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A.J.S. MOTOR CYCLES

A PRACTICAL GUIDE COVERING MODELS FROM 1931

By

F. W. NEILL

Service Manager
Associated Motor Cycles, Ltd.

LONDON
C. ARTHUR PEARSON LIMITED
TOWER HOUSE, SOUTHAMPTON STREET,
STRAND, W.C.2

CONTENTS

CHAPTER I

1931–1934 MODELS

ALL the models having single-cylinder engines produced during 1931–34, except overhead camshaft machines, are dealt with in this chapter, as are Big Twin models up to 1933 when the engine was changed. The reader is referred to Chapter II for information on the Big Twins, beginning with the year 1933.

The maintenance and repair of overhead camshaft machines are dealt with in Chapter III.

Lubrication

All the 1931 models, with exception of the special O.H.C. engines, which are dealt with in Chapter III, use the total-loss oiling system. This arrangement is sometimes confused with dry-sump lubrication, on account of the oil that is returned to the oil-tank via a small spout mounted inside the oil-tank just below the filler cap. This oil is simply a by-pass from the main delivery, and is an indication that the pump is working as intended. A sectional drawing of the oiling arrangement is given in Fig. 1, which is self-explanatory.

The amount of oil pumped to the engine can be varied by the control knob on the pump unit (see Fig. 2). Screwing down the control knob clockwise reduces the supply, unscrewing increases the oil supply. A "stop" screw is used under the control knob to prevent owners from closing down the oil supply completely. An approximate setting for the control knob is to open from the "stop" position half a complete turn. The oil supply should be

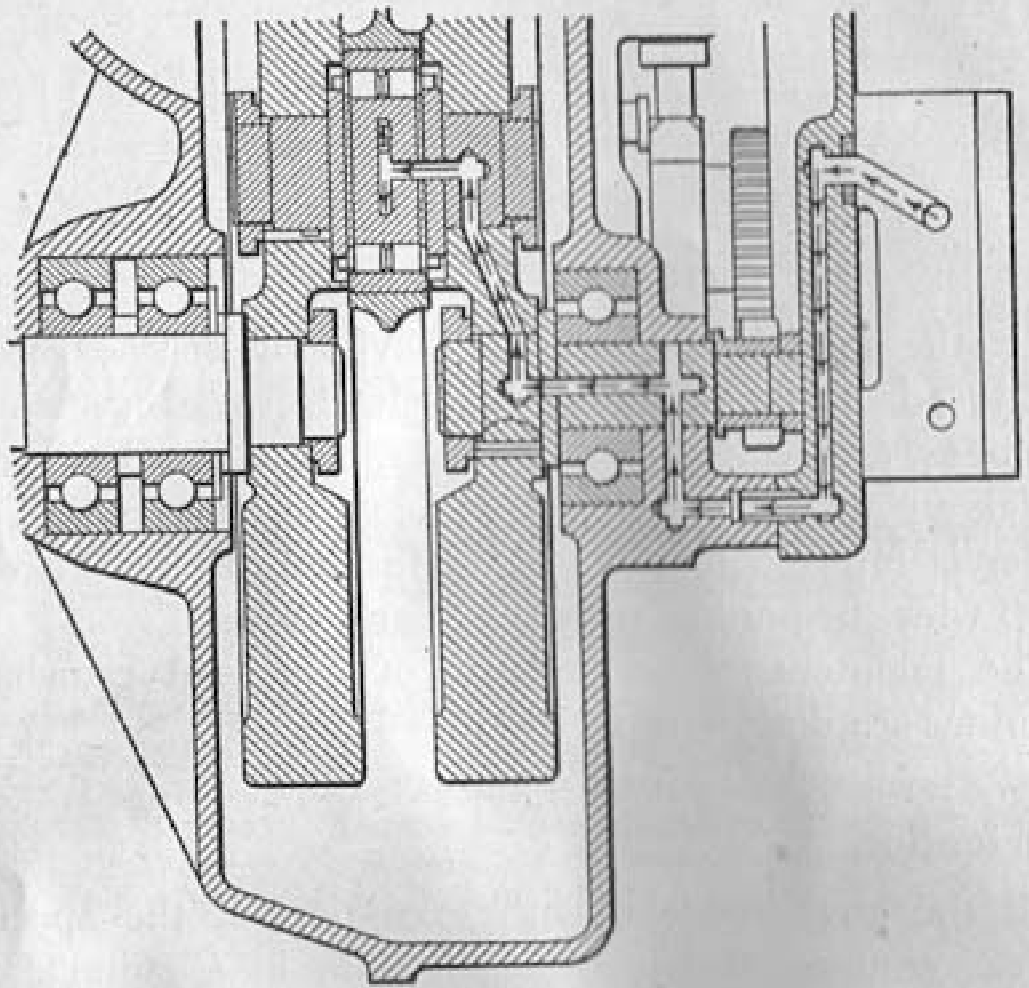


FIG. 1.—ENGINE OILING SYSTEM.

Oil is fed to the big-end *via* the timing-side mainshaft.

set so that a puff of smoke issues from the exhaust pipe when the throttle is sharply opened and then closed down.

The crankcase should be drained—a plug is provided for this purpose—every 2,000 to 3,000 miles. The best time to do this is when the engine is being decarbonised, and then replace the oil drained with half a pint of clean oil.

The oil-pump is simple in design and operation, and very rarely gives trouble. A cork washer is fitted in the timing cover which houses the pump, and in the event of oil failing to reach the engine, this washer should be inspected, and the oil cleaned, in case particles of the washer have entered the oil passages to the big-end assembly.

Rocker-Box Lubrication

Grease-gun lubrication is used for lubricating the rocker gear. Tecalemit nipples are fitted for this purpose. Use a high-melting-point grease and ensure that both valves are closed when the grease-gun is applied. Under-lubrication will be indicated by "squeaking" from the moving parts. Fresh grease every 300 to 500 miles should suffice. Two springs are inserted in each rocker-axle to take up end play; see that these are not misplaced if the rocker-box cover is removed. Details for dismantling the rocker-box are given on page 14.

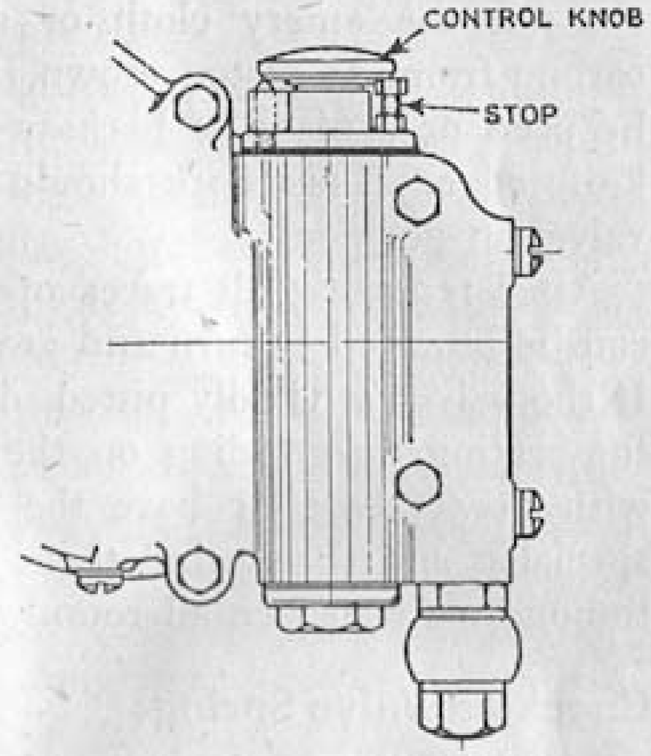


FIG. 2.—OIL PUMP UNIT.

Showing method of controlling oil supply.

Decarbonising Side-Valve Models

Most of the side-valve models are fitted with detachable cylinder-heads. In the case of Model S5 the cylinder and cylinder-head are in one piece.

Before removing the cylinder-head, paraffin should be brushed round the heads of the holding-down bolts and allowed to percolate through the holes for the bolts—this will enable them to be removed with ease and without damage to the hexagons on the bolts. The sparking-plug and H.T. wire can be detached whilst this is in progress, and the cylinder-head can then be taken away.

Care should be taken, if it is necessary to lever up the head, not to damage or break the cylinder-head fins.

All carbon deposit should be removed; the shape of the combustion chamber makes this an easy matter. Do not use emery cloth or any abrasive to remove carbon from the piston crown. An old blunt knife can be used or a piece of hacksaw blade ground to give a knife edge. This work should be carried out with the valves in position.

After removing all traces of loose carbon the valves can be removed in turn and ground in to their seatings. If the valves are badly pitted, do not attempt to restore the seating by grinding on the cylinder seat. Replace with new valves, or have the seating re-ground by a specialist and then grind them in until there is a continuous matt surface all round the seat.

Checking Valve Springs

Check the inlet valve spring against the exhaust spring (both springs should be the same length). If the exhaust spring has closed up more than ⅛ in. replace it with a new one. Weak springs will affect both performance and (in particular) petrol consumption.

If the cylinder barrel is removed (both types) place a piece of rag up and inside the piston to fill the "throat" of the crankcase, to prevent carbon or anything else falling into the crankcase.

Attention to Piston and Rings

To remove the piston a pair of round-nose pliers is required to take out either one or both gudgeon-pin circlips. Mark the piston to ensure it is replaced in the same position.

Piston-rings can be checked for wear by placing them in turn inside the cylinder. Make sure the ring is square

with the cylinder bore and not canted. Pushing the ring down with the piston inverted will ensure this; then the actual gap can be seen, or measured with a "feeler" gauge. The recommended gap is 0·003 in. to 0·004 in. for each 1 in. in cylinder-bore size.

When replacing the gudgeon-pin circlip, make sure it is sitting snugly in its groove, otherwise it may come out and damage the cylinder wall. Make certain that both the piston and the cylinder bore are perfectly clean. The piston-rings should be positioned so that the gaps are 120 degrees to each other.

Fit a new cylinder-base washer; it can be fixed to the cylinder before re-fitting, either with a little oil or with jointing compound. Do not apply jointing compound on the face of the washer where it sits on the crankcase, as the washer will break when the cylinder is next removed and it will be troublesome removing pieces of the washer off the crankcase.

Cover the piston with clean engine oil and oil the bore of the cylinder before the parts are assembled.

Tighten the cylinder-base nuts at opposite corners, and not two nuts on the same side.

The cylinder-head gasket must be in good condition to ensure a gas-tight joint—a coating of soft soap will enable it to be detached without damage.

Tappet Clearance

On the S5 model the exhaust pipe must first be removed before detaching the cylinder. A little paraffin on the threads for the exhaust-pipe fixing nut will facilitate removal. Carbon in the head of the cylinder will have to be chipped out with a long screwdriver or similar tool. Other details on this subject are the same as for the detachable head engines. Turn the engine round several times to allow the valves to settle, and then re-set the tappet clearance to 0·006 in. for the inlet valve and 0·008 in. for the exhaust valve.

On the twin-cylinder engine the petrol pipe, throttle slide and inlet pipe must be removed before the cylinders are lifted.

The tappet clearance is the same for all side-valve engines—these clearances are made when the engine is hot.

Decarbonising O.H.V. Models

Commence by removing the exhaust pipe, complete with silencer, the carburetter, petrol pipe and sparking-plug. If the throttle slide is taken away from the carburetter body, cover the parts with a clean rag and place it either on the saddle or out of harm's way whilst working on the engine. Release the push-rod cover-tube lock-nuts (top and bottom) and take away with the push-rod inside the tube. To do this the valve will have to be depressed (the engine should be positioned with the piston on the top dead centre of the firing stroke, with both valves closed) to release the rocker out of the push-rod tube. Next, unscrew the rocker-box fixing bolts—the two bolts nearest the valves can be withdrawn; the remaining pair are unscrewed until they are free. The rocker-box can then be taken off the cylinder-head on the right side of the engine.

Removing Valves

To remove the valves, a spring compressor should be available, which can be purchased from accessory firms or direct from Messrs. Terry of Redditch. If this tool is not available, the springs will have to be compressed by hand. Lay the cylinder head on a flat surface and support the head of the valve to be removed by placing under it a suitable block of wood, compress the spring and remove the split collets and put these in a safe place with the

hardened valve end-cap. Remove all carbon from the sphere of the head, the exhaust port and on the heads of the valves. Get rid of all loose carbon and grind each valve on to its seat. The inlet valve should require only a small number of half turns until a matt surface is made. When the valves are "saucer" shaped, due to wear or continued grinding, they should be re-ground by a specialist and the seatings in the head re-cut. Both valves and seats have an angle of 45 degrees.

The procedure for dismantling should be reversed to re-assemble.

Important Details

Should it be necessary to remove the cylinder barrel, refer to the instructions given for the S.V. models, which also apply.

The piston-ring gap is the same for all engines.

New valve-springs will act as a "tonic" for the engine. When new, the free length of the outer spring is $2\frac{1}{8}$ in. The inner spring is $2\frac{3}{16}$ in. Replace if springs have closed more than $\frac{1}{4}$ in.

It is desirable at this stage to clean out the carburetter, and where a flange fitting is used make sure the flange is not bent or buckled. If a straight-edge or ruler is placed along the flange, any distortion can be readily seen. The flange should be filed flat and a thin gasket used when the carburetter is replaced. A bent or buckled flange will create an air leak, with attendant hard starting, also irregular running. Do *not* use a thick gasket—this can compress round the bolt-holes and bend the flange.

The tappets should be re-set (engine hot) to 0·006 in. for the inlet and 0·008 in. for the exhaust valves respectively.

Dismantling the Fly-wheels

A stout box key or cup spanner will be required to unscrew the crankpin nuts. The crankpin is a force fit in both fly-wheels—a small key or dowel-pin is used to locate the pin. The fly-wheels will have to be parted, either by making a special tool or taking them to where a small hand-press is available. The connecting-rod liner is also a force fit in the rod. The assembly for the big-end includes crowded rollers.

Two types of crankpin and connecting-rod liners are used on the single-cylinder models. The following table will indicate the models and the finished diameter of the crankpin, also the bore size of the connecting-rod liner, with the liner in the rod. In these days of shortage of parts owners may be able to utilise parts from a later type engine.

The crankpin Part No. 16249 and liner Part No. 11896 were used on the following models:—

1930	R.4, R.6, R.8, R.9.
1931	S.4, S.6, S.8, S.9, S.9.H.
1932	T.6, T.8, T.9.
1933	33/6, 33/8, 33/B.8, 33/9.
1934	34/6, 34/8, 34/B.8, 34/9.
1935	35/6, 35/8, 35/18, 35/9.
1936	36/8, 36/18, 36/9.

Big-end rollers for the above were	$\frac{5}{16} \times \frac{1}{4}$ in.
Diameter of crankpin on roller path	1·20300 in. 1·20275 in.
Inside diameter of connecting-rod liner (in rod)	1·7050 in. 1·7045 in.
Width of roller path	0·627 + 0·002 in. − 0·000 in.

Crankpin Part No. 11956 and liner Part No. 11935 were used on the following models:—

1930	R.12, R.5.
1931	S.12, S.5, S.B.6.
1932	T.12, T.B.6, T.5.
1933	33/12, 33/B.6, 33/5.
1934	34/12, 34/5, 34/6.

Big-end rollers for the above were . . . $\frac{1}{4} \times \frac{1}{4}$ in.

Crankpin—finished diameter of roller track	1·20300 in. 1·20275 in.
Connecting-rod liner—finished size in rod	1·7050 in. 1·7045 in.

Over-size rollers can be used to take up small movement in the big-end assembly, providing the roller surface is not "pitted" or broken up. The liner for the connecting-rod will have to be lapped for concentricity and to allow the rollers to pass the unworn roller path.

End play between the connecting-rod and the fly-wheels is allowed for by location of the crankpin—the connecting-rod liner must not exceed 0·687–0·685 in. in width.

The oil passage in the fly-wheel and crankpin should be cleaned out by squirting paraffin through the drilled passages, if attention has been given to this part of the engine.

Dismantling Notes

The connecting-rod is reversible, but should be replaced in the same position as before removal. When the fly-wheels are put together the crankpin nuts should both be tightened lightly, using a straight-edge on the outside rim of the wheels (at 90 degrees to the crankpin), which will show up any mal-alignment and enable the operator to set them approximately true before the nuts are finally tightened. Checking for true running is best done in the centre of a lathe or special fixture of this kind.

The main ball races are a push fit in the crankcase; local heat, if not overdone, will assist in their removal. The makers' part numbers for these bearings are: R.L.S.7 for the light-weight engine and R.M.S.6, R.L.S.8 for the heavy-weight engines.

Wear in the cam-wheel bushes will create backlash in between the cam wheels and timing pinion. When replacing, ream in position (a pilot reamer is best) to 9/16 in. $\frac{+ \cdot 00075}{- \cdot 00050}$ in.

Re-assembling after Overhaul

When the fly-wheels are inserted in the crankcase do not overlook the paper washer for the joint, which should be in perfect condition, otherwise oil leakage will take place. There should be no appreciable end movement between the fly-wheels and the crankcase; if there is, use shim washers of suitable thickness, leaving the wheels perfectly free to rotate.

Check the radius on both tappets, as wear here will affect performance, also petrol consumption. Fig. 3 shows the normal shape of the tappets.

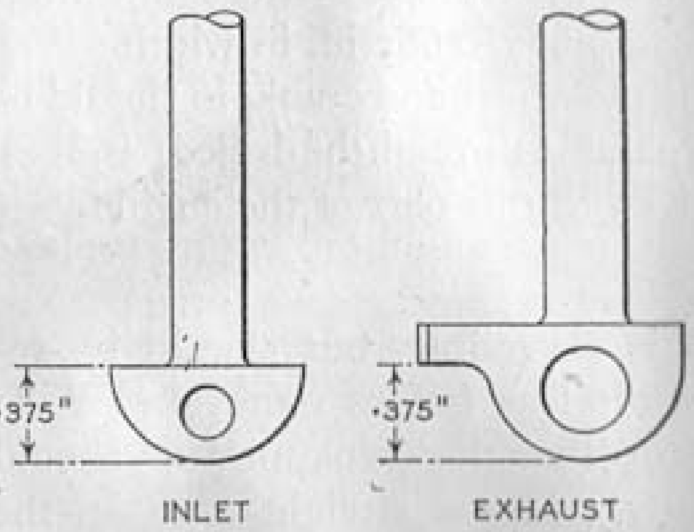


FIG. 3.—NORMAL SHAPES OF INLET AND EXHAUST TAPPETS.

Twin Engine Models

The foregoing details are applicable to the twin-engine models. The connecting-rods are interchangeable and should be re-fitted in the order removed.

Re-timing the Engine

The cam wheels and small pinion are all marked, and should be replaced to the makers' marking. Fig. 4 shows the method of replacing the cam gear for single-cylinder engines. Details of the twin engine are shown in Fig. 5.

To check the actual position where the valves open and close on the twin-cylinder engines, refer to the data sheet, set both tappets to 0·010 in. to check and then re-set to 0·006 in. for the inlet valve and 0·008 in. for the exhaust valve.

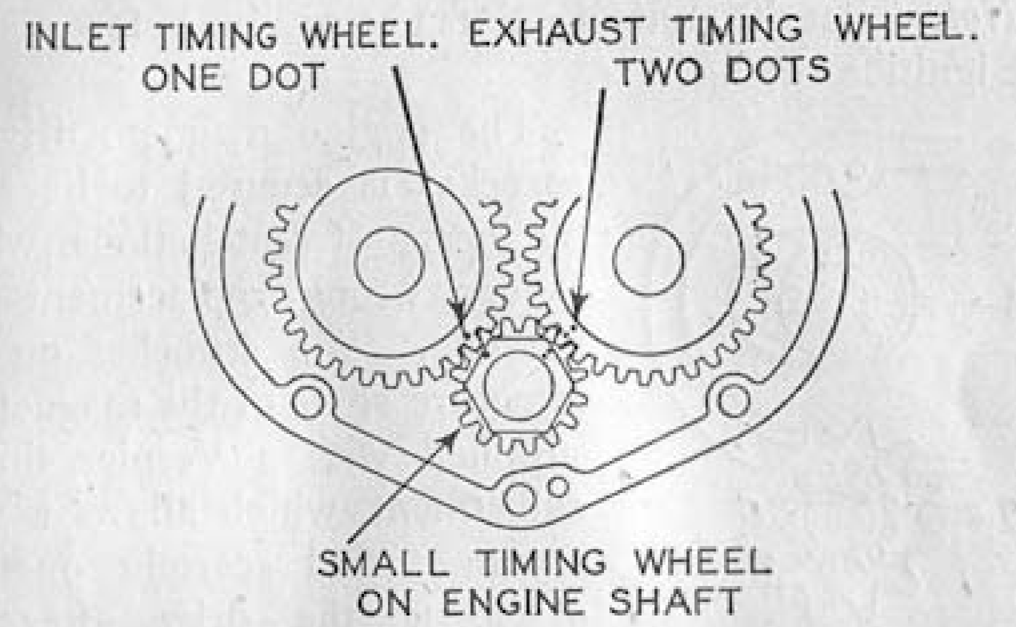


FIG. 4.—CORRECT SETTING OF TIMING WHEELS ON SINGLE-CYLINDER ENGINES.

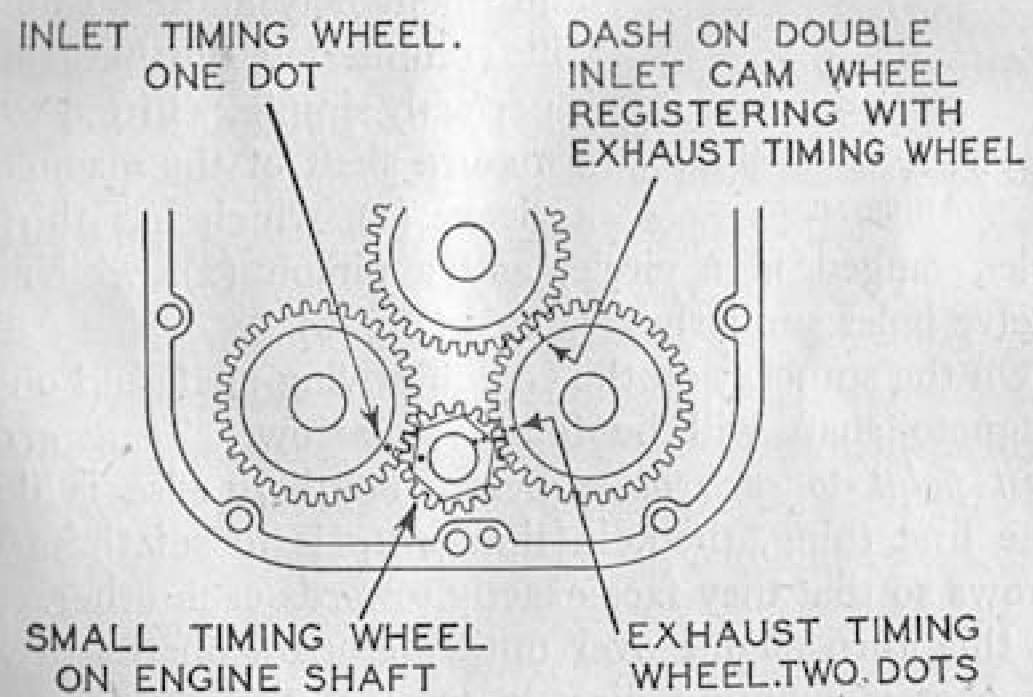


FIG. 5.—TIMING-WHEEL SETTING ON TWIN-CYLINDER ENGINES.

Re-timing the Magneto

On all models except those fitted with Maglita equipment, use the Vernier timing adjustment. This consists of a drilled sleeve, sprocket and peg plate, retained by a sleeve nut, which is shown in Fig. 6.

Note : Set the contact points to 0·012 in. before setting the ignition timing.

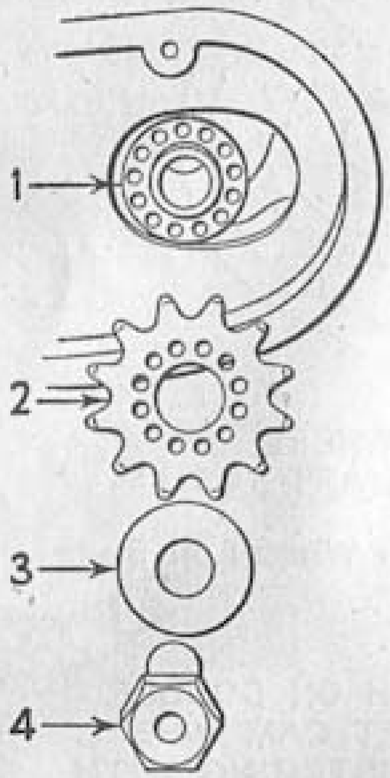


FIG. 6.—VERNIER TIMING ADJUSTMENT.

The engine magneto driving-sprocket is secured to its shaft by means of castellations, which render wrong replacement impossible. The sprocket on the armature shaft of the magneto is supplied with a Vernier timing adjustment, which allows a very accurate and certain method of fixing the drive after the correct setting has been arrived at. The setting of this Vernier adjustment may at first sound a trifle complicated, but in reality it is perfectly simple. Fitted to the armature shaft of the magneto is a sleeve (1), which has thirteen holes ranged in a circle, and a pinion (2), which has twelve holes similarly arranged (Fig. 6).

On the sprocket on the engine driving-shaft and on the magneto shaft will be found an arrow. *These arrows must point to each other* before anything else is done. The first thing, then, in timing up is to set these two arrows so that they face exactly towards each other. To do this, turn engine over until the arrow on the driving sprocket is pointing directly towards the arrow on the magneto sprocket. This latter should be held free in the fingers and moved a tooth backwards or forwards in the chain until the correct setting is arrived at. When this is accomplished, place the magneto sprocket on to the sleeve, and turn the armature shaft of the magneto until a mark found punched over one of the twelve holes on the sprocket exactly registers with a similar mark on the

outside of the collar of the sleeve. It will now be found that the marked holes in sleeve and sprocket respectively exactly coincide, so that all that has to be done is to push the peg-washer (3) into these holes, which effectively prevents the sprocket from moving from its correct setting. Now tightly screw up the sleeve lock-nut (4), which can be done without fear of the timing shifting in the process, as is often the case with other methods.

Checking Magneto Timing

As a means of verifying the timing, or if the sleeve (1) has been removed from the magneto armature shaft, set the piston its correct distance from the top of the compression stroke (see table, page 28, for details of settings of each particular model), making sure it is not on the exhaust stroke. With the piston in this position take off the sleeve lock-nut on the magneto sprocket and remove the peg washer. This will leave the armature free from the engine drive, but still connected via the chain to the engine. See that the sprockets have their arrows facing as previously mentioned. Move the ignition control lever to the limit of its motion of advance. Remove the cover of the contact-breaker and slowly turn the armature until the fibre-block of the make-and-break lever arises on the inclined plane of the steel segment just sufficient to separate the points. This is the firing point, and with the piston in the position referred to above, the sleeve and sprocket should register, if correctly fitted up. If so, the drive should be fixed up as before detailed. It is, however, always desirable to check the timing after tightening up.

Maglita Timing

This instrument is fitted to the light-weight models, and provides the lighting current as well as the H.T. for ignition. To obtain the necessary output, the armature runs at engine speed, in contrast to the magneto or magdyno, which both run at half engine speed. Sprockets of different sizes—*i.e.*, two to one—drive by a Duplex chain. This chain should have frequent attention, on account of the load, and should be maintained in correct adjustment.

Two flats are machined on the sleeve portion of the driving sprocket (instrument end) for the purpose of using a suitable spanner on the flats. In no circumstances should the sprocket nut be either tightened or untightened without the supporting spanner in position. Failure to observe these instructions may result in a bent armature. The sprocket is not keyed, as with other models.

The method of re-setting the ignition with a Maglita is a little more complicated than the normal equipment. After setting the piston on the top dead centre of the firing-stroke, with the sparking-plug removed, take off the bakelite cover on the instrument; this will allow the contact-breaker to fly back to the fully retarded position.

The ignition setting for the side-valve models is $\frac{7}{16}$ in. before top dead centre with the contact-breaker in the fully advanced position, and $\frac{9}{16}$ in. for the O.H.V. models.

Timing for Magneto and Magdyno is given in the data in table on page 28.

Carburetter.—The correct sizes of jet and throttle slide are given in the table on page 28. Adjustment is as given for later models, pages 82–85 and 168–171.

Gearbox

Sturmey-Archer type gearboxes were used on machines made prior to 1935, with the exception of the 1934

Model B6. These gearboxes are no longer made—the manufacturing right has been acquired by the Wincliffe Spare Part Co., of Broad Lane, Sheffield. Other Sturmey-Archer stockists may be able to supply replacements. This type of gearbox is simple in construction and will stand a lot of misuse. The usual faults and remedies are outlined below.

Clutch Slip.—This is usually caused by worn clutch inserts. Replace clutch-springs when fitting new inserts, as the springs may be weakened by heat of slipping clutch. Clutch-spring bolts should be screwed home tightly.

Gears Disengaging under Load.—This may be caused by:—

(1) Wear on main axle thrust-washer, allowing end play in mainshaft.
(2) Wear on dogs and sliding pinion.
(3) Worn layshaft bearing.

Light grease is specially recommended for the gearbox. If the gearbox has been dismantled, charge with $\frac{1}{2}$ lb. of light grease and $\frac{1}{3}$ pint of oil used for the engine. Re-charge with $\frac{1}{8}$ pint of oil every 1,000 miles. It is not advisable to use thick grease, as it may prevent the free operation of the kick-starter pawl. The various joints in the gear-changing lever mechanism should also be kept oiled regularly, to ensure freedom of action.

Do not put oil into the clutch in any circumstances, as this is designed to run dry.

Transmission

Adjustment of Chains.—To adjust the chain from engine to gearbox it is only necessary to slack off the nuts on top of the bracket and slide the box bodily backwards by means of the adjusting bolt. It is important that the nuts are screwed tightly again after adjustment.

Back Chain.—Slack off the nuts on each side of the back hub-spindle, and move the wheel backwards by means of the adjusting screws in the fork ends. Care must be taken to adjust each side equally, or the wheel will be out of alignment. Screw up the spindle nuts tightly again after the chain is properly adjusted. It may be found that moving the wheel back has caused the brake to be " on ". This is easily rectified by means of the brake adjustment.

If the chain is too slack it is apt to " whip ", which intensifies the wear and tends to break the rollers, especially in the case of the front chain. If, on the other hand, it is too tight, a crushing effect is produced on the rollers, and the whole chain is strained unduly.

The chains should be adjusted, and kept adjusted, so that they can be pressed up and down in the centre with the finger $\frac{3}{8}$ in. on both chains.

Steering Adjustment

To adjust the steering bearing, slack off completely the steering damper. It is advisable to raise the front wheel clear of the ground by placing a stout box under the crankcase.

Slacken the nut for the handlebar clip pinch-bolt, then tighten the large hexagon nut on the fork stem, slowly half a turn at a time, and, by lifting the wheel and fork assembly, test for movement in the bearing. Adjust until all movement has been taken up, leaving the fork assembly free to move. Ball races and balls are used, and the adjustment should be made in the same way as the rider would adjust a cycle wheel bearing. Re-tighten the loosened pinch-bolt nut.

If the machine is inclined to steer in an elongated

figure of eight, this indicates too much friction, either on the steering-head bearings or in the damper itself. If the bolt securing the damper steel plate to the frame is removed, this will prove if the fault lies with the damper.

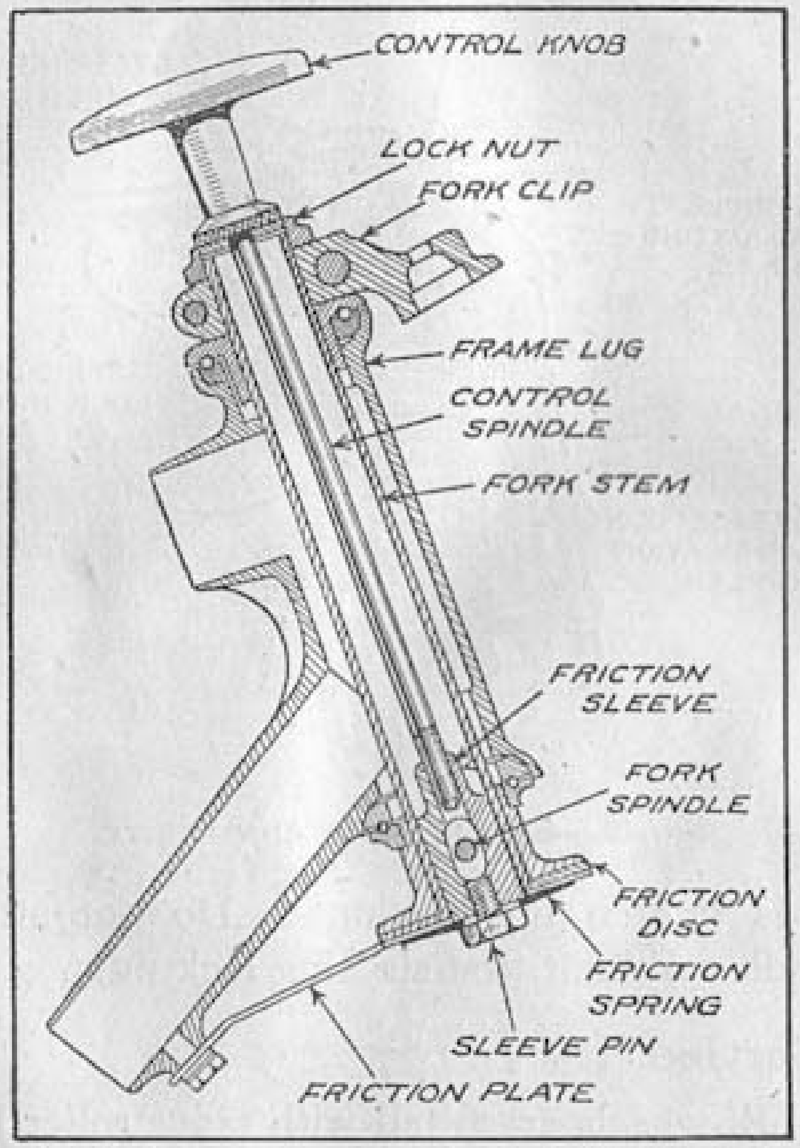


Fig. 7.—Steering Damper Arrangement.

In such an event the friction discs may be buckled or swollen as a result of moisture. Dry the discs slowly, and apply a little oil to the friction surfaces.

Spring-Fork Adjustment

To take up any play which may have developed in the side links, unscrew the spindle lock-nuts on the right-hand side of the forks (looking at the machine from the front, see Fig. 8) and turn the spindles by means of the heads on the left-hand side until all slackness is taken up.

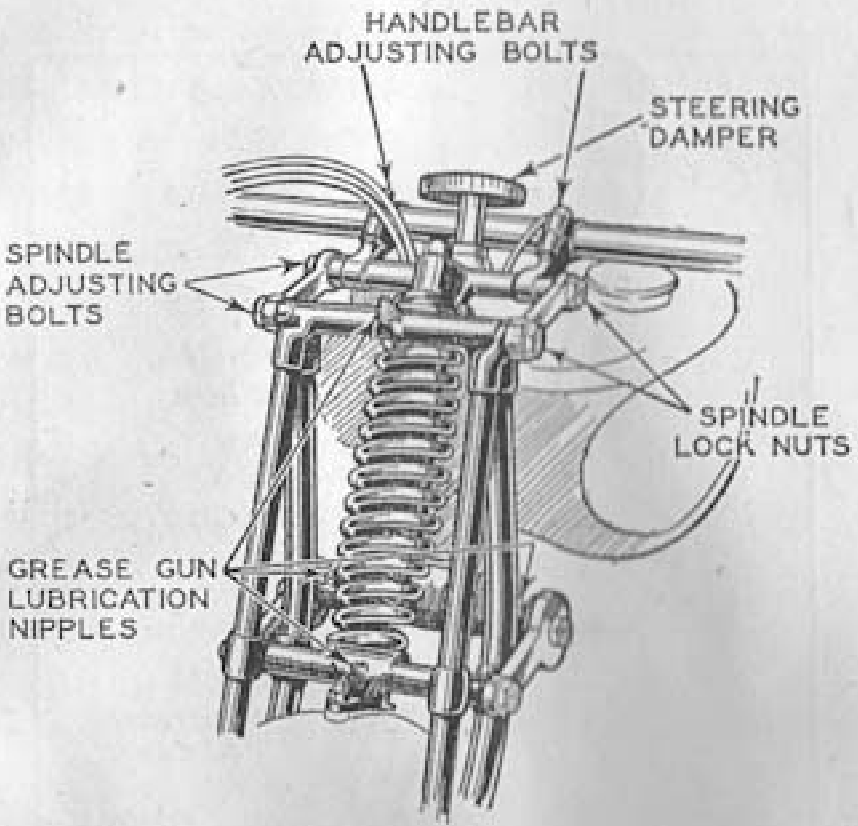


Fig. 8.—Spring Fork Adjustment.

Afterwards tighten up lock-nuts. Do not attempt to turn spindles without first slacking lock-nuts.

Wheel Service

All A.J.S. wheels are fitted with taper roller bearings, which design is still being used on the latest models; in fact the same rear-wheel spindles, with bearings, are to-day being used in the rear wheels of current models. See Chapter VII, page 130.

The three extended sleeve-nuts in detachable wheels should be checked periodically and kept tight. If the machine is run for any length of time with nuts loose, ovality will take place in the stud-holes in the hub-flange. Should this occur, it will be difficult to keep the fixing-

sleeve-nuts tight, and over-size studs must be fitted, after drilling out the holes in the hub-flange.

These early models used a solid spindle, which screwed into the brake-drum dummy spindle. Breakages at the position where the centre spindle leaves the dummy spindle are frequent. A modification can be made by using a 1936- or 1937-type dummy spindle, with a centre solid spindle to suit. To fit these parts, the holes in the centre plate of the brake-drum and in the brake-cover plate, and the slot in the fork end will have to be enlarged. The latest-type solid spindle passes *through* the dummy spindle, and does away with the shearing load on the older type. Details of the conversion are shown in Fig. 9.

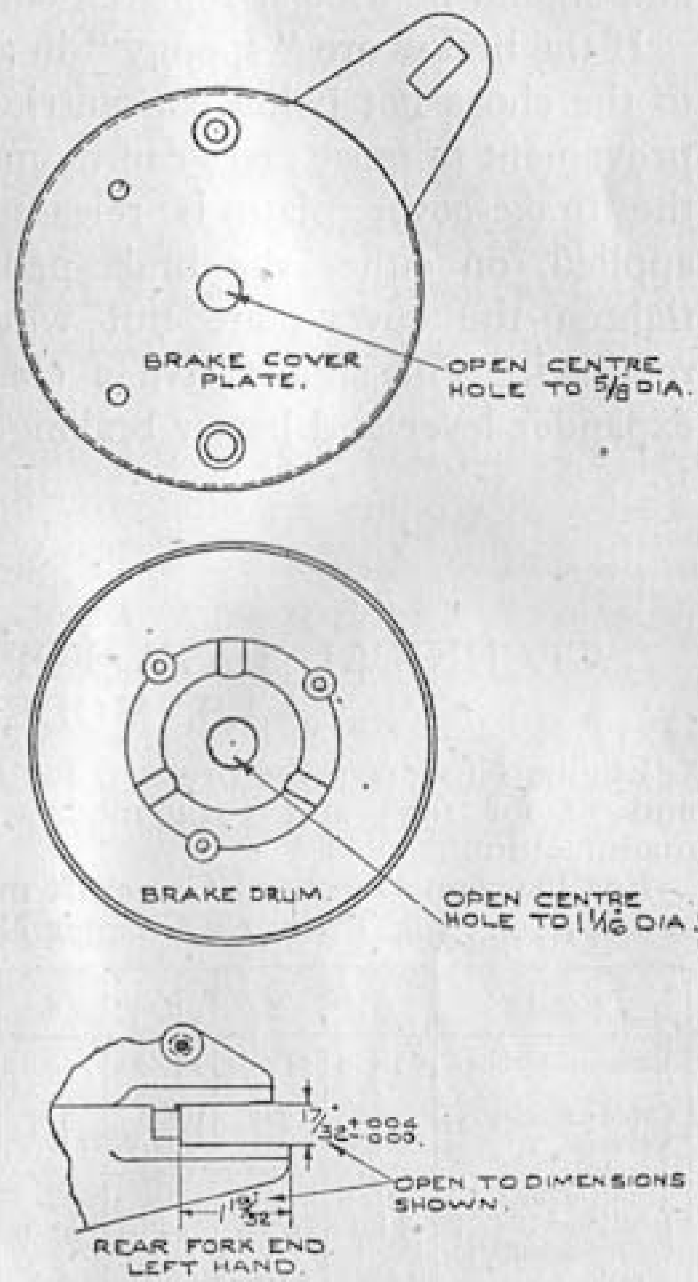


Fig. 9.—Conversion to Later Type Dummy Spindle.

Brakes

Most of the brake-shoes fitted to these early models are the same as used up to 1939.

If the heel-pads are worn by pressure of the expander they can be filed flat with a thin steel plate of the required thickness riveted to the shoe. The later type shoes have detachable steel "pads", which are a better arrangement, and should be used if replacements are needed.

If the brakes are "spongy" in action, this may be due to the shoes not being concentric with the drum. Improvement in most cases can be made if the nut securing the brake-cover plate is released, and with pressure applied, on either the brake-pedal or brake-lever, retighten the cover-plate nut while the pressures are retained. This should give a closer adjustment for the expander lever and better braking.

TECHNICAL DATA FOR 1931 TO 1934 A.J.S. MODELS

Engine Nos. have the prefix S for 1931, T for 1932, and 33 and 34 for 1933 and 1934 models to identify the year of manufacture.

For Data on Overhead Camshaft machines, *see* Chapter III and for 1933 Big Twin, *see* Chapter II.

Model.	12.	5.	B.6.	6.	B.8.	8.	9.	2.
Bore and stroke.	65×75	74×81	74×81	74×81	84×90	84×90	84×90	85·5×85·5
Cubic capacity .	248	349	349	349	498	498	498	990
Valves . .	O.H.V.	Side	O.H.V.	O.H.V.	O.H.V.	O.H.V.	Side	Side
Jet size . .	100	100	150	150	180	180	140	130
Throttle slide .	5/4	5/4	6/4	6/4	29/4	29/4	6/4	6/4
Ignition * . .	3/8 in.	1/16 in.	3/8 in.	1/16 in.	3/16 in.	3/16 in.	3/16 in.	5/16 in.
Compression ratio . .	6·6	4·3	6·1	6·3	6·1	5·7	4·9	4·8
Valve Timing:								
A . .	15°	27°	15°	15°	15°	15°	27°	17°
B . .	57°	76°	57°	57°	57°	57°	76°	60°
C . .	42°	68°	42°	42°	42°	42°	68°	64°
D . .	25°	48°	25°	25°	25°	25°	48°	14°

(A) Before top dead centre. (B) After bottom dead centre. (C) Before bottom dead centre. (D) After top dead centre. Use 0·014 in. tappet clearance to check readings.

* Ignition figures are given in inches of piston position before top dead centre with control lever advanced. Ignition is by magneto or maglita on 1932 models, by magdyno on 1933 and 1934 models.

CHAPTER II

BIG TWIN MODELS (1933–1939)

During the 1933 season a new model was introduced in the Big Twin range, the main alteration being confined to the engine. A Matchless type twin engine was fitted, but the remainder of the machine was basically the same.

The engine has a bore size of 85·5 mm. and stroke of 85·5 mm. Dry-sump lubrication is employed, which is described later on page 68. Detachable cylinder-heads were used with enclosed valve-springs. A magdyno unit was fitted as standard for ignition and electric lighting respectively. A fabric filter fitted in the oil-tank ensures the removal of all impurities from the oil in circulation. A four-speed Sturmey-Archer gearbox was fitted.

For details of engine lubrication, see page 68.

Decarbonisation

Detachable cylinder-heads are fitted, and it is a simple process to remove the heads and clean out carbon deposit in the combustion chamber, as well as the crown of the pistons. The details given in the previous chapter apply.

Usually machines of this type are fitted with sidecars, and if the engine is overhauled on account of heavy petrol consumption, attention should be paid to the following :—

(1) Make sure the valve-springs have not lost tension ; free length is $1\frac{3}{4}$ in.

(2) Ensure the valves are seating properly, in particular, inlet valves.

(3) Check inlet-pipe connections where they join the cylinder, also where the carburetter clips on to the inlet pipe.

When the valves are ground in there should be a continuous matt surface round the valve-seat and the seating in the cylinder. This is sometimes misleading, and the following test may be employed. Apply a smear of red lead mixed with oil on the valve-seatings and insert the valve into the cylinder, then with a screwdriver in the slot provided, press on the driver head and rotate the valve one complete turn and take it out. If the seating in the cylinder is correct, a deposit of red lead will show up all round the seating. If it does not do so, the seating should be re-cut (angle 45 degrees) with a suitable valve-seating cutter. If there is a leakage past the inlet valves, blow-back will take place and fuel will be wasted, resulting in heavy petrol consumption.

Uneven Running at Slow Speeds

It is not always easy to make a twin engine run slowly and "tick over" evenly. Owners usually take a pride in this, and the following details will help where trouble occurs.

First locate the cylinder that is at fault and remember that the carburetter will supply the same mixture to *both* cylinders.

Next check tappets, 0·004 in. for inlet and 0·006 in. for exhaust, then set plug points to 0·018 in. to 0·020 in. gap and make sure electrodes are clean.

Testing for Air-Leaks

If irregular running persists, test for air-leaks. To do this, first obtain a rubber plug, similar to the type used

for the ordinary kitchen sink. Insert a short piece of copper tube in the centre of the rubber plug, to fit tightly. Next obtain a short length of rubber tubing to connect to the piece of copper tube. Remove carburetter and fit the plug into the inlet pipe. Now turn the engine until the *front* exhaust valve is just about to close. In this position *both* inlet valves are shut. A second person is required for this test to watch the connection of the inlet pipe where it joins the cylinder, also the inlet-valve guides. Next, light a cigarette and draw in a good mouthful of smoke, place the rubber tubing between the lips and blow hard. If there is an air-leak the second person will be able, by evidence of smoke emerging, to determine *where* the leakage takes place, which should be dealt with as necessary.

The most likely place for an air-leak is at the joint of the inlet pipe where it is connected to the cylinder. Use of jointing compound, which should be allowed to set before re-testing, should have the desired result. The preceding test is one employed by factory testers, and is infallible.

If there is no improvement after dealing with the fault as previously described, check the ignition setting on each cylinder; any variation must be associated with the cam ring in the magneto portion, which can only be rectified by Messrs. Jos. Lucas, Ltd.

Once it is established that there are no air-leaks and everything else is in order, turn to the pilot-jet adjustment as described on page 84.

Ignition Timing

Some doubt may exist as to the correct position of the H.T. cables, and to which cylinder they should be connected. All magdynos are marked close to the brush-holders or H.T. pick-ups, as they are sometimes called. No. 1 is always connected to the rear cylinder.

To decide which cam on the contact-breaker cam ring is to be used for any particular cylinder to set the ignition, the following procedure should be carried out. Unscrew the nut fixing the magneto drive sprocket on the engine end. Pull the sprocket off its shaft (use a tyre lever with one end bent at 90 degrees), disconnect the H.T. lead from the cylinder (the rear is the most suitable), hold the brass terminal with one hand and turn the magdyno slowly in the correct direction of rotation. Immediately a "shock" is felt examine the interior of the contact-breaker, when it will be easily determined which cam on the cam-ring is to be used for timing the particular cylinder. See data for timing models 2 and 2A (page 85).

Various types of cylinder-heads have been used in these Big Twin engines. Generally the only alteration has been in connection with the position of the sparking-plug. A cylinder-head with the sparking-plug fitted near the *centre* is the most efficient, and should be used if detonation or indifferent running occurs at slow speeds. These cylinder-heads are mostly interchangeable on all models.

Engine Service

Side-by-side connecting-rods are fitted, with offset gudgeon-pin bushes. Detachable liners for the connecting-rods are fitted, to enable the big-end assembly to be renewed without replacing the connecting-rods. If the connecting-rods have been removed for attention they should be replaced as shown in Fig. 10.

Split-skirt pistons are a standard fitment; the split in the piston-skirt should be in front, or facing the front of the machine.

A bronze bush is used for the timing-side axle bearing; oil is fed direct to this bearing, and from here oil-passages in the timing shaft allow oil to be pumped to the big-end assembly via a hole drilled in the timing-side fly-wheel.

Fly-wheel end float should be 0·015 in. to 0·020 in. This clearance is made by either driving in or pulling out the bronze timing side axle bush—shim washers are *not* used.

If end-play between the fly-wheels and the crankcase is excessive, this may be due to a groove cut in the driving-side wheel rubbing on the steel sleeve used for the roller bearing. To remedy this, have the fly-wheel face machined back clear of the groove and make up a steel washer of the required thickness. This washer need not be hardened, but it must be flat.

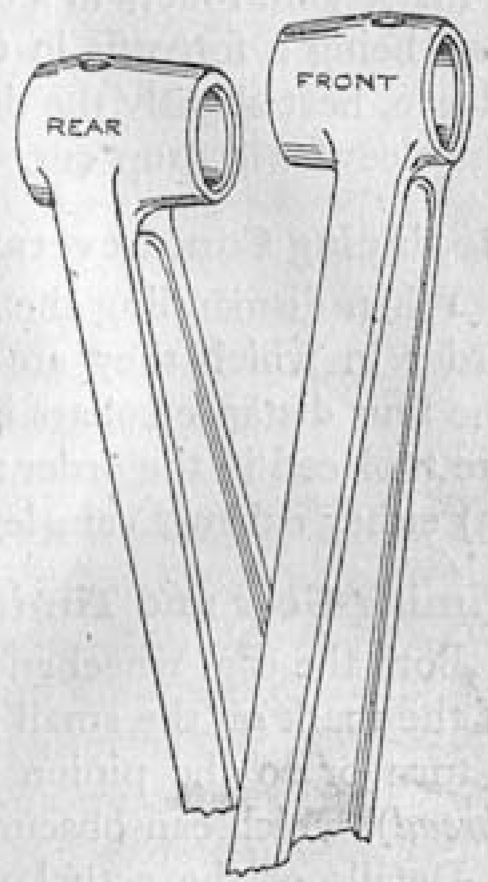


Fig. 10.—Arrangement of Twin Connecting-Rods.

Timing-side Bush and Driving-side Bearing

Oil is fed directly to the timing-side bush bearing, which does not require frequent renewal. Should the bush be replaced, the internal diameter is most important; it should be reamed in position to $\frac{7}{8}$ in. $\frac{+\,\cdot00075}{-\,\cdot00000}$ in. Wear on this bearing will create backlash between the small pinion and the cam wheel, with timing-gear noise. These remarks apply also to the cam-wheel bushes, the normal diameter of these being $\frac{1}{2}$ in. $\frac{+\,\cdot00075}{-\,\cdot00000}$ in. with bushes *in situ*.

c

Note : The oil groove in the cover bush should be on the *outside*, to prevent oil leaking from the timing-chamber.

The driving-side bearing is a built-up bearing, using ¼ in. × ¼ in. rollers in a cage, which run in a steel sleeve, this being a force fit in the crankcase. To remove this sleeve, heat slightly the driving-side half crankcase, when the sleeve will drop out.

Replacing Cam Levers (all twin engines up to 1939)

When dismantling the timing gears, note carefully the order in which they are removed, taking care to place the four distance collars in a safe place. The cam levers are replaced in the order: (1) rear inlet; (2) front inlet; (3) either exhaust cam levers.

Timing Gear and Timing

Both the cam wheel and the timing pinion are marked. If the mark on the small pinion cannot be seen, unscrew a turn or so the pinion fixing-nut (*this has a left-hand thread*), which can obscure the marking.

Details of the actual valve timing are given in data table (all 990-c.c. engines are the same) for later models of this type (see p. 85). Check with 0·016 in. tappet clearance.

Gearbox, Frame, Fork and Wheel Service.—No outstanding changes in design were made—previous instructions on this subject apply (see Chapter I).

1937, 1938 and 1939 Models

The general design for the 1933 to 1939 models is basically the same.

Forked-type connecting-rods were introduced in 1936, with a different position for the sparking-plug in the cylinder-head.

All cylinder-heads are interchangeable. The most efficient are those with the sparking-plug nearest to the centre of the cylinder-head. If these are changed, watch the ignition timing, as the position of the sparking-plug affects the timing. Maximum advance with the latest type heads is ¼ in. fully advanced.

Lubrication.—See 1939 models, page 68.

Tappet Adjustment.—See 1939 models, page 78.

Heavy Oil Consumption.—See 1935 models, page 57.

When oil fails to return from the sump correctly, an air leak at the rear end-plate for the pump-housing may be the cause. Oil seeping into the crankcase when the engine is stationary can only be due to either a scored or worn pump-plunger bore. Makers will make a bush to restore the pump-plunger bore to normal if crankcase is sent. See that vent hole in oil-tank filler cap is free, as pressure collected in the oil-tank can force oil past the plunger when the engine is stationary. In exceptional circumstances the oil passage from the sump to the pump might be obstructed by foreign matter or fluff, introduced into the engine whilst the cylinders are removed. To test oil passage take out pump plunger, also crankcase drain-plug, and clear obstruction with a spoke or length of wire, if it is not convenient to dismantle the engine. When replacing the pump guide-screw make sure it is located in the groove in the pump plunger, and use fingers, not a spanner, to locate.

Engine Service.—See 1939 Big Twin models, page 75.

Wheels, Forks, Transmission and Gearbox.—Details given for the 1939 models apply to the 1937 and 1938 models (see Chapter VII).

CHAPTER III

OVERHEAD CAMSHAFT MODELS

Model 7 (350 c.c.) and Model 10 (500 c.c.)

MACHINES of this type are mostly in the hands of experienced riders, and for this reason elementary details are not included. Usually owners are anxious to obtain the best possible performance from the engine unit, and instructions are in the main confined to this subject.

The O.H.C. models were first introduced in 1927. Some of the earlier models are still capable of a high maximum speed. Space will not permit description of all the above models, but the 1933 models and those made afterwards up to 1936 are covered in this chapter.

Engine Lubrication

All A.J.S. camshaft engines have dry-sump lubrication. Oil is fed to the big-end of the engine and rocker-box by the main pump on the timing-chain cover. This pump also draws oil from the sump and returns it to the filter in the oil-tank. By removing the plated hexagon plug in the top of the oil-tank, it is possible to withdraw the filter for the purpose of cleaning. To do this, immerse the filter in clean petrol, but always make sure that it is thoroughly dried out before replacing. The filter should be cleaned every 500/1,000 miles. It is recommended that all the oil is drained from the oil-tank every 4,000/5,000 miles and the tank replenished with fresh oil. It is necessary to top up the oil level in the tank from time to time, and obviously it is most economical to drain the

tank when the oil is at its lowest recommended level. The correct oil level in the oil-tank being almost up to the end of the return pipe, do not overfill, otherwise oil will leak from the filler cap; likewise never let the level fall to a position where the tank is less than half full.

A small adjustable oil-pump is fitted at the top of the timing-chain cover; the purpose of this is to drain the oil from the sump of the rocker-box and return it to the crankcase sump.

To increase the suction on this, unscrew the lock-nut on the adjuster and turn the adjuster with a screwdriver in an anti-clockwise direction, and to decrease the suction, vice versa. After making the adjustment always tighten the lock-nut.

COMPRESSION RATIOS

346 c.c.	6·8—1	7·5—1	11—1
495 c.c.	6·5—1	7·5—1	11—1

Separate pistons are used for these ratios.

Cylinder-Head Removal

First remove petrol pipe and carburetter complete.

As this is taken from the cylinder-head, remove knurled ring from top of the carburetter body and withdraw both slides; leave these attached to their cables and swing them out of the way. Extreme care should be taken not to damage the throttle needle whilst this is exposed. Remove sparking-plug, oil-feed pipes to valve-guides, oil-feed pipe from main engine pump to rocker-box and oil drain-pipe to rocker-box pump, also exhaust-pipe locking-ring, etc. Next remove the four pins holding the rocker-box pump and top inspection disc. Take away the pump drive and its retaining ring, and the camshaft lock-nut will then be visible; withdraw the cotter-pin from the nut, and this can then be unscrewed.

Prior to removing the pegged plate which locates the chain wheel and sleeve, turn the engine slowly over until the top of the compression stroke is reached; now unscrew the four rocker-box pins and withdraw the three that are free to come away; the rocker-box is then free. But when taking this away see that the chain wheel is held in position. Retain the top sprocket by copper wire (do not let the chain leave the bottom sprocket). The six cylinder-head bolts are now visible on top of the head, also two nuts holding the cylinder-head to the barrel underneath. Remove all these. The cylinder-head can now be lifted. See that the connecting-rod does not bruise the crankcase and piston when the cylinder is lifted. Should the piston be removed, see that it is replaced in the same position as before removal.

Cylinder-Head Joint

Note : Cylinder-head gaskets are not used on the O.H.C. models.

Originally the faces of the cylinder-head and barrel were ground in, and, providing they remain clean and unscratched, can be replaced without any jointing compound or attention other than washing with petrol. If, however, either of the faces is marked, due to compression leaks, unscrew the two holding-down studs by using two nuts locked together on the thread of the stud, then smear the faces with very fine emery paste, and grind in the same manner as in valve-grinding, until all the marks are removed. Be sure to remove all traces of emery paste with petrol after this operation.

Actually it is much better and easier to grind in these faces when both the cylinder barrel and head are away from the engine; there is then no danger of emery paste finding its way into the engine, and the cylinder-head can be rotated freely on the barrel. When the cylinder-head

is again in position replace the nuts to the studs which protrude through the cylinder barrel, follow on with the long cylinder-head bolts, and, lastly, the short cylinder-head bolts. Tighten these down together, not independently. Before replacing the rocker-box make sure that the small hardened caps are fitted over the valve-ends, and place the one rocker-box bolt nearest to the exhaust lifter into its hole, then locate the threaded end of the camshaft into the centre of the chain wheel, afterwards pushing out the tool holding this in position. See that the rubber washer between the rocker-box and the chain-cover settles into position properly.

Camshaft Chain Adjustment

When the chain wheel is in position on the shaft and the rocker-box tightened down, it is possible to feel the chain tension. Any excessive slackness after the machine has completed a considerable mileage can be taken up by fitting washers of the correct thickness under each leg of the rocker-box. It is essential, however, that approximately $\frac{3}{8}$ in. or $\frac{1}{2}$ in. of side movement always exists in the chain.

A small plug is situated about half-way up the camshaft drive cover; when this is removed it is possible to insert a narrow screwdriver to ascertain that the tensioner blade is following the chain, and not idle against the side of the cover.

Providing the fly-wheels have not been rotated, the pegged plate can be replaced through the chain wheel and sleeve, but if the fly-wheels are not in the original position, turn the engine slowly over until T.D.C. of the compression stroke is reached; the hole in the sprocket and that in the sleeve should then coincide, although sometimes the shaft has to be rotated slightly to bring the two into line so as to replace the pegged plate.

A rough check for the valve timing is that with the piston on T.D.C. and the contact breaker points just breaking with the ignition lever fully retarded, the holes in the chain wheel and the sleeve should be together at 50 degrees to the right from T.D.C.

When replacing the short oil-pipe from the rocker-box to the secondary pump make sure the union on the pump end of the pipe is secure, as an air-leak here will prevent oil being sucked from the rocker-box, with resultant oil leakage. A short oil-pipe is fitted to the top of the rocker-box cover to relieve pressure in the rocker-box and to allow oil to drain by gravity to the pump and valve-guide. Make sure the driving-block for the secondary pump is engaged correctly before fitting the pump-fixing screws.

Major Overhauls

Begin by removing the exhaust-pipe and other fittings, then remove the oil-pipes connected to the pump and timing-cover. Do not plug the end of the oil feed-pipe to prevent draining; this is dangerous, and it is preferable to drain the oil-tank if an overhaul is necessary. Remove cap covering magneto sprocket with nut and Vernier, and take off timing-chain cover. Release the nut fixing the camshaft sprocket, and the front chain can be disconnected.

The large screws fixing the rear portion of the timing-chain cover are usually very tight. To avoid damage to the screwdriver slots use a screwdriver "bit" and carpenter's brace for this work.

Remove the "spider" or support for the bottom sprocket bearing and take away the driving chains. The sprockets are marked with arrows, which can be disregarded, as full and simple instructions are given on the replacement and timing of the engine. Exercise care in taking off the back portion of the timing-chain cover, spigot fitting used.

It is advisable to take off the cylinder-head whilst the barrel is on the crankcase; the engine can then be removed from the frame. The engine can be removed assembled, but the former method is best for the average owner.

Bearings

Ball bearings (excepting big-end) are used throughout. The main bearings are of proprietary manufacture. Makers' references are as follows:—

Timing side bearing	R.M.S.8
Driving side bearing	R.L.S.8
Camshaft bearing	R.L.S.5

The small pinion fixing nut is right-handed; the pinion has a parallel bore with a Woodruffe key.

Twenty-eight rollers ¼ in. × ¼ in. are used with a cage for the big-end assembly on the 1933 models. This was modified in 1934, and an improved type fitted which can be adapted for the 1933 models.

Roller-track diameter.		Connecting-rod liner (size in rod).	
1933 type	1·20325 in. / 1·20300 in.	1933 type	1·7050 in. / 1·7045 in.
1934 type	1·5150 in. / 1·5145 in.	1934 type	2·0170 in. / 2·0165 in.

Should the big-end be replaced, check the connecting-rod alignment when the fly-wheels are assembled. It should be perfectly central in the crankcase; shim-washers should be used for this purpose. If the fly-wheel shafts are true and the bearings in order, the fly-wheels should "spin" without any tight places. Make sure this happens before completing the assembly.

Rocker-Box

The most likely parts to need attention are the rocker pads and the oil-sealing parts. Rocker pads can wear, also "fire-up" if a shortage of oil should take place. These pads were eventually replaced by rollers, which should be fitted as an improvement. The rollers are shown in Fig. 11.

Bars of hard felt supported by strips of rubber act as oil-seals. By reason of the simplicity of these parts no

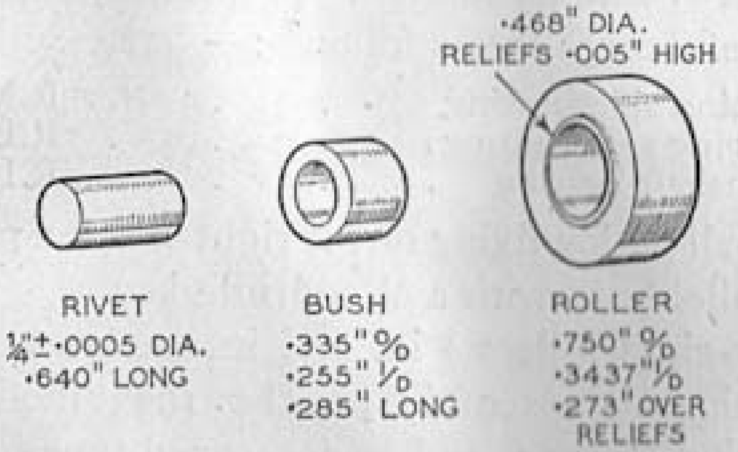


FIG. 11.—DETAILS OF ROLLER, RIVET AND BUSH TO REPLACE ROCKER PAD.

further comment is necessary, other than to state that the rockers should be stiff to move if the felts are in order. This stiffness will run off with short use. Before fitting the top cover the camshaft should be perfectly free, with no appreciable end-play. Do not over-tighten the small oil unions in the rocker-box, used for lubricating the valve-guides, as they break easily. Similarly, hold the union with a spanner before releasing the pipe union nuts.

Cylinder-Head

Coil-type valve-springs were used up to 1934. The free length of this type of spring is: inner $2\frac{31}{32}$ in., outer $2\frac{25}{32}$ in.

Pass a piece of clean rag through the valve-guides after

grinding and check the oil passages in the head with a suitable oil-squirt. Thoroughly clean the two valve-guide feed-pipes before they are re-fitted. To restrict the oil supply to this part of the engine the pipes can be "metered", by making an aluminium plug, with a small "flat" filed on it—the exact amount will have to be decided by experiment. There is suction on the inlet-guide pipe, and this must be the smallest orifice.

As an aid to tuning, the sparking-plug points should be flush with the sphere of the cylinder-head. Racing designers attach a great deal of importance to this. If the plug is "masked" and the points are well up inside the thread in the cylinder-head, machine back the face or seating for the plug, and use a *solid* copper washer to suit. Should the plug be exchanged, continue to use this washer in order that the same register is made.

Piston

When this is re-fitted, see that the connecting-rod is not bearing hard on either of the gudgeon-pin bosses in the piston. It should be central if the fly-wheels and connecting-rod are normal. Ring gap is 0·010 in.

If, for any special reason, the cylinder barrel has been reduced in length, this will affect the timing-chain adjustment, and may cause the valves to touch the piston when they are at full lift. There should be 3 mm. additional movement for the valves before contact with the piston, with valves at full lift and piston on T.D.C. Washers will have to be made to accommodate the difference in cylinder height, and are fitted under the rocker-box and cylinder-head bolts.

Assembling the Timing Gear

Before fitting the rear portion of the chain cover, clean both faces, crankcase and cover, and apply a little jointing compound. Use the screwdriver "bit" and carpenter's brace to securely tighten the fixing screws. Check the damper block; it should be sluggish in action if the damper is to work. The spring blade can be set to increase pressure, if care is taken. The "keep" spring should be located securely if the screw is removed. Insert the lower pinions and drape the chains round the sprockets. Fit the double-pinion support or "spider", and tighten securely.

Assuming the rocker-box has been fitted, to time, or set the valve timing, proceed by turning the engine until the piston is at the *bottom* of the stroke; this is to prevent the valves hitting the piston. Now adjust the tappets to have a clearance of 0·020 in., then fit the nut for the top driving-sprocket and turn the camshaft until *both* valves

VALVE TIMING O.H.C. MODELS

	1933–35 Standard Cam.		1935 T.T. Cam.	
	350	500	350	500
Inlet opens B.T.D.C. .	25°	23°	61°	62°
,, closes A.B.D.C. .	54°	60°	64°	72°
Exhaust opens B.B.D.C. .	65°	65°	69°	73°
,, closes A.T.D.C.	30°	29°	50°	55°

Readings taken with 0·010 in. tappet clearance.

Note.—See valve end-caps are perfectly flat before using "feeler".

MAGNETO TIMING (FULLY ADVANCED)

Year.	350 Model.	500 Model.
1933	45° or 3/4 in.	45° or 3/4 in.
1934	45° or 3/4 in.	45° or 3/4 in.
1935	45° or 27/32 in.	45° or 27/32 in.
1936–37 . . .	40° or 23/32 in.	40° or 23/32 in.

are open. This is when the valves are on the overlap. Next turn the engine until the piston is on the *top dead centre* of the stroke. Take off the nut used for turning the camshaft (give the spanner a sharp tap and it will unscrew without moving the cam) and make sure the engine does not move. Fit the sprocket on the camshaft, with its peg-plate, and lightly tighten the fixing nut. The valve timing is now approximately correct. Connect the magneto chain for attention later.

To check accurately the actual position where the valves open or close, a dial-plate graduated in degrees is essential. This is fixed to the driving-shaft, and a pointer made to indicate the top dead centre of the stroke, which should register with zero or 360 degrees on the dial-plate. Check and re-check the position of the pointer and the plate before recording the valve movement. Valve timing on all O.H.C. engines is checked with 0·010 in. tappet clearance. The tappets are now set to 0·020 in. clearance. Insert a 0·010 in. feeler between the tappet and the head of the valve and its cap, and record the position when the valves open and close.

The correct timing for the standard cam and T.T. cam is given in the table on page 44.

Bronze cylinder-heads were introduced in 1935, and were used on both the 350- and 500-c.c. models. On the 500-c.c. engines the valve-heads should be reduced in diameter to avoid "touching" at peak revs. Reduce dimensions—inlet valve to 1·640 in. and exhaust 1·5 in. Recommended tappet clearance for special cylinder-heads:—

Cast-Iron Head.	Bronze Head.
Inlet 0·016 in. Exhaust 0·018 in.	Inlet 0·015 in. Exhaust 0·025 in.

Carburetter

By reason of the petrol-tank position, horizontal mixing-chambers were fitted as standard up to 1935. This type of carburetter is not so efficient as the vertical mixing-chamber type. There will be an improvement in performance if the later type is used.

O.H.C. STANDARD CARBURETTER SETTING 1933–1935

Main Jet Size.		Needle position.	Cut-away.
33/7.	160	3	6/4
33/10.	200	3	6/5

RACING CARBURETTER SETTING

Main Jet Size.		Cut-away.	Bore Size.	Carb. Type No.
For 50/50 Petrol Benzole and 7·5–1 Engine Compression Ratio.				
33/7.	52	4/5	1 1/16 in.	N.M. 8617
33/10.	58	4/5	1 1/16 in.	N.O. 3131
For Discol R.D.1 Fuel, and 11–1 Engine Compression Ratio.				
33/7.	55	12	1·06	N.M. 7091
33/10.	65	12	1·18	M.D. 9921

The length of the carburetter outlet is important. Experiments in different lengths are worth while, starting with packing pieces to give the same length as the outlet on the horizontal mixing-chamber type. See that the port matches with the carburetter, and avoid any steps or abrupt change in diameter in this passage.

The exhaust-pipe length affects carburation; usually (dependent on the valve timing) a short exhaust pipe reduces the extractor effect, therefore the exact length of this pipe should be in the nature of an experiment. If the end of the pipe is about 3 in. to 4 in. past the rear wheel axle, this is a good length to begin with. Removing the silencer will have the same effect, and without alteration to the main jet the machine will probably have a higher maximum if the silencer is *not* removed.

CARBURETTER SETTINGS—1936 AND 1937.

O.H.C. 350 c.c.

Main Jet (50/50). 350. Slide 6/5. Needle 3 Position.
" (R.D.1). 720. " 6/5. " 3 "

Note.—Cylinder barrel on 1937—350 Models, can be reduced by 0·027 in. to give compression ratio of 9·5 to 1.

RECOMMENDED SPARKING-PLUGS

Touring type: HLN. or HLNP. K.L.G. LB.1. K.L.G. 583.

Racing type: RL. 49. K.L.G. 689. K.L.G. 731.

ENGINE SPROCKETS

350 *Model*: 21 teeth. 500 *Model*: 24 teeth Standard, 25 Racing.

Advanced O.H.C. Models

The above models in the 1938 and 1939 range of machines of this type were, as far as it was commercially possible, replicas of the machines used in the Tourist Trophy races.

Alloy cylinder-heads and cylinder-barrels formed part of the standard equipment.

The Burman special racing B.A.P.-type gearbox was used in place of the earlier Sturmey-Archer type.

In addition to many other improvements, check-springs were fitted to the front forks, also 27 × 3·25 in. and 27 × 3·00 in. tyres for the rear and front wheels respectively.

The petrol tank had a capacity of 4½ gallons, with a special oil tank of 1 gallon capacity.

These machines were practically "hand built", and were extremely reliable.

The following details will interest fortunate owners of these special models :—

Models 1938 7/R (350-c.c.) and Models 1939 7/R (350-c.c.).
Compression ratio (50–50%) : 8·8–1 with plate removed.
" " (racing fuel) : 11·0–1 with H.C. Piston.
Tappet clearance: 0·018 in. inlet.
" " 0·025 in. exhaust.
Oil-regulating screw : open to 1½ turns.
Valve-spring pressure : 130 lb. valve on seat.
Valve-timing : inlet opens 54° B.T.D.C. ; inlet closes 60° A.B.D.C. Exhaust opens 67° B.B.D.C. ; exhaust closes 45° A.T.D.C.
Ignition timing : 42 degrees fully advanced.
Recommended plugs : K.L.G. 731 and 689. LODGE RL. 49 and RL. 51.
Megaphone size : 15½ in. long, 4⅜ in. mouth.
Engine sprocket : 21 teeth.
Gear ratios : 5·3, 6·15, 7·69, 9·65.
Carburetter jet : Size 370, slide 6/4, 109 needle-jet.
Tyre sizes : front 27 × 3·00 in. ; rear 27 × 3·25 in.
Maximum speed : 102/104 m.p.h.
B.H.P. : 27 at 7200 r.p.m.

Gearbox

All O.H.C. models from 1933 up to 1937 were fitted with Sturmey-Archer-type gearboxes. They were all four-speed boxes. Some special racing machines were issued without kick-starters. This type can be converted for use with a kick-starter gear, by exchanging the gear-box cover plate, and fitting a kick-starter axle with its pawl and spring.

With workshop facilities, either the C.P. or B.A.P.-type Burman gearbox can be utilised as a substitute for the original type. Spares for this type of gearbox are available.

The Sturmey-Archer gearbox, with its free-dog type gears, is quite simple, and, as previously mentioned, has few inherent faults, and will withstand considerable

misuse. The Burman gearbox, with its positive foot-change, is an improvement in design, with much less backlash between the driving gears.

The foot-change arrangement on the Sturmey-Archer gearboxes was made by Associated Motor Cycles, Ltd., and is usually trouble-free, but with an unusually long movement for the operating pedal. A ratchet plate, and two spring-loaded pawls or plungers, were used for indexing the gears, and, providing the pawls on the knife-edge are not damaged, the mechanism is reliable in operation.

The main faults in selecting the gears are due to :—

(1) Worn or damaged pawls or plungers.

(2) Side-play between the operating lever and cam-plate.

To remedy the former is obvious, and, in the case of the latter, shim-washers used to absorb the end-play will have the desired result.

Front Chain Adjustment

To adjust the primary chain it is possible to swing the gearbox bodily on its lower fixing bolt, and to carry this out the following instructions should be observed :—

Slack off the centre nut on the foot gear-change mechanism and, to tighten the front chain, first slack off the nut on the adjuster bolt nearest the engine and turn the nut on the other side of the anchorage in the same direction —*i.e.*, anti-clockwise—until the correct chain tension is obtained. To ascertain this, remove the small inspection disc on the front chain cover ; the tension can then be felt with the fingers. It is most important to leave approximately ⅜ in. or ½ in. up-and-down movement. After the correct chain tension has been arrived at, retighten the adjuster nut nearest the engine and also the centre nut on the gear-change mechanism. Always make a point of adjusting the front chain first and the rear afterwards.

Should the gear positions of the foot gear-change mechanism not correspond to those of the gearbox index, the short rod between the operating lever on the foot-change mechanism and the striker lever on the gearbox can be adjusted, as provision is made for this.

To check off the relation between the two, first engage any gear, and then remove the split cotter and yoke end-pin from the top of the short gear-rod; if the two are correct, the holes in the yoke end and the lever coincide; that is, when the lever is centralised, as a small amount of free movement always exists in the lever. Otherwise unscrew the lock-nut under the yoke end and bring the yoke end into line, afterwards tighten the lock-nut and replace the pins, etc. Only a small alteration to the length of the gear-control rod is ever necessary.

Wheel Service.—See 1939 Models, Chapter VII, page 130.

Front Forks

Instructions for this part of the machine are the same as given for models described in earlier chapters.

To maintain safe and positive steering, the head bearing should be correctly adjusted, and in particular the fork-spring should be exchanged if the fork-links (with rider seated) are out of parallel, which indicates that the fork-spring has closed up.

To take up wear in the spindle holes in the fork-girders, fork-crown and handlebar lug, the holes can be enlarged and bushes fitted. The makers will do this if suitable equipment is not available for this work to be carried out. A generous clearance between the fork-spindles and the parts through which they pass is intended. A pad of

grease should be maintained between the working parts. With a close fit and failure to lubricate periodically, rust will form—thereby the spindles and possibly the links will have to be destroyed before the spindles can be removed. Where lubrication has been neglected, penetration oil should be applied, and in stubborn cases local heat is the only solution, with the assistance of a hand-press.

1935 Forks

Check-springs were used on the forks fitted in the 1935 season, which became a standard fitting from then on for the O.H.C. models.

The lugs for the check-springs on the links are out of centre, and the links should be replaced with the shortest distance between the lugs nearest the fork crown and handlebar lug.

Shim-washers are slipped over the fork-spindles to prevent wear on the fork-girder and fork-stem assembly spindle faces. Forks should be adjusted (damper released) until there is no side-play, the forks being free to move; then damp down by the hand-adjusting knob to give a sluggish action. A hard front tyre will cause violent fork motion.

Light grease is recommended for fork lubrication. Apply grease-gun on Tecalemit nipples and work forks up and down whilst grease is being injected, to facilitate penetration along the spindles.

Note : The fulcrum pins for check-springs are shaped to take the grease-gun nozzle.

Gearbox T.T. Replica Machines

A B.A.P. heavy-weight gearbox is used for these special machines, and they are practically a tool-room job. They are designed for lubrication by a non-fluid lubricant, such as light grease. However, oil can be used, and has been used in the Isle of Man races, without serious oil leakage.

Gearbox faults are few and far between, and are usually confined to indifferent gear indexing, after undue pressure on the gear-change pedal. This can result in a damaged rocking pawl, and a replacement is usually required to correct the fault. The same trouble can occur as a result of loose nuts retaining the kick-starter case, as a spigot is not used to locate the cover to the gearbox shell. A bent clutch push-rod will cause it to spin with the shaft and set up wear on the ends. The clutch is exposed, and has ample frictional area to cope with the power output from the engine. Replace clutch-springs if "slip" occurs, after removing any glaze from the friction inserts. The gearbox makers have been using a new type of clutch insert made from "Neoprene", which is practically indestructible; this is a good lining for any Burman-type clutch, more particularly when the clutch is enclosed in the chain-case.

Alteration to the internal gear ratios is carried out by exchanging the main driving-gear, together with the layshaft fixed pinion. There are thirty-one teeth on main gear and twenty-three on layshaft pinion. The normal internal ratios are: 1 to 1, 1·16, 1·45 and 1·82. Multiply these ratios by top gear (5·3) to determine actual intermediate gears.

CHAPTER IV

1935–1938 SINGLE-CYLINDER MODELS

During 1935, the following single cylinder models were introduced:—

35/12—250-c.c.	O.H.V.	Coil ignition.	Single-port.
35/22—250-c.c.	O.H.V.	Magneto ignition.	Two-port.
35/16—350-c.c.	O.H.V.	Coil ignition.	Single-port.
35/26—350-c.c.	O.H.V.	Magneto ignition.	Two-port.
35/4 —498-c.c.	S.V.	Magneto ignition.	—
35/14—498-c.c.	S.V.	Coil ignition.	—

For details of other 1935 Models refer to 1933–1934 Models described in Chapter I, Overhead Camshaft Models in Chapter III and the Big Twins in Chapter II.

The new machines were all fitted with Matchless-made engines using dry-sump lubrication. The principle is common to all Matchless engines, excepting rocker-box lubrication, which is not used on the O.H.V. machines listed above. For general details of oiling system, turn to pages 57 to 61 dealing with later models.

Four grease-nipples are used on the rocker-box for grease-gun application. Two of these nipples are for lubricating the rocker axles, the other two are for the push-rod ball-ends. Light grease should be injected every 300 miles, or weekly, according to the mileage covered.

Engine Overhauls

The general design of the engine is very much the same as used on models subsequent to those made in 1935 by the Matchless factory (Associated Motor Cycles, Ltd.). On all engines two ball-bearings (R.L.S.7) are used for the driving-side bearings. A plain bush, which has been common for all engines of this type since 1930, is still used. Detachable big-end liners are fitted to all connecting-rods to facilitate renewal of the big-end assembly.

Before the engine can be removed from the frame, the front chain-case, together with driving and dyno. chains and clutch sprocket, must be dismantled. It is easier to take off the rocker-box and cylinder-head with its barrel before removing the engine or crankcase assembly from the frame. At this stage, assuming the crankcase only remains in the frame with the fly-wheel assembly, the engine fixing-bolts should be removed, which will allow the crankcase assembly to be taken from the frame.

Before splitting the crankcase it is of vital importance to remove the oil-pump guide-screw, also the oil-pump plunger. The oil-pump end-caps will have to be taken off to remove the plunger from pump.

Take out cam wheels and release nut fixing small pinion (*left-hand thread*). This pinion is on a taper shaft; use sprocket puller to remove, and avoid damage to pinion. Crankcase can now be separated.

The makers allow a generous clearance between the timing-side shaft and the bronze bush; do not be misled by visual observation. The shaft size is $\frac{7}{8}$ in. $\frac{+\cdot0030}{-\cdot0035}$ in.

The bronze bush is reamed in position to $\frac{7}{8}$ in. $\frac{+\cdot00125}{-\cdot00150}$ in.

If the ball bearings on the driving side are removed (Part No. R.L.S.7) insert the first ball-race, then the smallest of the two spacing washers, also the large washer and finally the second ball-race.

Fly-wheel end-play (with shock absorber spring removed) should be 0·015 in. to 0·020 in. Wear in both timing-side bush and cam-wheel bushes will allow back-lash between timing pinion and cause valve-gear noise.

To Remove Tappet Guides

Remove valve-lifter shaft first; the guides are a force fit in the crankcase. Local heat will facilitate removal. The guides with tappets should be driven out from inside timing-gear chest. Use a stick of brass to do this, to avoid damage to tappet feet. The exhaust tappet has a split collar, fitted in a groove in the tappet itself. A screwdriver or wedge will expand collar for removal. Should the valve-lifter be inoperative, replace this split collar. When replacing guides reverse procedure for removal; guides should be flush with crankcase face, when in position.

To Re-assemble Timing Gear.—See 1939 Models, page 79.

Tappet Adjustment

O.H.V. Models.—Remove three nuts securing rocker-box cover. Rotate engine until piston is on top dead centre of firing-stroke. Adjust tappets so that there is no noticeable clearance up and down—the push-rods should be just free to rotate.

S.V. Models.—Position engine as for O.H.V. Models, adjust inlet tappet to 0·004 in. clearance and 0·006 in. for exhaust tappet.

Ignition Timing

Before checking or setting ignition timing, first check contact-breaker gap. For coil-ignition models, the gap should be 0·018 in., and 0·012 in. for magneto models.

To re-time ignition with coil-ignition models remove the bakelite cap covering contact-breaker. Slacken screw securing cam. A slot is machined in the rim of the cam, and to release the cam from its taper shaft, use a small punch operated in the slot provided, and give the punch a light tap. A bolt with a thread $\frac{3}{8}$ in. × 20 T.P.I. can be utilised to remove the cam. Position the engine as previously described, and rotate cam in an anti-clockwise direction until contact points are just about separate. Use a piece of cigarette paper inserted between points to determine actual point of opening.

Model.	Ignition.	Piston Position. (Before T.D.C.)	Contact Gap.
O.H.V.	Coil.	$\frac{5}{16}$ in.	0·018 in.
O.H.V.	Magneto.	$\frac{7}{16}$ in.	0·012 in.
S.V. (498-c.c.)	Coil.	$\frac{1}{8}$ in.	0·018 in.
S.V. (498-c.c.)	Magneto.	$\frac{1}{4}$ in.	0·012 in.
S.V. (990-c.c.)	Magneto.	$\frac{5}{16}$ in.	0·012 in.

Control lever fully advanced.

When a magneto is fitted, proceed as follows :—

Take away the magneto chain-case cover, release nut securing magneto chain sprocket on engine end—one or two turns will suffice. Use a tyre-lever with one end bent at 90 degrees, and lever the sprocket off its shaft. Position engine according to model, then set contact points as with coil-ignition models.

CARBURETTER DETAILS

Model.	Jet Size.	Throttle Slide.
250 O.H.V.	120	5/3
350 O.H.V.	120	5/4
498 S.V.	130	6/4
990 S.V.	140 *	6/4

(Needle position : second from top.)

* Main jet is governed by air filter fitted. With felt-type filter use 130 jet and size 150 if open intake is fitted.

Valve-Timing Details

Both cam wheels and small pinion are all marked. The nut securing small pinion has a *left-hand thread*; release nut a few turns if marking on pinion is obscured.

Model.	Inlet Opens. B.T.D.C.	Inlet Closes. A.B.D.C.	Exhaust Opens. B.B.D.C.	Exhaust Closes. A.T.D.C.
35/250	20°	67°	75°	28°
35/350	20°	67°	75°	28°
35/498 S.V.	20°	67°	75°	28°
35/990 S.V.	15°	50°	58°	12°

Readings taken with 0·016 in. tappet clearance.

Heavy Oil Consumption

Machine can be run with filter removed (replace filter cap) to test if filter is at fault. If in order, examine piston-rings and cylinder for wear. If wear exceeds 0·008 in., rebore; 1939-type pistons can be used (which are fitted with scraper ring to improve oil consumption) if cylinder wear is below 0·008 in. The release valve (on driving side of crankcase) should be examined when dealing with a fault of this kind. See that diaphragm is free to move. Secure diaphragm with smear of grease when replacing, to retain in position.

1936 Models

The A.J.S. Models made for 1936 were in the main the same as the 1935 Models. Details in preceding paragraphs apply to these machines. A modified rear brake-drum and sprocket was introduced, also totally enclosed foot-change mechanism.

1937 Models

The basic design of engines for 1937 was the same as that used for the 1936 season. The modifications included direct oil-feed from the pump to the rocker-gear. Inlet valve was positively lubricated and valve-springs were enclosed. Data given for the 1935 Models apply also to machines made in 1937.

Oil-pump arrangement remained unaltered, with the exception of a delivery of oil taken from the front of the oil-pump housing. Oil is fed from a by-pass off the main supply to the rocker-box. Oil passing through channels in the rocker-box lubricates rocker-spindles and returns to the sump via the push-rod cover tubes, lubricating the push-rod ends at the same time. Oil fed by gravity collected in rocker-box feeds inlet valve through a regulator (see Fig. 12).

Oil-Leaks

Oil-leaks are invariably due to the condition of the sealing washers and rubbers. Leakage from the rocker-box or valve-spring covers is usually due to worn felt rings interposed between the rocker-bushes. To replace felt rings, remove one bush (local heat will help) and renew felt ring. Use a taper mandrel on rod to force rings into position, and facilitate entry of rocker-sleeve upon assembly.

If valve-springs are rusty or dry, drill a $\frac{1}{16}$ in. hole high up in the valve-spring cover to relieve condensation. Rubber rings are fitted in groove in rocker-box for sealing joint at top of push-rod cover tubes. Apply a little jointing compound on the outside of tubes when fitting and allow compound to set before assembly.

Rubber rings are also fitted at the base of the push-rod tubes, over tappet guides. These will swell after contact with oil; the push-rod tubes, when rocker-box is assembled, should compress these rubbers.

Steel washers fitted over tappet guides will increase

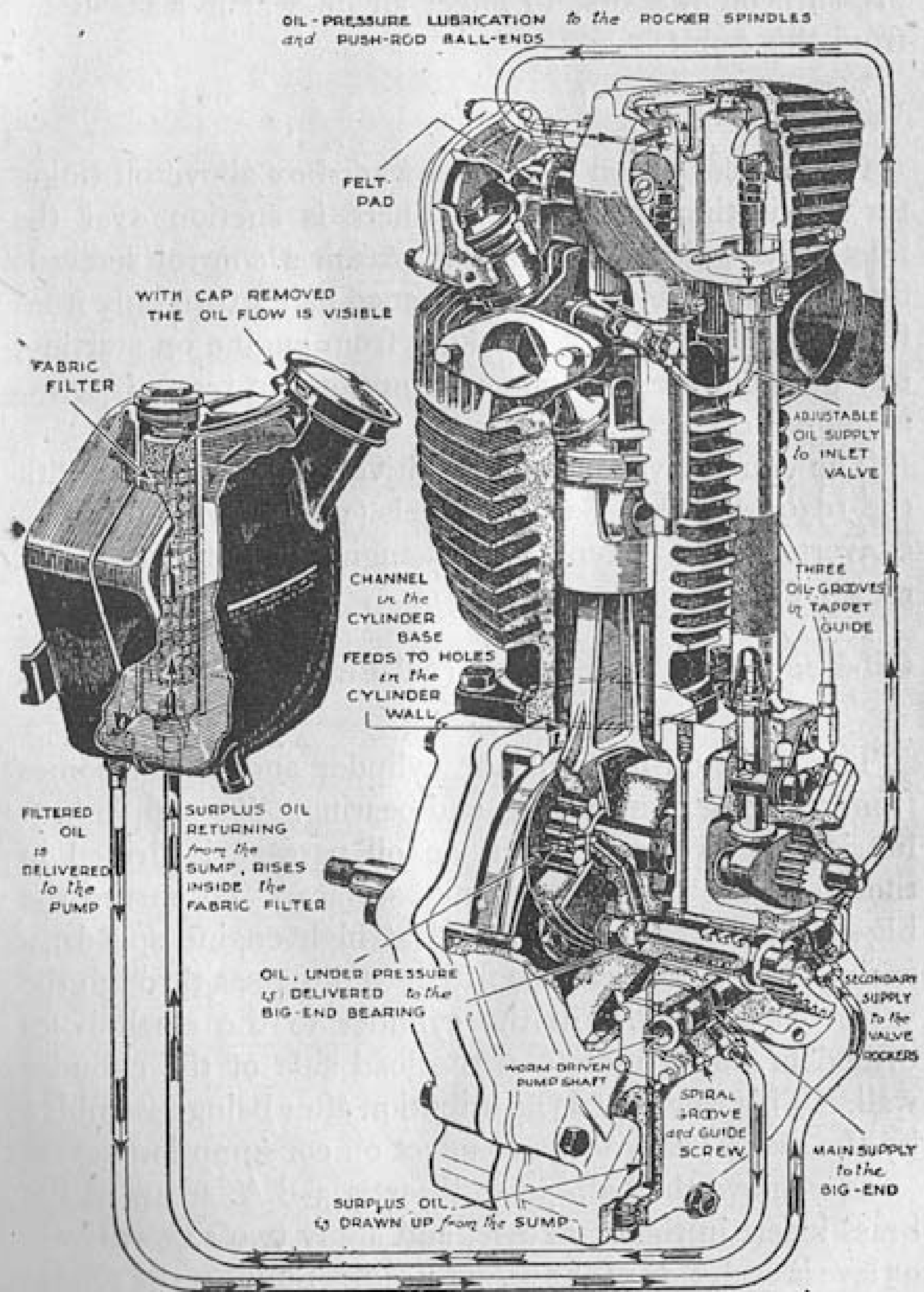


FIG. 12.—ENGINE LUBRICATION SYSTEM WITH DIRECT OIL-FEED FROM PUMP TO ROCKER-GEAR.

pressure on rubbers, to effect an oil-seal if leaks occur from this point.

Valve Oiling

Oil will collect on ledge in rocker-box above oil union for lubricating inlet valve. There is suction over the inlet valve-guide, and for this reason a control screw is fitted. The screw should be opened half a turn only from fully closed position. Smoking from engine on starting, oily plug or excessive oil consumption can result if screw is not set correctly.

The exhaust valve is not positively lubricated, as with the 1939 Models. Earlier models (1937 onwards) can be converted to 1939 type by exchanging cylinder-head and rocker-box.

Oil-Feed to Cylinder Wall (All Engines from 1935 to 1939)

The main oil-feed for the cylinder and piston comes from oil flung from the big-end bearing. To supplement lubrication to the cylinder, an oil passage is drilled in the crankcase up to the crankcase face. To ensure the big-end is correctly lubricated at high engine speeds, a spring-loaded ball-valve is fitted. Oil passes through the valve via a channel in the cylinder to the small holes drilled in the cylinder, on the load side of the cylinder wall. This valve needs no attention after being assembled by the works, and does not affect oil consumption.

To remove the ball-valve, insert a 3-B.A. screw in the brass insert in the crankcase, and apply two screwdrivers or levers each side of the screw-head. Support the screwdrivers to effect a levering action, and the insert will come out. If the engine is in the frame, fill the throat of the crankcase with clean rag to avoid the insert falling into the crankcase. When replacing the brass insert

it should be flush with the counterbore in the crankcase.

On the Big Twin engines made from 1933 onwards, two ball-valves are used with different springs. The strongest spring should be used for the rear cylinder.

Removing and Refitting Valve-Guides

On all O.H.V. models the valve-guides are a force fit, and are not shouldered. To remove, clean off all carbon and burnt oil on the outside of the guides, and if a hand-press is not available, tap out with a series of light blows, using a suitable drift or an old bolt inserted in the guide.

To refit valve-guides, put the valve through the cylinder-head and slip the guide over the stem protruding, press the guide into the head and register the oil-hole. Keep the valve on its seat with the disengaged hand; this will ensure that the guide is fitted parallel to the axis of the valve. When the guide has been "started", withdraw the valve and press home the guide to its normal position. The inlet guide should project outside the head $\frac{1}{2}$ in.; the exhaust should be $\frac{5}{8}$ in.

TECHNICAL DATA FOR 1937 AND 1938 MODELS

	250	350	500	990	250T.	350T.	500T.
M.P.G. petrol	100	95	85	60	95	85	80
Jet size	120	150	180	130	120	150	180
Bore in mm.	62·5	69	82·5	85·5	62·5	69	82·5
Stroke in mm.	80	93	93	85·5	80	93	93
Compression ratio	6·3	6·8	6·2	5·1	6·3	6·9	6·2
Ignition	$\frac{7}{16}$ in.	$\frac{7}{16}$ in.	$\frac{7}{16}$ in.	$\frac{1}{4}$ in.	$\frac{7}{16}$ in.	$\frac{7}{16}$ in.	$\frac{7}{16}$ in.

Note.—Compression ratios are with standard piston.
For gear ratios see page 150.

Chain Adjustment and Wheel Bearings

The original design of totally-enclosed front chain is common to the early models and details given on page 23 apply also to the 1935 machines.

Adjustment and assembly of wheel bearings is also common to all A.J.S. Models. Refer to details for 1939 models, page 130.

Fork-Spindle Adjustment

Provision is made for taking up side or end wear of the various fork-spindle bearings. The need for adjustment will be made apparent by a click or creaking noise when the stearing-head is abruptly turned. By placing the fingers partly over the spindle link end and partly upon the lug through which the spindle passes, while turning the steering-head, first ascertain which spindle or spindles require adjustment, then, after slackening off the right side nut on the spindle to be adjusted, carefully turn the spindle bodily, by means of its hexagonal head, in a clockwise direction to tighten, or vice versa to slacken. Do not adjust more than one half a revolution at a time before a re-trial, with the nut again tightened. Care is essential to avoid tight adjustment, which will make the fork stiff in action or entirely prevent it functioning. The necessary friction damper effect is provided independently, and is adjusted as described below.

Adjusting Fork-Action Damper

The fork-action damper can best be adjusted while the cycle is actually in motion, and a badly corrugated surface such as may be found on many bus routes provides the best condition for the purpose. The ebonite damper hand-nut should be screwed sufficiently tight to make the fork action sluggish in such circumstances as those

described, and will subsequently require very little variation for other conditions of road surface to provide the maximum degree of comfort.

Gearbox

Gearbox lubrication is as described on page 141, Chapter VII.

Whilst it is not difficult to completely dismantle the gearbox, a certain amount of mechanical knowledge is

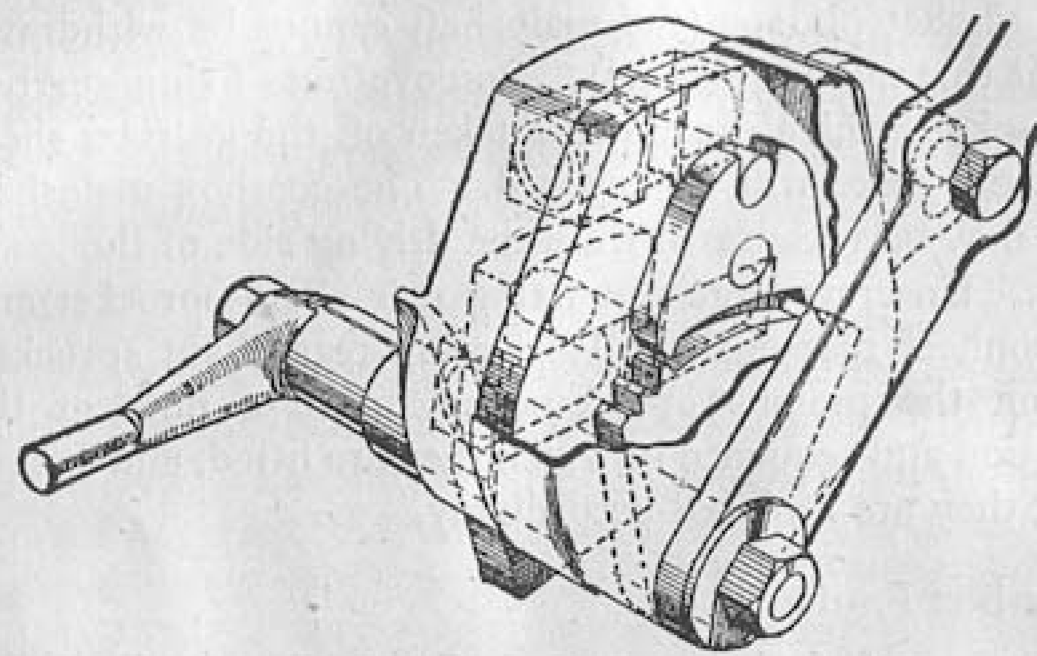


FIG. 13.—SPRING-BOX AND ROCKING-PAWL.

necessary. Without special fixtures or tools to hold the gearbox it is, in most cases, desirable to commence dismantling whilst the gearbox is held in the frame of the machine.

On the 1935 Light-weight gearbox ("H" type), both hand- and foot-operated gear-change mechanism were fitted. Details of the spring-box and rocking-pawl are shown in Fig. 13, which is used for the foot-operated type.

On the hand-change type a plain lever is connected to the shaft passing through the gearbox end-plate.

To Dismantle Gearbox—Light-Weight Type

Remove clutch-spring nuts and take out all friction and steel plates. Release mainshaft nut securing clutch-hub and pull hub off the shaft. Now turn to the other side of the gearbox. Take off bolts retaining clutch-lever bracket and plate covering kick-starter. The kick-starter crank, with its quadrant and return spring, can then be removed. This will expose the ratchet pinion and ratchet plate on the mainshaft. Unscrew nut retaining ratchet pinions (the mainshaft cannot be withdrawn until this nut is released). Remove nuts fixing gearbox end-plate, which can now be taken off the gearbox shell, and the gears will be exposed. The gearbox mainshaft can now be withdrawn from the driving side of the gearbox. Unscrew large nut fixing rear chain sprocket and disconnect rear chain. Take away rear chain sprocket. When the pinions are removed, make a note of the position and sequence in which they are fitted, and ensure that they are replaced accordingly.

Gearbox Faults

The usual faults are gears disengaging under load. This is invariably due to a combination of circumstances, and not one particular fault. Therefore, it is difficult, without prior examination, to define the actual reason for the trouble, which may, however, be confined to the following:—

(1) Lost motion or unwanted movement on the lever at the back of the gearbox end-plate.

(2) Wear on the dogs on layshaft, also in pinions.

(3) Worn layshaft bushes.

(4) Weak or broken pawl indexing spring (fitted in hole in gearbox shell).

(5) Broken pawl-spring.

(6) Damaged or worn pawl.

(7) Worn or damaged quadrant engaging with pawl.

To Replace Broken Pawl-Spring

The gearbox end-plate will have to be removed before access to spring is made (see details for dismantling gearbox). Remove broken spring and slip new one over quadrant shaft and ensure that the legs of the spring are separated, or opened out, with one leg placed each side of the pawl-pin. Take care ball mounted on the end of operating lever is correctly positioned in the inner control lever. A dab of grease will be of help in securing the ball during assembly.

Clutch

If new inserts are fitted, they will settle down with use, and when this happens the length of the clutch push-rod is affected. The effect will be to lengthen the push-rod, and, if not corrected, clutch slip might occur. Therefore always check the slack in the clutch operating lever on the handlebar, which should have at least $\frac{1}{8}$ in. to $\frac{1}{4}$ in. slack before pressure is brought to bear on the operating mechanism.

The clutch actuating lever on gearbox should be below the right-angle position when pressure is brought to bear on the push-rod. The length of the push-rod can be adjusted by the screw mounted in the outside clutch-plate (clutch-spring pressure plate), which is retained by a lock-nut. Unscrewing the screw or stud will effect clearance between the operating mechanism. If this is overdone, the actuating lever on the gearbox will tend to bend the push-rod before exerting pressure on the clutch-springs.

Clutch-Slip.—See page 147.

To Replace Kick-Starter Quadrant

Remove kick-starter crank as detailed in dismantling gearbox. The quadrant on the crank is a force fit, and a good-size vice will be needed, or a hand press, to remove quadrant. The quadrant is retained on the splines on the crank by a steel bush, which also serves as a bearing for spindle for the crank. The steel bush is a push fit, and can be driven out if a steel drift is inserted through the hole of the crank and tapped lightly. The drift should be placed alternately on each edge of the bush to ensure that it is removed parallel with its housing. The quadrant can now be removed. Reverse this procedure to re-fit crank.

To Replace the Kick-Starter Return Spring

New springs are supplied tightly coiled and bound with iron wire. It is only necessary to offer up the spring and cut the binding wire with a pair of pliers. If the original spring is to be used, fix the end of the spring to the crank, and to its locating pin. "Wind up" the crank about two to two and a half complete turns, taking care that the coils of springs do not over-ride—a screwdriver will correct this—then work kick-starter to its correct position.

Clutch Shock Absorber

Rubber inserts (four) are fitted between the clutch-sprocket and the clutch-driver. Excessive movement in between these two parts indicates worn or damaged shock-absorber rubbers. Remove the four bolts securing the metal retaining plates and renew the rubbers. The clutch sprocket runs on roller bearings; apply a little grease to these rollers when the clutch is given attention. A medium-weight gearbox (C.P. type) is fitted to

Models 35/4 and 35/14. This gearbox is described for the 1937/38/39 Models. The foot-change mechanism is totally enclosed, as fully described later (page 145). Four clutch friction plates are used in place of three plates on the light-weight models.

CHAPTER V

1939 AND LATER ENGINES

THE following is a list of the 1939 O.H.V. and side-valve models. After 1939, the range of models was restricted, but basic engine design remained the same with detailed alterations and service requirements as referred to in the latter part of this chapter.

O.H.V. MODELS

	C.c.	Ignition.	No. Ports.
39/12	250	Coil.	Single.
39/13M.	250	Magneto.	,,
39/22	250	,,	Two.
39/22T.	250	,,	Single.
39/16	350	Coil.	,,
39/16M.	350	Magneto.	,,
39/26	350	,,	Two.
39/26T.	350	,,	Single.
39/8	500	,,	,,
39/18	500	,,	,,
39/18T.	500	,,	,,

T = Trials machine (see Chapter IX).

SIDE-VALVE MODELS

	C.c.	Ignition.	No. Ports.
39/9	498	Magneto.	—
39/2	990	,,	—
39/2A.	990	,,	—

Engine Lubrication

It is false economy to use cheap oils and grease. Use the brands recommended (page 207). Reference to Fig. 14 will show the passage of oil from the pump.

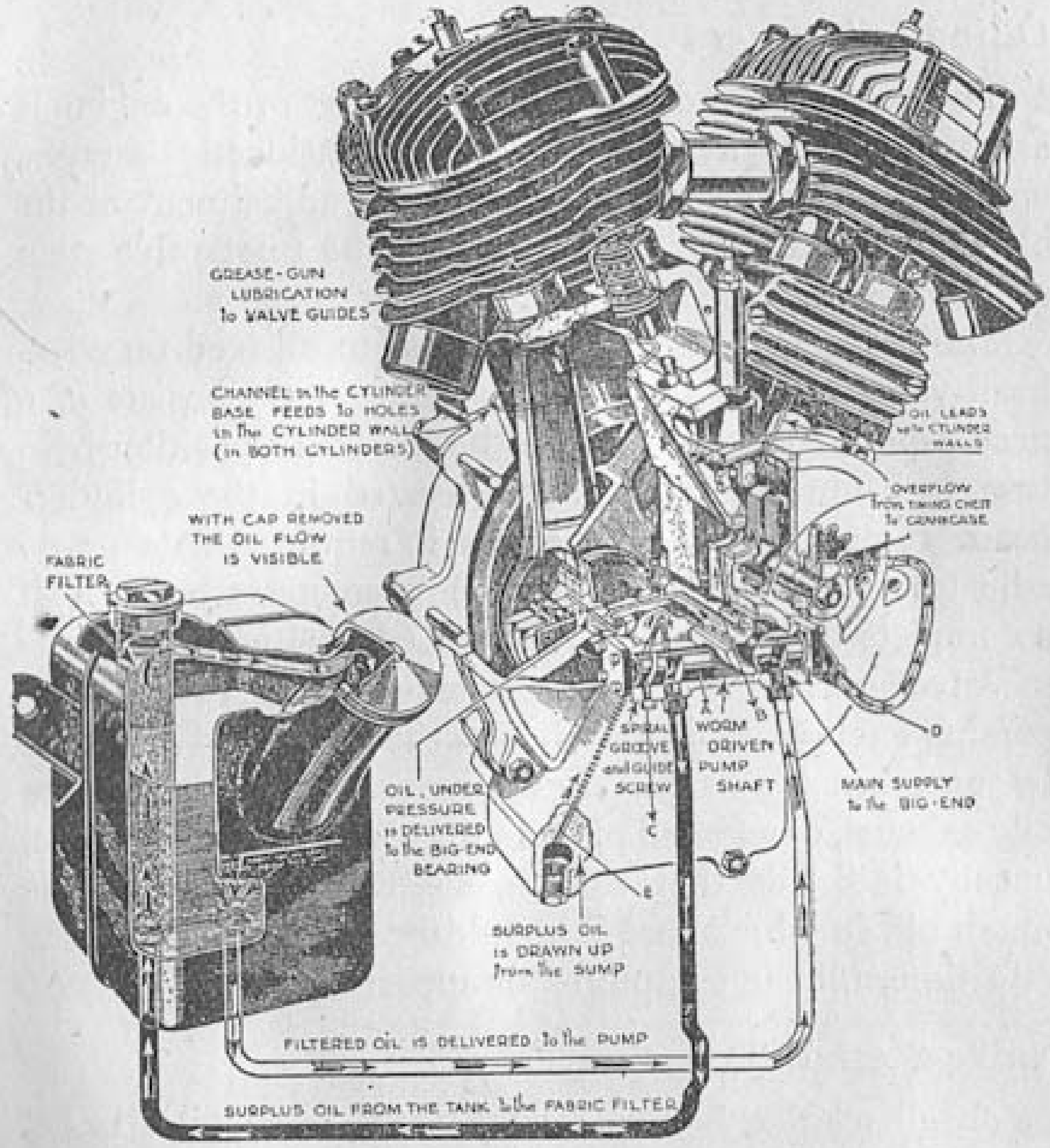


FIG. 14.—BIG TWIN LUBRICATION SYSTEM.

Oil pump plunger is rotated by worm on shaft B under the influence of screw C. Clean oil is drawn through port D on backward motion of pump plunger. Forward motion returns oil from passage E via filter to oil tank.

The Oil-Tank

At periods not greater than every 5,000 miles the oil tank should be drained, thoroughly washed out with petrol, and then refilled with fresh, clean oil. The felt cartridge oil-filter in the oil tank should be removed and thoroughly washed in petrol every 1,500 miles.

Oiling Adjustment

The correct delivery of oil to each part of the engine is arranged internally by suitably dimensioned passages, and no provision is made for external adjustment of the oil supply except for the oil-feed to the inlet-valve stem on all overhead-valve models.

The adjuster for the inlet-valve stem oil-feed on overhead-valve models (see Fig. 12, page 59) consists of a needle-pointed screw that can be locked in position by a thin lock-nut. This screw is located in the cylinder-head. Once the adjuster is set it requires little or no adjustment. The (approximate) correct setting is half a complete turn from the fully closed position.

Valve-squeak generally indicates that the valve is not passing enough oil, in which case the needle valve should be unscrewed a trifle. Excessive oil consumption, an oily exhaust, or an oiled plug, in the case of a new machine, usually indicates that this needle valve is passing too much oil, in which case it should be screwed up, a trifle at a time, till the symptoms disappear.

Valve-Stem Lubrication

On all overhead-valve models there is an oil channel cast in the cylinder-head to lead oil direct to the exhaust-valve stem. No adjustment is provided for this oil-feed because, in use, the oil passage allows oil to flow against the stem, and oil not immediately used by the stem is then by-passed back to the crankcase sump. The constant flow of oil against the stem, followed by the instant removal of the surplus, prevents the oil passage becoming choked with burnt oil. This feature, coupled with the means of lubricating the inlet-valve stem, is a definite advance in engine-lubrication design. This arrangement can be adapted to the

1937 and 1938 models by changing the cylinder-head and rocker-box.

On all side-valve models each valve-guide is furnished with a grease nipple in order to directly lubricate each valve-stem by means of a grease-gun. Only a small quantity of graphite grease or one of the recommended grades of grease should be injected through each nipple at intervals not more frequently than every 500 miles.

Checking Oil Circulation

Provision is made to observe the oil in circulation, and it is advisable to do this before each run. If the filler cap is removed, the returning oil can be seen running from the small spout just inside the filler-cap orifice. This check should be made immediately after starting the engine from cold. This is because, while the engine is stationary, oil from all parts of the interior of the engine drains back into the crankcase sump, so that until this surplus is cleared the return flow is very positive and continuous.

Normally the return flow is somewhat spasmodic and mixed with air bubbles. This is partly due to the fact that the return portion of the oil-pump plunger has greater pumping capacity than that delivering fresh oil, and partly due to the variations in the amount of oil in suspense in the crankcase, according to the engine speed. For example, upon a sudden acceleration the return flow may completely cease for a time, only, of course, to resume at a greater rate than normal upon deceleration.

Removing the Oil-Pump Plunger

To remove the oil-pump plunger, drain the oil-tank; remove the four bolts holding the oil-pump housing rear cap to the crankcase and take away the cap; unscrew the guide-screw for the oil-pump plunger (see Fig. 12).

The pump plunger can then be extracted from its housing.

Warning : If, for any reason, the engine is dismantled, the oil-pump plunger *must* be removed before the two halves of the crankcase are separated.

Replacing Oil-Pump Plunger

To replace the oil-pump plunger see that the interior and exterior of the oil-pump plunger and its housing are free from dirt. Then smear the plunger with clean engine oil. Insert the narrow end of the plunger in the rear end of the plunger housing, and gently push it into place.

Next, introduce the guide-screw into its hole and, while gently screwing this, slightly move the plunger in a to-and-fro motion until the narrow end of the guide-screw is felt to engage in the profiled groove cut in the end of the plunger. Once the guide-screw has engaged in the groove it should be screwed right home. If the screw does not engage in the groove, and it is tightly screwed against the body of the plunger, the plunger will be prevented from rotating, so that when the engine is turned for starting the teeth on the plunger and on the timing side fly-wheel axle will be stripped. Therefore, great care must be taken to prevent this occurring.

There is a paper washer under each end cap, and if either or both are damaged, replace with new ones. A little jointing compound will help to make an air-tight joint.

The petrol tank must be removed on all O.H.V. models before the cylinder-head can be taken off. The petrol tank must be drained, because a single petrol tap is used. The 1945 models, also the W.D. machines, are fitted with two petrol taps, which can be adapted to earlier models by changing the transfer pipe and using the later-type petrol pipe, with petrol taps to suit.

To Remove and Replace the Rocker-Box (All O.H.V. Models)

Before attempting to remove or replace the rocker-box, it is essential that the valves are closed. In that position the piston is at the extreme top of its compression stroke, and this can be easily determined by removing the side tappet cover from the rocker-box in order to expose the long push-rod adjustable ends and the rocker arms.

To remove the rocker-box, first remove the tank, and then disconnect the main oil-pipe that leads oil to the centre of the rocker-box. Slack off the bolt securing the engine steady stay to the clip on the frame-tube (350 and 500 models only) and, on 350 models, remove the nut and washer fixing the steady stay to the rocker-box rear long bolt, and gently spring the stay clear of the rocker-box bolt.

Remove the seven bolts that secure the rocker-box to the cylinder-head, and then the box complete with the rockers can be taken away. Beware of losing the steel cap or thimble that is on each valve-stem. These are disclosed when the rocker-box is removed, and, of course, should be in position on the valve-stems before the box is replaced.

To re-fit the rocker-box first thoroughly clean the top of the cylinder-head and the lower face of the rocker-box, and see that the composition washer is located between the cylinder-head and the box. Then reverse the procedure described above. Remember there is a steel washer under the head of each of the rocker-box fixing bolts, and when replacing these bolts screw each down, bit by bit, in turn, until all are fully home.

The rocker-box gasket should be in good condition if oil-leaks are to be avoided. If in doubt, fit a new one to avoid subsequent attention to this part of the engine. Re-set tappet clearance when rocker-box is refitted.

To Remove and Replace the Cylinder-Head (All O.H.V. Models)

To remove the cylinder-head, first raise (or remove) the petrol tank, remove the rocker-box and then proceed as follows:—

Remove the exhaust system by slackening the screw on the finned clamp on the cylinder-head (when this is fitted —not all models have one), and by removing all the bolts retaining the exhaust pipe and silencer to the frame and taking away the pipe and silencer as one unit. On two-port models it is necessary to remove both pipes and silencers. Unscrew the top cap of the carburetter mixing chamber and withdraw the throttle and air-slides, and also remove the sparking-plug.

Remove the four bolts retaining the cylinder-head to the cylinder barrel, and the head is then free to be taken away. While doing this the push-rod cover tubes will come away with the head, and the two long push-rods should be removed: these will be exposed as the head and cover tubes are taken away. Lay aside the push-rods so that they may be identified, because although they are identical in construction and size, they should not be interchanged. A gasket is fitted between the cylinder-head and barrel. If this is damaged a new gasket should be used when refitting the head.

To replace the cylinder-head, reverse the procedure described above, taking care to replace the cylinder-head gasket, the rubber gland-rings at the bottom of the cover tubes, and see that the lower ends of the long push-rods are lying in the cups at the tops of the tappets. When refitting the cylinder-head bolts, screw each down, bit by bit, in turn, until all are fully home.

Push-Rod Tubes

The cover tubes are a push fit in the cylinder-head. The oil-seal is made by special rubber sealing washers. Steel washers are fitted inside the apertures for the tubes to locate the rubber washers. A thick steel washer is used when a compression plate is in use. This should be exchanged for a thinner steel washer should the compression plate be removed. When the rocker-box is assembled, the push-rod tubes should be pressed down hard on to the rubber rings at the bottom of the cover tubes. If the tubes can be moved, use the thin steel washer as well as the thick ones, to apply additional pressure on the bottom rubbers.

To Remove Cylinder Barrels (Models 2, 2A and 990 Twin S.V.)

To remove the cylinder barrels, remove the cylinder-heads and then proceed as follows:—

Remove the front exhaust pipe and silencer, and rear exhaust pipe and silencer, as separate units, by removing all the bolts and slackening all the nuts that retain them to the main frame. (The rear pipe is secured to the frame by a bracket close to its front end.)

Unscrew the two union nuts that retain the inlet pipe to the cylinders. This will enable the inlet pipe, complete with the carburetter, to be taken away.

Next remove the two tappet cover-plates, which are retained to the cylinder barrels by two screws in the case of the front cylinder, and by a screw and knurled nut in the case of the rear cylinder.

Next turn over the engine till both the valves of the front cylinder are closed. This is when the piston is at the top of its compression stroke. Then remove the three nuts that retain the front cylinder to the crankcase;

this will leave the cylinder free to be taken away. While doing this take care to ensure that the piston assembly does not receive damage.

Finally, remove the rear cylinder in exactly the same manner as described for the front cylinder.

Converting to High Compression

To convert a 250 O.H.V. model to high compression a special piston must be fitted, together with a compression plate. Longer cylinder base studs are also needed to accommodate the plate under the cylinder. For ultra high ratios remove the compression plate.

On the 350 models, two types of special pistons are used, for high and ultra high ratios respectively. These special pistons are of the solid skirt type and were designed for use with special fuel.

To convert a 500 O.H.V. model to high compression merely remove the compression plate and replace the thick steel washers above the cover-tube gaskets with thinner ones. Note that the compression plate is a standard fitment on all 500 O.H.V. models. An ultra high compression ratio cannot be produced on 500 O.H.V. models.

Special high-compression pistons are supplied by the makers. Suitable slow-burning fuel—50% benzole and 50% No. 1—is necessary for high compression ratios. Racing fuel is used for ultra high ratios. See competition models for further details (Chapter IX).

To Remove and Replace Valves (All O.H.V. Models)

After cylinder-head removal, to remove the valves it will be found convenient to rest the head of each, in turn, on a small wood block while the valve-springs are compressed, to allow the valve-spring cap divided collets to be removed from the grooves cut in the valve stems.

These collets are a taper fit, and it may be necessary to give the valve-spring cap a sharp tap in order to release them.

Upon the removal of the split collet the pressure on the valve-spring cap should be released, which will permit the removal of the valve-spring cap and the springs, so that the valve will be free to be withdrawn from the head.

Valves for 250 models are identical in size and materials, and will interchange. The 350 models have dissimilar valves which cannot be interchanged. On the 500 models both valves are alike in size, but differ in materials. Valves are either stamped above collet grooves or etched on the valve-head. K.E. steel is used for the exhaust valve on these models.

A paper washer is used between the base of the cylinder and crankcase. Apply jointing compound to one side of the washer and stick it to the cylinder.

Apply fresh oil to the cylinder wall, then space the piston-rings evenly at 120 degrees to each other. Compress the rings and fit the cylinder over the piston. When the barrel is sitting properly on the crankcase, tighten the base nuts down evenly, until they are securely tightened.

Valve grinding is as given for the 1933 models, paying particular attention to the inlet valve seating.

Tappet Adjustment (All O.H.V. Models)

The top ends of the long tappet push-rods have screwed extensions. These are locked in position by nuts, and this provides tappet adjustment.

The correct tappet clearance between the rocker ends and the valve ends, when the valves are completely closed and the engine is cold, is the nearest possible approach to nil. This means that the push-rods should be free enough to revolve without any binding, and at the same time there should be no appreciable up-and-down movement possible. To adjust the tappet clearance, remove the nut or nuts that retain the rocker-box cap. This frees the cap for removal, so revealing the adjustable screwed ends, mentioned above. Revolve the engine until the piston is at the top of its compression stroke, in which position both the valves will be closed.

With spanners, hold the body C and slacken lock-nut B. Then screw in or out the head A until the

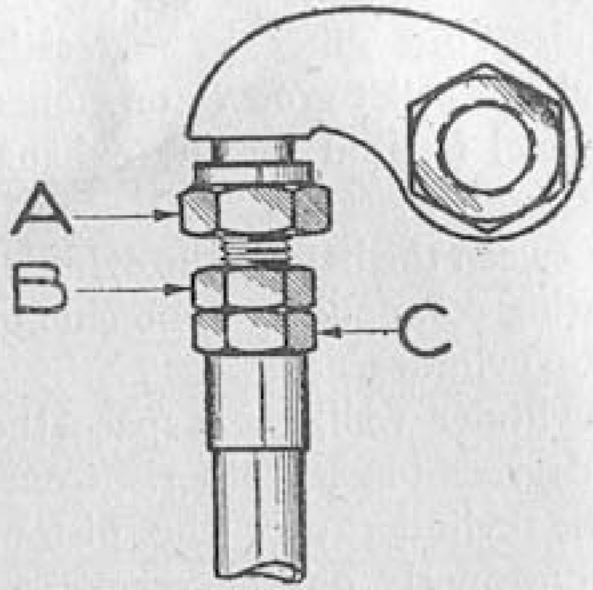


FIG. 15.—O.H.V. TAPPET ADJUSTMENT.

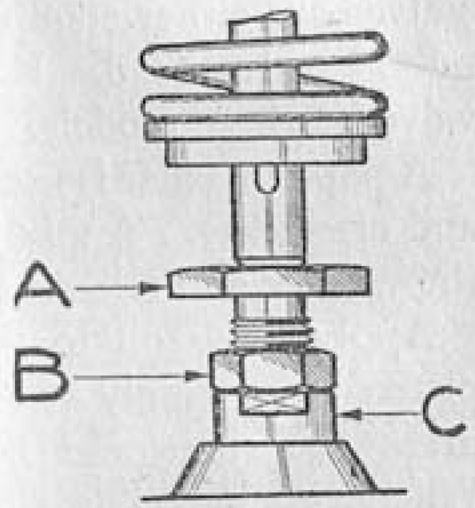


FIG. 16.—SIDE-VALVE TAPPET ADJUSTMENT.

clearance is nil. Next tighten lock-nut B and re-check the clearance (see Fig. 15).

Finally, replace the rocker-cap, taking care to replace the fibre washer that is under each knurled nut. Do not over-tighten these nuts, because the joint is made with a rubber fillet, and undue pressure is not necessary. Excessive pressure may crack the cap.

Tappet Adjustment (All Side-Valve Models)

The top ends of the tappets have screwed heads. These are locked in position by nuts, and this movement provides tappet adjustment (see Fig. 16).

The correct clearance between the valve-stems and the tappet heads, when the valves are completely closed and the engine is warm (not hot), are for inlet ·004 in., exhaust ·006 in.

To adjust the tappet clearance, remove the tappet-chamber cover and turn over the engine until both valves are closed. With spanners, hold the body C and slacken the lock-nut B. Then screw, in or out, the tappet head A, until the clearance is correct. Next, tighten lock-nut B and re-check the clearance.

Finally, replace the tappet-chamber cover. Note that this has a cork washer, and it is advisable to stick this washer to the cover with some liquid jointing compound. A feeler gauge will greatly facilitate setting the tappet clearances, and a set of feeler gauges can be purchased at any tool stores.

Valve Timing (All Models except 2 and 2A)

The timing gears are marked to facilitate their replacement. When checking valve timing, the tappet clearances must be set to 0·016 in. See data page 85.

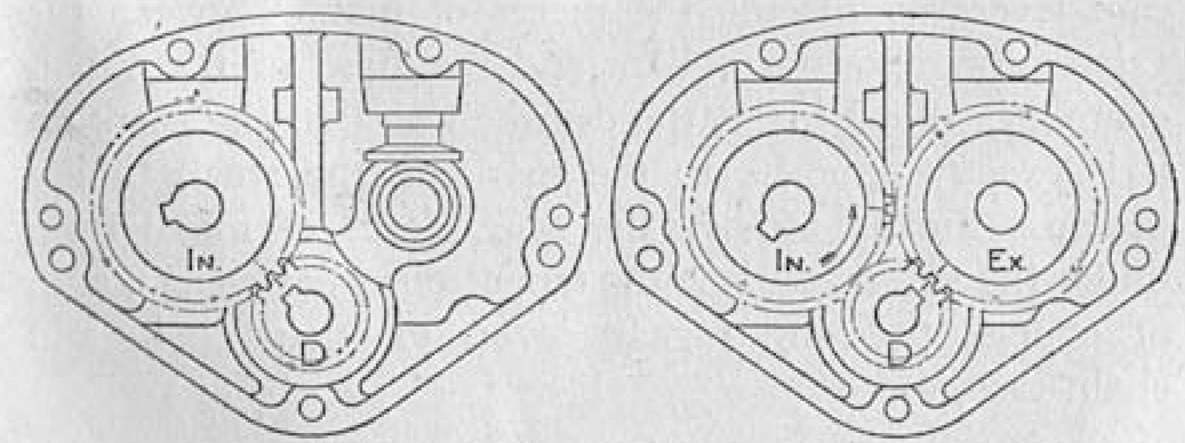


FIG. 17.—SETTING TIMING GEARS (ALL MODELS EXCEPT 2 AND 2A).

To reset the timing gears, by using the marks on the gears, turn over the engine till the mark on the small timing pinion D is in line with the centre of the inlet (rear) camshaft bush (see Fig. 17(*a*)). Insert the inlet camshaft " IN " so that the mark on it is in mesh with the mark on the small pinion D. Then rotate the engine in a *forward* direction till the mark on the small timing pinion D is in line with the centre of the exhaust (front) camshaft bush (see Fig. 17(*b*)).

Then insert the exhaust camshaft " EX " so that the mark on it is in mesh with the mark on the small timing pinion D.

Valve Timing (Models 2 and 2A S.V.)

The timing gears are marked to facilitate their replacement. When checking valve timing, the tappet clearances must be set to 0·016 in. (see data).

To reset the timing gears, by using the marks on the gears, obtain four bolts, or pieces of metal, each about $1\frac{3}{8}$ in. long and not more than $\frac{7}{16}$ in. in diameter, and proceed as follows:—

Remove the tappet-chamber covers from the cylinders and turn over the engine until the mark on the small timing pinion is pointing to the centre of the bush for the timing camshaft. Take all spring pressure off the timing-cam levers by placing the pieces of metal between the valve-spring bottom collars and the base of the valve-chamber. Next insert the camshaft so that the mark on it is exactly opposite to the mark on the small timing pinion. Finally remove the four pieces of metal from under the valves, replace the tappet-chamber covers, and, of course, the timing-gear cover, magneto chain and chain-case, etc.

Cam Contour

Owing to the presence on the cam flanks of what are technically known as quietening curves (which actually are very slight inclines from the base circles of the cams to the feet of the humps), it is necessary to make certain that the tappet ends are on the base circles when checking

valve clearances. It is for this reason that the clearances should be checked when the piston is at the top of its compression stroke, at which position both tappets are well clear of the quietening curves. For the same reason, it is necessary to check the valve timing with a tappet clearance of 0·016 in., which is sufficient to skip the slight inclines.

The nut retaining the small timing pinion has a left-hand thread.

To Re-time the Ignition

Have available a stout screwdriver, or an old-type tyre lever having a short turned-up end, and a bar of metal not less than $\frac{3}{16}$ in. in diameter and approximately $5\frac{1}{2}$ in. long. (The tommy bar of a tubular box spanner is suitable.) On magneto models, remove the sparking-plug, the outer cover of the magneto chain-case and the contact-breaker cover. On coil-ignition models, remove the sparking-plug and the contact-breaker cover. On all O.H.V. models, remove the rocker side cover plate. On all side-valve models, remove the tappet-chamber cover plate. (The plate on the rear cylinder on Models 2 and 2A.)

Then proceed as follows, according to the model.

Models 12*M*, 22, 22*T*, 22*SS*, 16*M*, 26, 26*T*, 26*SS*, 9, 8, 18, 18*SS* and 18*T*.—Unscrew the nut that retains the lower magneto sprocket and, with the screwdriver or tyre lever, gently lever the sprocket from the taper on the camshaft to which it is attached.

Turn over the engine until both valves are closed and, with the rod inserted through the plug-hole, feel the piston till, by partially rotating the engine forwards or backwards, it is felt that the piston is at the extreme top of its stroke. Place a mark on the bar, level with the top of the plug-hole, remove the bar, measure above the mark the advance recommended in the Technical Data Table, page 85, and record the position on the bar.

Place the handlebar ignition control lever in the fully advanced position, re-insert the bar in the plug-hole and slightly rotate the engine *backwards* until the upper mark on the bar is level with the top of the plug-hole.

By turning the sprocket on the magneto shaft, rotate the magneto in an anti-clockwise direction (as seen when viewing sprocket) until the contact-breaker points are just about to separate. Tighten the nut on the camshaft, taking care not to move the engine and/or the magneto shaft when doing so. Re-check the setting.

Ignition Timing (*Models* 2 *and* 2*A*).—Proceed exactly as described in the previous paragraphs, but time on the rear cylinder and the lower of the two humps, or cams, on the contact-breaker cam ring.

Coil Ignition (*Models* 12 *and* 16).—Slacken the screw securing the contact-breaker cam, and, with a small punch operating in one of the slots in this cam, give a sharp but light tap. This will loosen the cam from the tapered end of the shaft to which it is attached. Proceed to place the piston as described above, and then gently rotate the contact-breaker cam, with the fingers, in an anti-clockwise direction, until the contact points are just about to separate, in which position carefully re-tighten the screw that retains the cam. Re-check the setting.

Before timing the ignition, check the gap between the contact points, and adjust if necessary. To find the exact moment for the commencement of point separation, place a piece of tissue paper between the points and turn the magneto armature until the paper is just released, and no more, upon a gentle pull.

Standard Carburetter Settings

The correct sizes of main jets, chokes and throttle

slides, as in the table below, have been decided after much experiment and testing, and should not be altered save for some very good reason.

Models.	Main Jet.	Choke.	Throttle Slide.
250 c.c. . .	120	5–058	5/3
350 c.c. . .	150	6–058	6/4
500 S.V. . .	150	6–057	6/4
500 c.c. O.H.V.	180	29–068	29/4
990 S.V. . .	130	6–058	6/4

Carburation

The petrol level is maintained by a float-and-needle valve, and in no circumstances should any alteration be made to this. In the event of a leaky float or a worn needle-valve the part should be replaced.

The petrol supply to the engine is controlled, first, by the main jet, and secondly, by means of a taper needle, which is attached to the throttle valve and operates in a tubular extension of the main jet.

The main jet controls the mixture from three-quarters to full throttle, and the adjustable taper needle from three-quarters down to one-quarter throttle, the cut-away portion of the intake side of the throttle valve from one-quarter down to about one-eighth throttle, and a pilot jet, having an independently adjusted air supply, takes care of the idling from one-eighth throttle down to the almost closed position. These various stages of control must be kept in mind when any adjustment is contemplated.

With the standard setting it is possible to use full, or nearly full, air in all conditions, except perhaps when the engine is pulling hard uphill or is on full throttle, when some benefit may be obtained by slightly closing the air control.

Weak mixture is always indicated by popping, or spitting, at the air intake. A rich mixture usually causes bumpy or jerky running, and in some cases of extreme richness is accompanied by the emission of black smoke from the exhaust.

To Check Setting of Pilot-Jet

To check the setting of the pilot-jet and its air control, warm up the engine, then, with the ignition about two-thirds advanced and the air about three-quarters open, the engine should idle positively and evenly when the throttle is almost closed. If it fails to do so, adjust the pilot-jet air-screw, inwards or outwards, until even firing is obtained. (The pilot-jet air-screw will be observed at the base of the mixing chamber and its position is retained by a spring.) This adjustment is not unduly sensitive, and it should be possible to obtain the correct adjustment in a few seconds.

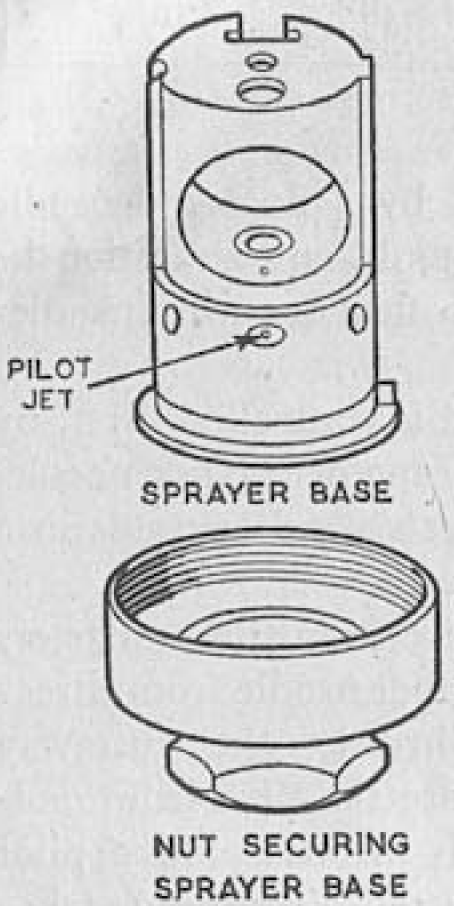


Fig. 18.—Location of Pilot-Jet.

In the event of the adjustment of the air-screw failing to provide the required result, it is possible the pilot-jet is obstructed with dirt. The pilot-jet is actually a passage cut in the sprayer base, or choke, and is very small, so there is always a latent danger of this becoming choked. Upon removing the float-chamber and the large union nut at the bottom of the mixing chamber, the sprayer base can be pushed out of the mixing chamber, and the jet can then be cleared

by using a strand of fine wire. Fig. 18 shows clearly the location of the pilot-jet in the sprayer base, or choke.

A throttle stop-screw, that can be locked in position by a nut, is located in the side of the mixing chamber. This screw runs obliquely into the chamber, and is situated above the pilot-jet air-adjusting screw.

Possible Carburetter Faults

Poor slow running may be due to :—

Pilot-jet obstructed (see above). Air leaks. Tappets too closely adjusted. Plug points too wide or too close (normally 0·018 in. to 0·020 in.). Ignition incorrectly set.

Heavy petrol consumption may be due to :—

Worn needle-jet. Weak valve-springs. Late ignition setting. Flooding carburetter (punctured float). General debility of engine.

Technical Data for 1939, Ex-W.D. 1940–41 and Post-War Models

Valve Timing.

Inlet opens B.T.D.C. :	
All Models, except 2, 2A	20° (32° 1945–49)
Models 2, 2A	15°
Inlet closes A.B.D.C. :	
All Models, except 2, 2A	67° (63° 1945–49)
Models 2, 2A	50°
Exhaust opens B.B.D.C. :	
All Models, except 2, 2A	78°
Models 2, 2A	58°
Exhaust closes A.T.D.C. :	
All Models, except 2, 2A	28°
Models 2, 2A	12·5°

Tappet Clearance.

Inlet :	All O.H.V. Models (engine cold)	Nil
	All Side-valve Models (engine warm)	0·004 in.
Exhaust :	All O.H.V. Models (engine cold)	Nil
	All Side-valve Models (engine warm)	0·006 in.

(Continued on next page)

TECHNICAL DATA—*continued*

Ignition Advance (max.).

All Models, except 12, 9, 2 and 2A	(36°) $\frac{7}{16}$ in.
	(39°) ($\frac{1}{2}$ in. 1949)
Model 12	$\frac{5}{16}$ in.
Models 9, 2, and 2A	$\frac{1}{4}$ in.

Sparking Plug Gap.

All Models	from 0·018 in. to 0·020 in.

Standard Compression Ratio.

Model 12	6·0 : 1
Models 12M, 22, 22T, 22SS	6·3 : 1
All 350 O.H.V. Models	6·3 : 1
Model 9	5·0 : 1
All 500 O.H.V. Models	5·9 : 1
Models 2 and 2A	5·4 : 1

High-Compression Ratio.

Models 12M, 22, 22T, 22SS	9·0 : 1
All 350 O.H.V. Models	9·5 : 1
All 500 O.H.V. Models	8·9 : 1

(50–50% mixture.)

Ultra High-Compression Ratio.

Models 12M, 22, 22T, 22SS	11·0 : 1
All 350 O.H.V. Models	11·0 : 1

(Racing fuel.)

(*Further Technical Data for post-war models will be found on pages 197–206*)

POST-WAR MODELS

Post-war models were introduced for the 1945 season, and up to 1949 were confined to 350-c.c. and 500-c.c. single-cylinder O.H.V. models.

The vertical twin-cylinder models of the 500 c.c. O.H.V. class are described on page 113 in Chapter VI, which is devoted to these models.

Engine service described for the 1939 single-cylinder models also applies to post-war single-cylinder models, and subsequent alterations made from year to year are mentioned in chronological order. Reference to technical data will indicate settings to be used on different models.

Oil-pump Modifications

For the 1947 models an improved type oil-pump was introduced by using a two-start worm on both the pump plunger and timing-side axle; this increases the pump speed and oil-delivery rate. This arrangement is common on all single models made up to 1950. Earlier types cannot be converted without serious alteration; the parts required are as follows :—

(1) Timing-side half-crankcase.
(2) Pump plunger (stamped 2S on one end).
(3) Timing-side axle (stamped 2S on one end).
(4) Pump guide-pin and sleeve.
(5) Large-diameter oil-feed pipe.
(6) The oil tank must be modified to take adapter for feed pipe.

To distinguish the new pump and shaft they are stamped 2S on one end of each item, and they will *not* interchange with the earlier type. Service staff and owners should check replacement parts with the originals before fitting.

A further alteration was made for the 1948–50 models by increasing the width of the profiled groove in the pump plunger from $\frac{3}{16}$ in. to $\frac{1}{4}$ in.; the guide-screw pin was increased in diameter to suit. This alteration cannot be adapted to the 1947 models without replacing the timing-side crankcase.

TRACING OILING TROUBLES

Oil Fails to Return from Sump

(1) Clean or replace felt filters.
(2) Air leak between rear pump end cover.
(3) Obstruction in oil passage from sump to pump.
(4) Broken pump guide-pin.
(5) Porosity in passage from sump to pump.

Oil Supply to Rocker-box Fails or is Insufficient

(1) Choked rocker-box feed-pipe.
(2) Gasket blocking oil passage in pump, front end cap.
(3) Worn or broken pump guide-pin.

Damaged or Worn Teeth on Pump Plunger

Damaged or worn teeth on the pump plunger can only occur as a result of overloading the pump gear. Cases are known where new parts have been fitted without investigating the reason for the wear and subsequent damage has taken place.

If the oil-pump guide-pin is not located in the profiled groove in the pump plunger and pressure is applied on the body of the plunger, the teeth will quickly become damaged on both the pump plunger and the timing-side axle. This can be avoided by moving the plunger backward and forward until the guide-pin enters the profiled groove. It should be possible to screw in the guide-pin by hand, finally tightening firmly with a spanner. By this method, damage cannot possibly take place.

A bright marking on the pump plunger along the side groove and on the tip of the pin is indisputable evidence of the cause of this damage. Where this evidence is not present, overloading of the pump gear is due to other causes.

It is possible to determine whether the overloading is either on the delivery or return side of the pump motion by carefully examining the pump plunger. The plunger rotates clockwise, and oil delivery is made when the plunger is at the forward end of its stroke. As the pump plunger is engaged below the timing-side axle, the position where damage has occurred in relation to the plunger position will indicate if the restriction or load is on either

the feed or return side of the oiling system. If in doubt, check in the following sequence :—

(1) Restriction in the filter or return pipe.
(2) Blocked oil passage to rocker feed (check paper washer).
(3) Blocked oil passage to big-end due to—
(*a*) Crankpin incorrectly located in flywheel.
(*b*) Oil passage in crankpin fouled or choked.
(*c*) Timing-side axle incorrectly located in flywheel.

After overhaul when new parts have been fitted, it is essential that oil passages are checked before fitting flywheels to crankcase, by using an old small-end bush placed over the timing-side axle. With a suitable oil squirt inserted in the oil hole for the small-end bush, oil can be forced through until it can be seen emerging from the crankpin at each side of the connecting-rod.

Damage to pump gear is usually indicated by a thumping noise at one-eighth engine speed.

Oil Seeps into Engine when Stationary

This kind of trouble is rare, but should it occur examine in the following sequence :—

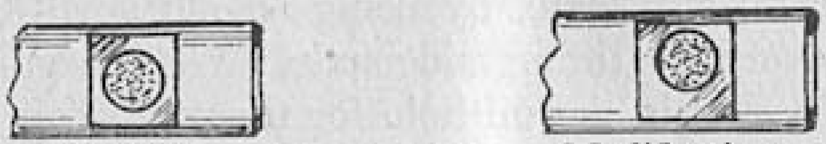
(1) Vent hole in oil-tank filler cap blocked (on models up to 1948).
(2) Diaphragm for crankcase-release trapped between crankcase seat and serrated body for release valve.
(3) Worn or scored pump-plunger bore in crankcase (smallest diameter) due to abrasive entering engine.

To remedy in case of worn or scored pump plunger, machine the plunger bore in the crankcase and manufacture bush to restore the bore diameter to normal. Alternatively, replace the timing-side half-crankcase.

Heavy Oil Consumption

Oil consumption is usually between 2,500 to 3,200 m.p.g. with an engine in good condition. Short-distance checks of oil consumption are usually inaccurate; tests should be made over a distance of at least 100 miles to determine actual figures.

If the oil consumption is below the above figure and has suddenly increased, the condition of the piston-rings and, in particular, the scraper ring may be responsible. Before replacing piston-rings, measure the bore for size



Original. Modification.

FIG. 19.—OIL-PUMP PLUNGER MODIFICATION FOR 1947–48 MODELS.

(see " Technical Data ") and rebore if wear is 0·008 in. or over. The inlet-valve oil-regulating screw, if unscrewed in excess of one-half a turn from its closed position, will also affect oil consumption.

Should the condition of the piston-rings and cylinder bore size be normal, the oil consumption can be improved by using a modified type oil-pump plunger. Fig. 19 illustrates both types, the alteration is confined to the angle of the port of the delivery side, which curtails the oil supply to the top part of the engine only.

Cylinder Wall Feed

The passage of oil from the timing-side bush to the cylinder wall is shown in Fig. 12. This part of the oiling system is often suspected in cases of over-oiling or heavy oil consumption, but has no connection with such troubles. To prevent the bulk of oil delivered to the engine being

directed to the cylinder-wall feed, a ball valve is used to ensure the big-end receives adequate oiling at high engine speeds. The ball valve is fitted in the end of the passage from the timing-side bush on the crankcase face. There is nothing to go wrong with this part of the system. To dismantle, a 3 B.A. screw should be inserted in the brass insert, which is a press fit in the crankcase, and the insert removed by levering out with two small screwdrivers placed under the head of the screw. Lever against two small pieces of wood or similar objects. Behind the insert is a spring and ball which complete the assembly. The brass insert should be flush with the counter-bore when replaced.

Remedying Oil Leaks

Serious oil leakage can affect oil consumption. Oil leaks are unlikely to occur if sealing gaskets and the parts used with them are in good order. The points where oil leakage can occur and the remedies are :—

Push-rod-cover Tubes.—Renew top and bottom rubbers, applying jointing compound around the reduced diameter of the cover tube and rubber. If oil leaks persist, test cover tubes for rigidity. Should it be possible to move these slightly, fit an additional *thin* steel washer in the apertures for the cover tubes in the cylinder-head in order to apply more pressure on the top and bottom rubbers. Where continual buckling of the top rubber occurs, change the cover tubes with others having a longer projection into the cylinder-head.

On 1950 models, fit a *thin* steel washer on the cover tube before fitting into the cylinder-head.

Rocker-box Cover.—Examine for cracks due to over-tightening; replace if necessary or renew the fillet, securing the fillet with jointing compound in the cover.

Rocker-box Gasket.—In view of the small cost, renew the rocker-box gasket when engine service is carried out in order to avoid subsequent attention after engine is assembled. Check the oil connection for the rocker-box when an oil leak occurs on the top part of the engine. Ensure that the lip on the gasket (on models up to 1948) goes over the aperture for the inlet-valve feed in the cylinder-head.

Crankcase Release Valve.—On all O.H.V. single-cylinder A.J.S. engines the crankcase release is mounted on the driving-side crankcase and consists of a release-valve body, diaphragm and release pipe. The release-valve body screws into a boss on the crankcase close to the driving-side bearing. This is a simple non-return valve the diaphragm moving away from its seating in the crankcase when the piston is on the downward stroke and allowing the pressure in the crankcase to escape into the atmosphere. On the upward movement of the piston the diaphragm is sucked on to its seating, thus preventing the entry of foreign matter into the engine. It follows that if the diaphragm is not free to move the pressure built up in crankcase cannot escape as intended. Once assembled correctly frequent attention is rarely necessary. After dismantling this valve apply a little grease to the serrated seat to hold diaphragm in position, thus preventing it becoming trapped between the release body and the crankcase.

A slight oil discharge from the crankcase release, with engine idling, is normal on engines using the two-start pump (1947 to 1950). This discharge does not seriously affect oil consumption and does not take place with normal driving.

Engine Smokes Unduly on Starting

Oil accumulated in the oil passages in the cylinder-head will drain into the combustion chamber when the engine has been stationary, particularly when a side stand is used. On all models before 1949, oil will collect in a well formed in the rocker-adjustment chamber. The oil level here can be reduced by drilling two $\frac{1}{16}$-in.-diameter holes in each side of the well; this allows oil to drain back into each push-rod-cover tube. Alternatively, the drain hole in the well, which feeds the exhaust guide, may be enlarged to take a $\frac{3}{16}$-in.-diameter copper tube protruding approximately $\frac{3}{16}$ in. to reduce the head of oil. The oil-regulating screw for the inlet valve should be checked (half-turn open only) before this modification is made.

ENGINE SERVICE

Bent Push-Rods

In the event of a bent push-rod, the cause should be investigated before straightening or replacing. Valve-operating mechanism should be carefully examined for :—

(1) Valve springs closing up with valve at full lift—due to pattern or non-standard springs (see "Technical Data").

(2) Incorrectly located valve guide fouling spring top collar.

(3) Broken inner valve spring pieces interfering with outer spring.

(4) Seized or sluggish valve (most likely the exhaust), allowing rocker arm (push-rod end) to leave adjusting cup, then fouling top of adjusting screw.

(5) Valve-end caps omitted or broken (models up to 1949), causing push-rod adjuster to foul rocker-oiling boss.

(6) Incorrectly located tappet guide; tappet foot fouls guide with valve at full lift.

(7) Valve collets incorrectly located on valve.

Note.—The push-rod crippling static load is 1,130 lb.

After fitting new parts to the cylinder-head, check the valve motion by rotating the engine until the valve is at full lift; then using a box key on the rocker axle nut try to lift the valve a little further. If no movement occurs investigate as advised above.

Exhaust Valve Seizes or Becomes Sluggish in Guide

Should the engine misfire and then cut out after fast driving, the exhaust valve is probably the reason. A closely adjusted exhaust tappet will cause the trouble by holding the valve slightly off its seat. The exhaust valve relies on contact with its seating in the cylinder-head to dissipate heat collected in the valve head; if contact is insufficient, heat will run up the valve stem and burn the oil in the guide. An excess of oil to this valve can also cause sluggish valve action (see "Engine Smokes on Starting").

Once the valve has seized, all carbon formed in the valve guide and on the valve stem must be removed to prevent a recurrence of the trouble. As some oils are more prone to carbon formation, a different brand of oil can be tried.

Decarbonising

Details given for 1939 O.H.V. models apply to all post-war O.H.V. single-cylinder models.

Removing Engine from Frame, O.H.V. Single-cylinder Models

(1) First refer to instructions to remove rocker-box (page 73).

(2) Take away front chaincase, clutch and driving chains.

(3) Remove magneto chaincase, magneto chain and then timing cover.

(4) Disconnect all engine-end oil pipes.

(5) Remove all crankcase bolts with front engine plate.

(6) Slack off gearbox bolts and rear engine-plate bolts to facilitate engine removal.

(7) Spring down front engine lug bottom end and the engine can be taken away with comparative ease.

Note.—Before separating crankcase, the oil-pump plunger must be removed. The small timing pinion nut has a left-hand thread.

To Remove Broken Bottom Crankcase Bolt

Over-tightening of the bottom small-diameter crankcase bolt will cause it to fracture when the crankcase becomes hot.

The removal of a broken bolt appears to present some difficulty by reason of the frame-tube position. It is not necessary to remove the engine, as is usually thought, if the bolt uniting the two tubes for the rear frame is withdrawn. With this bolt removed, one tube can be levered down sufficiently far enough and held in this position to permit withdrawal of the broken bottom crankcase bolt.

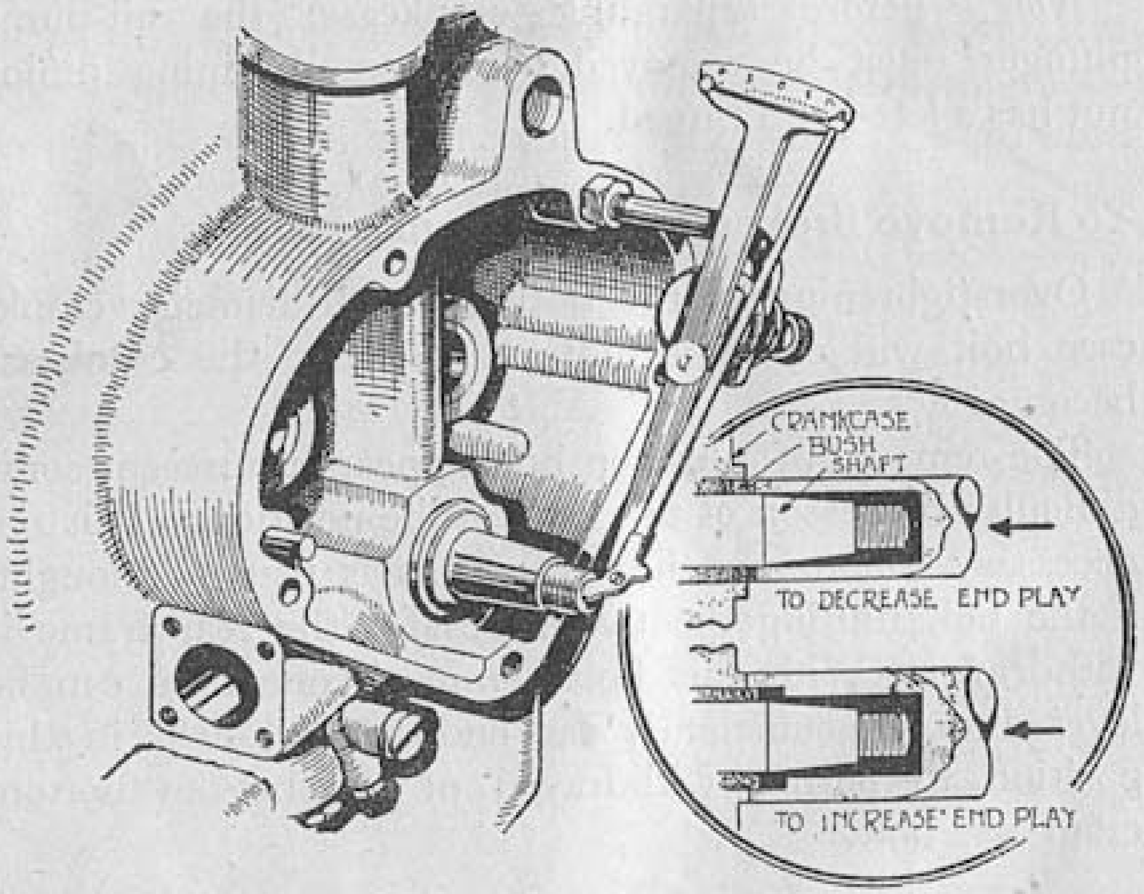
Flywheel End Float

Should it be necessary to replace the timing-side axle bush, end float is adjusted by moving the bush in its housing (where a long plain bush is fitted); shim washers are *not* used. An accurate method of checking is shown in Fig. 20, page 96; the shock-absorber spring must be removed before checking. Allow 0·025 in. movement. If flywheel end float is excessive *with the shock absorber assembled*, this is due to ball-races loose in their housing.

To remedy, make up two large washers with a pinch bolt to mask the inside of the bearings, then have a light copper deposit made on the outside diameter of both ball-races in turn to increase the outside diameter.

Warm crankcase before refitting races in the following order :—

(1) Fit one ball-race in crankcase.
(2) Next the distance piece (smallest in diameter).



"Motor Cycling" copyright drawing

FIG. 20.—METHOD OF CHECKING THE AMOUNT OF MOVEMENT BETWEEN FLYWHEELS AND CRANKCASE.

(3) Spacing washer.
(4) Remaining ball-race.

Note.—The inner members of each ball-race must be free to revolve independently in order to avoid end loading on races.

Rocker-Box Bearings

A little end play between rocker axle and bushes is usually blamed for engine noise. Where excessive side

movement occurs, drive out one bush to take up play, leaving rockers just free without side play.

Separating the Flywheels

The crankpin has taper shanks and is a force fit in the flywheel. A hand-press, together with two bars of stout steel placed under the flywheel to be removed, is normally the method used for parting the flywheels. When this equipment is not available a clamp or separating tool can be made up quite easily given suitable workshop facilities. Fig. 21 shows the simple construction of this tool with claws welded on the puller bar. A two-piece crankpin (hardened sleeve for roller path, and high tensile for centre shaft) is common on all single-cylinder models. On fitting a new crankpin the crankpin nuts should be screwed down an equal amount before finally tightening. Tightening one nut will pull the centre pin through the hardened sleeve. For factory use a torque spanner 213 ft. lb. is used.

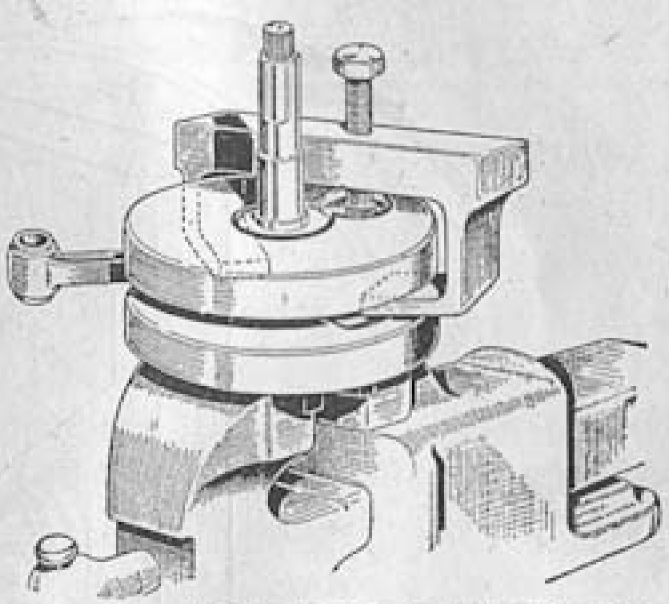


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FIG. 21.—SIMPLE TOOL FOR SEPARATING FLYWHEELS.

Replacing Timing-Side Shaft

On all engines this shaft has a taper shank where it fits into the flywheel. The shaft nut is retained by a 3 B.A. grub screw. It is important that the shaft, if replaced or removed, is correctly positioned, otherwise the oil supply to the big-end will be affected, and the valve usually stops the noise and gives indication as to the source. Proof of piston slap can be obtained by applying a large glove or piece of rag against the left side of the cylinder with the machine in motion: resonance caused by slap will be diminished or made inaudible when the cylinder is swathed, the noise reappearing when "swathing" is taken away. This method can be used with the machine stationary and bottom gear engaged, by letting clutch in slightly and applying pressure on the rear brake pedal. A second person is needed to apply the "swathing".

Before dismantling cylinder for attention, check ignition setting for correct advance. Have cylinder and piston carefully measured for size (see "Technical Data"), piston measurement being taken at the top and bottom of the skirt (right angles to gudgeon-pin axis); top lands or side clearance do not affect piston slap. Some owners are puzzled by clearance at the sides of the piston, which is machined oval.

Wire-Wound Piston

The introduction of the wire-wound type of piston was made, after a great deal of experimental work and exhaustive road tests, during the latter end of the 1948 season. Construction is shown in Fig. 23, which illustrates the five turns of high-tensile steel wire used to control expansion. "Y" alloy material is used with a tin-plated finish after machining.

The object of the wire binding is to equalise expansion, thus preventing distortion; a close running clearance of 0·001 in. is permissible. The shape of this piston is both oval and slightly tapered; the ovality occurs each side of the piston, with its maximum around the bosses for the gudgeon-pin, where expansion is greatest. This ovality is often confused with excessive clearance, but the clearance each side of the piston has no relation to

"slap". The wire binding is ground to the finished diameter of the piston and is not proud of the piston body.

Considerable care is taken during engine assembly to select or match pistons to the finished size of the cylinder, with very close limits. The finished size of the piston is stamped on the crown, that of the cylinder is stamped on the base flange. For example, if the

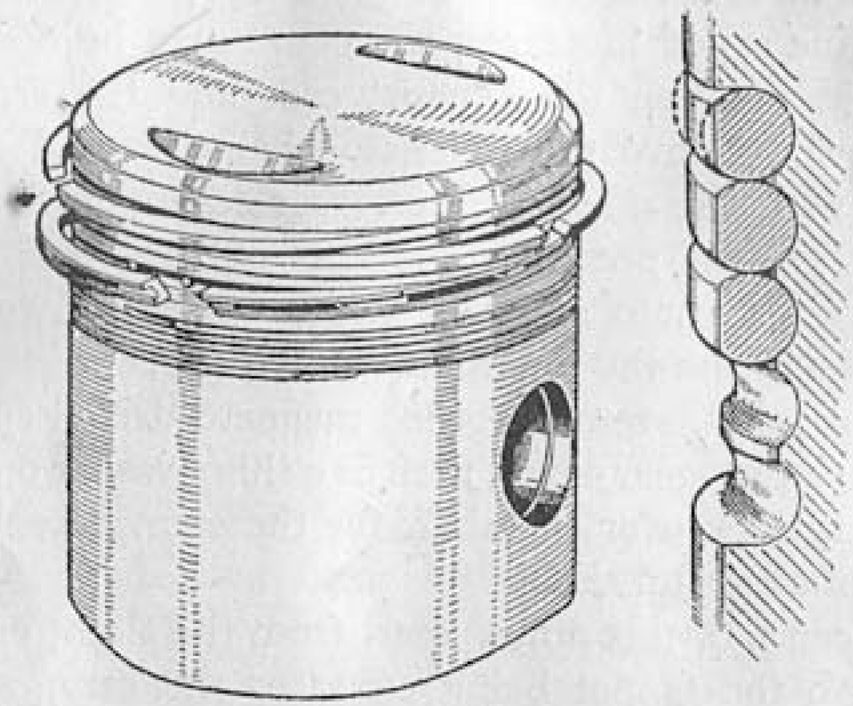


FIG. 23.—WIRE-WOUND CLOSE-FITTING PISTON.
Note the five turns of high-tensile steel wire used to control expansion.

cylinder has a mean diameter, a piston with the same tolerance is fitted, to ensure the drawing clearance is maintained. This also applies to cylinders that are rebored. A table of tolerances with symbols stamped on both cylinder and piston is shown in the technical data. This type of piston can only be fitted to engines made from 1947 onwards which use the short connecting-rod. This connecting-rod can be used on earlier models if this type of piston is desired.

By reason of the close running clearance permissible with the wire-wound piston, the fitment of a new piston into a worn cylinder barrel is of no benefit. Therefore the cylinder will have to be either rebored or fitted with a liner or sleeve to the normal dimensions.

Timing-Gear Noises

Should a clacking noise, similar to a very slack tappet, develop at low engine speeds and become inaudible as the engine speed increases, the cause may be due to the end float between the exhaust cam and the crankcase. To prove, remove the magneto chaincase and run the engine with the machine on a rear stand until noise is audible. Then press on the end of the shaft driving the lower magneto sprocket with a piece of wood. If noise disappears the end float is the cause.

To remedy, remove the magneto-drive sprockets and the timing-gear cover, then fit a shim washer 0·006 in.–0·010 in. thick over the shaft for the cam. Replace the parts removed and re-test.

The cause of this noise, apart from the slight end play, is due to the tappet being offset to the cam, with the object of ensuring that wear is distributed equally on the foot of the tappet, and not in one particular place. The position of the tappet, in relation to the cam, causes an oscillating movement on the cam, with the resultant noise. The outside bush for the cam axle can be moved inwards, if cover is removed, but the above method is preferable.

Should this noise persist when the engine has covered considerable mileage, backlash between the cams and the small timing pinion may be the cause. Worn camshaft bushes or the timing-side main bush may be responsible. Before fitting costly replacements try the effect of a new small timing pinion.

Resetting Valve Timing O.H.V. Models

Details shown on page 79 apply also to post-war models. Recent issues of replacement cams are interchangeable for both A.J.S. and Matchless engines marked 1 and 2. No. 2 is used for resetting A.J.S. engines.

Valve Springs

Coil valve springs are used on post-war models made before 1949. To minimise valve float, use 1948-type springs, which are slightly longer and stronger than those used previously. At the same time, valve-spring top collars of the 1948 type must also be fitted to prevent springs closing up at full valve lift (see "Bent Push-rods"). Alternatively, the recess for the inner spring in the collar can be machined back $\frac{1}{16}$ in. to provide the necessary clearance.

Hair-pin Valve Springs

Should a clicking noise develop in top part of the engine after fitting new hair-pin valve springs, remove the sharp corner at the end of the radius in the spring collar where the spring is located. To avoid breakage, these springs should be free from bruises or other damage. The spring wire should be polished during the process of tuning to ensure reliability. If one or more of these springs show evidence of a groove or marking on the wire, it is probably due to the rocker arm fouling the spring. Grind an additional radius on the rocker arm for clearance.

Worn Valve-ends

Worn valve-ends are rare, but in cases of this kind the valves can be made serviceable. Reduce the valve end by $\frac{1}{32}$ in. and use the earlier type hardened end caps.

This treatment is best suited to touring models, where high revs are not needed.

Removing Engine Shock-absorber Nut

The hexagon on this nut is somewhat shallow on models before 1950 and a tight-fitting ring spanner is required for its removal. To unscrew the nut (right-hand thread) rotate the engine against compression. Place the spanner in position and tap the end with a hammer in a series of light blows, and the nut will unscrew with comparative ease. This method is preferable to pressure applied on the spanner with the gear engaged. Fit the latest type of nut if the hexagon is damaged.

Oil Leakage from Front Chaincase

A new type of rubber chaincase-band is now available which is mushroom in section, with a narrow and a wide groove for both the front and rear portions of the chain-case. Where persistent oil leaks occur from this part of the machine, the new type rubber case will provide the remedy.

POST-WAR OVERHEAD-CAMSHAFT MODELS 350-c.c.

The 350-c.c. overhead-camshaft model was reintroduced in 1948, and in 1949 minor alterations confined to cycle parts were incorporated. Several modifications were introduced for the 1950 models all of which, unfortunately, cannot be adapted to earlier models. The alterations concerned are :—

(1) Lighter flywheels (see " Technical Data ").

(2) New crankcase, with sump filter.

(3) Larger centre shaft for crankpin, with force-fit timing-side axle.

(4) Modified valve angle of (1 degree).

(5) Larger inlet valve (see " Technical Data ").

(6) Cylinder-head located on small spigot for cylinder, eliminating annular space between spigot on cylinder and cylinder-head.

(7) Improved type of oil tank, larger-capacity fuel tank with " snap " filler caps.

(8) Cooling vents for both brake drums.

(9) Modified exhaust-pipe length and megaphone (see " Technical Data ").

Frequent dismantling of engine is not advocated unless performance deteriorates. The power of this type of engine usually improves with use, and is capable of running two I.O.M. races, without attention, except to check rocker clearance and the usual frame adjustments. Consequently, if the engine runs satisfactorily leave it alone.

The large inlet valve, introduced in 1950, can be used on earlier models providing the seating is re-cut and the inlet port is enlarged. As this valve uses a smaller stem, a new valve guide will also be required.

Engine-O.H.C. Model

When new, each engine of the O.H.C. model is " motored " for six hours before the power test when the most suitable carburetter jet is selected. The main jet required does not vary, usually size 400 (Octane 72), occasionally an odd engine will " breathe " a little more efficiently and a smaller jet is necessary.

Removing the Cylinder-head

Take off the steering-damper knob, the strap under the tank, disconnect both petrol pipes and remove both tank bolts. Depress the front end of the fuel tank as far as it will go, then lift the rear end of tank and take it away.

Remove the exhaust system (apply graphite grease to the pipe nut thread when replacing), take off the engine-steady plate, the H.T. cable and the rev-counter cable.

Mark the frame tube to indicate the remote float-chamber level before releasing clamp bolt. Having done this, swing the float chamber to clear the rubber connection.

Take off the top cap on chain cover, the oil-feed nozzle and the spring inside.

Remove the camshaft nuts, then mark with an indelible pencil the aperture where the peg for the locating plate is positioned; this plate can then be removed.

To avoid disturbing the valve timing pass a length of copper wire through top chain sprocket, around the chain, through the hole where peg plate was fitted and gently lever off chain and sprocket now wired together.

Release all rocker-box fixing bolts, the rocker-box can now be taken away.

Remove the four cylinder-head bolts, making sure not to misplace the four loose washers under the head bolts. If the cylinder-head is difficult to remove tap upwards with a soft mallet under the exhaust port.

To remove the cylinder barrel, release the two crankcase bolts on each side of the cylinder base.

Replacing the Cylinder-head

A ground joint is used on all engines. On the 1948/9 models the head joint is made by a machined face on the cylinder-head and the cylinder barrel; these wide faces are ground for a gas-tight joint. With 1950 models the head joint is made on a small spigot on the cylinder and a recess in the cylinder-head. When "mated" a

clearance of 0·0015 in. between the machined flange on both the cylinder-head and the barrel is essential. Remove the rubber grummets before grinding.

To use this arrangement on 1948/9 models, machine back the wide flange on the cylinder barrel to the extent of 0·015 in. and enlarge oil holes in the barrel for rubber grummets.

Compression Ratios

Fuel.	Compression Ratio.	Main Jet.	Needle Jet.	Magneto Timing.
72 Octane	8-45-1	400	109	40°
80 ,,	9-00-1	400	109	40°
50/50	10-75-1	400	109	37°
90% Methanol	13-00-1	750	118	35°
10% Benzole		850	120	35°

Gear Ratios

See "Technical Data".

Camshaft Wear

After a large number of racing miles the camshaft should be checked for wear. Should a replacement be necessary, both rockers should be examined for damage on the pads which contact the cam. When a new cam is fitted it is vital to have a perfectly smooth surface on the rocker pads to prevent further damage to the new cam. Markings on pads can be removed with a fine oilstone, finishing off to a mirror-like finish.

If rapid wear takes place, check all oil passages for the rocker-box, the spring behind the oil-feed pump $\frac{11}{16}$ in. long, alternatively fit 1951 type big-end feed nozzle modified for 1948/9 engines, which increases oil supply to rocker gear.

Rocker Adjustment

Clearance for racing is 0·005 in. for the inlet valve and 0·014 in. for the exhaust valve. These clearances are also used to reset the valve timing. To set the rockers take off both rocker covers, then slacken off the rocker-box bolts having extended heads. Loosen the nut on the end of the rocker axle, rotate the rocker axle, then with a tommy bar placed in slots provided, the "feeler" should be inserted between the rocker pad and the valve end, move the axle until the correct clearance is reached. Retighten the bolts with the extended heads and recheck.

Do not attempt to move the rocker axle without releasing these bolts.

Camshaft Chain Adjustment

Laminated shims are available to raise the rocker box for the chain adjustment. Rocker shims of equal thickness for both valve-spring chests must be used for this adjustment. When the chain is in correct adjustment a $\frac{1}{4}$-in. diameter bolt should just pass between the tension blade and the tension-blade spring.

Oiling System

In the oiling system of early models a feed pump with $\frac{1}{4}$-in. gears was used; these have now been reduced to $\frac{3}{16}$ in. The return pump has $\frac{1}{4}$-in. gears on all models.

The spring for the ball-valve feed pump is $\frac{11}{16}$-in. long; the length of this spring affects oil pressure to rocker gear. Should the engine smoke badly after a complete overhaul, remove the rubber connection on the crankcase for oil return and fill oil down the metal connection on the crankcase, then rotate the engine *backwards* several times to clear the air lock.

Early models used a short oil filter in the oil tank for the feed line, and owners are advised to fit the long filter as used on later models.

Setting the Valve Timing

For accurate reading a dial-gauge indicator is desirable. This instrument should also be used to indicate T.D.C. when locating pointer. An ivorine timing disc can be obtained from the makers for the purpose of setting or checking the valve timing.

When the engine has been completely dismantled, or the top sprocket has been removed, set the rocker clearance as previously described. Establish T.D.C. locating pointer for timing disc; this must be accurately carried out. Where a dial gauge is not available feelers can be inserted between the rocker pads and the base circle of the cam. When using the dial gauge the end of the instrument should sit on the valve-spring top collar. A rough method of resetting the valve timing, detailed on page 44, can be used for this type of engine; the timing can be correctly set by the moving-vernier arrangement. It is not always possible to record exactly the figures recommended, but an error of 3–5 degrees is of no serious consequence. It is, however, important to set the inlet-valve opening to the recommended figure.

When "feelers" are used for setting the valve timing an additional rocker clearance must be made to the extent of "feeler" size. For example, if the feeler is 0·004 in. the inlet clearance should be 0·009 in. and the exhaust 0·018 in.

Reset the rockers to the correct running clearance when the timing is completed.

O.H.C. Valve Springs

Valve springs are supplied by the makers in pairs; already set and checked for pressure. Should the pattern springs be used, it is important to check the spring pressure before use against details shown in the technical data.

Normally the measurement taken from the centre of the spring leg to the centre of the wire, which fits in valve collar, is 1¼ in. A simple valve-spring compressor is supplied by the makers with valve-spring seats of the 1950 type.

Replacing Piston-Rings

When new piston-rings are needed it is beneficial to fit them to the piston and lap them in with metal polish until a mirror-like finish is shown. *Do not* remove the rings after this process as they will distort.

Wash thoroughly both the piston and the rings before assembly. This applies also to push-rod engines tuned for speed.

Flywheel Service

Should it be necessary to split the flywheels for renewals, wherever possible, this is best carried out by the makers. A powerful press is used for reassembling, and without such facilities a rigid assembly cannot be made, and a broken crankpin with other serious damage to the engine may result.

Rear-chain Adjustment

This is best carried out with the actual rider seated on the machine. A tight chain must be avoided, on account of the heat from the rear brake transferring into the alloy rear-wheel sprocket, which will expand, tightening the chain in the process.

Chain should have a ½-in.–¾-in. whip with the rider seated.

Rear Springing

Details for standard machines also apply to this model.

Front Forks

The arrangement used is basically the same as for the standard models. See " Technical Data " for oil content.

Compression Plate

The compression plate was a standard fitting on all 500-c.c. O.H.V. models made from 1939 onwards. The plate reduces the compression ratio from 7·24 to 1 to 6 to 1, the former ratio being too high for Pool petrol.

Note.—The ridge formed in the cylinder after using a compression plate must be removed by honing before engine is reassembled without the plate.

High-Compression Pistons 500-c.c.

High-compression pistons are available for 500-c.c. models with short connecting-rods (6⅞ in. centre) made from 1947 onwards. For earlier models it is necessary to replace the connecting-rod when fitting these pistons, which give a ratio of 8·9 to 1 (50/50 fuel) when used without a compression plate and 7·24 to 1 when used with a plate ⅛ in. thick.

High-Compression Pistons 350-c.c.

High-compression pistons are available for both pre-war and post-war 350-c.c. models and give a ratio of 9·5 to 1 (50/50 fuel) when used without a compression plate and a ratio of 8·4 to 1 when used with a plate $\frac{1}{16}$ in. thick.

De-rusting Fuel-Tank Interior

All A.J.S. fuel tanks, with the exception of model 7R, are of the steel welded type. On ex-W.D. models which have been exposed to inclement weather without a filler cap being in place or when alcohol fuels with water content have been used, a formation of rust may possibly occur. Periodic fuel stoppage due to this can be rectified by the following treatment.

A small supply of strong commercial ortho-phosphoric acid is required. Use two parts water (hot if possible) with one part acid. Plug the petrol-tap holes, then pour the fluid into the tank and leave it for 10–30 minutes, according to the degree of rust formation. Pour out acid, rinse the interior several times with water and allow tank to dry thoroughly. The acid can be retained for further use if desired.

Note.—Phosphoric acid has a corrosive action on clothes, and hands should be rinsed after contact.

CHAPTER VI

TWIN-CYLINDER ENGINES

THE new twin-cylinder spring-frame model was first introduced in 1949, and the entire output from the factory, up to the end of 1950, was confined to "Export Only". (The spring frame is dealt with in Chapter VIII.) The design incorporates a three-bearing crankshaft with connecting-rods of the light-alloy type similar in shape and size to those used on the famous "Porcupine" racing machines.

Modifications introduced since 1949 are confined to minor details such as additional fabric filter in oil tank, modified pressure-relief valve, compression plates discarded and new pistons, also sludge traps in the crankshaft.

Engine Lubrication

The dry-sump system is used with two separate gear pumps for delivery and return of oil to the tank. Details of oil-pump arrangement are shown in Fig. 24.

The pump with the widest gears ($\frac{3}{8}$ in.) returns oil from the sump to the tank, its larger capacity keeping the crankcase clear of excess oil. After leaving the fabric filter in the oil tank, the oil passes directly to the crankshaft centre bearing and in turn through passages drilled in the crankshaft to the big-end bearings. A divided by-pass supplies oil to the camshaft bearings and on to the four O.H.V. rockers via passages drilled in the cylinders. At this stage the oil passes through the rockers for push-rod and valve guide lubrication. Note that the oil passages in the cylinder-head are plugged at the start of the feed line, whilst at the far end holes are left open. This arrangement gives some concern to those unfamiliar with the system, and sometimes an impression that an omission to plug *all* holes has been made. Fig.

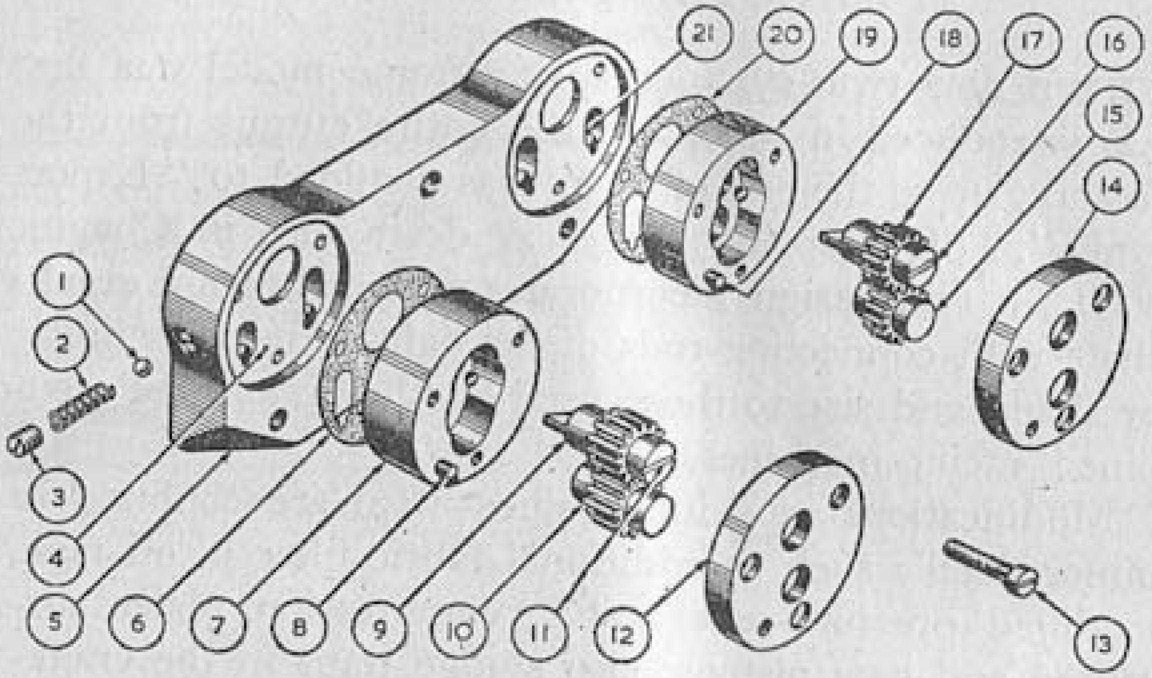


FIG. 24.—DELIVERY OIL PUMP (*on the right*) AND THE RETURN OIL PUMP (*on the left*).

1. Ball, for non-return valve.
2. Spring, for non-return valve.
3. Plug, retaining non-return valve spring and ball.
4. Bleed hole.
5. Plate, carrying oil pumps.
6. Washer, paper, for body of return pump.
7. Body of oil return pump.
8. Dowel pin, locating pump cover.
9. Driving gear, for oil return pump.
10. Driven gear, for oil return pump.
11. Screwdriver slot to enable driving gear to be correctly positioned during assembly.
12. Cover, for oil return pump body.
13. Screw (1 of 6) used to retain covers and bodies of oil pumps to the carrying plate.
14. Cover, for oil feed pump.
15. Driven gear, for oil feed pump.
16. Screwdriver slot, to enable driving gear to be correctly positioned during assembly.
17. Driving gear, for oil feed pump.
18. Dowel pin, locating pump cover.
19. Body of oil feed pump.
20. Washer, paper, for body of feed pump.
21. Bleed hole.

25 shows oil passages in the crankshaft and cylinder barrels.

The divided oil by-pass is operated by the oil distributor mounted in the driving-side crankcase and secured by a plated cap (see 13, Fig. 26).

Surplus oil from the top part of the engine builds up to

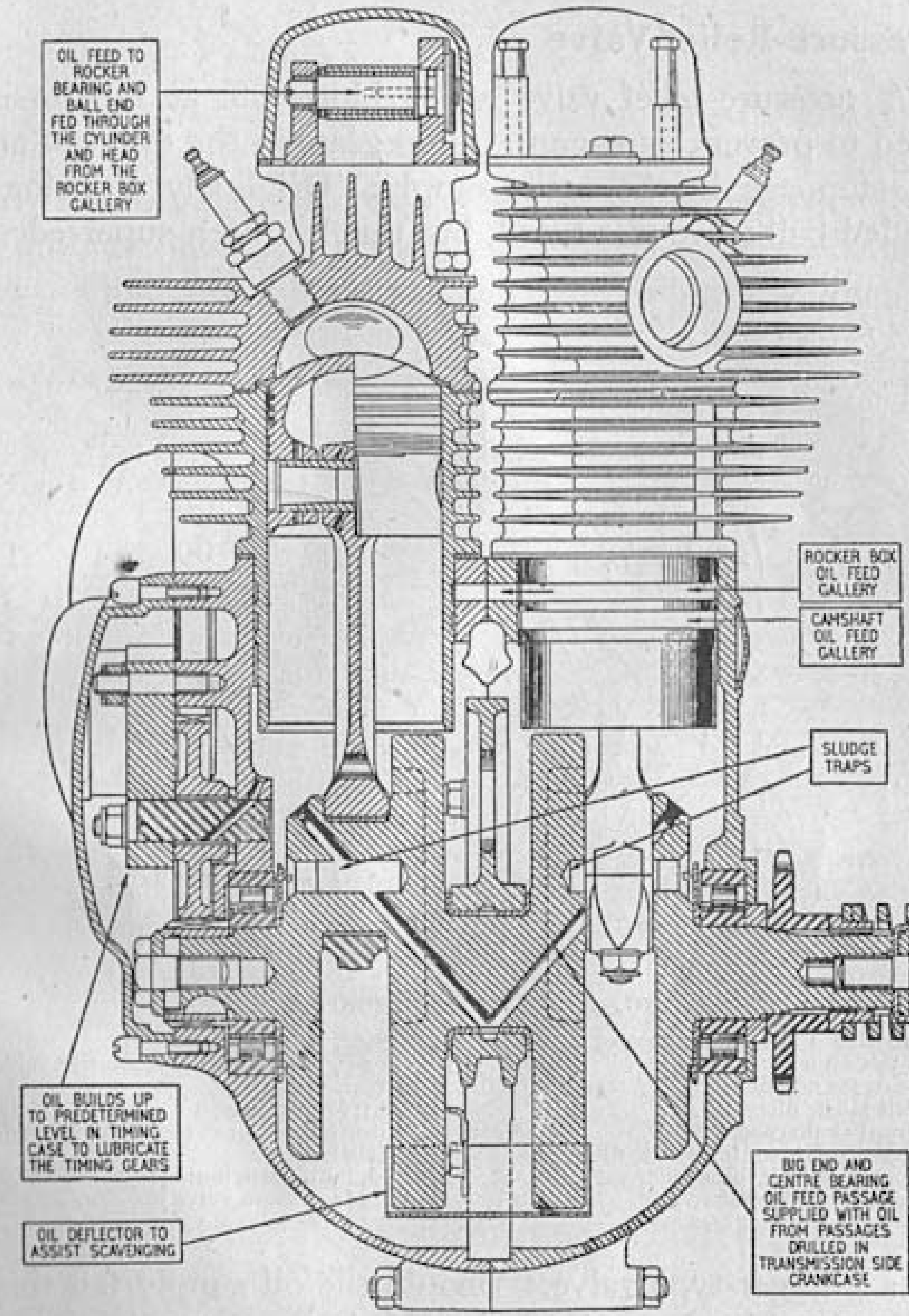


FIG. 25.—CROSS SECTION OF ENGINE SHOWING OIL GALLERIES, OIL PASSAGES, OIL DEFLECTOR AND SLUDGE TRAPS.

a pre-determined level in the timing-gear case for gear lubrication and drains by gravity into the sump, where it is filtered and returned to the oil tank.

Pressure-Relief Valve

A pressure-relief valve which blows off at 140 lb. is used to prevent damage to pump gears in the event of an oil stoppage in the main supply. Originally a spring-loaded ball valve was fitted, but this has been superseded

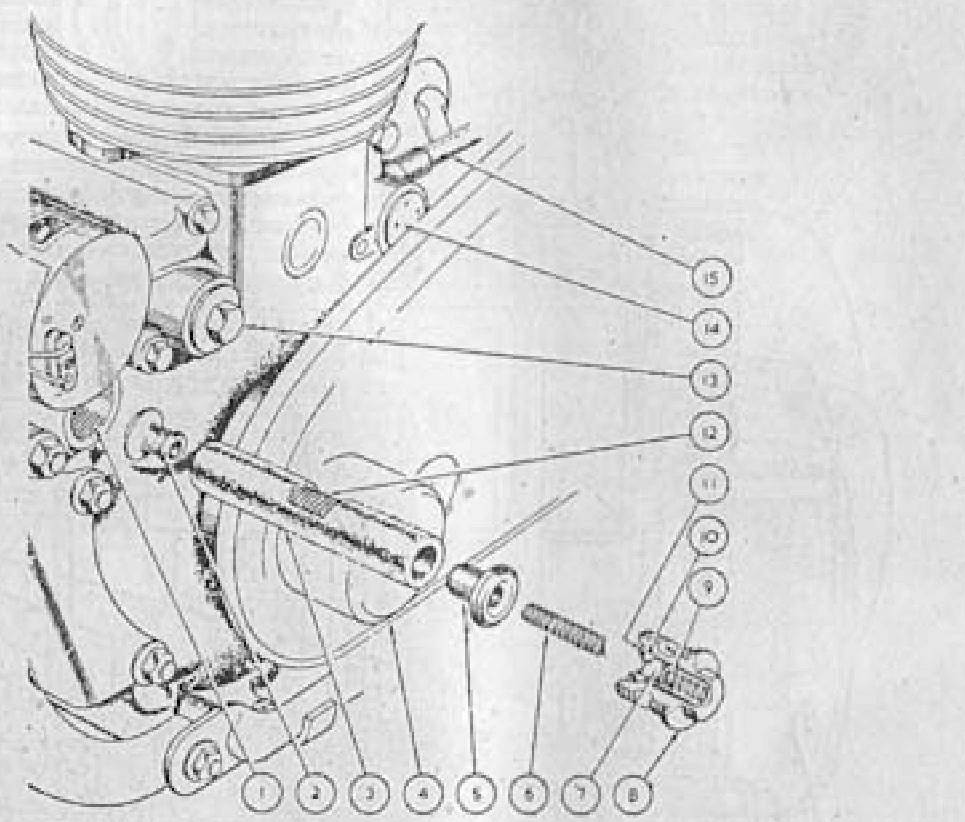


FIG. 26.—OIL DISTRIBUTOR.

1. Housing (part of crankcase) for oil felt filter.
2. Seat, for oil felt filter.
3. Felt fabric filter.
4. Front chain case.
5. Relief valve, for felt fabric filter.
6. Spring, for felt filter relief valve.
7. Ball, for non-return valve.
8. Cap, for felt filter housing.
9. Spring, for non-return valve.
10. Circlip, retaining non-return valve seat.
11. Seat, for non-return valve.
12. Wire former, or support, for felt fabric filter.
13. Cap, for oil distributor housing.
14. Cap, for release valve housing.
15. Pipe, from release valve to oil-tank.

by a plunger-type valve. Should the oil supply fail this valve should be examined, for if it is not properly seated oil will be allowed to circulate round the feed pump instead of passing to the main bearing as intended.

This valve is situated on the timing-side crankcase alongside the oil-delivery pipe (right-hand pipe on crankcase) (see Fig. 27).

Non-return Valve

To prevent oil seeping into engine when stationary a spring-loaded non-return valve (Fig. 26) is used. On later models this valve incorporates a union for the attachment of a pressure gauge. After engine servicing, the oil pressure should be checked. With the engine

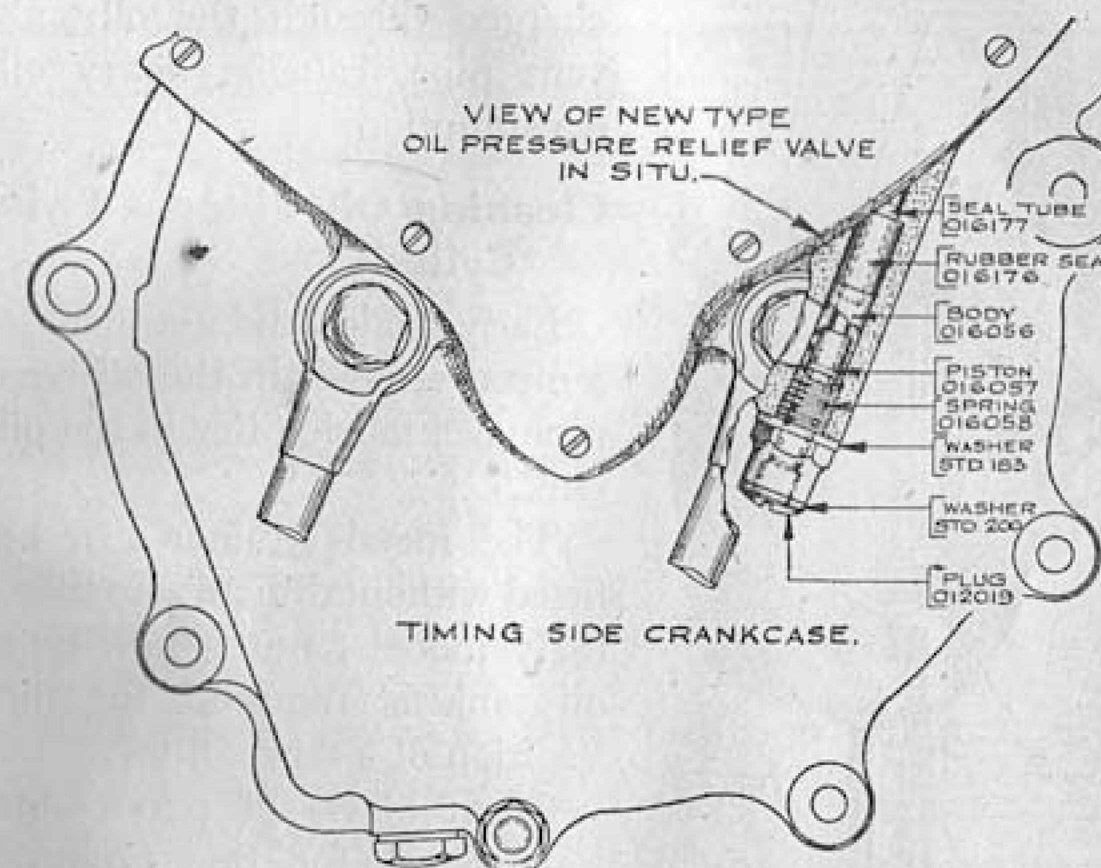


FIG. 27.—TIMING-SIDE CRANKCASE, SHOWING POSITION OF OIL-PRESSURE RELEASE VALVE.

idling the pressure of cold oil (SAE 30) should be approximately 140 lb., falling to 20–40 lb. when the oil is warm.

Crankcase Pressure-Release Valve

The position of this valve is shown in Fig. 26. The valve is of the rotating type, driven by an inlet camshaft; it is not "timed" and has an 180 degrees location. Oil mist released by crankcase pressure is taken to the oil tank for discharge (see Fig. 28).

Oil Tank

This is shown in Fig. 28, which is self-explanatory. The oil level should not exceed 6 in. from the bottom of the tank, otherwise oil can be discharged through the oil-tank vent pipe, causing heavy oil consumption.

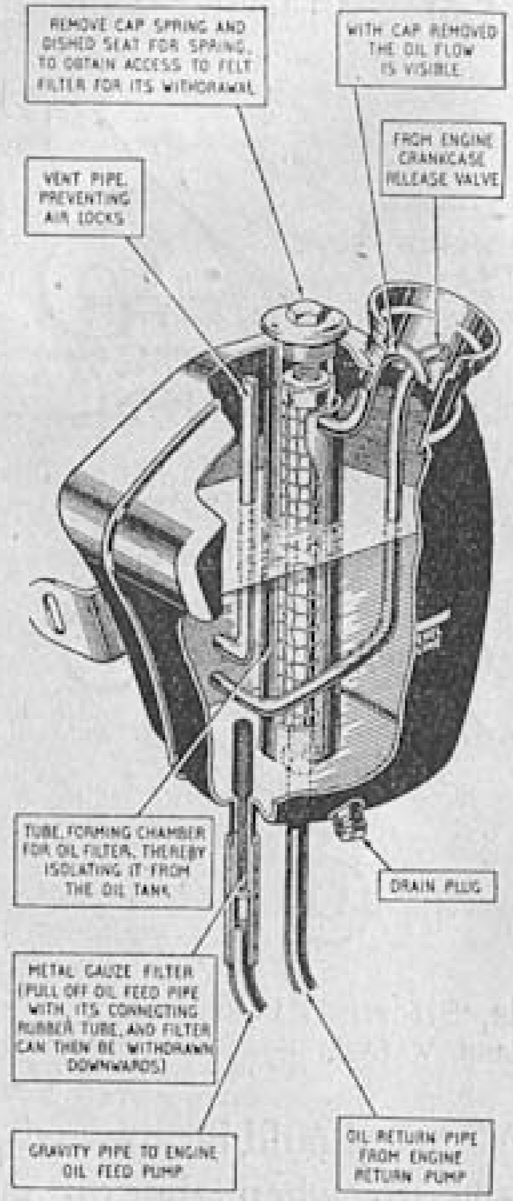


Fig. 28.—Oil Tank.

Cleaning Oil Filters—Twin Cylinder

Early models did not include a metal strainer in the oil-feed pipe or a fabric filter in the oil tank.

The metal strainer can be fitted without difficulty to these early models, but a new-type oil tank is required for the addition of a fabric filter.

Clean oil is of paramount importance for this type of engine, and owners should insist on oil being supplied in sealed containers.

Clean all oil filters when oil is changed or at 500 miles with a new or reconditioned engine. A further oil change should be made at 1,000 miles. From then on at every 5,000 miles.

To Remove the Metal Strainer

Release the oil-feed pipe engine end (left-hand con-

nection on the crankcase) then disconnect the rubber connection where it joins the oil tank. The metal strainer may come out with a rubber sleeve, if so do not disturb it. Should it remain in the tank, it can be pulled out for cleaning in petrol and allowed to dry before refitting.

To Remove Fabric Filter in Crankcase

The fabric filter is illustrated in Fig. 26. To remove, unscrew the non-return valve and carefully withdraw the spring and alloy relief plug; the filter can then be withdrawn by inserting a finger in the open end. Wash thoroughly and dry. Examine the fabric for broken stitches or holes where the oil can pass unfiltered, if damaged replace with new filter.

To Remove Fabric Filter in Oil Tank

Unscrew the plated hexagonal nut on the oil tank and take out the spring and dished washer. Withdraw the filter by inserting one finger in the open end.

Lubrication Troubles—Over-Oiling

Should the engine smoke badly with the piston-rings and cylinder in good order, the trouble may be due to bad sump scavenging caused by an air leak where the oil-return pump is mounted. Renew the gaskets and use jointing compound sparingly, also check paper washers fitted to pump-support plate.

Oil Shortage to Top Part of Engine

Check the oil hole in distributor bush ($\frac{3}{64}$ in. diameter) for obstruction, also check oil passages through barrels and rockers. Fit a pressure gauge to check the oil pressure by using screwed adaptor in non-return valve, for connection to pressure gauge. (*Note.*—Latest type valves are machined for screwed adaptor.) If the pressure is low, examine the relief valve for foreign matter under the seating.

Oil Filter

Three filters are used and are shown in Figs. 26 and 28; these should be cleaned in petrol whenever the oil is changed. The fabric filter in the crankcase has a spring-loaded plug also acting as a relief valve. If by reason of neglect to clean the filter or through using a thick oil in cold weather the filter becomes choked the oil pressure will lift the valve to give either temporary or permanent relief.

Note.—If a jointing compound is used to secure the rubber oil-pipe connections it should be used sparingly as it is solvent in oil. If dislodged flakes of compound become lodged in the crankcase the valve will react as already described. Jointing compounds such as "Well Seal" are not affected in this manner.

Oil Passages in Cylinder-Heads

Certain oil passages in the cylinder-head are plugged at the start of the oil-feed line to ensure oil is delivered at the end of the feed line. This may be mistaken for an omission to plug all holes or that the plugs have been removed by previous owners. Actually, two plugs for both inlet- and exhaust-valve oil feed are used on the *left side* of the cylinder-head, the inlet is plugged only on the *right side* of the cylinder-head.

ENGINE SERVICE

A simple and rapid method for adjusting the rocker clearances is shown in Fig. 29.

To adjust or reset the rocker clearance remove one cover

at a time, then rotate the engine until the piston is on T.D.C. of firing stroke (quietening curves are used on both cam flanks) otherwise correct adjustment cannot be effected.

Slack off *slightly* the self-locking nut of the clamping bolt, then rotate the eccentric spindle to increase the rocker clearance (clockwise for exhaust, anti-clockwise for inlet). Insert a 0·006-in. feeler gauge between the valve stem

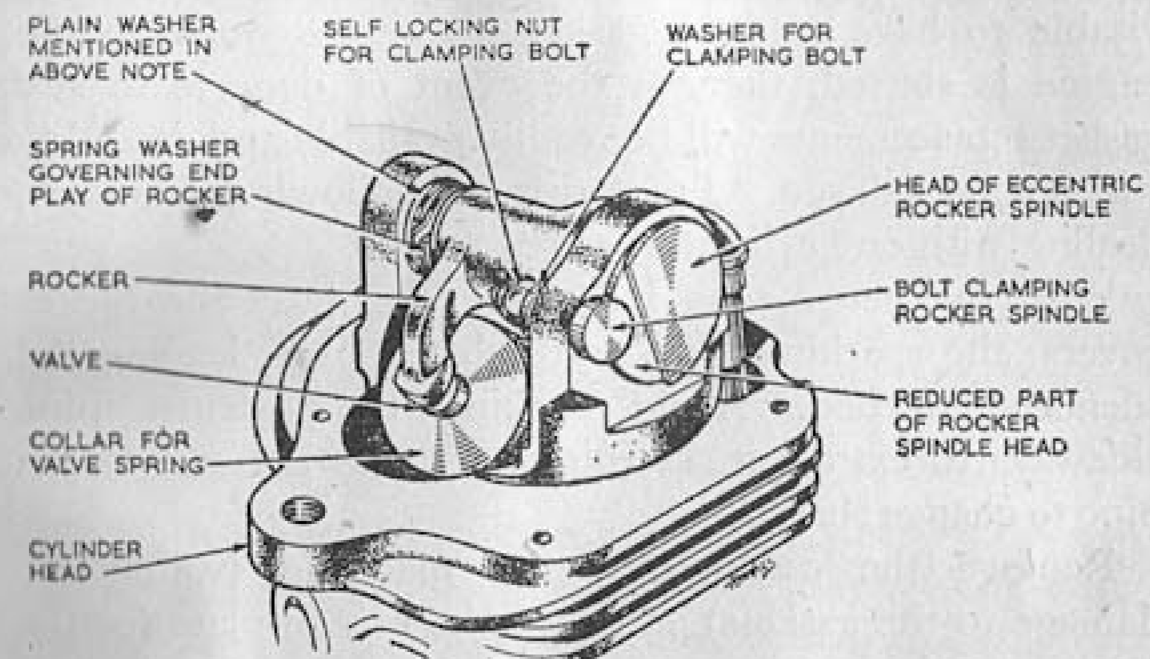


FIG. 29.—ROCKER ADJUSTMENT.

If speeds over 85 m.p.h. are not required rocker clearance can be reduced to nil for inlet and 0·002 in. for exhaust with cold engine.

and the rocker pad, now rotate the eccentric spindle in the opposite direction so that the "feeler gauge" is just stiff to move. Retighten the nut of the clamping bolt and recheck the clearance.

Replace the cover of the rockers, but do not over-tighten the bolts securing the cover. Apply the same procedure for the other valve; use 0·006 in. clearance for all valves when the engine is cold.

If speeds over 85 m.p.h. are not required rocker clearance can be reduced to nil for inlet and 0·002 in. for exhaust with cold engine.

Note.—If the nut for the self-clamping bolt is removed or released to an unnecessary extent the plain washer may fall out of position by the side movement of the spindle. Should this occur and not be detected, damage can be caused when the clamp bolt is retightened.

Cylinder-Head Removal

For all service to the top part of the engine the petrol tank must be removed for ease in working. It is advisable to have ready a gasket set before work on the engine is started, then in the event of damage to any gasket replacements will be readily available and assembly will not be delayed. Proceed in the following sequence, dealing with one cylinder-head at a time.

With the petrol tank removed, take away the rocker covers, the sparking plug and exhaust pipe, leaving the silencer attached. Avoid rocking the exhaust pipe sideways to extract it, as this may cause the end of the pipe to change shape.

Remove the carburetter, the manifold (watch for damage to the gaskets) and then the bridge plate for the engine steady.

With a suitable box spanner unscrew the four domed nuts securing the head, the head can now be lifted from cylinder barrel. Four washers are used in the recesses for the domed nuts, remove these before inverting the head for inspection.

As these machines are usually owned by experienced motor cyclists, elementary details for decarbonising are not necessary, as the method to be used is common to all O.H.V.-type engines. For valve grinding a short piece of rubber tube, ¼ in. bore, pressed on to the valve end is a suitable tool.

Cylinder Removal

At this stage the cylinder barrel can be lifted. First

take out the push-rods (identify them for refitting), then by using upward pressure the cylinder will leave the crankcase; at this stage stuff a piece of clean rag in the crankcase aperture before taking the cylinder away in case there is a broken ring, the pieces of which will fall into the crankcase.

Piston Removal

Early engines use gudgeon-pins with a close push fit. Should difficulty in removal exist, place a piece of rag soaked in boiling water on the piston (in relays) until the piston expands, when the gudgeon-pin can be removed with ease.

When refitting, ensure that the split in the piston skirt faces the front of the machine, and that the circlip is correctly located in its groove.

Replacing Cylinder-Heads

If both heads are removed, refit the cylinders and push the rods into the position from which they were removed. Refit both heads, leaving the dome nuts securing them finger-tight only. Replace the inlet manifold and its gaskets with securing nuts.

Next tighten the cylinder-head nuts diagonally in turn, until they are fully secure. Check the rocker clearance as described. Replace the engine steady, then fit the carburetter. Run the engine for a very short period to settle down the valve gear. Recheck the rockers after the engine cools down, when the rocker covers can be replaced.

Valve Timing—Twin-Cylinder Models

With the pump plate removed the four pinions associated with the valve timing are shown in Fig. 30. The pinions for the magneto and dynamo are not marked.

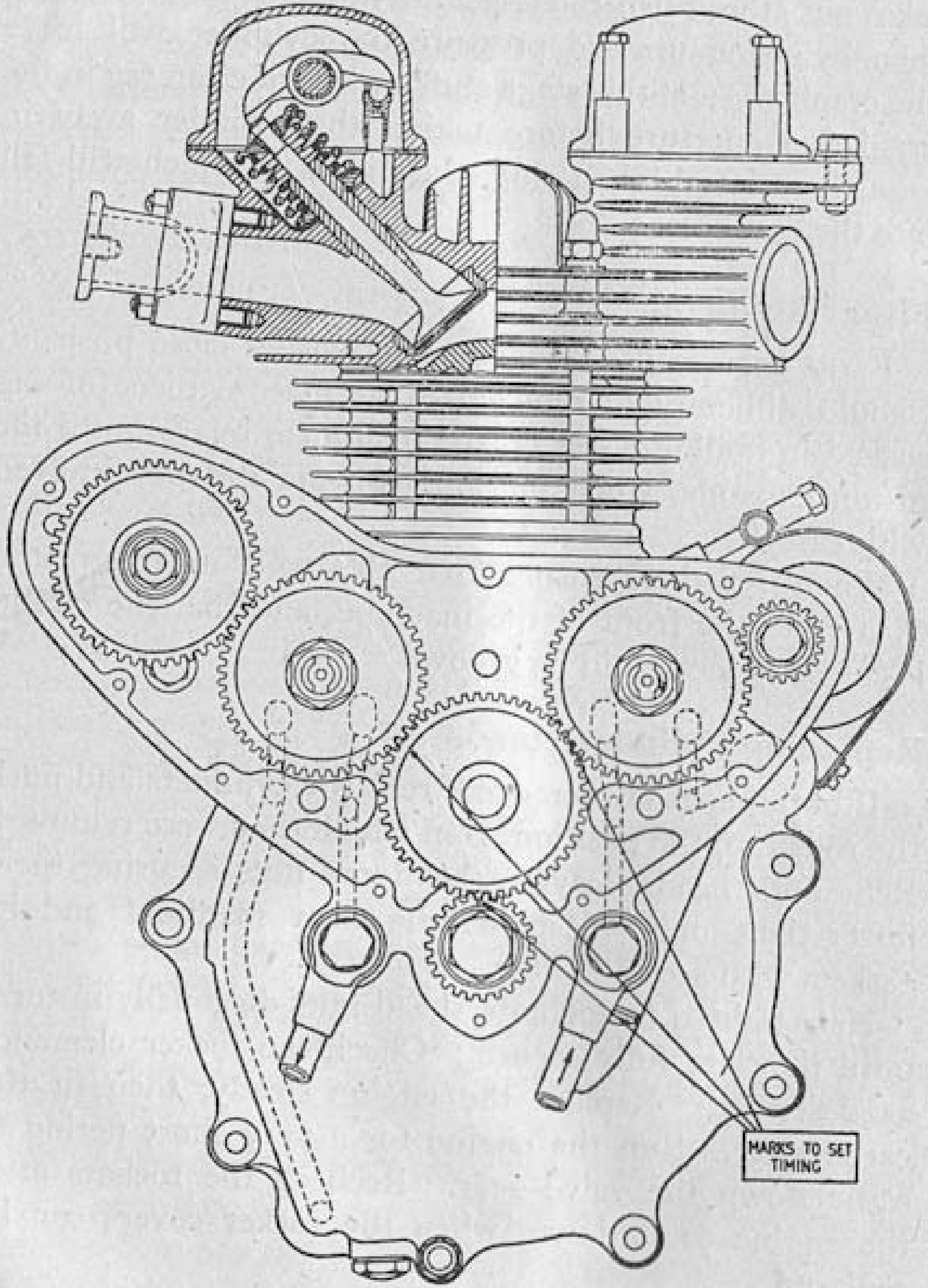


FIG. 30.—VALVE TIMING.
Illustration shows valve and components, and timing gear.

If the valve timing has been disturbed or after an engine overhaul, rotate the engine until the pistons are at B.D.C.

Fit the pinion to the inlet cam, then turn it until the mark on the pinion is at four o'clock. Fit the pinion for the exhaust cam with its mark at eight o'clock, now rotate engine until the mark on the small crankshaft pinion is at twelve o'clock.

Examination of intermediate or idling pinion will indicate three separate markings, namely, two double-dot punch marks and one single. Introduce the idling pinion with the single mark to mesh with the mark on the small crankshaft pinion; the double marks are meshed with the camshaft pinions as shown in Fig. 30.

To check the valve setting use 0·012 in. tappet clearance and refer to technical data.

Removing Timing-Gear Pinions

It is not necessary to withdraw the small pinion for the crankshaft when the crankcase is separated. Should it be necessary to remove this pinion with the engine assembled, a special tool is required (makers' number 015273) which screws on to the threaded portion of the pinion, and has a draw bolt for pinion extraction. This tool is also used for the magneto pinion. Both gears on the camshaft are drilled to accommodate two bolts for use with a draw bar, which can be easily manufactured. The makers' number for this tool is 015374.

The pinion for the dynamo is best removed with the dynamo taken away from the engine, and it is then a simple operation.

To Re-time Ignition—Twin Models

First check the contact-breaker gap; full separation is 0·012 in. Having loosened the nut securing the pinion for the magneto with the special tool (makers' number

015273), release the pinion from its tapered shaft. To find the T.D.C. of the firing stroke, remove the off-side inlet rocker cover and the sparking plug on the same cylinder. Insert a thin spoke or a stiff wire through the plug hole as vertically as the angle of the hole will permit. Rotate the engine slowly until the exposed inlet closes, rocking the engine to find the exact T.D.C. of the firing stroke which must be accurately positioned. Make a mark on the spoke to register with the seat for the plug on the cylinder-head, withdraw the spoke and then make a further mark $\frac{3}{8}$ in. upwards. Fully advance the ignition control lever and insert the spoke in the cylinder, then turn the engine *backwards* until the top mark registers with the seat for the plug.

The exact separation point on the contact-breaker is best made with a piece of cigarette paper between the points. Rotate the contact-breaker clockwise (looking at the contact-breaker end) until the paper will move with a light pull. (The bottom cam is used to time the off-side cylinder.) Retighten the pinion nut, then recheck the timing.

Dismantling Twin-Cylinder Engine

With the engine removed from the frame a pinion extractor, as described in " Re-timing Engine ", and a draw bar for the camshaft pinions will be required, in addition to the usual workshop spanners. Proceed as detailed to " Remove Cylinders " then dismantle in the following order :—

Remove the timing cover (ten screws).

Remove the plate with both pumps assembled.

Remove the dynamo with pinion attached.

Remove the mangeto pinion, with the special tool, and magneto (three nuts).

Remove the camshaft pinion nuts *Left-hand Thread*, then draw off both pinions with the special tool.

Remove the intermediate pinion.

Remove the filter housing cap (non-return valve), then extract the filter with its spring, cap and seat.

Remove the cap for the oil-distributor bush and the distributor.

Remove the release-valve end cap and body.

Remove the bolts binding crankcase.

Remove the timing-side half-crankcase.

Remove both the inlet also the exhaust camshafts with rockers and distance pieces.

Remove the six nuts securing the centre web.

Remove the driving-side crankcase; crankshaft with connecting-rods can now be removed leaving the small timing pinion in position.

Reassemble in the reverse order; check location of pump drivers with slots in camshafts when refitting pump plate.

Note.—For factory use torque spanners with 28 and 22 ft lb. are used to tighten centre web and connecting-rods respectively.

CHAPTER VII

FORKS, WHEELS, TRANSMISSION AND GEARBOX

ALTHOUGH the following notes particularly refer to 1939 and subsequent models, some of the instructions are applicable to previous models.

Steering-Head Adjustment

The steering-head races are of the floating, self-aligning type, and have spherical seats. The two races in the head-lug and race in the head-clip are all identical. Occasionally test the steering-head for correct adjustment by exerting pressure, upwards, from the extreme ends of the handlebars. (The steering damper should be completely slack.) Should any shake be apparent, jack up the front of the machine so that all weight is taken off the front wheel, slacken the top nut on the steering column and screw down the lower nut until all trace of slackness has disappeared. Then tighten the upper nut, holding the lower nut while so doing. It is of the utmost importance that the upper nut is most securely tightened.

Fork-Spindle Adjustment

Never attempt to adjust more than one spindle at a time. Slack off both spindle-nuts, and, by means of the small hexagon on the right-hand side of the spindle, turn the spindle in a clockwise direction to take up play between the fork girders and the links. Do not turn the spindle more than half a revolution before tightening the two spindle lock-nuts and testing the adjustment. Guard

against having the adjustment too tight, because then the fork will be very stiff in action, or, most probably, refuse to function.

The washers which are fitted on the spindle ends are not provided for frictional purposes, but to prevent actual seizure in the event of the fork-spindle adjustment being too tight. A generous clearance is allowed between the spindles and the fork parts, and a pad of grease should be maintained between these two parts. When ovality takes place, the makers can fit bushes to the fork parts as required. Failure to lubricate frequently will result in damage and difficulty in removing spindles. It is for this reason that a generous clearance is allowed by the makers, as a precaution against neglect.

Adjusting Dampers

The fork damper is best adjusted when the machine is actually in motion. A road with a badly corrugated surface provides the best conditions for this purpose.

The ebonite hand-nut should be screwed home, in a clockwise direction, sufficiently to make the fork action sluggish in the circumstances described above, and, subsequently, should require very little attention for other conditions. Grease on the friction discs will make damper ineffective. To remedy, wash in petrol and apply a little fuller's earth to absorb grease.

The steering damper is controlled by the ebonite hand-nut mounted on top of the steering column. This nut should be turned in a clockwise direction to increase the damping action. Normally very little damping action is required or is desirable. Too much, or unreleasable friction, will give wavy or elongated figure-of-eight steering. Fibre discs may be swollen or distorted. Test machine with bolt securing steel plate to frame removed.

To dismantle steering damper, raise front wheel clear of the ground with a box under the crankcase. Take out bottom fork spindles, and damper can then be dismantled.

To Dismantle Wheel Bearing

To dismantle the bearings in a wheel, having removed the wheel from the machine, proceed as follows :—

If the wheel is a front wheel, remove the nut on the

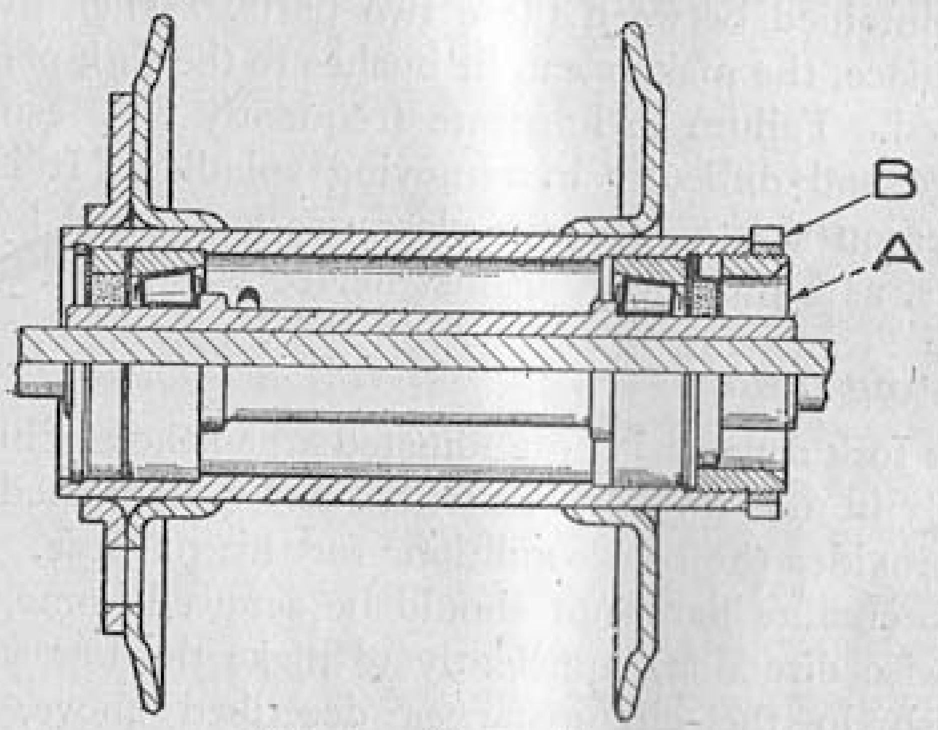


FIG. 31.—WHEEL BEARING.
A, adjusting-ring. B, locking-ring.

left-hand side of the centre solid spindle, withdraw the spindle and remove the brake cover-plate. Then, slacken the locking-ring B that is on the right-hand side of the hub (Fig. 31), and completely unscrew the adjusting-ring A, which will come away with the locking-ring B. A dished plate, felt washer and a plain plate are then free to be removed. On the opposite side of the hub remove the spring-ring just under the hub-shell, to permit the removal of another felt-washer assembly consisting of two metal plates, a felt washer and a spacing-ring.

The hollow spindle, complete with rollers and cages

and one outer bearing-ring, can then be pressed out of the hub-shell, from either end, leaving one outer bearing-ring in position. If desired, this remaining ring can then be driven or pressed out.

To Assemble Wheel Bearing

It will be noticed that the tracks for the rollers on the hollow spindle are not evenly spaced. It is essential that the longer end of the spindle is assembled in the hub so that it is on the adjusting side. (Right-hand side of wheel, see Fig. 31. Left side, post-war models.)

To assemble the wheel bearings, first, thoroughly clean all parts as well as the interior of the hub. Press one of the outer bearing-rings into the plain end of the hub so that the thinner end of the ring is inward, and its position a little nearer the centre of the hub than it normally occupies. Take care, when pressing this ring into the hub, that it is quite square to the hub body. Next replace the felt-washer and plate assembly removed from this end of the hub, and, finally, replace the spring-ring. Fig. 31 clearly shows the order of assembly of these parts.

From the threaded end of the hub force back the outer bearing-ring until the felt-washer assembly is tight against the spring-ring. Next from the threaded end of the hub introduce the hollow spindle, entering the shorter end first, and push it, without undue force, as closely to the outer bearing-ring as possible. Then press the second outer bearing-ring (thinner edge inwards) into the hub-shell until there is about $\frac{1}{16}$ in. play in the bearings.

Next replace the right-hand side felt-washer assembly, followed by the screwed adjusting-ring with its locking-ring, and proceed to adjust the bearing. It is of the utmost importance that the bearings are not adjusted too tightly, as this would ruin them in a very short distance.

There must always be a slight degree of end-play. This should be about 0·002 in.

To adjust a wheel bearing, slacken the large locking-ring on the right-hand side of the hub. Then screw inwards, or outwards, the adjusting-ring on which the locking-ring is threaded, until the correct adjustment is obtained (inwards to tighten, outwards to loosen the bearing adjustment). See Fig. 31. Finally, tighten the locking-ring, taking care that the adjusting-ring does not creep forward and make the bearings too tight. Always check the adjustment after tightening the locking-ring. Inject a quantity of grease into the hub and refit wheel.

Brake-Shoe Adjustment

As the brake linings wear, this can be taken up by suitably adjusting the finger nut on the rear brake-rod, but after some considerable mileage this continual adjustment causes the brake expander to lie in such a position that the leverage available is considerably reduced, and consequently the brake loses in efficiency. To overcome this difficulty the brake-shoes are fitted with detachable heel-pads.

When it no longer becomes desirable to take up the wear of the brake linings by adjustment of the finger nut on the brake-rod, the brake-shoes should be removed, and then, if the steel pads are taken away from the shoes, one or more steel shim washers can be placed on the stem of each pad. This will have the effect of centralising the cam expander, thereby restoring the efficiency of the brake to an "as new" condition. The front brake-shoes are also fitted with detachable heel-pads, thereby providing major adjustment for the front brake.

Front-Chain Adjustment

To provide front-chain adjustment, the gearbox hinges

on its lower fixing bolt, while the top fixing bolt can slide in slots cut in the engine plates. This movement is controlled by an eyebolt which encircles the top fixing bolt; the threaded end of the eyebolt passes through a block secured to the right-side engine plate. By altering the position of the eyebolt in the block, the gearbox top fixing bolt can be moved in its slots.

To tighten the front chain, remove the inspection cap from the front chain-case, slacken the nuts on the right-hand ends of the top and bottom fixing bolts of the gearbox and screw up the forward nut on the eyebolt two or three complete turns. Then screw up the rear nut on the eyebolt until, by testing through the front chain-case inspection cap orifice, it is felt the front chain adjustment is correct.

If the chain can whip, or move, about $\frac{3}{8}$ in. as it is pressed up and down, midway between the sprockets, the adjustment is correct. Check the chain-whip in more than one position.

Finally, unscrew the forward nut on the eyebolt till it is tightly down on the block, tighten the nuts on the top and bottom gearbox fixing bolts, re-check the amount of whip and replace the chain-case inspection cap.

If the front chain is closely adjusted, and should the gearbox move (as it can, on account of the tolerance between the holes in the gearbox shell and the bolts securing), it is essential to adjust the chain until it is just tight, and make the last adjustment to move the gearbox forward, or slacken the chain. This action will prevent the gearbox moving under the influence of chain pull.

To Adjust Rear Chain

On detachable wheel models, unscrew the nut securing the centre solid spindle, which passes through the hub, a few turns. Release slightly the large nut retaining the dummy spindle nut; both these nuts are adjacent to each other. Run back the two lock-nuts on the chain adjuster bolts (hold the bolt whilst doing this), then screw in the left-side adjuster (for brake drum) until chain tension is correct. Re-tighten dummy spindle nut (the larger of the two nuts), now screw in the right-side chain adjuster. Run back the chain adjuster lock-nuts and check chain adjustment in more than one position; the correct whip is about $\frac{3}{8}$ in. to $\frac{1}{2}$ in. for this chain.

Note: The position of the chain adjuster will not guarantee the wheel alignment is correct. Check wheel alignment by placing a long wooden batten, with a straight edge, along the left side of both tyres, and alter position of rear wheel so that both tyre edges make contact with the batten, with the handlebars at complete right angles to the frame.

Before adjusting the rear chain make sure the front chain adjustment is correct, as the rear chain is also affected when the front one is adjusted.

Running with a badly worn or stretched rear chain will cause damage to teeth on both gearbox and rear-wheel sprocket.

To tighten the rear chain on non-detachable wheel models, slacken the nut on the centre solid spindle and the nut that locks the brake-drum sleeve to the fork end. Both these nuts are on the left-hand side of the machine and are concentric to each other. Then proceed as detailed above.

Dynamo Chain Adjustment

The dynamo armature shaft is eccentric to the body of the dynamo. Therefore, by partially revolving the dynamo in its housing (the engine plates) the distance between the two dynamo driving-sprockets can be varied. Provision is made to revolve the dynamo in order to

adjust the driving-chain. This is done by applying a thin spanner to the boss that is cast on the driving side of the dynamo body.

To adjust the dynamo driving-chain, remove the inspection cap from the front chain-case and slacken the dynamo clamping bolt. Rotate the dynamo in a forward direction, until, by passing a finger through the inspection cap orifice, it can be felt that the dynamo chain has a whip of about $\frac{1}{4}$ in. This adjustment is important. Finally, tighten the dynamo clamping bolt, re-check the whip and replace the inspection cap.

Should it ever be necessary to remove the chain sprocket from the dynamo armature shaft, it is absolutely essential to hold the sprocket with a spanner while loosening the sprocket retaining nut. Before attempting to loosen that nut it is essential to remove the spring-ring that encircles it and the lock-washer that is next to the spring-ring.

There are two flats on the boss of the sprocket to accommodate a spanner. The above action is necessary to relieve the armature shaft of any twisting or bending stress, and must also be taken when refitting the sprocket.

Magneto and Magdyno Chain Adjustment

The magneto platform can be moved to enable the magneto driving chain to be adjusted to give a whip of $\frac{1}{4}$ in. A similar arrangement is provided in the case of magdyno chains.

TELEDRAULIC FORKS

A number of riders will wish to fit these forks into their A.J.S. machines when they are available. They will not interchange with the girder-type fork without alteration. Teledraulic forks will fit heavyweight frames (500-c.c. models) for machines made since 1935, as the head lug and steering races are the same as used on the present-day models. On the 250- and 350-c.c. machines the head lug is shorter to the extent of ½ in. The following alterations are necessary :—

500-c.c. *Models.*—Exchange large front brake for light-weight type. Fit present-day front wheel spindle (other hub parts are the same). Arrange for speedo. to be driven either from rear wheel or gearbox. *Note :* There is no provision for speedo. drive on 1938 and 1939 gearboxes. Fit ⅞ in. handlebars. Convert controls to take ⅞ in. bar.

250- *and* 350-*c.c. Models.*—Shorten the two top fork cover tubes to extent of ½ in. Shorten fork stem, or use distance piece ½ in. wide. Use present-day front wheel spindle. Arrange for speedo. drive as with 500-c.c. models. Suitable front guard with stays will be required for both models.

A special light grade of oil is used in teledraulic forks. See list of recommended lubricants. Six-and-a-half ounces is filled to each fork tube, and if leakage does not occur, it is not necessary to "top up" or replenish the oil. A heavy-grade oil will cause the forks to be sluggish in operation ; use only recommended grades.

Assembly of Forks

The forks are put together in sub-assemblies, in the following order :—

(1) Fork crown and cover tubes (top and bottom).
(2) Inner-tube assembly.
(3) Slider and damper-tube assembly.

Fit top and bottom portions of fork cover-tubes.

Fork-Tube Assembly

Assemble parts used on the centre fork tube in the following order :—

Leather washer, fork spring, leather washer, slider extension (unscrewed end first), oil-seal (leather side first), paper washer, bakelite bush (flanged end first), buffer spring (if fitted), steel bush and retain by circlip (make sure it is home in its groove).

Damper-Tube Assembly

Fit pin to hole and damper rod. Place damper valve (steel cup) with pin inside cup. Next, valve seat (brass). Screw home the ¼-in. nut on rod. Insert above assembled parts into the damper tube. Slip over the rod the steel plunger sleeve (sleeve has a groove in the centre). Locate plunger sleeve until groove registers with slot milled in the damper tube, and secure by the plunger-sleeve clip or wire.

Fork Slider Assembly

The above sub-assembly (damper tubes) can now be fitted to each of the bottom sliders. See that fibre-washer is used under the head for the tube bolt. A thin-walled box spanner will be required to tighten the damper bolt. Remember the left slider is the one with the brake anchor stud. Finally, the $\frac{5}{16}$-in. nut is fitted to the rod.

Note : The brake anchor stud, if removed, can be easily replaced if a blob of grease is put on the end of a piece of strip steel, with the bolt stuck in the grease. Taking care the bolt does not fall, introduce the steel strip down the slider until the bolt registers with the hole, and pull it through. This bolt must be tight, to avoid oil leak.

Fitting the Fork-Tube Assembly

With all its fittings as previously described, force home the tube into the top handlebar lug. The pinch-bolts on the fork-crown lug must be unscrewed before tubes are fitted. Pull the tubes home with the top bolt and re-tighten the fork-crown pinch-bolt.

Now fit the fork-slider with damper tube assembled. The oil-seal should be a tight fit on the centre tube, and must be pushed up inside the slider extension before the slider thread can be engaged. Use a piece of copper wire to "fish up" the damper rod, and then attach the rod to one of the fork-tube top bolts and lock with the nut already on the rod.

Screw home the fork-sliders and fill $6\frac{1}{2}$ oz. of correct oil to each fork-tube and tighten top bolts. When the front wheel is replaced, leave the cap-nuts loose, then work the forks up and down to allow the centre tubes to work freely, then re-tighten wheel fixing nuts on the bottom caps.

Note : The fork centre tubes assembled with the slider and damper tube can be fitted to the tube lugs as a single unit. A tool will be needed to draw the tubes into the top lug.

Frame and Fork Service 1945–49 Models

Details of front forks for the 1945–6–7 models are as described. Lighter fork springs of the three-rate type were used for the 1947 models, with buffer springs fitted immediately behind the bottom steel bush. These additional springs will prevent the forks extending when the front wheel leaves the ground during cross-country runs.

1948–9 Teledraulic Forks

The damper tube and rod fitted to earlier-type teledraulic forks was discarded and substituted with a shuttle damper mounted on each fork inner tube. In addition a much lighter fork spring was fitted. These alterations provide a light and easy fork movement with added comfort to the rider. Material alterations apply only to the alloy handlebar lug mounted on top of the forks. With this type of fork it is important that an air leak does

not occur from the two bolts which pass through the handlebar lug into the fork centre tubes. Air pressure is built up which augments the normal spring pressure.

If forks have been dismantled, or leakage takes place, it is essential that the front wheel is raised clear of the ground by placing a box beneath the crankcase to *fully extend the forks*. Ensure there is 10 oz. of oil of the recommended type (see page 207) filled to each fork leg. The oil content is most important, therefore make certain that every drop of oil is drained before refilling with the recommended amount of fluid. With the drain plugs removed, turn the front wheel first to the left and then to the right in order that the oil remaining in the sliders can be drained. Leave the forks extended. Clean both bolts for fork tubes and washers to remove oil or grease (1948 models only), then coat the threads of both bolts with jointing compound. The jointing compound should be allowed to dry before the forks are used. On the 1949 models new type top bolts with rubber sealing rings are employed, dispensing with the above treatment; these can be fitted to 1948-type forks.

In some cases a clicking noise is made, either when the front brake is applied with fork at full deflection, or when the machine is ridden over steps with the same effect. To rectify, carefully check the oil content, then add an additional $\frac{1}{2}$ oz., making a total of $10\frac{1}{2}$ oz.

Oil Leaks

A super seal is fitted to each fork slider. Oil leakage above the slider may be due to an excess of oil which can break down the oil seal. To remedy, replace seal. The seal is a force fit in the slider in order to prevent leakage past the outside diameter. Apply local heat to slider, which will expand, thus facilitating removal and access to the oil seal.

Forks for Sidecar Work

Solo-type springs, as fitted to 1947–8–9 models, are not suitable for sidecar work. Replace these with springs of 1945–6 or W.D. type and fit an alloy distance piece $\frac{3}{4}$ in. wide on top of each fork spring; also a narrow distance piece, $\frac{1}{4}$ in. wide, at the bottom of each spring, using normal oil content. *Do not use thick oil* to stiffen the fork motion. Distance pieces are obtainable from the makers of the machine.

Note : A steering damper (obtainable from the makers) is usually required when a sidecar is attached.

Attaching a Sidecar

Owners who intend to attach a sidecar to post-War models should refer to the details given above for alteration to fork springs and use of steering damper.

The trail or castor action of the front forks is suitable for either solo or sidecar use. The only alteration required in addition to the forks is a smaller engine sprocket. The solo sprocket on 500-c.c. models has 21 teeth, which must be replaced with a sprocket of either 18 or 19 teeth, dependent on the weight and size of the sidecar attached.

The 350-c.c. model was not intended for sidecar use, but as the frame, wheels and gearbox are the same, the machine will not be adversely affected if a sidecar is fitted. With this model use an engine sprocket with 16 teeth.

All post-War models do not incorporate sidecar lugs in the frame assembly; clip-on fittings can be obtained from the makers of the sidecar chassis. The makers of the machine do not make or stock fittings of this kind. Where difficulty is experienced in obtaining suitable sidecar connections owners should apply to T. C. Munday and Co., Ltd., 124 Dalberg Road, London, S.W.2, who are sidecar specialists for A.J.S. machines.

GEARBOX AND CLUTCH

Burman gearboxes are fitted to all models, foot-operated. Four speeds are used on all models, with exception of the Colonial model, which has hand-change and three speeds, also a reverse gear. The following table will indicate the type of gearbox fitted to each model :—

250-c.c. Model . .	Light-weight, H.P. type.
350-c.c. Model . .	Medium-weight C.P. type.
500-c.c. Model . .	Medium-weight C.P. type.
990-c.c. Model . .	Heavy-weight B.A.P. type.

Competition models use C.P. type with low bottom gears and have C.P.B.L. stamped on the gearbox. The only difference between the standard and competition type gearbox is confined to the main driving gear and layshaft fixed pinion.

Note : The medium-weight gearbox can be fitted to the 250-c.c. models if the engine plates and dyno clamping parts are exchanged at the same time.

Lubrication

Some doubt usually exists as to type of lubricant to be used for this part of the machine. The figures stamped on the gas-case cover of standard touring models indicate the year of manufacture. All gearboxes made prior to 1947 are lubricated with light grease (fill $1\frac{3}{4}$ pints when rebuilding), grades to be used are shown in the table for lubrication. With grease-lubricated gearboxes a teacupful of engine oil can be used with benefit, particularly during cold weather. On no account should grease be used for lubricating gearboxes made from 1948 onwards.

Gearbox Noise

With a tightly adjusted chain, or possibly during cold weather, a high-pitch shriek, mostly in top gear, indicates a dry main ball-race. This applies to grease-filled gearboxes. To remedy, pour one teacupful of engine oil into the gearbox, then lay the machine over on its left side as far as it will go. The oil will then run into the bearing without further trouble. Grinding noises that develop are mostly due either to wear in the layshaft bushes or in the small layshaft fixed pinion.

Gearbox Troubles after Prolonged Use

Gears disengaging under load are usually due to damage on internal teeth, caused by bad gear changing or continued clutch-drag.

Uncertain gear indexing or selection is usually due to either a damaged rocking-pawl, quadrant engaging with pawl, or, in the case of the H.P. box, a broken pawl-spring. Should the trouble be confined to the top gear, the bush for the mainshaft in the main gear may be protruding. Movement on the kick-starter case (loose nuts) and the fixing studs will have an adverse effect on gear selection.

Note : When replacing either of the springs used for the foot-change pawl or pedal (H.P. type), see that the legs of the springs are separated and one leg is placed each side of the pin.

To Dismantle Gearbox

Gearbox internals can be removed with the gearbox in its normal position.

If the main driving gear is to be withdrawn, begin by dismantling the front chaincase to remove the clutch complete. To remove only the sliding gears, the clutch can be left in position.

Disconnect the clutch-cable gearbox end and remove the foot-change lever and the neutral indicator. Unscrew the nuts securing kick-starter case cover. Pull away the cover with foot-change mechanism and the kick-starter. Remove the forked plunger and the ¼ in. steel ball. Unscrew the ratchet pinion nut securing spring with ratchet plate, the four nuts for kick-starter case can now be withdrawn. Do not misplace the twelve rollers (if fitted—some boxes use plain bush) for the camshaft bearing.

Take out the pawl plug in the bottom of the gearbox shell (this has a screwdriver slot) with its spring for pawl in camshaft. Do not attempt to remove the gears with the plug in position. The gears, with the exception of main driving gear, with the layshaft and the camshaft can now be taken out.

To dismantle completely, remove the clutch rear chain and the nut securing the sprocket for rear chain with its tab washer. The mainshaft comes out on the clutch side of the gearbox. The main gear can now be pushed out of its housing.

A ball bearing, used for the main gear, is retained by a spring circlip and washers, behind it is the seal, a felt ring for grease and a super-seal for the oil boxes.

To Reassemble Gears

Apply a little oil to the ball-race, replace the main gear with a washer in the order removed, secure the circlip in position. Refit the main gear, spacing the washer tab washer with a fixing nut, but do not fully tighten. Insert the mainshaft through the main gear.

Assemble on the layshaft the free pinion (longest splined end of shaft) and next the fixed pinion (competition models have eighteen teeth, standard models twenty teeth). Fit the sliding clutch followed by the layshaft first gear and finally the layshaft third gear. The layshaft with its gears goes back with the camshaft, now hold the layshaft assembled in left hand, with the small pinion to the left. Take up the camshaft, with the small pinion to the right, and engage the largest of the two striker forks in the centre of the sliding clutch. Put the

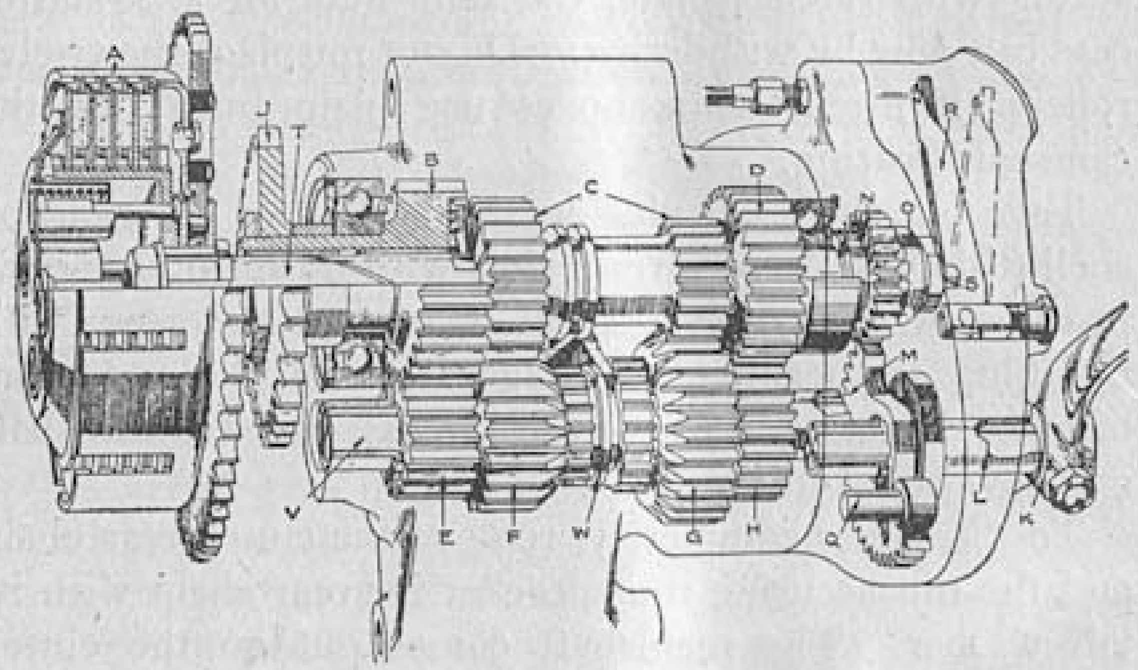


FIG. 32.—GEARBOX.

(A) Clutch. (B) Main gear. (C) Mainshaft, third and fourth sliding gear. (D) Mainshaft third gear. (E) Layshaft gear. (F) Layshaft second gear. (G) Layshaft first gear. (H) Layshaft third gear. (J) Chain sprocket. (K) Foot-start pedal. (L) Kick-start shaft. (M) Kick-start quadrant. (N) Rachet wheel. (O) Driving rachet. (Q) Stop pawl. (R) Clutch-operating lever. (S) Clutch-adjusting operating sleeve. (T) Mainshaft. (V) Layshaft. (W) Layshaft sliding clutch.

mainshaft sliding gear (largest end to the left) on the small striker fork; the whole assembly can now be inserted in the gearbox shell. Fit the mainshaft large free pinion to complete the gear assembly. At this stage pack $1\frac{3}{4}$ oz. of grease in the shell of the early type boxes. Refill after every 1,000 miles with 2 oz. of grease.

Apply grease to retain the rollers (if fitted) on camshaft when the kick-starter case is next fitted with its four retaining nuts. Fit the ratchet pinion bush and the

ratchet pinion with the spring ratchet plate, which must be firmly secured by its nut.

Refitting Foot-Change Mechanism

This is " timed ", and must be replaced correctly to ensure correct index of gears. The small pinion on the camshaft is stamped with the letter "O". To re-assemble turn this pinion with a pair of pliers until " O " is at nine o'clock or 270 degrees. Now examine the sector which engages with this pinion and which is also

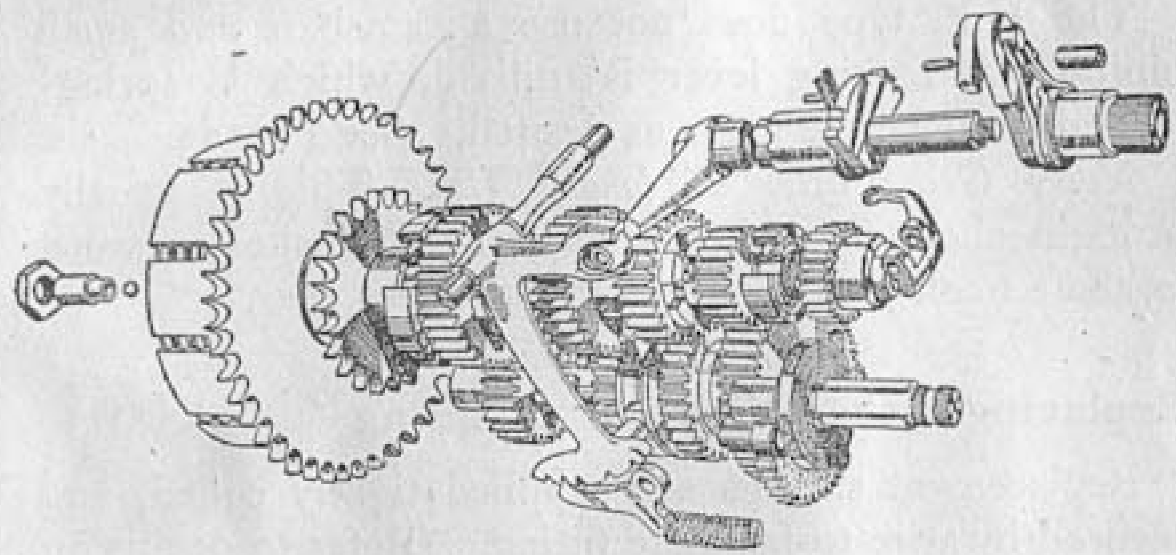


FIG. 33.—H.P.-TYPE GEARBOX.

stamped with letter " O ". Introduce the mechanism with both the marks in mesh. Next insert the long push-rod through the shaft (clutch end) leaving about 2 in. exposed. Insert steel ball in the mainshaft (kick-starter side) then the short plunger with the slot vertical. Fit the return spring for the kick-starter crank and insert spindle in case cover, making sure that the inner end of the spring engages with one of the slots milled in the spindle. The crank can now be temporarily fitted. Wind up the crank, *two complete turns*, holding it so as to prevent the spring unwinding. Replace the case so as to locate the clutch-operating lever in the fork, and engage the foot-change quadrant. Push home gently and secure the case stud nuts. Re-position the kick-starter crank, the foot-change pedal with indicator and the clutch cable. Fill later-type boxes with 1 pint of engine oil.

Refit the rear chain to hold the sprocket and firmly tighten the nut for the rear-chain sprocket, making sure to locate the tab washer. Replace the clutch and the driving chain.

A view of a gearbox, also applicable to pre-war models, is shown in Fig. 32.

The H.P. type does not use a camshaft and small pinion. A rocking lever is utilised, which is spring-loaded to move the gears as desired. See Fig. 33.

Noisy Gears after Prolonged Use.—This is usually brought about by either worn layshaft bushes or worn layshaft small pinion engaging with main gear.

Replacing Broken Kick-Starter Spring

Replacement springs are supplied tightly coiled, and secured by wire to facilitate fitting. (Refer to details on dismantling the gearbox.) With the kick-starter-case cover removed, place the spring in position and cut the wire, then follow the details for gearbox reassembly.

Clutch—All Models Except 7R

The general arrangement is identical for both pre-war and post-war models. With fluid lubrication several pinions with brass bushes were introduced and, therefore, for this type of gearbox grease is not a suitable lubricant. For the 1950 season, five-spring clutches were fitted to the competition and also the 500-c.c. models. The clutch lay-out is shown in Fig. 35.

The presence of oil in the front chaincase does not

affect the clutch efficiency providing the oil level does not exceed $\frac{1}{8}$ in. from bottom of the filler orifice.

Should clutch slip take place first check the operating cable, which should have at least $\frac{1}{4}$ in. free movement at the handlebar end. Next examine the clutch-operating lever, inside the kick-starter case through the screwed cup, which should have $\frac{3}{32}$ in. of free movement at top

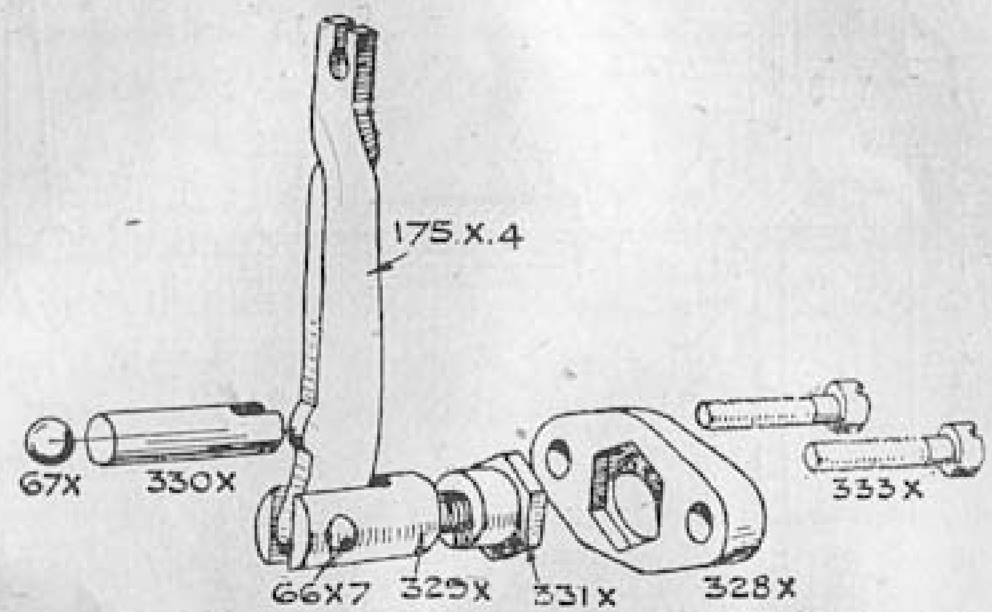


FIG. 34.—CLUTCH-OPERATING LEVER.

175.X.4. Lever, operating clutch.
67.X. Ball (steel), for operating plunger.
330.X. Operating plunger.
66.X.7. Pin, or axle, for operating lever.
329.X. Fork, for operating lever.
331.X. Sleeve, or nut, for operating lever fork.
328.X. Cap, covering sleeve (screwed to kick-starter case cover).
333.X. Screw, fixing cap to kick-starter case cover.

of the lever. When new inserts have been fitted these settle down quickly and have the effect of increasing the length of clutch push-rod. In such circumstances it is possible for the clutch-operating lever to be pushed back against its cover, partially holding out the clutch. Adjustment of the push-rod length is effected by removing the small plate on the gearbox cover to expose the sleeve-adjusting nut 331X as shown in Fig. 34.

To increase the push-rod clearance turn the sleeve nut clockwise, one or two turns should suffice. Retighten the plate screws to check the movement of the operating lever.

Slight clutch slip must be dealt with promptly, otherwise damage can be caused to the withdrawal mechanism by reason of the intense heat generated, which can also cause

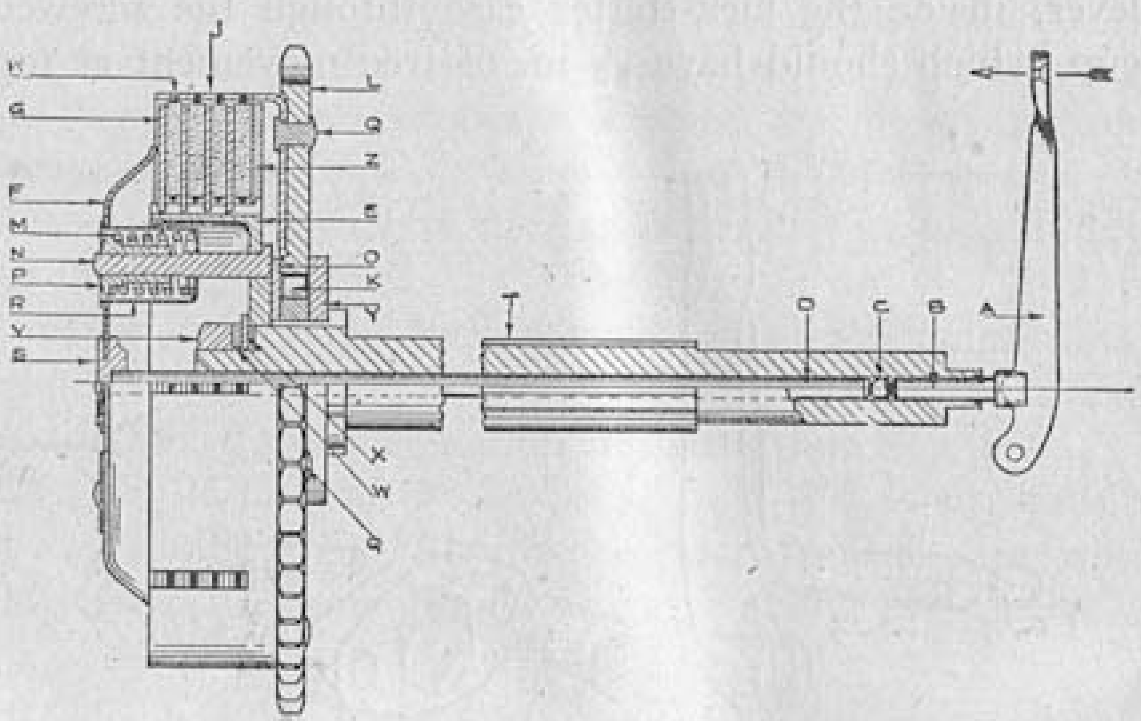


FIG. 35.—CLUTCH, GEARBOX MAINSHAFT AND CLUTCH-OPERATING MECHANISM.

(A) Operating lever. (B) Operating plunger. (C) Ball (steel). (D) Thrust rod. (E) Clutch centre. (F) Spring pressure plate. (G) Plain steel clutch plate (thin). (H) Friction clutch plate (with inserts). (J) Case. (K) Roller, for chainwheel bearing (24 used). (L) Chainwheel. (M) Spring (4 used). (N) Stud (4 used). (O) Washer (thin), for chainwheel bearing. (P) Adjustment nut, for clutch spring (4 used). (Q) Rivet, for chainwheel and clutch case (8 used). (R) Cup, for clutch spring (4 used). (S) Hard centre of spring pressure plate (not supplied separate from plate). (T) Mainshaft for gearbox. (V) Nut, retaining clutch centre to mainshaft. (W) Washer (spring). (X) Washer (plain). (Y) Washer (thick), for chainwheel bearing. (Z) Plain steel clutch plate (thick).

clutch springs to partially collapse. If the specified free movement is made and slip persists, dismantle the clutch and remove the glaze on the friction inserts with a steel wire brush or with glass-paper, check the clutch springs for free length and renew them if their overall length has shortened by ¼ in. or more.

Note.—The friction inserts protrude an equal amount each side of steel plate. (See section on competition models for acute clutch trouble.)

Fig. 35 shows the clutch fitted to the C.P.-type gearbox, with clutch-operating mechanism.

It is essential to see that there is about $\frac{1}{32}$-in. clearance between the fork plunger B and the nose on the lever A, when the clutch cable is fitted.

Fig. 36 shows the clutch-operating mechanism, as used on the H.P.-type gearbox. In operation, the clutch cable lifts the lever A and exerts pressure on the thrust-rod B on long push-rod, which passes through the gear-box mainshaft. Here again it is essential there is movement between the operating lever and the thrust-rod to the extent of $\frac{1}{32}$ in. Screwed in the centre of the outside clutch plate is a stud, locked by a nut. Alteration to the clutch-withdrawal mechanism can be effected by moving this stud in the required direction. See that the lock-nut is firmly secured.

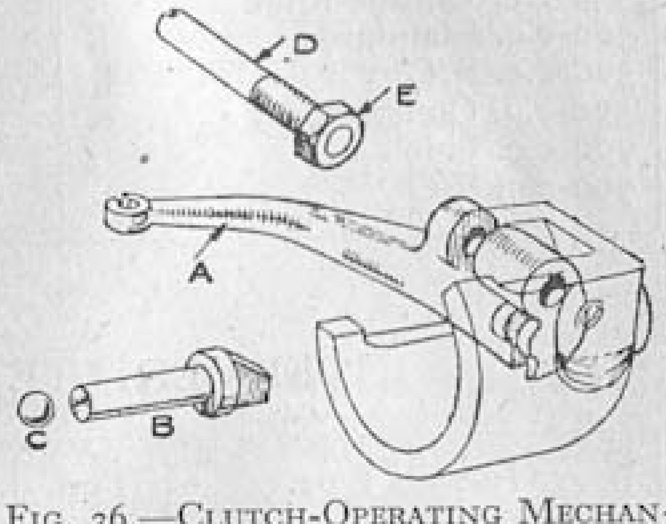


FIG. 36.—CLUTCH-OPERATING MECHANISM USED ON H.P.-TYPE GEARBOX.

(A) Operating lever for clutch. (B) Short push-rod. (C) Steel ball. (D) Hinge pin. (E) Lock-nut for pin.

Clutch-Drag.—Check the position of the clutch-spring adjusting screws—they should be unscrewed an equal number of turns. Springs should be unscrewed four complete turns from the screwed-home position. Next check the amount of play in the operating lever on the handle-bar—¼ in. movement is allowed. If the trouble persists, dismantle the clutch and wash the friction plates in paraffin, then re-assemble.

TOP GEAR RATIOS (1937–8–9 Models)

Model.	Top Gear.	Engine Sprocket Teeth.
250-c.c. Standard . . .	6·25	16
250-c.c. Competition . .	6·56	16
350-c.c. Standard . . .	5·55	18
350-c.c. Competition . .	6·17	16
500-c.c. Standard . . .	5·0	21
500-c.c. S/C . . .	5·52	19
500-c.c. Competition . .	5·52	19
990-c.c. Solo . . .	4·72	23
990-c.c. S/C . . .	5·17	21

INTERMEDIATE RATIOS

Gearbox type.	Top.	Third.	Second.	First.
H.P. type . . .	1	1·4	1·97	2·97
C.P. ,, . . .	1	1·28	1·76	2·67
C.P. ,, Competition	1	1·51	2·08	3·16
B.A.P. ,, (4-speed) .	1	1·26	1·57	2·67
B.A.P. ,, (3-speed) .	1	—	1·84	3·14

To determine actual ratios, multiply top-gear ratio, with figures given in the above table.

CHAPTER VIII

SPRING FRAMES

THE general arrangement is shown in Fig. 37, which is self-explanatory. Lubrication for the hinge bearings is effected by removing the screw in the end cap. The oil content is $1\frac{1}{2}$ oz. (42·6 c.c.), heavy oil is the most suitable and should be injected into the reservoir, the screw hole serving as a level.

Rear-Frame Legs

The construction is shown in Fig. 38. The use of a grade and quantity of oil recommended by the makers is most important. A heavy oil, or amounts in excess of those recommended, will damage the oil seals (see "Lubrication Chart").

In consequence, it is equally important to avoid "topping up". If the correct amount of oil is used and leakage does not take place, additional oil is not required.

Checking the Oil Content

Deal with each leg in turn by removing both the top and bottom pivot bolts, note the spacing washer for the top bolt.

Place the leg vertically in a vice, securing the bottom end (do not grip too tightly). By using a hook spanner release only the serrated ring above bottom pivot.

Reverse the leg in the vice and unscrew by hand the pivot body. The serrated ring can now be removed with its dowel pin (ensure this is not misplaced) and the oil content will be exposed. Remove the cover tube with its steel seating washer, the spring and the second cover tube. If the oil content is to be checked, remove the top pivot body from the vice and pour the oil into a graduated glass. When the oil ceases to flow, remove the screwed filler plug, hold the alloy damper tube in one hand and pump the steel tube several times to eject the residue of the oil.

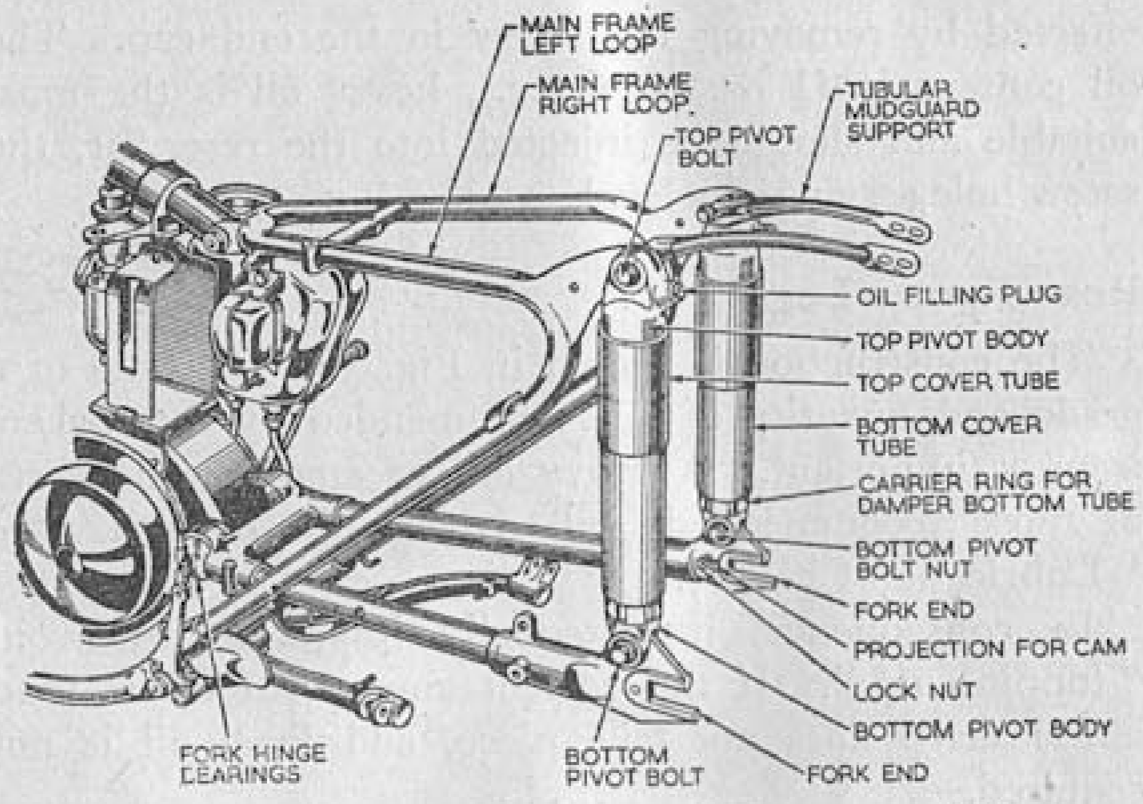


FIG. 37.—REAR SPRUNG FRAME AND "TELEDRAULIC" LEGS.

To assemble reverse the foregoing instructions, then with the leg again vertical in a vice (top pivot uppermost) refill through the filler plug into the damper chamber $1\frac{3}{4}$ oz. (50 c.c.) of the specified oil.

To Replace Oil Seal

Dismantle one fork leg, as described for checking the oil content, as far as removing cover tubes and spring. For further dismantling, a peg spanner will be needed to unscrew the cap retaining oil seal. With the cap removed,

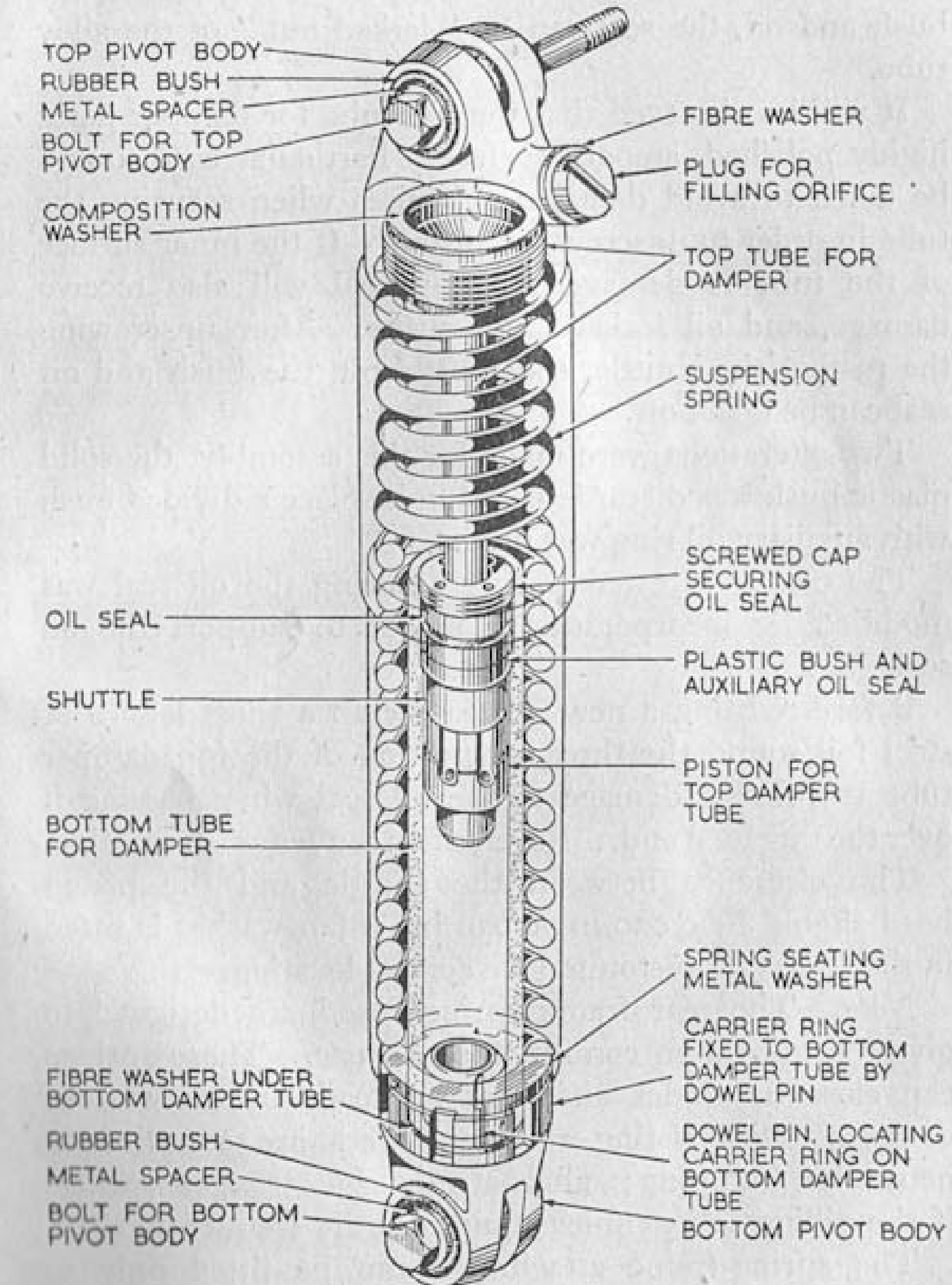


FIG. 38.—GHOST VIEW OF "TELEDRAULIC" LEG.

the top tube for damper with the piston, the shuttle, the bush and oil, the seal can be "jerked out" of the alloy tube.

It will be observed that the top tube for damper has a highly polished, smooth surface. Particular care should be taken to avoid damage or bruises when securing the tube in order to unscrew the piston. If the inner surface of the tube is damaged the oil seal will also receive damage, and oil leakage will ensue. After unscrewing the piston, the shuttle, the shuttle pin the bush and oil seal can be taken off.

Two alterations were made for this assembly, the solid plastic bush was discarded, and in its place a divided bush with auxiliary oil ring was used.

The cap or screwed washer securing the oil seal was modified by incorporating a spigot to support the oil seal.

Before refitting a new oil seal, wrap a short length of steel foil round the threaded portion of the top damper tube to prevent damage to the oil seal when passing it over the threaded end. Reverse this sequence to assemble.

The clearance between the shuttle and the piston head should be 0·020 in.–0·030 in., a fan washer is fitted in the recess for piston to give correct location.

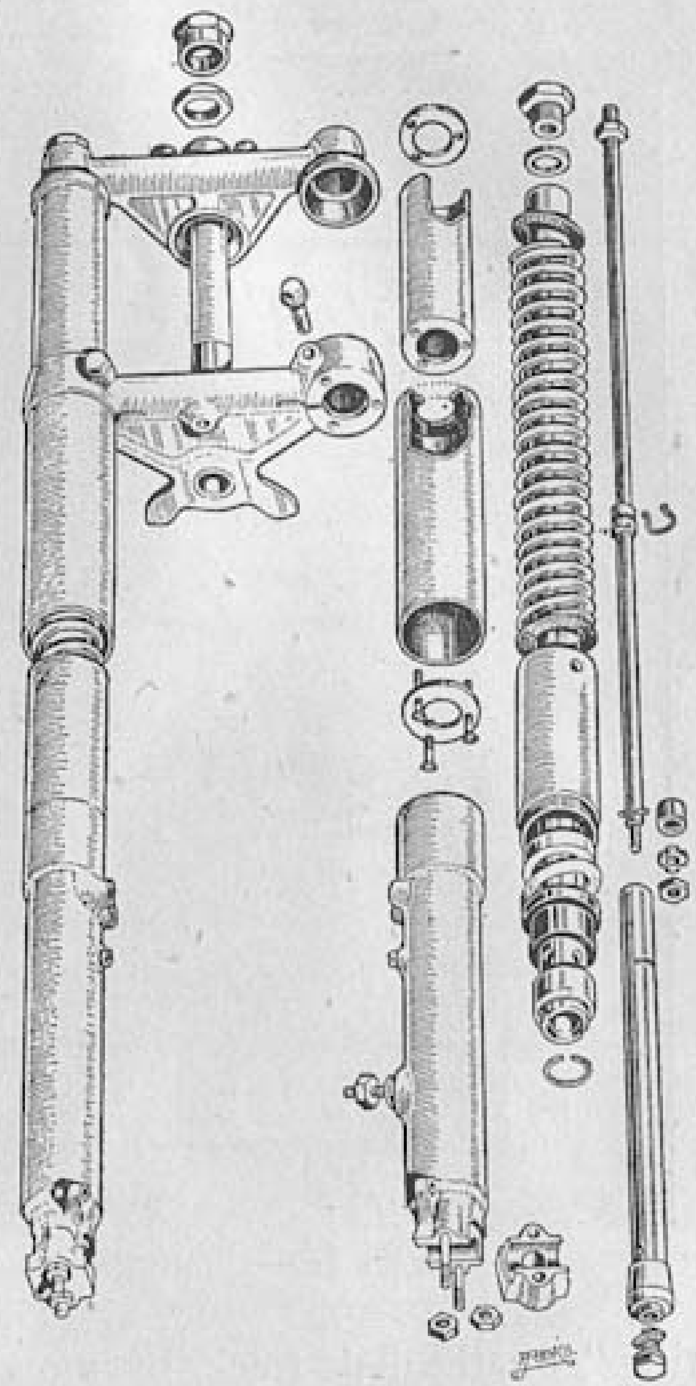
Note.—The rear frame springs used are designed to give the maximum comfort for solo use. These springs can close up under an abnormal road surface without damage. Oil-resisting rubber buffers are supplied to neutralise bumping; alternatively, fit stronger springs if the pillion and pannier equipment are frequently used.

The spring-frame attachment can be fitted only to machines made from 1949 onwards as, apart from a complete new rear frame portion, a new rear wheel is also required as a wider hub is used on the spring-frame models.

Front Forks

For modifications see page 138.

Where stiff fork motion or jamming of forks is found, and the machine has not received damage resulting in a bent tube, stiffness is due to tight Bakelite bushes which sometimes swell or expand. To rectify, dismantle the fork legs and ease the internal diameter of the bushes to give free movement, oil and replace.



"Motor Cycling," copyright drawing.

FIG. 39.—TELEDRAULIC FORKS.

Changing Fork Springs

A quick and easy method of exposing the fork springs is shown in Fig. 40. A long bolt, to fit the fork inner tubes, is required to drive out each tube in turn after first removing the two top bolts in the handlebar lug and releasing the nuts (or bolts) on the fork crown which clamp the inner tubes. Fork springs rarely collapse or close up, always check the overall length from technical data before replacing them.

Steering-Head Adjustment

The steering-head races are of the self-aligning type. Correct adjustment must be maintained to avoid "pit-

FIG. 40.—CHANGING FORK SPRINGS.

ting" on the ball track, by movement in the headrace bearing. To check the adjustment, raise the front wheel clear of the ground with a support under the crankcase. Grasping the front guard with the right hand, place the fingers of the left hand at the rear of both the handlebar lug and the frame. If movement can be felt with the left

FIG. 41.—STEERING-HEAD ADJUSTMENT.

If movement can be felt with the left hand (*see illustration*) when front wheel is raised from the ground the bearing is loose.

hand when the front-wheel assembly is raised (see Fig. 41) the bearing is loose.

To adjust, slack off the steering damper (if fitted) and release the top nut on the fork stem. Screw down the bottom nut until movement disappears, leaving the front assembly free to move. Retighten the top nut securely and replace the damper.

Front Fork Noise

With forks using the shuttle type damper a clacking noise from impact against the front wheel is sometimes audible. This is often mistaken for "bottoming", which cannot occur if the oil content is correct (see "Technical Data").

This noise is difficult to eliminate, refer to details on page 139 for possible cure.

Fork Spring Noise

Occasionally one or both fork springs will vibrate in sympathy with a slight engine period. To eliminate this check that the engine, the frame and the gearbox bolts are secure.

A loose steering-head bearing or engine-steady stay (on 500-c.c. models) will have the same effect. Should no benefit result after adjustment ensure that both ends of the fork springs are at right angles to the axis of the spring to prevent spring buckle, which brings the spring affected close to its casing. To remedy spring buckle the end of the spring should be ground to correct this, or replace the spring if facilities for grinding are not available.

Wheel Bearings

An exploded view of wheel bearings is shown in Fig. 42. The front wheel-bearing arrangement is common to

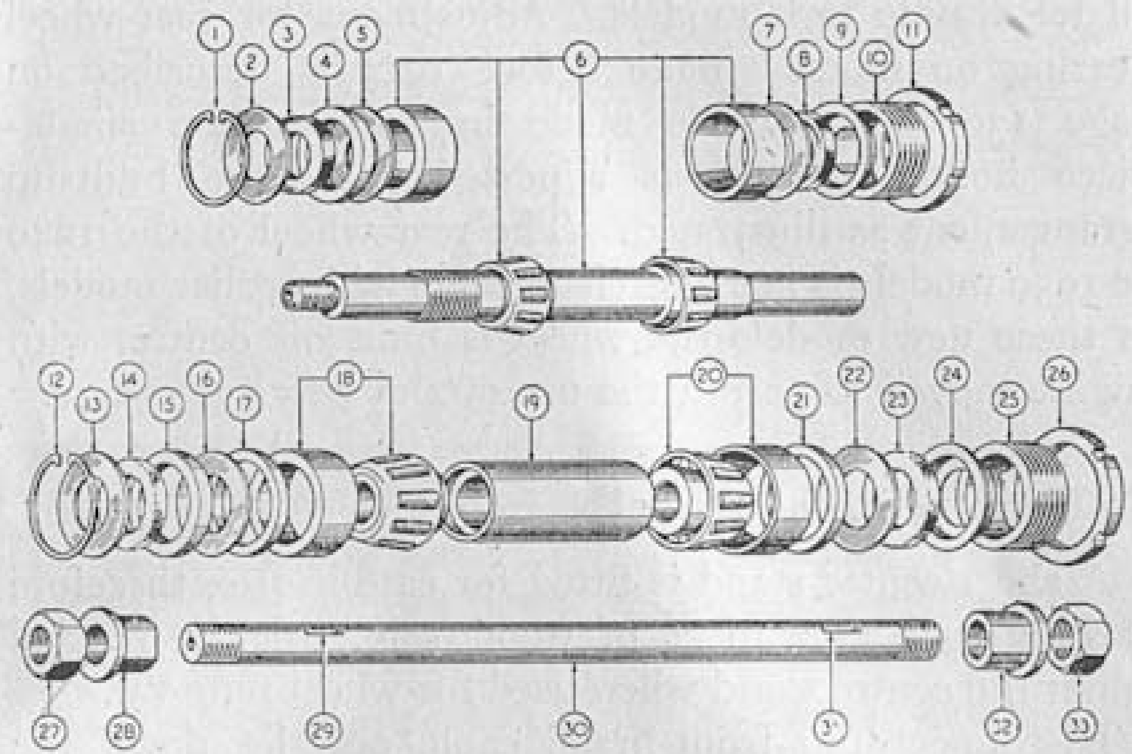


FIG. 42.—EXPLODED VIEW OF HUB BEARING COMPONENTS IN THE ORDER OF ASSEMBLY.

Upper part is that of front bearings (Rigid and Spring-frame Models). Lower part is that of rear bearings (Spring-frame Model only).

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 (2 off). Centre spindle. Rollers in cages (2 sets). These are not supplied separately. Also, rollers are not supplied separately.
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 (outer cup, cage for rollers and rollers). These are not supplied separately. Also rollers are not supplied separately.
19. Spacer, between bearings.
20. Taper bearing (outer cup, cage for rollers and rollers). These are not supplied separately. Also rollers are not supplied separately.
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 rear 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.

all teledraulic fork models. Adjustment for rear-wheel bearing on models made before 1949 is described on page 130. On models made in 1949/50 the single-piece hollow spindle is superseded by the built-up arrangement as illustrated. The rear wheel of the 1949 or 1950 models is not interchangeable with earlier models, in these new models the wheel is built off centre, with engine moved to permit the use of 4·00 × 19 rear tyre.

To Remove Front Wheel

A short centre stand is fitted for ease in use, therefore packing such as a piece of wood 1 in. thick is needed under the centre stand when used for wheel removal.

Disconnect the front-brake cable and let down the front stand, which must not be perfectly vertical.

Remove the brake anchor from the forks and release the nut on the left side of the spindle. Take away the four nuts retaining fork-slider caps. (*Note.*—These caps must be refitted in their original positions.) The wheel can now be removed. The wheel is replaced in reverse order.

Removing Rear Wheel of Spring-Frame Models

With packing under the centre stand, disconnect the detachable portion of the rear guard (two rearmost bolts) and also the rear-lamp connection.

Unscrew the knurled knob on the brake rod, depress pedal to disconnect and remove the rear-chain connecting link.

Unscrew the speedo cable gland nut and withdraw the cable. Slacken the nut securing the speedo drive, then release the rear axle nuts. With a suitable spanner on the hexagon body of adjusting cam, rotate the body, causing the wheel to move in forward position.

Tilt the rear wheel to the right to clear the brake anchor plate from its stud, then withdraw the wheel.

To refit the wheel, reverse this sequence, but leave the

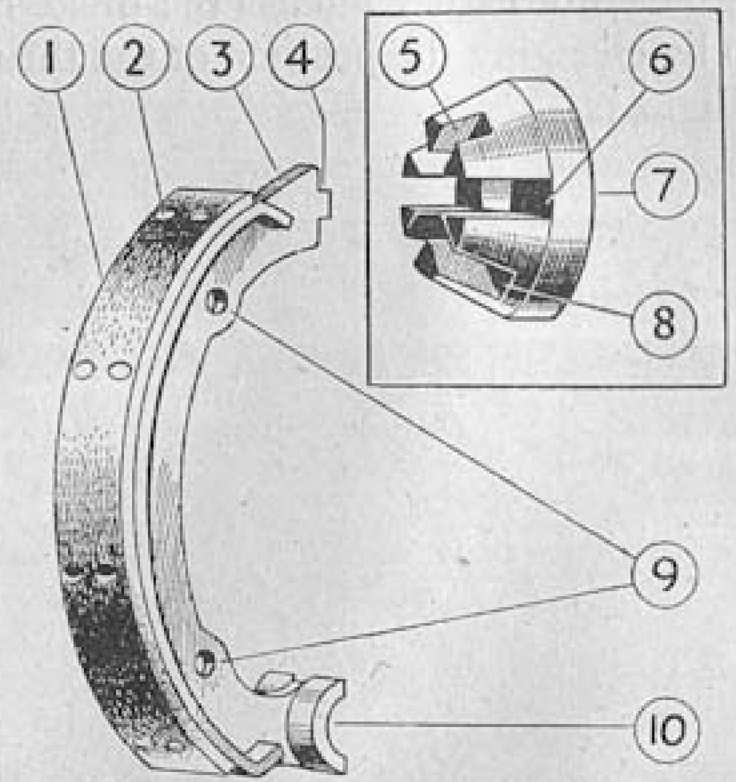


FIG. 43.—BRAKE SHOE AND THRUST PIECE.

1. Brake lining.
2. Brake rivet. (Eight used on one shoe.)
3. Brake shoe.
4. Tongue, or brake shoe, which fits into the centre of the brake expander thrust collar (7).
5. One of the two shallow slots of the thrust collar. (Used when brake linings have had extreme wear.)
6. One of the two deep slots of the thrust collar. (Used when brake linings are new.)
7. The brake expander thrust collar.
8. One of the two medium depth slots of the thrust collar. (Used when brake linings have had reasonable wear.)
9. Hole, to accommodate the brake shoe spring.
10. Brake shoe heel which pivots on the pin forming an integral part of the brake cover plate.

speedo drive nut loose until the cable has been refitted and both axle nuts have been tightened.

Note.—To exclude water pack the speedo drive with H.T.M.P. grease before refitting.

To Adjust Wheel Bearings

Details given for earlier models apply to post-war models.

Brake-Shoe Adjustment

Details given on page 132 apply to models made from 1948 onwards. For earlier models the brake-lining wear is taken up by changing the position of the thrust piece as shown in Fig. 43.

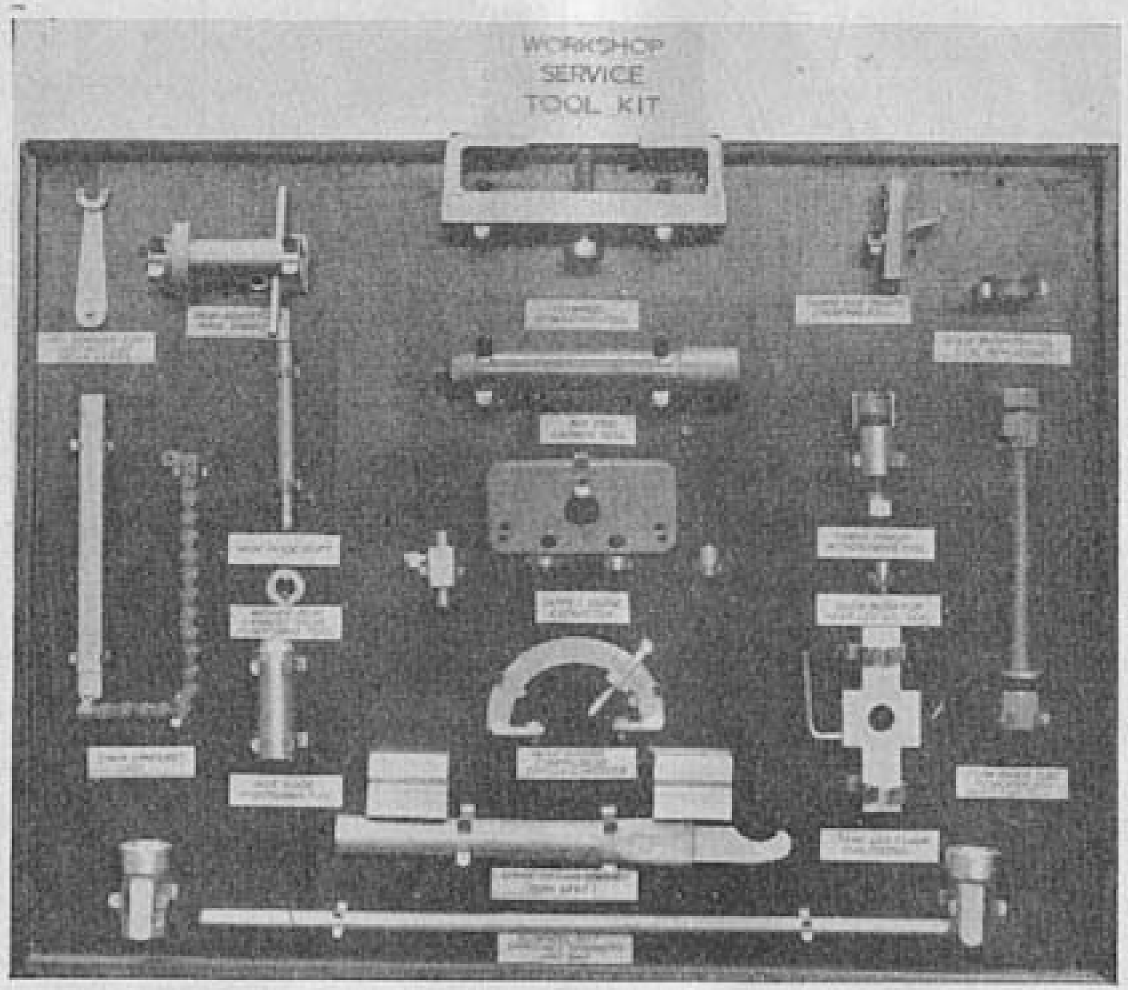


FIG. 44.—SERVICE TOOL KIT.

From left to right (*top row*): Peg spanner for screwed cap (rear legs). Hub adjusting ring spanner. Flywheel-separating tool. Timing-side shaft locating tool. Split bush for oil-seal replacement. (*Second row*): Valve-guide drift. Big-end lapping tool. Timing-pinion withdrawing tool. (*Third row*): Chain sprocket grip. Washer for exhaust-valve positioning tool. Tappet-guide extractor. Guide bush for rear-leg oil seal. Fork inner tube removing and refitting tool. (*Fourth row*): Valve-guide positioning tool. Valve-spring compressor, standard models. Frame-leg clamp for piston. (*Fifth row*): Serrated ring spanner (rear legs). (*Bottom*): Flywheel nut sprocket spanners and bar.

Special Tools

A set of service tools, supplied by the makers, are invaluable to Service depots and to owners who execute their own repairs. For motor-cycle clubs with numerous A.J.S. members, a collective purchase of these tools for loan is worthy of consideration. (Fig. 44.)

The use of the fork-tube draw bolts will facilitate front-fork service.

CHAPTER IX

COMPETITION AND RACING

THE details given for Competition Models have been compiled for the benefit of riders who have little knowledge of trials and the preparation of their machines for events of this kind. The writer has had a fair measure of success for a period of several years, including such events as the Scottish Six Days and International Six Days trials, and had the honour to represent this country in the British teams on five separate occasions, and was also a member of the winning team on two occasions. Experienced trials riders will probably consider the information given to be very elementary, but possibly some of the points mentioned will prove useful.

Riders who intend to take up trials seriously should make reliability their keyword. It is a common occurrence for riders to retire in both trials and scrambles, due to some part or parts of the machine and engine failing, or falling off. Such circumstances, in a number of cases, are due to lack of preparation, and not bad luck, which is usually claimed. Some riders are inclined to pay too much attention to the engine, in an endeavour to get maximum power and highest speed. At the same time, important details on the frame and transmission are either overlooked or receive scanty attention. It follows that systematic preparation is essential to ensure that the machine and its fittings are reliable as far as possible.

Modern trials are now termed "Sporting Trials", and usually the time taken to cover the course is not seriously taken into account. However, there are one or

two exceptions. The rider should have time, during the event, for instance, whilst waiting at the start of a section, to check the rear-chain adjustment, inflate or deflate the tyres as the occasion or type of section necessitates, and give the machine a quick run over. A little oil on the chain will help to save the "odd coppers" for replacing the chain after short service. Factory-supported riders do this, because their skill in riding and looking after the machine gives them the best possible chance of success. Attention of this kind is of vital importance in trials of the long distance or Six Days type.

Engine Preparation

The engine should be tuned to give good power at slow speed, without seriously affecting the acceleration. The following compression ratios are recommended for solo machines:—

250-c.c.	350-c.c.	500-c.c.
6·5 : 1	5·8 to 6·3 : 1	5·4 to 5·8 : 1

Engine Clearances

Engines will run at a much higher temperature in trials than they would on the open road. Therefore close clearance between working parts is undesirable. If a new cylinder and piston are fitted, or the cylinder is rebored, there should be an extra clearance over the standard size, to the extent of 0·001 in., which is usually effected by enlargement of the cylinder bore. Tight valve-guides will cause the valve to "hang up" or stick in the guide under these conditions.

High engine temperature will also affect the valve-springs, which should be checked each time the cylinder-head is removed. Inner spring has a "free" length of $1\frac{13}{16}$ in. and the outer $2\frac{1}{16}$ in. Fit new ones when they have closed up $\frac{1}{4}$ in. or more.

Make sure the oil passages in the cylinder-head are free when the cylinder-head has been cleaned out, by squirting paraffin through the holes drilled in the head.

Valves and Valve-Guides

Do this also, when new guides have been fitted, to check the alignment of the oil-holes in the guide. Valve-guides should protrude outside the head to the extent of ½ in. for the inlet valve and ⅝ in. for the exhaust valve.

Both valve-stems when issued by the makers are chromium-plated on the stems. The object is to minimise the possibility of the valve seizing or "picking up" metal from the guides when the parts are first used. The chrome deposit has a soapy-like surface and tends to polish the internal diameter of the valve-guides.

Grind the valves to their respective seatings. The 350-c.c. valves are dissimilar in size, but on the 500-c.c. models both valves are the same size, but made from different material. It is essential that the valves for the 500-c.c. models are replaced correctly. These valves are either marked by etching on the valve-head or stamped on the top of the stem above the collet grooves, either INLET or EXHAUST.

Pass a piece of clean rag through both valve-guides after grinding, and apply a little engine oil to the valve-stems before assembly.

To obtain the maximum efficiency from the engine, the carburetter outlet and carburetter distance piece should have a smooth finish, and before reassembling the valves, fit the carburetter and distance piece to the cylinder-head to determine if the bore is free from abrupt changes in diameter; also see that the packing piece registers with the inlet port in the cylinder-head. To do this it may be necessary to either "flare out" or chamfer the parts where they join, so that they are in complete register and match up—this will provide an uninterrupted flow of gas, thus improving the volumetric efficiency of the engine. As to the carburetter packing piece, the aluminium type is preferable, although the composition type will prevent heat from the head running back to the carburetter, which is not always desirable.

See that the valve end-caps are free to rotate on the valve-stems, otherwise wear may take place, if contact with the rocker is continually made with the cap in one particular position.

The cylinder-head can now be put aside for assembly later.

Piston

Next turn to the piston and check ring-gap with rings inserted in cylinder barrel; push the rings down the bore, using the piston skirt to do so. This will set the rings square with the bore, when the ring-gap can be checked, which should be 0·003 in. to 0·004 in. for each 1 in. in cylinder bore size.

Compression Plate

For "plonking" tactics, a compression plate, obtainable from the makers, can be fitted between the cylinder base and the crankcase. Two steel washers will have to be fitted over the tappet guides, and under the bottom sealing rings to account for the thickness of the compression plate. These parts were a standard fitment on the Army engines. A standard-type piston, using the compression plate on the 350-c.c. engine, will reduce the compression ratio from 6·3 to 5·8 to 1.

On the 500-c.c. models made in 1939, compression plates were used as part of the engine assembly, which should be retained for ordinary trials work. Removing this type of plate will increase the compression ratio from 5·9 to 7·24 to 1, (see Table of "Special Fuels" page 177).

The cylinder barrel can now be fitted, with new cylinder-base washers, rubber rings for the bottom of the push-rod tubes and a new rocker-box gasket, used on the 1939 and present-day engines.

Carburetter

Before replacing the carburetter, take it to pieces and clean out the pilot passages (see Figs. 18 and 45); also check the flange on the carburetter body by placing on it a straight-edge or rule. If it is buckled, file it flat before reassembling the jet-block.

The illustration for the carburetter shows a hole drilled in the carburetter outlet, which may interest owners of ex-W.D. machines. This hole (No. 9) was used to prevent petrol entering the engine when the petrol-taps were left ON, with the machine on the stand. The hole should be sealed with a metal plug of suitable size, with a force fit, and do not overlook the petrol taps when the machine is parked on the stand.

All the tuning and care on the engine will be valueless if the carburetter is not set properly, and the importance of the pilot-jet is again stressed. If it is necessary to screw home, or nearly home, the pilot regulating screw, either the pilot orifice is small or there is an air-leak. With the pilot working properly, it should be possible to make the engine run unevenly or "rich", by screwing home the regulating screw.

Fig. 45 is a carburetter of the Army type. The holes over the primary choke are not shown. This is because Army-type carburetters were designed for use with air-filters—all air taken into the engine has to pass through the air-filter. Nevertheless, the principle of the car-

buretter is the same. On all civilian-type carburetters there is a small "bleed" hole drilled in the body underneath the passage for the pilot adjusting screw. The

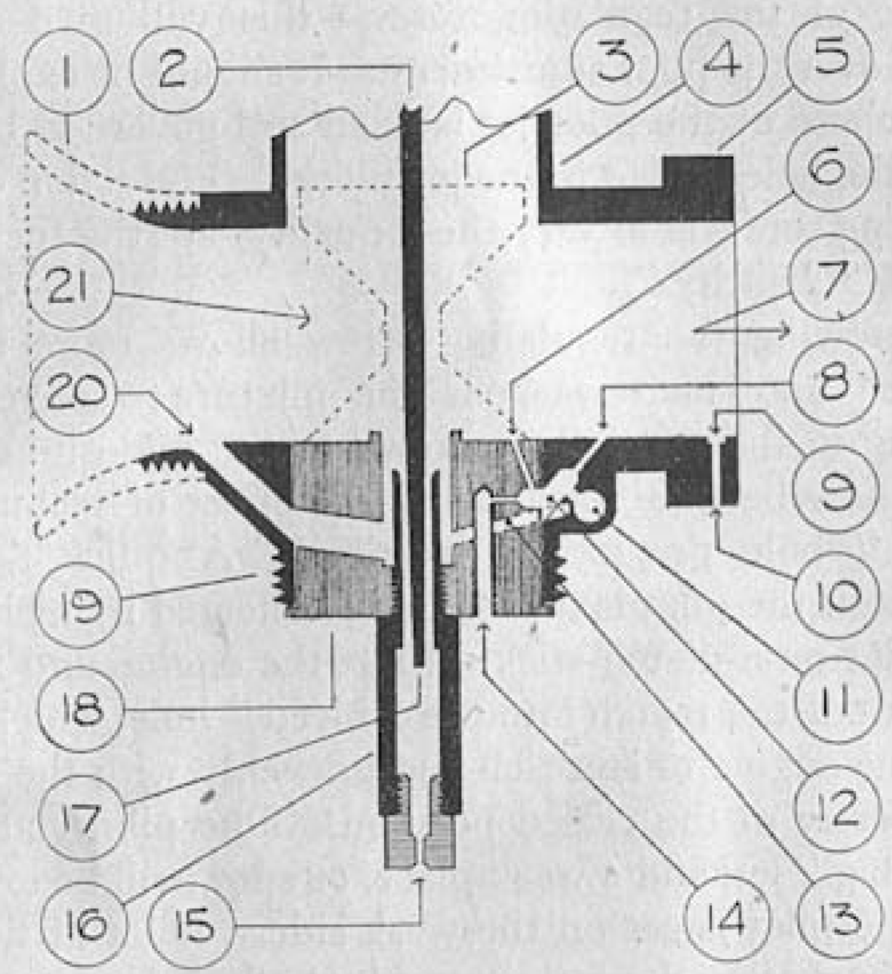


FIG. 45.—CARBURETTER JET BARREL OR CHOKE.

Showing pilot-, main-, and needle-jets. (1) Air tube. (2) Jet needle. (3) Upper portion of the jet barrel or choke. (4) Mixing body. (5) Flange. (6) Air balance passage (pilot by-pass). (7) Direction of gas flow to inlet port of engine. (8) Pilot outlet (passage to inlet port for mixture provided by pilot-jet). (9) and (10) Drain passage for unvaporised petrol. (11) Threaded hole, to accommodate pilot-jet air adjusting screw, the far end of which communicates with the passages 8, 13 and 14. (12) Enlarged end of pilot-jet. This is drilled in the jet barrel or choke. (13) Passage to conduct air to pilot-jet mixing chamber. (Also feeds air to the pilot-jet air adjusting or metering screw.) (14) Passage for petrol supplied to pilot-jet: this is drilled in the jet barrel, or choke, and its lower end is below the level of petrol in the float chamber. Suction on the pilot-jet causes petrol to rise in this passage and pass through the pilot-jet. (15) Main-jet. (16) Needle-jet. (17) Lower (tapered) end of the jet taper needle. (18) Lower portion of the jet barrel, or choke. (19) Thread for mixing chamber union nut. (20) Passage to conduct air to the needle-jet well and also to the pilot-jet mixing chamber (W.D. type only). (21) Direction of main air flow through choke of carburetter.

carburetter makers use this hole to prevent owners completely closing off the air which passes over the pilot passage. This small hole can be sealed if intelligent use is made of the regulating screw—this will give a full control over the pilot adjustment. It should be explained that the size of the pilot-jet is fixed and governed by the size of the hole drilled in the jet-block. The action of the regulating screw is to vary the " quality " of the fuel, and not the " quantity ".

Unscrewing the regulating screw allows more air to be taken in, which weakens the mixture; conversely, screwing in the regulating screw has the opposite effect. It will now be quite clear as to the effect of sealing the " bleed " hole previously described. A quick test to ascertain if the pilot is fouled can be effected by making a fine point on a match-stick. Start the engine and insert the point of the match into the " bleed " hole, which will cause the engine to run rich and unevenly with the regulating screw in the closed position. The pilot acts as a " bridging " jet, and a weak place, or spot, will be evident when the pilot is set on the weak side. A lot of time is wasted on setting the carburetter by both experienced and inexperienced riders, by permitting the engine to get too hot whilst the carburetter is being set.

The following " drill " is recommended :—

(1) Check tappets.
(2) Plug points gap 0·018 in. to 0·020 in.
(3) Start engine on stand.
(4) Retard ignition lever about one-eighth of its movement.
(5) Let engine idle by closing back throttle.

If the pilot is correctly set, the slow running should be positive. Retard the ignition lever fully, and the engine should continue to idle at a slower speed. If the engine stops, re-start and re-set the regulating screw by screwing in the screw slowly until the slow running is positive. Snap open the throttle once or twice, and re-check for slow running. The throttle-slide stop-screw will have to be readjusted until the desired engine speed is arrived at. Retarding the ignition puts the engine under load—it should be possible to open the throttle, providing the ignition is correctly set, up to two-thirds throttle with engine running evenly, and without any " spitting back ". With this setting the rider can rest assured that he will be able to drive at very slow speed, without " losing the engine ".

Make these adjustments as quickly as possible, because if the engine becomes unduly hot a false setting will be arrived at when the machine is actually in motion. It is in these circumstances that time is wasted on this adjustment. It should not be necessary to alter the main jet size; the only alteration that may be needed is to vary the position of the taper needle. Usually (on civilian models) this is secured in the second notch from the top of the needle. For maximum power, if petrol consumption is not taken into account, place the needle in the third notch from the top.

Forks

Girder-type fork-links can be altered to either increase or decrease the trail or castor action, by either increasing or decreasing the length of the two bottom fork-links. If alternative fork-links are made, they must be sound in design and material for such a vital part of the machine. The length of the fork-spring is important. When this spring has closed up or decreased in length, the steering, particularly at high speeds, will be affected. The links should be out of parallel to the ground and highest at the frame end. Packing pieces can be fitted on top of the fork-spring to raise the frame and keep the castor action constant, also increase ground clearance.

The forks should be damped down by hand knob to give a sluggish movement. If the damper is not efficient a solution of powdered resin and methylated spirit (1% of resin only) lightly brushed on the friction discs will improve its efficiency. Ovality in the fork members can be rectified by bushes fitted by the makers. It is rare for the spindles to wear if lubricated from time to time.

Mudguard and Tyre Clearance

In the case of a standard machine, the mudguard clearance is not sufficient (by reason of appearance) for sporting trials. The rider will have to increase the clearance by longer guard stays on the front guard, and make sure the fittings altered are sound. Alteration to the rear guard is not so easy. Riders with workshop facilities can move the rear mudguard bridges and fit longer stays to permit the use of a 26-in. × 4·00-in. tyre, and at the same time increase the clearance to prevent mud piling up and having a braking effect on the wheel. A maximum clearance of 2½ in. to 3 in. is ample for the rear mudguard. Shortening the rear guard will cause mud to be thrown over the rider's back, and will make the machine generally dirty; do not shorten the guard unduly. In passing, it may be mentioned that the extension on the rear chain-guard is important. Mud can be carried by the tyre until it piles up at the chain-stays and will be forced into the front chain-case, where the gearbox mainshaft enters the case. The aperture for the dyno. shaft (if dyno. is removed) can be sealed by using another chain-case inspection cap in this position.

Waterproofing

The best known medium for keeping water off the H.T. point of the magneto is undoubtedly plasticine.

Apply this material copiously round the brush-holder, to completely cover the brush-holder and H.T. cable entry. The contact-breaker cover round the joint can be treated likewise. A small hole is drilled in this cover; this should not be sealed unless deep water-splashes are expected, in which case the hole should be reopened as soon as the trial is finished.

Insulating tape, completely covering the porcelain of the sparking-plug, also the brass terminal on the H.T. cable, is the best arrangement. This will prevent a quick change of the sparking-plug, but it will be worth while. Wet leaves blown on the plug can cause the engine to falter, and result in a stop, traversing an observed section. *Note.*—K.L.G. plug WF.70 is waterproof.

Water can enter the engine via the crankcase release in a water-splash. A piece of petrol-proof tube joined to the release pipe and carried up on to the seat-tube of the frame will help. Use a little jointing compound to stick the rubber tube on to the copper pipe. If the H.T. cable is held to the frame by metal clips, discard these and use insulating tape. When water-splashes are not included in the course the rubber tube can be directed on to the rear chain for lubrication. Insulation on the H.T. cable can break down and cause the engine to cut out on heavy load.

Control Cables

The benefit of well-lubricated control cables can be appreciated by experience. It is important that at least the throttle and clutch cables are well lubricated. Soaking the control cables first in paraffin and then in thin oil will help. The most common cause of cable breakage is stiff nipples in the control levers. If the large nipple cannot revolve as the lever is moved, a bending action on the cable will occur. This causes the cable to fray and eventually fail.

SCRAMBLES AND GRASS-TRACK MACHINES

Riders usually have the same machine for both scrambles and trials. Trials gear ratios are generally suitable for both types of event. The large step-up in gear ratios from the ultra low gear needed for trials is a problem on certain scramble courses. It is most unlikely that riders will go to the trouble of exchanging the main

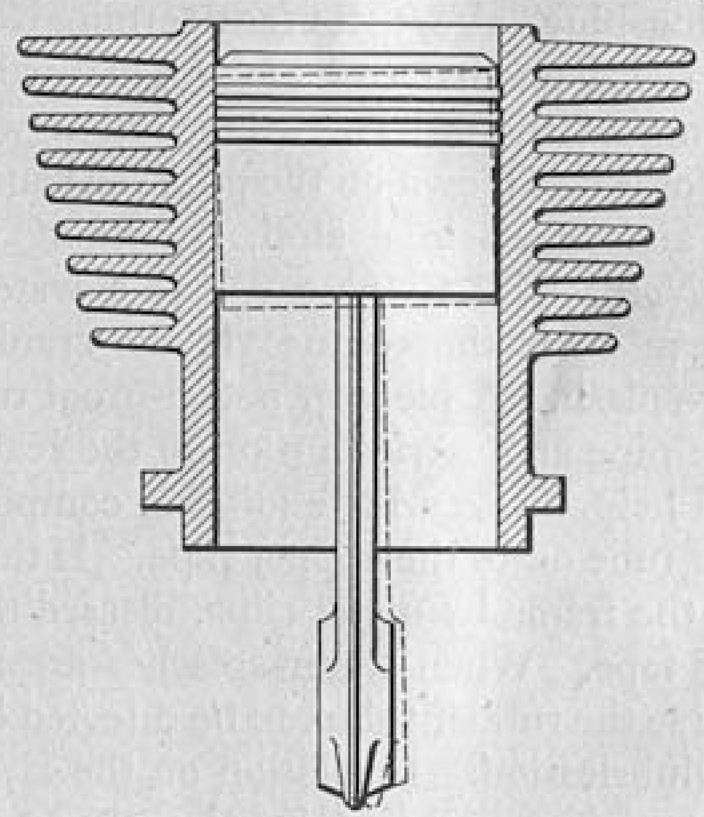


FIG. 46.—CHECKING CONNECTING-ROD ALIGNMENT USING OLD CYLINDER.

gear and layshaft pinion mentioned in the paragraph dealing with the gearbox.

Apart from tuning the engine in the normal way by polishing ports, etc., the easiest method of increasing the engine efficiency is to raise the effective compression ratio by using a high-compression piston, on assumption that special fuels are available (see table "Special Fuels").

Other special parts are not available, but with good

workshop facilities certain alterations can be effected which are not normally used by the makers but which will give good results if owners are prepared to adapt in nature of experiment.

Increasing the size of inlet valve by $\frac{1}{16}$ in. by blending out the port will increase the volumetric efficiency, together with the use of a larger-bore carburetter of the T.T./10 type.

For 350 c.c. O.H.V. a suitable bore size is $1\frac{1}{16}$ in. and up to $1\frac{3}{16}$ in. for the 500 c.c. O.H.V. The size of inlet valve is limited by its proximity to the cylinder barrel. Obviously the inlet port should match up with carburetter bore with a perfect flow tube devoid of abrupt changes in diameter.

Valve lift can be also increased by reducing the base circle of each cam by $\frac{1}{32}$ in. radius. With this modification the valve and the tappet motion must be carefully checked to prevent bent push-rods and other damage. The valve lifter, if fitted in the crankcase, will need grinding to allow the exhaust tappet to sit on the base circle of the cam. The exhaust-pipe length is important for O.H.V. models, 48 in. measured on inside bend with pliable wire is best suited for these engines. Overseas riders have used a megaphone 14 in. long 4 in. throat diameter with beneficial results. A sparking plug with a high heat factor is essential when engine efficiency has been increased.

Note.—High-lift cams are used on competition models for 1951, and these can be fitted to earlier type engines.

Early-type Cam.	Latest-type Cam.
Inlet valve opens 20° B.T.D.C.	Inlet valve opens 32° B.T.D.C.
Inlet valve closes 67° A.B.D.C.	Inlet valve closes 63° A.B.D.C.

Readings taken with 0·016 in. tappet clearance.

To maintain engine efficiency, valve-springs should be exchanged, say, after every three to four meetings, purely as a precautionary measure.

1950 Competition Models

Alloy cylinders and cylinder-heads are fitted to these models. In place of base stud to secure cylinder barrel four long studs with sleeve nuts passing through cylinder-head secure both the cylinder and head.

These new parts cannot be fitted to earlier models on account of the crankcase drilling for cylinder studs.

This engine is ideal for scrambles or short circuit racing and, with high-compression piston fitted, normal compression ratios are identical to standard engines.

A ground joint for the cylinder and the head in place of the normal gasket is used. Top engine service is straightforward, and details for the standard engines apply. The long-reach sparking plugs used in this engine can seize in threads if graphite grease is not applied on them from time to time.

Setting the Main Jet

With an open exhaust pipe the standard jet will have to be increased, apart from the increase in compression ratio. Start with a larger jet—say, 170 for the 350 c.c. —and test for the best jet size. The best indication of the correct jet size is the condition of the sparking-plug points. Riders who can, without breaking the law, drive their machines with an open exhaust pipe for some distance can arrive at the correct jet size by driving the machine flat out for about ½ mile and then shut the throttle sharply to avoid engine idling, then look at the plug points. A white colour indicates weak mixture, a dark or sooty colour is due to "rich" mixture, and the tester should aim for the points to be a brown or chocolate

colour. The engine is usually fastest with a small jet, but not for long if driven at full throttle for any length of time.

TABLE OF SPECIAL FUELS

Compression Ratio.			Fuel.
350-c.c.	O.H.V.	9·5 –1	Methanol 60%, Benzole 20%, Pool 20%
,,	,,	7·5 –1	Petrol 85 octane
,,	O.H.C.	8·45–1	Petrol 72 octane
,,	,,	9·0 –1	Petrol 80 octane
,,	,,	10·75–1	Petrol 50%, Benzole 50%
,,	,,	13·0 –1	Methanol 90%, Benzole 10%
500-c.c.	O.H.V.	7·24–1	Pool 90%, Benzole 10%
,,	,,	8·9 –1	Petrol 50%, Benzole 50%

Note.—For higher ratios on O.H.V. models use methanol 90 per cent., benzole 10 per cent.

When using methanol-base fuels the main jet must be increased by 100–150 per cent. of the petrol jet size. In addition, the needle jet must also be opened out to 0·113 in. for O.H.V. engines and 0·120 in. for O.H.C. engines.

RECOMMENDED SPARKING-PLUGS

18-mm. type: K.L.G. M.80; K.L.G. 356.
14-mm. type: K.L.G. F.70; K.L.G. 583.

If the cylinder barrel is reduced in overall length to increase the compression ratio, the permissible reduction in length will have little benefit as regards acceleration and maximum speed. Do not discard the head gasket, with the same object in mind. There should be at least 3 mm. extra movement on the valves, when at full lift, before contact with the piston crown is made. This has been allowed for, with use of the special pistons, and is mentioned in the event of the cylinder being shortened and the standard piston retained.

Steering

The normal steering-head angle is 61 degrees. Competition models use an angle of 63 degrees. This is accomplished by setting the frame tubes, and is best done by the makers.

The use of a 21-in. front wheel, with teledraulic forks, will increase the trail or castor action. A generous amount of trail (usually $3\frac{3}{8}$ in.) is useful for trials, but not for short-circuit grass tracks. Trail helps to keep the front wheel straight when road speed is above 15 to 20 m.p.h. If the trail is excessive the machine will not go round bends nicely, and will have a tendency to go straight on.

On standard machines the makers compromise with a steering angle and trail to make the steering safe and to enable fast corners to be negotiated with safety.

With teledraulic forks it is possible for the two centre tubes to turn in their housings after a fall, or bad skid. Wheel alignment can be restored by releasing the two top bolts securing the fork inner tubes, also the two nuts on the fork crown, which clamp the tubes. By gripping the front wheel with both knees astride the wheel, the handlebars can be turned to the required direction to restore the fork tubes to their original position. The wheel alignment should then be checked.

Checking Wheel Alignment

Use a long wooden batten with a straight edge placed along the rear tyre edge; move the rear wheel in the required direction so that the batten makes contact with both the front and rear tyre edges at the same time. Make allowance if a larger tyre is used on the rear wheel and see that the gap for the front wheel is equal and parallel.

To be successful the machine must be reliable—pay attention to the control-lever fulcrum screws and nuts, centre pop the end of the screws for security.

Scrambles play havoc with rear chains. Should a rear chain jump the sprocket teeth, this is not bad luck, but bad preparation and attention. If the rear chain is soaked in oil, run the machine for a few miles and readjust the chains, which will loosen after the oil has been squashed out of the rollers. Small points of this kind all help for a trouble-free ride.

CHAPTER X

ELECTRICAL EQUIPMENT

To Remove Dynamo

DESPITE the seemingly inaccessable position of the dynamo, it can be removed quite easily if the following revised instructions are used :—

(1) Take away front portion of chaincase.

(2) Remove circlip, lock washer and nut for armature shaft.

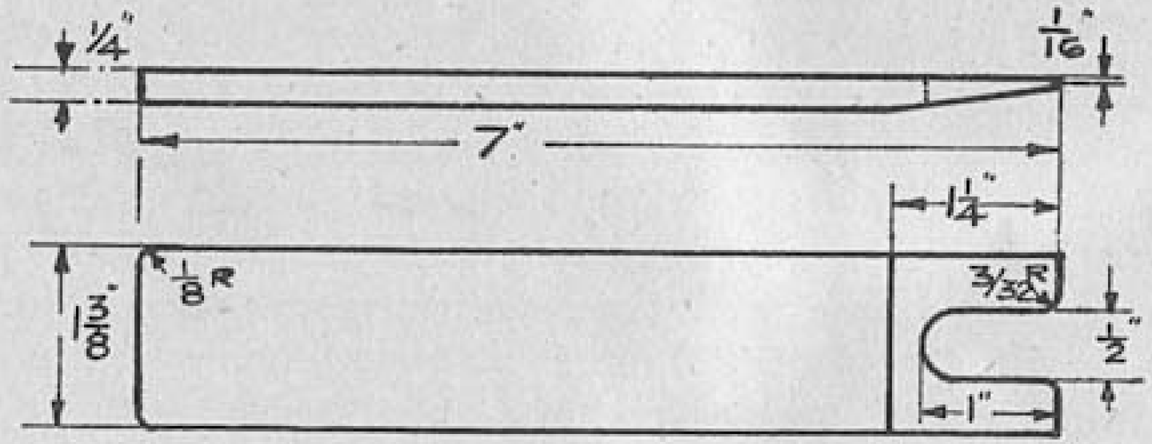


FIG. 47.—MAGNETO AND DYNAMO SPROCKET REMOVAL TOOL (1/4-IN. MILD STEEL).

(3) Release the nut for the armature, see special instructions, page 135, insert wedge (Fig. 47) between dynamo sprocket and dynamo body. A sharp tap on end of wedge will dislodge sprocket without damage.

(4) Remove nut for bottom gearbox bolt (left side) slack off nut for top gearbox bolt.

(5) Pull out bottom bolt (see it clears oil pipe), the gearbox can now be pulled backwards to allow the dynamo to be withdrawn after loosening clamp bolt and the two cables attached to dynamo end cover.

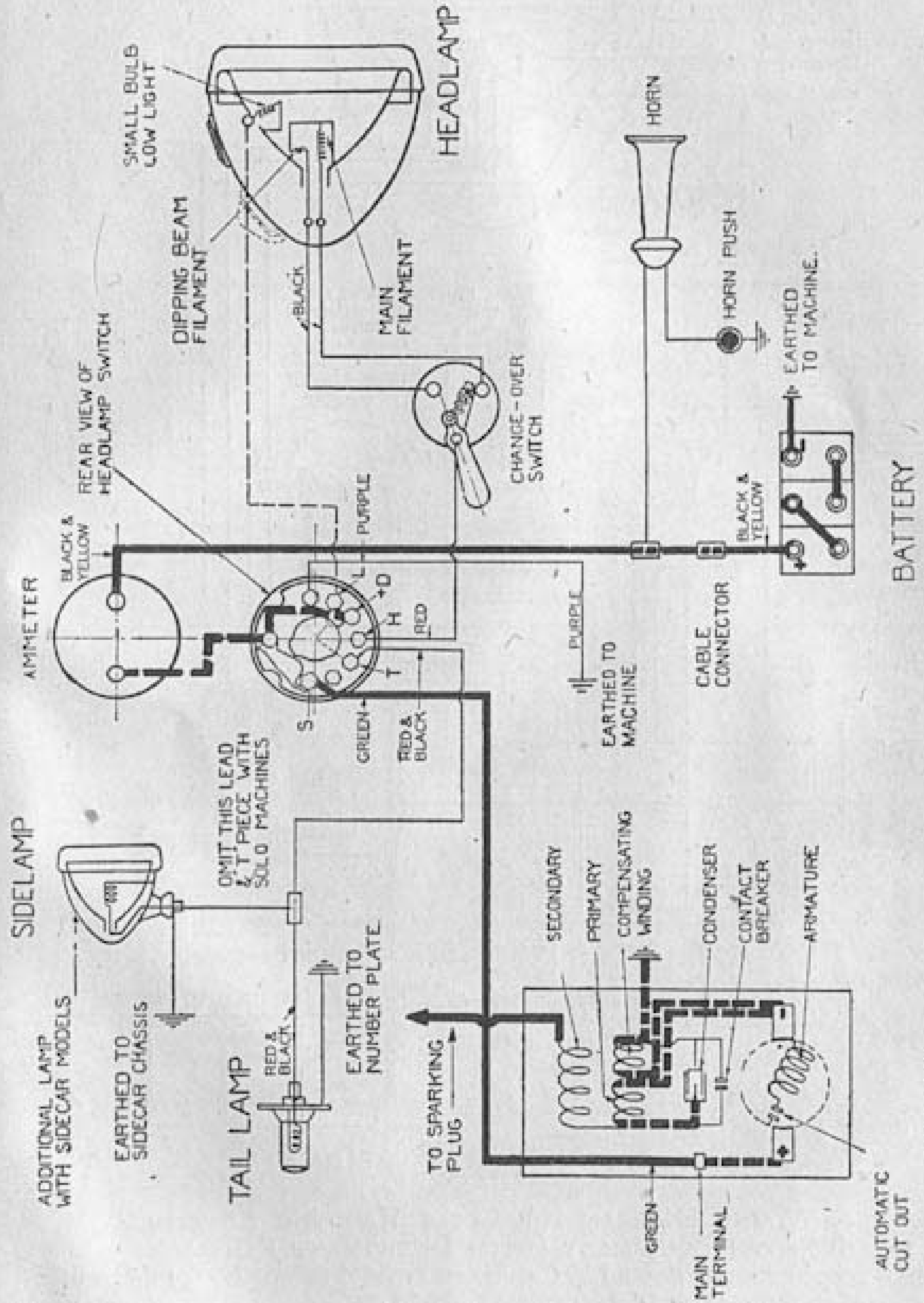


FIG. 48.—WIRING DIAGRAM FOR LUCAS "MAGLITA" COMBINED LIGHTING AND IGNITION EQUIPMENT.

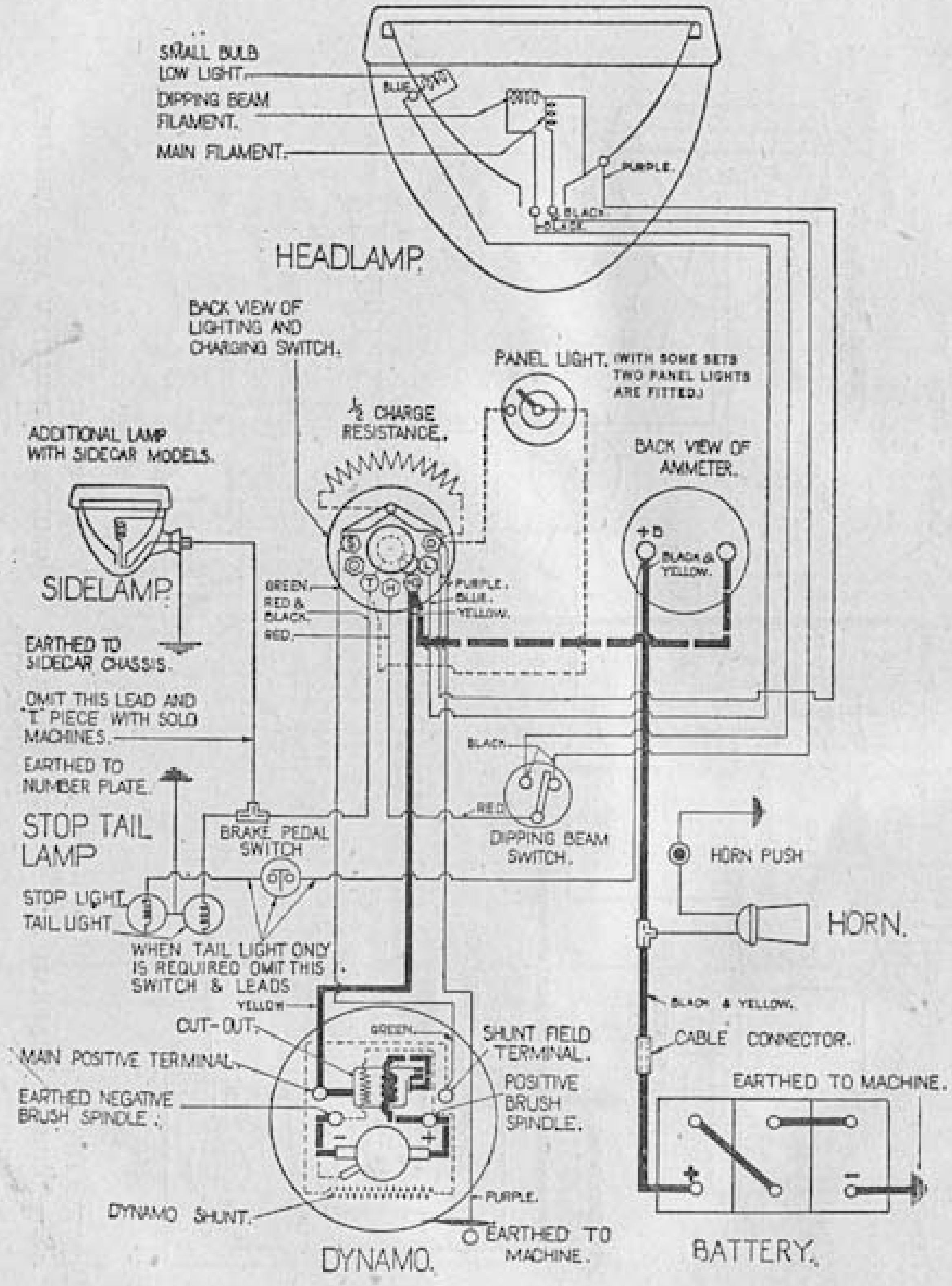


Fig. 49.—Wiring Diagram for Lucas Magdyno Lighting and Ignition Equipment (with Instrument Panel).
Internal connections dotted. Cable ends identified by coloured sleevings. Magdyno, type MS.

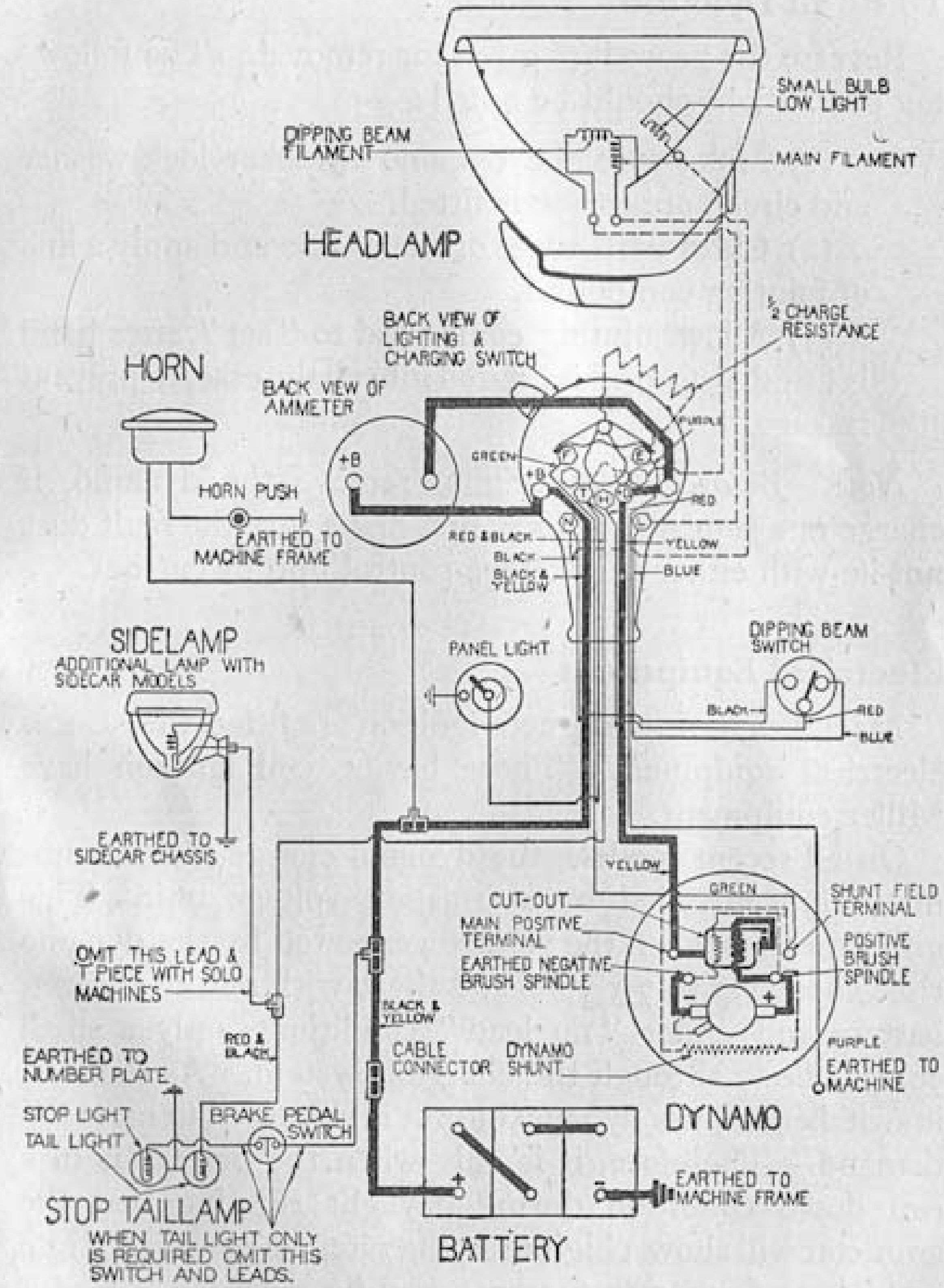


Fig. 50.—Wiring Diagram for Lucas Magdyno Lighting and Ignition Equipment.

To Re-fit Dynamo

Reverse the procedure given for removal. The following precautions should be noted :—

(1) Make sure the dynamo sprocket lock-washer and circlip are correctly fitted.

(2) Clean both edges of chain-case and apply a line of jointing compound.

(3) Allow jointing compound to "set" after band is fitted, before oil is poured into chain-case, to prevent leakage.

Note.—Before attempting to remove the dynamo, if charge rate is unsatisfactory, first make sure the fault does not lie with either the voltage control unit or cut-out.

Electrical Equipment

Machines having magneto ignition are fitted with Lucas electrical equipment. Those having coil ignition have Miller equipment.

On all recent models, the dynamo charge rate is automatically controlled by a constant voltage unit. This unit functions when the voltage generated by the dynamo rises above 7·3 to 7·5 volts and then, with a fully charged battery and under "no load" conditions, only a small current flows through the charging system. As the load is switched on, the dynamo output is increased to meet the demand. Therefore, it is only when the battery is in a run down condition during daylight running that the ammeter will show a high charging rate, when a charge rate as high as from 5 to 6 amps. may be recorded. Under normal conditions, the charge rate is between 2 and 4 amps., according to the state of the battery.

This constant voltage system is designed to maintain a fully charged battery without the risk of overcharging,

once so commonly experienced with lighting sets having only switch charging control.

All the wiring is the single-pole type, the frame of the machine being used for the negative or earth return.

Except on competition, ex-W.D. and post-war models,

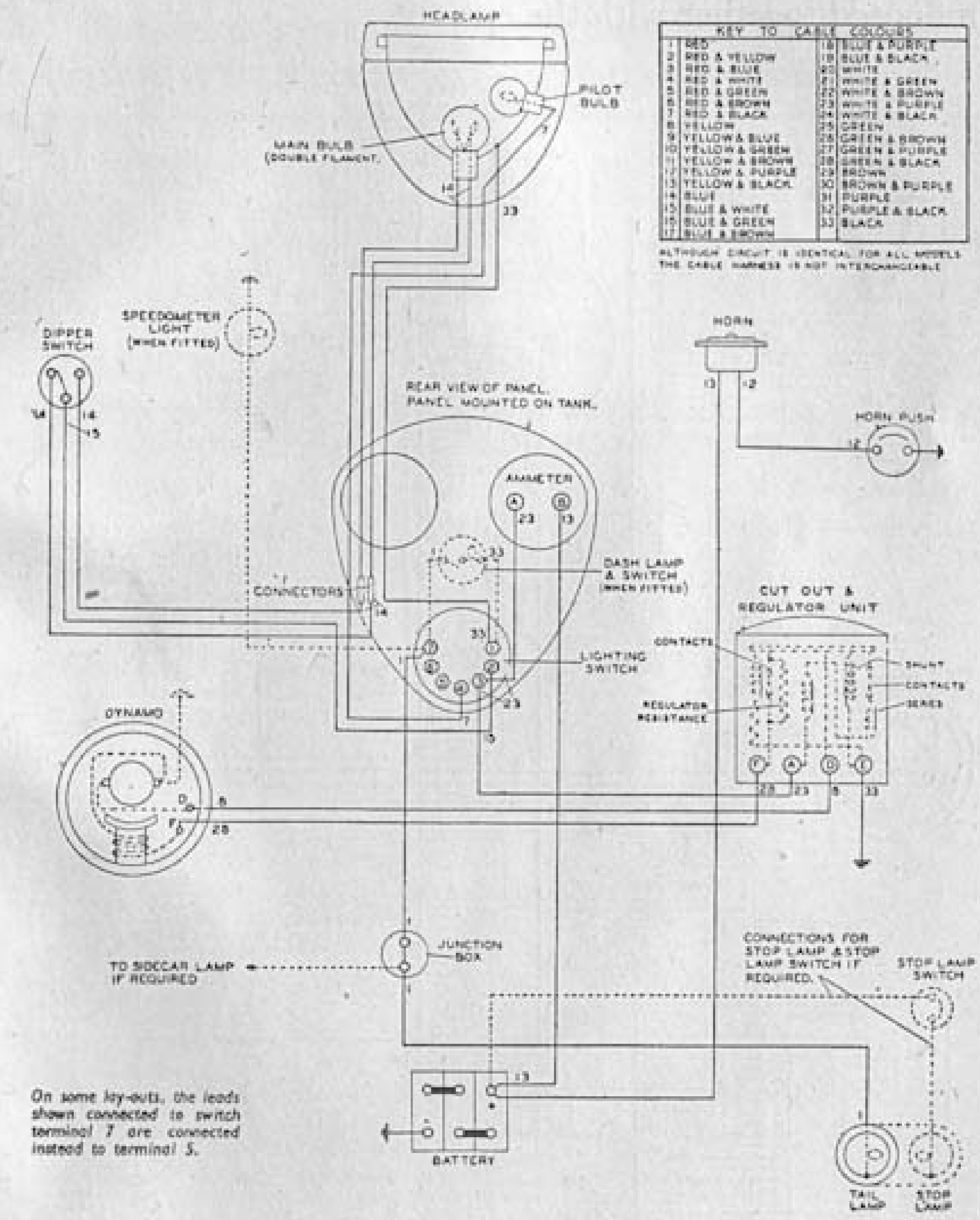


FIG. 51.—WIRING DIAGRAM FOR LUCAS MAGDYNO AND SEPARATE DYNAMO, COMPENSATED VOLTAGE CONTROL EQUIPMENT (WITH INSTRUMENT PANEL).

the main lighting switch is located in the panel mounted on top of the petrol tank. On competition models it is located in the back of the headlamp.

Regulator and Cut-out

The voltage control unit consists of a regulator which is mounted together with the cut-out.

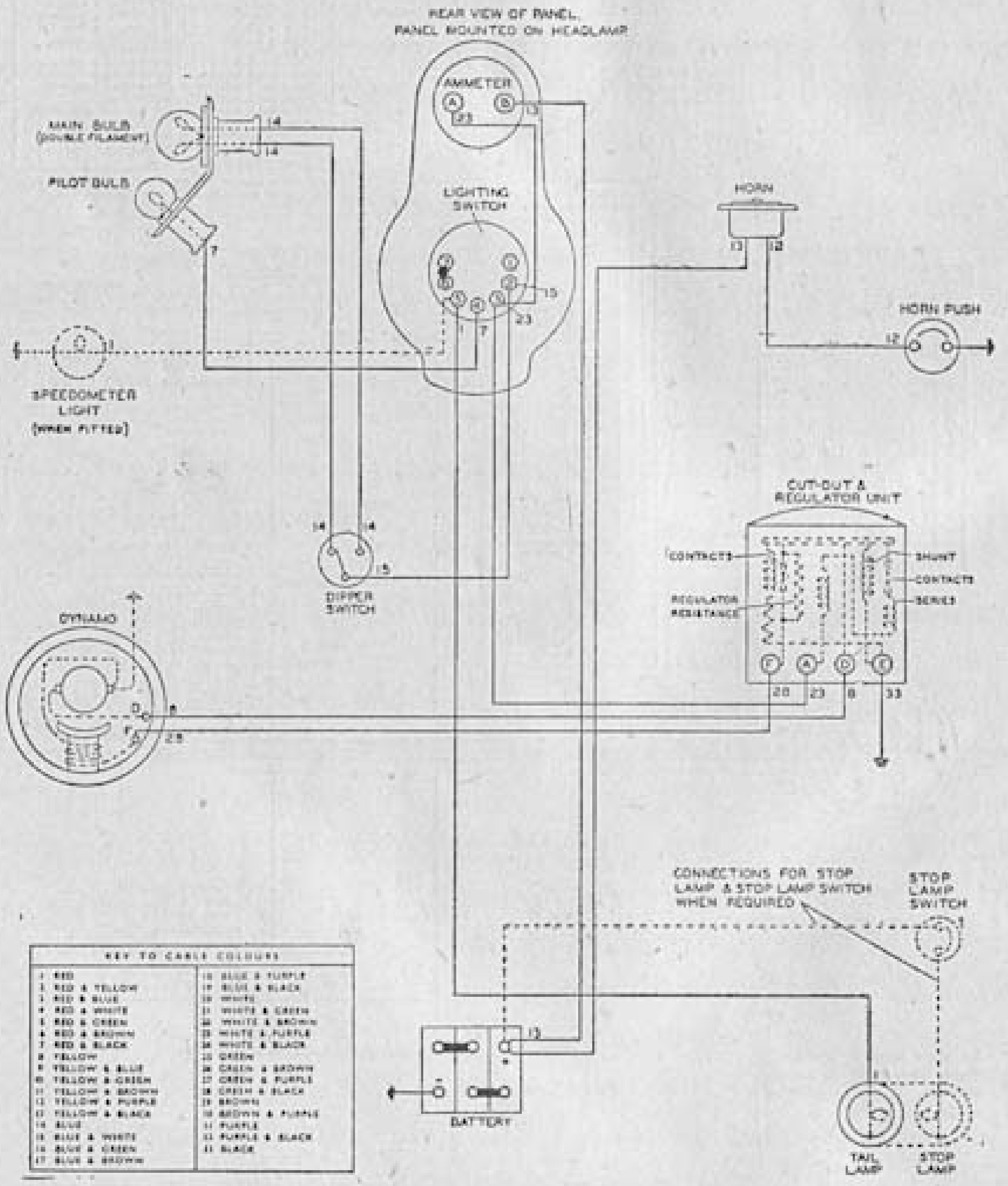


Fig. 52.—Wiring Diagram for Lucas Magdyno and Separate Dynamo, Compensated Voltage Control Equipment, without Instrument Panel.

The regulator causes the dynamo to give an output which varies according to the load on the battery and its state of charge.

When the battery is discharged, the dynamo gives high output, so that the battery receives a quick recharge which brings it back to its normal state in the minimum possible time. On the other hand, if the battery is fully charged, the dynamo is arranged to give only a trickle charge which

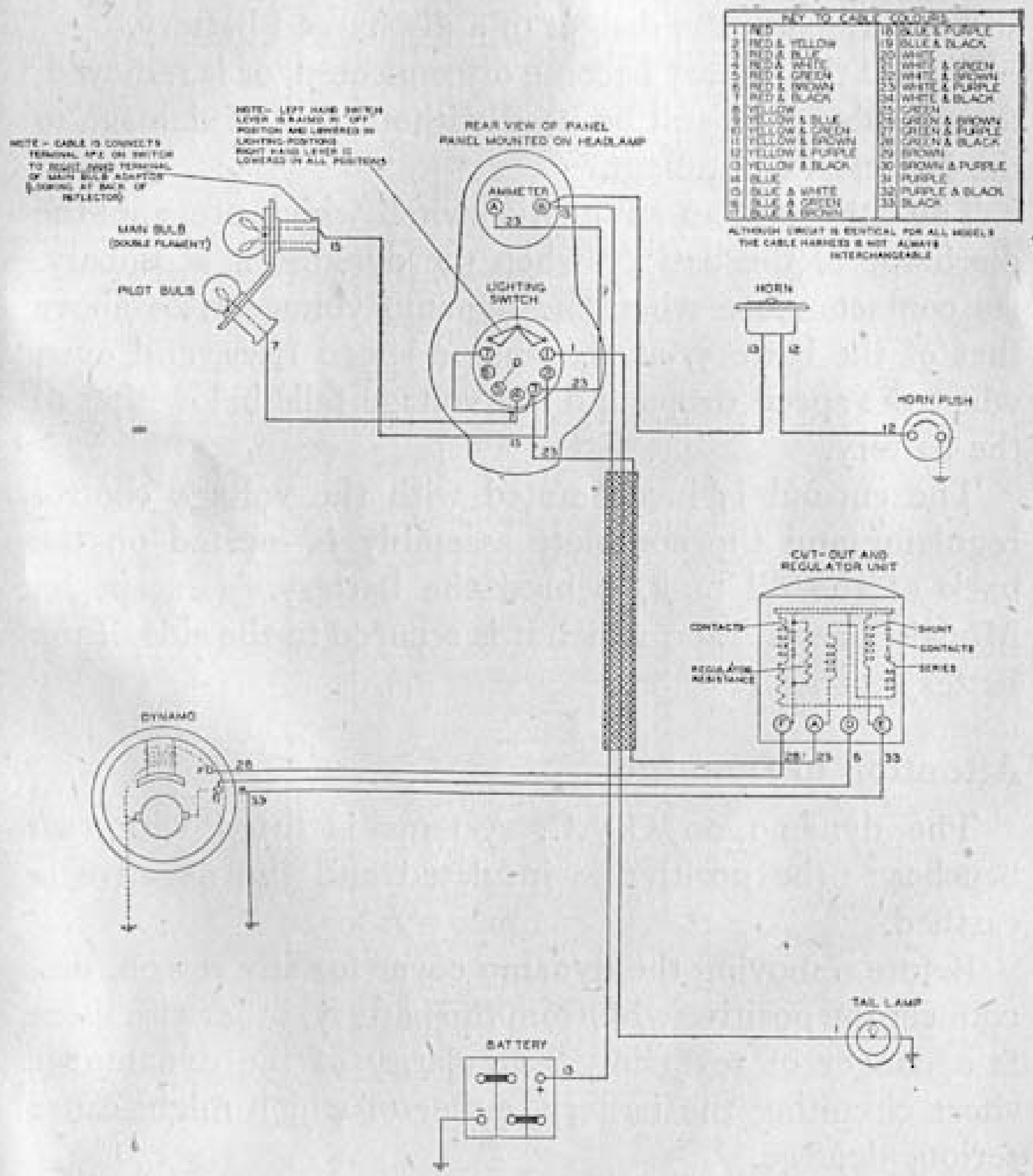


Fig. 53.—Wiring Diagram for Ex-W.D. and Post-war Models.

is sufficient to keep it in good condition without the possibility of causing damage to the battery by over-charging. In addition to controlling output of the dynamo according to the condition of the battery, the regulator provides for an increase of output to balance current taken by the lamps or other accessories whenever they are switched on.

This compensated voltage control (C.V.C.) system ensures the battery is charged, even during the winter, and it eliminates the danger of a discharged battery.

Should the battery become disconnected, or is removed, the machine may still be used without fear of damage to the electrical equipment.

The cut-out is an automatic switch which prevents the discharge of the battery when the dynamo is stationary. Its contacts close when the dynamo voltage rises above that of the battery, as the engine speed rises, and open when the speed drops and the voltage falls below that of the battery.

The cut-out is incorporated with the voltage control regulator and the complete assembly is located on the back of the oil tank, behind the battery. (Except on Models 2 and 2A, on which it is secured to the side of the battery carrier.)

Attention to Dynamo

The dynamo on C.V.C. systems is fitted with two brushes; the positive is insulated and the negative is earthed.

Before removing the dynamo cover for any reason, disconnect the positive wire from the battery, otherwise there is a danger of reversing the polarity of the dynamo or short circuiting the battery, either of which might cause serious damage.

Occasionally examine the dynamo brushes. They can

be removed from their holders when the spring lever is held aside. They should slide freely in their holders and make good contact with the commutator. If the brushes are dirty or greasy, clean them with a cloth moistened with

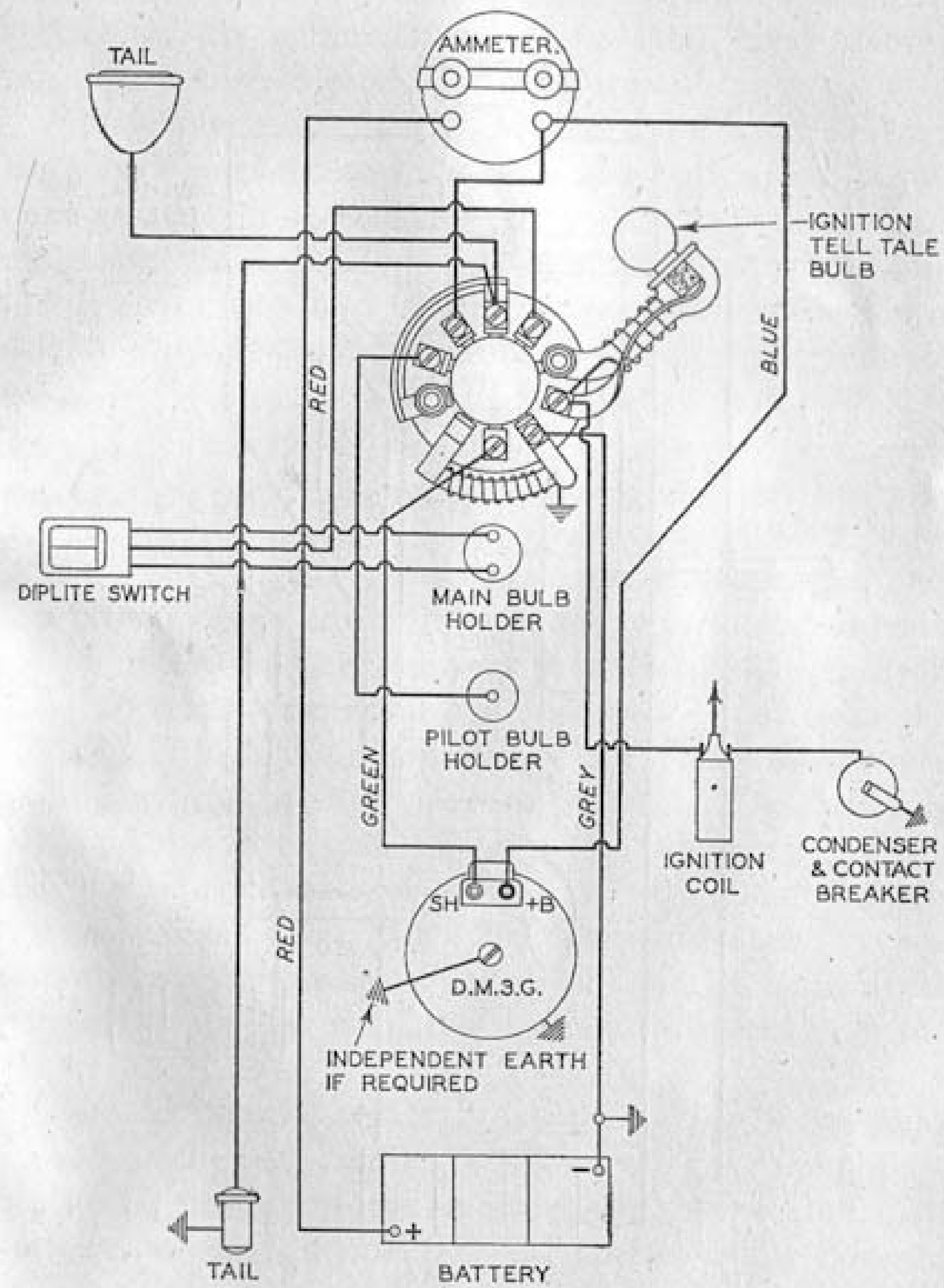


FIG. 54.—WIRING DIAGRAM FOR MILLER CHARGING, LIGHTING AND COIL IGNITION EQUIPMENT (THIRD BRUSH DYNAMO).

petrol. Replace the brushes in their original position. After long service, when the brushes have become so worn that they will not bear properly on the commutator they should be replaced with new.

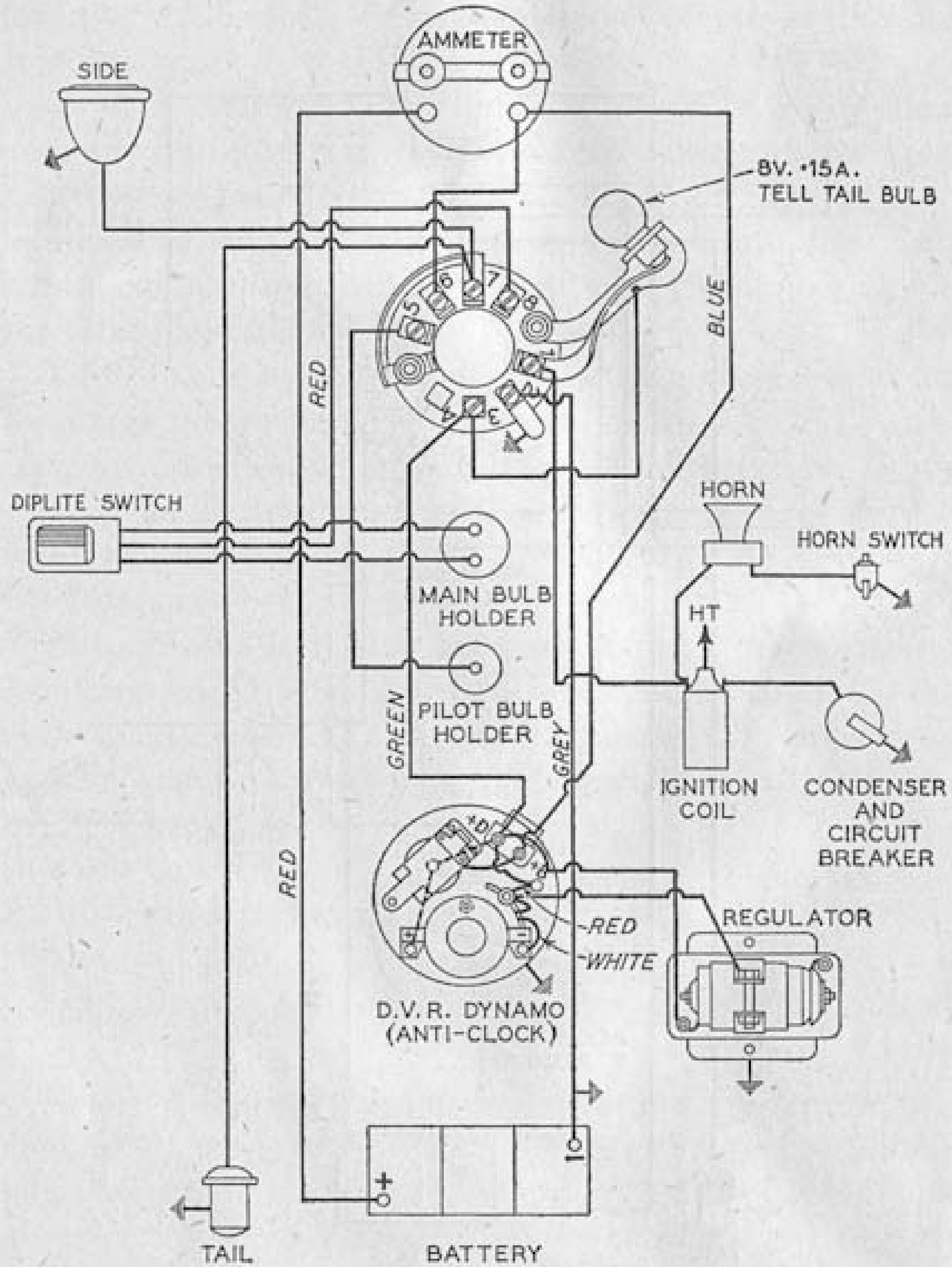


FIG. 55.—WIRING DIAGRAM FOR MILLER CHARGING, LIGHTING AND COIL IGNITION (COMPENSATED VOLTAGE CONTROL).

Keep the commutator clean and free from oil. The best method of cleaning without disconnecting any leads (wires), is to remove one of the brushes from its holder and, inserting in its place a soft duster, hold the duster, by means of a suitably shaped piece of wood, against the surface of the commutator, at the same time turning the engine so as to rotate the armature.

A magdyno unit is fitted to Models 2 and 2A. This is a combined magneto and dynamo, and both are self-contained units. The magneto portion forms the base part and takes the drive from the engine camshaft chain and the dynamo is secured to it by a strap and screws, and is driven from the magneto armature shaft by a train of gears.

Magneto Maintenance

Occasionally remove the high-tension pick-up, remove the carbon brush and spring that slide in the brass-lined sleeve of the pick-up, and, with petrol and rag, clean away all traces of oil and carbon dust. Then clean the slip ring, which is on the end of the magneto armature and on which the carbon brush presses. The best way of doing this is to take an ordinary lead pencil and, on the unsharpened end, wrap one or two folds of a soft duster, insert this in the opening disclosed by the removal of the pick-up and push gently against the bottom of the slip ring, at the same time revolving the engine.

Then replace the carbon brush and spring in the pick-up and fix the pick-up to the magneto. Take the opportunity of examining the high-tension cable, and if it appears perished, denoted by the surface being covered by a multiplicity of small cracks, it is advisable to replace with new.

Magneto Contact Breaker

About every three months, remove the contact-breaker cover and examine the contacts. On the face-cam type one contact point is mounted on the end of the spring blade. The other point is adjustable and screws into the face of the magneto and is locked in position by a nut. If the points are burned or blackened, clean them with the finest grade of emery cloth and afterwards clean them with a rag moistened with petrol.

Check the gap between the two points by turning the engine till both points are separated and measure the gap. The gap should be 0·012 in. and a gauge this thickness is a part of the magneto spanner. The gauge should just pass between the points without any binding or slackness. If necessary, adjust the gap by slackening the lock-nut on the adjustable point and screwing the point inwards, to increase the gap, or outwards, to decrease it. Then tighten the lock-nut and recheck the gap.

On Models 2 and 2A, the magdyno has a rotating type of contact breaker. One contact point is mounted on the end of a steel rocker-arm and the other, which is adjustable, is screwed into a brass block in the centre of the contact breaker. To decrease the gap between the points this adjustable point is unscrewed and vice versa to increase the gap.

On this type of contact breaker it is essential the rocker-arm is quite free. If its movement appears to be sluggish, slacken the two screws that secure the two ends of the rocker-arm spring, swing aside the spring blade that retains the arm in position and pull the arm from the pin on which it hinges. Clean the steel pin, and the fibre bush mounted in the rocker-arm, with rag moistened with petrol, and lubricate the pin with an extremely minute

quantity of vaseline, finally replacing the arm, the spring blade and tightening the two spring-retaining screws.

Coil Ignition Contact Breaker

On models equipped with coil ignition, the contact breaker is mounted in an aluminium housing that is an integral part of the timing-gear cover on the crankcase.

One contact point is mounted on the end of a steel rocker-arm, the other, which is adjustable, is screwed into a bracket in the centre of the contact breaker. This point is locked in position by a nut.

Check the gap between the points by turning the engine till both points are separated and measure the gap. The gap should be 0·018 in. and a gauge this thickness should just pass between the points without any binding or slackness. If necessary, adjust the gap by slackening the lock-nut on the adjustable point and screwing this point inwards, to increase the gap, or outwards, to decrease it. Then tighten the lock-nut and recheck the gap.

The interior of the aluminium housing should be kept clean of oil and this can best be done by applying a little petrol with a brush.

Sparking-plugs

All models made prior to 1938, excepting O.H.C. models, were fitted with 18-mm. plugs. From then onwards, 14-mm. plugs were used.

1931 to 1937.	O.H.V. Models .	Lodge H. 1. type.
1931 to 1937.	S.V. Models .	Lodge T.S. 3. type.
1938 to 1939.	O.H.V. Models .	Lodge H. 14 or H. 14 type.
1938 to 1939.	S.V. Models .	Lodge C. 14 type.
1939 to 1949.	O.H.V. Models .	Lodge H. 14 type.

Normal plug gaps—0·018 in.–0·020 in.

If the plug points are set too closely there will be a tendency to misfire, and this may be accompanied by explosions in the silencer.

If the plug points are set too far apart, starting will be difficult and, in any case, an undue strain will be placed on the insulation of the magneto armature, or, in the case of coil ignition, on the coil.

YEAR OF A.J.S. MODELS

If doubt exists as to the model or year of manufacture, the makers will confirm the model if the complete engine and frame numbers, with all letters and figures that may precede the actual numbers, are given with the enquiry. Cases are known when the cubic capacity of the engine has been shown incorrectly in the registration book. It is possible to determine the year of manufacture of models introduced in 1935 and onwards, by the two figures that precede the engine serial number. For example, 35/12 would indicate a 1935 model of 250 c.c. and 35/26 a model of the same year of 350 c.c.

APPENDIX

GEAR RATIOS—MODEL 7R

Engine Sprocket.	Rear-wheel Sprocket.	Top-gear Ratio.
22 Teeth	56 Teeth	5·08
21 ,,	54 ,,	5·14
22 ,,	57 ,,	5·18
21 ,, *	55 ,,	5·24
21 ,,	56 ,,	5·33
20 ,,	54 ,,	5·40
21 ,,	57 ,,	5·43
20 ,,	55 ,,	5·50
20 ,,	56 ,,	5·60
19 ,,	54 ,,	5·68

Intermediate ratios 1948/9 gearbox: 1·936, 1·35, 1·136, 1–1.
Intermediate ratios 1950: 1·87, 1·35, 1·09, 1–1.

* Standard sprockets.

TWIN-CYLINDER GEAR RATIOS

Engine Sprocket.	1st Gear.	2nd Gear.	3rd Gear.	Top Gear.
19 Teeth	14·7	9·7	7·0	5·5
20 ,, *	14·0	9·2	6·7	5·25
21 ,,	13·4	8·8	6·4	5·0
Internal ratios	2·67	1·76	1·28	1–1

* Standard sprockets for Twin Models.

GEAR RATIOS—MODELS 16M, 16S, 18S

Engine Sprocket.	1st Gear.	2nd Gear.	3rd Gear.	Top Gear.
15 Teeth	18·69	12·32	8·96	7·0
16 ,,	17·5	11·54	8·39	6·56
17 ,,	16·44	10·84	7·88	6·16
18 ,, *	15·57	10·26	7·47	5·83
19 ,,	14·6	9·6	7·0	5·49
20 ,,	14·01	9·24	6·72	5·25
21 ,, †	13·35	8·8	6·4	5·0
Internal ratios	2·67	1·76	1·28	1–1

* Standard sprocket for 16M, 16S.
† Standard sprocket for 18S.

GEAR RATIOS—MODELS 16C, 18C

Engine Sprocket.	1st Gear.	2nd Gear.	3rd Gear.	Top Gear.
15 Teeth	22·12	14·63	8·96	7·0
16 ,, *	20·72	13·71	8·39	6·56
17 ,,	19·46	12·87	7·88	6·16
18 ,, †	18·44	12·20	7·47	5·83
19 ,,	17·34	11·47	7·0	5·49
20 ,,	16·59	10·97	6·72	5·25
21 ,,	15·8	10·45	6·4	5·0
Internal ratios	3·16	2·09	1·28	1–1

* Standard sprocket for 16C.
† Standard sprocket for 18C.

Note.—Gear ratio *chart applies also to pre-war Models using C.P. type gearbox.*

TECHNICAL DATA

	1945/ 16M.	1945/ 18.	1945/ 16C.	1945/ 18C.	1946/ 16M.	1946/ 18.
Bore, m.m.	69	82·5	69	82·5	69	82·5
Stroke, m.m.	93	93	93	93	93	93
Capacity, c.c.	347	498	347	498	347	498
B.H.P. @ R.P.M. acceptance	16 @ 5600	23 @ 5400	16 @ 5600	23 @ 5400	16 @ 5600	23 @ 5400
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.T.D.C.	65°	65°	65°	65°	65°	65°
Exhaust closes A.B.D.C.	30°	30°	30°	30°	30°	30°
Ignition before T.D.C., full advance	7/16	7/16	7/16	7/16	7/16	7/16
Tappet clearance, engine cold	All models nil clearance Set with piston on T.D.C. firing stroke					
Carburettor, 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	2·7187	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	All 0·012					
Gear-box lubricant	1¼ pints light grease					
Front fork fluid, S.A.E. 20	All 6¼ ozs.					
Rear frame fluid, S.A.E. 20	Spring frame models only					
Petrol tank capacity, pints	All 24 pints					
Petrol tank reserve, pints	All 4 pints					
Oil tank capacity, pints	All 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	All models 7/8 −0·0010 −0·0013					
Connecting-rod length, centres	All 7⅜					

(All dimensions are in inches unless otherwise indicated.)

TECHNICAL DATA

	1946/ 16C.	1946/ 18C.	1947/ 16M.	1947/ 18.	1947/ 16C.	1947/ 18C.
Bore, m.m.	69	82·5	69	82·5	69	82·5
Stroke, m.m.	93	93	93	93	93	93
Capacity, c.c.	347	498	347	498	347	498
B.H.P. @ R.P.M. acceptance	16 @ 5600	23 @ 5400	16 @ 5600	23 @ 5400	16 @ 5600	23 @ 5400
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.T.D.C.	65°	65°	65°	65°	65°	65°
Exhaust closes A.B.D.C.	30°	30°	30°	30°	30°	30°
Ignition before T.D.C., full advance	7/16	7/16	7/16	7/16	7/16	7/16
Tappet clearance, engine cold	All models nil clearance. Set with piston on T.D.C. firing stroke					
Carburettor, 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	2·7187	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	All 0·012					
Gear-box lubricant	1¾ pints light grease					
Front fork fluid, S.A.E. 20	All 6½ ozs.					
Rear frame fluid, S.A.E. 20	Spring frame models only					
Petrol tank capacity, pints	All 24 pints					
Petrol tank reserve, pints	All 4 pints					
Oil tank capacity, pints	All 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	All models 7/8 −0·0010 −0·0013					
Connecting-rod length, centres	All 7⅜	All 6⅞				

(All dimensions are in inches unless otherwise indicated.)

TECHNICAL DATA

	1948/ 16M.	1948/ 18.	1948/ 16C.	1948/ 18C.	1949/ 18M.	1949/ 18.
Bore, m.m.	69	82·5	69	82·5	69	82·5
Stroke, m.m.	93	93	93	93	93	93
Capacity, c.c.	347	498	347	498	347	498
B.H.P. @ R.P.M. acceptance	16 @ 5600	23 @ 5400	16 @ 5600	23 @ 5400	16 @ 5600	23 @ 5400
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.T.D.C.	65°	65°	65°	65°	65°	65°
Exhaust closes A.B.D.C.	30°	30°	30°	30°	30°	30°
Ignition before T.D.C., full advance	7/16	7/16	7/16	7/16	1/2	1/2
Tappet clearance, engine cold	All models nil clearance. Set with piston on T.D.C. firing stroke					
Carburettor, 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	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	F80
Magneto contact gap	All 0·012					
Gear-box lubricant	1 pint engine oil					
Front fork fluid, S.A.E. 20	All 10 ozs.					
Rear frame fluid, S.A.E. 20	Spring frame models only					
Petrol tank capacity, pints	All 24 pints					
Petrol tank reserve, pints	All 4 pints					
Oil tank capacity, pints	All 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	All models 7/8 −0·0010 −0·0013					
Connecting-rod length, centres	All 6⅞					

(All dimensions are in inches unless otherwise indicated.)

TECHNICAL DATA

	1949/ 16C.	1949/ 18C.	1950/51 16M.	1950/51 18.	1950/51 16C.	1950/51 18C.
Bore, m.m.	69	82·5	69	82·5	69	82·5
Stroke, m.m.	93	93	93	93	93	93
Capacity, c.c.	347	498	347	498	347	498
B.H.P. @ R.P.M. acceptance	16 @ 5600	23 @ 5400	16 @ 5600	23 @ 5400	16 @ 5600	23 @ 5400
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.T.D.C.	65°	65°	65°	65°	65°	65°
Exhaust closes A.B.D.C.	30°	30°	30°	30°	30°	30°
Ignition before T.D.C., full advance	½	½	½	½	½	½
Tappet clearance, engine cold	All models nil clearance Set with piston on T.D.C. firing stroke					
Carburettor, bore size	1	1 5/32	1	1 5/32	1	1 5/32
Main jet	150	180	150	180	150	180
Slide	6/4	29/4	6/4	29/4	6/4	29/4
Needle position	3	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	FE80	F80	FE80
Magneto contact gap	All 0·012					
Gear-box lubricant	1 pint engine oil					
Front fork fluid, S.A.E. 20	All 10 ozs.					
Rear frame fluid, S.A.E. 20	Spring frame models only	1¾ ozs.				
Petrol tank capacity, pints	All 24 pints	All 18 pints				
Petrol tank reserve, pints	All 4 pints					
Oil tank capacity, pints	All 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	All models ⅞ −0·0010 −0·0013					
Connecting-rod length, centres	All 6⅜					

(All dimensions are in inches unless otherwise indicated.)

TECHNICAL DATA

	1948/ 7R.	1949/ 7R.	1950/51 7R.	1949/ Twin.	1950/51 Twin.
Bore, m.m.	74	74	74	66	66
Stroke, m.m.	81	81	81	72·8	72·8
Capacity, c.c.	348	348	348	498	498
B.H.P. @ R.P.M. acceptance	31 @ 7000	31 @ 7000	33 @ 7000	30 @ 7000	30 @ 7000
Compression ratio	8·5 *	8·5 *	8·5 *	7·1	7·1
Valve timing					
Inlet opens B.T.D.C.	63°	63°	63°	35° †	35°
Inlet closes A.B.D.C.	73°	73°	73°	65°	65°
Exhaust opens B.T.D.C.	62°	62°	62°	65°	65°
Exhaust closes A.B.D.C.	43°	43°	43°	35°	35°
Ignition before T.D.C., full advance	40°	40°	40°	⅜ 39°	⅜ 39°
Tappet clearance, engine cold					
Inlet	0·005	0·005	0·005	0·006	0·006
Exhaust	0·014	0·014	0·014	0·006	0·006
Carburettor, bore size	1⅛	1⅛	1⅛	1	1
Main jet	400	400	400	180	180
Slide	4	4	4	6/3	6/3
Needle jet	109	109	109	4·061	4·061
Needle	—	—	—	6	6
K.L.G. sparking plug	689	689	689	FE80	FE80
Magneto contact gap	All 0·012				
Gear-box lubricant	1 pint engine oil				
Front fork fluid, S.A.E. 20	8¾ ozs.			10 ozs.	
Rear frame fluid, S.A.E. 20	1¾ ozs.			1¾ ozs.	
Petrol tank capacity, pints	32	32	36	32	32
Petrol tank reserve, pints	—	—	—	4	4
Oil tank capacity, pints	8	8	8	4	4
Top of skirt, piston diameter	2·904	2·904	2·904	2·5976	2·5976
Top of skirt, mean diameter	—	—	—	2·59725	2·59725
Bottom of skirt, piston size	2·905	2·905	2·905	2·5984	2·5984
Bottom of skirt, mean diameter				2·59765	2·59765
Gudgeon-pin size	0·875	0·875	0·875	0·7498	0·7498
Connecting-rod length, centres	6·375	6·375	6·375	5·75	5·75

* Octane 72. † With 0·012 tappet clearance.

(All dimensions are in inches unless otherwise indicated.)

TECHNICAL DATA

	1945/ 16M.	1945/ 16C.	1945/ 18.	1945/ 18C.	1946/ 16M.	1946/ 16C.
Timing-side shaft diameter	All $\frac{7}{8}$ $^{-0·0020}_{-0·0025}$					
Rocker-axle bush	All $\frac{5}{8}$ $^{+0·00075}_{-0·00050}$					
Camshaft bush	All $\frac{1}{2}$ $^{+0·0005}_{-0·0005}$					
Rocker-axle sleeve	All high limit 0·6235, low limit 0·6230					
Camshaft axle	All $\frac{1}{2}$ $^{-0·00125}_{-0·00175}$					
Small-end bush	All $\frac{7}{8}$ $^{+0·00050}_{-0·00025}$					
Flywheel end float	All 0·025 maximum. With shock absorber spring removed					
Flywheel diameter	All 350 $7\frac{1}{8}$ × 1·098; All 500 $7\frac{3}{4}$ × 1·156					
Balance factor	All 65%					
Total rotating weight	All 350 843·3 grms. All 500 843·3 grms.					
Reciprocating weight	All 350 497·4 grms. All 500 673·2 grms.					
Balance weight	All 350 1 lb. 4 ozs. $9\frac{3}{4}$ grms. (one flywheel); All 500 1 lb. 6 ozs. $8\frac{1}{2}$ grms. (one flywheel)					
Exhaust pipe	Best length (open) all 48					
Wheel base	All 53					
Head angle	All 63°					
Trail	All $2\frac{5}{8}$					
Valve spring, free length inner	$1\frac{13}{16}$	$1\frac{13}{16}$	$1\frac{13}{16}$	$1\frac{13}{16}$	$1\frac{13}{16}$	$1\frac{13}{16}$
Valve spring, free length outer	$2\frac{1}{16}$	$2\frac{1}{16}$	$2\frac{1}{16}$	$2\frac{1}{16}$	$2\frac{1}{16}$	$2\frac{1}{16}$
Valve lift	$\frac{5}{16}$	$\frac{5}{16}$	$\frac{5}{16}$	$\frac{5}{16}$	$\frac{5}{16}$	$\frac{5}{16}$
Valve-seat angle (all engines)	45°	45°	45°	45°	45°	45°
Push-rod, overall length	$9\frac{11}{64}$	$9\frac{11}{64}$	$9\frac{5}{32}$	$9\frac{5}{32}$	$9\frac{11}{64}$	$9\frac{11}{64}$
Valve guide (inlet)	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
Protrusion (exhaust)	$\frac{5}{8}$	$\frac{5}{8}$	$\frac{5}{8}$	$\frac{5}{8}$	$\frac{5}{8}$	$\frac{5}{8}$
Valve stem (inlet)	All 0·3730 high limit and 0·3720 low limit					
Diameter (exhaust)	All 0·3715 high limit and 0·3705 low limit					
Crank-pin diameter	All 1·20375 high limit and 1·20350 low limit					
Crank-pin rollers	All 0·250 × 0·0250 (30 off)					
Connecting-rod sleeve diameter	All 1·70400 high limit and 1·70375 low limit					
Timing-side bush	All $\frac{7}{8}$ $^{+0·00075}_{+0·0}$					
Driving-side shaft	All 1·0002 high limit and 0·9997 low limit					

(All dimensions are in inches unless otherwise indicated.)

TECHNICAL DATA

	1946/ 18.	1946/ 18C.	1947/ 16M.	1947/ 16C.	1947/ 18.	1947/ 18C.
Timing-side shaft diameter	All $\frac{7}{8}$ $^{-0·0020}_{-0·0025}$					
Rocker-axle bush	All $\frac{5}{8}$ $^{+0·00075}_{-0·00050}$					
Camshaft bush	All $\frac{1}{2}$ $^{+0·0005}_{-0·0005}$					
Rocker-axle sleeve	All high limit 0·6235, low limit 0·6230					
Camshaft axle	All $\frac{1}{2}$ $^{-0·00125}_{-0·00175}$					
Small-end bush	All $\frac{7}{8}$ $^{+0·00050}_{-0·00025}$					
Flywheel end float	All 0·025 maximum. With shock absorber spring removed					
Flywheel diameter	All 350 $7\frac{1}{8}$ × 1·098; All 500 $7\frac{3}{4}$ × 1·156					
Balance factor	All 65%					
Total rotating weight	All 350 843·3 grms. All 500 843·3 grms.					
Reciprocating weight	All 350 497·4 grms. All 500 673·2 grms.					
Balance weight	All 350 1 lb. 4 ozs. $9\frac{3}{4}$ grms. (one flywheel); All 500 1 lb. 6 ozs. $8\frac{1}{2}$ grms. (one flywheel)					
Exhaust pipe	Best length (open) all 48					
Wheel base	All 53					
Head angle	All 63°					
Trail	All $2\frac{5}{8}$					
Valve spring, free length inner	$1\frac{13}{16}$	$1\frac{13}{16}$	$1\frac{13}{16}$	$1\frac{13}{16}$	$1\frac{13}{16}$	$1\frac{13}{16}$
Valve spring, free length outer	$2\frac{1}{16}$	$2\frac{1}{16}$	$2\frac{1}{16}$	$2\frac{1}{16}$	$2\frac{1}{16}$	$2\frac{1}{16}$
Valve lift	$\frac{5}{16}$	$\frac{5}{16}$	$\frac{5}{16}$	$\frac{5}{16}$	$\frac{5}{16}$	$\frac{5}{16}$
Valve-seat angle (all engines)	45°	45°	45°	45°	45°	45°
Push-rod, overall length	$9\frac{5}{32}$	$9\frac{5}{32}$	$9\frac{11}{64}$	$9\frac{11}{64}$	$9\frac{5}{32}$	$9\frac{5}{32}$
Valve guide (inlet)	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
Protrusion (exhaust)	$\frac{5}{8}$	$\frac{5}{8}$	$\frac{5}{8}$	$\frac{5}{8}$	$\frac{5}{8}$	$\frac{5}{8}$
Valve stem (inlet)	All 0·3730 high limit and 0·3720 low limit					
Diameter (exhaust)	All 0·3715 high limit and 0·3705 low limit					
Crank-pin diameter	All 1·20375 high limit and 1·20350 low limit					
Crank-pin rollers	All 0·250 × 0·0250 (30 off)					
Connecting-rod sleeve diameter	All 1·70400 high limit and 1·70375 low limit					
Timing-side bush	All $\frac{7}{8}$ $^{+0·00075}_{+0·0}$					
Driving-side shaft	All 1·0002 high limit and 0·9997 low limit					

(All dimensions are in inches unless otherwise indicated.)

TECHNICAL DATA

	1948/ 16M.	1948/ 18C.	1948/ 18.	1948/ 18C.	1949/ 18M.	1949/ 16C.
Timing-side shaft diameter	All 7/8 −0·0020 −0·0025					
Rocker-axle bush	All 5/8 +0·00075 −0·00050					
Camshaft bush	All 1/2 +0·0005 −0·0005					
Rocker-axle sleeve	All high limit 0·6235 low limit 0·6230					
Camshaft axle	All 1/2 −0·00125 −0·00175					
Small-end bush	All 7/8 +0·00050 −0·00025					
Flywheel end float	All 0·025 maximum With shock absorber spring removed					
Flywheel diameter	All engines (after 8000) 7 3/4 × 1·156					
Balance factor	All 65%					
Total rotating weight	All 350 843·3 grms. All 500 843·3 grms.					
Reciprocating weight	All 350 497·4 grms. All 500 673·2 grms.					
Balance weight	All 350 1 lb. 4 ozs. 9 3/4 grms. (one flywheel) All 500 1 lb. 6 ozs. 8 1/2 grms. (one flywheel)					
Exhaust pipe	Best length (open) all 48					
Wheel base	53	53 5/16	53	53 5/16	54	54
Head angle	63 1/2°	63 1/2°	63 1/2°	63 1/2°	63 1/2°	63 1/2°
Trail	2 5/8	3 1/8	2 5/8	3 1/8	2 5/8	3 1/8
Valve spring, free length inner	2	2	2	2	—	—
Valve spring, free length outer	2 13/64	2 13/64	2 13/64	2 13/64	—	—
Valve lift	5/16	5/16	5/16	5/16	5/16	5/16
Valve-seat angle (all engines)	45°	45°	45°	45°	45°	45°
Push-rod, overall length	9 41/64	9 41/64	9 5/32	9 5/32	9 5/32	9 5/32
Valve guide (inlet)	1/2	1/2	1/2	1/2	1/2	1/2
Protrusion (exhaust)	9/16	9/16	9/16	9/16	9/16	9/16
Valve stem (inlet)	All 0·3730 high limit and 0·3720 low limit					
Diameter (exhaust)	All 0·3715 high limit and 0·3705 low limit					
Crank-pin diameter	All 1·20375 high limit and 1·20350 low limit					
Crank-pin rollers	All 0·250 × 0·0250 (30 off)					
Connecting-rod sleeve diameter	All 1·70400 high limit and 1·70375 low limit					
Timing-side bush	All 7/8 +0·00075 +0·0					
Driving-side shaft	All 1·0002 high limit 0·9998 low limit					

(All dimensions are in inches unless otherwise indicated.)

TECHNICAL DATA

	1949/ 18.	1949/ 18C.	1950/51 16M.	1950/51 16C.	1950/51 18.	1950/51 18C.
Timing-side shaft diameter	All 7/8 −0·0020 −0·0025		7/8 −0·00150 −0·00175			
Rocker-axle bush	All 5/8 +0·00075 −0·00050					
Camshaft bush	All 1/2 +0·0005 −0·0005					
Rocker-axle sleeve	All high limit 0·6235 low limit 0·6230					
Camshaft axle	All 1/2 −0·00125 −0·00175					
Small-end bush	All 7/8 +0·00050 −0·00025					
Flywheel end float	All 0·025 maximum With shock absorber spring removed					
Flywheel diameter	All engines (after 8000) 7 3/4 × 1·156					
Balance factor	All 65%					
Total rotating weight	All 350 843·3 grms. All 500 843·3 grms.					
Reciprocating weight	All 350 497·4 grms. All 500 673·2 grms.					
Balance weight	All 350 1 lb. 4 ozs. 9 3/4 grms. (one flywheel) All 500 1 lb. 6 ozs. 8 1/2 grms. (one flywheel)					
Exhaust pipe	Best length (open) all 48					
Wheel base	54	54	54	53	54	53
Head angle	63 1/2°	63 1/2°	63 1/2°	63°	63 1/2°	63°
Trail	2 5/8	3 1/8	2 5/8	3 5/16	2 5/8	3 5/16
Valve spring, free length inner	—	—	—	—	—	—
Valve spring, free length outer	—	—	—	—	—	—
Valve lift	5/16	5/16	5/16	5/16	5/16	5/16
Valve-seat angle (all engines)	45°	45°	45°	45°	45°	45°
Push-rod, overall length	9 5/32	9 5/32	9 5/32	9 5/32	9 5/32	9 1/16
Valve guide (inlet)	1/2	1/2	1/2	1/2	1/2	1/2
Protrusion (exhaust)	9/16	9/16	9/16	9/16	9/16	9/16
Valve stem (inlet)	All 0·3730 high limit and 0·3720 low limit					
Diameter (exhaust)	All 0·3715 high limit and 0·3705 low limit					
Crank-pin diameter	All 1·20375 high limit and 1·20350 low limit					
Crank-pin rollers	All 0·250 × 0·0250 (30 off)					
Connecting-rod sleeve diameter	All 1·70400 high limit and 1·70375 low limit					
Timing-side bush	All 7 +0·00075 +0·0		7/8 +0·0005 +0·0000			
Driving-side shaft	All 1·0002 high limit and 0·9997 low limit					

(All dimensions are in inches unless otherwise indicated.)

TECHNICAL DATA

	1948/ 7R.	1949/ 7R.	1950/51 7R.	1949/ Twin.	1950/51 Twin.
Timing-side shaft diameter	—	—	—	1 3/8 +0·0002 −0·0003	
Rocker-axle bush	—	—	—	0·5005	
Camshaft bush	—	—	—	11/16 +0·001	
Rocker-axle sleeve	—	—	—	—	—
Camshaft axle	—	—	—	11/16 −0·00175 −0·00225	
Small-end bush	0·875 +0·0005 −0·00025			3/4 +0·0005 −0·0000	
Flywheel end float	—	—	—	—	—
Flywheel diameter	7 3/4 × 1 3/64		7 1/2 × 1 1/16	—	—
Balance factor	80%			50%	
Total rotating weight	—	—	—	—	—
Reciprocating weight	—	—	—	—	—
Balance weight	—	—	—	—	—
Exhaust pipe	31 1/4	31 1/4	31 1/4	33	33
Wheel base	56	56	56	55 1/4 All spring frames	
Head angle	—	—	—	63 1/2°	63 1/2°
Trail	—	—	—	2 5/8	2 5/8
Valve spring, free length inner	—	—	—	1 13/32	1 13/32
Valve spring, free length outer	—	—	—	1 3/4	1 3/4
Valve lift	7/16 inlet 3/8 exhaust			—	—
Valve-seat angle (all engines)	45°	45°	45°	45°	45°
Push-rod, overall length	—	—	—	8 1/16	8 1/16
Valve guide (inlet)	—	—	—	—	—
Protrusion (exhaust)	—	—	—	—	—
Valve stem (inlet)	11/32	11/32	5/16	H.L. 0·27975 L.L. 0·27875	
Diameter (exhaust)	3/8	3/8	3/8	H.L. 0·3100 L.L. 0·3090	
Crank-pin diameter	H.L. 1·5150 L.L. 1·5145			1 3/8 +0·00075 −0·00025	
Crank-pin rollers	1/4 × 3/8 (14 off)		—	—	—
Connecting-rod sleeve diameter	H.L. 2·01600 L.L. 2·01575			1 3/8 +0·00025 −0·00025	
Timing-side bush	—	—	—	—	—
Driving-side shaft	1 3/8 −0·00200 −0·00225		H.L. 1·37300 L.L. 1·37275	1 3/8 +0·002 −0·003	
Centre shaft size	—	—	—	1 3/8 +0·00125 +0·00075	
Centre bearing size	—	—	—	H.L. 1·62625 L.L. 1·62575	

(All dimensions are in inches unless otherwise indicated.)

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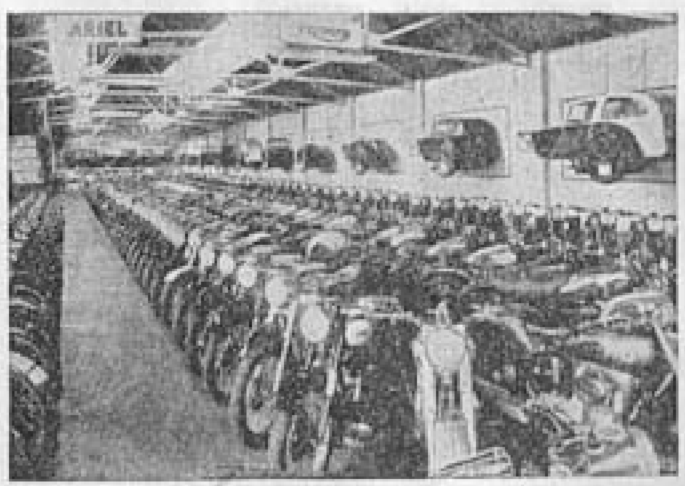

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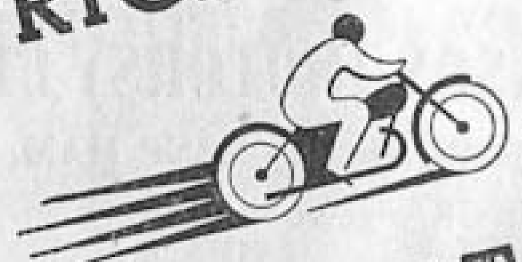

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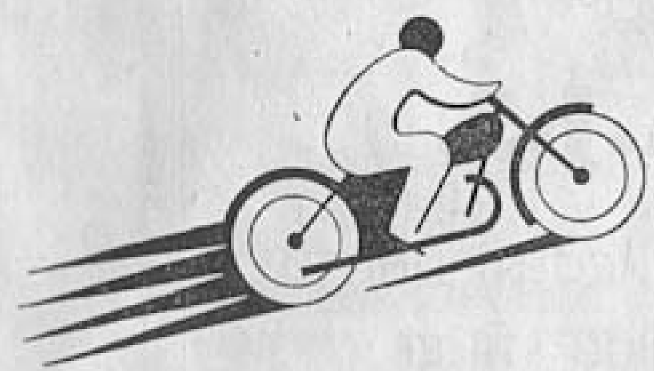

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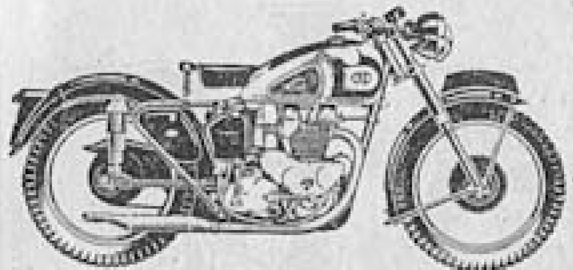

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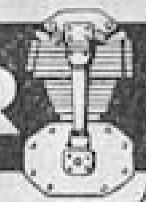

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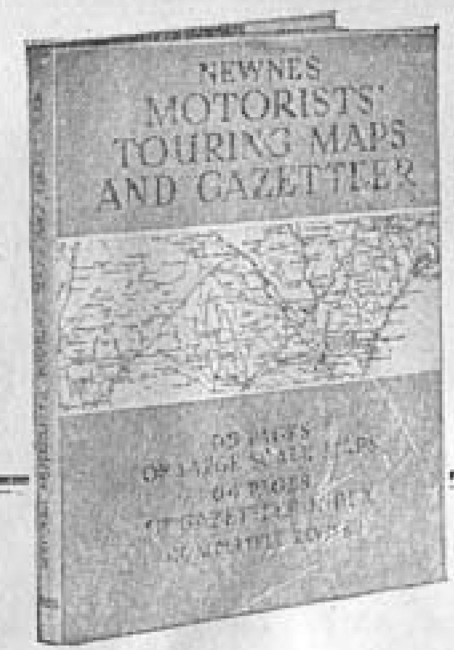

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