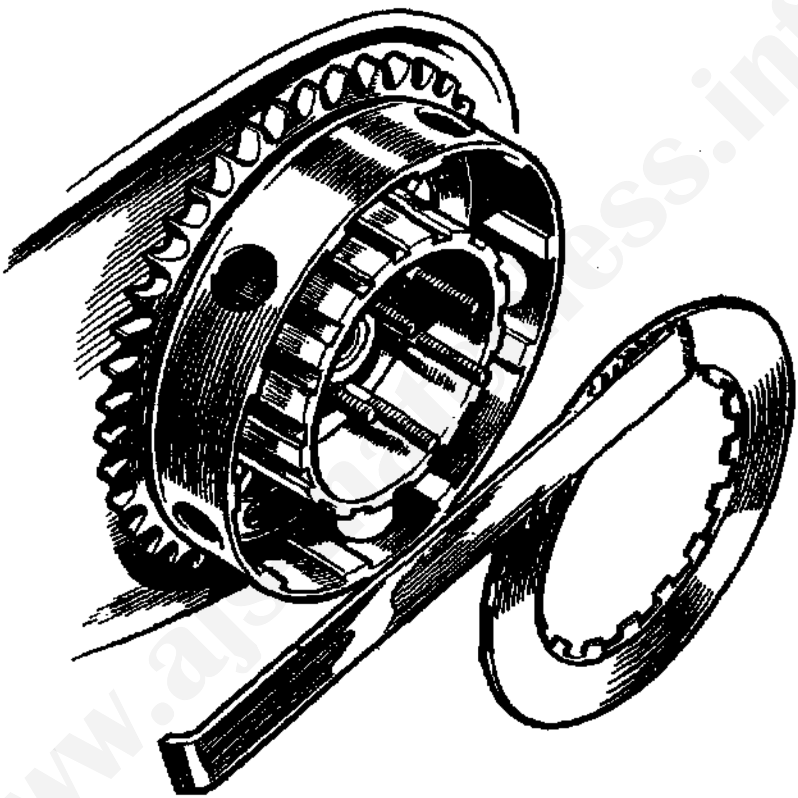


FIG. 8.—TOOL FOR CLUTCH-NUT REMOVAL.

machined on the back of the sprocket to prevent bending the armature shaft and unscrew the shaft nut, leave the sprocket in position.

Next, turn to the engine-shaft shock-absorber fixing nut, which can be difficult to unscrew. The hexagon for this nut is shallow, therefore the ring spanner must be a close fit, for if the hexagon is damaged it will be next to impossible to unscrew

ENGINE DESIGN CHANGES

1947 MODELS

(1) Improved type oil-pump plunger (two-start type) with new timing-side axle (identified by 2S stamped on plunger).
(2) Oil-feed passage in timing-side half crankcase increased to 9/32 in. diameter to prevent cavitation, with corresponding increase in diameter of the oil pipe, (3/8 in. diameter).
(3) A two piece oil pump guide pin 3/16 in. in diameter to prevent wear on the pin due to the increased plunger speed.
(4) Shorter connecting-rod (see " Technical Data ", page 178, for centres).
(5) The use of a long plain bush for the timing-side bearing; the small roller bearing is now obsolete. Engines fitted with the old-type bearing can use a modified bush with two external diameters. The steel sleeve is retained to locate the new bush on the large external diameter.

1948 MODELS

(1) Annular groove in pump plunger increased from 3/16 to ¼ in. diameter with suitable guide pin.
(2) Wire-wound pistons fitted to 500-c.c. models.
(3) 500-cc. type high crankcase used for 350-c.c. models after engine number 8000.
(4) 500-c.c. flywheels used for the 350-c.c. model.
(5) Larger brakes (7 in. diameter).

1949 MODELS

(1) New-type cylinder-head, with hair-pin valve springs with rocker box to suit.
(2) Valve lifter transferred from crankcase to rocker box.
(3) Wire-wound pistons for all models.
(4) Longer valves, hardened valve end caps discarded.
(5) New rockers for longer valves, also new valve guides.

1950 MODELS

(1) Alloy cylinder-heads and barrels used on Competition models only. Steel crankpin washer in place of bronze type.

1951 MODELS

(1) Alloy cylinder-heads used on both touring-type engines. Crankpin washers discarded, flywheels altered.

1952 MODELS

(1) Open-tray valve-spring seat, prongs for valve springs increased in length.
(3) Cylinder barrel lengthened 1/8 in. on 500-cc. touring engine, compression plate discarded.
(3) Recess for driving-side bearings in crankcase with two diameters, for close and easy interference fit to avoid " end loading " of these bearings.
(4) Top compression ring chrome-plated.

ENGINE DESIGN CHANGES—*continued*

1953 MODELS

No change.

1954 MODELS

(1) Oil feed in rocker box modified to increase oil supply to rocker end of inlet valve and stop valve-spring wear.
(2) New rockers for valve ends with groove in side for oil duct.
(3) High-lift cams.
(4) Larger-diameter timing-side shaft, with flywheel to suit,
(5) Two-diameter timing-side bush, steel sleeve discarded.
(6) Automatic ignition control on 500-c.c. model.

1955 MODELS

(1) New crankcase to use one small and one large driving-side bearing.
(2) New driving-side flywheel (keyways at 180°).
(3) Circlip fitted to exhaust-valve guide.

1956 MODELS

(1) Cylinder-wall oil feed discontinued.
(2) Compression ratio increased to 7·5 for 350-c.c. models, 7·3 for 500-c.c. models.
(3) Oil-tank felt filter deleted and magnetic filter fitted in crank-case.

1957 MODELS

(1) Engine-shaft shock absorber discarded, shock absorber incorporated in the clutch assembly.
(2) A.M.C. gearbox on all models.
(3) Improved detachable rear-wheel design.
(4) Girling rear suspension units introduced.

it with a spanner. Turn the engine against compression, apply the spanner and give the free end a series of light blows with a hammer. Using leverage will only close up the shock-absorber spring. If the nut resists removal, engage top gear and press on the rear-brake pedal and try again. Loosen the nut and remove the clutch, by detaching the clutch-spring nuts, the springs and cups, then the pressure plate. Straighten the shaft-nut lock-washer, engage top gear or use the tool shown in Fig. 8, then unscrew the mainshaft nut. Take out the front-chain connecting Link, remove the chain and refit the link to avoid loss. Pull the clutch assembly away from the mainshaft and watch for twenty-four loose rollers in the clutch bearing.

Separate the dynamo sprocket from the armature with the tool shown in Fig. 9 placed between the back of the sprocket and the dynamo body. One or two light blows with a hammer, on the end of the spanner, will dislodge the sprocket. Take away the engine sprocket, shock absorber, dynamo chain and sprocket, take out also the distance piece behind the engine sprocket in case it becomes misplaced.

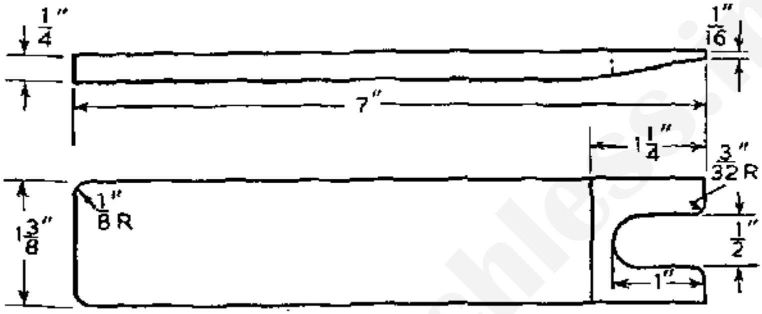


FIG. 9.—TOOL FOR REMOVING SPROCKETS FROM MAGNETO AND DYNAMO.

Remove the bolt connecting the battery strap attached to the rear portion of the chaincase. Straighten the three tab-washers and unscrew the three bolts fixing the chaincase to the engine. These bolts are an " odd " size—0·321 in. across the flats. Take off the nut on the central chaincase bolt and identify the distance piece under the nut. If the engine number is after 8000 tap out the chaincase bolt and identify the distance piece on it. The rear portion of the chaincase can be removed.

Drain the oil tank, take off the magneto chain cover, the two magneto sprockets and chain (see details on " ignition setting ", page 32). Remove the screws fixing the timing cover to the crankcase and tap off the cover. Identify location of these screws. Disconnect the magneto control cable, handlebar end.

Wheal the oil tank is empty remove the two oil pipes, tank and engine end. *When releasing the top oil-pipe union from the crankcase me extreme care to avoid the spanner jamming* *against the lower oil union, which can break away the union boss and ruin the crankcase beyond further use.*

Remove the magneto platform with the magneto on it, with the front engine plates. Disconnect the valve-lifter cable (early engines) also the rocker-box oil-feed pipe. Take out all bolts passing through the crankcase and frame and slack off the gearbox fixing bolts.

Grasping the cylinder, the engine can be lifted up to clear the rear engine plates and taken out of the frame. It may be necessary to spring outwards the front frame down tube a trifle to clear the crankcase.

Removing the Piston

After lifting the cylinder barrel and compression plate (if fitted), the piston is taken off by using special circlip pliers for compressing and removing one of the circlips. The gudgeon-pin is a sliding fit, which if difficult to extract may be due to a burr caused by the circlip groove. It is best to remove this burr with a pointed scraper, in preference to driving out the gudgeon-pin, to avoid distorting the piston.

Pistons of the wire-wound type are made to very close limits, and should be handled carefully.

Separating the Crankcase

First, clean off all traces of road grit and dirty oil from the bottom of the crankcase before it is placed on the bench, A wire brush is recommended for this purpose, with a paraffin wash to follow.

Any attempt to separate the crankcase before removing the oil-pump plunger will result in serious damage. Remove front and rear oil plunger end caps, together with the guide screw, which is shown in Fig, 10.

Next, unscrew the nut fixing the small timing pinion, which has a *left-hand thread.* The small pinion has a taper bote and needs a tool to remove it (Part No. B.2151).

Remove the bottom small crankcase bolt, if fitted, and then crankcase can be parted.

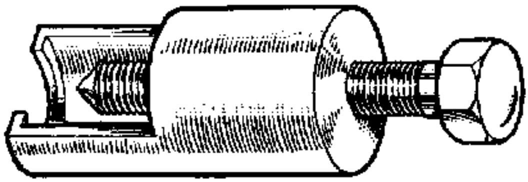


FIG. 10 *(above)*. — GUIDE SCREW FOR OIL-PUMP PLUNGER.

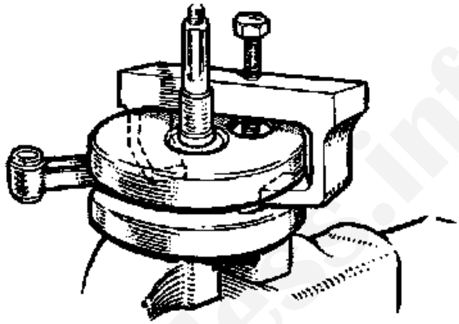


FIG. 11 *(right)*.—METHOD OF SEPARATING FLY-WHEELS.

Checking Big-end Assembly

Before testing for up-and-down movement between the connecting-rod and bearing, squirt paraffin or petrol through holes in the timing-side axle, preferably by placing on this shaft an old gudgeon-pin bush, to wash away oil in the assembly. Any slight movement will then be apparent The oil acts as a cushion, preventing play being detected. This is why big-end noise is not audible when the engine is cold. Connecting rod side play should be approximately 0·010 in.

Separating Flywheels

The centre shaft for the crankpin is slightly tapered and a force fit in the flywheels. An arbor press, or separating tool as shown in Fig. 11, is needed to part the flywheels when the crankpin nuts are removed.

Removing Main Bearings

On all engines made from 1938 to 1954 the two driving-side shaft bearings are identical in shape and size. Up to 1952 both bearings should be a close fit in the crankcase and a snug push fit on the shaft. From 1952, the bearing housing has two dissimilar diameters as described in " Flywheel End Float " (see page 23).

On all engines the crankcase should be uniformly heated to remove these bearings, with aid of a plain drift, 1¼ in. in diameter, with the crankcase supported on the inside with a piece of tube, not less than 2½ in. in diameter. The bearing spacing washers will come out with the bearings.

Removing Cam-wheel Bushes

These bushes are a press fit. Use a drift with a pilot 0·495 in. In diameter by ½ in. long (the handle is 9/16 in. in diameter and 4-6 in. long) to drive out the metal cup covering the cam-wheel bush, which is also a press fit. With the cover supported, drive out the cap with a 7/16 in. drift.

Removing Timing-side Bush

On engines fitted with a short bush and roller bearing, the bush is forced out from inside the case with a tube to support the case placed round the bearing box inside the timing gear. This tube should be 1½ in. outside diameter and 1¼ in. internal diameter. Where a double-diameter bush is used, obviously these are pressed out from inside the timing cover with the crankcase suitably supported on the inside.

Connecting-rod Service

This rod uses a detachable liner, replacements are made to a " spares " size to allow for contraction. Even so, correct

FIG. 12.—LAPPING TOOL.

concentricity cannot be guaranteed, as contraction varies with different rods. It is therefore recommended to send the rod to the factory for a service exchange, as the liners in this type of rod are ground after fitting. A new small-end bush, which is also ground, is fitted in addition to the new liner.

When it is not possible to have the rod exchanged a lapping process is necessary to ensure concentricity, by using a lapping tool, as shown in Fig. 12, obtainable from the makers (Part No. A8078). A mixture of paraffin and grinding paste is the lapping medium used.

For the best results the rod, after fitting the cage and rollers, should just go over the rollers, with no side rock in the rod. Selective assembly is used in the factory for new engines.

The lapping process is required only when the rod is stiff to rotate after fitting, or the rod will not pass over the rollers.

Removing Flywheel Shafts

Both shaft nuts are right-handed, the driving-side shaft is parallel and a force fit. On engines made up to 1954 the timing-side shaft uses a taper. Engines made after this date have a larger-diameter shaft, which is parallel in the flywheel. An arbor press should be used for removing these shafts.

Dismantling the Rocker Box

The general arrangement of the rocker-box assembly is shown in Fig. 13. Each rocker assembly is built up with an

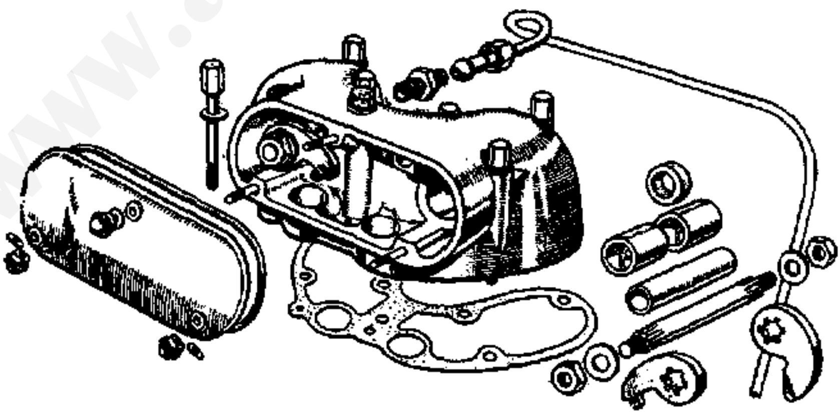


FIG. 13.—ARRANGEMENT OF ROCKER-BOX ASSEMBLY.

axle, bearing sleeve, two rocker arms and two fixing nuts and washers. The axle is a loose fit in the sleeve, which is intentional, as the axle is gripped on the sleeve when the fixing nuts are tightened.

To dismantle, remove the axle nut securing the valve rocker the axle with the push-rod rocker can then be withdrawn. The steel sleeve is then extracted, or it may come out with the axle.

It will be observed that a felt sealing ring is situated between both rocker bushes, which also acts as an oil distributor. This can be lifted out with a sharp-pointed tool. Rocker bushes can be tapped out with a drift 0·490 in. diameter.

Engine-nut Sizes

These details are provided to enable the operator to collect the necessary tools before starting work. Measurements shown are taken across the flats of the nuts and bolts, so that spanners can be checked by measurement.

Nut size, in.		Standard Whitworth spanner, in.	Spanner size across flats, in.
Engine and frame bolts	1/4	3/16	29/64
	5/16	1/4	17/32
	3/8	5/16	19/32
	7/16	3/8	45/64
	3/8	3/8	45/64
S A nut		9/16	1 1/64
Clutch nut (old type)		9/16	1
Clutch nut (late type)		3/4	1 3/16
Front chaincase retaining bolt		2 B.A.	21/64
Timing-pinion nut		3/8	45/64

Tappet-guide Removal

Both guides are a force fit in the crankcase. With engines made from 1938 up to 1948, the valve-lifter shaft must be extracted before the exhaust guide can be removed. A tool

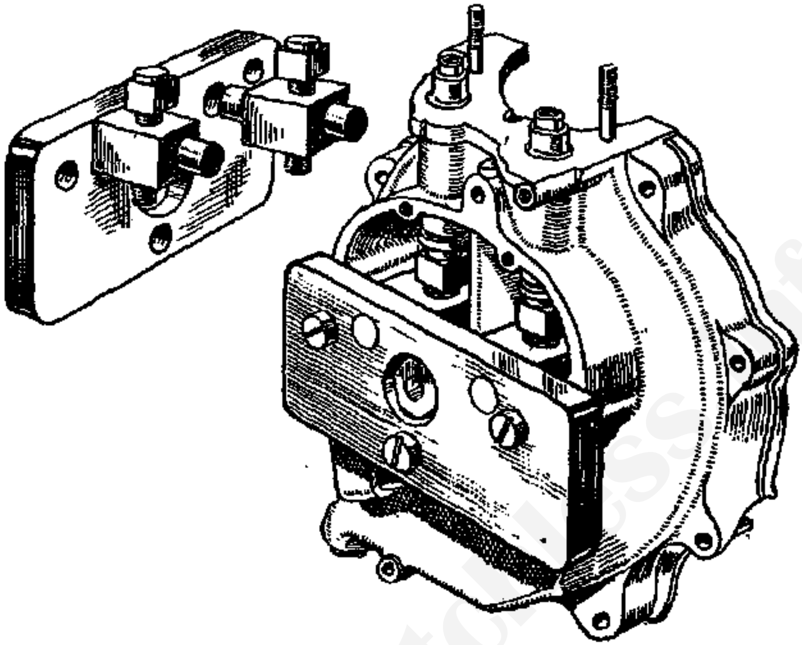


FIG. 14.—TAPPET-GUIDE REMOVING FIXTURE.

The fixture is screwed to the crankcase, the projections entering the camshaft bushes in the crankcase. By turing the squares with a spanner, the tappet guides are pressed upwards to remove them.

used for this purpose is shown in Fig. 14. Without the use of this tool the crankcase must be uniformly heated, then the guides with the tappets assembled can be driven upwards from inside the timing-gear chest It may also be necessary to heat the crankcase when the removal tool is used if these guides resist moving.

As these parts are not prone to wear, they should not be removed without good reason or unless wear or damage to the foot of the tappet has occurred (see " Cam Wear ", page 17). If modification is to be effected by fitting multi-groove guides the exhaust guide must be slotted as shown in Fig. 15 for valve-lifter operation on engines made before 9310 (350-c.c.) and 8765 (500-c.c).

To dismantle the guide, use a screwdriver to expand the collar clear of the tappet groove, when the tappet can be pushed out.

Before removal note the position of these guides in the crankcase, so that the replacements are made in the same location.

Replacing Flywheel Shafts

In the event of fitting new shafts, extreme care must be exercised in correctly locating the timing-side shaft, otherwise the valve timing will be affected. Incorrect location may also cause damage to the oil pump and worm on the timing-side axle, by partial or total restriction of the oil feed to the big-end, due to the oil hole in the shaft and the flywheel not being in complete register.

To ensure correct location if the locating tool as shown in Fig. 16 is not available, draw a pencil line on the taper of the shaft passing through the centre of the oil hole drilled in the shaft. Offer up the shaft so that the pencil line registers exactly with the oil hole drilled in the flywheel. Press the shaft firmly home and then tap the pinion end of the shaft with a rawhide mallet or similar tool to drive the shaft home

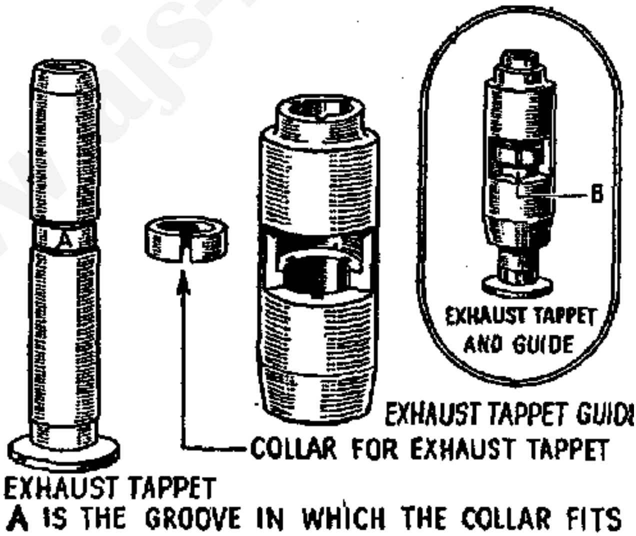


FIG. 15.—SHOWING POSITION OF SLOT IN TAPPET VALVE.

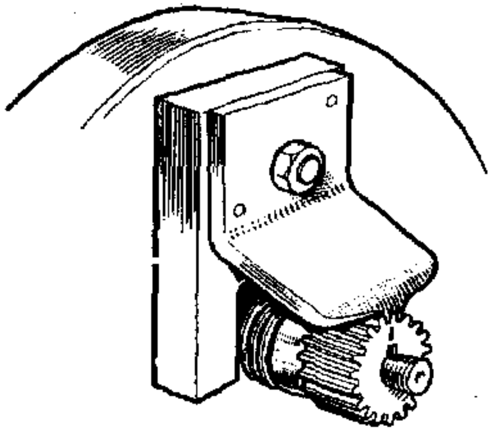


FIG. 16.—SHAFT-LOCATING FIXTURE.

on its taper to prevent it moving when the fixing nut is tightened. As a taper is used, do not use undue force in tightening the nut. On early-type engines, position the nut so that the lock-screw can be fitted.

REASSEMBLING THE ENGINE

Details in this chapter apply to all engines made from 1938 to 1958.

Flywheel Assembly

Assuming the flywheels have been completely dismantled, commence the assembly by first fitting the timing-side axle in correct location as previously described. Next, fit the driving-side axle and firmly tighten the fixing nut. Take up the crankpin, squirt oil through the hole drilled in the centre shaft, to ascertain that the oil drillings are free from obstruction.

Scribe a pencil line on the centre shaft passing through the oil hole, insert the crankpin and washer if fitted in the timing-side flywheel, when the shaft can be pressed into the flywheel against the face on the centre sleeve. Place on the crankpin the roller cage, fit thirty rollers in the cage slots, apply clean oil, place the other crankpin washer (if fitted) over the crankpin. Offer up the driving-side flywheel and roughly align both flywheels with a straight-edge or steel rule.

To rely on the shaft-nut pressure is unsatisfactory, for unless both wheels are pressed firmly against each shoulder of the centre sleeve for rigidity the flywheels will flex under load, which in time will result in a fracture of the crankpin centre shaft.

Therefore, the use of an arbor press is essential for this work.

As the centre shaft is movable, the crankpin nuts should be run down evenly, otherwise the centre shaft will be pulled through the sleeve during the process of tightening the crank-pin nuts.

In factory service a torque spanner set to 190 ft.lb. (220

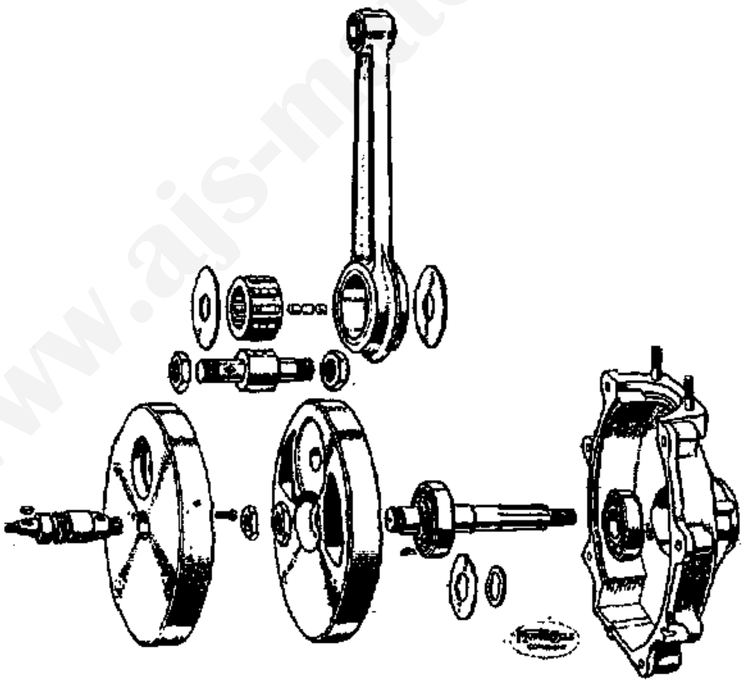


FIG. 17(*a*).—FLYWHEEL ASSEMBLY—1945/54 MODELS.

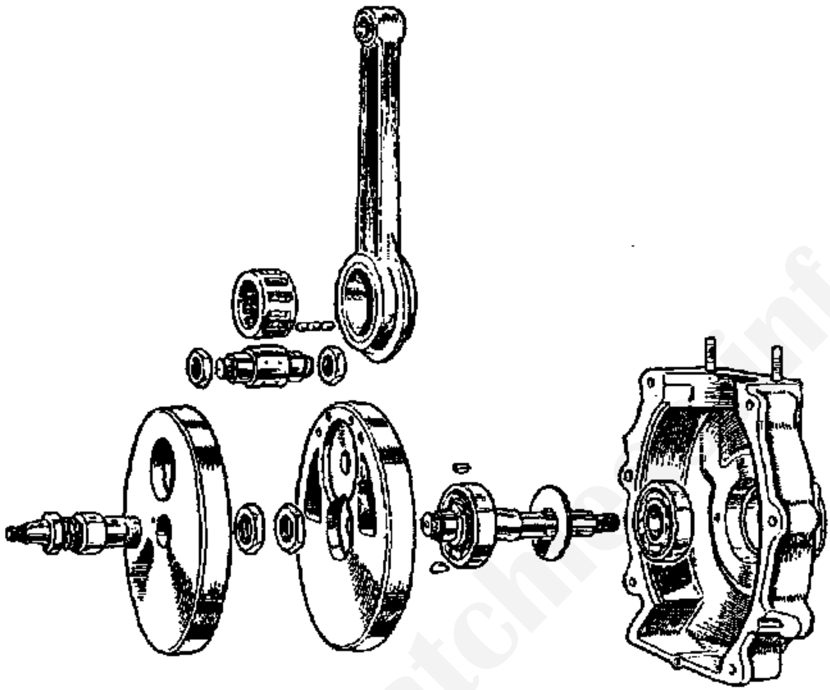


FIG. 17(*b*).—FLVWHEEL ASSEMBLY—1955-57.

ft.lb. for special Scrambles models) is used to tighten both crankpin nuts.

A further check of the oil passages should be effected as described in " Choked Big-end Feed " (see page 14). After finally tightening both crankpin nuts, flywheels are set to run true with a maximum error of 0·001-0·002 in. checked between centres with a gauge on the shafts as close to the flywheel face as possible, to record the maximum error.

Crankcase Assembly

When fitting a new timing-side axle bush the chamfered end of the bush is inserted in the crankcase to facilitate entry and location. Although the finished bore size is made for replacements, contractions on this bush will occur when in position, dependent on the interference fit of this bush in the crankcase. The bush must therefore be reamed to size (see

"Technical Data", pages 181 and 182), as insufficient clearance between the bush and its shaft will result in a seizure.

In production, this bush is " fine bored " on a special machine designed for the purpose.

Insufficient flywheel end-float can cause a " thumping noise " under load with the risk of a seizure.

Refitting Driving-side Bearings

Uniformly heat the crankcase half to facilitate assembly. The position of bearing spacing washers is shown in Fig. 17, A pilot drift is shown in Fig. 18, which will centralise the spacing washers whilst the outer bearing is pressed home. See details on " Flywheel End-float " to avoid end loading bearings when in position. 1955-57 engines use one spacing washer between the bearings.

Refitting Camshaft Bushes

The four bushes used have a chamfer on one end, and must be pushed in with the chamfered end first. The bush for the cam wheel which drives the magneto in the timing cover has a spiral groove machined at one end, to stop oil pumping into the magneto chaincase cover. This bush must be fitted with the oil groove on *the outer end of the bush,* nearest the magneto drive sprocket. Bushes will need reaming after fitting (see " Technical Data " for size). These bushes are identical on all models.

To ensure correct alignment, firmly fix the timing cover to the crankcase and use a pilot reamer as shown in Fig. 19. After reaming, camshafts can be fitted to test for free movement and also for end-float; this should be nil.

Refitting Tappets and Guides

This operation should be carried out when the crankcase is bolted together for rigidity. The tappets inserted in the guides are driven downwards from the crankcase face until the large diameter of the guide is flush with the crankcase.

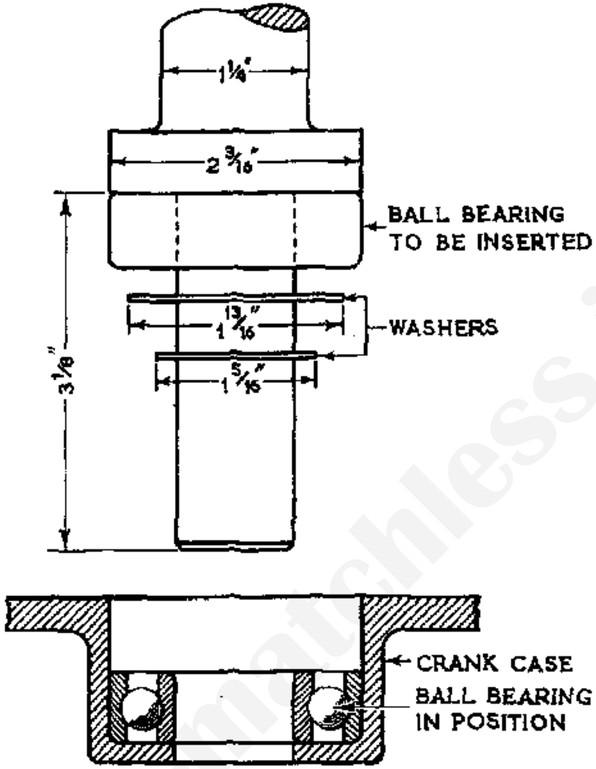


FIG. 18.—PILOT DRIFT FOB BEARINGS.

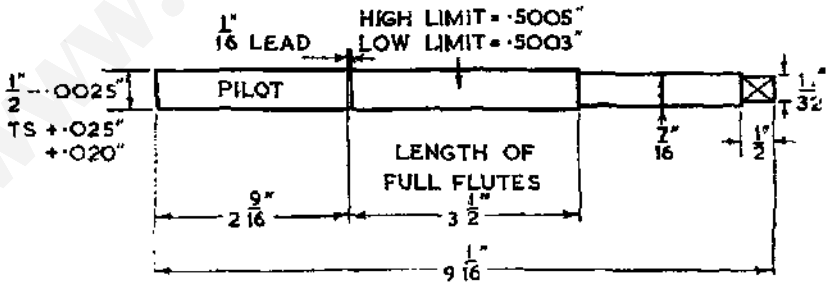


FIG. 19.—DIMENSIONS OF PILOT REAMER USED IN REFITTING CAMSHAFT BUSHES.

Reassembling the Crankcase

Apply some clean oil on the bearings in the crankcase. Locate the bearing separating washers, fit the driving-side on to the flywheels and press the case home. Invert the flywheels, apply jointing compound on the crankcase face, if " Wellseal " is used allow the compound to become " tacky " before fitting the other portion of the crankcase. Put at least three bolts through the crankcase temporarily, including the small one at the bottom.

See that both crankcase halves are in register on the face for the cylinder before the bolts are tightened, to ensure an oil-tight joint. Fit the piston with care, to locate the circlip, with the split in the skirt facing the front. Space the piston-ring slot at 120° to each other. Take up the cylinder, stick a paper washer on to the cylinder base, wipe the bore with a piece of fluff-proof rag and oil the piston. Raise the piston and put a piece of clean rag under it, in case a piston ring breaks when fitting the cylinder. Carefully fit the cylinder, closing in the rings with one hand until the piston has entered the barrel. Take away the rag from under the piston and lower the barrel on to the crankcase. Screw down the base nuts diagonally and tighten firmly.

Fit the small timing pinion and nut *{left-hand thread).* Overtightening this nut can split the pinion. Fit the cam wheels as already described. Copiously oil the oil-pump plunger and move the plunger to and fro whilst the guide pin is fitted to *ensure the pin is located in the plunger groove.* Apply a little jointing compound on the pump end caps before fitting. Take out the bolts temporarily fitted through the crankcase, put some clean rag over the cylinder and get the frame parts cleaned. Then refit the engine back into the frame.

Refit the parts removed in the reverse order described for dismantling, not forgetting to refill the oil tank when the oil pipes are replaced.

Fitting Special Camshafts

Both the high-lift and racing-type camshafts can be fitted to all types of engines. On early type engines the boss surrounding the timing-side bush must be machined to provide clearance for the higher lift of these camshafts. If the engine is dismantled this is an opportune time to deal with the crankcase and check these shafts in position as described in " Refitting Camshaft Bushes " (see page 51).

Engines fitted with a valve lifter in the crankcase will need an alteration to the valve-lifter shaft, by grinding the flat which makes contact with the split collar on the exhaust tappet, see Fig. 47. Omission to do this will result in the exhaust tappet being held off the base circle of the cam, causing incorrect valve clearance and valve timing.

The valve motion must also be checked when these cams are used, particularly on engines made before 1954. For details on checking see " Wear on Camshafts " (page 17).

Types of Special Camshafts

High-lift cams are marked with the letters HL etched on one side of the cam flanks, and are designed to increase the volumetric efficiency of the touring models.

Racing camshafts are marked SH, and are designed for a straight-through exhaust-pipe system. There will be a loss of power if these cams are used on a machine fitted with a silencer.

For valve timing see details on Scrambles models (Chapter VII).

To obtain the full benefit of these camshafts, a slightly larger bore carburetter is recommended, namely 1 1/16 in. for the 350-cc. and 1 5/32 in. for the 500-c.c. models.

Increasing Compression Ratio

Now high-octane fuels are available the compression ratio on models made before 1956 can be increased to 7·5 for the 350-c.c. and 7·3 for the 500-c.c, model.

It will be noted in the table of modifications that the compression plate on the 500-c.c. model was discarded for the 1952 season. Therefore a new piston of the 1956 type must be used to raise the compression ratio on this model.

On similar models made before 1952 the compression plate can be discarded, providing the ridge formed in the cylinder barrel at the end of piston-ring travel is also removed. Otherwise the top piston ring will break by contact with the ridge.

The 350-c.c. civilian models do not use a compression plate; therefore a new piston to give the above ratio is needed. No alteration in ignition timing or carburetter is necessary after this alteration,

A special type of piston is used on Scrambles models to give a ratio of 9·5 for the 350-c.c. and 8·3 for the 500-c.c., these ratios are not recommended for touring models.

For continued fast driving, a sparking-plug with a higher heat factor is beneficial, such as the K.L.G. FE.100 or FE.220 for engines with alloy head or K.L.G. F.100 or F.220 for engines with iron heads.

CARBURETTERS (1945 ONWARDS)

In view of the numerous types fitted since 1945, a table of types used, compiled from the carburetter makers' records are so that rectification as to whether the correct type of carburetter is in use.

350-c.c. MODELS

Year.	Type.	Bore size, in.	Slide.	Needle position.	Main jet.
1946-50	76 DIJ	1	6 x 4	2	150
I951-53	76 AE/IAK	1	6 x 4	2	150
1954	76 AV/IED	1	6 x 4	2	150
1955	376/5	1 1/16	376/060.3	3	210
1956-57	376/5	1 1/16	376/060.3½	central	210

500-cc. MODELS

1946-53	89 B/IAK		29 x 4	3	180
1954	89 N/IED	1 5/32	29 x 4	2	180
1955	389/1	1 5/32	389/060.3	3	260
1956-57	389/1	1 5/32	389/060.3½	central	260

Erratic Running at Slow Speeds

If the engine fails to run slowly, or idle, this is usually associated with the pilot jet. The trouble can also be due to distortion of the carburetter flange (see " Cleaning the Carburetter ", Chapter I).

On all carburetters fitted before 1954 a definite improvement in the slow running and control can be effected by making a slight alteration to the mixing chamber. Whilst this alteration is not difficult, the utmost caution must be exercised in the manipulation of the very small drill that is used. The equipment needed is a No. 66 drill (0·033 in.), a watchmaker's hand chuck or Eclipse pin vice No. 121.

Remove the carburetter and dismantle it completely, excluding the slide stop screw. With the drill firmly secured in the vice introduce the drill into the hole drilled diagonally in the mixing chamber leading into the inlet tract (pilot outlet), see Fig. 20, from the counter-bored end. Rotate the drill slowly with the vice held between finger and thumb, without using force. Withdraw the drill from time to time to clear metal from the flutes in the drill and continue drilling until the end of the drill emerges into the inlet tract. Remove the burr caused by the drill breaking through. Deal with the carburetter as previously recommended in " Decarbonising " (Chapter 1). It should now be possible to obtain full control over the pilot adjustment, as the volume of fuel (not the quality, affecting consumption) has been increased.

If everything is in order the pilot control screw should be 1½ to 2 turns open from fully closed position. It is most important to adjust the pilot air-control screw to obtain positive slow running as quickly as possible before the engine becomes unduly hot. If made with the engine unduly hot, the setting will be weak under running conditions.

The sparking-plug gap should be between 0·020 and 0·022 in. to ensure positive slow running. See " Technical Data " for settings for carburetter.

Heavy Petrol Consumption

Assuming the internal condition of the engine is normal and without loss of valve-spring pressure, the only part of the carburetter that can wear and affect consumption is the needle jet. If ovality in the needle aperture occurs the fact of

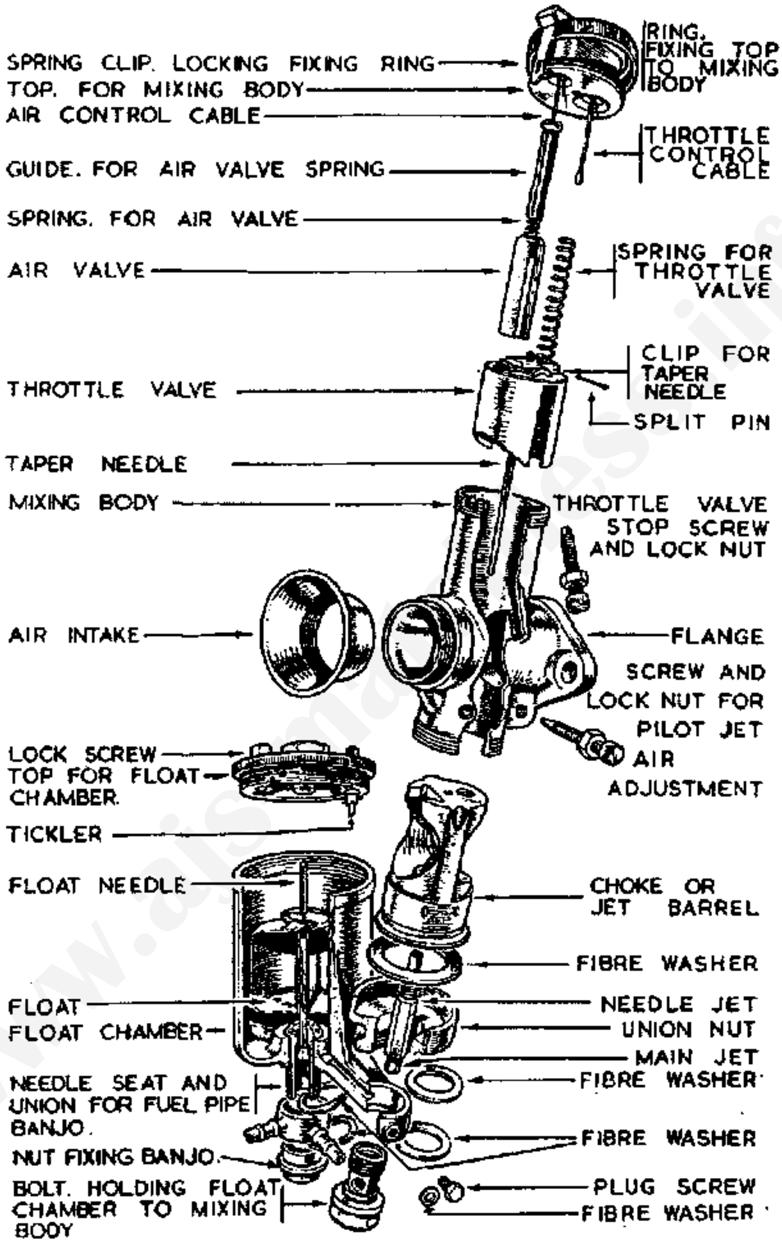


FIG. 20.—ARRANGEMENT OF CARBURETTER FITTED UP TO AND INCLUDING 1954.

lowering the taper needle will have no beneficial effect in reducing consumption.

A new needle jet should be used in the first instance, before investigating further. A punctured float will also cause excessive petrol consumption.

Throttle Slide

The meaning of the type or marking on the throttle slide is not generally known. On 350-c.c. models the normal slide is type 6 x 4. The first figure is the carburetter type and the second is the amount of cut-away from the bottom edge of the slide measured in 1/16 in., which in this case is ¼ in. The slide cut-away has an influence on the depression of the fuel supply between the pilot and needle setting, thus affording a means of tuning at this position of the throttle range. Consequently, the use of a slide with a larger cut-away weakens the mixture between the two positions previously described. Conversely, a slide with a smaller cut-away richens the mixture.

It is not unusual for owners to use a throttle slide with a smaller cut-away to overcome a flat or weak place after leaving the pilot-jet position. This must necessarily increase petrol consumption, and the remedy is to ensure the pilot setting is not unduly weak before a change of throttle slide is made. Should the cut-away be unnecessarily small, a surging effect will take place at road speeds of about 30-40 m.p.h. Throttle slides can be obtained with a variation in cut-away of 1/32 in. to provide finer adjustment.

It is therefore imperative that the slow-running (pilot adjustment) is correctly set before any other alteration to carburetter settings is contemplated.

Checking Petrol Consumption

It is difficult to assess the amount of fuel consumed over a known mileage, as by reason of the irregular shape of the petrol-tank base it is not possible to run the machine until all the fuel is consumed.

For accurate recording, the use of a small test tank, say to hold 1 pint, is a satisfactory medium for this purpose. Mount that tank in a convenient position and fill it with exactly 1 pint of fuel. Set the trip on the speedometer to " Zero " and drive the machine on " give and take " roads at 40 m.p.h. until the fuel is exhausted.

If, for example, the distance covered is 10 miles, then the fuel consumption is 80 m.p.g. If the slightest amount of fuel is spilt during filling, empty and refill so that exactly 1 pint is used for this test. This is essential if an accurate recording is to be made.

Locating the Taper Needle

The main jet size has been determined by the makers. No gain in fuel consumption will be achieved by reducing the main jet size, as this setting does not have any effect until the throttle is at least three-quarters open.

In consequence, tuning for a better fuel consumption is confined to the slide cut-away and needle position. The needle position affects performance and consumption only at road speeds round about the 50-m.p.h. mark. Raising the needle one notch at a time will improve acceleration. Generally speaking, fuel consumption is governed by the amount of throttle opening used.

Banging Noise in Silencer

This may be due to a weak pilot setting when the throttle is closed, or practically closed, or to a rich pilot setting with an air leak between the exhaust pipe and the port.

To rectify, reset the pilot as required and make the exhaust pipe a tight fit in the exhaust port by driving a taper wedge, shaped like a carrot, into the pipe at the port end to increase its diameter.

The Monobloc Carburetter

This carburetter was first introduced for the 1955 season, and incorporates such features as detachable pilot jet and a combined fuel and mixing chamber. The primary air choke has a compensating action, in conjunction with two bleed holes drilled in the needle jet, which serves the dual purpose of air—

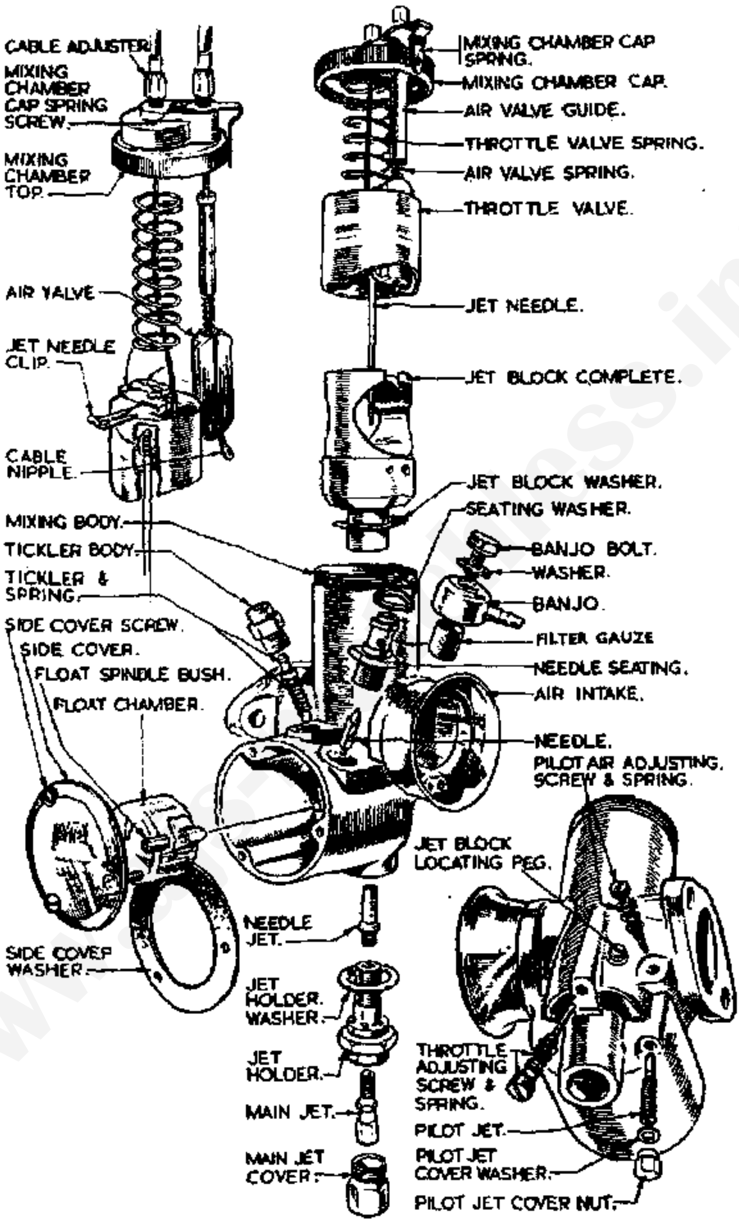


FIG. 21.—THE MONOBLOC CARBURETTER FITTED FROM 1955.

compensating the mixture from the needle jet and providing a well of fuel outside the needle jet for snap acceleration.

The sequence of tuning is similar to that of the earlier-type carburetters, and attention will be confined to cleaning out the float chamber, the filter or removing obstructed jets. The assembly details for Monobloc carburetters are shown in Fig. 21.

Removing the float

Take away three screws fixing the side cover and raise the float off its hinge pin. After cleaning the float chamber, shake the float; when held close to one ear it should be possible to hear fuel washing inside the float if it is punctured. It is preferable to replace the float instead of attempting to repair it. When replacing the float ensure that the narrow hinge leg is uppermost.

Removing the Float Needle

Take away the banjo bolt, washer and filter gauze, unscrew the needle seating and lift out the needle. Clean the needle point and also its seating. Handle the needle and gauze with care, as they are fragile. Do not attempt to grind this needle.

Removing the Pilot Jet

Remove the pilot-jet cover nut with the washer. The jet can be unscrewed with a screwdriver, when it can be checked for obstruction. Check also the pilot by-pass and pilot outlet.

When replacing the pilot jet do not use undue force in tightening, as this can deform the pilot-jet seat in the carburetter body and cause irreparable damage.

Jet-block Removal

Remove both air and throttle slides and the jet holder, complete with needle jet and main jet. Unscrew the throttle-slide adjusting screw to its full extent. The jet block can then be lifted upwards from the mixing chamber. Upon reassembly make sure the gasket at the base of jet block is undamaged, otherwise fuel will leak across its face, causing rich mixture and heavy petrol consumption.

When replacing the slider carefully locate the taper needle into the middle hole in the jet block.

Carburetter Adjustment

The main jet size has been determined by the makers, and further adjustment is confined to the needle location or pilot setting. It is imperative to ensure correct pilot-jet adjustment before any further alteration is made. First check those settings associated with positive slow running, i.e., plug gap, contact-breaker gap and valve-rocker adjustment.

Start by screwing home the pilot air-adjustment screw, then unscrew to one and a half turns. With machines fitted with manual ignition control retard the lever about 1/8 in.

Start the engine, open fully the air lever and run until the engine is warm. Set the throttle-adjusting screw, so that the engine runs too fast for an idling, or slow-running, speed with twist-grip closed.

Slowly unscrew the throttle-adjusting screw to reduce engine speed, when the engine will hesitate or falter. Screw in or out the pilot-adjusting screw until the engine runs evenly and slowly. If the engine speed increases unduly the pilot setting is too weak for normal use. In which case repeat the process, opening the throttle and closing sharply to establish that positive slow running occurs.

If the engine becomes unduly hot during this process a false setting will occur, as the slow running will cease when the machine is on the road and its temperature decreases. Therefore, endeavour to set the slow running before the engine becomes unduly hot.

Excessive Petrol Consumption

When it is known that the internal condition of the engine is normal, first ascertain that intermittent flooding is not the cause. Also check that the pilot jet is correctly seated. Try the effect of a new nylon needle and check the washer at the base of the jet block for deformation. If the machine has covered a considerable mileage replace the needle and needle jet. A smaller jet size is not advocated.

On 350-c.c. models made before 1956 using this type of

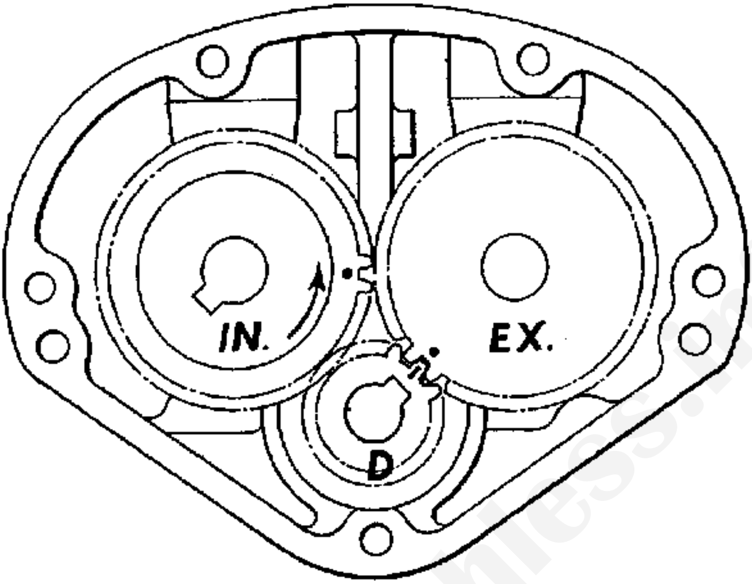


FIG. 22.—SETTING TIMING GEARS ON 1945-48 MODELS.

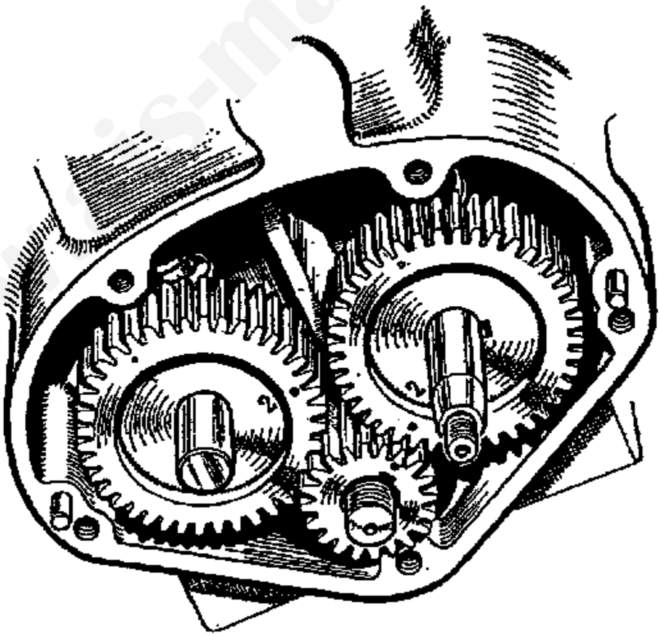


FIG 23.—VALVE-TIMING MARKINGS FOR 1949-51 ENGINES.

carburetter, try the effect of a slide with a larger cut-away (Size 3½), which should improve petrol" consumption by 9-13 m.p.g. at 40 m.p.h.

If at any time the jet block is replaced, ensure that the holes drilled in the mixing chamber are in complete register with the holes for the primary choke.

As a final resort, lower the taper needle to the extent of one notch only. Lowering the needle position unduly will impair acceleration.

VALVE TIMING

All types of cams as well as the timing pinion are marked during manufacture. Providing the timing-side shaft is correctly located, timing must be corrected if the maker's marks are used for assembling the cam gear.

As the method of cam marking has been altered since 1945 to avoid confusion, the year of manufacture and type of marking used are described below.

1945-48.—Cams are marked with a dot. The pinion has a line on the outside face midway in the keyway slot (see Fig. 22).

1949-51.—Cams are marked *one* and *two* for use on both Matchless and A.J.S. engines. Number *one* marks are for Matchless engines, number *two* for A.J.S. engines (see Fig. 23).

1952-53 (VALVE LIFT 0·326 in.).—Marking similar to 1950-51 models, with the exception of assembling, when number *two* marks are used for *both* Matchless and A.J.S. models inlet and exhaust. (Both models now have magneto in front of cylinder.)

1954-55 (VALVE LIFT 0·362 in.).—Cams are of the high-lift type (marked HL). Additional figure number *three* is used for setting inlet timing on the *350-c.c. model only.* Number *two* marks for the 350-c.c. exhaust and for both valves of the 500-c.c model (see Fig. 24).

1956-57 (VALVE LIFT 0·362 in.).—Number *three* used for the *350-c.c. inlet,* number *two* for the *500-c.c. inlet* and number *one* for the *350-c.c.* and *500-c.c. exhaust* (see Fig. 24).

Note.—The latest type camshafts do not use a keyed shaft

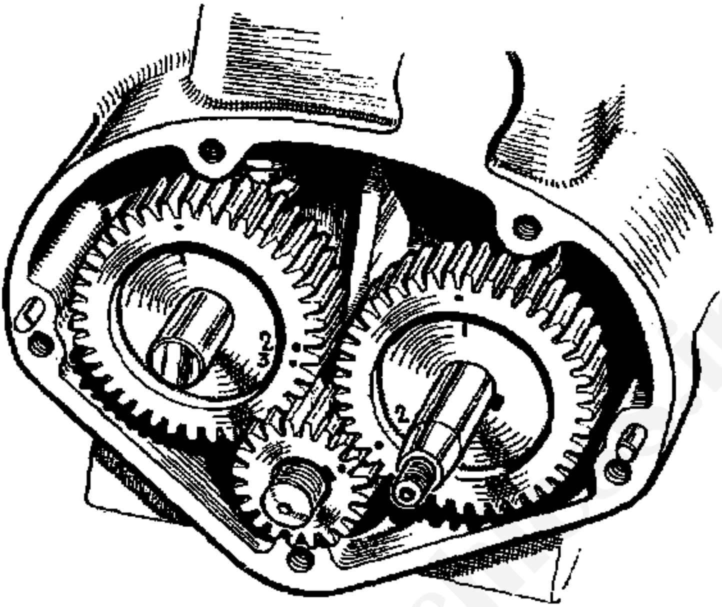


FIG. 24.—VALVE-TIMING MARKINGS FOR 1954-55 ENGINES.

to drive the magneto. If a keyway is not visible in the cam wheel use No. 1 mark for the exhaust-cam setting, before 1956-57.

Refitting Cams

The method of fitting the cams is the same for all marks. Proceed as follows:

(1) Turn the engine until the mark on the pinion points to the left of inlet-cam-wheel bush hole.

(2) Insert the inlet cam with its mark in mesh with the mark on the pinion.

(3) Turn the engine forward (about 20°) until the mark on the pinion now points to the exhaust-cam-wheel bush hole.

(4) Insert the exhaust cam with its mark in mesh with the mark on the pinion.

Do not neglect to apply oil to the camshafts before fitting. Also generously oil all pinion teeth.

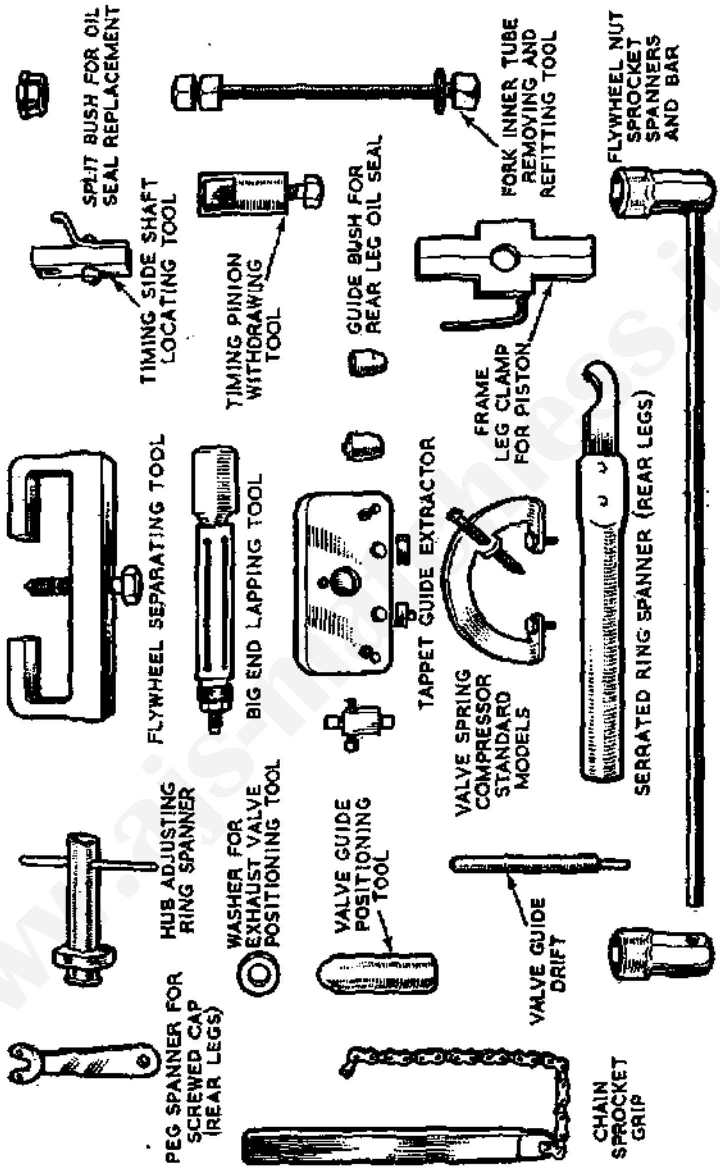


FIG. 25.—SERVICE TOOL KIT.

Checking Valve Timing

There is no useful purpose in deviating from the maker's markings. It should be remembered that any alteration is confined to one tooth on either the cam or pinion, which represents 18° on the engine stroke.

As quietening curves are used on touring and high-lift cams, a push-rod clearance of 0·016 in. is used for checking valve timing.

FITTING A LATER TYPE ENGINE

It often happens that owners have the opportunity to purchase an engine of more recent manufacture than the one originally fitted, and that some doubt exists as to whether engines will interchange.

Providing the earlier-type engine is of the O.H.V. type, a later-type engine should interchange, as the crankcase mountings are identical. Engines made before the mid-season of 1948 used the narrow-type crankcase, and it is a simple matter to alter the crankcase-to-the-frame distance pieces.

For the 1954 season the lower crankcase boss hole was increased from 5/16 to 3/8 in. in diameter. In this case, the two front frame holes must be enlarged accordingly if a crankcase of this type is to be used in an earlier frame.

To use a 1957-type engine in an earlier frame, the flywheel driving-side axle must be exchanged for an earlier type, as an engine shock absorber is not used on the 1957 models. For chain-line arrangement, the distance taken from the centre of the clutch-sprocket teeth to the crankcase centre line (crankcase joint) is 4 1/16 in.

CHAPTER III

TRANSMISSION

THIS chapter deals with maintenance and fault location. The gearboxes and clutch covered include the C.P. type (1945-51), B.52 type, and the A.M.C. 1957-type gearbox.

Chain Adjustment

Front-chain adjustment is effected by moving the gearbox. It must be emphasised that when this chain is adjusted the gearbox must be pulled back until the chain is tight and then moved forward until correct adjustment is reached. This is to prevent the gearbox moving and thus tightening the chain after adjustment.

Tightening Front Chain

To tighten the front chain proceed as follows:

(1) Remove the chaincase inspection cap.

(2) Slacken the top gearbox bolt on the right-hand side.

(3) Unscrew the *forward* nut on the gearbox-adjusting bolt three or four turns. Tighten the *rear* nut until the chain is just tight; this can be felt by inserting the index finger through the filler-cap orifice.

(4) Unscrew the *rear* nut three or four turns. Tighten the *forward* nut a trifle at a time, checking the chain tension after each movement of this nut until the chain whip is 3/8 in. As chains do not stretch evenly, the tension should be checked in more than one position,

(5) Retighten the rear nut on the chain adjuster.

(6) Retighten the top gearbox-bolt nut firmly.

(7) Replace the inspection cap.

Rear-chain Adjustment (1950-54 Models)

Wheel alignment is checked at the factory by adjusting the position of a small bolt screwed into the right-hand side of the swinging arm; the position of this bolt should not be altered.

The rear wheel is moved to adjust the rear chain fay turning the two cams, which move together, mounted on the rear-wheel spindle.

The adjustment is carried out as follows:

(1) With the machine on the centre stand, slacken the nut on the right-hand side of the speedometer gearbox.

(2) Slacken the nuts at the ends of the rear-wheel axle.

(3) Push the wheel forward so both cams are in contact with the projections on the swinging arm.

(4) Apply a spanner to the hexagonal body of the chain-side cam, turn the spanner until correct adjustment is obtained (1 1/8 in. whip in centre run of chain).

Rear-chain Adjustment (Detachable-wheel Models, 1955-57)

Slacken the wheel-spindle nut and the nut on the brake dummy spindle.

Slacken the two lock-nuts on the chain adjuster, then screw in the chain adjuster an equal amount until the correct chain whip is obtained, namely 1 1/8 in., in the centre of the bottom chain run.

Dynamo-chain Adjustment

The dynamo armature shaft is eccentric to the body of the dynamo. By partially revolving the dynamo in its housing, the distance between the two chain sprockets is varied to provide chain adjustment.

Tightening the Dynamo Chain

To tighten the dynamo chain:

(1) Remove the inspection cap from front chaincase.

(2) Slacken the dynamo clamp bolt (located between the engine plates).

(3) Apply a spanner to the flats cast on the left-hand side of the dynamo. Rotate the dynamo anti-clockwise

s ¼ in. whip, which can be felt by passing a
gh inspection-cap orifice. (Do not become
:h the adjacent front driving chain.)
en the dynamo clamp bolt and recheck the
n.
ce the inspection cap.

Ma Adjustment

Tplatform hinges on one of its fixing bolts to
enaistment to be made.

T magneto chain:

ve the magneto chaincase cover.
n the nuts on the bolts supporting the
tform.
a screwdriver inserted under the end of plat-
is slotted) lever upwards until the chain whip

en the nuts on the platform bolts and recheck
nsion.
grease to the magneto chain and replace

the adjustment in several places by rotating
s chains do not always stretch evenly.
tighten the axle-nuts, position the speedo-
ox and tighten the fixing nut, to avoid strain
cable.

Rejustment (Rigid-frame Models)

r-chain adjustment the rear wheel is bodily
mcar frame fork ends, which are slotted for the
pusting screws with lock-nuts are provided on
the of each slotted end.

to front-chain adjustment will affect the rear-
chat. Therefore, check the front chain before
adear chain. Altering the rear-wheel position
fortment will also affect adjusting of the rear
br

Rear-chain Lubrication

To lubricate the rear chain effectively, with a lasting effect, remove the chain and clean it in paraffin. Obtain a small quantity of anti-centrifuge grease (see " List of Recommended Lubricants ", page 165). Slowly heat the grease in a flat tin until it is fluid, immerse the chain, then reheat the grease, which will have cooled off when the chain was immersed, until the grease is again fluid.

Leave the chain to soak; wipe off the surplus grease, then refit the chain. After a few miles, the grease having been squeezed out of the links and rollers, it may be necessary to readjust the chain.

The time devoted to such process will be amply repaid, particularly during inclement weather, by prolonging the life of the chain.

GEARBOXES

Three types of gearboxes have been used on the single-cylinder models. Type C.P. was used for the 1945-51 seasons. Type B.52 for the 1952-56 and the A.M.C. gearbox for 1957. Prior to 1948, gearboxes are lubricated with light grease, After this year, engine oil is used for lubrication—normal content, 1 pint.

The B.52 gearbox is a great improvement over the early type, the foot-change operation is smooth, and can be improved further if all the operating parts used for gear selection are highly polished.

The CP. gearbox remained basically unaltered for several years, although it was superseded for 1952. This is no indication that it was unreliable or unsatisfactory.

GEARBOX FAULTS (CP. TYPE, 1945-51)

Gearbox Noise

A noisy third gear is usually associated with wear on the layshaft fixed pinion and possibly the main driving gear which

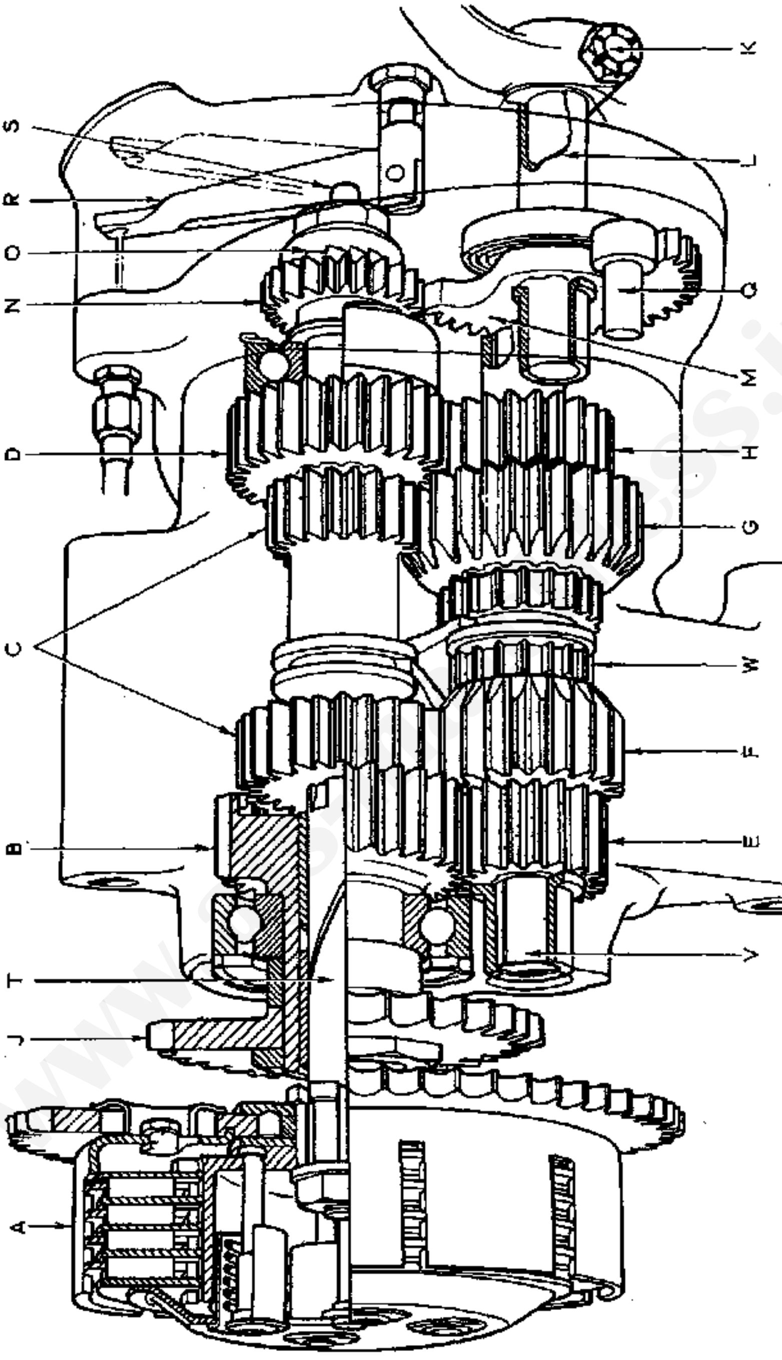


FIG. 26.—SECTIONAL VIEW OF TRANSMISSION SYSTEM—CP TYPE.

FOR KEY TO LETTERS, SEE PAGE 73.

KEY TO FIG. 26.

A. Clutch assembly.
B. Main gear-wheel.
C. Mainshaft sliding gear.
D. Mainshaft third gear.
E. Layshaft small gear.
F. Layshaft second gear.
G. Layshaft first gear.
H. Layshaft third gear.
J. Final-drive sprocket.
K. Kick-starter crank.
L. Kick-starter axle.
M. Kick-starter quadrant.
N. Kick-starter ratchet pinion.
O. Kick-starter ratchet driver.
Q. Kick-starter stop.
R. Clutch-operating lever.
S. Clutch thrust rod.
T. Gearbox mainshaft.
V. Layshaft.
W. Layshaft sliding dutch.

engages with the layshaft fixed pinion. Wear on the layshaft bushes can also create a similar noise.

Top Gear Disengages Under Load

Check the striker forks for wear. If these are in order the main driving-gear bush may have moved towards the kick-starter side of the gearbox, preventing full-tooth engagement of the gears.

To remedy, replace the bush and ensure that it is a good fit in the main driving gear. Two bushes are used for the main-shaft in this gear. A weak gear-indexing mechanism will have a similar effect.

Faulty Gear Selection

If this is present with more than one gear check the foot-change assembly, which is " timed ". Remove the foot-change pedal and take away the nuts securing the kick-starter case cover. Remove the foot-change assembly. The small pinion on the camshaft is marked with letter " O ". Using pliers, turn the shaft until letter " O " is at nine o'clock. Take out the foot-change mechanism for examination when it will be seen that the toothed sector which engages with the cam-shaft pinion and is also marked with a letter " O ". Fit the assembly with marks in register, then refit the kick-starter cover and the foot-change pedal. The gears should now be indexed correctly.

Should the trouble still prevail, take out the gears and examine the strike forks for wear.

Noisy Gear Engagement

This usually occurs when starting out, when first gear is engaged. Generally, the fault is due to torque on the gearbox mainshaft caused by clutch " drag ".

This can be proved by holding out the clutch, with the lever against the handlebar, and then depressing the kick-starter crank several times. If, after this operation, the gear engages without noise, clutch drag is the cause of the trouble. Clutch drag can be due to:

(1) Excessive lost motion in the clutch-operating mechanism.
(2) Gumminess of clutch friction plates, due to oil.
(3) Buckled steel clutch-driven plates.
(4) Clutch-spring pressure plate not running true.

To remedy (1) refer to clutch adjustment on page 89; (2) and (3) can be dealt with by dismantling the clutch and washing all parts in paraffin. Put the steel plates together and hold up to the light; distorted or buckled plates will be observed.

To check (4) remove the outer portion of the front chaincase, pull out the clutch lever on the handlebars, depress the kick-starter and observe if the pressure plate is running out of truth. Balancing the clutch-adjusting screws, within reasonable limits, should correct this fault.

Check also the rim of the pressure plate for uneven machining, Insufficient clutch-plate separation, due to wear on the operating mechanism, will also create clutch drag and noisy gear operation. Should the clutch suddenly fail to disengage, check the nut retaining the kick-starter ratchet pinion, and check the thrust stud in the clutch pressure plate. If these are not at fault check the clutch-hub retaining nut.

Should this trouble develop gradually, check the push-rod ball for wear, together with the operating lever in the kick-starter case.

Kick-starter Fails to Turn Engine or Jams

Check the quadrant on the kick-starter crank for damage to the first tooth. This tooth can be ground off to restore operation to normal, with slight loss of leverage.

A disintegrated stop rubber will have the same effect.

Kick-starter Fails to Operate

Remove the kick-starter cover and check the ratchet pinion and spring for security. The pinion may be sluggish on the mainshaft if the spring is in order.

Side Movement, or Rock, on Clutch Sprocket

This may be due to wear on the clutch hub rollers or bearing sleeve. If the bearing surfaces are in order reduce the overall width of the bearing sleeve on the gearbox mainshaft and fit new rollers.

Use an anti-centrifuge grease to lubricate the rollers before reassembly.

End-play on Gearbox Mainshaft

If the kick-starter-pinion retaining nut is tight the small bearing accommodating the mainshaft in the kick-starter case may be worn. The use of shim washers between this bearing and its housing will absorb slight movement.

Broken Teeth on Gears

If a gear has to be replaced for this reason, have the mainshaft and the layshaft checked between centres for bending before reassembling the gearbox.

These shafts can be straightened, between V-blocks, provided that the bow is within reasonable limits.

Clutch Rattle with Engine Idling

This is due to backlash between the tongues on the clutch friction plates and the slots for the clutch driver. This can be proved by pulling back the clutch lever on the handlebar, when the noise should cease.

To remedy, the metal or tongues on the friction plates can be drawn out. Place the tongues of the friction plates on a flat vice or block of steel and tap the tongues lightly with a light hammer to draw out the metal; thus reducing the clearance between the tongues and the slots in the clutch driver.

GEARBOX FAULTS (B.52 TYPE)

As the clutch arrangement on this type of gearbox is basically the same as the CP. type (excluding the withdrawal mechanism), refer to the instructions for this type-

Faulty Gear Selection

This is, invariably, due to the small plunger which engages with depressions in the cam barrel sticking or sluggish in its housing. Cleaning the outside diameter of the plunger with emery cloth is usually sufficient to restore the gear selection to normal. Check also the two steel pins in the selector shafts. Wear on these pins will cause bad indexing.

Top Gear Disengages Under Load

This is uncommon, but in some gearboxes the housing for the main bearing is machined too deeply. This causes only partial engagement between the main driving gear and the mainshaft sliding gear.

To create deeper dog engagement, a steel washer must be made to fit over the shaft between the main driving gear and the main bearing. The washer should be approximately 1/16 in. thick.

Evidence of shallow dog engagement can be seen on the two pinions concerned.

Gears Disengage Under Load

This fault is usually due to a weak V-shaped foot-change centralising spring mounted in the kick-starter case; stretch this spring slightly to increase pressure.

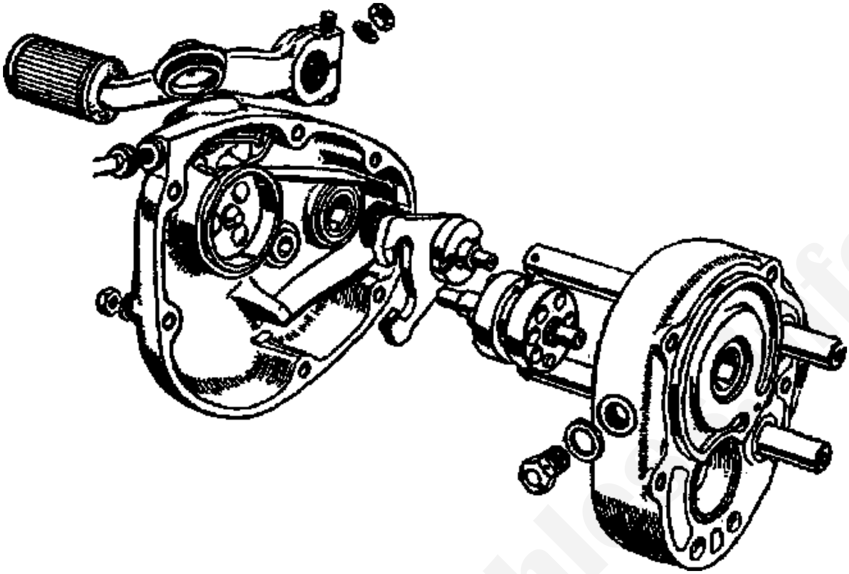


FIG. 27.—FOOT-CHANGE SPRINGS.

A weak foot-change quadrant coil spring will display the same symptoms. These springs are shown in Fig. 27.

Noisy Gear Selection

When a grating noise ensues as the first gear is engaged, check the clutch-withdrawal mechanism. To fully understand the working of the clutch-operating mechanism, a study of the arrangement shown in Fig. 28 should be made.

From this, it will be seen that any reduction in leverage brought about by shortening the clutch cable (unscrewing the cable adjuster) will reduce the movement of the clutch push rod. This usually creates a clicking noise when the handlebar lever is operated.

To remedy, run down the clutch-cable adjuster as far as it will go. Next, turn to the opposite side of the gearbox. Remove the chaincase outer portion or clutch cover, whichever is fitted. With a sparking-plug box key, release the nut locking the thrust cap or stud, mounted in the centre of the clutch-spring pressure plate. Place a screwdriver in the thrust-stud slot, screw in the stud exactly half a turn and

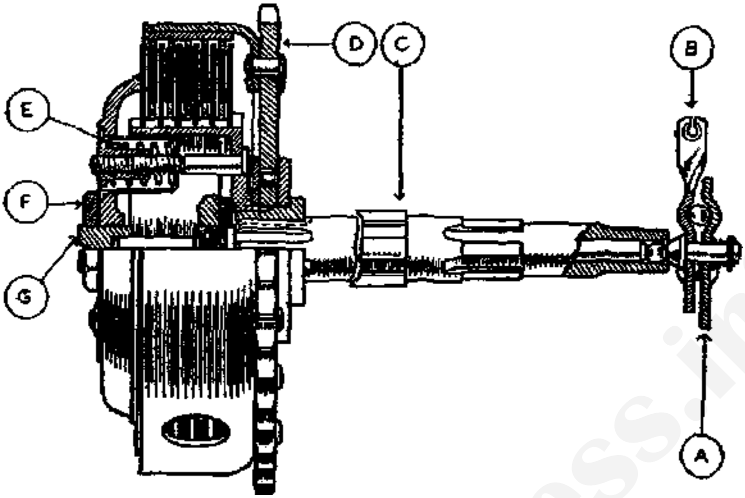


FIG. 28.—CLUTCH-OPERATING MECHANISM—B.52 TYPE.

A. Fixed actuating plate.
B. Operating lever.
C. Mainshaft.
D. Clutch sprocket.
E. Clutch spring.
F. Lock-nut for thrust cup.
G. Thrust cap (in pressure plate).

retighten the lock-nut, taking care that the stud does not move during this process.

Now, go back to the clutch-cable adjuster, and unscrew until there is 1/8-3/16 in. free movement in the outer casing for the clutch cable. Retighten the cable-adjuster lock-nut

Should the trouble still prevail, check for " clutch drag " as described for the C.P.-type gearbox (see page 89).

Clutch Rattle

The details given for the C.P. type clutch are applicable also to this clutch.

Foot-change Lever Sticks

The most likely cause of this defect is friction between the foot-change shaft and its bearing in the kick-starter-case cover. First try the effect of squirting a little paraffin, or penetrating oil, around the shaft, and lean the machine over to the left to assist oil penetration.

If this does not effect a cure take off the kick-starter-case cover, ease down the shaft with emery cloth, oil and refit.

It should be noted that a weak centralising spring can have the same effect.

Kick-starter Crank Sticks after Use

Release the screws fixing the kick-starter-case cover; operate the kick-starter crank. If the crank does not return to its normal position the return spring is probably broken, see " Dismantling Gearbox " (page 86).

If the kick-starter returns, with the cover screws loose, it is quite possible that the kick-starter axle bearings, in the case and the cover- are not in line, due to movement of the cover.

To correct, lightly tighten the cover-fixing screws, then with a mallet tap the cover upwards from underneath. Re-tighten the cover-fixing screws firmly, but do not overtighten; the crank should then operate normally.

A formation of rust on the kick-starter axle will have the same effect.

Note that it is dangerous to drive with the kick-starter trailing or with the quadrant in engagement with the ratchet pinion. The ratchet pinion will seize on the mainshaft if the machine is used in this condition for any length of time.

Oil Leakage from Gearbox, Driving Side

The Super oil seal fitted to the gearbox shell will be satisfactory until the machine has covered a considerable mileage. To determine where the oil leakage takes place, wash the gear-box shell with petrol and check that the oil level is correct by draining and refilling with exactly 1 pint of oil (SAE 50). Make a short road test, stop the machine and check the gear-box shell exterior for the position of the oil leakage.

This can take place from the two metal plugs sealing the shaft holes or from the main bearing. Should the leaks come from the two metal plugs, wash again with petrol and apply jointing compound copiously around the plugs. Leave the machine stationary until the jointing compound has " set ".

In the case of leakage from the main bearing, the oil seal must be replaced.

Oil Leakage from Kick-starter-case Cover

This is usually due to a broken or deformed gasket, fitted between the case and cover. A new gasket fitted to the case with jointing compound will have the desired effect.

DISMANTLING AND REASSEMBLING THE CP. TYPE GEARBOX IN THE FRAME

A stout box key or ring spanner is required for the large nut securing the gearbox sprocket and the nut securing the clutch hub to the mainshaft. These nuts are 2 1/16 in. and 1 5/16 in. across the flats respectively. New gaskets for the kick-starter case and cover and a new oil seal for the main driving gear will be required.

Removing Exhaust Pipe, Silencer and Chaincase

Remove together the exhaust pipe and silencer in one piece. Do not unduly rock the exhaust pipe sideways in the port, apply a little paraffin if difficult to extract. Remove the nut on the left-hand side footrest rod and also, on machines where the footrest is inside the frame, the nut for the centre stand spindle, together with the lower front-frame uniting bolt. The footrest can now be moved forward.

Place a tray to catch oil when the outer portion of the chain-case is taken away, with the rubber band, if fitted, between the chaincase halves. Fully open the throttle, turn the engine against compression. Using a suitable ring spanner on the engine-shock-absorber fixing nut, apply a series of light blows on the end of the spanner with a light hammer, in preference to a levering motion, when the nut will release. Disconnect front chain. Take away the clutch-adjusting screws, springs, cups and pressure plate. Turn back the tab-washer behind clutch-hub fixing nut.

Removing Clutch Assembly

Engage top gear, press hard on the rear-brake pedal and unscrew the hub nut. Place one hand on the back of the clutch assembly and the other against the washer covering the clutch rollers. Then, the complete assembly will come away without losing the rollers (twenty-four in number). Remove the long hexagon bolt uniting the rear chainguard to the back portion of the chaincase. After turning back the tab-washer unscrew three bolts (5/16 in. A/F) retaining the chaincase to the crankcase, and also the nut on the bolt in the centre of the case, which can now be removed.

Dismantling

Work on the gearbox can now commence by removing the drain plug in the bottom of the gearbox shell and catching the oil drained in a suitable receptacle.

Remove:

(1) The clutch cable.

(2) The four nuts fixing kick-starter-case cover and withdraw, leaving the kick-starter crank and-foot-change pedal in position. Fit a rubber band between the kick-starter crank and foot-change pedal *to* prevent the kick-starter spring unwinding.

(3) The clutch lever in the kick-starter-case cover, also the short push rod. Watch for the ¼ in. steel ball used between the short and long push rods.

(4) The kick-starter pinion nut; pull off the pinion and spring.

(5) The four nuts fixing the kick-starter case to the gearbox shell.

(6) The kick-starter case. Watch for the twelve rollers on the camshaft.

(7) The slotted bolt at bottom of the gearbox shell, with its spring, which operates the pawl.

(8) The whole of the gears and layshaft, except the main driving gear, with camshafts.

(9) The rear chain. The mainshaft can now be withdrawn from the clutch end of the gearbox. Using a chain bar, which is simple to make (Fig. 29), with a short length of 5/8 in. x 3/8 in. chain attached, drape the chain round the sprocket, with the bar propped against the frame. Should it be inconvenient to make a tool of this kind, leave the chain attached and apply pressure on the brake pedal to release the sprocket-fixing nut after turning

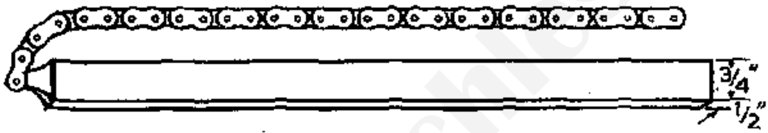


FIG. 29.—CHAIN BAR.

up the tab-washer. This nut is usually very tight, which is intentional, and for this reason the use of a chain bar is desirable.

(10) The sprocket spacing collars; recording the position in which they are fitted.

(11) The main driving gear; which can be tapped into the gearbox shell.

(12) The main bearing; after extracting the circlip, washer and oil seal.

(13) The mainshaft ball bearing in the kick-starter case, which is also retained by a circlip.

The gearbox is now completely dismantled, with the exception of the layshaft bushes. These bushes, a force fit in both the gearbox shell and kick-starter case, are made from self-lubricating bronze and are somewhat brittle, so care should be taken when new bushes which do not require reaming for size are fitted.

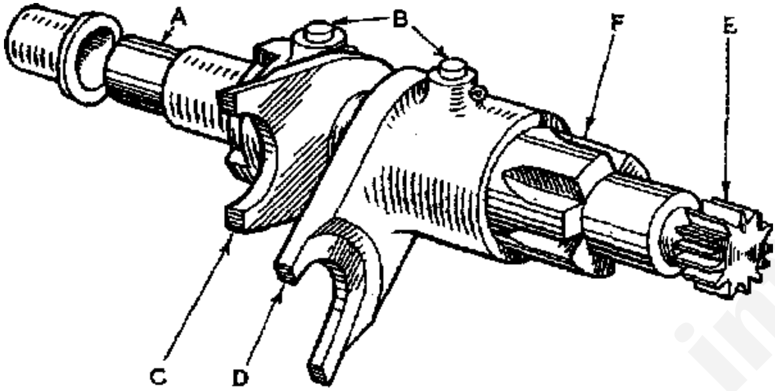


FIG. 30.—CAMSHAFT ASSEMBLY.

A. Camshaft,
B. Pegs for forks.
C. Mainshaft fork
D. Layshaft fork.
E. Pinion
F. Locking-pawl groove.

Extracting Bushes

To extract the layshaft bush in the gearbox shell, tap out the steel " glut " or disc, then the bush can be pressed into the interior "of the gearbox shell. The bush in the kick-starter case can be pushed out by supporting the case with tubing or a box key of suitable size.

There is very little load, or turning movement, on the camshaft bush in the gearbox shell. To remove, use the method described for extracting the layshaft in the shell. Details of the camshaft assembly are shown in Fig. 30.

Two inexpensive self-lubricating bushes are fitted in the main gear pinion. Insert the mainshaft and check for wear. These bushes are a force fit and can be pressed out without difficulty. They must be a tight fit in the pinion, for a loose bush will affect top-gear engagement. The pinion on the layshaft which engages with the main gear should also be a tight fit on the splines for the layshaft. If the shaft is chipped, or a pinion loose, fit replacements. Carefully examine the striker forks on the camshaft for wear, as a badly worn fork can allow two gears to engage simultaneously, with disastrous results.

Reassembling Gearbox

Wash and oil all parts before reassembly.
Replace in the following order:

(1) The main driving bearing, oil seal, retaining washers and circlip.

(2) The main gear, with spacing collars, washers, chain sprocket and tab washer, with fixing nut. Apply chain bar firmly, tighten the sprocket nut and turn down the tab-washer.

(3) The mainshaft; through main gear.

(4) The gears on the layshaft in the order shown in Fig. 31. The fixed pinion is fitted to the short end of the layshaft.

(5) Hold the layshaft assembly in hand, with the fixed pinion on the left. Take up the camshaft (small pinion to the right), and engage the larger of the two striker forks in the groove for the sliding clutch.

(6) Hold the mainshaft sliding gear, large pinion to the left, along the camshaft assembly, so that the smaller striker fork engages with its central groove.

(7) Insert the entire assembly into the gearbox shell, sliding the mainshaft gear along the mainshaft, and push home, locating the camshaft and layshaft into the respective bushes.

(8) Slide the remaining free pinion on the mainshaft.

(9) Pawl, spring and slotted screw, locating gears.

(10) The twelve rollers, with grease to hold in position.

(11) The mainshaft ball bearing for kick-starter case; locate with circlip.

(12) Paper washer for gearbox shell, with grease applied on gearbox face.

(13) The kick-starter case. Ensure that the rollers enter the housing in the kick-starter case. Fit the four case nuts and firmly tighten.

(14) The ratchet pinion bush and spring on mainshaft ratchet pinion (teeth outwards). Follow with the ratchet driver and fully tighten the fixing nut.

(15) The paper washer for the kick starter case, with grease on face of case, carefully passing the washer over studs to avoid damage.

Replacing Foot-change Assembly

Particular care is needed for this operation to ensure that the gears are correctly indexed. The small pinion on the camshaft is marked with a letter " O ". The sector engaging with the pinion is marked likewise. Proceed as follows:

(1) Turn the camshaft til! the " O " is at nine o'clock.

(2) Fit the sector, with the " O " stamped on it, to mesh with " O " on the small pinion.

(3) Apply graphite grease on the length, and both ends of the long push rod and insert it into the mainshaft from the clutch end with 2 in. protruding.

(4) From the kick-starter end of the mainshaft insert the ¼ in. steel ball, short push rod, with the slot nearly vertical.

(5) Take up the spring box. See that the springs are not broken and that the four small steel plates are in position.

(6) Place the metal cover on the spring box and fit the quadrant with its peg engaged between the two small springs.

(7) Fit the rocking pawl. The complete assembly can now be inserted in the kick-starter case, locating the peg in case between the two large springs.

(8) Place the gasket in position. Put back the case cover, after discarding the rubber band, holding the kick-starter crank in its normal position, then push the cover firmly home. If the cover does not go fully home this may be due to the rocking pawl being out of position (work the gear pedal up and down) or the slot in the short push rod engaging with the clutch-operating lever.

(9} Fit the gear-change indicator and the clutch cable.

(10) Fill the gearbox with 1 pint of engine oil SAE 50.

(11) Reassemble the clutch in the reverse order.

DISMANTLING AND REASSEMBLING THE B.52 TYPE GEARBOX IN THE FRAME

The general arrangement shown in Fig. 31 illustrates the internal gearbox lay-out, together with the foot-change mechanism and the kick-starter.

Removing the Kick-starter-case Cover

To inspect the gear-change, clutch-operating mechanism and kick-starter remove the kick-starter-case cover as follows:

(1) Drain the gearbox after removing the drain plug in the bottom of the gearcase.

(2) Unscrew the filler cap on the kick-starter-case cover.

(3) Screw down the clutch-cable adjuster, to permit the clutch-cable wire to be disconnected.

(4) Unscrew the clutch-cable adjuster to remove the cable.

(5) Remove the nut securing the gear-position disc, with its spring.

(6) Take out the five cheese-headed screws securing the case cover.

(7) Pull off the case cover about ½ in., turn the kick-starter crank so that it can be tied to the foot-change lever with a rubber band, preventing the kick-starter from unwinding.

(8) The case cover can now be taken off.

Parts subject to wear are the plunger, or thrust dowel, the steel ball and the clutch push rod. Wear of this kind is caused by continual pressure on these two parts, see " Clutch-cable Adjustment " (page 89).

Refitting the Kick-starter-case Cover

After refitting the parts in the reverse order to that given above ensure that the fixing screws are correctly positioned as detailed.

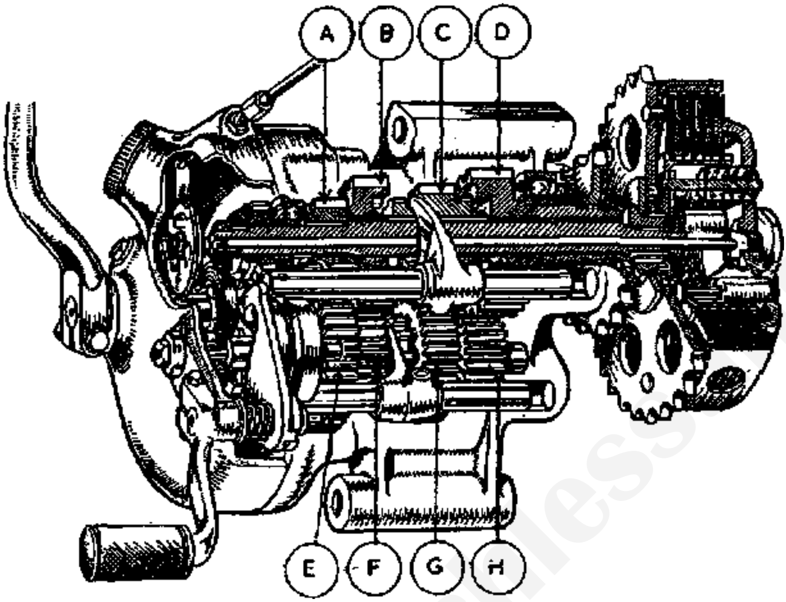


FIG. 31.—SECTION THROUGH GEARBOX SHOWING GEARS AND CLUTCH WITH ACTUATING MECHANISM.

A. Low gear on mainshaft.
B. Third gear on mainshaft.
C. Second gear on mainshaft.
D. Main driving gear.
E. Low gear on layshaft.
F. Third gear on layshaft.
G. Second gear on layshaft.
H. Small pinion on layshaft.

Fill with 1 pint of engine oil SAE 50.
Top screw 3 1/8 in. under head.
Bottom screw 2 7/8 in. under head.
Rear screw 7/8 in, under head.
Front screws 1 3/8 in, under head.

Removing the Gears

Remove the kick-starter case as previously described. Remove the split pin securing the striker-shaft pins and withdraw both pins, cam barrel, spring and the short plunger, which engages with the cam barrel. Unscrew the mainshaft nut. Take off the kick-starter ratchet, ratchet-driver bush and spring. Upon removing the three screws in the kick-starter case, the case, complete with the cluster of gears *in situ*, will be exposed when the case is pulled away. If the mainshaft has to be removed, release the nut on the clutch end.

Removing the Main Driving Gear and Bearing

The nut securing the rear-chain sprocket is firmly tightened, therefore some difficulty may exist in holding the sprocket during this process. The chain bar (Fig, 29) is the tool for this job, fitted on to the sprocket, with the bar propped against the frame after disconnecting the rear chain.

Proceed by turning down the lock-washer behind the sprocket nut. Remove the sprocket nut, lock-washer, two distance pieces and then the sprocket, which can be pulled off easily without an extractor. Take away the distance piece, the circlip and the oil seal, when the main gear can be tapped into the gearbox shell.

When the case is removed the two striker shafts and layshaft, with gear pinions assembled, will come away in a cluster. The position of gears should be carefully noted.

Refitting the Gears

With the mainshaft in the gearbox, fit the parts in the following order:

(a) Take up the layshaft and fit over splined end.

(b) Fit second-gear pinion, 24 teeth, and layshaft fixed pinion, 18 teeth.

(c) Fit mainshaft second gear, 22 teeth, into mainshaft striker forks.

(d) Fit mainshaft third gear, 25 teeth, into layshaft striker forks.

(e) Fit third gear on layshaft, 21 teeth.

(f) Fit low gear on mainshaft, 17 teeth, with spigot end towards kick-starter.

(g) Fit low gear on layshaft, 29 teeth.

With striker fork shafts mounted in the case, the complete assembly can go into the gearbox shell. Reassemble the clutch and foot-change assembly.

CLUTCHES

Clutch Operation (C.P. Type)

When the handlebar control lever is operated the clutch lever *A* (Fig. 32) is moved in the direction of the arrow, thus separating the clutch friction plates. This action compresses the clutch springs, which must be evenly adjusted, otherwise clutch drag or slip will take place.

It will be observed that if wear takes place on the operating lever *A*, the short push rod *B* or the push rod *D*, the withdrawal movement of the clutch will be curtailed by contact between the slotted end of the short push rod *B* and the end of the main-shaft.

To increase the movement, turn the sleeve nut clockwise (usually half to one turn will suffice). Replace the cap and check the movement of the lever with a finger inserted in the oil-filler plug orifice, To decrease the movement, rotate the sleeve nut anti-clockwise.

Removing the Clutch Cable

To remove the clutch cable proceed as follows:

(a) Remove the oil-filler plug.

(b) Screw home the clutch-cable adjuster.

(c) Press in the lever with a screwdriver to disengage the clutch-cable inner wire.

(d) Unscrew the clutch-cable adjuster completely.

(e) Disconnect the inner wire from the handlebar lever.

(f) If numerous cable clips or insulating tape are used to secure the outer cable to the frame tube it may be necessary to remove the petrol tank.

Replacing the Clutch Cable

Reverse the removal procedure. Take care to ensure that sharp bends do not occur in this cable.

Lubricating the Clutch Cable

The benefit of a well-lubricated clutch cable has to be experienced to be appreciated. With the cable removed, shape a small funnel made from plasticine moulded on the end of the outer cable. Hold the cable vertical and fill the funnel with

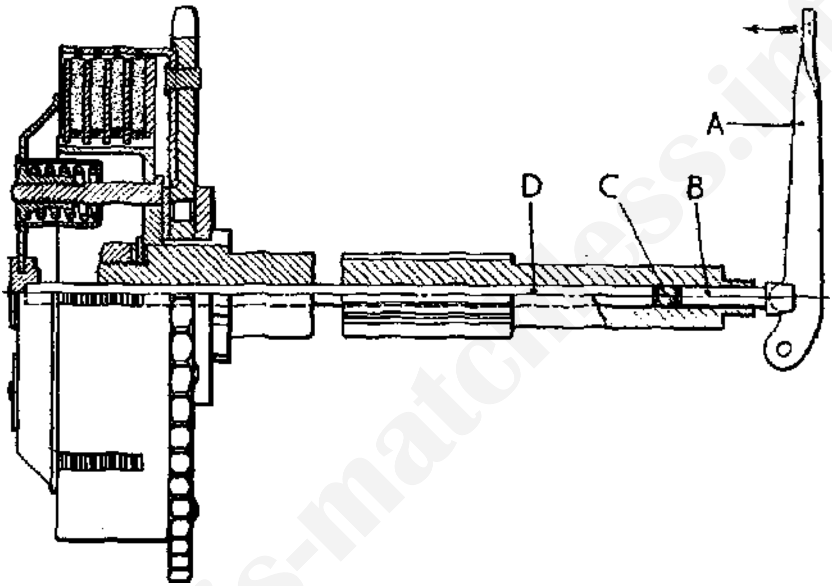


FIG. 32.—CLUTCH-OPERATING MECHANISM—CP TYPE.

A. Operating lever.
B, C, D. Push rods and bearing.

paraffin to assist oil penetration; when the paraffin has drained down the cable fill the funnel with light oil. Suspend the cable to allow the oil to percolate down the inner wire.

Clutch Slip

This can be result of:

(a) Insufficient clearance (correct clearance should be 1/32 in.) between the clutch lever, 175-X-4, and the plunger, 330-X.

(b) Insufficient free movement (correct amount is 1/8-3/16 in.) of clutch handlebar-operating lever before resistance of the clutch springs is felt.

(c) The top of the operating lever, 175-X-4, may be fouling the oil-filter plug.

If the above points are not at fault, then there may be oil on the clutch-plate friction discs, or the clutch springs may be weak (normal free length 1 ¾ in.).

Should the fault be due to oil-impregnated friction inserts, the effect of washing all the friction plates in petrol and then dusting them copiously with Fuller's earth should be tried. If it proves ineffective, replace the inserts with a type, now available, which is impervious to oil. If clutch slip has prevailed for any length of time the heat generated will probably have weakened the clutch springs. In this case, to avoid subsequent attention, fit a new set

Note that on the CP. type gearboxes a large nut was used to retain the clutch hub on the mainshaft, and it is possible for the clutch spring cups to foul this nut and cause clutch slip.

To correct, use the slightly smaller B.52 type clutch hub nut.

Dismantling and Reassembling the Clutch Complete

Remove the following:

(1) The outer portion of chaincase.

(2) The five screws for the clutch, with pressure plate, springs and cups.

(3) The lock-washer under the clutch hub nut.

(4) Engage top gear, fit a box key to the clutch hub, press on rear-brake pedal and unscrew nut. Disconnect the front chain.

(5) As the clutch hub is on splines, a tool is not needed to remove it. Take away the clutch assembly complete, but watch for the clutch rollers (24), which will drop out when the assembly is removed.

(6) The gearbox mainshaft.

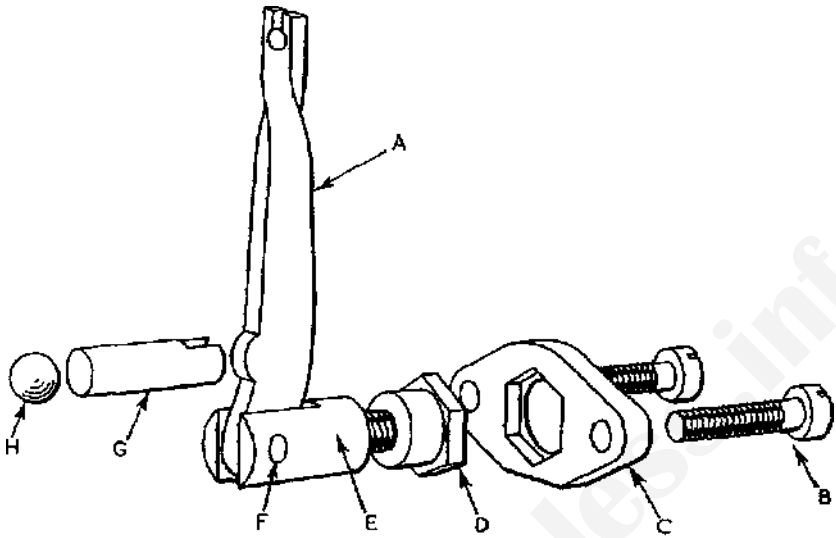


FIG. 33.—ARRANGEMENT OF CLUTCH-OPERATING LEVER.

A. Clutch-operating lever.
B. Screw, fixing cap to kick-starter case cover.
C. Cap, covering sleeve (screwed to kick-starter case cover).
D. Sleeve, or nut, for operating lever fork.
E. Fork, for operating lever.
F. Pin, or axle, for operating lever.
G. Operating plunger-
H. Ball bearing for operating plunger.

To reassemble, use anti-centrifuge grease to stick rollers in position. Reverse the dismantling order.

1957 TYPE GEARBOX (A.M.C. TYPE)

This gearbox is entirely new in design, with a shock absorber incorporated in the clutch assembly. It will not interchange with earlier types unless special rear engine plates are made to adjust the chain line. Engine oil SAE 50 is used to lubricate the gearbox—normal content 1 pint.

Foot-change Operation

If there is difficulty in selecting the gears, first check the pawl-operating spring (Fig. 34). If this spring is incorrectly fitted or distorted,' gear selection will not be positive. It is vital that the straight leg of this spring is in the uppermost position as shown.

Where the spring is correctly fitted, try the effect of fitting a new spring. A new-type plunger spring will eliminate stiffness in gear operation. Polishing the periphery of the cam plate is also beneficial. Clutch drag will also cause noise and difficulty in selecting the gears.

Clutch Adjustment

The clutch-operating mechanism is shown in Fig. 35. This should be studied if clutch adjustment is necessary.

To prevent pre-loading the operating mechanism in order to provide sufficient lost motion in the cable and push rod, 1/8-3/16 in. movement in the clutch-operating cable is essential. The movement can be checked by lifting the clutch outer casing near the adjuster or at the handlebar operating lever. To obtain this movement, first run down the clutch-cable adjuster as far as it will go. Take off the dome covering the clutch assembly, unscrew the central lock-nut (*B*, Fig. 35) for

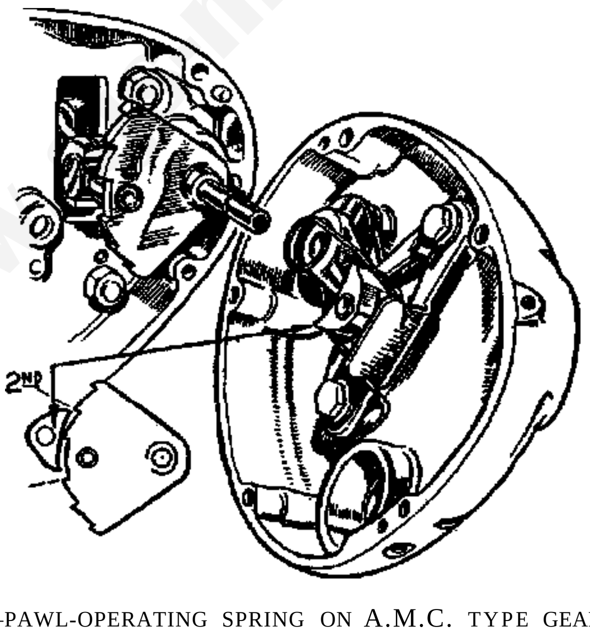


FIG. 34.—PAWL-OPERATING SPRING ON A.M.C. TYPE GEARBOX.

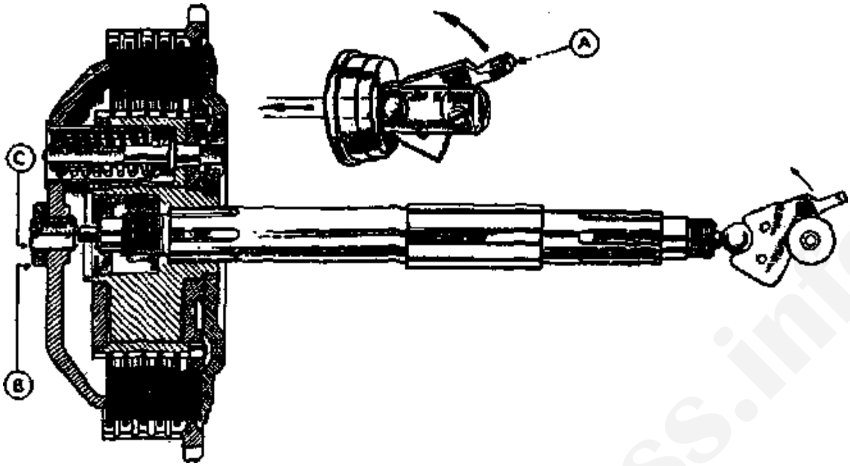


FIG. 35.—CLUTCH, GEARBOX MAINSHAFT AND CLUTCH-OPERATING MECHANISM.

A.. Pawl-op crating spring.
B. Lock-nut.
C. Adjusting screw.

the thrust stud one or two complete turns, using the sparking-plug box key.

Screw in gently the adjusting screw *C* till it is in contact with the push rod. Unscrew the adjusting screw exactly half a turn and retighten the lock-nut. It is advisable to keep the screwdriver in the slot for the adjusting screw whilst tightening the lock-nut, to prevent the adjuster from turning.

Revert to the clutch cable and unscrew the cable adjuster to give the required amount of movement, tighten the lock-nut and refit the clutch dome.

Clutch Slip

After considerable use and if the clutch' is slipped unduly wear on the friction inserts will tend to absorb the lost motion or free movement in the operating mechanism and cause the clutch to slip. Reset the cable movement as described.

Where the correct cable movement is made, if clutch slip persists, first try the effect of increasing the clutch-spring pressure, by screwing inwards, in turn, the three clutch-spring adjusting screws one complete turn. If clutch slip still prevails, dismantle the clutch. Oil on the friction inserts can be neutralised by copiously dusting the inserts with Fuller's earth.

Before reassembling examine the cups, for the clutch spring, for marking or evidence of contact with holes in the shock-absorber plate, Fig. 36. Where contact is shown, ease down the outside diameter of each spring cup and put a chamfer or radius on the edge of each hole in the shock-absorber plate. Check the free length of the clutch springs, which is normally

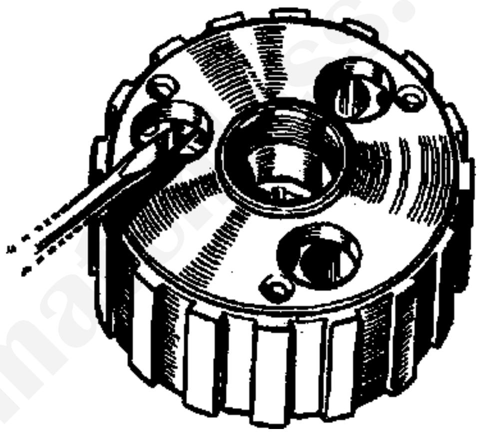


FIG. 36.—CLUTCH SHOCK-ABSORBER PLATE SHOWING HOLES FOB LOCATION OF SPRING CAPS.

1 7/8 in., and replace if the springs have collapsed or shortened to the extent of 3/16 in.

The correct position of the clutch-adjusting screws should be with the screw head *just flush with the spring cup.*

Dismantling Clutch Assembly

If the gearbox is to be completely dismantled or the mainshaft removed, the clutch assembly must be dismantled.

With the chaincase cover off, unscrew the three clutch-spring adjusters.

Take off the pressure plate, the spring cups and spring. Engage top gear, press hard on the brake pedal and unscrew the mainshaft nut. The clutch centre, which is splined, should come away easily.

Removing the Gearbox Outer Cover

Remove the oil-drain plug situated at the bottom of the gearbox shell, close to the dome nut for the cam plunger. Take off the filler-cap cover and disconnect the clutch inner cable from *A,* Fig. 35.

Unscrew the bolt retaining the gear-indicator plate and leave the pedal in position. Take off the kick-starter crank and remove the five cheese-headed screws securing the cover.

Gently ease off the cover, by pulling on the gear pedal with care to avoid damage to the gasket.

Removing Gearbox Inner Cover

Remove the ratchet plate and spindle, also the clutch-operating arm and rollers. Unscrew the lock-ring securing the clutch-operating body and the ½-in. ball inside. Unscrew the mainshaft nut, now visible after the clutch-operating body is removed.

Take off the seven nuts fixing the inner cover to the gearbox shell by gently tapping the rear of the cover until it is clear of the dowels, without damage to the gasket.

Removing the Cam Plate

Remove the hexagonal dome nut on the front end of the gearbox shell and take out the plunger and spring. Also remove the two bolts above the plunger housing, when the cam plate and the quadrant can be taken off the gearbox shell.

Removing the Gearbox Internals

Remove the low gear on the layshaft, Unscrew the striker-fork spindle with a spanner placed on the two flats.

Disengage the striker forks from the cam plate and pull out the mainshaft complete with gears; also the push rod. Take out the layshaft and gears, by rocking the shaft up and down until it is clear of the halt-race.

Remove the lock-screw and plate securing the rear-chain sprocket nut. The chain bar shown in Fig. 29 can be used to hold the sprocket whilst the fixing nut is unscrewed; this has a *left-hand thread.* The sprocket with the distance collar mounted on spline will come away without difficulty.

Gently tap the main or sleeve gear into the gearbox shell and remove.

Removing the Oil Seal and Ball-races

The sleeve-gear oil seal is a close fit in the shell, and it is doubtful if it can be extracted without damage. Gentle heat applied to the gearbox shell will enable it to come out easier.

Pre-heat the gearbox shell and drop it gently face downwards on a clean wood bench, the races will then fall out.

Removing and Replacing the Clutch Shock Absorbers

Six rubber blocks (three thin and three thick) are incorporated in the clutch hub, which are retained by a steel plate and three countersunk screws, see Fig. 36. To remove and replace these rubbers, this is best carried out with the gearbox in the frame, unless an old gearbox mainshaft is available. This can be fixed in a vice to hold the clutch body whilst the rubbers are compressed. With the gearbox *in situ* dismantle the clutch to expose the shock-absorber assembly, Fig. 36.

Remove the three countersunk screws and tap round the cover plate as illustrated. The plate can then be prised out. With the aid of a C-shaped spanner to engage in the slots for the clutch plates or preferably a tool as shown in Fig. 8, engage top gear, press on the brake pedal and by lifting the tool used to compress the thick rubbers, the thin ones can be extracted with a short piece of wheel spoke. The thick rubbers will come out without difficulty. Reverse this method to replace the parts removed.

Clutch Bearing

Remove the clutch hub from the mainshaft and also the three clutch spring stud nuts. Separate the hub from the back-plate and take out the bearing.

Reassemble in the reverse order.

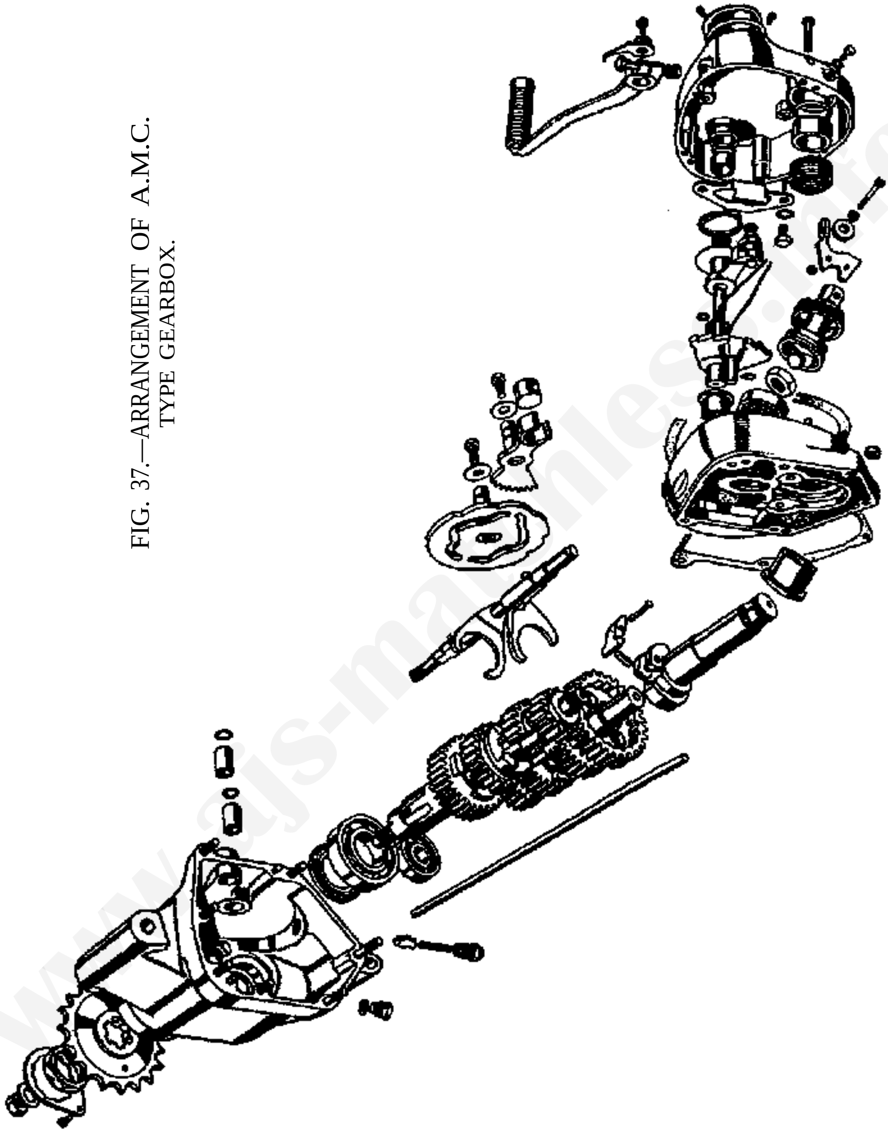


FIG. 37.—ARRANGEMENT OF A.M.C.
TYPE GEARBOX.

Kick-starter Assembly

With the gearbox outer and inner cover removed, use a piece of stiff wire shaped like a button hook to pull out the end of the kick-starter return spring from its anchorage in its housing.

Lift out, also, the opposite end of the spring from the kick-starter axle and withdraw the axle, which will give access to the kick-starter pawl with its plunger and spring. If the spring is inclined to slip out of its anchorage the turned-in end of the spring has taken a " set " and a new spring should be used.

Reassembling the Gearbox

If the gearbox is completely dismantled, apply gentle heat to the gearbox shell. Fit the main bearing, layshaft bearing and oil the seal with the spring inside. Pass the sleeve gear through the bearing, fit the distance piece, sprocket and firmly tighten the sprocket nut, which has a *left-hand thread.*

Take up the mainshaft and fit on it the third- and second-gear pinion with the striker fork in the third gear. Introduce the spigot on the striker forks into the groove in the cam plate.

Take up the layshaft and fit the small gear, third and second gears on the shaft, with the striker fork in the second gear. Engage the striker-fork spigot into the groove in the cam plate. After lining up the spindle holes in the striker fork, insert the spindle and firmly tighten. It will help to align the spindle holes if the cam plate is moved during this process. Finally, fit the kick-starter or low-gear pinion.

Refitting the Cam Plate

Position the quadrant and secure with the bolt and washer. Raise the lever on the quadrant into the top-gear position, with the radius on the lever in line with the top right-hand cover stud.

Fit the cam plate, so that the first two teeth on the quadrant are visible through the groove in the cam plate, secure the plate with its washer and nut. Refit the cam-plate plunger, spring and dome nut. Replace the drain plug.

Refitting the Outer Cover

With the kick-starter assembled, fit a new gasket if the original is damaged, fit the cover and firmly tighten the seven fixing nuts. Fit the mainshaft nut, clutch-operating body and the steel ball.

Locate the operating body so that the actuating lever lines up with the hole in the cover for the clutch cable. Secure the lock-ring, fit the actuating lever and roller. Insert the ratchet plate and spindle.

See that the gasket is undamaged before fitting. Check the pawl spring for position (Fig. 34), with the straight leg in the uppermost position.

Fit the cover and secure with five cheese-headed screws. Assemble the remainder of parts removed in the reverse order described for dismantling.

Refitting the Clutch Assembly

Insert the push rod in the mainshaft. Fit the clutch hub on to the mainshaft, a spring washer and shaft nut, which must be very firmly tightened. If the back of the clutch hub fouls the sleeve bearing when the nut is tightened the hub splines are worn or damaged and should be replaced.

Proceed by assembling the clutch sprocket, steel and friction plates alternately, then the pressure plate, engaging the push rod into the screwed adjuster stud. Assemble the clutch springs, cups and adjusting screws with the head of each screw flush with the spring cup. Adjust the clutch cable as described elsewhere.

CHAPTER IV

FRAME AND FORKS

MAINTENANCE of the frame and cycle parts is confined generally to regular greasing and occasional adjustment of the steering-head bearings. The forks and rear suspension legs require virtually no attention for many thousands of miles; when, however, it is necessary to dismantle and inspect for wear, the job is well within the capability of any enthusiastic owner equipped with a reasonable number of workshop tools, plus the few special tools that are essential.

Steering-head Adjustment

Self-aligning ball-races are fitted to both ends of the frame head-lug, which must be kept in close adjustment, for movement, which will occur when the front brake is applied, will damage both the races if the correct adjustment is not maintained. This adjustment must be made with the front wheel clear of the ground, using a box under the crankcase. To tighten the bearing, release slightly the two nuts, or Allen screws, whichever are fitted, situated under the headlamp, that clamp the fork inner-tubes. Slacken off the top nut on the fork stem, which passes through the handlebar lug. Screw down the lower nut on the fork stem half a turn. Place the fingers of the left hand on the handlebar lug and the end of the frame head-lug. Lift up the front-wheel assembly, with right hand on the mudguard, when movement will be felt by the left hand (Fig. 38). Retighten the lower nut if necessary, until movement is taken up. Bearings should be free from friction, and not overtightened.

It is of vital importance to ensure the nuts, or Allen screws, clamping the fork tubes are firmly retightened when adjustment is complete, for if movement between the fork tubes and the fork crown occurs " fretting " will take place, which can result in a fracture of the fork inner tube.

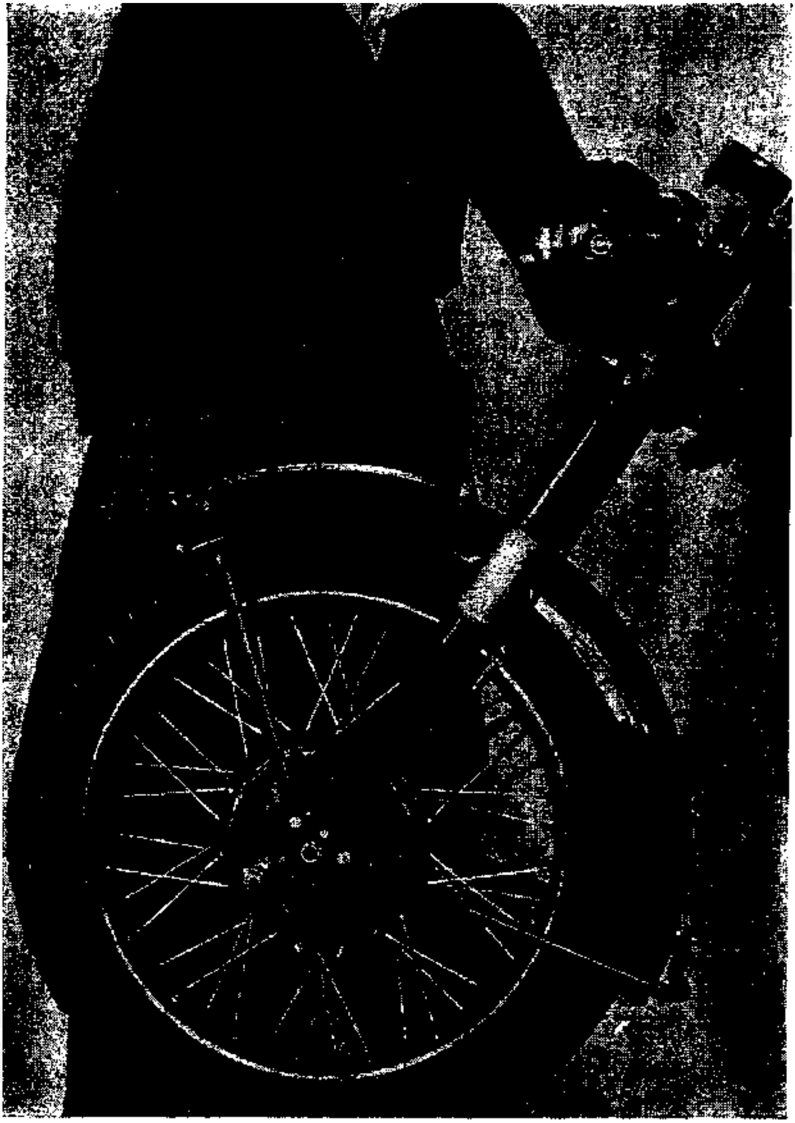


FIG. 38.—CHECKING STEERING-HEAD ADJUSTMENT.

To check adjustment grasp machine as shown and rise front wheel clear of the ground. Should movement be felt by the left hand the bearing is loose.

Steering Troubles

If the machine has been run for any length of time with a loosely adjusted steering-head bearing, pitting in the ball-races will create a rolling motion in steering, which can only be rectified by replacing the damaged ball-races. This can be proved by jacking up the front wheel as previously described, when, if the handlebars are moved sideways slowly, the " pitting " in the ball-races can be felt.

If a steering-damper is fitted, the same effect will result if unwanted friction in the damper takes place. Removing the bolt anchoring the damper steel plate to the head-lug will prove after road test if the fault lies with the steering-damper. Swollen friction discs, or bent damper plates, are associated with this fault. Both damper steel plates should be parallel to each other; the use of a steel washer between the damper plate and the head-lug will have the desired result.

Handlebars Wobble at Slow Road Speeds (Solo)

This usually occurs after tyres have been removed, or replacements fitted, and is entirely due to one or both tyres running out of true with the wheel rim. The truth of tyres can be checked, in the case of the rear wheel, by raising the rear wheel clear of the ground. Start the engine, engage the top gear. With the rear wheel spinning, watch the rear wheel as it revolves, when a " wobbly " motion of the rear tyre will indicate if the fault lies with this part of the machine.

In the case of the front wheel, which is the most probable cause of the fault, the wheel must be rotated by hand as fast as possible to observe if the tyre is true with the rim. Usually, over-inflating the tyre to 40 lb./sq. in. will cause the tyre to take up its proper position, if not, deflate the tyre and strike it carefully with a mallet until it is even with the wheel rim.

Fitting a Steering-damper

The steering-damper is supplied assembled. To avoid removing the front wheel and guard, take off the damper knob and washers, then unscrew the long draw bolt from the damper base. Remove the dome nut on the fork stem and pass the long draw bolt up the fork stem from the base of the fork crown. Screw on the damper knob to retain the bolt,

Refit the draw bolt to the damper base and fully tighten its lock-nut. Attach the flat steel plate to the fork crown and the cranked plate to the boss on the frame. It may be necessary to use a ¼-in. washer on the bolt locating the plate to the frame. If this bolt is difficult to screw home, use a ¼ in. X 26 T.P.I. tap to remove enamel in the bolt hole.

To complete the damper assembly, fit in the following order:

A plain stem nut to replace dome nut.
Cap washer.
Spring washer.
Serrated washer.
Damper knob.

Checking Wheel Alignment

This is best accomplished by obtaining a long wooden batten with a straight edge, and placing it along both edges of the rear tyre. The front end of the track stick, as it is called, should be parallel with both edges of the front tyre. When the section of the rear tyre is larger than the front tyre, the space between the batten, taken on the front tyre each side, must be equal.

Once the correct wheel alignment has been established, a measurement should be taken, from the rim of the rear wheel and the centre of the tubing for the swinging arm. When this is recorded it is only necessary to position the rear wheel to the same measurement to ensure that the wheel alignment is correct. A strip of steel, suitably marked after adjustment, wilt also serve as a guide for subsequent adjustment.

Steering Uncertain on Bends

Test for wheel alignment, then check wheel bearings for loose spindle or bearings. Remove one rear-suspension unit at a time and check each unit for equal damping. Any variation can be due to a damaged oil seal, low oil content or broken damper tubes. Check the swinging arm for side movement; this is likely only on machines that have been in commission for several years. The replacement of worn bushes is a major operation that should be carried out by the makers.

" TELEDRAULIC " SUSPENSION

The three types of front forks used are basically the same, with the exceptions of the shuttle damping arrangement used on the 1948-50 models, and large-diameter fork inner tubes for 1955-57 models. The shuttle-type damping was discarded through a " clacking noise " on violent impact, or on application of the front brake violently. The noise is caused by shuttle movement, and has no adverse effect on reliability. In some cases, improvement is made by increasing oil content by ½ oz. to each fork tube (10½ oz.).

Faults in the Front Forks

Forks sticking is caused by Bakelite bushes swelling, creating friction between bushes and fork inner tubes. This is on the assumption that the fork tubes are not bent. Sometimes this fault will cause a " creaking noise " when handlebars are turned slowly with the machine stationary, often confused with a cracked ball-race in the steering-head. To remedy, dismantle the forks, ease down with emery cloth internal diameter of both bushes for a free fit on tubes; oil and refit. Should the forks become stiff after refitting the front wheel, loosen the four nuts clamping the front-wheel spindle, work the forks violently up and down and retighten the four nuts. This will permit the fork tubes to be relieved of the side thrust. On 1955-57 models similarly affected, take off the two nuts fixing the front guard to the fork slider, and test. If the forks work freely in this condition, set stays on the front guard, which are under tension.

Grating Noise with Fork Movement

This noise is due to one or both springs in contact with the cover tubes. Grease applied on the outside diameter of the springs will have a lasting effect. Buckled springs can be cured by grinding the ends square with the axis of the spring.

Rattle in the Front Forks

This will occur if the oil content is nil or very low, noise comes from the damper tubes or rods. The damper rod disconnected from the fork top bolt can also cause this noise.

Lateral Flay in the Forks

Caused by worn Bakelite bushes or, in the case of a very old machine, wear between the bottom steel bush and the slider.

Dismantling the Forks

To facilitate dismantling and. reassembly, a draw bolt is most desirable, details and dimensions are shown in Fig. 39.

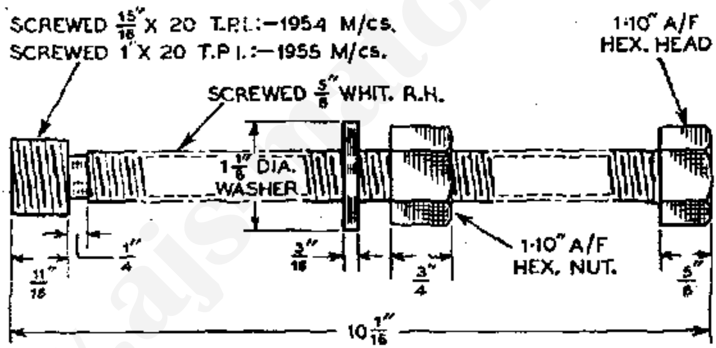


FIG. 39.—DIMENSIONS OF DRAW BOLT FOR FORK DISMANTLING.

This tool is used to drive out the fork tubes without damage, and in particular to pull back the tubes against the resistance of the fork springs on assembly. Without this tool, dismantling the forks from the bottom end is necessary.

Changing or Servicing the Fork Springs

A quick and easy method of exposing fork springs is shown in Fig. 40. With draw bolt available, disconnect the front-brake cable, slacken the nuts or Allen screws, whichever are

FIG. 40.—CHANGING FORK SPRINGS.

Fork springs rarely collapse or close-up, but check overall length (" see Technical Data.") before replacing them.

fitted and situated below the headlamp, for clamping the fork tubes. Remove the large nuts on the handlebar lug, disconnect the damper rod. Screw the draw bolt into one fork tube, tap the tube downwards a slight amount, unscrew the draw bolt, insert it into the other tube, tap the tube down a similar amount, repeat this process, so that the tubes are moved an equal amount, until they are clear of the lower fork crown.

To refit the forks, enter the tubes into the fork crown, pass draw bolt through the handlebar lug, screw it into the tube.

Run down the nut on the draw bolt to pull back the tube a slight amount, then deal with the other tube in a similar manner, changing over the tool until the tubes are fully home. A loop of copper wire can be used to " fish " up the damper rod, or a length of rod, screwed 5/16 in. X 26 T.P.I., with a nut partially screwed on, it can be connected with the damper rod to pull it up. Relit both the damper rods, firmly tighten the large nuts for tubes, retighten the clamping bolts or screws, and connect the brake cable.

Removing the Fork Slider

Raise the front wheel clear of the ground and disconnect the damper rod. Unscrew the fork-slider extension, screwed into the fork slider. Remove the front-brake cable, wheel, stand and the mudguard. The oil seal fitted in the top enlarged end of the slider is a close fit, to make a satisfactory seal.

The application of heat to this part of the slider will cause it to expand, when with a sharp jerk downwards, the slider will come away. The reassembly is carried out in reverse order. Alternatively, the fork tube with the slider and springs can be driven out as detailed for exposing the fork springs. If the fork tube is held on a vice, use soft clamps to avoid bruising the tube.

Replacing the Oil Seal

On the front forks fitted to the 1948-50 models, the oil seal must be fitted from the top or screwed end of the tube. The seal will receive damage, and become ineffective, unless care is taken.

Using a piece of sheet foil (4 in. x 3 in.) wrapped round the top of the tube, slide the seal down the sheet foil with a rotary motion, with the exposed spring in the seal facing downwards, the metal backing abutting against the screwed extension.

Checking the Oil Content (1948-50)

Normal oil content with dry forks is 10 oz. (248 c.c.) SAE 20. This type of fork should be serviced with the front wheel clear of the ground. A graduated glass measure of not less than 10 oz. should be available. Remove both nuts on handlebar lug securing the fork tubes. Turning the front wheel to the right against steering stop, when dealing with the right slider, and to the left when this slider is serviced, will facilitate draining.

Remove the drain plug from one slider, oil drained, usually 8-8½ oz. Refit drain plug, work the forks up and down violently several times with the wheel on the ground, to pump residue of oil into the slider. Again remove the drain plug, catch the residue of oil, usually making a total of 9½ fluid oz. If the oil content is low, measure and pour back exactly 9½ oz.

A rubber grommet, which must be undamaged, is fitted around large nuts for the tubes. These nuts must be firmly tightened before the wheel is placed on the ground.

Checking the Oil Content (1951-57)

Normal oil content with dry forks is 6½ oz. (184 c.c.) SAE 20. The machine must be vertical on both road wheels; placing boxes under the footrests is the best method to achieve this. Unscrew the large nuts on the handlebar lug. Use the graduated measure and turn the wheel to the right, then remove drain plug in the right slider. Catch the oil in the measure, watch oil does not spurt out when the drain plug is removed.

Refit the drain plug, work the damper rod attached to the large nuts up and down several times, wait a few minutes before removing the drain plug, catch the residue of oil in the measure, which should total 6 fluid 02. (170·4 c.c). If the oil content is low, refill with 6 fluid oz., replace the large nut on the handlebar. The reason for the difference of 6½ oz. and 6 oz. is due to the presence of unexpelled oil.

Removing the Front-fork Assembly

Support tie machine on two suitable wood boxes under each footrest to raise the rear wheel clear of the ground. Remove front wheel by disconnecting front-brake cable at the wheel end. Release the front-brake anchorage and slacken the nut on the left side of the wheel spindle. Remove the four nuts fixing the caps to the fork sliders and mark them for correct position for reassembly.

Take off the front mudguard and stand. Disconnect the

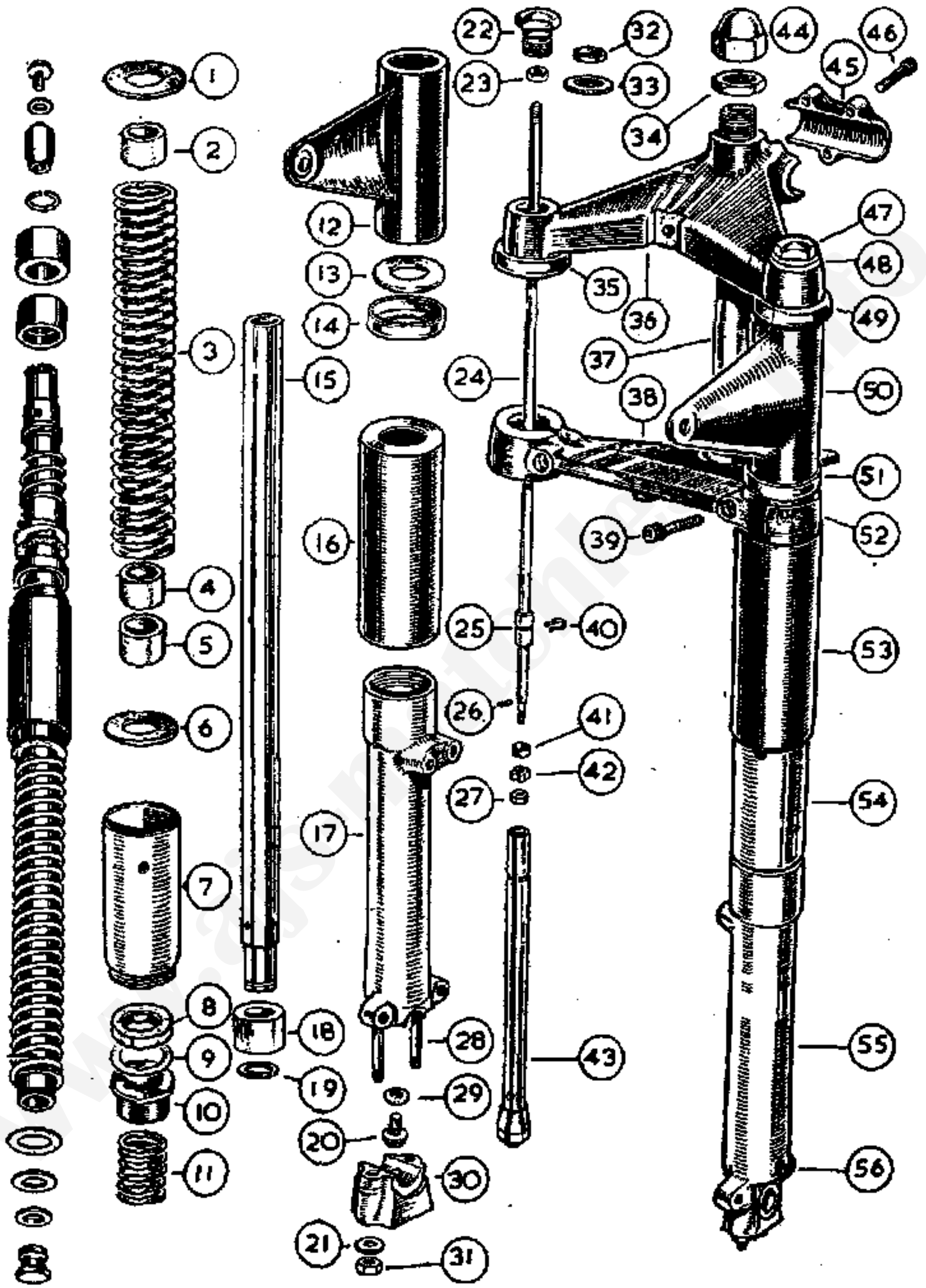


FIG. 41 *(left)*.—DAMPER ARRANGEMENT—1948-50 MODELS.

FIG. 42 *(right)*.—GENERAL ARRANGEMENT OF FRONT FORK AND DAMPING FOR ALL MODELS EXCEPT 1948-50, WHICH USE A SHUTTLE DAMPER AS SHOWN IN FIG. 41.

For key see page 111.

KEY TO FIG. 42.

1. Washer, leather, for fork spring top seating.
2. Buffer, rubber, for fork inner tube (one of three).
3. Spring, main, for front fork.
4. Buffer, rubber, for fork inner tube (one of three).
5. Buffer, rubber, for fork inner tube (one of three).
6. Wisher, leather, for fork spring bottom seating.
7. Extension, for fork slider.
8. Oil seal, rubber, for fork inner tube (an alternative oil seal is made of leather).
9. Washer, paper, for use only with *leather* oil seal.
10. Bush, top, plastic, for fork inner tube.
11. Spring, buffer, for front fork.
12. Tube, fork, cover, top, right, with lamp lug.
13. Washer, rubber, for top cover tube bottom cap.
14. Cap, for fork top cover tube, bottom location,
15. Tube, fork, inner.
16. Tube, fork, cover, bottom.
17. Slider, for fork, with studs.
18. Bush, bottom, steel, for fork inner tube.
19. Circlip, locating fork inner tube bottom bush.
20. Bolt, fixing damper tube to slider.
21. Washer, plain, for fork slider cap securing stud.
22. Bolt, top, for fork inner tube.
23. Nut, lock, for top end of damper rod.
24. Rod, for fork damper.
25. Sleeve, plunger, on fork damper rod,
26. Pin, stop, for fork damper valve,
27. Nut, lock, for damper valve sett.
28. Stud, securing cap to fork slider.
29. Washer, fibre, for damper tube bolt,
30. Cap, for fork slider.
31. Nut, for fork slider cap securing stud.
32. Ring, rubber, sealing, for inner tube top bolt.
33. Washer, plain, for inner tube top bolt.
34. Nut, adjusting, for fork stem.
35. Cap, for fork top cover tube, top location.
36. Lug, for handlebar and steering head.
37. Stem, for fork crown (not available separately).
38. Fork crown (available only as an assembly of crown, stem and stem circlip).
30. Screw, pinch, for fork crown.
40. Clip, retaining damper rod sleeve.
41. Valve, for fork damper.
42. Seat, for fork damper valve.
43. Tube, for fork damper.
44. Nut, lock (domed), for fork stem.
45. Clip (half only), for handlebar lug.
46. Screw, pinch, for handlebar lug clip.
47. Bolt, top, for fork inner tube.
48. Washer, plain, for inner tube top bolt.
49. Cap, for fork top cover, top location.
50. Tube, fork cover, top, left, with lamp lug.
51. Cap, for fork top cover tube, bottom location.
52. Fork crown.
53. Tube, fork cover, bottom.
54. Extension, for fork slider.
55. Slider, for fork, with cap, studs and nuts.
56. Screw, plug, with fibre washer, for fork slider oil drain hole.

---

steel plate for steering-damper, if fitted. Remove the head-lamp and speedometer. Take out the two large bolts that secure the fork tubes in the handlebar lug. Disconnect the damper rods attached to these bolts (damper rods are not used on 1948-50 models).

Place an old coat on the petrol tank to avoid damage to the enamel when the handlebars are placed on it. Take off the handlebar clamp, lay the bars on the petrol tank. Remove both nuts on the steering-column, then, using a soft mallet, tap the handlebar lug upwards until it clears the fork column. Steady the forks during this process, as they will drop down when the handlebar lug is free. Watch for the steel balls in the head-race bearings, fifty-six in number.

Refitting the Front-fork Assembly

Fill the ball-race on top of the frame head lug with grease and also the ball-race on the fork crown. Place twenty-eight steel balls in each of these races, then reverse the instructions given for removal, but make sure the damper rods are fully tightened before the two large bolts are finally secured.

Removing a Fork Inner Tube

Remove the front mudguard and stand. Unscrew the slider extension, which screws into the top end of the fork slider, then remove the front wheel as previously described.

Take out the top bolt passing through the handlebar lug. Disconnect the damper tube if fitted. Slacken the bolt or screw, whichever is fitted, situated in the fork crown below the headlamp. The fork can now be removed.

If the tube is a tight fit in the fork crown, the fork draw bolt should be screwed into the tube and hammered to drive the tube out of position. Without this tool the large bolt securing the fork tube can be used; this will move the tube a limited amount only, because of its short length.

Completely Dismantling the Inner-tube Assembly

Remove the fork slider and the bolt in the bottom of the slider; take out the damper assembly. Remove the circlip on the end of the fork tube carefully, to avoid distortion. Gently tap off the steel bush.

Remove the buffer spring, Bakelite bush, the washer and oil seal, the main spring, three buffer rubbers, used to prevent spring rattle.

Note.—The surface of the fork tube, particularly where oil seal operates, must be perfectly smooth and undamaged, otherwise the seal will become ineffective.

Reassembling the Fork Inner Tube

Refit the bare fork tube into position, which will facilitate assembly, when the tube can be tapped home before com-

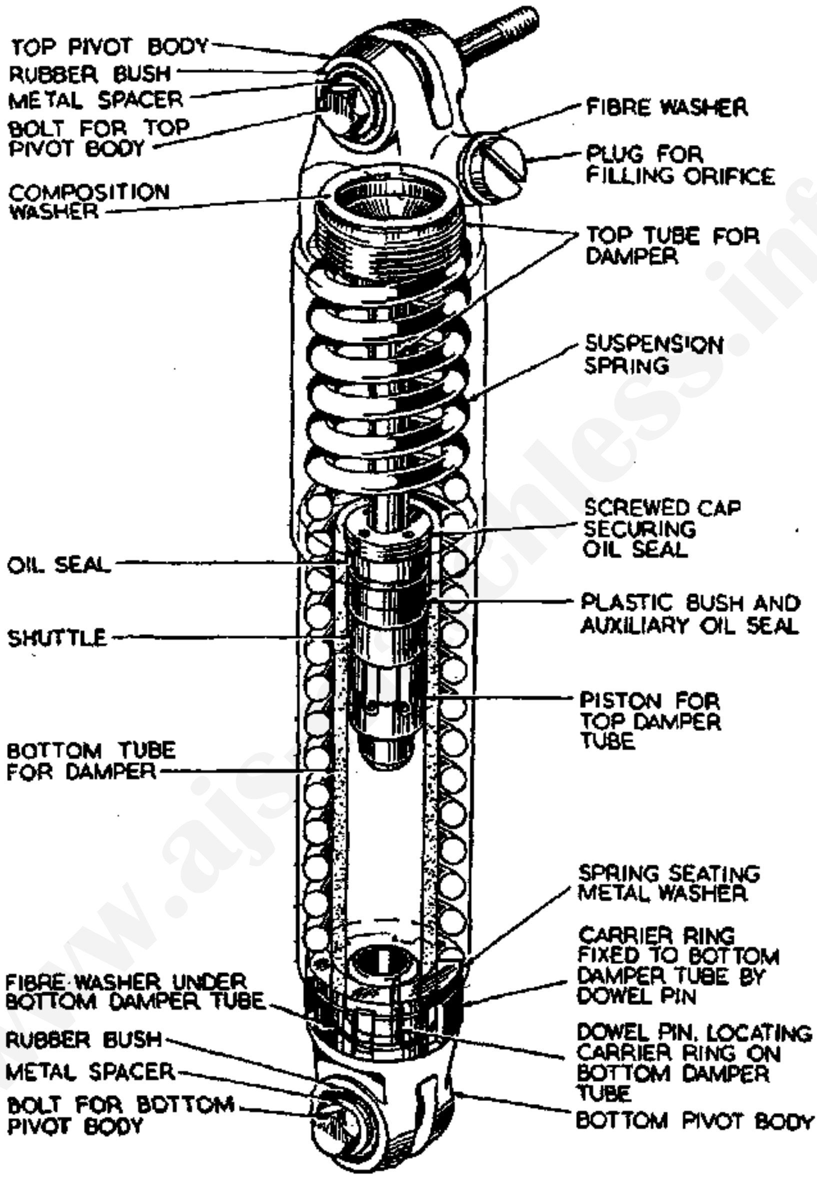


FIG. 43.—VIEW OF " TELEDRAULIC " LEG.

ponents are reassembled. Graphite painted on the tube and the steel bush is of benefit for free movement.

Rear-suspension Service

Details of this part of the machine are confined to two types, the early type used up to 1950, and the " jam-pot " type used from 1951 to 1956. Fig. 4.3 shows the early arrangement, which gave a nice soft ride, but was inclined to " bottom " when a heavy pillion passenger was carried.

The oil content is most critical, and should not exceed 1¾ fluid oz. (50 c.c.) SAE 20; an excess can burst the oil seal. Stronger springs are now available which will not cause discomfort, even without a passenger.

Checking Oil Content (1946-51)

Remove one suspension unit at a time. Take out the top pivot bolt and the spacing washer. Remove the bottom pivot bolt and take away the unit. Hold the unit vertical in the vice, gripping the bottom pivot (use a spanner or similar object) in slot for pivot, to avoid bending, when the vice is closed. Slacken the serrated carrier ring, with a C-spanner. Reverse position of the unit in the vice grip. Unscrew the bottom pivot (now uppermost). Carefully take off serrated carrier ring and dowel pin, locking ring, to the damper tube. Take off the cover and the spring.

The oil content is poured into a graduated glass or measure. When the oil stops draining, take off the filler plug and pump the assembly, by holding the damper tube, several times, to expel residue of oil. Reassemble parts in reverse order. Hold the unit vertical and refill with 1¾ oz. (50 c.c.) SAE 20 oil exactly. Move the unit slowly up and down to expel air.

Completely Dismantling the Unit

Proceed as for " checking oil content ". The following tools will be needed:

(a) Clamp to hold the smooth surfaced damper tube.
(b) Peg spanner for removing the screwed cap in the tube, securing the oil seal.

Rear Suspension (1951 Onwards)

Suspension units of an improved design were introduced for the 1951 season and continued without any material alteration up to 1956. Two types of springs are available, i.e., for solo or sidecar use. When camping equipment, panniers, etc., are carried, the sidecar-type springs should be used, to accommodate the additional weight.

Drain plugs were used on the bottom pivot for the 1951 models; these plugs served no useful purpose, and were discarded in 1952.

Checking the Oil Content (1951 Onwards)

Normal content is 3 fluid oz. (85 c.c.) SAE 20. To service these units, a clamp, such as an old connecting-rod, is desirable to clamp the tube close to the bottom pivot. With the clamp in a vice, adjacent to the bottom pivot, loosen the bottom pivot.

Holding the unit vertical, bottom end uppermost, remove the pivot lug. Hold the exposed end of the damper tube, use a pumping action to eject the oil under the damper, allow the oil to drain into the measure for several minutes. If the content is correct 2 oz. (75 c.c.) will drain out, if content is low refill with 2 oz., using care in pouring fluid back into the tube, to avoid spilling; assemble in reverse order.

Dismantling and Reassembling Rear-suspension Units (1951-54)

To dismantle these units the following tools are necessary:

(1) Clamp (suitable scrap connecting-rod) for the 1 7/8-in.-diameter outer tube (016407).

(2) Clamp (suitable scrap connecting-rod) for the 1 1/8-in.-diameter inner tube (016406).

(3) Peg spanner for the ring nut (016424) supporting the spring and cover tubes.

(4) Peg spanner for the screwed collar in the outer tube (016078), also a receptacle or graduated glass for oil content.

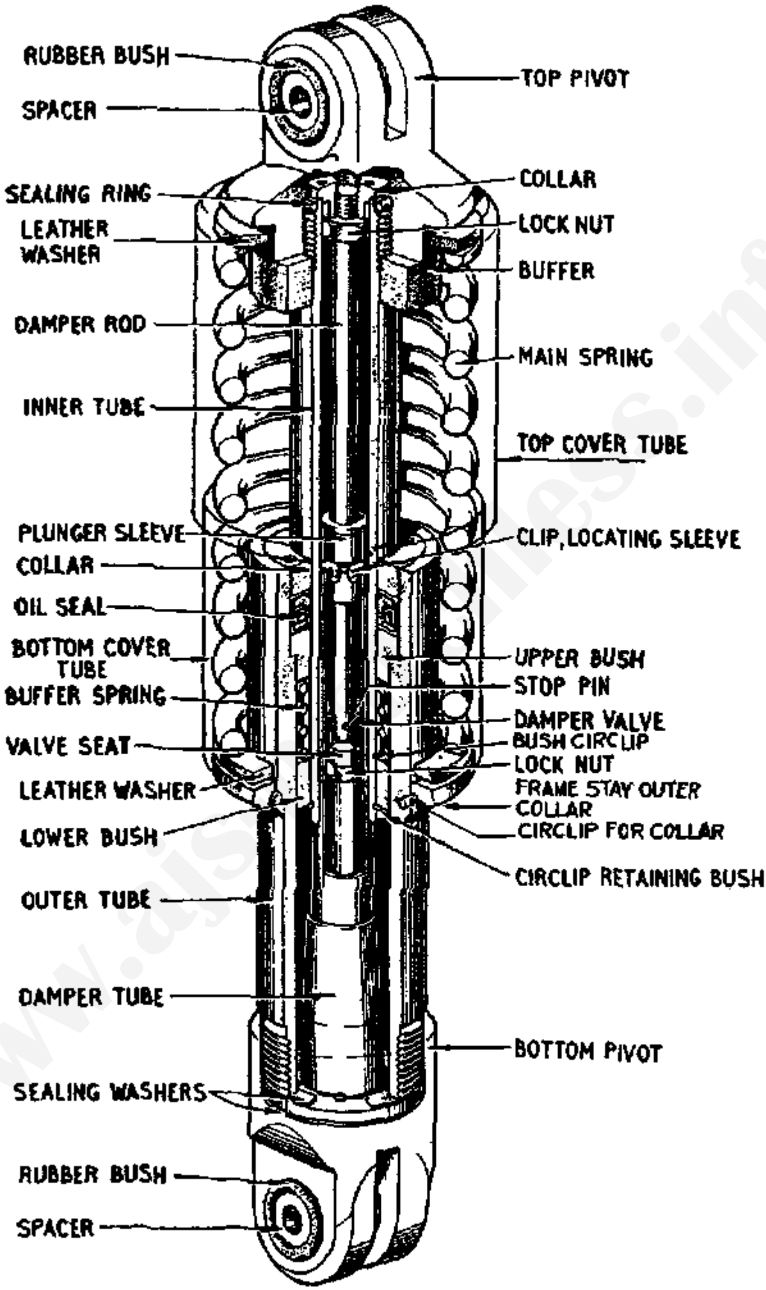


FIG. 44.—TELEDRRAULIC DAMPER FITTED TO 1954-56 MODELS.

Remove one unit at a time from the frame, holding the bottom pivot in a vice, with a packing piece in the pivot fork to avoid bending. Remove the collar nut (016424) supporting the spring, when both cover tubes and the spring will be released, exposing the inner tube (016406). Fit the smallest of the two clamps to the inner tube close to the top pivot, which can then be unscrewed and removed. Take away the small clamp, also the rubber buffer (016251); fit the largest clamp to the outer tube (016407) to unscrew the bottom pivot The oil content can now be poured into a suitable container or graduated glass. The cover tubes and spring can now be removed and placed aside.

Lift up the damper rod (016342) as far as it will go, so that the lock-nut can be released to take off the screwed collar (016343). Now the damper tube (016349) can be withdrawn from the bottom end of the outer tube. Next, turn to the screwed collar fitted to the top end of the outer tube, using the peg spanner mentioned previously, which when unscrewed will allow the black bush and oil seal to be pushed out of the outer tube, and note the way the oil seal is fitted (metal side uppermost).

Note.—To avoid damage to the oil seal, it is essential to replace the inner tube into the outer tube before the black bush and oil seal are replaced. Examine the rubber sealing-ring in pivot (016291), and renew if damaged. Ensure sealing the top washers (016349) are fitted to each side of the damper tube. Reverse the above procedure to reassemble and fill 3 fluid oz. SAE 20 oil (85 c.c.) before replacing the top pivot.

Dismantling Rear-suspension Unite (1955-56)

Hold the unit firmly in a vice, compress the spring either by the use of an adjustable clamp or by hand with the help of a second person to extract the circlip for collar 021655 (Fig. 44).

Instructions given for the 1954 models apply after the spring pressure has been released.

Rear-suspension Units (1957)

Topping up is not necessary, as the units are sealed and are not intended to be serviced. The correct amount of lubricant is used during manufacture and is sufficient for the life of the machine.

The damper unit, shown in Fig. 45, the springs and dust shields and the pivot rubbers are the only parts that can be exchanged; the damper unit being only sold complete. A table of alternative springs with the colour code is given below for spring identification. A cam ring on each unit is provided to pre-load the springs for varying loads. Turn the cam ring clockwise for heavier loads. A squeak when the units move can be cured by applying heavy grease on the outside diameter of the springs,

Removing the Springs (1957)

The top dust shield is retained by split collets. With the unit in position, press down the top shield and take out the collets. Remove the top and bottom pivot bolts and take the unit away from the frame. The top shield, spring and bottom shield can be lifted off.

Reverse this method to reassemble the unit.

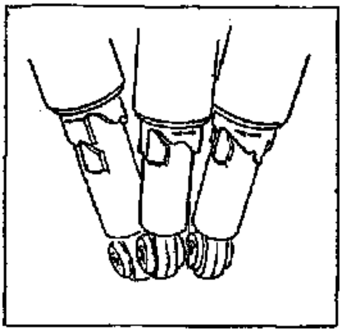
TABLE OF SPRINGS AND COLOUR CODE

Model.	Part No.	Colour.
Touring . . .	023373	Red and pink
Sidecar . . .	023372	Blue and yellow
Trials . . .	023313	Yellow and yellow
Scrambles . .	023314	Green and yellow

Removing the Oil Tank (1956-57)

Take off the twin seat and remove the frame cover behind the carburetter. Drain the oil from the tank and disconnect, at the tank end, both oil pipes.

The tank is attached to the frame by four brackets, remove the fixing nuts and bolts and take off the tank.



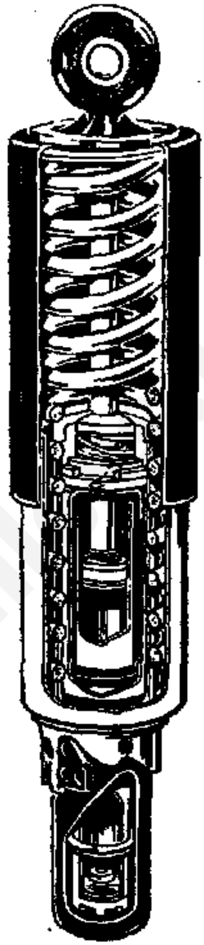


FIG. 45.—INTERNAL VIEW AND ARRANGEMENT OF SUSPENSION UNIT.

Removing the Oil Tank and Battery Carrier (1950-54)

The oil tank, also the battery carrier, are secured by two studs brazed on the frame down-tube. Removing these two parts is a lengthy process, simplified on the 1955 models by using two easily withdrawn bolts.

Drain the oil tank, disconnect the battery cables and take off the battery. Remove the oil-feed pipe, the vent pipe at rear of oil tank, the bolt fixing the oil-tank stay to the rear mud-guard, screw in the base of the battery carrier, and the two nuts and washers on the frame studs.

The brackets spot-welded to the battery carrier are slotted, but it may be necessary to lever up these brackets to clear studs, avoiding damage to the stud threads. Replace the parts in reverse order.

Removing the Oil Tank and Battery Carrier (1955)

Drain the oil tank, disconnect the wires from the battery terminals and remove the battery. Disconnect the oil-feed pipe and the oil-return pipe from the bottom of the oil tank. Disconnect the vent pipe from the back of the oil tank. Remove the bolt retaining the oil-tank stay to the frame. Remove the screw in the base of the battery carrier, retaining the carrier to the stay from the front chaincase. Remove the two nuts and washers retaining the battery-carrier to the two mounting studs and remove the carrier. The oil tank with supporting studs can then be withdrawn.

To refit, reverse the above instructions.

Frame Modifications

It is possible in A.J.S. frames manufactured subsequent to 1946 to interchange certain components. A list of the permissible frame modifications which can be made if desired is given on p. 121.

PERMISSIBLE FRAME MODIFICATIONS

FRONT FORKS

Longer Fork Springs (free length 12¾ in.) can be used in place of earlier types, which were 9·997 in. and 11 in. free length. The longer springs improve the fork motion, but will expose the holes in the slider extension, which can be corrected by using a later-type extension first used in 1954. Buffer springs for fork inner tubes can be used on models before 1947.

1948 Top Fork Cover Tubes with incorporated lamp brackets will interchange with the earlier type to discard the strip-steel lamp brackets.

Polished Fork Sliders, in place of the black-enamelled type, can be fitted without other alteration.

A 1956-type Front Mudguard, which dispenses with the two strip-steel stays, will fit any machine fitted with teledraulic forks made before 1956. Front forks with large-diameter tubes (1955-57) can be fitted to earlier models.

REAR SUSPENSION

"Jam-pot" Units, first used in 1951, can be adapted for 1950 models if the top anchorage on the frame loop is cut away to clear the unit top pivot.

FRONT CHAINCASE

The outer portion of the chaincase with a detachable clutch cover for clutch adjustment, without disturbing the chaincase, first used in 1954, can be fitted to earlier models.

FULL-WIDTH HUBS

If expense is unimportant, the full-width front hub can be fitted to any model which has teledraulic forks.

Rear-wheel hubs of the same type can also be fitted to any spring-frame model.

SPRING FRAME

Rigid-frame models made from 1949 can be converted into a spring frame model, but the cost for the conversion is most expensive.

CHAPTER V

WHEELS AND BRAKES

THE instructions given in this chapter apply to all models, except in the case of removing the rear wheel, where the procedure differs on Trials and Scrambles models and models subsequent to 1955.

Adjusting Front-wheel Bearings

Whilst it is possible to adjust the bearing with the wheel in position, it is preferable to place the machine on the centre stand and remove the wheel for this adjustment.

Disconnect the brake cables from the expander lever. Remove the brake anchor stay. Remove the four nuts fixing the caps to fork sliders. Remove both caps, noting location for reassembly, which must be as originally fitted. Remove the front wheel; if may be necessary to flatten the tyre to permit the wheel spindle to clear the slider studs.

For correct adjustment, slacken the lock-ring and tighten the adjusting ring to take up all slackness. Unscrew the adjusting ring half a turn, and retighten the lock-ring, making sure that the adjusting ring does not move. With a rawhide mallet, or hammer, with a piece of wood against the left end of spindle, deliver a light blow to move bearing sleeve towards the adjusting ring, to create a little end play, 0·002 in.

This method applies also to machines fitted with full-width hubs, when the metal disc for access to the grease nipple must be located before the lock-ring is finally tightened.

Dismantling Front-wheel Bearings

First refer to Fig. 46 for assembly arrangement, which will also indicate the order in which the parts should be removed.

Remove the front wheel and the cover plate, together with the brake shoes. Slacken the lock-ring (11). Completely un-

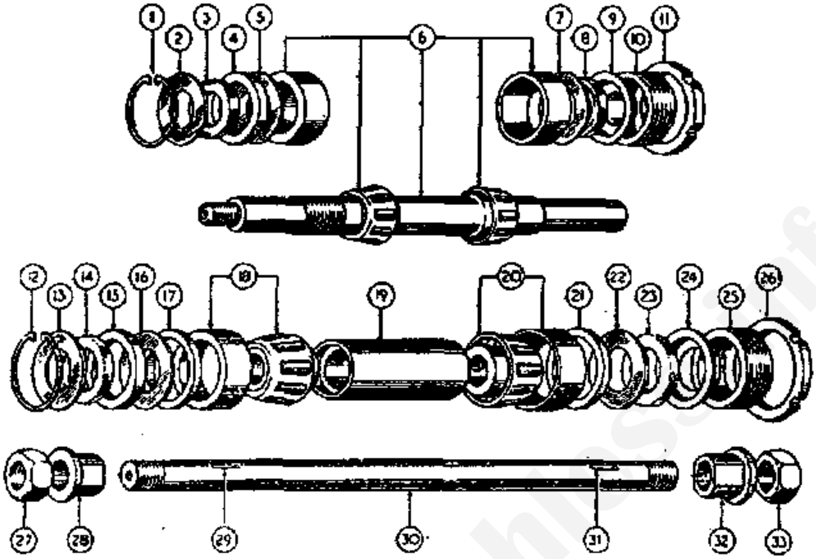


FIG. 46.—ARRANGEMENT OF WHEEL BEARINGS.
(Top) Front : *(bottom)* rear.

1. Circlip.
2. Washer, metal, outside oil seal.
3. Oil seal.
4. Spacing collar, encircling oil seal.
5. Washer, metal, between oil seal and taper bearing.
6. Outer races.
7. Washer, metal, between oil seal and taper bearing.
8. Oil seal.
9. Cup housing for oil seal.
10. Adjusting ring.
11. Lock-nut, for adjusting ring.
12. Circlip.
13. Washer, metal, outside oil seal.
14. Oil seal.
15. Spacing collar, encircling oil seal.
16. Washer, metal, between oil seal and spacer.
17. Spacer, between oil-seal washer and taper bearing.
18. Taper bearing.
19. Spacer, between bearings.
20. Taper bearing.
21. Spacer between oil-seal washer and taper bearing.
22. Washer, metal, between oil seal and spacer.
23. Oil seal.
24. Cup, housing, for oil seal.
25. Adjusting ring.
26. Lock-nut, for adjusting ring.
27. Nut, external, for rear-wheel spindle.
28. Bush for tear-wheel spindle (fits in fork end).
29. Keyway, to accommodate key locking cam to rear-wheel spindle.
30. Rear-wheel solid-centre spindle.
31. Keyway, to accommodate key locking cam to rear-wheel spindle.
32. Bush for rear-wheel spindle (fits in fork end).
33. Nut, external, for rear-wheel spindle.

screw the adjusting ring (10) with the lock-ring attached. The bearing sleeves are a close fit in the hub, pressure must be applied on the threaded end of the spindle to force out, from adjusting side of the hub, the oil-seal cup (9), oil seal (8), metal washer (7), together with the spindle bearings and sleeve. With the left side of the hub uppermost, press down on the washer behind the circlip to remove the circlip. Turn the wheel over, apply pressure on the inside end of the bearing sleeve (6), to force out the oil-seal washer (2), oil seal (3), spacer collar (4) and plain washer (5). To reassemble, reverse dismantling procedure, remembering to leave space between the bearing sleeve and the slot for the circlip. When the circlip is fitted, press the bearing sleeve up against the circlip. Adjust the bearing as previously described.

Adjusting Rear-wheel Bearings (Rigid-frame Models)

The bearing adjustment is made on the left or brake-drum side of the hub.

Remove the rear wheel, the spindle and cover plate. Unscrew the lock-ring two or three turns. Screw in the adjusting cup to the required amount. Usually about one turn on the adjusting cup is sufficient to take up side movement in the bearing. It is preferable to first take up any slackness in the bearing, then unscrew the adjusting cup exactly half a turn and retighten the lock-ring.

Tap the opposite end of the bearing with a light mallet to drive the bearing ring against the adjusting cup, when the bearing slackness should be approximately 0·002 in. or 1/64 in. rock on the wheel rim.

Dismantling Rear-wheel Bearing (Rigid-frame Models)

(see Fig. 47)

Disconnect the speedometer cable and take out the wheel. Pull out the centre spindle, take off the brake-cover plate. Slacken the bearing lock-ring and unscrew the adjusting cup. Extract from the hub the dished-steel washer, the oil seal and the plain steel washer. Turn the wheel over and prise out the circlip, take out the plain washer, the oil seal and spacer, a

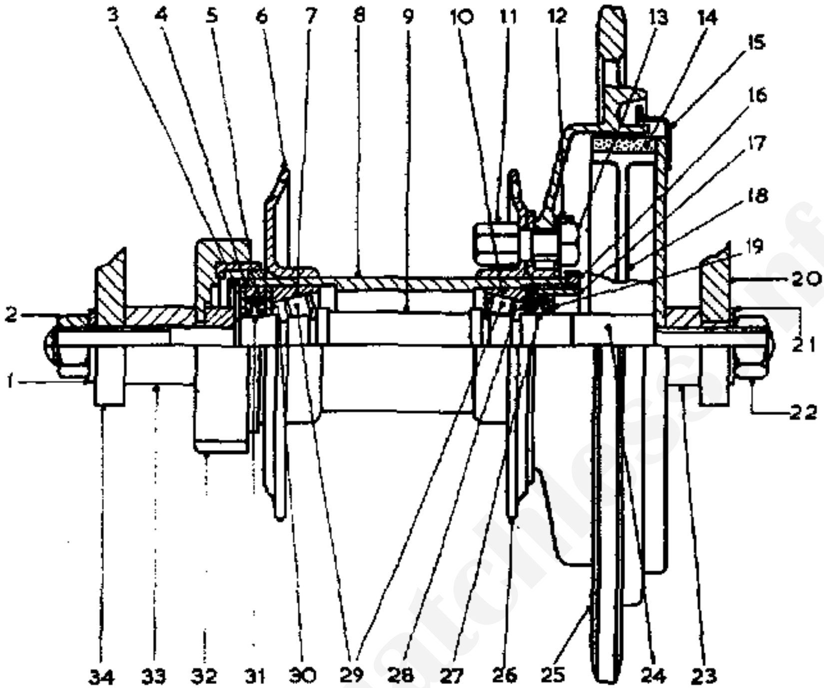


FIG. 47.—WHEEL HUB FOR RIGID-FRAME MODEL.

1. Washer, solid spindle.
2. Nut, solid spindle.
3. Spring circlip.
4. Retaining ring, for oil seal.
5. Collar, round oil seal.
6. Hub flange, right side.
7. Bearing outer cup.
8. Hub shell.
9. Hollow spindle.
10. Bearing outer cup.
11. Bolt, fixing sprocket.
12. Lock-washer, sprocket nut.
13. Nut, sprocket bolt.
14. Brake lining.
15. Brake cover plate.
16. Lock-nut, bearing adjusting ring.
17. Ring, adjusting bearing.
18. Brake shoe.
19. Dished cup, for oil seal.
20. Fork end of frame.
21. Washer, solid spindle.
22. Nut, solid spindle.
23. Spacer, between brake cover plate and fork end. (Flat part fits in fork end slot.)
24. Spacer, inside brake cover plate.
25. Sprocket and brake drum.
26. Hub flange, left side.
27. Oil seal.
28. Retaining ring, for oil seal.
29. Taper roller.
30. Retaining ring, for oil seal.
31. Oil seal.
32. Gearbox, for speedometer, drive.
33. Spacer, between gearbox and fork end.
34. Fork end of frame.

further steel washer. The spindle complete with bearings with one bearing cup can be pressed out through the hub. The remaining bearing cup can be driven out of the hub.

To reassemble, the only precaution is to make sure the spindle is fitted the right way round. The plain portion of the spindle is not symmetrical, one portion is longer than the other; insert the *short end* into the hub first.

Adjusting the Rear-wheel Bearing (Spring Frame)

Use the method described for rigid-frame models.

Dismantling Rear-wheel Bearing (Spring Frame)

Follow the instructions given for the rigid-frame models, and take out the parts from the assembly in the order shown in Fig. **46.**

Removing Rear Wheel (1950-54)

With the machine on the centre stand, loosen the bolts on the tubular members to which the detachable portion of the rear mudguard is attached. Slacken the two bolts at the mudguard joint, and take away the detachable portion of the mudguard. Disconnect the rear-lamp cable, and the stop-light cable, if fitted. Remove the rear-brake-rod adjusting nut.

Engage a gear to prevent the gearbox sprocket turning, and remove the rear-chain connecting link. Unscrew the speedometer cable from the rear wheel gearbox. Slacken the nut fixing the speedometer gearbox on the spindle. Slacken both the spindle-end nuts. Use a spanner on the hexagonal body on the left-hand adjusting cam, turn the adjusting cam to push the wheel forward. Cock the wheel to the right to clear the brake plate from the anchor stud; pull the wheel out of the fork ends.

Removing Rear Wheel (1955-57)

Follow instructions given for 1950-54 models up to disconnecting the speedometer-drive cable.

Then remove the axle nut, pull out the spindle, pull the wheel off the drive studs; the spindle distance piece will fall as the spindle is withdrawn.

Refitting Rear Wheel (1955-57)

Place the wheel into the swinging arm. Take up the wheel spindle, leave the distance collar aside. Raise the wheel and enter the spindle through the fork and hub,

Position the wheel on the driving studs. Pull out the spindle, put the distance collar in position and reinsert the spindle. Position the speedometer gearbox, tighten the axle

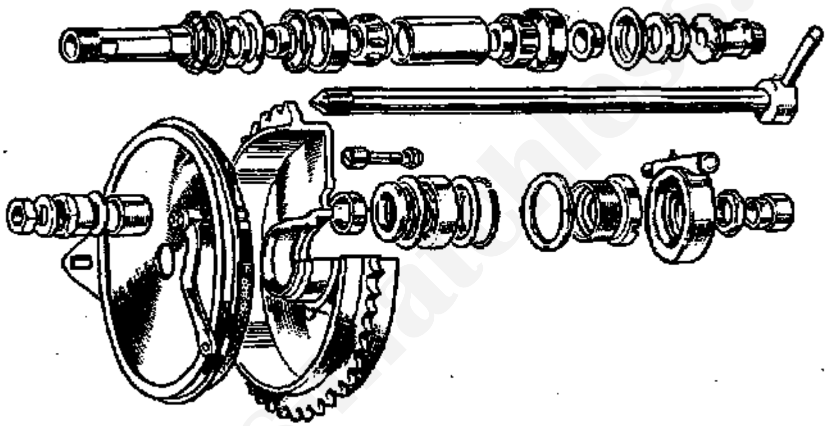


FIG. 48.—ARRANGEMENT OF REAR BRAKE DRUM 1955-56 MODELS.

nut and refit the speedometer cable. Ensure that the collar on the spindle abuts against the chain-adjuster bolt for correct wheel alignment.

Rear-brake Drum (1955-56)

The brake drum runs on a ball-bearing separate from the hub bearings. The method of bearing retention and the assembly order can be seen in Fig. 48. To dismantle, after removing rear wheel, disconnect rear chain, take off the nut and washer for the dummy spindle, cock the brake to the right to clear the anchor-plate stud and remove the assembly complete. After removing the circlip, the bearing and the oil seal, etc., can be pressed out. Before reassembly, lubricate the bearing sparingly with anti-centrifuge grease.

Rear-wheel Removal (Trials and Scrambles Models)

With the machine on its centre stand disconnect the rear chain, the rear brake rod, the speedometer drive cable.

Remove the bolt which passes through the rear chain guard, and the rear-brake cover-plate anchor lug.

To avoid disturbing the wheel-spindle distance pieces, leave the spindle in position and remove both spindle nuts only. Twist the wheel to the right until the cover plate is clear of its anchorage and withdraw the wheel.

Adjusting the Rear-wheel Bearings (1955-57)

With the wheel in position, slacken the speedometer-gear-box fixing nut, disconnect the speedometer-drive cable and remove the wheel as previously described. Remove the speedometer-gearbox fixing nut and take off the nut to remove speedometer-gearbox, adjust the bearings as described on page 124.

1955-56 Quick-detachable Wheel

Backlash between the rear-wheel driving studs and the holes for these studs in the brake drum can be rectified by fitting oversize wheel-driving studs supplied by the makers.

It is also possible to convert these machines into the 1957 type by fitting the latest-type hub and driving studs, together with a new brake drum.

BRAKES

Removing and Replacing the Brake Liners in Wide Hubs

Liners for these hubs are not supplied as a separate item to stockists in Great Britain. Should severe wear take place, hubs should be returned to the factory for service.

When it is not possible to return the hub to the factory the following procedure should be carried out. Unspoke the wheel and remove the bearings. Remove self-locking nuts

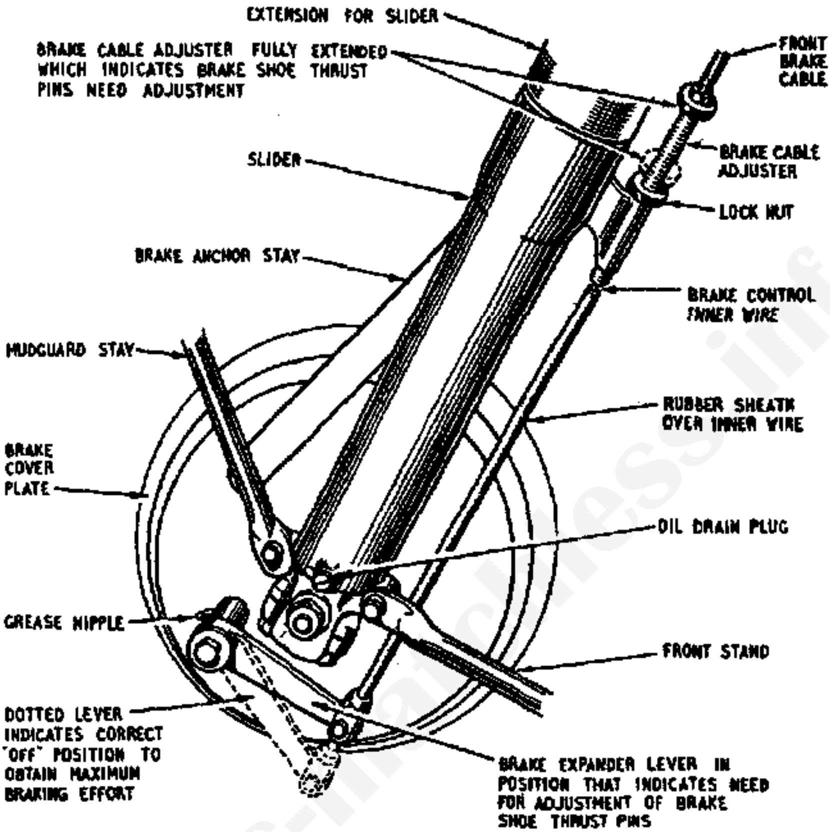


FIG. 49.—SHOWING FRONT BRAKE CABLE ADJUSTED THREAD EXHAUSTED, INDICATING BRAKE-SHOE THRUST-PIN ADJUSTMENT IS NECESSARY.

retaining liner and discard. Heat the hub shell to 220-250^0 C. and soak at this temperature for 20 minutes, when a sharp tap on the bench, whilst the hub is still hot, will dislodge the liner.

Fitting New Liner

Heat the hub shell to 210-215° C. for 10 minutes and, with the liner clean and free from burrs, slide the liner into position whilst the shell is still hot, making sure that the liner is square on its seating before the shell cools off.

When the shell is cold reassemble the spindle and the wheel

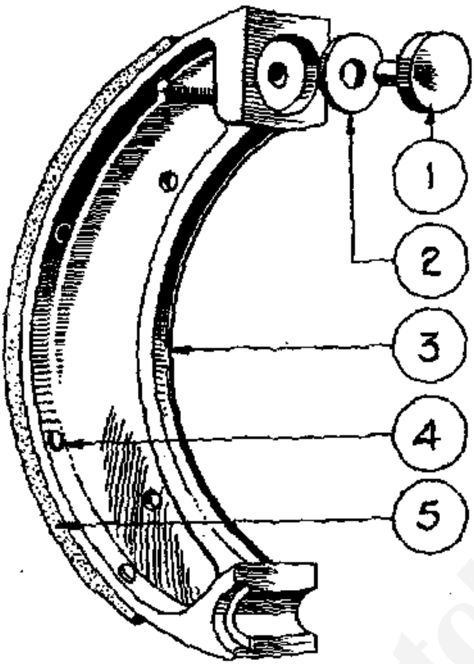


FIG. 50(a).—BRAKE-SHOE LAY-OUT.

1. Thrust pin.
2. Thrust-pin packing washer.
3. Brake shoe.
4. Rivet, securing lining.
5. Lining.

bearings, and respoke the wheel. Mount the wheel on a lathe, using the centres in the spindle for location, and bore the liner to 7·025-7·030 in. Remove the sharp corner from the edge of the liner.

It is essential that the liner be machined to size *after the wheel is laced.*

Brake-shoe Adjustment

Minor adjustment is effected by altering the position of the front-brake cable adjuster and the finger adjuster on the rear-brake rod.

Major adjustment, to compensate lining wear, is achieved packing washers under the thrust pins (see Figs. 50 *(a)* and *(b)),*

Ineffective Brakes

Assuming that the brake linings are not badly worn, and that the cam is in the normal position, the brake shoes may not be concentric with the drum.

The front-brake shoes can be centralised by releasing the nut securing the brake-cover plate and the shoe fulcrum nut at the top of the cover plate. To centralise the shoes, pressure is applied on the expander lever either by pulling hard on the hand-operated lever or by disconnecting the brake cable from the expander lever, with pressure applied by a box key to obtain more leverage.

Retighten the brake-cover-plate nut and the shoe fulcrum nut whilst the pressure is maintained. If this fails to work, take out the wheel, remove the cover-plate fixing nut and see if there is clearance between the hole in the brake-cover plate and the spindle. If not, enlarge the hole in the cover plate to give concentric clearance, 1/32 in. will do, and repeat the same process.

The object of this is to allow the brake-cover plate to move and make the shoes concentric with the brake drum when

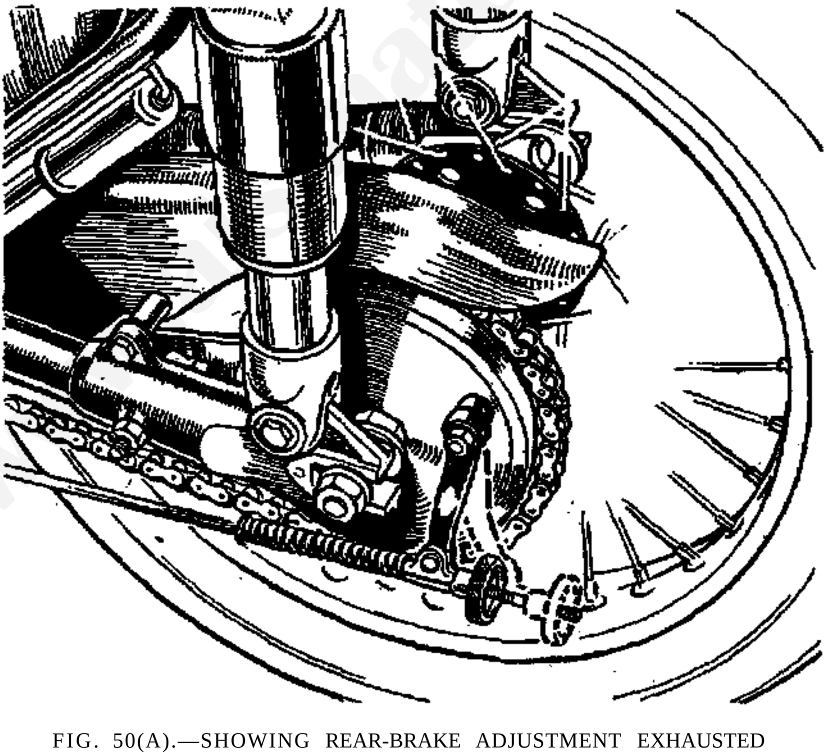


FIG. 50(A).—SHOWING REAR-BRAKE ADJUSTMENT EXHAUSTED pressure is applied on the expander. Deal with the rear brake in the same manner, using the brake pedal to apply pressure.

Brake Squeal

Check both brake shoes for lack of chamfer on the ends of the linings and centralise as previously described.

If difficulty exists in removing the nut securing the brake plate on the front wheel, clamp the right-side end of the wheel spindle into the fork slider, which will act as a vice to prevent the spindle turning.

SIDECAR CONVERSION

Suitable sidecar chassis are made by all the leading sidecar makers, suitable for the spring-frame models.

To convert a solo model of either the rigid- or spring-frame type, a smaller engine sprocket must be used. For a 500-c.c. model the engine sprocket should have 18 teeth and 16 teeth for a 350-c.c. model. On the 1957 models, with the A.M.C. gearbox, the sprocket should have 19 and 17 teeth respectively.

Stronger fork springs should be used, together with sidecar-type springs for the rear suspension units (except 1950 models). The fitting of a steering-damper to damp down handlebar " wobble " will complete the conversion.

CHAPTER VI

IGNITION AND ELECTRICAL EQUIPMENT

A LUCAS magneto, Type N1-4, is fitted to the 1945-53 models. Competition models use the racing-type magneto Type NR1, which has a free-wire ignition control. The 1954-55 500-c.c. models ate fitted with automatic ignition advance units. All 1955 models use a magneto, Type SR-1, with rotating magnets.

When setting the ignition where an automatic advance unit is used, insert a wooden wedge between the moving unit and its stop to hold it in the fully advanced position.

Removing the Contact-breaker (N1-4 Magneto)

To remove the contact-breaker on the N1-4 magneto, proceed as follows:

(1) Move aside the blade retaining the contact-breaker cover, and remove the cover.

(2) Remove the screw and spring washer *E* securing the spring blade *A* also the backing spring *D* (see Fig. 51).

(3) Remove the screw *B* and the fibre bush.

(4) Straighten the lock-washer *D* (Fig. 51) under the centre screw *H* retaining the contact-breaker, finally prise off the contact-breaker.

Before assembly apply a few drops of thin machine oil to the wick in screw *B*.

Cleaning the Contact-breaker Points

If both points are discoloured or pitted, reface with a fine carborundum stone, or use a special abrasive strip now sold for this purpose.

After cleaning, wipe the points with a doth moistened with petrol.

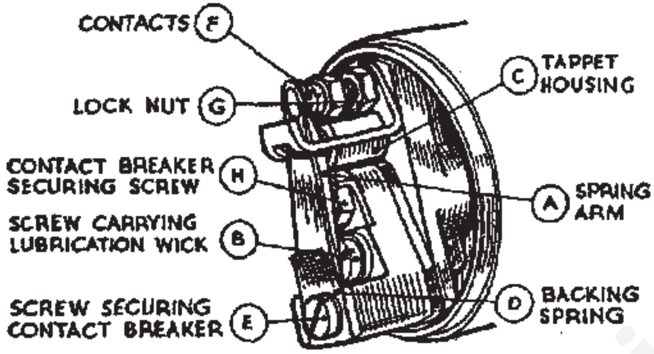


FIG. 51.—CONTACT-BREAKER COMPONENTS.

It should be noted that continual point burning is usually associated with a faulty condenser in the magneto, which must be dealt with by a Lucas Service Depot.

Checking the Contact Point Gap

With the contact-breaker cover removed, turn the engine until the contact points *F* (Fig. 51) are fully open. Insert the gauge attached to the spanner for adjusting the points. If the gap is correct, i.e., 0·010-0·012 in., the gauge will be an easy sliding fit.

To reset the gap slacken the lock-nut *G* (Fig. 51), apply a magneto spanner to the adjustable contact and adjust as required.

Finally retighten the locknut and recheck the setting.

These instructions do not apply to the racing-type magneto NR1 except for setting the contact point gap.

Cleaning the Contact-breaker points (Type SR1), Rotating-magnet Model

The contact-breaker is exposed by removing three screws securing the moulded cover (see Fig. 52).

To remove the contact-breaker lever, slacken the nut securing the end of the contact-breaker spring, which is slotted for easy removal.

Clean the points as described for early models.

Checking the Contact-breaker Point Gap (Type SR1)

Turn the engine until the contact points are fully open, check the gap with the gauge on the magneto spanner; if correct this should be between 0·010 and 0·012 in.

For adjustment, slacken two screws securing the fixed contact plate and alter the position of the plate until the gap is correct.

Converting to Positive-earth System

A change from negative-earth to positive-earth system can be carried out on models made before 1951 quite easily.

First connect the positive terminal of the battery to earth, then reverse the wires on the ammeter. Take the negative lead from the battery and flash once or twice on the *F* terminal of the dynamo; this will reverse its polarity.

Finally, connect the negative battery in the position previously used for the positive lead.

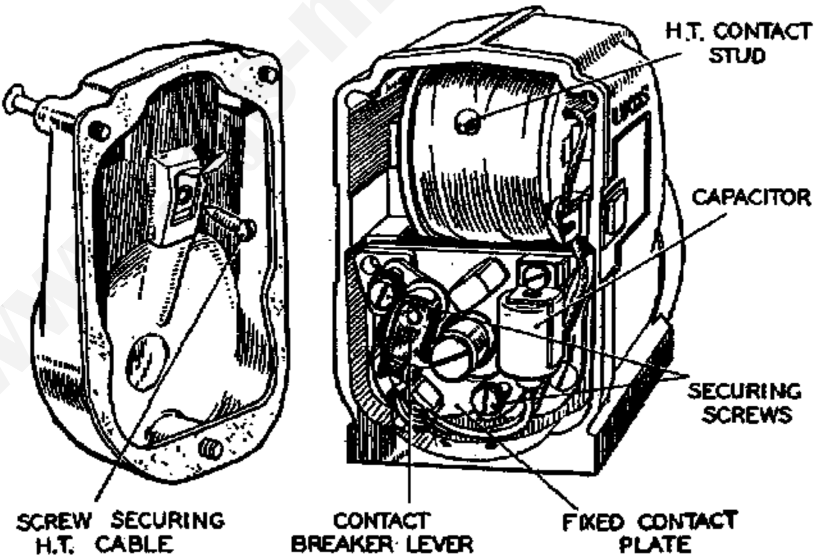


FIG. 52.—ABRANGEMENT OF ROTATING-MAGNET CONTACT-BREAKER.

Removing the Magneto

The magneto is bolted to a platform mounted on the front engine plates. Disconnect the high-tension cable and the ignition-control cable, where fitted, at the handlebar end.

Remove the magneto-chain sprocket from the armature shaft (after taking off the nut) using the tool shown in Fig. 9 inserted between the sprocket and the magneto body. A light tap on the end of the tool will be sufficient to release the sprocket. If an automatic timing control is used the sprocket will be released automatically as the armature shaft nut is unscrewed.

Take off both nuts on the platform-fixing bolts and pull out the bolts, watch for the distance pieces, which should be identified for correct assembly. The magneto and its platform can then be lifted off the engine plates.

The Dynamo

The 1945-49 models use Type E3AR/AO5/1, negative earth, and 1950-57 models use Type E3N, positive earth after 1951.

The 1950 type is slightly longer, with an improved bearing support and new commutator end plate. This type can be fitted to earlier models if the kick-starter case on the gearbox is changed for a type designed to clear the longer dynamo. The part number for the new kick-starter case is 3-C-10.

Removing the Dynamo (All Models Before 1953)

Before removing the dynamo for a charging fault, first check other parts of the electrical system, such as the A.V.C. unit, ammeter or battery connections, then check the output as previously described.

To remove this type of dynamo, follow the instructions given for models made after 1952, up to " Disconnecting Cables Attached to the Dynamo ". Then remove the left-hand side bottom gearbox fixing bolt and pull out the bolt on the right-hand side of the machine, taking' care not to damage the oil pipes. Slacken the top gearbox fixing-bolt nut and pull the gearbox backwards as far as it will go.

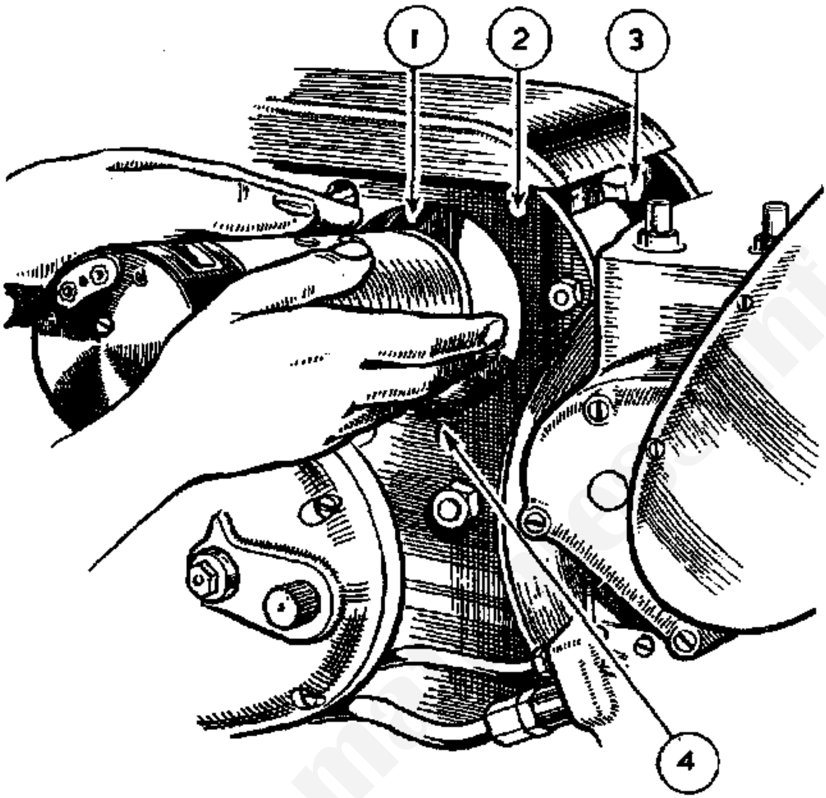


FIG. 53.—REMOVAL OF DYNAMO (SUBSEQUENT TO 1952).

1. Dynamo clamp.
2. Crossbar for bolt.
3. Clamp bolt.
4. Hinge pin for clamp.

Rotate the dynamo by hand so that the locating strip is in line with the keyway cat in the engine plates, the dynamo can then be extracted on the right-hand side of the machine. The locating strip is used to ensure correct chain line, which must be rechecked if this strip is detached.

Removing Dynamo (Models after 1952)

An alteration in the design of the rear engine plates permits the dynamo to be removed without disturbing the clutch, engine sprocket and rear portion of the chaincase (see Fig. 53).

Proceed as follows:

(1) Remove the outer portion of the chaincase.

(2) Remove the spring circlip and lock-plate from the dynamo shaft nut.

(3) Use a spanner applied to the flats machined on the back of the dynamo sprocket, whilst unscrewing the sprocket out. This relieves the dynamo shaft from bending strain during this process.

(4) Use a wedge-shaped tool, as shown in Fig. 9, placed between the dynamo sprocket and the' dynamo body. A light tap on the end of this tool will dislodge the sprocket, without damage to the armature.

(5) Disconnect the cables attached to the dynamo.

(6) Rotate the dynamo by hand until the locating strip on the body is in line with the keyway cut in the engine plates.

(7) Withdraw the dynamo on the transmission side of the engine by tilting upwards to clear the gearbox casing.

Refitting the Dynamo

Reverse the instructions for removal, taking particular care to accurately locate the lock-plate and circlip after the armature nut is retightened. The armature must also be supported by a spanner on the back of the dynamo sprocket as previously described.

Checking the Dynamo Output

To check this instrument *in situ*, a moving-coil voltmeter with a full-scale reading of at least 0-10 volts is required.

(1) Remove the two wires from the dynamo terminals and link the two terminals together with a short length of wire.

(2) Connect the positive wire from the voltmeter (negative wire if a positive-earth system is used) to one of the dynamo terminals. Connect the other voltmeter wire to a convenient earth point

(3) Start the engine and gradually increase the engine speed, when the voltage reading should increase without fluctuation. Do not race the engine unduly, keep the speed about 2,000 r.p.m. and do not let the voltage rise above 10 volts. If this reading is recorded the output is normal. If there is no reading on the voltmeter check the brushes and commutator. If the reading is low (½ volt) the field winding is faulty. A low reading of 1½-2 volts indicates that the armature winding is at fault.

If a voltmeter is not available a 6-volt lamp bulb can be used. The bulb should light as the engine speed is increased if there is voltage output.

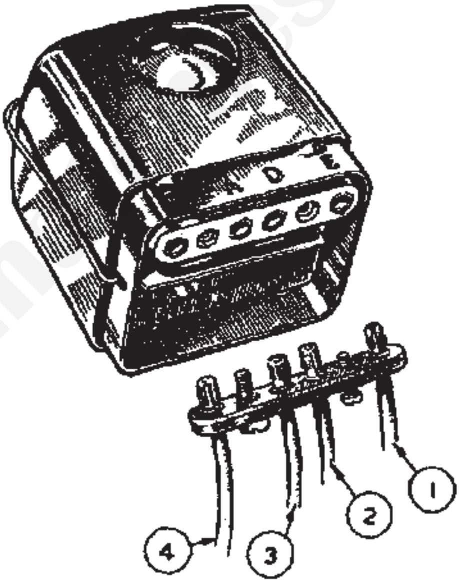


FIG. 54.—DIAGRAM OF CONNECTIONS TO A.V.C. UNIT.

1. Earth.
2. Terminal D on dynamo.
3. Terminal 3 on switch.
4. Terminal F on dynamo.

Cut-out and Regulator Unit (A.V.C.)

Two types are used, namely MCR.1, on models made from 1945 up to 1951, and MCR.2 on machines made from 1952 to 1957- Both types have four external connections, i.e., *D*, dynamo main lead; *F*, dynamo field lead; *A*, lead to ammeter, and *E*, the main earth connection. Unless the operator has some electrical ability, it is preferable to have an instrument of this kind serviced by an accredited Lucas Service Depot.

The possible faults are erratic operation, overheating or burnt-out dynamo, due to a defective earth between terminal *E* and the frame. If the earth connection is made on the frame-seat lug bolt select an alternative position, such as the dynamo body or convenient position on the engine. Burnt or welded contacts are caused by the *D* and *F* wires reversed at the dynamo terminals.

Although the voltage regulator and the cut-out are combined structurally, they are electrically separate. The cut-out is the bobbin on the right-hand side of the unit, which automatically connects the dynamo to the battery when the generated voltage reaches approximately 6·3 volts. It also serves to disconnect the dynamo from the battery when the dynamo voltage falls below that of the battery.

Cut-out Contacts Burnt or Dirty

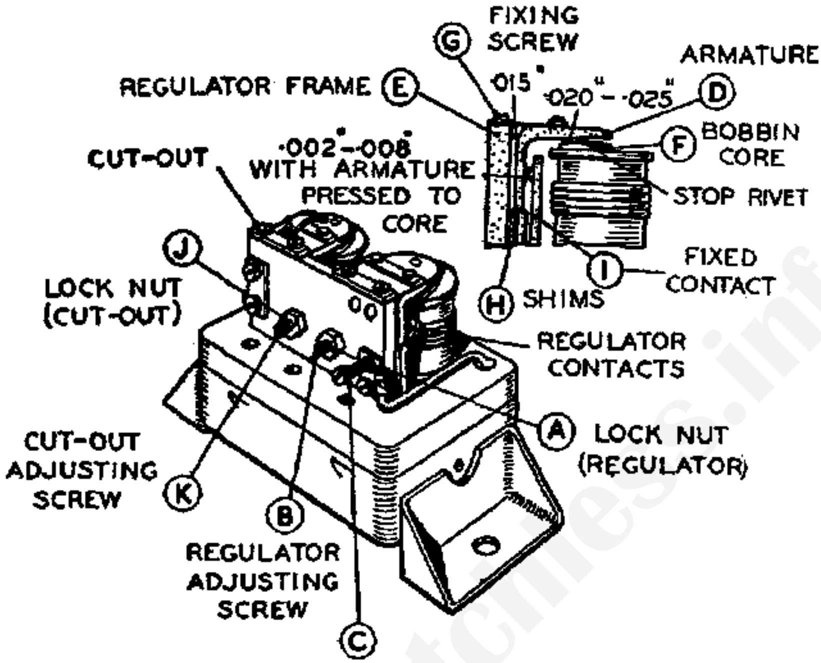
To clean the contacts, use a strip of fine glass-paper or abrasive strip now obtainable for the purpose. Place the cleaning medium between the points, close the contacts by finger pressure and draw the cleaning strip through two or three times with the abrasive side towards each contact in turn.

Cleaning Regulator Contacts

Two screws secure the plate carrying the fixed contact, loosen the bottom screw slightly and remove the top screw. The fixed contact can be moved outwards for cleaning with carborundum paper. Wipe the contacts with a clean cloth and reassemble.

Testing Regulator

If the dynamo output is satisfactory, test the regulator by making sure that the wiring between the battery and the regulator is in order. To do so disconnect the wire from terminal *A* on the regulator. Connect the end of the wire removed to the positive wire for the voltmeter (negative if positive earth); the other voltmeter lead is connected to earth.



TOP SCREW REMOVED TO GAIN ACCESS TO CONTACTS FOR CLEANING

FIG. 55.—REGULATOR AND CUT-OUT ADJUSTMENT AND SETTING.

If a voltage reading is observed the battery and wiring is in order. Without a reading check wiring and connections for loose or broken wires.

Regulator Adjustment

Take off the unit cover and insert a thin card or piece of paper between the cut-out contacts.

Connect one lead from the voltmeter to terminal *D* on the regulator; the other voltmeter wire is earthed. If the earth system is negative, use the positive wire connected to terminal *D*, or negative wire if the earth system is positive.

Start the engine, slowly increase its speed until the meter needle flickers and remains steady. Under average atmospheric temperatures the voltage reading will be between 7·8 and 8·2 volts. If the reading is outside these figures adjustment is necessary. Stop the engine, release the lock-nut

A (Fig. 55) on the adjusting screw *B,* turn this screw clockwise to increase the reading, or anti-clockwise to reduce the reading. The screw must be moved only a fraction of a turn when making this adjustment.

Tighten the lock-nut when the adjustment is completed. Remove material used between cut-out contacts.

Do not run the engine for an undue length of time and not above one-third throttle. Mechanical setting of the contacts should be dealt with by a Lucas Service Depot.

Testing and Setting the Cut-out

If with the regulator correctly set there is still no current from the dynamo to the battery, the cut-out may be at fault or there may be an internal wiring fault.

To test, remove the cables from terminal *A* on the regulator, connect the voltmeter lead (previously used on terminal *D)* to terminal *A.* Start and run the engine as with the regulator test, when the same voltage reading should be recorded. When a reading does not occur the cut-out is not closing.

To function correctly, the cut-out should close when the dynamo voltage is between 6·2 and 6·6 volts. - Check the voltage with the voltmeter connected between terminal *D* on the regulator and earth, If the reading is outside these figures adjust by releasing the lock-nut *J* (Fig. 55) for the adjusting screw *K.* To raise the voltage turn the screw clockwise a fraction of a turn at a time Or anti-clockwise to lower the voltage. Make the adjustment as the throttle is slowly opened until the cut-out contacts close. Tighten the lock-nut when the adjustment is completed.

Removing the Headlamp Front and Interior

Slacken the screw on the top of the lamp body at the front, pull the rim outward from the top and, as the front comes away, raise slightly to disengage the bottom tag from the lamp shell. The cap which carries the bulbs is secured to the reflector by means of two spring plungers. To remove the cap, depress one plunger and tilt the cap bodily.

The reflector and front glass unit is secured to the rim by means of five spring clips. These can be disengaged from the turned-up inner edge of the rim by pressing with a screwdriver blade and, at the same time, working away from the edge.

Replacing the Headlamp Front and Interior

Lay the reflector and glass unit in the rim so that the block on the reflector back engages with the forked bracket on the

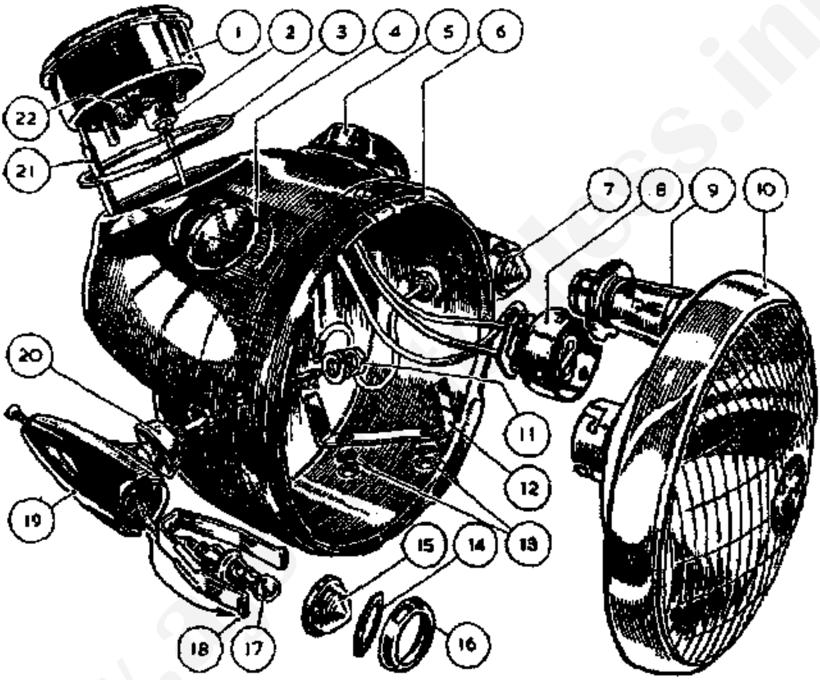


FIG. 56.—HEADLAMP AND SPEEDOMETER ASSEMBLY—1955-58 MODELS.

1. Speedometer.
2. Speedometer lamp.
3. Sealing ring.
4. Ammeter.
5. Lamp control switch.
6. Headlamp shell.
7. Pilot lamp.
8. Lamp connector.
9. Headlamp bulb.
10. Glass, reflector and bulb holder.
11. Nut and washer, fixing pilot lamp.
12. Securing bracket.
13. Nut and washer for 12.
14. Pilot-lamp sealing ring.
15. Pilot-lamp glass.
16. Pilot-lamp rim.
17. Pilot-lamp bulb.
18. Pilot-lamp securing clip.
19. Pilot-lamp shell.
20. Pilot-lamp rubber shell.
21. Speedometer trip reset.
22. Driving-cable connector union.

rim. Replace, by swinging in, the five spring clips so that they are evenly spaced around the rim.

Offer up assembly to the lamp shell, engaging the bulb-carrier cap in the position in which the pilot bulb is against the small window of the reflector. Engage the bottom tag on the lamp rim with the small slit in the shell and gently force the top of the rim back into the shell, after which retighten the locking-screw on the top of the lamp body.

Removing the Headlamp Rim and Light Unit (Pre-focus Type)

Slacken the screw on the top of the lamp body at the front, pull the rim outward from the top and, as the front comes away, lower slightly to disengage the bottom tag from the lamp shell. Twist the back shell in an anti-clockwise direction and pull it off, the bulb can then be removed.

The light unit is secured to the rim by means of spring clips. These can be disengaged from the turned-up inner edge of the rim by pressing with a screwdriver blade and, at the same time, working away from the edge.

Replacing the Headlamp Rim and Light Unit (Pre-focus Type)

Lay the light unit in the rim so that the location block on the unit back engages with the forked bracket on the rim.' Replace, by springing in, the spring clips so that they are evenly spaced around the rim.

To replace the back shell, engage the projection on the inside of the back shell with the slots in the holder, press on and secure by twisting it to the right.

Take care to engage the back shell correctly so that the pilot bulb is opposite the aperture provided in the light unit. Engage the bottom tag on the lamp rim with the small slit in the shell and gently force the top of the rim back into the shell, after which retighten the locking-screw on the top of the lamp body.

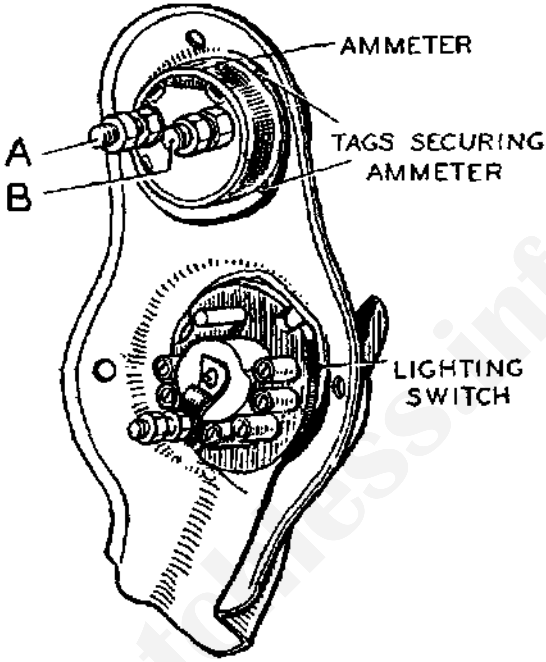


FIG. 57.—SHOWING AMMETER AND LIGHTING-SWITCH CONNECTIONS.

Sparking-plugs

A sports-type sparking-plug is essential for O.H.V. type engines. Engines using a cast-iron cylinder-head require a short-reach plug, K.L.G. Type F.80. All engines with alloy cylinder-heads, must use a long-reach plug, K.L.G. Type FE.80, both types have 14-mm.-diameter threads.

The plug gap is between 0·020 and 0·022 in., to widen or narrow the gap move only the earth electrodes, which are attached to the body of the plug. Never attempt to move the central electrode. The plug gap should be checked every 3,000 miles, or earlier if the slow running is impaired or starting becomes difficult.

Ammeter (Testing in Position)

Remove the lamp front and with a voltmeter check the voltage at each ammeter connection *A* and *B* in turn. Both readings should be identical. If mere is a reading at one terminal only the meter is defective and must be replaced. To

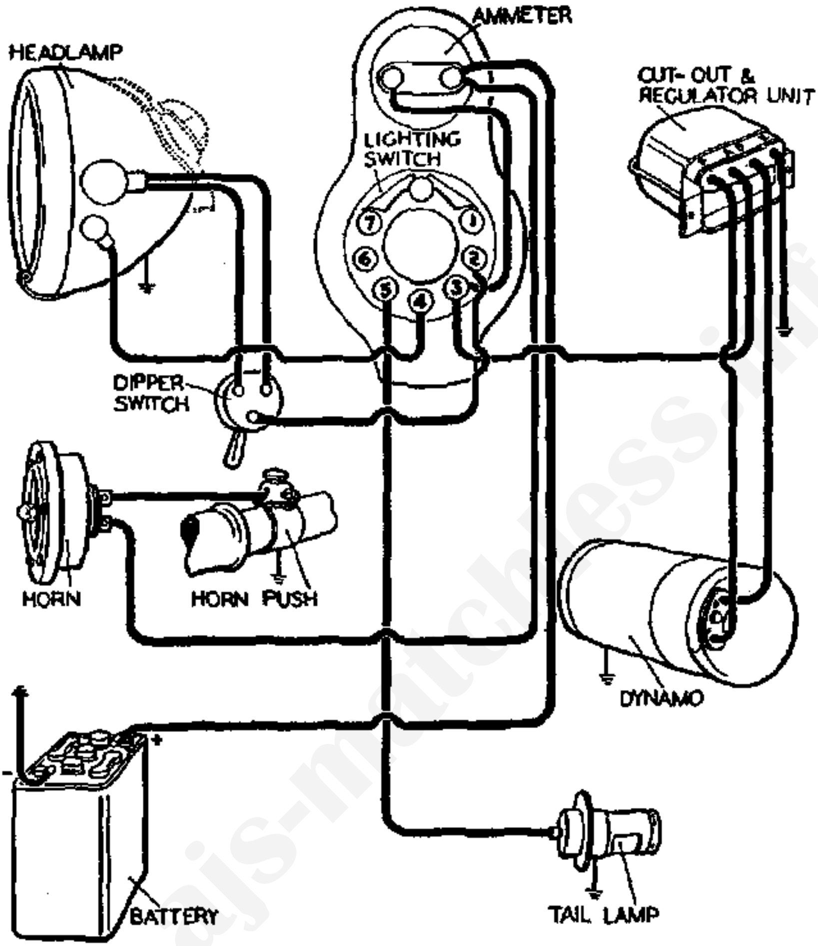


FIG. 58.—WIRING DIAGRAM—1945-50 MODELS (NEGATIVE EARTH).

remove the meter disconnect the cables from each terminal, bend back the four metal tags and remove it from the panel (see Fig. 57).

The Battery

A 6-volt, 12-ampere-hour type is used on all models, and is often the most-neglected part of the machine. Owners are advised to check the electrolyte level at frequent intervals and remove sulphate, which is a white deposit, from the battery

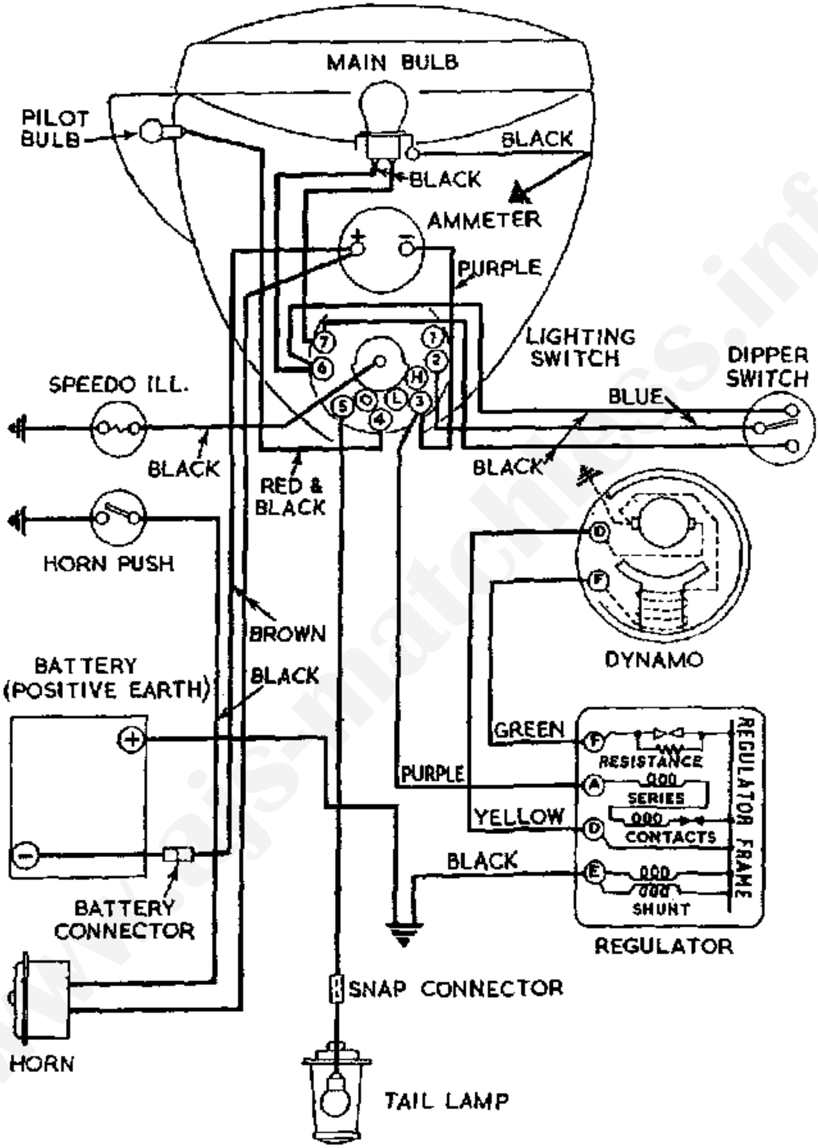


FIG. 59.—WIRING DIAGRAM FOR 1951-53 MODELS.

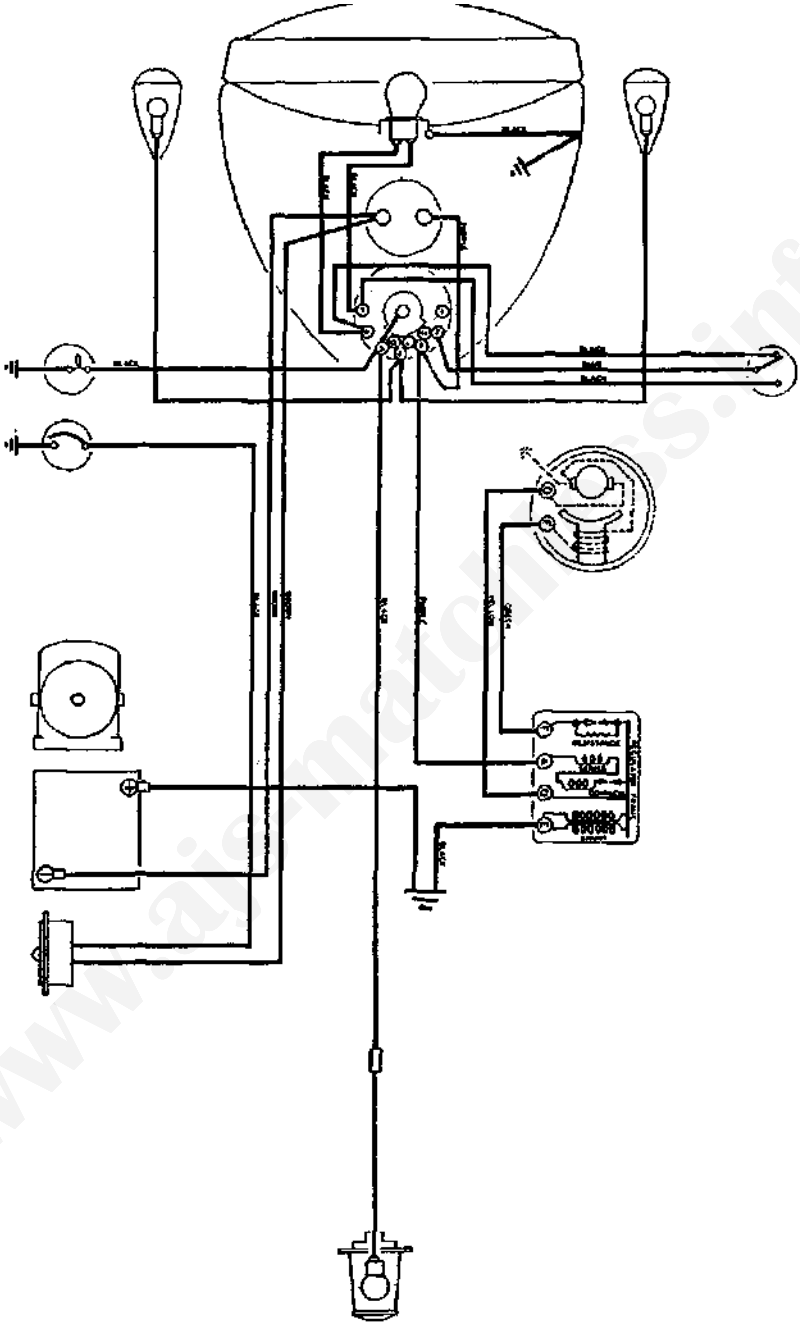


FIG. 60.—WIRING DIAGRAM—1954-57 MODELS (POSITIVE EARTH).

terminals. A little Vaseline should be applied to the terminals after cleaning if they are of the detachable type. After topping up with distilled water only, wipe all the metal parts and the battery top with a rag soaked in ammonia to neutralise the acid, the rag should be thrown away after use.

Some batteries have " topping-up " instructions moulded in the battery lid, and the later types use an automatic level device that accepts just as much distilled water as required.

If the battery is inclined to " boil " or need frequent topping up the charge rate is excessive and the regulator should be reset.

Lamp Bulbs Blowing

This fault is caused by an open-circuit, due to one of the battery leads being disconnected, or a bad battery earth connection.

Where this connection is made on the frame-seat lug bolt, take out the bolt, file away enamel or rust in the frame holes and clean the bolt.

A dry battery will also cause the same effect.

CHAPTER VII

TRIALS AND SCRAMBLES MODELS

THESE machines were first introduced in 1956, and the information given has been compiled for the benefit of riders who have little knowledge of trials and the preparation of their machines for events of this kind. .

TRIALS MODELS

A high-efficiency engine is not desirable for this type of machine. Dead-slow running with abundant power at low road speeds with a good pick-up is accomplished by

(1) Using a low compression ratio, 6·3 for 350-c.c., 5·8 for 500-c.c.

(2) Standard cams (not high-lift or racing type).

(3) Complete control over pilot adjustment (see carburetter modification).

(4) Possibly the use of a throttle slide with 1/16 in. less cut-away.

The engine must be devoid of air leaks between cylinder-head and carburetter to obtain this effect.

Flywheels

Heavy flywheels are best suited to obtain " Plonk "—a phrase coined by competition riders and meaning good pulling power (gas-engine effect) at slow road speeds.

For several seasons flywheels are identical in size on both 350-c.c. and 500-c.c. models, with exception of balance. Therefore no alteration is necessary to this part of the engine, providing the machine is a competition model.

As a further aid to obtaining good pulling power at slow road speeds, a manually operated ignition control is required.

Gear Ratios

An ultra-low bottom, or first, gear is most necessary (see table of gear ratios, page 175), obtainable by using an engine sprocket with 16 teeth for 350-c.c. models and 18 teeth for 500-c.c. models.

For events such as Scottish Six Days Trial a 15-tooth sprocket will be of advantage where steep, rocky gradients are expected. Use a 16- or 17-tooth sprocket for the 500-c.c. model.

Front Chaincase

When competition models are used frequently in wet, muddy sections, mud and water will enter the front chaincase, and possibly get into the engine. Owners of early models made before 1952 should use a rear portion of front chaincase of a later type with a mud excluder fitted for the gearbox mainshaft aperture.

The use of a felt sealing washer between the back of the engine sprocket and crankcase will prevent mud or water entering the engine. An extension of rubber tubing attached to the crankcase-release pipe carried and attached high up on the frame seat tube (underneath the saddle) will prevent water entering the engine.

Converting Standard Models for Trials Work

A considerable amount of work is involved in a conversion of this kind, and apart from the engine, both front and rear mudguards must be raised, to avoid mud clogging both wheels.

To deal with the front guard is simple, but in the case of the rear guard on competition-type models the bridge piece locating the guard must be removed into a higher position,

Gearbox

To obtain ultra-low ratios, the main driving gear and lay-shaft fixed pinion must be exchanged, in addition to the engine sprocket.

Steering Angle

Additional trail or castor action is used on the special competition models, which is in excess of the standard machines.

Therefore a converted machine will not handle as efficiently as the designed competition model. This difference lies with the frame head-lug angle.

Brakes

A brake lining which is impervious to water or oil has been used for some time. Service brake shoes fitted with this type of lining are available from the makers for machines fitted with 7-in. brakes.

Preparation for Competition Riding

It is a common fault to devote too much time to the engine, overlooking such important parts as control cables, clutch adjustment and security of attachments, such as exhaust pipes and silencers. To have one of these items becoming loose or falling off in a competition is not bad luck, but bad preparation.

Pay attention to waterproofing such parts as the high-tension brush holder, which if covered with plasticine will stop arcing. A sparking-plug waterproof cover should always be used.

Electrical System

To reduce weight, owners will possibly take off the battery, which is in order, providing the two dynamo wires on end cap are disconnected (two-brush type).

SCRAMBLES MODELS

Maximum engine efficiency can be effected by shaping the inlet port on the 500-c.c. engine to dimensions shown in Fig. 61.

After polishing the ports and the sphere of the head the best results are obtained by:

(1) Using a compression ratio of 9·5 for 350-c.c. and 8·3 for 500-c.c. models.

(2) Fitting special cams, as previously described (see "Technical Data" for timing and rocker clearance); these are marked " SH ".

(3) Fitting an open exhaust pipe system 48 in. long for machines made before 1956 and 42 in. for the 1956-57 models.

A T.T.-type carburetter was used before 1956, later models use the Monobloc type, which is considered to be more effective than the T.T. type.

Compression ratios recommended are suitable for high-grade fuels. The benefit of using a methanol-benzole mixture is problematical, for, unless ultra-high compression ratios

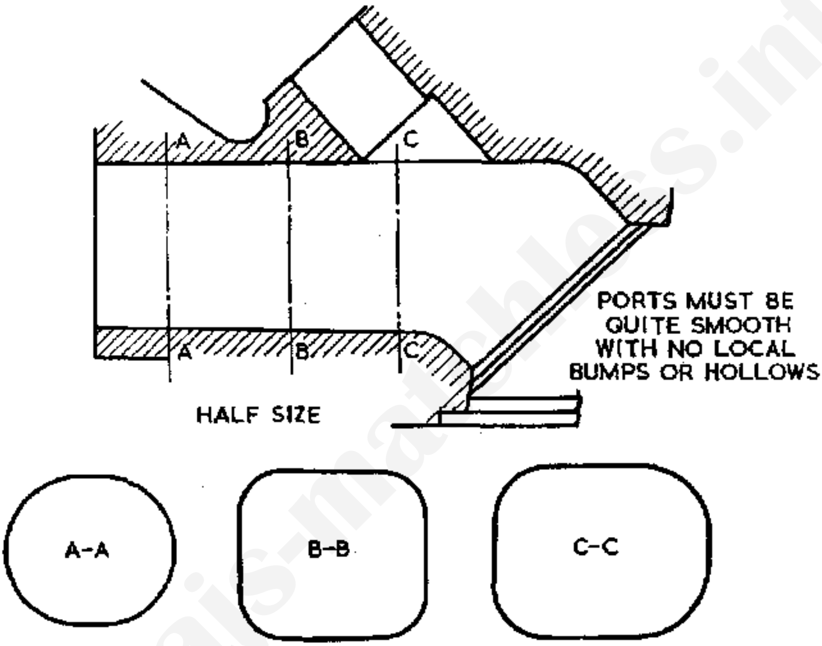


FIG. 61.—DIMENSIONS FOR SHAPING INLET PORT ON 500-C.C. MODELS.

in the region of 11 or 13 to 1 are used, there is no gain in using special fuels of this kind.

High-compression Pistons

These are of the solid-skirt type, and can be reversed, as the cut-away for valve clearance is symmetrical. The load and thrust sides of these pistons are important, and should be retained in original position, as removed.

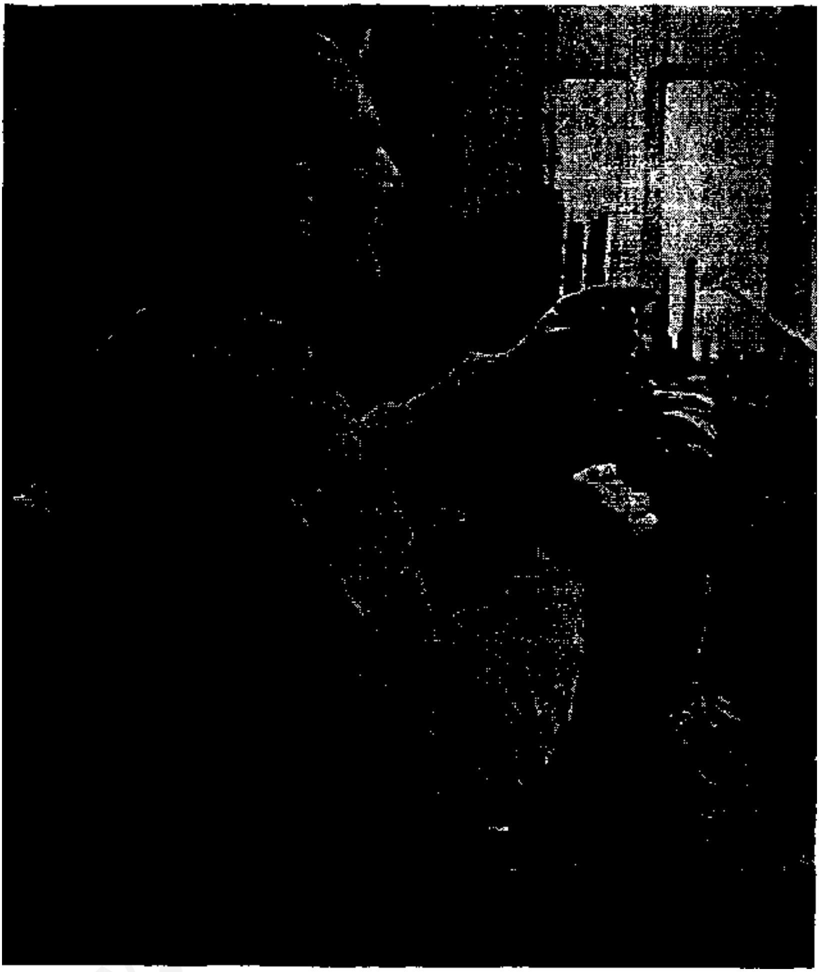


FIG. 62.—CHECKING COMPRESSION RATIO.

Sparking-plugs

To withstand the compression ratio, plugs with a high heat factor are essential. The K.L.G. type FE.250 or FE.220 for alloy heads are recommended, and F type (short reach) for iron heads. Use graphite grease on plug threads.

Measuring Compression Ratio

When the compression ratio is not known it can be measured by using a fluid, which can be either water or paraffin, together with a graduated glass tube called a burette, graduated in c.c.

The compression ratio is measured by recording the amount of fluid in the combustion chamber when the piston is on the top of the stroke (T.D.C). To avoid fluid leakage past the piston rings they should be coated with a little clean light grease.

Set the engine, with the piston as previously described, and lay the engine aslant so that the combustion chamber can be completely filled (see Fig. 62). The fluid should be up to the level of the bottom of the sparking-plug hole.

With fluid in the burette, place a finger over the open end, turn the burette upside down, to displace air, and drain fluid by opening the tap until fluid reaches the maximum mark. Place the end of burette into the sparking-plug hole, open the tap, watch carefully as fluid rises to avoid overfilling, if fluid is spilt empty combustion chamber and start again.

Record the amount of fluid taken to fill the combustion chamber, A simple calculation can be made by dividing the combustion-chamber content into the cubic capacity of the engine, plus one ratio which is already in the combustion chamber. This will indicate the static compression ratio.

For example;

$$\frac{\text{Engine capacity (c.c.)}}{\text{Combustion-chamber content (c.c.)}} = \frac{347}{40} = 8{\cdot}7$$

$$\text{Plus one ratio} = 9{\cdot}7$$

Measuring Exhaust-pipe Length

This is an important factor for engine efficiency. So much so that works racing exhaust pipes are checked against a fluid content. The pipe lengths already recommended can be measured with a long piece of copper wire with a weight, such as a large nut, attached to one end of the wire. Drop the weight attached to the wire down the exhaust pipe and pull the wire taut against the inside bend of the pipe. After marking the loose end of the wire, measure the total length, then either lengthen or shorten the pipe to obtain the correct length.

Note that as the engine revolutions increase the pipe length should be decreased, providing the main jet size is adjusted accordingly.

Sparking-plug Register

The position of the plug points, in relation to the sphere of the cylinder-head, affects the flame rate when combustion occurs.

A short-reach plug used in a head designed for a long-reach plug will have the effect of retarding the ignition setting. When tuning for engine efficiency aim to have the plug points just flush with sphere of the head. It may be necessary to cut back the face for the plug on the head.

Use a solid copper plug washer, which can also be altered in width to obtain plug-location. Retain this washer if the plug is changed.

The use of a long-reach plug in a short-reach head will cause burning on the threads protruding into the combustion chamber. This will make it difficult, or impossible, to remove the plug.

Checking Connecting-rod Alignment

If the connecting-rod is slightly bent there will be a " witness " on the top of one side of piston and on the bottom of the opposite side. The connecting-rod can be reset *in situ* within reasonable limits by using a mandrel and steel block with parallel faces, as shown in Fig. 63.

Flywheels

It has become increasingly popular to use a light flywheel weight to improve acceleration of the engine. This can be carried out with limitations, for reducing flywheel weight can result in wheel spin when accelerating from low road speeds.

The early type flywheels were 2·5 lb. lighter than those fitted to engines after No. 8000. If the flywheel rim diameter is reduced by 1/8 in. by machining (not on the side) the balance will not be affected.

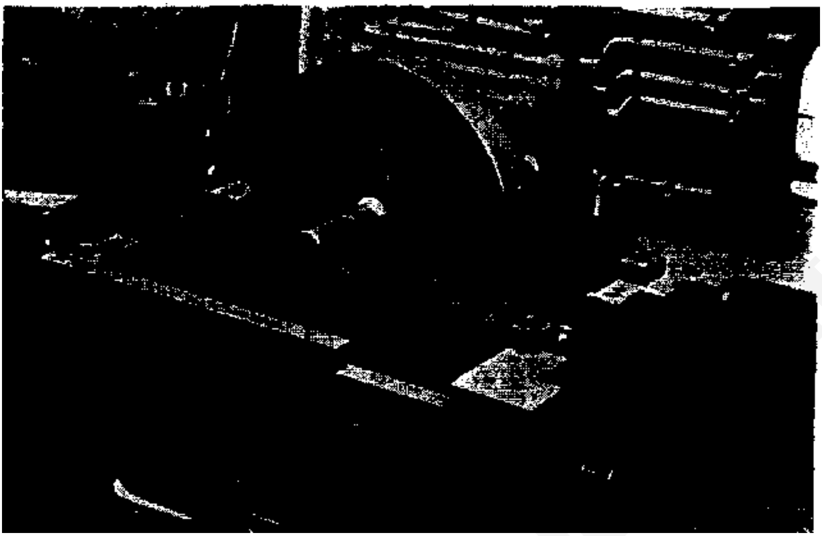


FIG. 63.—FLYWHEEL BALANCING FIXTURE.

If it is desired to check the balance, the rotating and reciprocating weight, together with the balance weight, to be attached to the flywheel crankpin hole has been calculated and is shown in " Technical Data " (see page 179). Weights given are for each flywheel balanced individually and not as a mass. By using this method, if a flywheel is replaced further balancing is not necessary.

On old engines, and where the crankpin has been replaced several times, the interference fit of the crankpin shaft may be impaired.

As Scrambles models are subjected to severe stresses, particularly when the machine leaves the ground, and if intelligent throttle control is not used on landing, the shock load on the flywheel assembly is considerable. Under these conditions the flywheels may move, and this can be rectified only by closing up the interference fit by having a copper deposit made on both shanks of the crankpin to the extent of 0·002-0·003 in. to increase its effective diameter. Where bronze crankpin washers are used, fit steel washers for better rigidity.

Short-circuit Racing

Details given for Scrambles engines apply also to events of this kind, with the exception of gear ratios, which must be adjusted to suit the size and shape of the course by changing the engine sprocket.

If touring models are used for this type of event with silencers removed, the carburetter must be adjusted by increasing the carburetter main jet size by one to two sizes larger or 10 to 20 c.c, namely from 150 to 160 or 170 on the 350-c.c. models, or from 180 to 190 or 200 on the 500-c.c. model.

When a Monobloc carburetter is fitted the corresponding increases should be from 210 to 220 for the 350-c.c. model and from 260 to 280 for the 500-cc. model. The reason for an increase in jet size is due to the loss in restriction of exhaust gases caused by removing the silencer.

Where prolonged full-throttle driving is permissible, a sparking-plug with a higher heat factor is essential. Types of plugs to be used have been mentioned previously in this chapter-

Wheel Balance

If either the front or rear tyre is out of balance, particularly the front, the steering can be affected and cause the front forks to " flap ". Modern tyres are claimed to be balanced, and this is indicated by white dots on the cover.

Either wheel can be balanced only by removing friction caused by the oil seal fitted to both wheel spindles. If the wheel is properly balanced it should remain stationary when placed in any position.

If the wheel moves, say with the tyre valve, or security bolt to 180 degrees, or six o'clock, the wheel is heavy at this point. To counter balance, attach strips of lead on one of the spokes at 180 degrees to the valve or security bolt and set the wheel in several different positions by adjusting the amount of lead strip so that it will remain motionless. When the wheel is totally balanced fix the weight to the spoke with insulating tape. This process may appear to be tedious, but is essential in the preparation of the machine.

Racing-machine Check

Before practice or race events, factory-prepared machines should be checked from front to rear for security of components. The remarks made for Trials models (see page 152) also apply.

T.T. Type Carburetter

The Scrambles models were fitted with an Amal T.T.10 type carburetter, and settings for 350-c.c. and 500-c.c. models are given below.

CARBURETTER SETTINGS

350-c.c. TYPE 376/1

Bore size	1 1/16 in.
Throttle slide	Type 5
Needle jet	109
Main jet	300

500-c.c. TYPE 389/1

Bore size	1 3/16 in.
Throttle slide	Type 7
Needle jet	109
Main jet	340

These settings are for premium grades of fuel. For proprietary brands of alcohol fuels, the main jet must be increased in accordance with the carburetter maker's recommendations.

As the increased jet size will be larger than the needle jet the orifice of this jet must be increased also. On the 350-c.c. model, for alcohol fuels, use a needle jet size 0·113 in. and 0·120 in. for the 500-c.c. model.

Racing fuel.	Jet increase, per cent.
J.A.P.	150
Esso No.1	150
Esso No.2	120
Esso No.3	130
Shell R.S.1	150
Shell R.S.2	140
Shell R.S.5	125
Shell R.S.7	100
Shell R.S.8	50

THE 1956-57 SCRAMBLES ENGINES

Since these engines differ considerably from earlier engines and as they are not fully described in the makers' handbook, descriptive and service details are given below.

Design alteration is based on racing practice. By using a short stroke, the 500-c.c. engine is " over square ". The big-end assembly is similar and dimensionally the same as the Racing 7R model. Flywheels machined from steel billets use flanged end shafts, in place of the orthodox threaded type with a close interference fit.

A large roller bearing in conjunction with a short bronze bush forms the timing-side axle bearing. The driving-side axle runs on two ball-races of different diameters.

A bi-metal cylinder, with alloy muff bonded to iron liners, has push-rod tunnels cast in it. Oil seals of heat-resisting rubber rings are fitted in grooves machined in both cylinder faces.

Special cams of a type already described (marked SH) are used for maximum engine performance with an open exhaust pipe.

Push-rod Adjustment

With engine cold use a nil clearance for inlet valve and 0·005 in. clearance for exhaust. To obtain exhaust-valve clearance first use a nil clearance, then unscrew the adjusting cup one-sixth of a turn or one flat on the hexagon. The piston must be on top dead centre of firing stroke when this setting is made.

Valve Timing

To refit cams see instructions for earlier type engines, but use number *two* mark for inlet and number *one* for exhaust.

Checking Valve Timing

For accuracy, valve timing readings are taken either with the valve 0·001 in. off its seat or when the valve has moved to this extent.

Use normal pushrod adjustment, which should give the following valve timing, taken as a mean reading from a number of engines.

Inlet opens	59° B.T.D.C.
Inlet closes	69° A.B.D.C.
Exhaust opens	69° B.B.D.C.
Exhaust closes	48° A.T.D.C.

Ignition Timing

The correct ignition timing is:

350-c.c. engine 41° B.T.D.C }
500-c.c. engine 39° B.T.D.C. } Control lever fully advanced.

Check contact gap (0·012 in.) before setting is made.

Exhaust Pipes

The mean pipe length for both engines is 42 in. Pipes are 1½ in. in diameter for 350-c.c. models and 1¾ in. for the 500-c.c. models.

Carburetter

Main jet sizes are given in the " Technical Data " (see page 178) for these engines. They are for an open-exhaust-pipe system.

Gear Ratios

Internal ratios are identical to the touring models made from 1952 and after (see table of gear ratios, page 174).

Fuels

Premium-grade fuels are suitable for the compression ratio used on both engines.

Decarbonising

It is not desirable to polish the sphere of the cylinder head or the piston crown each time the engine is taken down. If there is no carbon formation deal with the valves only.

The best results are obtained when the combustion chamber is in a nice dry ebony black condition and not brightly polished as commonly assumed.

Details given for taking down standard engines apply also to this type.

Major Overhauls

When possible, flywheel service should be carried out by the makers, unless proper equipment is available.

Timing-side Axle Bush

The outer end, nearest to the timing pinion of this bush, is swaged out to prevent the bush " creeping " towards the roller bearing, this bush must therefore be pressed out from *inside* the crankcase half.

Flywheel Axles

These are a close interference fit, as fixing nuts are not used to secure them. An arbor press is necessary to force shafts out of flywheels and also to replace them.

Tappet Guides

These are a push in fit. Remove the Alien screws before the guides are extracted.

TECHNICAL DATA

Model.	350.	500.
Engine capacity . .	348 c.c.	497 c.c.
Bore and stroke . .	72 mm. x 85·5 mm.	86 mm. x 85·5 mm.
Compression ratio .	9·9	8·7
Carburetter Amal Monobloc . .	389/18	389/12
Choke diameter . .	1 1/8 in.	1 3/16 in.
Main jet No. . .	270	440
Pilot jet No. . .	30	30
Slide No. . . .	3	3
Needle position . .	Centre notch	Centre notch
Needle jet . .	0·106	0·106
Petrol-tank capacity .	2 gallons	2 gallons
Oil-tank capacity .	4 pints	4 pints
Brakes . . .	7 in. x 7/8 in.	7 in. x 7/8 in.
Rear chain . .	5/8 in. x 0·380 in., 97 links	97 links
Primary chain . .	3/8 in. x 0·305 in., 66 links	67 links

PERIODIC MAINTENANCE

Daily

Check oil level and circulation.

Weekly

Test tyre pressures.
Check battery electrolyte level.

Every 500 Miles

Check oil in front chaincase.
Check front- and rear-chain adjustments.
Check gearbox oil level.
Oil rear chain.

Every 1,000 Miles

Grease hub bearings.
Grease brake-expander lever bushes.
Grease steering-head bearings.

Oil small parts, control levers, clevis pins for brakes, brake pedal, etc.
Test steering-head bearings.
Check rocker clearance.

Every 3,000 Miles

During wet weather remove and soak rear chain in molten anti-centrifuge grease.
Clean and check contact points on magneto.
Clean and reset plug points to 0·020-0·022 in.

Every 5,000 Miles

Drain oil tank, fill with fresh oil. If the machine is used frequently for short journeys, change the oil every three months, whichever occurs first.
Clean oil filter.
Check front-fork oil content.
Check rear-suspension unit oil content.
Oil hinge-bearing for swinging arm.
Clean out carburetter float chamber.
Clean air-filter element and re-oil.

RECOMMENDED LUBRICANTS

	Shell.	Vacuum.	Price's.	Esso.	Wakefield.
Engine:					
Summer	X-100 (SAE 50)	Mobiloil D	Energol 50	Essolube 50	Castro] Grand Prix
Winter	X-100 (SAE 30)	Mobiloil A	Energol 30	Essolube 30	Castro] XL
Gearbox	X-100 (SAE 50)	Mobiloil D	Energol 50	Essolube 50	Castrol Grand Prix
Frame and Hubs	Retinax Grease CD or A	Mobilgrease No.	Energrease C3	Esso Pressure Gun Grease	Castrolease Heavy
Front Forks and Rear Legs	X-100 (SAE 20)	Mobiloil Arctic	Energol 20	Essolube 10	Castrolite
Primary Chain	X-100 (SAE 30)	Mobiloil Arctic	Energol 20	Essolube 20	Castrolite
Rear Chain	Retinax Grease CD or A	Mobilgrease No.	Energol A.O.	Esso Fluid Grease	Castrolease Graphited

CHAPTER VIII

TUNING THE ENGINE

WITH mechanical ability and workshop facilities, A.J.S. engines can be tuned for speed to give a good account against engines of a similar class.

It is, however, unreasonable to expect the performance of a race-bred model from a high-speed touring machine.

Owners with serious intentions will first ensure that the engine is in good order, particularly in respect of the flywheel assembly. The engine shafts must run true to a maximum error of 0·001-0·002 in.

Engine Assembly

If the crankpin is replaced the flywheels should be pressed firmly against the shoulders of the crankpin, and not rely on the pressure of the crankpin nuts only. An arbor press is essential for this work if the assembly is to be rigid. If this process is omitted the flywheels can flex, which will absorb power and subsequently fracture the crankpin.

Before bolting the crankcase together, fit the camshafts into the timing chest, fit the cover and tighten the fixing screws. Check each camshaft for free running, and clearance if SH cams are to be used. Also check for end-float.

Follow the details given for overhauling the engine, not forgetting to check the connecting-rod for alignment.

As fuels with a high octane rating are now obtainable, pistons to give a ratio of 9·5 to 1 for the 350-c.c. engine and up to 8·4 for the 500-c.c. engine are supplied by the makers.

A super-sports-type sparking-plug must be used if this type of piston is fitted.

Valves and Guides

Where machining facilities are available a larger inlet valve can be used, with an increased head diameter of 1/32 in. A

500-c.c. inlet valve, of the same valve-stem length, can be used on the 350-cc. engine if the valve-seat area is increased accordingly. Alternatively, a valve with a 5/16-in.-diameter stem together with a bronze inlet-valve guide, as used on the 7R model, will have a beneficial effect. The valve material must be of the austenitic type, i.e., KE965, or Jessops G.2.

With a larger valve, the valve head may foul the cylinder barrel when at full lift. A radius filed on the cylinder when contact occurs will be satisfactory.

Carburetters

In conjunction with the larger inlet valve the inlet port and distance piece can be enlarged for a bigger-bore carburetter up to 1 1/16 in. for the 350-c.c. and 1 3/16 in. for the 500-c.c. engine. The carburetters should be offered up to check the inlet tract. Ensure that the distance piece between the cylinder-head and carburetter are identical in diameter to give an uninterrupted gas flow. If the distance piece is alloy, a fibre flange washer ¼ in. thick will prevent heat flowing back from the cylinder-head.

Valve-spring Pressure

To avoid valve-float at high engine revolutions the valve-spring pressure is important, and springs should be renewed more frequently if maximum engine efficiency is desired.

See also Chapter VII for exhaust-pipe length.

Fitting Special Camshafts

Current-type camshafts can be fitted to engines made before 1954. These have a higher valve lift and are identified by " HL " etched on the cam flank (see details on *' Valve Timing " for timing marks, page 64).

If the exhaust-valve lifter is mounted in the crankcase the flat on the valve-lifter shaft, which engages with the split collar surrounding the exhaust tappet must be ground away slightly to allow the exhaust tappet to contact the base circle of the cam.

If this is not carried out the valve motion will be affected and the tappet will cause a rattle, with a risk of breaking the tappet foot,

Racing Cams (SH Type, Valve Lift 0392 in.)

These are used on new Scrambles-type engines, and are designed for an open-exhaust-pipe system. Engine performance will deteriorate if a silencer is used.

These cams can be fitted to early type engines, but as the valve lift is higher, the apex, or cam peak, will foul the crankcase each side of the timing-side shaft-bush housing. An increased clearance by machining the crankcase is therefore necessary.

The valve-lifter shaft must also be modified as described for HL-type cams.

Camshaft markings and push-rod adjustment are detailed for the Scrambles-type engine.

CHAPTER IX

WORKSHOP TOOLS AND APPLICATION

B.2151. Timing-pinion Extractor

The small pinion on all single-cylinder O.H.V. models has a taper bore. With left-hand nut for pinion removed the flange on the tool is placed behind pinion, which can be removed on tightening lightly the drawbolt, and tapping the end of the bolt. Overtightening the bolt will break the Up on the tool.

B.2139. Chain Grip

With the rear chain removed the chain portion is draped round the sprocket for the rear chain on the gearbox, with the handle against a convenient position of the frame, to prevent either engine or gearbox shaft rotating, during the process of releasing, or tightening.

(a) Nut on gearbox mainshaft for clutch huh.
(b) Nut-retaining sprocket for gearbox.
(c) Shock-absorber nut on engine mainshaft.
(d) Small tuning-pinion nut (engine in frame).

B.2140. Flywheel-separating Tool

With one crankpin nut removed, place the tool over the flywheel, with the draw bolt correctly located against the crankpin.

The flywheel is removed from the crankpin by screwing in the drawbolt.

B.247-240. Valve-guide Drift and Positioning Tool

Where a hand press is not available the drift is used for removing the valve guide, by a series of light hammer blows.

The valve-guide positioning tool locates the inlet guide, add washer for locating exhaust guide (for engines up to 1948).

See maker's instruction book for guide protrusion 1949-51 models.

B.152. Tappet-guide Extractor

This tool can be used for extracting the tappet and its guide, with the engine in position or the crankcase dismantled. With the rocker box and cover tubes removed, expose the valve gear, take out the cam wheels, also the valve-lifter shaft for engines before 1949 if the exhaust tappet is to be removed.

With the small pinion in position, introduce the cross head into the cam-wheel bush (short end) below the tappet to be removed. Place the plate on dowel pins, with the counter-bored screw holes outwards. Secure plate with timing-cover screws; the tool is then ready for use. The action of un-screwing the coarse-threaded bolt forces the tappet with its guide out of the crankcase.

When the limit of the thread is reached introduce the thrust pieces, also supplied, between the head of the bolt and the tappet base. Should the guide resist removal, local heat will facilitate movement.

A.9640/7/8. Timing-shaft Locating Tool

To renew or refit the timing-side axle, correct location is vitally important With the shaft removed, insert the stub. on the tool in the aperture for the crankpin in the flywheel.

Fit the small pinion and key on the shaft and insert in the flywheel, with the mark on the pinion in register with the mark on the tool. The shaft nut can now be refitted, thus ensuring correct shaft location.

A.8078. Big-end Lapping Tool

Connecting-rod liners supplied as spares are machined to a special size, to allow for contraction when fitted to the rod. Concentricity of the liner, when in position, can be effected by applying grinding paste for the lap on which the connecting-rod liner is placed. Using a reciprocating movement, the liner can be lapped until it is concentric.

Provision is made for expanding lap, within reasonable limits. By this means the liner can be enlarged for the use of oversize rollers.

B.2141. Fork Inner-tube Tool

This tool is essential for teledraulic fork service, for both removing and refitting fork inner tubes. This special tool has a cap nut (below washer) to protect the thread on the tool when not in use. To remove the fork tube (with the front wheel and mudguard removed) slack off the pinch bolt through the fork crown, then take out the large bolt in the handlebar lug securing the fork tube. With the tool screwed well down with full engagement of the thread, the inner tube can be driven out from its housing with a light mallet.

To replace, insert the tube in its housing as far as it will go. Introduce the tool through the handlebar lug to engage with the threaded portion of the tube. Run down the nut against the washer and screw down with a suitable spanner to draw the tube into position.

NOTE.—With this tool it is possible to remove complete the front assembly after disconnecting the front brake cable by the above method, leaving the wheel and mudguard with lamp and speedometer assembled, should it be necessary to examine or exchange fork springs.

B.2150. Flywheel Spanners for Crankpin

For use, place a plain socket spanner (without hole for tommy bar) in vice and firmly tighten. Upturn the flywheel assembly, then locate one crankpin nut in the socket spanner; the exposed nut can now be unscrewed with a second socket spanner and tommy bar. (See details for tool B.2140.) Can also be used for driving-side axle.

B.2160. Split Bush for Fork Oil-seal Replacement

The front fork oil seal is necessarily a close fit in the fork slider, to prevent oil leakage. Application of gentle heat will cause the slider to expand and so facilitate both removal and replacement of oil seal.

Where such facilities are not available, this tool is used to push the oil seal into the slider far enough to permit engagement of the slider extension. For use, split bush circles fork tube flange uppermost, a series of light blows with a mallet on the bottom end of the fork slider will force the oil seal into position.

B.3334. Hub-adjusting Ring Spanner

This tool is used for wheel-bearing adjustment. With the hub lock-ring removed, the tool is screwed on to the hub, with dogs engaged in slots for the adjusting cup. Adjustment can then be made both quickly and accurately.

B.2237. Peg Spanner for Screw Cap (1950 Type)

For rear-leg service follow instructions in manual issued with the machine under paragraph " to check oil content teledraulic leg ". To dismantle further, this tool is used to unscrew the screwed cap securing the oil seal.

The tool can also be used to push the oil seal into the bottom tube for the damper, by raising the screwed cap. With the spanner placed on the oil seal, applying pressure on the top tube will force the oil seal into position.

B.3573. Block for Rear Leg Top Tube (1950 Type)

The block is used to secure the rear leg top tube and to unscrew or replace the piston for the top damper tube. The clamp is made from soft alloy to prevent damage to the highly polished surface on the top tube. If this tube is bruised or scored the oil seal will be rendered ineffective with short use.

B.3572. Clamp for Frame Leg Piston (1950 Type)

With the rear frame top tube secured by tool B.3573, the clamp is used to remove and also to replace the piston, which must be firmly secured.

B.3570. Guide Bush for Rear Leg Oil Seal (1950 Type)

The bush is fitted over the threaded portion of the top tube, before fitting the oil seal in position, thus avoiding damage to the seal by passing the threaded portion of the tube.

B.3571. Serrated Ring Spanner Rear Legs (1950 Type)

This is used to slacken the serrated carriers ring for the rear frame leg in place of tool-kit spanner, 010438.

B.4401. Block for Rear Leg Inner Tube (1951 Type)

To grip the inner tube when screwing on the top pivot lug, this tool will be useful.

B.4403. Block for Rear Leg Outer Tube (1951 Type)

This tool is used to grip the bottom tube of the rear leg while unscrewing the bottom pivot lug.

B.4212. Pin Spanner for Ring Nuts of Rear Leg (1951 Type)

The pin spanner is useful for unscrewing the rear leg outer tube ring nut, 016424, and also the ring nut securing the rear leg oil seal, 016078.

B.4274. Pin Spanner for Rear Leg Damper Rod Top End Collar, 016343

B.4334. Guide Bush for Rear Leg Oil Seal (1951 Type)

The bush is fitted over the end of the inner tube before passing through the oil seal, so preventing contact with the sharp end of the inner tube.

B4494. Front-fork Slider Extension Spanner

B.3335. Hub-bearing Adjusting Ring Tool (Springer)

B.4432. A.B.D.C. Tool for Frame Stay Rubber Buffer

TABLES OF GEAR RATIOS—1945-56 MODELS

Gearbox Internal Ratios

	First gear.	Second gear.	Third gear.	Fourth gear (top).
Standard	1 to 2·67	1 to 1·76	1 to 1·28	1 to 1
Competition	1 to 3·16	1 to 2·09	1 to 1·28	1 to I

Gear Ratios (Models 16M, 16S, 18, 18S)

Engine sprocket size.	First gear.	Second gear.	Third gear.	Fourth gear (top).	Part number.
15 teeth	18·69 to 1	12·32 to 1	8·96 to 1	7 to 1	014015
16 teeth	17·5 to 1	11·54 to 1	8·39 to 1	6·56 to 1	014016
17 teeth	16·44 to 1	10·84 to 1	7·88 to 1	6·16 to 1	014017
18 teeth *	15·57 to 1	10·26 to 1	7·47 to 1	5·83 to 1	014018
19 teeth	14·6 to 1	9·6 to 1	7·0 to 1	5·49 to 1	014019
20 teeth	14·01 to 1	9·24 to 1	6·72 to 1	5·25 to 1	014020
21 teeth †	13·35 to 1	8·8 to 1	6·4 to 1	5·0 to 1	014021

* Standard Solo sprocket for Models 16M and 16S.
† Standard Solo sprocket for Models 18 and 18S.

Gear Ratios (Trials Models)

Engine sprocket size.	First gear.	Second gear.	Third gear.	Fourth gear (top).	Part number.
15 teeth	22·12 to 1	14·63 to 1	8·96 to 1	7 to 1	014015
16 teeth *	20·72 to 1	13·71 to 1	8·39 to 1	6·56 to 1	014016
17 teeth	19·46 to 1	12·87 to 1	7·88 to 1	6·16 to 1	014017
18 teeth †	18·44 to 1	12·20 to 1	7·47 to 1	5·83 to 1	014018
19 teeth	17·34 to 1	11·47 to 1	7·0 to 1	5·49 to 1	014019
20 teeth	16·59 to 1	10·97 to 1	6·72 to 1	5·25 to 1	014020
21 teeth	15·8 to 1	10·45 to 1	6·4 to 1	5·0 to 1	014021

* Standard Solo sprocket for Model 16C.
† Standard Solo sprocket for Model 18C.

TABLE OF GEAR RATIOS—1957 MODELS

Touring Models

Engine sprocket size.	First gear.	Second gear.	Third gear.	Fourth gear (top).
16 teeth	18·39 to 1	12·19 to 1	9·30 to 1	6·89 to 1
17 teeth	17·30 to 1	11·47 to 1	8·74 to 1	6·48 to 1
18 teeth	16·34 to 1	10·83 to 1	8·26 to 1	6·12 to 1
19 teeth *	15·48 to 1	10·26 to 1	7·83 to 1	5·80 to 1
20 teeth	14·71 to 1	9·75 to 1	7·43 to 1	5·51 to 1
21 teeth	14·01 to 1	9·29 to 1	7·08 to 1	5·25 to 1
22 teeth †	13·37 to 1	8·86 to 1	6·76 to 1	5·01 to 1

* Standard for 350-c.c. Touring Models.
† Standard for 500-c.c. Touring Models.

Trials Models

Engine sprocket size.	First gear.	Second gear.	Third gear.	Fourth gear (top).
16 teeth	22·59 to 1	16·46 to 1	10·12 to 1	6·89 to 1
17 teeth *	21·25 to 1	15·48 to 1	9·52 to 1	6·48 to 1
18 teeth	20·07 to 1	14·62 to 1	8·99 to 1	6·12 to 1
19 teeth †	19·02 to 1	13·86 to 1	8·52 to 1	5·80 to 1
20 teeth	18·07 to 1	13·16 to 1	8·10 to 1	5·51 to 1
21 teeth	17·22 to 1	12·54 to 1	7·71 to 1	5·25 to 1
22 teeth	16·43 to 1	11·97 to 1	7·36 to 1	5·01 to 1

* Standard for 350-c.c. Trials Models.
† Standard for 500-c.c Trials Models.

FORK SPRING DATA

Part No.	Year.	Free length.
017127	1945-46	9·997 in. Solo 6G (Use 016782 for sidecar)
010308	1948	10 1⁄32 in. Solo 6G (Use 016782 for sidecar)
012972	1949	11 in. Solo 6G (Use 016782 for sidecar)
015002	1950	12·09 in. Solo 6G
016526	1951-54	12¾ in. Solo 6G
016782	1951-54	12¾ in. Sidecar 0·212 in. dia. wire
021784	1955	12¾ in. Solo 5½G
021789	1955	12¾ in. Sidecar 0·212 in. dia. wire

REAR SUSPENSION SPRING DATA

011945	1950	8 5⁄8 in. 9⁄32 in. dia. wire
016297	1951-56	5¾ in. 5⁄16 in. dia. wire (Solo)
016061	1951-56	5¾ in. 11⁄32 in. dia. wire (Sidecar)

TECHNICAL DATA
1956-57 SCRAMBLES MODELS

	350 c.c.	500 c.c.
Finished cylinder size	2·835-2·834	3·386-3·385
Valve-diameter:		
Inlet	1·6875	1·750
Exhaust	1·500	1·6875
Valve-spring free length	—	—
Valve-spring pressure	Seat load 100 lb.	Max. lift 162 lb.
Valve-guide overall length:		
Exhaust	2 3/16	
Inlet	2 5/16	
Valve-guide protrusion (all)	½	
Crankpin diameter (all)	H/1·5156	L/1·5154
Connecting-rod big-end eye (all)	H/2·01600	L/2·01575
Timing-side shaft dia. (all)	H/0·8735	L/0·8732
Timing-side bush	H/0·8757	L/0·8752

All dimensions are in inches.

TECHNICAL DATA

1945-47

	1945 350-c.c.	1945 500-c.c.	1946 350-c.c.	1946 500-c.c.	1947 350-c.c.	1947 500-c.c.
Bore, mm.	69	82·5	69	82·5	69	82·5
Stroke, mm.	93	93	93	93	93	93
Capacity, c.c.	347	498	347	498	347	498
Compression ratio	6·35	6·0	6·35	6·0	6·35	6·0
Valve timing	All models use 0·016 tappet clearance					
Inlet opens B.T.D.C.	32°	32°	32°	32°	32°	32°
Inlet closes A.B.D.C.	63°	63°	63°	63°	63°	63°
Exhaust opens B.B.D.C.	65°	65°	65°	65°	65°	65°
Exhaust closes A.T.D.C.	30°	30°	30°	30°	30°	0°3
Ignition before T.D.C., full advance	All ½					
Tappet clearance, engine	All models nil clearance Set with piston on T.D.C firing stroke					
Carburetter, bore size	1	1 3/32	1	1 3/32	1	1 3/32
Main jet	150	180	150	180	150	180
Slide	6/4	29/4	6/4	29/4	6/4	29/4
Needle position	2	2	2	2	2	2
Needle jet	4·061	29·076	4·061	29·076	4·061	29·076
Needle	6	29	6	29	6	29
Cylinder size	2·7187	3·250	3·7187	3·250	2·7187	3·250
Tolerance + 0·0005 – 0·0005						
K.L.G. sparking-plug	F80	F80	F80	F80	F80	F80
Magneto contact gap	0·012					
Gearbox lubricant	1¾ pints light grease					
Petrol-tank capacity, pints	24 pints					
Petrol-tank reserve, pints	4 pints					
Oil-tank capacity, pints	4 pints					
Top of skirt, piston diameter	All 350 c.c. 2·7132					
Top of skirt, mean diameter	All 500 c.c. 3·2435					
Bottom of skirt, piston size	All 350 c.c. 2·7143					
Bottom of skirt, mean diameter	All 500 c.c 3·2446					
Gudgeon-pin size	⅞ — 0·0010 — 0·0013					
Connecting-rod length, centres	7⅜ (1945-46) 6⅜ (1947)					

(All dimensions are in inches unless otherwise indicated.)

TECHNICAL DATA

1945-47 *(continued)*

	350-c.c. and 500-c.c. models.
Timing-side shaft diameter	⅞ – 0·0020 – 0·0025
Rocker-axle bush	⅝ + 0·00075 – 0·00050
Camshaft bush	½ + 0·0005 – 0·0005
Rocker-axle sleeve	High limit 0·6235 Low limit 0·6230
Camshaft axle	– 0·00125 – 0·00175
Small-end bush	⅞ + 0·00050 – 0·00025
Flywheel end-float	0·025 maximum With shock absorber spring removed
Flywheel diameter	All 350 7⅛ x 1·098 All 500 7¾ x 1·156
Balance factor	All 65%
Total rotating weight	All 350 843·3 gm. All 500 843·3 gm.
Reciprocating weight	All 350 497·4 gm. All 500 673·2 gm.
Balance weight	All 350 1 lb. 4 oz. 9¾ gm. (one flywheel) All 500 1 lb. 6 oz. 8½ gm. (one flywheel)
Exhaust pipe	Best length (open) 48
Wheel base	53
Head angle	63°
Trail	2 ⅝
Valve spring, free length inner	1 13/16
Valve spring, free length outer	2 1/16
Valve lift	5/16
Valve-seat angle (all engines)	45°
Push-rod, overall length	All 350 9 41/64. All 500 9 5/32
Valve guide (inlet)	½
Protrusion (exhaust)	⅝
Valve stem (inlet)	0·3730 high limit and 0·3720 low limit
Diameter (exhaust)	0·3715 high limit and 0·3705 low limit
Crankpin diameter	1·20375 high limit and 1·20350 low limit
Crank-pin rollers	All 0·250 x 0·0250 (30 off)
Connecting-rod sleeve diameter	1·70400 high limit and 1·70375 low limit
Timing-side bush	⅞ + 0·00075 + 0·0
Driving-side shaft	1·0002 high limit and 0·9997 low limit

(All dimensions are in inches unless otherwise indicated.)

TECHNICAL DATA
1948-58

	1948 350-c.c.	1948 500-c.c.	1949 350-c.c.	1949 500-c.c.	1950-58 350-c.c.	1950-58 500-c.c.
Bore, mm.	69	82·5	69	82·5	69	82·5
Stroke, mm.	93	93	93	93	93	93
Capacity, c.c.	347	498	347	498	347	498
Compression ratio	6·35	6·0	6·35	6·0	6·35	6·0
Valve timing	All models use 0·016 tappet clearance					
Inlet opens B.T.D.C.	32°	32°	32°	32°	32°	32°
Inlet closes A.B.D.C	63°	63°	63°	63°	63°	63°
Exhaust opens B.B.D.C	65°	65°	65°	65°	65°	65°
Exhaust closes A.T.D.C,	30°	30°	30°	30°	30°	30°
Ignition before T.D.C., full advance	All ½					
Tappet clearance, engine cold	All models nil clearance Set with piston on T.D.C. firing stroke					
Carburetter, bore size	1	1 3/32	1	1 3/32	1	1 3/32
Main jet	150	180	150	180	150	180
Slide	6/4	29/4	6/4	29/4	6/4	29/4
Needle position	2	2	3	2	3	2
Needle jet	4·061	29·076	4·061	29·076	4·061	29·076
Needle	6	29	6	29	6	29
Cylinder size	2·7187	3·250	2·7187	3·250	2·7187	3·250
Tolerance + 0·0005 – 0·0005						
K.L.G. sparking-plug	F80	F80	F80	F80	F80	FE80*
Magneto contact gap	0·012					
Gearbox lubricant	1 pint engine oil					
Petrol-tank capacity, pints	24 pints					
Petrol-tank reserve, pints	4 pints					
Oil-tank capacity, pints	4 pints					
Top of skirt, piston diameter	All 350-c.c. 2·7176					
Top of skirt, mean diameter	All 500-c.c. 3·2490					
Bottom of skirt, piston size	All 350-c.c. 2·7180					
Bottom of skirt, mean diameter	All 500-c.c. 3·2494					
Gudgeon-pin size	⅞ – 0·0010 – 0·0013					
Connecting-rod length, centres	6⅜ (1948-51)					

* Alloy head.

(All dimensions are in inches tiniest otherwise indicated.)

TECHNICAL DATA
1948-53 *(continued)*

	1948 350-c.c.	1948 500-c.c.	1949-51 350-c.c.	1949 500-c.c.	1950-53 500-c.c.
Timing-side shaft diameter	All 1948-49 ⅞ – 0·0020 – 0·0025 All 1950-51 ⅞ – 0·00150 – 0·00175				
Rocker-axle bush	⅝ + 0·00075 – 0·00050				
Camshaft bush	¼ + 0·0005 – 0·0005				
Rocker-axle sleeve	High limit 0·6235 Low limit 0·6230				
Camshaft axle	½ – 0·00125 – 0·00175				
Small-end hush	⅞ + 0·00050 – 0·00025				
Flywheel end float	0·025 maximum With shock absorber spring removed				
Flywheel diameter	All engines (after 8000) 7¾ x 1·156				
Balance factor	65%				
Total rotating 'weight	All 350 843·3 gm. All 500 843·3 gm.				
Reciprocating weight	All 350 497·4 gm. All 500 673·2 gm.				
Balance weight	All 350 lb. 4 oz. 9¾ gm. (one flywheel)				
Balance weight	All 350 1 lb. 4 oz. 9¾ gm. (one flywheel) All 500 1 lb. 6 oz. 8¼ gm. (one flywheel)				
Exhaust pipe	Best length (open) 48				
Wheel base	53	53	54	54	54
Head angle	63¼°	63¼°	63¼°	63¼°	63¼°
Trail	2 ⅝	2 ⅝	2 ⅝	2 ⅝	2 ⅝
Valve spring, free length inner	2	2	2	2	2
Valve spring, free length outer	2 13/64	2 13/64	—	—	—
Valve lift	5/16	5/16	5/16	5/16	5/16
Valve-seat angle (all engines)	45°	45°	45°	45°	45°
Push-rod, overall length	9 41/64	9 5/32	9 9/32	9 9/32	9 5/32
Valve guide protrusion (inlet) (exhaust)	¼ 9/16	½ 9/16	½ 9/16	½ 9/16	½ 9/16
Valve stem dia. (inlet)	0·3730 high limit and 0·3720 low limit				
„ „ (exhaust)	0·3715 high limit and 0·3705 low limit				
Crank-pin diameter	1·20375 high limit and 1·20350 low limit				
Crank-pin rollers	0·250 x 0·250 (30 off)				
Connecting-rod sleeve diameter	1·70400 high limit and 1·70375 low limit				
Timing-side bush	All 1948-49 ⅞ + 0·00075 + 0·0 All 1950-51 ⅞ + 0·0005 + 0·0000				
Driving-side shaft	1·0002 high limit 0·9998 low limit				

(All dimensions are in inches unless otherwise indicated.)

TECHNICAL DATA

1954-58

	350-c.c. and 500-c.c. models.	
Timing-side shaft diameter	1·2275—1·2300	
Rocker axle bush	⅝ + 0·00075 − 0·00050	
Camshaft bush	½ + 0·0005 − 0·0005	
Rocker-axle sleeve	High limit 0·6235 Low limit 0·6230	
Camshaft axle	⅜ − 0·00125 − 0·00175	
Small-end bush	⅞ + 0·00050 − 0·00025	
Flywheel end float	0·025 maximum With shock absorber spring removed	
Flywheel diameter	All engines (after 8000) 7¾ x 1·156	
Balance factor	All 65%	
Total rotating weight	All 350 843·3 gm. All 500 843·3 gm.	
Reciprocating weight	All 350 497·4 gm. All 500 673·2 gm.	
Balance weight	All 350 1 lb. 4 oz. 9¾ gm. (one flywheel) All 500 1 lb. 6 oz. 8¼ gm. (one flywheel)	
Exhaust pipe	Best length (open) 48	
Wheel base	54	
	500-c.c.	350-cc
Head angle	63¼°	63¼°
Trail	2 ⅝	2 ⅝
Valve spring, free length narrow	3 ⅛ 2	2 ⅝ 2
Valve spring, free length wide	2	2
Valve lift	5⁄16	5⁄16
Valve-seat angle (all engines)	45°	45°
Push-rod, overall length	9 5⁄32	9 9⁄32
Valve guide protrusion (inlet)	½	½
Valve guide protrusion (exhaust)	½	½
Valve stem dia. (inlet)	0·3730 high limit and 0·3720 low limit	
(exhaust)	0·3715 high limit and 0·3705 low limit	
Crankpin diameter	1·20375 high limit and 1·20350 low limit	
Crankpin rollers	0·250 x 0·0250 (30 off)	
Connecting-rod sleeve diameter	1·70400 high limit and 1·70375 low limit	
Timing-side bush	1·125—1·1255	
Driving-side shaft	1·0002 high limit and 0·9997 low limit	

(All dimensions are in inches unless otherwise indicated.)

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