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The BOOK *of the* A.J.S.



W. C. HAYCRAFT

THE BOOK OF THE A.J.S.

A COMPLETE GUIDE FOR OWNERS
AND PROSPECTIVE PURCHASERS
OF A.J.S. MOTOR-CYCLES

BY
W. C. HAYCRAFT

DEALING WITH EVERY PHASE OF THE SUBJECT,
INCLUDING CHAPTERS ON DRIVING, TOURING,
PRELIMINARIES, I.C. ENGINE THEORY, TRACING
FAULTS, AND OVERHAULING

THIRD EDITION

LONDON
SIR ISAAC PITMAN & SONS, LTD.
1933

PREFACE

WORLD-WIDE trade depression during 1931 has resulted in several firms being taken over by new proprietors. On going to Press with the Third Edition of this little handbook, the author finds that the firm of Messrs. A. J. Stevens & Co., Ltd., no longer exists, the whole of their goodwill and equipment having been taken over by the well-known Matchless concern (Messrs. Colliers, Ltd., of Plumstead). It is the intention of this firm to carry on the manufacture of A.J.S. machines of exactly the same high quality as have issued from the Wolverhampton concern. During the 1932 season a limited programme is available, comprising four overhead-valve and two side-valve models. Series "T," as these machines are known, are dealt with in the present edition. They are rather similar but improved versions of the 1931 "S" series. It will be observed that series "T" includes no "camshaft" models, but speedmen and racing enthusiasts will be delighted to learn that the famous and successful "camshaft" models, on one of which Denly attained a speed of 118.98 m.p.h. at Arpagon in France, will be reintroduced as soon as the new firm has completed its reorganization of the A.J.S. manufacturing equipment now transported bodily to Plumstead. A.J.S. Big Twins will also be revived.

Series "T" will be continued practically unaltered for 1933, and hence this edition will remain quite up to date until 1934. The author has retained many useful notes for the benefit of owners of 1929-31 models, but he does not propose to deal at any length with the "camshafts," as these machines are primarily designed for racing and competition purposes and thus outside the intended sphere of this handbook.

It is only fair to conclude by mentioning that the author has no present or past connection with Messrs. A.J.S. Motor Cycles (Colliers), Ltd., to whom he is greatly indebted for supplying information and photographs.

As hitherto, the author's advice is at the disposal of readers who care to write to him c/o the Publishers.

W. C. H.

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THE BOOK OF THE A.J.S.

CHAPTER I

THE A.J.S. SERIES

Series "T." The 1932 programme, which may be regarded as a temporary measure prior to the introduction of a more comprehensive range, including overhead camshaft machines early in 1933, comprises six machines, all of which have inclined engines. Of these, four are of the overhead-valve type and two of the side-valve type. The overhead-valve models, all of which enable a rider to enjoy a 70 m.p.h. "blind" if he so desires and have extraordinary acceleration, are Models T6, TB6, T8, TB8, and their respective prices are, excluding electric lighting, £50, £40, £55, £47. Models T6, T8 have twin-port engines and *four-speed* gear-boxes, while Models TB6, TB8 are "big port" (single-port) models, and have Sturmey-Archer three-speed countershaft gear-boxes of special design. The two side-valve models are Models T5, T9, priced at £38 10s. and £49 respectively. These two machines are fast, and Model T9 is notable for the fact that it has a detachable aluminium alloy cylinder head. Below the principal characteristics of the 1932 range are given, the modifications for 1933 being dealt with on page 26.

SERIES "T" (1932-33) AT A GLANCE

Model	c.c.	Bore and Stroke (m.m.)	Valves	Lubrication	Gear Ratios	Tyres
T6	349	74 × 81	O.H.V.	Mech.	5·8, 7, 12·6, 17·4	26 × 3·25
TB6*	349	74 × 81	O.H.V.	Mech.	5·25, 8·12, 14·45	25 × 3
T8	498	84 × 90	O.H.V.	Mech.	4·81, 5·8, 10·4, 14·4	26 × 3·25
TB8	498	84 × 90	O.H.V.	Mech.	5·03, 7·38, 13·43	26 × 3·25
T5*	349	74 × 81	S.V.	Mech.	5·8, 9, 16	25 × 3
T9	498	84 × 90	S.V.	Mech.	4·81, 7·06, 12·85	26 × 3·25

* These models weigh under 224 lb. and are thus taxed at 30s. p.a. In the case of model TB6 this weight is exclusive of the weight of the tool kit (see page 29).

SPECIAL A.J.S. FEATURES

Tank-mounted Instrument Panels. Provision is made on all A.J.S. machines, except Models T5 and TB6, for the fitting of instrument panels on top of the petrol tank. These two models where electric lighting is specified are fitted with the Lucas "Maglita" lighting set, the extra price for which is £5. In this instance the lighting switch is incorporated in the headlamp, and if a speedometer is fitted it is mounted on the petrol tank itself. On all other models the lighting set specified is the Lucas "Magdyno," and the cost of fitting this (£9 10s.) includes the instrument panel shown in Fig. 1, complete with speedometer, ammeter clock, main switch, and concealed lighting switch.

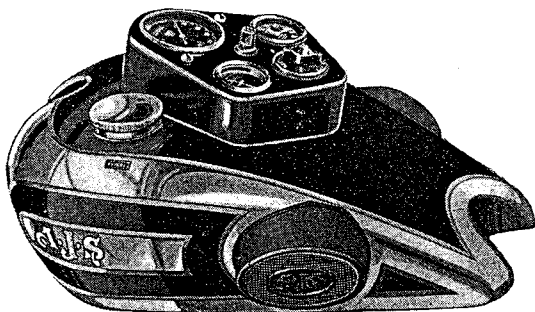


FIG. 1. SHOWING THE NEAT MOUNTING FOR THE INSTRUMENTS AND ELECTRIC LIGHTING SWITCHES (SEE PAGE 26)

Without the panel the extra charge for Lucas "Magdyno" lighting is £5 10s. If preferred, instead of the standard finish for the petrol tank (which holds 2 gal. except on Models T5, TB6), a black and chromium finish may be specified for £1 extra. The speedometer, it will be observed, is placed well forward so it may be read easily and safely while travelling fast.

Adjustable Saddle. A really excellent feature on heavyweight A.J.S. machines is the manner of mounting the saddle to make adequate allowance for the variations in physical stature of different riders. As may be seen in Fig. 2, in the case of Models T6, T8, TB8, and T9, the saddle undercarriage at the front end is provided with a bolt which may be inserted in either of three holes in a lug on the top tube, and the rear end of the undercarriage is slotted to allow of the saddle being moved backwards or forwards. As the illustration shows, the bottom of the coil spring is permanently attached to the frame.

"Clean" Handlebars. Considerable attention has recently been paid to cleaning up the handlebars. As may be observed by a glance at Fig. 25, the arrangement is now not only

exceptionally tidy, but the various levers and controls are situated so as to fall easily to the hands. Their mountings are also made integral with the bars, so that the possibility of vibration loosening them is very remote.

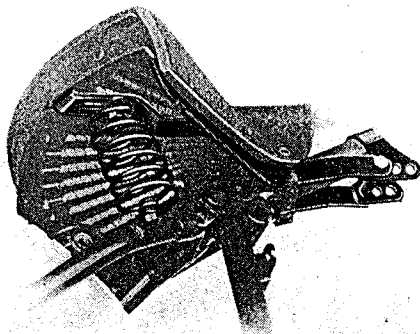


FIG. 2. THE ADJUSTABLE SADDLE

Detachable Rear Carrier. Many riders who find a carrier sometimes invaluable, but who declare that this fitment detracts

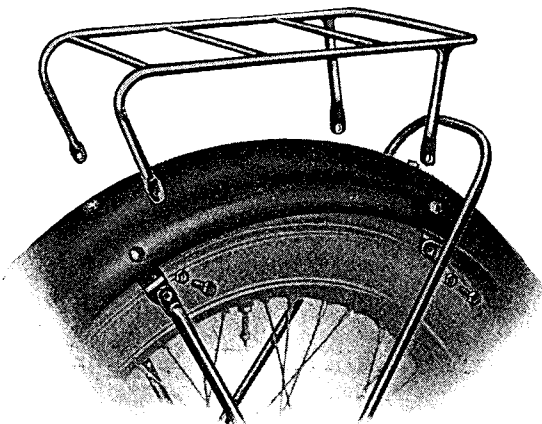


FIG. 3. THE DETACHABLE CARRIER

from the appearance of a sports model, are catered for by the designers of the A.J.S. For an extra charge of 12s. 6d. the carrier shown in Fig. 3 may be specified. Once fitted, its instant removal requires only the taking off of four nuts and bolts, leaving the

rear guard absolutely clear. The carrier itself is constructed of steel tube, oxy-acetylene welded. It is standard on T6, T8, T9.

Quickly Detachable Rear Wheels. Punctures are rare nowadays, but such things do occur when tyre treads begin to show wear. It is then that a quickly removable rear wheel is an absolute boon to the rider. To facilitate removal of the wheel the mudguard on Models T6, T8, T9 is hinged, as shown in Fig. 4. This, in conjunction with the special method of securing the rear wheel,

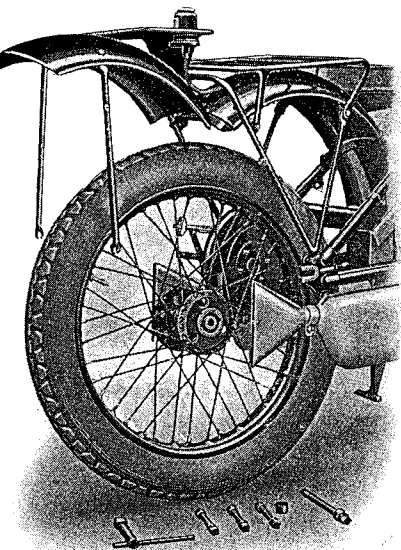


FIG. 4. SHOWING HOW READILY
THE REAR WHEEL MAY BE
REMOVED

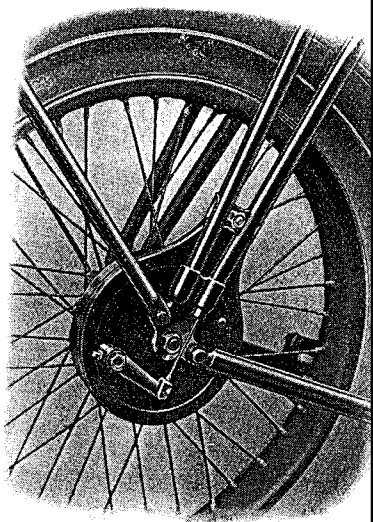


FIG. 5. HOW THE CABLE TO THE
FRONT BRAKE ANCHOR PLATE
LEVER IS LED FROM THE
HANDLEBARS

renders removal of the latter an extraordinarily simple operation devoid of any "snags." No interference with wheel alinement, brake adjustment, or transmission is involved. All the rider has to do is to remove three sleeve bolts, a centre pin and a distance piece. It would be difficult to imagine a more simple yet absolutely efficient system.

Front Brake Operation. On all models except Model T5 the operating cable of the front brake passes down the front fork blade. It is thus completely enclosed but for the small portion protruding close to the operating lever to which it is attached.

Adjustment for the Bowden cable is provided at the top of the forks.

Four-speed Gear-boxes. Four-speed gear-boxes are fitted as standard on Models T6, T8, 33/2, but may also be specified for 30s. on Models TB8 and T9. The ratios have been carefully

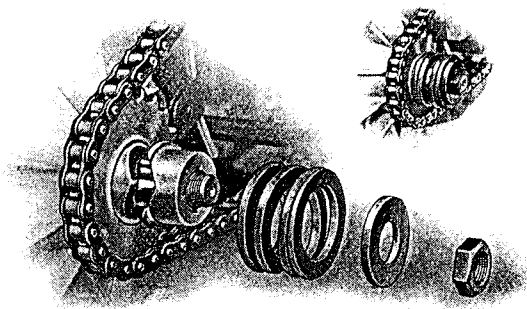


FIG. 6. SHOWING DETAILS OF TRANSMISSION SHOCK ABSORBER

chosen so as to provide a first-class, all-round performance. Acceleration and hill climbing capacity are greatly improved by the inclusion of this extra speed.

Transmission Shock-absorber. An efficient shock-absorber, details of which are shown in Fig. 6, is fitted to the engine shaft of

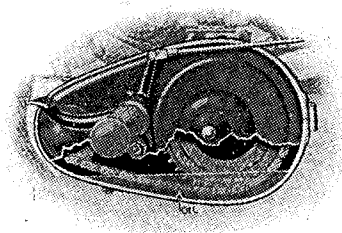


FIG. 7. PRIMARY CHAIN CASE

all models. It provides a more even torque and damps out all transmission shocks, thus imparting a sweeter top gear performance when travelling at low speeds.

Totally Enclosed Primary Drive. Every 1932 A.J.S. has the entire front chain, and also the clutch, enclosed in an oil-tight chain case (Fig. 7). The chain thus requires only periodical attention in order to maintain the oil level shown. An inspection disc at the base of the case constitutes an oil level indicator.

Adjustable Magneto Platform. The tension of the magneto driving chain can, on all A.J.S. machines, be adjusted in a very simple manner due to the provision of a special design of platform to which the magneto is secured. This adjustable platform is shown in Fig. 8. As may be seen, the platform has a radial slot which permits of the platform being tilted sufficiently to take up any reasonable amount of slack. Two long threaded bolts pass through the platform and screw into a tapped link on the opposite

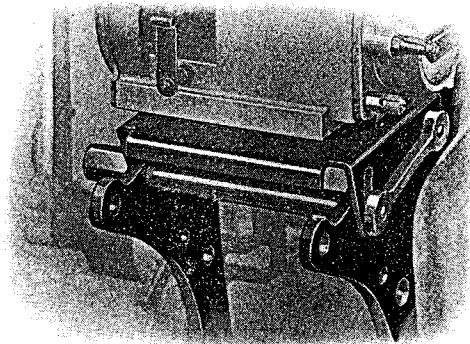


FIG. 8. ADJUSTABLE MAGNETO PLATFORM FOR TAKING UP CHAIN SLACKNESS

side. These only have to be loosened in order to raise or depress the front of the platform.

Vernier Magneto Timing. All except 33/2 and "Maglita" models have the patented system of vernier magneto timing, which enables the magneto to be timed quickly and with great precision (see page 125).

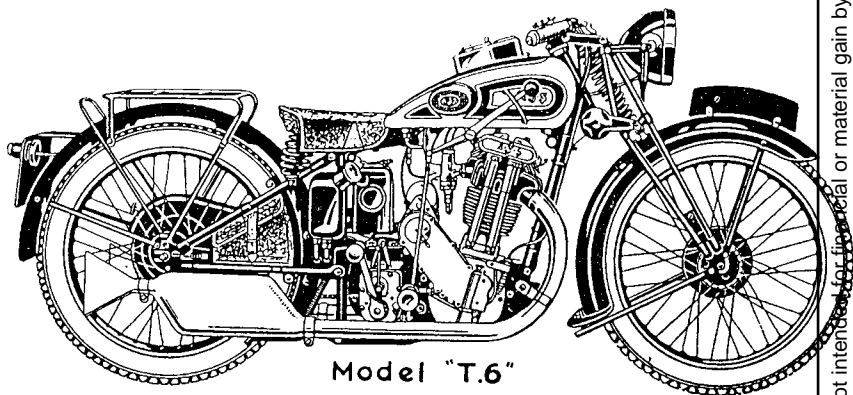
Inclined Engines. All A.J.S. motor-cycles except Models T5 and TB6 have their engines inclined forwards in the frame at an angle of 16 degrees to the vertical. On the two models mentioned the angle is 20 degrees. Besides facilitating cylinder removal this enables the magneto to be placed behind the cylinder.

Big-port Engines. Round about 1925 some single-port models were produced having unusually large diameter exhaust ports. These machines had a reputation in the motor-cycle world for their high turn of speed and general liveliness. It is therefore satisfactory to note that two big-port models are available at the present time. They are Models TB6, TB8. Both these machines are genuine "mile-eaters," and are much more flexible and pleasing to drive than their predecessors.

Detachable S.V. Cylinder Head. One side-valve model (T9) has

a detachable aluminium alloy cylinder head designed so that removal of the head for decarbonizing leaves the carburettor and valves undisturbed (see Fig. 16A). The shape of the combustion chamber is excellent with this arrangement, and the lightness of the alloy results in a very appreciable reduction in weight.

Twin-port Exhaust System. Models T6, T8 have twin ports and dual silencers of large capacity. This reduces exhaust noise to a not unpleasant "zoom" to which no one can take offence. The



Model "T.6"

FIG. 9. THE 3.49 H.P. O.H.V. DE LUXE MODEL T6 (TWO PORT)

silencers, which embody the blind-ended drilled tube principle with fishtail ends, are substantially made of sheet steel and are heavily chromium plated.

Improved Mechanical Lubrication. This system, where the oil in a separate tank is fed to and circulated throughout the engine by a double-action mechanical pump, is used on all S.V. and O.H.V. "singles." Once the correct regulator setting has been obtained no attention is necessary other than occasional draining of the crankcase and regular replenishment of the oil tank.

THE 3.49 H.P. O.H.V. DE LUXE, TWO-PORT MODEL T6

This machine, which is one of the fastest "three-fifties" on the road, combines the acceleration of a sports machine with the smooth running and flexibility of a touring machine. It can be ridden "hands-off" below 20 m.p.h., is rock steady, and has a beautiful "spongy" action of the brakes. At £50 it is indeed cheap, having regard to its fine finish and complete equipment. Its specification is as follows—

ENGINE. The power unit is of 74×81 m.m. bore and stroke giving a capacity of 349 c.c. Two large diameter, alloy steel,

tulip valves, hollowed out for lightness, are symmetrically placed at $82\frac{1}{2}^{\circ}$ to each other in the detachable cylinder head so that, when seated, their heads are roughly flush with the walls of the hemispherical combustion chamber; slightly in front, on the left-hand side of the cylinder, is a sparking plug with its electrode points pocketed within the chamber. This arrangement is ideal, having regard to instantaneous combustion, good cylinder charging and exhaustion, and last, but by no means least, good turbulence. On all O.H.V. engines the exhaust valve guide is a steel housing with phosphor bronze lining. The inlet guide is of cast iron (except TB6). Lubrication of guides is not provided.

The valves are operated by polished duralumin rockers, splined to the tubular rocker shafts, carried by a sturdily built rocker box which is fixed by four pins to the cylinder head. This rocker box has an inspection cover in the centre of which is a Tecalemit nipple for greasing the push-rod ball joints. Two coil springs fitted inside the rocker spindles keep the rocker balls in contact with the rods and also prevent rocker end play. The arms carry at their extremities grub screws and lock-nuts, which enable valve adjustment to be effected at the rocker arms. The whole of the overhead valve mechanism and the two duralumin push rods are totally enclosed and adequately lubricated. With a *hot* engine the clearance between inlet valve and rocker is $\cdot006$ in., and the exhaust clearance is $\cdot008$ in. The rockers have large area plain bearings. The crankcase valve actuating mechanism is, of course, the same as on the S.V. engines. The valve springs are noteworthy, being of the two-in-one variety. The valve movement slightly overlaps the piston stroke, and in consequence two small segments are milled off the piston crown to prevent fouling of the valves.

The piston is of aluminium alloy, and has four narrow width rings, the bottom ring being primarily designed to prevent piston slap. The gudgeon pin is hollow, and is secured in position by two spring circlips. This piston, unlike many of its type, does not suffer from that distressing malady, "piston slap." The correct gap at the rings is $\cdot005$ in. to $\cdot010$ in. The compression ratio is 6 to 1 with the standard piston, but a special high compression piston giving a ratio of 7.5 to 1 is obtainable.

Within the cast aluminium crankcase is the crankshaft assembly, comprising two heavy rimmed cast-iron flywheels of comparatively small diameter, with their main shafts running in ball bearings, and the crankpin upon which the big end roller bearing of the connecting rod is mounted. Two ball races are fitted on the driving side and one on the timing side. Those on the driving side are separated by a white-metal, oil-retaining ring (see Fig. 40). This ring has its outside ring grooved and drilled radially so that any oil reaching the ring is returned to the crankshaft.

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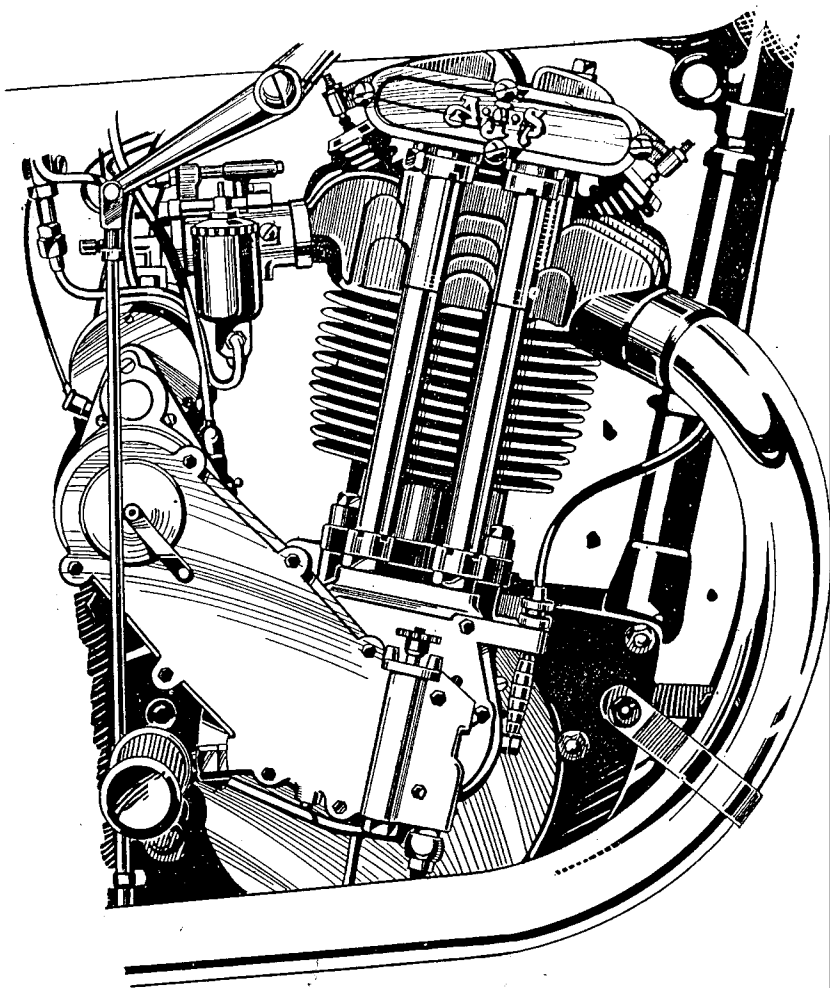


FIG. 10. THE 1932 OVERHEAD VALVE A.J.S. POWER UNIT

The engine illustrated is a 4.98 h.p. twin-port model T8, and is shown with the Bowden carburettor. The 3.49 h.p. engines are similar as regards external appearance. T6, TB6 pistons have segmented convex crowns. All others have the flat type chamfered at the sides. During 1933, overhead valve A.J.S. engines will be available as proprietary engines under the pseudonym "Majestic"

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The big end bearing is interesting, owing to the somewhat unusual mounting of the rollers. The cage is of duralumin and the rollers themselves lie end-to-end in the slots and between flanges on the crank pin; the sides of the rollers are clear of the fly-wheel bosses, and thus there is no deleterious end thrust.

A disc-type crank case breather is not used on A.J.S. machines, but merely a release pipe from the timing chest, a plain union being screwed into the timing chest and the release pipe taken from this. A non-return valve is not included, neither is it necessary.

The timing gear is extraordinarily simple, and does its duty in a noiseless and trouble-free manner. It consists of the engine main shaft small pinion and two large half-time cam wheels. The cams act directly on the tappets, no toggles being interposed, as the tappets have half-moon feet.

The new type silencers and fishtails are very effective in reducing the exhaust noise, and should absolutely guarantee the rider against police prosecution for noise, which has recently become so prevalent. The principle employed consists of the use of blind ended, and drilled, extensions to the two pipes; and it is thus utterly impossible for the gases to flow straight through. This system was thoroughly tried out before being standardized for use on the 1932 range of A.J.S. engines, and it was found that the resultant back pressure was negligible. Both silencers and exhaust pipes are heavily plated. A flange fixing now replaces a clip or screw fastening on the induction pipe for the carburettor on all except the T5 and 33/2 engines.

CARBURETTOR. A No. 76/014A Amal, 2 jet, 2 lever, semi-automatic carburettor with bottom petrol feed is fitted, and the standard setting is—jet 150; needle position, 2; type of valve, 6/4. This gives fierce acceleration and perfect slow running. Twist-grip throttle control is provided. Petrol consumption at 30 m.p.h. is over 75 m.p.g. Riders who wish to fit an Amal "acceleration pump" should note that on nearly all A.J.S. engines a conversion is simply effected. See notes on page 81.

IGNITION. The current is generated by a H.T. Lucas variable ignition type M.S.I. magneto. chain driven off a sprocket splined to an extension of the inlet camshaft. The other sprocket fits on a sleeve keyed to the armature shaft, and has a vernier adjustment for securing accurate timing. Actually, the flash across the plug electrodes is timed to occur $\frac{1}{8}$ in. before the top of the compression stroke on full advance. The sparking plug used is the Lodge H.1. The magneto is a well-protected instrument, and has, of course, a clockwise armature rotation, viewed from the contact-breaker side. A circular cover held in place by a spring gives access to the magneto sprocket and vernier adjustment.

LUBRICATION. Mechanical lubrication is employed. Oil is pressure-fed into the crankcase by a duplex pilgrim pump continually, but a portion of the oil fed to this pump is returned to the tank before entering the engine (see page 88). The flywheels splash it on to the cylinder walls, and oil is also pressure-fed into the timing case, whence it drains to the sump. The pump is driven from the crankshaft and enclosed within the timing cover.

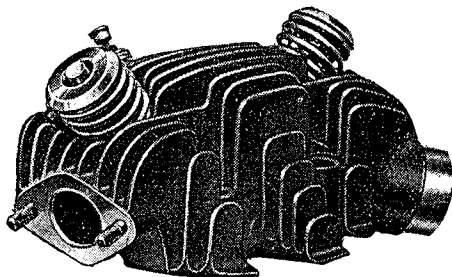
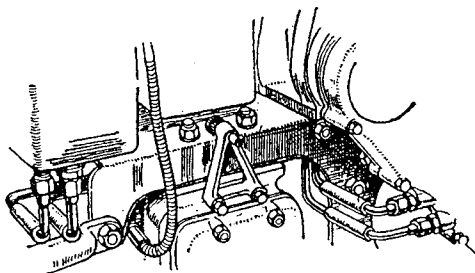


FIG. 10A. TWO-PORT O.H.V. CYLINDER HEAD

Both upper and lower plungers are connected by a common lead. The upper plunger delivers oil to a false bearing on the timing end of the crankshaft, and thence through the crankshaft and flywheel to the big end. The lower pump returns some oil direct to the



(From "The Motor Cycle.")

FIG. 11. SHOWING NEAT CONCEALMENT OF THE OIL PIPES

tank, where the functioning of the pump can be verified by the outflow from the return pipe placed immediately below the filler cap and visible on its removal.

Mechanical lubrication undoubtedly relieves the rider of a source of constant anxiety and annoyance; and also saves him no small amount of money in the long run on the score of economy in engine oil. Moreover, correct lubrication ensures the minimum production of carbon deposits on the piston crown and combustion chamber, and thereby gives the maximum mileage before the

rather odious, but nevertheless easy, job of decarbonization becomes necessary. This mileage should approximate 2,000. In practice, however, the owner usually "decokes" as soon as an appreciable loss of power and tendency to "knock" become manifest.

The makers recommend the use of only the highest quality oil for lubrication. Castrol "X.L." and "C" are highly recommended for touring and Castrol "R" for racing.

FRAME AND FORKS. These two supplementary units have been

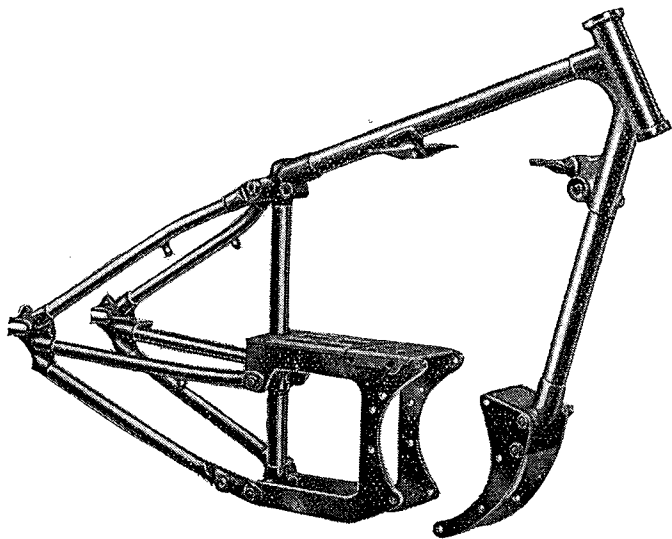


FIG. 12. THE STURDY SEMI-CRADLE FRAME

designed to give together a reasonably short wheel base ($56\frac{1}{2}$ in.), and a 29 in. saddle height. Care has been taken to ensure good general stability at speed and on treacherous road surfaces. The A.J.S. forks are of the original 1930 pattern, and efficient shock absorbers are incorporated at the rear end of the lower fork links. The links are adjustable for side play. Fitted to the forks is a very neat design of mounting (see Fig. 14A), which permits of a lamp being bracketed in a very low position that greatly enhances the appearance. A centrally placed compression spring is embodied in the forks, and a steering damper included on all 3.49 h.p. and 4.98 h.p. models. This produces excellent steering without looseness, and the efficient steering damper when tightened down prevents any possibility of speed wobble occurring. The forks

are provided with grease-gun lubrication. The frame is of triangular form of high tensile steel tubing. As may be seen in Fig. 12, the frame is really a semi-cradle type with torque tubes to the fork ends, which absorb all torsional stresses of the transmission. The bottom bracket and rear engine plates are in one piece, thus affording great strength and rigidity. The saddle pillar tube also extends right down to the lower cradle plates and torque tubes. A single rail only is employed for the top tube, this being of very large diameter.

GEAR-BOX. The gear-box is an A.J.S. countershaft four-speed gear, fitted throughout with ball bearings, and is standard for two models. It is operated by a right-hand gate change lever, affixed to the tank on the right-hand side; and it gives solo ratios of 5.8, 7, 12.6, and 17.4 to 1. Sidecar ratios: 6.41, 7.77, 13.9, 19.23.

Moving the change speed lever forward from front to rear position, the consecutive gears engaged are—first; neutral; second; third; top. On to an extension of the splined main shaft, which has a very robust thrust bearing on the driving side, are fitted two sprockets—one small and one large—for primary and secondary drives, respectively. The larger sprocket, incidentally, is part of the clutch (see page 137), which is of the multiple plate and cork insert type with multiple springs, and has handlebar control on the left-hand side. No adjustment for clutch spring tension is provided. The kick-starter lever (seen in Fig. 23) is in a position such that ample leverage can be exerted upon it with the foot while astride the saddle. Its operating mechanism is entirely enclosed. Only a high grade oil made by a firm of repute should be used for gear-box lubrication, and the oil recommended is "Castrolase Light" for summer and Castrol "D" for winter.

TRANSMISSION. Both primary and secondary drive are by substantial $\frac{1}{2}$ in. pitch by .305 in. wide Coventry roller chain. The chain of the former is completely enclosed (Fig. 7), while that of the latter has a protecting guard on the upper half only, giving easy access to the chain for inspection and lubrication purposes. These guards are designed to protect both rider and chains.

An efficient shock absorber on the engine mainshaft allows the power to be absorbed gradually, and thereby eliminates "snatch," which soon ruins any chain. In consequence, it is a very rare occurrence for a properly tensioned and lubricated chain to break on the road. The chain wears out completely long before this.

BRAKES, WHEELS, AND TYRES. Quickly adjusted, internal expanding brakes are fitted to both front and rear wheels, which are tyred with 26 in. by 3.25 in. wired-on, heavy type "Non-Skid" "Firestones" with Schrader valves. The rear brake is operated by a foot pedal on the left-hand side and the front brake is controlled by a handlebar lever on the right side. Both

brakes are very smooth and powerful in action. Fig. 13 shows the brake drum and shoes of the rear brake. Rear wheel quickly detachable; both wheels have taper roller bearings.

TANKS. A handsome, black enamelled, and bulbous nosed saddle petrol tank of welded steel is secured by bolts to lugs on the bottom frame tube, and has a capacity of 2 gallons of petrol. The filler cap is of the snap action bayonet type. Fastened by means of concealed plates are good quality rubber knee-grips. Where an instrument panel is not or cannot be specified, the gear-box driven speedometer is let into a recess in the tank and held

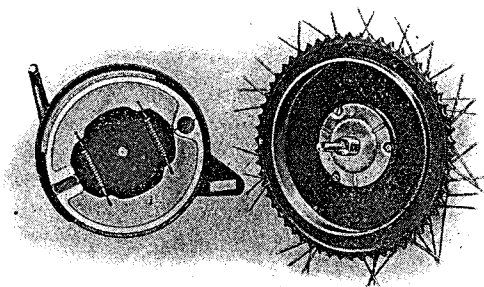


FIG. 13. SHOWING REAR BRAKE DRUM AND ANCHOR PLATE WITH SHOES

in place by two pins. The tank on T6, T8, T9 is finished in chromium plating with a black panel and the usual transfer. A separate oil tank behind the down tube holds $4\frac{1}{2}$ pints. TB6, TB8, T5 have black enamel finish and gold lining.

MISCELLANEOUS DETAILS. The semi- "T.T." adjustable handlebars have rubber grips with integral controls and in the centre a steering damper; just below the engine plates are rubber footrests, adjustable for position. This combination gives a very comfortable and natural riding position. The saddle itself is a Lycett medium weight model, with special adjustable mounting (Fig. 2). Valanced mudguards are fitted. Over the rear mudguard is a strong detachable carrier capable of safely supporting a passenger; but it is not exactly a flapper-bracket (to use the latest newspaper description of a pillion seat); it is really intended for luggage. Between the rear fork stays are secured two pannier bags with a full kit of tools. A central spring-up stand is provided. The general finish, including the handlebars, is black enamel on a special anti-rust process. The usual parts are all heavily plated. All oil and petrol cocks are of the quick action, push type. Electric lighting (Lucas) is extra; see pages 2, 26.

THE 3.49 H.P. "BIG PORT" MODEL TB6

The specification of this machine, which is eligible for the 30s. tax, with electric lighting, provided it is licensed prior to 1st January, 1933, is the same as that of Model T6, except for the following—

ENGINE. The engine has a bore and stroke of 74×81 mm., but instead of there being two exhaust ports there is only one port tapering to 2 in. diameter at the outside. Through this large port the products of combustion emerge at high velocity, and there is no decrease of efficiency caused by having a single port. In

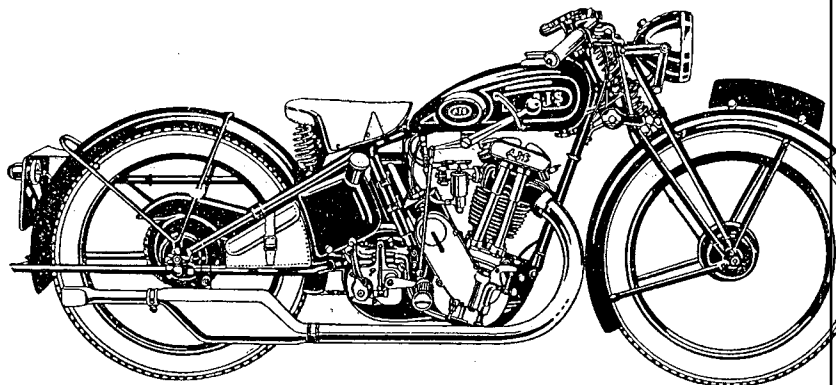


FIG. 13A. THE 3.49 H.P. O.H.V. MODEL TB6 (BIG PORT)

this engine a three-ring piston is fitted. Both inlet and exhaust valve guides (80°) are steel housings with phosphor bronze linings. There is, of course, also only one silencer of somewhat different shape from that fitted on Model T6. No fishtail is provided, but the end of the tail pipe is "pinched." The carburettor is an Amal of exactly the same type and setting as that fitted to model T6. A Lucas "Maglita" or N.S.A.1 magneto is fitted. Ignition timing is $\frac{3}{8}$ in. before T.D.C., and the compression ratio is 6.5 to 1.

GEAR-BOX. This is a Sturmey-Archer three-speed light-weight B.W. with enclosed kick-starter mechanism and two-plate clutch. Instead of the clutch having several springs arranged radially it has one large central spring only. The standard gear ratios are 5.25, 8.12, and 15.45 to 1.

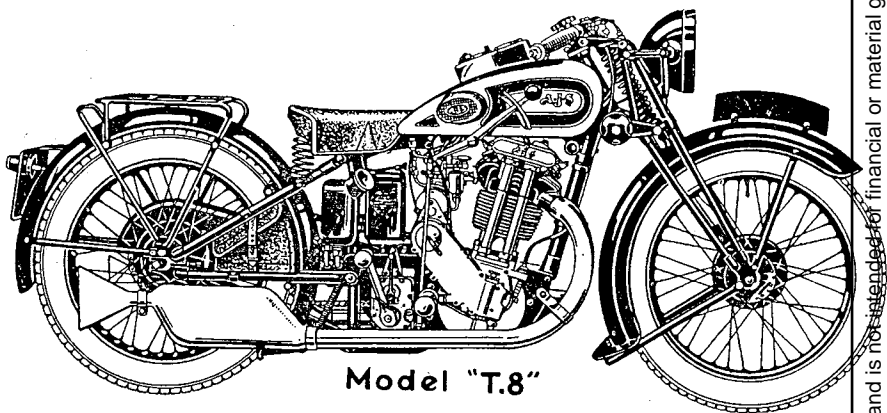
Other variations in specification are the provision of 25 in. \times 3 in. tyres, non-valanced racing type mudguards, (the rear of which is not hinged), a petrol tank of $1\frac{3}{4}$ gal. capacity and an oil tank of $3\frac{1}{2}$ pints. No carrier is fitted (though this can be had as an extra) and no instrument panel is or can be specified, a

Lucas "Maglita" lighting set being used instead of the "Mag-dyno" set on electrically equipped models. Also a rear stand is used instead of a central spring-up stand. Wheel base is 52 in.

THE 4.98 H.P. DE LUXE O.H.V. TWO PORT MODEL T8

This machine has an appearance absolutely identical to that of Model T6, and as a matter of fact it is a more powerful version of this machine. The main differences in specification are as follows—

ENGINE. The general layout of this engine, whose predecessors have performed so creditably in the Tourist Trophy Races, is



Model "T.8"

FIG. 14. 4.98 H.P. O.H.V. TWO-PORT

similar to that of the 3.49 h.p. O.H.V. engine; some parts are actually interchangeable. The machine illustrated has, it will be noticed, a Bowden carburettor, but an Amal is now standard. It is of 84 by 90 mm. bore and stroke, giving 498 c.c. capacity. Like Model T6 engine, it is fitted with a detachable cylinder head, enclosed valve lifter mechanism, an aluminium alloy piston with non-segmented crown, and compound type valve springs. The correct valve clearance is .006 in. for the inlet and .008 in. for the exhaust valve, and the ignition advance, $\frac{7}{16}$ in. before T.D.C.

Model T8 is undoubtedly very fast indeed. Its full throttle speed, as given by the manufacturers, is 78 miles per hour. It should attain this speed after careful running-in. The utmost care is taken in the erection, tuning, and testing of every machine. There is no doubt, however, that the crack rider who has the time, skill, and patience available can still further improve upon this very excellent performance and, given a certain amount of luck, could "boost" the machine up to a speed of 85 m.p.h. To attain

such a speed it is not necessary to run on anything except petrol-benzole, using a high-compression piston and well-tuned carburettor. As a matter of fact, two aluminium pistons are available for this machine. One is a low-compression member for use with ordinary petrol or petrol-benzol mixtures, and gives a compression ratio of 5.7 to 1. The other is a high-compression piston which provides a ratio of 7.5 to 1. This is a comparatively high ratio, and permits of every available ounce of fuel energy being utilized in the production of power with the rapidity of combustion at its highest value. Only by exceptionally rapid and complete gas combustion can mean piston speeds of approximately 30 m.p.h.

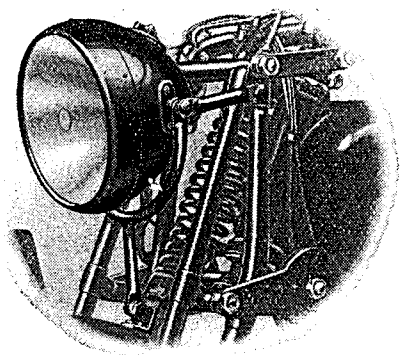


FIG. 14A. SHOWING A.J.S. FORK SUSPENSION AND HEADLAMP MOUNTING

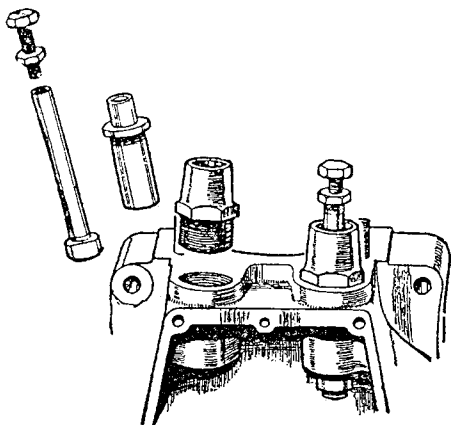
be obtained (and this is the piston speed corresponding roughly to a road speed of 90 m.p.h. with a gear ratio of 5 to 1). It needs little imagination to realize what large inertia forces the connecting rod and bearings are called upon to resist in view of the fact that at 90 m.p.h. the piston is undergoing alternately positive and negative accelerations of a very high order nearly 200 times every second! The connecting rod and double row $\frac{1}{4}$ in. roller bearings fitted to the big end are thus of very robust construction to stand up to the gruelling ordeal to which, on occasions, they are submitted. The engine mainshafts rotate on ball bearings.

An Amal type 29/004 carburettor is fitted and the setting is: jet 180, valve 29/4, needle position 2. It is semi-automatic, and has twist-grip control. The ratios of the four-speed gear-box are: 1st, 4.81; 2nd, 5.8; 3rd, 10.4; 4th, 14.4 to 1. Various parts of the engine and machine have been slightly stiffened to withstand the very high speed which this model is capable of attaining. Recommended sidecar gear ratios are 5.53, 6.7, 12.0,

16.5 to 1. A carrier is fitted. Fuel consumption is 70-75 m.p.g., and oil consumption about 1,200 m.p.g.

THE 4.98 H.P. O.H.V. "BIG PORT" MODEL TB8

This, the largest "big port" machine, has the same specification as Model T8, except that the twin exhaust system has been scrapped in favour of the single port, a three-ring piston is used, and the equipment does not include a carrier. The compression ratio is 6.1 to 1, and the magneto advance $\frac{1}{8}$ in. before T.D.



(From "The Motor Cycle")

FIG. 15. OIL RETAINING TAPPET GUIDES ON THE S.V. ENGINES

Racing type mudguards are used, and the three-speed ratios are 4.8, 7.0, 12.85, solo, and 5.53, 8.12, 14.7, S/C.

THE 3.49 H.P. STANDARD S.V. LIGHTWEIGHT MODEL T5

This machine, priced at the remarkably low price of £38 10s. is the second of the lightweights taxed at 30s. It is a smart little machine with quite a snappy performance, and makes an excellent general touring machine. It is capable of accelerating rapidly to the mile-a-minute mark without "fuss." The specification is as follows—

ENGINE. This, like all the other engines, is of A.J.S. design and construction. The keynote of the design is simplicity and sturdiness. It is a side valve, inclined single cylinder, four-stroke engine of 74 mm. bore, and 81 mm. stroke, giving a capacity of 349 c.c., or (according to A.C.U. rating) 3.49 h.p. A four-ring aluminium-alloy piston reciprocates in a cast-iron cylinder with horizontally finned, non-detachable head. The head on the T5

cylinder departs from earlier A.J.S. practice in that no longer is the hitherto special A.J.S. method of holding down the cylinder retained; this comprised a central bridge piece and two long bolts with turnbuckle adjustment. In this head large non-interchangeable and mechanically operated valves of heat resisting alloy steel are placed side by side in deep pressed-in cast-iron guides. The large area of these valves ensures perfect charging and scavenging of the cylinder, besides giving good heat dissipation and freedom from distortion and pitting of the valves themselves.

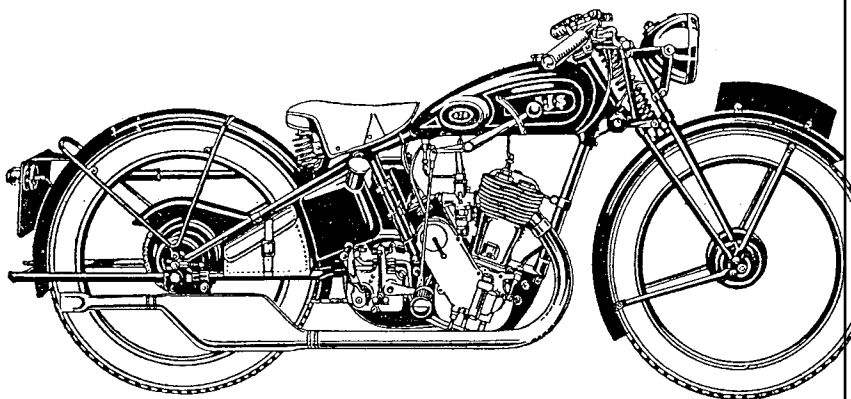


FIG. 16. THE 3.49 H.P. STANDARD LIGHTWEIGHT MODEL T5

The tappets operating these valves have, of course, adjustable heads to give correct clearances of $\cdot006$ in. and $\cdot008$ in. in the case of the inlet and the exhaust valves, respectively, when the engine is hot. They also have oil retaining guides (Fig. 15). A valve chest cover completely encloses the valves and springs. Internally the engine is practically the same as the 3.49 h.p. O.H.V. unit already described in detail. It has the improved type of mechanical lubrication, roller bearings to the big end of the connecting rod, ball-bearing main shafts, and a flat crown aluminium alloy piston. The compression ratio is 4.3 to 1. As on all present engines, the magneto is placed in a sheltered position behind the engine. The correct spark advance, which is given on page 20, can be accurately determined by means of the vernier adjustment for the magneto sprocket. The exhaust system is similar to that on the O.H.V. lightweight. Castrol "X.L." or "C" is recommended for engine lubrication.

Carburettor. This is a semi-automatic Amal instrument (type 5/148) with twist-grip throttle control. Unlike all other models it has a screw-in fastening. Recommended combination for low

consumption, and best performance are: Jet, 100; valve, $5/4$; needle position, 4. Petrol consumption is 90-95 m.p.g.

Ignition. Either a Lucas magneto or the Lucas "Maglita" chain-driven from the inlet camshaft, and the spark advance is $7/16$ in. before T.D.C. The sparking plug is a Lodge H.1.

The rest of the specification is the same as that of the O.H.V. lightweight (TB6) except that the three-speed gear-box gives ratios of 5.8, 9.1, and 16 to 1. The machine is illustrated on page 199.

THE 4.98 H.P. DE LUXE S.V. MODEL T9

As may be observed from the illustrations, the general specification of all the heavyweight models is practically the same.

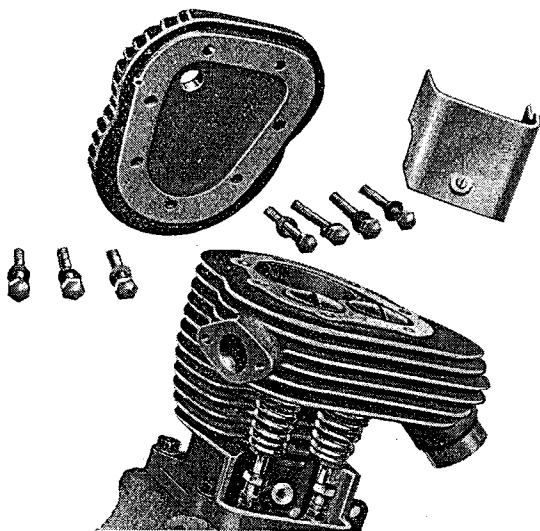


FIG. 16A. THE CAR TYPE DETACHABLE CYLINDER HEAD ON THE 4.98 H.P. S.V. MODEL

this instance model T9 is the S.V. counterpart of the 4.98 h.p. de luxe O.H.V. model and has the same bore and stroke. Actually, apart from the engine and carburettor, the only important difference is that a three-speed gear-box giving ratios of 4.81, 7.06, and 12.85 to 1 is fitted as standard. S/C ratios—5.53, 8.12, and 14.7.

ENGINE. Below the cylinder the engine is the same as the O.H.V., model except, of course, that a different valve timing is used. The piston is of aluminium alloy, and has the usual four rings. The cylinder in which it reciprocates has six broad horizontally-arranged fins, and contains the valves as shown in Fig. 16A, a special car type aluminium cylinder head being bolted to the top of the barrel with seven bolts. A copper and

asbestos gasket is used between the two. The strength seen runs on 120 to 1. As is self-evident, removal of the cylinder head does not mean interference, the carburettor is interfacing with the valves in a most efficient and true. The point of view of the rider who likes to devote a minimum of time to top overhauls. The valves, springs, and tappets are all enclosed, as shown, by a quickly detachable cover plate, so valve caps are wanted. Tapped clearances are good and sufficient, with a hot engine for inlet and exhaust respectively. Castrol "S.V." or "C.V." is recommended and the engine's timing is 1/8 in. before T.D.C. fully advanced.

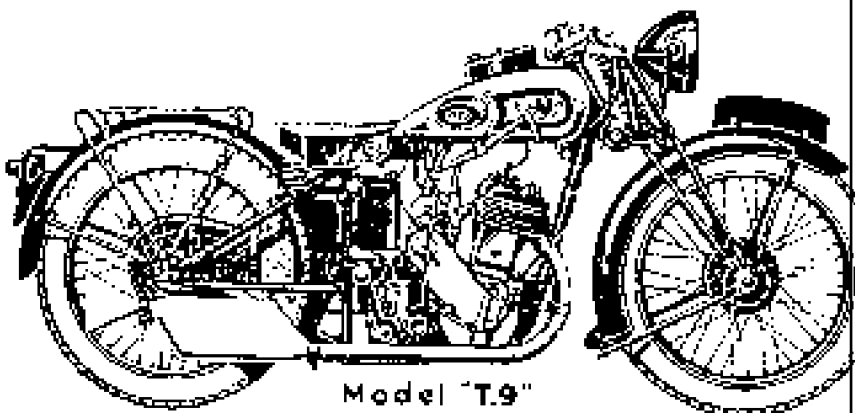


FIG. 15. THE A.J.S. Model "T.9" or S.V.

CARBURETTOR. The carburettor, which is fed by its charge direct to the cylinder barrel, is a Joffe-fed, semi-automatic 0/2004 Amal with 140 jet, 0/4 valve and needle position 3.

THE 9.90 H.P. STANDARD S.V. (1933) BIG TWIN

On going to press the author finds that the reproduction of the famous Big Twin, referred to in the Preface of this handbook, has become a *fait accompli*. On 7th July, 1932, details of the two Big Twins, which are really advanced 1933 models, were announced. They bear a close resemblance to earlier A.J.S. machines of this type although greatly improved and a thoroughly up-to-date design. Two models are available, the Standard model and the "Export" model, and their prices are, without Lucas electric lighting, 265 in each case. The Standard model has the following specification.

Engine. This engine has a bore and stroke of 65.5 mm. x 55.5 mm., giving a cubic capacity of 690 c.c. The two cylinders are set at 50 degrees to each other, and the bores, being "square"

with the cylinder castings, the firing angle is also 50 degrees. Fig. 19 shows the general design and construction of the power unit.

The crankcase itself is a very neat aluminium casting split longitudinally in the usual manner. An extension immediately below the annular timing case, which has a readily detachable cover, houses the dry sump plunger, and if separation of the crankcase halves is contemplated care is necessary in respect of this unit. A disc breather maintains atmospheric pressure in the

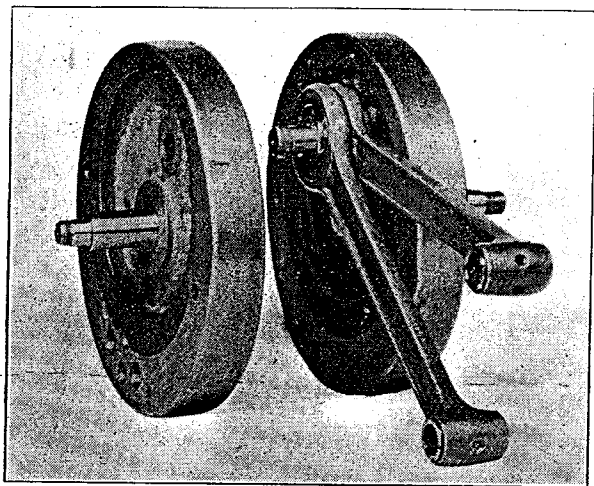


FIG. 18. CONNECTING-ROD MOUNTING ON TWIN CYLINDER ENGINES

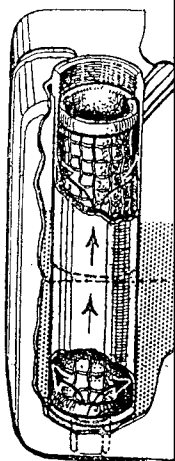


FIG. 18A. FABRIC FILTER

Left is shown a 1930 assembly. The crankpin on the new 33/2 engine has parallel location in the flywheel. It is flanged on either end of the "run," $\frac{1}{4}$ in. \times $\frac{1}{4}$ in. rollers are used, and these run in a small metal cage. No separate big-end liner is used in the connecting rod and the diameter of the gudgeon pins are now much larger. Where the connecting rods were offset on the small end of the earlier engine, they are now square with the connecting-rod, and the small-end bush stands out farther on one side than the other. On the right is shown the detachable fabric filter in the oil tank

crankcase. An oil bath (Fig. 7) lubricates the primary chain. The crankshaft assembly is an ordinary single-throw type built up of two flywheels, to which are keyed the friction fitting mainshafts and a flanged crankpin upon which, with two sets of caged rollers interposed, but no bushes, are mounted a pair of "H" section connecting rods having $\frac{7}{8}$ in. (I-D) phosphor-bronze small end bearings. With regard to the crankshaft bearings, that on the driving side has a heavy double-row caged roller bearing, while the other one is of the plain bush type. The pistons themselves are of aluminium alloy and have four rings each, the lower acting as a scraper ring. They are split diagonally across the skirts to

allow for expansion, and they have fully floating gudgeon pins secured by small spring circlips to prevent scoring. With a cold engine the correct gap at the piston ring slots is .005 in. to .010 in. Permissible crankshaft end play is .025 in.

The cylinders, which have a compression ratio of 4.8 to 1, have cast-iron detachable heads, and the cylinder barrels are cast

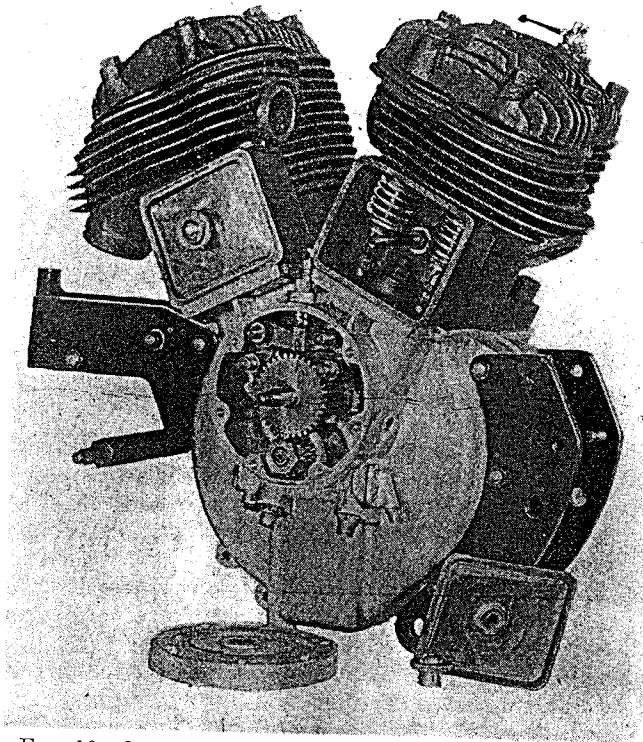


FIG. 19. CLOSE-UP VIEW OF THE 9-90 H.P. 33/2 ENGINE

The timing case cover and one valve cover plate have been removed to show the valves and timing gear. The induction manifold and carburettor are also removed. It is of interest to note that this engine is identical to that installed in the Matchless Big Twins

integral with two very neat valve chests which entirely enclose and protect the valves and their springs, two pressed steel cover plates held firm by centrally placed knurled nuts giving instant access to the valves. The barrels are deeply spigoted at their bases and paper washers are used; C. and A. gaskets are fitted between the barrels and heads, which are of semi-turbulent design. The

sparkling plugs are not centrally located over the cylinder heads, but are placed in an offset position over the inlet valves. The two cylinders are interconnected by a horizontal induction manifold with screw-on unions.

The valves themselves are of large diameter and of the mushroom type with single springs and slotted valve stems for the flat cotters used for anchorage. They reciprocate in chilled cast-iron guides which are readily detached for renewal. Round section tappets are used, and the adjustable heads screw into the tappet bodies and are secured by lock-nuts. The timing gear is extremely simple. It comprises a single cam wheel having three cams, one each for the exhaust and one for the inlet valves, driven off the engine pinion, and four toggles mounted on pivot pins and separated from the back of the timing case by $\frac{29}{64}$ in. distance collars. The arrangement of these toggles is shown by Fig. 19, and the neat exhaust valve lifter mechanism in the centre is also clearly illustrated; the timing pinions are marked for mesh. The products of combustion are swept out from the exhaust ports into an imposing and exceedingly quiet exhaust system comprising two $1\frac{3}{4}$ in. diameter chromium plated pipes, each terminating on the off side in a standard A.J.S. silencer and fish-tail.

The magneto, or "Magdyno," as the case may be, which is mounted on a platform above the gearbox, is driven by chain and sprockets direct off the camshaft. The camshaft sprocket fits on a slight taper, is not keyed, but held firmly by a nut screwed to the threaded end of the shaft. Chain tension is adjusted by tilting the special magneto platform (Fig. 8). A chromium plated and black-enamelled pressed steel chain case protects the chain.

The lubrication of the engine is carried out by a D.S. system similar to that described on page 88. The double-acting oil pump forces oil under pressure to the big ends of the connecting rods, the mainshaft bearings and the camshaft bearings, while the whole of the timing gear runs submerged in oil, the surplus being returned to the crankcase through a small oil level hole.

With this lubrication system there is no means of adjustment provided as on the other models.

Tappet clearances	.004 in. inlet and .006 exhaust (warm)
Magneto advance	$\frac{7}{16}$ in. before T.D.C. on full advance

CARBURETTOR. This is a No. 6/012 Amal. Particulars: main jet, 140; needle valve, 6/5, in position 2.

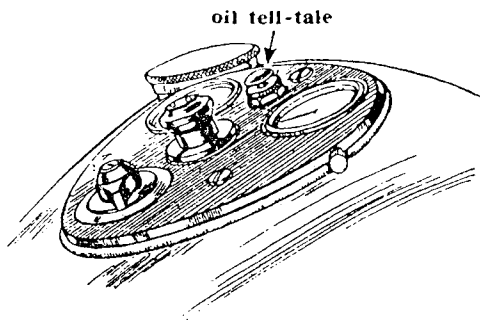
IGNITION. Lucas magneto behind the engine without vernier timing adjustment. The magneto sprocket is not keyed to the armature shaft, but is a tapered friction fit. Lodge H.1 sparking plugs.

LUBRICATION. On the Big Twin the lubrication system is of the dry-sump type, different from that used on the 1933 "camshafts." It differs absolutely from the improved mechanical

lubrication system fitted to the 1932 range of six machines. A half-gallon oil tank with fabric-type oil filter is mounted on the seat tube. On the instrument panel (Fig. 19A) is an oil tell-tale. This should indicate pressure when the engine is running.

FRAME. This is a semi-cradle design with a very robust seat post, twin tubes running from the front of the power plant and swept to the rear wheel spindle, and a very large-diameter top tube. Standard A.J.S. forks are used except that the shock absorbers are adjustable by a hand-wheel on the off-side. There is also a steering damper.

TRANSMISSION. $\frac{5}{8}$ in. pitch by $\frac{3}{8}$ in. wide, Coventry rear chain,



(From "The Motor Cycle")

FIG. 19A. SHOWING OIL TELL-TALE ON INSTRUMENT PANEL

totally-enclosed $\frac{1}{2}$ in. by .305 in. front chain with oil bath and shock absorber on engine mainshaft.

CLUTCH AND GEAR-BOX. The clutch is of the multiple plate and cork insert type, hand controlled. Gear-box is a four-speed, pivot mounted, Sturmey-Archer, with ratios of 4.5, 5.5, 7.3, and 13.5 to 1 solo.

WHEELS, TYRES, AND BRAKES. Both of the wheels quickly detachable and interchangeable, with 27 in. by 4 in. wired on, heavy type, non-skid Firestone tyres. Brakes of internal expanding type with 7 in. front and $7\frac{3}{4}$ in. rear diameter drums and dust and water-excluding flanges. The front and rear brakes are operated by a lever and foot pedal situated on the right and left-hand sides respectively, quick finger adjustment being afforded.

TANKS. The petrol tank has capacity for $3\frac{1}{2}$ gallons of petrol, which is sufficient for 150–200 miles. On the top of the tank is a flush-fitting instrument panel with the oil tell-tale. The oil tank holds four pints. Standard A.J.S. finish.

MUDGUARDS. Well valanced, and fitted with drip channels. Rear: $6\frac{3}{8}$ in. wide, with detachable portion for wheel removal.

MISCELLANEOUS. Included in specification are—Lycett saddle, semi-sports handlebars, rubber footrests, stands to front wheel

and central spring-up stand, a complete set of tools. Lucas electric lighting costs £5 17s 6d. There are also various extras obtainable, such as an 8-day clock, electric horn, gearbox-driven speedometer, etc.

THE 9.90 H.P. S.V. "EXPORT" MODEL

The specification of this machine differs from the standard model in regard to a few points only. The main differences are as follows—Long touring handlebars are provided. A left-hand gear change is used. There is a ratchet control for the foot brake.

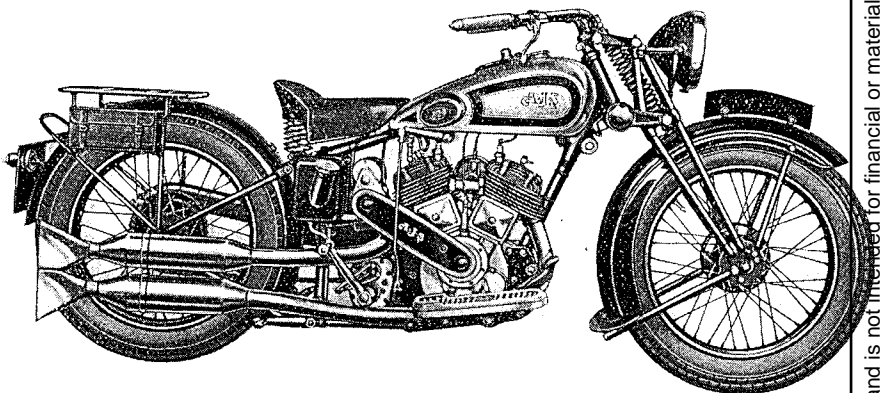


FIG. 20. THE 33/2 "EXPORT" MODEL

The clutch has foot control. Rubber footboards are specified instead of footrests. An air cleaner is fitted.

1933 MODIFICATIONS

The six 1932 models are being continued for 1933, with the exception of the 349 c.c. big port lightweight model TB6. This machine will be replaced by a 248 c.c. model having a very similar specification and costing £41 10s. It will be known as model 33/12, and will be taxed at 30s. under the new licensing regulations. The other five models (which incidentally will be known as models 33/6, 33/8, 33/B8, 33/5, 33/9) will be unaltered except in regard to a few minor details. The raised type of tank-mounted instrument panel (Fig. 1) will be scrapped in favour of a neat flush fitting panel (Fig. 19A). This panel, which, with complete lighting equipment (£5 17s. 6d.), will be available as an alternative to the plain "Magdyno" lighting set (£5 10s.), with switch situated on the back of the headlamp, will include the main lighting switch, a combined panel and inspection light, an ammeter and provision

for a Smith 8-day clock (30s. extra). The Smith speedometer, where specified with instrument panel, will be fitted on the front of the handlebars; otherwise it will be fitted on the tank. Hand-operated shock absorbers will be provided in addition to the steering damper on all models. On model 33/B8 a foot gear change and upturned exhaust pipe will be optional.

1933 Camshaft "Trophy" Models. Apart from the Big Twins and the little "two-fifty," the only other entirely new machines in the 1933 programme are the two eagerly awaited overhead camshaft models, which are to be known as "Trophy" models in view of Mr. G. Rowley's fine performance on one of them as a member of the team which brought back the International Trophy to England in 1932. The "Trophy" models will be known as Models 33/7 and 33/10, and will have engines of 346 c.c. and 495 c.c. respectively. Prices will be £65 and £70 respectively. Both models will have a very similar specification, and each will be obtainable in racing or competition form. The racing form will have a straight-through exhaust, no kick-starter, two pairs of footrests, a mudguard pad and specially tuned engine with alternative pistons giving compression ratios of 7.5, 9, and 11 to 1. The competition form will have an upswept exhaust pipe with tubular silencer, a kick-starter, a special crankcase shield, and compression ratios of 7.5 to 1 and 6 to 1 in the case of the 347 c.c. and 495 c.c. models respectively.

The single-port engine is an improved version of the 1929 type, with camshaft driven by an automatically tensioned chain, but the magneto is now placed behind the cylinder, and the dry sump lubrication system incorporates in addition to the usual gauze filter a fabric filter in the tank of the same type as that used on the Big Twins. A duplex pump similar to that fitted to the magneto chain cases of the series "T" machines forces oil to the main shaft bearings, the big end bearings and timing gear, and also to the rocker box and both valve guides. All the oil in the tank is constantly circulated. 14 mm. plugs are used. The whole engine (see page 114) has been thoroughly cleaned up.

The specification includes a pivot mounted 4-speed S.A. gearbox with foot change, a 3 gallon fuel tank, twin float-chamber Amal carburettor, detachable rear wheel, hinged mudguard, adjustable saddle, and 26 in. by 3.25 in. tyres. A speedometer and engine revolution counter to match, as well as "Magdyno" electric lighting, with or without panel, can be fitted on both models 33/7 and 33/10 as extras.

A.J.S. Sidecars. Three sidecars will be obtainable during 1933. They will be model "A" Sports (£18 10s.), model "B" Launch (£17 10s.), and model "C" Occasional Two-seater (£25). For the two-seater a spare wheel will be available at six guineas extra.

CHAPTER II

VARIOUS PRELIMINARIES

IN this chapter we assume that the reader has selected and ordered his new mount, and desires to get it on the road as soon as the various legal formalities and requirements have been satisfied.

The absolute novice is strongly advised not to attempt to ride the machine away from the works. This is courting disaster if the route involves driving through much traffic. Often an expert driver, who has been accustomed for years to driving a machine with throttle control action working in the reverse direction to that of the new machine, finds that he is not quite happy on this mount for several days. As we all know, the subconscious mind plays a great part in driving, and especially in a sudden emergency. The strong probability is that, when confronted with sudden danger and an instantaneous and unpremeditated decision has to be made, the wrong action would instinctively be taken, that is to say, the throttle would be opened wide instead of being shut, or vice versa, with appalling results. This has actually happened in quite a number of instances. The wisest course is to make arrangements with the nearest agent to have the motor-cycle delivered for a nominal charge by one of his employees. A.J.S. dealers are scattered widely throughout the United Kingdom, and no difficulty should be experienced in this connection. First supply the dealer with the registration licence before the machine can be delivered. One of the largest and most conveniently situated spares stockists in the Metropolitan area is H. Taylor & Co., Ltd., of 135 London Road, Kingston-on-Thames (Branch: 2 Tichbourne Court, W.C.1). Buyers resident in London would do well to purchase their spares direct from the manufacturers at Plumstead. It is also well to remember that at Plumstead A.J.S. owners have at their disposal a comprehensive A.J.S. Service Department capable of dealing with any repairs and overhauls.

Registration and Tax. All motor-cycles are subject to registration and taxation, and a machine cannot be used on the highway until a registration number has been allotted to it and a licence obtained from the local borough or county council office. This registration or index-number belongs to a machine until such machine is no longer used on the highway. If, after expiry of a licence, no renewal is made for a prolonged period, the authorities must be informed of the reason in advance. In the case of motor-cycles the tax is to be on cubic capacity, not a weight basis.

There has been persistent urging by many people for the reintroduction of a petrol tax, but so far no change has been made. On and after 1st January, 1933, 150 c.c. machines will be taxed at 15s. per annum, 150-250 c.c. at 30s. per annum, and 250-1000 c.c. at £3 per annum.

A licence application form (R.F. 1/2) is obtainable from any head post office, and must be very carefully filled in and posted to the licences dept. of the county council in whose area the machine is usually kept. Certain data, e.g. engine No. and frame No., will have to be first obtained from the dealer, if the machine is not delivered by rail. On page 31 a portion of an application form is reproduced. It will be observed that quarterly licences as well as annual licences may be taken out at the rider's discretion. Common sense dictates what licence should be taken out under the prevailing circumstances. A point to be noted, however, is that a post office can only issue renewals of the same type as already existing, that is to say, that a quarterly licence can only be renewed as a quarterly licence, and an annual one as an annual one. Application for annual licence renewal must be made between the 1st and 15th of January each year. In calculating the weight unladen, the weight of all parts normally used must be included, exception being given only in the case of fuel, water, oil, accumulators, and loose equipment.* The registration authorities, if they doubted the accuracy of a weight declaration, might call upon the owner to have the machine weighed on an approved weighbridge in the presence of authorized officials. When selling a machine, the licence, if unexpired, may be handed over to the new owner, and the registration book must be handed over to the new owner, who is required to pass it on to the registration authority after entering particulars of ownership. Both vendor and purchaser must notify the authorities of the transaction. It should be thoroughly understood that every taxation licence is issued for use with one machine, and one only. It is kept for use with that machine, whatever changes of ownership may occur. In the registration book all changes of ownership are recorded, as well as full particulars of licences issued. The book thus forms a complete record of the machine's history, and, incidentally, is of no little interest to the purchaser of a second-hand machine.

If a motor-cycle is registered as a solo machine, and the motorist decides to attach a sidecar, he must take out a fresh licence, and return the existing one, plus the balance due on a sidecar, i.e. 20s. All 1932 solo A.J.S. machines, except models T5 and TB6, are taxed at the rate of £3 per annum. These two lightweight

* In the event of the authorities requiring a TB6 to be weighed the tools must be removed or it will be taxed at £3.

models, weighing under 224 lb., are subject to the 30s. per annum tax *provided their registration is effected before 1st January, 1933*, and they will thereafter continue to be taxed at this rate.

When the machine is on the road it must carry the licence—which is in the form of a disc—in a conspicuous position, visible always by daylight from the near side of the machine. The licence should be carried in a weatherproof holder, and may be mounted (1) on the front number plate, (2) on the handlebars, (3) at the side of the tank, (4) in the case of sidecar machines on the side panel of the sidecar body. The licence is of a distinctive colour, which is changed annually, and therefore a police officer can tell at a glance when an annual licence is out of date. Fourteen days' grace, however, is allowed from the expiry to the renewal of an annual licence.

Driving Licence. It is unlawful to drive any motor vehicle on the road without a driving licence bearing the rider's signature which may at any time be demanded by a police officer together with a "certificate of insurance." Five days' grace is now allowed, however, for the licence to be produced *in person* at a police station specified. The fee for a licence is 5s., and it is valid for one year from the day it is issued. Applications should be made to the licences department of the county council in whose area the motor-cyclist normally resides. If the applicant is 16 years of age, he can, subject to a certain standard of physical fitness, obtain a licence to drive a motor-cycle only; but if he be 17 or over, a licence enabling him to drive a car or motor-cycle is, subject to the same condition, obtainable. For forging or altering a licence, the offender makes himself liable to two years' imprisonment.

With regard to physical fitness, no test is *compulsory*, but a driver is required to make a declaration on Form DF1 that he suffers from "*no such physical infirmity as to render him a source of danger to the public*." A "source of danger" includes a man having abnormal eyesight to the extent that he cannot read a car number plate at a distance of 25 yd., has lost a limb, has muscular paralysis, is liable to fainting or giddiness, or suffers from any form of epilepsy. It should be stated, however, that if after the licence application form has been filled up, the licensing authorities are doubtful as to the driver's fitness, they may decline to issue a licence, but the would-be motor-cyclist can demand an official test for driving fitness, the fee for which is 10s. Defective eyesight, epilepsy, or giddiness definitely bar a man from obtaining a licence. The penalty for making a false declaration is a fine not exceeding £50, and if done deliberately may incur imprisonment. The driving licence is strictly non-transferable, and is liable to be endorsed or even suspended at the jurisdiction of any

magistrate, under the Motor Car Act of 1903. No police officer may lawfully peruse the endorsements at the back of a licence. This eliminates prejudice that the officer might have against the offending motorist before deciding to report him for contravening the law. It is not, however, wise to roundly abuse an officer for this, or for any other reason. Remember that the British policeman, in spite of all the intolerance often unjustly attributed to him, is a very fair, reasonable, and just man, when treated with due respect. When treated otherwise, however, he is a decidedly stiff proposition to deal with.

PORTION OF REGISTRATION LICENCE FORM (1932)

I apply for a licence expiring* on 193 , for a :	Annual Licences expiring on 31st December	Quarterly licences expiring on 24th March, 30th June, 30th Sept., or 31st December
	Duty £ s. d.	Duty £ s. d.
MOTOR-CYCLE (or motor scooter or cycle with auto-wheel or other motor attachment). Note: Motor-cycles exceeding 8 cwt. in weight unladen are chargeable to duty as cars.		
(a) Bicycle—		
Weight unladen, not exceeding 224 lb.	1 10 -	8 3
Weight unladen, not exceeding 224 lb. with right to draw trailer or sidecar	2 10 -	13 9
Weight unladen exceeding 224 lb., but not exceeding 8 cwt.	3 - -	16 6
Weight unladen exceeding 224 lb. with right to draw trailer or sidecar	4 - -	1 2 -
(b) Tricycle (not exceeding 8 cwt. in weight unladen)	4 - -	1 2 -

* A refund can now be obtained for the unexpired period of a licence, on surrender, so long as it is not less than one month.

Third-party Insurance. It is now compulsory for every motorcyclist to insure himself against third-party risks. Failure to do so involves severe penalties. The law now requires that every person knocked down by reason of careless or negligent driving shall be able to recover from the motorist or motor-cyclist, through the insurance company, damages up to £25 for every accident he may be involved in. The premium for third-party cover is very reasonable, being about 30s. per annum unless pillion riding is indulged in or the policy covers the driving of more than one machine, in which case a higher rate is charged. If a pillion passenger is carried the insurance policy must cover him, and likewise any sidecar passengers. On paying the insurance premium and supplying all necessary information to the company, they will issue to the applicant the all-important

"Certificate of Insurance," which must be sent with the driving licence application form and afterwards produced on demand. Riders already insured thereafter receive reminders from their insurance companies before the policy expires, and on renewing them automatically receive their new "certificates." Altering or forging a "certificate" is a criminal offence. If a certificate cannot be produced on demand a summons will follow unless the rider can produce the certificate at a police station specified within five days.

In the case of a new machine it is, of course, desirable to take out an insurance policy covering besides third-party risks damage to the machine. If the machine is bought on the hire-purchase system this will be insisted on.

It is best to take out a comprehensive policy with a reputable company. Most insurance companies give no-claim bonuses. It therefore does not pay to worry a company over trifling and inexpensive details. All risks can be covered for a medium power machine for about £6 per annum. The insured should guard against any conduct likely to invalidate his policy. All clauses should be very carefully studied and complied with; otherwise in the hour of need the insurance company will remain neutral and repudiate liability, citing as its reason the violation of some clause of its policy by the insured person, and the rider may have to foot the bill himself.

Number Plates. It is not sufficient merely to have a number plate on the machine. The number plate must be in accordance with a definite scheme and definite dimensions laid down. Up till 6th October, 1930, both number plates were permitted to be in accordance with the dimensions given at *A* (Fig. 21). This still holds good in respect to the *front* number plate, but as regards the rear plate new dimensions are now specified. They must be as shown at *B* (Fig. 21). All letters and figures must be $2\frac{1}{2}$ in. high, with a total width for each letter or number of $1\frac{3}{4}$ in., except in the case of the figure 1. Every part of every letter and figure must be $\frac{3}{8}$ in. broad. The space between adjoining letters and between adjoining figures must be $\frac{1}{2}$ in., and there must be a margin between the nearest part of any letter or figure, and the top, bottom, and sides of the black background of at least $\frac{1}{2}$ in. The lettering if placed above the numbers need not be centralized, but the letters themselves cannot be separated more than the prescribed $\frac{1}{2}$ in., and there must be $\frac{1}{2}$ in. space between the bottom of the lettering and the top of the numbers. The rear plate must be illuminated after dark by a suitable tail light.

Audible Warning of Approach. The exhaust noise does not come within this category; the law stipulates that an independent warning mechanism must be provided on the machine. This may

be in the form of a mechanical, electric, or bulb type horn. They all have their merits. For touring purposes a bulb type is suitable, but for the sports rider, mounted on a fast and perhaps slightly noisy machine, a mechanical horn, mounted on the handlebars, or an H.F. electric horn, is invaluable. The ideal is to have two, but do not buy one of those cheap horns which begin by sliding

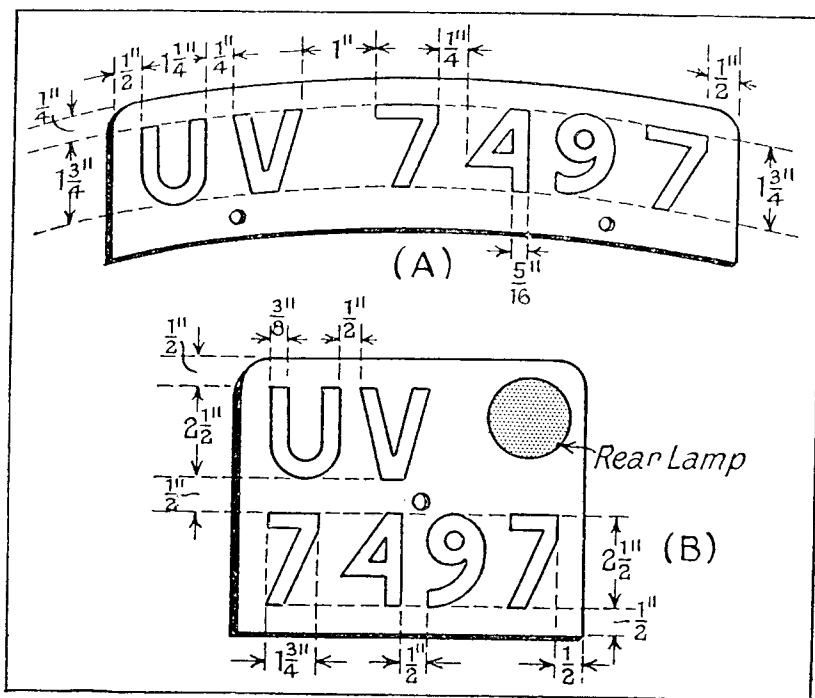


FIG. 21. NUMBER PLATE DIMENSIONS

At A are shown the old dimensions still used for a front plate and at B the new dimensions required for rear plates

down the handlebar towards the steering head, and end by dissolving into their component parts.

Never use a horn unnecessarily—particularly the mechanical type—for it is apt to offend people when thus used, and remember the sounding of the horn with the machine stationary is technically an offence!

Lamps. During the period between one hour after sunset and one hour before dawn (summer time) it is compulsory to show a white light facing to the front and a red one to the rear in the case of both solo and sidecar machines. The sidecar lamps must

be fitted on the offside so as to indicate the entire width of the vehicle. At present it is compulsory to fit a rear lamp, not just a reflector. Recent legislation now makes it a punishable offence to take any mechanically driven vehicle on the highway at night without a red rear lamp fitted. Reflectors are allowed only on pedal cycles.

Lighting sets are either of the acetylene or electric type. Electric lighting is now becoming almost universal, and has revolutionized night riding; for there can be no possible doubt that it is far and away the best of the two types. It is, of course, purely a matter of expense. (See pages 2, 25.)

Other legal aspects affecting, chiefly, the conduct of the driver, will be considered in Chapter III. We may assume that the makers have complied with the law in the fitting of brakes and sidecar. The former, however, must be kept in proper order, otherwise a breach of the law is incurred.

Speedometer. Many people are apt to regard this instrument as a pure luxury. This view is wrong; it is practically a necessity. By its agency both your tyre mileage and your fuel consumption can be accurately estimated; it is of vast service in watching the tune of your engine by informing you when the machine is losing speed, or climbing a hill slower than it used to do, and by indicating whether any mechanical adjustments that you may have made result in an increase of engine revolutions. Watching the fluctuations of a speedometer needle is at all times fascinating, and in long distance tours the instrument is of great assistance. Tank-fitted or tank panel-fitted "Smith" speedometers driven from the gear-box are not standardized on any model, but can be had as an extra. The "Smith" can be fitted on all 1929-33 models.

All speedometers work on one of two principles—the centrifugal or the magnetic—and the average cost of an instrument is £2 to £2 10s. Most popular among the centrifugal type are the "Cowey," the "Smith," and the "Watford." The "Stewart" works on the magnetic principle, however. All these instruments are wonderfully accurate, and require little attention. An ultra-modern instrument is the "Bonnixsen" time speedometer, which registers both time and distance, thereby elucidating the average speed. Those owners of early A.J.S. motor-cycles are strongly advised, also to fit one of the above mentioned instruments to their machines; a front wheel drive is easily arranged.

Joining a Club. At the present time there are numerous clubs throughout the country that are willing to accept members for a small fee. These clubs frequently hold meetings, including hill climbs, reliability trials, and social events. There is no doubt that one derives many advantages from joining a local club. But if you value your machine do not enter for one of those freak scrambles

which occasionally take place, which assume the form of paper chases, in which paper is substituted by fragments of the leading pack in the form of fish tails, silencers, and sundry loose equipment. Enter for the more sober reliability trials and hill

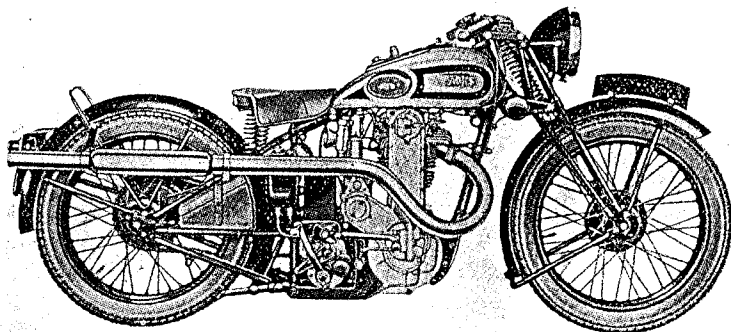


FIG. 21A. THE 1933 OVERHEAD CAMSHAFT IN COMPETITION FORM

This machine is available with a 3.46 h.p. or a 4.95 h.p. engine, and a racing edition is available as an alternative to the competition type shown (see p. 27)

climbs. For competition and track racing the new overhead camshaft A.J.S. shown in Fig. 21A is an ideal mount.

Besides these smaller clubs there are three great road organizations, one of which it is advisable to join. Innumerable benefits are obtainable on payment of a nominal annual subscription. They comprise, among other things, free legal advice, "get-you-home" schemes, general road assistance, and use of road telephones.

In some cases the smaller clubs are affiliated to one of these bodies. The addresses of these clubs are as follows—

Auto-Cycle Union,
83 Pall Mall,
London, S.W.1.

Royal Automobile Club,
Pall Mall,
London, S.W.1.

Automobile Association and Motor Union,
Fannum House,
New Coventry Street, W.1,

Preliminary Instruction. At this point in the proceedings we take it that the reader's mount has been fully equipped for taking the public highway, and is now garaged awaiting its first run on the road. This first trip is always regarded by the "tyro" with something approaching awe. Any preliminary nervousness, however, disappears almost instantly on taking the road, and confidence is gradually, and then rapidly, acquired. Thereafter progress is very rapid indeed, and after about a dozen runs or so the rider usually feels capable of undertaking his first long cross-country trip, and begins to thoroughly enjoy the sport; for motor-cycling is undoubtedly one of the finest tonics in the world for the average man, distracting, as it does, the mind from all business and domestic worries. But the rider should guard against becoming prematurely over-confident of his own abilities, and keep his speed down to reasonable proportions for some considerable time. Failure to do this usually results in his having some hairbreadth escapes, which quickly remind him that he is yet a beginner, and that, if he pursues his suicidal tendencies, he will be a beginner somewhere else. Indeed, very high speed should not be indulged in until the subconscious mind can be trusted completely to carry out the various muscular control movements automatically in the lightning emergencies which all road users are bound to be confronted with, sooner or later.

We will now turn to the question of actually preparing for the first run, which should be taken over a road well known to the rider and comparatively deserted. Firstly, it is advisable to read carefully through the maker's instruction handbook, carefully noting and, if possible, memorizing the more important details, especially those regarding gear changing; for the gear-box, remember, is a very expensive item of the equipment, and is subject to much damage if carelessly handled. Then place the machine on its stand by releasing the latter and dragging the machine upwards and backwards upon it. Pump up the tyres if they need it (for correct inflation pressures see page 46), and replenish the tanks. When filling the petrol tank, which holds about 2 gallons, take care to use a good size funnel with gauze filter when filling from a can; otherwise you may allow dirt or grit to find its way into the petrol system, and, perhaps, choke a carburettor jet, though this is unlikely, since there are filters in the system itself. As regards

fuel, the author would mention that No. 1 petrol is suitable for all models except TB6 and TB8, where No. 1 petrol and benzol (equal proportions) gives the best results. For racing, alcohol fuels are desirable, but these require special compression ratios, and are really beyond the scope of this handbook. Always replenish the oil tank with the same lubricant. The A.J.S. Co. advise the use of none but the finest brand of oil for lubrication. Any reputable oil firm will give the reader advice on the particular grade to use.

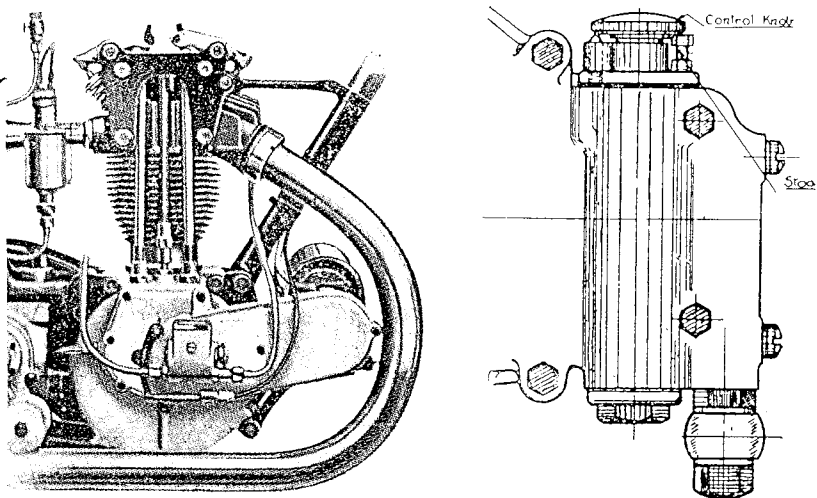


FIG. 22. SHOWING PUMP UNIT AND OIL SUPPLY CONTROL

1926-28 A.J.S. machines had a sight-feed Pilgrim pump (*left*) driven by a dog coupling off the inlet camshaft. To increase the oil supply rotate the milled adjuster anti-clockwise. 1929-30 machines had dry sump lubrication without a main supply adjustment. 1931-33 singles have a duplex pump (*right*) with regulator

The gear-box oil level should be roughly ascertained by removing the lubricator at the side of the gear-box (see Fig. 57). Wakefield "Castrolase" is recommended (for instructions see page 134). Open the petrol cock by pushing the press button forward.

Engine Lubrication. All A.J.S. machines, except Big Twins and O.H.C.'s, now have adjustable mechanical lubrication, so that no attention whatsoever is required other than seeing that the oil level in the tank is kept at the correct level and occasionally draining the crankcase (see page 123). The amount of oil pumped to the engine can be varied by altering the setting of the control knob on the pump unit (Fig. 22). Screwing this knob down, i.e. in a clockwise direction, cuts down the supply of oil, while turning

it the reverse way increases the supply. As may be seen in Fig. 22, a stop below the control knob prevents the oil supply being cut right off. When the engine leaves the factory the oil supply is set on the generous side, and after the engine has been well run-in, say after a mileage of 500 to 600, or if the engine smokes excessively, the control knob should be screwed down about one-eighth of a turn and then re-tested for about 50 miles. If the oil supply is excessive, continue to cut it down by turning the control knob a further eighth of a turn, and so on, until the correct degree of lubrication is obtained. *An approximately correct setting is arrived at by screwing the control knob lightly down to the stop and then unscrewing half a turn.* If the lubrication system is functioning correctly, oil should be observed flowing from the small pipe inside the oil tank immediately below the filler cap.

On 1929-30 machines the main oil supply was not adjustable, but an auxiliary oil feed to the piston had a needle valve control. When using these machines for racing, the needle valve seen in Fig. 41 should be unscrewed one or two turns. This feeds oil direct to the piston. On A.J.S. motor-cycles designed 1926 to 1929, Pilgrim sight feed mechanical pumps were fitted, supplemented by an auxiliary hand pump. One increases the supply by rotating the regulating disc on the side of the pump in an anti-clockwise direction $\frac{1}{8}$ in. at a time, or giving a separate charge of oil from the auxiliary hand pump. AN ENGINE SHOULD BE LUBRICATED SO THAT ON ACCELERATING IN LOW GEAR A PUFF OF BLUE SMOKE ISSUES FROM THE EXHAUST. Once this ideal is obtained, leave the setting alone. While learning to drive, the lower gears are used very much, and consequently lack of good air cooling makes the engine rather hot. Therefore, before setting out on the first run, it is advisable to give more oil than would normally be given. To operate the hand-pump fitted prior to 1929, depress the plunger to its full extent. This fills the barrel with oil, and the plunger, being spring loaded, will automatically ascend, and, while doing so, injects the oil directly into the crankcase. The lubricator can be put out of action by depressing the plunger, and fixing it in its fully depressed position by means of the small catch provided for that purpose. In the case of an early machine equipped with hand-pump only, a full charge should be given every six or seven miles, and, when the engine is being unduly worked, small injections should be frequently made.

Before actually starting up the engine, it is best to take a good look over the machine and get thoroughly conversant with the positions and actions of the various controls. Experiments may afterwards be made with them with the engine running on the stand.

The A.J.S. Controls. The reader should not merely content

himself with knowing how the various controls work, but he should understand their exact functions. He should also understand the four-stroke principle which is described in chapter V. He will then not drive the machine like a Robot, but like an intelligent being. It is a popular idea that motor-cycling requires little intelligence. This is not so; skilful driving requires deep

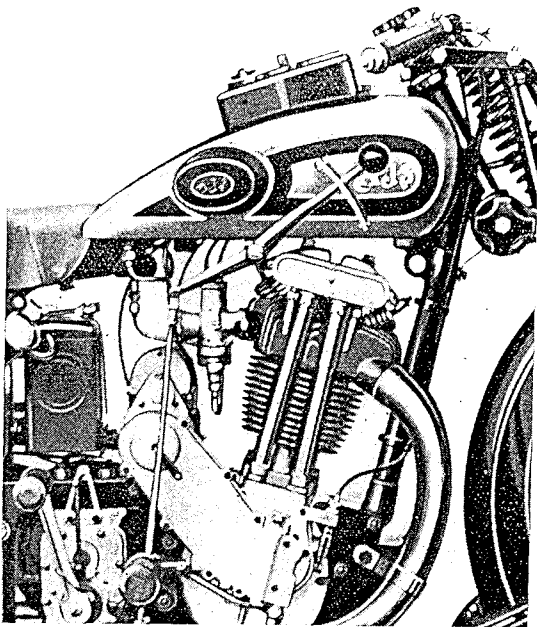


FIG. 23. CLOSE-UP OF 1932 O.H.V. A.J.S. SHOWING ARRANGEMENT OF LUBRICATION SYSTEM AND GEAR CONTROL

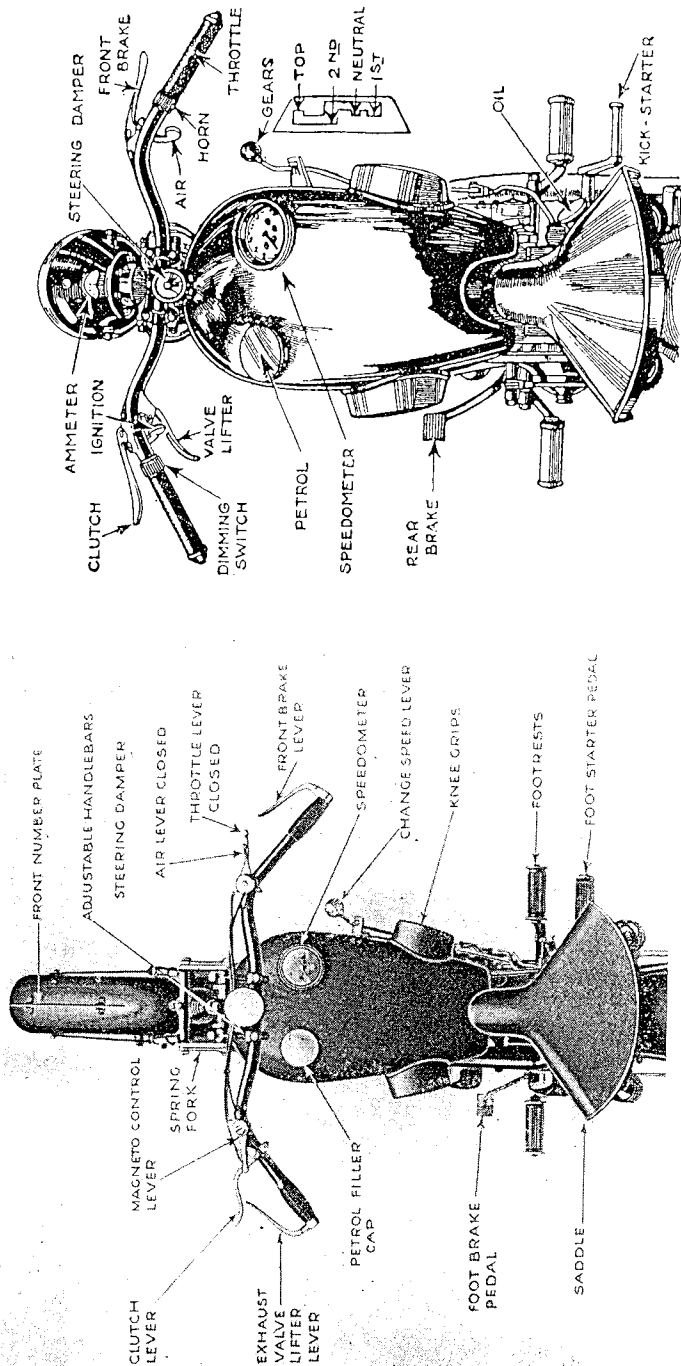
concentration and thought. In fact, nearly all the faculties are brought into active play while driving a motor-cycle; and hence the satisfaction and pleasure that the motor-cyclist derives.

Motor-cycle controls are of two types: (1) engine controls, (2) cycle controls. The former are the most sensitive and important; they are analogous to delicate nerves which convey impulses from the driver's hands to the interior of the engine. If the reader has ridden a three-speed pedal cycle, he will understand the purposes of the gear-box. It is to be hoped, anyway, that he has ridden a "push-bike," for he will then have no difficulty in balancing the motor-cycle straight away. Moreover, he will

have acquired some road sense which only experience can give. A sketch of the 1931, 1932, A.J.S. controls is shown in Fig. 25. The engine controls are all mounted on the handlebars and comprise four: (1) throttle twist-grip; (2) air lever, which on the Bowden carburettor (page 82) is substituted by a mixture control for starting and normal running; (3) lever for advancing and retarding spark, (4) exhaust valve lifter. The two carburettor lever controls are mounted on the right-hand side of the handlebars. A twist-grip (opening inwards) constitutes the throttle which regulates the supply of gas to the engine, and a short trigger below the inside of it the air lever, which likewise controls the air supply. The air trigger is opened by pushing to the right. Their functions will be explained in that section of Chapter V dealing with the carburettor. The exhaust valve lifter, which may be seen on the left-hand side, is primarily intended as a decompressor for facilitating starting. The magneto trigger advances the spark by being pushed towards the right, except in the case of some 1931 and earlier models where it is pushed to the left. For all normal purposes it may be left on three-quarters advance, except for starting, when it should be a quarter to half retarded to prevent the engine back-firing, and thereby delivering a nasty blow to the foot operating the kick-starter. The nove may disregard this lever, leaving it on half advance.

The cycle controls consist of the clutch, the gear-change lever, and the two brakes. The front brake for the present may also be disregarded. Later on use both brakes simultaneously. The clutch is for coupling up the engine to the gear-box. The general principle of the latter should be thoroughly grasped.

Function of the Gear-box. This is made clear if the simple principles involved are understood. The reader will agree that work done is proportional to horse-power developed (neglecting transmission losses). An engine may be called upon to do the same amount of work climbing a gradient a quarter of a mile long as it does on a level mile. The essential difference is that the rate of work is much greater in the former case; that is to say, the work is distributed over a shorter distance. Assuming the speed of the motor-cycle to be kept constant in both cases, four times as much work will have to be done in the same time. The number of firing strokes in the case of a direct driven machine is, of course, the same in both cases, and therefore the power of each stroke will have to be increased by enriching the explosive mixture, i.e. by opening the throttle. But suppose that the throttle is wide open, and the output of work does not exceed the load imposed by gravity when climbing; then, naturally, the machine will slow up and probably stop. There is only one way out of the problem, and that is to increase the number of power strokes until the



FIGS. 24, 25. ARRANGEMENT OF THE CONTROLS ON A.J.S. MACHINES MANUFACTURED 1930-33

On the left is shown the control layout on 1930 series "M" machines of which a great number are in use to-day. On the right is the arrangement on the 1931 series "S" machines and the 1932-33 "T" machines. The machine illustrated is a model TBS without instrument panel, but the controls are the same for all models except that on 4-speed models top gear position is at the rear and bottom gear position at the front of the gate; also no air trigger is provided on 4-speed models. **This scan is explicit for non-commercial use and is not intended for financial or material gain by anyone**

power output is quadrupled in the given time. This means, incidentally, quadrupling the engine revolutions. This can be done by incorporating a gear-box whereby the ratio of engine speed to rear wheel speed can be varied at the will of the driver. The principle on which all gear-box designs are based is the fact that the larger the circumference of a rotating wheel is, the greater is the speed of any point on that circumference relative to the axial speed. Thus a combination of wheels or pinions can be arranged on a countershaft (i.e. a shaft between engine and rear wheel) such that, by the engagement of different pinions of varying sizes, variations of the relative speeds of engine and rear wheel can be obtained.

That destructive weapon of war—the tank—is a good example of how huge driving force can be obtained from a comparatively small motor by the employment of a sufficiently low gear. Up to a point the brake horse-power developed is proportional to the engine revolutions, or (to use an apparently contradictory statement) the power curve is a straight line. The reason for this is apparent if a moment's thought is given to the subject.

The novice is recommended to experiment with gear changes on the stand with the engine shut off. This may be done by moving the rear wheel and coaxing the gears and dogs into engagement. But never force a gear into engagement. The gear-box is not designed for such treatment, and will not stand it for long.

Starting the Engine. We presume that petrol and oil cocks are left open. For easy starting the throttle setting is important. To find the correct setting, first shut the throttle and air controls right back. On machines with the Bowden carburettor there is no air lever, but set the mixture control lever to the closed or starting position. This mixture control lever corresponds to the corrector or choke generally used on car carburettors. Now on machines with lever control open the throttle about one-quarter of its travel or less. In the case of twist-grip control the air control is a separate trigger. The twist-grip is operated by turning inwards to open and outwards to shut. Shut the twist-grip right back, and then turn the twist-grip inwards very slightly so that there is about $\frac{1}{8}$ in. pull on the wire after you have felt the resistance of the throttle spring. On models having the Bowden carburettor $\frac{1}{8}$ in. throttle opening is sufficient. For these settings to be correct there must be no slack in the controls; that is to say, when the lever or twist-grip is shut right back, a slight movement should begin to move the throttle; if it does not do so, the slack should be taken up by means of the adjusting screw on the top of the carburettor. Do not forget the throttle stop. Leave the air level or trigger slightly open, unless the engine is stone cold,

when it is advisable to close it completely. The ignition lever or trigger should be retarded about one-quarter or one-half its travel. Before getting astride the saddle satisfy yourself that the gear lever is locked in "neutral" position and flood the carburettor by "tickling" the needle for a second (it is unnecessary to flood in the case of the Bowden carburettor). Now raise the exhaust lifter and engage the starter with the right foot. Turn the engine over several times with the aid of exhaust lifter, thereby sucking the mixture in. It is best to use the lifter merely for overcoming compression. If this is done, full suction will occur on each inlet stroke. Should an early pattern A.J.S. engine with cast-iron piston be very stiff, it may be necessary to prime it by opening the cock on top of the cylinder, and allowing a few drops of petrol to enter by means of the small priming pipe provided. This should free the "gummed" up piston. But do not prime unless absolutely necessary. Then give one vigorous kick, dropping the exhaust lifter just before the foot reaches the bottom. The engine should now fire. Take the foot off the starter instantly it does so, but do not allow it to spring back with a "bang" after starting the engine. Bring the foot back with the pedal and thereby prevent a heavy blow being given to the stop. If only a few muffled explosions occur, open the air lever slightly and also give more gas. The engine should then fire instantly. No carburation difficulty should be experienced once the engine warms up. As soon as the engine starts push open the air lever or mixture control. When the engine has just started from cold with the air or mixture control fully closed it will be found that the mixture is very rich, so steadily open the control until the engine runs smoothly. After the engine has warmed up full air may be given. Never leave the engine running by itself. As soon as the oil circulates properly, and the engine gets into its stride, the revolutions will increase greatly, and the throttle must be closed accordingly. In regard to easy starting (as may be understood by referring to the context and diagram of the Amal carburettor on pages 79-82) it is essential to keep the throttle nearly closed, so as to induce a high velocity air current over the smaller, or pilot, jet. Under such circumstances it is worse than useless to attempt to start up with the throttle wide open. Refusal to start is always due to some definite cause, and repeated operation of the kick-starter under the same conditions is futile, besides being very exhausting and exasperating. If the engine does not start easily after the first attempt, the rider is usually inclined to flood the carburettor excessively, and so cause the mixture to become much too rich. In this case open the throttle and air lever fully, raise the exhaust valve lifter, and kick the engine over several times. This will result in the excess petrol being cleared out. When starting with the engine warm

keep the air lever or mixture control fully open. Most modern machines, however, are not addicted to starting trouble, except on rare occasions. We will deal with these and their remedies later.

THE FIRST RUN

A tip worth noting is, "Don't go out for a ten minute spin: stop on the road until you get the 'feel' and handling of the machine thoroughly—even if you do keep your lunch waiting." You will then reduce to the minimum the time during which you are a potential source of danger to yourself and all other road users. Now for the first run. Don't forget the driving licence and the insurance "certificate."

Standing on the left-hand side of the machine, push it gently off the stand with the engine still revving and the gear in neutral. The machine will undoubtedly, to the new rider, appear at first rather unwieldy. Therefore, stand close up to your mount when wheeling it about, otherwise you may find yourself underneath the machine. Take things coolly, as though you had driven all your life, and, sitting on the saddle, raise the clutch and push the gear lever into first gear position. Then speed up the engine slightly by opening the throttle and engage the clutch by gently and slowly releasing the lever. You will then move off. It is best not to place the feet on the rests just at first, but to let them dangle on the road ready to support the machine if you find balance difficult. But place them there as soon as you feel able to do so. Bear in mind that you can stop the machine instantly you are in difficulties by raising the exhaust lifter or declutching, and applying the brakes. Never attempt to use any of the gears without first declutching. The novice always gets the impression that he is travelling very fast on first gear, and does not at first feel equal to changing into "second." Moreover, when changing, he feels it imperative to look down at the gear quadrant to verify the gear lever position. If the gears are fumbled, instantly whip out the clutch and start afresh. It is advisable, therefore, to travel some considerable distance on bottom gear, and practise going back into "neutral" without stopping the engine. After getting accustomed to driving on first gear, a change should be made into "second" on a piece of road with no cross-roads. Speed up the machine, and then throttle down, lift the clutch, and push gear lever into position, afterwards letting in clutch again. It is worth while, now you are getting "warmed up," to go a step further, and get into top gear by repeating the former operations. Be careful not to allow the engine to "knock," which it will do if driven too slowly under load. "Knocking" is intensely injurious to an engine, and is usually due to pre-ignition.

Therefore, open the throttle to speed the engine up, and slightly retard the ignition temporarily. It is always advisable to ease the clutch a little until the engine impulses become uniform and smooth. Once in top gear, it will be found that riding is much easier, and you will now begin to acquire considerable confidence. The pleasant "zoom" of the exhaust seems very stimulating after the comparative clatter and "fuss" that is noticeable when driving on low gear. You will probably be tempted almost immediately to open up a bit—even have a burst of speed. There is no harm in this if the road is clear and straight; but for heaven's sake don't do it if there is a suspicion of an obstruction ahead. Also remember that you are driving a new engine (see page 46). When slowing up, leave a good margin of safety. On changing down, the machine should be slowed up until it is travelling at a speed at which it normally does on the gear that is about to be engaged, and the engine must be revved up slightly. The two engaging pinions will then be running at the same speed. No changes down should ever be made while travelling over 15 m.p.h.

This is about all that need be said regarding the first run. We will conclude this chapter with some general hints on driving, and a survey of the chief dangers of motor-cycling and legal matters.

HINTS ON DRIVING

Use of Gear-box and Clutch. This has been dealt with to some extent in the foregoing paragraphs, and the remarks there should be carefully borne in mind, and if carefully observed should enable perfect gear changes to be made. A few additional remarks regarding possible abuses of the gear-box and clutch that may unknowingly be committed are added herewith—

Never employ a low gear for braking purposes; that is to say, never engage a low gear when travelling fast in order to pull up, and do not use a low gear when descending hills, unless they are quite out of the ordinary, for the internal expanding type brakes should be capable of fulfilling all requirements in this direction.

The machine should also never be run unnecessarily on first gear. This gear is only provided for ease of starting and climbing steep gradients, or when negotiating very heavy traffic demanding a very slow rate of progress. Using the first gear unnecessarily simply means extra wear and tear, high petrol consumption, and shortens the life of the engine and transmission.

Never slip the clutch as an alternative to gear changing. Prolonged slipping under load will burn out the cork inserts. Moderate slipping on the level at low speed does no harm.

Take care never to allow oil to find its way on to the clutch plates.

Tyre Inflation. Tyres should always be pumped up to a definite pressure by consulting a pressure gauge. On the Firestone tyres, used on all A.J.S. machines, Schrader valves are fitted, and a Schrader pressure gauge is obtainable. The tyres must not be soft or rolling will occur on corners and the covers will wear badly. Soft tyres are also liable to creep and thereby cause damage to the inner tubes. If, on the other hand, tyres are over-inflated, excessive vibration will result, with horrible discomfort to the driver. Needless to say, the rear tyre usually requires more inflation than the front one. Well inflated tyres have least skidding tendency, and produce the minimum amount of wheel slip at speed. In the case of the two lightweight models (T5, TB6) the 25 in \times 3 in. tyres should be inflated to the following pressures: front tyre, 15-16 lb.; rear tyre, 22-24 lb.

With the heavyweight machines (T6, T8, TB8, T9) shod with 26 in. \times 3.25 in. tyres, recommended pressures are: front tyre, solo, 15-16 lb.; single S.C., 15-16 lb.; double S.C., 17-18 lb. Rear tyre: solo, 18-20 lb.; single S.C., 20-22 lb.; double S.C., 24-26 lb. Sidecar tyre: single S.C., 15-16 lb.; double S.C., 20-22 lb. The above recommendations apply to average weight drivers. For abnormal weight or carrying pillion passenger add 2 lb. to rear tyre pressure only.

"Running-in" a New Engine. When an engine is assembled the bearings are made as tight a fit as is reasonably possible. Owing to the crystalline nature of metal, an extensive and prolonged smooth rubbing will compress the bearing surfaces of the metal together until they attain a glass-like uniformity and hardness. During the process, of course, a certain amount of play arises in the bearings—just sufficient for good running fits. Thereafter wear is very slow. But imagine what will happen if the bearings are straight away subjected to violent friction and heat. Instead of the surfaces acquiring a glassy surface, they will rapidly wear down and become scored or abraded, and continue to be rather soft. Another important point to consider is the fact that until there are good running fits throughout the engine, oil will be unable to find its way about in any quantity over the bearing surfaces, which in consequence will remain partially dry if the engine is unduly worked, with the attendant danger of seizure. Distortion through overheating is also liable to arise. Distortion is of two kinds—temporary and permanent. If permanent distortion of the valve seatings takes place, an engine will never be fully efficient afterwards. All A.J.S. machines are tested on the road at Plumstead before leaving the manufacturers; but as the mileage they do is not great, the rider

should therefore restrain his desire to drive the engine hard until at least 500 to 600 miles on the road have been covered.

Sparking Plugs. Always run with a decent plug in the "pot." There are many good plugs now available, such as the Lodge H.1. A cheap plug causes loss of power and pre-ignition.

Keeping an Engine Cool. If an engine's tune is to be maintained, it is essential not to overheat it. In spite of plenty of cylinder finning, all air cooled engines are liable to become overheated. To prevent this the controls should be handled carefully.

Always drive with the air lever of the carburettor open as far as possible, consistent with even running, and the spark lever well advanced.

After climbing a stiff gradient, never open out on the other side; allow the engine to cool either by raising the exhaust lifter, or by nearly closing the throttle and opening the air lever. The throttle must not be completely closed, otherwise no cooling air enters the cylinder and the oil is liable to be sucked into the combustion chamber by the vacuum thereby created which, of course, accelerates carbonization. Some of the bad effects of overheating have already been mentioned.

Methods of Controlling Speed. Speed may normally be controlled in two ways—(1) driving on the throttle, (2) using the exhaust lifter. The latter method is bad practice, and on the O.H.V. models may cause bent exhaust valves, for if the exhaust valve is held up while the throttle is left open enough to produce a combustible mixture, it will be continually swept by a high temperature flame. That this does happen is indicated by the banging that usually occurs along the exhaust pipe and silencer when this practice is adopted. Moreover, the use of the exhaust valve lifter necessitates complete removal of fingers from the throttle, which is in itself dangerous. Driving on the throttle has many points in its favour. Closing the throttle exerts a powerful braking effect, which can be used to advantage both when driving on the level and descending hills. Indeed, the really good driver seldom uses his brakes. He cultivates such good judgment of speed and distance that he does not often require them. An occasional jab of a brake is all that he needs. A front brake must never be used suddenly; a skid will probably ensue. The rear brake should always be applied first.

Cruising Speed. Every machine has what, for want of a better name, may be called its cruising speed. By this we mean the speed at which the engine runs most sweetly. It usually lies somewhere between 25 and 35 miles an hour. The rider should find out what this speed is in the case of his own mount, and drive most frequently at that speed. If a long life is desired of an engine it should always be driven well within its maximum capacity,

that is to say, on about $\frac{3}{4}$ throttle. In the case of most riders there is not much danger of doing this owing to the winding nature of the roads in this country. At 65 m.p.h. what appears normally to be a straight road often becomes suddenly full of nasty bends which have to be negotiated carefully. Nevertheless it is easy to over-drive an engine in hilly districts. While on the subject of speed we will deal with that so hotly-discussed problem, "What is a safe speed?" The answer to this question is, "A speed at which the driver has complete mastery over his mount in the given circumstances." In many cases the man with leather helmet and goggles hurtling along at 60 m.p.h. is far less dangerous than the sublime idiot who leisurely careers over minor cross-roads at speeds varying from 15 to 20 miles an hour. When somebody on the main road nearly dispatches him and himself to eternity (the best place for him), he miserably complains that he was only doing 20 m.p.h.—20 m.p.h. across a main road! Such people ought not to be charged with exceeding the speed limit, but with attempted murder and suicide! The author has had the misfortune to run up against one of these maniacs, and realizes the nasty sensations that surge up when crashing broadside-on into a vehicle, as well as the nasty repair bill that must inevitably follow. A theory has actually been advanced by some motor-cyclists that it is safer to take cross-roads at high speed because there is less time during which you may hit anything coming across. This line of thought is analogous to that of the Irishman who, when stopped for speeding, said that he was racing to get home as quickly as possible because his brakes had failed, and he was afraid of smashing into anything! Comment on this illogical and suicidal reasoning is needless.

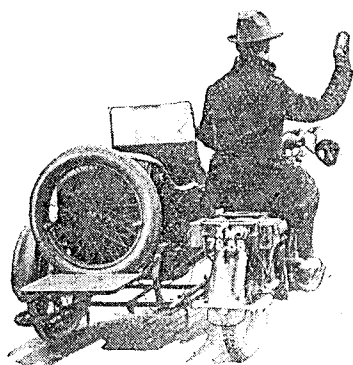
Cornering. The art of cornering takes some time to master. We all know that for a bicycle or motor-cycle to get round a bend fast without skidding it is necessary that the machine should be banked, i.e. the rider must lean the machine inwards towards the centre of the circle. The reason for this is as follows—every moving body possesses momentum, and that momentum at any given time acts in the direction that the body is moving at that time. In the instance of a body describing a circle it is evident that the body is continually changing its direction (a circle theoretically consists of an infinite number of straight lines), and consequently the momentum acts tangentially. Thus there are resultant forces continually urging the centre of gravity of the motor-cycle outwards from the centre, when rounding a bend. But this can be counteracted by inclining the body and machine inwards. A better method, used by some fast drivers, is to incline the machine inwards and the body outwards. Using this method, one may corner almost on the exhaust pipe. Make a habit

of always cornering close in at the blindest part, and indicate your intentions well before actually turning off at a sharp bend. It is no consolation to be able to say that you gave a hand signal, after a high-powered car has buckled up your rear wheel. Never omit to sound the horn at all corners. Sometimes it pays to swerve slightly to the offside before approaching a moderate bend at high speed, throttle down, and bank inwards, thereby cutting the corner somewhat and at the same time keeping close in. The throttle may be opened up again half way round the bend. This kind of cornering, however, comes under the heading of "stunt" driving, which is not recommended to any but the experienced driver.

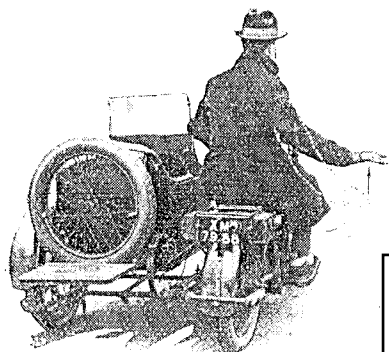
When cornering with a pillion passenger for the first time, reduce speed well below that at which you generally take a corner solo. Failure to do this will probably cause you to drift well away from your proper side of the road—a most risky procedure—because you are afraid of banking too steeply. It is, undoubtedly, unpleasant to bank steeply with a passenger riding pillion. We will deal with pillion riding again later.

Left-hand corners demand special caution on the part of the driver of a sidecar outfit, according to the speed at which corners are taken. He should throw the weight of his body towards the left. A passenger may assist the driver by leaning in towards the centre of the bend; but he should not adopt "T.T." acrobatic methods. Your passenger might easily break his neck against a lamp-post, to say nothing of the indignation and terror that would be caused to any witnesses of the occurrence. The proper manner to navigate a sidecar round a left-hand corner is as follows: approach the corner at a pace well below that which safety requires, and open the throttle gradually and cautiously on the bend; the outfit will then pivot on the sidecar wheel, which is precisely what is required. Conversely, on a right-hand corner either close the throttle or apply the brake a little as the outfit is actually swinging round the bend; it will then pivot on the rear wheel of the motor-cycle. Always endeavour to take corners with a sidecar at a reasonable speed, especially when turning to the left, as centrifugal force puts a great lateral strain on the machine. When turning to the right the lateral strain is reversed in direction and has a crushing effect on the sidecar axle via the torque arms. At high speed the strain is terrific, and a sidecar axle may break. Result, an inquest. Difficulty is often experienced in the management of an empty sidecar while cornering. Ballast substituted for the passenger is of great assistance in this connection.

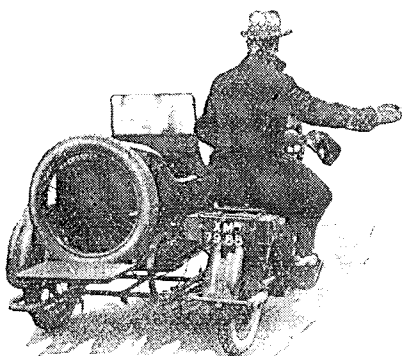
Sidecar Alinement. If a sidecar outfit has a tendency to steer to the right or left due to reasons other than road camber, the motor-cycle is probably not upright or else the sidecar itself is



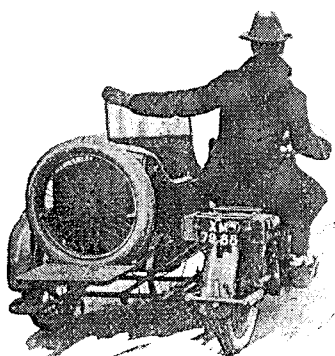
(A)



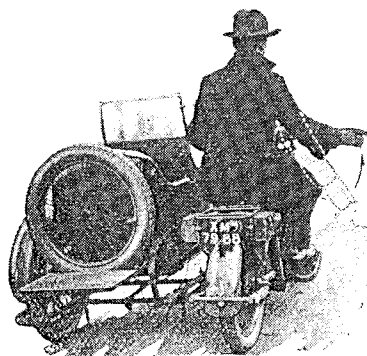
(B)



(C)



(D)



(E)

(From "The Motor Cycle")

FIG. 26. RECOGNIZED SIGNALS TO BE USED BY DRIVERS

A = Signal to stop
B = Slowing down

C = Turning to right
D = Turning to left

E = Overtake me

out of alinement (see page 151). After a new A.J.S. sidecar has done a considerable mileage it occasionally happens that the sidecar fittings take a permanent "set," causing the machine to lean slightly towards the sidecar. This trouble can be easily cured by means of the adjustable arms.

Hill Climbing. There are few hills likely to be encountered by A.J.S. riders which present any serious difficulties. It is purely a question of making the best job of it, or in other words, a climb that will not bring the blush of shame if there should happen to be critical motor-cyclists watching hill ascents, as is often the case, by the side of the road. It is advisable, before an ascent is made, to allow the engine to cool down very thoroughly first. Unless the road is notoriously bad, take a fast determined rush at the hill, and get up as far as possible on top gear. But never allow the engine to labour. As the machine slows up it will be necessary to give less air and retard the ignition gradually. Change to a lower gear instantly the revolutions fall seriously, and there is danger of overstraining the engine. Do not race the engine on low gear, for racing an engine takes more wear out of it than hundreds of miles of normal usage. If a bad patch of road looms ahead which will necessitate changing down again, change down before you reach it. Choose your path carefully, and swing wide round all corners that are not blind. It is preferable to drive at a good speed on some bad surfaces. This also applies to driving on "wavy" level roads. It will be found that periodic "plunging" does not then occur. Sometimes speed variations will also produce the desired effect. Having made a hill ascent, allow the engine to cool either by stopping it or by using the exhaust lifter while descending the next hill.

When climbing a steep hill with a sidecar it is not necessary on taking a left-hand bend to lean over in that direction, as the natural sidecar side-drag tends to turn the machine to the left. This does not apply with a right-hand bend.

When climbing a very steep gradient the passenger can assist the driver by placing as much weight as possible over the rear wheel. Similarly, on descending an unusually steep gradient, he should try and put as much weight as possible on the driving wheel so as to assist the steering.

Coasting. Running declutched down hill with engine stopped is very popular among riders. It cannot be denied that the smoothness and noiselessness of it is altogether a delightful sensation. This procedure, however, unless the hill be very long, does not lend itself to cooling the engine very well, and we must assume that the driver has been climbing—unless, of course, his garage is situated on the top of a hill. It is far better to use the exhaust lifter or, if the hill is steep, to open the air lever and

partially close the throttle. When letting in the clutch again, it is desirable that it should not be let in under full compression with the machine travelling fast; such action may result in a bad skid, and damage the rear tyre. Wait until your mount has slowed up to about 20 m.p.h.; then raise the exhaust valve and let the clutch in gently; when the click and whirr of the valves indicate that the engine is coupled up again, drop the exhaust valve. The throttle being only slightly open, the power strokes will be resumed gradually.

Engine Sprockets for Hill Climbs. For 3.49 h.p. models it is useful to have spares with from 18 to 22 teeth. For 4.98 h.p. machines suitable sprockets have 18 to 20 teeth. A 19-tooth sprocket suits the average hill, but 18 teeth gives more speed for steepish gradients. As a rule, in a hill-climb it is better to gear too low rather than too high. Experience is the best guide.

Pillion Riding. We will not enter into the question whether pillion riding is dangerous or not. Undoubtedly much depends upon the qualities of the driver and the circumstances under which it is undertaken. The fact remains that, as the law stands at present, the only legal requirements are that the pillion passenger shall sit *astride* a suitable pillion seat *fixed* to the machine and shall be covered by insurance. We will, therefore, give a few hints which, if observed, will contribute to safety.

1. The pillion rider should sit astride as close to the driver as possible, so as to put the minimum weight on the tail of the machine. Preferably he, or she, should hold the driver lightly by the waist, and sit on the machine as limply as possible.

2. Footrests should always be provided for the passenger. The feet cannot then foul any of the mechanism, or interfere with the stability of the machine (see Fig. 27A).

3. The driver should not engage in protracted conversation with his passenger while driving.

4. If the roads are greasy do not take a passenger on the back. Crossing and recrossing greasy tramlines on top gear with a passenger is a risky business. It is safer to engage a low gear, and place the feet on the road.

5. Never swerve or bank violently, two-up. The passenger may get terrified, and cause a disaster by leaning one way or the other.

6. Never take a pillion passenger on a long distance night run.

GENERAL HINTS

1. Use the hooter as sparingly as possible. When essential, deliver two or three quick imperious blasts, and be always

prepared to stop abruptly. Sometimes it may be found essential to yell out to somebody rather than use the horn. The language is usually highly coloured, but under such circumstances politeness is criminal. Always use the horn at cross-roads and corners.

2. Always give hand signals, even if you think you are alone on the earth. If a habit is made of it, you will give them instinctively. Remember, however, to give signals in ample time. When stopping, either put your right hand up, as shown in Fig. 26, or move the left hand up and down vertically, as many people do. In any case make your intentions *clear*. A signal that is rarely used, but which is sometimes invaluable, is the signal indicating that you intend to proceed straight ahead. This should be given when you are confronted with oncoming traffic which doubts your intentions at a cross-road. In any doubtful situation, instantly whip out your hand to show what you are going to do, and do it. Everybody knows the utter folly of two people dodging each other. On the pavement two pedestrians doing this invariably fail to clear each other, unless one stops or gives way.

3. Never hesitate. Do the wrong thing rather than run amok. You will then retain your nerve and keep your wits about you.

4. If you should have to choose between killing someone or risking death yourself, do not be a coward, but take the risk. It is usually possible to slip backwards over the carrier at the last moment.

5. Approach cross-roads dead slow.

6. Keep the eyes well ahead. By doing this it is often possible to see over hedges traffic that is rapidly approaching. The habit of taking a sweeping survey of the view ahead is invaluable, and after a time becomes second nature.

7. Always remember that cows and sheep believe strongly in obstruction.

8. Obey all special speed limits and notices (see Fig. 27) and respect the *white lines* and automatic traffic signals.

By disregard of these you bring contempt upon motor-cyclists as a body.

9. Never take things too fine. In ninety-nine cases out of a hundred you will escape, but on the hundredth you may crash. This particularly applies to "cutting in."

10. When streets are greasy, give and take as much room as possible. A side slip on the open road, at reasonable speed, seldom does much harm; but a skid in front of a lorry means either the hospital or the cemetery. Therefore, never behave rashly in front of heavy vehicles.

11. Always have a finger close to the throttle and a foot ready for the brake.

12. Always ensure that the oil tank and gear-box contain sufficient lubricating oil.

13. Keep the "certificate" in a safe place with the driving licence on your person.

14. The speed limit has gone, but don't demonstrate the fact too often in the wrong place.

15. If you have an electric lighting set look after the battery and charge during the day.

ROAD DANGERS AND THEIR PREVENTION

Nowadays road dangers constitute a very real menace to life and limb, but most of them can be effectively counteracted. Some are unavoidable. Others are caused by the selfishness or inexperience of the drivers themselves. The golden rule is this: "Cultivate sufficient imagination to ride in a state of constantly expecting the unexpected, especially over unfamiliar roads, and always assume the other fellow may do the wrong thing." Remember that bad accidents always arise from some unexpected or sudden incident, e.g.—

A child suddenly darting across the highway.

Vehicles in front stopping suddenly (beware four-wheeled brakes).

Cars you are overtaking drawing out.

A steam roller round the corner.

Cyclists riding abreast the other side of a canal bridge.

Faulty hand signals.

Sudden brake failure.

Snap of a throttle cable.

Attempted suicide by dogs, poultry, drunken men, old ladies.

Skid of a vehicle in front.

Passengers dismounting from tramcars.

Pedestrian stepping off the kerb with eyes skywards.

Person emerging from behind stationary vehicle.

There are a thousand and one other contingencies that the mind can conjure up, any or all of which may arise in lightning fashion. It therefore behoves the motor-cyclist to concentrate on his job, and never to allow either his mind or his eyes to wander. When driving in traffic, a glance to ascertain whether any blue smoke is issuing from the exhaust may easily cost a man his life. Absent-mindedness in the professor's study is said to be a sign of genius, but on the road it is a sure passport to eternity.

"Dangerous" and "Careless" Driving. Although the general

20 m.p.h. speed limit, honoured more in the breach than the observance, has now disappeared, a vigilant police watch on driving is kept by the new mobile police force, and woe to the motor-cyclist or motorist caught driving to the public danger. "Dangerous driving," now heavily punished, means driving at a speed or manner *dangerous having regard to all the circumstances* actual or hypothetical, i.e. having regard to other traffic or pedestrians that are in the vicinity or might reasonably be expected to be there.

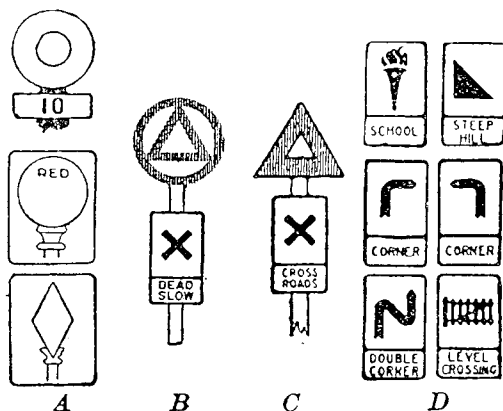
In order to meet cases of negligent driving of an unpremeditated nature, such as failure to give hand signals, "careless driving" is made an offence with which a motorist may be charged, and the penalties for this are not quite so severe as for "dangerous driving." Passing on corners and cutting-in would come under the first heading, however. "Drunk in charge" usually means imprisonment and automatic suspension of the driving licence. A summons must be served within fourteen days of an alleged offence, and the driver must be notified at the time of committing it that prosecution will be considered.

Danger Signs. There are various types of signs scattered about the country, and they should be implicitly obeyed. Fig. 27 shows the principal types. Those shown at *A* from top to bottom are respectively the local speed-limit sign, one indicating that road traffic is prohibited, and a general motor notice. At *C* and *D* are a group of self-explanatory signs. In spite of the abolition of the general speed limit, some local limits still exist and must be strictly observed. A special sign designed to show when a driver is approaching a main road from a subsidiary road is now in common use. This sign is shown at *B* (Fig. 27).

Skidding. Nerve is the best antidote to skidding. A bold rider seldom skids, and when he does he usually corrects it. Skids seldom occur on dry roads. Too violent braking or crossing tramlines in a timid fashion is usually the cause. Brakes should be very gingerly applied on wet roads, and tramlines should be negotiated fearlessly at a good speed and at a sharp angle. A rear tyre with worn tread usually facilitates skidding. Therefore, during the winter months, if the rear tyre is worn badly, change it over to the front. This procedure is recommended, anyway; for it enables the best tyre mileage to be obtained. If a skid does occur, instantly declutch and turn the machine in the direction of the skid, braking at the same time. If you do not go over, carry straight on without stopping.

Animals on the Road. Animals that the motor-cyclist encounters on the road vary from small Pekingese dogs, complete with pink ribbons, to vicious-looking bulls. The former may be completely ignored, but the latter must be treated very cautiously.

If a fierce terrier, or an Alsatian wolfhound, leaps at you, it is safer to deal severely with it, rather than say, "Good dog," or something to that effect. By this we mean throttle up and either kick out or land out with a clenched fist. This action is unlikely to harm the dog, but the suddenness of it will momentarily deter it from its canine instincts and will enable you to accelerate clear. A dog jumping about under the front wheel is decidedly dangerous and do not be afraid of accelerating. A dog can always get clear



(From "Road Sense," 1930)

FIG. 27. SOME IMPORTANT ROAD SIGNS

of a single track motor-cycle, but not a car. A car driver should always slow down. Straying cattle are sometimes encountered on country roads at night, and the rider should be prepared to meet with unlighted objects accordingly.

Always throttle right down when passing horses. If you are signalled to stop and fail to do it you are violating the law. Apart from this, a horse is a very faithful and intelligent animal, and you have no right to frighten it by roaring past. Such action is contemptible.

Dazzle. When driving by night, cars with glaring headlights are frequently met. If the eyes are allowed to face such lights, the pupils contract to such an extent that temporary blindness ensues immediately after the lights have passed. This is very dangerous if there is any traffic immediately ahead of you. Make it a rule to keep the eyes focused on the ground in front, and "concentrate" them at the moment of passing. This should entirely eliminate what is usually called "dazzle." It is purely a question of using a certain amount of will power and common sense. On a model provided with Lucas

electric lighting always dim the headlamp when approaching a brightly illuminated vehicle. Its driver, if he is a gentleman, will then cut out the glare from his lamp or lamps.

When a fog is coming on before dark, it is imperative not to waste a second during daylight if bound on a long run with little prospect of "getting there" by any other means. There are three reasons for this—(1) As soon as the ground temperature falls on the approach of night, the fog will rapidly thicken, (2) lights in fog are worse than useless for picking out one's way, (3) the fog will drive most road users off the road, and there will be little likelihood of any assistance forthcoming, should you have any trouble. If engine trouble should develop just before dusk, you will have to do one of two things—either work like a Trojan and get the engine running again, or abandon all attempts to proceed farther. Driving long distances in thick fog requires all the courage and nerve that you can summon up. If a vehicle ahead is making good progress, follow its tail light. It is astonishing how a man can steer his machine dead straight, so long as he has a sense of direction, even though he may be unable to see the road at all. In some cases frost-covered telegraph wires show up above a low lying fog and give considerable assistance. Similarly tramlines are very useful. A dense fog is often accompanied by icebound roads. Driving on an icebound and fogbound road by night is not one of the best forms of amusement. Skilful use of the throttle has to be made to eliminate wheel spin, and brakes have to be used super-cautiously. Driving in fog, in spite of its dangers, has attractions to some people. It undoubtedly tests to the utmost the driver's abilities and endurance.

GENERAL REMARKS

Obey the law not only in letter but in spirit, and be courteous to all other road users. Never pass by a stranded motor-cyclist without asking whether you cannot assist. Nothing fills a rider with such disgust as for men to roar past when it is obvious that the driver requires help. It may be only a special size spanner that he requires, but stop to inquire. Remember, the modern motor-cycle is a ghastly thing to push up hills. Troubles that may beset the rider are many, but, actually, troubles are few and far between. All possible troubles are fully dealt with in Chapter VI. After considerable experience on the road the driver can tell by the sound and behaviour of his engine whether it is running as it should, and can diagnose trouble instantly it occurs. In fact, the machine becomes an open book to him, and he never lets the idea of getting stranded enter his head; also he feels confident of rectifying any trouble that may occur. Every engine has a

personality of its own which only the driver who has studied it understands, and it will only give of its best to this driver.

Road Accidents. To conclude these hints, the author feels he must emphasize the very real need for the cultivation of driving skill and road sense among all motor-cyclists. Statistics of road accidents for the past year, recently issued by the Ministry of Transport, and which the author has before him as he writes these words, make appalling reading. No less than 6,500 people met their deaths on the road in 1931—an average of eighteen per day. Altogether there were about 200,000 accidents known to the police as compared with 40,000 in 1918. Thus in thirteen years road accidents have become five times as frequent. The proportion of motor-cycle accidents does, however, show in a favourable light. Something must be done to stop this wanton destruction and maiming of human beings! It is your bounden duty as an A.J.S. motor-cyclist to see that *you* do not contribute to the list of killed and injured on the roads of Great Britain during the forthcoming years, when motorists and motor-cyclists will become more and more numerous.

SOME POINTS ABOUT THE LAW

The legal matters regarding licensing and registration having been disposed of it remains to deal with questions concerning breakage of the law. It is wise to remember that in all cases of accidents or of legal trouble the legal departments of the Automobile Association and other road organizations are always ready to assist members on receipt of an S.O.S., and to give free legal defence in the case of certain offences. The following information is given because in law "ignorance is no defence."

What to do in Case of Accident. The first thing to do in case of accident is to obtain the names and addresses of at least two independent witnesses who are *likely to assist your case*. Carefully jot down on paper all particulars of road width, place of accident, your speed at time of accident, whether horn was sounded, and all other particulars relating to the accident. Remember that insurance companies rely mainly upon the police reports. Therefore, it is essential to summon a police officer so that he can take down *signed* statements from both parties, both for perusal by police headquarters and for the benefit of the insurance companies concerned. A full truthful statement must be made. Anything withheld will react unfavourably against the driver later on. If an injured person is likely to make a claim, an independent medical man should be called to examine him and make a report. Do not engage in any correspondence without legal advice, or if this is not taken, make clear that all your statements in the letter are made without prejudice to your case; and refrain from making

statements either at the time of accident or afterwards, which might be construed as admission of liability. Never offer money to the injured person, for motives of sympathy are often construed into admissions of legal liability.

Name and Address. To anyone who complains that the motorist has committed an offence of driving to the common danger, the driver must give his name and address. The maximum penalty for refusing, or for giving a false name and address, is £20, with heavier penalties for subsequent offences.

The Order to Stop. A person in charge of a horse may order a motor-cyclist to stop, and so may a constable in uniform, or a man injured by your machine. To fail to do so is an offence. In any case an order to stop should never be ignored. The signal to stop should be made as already noted on page 50.

Endorsement of Licence. Convictions under the Road Traffic Act, 1930, may be endorsed on the back of the licence, except a conviction for obstruction. In the case of "dangerous driving" (page 55) an endorsement automatically follows. It is not widely known that a driver who has had his licence endorsed can obtain a clean licence at any time for the fee of 5s., provided that he has not, during a continuous period of not less than three years, had any conviction endorsed.

Drunkenness. A person found in charge of a motor-cycle while under the influence of drink is liable to imprisonment without the option of a fine, and on conviction his licence is automatically suspended.

Warning of Approach. It is compulsory to give audible warning of approach whenever it is necessary. Failure to do so renders the driver liable to conviction for "dangerous driving," and to an action for negligence if anybody is injured as a result.

Exhaust Cut-out. It is illegal to use an exhaust cut-out, or any contrivance enabling the exhaust gases to escape into the atmosphere without first passing through an effective silencer.

Arrest. The driver is liable to arrest by a police constable (whether in uniform or not) if he refuses to give his name and address, refuses to produce his licence on demand, or if his machine does not bear the identification (registration) marks.

Rules Regarding Number Plates. The driver of a motor-cycle is guilty of an offence if the number plates are not properly fixed, or if they are in any way obscured or rendered illegible or not properly illuminated, unless he can prove that he has taken reasonable steps to prevent this, and if the driver is not the owner the latter may be charged with aiding and abetting.

Illumination (see also Chapter II). The driver must always comply with the existing lighting regulations; otherwise he may be summoned. One number plate must be properly illuminated

Regarding the Registration Book. When a licence is issued a registration book is issued to the owner, and this must be sent to the Council with whom the vehicle is registered as follows—

1. When any alteration is made to the vehicle.
2. On sale or change of ownership.
3. On change of address.
4. When vehicle is broken up, destroyed, or permanently sent out of the United Kingdom.

Obstruction. The machine must not be left for an unreasonable or unnecessary time on the highway in such a position that it constitutes an obstruction to other traffic or pedestrians.

Time Limit for Summons. Unless previously warned at the time the offence is committed, notice of an intending prosecution for committing any motor-cycling offence must be given to the driver or the registered owner of the motor-cycle within 21 days of the alleged offence.

Right of Appeal. A person convicted of an offence under the Road Traffic Act, 1930, has the right to appeal to next Court of General Quarter Sessions. A right of appeal lies against an order disqualifying any person from obtaining a driver's licence.

Speed Limit. Although general speed limit has been abolished, special limits of 8 or 10 miles per hour are fixed in certain towns and villages. These must still be strictly observed.

Leaving the Machine. A motor-cycle may not be left with the engine running while the owner is absent, however short the period.

Police Warnings. A new system of dealing with first offences of a minor nature has recently been introduced. Under this system it is customary, unless the offence be serious, to give the offender an official warning instead of bringing a prosecution. Whether or not the offender be prosecuted is left to the discretion of the Commissioner of Police. This system is a step in the right direction and does much to avoid frivolous prosecutions.

Petrol Storage. Those who desire to possess a petrol "dump" on their own property should remember that a maximum of 60 gallons in 2-gallon tins is permissible, and it must be located at least 20 ft. from an occupied building. Also the store must be arranged such that, in the event of fire and leakage from the tins, the inflammable liquid will not escape. Suitable ventilation must be provided, and when any petrol is kept other than in the fuel tank, a fire extinguisher or sand must be kept on the premises.

CHAPTER IV

RUNNING COSTS AND TOURING

IN this chapter we will consider briefly the expenses connected with motor-cycling, and thereafter we will discuss some matters relating to touring. Most motor-cyclists, sooner or later, have a desire to extend their field of activities. They become tired of constantly wandering over their old routes, which are usually confined to a radius of about 50 miles from their homes, and they wish to set out on a long distance tour, either in this country or abroad. For the present let us deal with running costs.

RUNNING COSTS

Cost of the Machine. This is the principal cost of motor-cycling, representing as it does an initial outlay of some £50 or more, according to the type of machine purchased. But remember this is really an investment, and the expended capital can be recovered minus a certain sum representing depreciation on selling the machine. Any A.J.S. model can also be bought on the hire-purchase system.

Depreciation. This ugly item is an added reason for purchasing a reputable machine in the first place, for such machines always command a fair market price. It is a hideous fact, but nevertheless true, that the purchaser loses at least £5 in removing the machine from the shop window. From that time onwards the machine can no longer be regarded as new. It stands to reason that depreciation* depends mainly on the way the machine is kept, but it also depends largely upon the age of the machine. Many people will not buy a machine that is more than three or four years old (old in the sense of date of design). Therefore, unless the rider intends to stick to the machine until it is thoroughly worn out, it usually pays to sell after a couple of years' riding. The vendor may then reasonably hope to recover at least 50 per cent of his capital expenditure. If the machine is in sound condition, and the appearance is still good, he may get back as much as 70 per cent. In reckoning the cost of motor-cycling, this factor must be taken into consideration. Reckless or careless driving and general neglect of the machine cause depreciation to be very rapid, and motor-cycling becomes a costly affair.

Cost of Licences. This has been already dealt with in Chapter

* Depreciation is usually reckoned at $33\frac{1}{3}$ per cent per annum.

II. It represents a very fair outlay to the motor-cyclist, and is rather disproportionate to the damage done to the highways. However, under the present system of taxation, it must be faced cheerfully.

Garaging. Keeping a solo motor-cycle at a public garage costs about 2s. 6d. a week on the average, or £6 a year, and a combination an extra shilling a week. If circumstances permit, it is well worth while erecting a cheap shed or buying a portable and collapsible shed ready-made. Overhauls can then be carried out in perfect seclusion and, moreover, no objection can be made to coming in at "unearthly hours." Such a shed should not cost more than £4 or £5, and, of course, it will last indefinitely. Due regard must be paid to fire regulations (see page 60), and *before* erection, plans of the structure must be submitted to the local surveyor for approval.

Petrol Consumption. Petrol consumption depends on many factors. Fast driving or driving on low gears results in a high consumption. Also a badly tuned carburettor will not contribute to fuel economy. Speaking generally, however, the average 3.49 h.p. machine should have a fuel consumption of at least 80 m.p.g., and when specially tuned should do about 90 to 95 miles on a gallon of spirit. A 4.98 h.p. machine should do at least 70 m.p.g. solo, and at least 50 m.p.g. with sidecar.

Oil Consumption. One quart of oil should suffice for a mileage of at least 500, with considerate driving of a 3.49 h.p. solo machine and at least 350 for a 4.98 h.p. model.

Tyres. Tyres, when well inflated, should have a useful life of from 10,000-12,000 miles. A certain amount of luck enters into the question, for a severe gash due to a piece of broken glass may practically ruin a new tyre, but this rarely happens. Some words on tyre maintenance are given in Chapter III (see page 46). When buying new tyres it always pays to get the best, and nothing but the best. Firestone tyres are standard on all A.J.S. machines.

Sparking Plugs. Quality here again is important. Cheap plugs give poor service, and soon want renewal. Buy plugs as recommended by the makers (see page 47). These should only need annual renewal. Unsatisfactory plugs often cause mysterious loss of power.

TOURING

Dress. Long distance touring requires careful preliminary consideration regarding dress if any enjoyment is to be derived from the tour—or rather if acute discomfort is to be avoided. The all-weather motor-cyclist has to cope with every variety of heat and cold, wind and wet. For short distance runs dress does not matter much. All that is required is protection of the

clothes and eyes from dirt. Clothing for this work is left to the rider's fancy. Some go about clad in flying suits, helmet, and so on. Others go about dressed in riding breeches, leggings, and a bright coloured b  ret. All this is a question of individual taste, but where touring is concerned, the rider must have plenty of warm waterproof clothing and goggles should be worn. Constant and prolonged exposure of the eyes to cold and dust produces chronic inflammation, and is thoroughly bad for the eyes.

All-Weather Riding. Whilst it cannot be denied that riding in spring and summer weather is very pleasant, winter riding has its charms. Many riders openly avow that they do not care what the weather is like. They get plenty of satisfaction under all conditions. This is, perhaps, true in the case of a certain class of rider, but not for the majority. This type of motor-cyclist keeps himself warm through sheer excitement, not woolly under-clothing! However, we will deal with the average rider, who places bodily warmth foremost.

The commonest type of winter dress consists of the ordinary buff waterproof coat and leggings, the latter either buttoning up the sides, or lacing. Most accessory dealers sell this type of apparel. They are, however, rather clumsy, and apt to get torn and become generally dilapidated looking. A far more satisfactory garment is one of the surplus R.A.F. Sidcot flying suits with fur collar, that can be obtained for the modest sum of about three guineas. Better still, get a leather coat and trousers to match. No definite instructions regarding apparel can be given. It is all a question of taste and money available.

Headgear. A tight-fitting cap is the most suitable headgear for normal motor-cycling purposes. If predisposed to blow off, it may be reversed, that is, placed peak to the rear. Many riders are inclined to dispense with headgear altogether. This is all right provided that the hair is not liberally swamped with hair grease. In this case dust and grit accumulate horribly. For long distance touring, in cold weather, the helmet is unchallenged; it keeps the ears and face warm and free from road dust. For competition riding (reliability trials excluded!) the crash helmet is essential. In all track racing it is compulsory to wear such a helmet.

Gloves. The problem of keeping the hands warm and at the same time enabling them to finger the controls sensitively is a difficult one. Many fast riders prefer to do without gloves, saying that they would rather have the finger tips cold than run the risk of being cold all over. Woollen gloves are dangerous, as they may open the throttle by catching on the lever when removing the hand to change gear. Gauntlets keep out the cold, but spoil the sensitiveness of control. An attempt to solve the glove difficulty has been made by several firms who market a rubber muff which

fits over the handlebar grip and controls. This idea is very sound, and should the rider experience great discomfort through cold hands he cannot do better than obtain a pair of these muffs.

Preparing for a Tour. If the reader is contemplating an extensive tour, and is a member of one of the Associations mentioned in Chapter II, he should write to the secretary of the Association concerned and apprise him of the intended route. A detailed itinerary will then be supplied, and useful information concerning state of roads, etc., given. When undertaking a Continental tour, the society, if requested to do so, will obtain the member's passports, carnets, or triptiques, and thereby eliminate the necessity for leaving deposits when visiting a foreign country.

Maps and Guides. These are very necessary adjuncts to touring, and indeed the fascination of planning a tour is part of its pleasure. The route should be traced out in red ink on the map to facilitate reading. Large scale Ordnance Survey maps are the best, as they show all contours, and the route may be chosen so as to avoid all the worst gradients, unless the tourist wishes to include all the fine view points, and then, of course, he will select the hilly roads. The tourist, if his time is limited, should split up the route into sections, allotting so much time for each section. He can then run to a definite time schedule. For long distance touring in the United Kingdom, the Michelin guide is of great value, giving as it does all particulars regarding hotels, repairers, and other useful information.

Spares. There is little need to carry more than a repair outfit, pump, complete tool kit, spare plugs, spare tubes, spare chains and links, one spare valve complete with spring, washer, and cotter, and a complete repair outfit for tyres, as before mentioned. Pack the tools tightly with rags. Also take some spare bulbs.

Luggage. For touring purposes, it is obviously senseless to burden up the machine with luggage. Carry on the machine the absolute minimum amount necessary. Send the rest by rail. We will not defile these pages with a description of all the gear and tackle necessary to keep man in a civilized and respectable condition. We will leave that to the reader's common sense.

Taking the Machine Abroad. The triptique, referred to previously, enables the owner to travel in Finland, France, Italy, Holland, Belgium, Romania, Spain, Portugal, Russia, Norway, and Sweden, or as an alternative a member may get an International Customs Pass, issued by the A.C.U. and A.A. to members and non-members, whereby the highest continental duty payable suffices for all the countries forming part of the convention.

International Travelling Passes (duration, 12 months) are also issued, enabling the holder to travel in all countries which are parties to the agreement, without obtaining the special licences

or carrying special numbers in each country as hitherto. The Customs Pass concerns the customs duty payable ; the Travelling Pass is exclusively a licence for the machine and driver abroad.

It is no longer necessary for the tourist to be examined by a foreign official, to obtain foreign licences, or to undergo any other formalities. It is only necessary to obtain the International Pass and fix an oval plate to the machine with the letter G.B. painted in white on a black background. This plate must be illuminated by night.

Continental Rule of the Road, etc. As a general rule *Keep to the Left and Pass on the Right* in Austria, Hungary, Portugal, and Sweden.

As a general rule *Keep to the Right and Pass on the Left* in Belgium, France, Germany, Holland, Italy, Russia, Spain, Switzerland, and the following provinces of Austria and Hungary, viz., Carniola, Dalmatia, Tyrol, Istria; Carinthia.

The speed limit in Belgium is 40 kilom. an hour in the country and 15 in town. Special regulations apply to Brussels. Most Belgian roads are very bad.

Lighting-up time in France is 15 minutes after sunset. Rear number plates must be illuminated. French roads are, on the whole, good. Cars and motor-cycles entering Paris are stopped, the petrol in tanks measured, and *octroi* duty charged.

The roads in Holland are generally good, but narrow and winding. No special limit is fixed on country roads, but motorists can be prosecuted for driving to the common danger. Some roads are closed to motor traffic.

The general rule of the road in Italy is to keep to the right, but it is frequently reversed in many districts and towns.

In Northern Italy and parts of Central Italy the roads are good and often excellent. In the Southern Provinces the roads are bad.

The speed limit in Spain is under 20 m.p.h. in parts.

GENERAL HINTS ON TOURING

A few general hints on the subject of touring may well conclude this chapter and, if acted upon, will contribute to the pleasure derived by the tourist—

1. Before setting out on a long distance tour satisfy yourself that the machine is in sound mechanical condition and that the tyres, which can mar or make a tour, are likewise in good condition.

2. See that you have aboard a complete tool kit and repair outfit and a few vital spare parts.

3. If you are driving a combination, put a passenger in the "chair."

4. When touring abroad remember that *you* are the foreigner, not those with whom you come in contact.

5. Never drive further in a day than you feel fit for, and keep the speed for the greater part at 25-35 m.p.h. Such a speed is not conducive to physical fatigue and enables you to *see* the country through which you are passing.

6. Avoid the big towns and cities as much as possible.

7. Plan the whole tour carefully before setting out.

8. See that you are fully insured against accident, and against third party risks and have the necessary "certificate."

9. Smear potato juice on goggles in wet weather to prevent blurring.

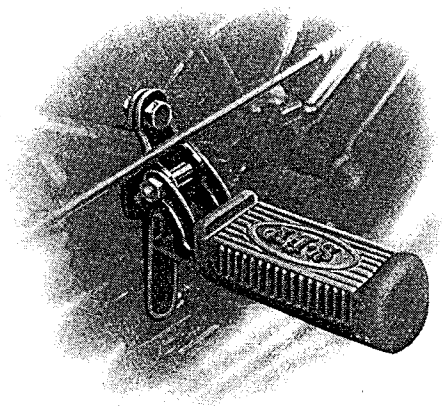


FIG. 27A. A USEFUL ACCESSORY: A.J.S. PILLION FOOTRESTS, ADJUSTABLE FOR ANY POSITION

INTERNATIONAL MARKS

An oval plate is used, the distinguishing marks of the country of origin, consisting of one or two letters, painted in black upon a white ground.

A	Austria	F	France	NL	The Netherlands
B	Belgium	GB	Gt. Britain & Ireland	P	Portugal
BG	Bulgaria	GR	Greece	R	Russia
CH	Switzerland	H	Hungary	RM	Romania
CS	Czechoslovakia	I	Italy	S	Sweden
D	Germany	E	Spain	US	U.S.A

CHAPTER V

HOW THE ENGINE WORKS

IN these days, when the internal combustion engine is of such vast service in so many spheres of locomotion—when it provides the motive power for airways that are rapidly spreading throughout the world, when it is mechanizing great armies, and when it is giving millions of people the facilities for enjoying healthy recreation in the way of motoring, yachting, and other sports—there are, perhaps, few people who have no glimmering as to how the four-stroke internal combustion engine works. Nevertheless, in a book primarily designed to meet the needs of the novice, a brief explanation of the behaviour of the four-stroke cycle engine can scarcely be omitted.

During the titanic struggle in Europe, which waged incessantly from 1914 to 1918, the petrol engine progressed by leaps and bounds. This was brought about through dire necessity. The belligerent which had the mastery of the air was at liberty to bomb and photograph every part of the enemy's lines, and to wreak havoc and destruction miles in their rear. Thus the frantic race for supremacy in engine design went on year after year, for the performance of aeroplanes depends largely upon the weight/horse-power ratios of the engines installed. But the fundamental principle upon which the four-stroke engine works has not altered one iota, and probably never will. True it is that wonderful inventions are made from time to time—take, for example, the Constantinesco Torque Converter—but basic principles remain unaltered. Those who have some knowledge of the “Otto,” or “four-cycle” stationary gas or oil engine, start with a considerable advantage in the study of the petrol motor, because the principles involved are identical in each case, although the mechanical differences are very great.

THE FOUR-STROKE ENGINE

Coal gas and several other gases become explosive when mixed with certain percentages of air (or oxygen), the percentage varying with the particular gas used, and, to a lesser extent, with the character and temperature of the atmosphere, so that a certain gaseous mixture imprisoned in a space (called the combustion chamber) will, if ignited, exert a pressure in all directions due to the rapid rise of temperature on combustion; and here it is well to impress upon the reader the fact that all internal combustion

motors are heat engines, i.e. they derive their power from the intensely rapid production of heat at the moment of explosion ; and it should further be noted that the more rapid the ignition, and the more complete the combustion, the greater will be the power of explosion. Strictly speaking (turning to the ridiculous), an H.E. bomb is a heat engine—an engine capable of vast destruction, including itself ! To effect complete combustion it is essential that the mixture is correct. In the case of the petrol engine, a good explosive mixture contains by weight about 93 per cent of air and 7 per cent of petrol. Any variations from this proportion will result in the combustion being incomplete, or slow. In the latter case the mixture will burn rather than explode—after all, the only difference between burning and exploding is that intensely rapid burning generates great heat in an infinitesimally small period, with the result that a loud bang (called an explosion) occurs when the hot exhaust gases come up against the atmosphere. The importance of having complete combustion will be seen later. Incomplete combustion necessarily entails a considerable loss of power.

A crude illustration of the basis of gas engine or petrol motor construction may be given if a coffee canister with tight-fitting lid be imagined to be filled with the explosive mixture, and by some means the contents ignited ; the result would be that, the pressure in all directions being equal, a violent explosion would hurl the lid far away ; but if for that loose lid we substitute the piston *A*, Fig. 28, a close sliding fit in a fixed cylinder *B*, the piston being directly coupled to a crank *C*, by a connecting rod *D*, the shaft *E*, on which the crank is fitted, will now have reciprocatory movement of the piston transformed into rotary movement of the shaft, and, at the moment of explosion, the shaft will begin to rotate. Suppose the shaft *E* is attached to a wheel *F* called the flywheel ; then this wheel will be set in rotation also. Being purposely made heavy, it will go on spinning for some time—in fact, if there were no friction it would go on for ever—owing to the kinetic energy it derives from the initial explosion by virtue of its inertia, and will cause the piston to reciprocate in the cylinder. It can clearly be seen that the piston makes two strokes for every revolution of the flywheel. Let us assume that the explosion has just occurred, and that the piston after reaching the bottom of its stroke, is ascending again. Imagine a valve at the top of the cylinder to be open during this stroke. Then the products of combustion will be swept out of the cylinder. Similarly it is easy to see that, if on the commencement of another down stroke, a second valve opens admitting an explosive mixture, while the first valve closes, the cylinder can be recharged with gas during this down stroke. If, on again reaching the bottom

of its stroke, both valves close, the charge of gas will be trapped and compressed during the ensuing upward stroke ready for the next explosion. Thus, clearly, the flywheel can be made to rotate continuously, so long as provision is made for supplying the explosive mixture and causing a spark to take place at the right time. The explosive mixture is supplied by what we call a

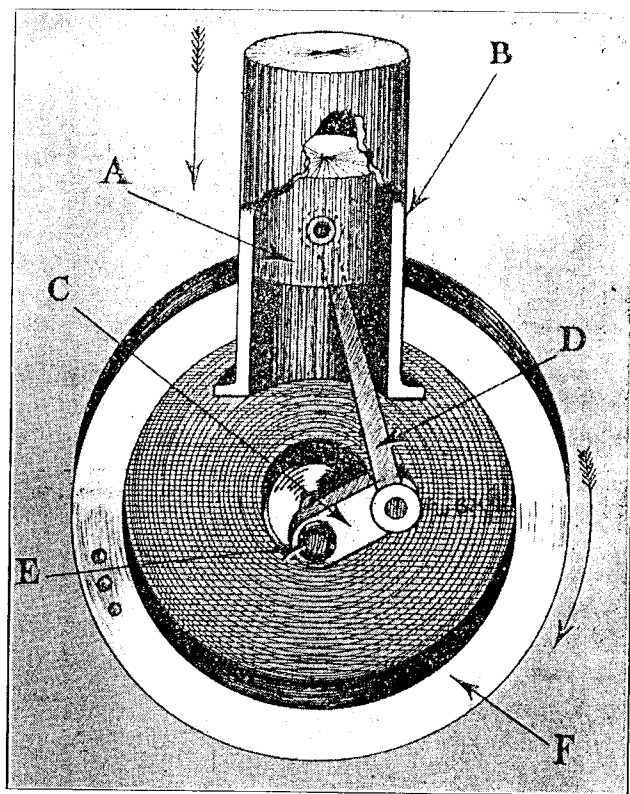


FIG. 28. DIAGRAM ILLUSTRATING HOW A PISTON (A), SLIDING IN A CYLINDER (B), ROTATES THE FLYWHEEL (F)

carburettor, and the spark by a *magneto*. We will for the present confine ourselves to a more detailed description of the four-stroke cycle. Let us refer to Fig. 29, which illustrates the cycle of operations very clearly.

Two valves are fitted in the cylinder head, namely, the *inlet valve* and the *exhaust valve*. When both these valves are closed upon their seatings, the space above the piston is a sealed chamber.

If the *inlet valve* is open, the cylinder is in communication through the *induction pipe* with the carburettor. If the *exhaust valve* is

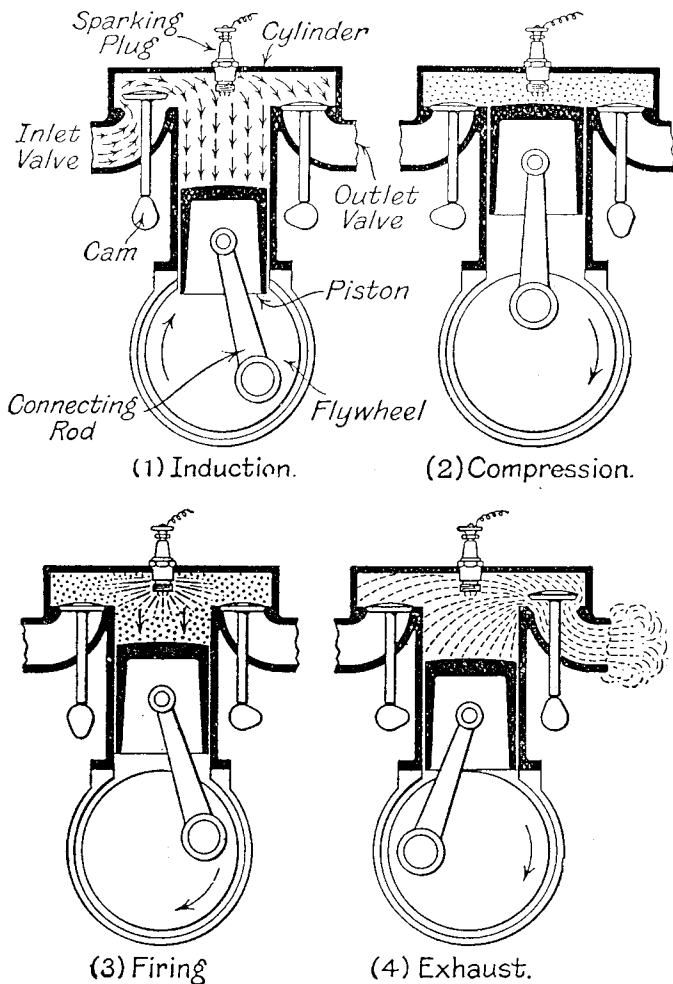


FIG. 29. THE PRINCIPLE OF THE FOUR-STROKE ENGINE

open, the cylinder is in communication through the *exhaust pipe* with the silencer. .

We will now suppose that the piston has just reached the top of its stroke after sweeping out through the open exhaust valve

the hot gases left in the cylinder after a firing stroke. During this upward stroke the inlet valve has, of course, remained closed, for otherwise the hot gases would have had access to the carburettor via the inlet valve, with dire consequences that may be left to the imagination. The two valves are open and closed at the correct moments by cams upon the *half-time shafts* driven by gearing off the engine shaft at half engine speed. Fig. 30 illustrates how a valve tappet *A* is operated by a cam *B*, with rocker *C*, on a half-time shaft *D*, driven by a gear wheel *E*, off the engine pinion *F*. See also Fig. 54.

As the piston reaches the top of its "sweeping-out," or exhaust stroke, the exhaust valve closes, and a moment afterwards the inlet valve opens. This is the point from which we shall assume our four-stroke cycle to begin, and we shall consider exactly what happens during the four strokes which take place before we arrive back to the starting point and begin a fresh cycle. The four strokes are called the *induction* stroke, the *compression* stroke, the *firing* stroke, and the *exhaust* stroke.

1. Induction Stroke. The exhaust valve has now closed, and the inlet valve has opened. The downwardly moving piston has to fill the space behind it with air. This produces an intense draught or suction through the induction pipe and carburettor. The blast of air sweeping over the small aperture, or "jet," to which a supply of petrol is constantly fed, causes a fine jet of petrol to rise like a fountain in the carburettor. The fountain resolves itself into spray, or is "atomized," and the "mixture," consisting as it were of air converted into a fog by the tiny petrol particles, passes along the induction pipe into the cylinder. If the induction pipe is warm the fog may, of course, evaporate before it reaches the cylinder, a true mixture of air with the petrol vapour being then supplied. In any case the fog will be evaporated by the warmth within the cylinder itself. At the end of the downward stroke of the piston the inlet valve closes, and the cylinder becomes a sealed chamber containing the explosive mixture.

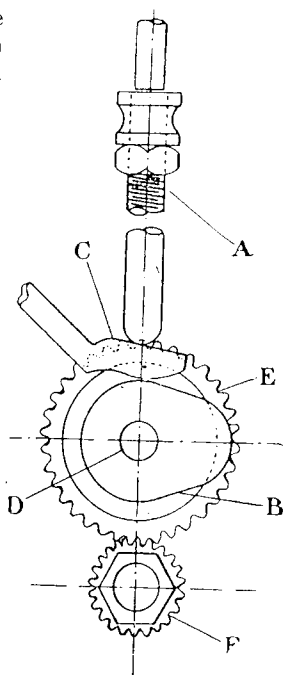


FIG. 30. VALVE CAM ACTION

2. Compression Stroke. The crank on the engine shaft, assisted by the flywheels, passes over its dead point, and the piston commences its upward stroke. The well-fitting piston rings prevent the escape of the mixture on charge into the crankcase chambers, and the charge undergoes compression. The amount of compression effected during the stroke depends, of course, upon the design of the engine, that is to say, upon the relative volume of the whole cylinder when the piston is at the bottom of its stroke to the space left above the piston when it has reached the top of its stroke. This is called the *compression ratio*. Gases, as we all know, are heated by compression, and consequently, if a gas is quickly compressed to, say, one-fifth of its original volume, its pressure is increased considerably more than five times. As a result, the pressure at the end of the compression stroke in an engine having a 5 : 1 compression ratio is well over one hundred pounds to the square inch.

3. Firing Stroke. We have now reached the moment at which the charge is to be fired. The inlet and exhaust valves are closed, the charge is fully compressed, and all is ready for the explosion. This, of course, is brought about by the properly timed passage of an electric spark between the *electrodes*, or points, of the sparking plug. It might be supposed that this spark should occur just as the piston reaches the top of its compression stroke. This, however, is not the case. The correct time for the spark depends upon the speed at which the engine is running. The reason for this is clear when we consider that no explosion—not even the explosion of cordite in the breech of a howitzer—is absolutely instantaneous. In the case of an explosive mixture of air and petrol vapour, the explosion takes quite an appreciable time, and there is a lag, so to speak, between the passage of the spark and the moment when the exploded charge reaches its maximum temperature and pressure. If, therefore, the engine is running fast, the ignition must be so far advanced (i.e. timed to take place early) as to allow the maximum pressure to occur when the piston has only just passed over its dead point. When ignition timing is correct, the maximum pressure may be taken as about 450 lb., and the average pressure during the working stroke as about 100 lb. per square inch. Of course, if the ignition is too far advanced, the exploding gases may administer a blow on the head of the rising piston, and produce a *knock*. The phenomenon of knocking is very curious, and is often the subject of heated argument. If, on the other hand, the ignition is not advanced proportionally to the engine speed, the full pressure will not be reached until the piston has moved an appreciable distance on its downward stroke, and some of the energy of the explosion will be lost.

If by some mischance a gross error of timing were made in

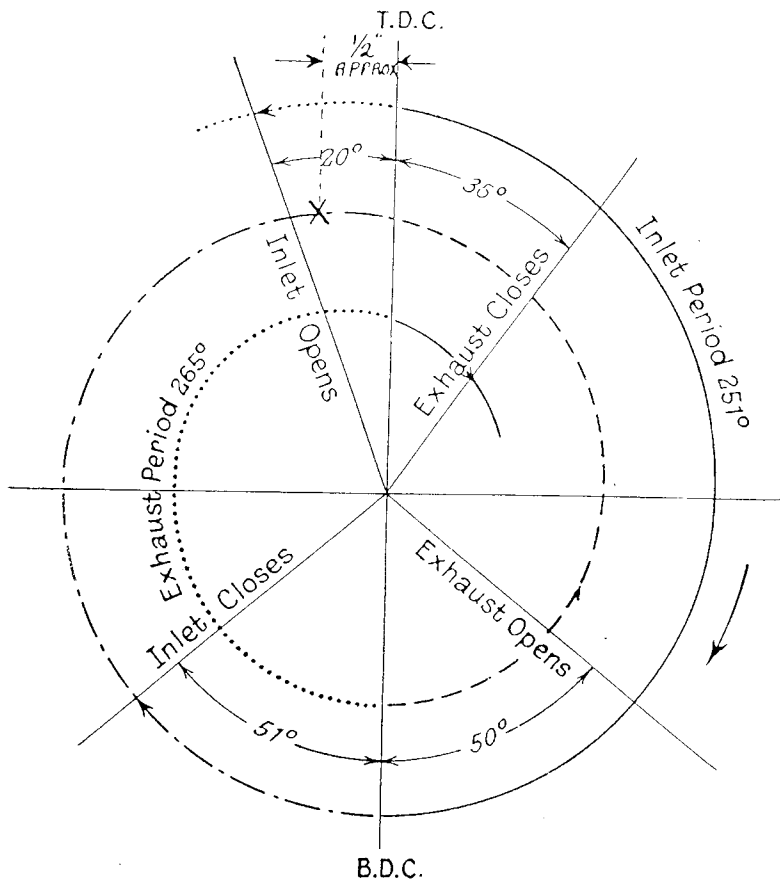
the direction of retardation, or lateness, so that the piston had moved far down the cylinder before the explosion occurred, the mixture would burn slowly instead of exploding, there would be little power, and the exhaust gases would be still flaming when they were finally allowed to escape, so the exhaust valve would be liable to be badly burnt. It is for a similar reason, namely, slow and imperfect combustion, that a weak mixture, containing an excess of air compared with the amount of petrol present, may cause burning of the exhaust valve. This effect of a weak mixture sometimes appears to the novice rather paradoxical. In point of fact, of course, the whole object of the internal combustion engine is firstly to develop heat, and then to convert it into work. If through the use of an unsuitable mixture, or by faulty timing of the ignition, the working conditions of the engine are such that the heat cannot entirely be transformed into work, we get the dual conditions of (1) loss of power, and (2) an excess of heat in the exhaust gases with consequent damage to the exhaust valve during the exhaust stroke.

4. Exhaust Stroke. The exhaust valve now opens, and the products of combustion are ejected from the cylinder into the exhaust pipe and silencer by the ascending piston. After undergoing cooling the burnt gases are now finally allowed to escape into the atmosphere.

THE PRINCIPLE OF THE CARBURETTOR

The problem of perfect carburation is a very complex one, and as yet unsolved, for it is dependent on many factors. The chief difficulty which presents itself is the constantly varying engine speed and load. A certain mixture of petrol vapour and air is only suitable for an engine running at a certain speed and with a certain load, and should the speed or the load vary, the mixture should also be varied to meet the new conditions. Up to now it has not been possible to construct an instrument which will produce the necessary alterations exactly, and the best carburetting system is, therefore, a compromise. Other complications introduced are : the temperature of the engine and of the air, density of the atmosphere, and quality of the fuel. Petrol spirit used for ordinary motor work is a doubly distilled, deodorized spirit, of about .700 specific gravity, derived from crude petroleum. Other fuels, however, including benzol and paraffin, may also be used, but are not satisfactory except in the case of benzol, which is commonly used. Discol is frequently used for racing purposes. It is essential that a high-speed engine should run on a fuel having a high degree of volatility.

The carburettor is an *atomizer*, and its duty is to convert liquid petrol into a mixture of air saturated with the finest particles of



Inlet Stroke.....
Compression Stroke.....
Firing Stroke.....
Exhaust Stroke.....
Ignition Advance * (Full)..... X

FIG. 31. VALVE TIMING DIAGRAM OF 1929-33 (SERIES M, R, S, T) SINGLE-CYLINDER S.V. AND O.H.V. 3.49 H.P. AND 4.98 H.P. ENGINES Measured in degrees of crankshaft rotation with a valve clearance of .006 in., giving a valve lift of .3125 in. This diagram is interesting from a theoretical aspect only, for in practice the motor-cyclist never has occasion to retime his valves since the timing pinions are carefully marked (see page 128)

* The correct ignition advance in the case of all A.J.S. engines will be found in the specifications in Chapter I.

fuel in the right proportions under all conditions ; the correctness (approximate) is attained by either automatic, semi-automatic, or controlled means. In the case of the Amal carburettor (see page 79), used on all A.J.S. machines, the action is semi-automatic. The general principle on which all carburettors work will now be reviewed.

It has been found by experiment that the most satisfactory way of encouraging petrol to evaporate is to drive it under pressure through a very tiny hole, called a jet, and the process is assisted by heating the spraying device. Owing to the proximity of the carburettor to the combustion chamber, ample heat is, of course, conducted to it via the induction pipe, once the engine has warmed up. In practice it is not common to employ forced induction, or *supercharging* (i.e. to blow the mixture into the cylinder). Moreover, it is entirely unnecessary for normal requirements in the case of motor-cycle engines. The powerful suction through the inlet pipe on the inlet stroke can be relied upon to atomize the fuel completely. Let us refer to Fig. 32, which shows the salient features of a carburettor in action. It will be observed that the petrol level in the jet must be below the orifice at the top ; otherwise the petrol will overflow and cause *flooding* of the carburettor. The level is automatically regulated by the action of a *float* attached to a spindle, which operates a needle valve, thereby cutting off the petrol supply immediately the level in the chamber reaches the height of the jet orifice. On the downward stroke of the piston, air is sucked in through the air intake, past the partially open throttle, which is a closely fitting hand controlled slide, operating up and down in a barrel, past the jet, past the inlet valve, and thence into the cylinder. The extremely high velocity air current that must obviously sweep over the jet causes the fuel to issue in a small fountain, and simultaneously causes the spirit to be atomized and diffused with the air rushing in towards the combustion chamber. This, briefly, is the principle of the carburettor.

Actually, no carburettor is by any means as simple as that shown in the diagram, for consider the failings of such a carburettor. The rider will wish to vary the speed of his engine to meet various conditions ; he could do so by opening or closing the butterfly throttle valve or gas tap shown in the diagram. But, unfortunately, petrol and air are dissimilar vapours, and do not respond evenly to varying suctions ; so the carburettor illustrated will give a mixture of different proportions for every throttle setting, and since petrol and air are only highly explosive when mixed roughly in the proportions of 13 : 1, only one of these settings will be correct. This might work tolerably well in the case of a stationary gas engine with a governor, but would be quite hopeless

for all locomotion purposes. Thus it is essential to be able to control the gas and air independently. This can be done by having two slides working independently—one for throttling the air intake and one for throttling the entry to the induction pipe (see Fig. 36). Hence, although the air intake may be fully open, a high velocity air current over the jet can still be obtained with the gas throttle only slightly open. And so the amounts of gas and air can be varied at will to suit the conditions.

The various refinements and complications that are incorporated in all modern proprietary carburettors (including the Amal)

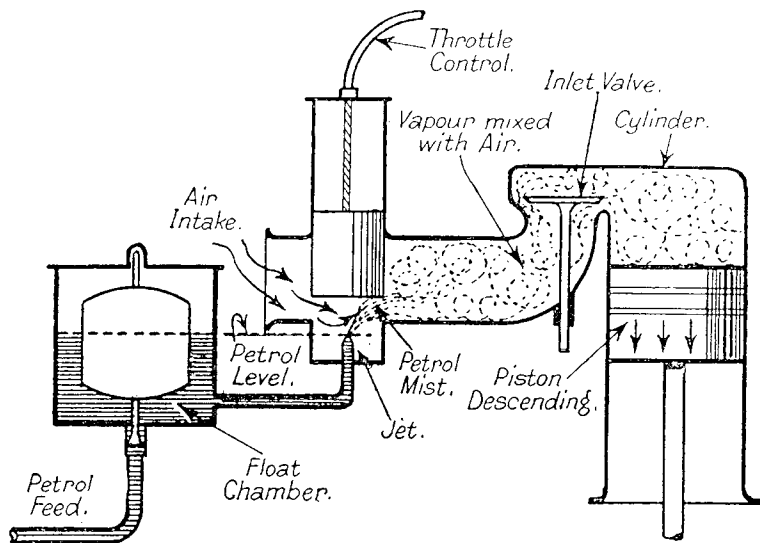


FIG. 32. ILLUSTRATING PRINCIPLE OF THE CARBURETTOR

are designed to (1) make the mixture as homogeneous as possible, (2) simplify the control, (3) enable automatic slow running to be obtained, (4) enable settings for special purposes to be made.

THE IGNITION SYSTEM

The High Tension Magneto. This (a Lucas on all A.J.S. machines) is so called because, unlike an ordinary dynamo, it generates a small current at a very high voltage. An experiment that demonstrates this very convincingly(?) is to place a finger on the plug terminal while the engine is "ticking-over." The instrument is very complicated, and requires very delicate handling when being taken to pieces; no amateur ever dreams of dissecting a magneto. Magnetos of to-day are extraordinarily reliable

instruments, and seldom give trouble. When trouble does arise, it can usually be located in the contact breaker (see page 124), and can be remedied easily by almost anyone. Therefore, we will conclude this chapter with the briefest description of the magneto, and how it works.

The magneto primarily consists of three parts—(1) the *armature*, (2) a “U” shaped *magnet*, (3) the *contact breaker*.

The armature comprises an iron core or bobbin of “H” section, on which are two *windings*: firstly, a short winding of fairly heavy gauge wire, and secondly, on top of the former, a very big winding of fine wire. The first winding is known as the *primary*, and the second as the *secondary*.

The armature, which can rotate on ball bearings, is placed so that on rotation it periodically cuts across the *magnetic field* of the magnet, and creates a current in the primary winding. Incidentally, the contact breaker forms part of the primary circuit. This current, however, is at a very low voltage—far and away too small to produce anything in the nature of a spark. But if a *break* is suddenly caused in the primary by separating the platinum

contacts when the current is at its maximum flow, a high voltage or tension current will be instantly *induced* in the secondary winding—sufficient to jump a small space, if the circuit be incomplete. In this circuit the sparking plug is included, and things are so arranged that, in order for the secondary circuit to be complete, the current must jump across the electrodes of the plug, or, in other words, a spark must occur. Now in the case of a single cylinder engine, the points in the rotating contact breaker separate once in every armature revolution (there being one cam only), and the armature to which the contact breaker is fitted being driven off the inlet camshaft by sprockets and chain consequently runs at half engine speed; that is to say, a “break” takes place once every two engine revolutions, i.e. four strokes of the piston. Hence if the initial “break” be timed to occur when the piston is at the top of the compression stroke, all the other “breaks” (and therefore sparks) will occur at this point also, and thus the engine will go on firing correctly. Besides the “break” being timed to take place when the piston is in a certain position (which we call “timing the magneto,” see page 124), it must also be timed to occur at the moment when the bobbin is having the greatest effect on the magnetic field (see Fig. 33).

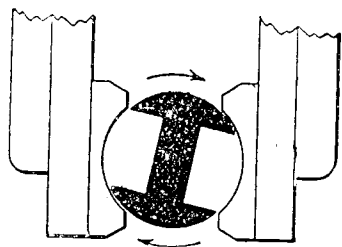


FIG. 33. POSITION OF MAGNETO ARMATURE WHEN CONTACTS SHOULD OPEN

This, of course, is allowed for in the design of the magneto, and does not really concern the reader. Also, it is essential that the primary circuit should be complete (i.e. the contacts must be properly closed) both before and after the "break," which should be of very short duration.

The *cam ring*, against which the cam of the contact breaker works, can be rotated by handlebar control through about 30° , thereby giving means of advancing and retarding the spark.

The *condenser* is a device for the purpose of eliminating "arcing," and the *distributor*, a "brush" mechanism for distributing

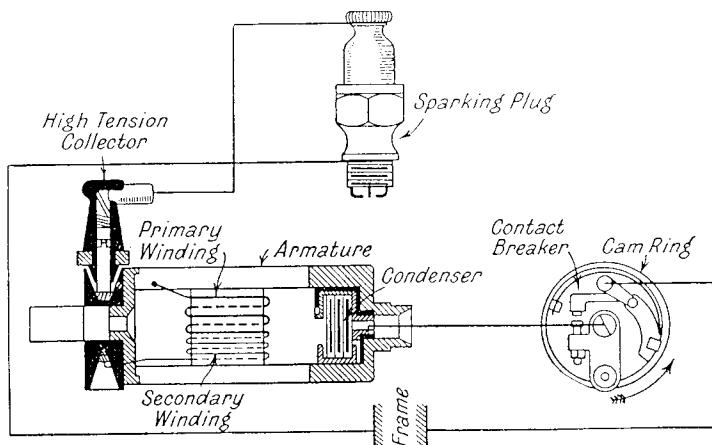


FIG. 34. MAGNETO IGNITION WIRING DIAGRAM

the H.T. current collected off the *slip-ring* (which is connected to the secondary) to the H.T. plug leads. A distributor is, of course, fitted only in the case of the Big Twins, and rotates at half engine speed.

For convenience in enabling the reader to obtain a better idea of the relation between the various parts and how they function as a whole, a wiring diagram of a simple magneto ignition system is given on this page. This diagram, if studied carefully in conjunction with the above general description of the H.T. magneto, should give an excellent idea of how that instrument, so often regarded as a complete mystery, operates. We will not enter into details of the method of construction since, as previously pointed out, beyond attention to the contact breaker (see page 124) the motor-cyclist is never likely to have cause to tamper with the magneto and is certainly ill-advised to do so. So much, then, with regard to the generating portion of the ignition system.

The Sparking Plug. Passing reference has been made in respect of the "results" end of the system, i.e. the sparking plug. This small member requires and deserves some further consideration. It is astonishing how efficient modern sparking plugs are, considering the enormous heat they are subjected to, and the millions of hot sparks they are called upon to deliver during their working lives. The "expectation of life" of the present plug is nearly double that of plugs made a few years back.

The purpose of the sparking plug is to provide at regular intervals a spark in the combustion chamber. The electric current for this job is generated, as we have seen, by the magneto. Fig. 35 shows the construction of a Lodge plug. That shown is partly sectioned. It comprises a piece of insulating material *E* held in a metal support consisting of the plug *A* and the gland nut *B* which are locked together firmly and screw into the cylinder head. Down through the centre of this insulator (usually mica, porcelain, or steatite) passes a thin metal rod *D* which is known as the *centre electrode*. To its upper end is attached a terminal *F* which holds fast the H.T. "juice" wire from the "mag." At its bottom end are placed either one or two *earthed electrodes* (the plug shown has two) in close contact with, but not touching, the central electrode. Sparks jump from the centre to the earthed electrodes as soon as a current of sufficient voltage to jump the gap at the electrodes is generated by the magneto. Clearly the gap at the electrodes is of great importance (see page 122).

According to whether there are one or two earthed electrodes so is the sparking plug known as a "single point" or a "two point."

SOME A.J.S. MECHANICAL DETAILS

The Amal Carburettor (fitted to all present models). This instrument combines the best and most useful characteristics of both Amac and Brown and Barlow instruments. It is thus a thoroughly "brainy" job, and gives remarkable results. On the

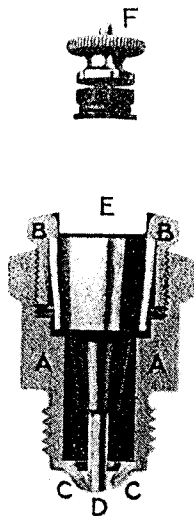


FIG. 35. THE LODGE SPARKING PLUG

opposite page is shown a sectional view of the Amal two-lever carburettor, and its working will now be described. It is presumed that the reader is cognizant of the principle of the carburettor already clearly set forth. Space and time will therefore not be wasted in proffering redundant information on the action of the float, etc.

In connection with the float chamber of the Amal it should be pointed out that alteration in the float position can only have detrimental results.

Referring to the sectional diagram which illustrates the construction, *A* is the carburettor body or mixing chamber, the upper part of which has a throttle valve *B*, with taper needle *C* attached by the needle clip. The throttle valve regulates the quantity of mixture supplied to the engine. Passing through the throttle valve is the air valve *D*, independently operated and serving the purpose of obstructing the main air passage for starting and mixture regulation. Fixed to the underside of the mixing chamber by the union nut *E* is the jet block *F*, and interposed between them is a fibre washer to ensure a petrol-tight joint. On the upper part of the jet block is the adaptor body *H*, forming a clean through-way. Integral with the jet block is the pilot jet *J*, supplied through the passage *K*. The adjustable pilot air intake *L* communicates with a chamber, from which issues the pilot outlet *M* and the by-pass *N*. The needle jet *O* is screwed in the underside of the jet block, and carries at its bottom end the main jet *P*. Both these jets are removable when the jet plug *Q*, which bolts the mixing chamber and the float chamber together, is removed. The float chamber, which has bottom feed, consists of a cup *R* suitably mounted on a platform *S* containing the float *T* and the needle valve *U* attached by the clip *V*. The float chamber cover *W* has a lock screw *X* for security.

The petrol tap having been turned on, petrol will flow past the needle valve *U* until the quantity of petrol in the chamber *R* is sufficient to raise the float *T*, when the needle valve *U* will prevent a further supply entering the float chamber until some in the chamber has already been used up by the engine. The float chamber having filled to its correct level, the fuel passes along the passages through the diagonal holes in the jet plug *Q*, when it will be in communication with the main jet *P* and the pilot feed hole *K*; the level in these jets being, obviously, the same as that maintained in the float chamber.

Imagine the throttle valve *B* very slightly open. As the piston descends, a partial vacuum is created in the carburettor, causing a rush of air through the pilot air hole *L* and drawing fuel from the pilot jet *J*. The mixture of air and fuel is admitted to the engine through the pilot outlet *M*. The quantity of mixture

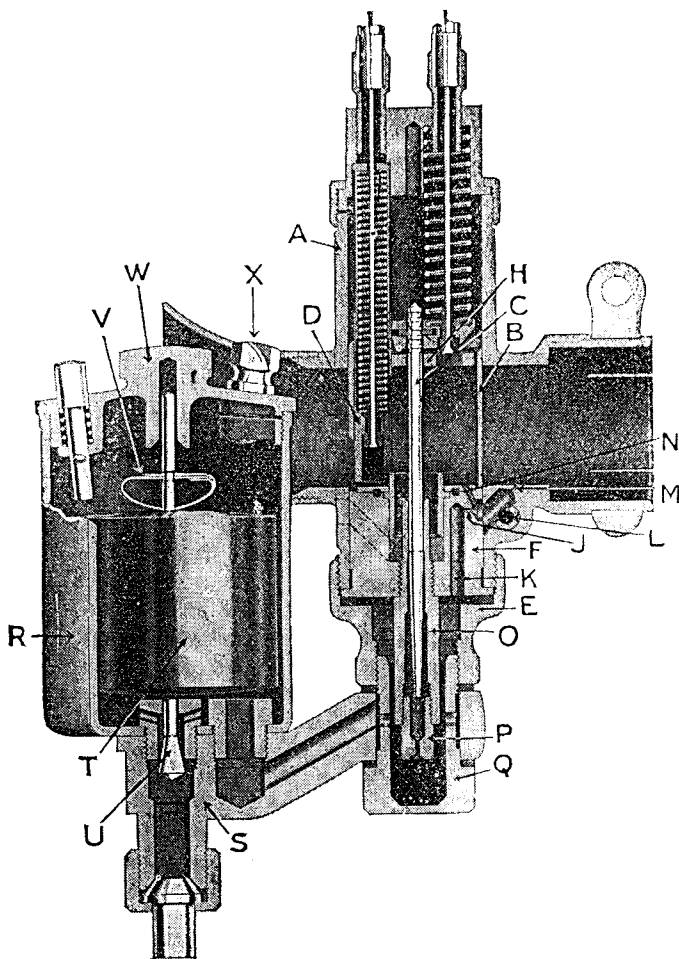


FIG. 36. SECTIONAL VIEW OF AMAL SEMI-AUTOMATIC TWO-LEVER CARBURETTOR

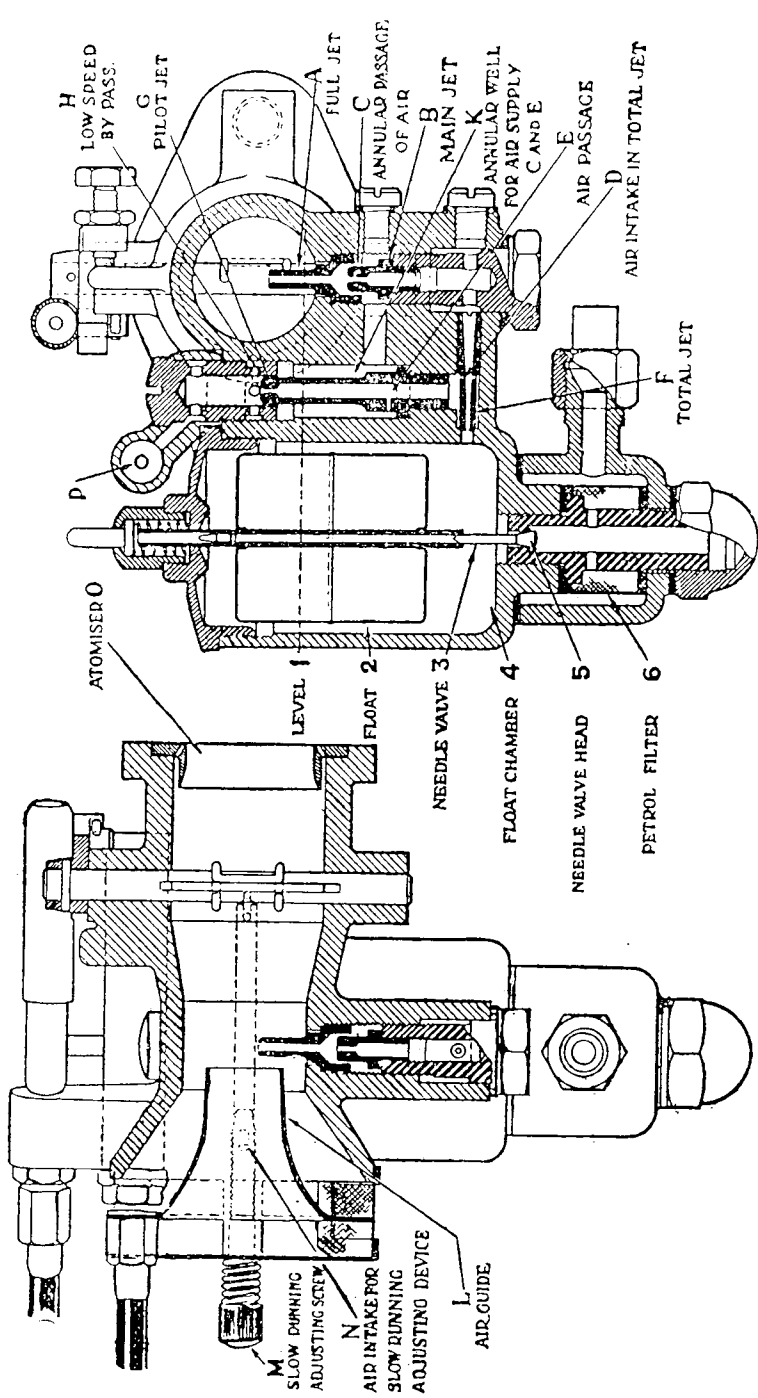
This carburettor was fitted to the whole of the 1930 and all except SS, SB8, SB6 of the 1931 A.J.S. range and replaced the Binks model. These three machines had the new Bowden carburettor. The manufacturers of Amal, B and B, Binks carburettors have now amalgamated, and the Amal carburettor is their latest achievement. For 1932 the Amal instrument is fitted to all models, although some early 1932 T8, TB8, T6 models had the Bowden carburettor. Except in the case of Model T5, the clip fixing shown is replaced by a flanged fixing. All 1933 machines will have the Amal instrument. The throttle stop is not shown in the above view

capable of being passed by the pilot outlet *M* is insufficient to run the engine. This mixture also carries excess of fuel. Consequently, before a combustible mixture is admitted, throttle valve *B* must be slightly raised, admitting a further supply of air from the main air intake. The farther the throttle valve is opened, the less will be the depression on the outlet *M*, but, in turn, a higher depression will be created on the by-pass *N*, and the pilot mixture will flow from this passage as well as from the outlet *M*. As the throttle valve is opened farther the fuel passes the main jet *P*, and this jet governs the mixture strength from seven-eighths to full throttle. For intermediate throttle positions the taper needle *C* working in the needle jet *O* is the governing factor. The farther the throttle valve is lifted, the greater the quantity of air admitted to the engine, and a suitable graduation of fuel supply is maintained by means of the taper needle. The air valve *D*, which is cable-operated on the two-lever carburettor, has the effect of obstructing the main throughway, and, in consequence, increasing the depression on the main jet, enriching the mixture. An accelerating pump unit may be fitted if desired.

The Bowden Carburettor (fitted to some 1931-32 models). This carburettor, introduced for the first time last year on three of the A.J.S. range, is an entirely different design from the Amal carburettor just described. Besides having a butterfly valve instead of a throttle slide, it has a completely automatic action. Although two controls are provided, the twist-grip throttle control is the only one required to be used while driving. The second control (the mixture control) is opened only for starting purposes. Thus manipulation of an air lever while negotiating traffic is not necessary, with consequent low petrol consumption, absence of sooting up of plugs and general efficiency, the mixture being correct under all conditions.

If desired, an accelerating pump unit can easily be fitted to the Bowden carburettor. It is an excellent extra obtainable from the manufacturers, and provides ultra-rapid acceleration without supplying excessive fuel to the engine. Hints on tuning the Bowden carburettor will be found on page 131. The principle of the carburettor is as follows.

Automatic action of the carburettor is obtained by means of a submerged jet, combined with two air injections in series, taking place at different engine speeds. Most people realize that a calibrated jet subjected to a variable suction, will not, under varying conditions of depression, deliver a proportionate weight of petrol to the weight of air passing through the choke tube. If, for example, such an arrangement is used to provide a correct mixture at medium engine revolutions, the mixture supplied at higher engine revolutions will be much too rich. This is corrected by an



FIGS. 37, 38. SECTIONAL VIEWS, SHOWING DESIGN AND ACTION OF THE BOWDEN AUTOMATIC CARBURETTOR

This scan is explicit for non-commercial use and is not intended for financial or material gain by anyone

air injection which reduces the flow of petrol through the jet, and prevents it from increasing too quickly in relation to engine speed. However, above a certain speed, the mixture has a tendency to become rather rich again, and the single air injection is no longer effective.

In the Bowden carburettor, a second air injection is provided which works in series with the first one. The various means of adjustments for tuning on the Bowden carburettor, ensure that it can be made automatic for any particular engine. Special devices and adjustments are provided to ensure easy starting, slow running, and rapid acceleration.

Figs. 37, 38 show sectional views of the Bowden carburettor from which its general design may be understood. With the engine stopped, the petrol coming from the float chamber passes through the total jet *F*. By the holes *D* it reaches the pilot jet *G*, and through the hole *E*, fills up the pilot jet well. In the illustration it will be seen that the petrol goes into the full jet *A*, passing through the main jet *B*, which is the power jet of the carburettor. The pilot jet *G* is therefore slightly above the petrol level; the main jet *B* is under this level, together with the total jet *F*. These two jets are called submerged jets.

In addition, and independently to the two principal air intakes through the choke tube and venturi (air guide), three other small air intakes are provided at different points in the carburettor; at *P*, where the intake is regulated by a needle valve, controlled by a lever on the handle bar; at *N*, an air intake for slow running, adjustable by means of a screw *M*. A third intake is provided underneath the slow running intake, and by a suitable channel air is brought to the pilot jet well *K*.

Referring to Figs. 37 and 38, let us see exactly how the Bowden carburettor functions. When starting the engine, the butterfly being almost closed, the suction on the full jet *A* is negligible. The channel delivering the mixture for slow running comes out at the edge of the butterfly, causing very great suction on the pilot jet *G*. This suction can be increased by closing, partly or fully, the air intake at *P*, by means of the mixture control lever, in the case of the starting of an engine from cold.

For slow running, the pilot jet *G* delivers the petrol, which is atomized by the air coming from the intakes *N* and *P*. The mixture thus formed passes to the butterfly, where it is mixed with an additional quantity of air, regulated by the opening of the butterfly, and is then delivered to the cylinder.

As the butterfly is gradually opened, the suction on the full jet *A* becomes stronger. This jet delivers petrol, and as air enters into the pilot jet well *K*, through the suitable channel, the petrol level in this well falls down until the duct communicating with the

annular passage C is fully uncovered. At this moment the submerged main jet B delivers petrol into full jet A , and to prevent an increase of this delivery with the increase of the engine speed, it is corrected by a first air injection passing through the suitable channel into K and C . When the throttle is fully opened, the remaining petrol contained in the pilot jet well K and inside the pilot jet G is drawn through holes E and D , allowing the air to pass through the same holes, when it becomes mixed with the

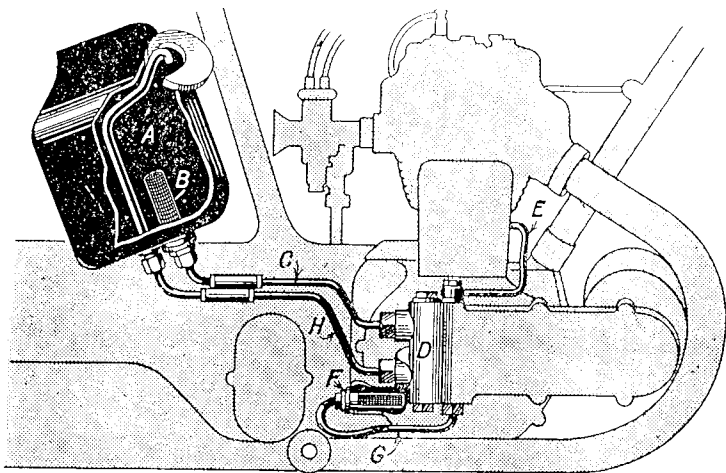


FIG. 39. SHOWING GENERAL ARRANGEMENT OF 1929-1930 DRY SUMP LUBRICATION SYSTEM

On 1931-33 "T" models the general principles of the system and details are different (see Figs. 10, 22, 40), the pilgrim pump being situated differently, and the oil being fed to the timing side of the crankshaft instead of the driving side and not kept in constant circulation between the engine and tank

petrol delivered by total jet F . The result is a fine emulsion of petrol and air, made possible by this new air injection.

At high engine speeds the submerged total jet F is subjected to a first air injection through D . The petrol and air emulsion passes through the main jet B , when a second air injection takes place in the annular passage C . The petrol mixture delivered by full jet A has therefore been subjected to two air injections in series. It is then finely emulsified. This emulsion is finally diffused in the main air current coming through the venturi and choke tube before it passes into the cylinder. Acceleration at small throttle openings is ensured by the reserve of petrol contained in well K . This petrol is rapidly drawn into the cylinder when the throttle is opened quickly.

1926-28 Mechanical Lubrication System. Prior to 1929 it was the practice for the A.J.S. concern to fit to all production models

an engine lubrication system, comprising a Pilgrim mechanical pump (see page 37), gravity-fed from the oil compartment of the tank, and an auxiliary spring-loaded hand pump, or in some cases a hand pump only. This system has worked fairly well, but its day is now definitely past. During the past three years a new and

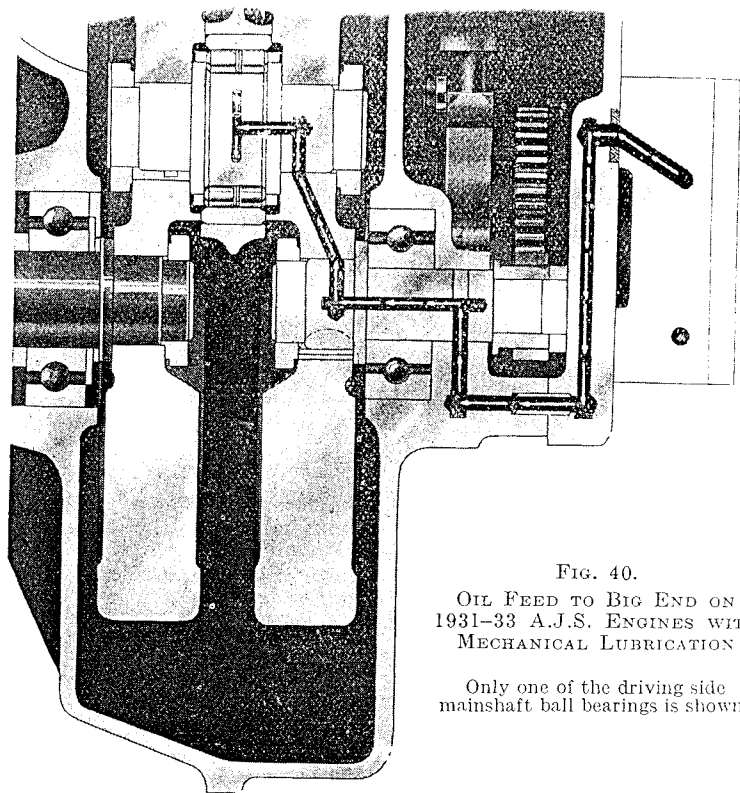


FIG. 40.
OIL FEED TO BIG END ON
1931-33 A.J.S. ENGINES WITH
MECHANICAL LUBRICATION

Only one of the driving side
mainshaft ball bearings is shown

infinitely better system of mechanical lubrication has been evolved and perfected by the experimental and research department. The first machines fitted with this system were overhead valve racing machines, and these, later on, were followed by the O.H.V. standard models. Various races were entered, including the T.T. races, and the functioning of the lubrication carefully noted, and various minor defects afterwards remedied, with the result that to-day it is almost perfect after a few initial disappointments, and is standardized on all models except the 1933 camshafts and

big twins. The main oil supply is now capable of adjustment by a control knob.

The 1929-30 Dry Sump System. This is shown diagrammatically in Fig. 39, while Fig. 41 shows how the oil circulates. The essential difference between the dry sump system and other methods is that in the former case a large quantity of oil is in continuous circulation throughout the engine and tank, while in the latter case only a comparatively small volume of oil at any given time is circulating. Chief among the advantages accruing to the D.S. system are the following: (a) No attention is required by the rider other than maintaining the oil in the separate tank mounted on the rear down tube at the correct level. (b) Superior cooling of the engine lubricant is obtained. (c) Simple means for filtering the oil and preventing the rapid accumulation of pulverized carbon deposits can be provided. (d) There is no possibility of the engine being greatly over-oiled since the sump remains practically "dry," all superfluous oil being returned to the tank by the duplex pump. (e) Oil consumption remains remarkably low, due to a minimum of leakage or combustion taking place. So much, then, regarding the merits of the system. We will now inquire into the construction and working of the 1930 system.

The "heart" of the circulation system is the duplex pump *D* driven by a simple coupling from the inlet cam shaft. Lubricating oil from the main tank *A* is drawn via the pipe *C*, after passing through the filter *B*, into the pump itself and thence projected along pipe *E* to the near side of the engine. It then passes down through a channel in the crankcase and is forced, under pressure, into the hollow mainshaft (see Fig. 41) along which it travels to the all-important big end roller bearing. This it very thoroughly lubricates as the oil oozes out and drips upon the flywheels which, by centrifugal force, splash it upon the cylinder walls. Oil mist, in fact, penetrates throughout the working parts. Oil is also pressure-fed to the timing case. It should be noted from Fig. 41 that by rotating the needle valve, seen on the left, a few turns, lubricant can be fed direct to the cylinder walls via a by-pass. This, however, is only intended for fast racing work. All lubricating oil, after effecting its purpose, eventually drains to the bottom of the sump, thence to be returned to the pump via the pipe *G* (Fig. 39) after passing the second filter *F*. Finally, it is forced under pressure up the pipe *H* and back into the tank again to be recirculated *ad infinitum*.

1931-33 Improved Mechanical Lubrication. All 1931 to 1933 engines, except the 33/2 models and "camshafts," incorporate a lubrication system quite different from the 1930 system in principle as well as design. The oil in the tank is not kept in constant circulation, and the duplex Pilgrim pump (Fig. 22) is driven from

the crankshaft. The upper plunger sucks oil from the tank via the delivery pipe, and delivers it direct to a false bearing on the timing side, not the driving side, of the crankshaft. The oil-way is totally enclosed, no pipe being used as on the 1930 system. The oil is then pressure-fed to the big end bearing, as shown in Fig. 40. Some of it is also forced to the timing gear. Surplus oil drops down from the big end on to the flywheels and is distributed

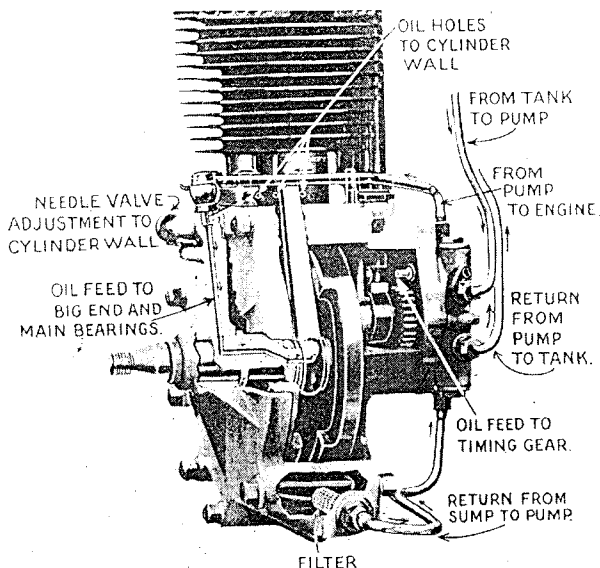


FIG. 41 OIL CIRCULATION ON 1929-30 DRY SUMP MODELS

by splash throughout the engine. The lower pump plunger collects some oil from a by-pass from the main feed and returns it to the tank via the return pipe, from whose orifice oil may be seen emerging on removing the filler cap. There is no separate oil feed to the cylinder walls as on the D.S. system, but the main supply can now be controlled by means of the regulator on top of the pump, illustrated on page 37. The oil return to the tank only shows that the pump is working.

The Dry Sump Lubrication System (Big Twins). The lubrication system for 1933 does not apply to 1931 or the "camshaft" models. It is of the force-feed, constant circulation type with dry sump. Briefly its working is as follows: Oil is *sucked* from the tank; distributed throughout the engine, and finally returned to the tank by a duplex internal pump. This comprises a single double-acting, steel plunger (Fig. 41A), housed in the crankcase casting

below the timing case between two rectangular end caps horizontally and at right angles to the crankshaft axis, and able simultaneously to rotate and reciprocate. This dual action of the plunger is obtained, as is more fully explained on page 90, by the fact that while a positive rotation at one-fifteenth engine speed is effected by direct engagement of a central hobbled portion with a worm cut on the mainshaft, an endwise movement is secured by having an annular cam groove cut in the plunger body in permanent contact with the hardened end of a fixed guide screw. The actual oil circulation is brought about by alternate displacements and suction at the two ends of the reciprocating plunger, one end being of greater diameter than the other to ensure complete scavenging of the sump and the return of all surplus oil to the tank. Two segments cut in the plunger body constitute the main ports which regulate the circulation. There is no adjustment however. A point worthy of notice here is that the crankcase cannot safely be split until the pump plunger has first been removed.

With regard to the actual oil distribution, the system adopted is made clear by reference to Fig. 41A. The small end of the plunger (i.e. the front one) forces oil up into the timing case to a predetermined level, such that the camshaft bearings and drive are adequately lubricated. All surplus oil overflows into the flywheel chamber, and is eventually returned to the sump, although some of it is caught up by the flywheels and splashed upon the big-ends and the cylinders. Splash lubrication, however, is not relied upon to any extent owing to the small volume of oil remaining at any time in the sump. Oil is forced under pressure direct to the big-end bearings and to the crankshaft bearing on the timing side by means of carefully drilled passages in the flywheel and mainshaft concerned, respectively. Oil is also fed to three points on each of the cylinder walls in such a position that the bulk of the oil is discharged on to that part of the thrust side of the cylinder walls where the maximum cooling effect upon the pistons is required.

The constant circulation system with fabric filter (see page 22) guarantees a continual supply of clean, cool oil to the engine whenever the latter is running. The oil circulation may be verified occasionally by removing the oil tank filler cap and noting whether oil is being ejected from the return pipe orifice. This check upon the oil circulation should be made preferably upon starting up the engine from cold. Remember the fact that when the engine has been left stationary for some time, oil from various parts of the engine has drained to the sump, and, until this surplus has been cleared, the return to the tank is very positive, whereas normally it is somewhat spasmodic and,

perhaps, mixed with air bubbles, due partly to the fact that the capacity of the return part of the pump is greater than that of the delivery portion, and partly to the fact that there are considerable variations in the amount of oil held in suspense in the crankcase. For example, upon suddenly accelerating, the return flow may decrease entirely for a time only, of course, to resume at a greater rate than before when decelerating. It may be mentioned, however, that on all Big Twin models the provision of a tell-tale on the instrument panel, illuminated at night, obviates the necessity for removing the filler cap, the oil supply to the timing-box being first by-passed up to the panel. It is important that no air leaks occur in this system.

The Double-acting Oil Pump. A general description of the 33/2 dry sump lubrication system has already been given, and Fig. 41A shows how the oil is circulated. It remains to deal with the action of the pump itself. As already mentioned on page 89, the pump has only one moving part—a steel plunger driven at $\frac{1}{15}$ engine speed by a worm cut on the engine mainshaft. This plunger slowly oscillates to and fro, its precise travel being determined by the relieved end of a guide screw (*b*, Fig. 41A) screwed into the rear of the pump housing and engaging with a profiled cam groove at the large return end of the plunger. This groove plays an all important part. In addition to causing the plunger to oscillate and thereby obtain a pumping action at each end (for the plunger is completely enclosed by its housing and end caps), its carefully planned contour enables the pumping impulses to be synchronized with the opening and closing of two main ports and a small auxiliary port, thus definitely regulating the oil circulation and controlling the supply of oil to the engine and the return of oil to the tank.

The two main ports are shown at *D* and *C*, and the small auxiliary port at *E*, Fig. 41A. The main ports are known as the *delivery* port and the *return* port respectively. They comprise two shallow segments cut in the pump plunger body and communicating with the hollowed ends of the plunger by two holes. The auxiliary port comprises simply an $\frac{1}{8}$ in. diameter hole drilled at the back of the main delivery port segment. The plunger itself, as mentioned on page 89, has two diameters, and, therefore, the capacity of the return portion of the pump is greater than that of the delivery portion, so that the sump is always kept clear of oil. Fig. 41A enables the action of the pump to be understood. Oil flows by gravity, assisted by suction, from the tank to a point in the pump housing, such that no further passage can take place until the plunger has moved to a point, approximately, as shown when oil flows into the hollowed end *via* the cut-away segment constituting the delivery port. Then as the plunger continues to

advance with simultaneous reciprocation, the oil which has completely filled the hollowed end is momentarily retained and the bulk of it finally ejected by displacement from this port into an oil passage opposite the point of entry, and forced to the cylinder walls and main engine bearings. During the advance of the

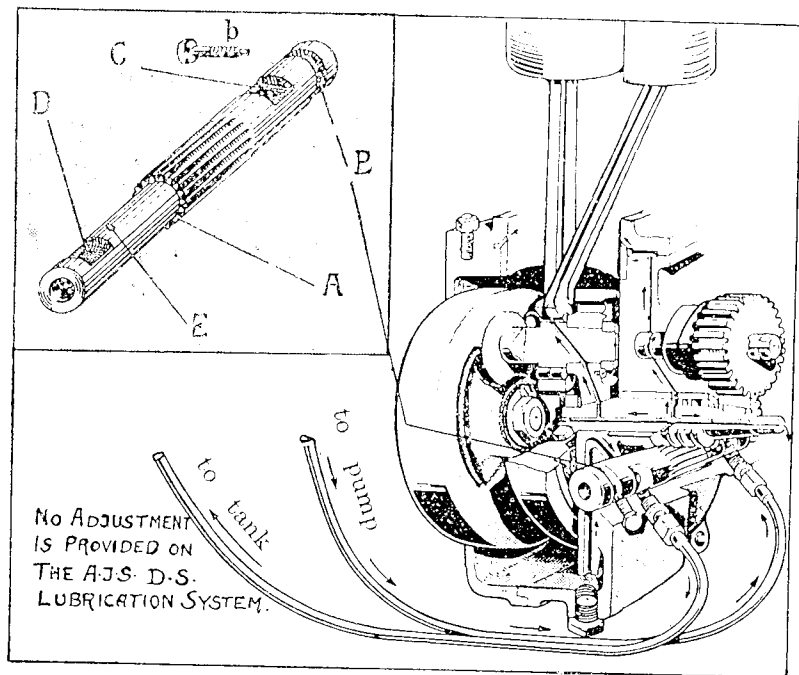


FIG. 41A. DIAGRAM SHOWING THE OIL CIRCULATION IN THE DRY SUMP LUBRICATION SYSTEM USED ON THE 1933 BIG TWINS

The 1933 "camshaft" models have a different type of lubrication system

Ins: it is shown the pump plunger itself, whose parts are as follows--

A--Hobbled portion of plunger

B--Annular cam groove

b--Guide screw (crank case)

C--Plunger return port

D--Plunger delivery port

E--Small auxiliary port

plunger culminating in the automatic injection of fresh oil into the engine, the receding of the large end of the plunger causes a strong vacuum directly opposite an oil passage leading from the sump base, and communicating with the plunger interior only when the return port is in a suitable position. All surplus oil in the sump is, therefore, sucked up as the plunger advances, and retained when the port closes until the plunger begins to reverse its motion, when the return port, coming into line with the return

pipe passage, the oil is forcibly ejected by displacement into this pipe, and so to the oil tank, where its intermittent emergence can, though a tell-tale (Fig. 19A) is provided, be observed.

Thus it will be seen that so long as the engine is running fresh oil is being constantly fed to it and then, after circulation, sucked from the sump and forced up back into the tank to be recirculated *ad infinitum*. Coincident with the ejection of oil from the main delivery port a supply of oil is forced out of the auxiliary port to the timing box. Since a tell-tale is provided it is first forced up into the panel, whence it flows by gravity to the respective parts requiring lubrication. Only a small portion of the total oil feed to the engine is diverted in this manner, but this portion is important and a definite index as to the correct functioning of the whole D.S. lubrication system, for only when the pump is forcing oil into the engine at a certain pressure can the rise of the tell-tale plunger be observed. The action of the pump plunger is almost fool-proof, but care must be taken to remove the plunger before separating the crankcase, and the guide screw (*b*) must always be kept fully tightened. A point worthy of note is that with the plunger stationary no oil can possibly enter the engine.

The Sturmev-Archer Gear-boxes. There are three types of gear-boxes fitted to A.J.S. machines—the new heavyweight four-speed, the heavyweight three-speed (TB8, T9), and the lightweight three-speed boxes (T5, TB6). On the two first mentioned the layshaft is below the mainshaft, but in the latter case the layshaft is placed immediately behind the mainshaft with a totally-enclosed kickstarter drive taken through the low gear pinions. The heavyweight four-speed gear-boxes are standard S.A. gear-boxes, except that they have a special end cover, having a swivelling fulcrum arm and anchorage. The clutch-operating control on all boxes comprises a lever mechanism. Both three-speed boxes work the same, though some constructional features are different (page 97).

The Heavyweight Four-speed Gear-box (Standard on Models T6, T9, 33/2). Referring to Fig. 42, the clutch body (14A) is keyed and held by a nut to the end of the mainshaft (1). Rigidly fixed to the clutch body and moving with it are four driven plates (14) kept in contact by the clutch springs (15) with three friction insert plates (13), of which the rearmost constitutes the clutch sprocket (3) driven by chain from the engine sprocket. These friction plates, owing to their construction (see page 137), rotate when the engine is running as a single unit, and the driven plates also rotate with them, except when the clutch spring pressure is released by the lever (17) through the plunger (16). It will thus be seen that with the clutch engaged, the engine always drives the gear-box mainshaft at a speed equal to the ratio of the

engine sprocket diameter to the clutch sprocket diameter (i.e. at about half engine speed).

The mainshaft itself is carried in two bearings, that on the clutch side, where the secondary transmission thrust is received, being a heavy single-row, self-aligning ball bearing, and that on the opposite side a light double-row ball bearing. The mainshaft, however, is not carried direct on the large bearing, for the

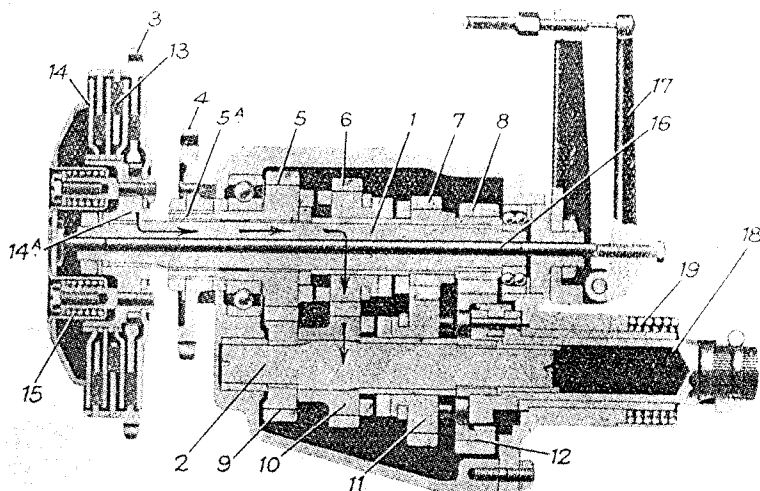
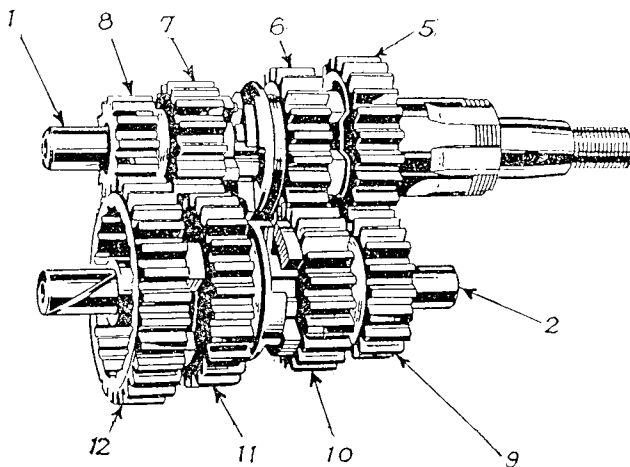


FIG. 42. SECTIONAL ARRANGEMENT OF STURMEY-ARCHER HEAVYWEIGHT 4-SPEED GEAR-BOX AND 3-PLATE CLUTCH

- | | |
|-------------------------------|-----------------------------------|
| 1—Main shaft | 10—Layshaft third gear dog wheel |
| 2—Layshaft | 11—Layshaft sliding dog wheel |
| 3—Clutch sprocket | 12—Layshaft driven k.s. dog wheel |
| 4—Gear-box sprocket | 13—Clutch friction plates |
| 5—Top gear dog wheel | 14—Clutch-driven plates |
| 5A—Top gear dog wheel sleeve | 14A—Clutch body |
| 6—Mainshaft sliding dog wheel | 15—Clutch springs |
| 7—Second gear dog wheel | 16—Clutch plunger |
| 8—First gear pinion | 17—Clutch actuating lever |
| 9—Layshaft driving pinion | 18—Kick-starter axle |

gear-box sprocket (4), which is connected to the rear wheel sprocket by chain, is rigidly attached to a sleeve (5A), which also carries the top gear dog wheel (5), and the whole is free to revolve on the mainshaft with a phosphor-bronze bush as a bearing. It is the sleeve itself which is carried by the thrust ball bearing, and, consequently, the loading of both primary and secondary transmission is taken through this bearing. The top gear dog wheel is in permanent engagement with a small fixed layshaft driving pinion (9), and so the gear-box sprocket rotates whenever the

layshaft is in motion, and *vice versa*. Adjacent to this small layshaft pinion is another slightly larger pinion (10), free to rotate on the layshaft and dogged on its inner side. This pinion provides third gear. At the end of the mainshaft opposite the clutch are two small pinions, the second gear dog wheel (7), free to revolve on the mainshaft, and the low gear pinion (8), which is not dogged, but is fixed to the mainshaft and in constant mesh with the large



(Sturmey-Archer Gears, Ltd.)

FIG. 42A. THE STURMEY-ARCHER 4-SPEED TRAIN OF PINIONS

This illustration should be studied in conjunction with Fig. 42

layshaft driven kickstarter dog wheel (12), which can revolve freely on the layshaft. As may be seen from Fig. 42, with the gears in neutral, the kickstarter axle, when rotated anti-clockwise, drives by means of the pawl and ratchet the large layshaft k.s. pinion (12), which, in turn, rotates the first gear pinion and thus drives the mainshaft and clutch sprocket clockwise. Taking the engine sprocket into consideration, a total gear reduction of about 4 : 1 occurs. Between the top gear and the second gear mainshaft dog wheels on a splined portion of the mainshaft is one of the two sliding pinions (6). Below this on a splined portion of the layshaft is the second sliding pinion (11). Both these sliding pinions are dogged on each side, and together are capable of engaging four dog wheels.

A very clever cam operating mechanism, whose design is made clear by Fig. 42B, co-ordinates and controls the horizontal motion of the two sliding pinions, which have grooves into which the striker forks *A* fit. The cylindrical bases of the striker forks

can slide endwise on a fixed shaft *B* mounted parallel to the mainshaft, and the necessary and somewhat complex movement of the two strikers is obtained by partial rotation of a cam plate *G*, into whose curiously shaped grooves *C* fit closely two small studs on the striker fork bases. The cam plate itself has a central stub spindle bearing, and is caused to rotate by the gear-box lever *F* through the agency of a toothed quadrant *E* engaging a pinion fixed to the back of the cam plate. To prevent the possibility of the gears being missed, the periphery of the cam plate has

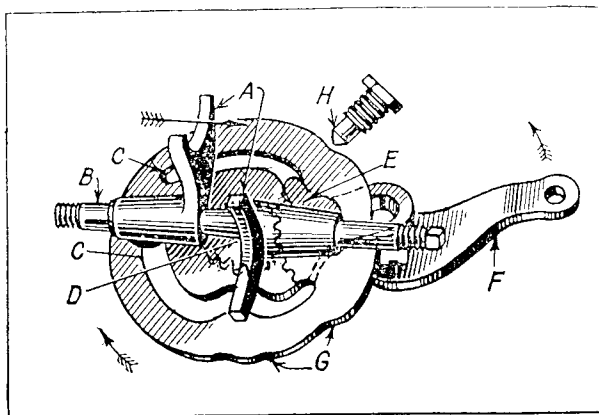


FIG. 42B. THE CAM GEAR OPERATING MECHANISM AND STRIKING FORKS ON THE 4-SPEED GEAR-BOX

- | | |
|--|---|
| <i>A</i> —Striking forks | <i>E</i> —Actuating quadrant (shown dotted) |
| <i>B</i> —Fork shaft (fixed) | <i>F</i> —Gear-box lever |
| <i>C</i> —Cam grooves | <i>G</i> —Cam plate index notches |
| <i>D</i> —Cam plate and pinion bearing | <i>H</i> —Spring-loaded plunger |

five notches *G*, which are engaged by the end of a spring-loaded plunger *H*.

Briefly the action of the gear-box is as follows—

Fourth Gear. The upper sliding pinion is moved to the extreme left (Fig. 42) until the dogs of the mainshaft sliding pinion engage with those of the top gear dog wheel, when the mainshaft and top gear dog wheel sleeve become locked together and rotate as one. There is thus no gear reduction (pinion 11 in neutral), and the layshaft simply idles, while the clutch and gear-box sprockets rotate together at the same speed.

Third Gear. The mainshaft sliding pinion is moved to the right into the position shown at Fig. 42, while the layshaft sliding pinion is interlocked with the third gear layshaft dog wheel which is in mesh with the mainshaft sliding pinion. Here the drive is taken from the clutch sprocket, transmitted through these two pinions,

the lower of which is now locked to the layshaft, and then back to the sliding sleeve and gear-box sprocket through the layshaft driving pinion and top gear dog wheel, which are in constant mesh. Only a small gear reduction, equal to the resultant ratio of the diameter of the four pinions, occurs.

Second Gear. The upper sliding piston is moved across further to the right until the dogs on the mainshaft sliding pinion interlock with those of the second gear mainshaft pinion, thus locking the latter to the mainshaft. The drive is here taken from the clutch sprocket, transmitted along the mainshaft, and passed to the layshaft through the second gear and layshaft sliding pinions to the layshaft, and then back to the gear-box sprocket sleeve through the layshaft driven pinion and top gear dog wheel. Two separate gear reductions of considerable magnitude occur.

Neutral. *Neutral* is obtained by positioning the sliding pinions as shown in Fig. 42, when, as may be seen, the pinions on either side of them run idly and no motion is imparted to the layshaft whatsoever. One of the sliding pinions is always in *neutral*.

First Gear. The layshaft sliding pinion is moved across to the extreme right until it interlocks with the layshaft driven kickstarter dog wheel. Here again two considerable gear reductions occur, the drive being transmitted to the gear-box sprocket in the usual manner after transmission via the low gear pinion and kickstarter dog wheel.

The Sturmey-Archer Three-speed Gear-boxes (Fitted to Models T5, TB6, TB8, T9). Referring to the sectional view at Fig. 43, the clutch body (51) is keyed to the tapered end of the mainshaft, and the clutch sprocket, which becomes locked to the body by the spring (12), pressing the driven plates (19) against the friction inserts of the clutch sprocket. Thus so long as the engine is running and the clutch lever (23) is not causing the mainshaft thrust plunger (10) to release the spring pressure, the mainshaft (20) rotates on its ball bearings. On the clutch lever side a double-row ball bearing is used, while on the sprocket side a heavy single-row thrust ball bearing is used. Interposed between this and the mainshaft is a sleeve (26), to which are fixed the top gear dog wheel (16) and the gear-box sprocket (17). This sleeve is free to rotate on the mainshaft. The top gear dog wheel is in constant mesh with the layshaft driving pinion (29) keyed to the layshaft, so that whenever the layshaft is in motion (top gear excepted), the sleeve and gear-box sprocket transmitting the drive also rotate at a speed equal to layshaft speed \times ratio of the diameters of the two meshing pinions. Keyed to the end of the mainshaft opposite the clutch is the bottom gear pinion (22), and free to rotate upon the layshaft and in constant mesh with it is the layshaft driven dog wheel (31), which has a ratchet on its outer face, with

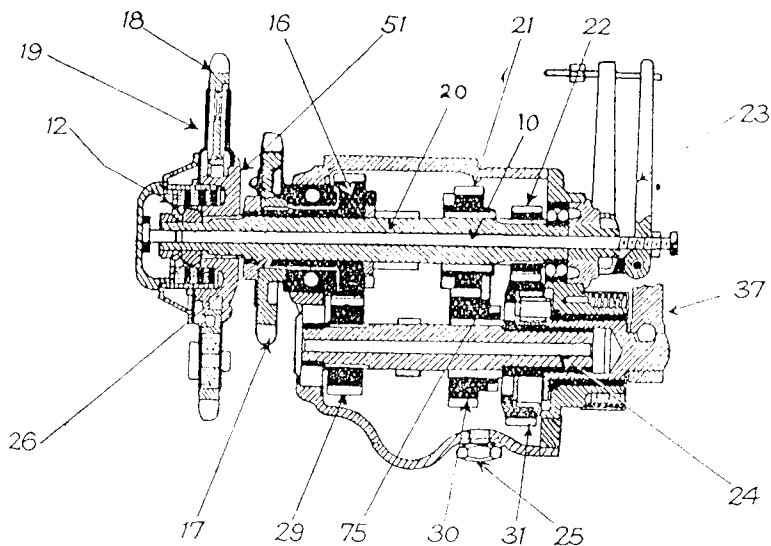


FIG. 43. SECTIONAL VIEW, SHOWING ARRANGEMENT OF STURNEY-ARCHER 3-SPEED 1930-33 LIGHTWEIGHT GEAR-BOX AND CLUTCH

Both the B.W. and the L.S. heavyweight gear-boxes fitted to A.J.S. machines work in exactly the same manner, but some constructional details, such as the striker mechanism, are different. They can be readily dismantled by removing the end plate, when the low, middle gear pinions and the layshaft may be withdrawn. Clutch shown incorrect (see Figs. 58, 60)

- | | |
|--------------------------------|--|
| 10—Clutch operating plunger | 24—Layshaft |
| 12—Clutch spring | 25—Drain plug |
| 16—Top gear dog wheel | 26—Top gear dog wheel sleeve |
| 17—Gear-box sprocket | 29—Layshaft driving pinion |
| 18—Clutch sprocket | 30—Layshaft sliding dog wheel |
| 19—Clutch driven plates | 31—Layshaft driven kickstarter dog wheel |
| 20—Mainshaft | 37—Kickstarter crank |
| 21—Mainshaft sliding dog wheel | 51—Clutch body |
| 22—Bottom gear pinion | 75—Striking plate |
| 23—Clutch operating lever | |

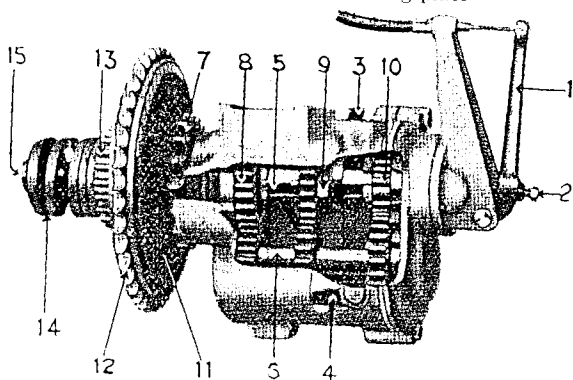


FIG. 43A. SECTIONAL VIEW OF A.J.S. 3-SPEED (1927-29) GEAR-BOX AND SINGLE SPRING CLUTCH

The A.J.S. gear-box has one sliding pinion only, the sliding dogwheel 9. All layshaft pinions are fixed, but the low gear dogwheel 8 is on a sleeve to which is fixed the gear-box sprocket 7. Bottom gear is obtained by coupling 9, 10. Middle gear is obtained as illustrated, and top by coupling 8, 9 together; 2 shows adjuster; 3, filler cap; 4, oil level indicator; 15, clutch spring adjusting nut; 13, k.s. ratchet wheel

which the kickstarter pawl engages, thus rotating the clutch sprocket direct *via* the fixed low gear pinion and this dog wheel. The mainshaft is splined for a considerable portion of its length, the unsplined part being that adjacent to the low gear pinion. Similarly, the layshaft is splined, except adjacent to the driving pinion. Two sliding dog wheels—one on the mainshaft and one on the layshaft—are simultaneously moved by a single striking plate (75, Fig. 43) and two forks, whose endwise movement is controlled by a lever arm engaging a ball end; positive indexing of the gear positions is provided by a spring-loaded plunger engaging four small circular recesses in one of the fork sides. The two sliding dog wheels are responsible for connecting the primary and secondary drives, and providing the three speeds which are obtained as follows.

Top Gear (Third). The mainshaft and layshaft sliding dog wheels are moved to the extreme left (Fig. 43), until the mainshaft sliding dog wheel interlocks with the top gear dog wheel. The layshaft sliding dog wheel thus automatically becomes free to idle on the layshaft non-splined portion, while the top gear dog wheel, gear-box sprocket, and clutch sprocket rotate as a single unit giving a direct or top gear drive.

Middle Gear (Second). The sliding dog wheels are moved slightly to the left of the halfway position, thus allowing the layshaft splines to engage with the corresponding keyways on the lower sliding dog wheel. The drive is then transmitted from the mainshaft *via* the two sliding dogwheels, layshaft, and layshaft-driving pinion back to the top gear dog wheel sleeve and gear-box sprocket. The resultant gear ratio obtained (about 1.5 to 1) depends upon the relative diameters of the two pairs of gear wheels involved.

Neutral. The sliding dog wheels are moved a trifle farther to the right until the mainshaft sliding dog wheel leaves the mainshaft splines and simply idles on the mainshaft, causing no rotation whatever of the layshaft. Fig. 43 shows neutral position.

Bottom Gear (First). The sliding dog wheels are moved to the extreme right until the layshaft sliding dog wheel engages with the dogs of the layshaft-driven kickstarter pinion. The mainshaft sliding dog wheel has now left the mainshaft splines, and idles while the mainshaft drive is transmitted to the layshaft by the bottom gear pinion and layshaft-driven kickstarter dog wheel, and thence to the gear-box sprocket and secondary transmission *via* the layshaft driving pinion and top gear dog wheel. Two separate gear reductions occur, giving bottom gear.

CHAPTER VI

FAULTS : THEIR LOCATION AND REMEDY

THE four tables given on succeeding pages enable faults to be located readily by means of a system of elimination. The experienced driver can narrow the possible causes of trouble to a very small field almost immediately. Troubles, however, are now so rare that little heed is paid to them until they actually arise. But it is advisable to be prepared for all contingencies. The chapter dealing with the engine should have given the reader a general idea of what troubles to expect. Remember that IF A CHARGE OF PROPERLY PROPORTIONED GAS IS COMPRESSED INTO THE CYLINDER, AND A SPARK OCCURS AT THE RIGHT TIME, THE ENGINE MUST FIRE. It cannot do otherwise. Troubles are usually due to faults either in (1) the ignition system, (2) the carburettor, (3) the engine mechanism itself. In tracking down the origin of engine trouble, it is highly important to make a mental note of the symptoms displayed immediately before the engine "gives up the ghost." This should greatly assist quick and accurate diagnosis. Do not get "hot and bothered" over an engine, and start vigorously pulling things to pieces—they have all to be replaced, by the way—but calmly reflect upon the probable cause of trouble and act accordingly. It may be mentioned that a complete engine stoppage is usually more easy to rectify than a partial one. We will now deal with some of the principal troubles and their remedies, starting with ignition troubles first, as they are by far the most frequent. The symptoms of any particular trouble may, of course, apply to other troubles, but a particular trouble always produces definite symptoms.

IGNITION TROUBLES

Pre-ignition

Symptoms. Sudden stoppage during hard work, either with a very dirty engine or a new sparking plug. Probably knocking occurs. Slight bouts of pre-ignition are often confined to hill work ; the engine starts knocking and ceases work at once. In some cases it is due to overheating alone, and the engine will restart immediately after cooling. In others it is due to running with spark too far advanced.

Remedy. This varies with the cause. If due to carbon deposits, decarbonize ; otherwise clean or renew sparking plug. If due to overheating alone, allow to cool and give more oil. Verify magneto timing.

Wet Plugs

Symptoms. Misfiring or stoppage of cylinder concerned due to shorting through water particles.

Remedy. Dry plugs and wrap terminals with insulating tape, if necessary, or fit waterproof terminals.

Oily or Sooted Plug

Symptoms. Same as for wet plug.

Remedy. Clean or renew plug, and cut down oil supply.

Plug Points Too Far Apart

Symptoms. Great difficulty in starting but no trouble once started.

Remedy. Reset points with gauge to .02 in.

Bad Condition of Contact-Breaker Points

Symptoms. Misfiring or cessation of work.

Remedy. Adjust "break" and clean contacts. Make certain that contacts close properly.

Rocker Arm Sticking

Symptoms. Irregular firing of engine due to rocker arm of contact breaker sticking. This arm has a small fibre bush bearing, and in damp weather this occasionally swells and causes the rocker to stick intermittently.

Remedy. Remove bush and carefully ease it with emery cloth or a file. Do not oil it. This will produce further swelling.

Broken Contact Spring.

Symptoms. Sudden and complete stoppage.

Remedy. Replace spring, or effect temporary repair with a small elastic band.

Insulated Contact Points

Symptoms. Engine cannot be started. Insulation is caused by dirt or oil. It is a common practical joke to place a slip of paper between the points; this insulates them also.

Remedy. Clean and reset points, or remove paper slip with as mild language as possible.

Loose Contact Points

Symptoms. Intermittent misfiring. Looseness discernible to eye on scrutiny.

Remedy. If the platinum itself is loose in screw, get the rivet soldered tightly in place by a jeweller. If screw is loose, tighten up lock-nut.

Weak Contact-Breaker Spring

Symptoms. Missing at high speed after big mileage.

Remedy. Renew offending article.

Magneto, Loss of Magnetism

Symptoms. Great difficulty in starting unrectified by all ordinary adjustments. Engine runs fairly well at speed, but poorly at low speed. This trouble, however, is rare.

Remedy. Send to makers for re-magnetizing.

Condenser Broken Down

Symptoms. Misfiring or stoppage with heavy sparking across the contact-breaker points which are rapidly pitted and blackened. If a magneto suddenly starts eating up the platinum contacts, suspect a faulty condenser immediately.

Remedy. Return to factory.

Magneto Insulation Broken Down

Symptoms. No "juice" anywhere.

Remedy. Send back to makers.

Defective High Tension Cable

Symptoms. Occasional misfiring due to rubber on cable becoming burnt by contact with hot cylinder, or rotted, thereby causing defective insulation.

Remedy. Replace. Temporary repair made by binding faulty cable with insulating tape.

Crossed Wires

Symptoms. Usually a Big Twin fails to start though inspection reveals a spark at each plug. Explosions may occur in the silencer, or the engine may backfire.

Remedy. Connect up the high tension cables to their respective plug terminals (front Magdyno pick-up goes to rear cylinder).

Slipped Magneto Timing

Symptoms. Very sudden stoppage after running perfectly. If the sleeve lock-nut on the armature shaft (of an early engine with the sleeve not keyed), or the lock-nut on the camshaft of a 1933 twin works loose, the timing may slip.

Remedy. Re-time and do up nut securely.

Defective Carbon Brush

Symptoms. Bad misfiring or stoppage due to beads of water or grit between the contacts.

Remedy. Clean slip-ring and see that the carbon is not broken or cracked. Also see that brush is held down by the spring properly.

Incorrect Magneto Timing

Symptoms. If too far advanced, very difficult starting and pronounced tendency to knock at the least provocation. If over retarded, great loss of power with explosions in exhaust.

Remedy. Re-time magneto accurately.

Broken Ignition Cable

Symptoms. Those of incorrect timing in the direction of lateness, producing loss of power and, perhaps, red-hot exhaust pipe.

Remedy. Obvious. Temporary repair may be effected by securing cam-ring on three-quarter advance position, and running on fixed ignition.

CARBURETTOR TROUBLES

Punctured Carburettor Float

Symptoms. The effects vary from complete flooding (when petrol is visibly dripping from carburettor) to choking and starting difficulties. An engine normally started easily with slight "tickling" will now be difficult to start, while an engine normally only started with liberal "tickling" will start readily. If the trouble is mild there may be merely slight overheating and excessive petrol consumption. When the float is removed and shaken, petrol may be heard splashing about inside.

Remedy. Immerse the float in boiling water, thereby volatilizing and expelling all petrol. Mark the puncture indicated by air bubbles, and send the float to a jeweller to get the hole sealed with a small blob of solder. When repaired, place the float in water and see whether it swims on an even keel. If not, correct balance by adding another spot of solder in an appropriate position; otherwise the float will tend to bind on its spindle in the carburettor.

Water in Petrol

Symptoms. Intermittent misfiring occasionally bad enough to cause a stoppage, and "popping back."

Remedy. If trouble does not rectify itself, drain tank, clean gauzes, and refill tank.

Choked Jet

Symptoms. Misfiring or stoppage.

Remedy. If a choked jet is suspected, take out the clutch and open the throttle wide for a few seconds. The extra suction concentrated on the jet by this violent acceleration will often clear the jet. Failing this, remove and clean, or insert a spare. A jet should be cleaned very carefully indeed. Blow through

orifice hard and see whether this removes obstruction. If it does, leave the jet alone afterwards.

Jets Wrong Size

Symptoms. Indifferent general performance of engine.

Remedy. Tune the carburettor (see page 129).

Incorrect Petrol Level

Symptoms. If too high, petrol will slowly drip from jet orifice and issue from bottom of spray chamber, and overheating and high petrol consumption will ensue. If too low, the engine will be difficult to start, and will run best at high speed, but never develop full power. Interference, however, seldom advisable.

Remedy. Readjust by moving the float slightly upwards on its needle. First see that the carburettor is "square" with the engine. If tilted, the petrol level will be altered accordingly.

Float-chamber Needle not Seating Properly

Symptoms. They vary from mild to profuse flooding of the carburettor.

Remedy. Clean valve seat and valve itself and grind-in with the fingers until a ring contact is evident. Be careful to hold needle quite vertically when doing this. See whether needle is bent, and renew if it is so. Verify float action.

Choked Petrol Pipe

Symptoms. Engine runs well at small throttle openings but weakly at speed and when hill climbing. Moreover, the carburettor cannot be flooded instantly.

Remedy. Remove and clean.

Sticking Carburettor Slides (Amal)

Symptoms. Erratic behaviour of engine and uncertain response to control movements.

Remedy. Dismantle, clean, and adjust until they work up and down freely.

Choked Air Vent in Petrol Tank

Symptoms. This can easily be mistaken for a choked petrol pipe, there being, of course, insufficient fuel supplied to the carburettor owing to a partial vacuum caused by petrol displacement.

Remedy. Obvious.

Defective Control Cables

Symptoms. Control cables may be slack, broken, or stiff. In any case the engine will not respond correctly to the control lever movements, and erratic running will result.

Remedy. If slack, take up the slack with adjusting screws; if broken, renew or repair; if stiff, remove frayed portions and grease, or if necessary, renew.

Petrol Spraying from Air Intake

Symptoms. Self explanatory. Wet petrol is blown against the hand held to the air intake. It is occasionally accompanied by loss of power, overheating, and heavy fuel consumption.

Remedy. If engine runs well do not pay much heed to this trouble. It occurs to a certain degree with 90 per cent of the petrol engines on the road. If the phenomenon is so marked as to impair running, renew the inlet valve spring.

Air Leaks at Induction Pipe (with Clip Carburettor Fixing)

Symptoms. Difficulty in starting, slow acceleration, inability of engine to take full air.

Remedy. Bind with insulating tape, or better, use a jointing compound.

Carburettor Ablaze

Symptoms. Horribly obvious.

Remedy. Instantly switch off petrol and open throttle. The petrol in carburettor will be then used up rapidly. Also try and smother the seat of the fire with a rag or cap if available. No disastrous effects should then accrue. If, however, any delay is made before taking action, the flames will spread to the petrol tank, and if that ignites it will be fatal for the machine. When the fire is quenched the rider should ascertain the cause, and take such action as will prevent a recurrence. Common causes are petrol dripping on part of hot exhaust system, an electrical short circuit, and sticking inlet valve causing a blow-back of burning gas into the carburettor.

ENGINE TROUBLES

Gummed-up Piston

Symptoms. Impossibility of turning cold engine over fast enough to fire.

Remedy. Prime.

Seized Piston

Symptoms. If, when travelling on the road, the machine pulls up suddenly for no apparent reason, piston seizure can be suspected. If the rider is travelling fast when this occurs, a violent skid will ensue, which should be corrected by instantly declutching and turning into the skid.

Remedy. After the cylinder has cooled down pump sufficient

oil into the engine to produce a smoky exhaust, get the engine re-started and proceed quietly until the machine can be examined by a competent mechanic.

Sticking Inlet Valve

Symptoms. If stuck permanently open, there is no compression and violent puff-backs can be heard emerging from the carburettor, sometimes accompanied by smoke or flame, or the carburettor may be even set on fire. If occasional sticking occurs there is loss of power and the foregoing symptoms disappear and reappear.

Remedy. Clean valve stem and examine spring. If weak, renew.

Wrong Valve Clearances

Symptoms. Loss of power, noise.

Remedy. Reset (as described in following chapter) with gauge.

Piston Rings Stuck in Grooves

Symptoms. Loss of compression, hot crankcase, hissing heard in crankcase.

Remedy. Remove and clean grooves. If piston rings are discoloured, renew.

Exhaust Valve Stuck Open

Symptoms. If partial, loss of power, explosions in silencer; if jammed completely, no compression and cylinder ceases firing.

Remedy. Remove valve and examine seat for particle of grit that might prevent valve seating properly. Also inspect for dirt in guide, binding valve stem, no valve clearance, broken spring, wrong valve lifter adjustment, and anything likely to prevent the valve seating itself.

Insufficient Lubrication

Symptoms. If slight, weak running, especially on gradients, with tendency for pre-ignition. If gross, dreadful knocking, marked overheating, terminating in a partial or complete seizure.

Remedy. Turn on more oil.

Loose Gudgeon-Pin Bearing

Symptoms. A slight metallic click, accelerating into a jingle at speed.

Remedy. Fit a new bush (see page 134).

Leaky Valves

Symptoms. Poor compression, power unsatisfactory. Inspection reveals pitted faces and seats.

Remedy. Grind-in.

Loose Bearings

Symptoms. Gradual power decline and development of rattly noises. A tight engine (not an engine full of alcohol!) should emit the following noises only, viz., click of the valves, suck of air intake, and puff of the exhaust. If in addition to these noises a rattling looseness becomes audible, the bearings are in a bad state.

Remedy. Give the machine a complete overhaul.

TABLE I
ENGINE REFUSES TO START

OBSERVATIONS	PRIMARY CAUSE
No petrol at jet	<ul style="list-style-type: none"> — Needle of float sticking — Air vent in tank choked — Air lock in petrol pipe — Choked petrol pipe — No petrol in tank — Petrol cock closed — Choked jet
Carburettor floods when "tickled"	<ul style="list-style-type: none"> — Air leak — Wrong setting of carb. levers — Closed throttle — Controls failing to work — Magneto timing slipped — Incorrect timing — Weak spark
<ul style="list-style-type: none"> — Spark at points of plug — No spark at plug 	<ul style="list-style-type: none"> — Spark at terminal <ul style="list-style-type: none"> — Weak spark — Plug sooted — Plug short-circuited — No spark at terminal <ul style="list-style-type: none"> — Contact breaker sticking — Contacts dirty or worn — Short circuit — H.T. cable detached — Loose contact points — Broken carbon brushes — Insulation of mag. broken down — Magnets need re-magnetizing — Key of contact breaker sheared

TABLE II
ENGINE STOPS

OBSERVATIONS

PRIMARY CAUSE

Petrol supply FAULTY	—	<ul style="list-style-type: none"> —Closed petrol tap —Jet choked —No petrol —Petrol pipe choked —Float needle stuck —Air vent in tank closed
Good compression—	—Carburettor O.K.	<ul style="list-style-type: none"> —Under-lubrication —Excessive valve clearance —Overheating —Defective controls —Valve spring broken —Air leak —Valve broken —Valve cotter broken —Wrong timing
	—Carburettor defective—	<ul style="list-style-type: none"> —Carburettor flooding —Float needle sticking —Punctured float —Choked jet
Bad compression—	—	<ul style="list-style-type: none"> —Valve badly pitted —Valve spring broken —Valve cotter broken —Rings gummed up —Rings broken —Ring slots in line —Valve guide tight —Cracked piston —No valve clearance —Cracked gudgeon pin

TABLE III
ENGINE RUNS BADLY

OBSERVATIONS	PRIMARY CAUSE
Loss of power	—Constantly —
	<ul style="list-style-type: none"> —Wrong valve clearance —Bad compression —Carbon deposit —Partial petrol stoppage —Wrong timing —Choked silencer —Bad mixture —Weak valve springs —Gear too high —Worn cams
	—Intermittently —
	<ul style="list-style-type: none"> —Loose controls —Valve guide tight —Partial petrol stoppage
Engine knocks	<ul style="list-style-type: none"> —Ignition too far advanced —Pre-ignition (carbon deposit) —Excess of air —Overheating
Misfiring	—Irregular spark —
	<ul style="list-style-type: none"> —Dirty contacts —Stuck rocker arm —Water in petrol —Sooted plug
	—Regular spark —
	<ul style="list-style-type: none"> —Weak mixture —Temporary short circuit —Partial petrol stoppage

TABLE IV
ENGINE STOPS DUE TO IGNITION

OBSERVATIONS	PRIMARY CAUSE
No spark at plug	—No spark at magneto —
	<ul style="list-style-type: none"> —Short circuit —Stuck contact breaker —Dirty contacts —Loose contacts —Broken carbon brushes —Broken contact breaker spring —Sheared contact breaker key —Defective condenser —Breakdown of insulation
	—Spark at magneto —
	<ul style="list-style-type: none"> —Sooted plug —Slipped magneto timing —Broken plug —H.T. cable detached

CHAPTER VII

OVERHAULING

If a machine is to be kept in efficient condition and its depreciation and repair bill reduced to the absolute minimum, it is essential that the rider should devote some considerable time to its periodic overhaul. Overhauls are of two types—(1) the complete overhaul, (2) the ordinary overhaul. A *complete overhaul* is usually undertaken once every 8,000 miles, or about once a year. This overhaul should be treated seriously, and the whole machine should be dismantled completely. Every component should be cleaned, scrutinized, and, if necessary, replaced. The engine and gear-box must, of course, be removed from the frame for this operation. Special points to be noted in the complete overhaul are set out herewith—

FRAME. Alinement, existence of flaws or cracks, play in spring forks, looseness of steering head, wear caused by friction of all attached parts, condition of enamel.

WHEELS. Condition of taper roller bearings, truth of wheels, alinement, loose spokes, condition of rims, wear of tyres.

CHAINS. Excessive wear, cracked or broken rollers, joints.

ENGINE. Oil leaks, compression leaks, main bearings, valves, valve guides and tappets, overhead valve rockers, valve springs, valve seats and faces, cotters, condition of cylinder bore, piston, piston rings, play in big-end and small-end bearings, timing wheels, shafts and bearings, cams, cleanliness of oilways.

GEARS. Condition of teeth on sprockets and pinions, damaged ball races, and loose parts generally. Do not forget index mechanism.

The examination should also include all control rods and cables, tank filters, clutch and brake linings, etc. To sum up, everything should be dismantled, cleaned, and readjusted.

An *ordinary overhaul* should be undertaken every 1500–2,000 miles. This should comprise decarbonization of the engine, valve clearance adjustment, adjustments of contact-breaker and plug points, valve grinding, general lubrication, and sundry adjustments.

Apart from these overhauls the rider should make a point of regularly going over the various nuts with a spanner. Vibration frequently loosens them. All working parts must also be kept well lubricated (see lubrication chart, Fig. 44), and odd adjustments made as they are needed. The rider who callously runs a machine until “something happens” is asking for trouble and,

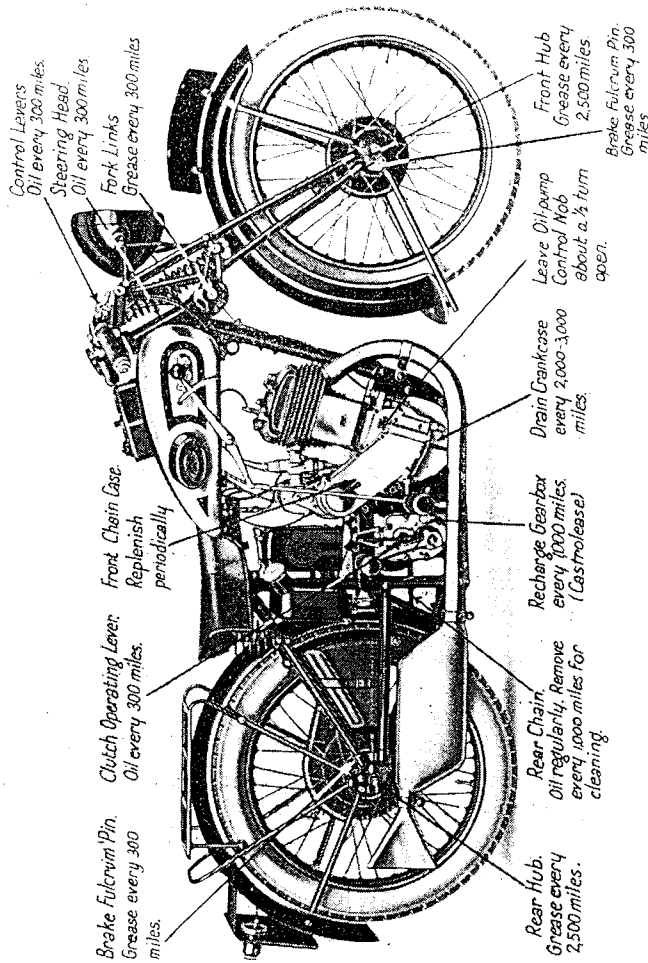


FIG. 44. THE IMPORTANT PARTS REQUIRING LUBRICATING

The above chart, depicting a T9 A.J.S., is intended as a general guide and need not be strictly adhered to. The chart is applicable to all of the 1932-33 models. In the case of the overhead-valve models there are additional points, such as the O.H.V. actuating gear requiring lubrication (see page 121). On dry sump models the oil tank should be drained every 5000 miles and the fabric filter (Fig. 18A) should be cleaned every 500 miles. On all models keep the oil tank properly replenished. On sidecar outfits there are also the spring pivot joints requiring lubricating.

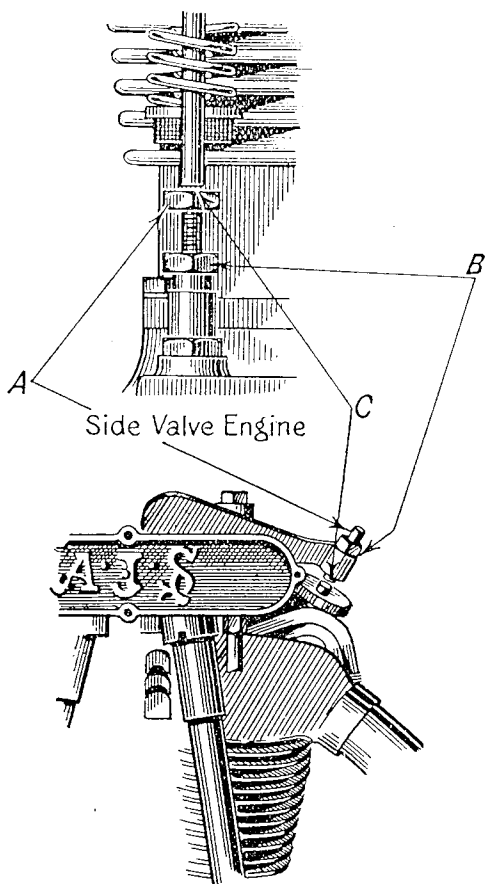
moreover, will assuredly get it! If a machine is properly overhauled and cleaned the owner will be amply rewarded for his pains by the machine giving long service, perfect running at small cost. Overhauling is by no means as tedious a business as appears on paper; experience and common sense soon enable all overhauling to be done rapidly and easily, as it is required. For the guidance of those who are not yet proficient in the art of overhaul, or those who wish to have a work of reference, we will conclude this chapter by giving detailed instructions appertaining to all types of overhaul of A.J.S. motor-cycles.

Cleaning. Cleaning the machine is highly important; it is a necessary preliminary to overhaul. If neglected it renders overhaul difficult and results also in great deterioration of the plating and enamel, and the machine soon becomes shabby, and its market value rapidly falls. After a dirty ride in wet weather cleaning may occupy at least an hour. It entails the use of stiff bristle brushes and paraffin for removing the filth from the lower part of the machine, together with cloths, leather, and polishes for the bright upper surfaces. On no account should the machine be left soaking wet overnight. A serious amount of rusting may occur. If the rider has not the time available for systematic cleaning, the machine should be thoroughly greased all over before use.

Valve Clearances. In order that the valves shall seat properly at all engine temperatures it is necessary that clearances should exist between the valve stems and the rocker studs or tappet heads, as the case may be, when the engine is hot. The clearance should be checked now and again with the feeler gauge on the magneto spanner, although it is unlikely that adjustment will be required unless the valves have been ground-in or the engine partly dismantled. In the case of a new engine, however, the clearances will increase until the engine has been thoroughly run-in. Fig. 45 illustrates the point where the clearance should exist (*C*) and the means of adjustment (*A*) in both S.V. and O.H.V. type engines. This clearance should be .006 in. and .008 in. in the case of the inlet and exhaust valves respectively with a *hot* engine. In the case of the O.H.C. engines the clearances should be with a *cold* engine .016 in. and .018 in. The clearance of the exhaust valve is slightly the greater because this valve is subjected to greater heat, and accordingly the stem expands somewhat more than that of the inlet valve. To check and adjust clearances proceed as follows—

Turn the engine over until compression is felt; then raise the exhaust lifter and turn over a trifle more until the piston is at the top of its stroke. Before checking the clearance make quite sure that the exhaust valve lifter is not determining in any way the position of the exhaust valve tappet head or rocker stud. There

should be a small interval between the time when the lifter is raised and the tappet head or the O.H.V. rocker commences to move. If this is not so the tappet foot or the toggle will not be resting on its cam. If the valve clearances are not correct this must



Overhead Valve Engine

FIG. 45. VALVE CLEARANCE ADJUSTMENT

clearances are comparatively large due to the fact that as the engines warm up the clearances decrease instead of increase, as they do with the S.V. and O.H.V. power units. An approximate setting can be obtained by screwing the rocker stud up with valves closed until contact is felt, slackening off half a turn and locking in position. It is, of course, much better to obtain the exact setting with a gauge.

be rectified. In the case of the S.V. engine, hold the tappet head with a spanner and loosen the lock-nut (B) below with another spanner; now screw up or unscrew the tappet head until the correct clearance is obtained, and retighten the lock-nut.

Check again after tightening the nut. In the case of the O.H.V. and O.H.C. engines, loosen the lock-nut (B) which is provided for securing the adjustable grub screw (A), adjust the latter, check the clearance at (C), and retighten. Check again afterwards. It is worth while adjusting the valve clearances carefully, for excessive clearance will produce noise accompanied by considerable loss of power, while insufficient clearance may cause actual damage to the valves, especially the exhaust valve, as well as loss of power. In the case of the O.H.C. engines valve

Decarbonizing the Engine. After about 2,000 miles on the road the exhaust note becomes "woolly," instead of being a crisp "bark," and the engine sluggish and very prone to "knock." These symptoms clearly indicate that the time has arrived when the engine must be decarbonized, that is to say, all carbon deposits on the piston head and in the combustion chamber must be removed. Carbon deposits, incidentally, are due to three things—(1) incomplete combustion of fuel, (2) carbonization of road dust entering the cylinder, (3) burnt lubricating oil. When decarbonizing it always pays to inspect the valve faces and seats, and

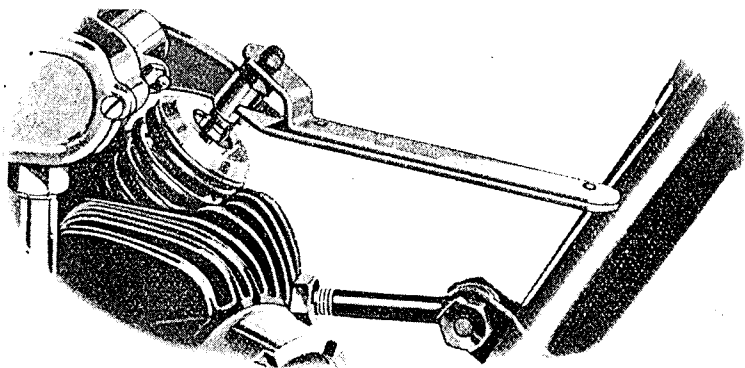
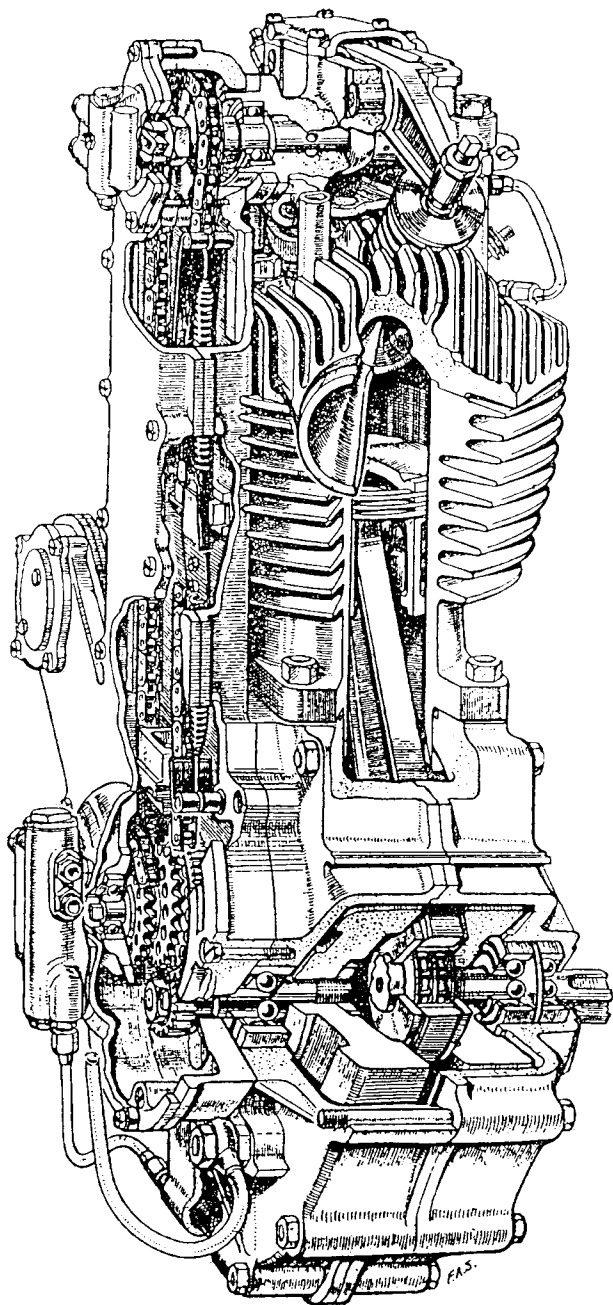


FIG. 45A. THE A.J.S. PUSH-ROD EXTRACTOR

grind in the valves if necessary. In any case, removal of the valves enables the combustion chamber and also the ports to be very thoroughly cleaned. Before decarbonizing, it is first necessary to remove the cylinder or cylinders, as the case may be; but whether the engine is a single S.V., a twin S.V., or an O.H.V. or O.H.C. model, the procedure is much the same. Overhead valve mechanism is apt to frighten some people, but actually there is nothing in it at all. All A.J.S. engines, except the 3.49 h.p. lightweight Model T5, have detachable cylinder heads. This greatly facilitates cylinder removal; there is no expert juggling required to get it off. Furthermore, the valves may be attended to, if desired without disturbing the cylinder at all.

Initial Preparations. In the case of *Model T5* the cylinder barrel and head are in one piece and the latter cannot therefore be detached as on other models. Preparatory to removing the cylinder barrel on this machine it is necessary to detach the H.T. lead to the sparking plug, and disconnect the exhaust pipe and the steady between the cylinder and front down tube. Remove the steady



(From "The Motor Cycle")

FIG. 46. PARTLY SECTIONED VIEW OF THE 1933 O.H.C. ENGINE

This engine, which is made in two sizes, 350 c.c. and 500 c.c., has double-row roller bearing for the big end, ball bearings for the crankshaft and the camshaft, channel section rockers, drilled sprockets for the rear magneto and camshaft drives, and an automatic spring tensioning device for the camshaft driving chain

bolt. The Amal carburettor may either be left in place on the cylinder by removing the slides and the petrol pipe from the base of the float chamber, or, alternatively, the carburettor may be taken off by undoing the screw-in fastening.

When dealing with *Model T9* with detachable aluminium alloy head the only preliminary operation necessary before removing the head is to disconnect the H.T. lead. In the case of the twin cylinder engine disconnect the H.T. leads and remove the plugs. If the reader's mount is of the O.H.V. type (T6, T8, TB6, TB8), first disconnect all fittings, such as exhaust pipes, carburettor slides, and then proceed to remove the tubes enclosing the push rods and the push rods themselves.

Push Rod Removal. To remove the push rods the special extractor tool (obtainable for 1s.) must be used after shortening the two covers by undoing the lock-nuts and telescoping them. The end of the tool is arranged to fit over the rocker adjusting screw (Fig. 45A) in such a way that by pressing the tool handle down it compresses the valve spring. Press down on this tool and seize the base of the tappet tube with the other hand. The push rods may then be withdrawn by lifting their hollow cups off the tappets complete with covers. The rocker-box should now be removed.

Rocker-box Removal. To remove the rocker-box for the purpose of giving access to cylinder removal, the lock-nuts at the top and bottom of the push rod covers will, of course, have to be dealt with as first described. Next unscrew the four pins holding down the rocker-box. The two pins at the right or push rod side of the rocker-box need only be unscrewed until they are free, but those nearest to the valves must be withdrawn entirely. The rocker-box can now be drawn off the cylinder head from the right side.

Removing Cam-box on 1930 O.H.C. Engine. With this O.H.C. engine remove the cam box in a similar manner after taking off the cap and split fixing nut on the camshaft. While removing the cam box an assistant should hold and steady the chain-wheel.

Removing Cylinder Head. Next remove the bolts holding down the cylinder head, and remove the latter. Care should be taken to relieve the pressure evenly on both sides while untensioning the bolts. The head can then be removed by inserting a screw-driver, or similar tool, between the top cylinder-fin and head, prising *upwards* the head carefully off the barrel on both sides. Avoid scratching the cylinder head or the C. and A. gasket.

Drawing Off Cylinder Barrel. When the head is removed it is a simple matter to draw off the cylinder barrel. When doing this the engine should be turned over until the piston is at the lowest position of its stroke, and the barrel gently slid off, care being required to prevent the loose piston falling sharply against the connecting-rod which might damage or distort the piston skirt.

While turning a "camshaft" engine support the chain wheel with the fingers, or a suitable instrument, permitting of its unobstructed rotation. *On no account allow the chain wheel to fall out of the chain.* Use the special supporting tool. Having removed the cylinder, wrap a clean rag round underneath the piston, so as not to allow dirt or foreign matter to enter the crankcase. Remember, that should you by some mischance allow even the smallest article to fall into the crankcase (which the author confesses to having done once) it may be necessary to take the engine right out of the frame in order to extract the offending article. Anyway, fishing for a small nut with a piece of wire is at the best of times depressing, especially on a fine afternoon! Before actually starting to remove any carbon the piston should be taken off. It is desirable to mark the interior of the piston to ensure its correct replacement.

Piston Removal. Decarbonizing can be carried out without removing the piston, but each alternate occasion it is advisable to remove the piston so that the ring grooves can be cleaned. On all A.J.S. engines the gudgeon-pin is of the "floating" type, and is secured in position by two small retaining springs, one on each side. These springs fit into recessed rings in the piston bosses, and to be withdrawn must be squeezed together with the special pliers provided. Afterwards the gudgeon-pin may be pushed out from the driving or timing side. The piston can then be removed from the connecting-rod.

Removing the Valves. Valves of the side-by-side type can be removed, if desired, without disturbing the cylinder. Take off the valve chest cover and the valve caps in the case of a T5 engine, or remove the cylinder head in the case of a T9 engine and place the hooked end of the special valve extractor on the top of the valve, using the valve cap spanner, which fits the bottom of the hook, for the necessary leverage to lift the valve spring to allow the cotter to be withdrawn. The valve can then be pushed up and drawn out of the head. Remove the other valve similarly. Remember that side valves are more readily removed with the cylinder in situ. On a 33/2 or T9 use a proprietary extractor.

In the case of the engine with overhead valves it is necessary to remove the cylinder head entirely from the engine to enable the special valve extractor (price 5s. 9d.) to be used. This is a clamp-like tool for extracting the valves readily. For portability the tool is made to fold up. Unfold it and place the end opposite the screw over the upper valve spring cap in the manner illustrated on the next page. Screw up until the point of the screw presses inside the hollow of the valve head. Hold the cylinder head firmly, keep screwing, and it will be found that the spring is compressed. Then the two small split cones can be taken away from the recess in the valve stem, and the valve may be withdrawn. Repeat this

operation for each valve. When removing valves, note where they come from and replace them in the same order. The valves are interchangeable on some engines, but it is best not to change them about unless necessary, as different steel is used.

Removing the Carbon. Procure an old screw-driver, or similar tool, and scrape off all carbon from the piston head. If this is done with the piston not removed be careful not to impose side strain on the connecting-rod. The piston may then be polished

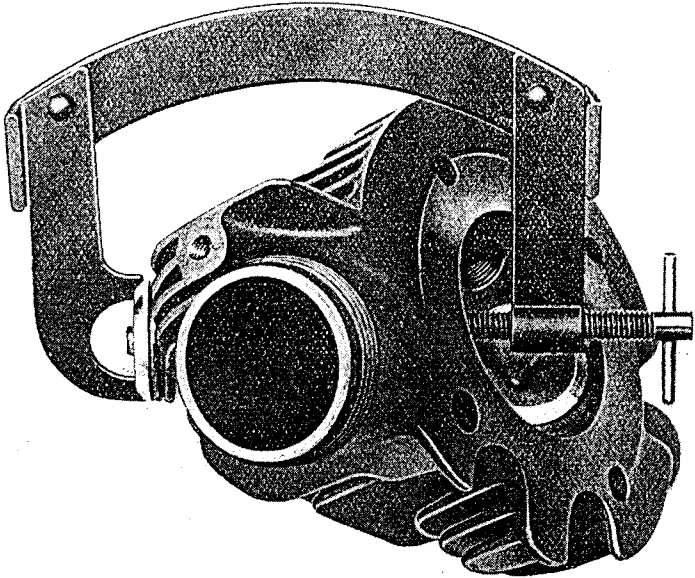


FIG. 47. THE A.J.S. OVERHEAD VALVE EXTRACTOR

with very fine emery cloth, but do not touch the sides of the piston at all. With aluminium pistons the use of emery cloth is not advised, and if used great care must be taken to remove abrasive particles. If the deposit is very hard it may be necessary to allow the piston to soak in paraffin in order to soften the carbon. Now scrape off all deposits in the cylinder head, being careful not to scratch deeply the walls of the combustion chamber during this operation. Incidentally, it should be mentioned that carbon deposits form less rapidly on smooth surfaces, and therefore it is worth doing the job thoroughly. On no account use emery cloth or, indeed, any abrasive on either the combustion chamber or cylinder walls. Any abrasive particles left would cause very serious damage in the event of their finding their way between the

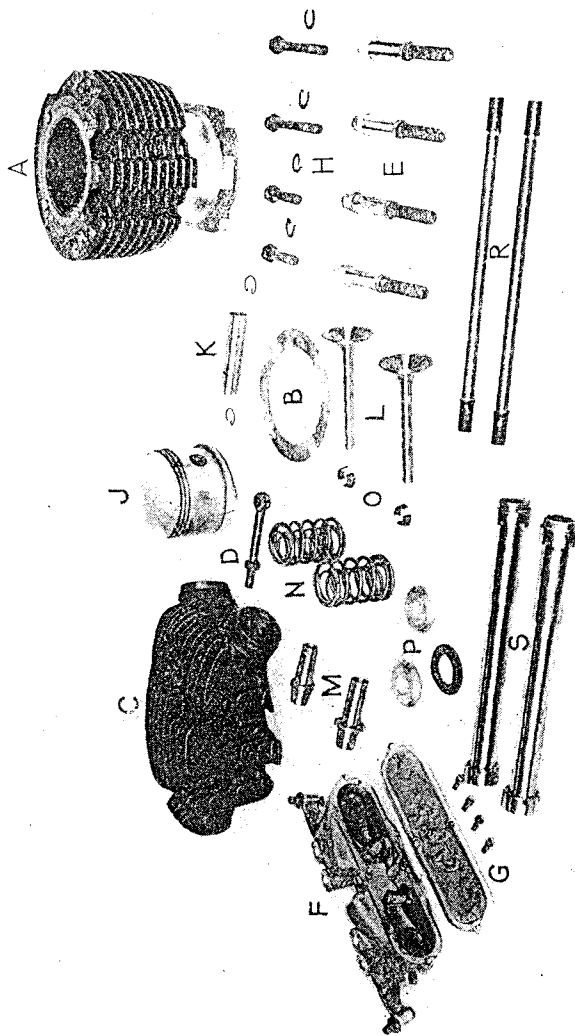


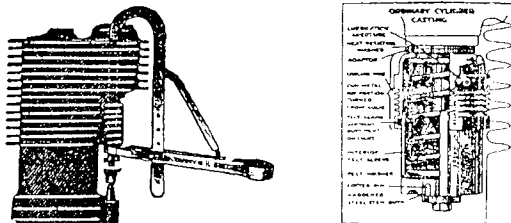
FIG. 48. COMPONENT PARTS OF A.J.S. OVERHEAD VALVE MECHANISM

The engine parts shown are not those of a 1932-33 power unit, but nevertheless almost identical. The cylinder head stay shown at *D* is, however, now omitted

A = Cylinder barrel
 B = Cylinder head gasket
 C = Cylinder head
 D = Cylinder steady bolt
 E = Cylinder head studs
 F = Rocker box complete with rockers
 G = Rocker box cover
 H = Rocker box cover and screws
 I = Rocker box bolts
 J = Piston
 K = Gudgeon pin and circlips
 L = Valves (tulip)
 M = Valve guides
 N = Valve springs
 O = Split cones
 P = Valve spring caps
 R = Push rods
 S = Push rod covers

piston and cylinder. Chip off all deposits around the valve pockets and the ports, afterwards wiping all surfaces over with a clean rag slightly damped with paraffin.

Grinding-in the Valves. Should the valves or valve seats show signs of "pitting," the valves will have to be ground-in. This



FIGS. 49, 49A. TWO USEFUL ACCESSORIES FOR S.V. ENGINES

Left, Terry spring compressor; *right*, F.E.W. valve stem lubricator. Both these items are obtainable from Messrs. James Grose, Ltd.

requires considerable patience and care. We will deal first with the S.V. type of engine. Stuff a rag into the combustion chamber

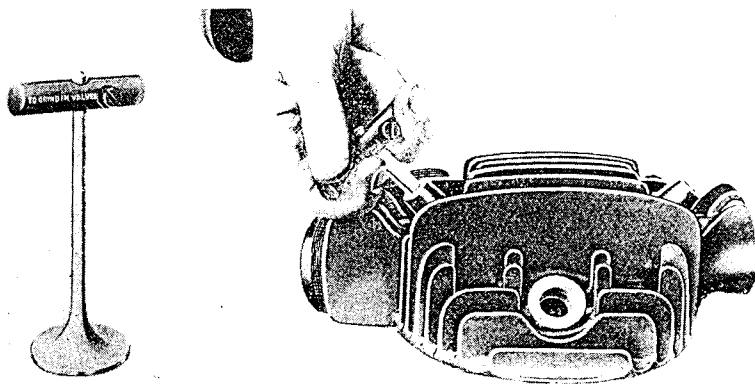


FIG. 50. USING THE A.J.S. VALVE GRINDING TOOL

On S.V. engines with detachable heads not housing the valves (33/2, T9) grinding-in does not necessitate cylinder removal, but care should be taken to screw down the tappet heads a few turns to ensure the valves seating with piston on T.D.C.

or cylinder to prevent dirt getting in, and then, if removed, place the head or barrel firmly on a bench with valve seats uppermost. The best preparation for valve-grinding is a compound such as carborundum (supplied in two grades, coarse and fine).

Smear the valve face lightly with some of the coarse carborundum paste, and insert the valve on its seat. Only use a little of the compound at a time. Now oscillate the valve repeatedly under moderate pressure with the aid of a screw-driver or a screw-driver blade gripped in a brace. Lift the valve at intervals, and turn it round a few degrees before dropping it again. Remove it at intervals, wipe and inspect the face. If there are still signs of "pitting," apply more paste and carry on. When there is a bright ring contact all the way round, and the little brown or black pock-marks have disappeared, the valve is a good fit again, and may be refitted. It is a refinement to finish off with a fine grade of abrasive, or even with rouge or metal polish. After grinding-in both valves, carefully remove every particle of abrasive from the cylinder head. Never attempt to grind-in a very badly pitted valve; it should be returned to the makers to be refaced. To grind-in such a valve effectively would cause very bad wearing down of the valve seat, and would ultimately result in the valve becoming "pocketed," with consequent loss of power. A light spring under the valve will assist grinding-in.

Grinding-in overhead type valves is very similar to the procedure described above; but, of course, the valves, instead of being pressed down upon their seats, have to be pulled up against them. For this purpose a special tool is provided (see Fig. 50).

Having ground-in the valves and thoroughly cleaned out all dirt and abrasive, as well as any fluff on the valve seats, proceed to replace the valves and valve springs, together with the valve caps in the case of the 3.49 h.p. lightweight Model T5. When replacing valve caps, smear a jointing medium, such as "Metales-tine," on the threads, also see that all copper-asbestos washers are in sound condition. Valves should be replaced in their correct places. The colour of the steel usually indicates which is the exhaust valve. As a rule this valve is rather blue. If it is greatly discoloured it is a sign of overheating having occurred.

Examining and Removing Piston Rings. The piston rings are the main guard of the compression. They must, therefore, be full of spring, free in their grooves, and set with their slots equally spaced round the piston, i.e. at distances of 120° . If all the rings are bright all the way round they are obviously being polished against the cylinder walls, and are perfect, and should be left alone. If, on the other hand, they are dull or stained at some points, they are not in proper contact with the walls of the cylinder. Perhaps they are stuck in their grooves with burnt oil, and will function properly if the grooves are cleaned. If vertically loose in their grooves or very badly marked, the rings must be renewed. Piston rings are of cast-iron, and being of very small section must be handled very, very carefully. If not, they

will certainly be broken. They cannot safely be opened out wider than will allow them to slip over the crown of the piston. Therefore, to put them on or remove them requires the insertion of small strips of metal, about $\frac{1}{4}$ in. wide, which are placed in the manner illustrated by Fig. 51. When fitting new piston rings, thoroughly clean the grooves into which they fit, as any deposit left at the back of new rings forces them out, and makes them too tight a fit. Paraffin usually loosens stuck piston rings. Piston rings are made to very accurate dimensions, and it is very bad practice to attempt to "fit" oversize or undersize rings unless you know exactly what you are doing. Lapping-in oversize piston rings is a skilful job, and unless the slot sizes are exactly right the rings will not function well, and may even produce an engine "seizure." Therefore, always use piston rings guaranteed to be of A.J.S. manufacture. These have a slot gap of .00512.

Lubricating O.H.V. Rockers. The rocker gear can be inspected by removing the inspection cover, but this need not be taken off in order to lubricate the upper ball joints of the push rods. In the centre of the cover will be found a "Tecalemit" grease gun nipple (see Fig. 10). Grease should, *with both valves closed*, be forced through this nipple, when it will automatically find its way to the two ball joints. It is important when this is being done that both valves are in a closed position. If the inspection cover is removed, care should be taken to see that the two coil springs, which fit inside the rocker spindles, are not lost. These coil springs press against the inside of the cover, and have their other bearing against the end of the hollow rocker spindle.

Cleaning the Outside of Cylinder. Rain and heat soon make the outside of an air-cooled cylinder look red and rusty. This does not affect the running, but does not improve the appearance of the machine, and to a very small extent reduces heat radiation. To remedy this the cylinder head and the cylinder radiating fins should be cleaned with a stiff brush soaked in paraffin, and afterwards painted with cylinder black. There are plenty of such compounds on the market.

The Sparking Plug. Thoroughly clean the sparking plug with

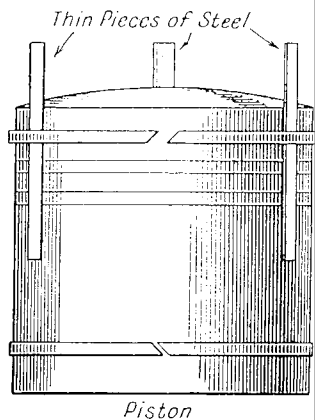


FIG. 51. HOW TO REMOVE PISTON RINGS

The above is the accepted method, unless one has a special tool available

petrol and scrape the electrode points lightly with a sharp pocket-knife, afterwards checking the gap between them, which should be about .02 in. The reach of the sparking plug is also of importance. The sparking plug should be frequently inspected. It is susceptible to oiling-up.

Reassembly of Engine. After thorough decarbonizing, the engine may be reassembled. Care should be taken to replace all paper washers and C. and A. washers if fitted; any damaged washers should be at once renewed when reassembling the engine. The piston should be oiled before being attached to the connecting rod with the gudgeon pin. It must be replaced the same way round as taken off with the rings properly spaced. Do not forget the retaining springs. These must be a snug fit. Hold the cylinder in the rear angle of the frame, and place the piston a little before bottom dead centre on the downward stroke. By pressing the rings in with the fingers without disturbing the slot positions, the barrel may be slid over the piston. When replacing the cylinder of Model T5 remember that it must be tightened down before the steady is again attached to the down tube. When the cylinder has been finally tightened down, then the stay of the steady can be adjusted so that the pin passes through the clip on the down tube and eye of the stay without force. The rest of the assembly is quite straightforward. There are two points to be noted, however: (1) see that the overhead valve rocker bearings are lubricated, (2) make certain that the lift of the exhaust valve on the O.H.V. engine does not exceed $\frac{1}{8}$ in. when the exhaust lifter is raised. If the valve lifter lifts the valve, say, $\frac{1}{4}$ in., the inlet and exhaust valves may foul each other with disastrous consequences when the engine is restarted (this applies only to 1927-29 engines).

In the case of a camshaft engine, after replacing the cylinder and cylinder head fit the cam box, carefully placing the chain wheel on to the camshaft spigot and rotate the engine until the hole in the camshaft sleeve is opposite to the hole in the chain wheel. Now insert the washer with its special key and tighten the nut and fit the split cotter. Finally, remove the tool supporting the chain wheel and replace the inspection cap in the chain case. The remainder of the assembly is straightforward.

After assembly, test the engine compression by trying to pull the rear wheel over with top gear engaged. Do not stand on the kickstarter, as this puts an ill-advised strain on the gear-box layshaft bearings. It should offer powerful resistance for several seconds on full compression. But bear in mind that the compression will improve still further when the oil has circulated again throughout the engine, and the valves and piston rings have rebbed themselves again. The machine is now ready for the road again.

Carburettor Fitting. All 1932-33 machines except T5, 33/2, have flanged fitting carburettors, and if the carburettor is removed great care must be taken to ensure on refitting an absolutely airtight joint. If the washer is damaged fit a new one at once or the bad joint will result in air leaks and erratic running of the engine.

Concerning Engine Lubrication. In the case of A.J.S. machines manufactured during the period 1926-1928, the motor-cyclist should take out the sparking plug occasionally, and see if it is unduly wet with oil. If the plug is not dead dry, cut down the supply of oil by turning the adjuster on the side of the mechanical pump to the right, moving $\frac{1}{16}$ in. at a time until the engine gets a definite oil supply without oiling-up the plug. The sight indicator on the pump will show whether oil is being pumped in all right. Where a hand-pump alone is fitted the remedy is obvious—give less oil. Over-lubrication is shown by oil unduly working out from the tappet guides (although cups are fitted to A.J.S. engines to minimize this) and smoke issuing from the exhaust. If the oil supply is such that when the throttle is smartly opened on low gear a puff of blue smoke issues from the exhaust pipe, the lubrication is approximately correct.

In the case of the "T" class A.J.S.'s the rider has the satisfaction of knowing that his engine is at all times being fed with the correct quantity of lubricant, *provided that the oil level in the tank is correct and he has adjusted the pump control knob properly* (see page 37). The level should be checked periodically. As is the case with all internal combustion engines, a sediment gradually collects at the bottom of the crankcase, and should be eradicated by draining it about every 2,000-3,000 miles. A plug in the bottom of the crankcase and a plug near the base of the cylinder on the driving side are provided for this purpose. Afterwards replenish with half-a-pint of clean oil. On the 1933 Big Twins keep oil tank half to three-quarters full, and drain every 500 miles. On this machine maintenance of the correct oil level is important. Every 5,000 miles remove and clean with petrol the fabric filter in the tank. Keep an eye on the "tell-tale."

Care of the Magneto. The Lucas magneto is provided with ball bearings throughout, which are packed with grease before leaving the manufacturers. Fresh lubricant should not be required under normal circumstances before some 12,000 miles.

The platinum contacts of the contact-breaker should be examined about every 1,000 miles, and, if the "break," shown by the arrow (Fig. 52), should be more than will just hold a 12 thou' blade of a feeler gauge, they should be adjusted. Too great a gap will advance the timing. A special magneto spanner is provided, which includes a gauge for checking the "break." It is

unnecessary to remove the contact-breaker to make this adjustment. If it is necessary to take the contact-breaker off for some reason, unscrew the long taper fixing screw, and withdraw the contact breaker bodily. The contacts only need attention at long intervals, and the reader should not interfere unnecessarily with them. The platinum points must only be dressed with a dead smooth file if the surfaces have become at all pitted, and then the least possible amount taken off. The greatest care must be exercised, as platinum is a very expensive metal. Always keep

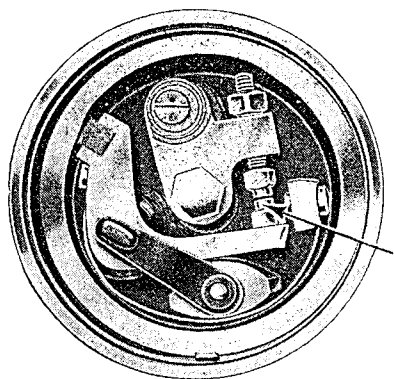


FIG. 52. THE CONTACT-BREAKER

the contact breaker scrupulously clean and free from oil.

It will prevent misfiring and render starting easier if the slip-ring is cleaned occasionally. This is done by taking off the H.T. terminal and, while the magneto is being revolved by slowly turning the engine over, inserting a lead pencil, the end of which is covered with a clean rag moistened with petrol. The pencil should be pressed against the rotating slip-ring.

Beyond the above-mentioned points, the magneto should not be interfered with. If internal

trouble develops, return the instrument to the makers for repair.

Those riders who have "Magdyno" lighting on their machines should note that the above information applies to the magneto portion of the Lucas "Magdyno." As in the case of the Lucas magneto, the bearings are packed with grease on both instruments. For "Maglita" contact-breaker attention, see Fig. 67.

When Ignition Trouble is Suspected. Before interfering with the magneto verify that the sparking plug, the cable, and connections are correct. If these are in order turn the engine over slowly and watch if the contact breaker arm works properly. This is bedded in a fibre insulating bush, and in moist weather there is an occasional danger of the material swelling. If this happens prise the rocker arm off its bearings and clean the pin on which it works with fine emery cloth, and smear a very small quantity of oil on it before replacing. Do not take the magneto to pieces needlessly. It is easily possible to damage it.

Re-timing the Magneto. If the magneto has been removed from the machine, or the drive disturbed, it will be necessary to see that it is re-timed correctly after it is fitted again. 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 (see Fig. 53), 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.

Keyed to the armature shaft of the magneto or "Magdyno" (in the case of 1931-33 engines—on some early types it is a push-on taper fit) is a sleeve (1) which has thirteen holes ranged in a circle. Fitting over a collar on this sleeve is the chain sprocket (2), which has twelve holes similarly arranged. Now on the sprocket on the engine shaft and on the magneto shaft an arrow will be found. These must point to each other before anything else is done. The first thing then in re-timing is to set these arrows so that they exactly face towards each other. To do this turn the engine over until the arrow on the driving sprocket is pointing directly towards the arrow on the magneto sprocket. The 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 so, place the magneto sprocket on to the sleeve, and rotate armature shaft of 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 sleeve collar. It will now be found that the marked holes in sleeve and sprocket, respectively, coincide exactly, 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, and 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. Set the piston at its correct distance (given in Chapter I, Specifications) from the top of the compression stroke—make sure that it is not on the exhaust stroke. With the engine in this position, take off

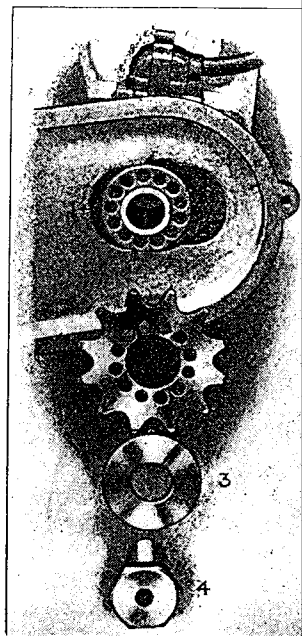


FIG. 53. THE VERNIER
TIMING ADJUSTMENT

the sleeve lock-nut on magneto sprocket, and remove peg washer. This will now 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 spark lever to the limit of its motion of advance. Remove the cover of contact breaker and slowly turn the armature till the fibre block of the make-and-break lever rises on the inclined plane of the steel segment sufficiently to just separate the platinum points. This is the firing point, and in this position the markings previously referred to on 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 advisable to check the timing after tightening up.

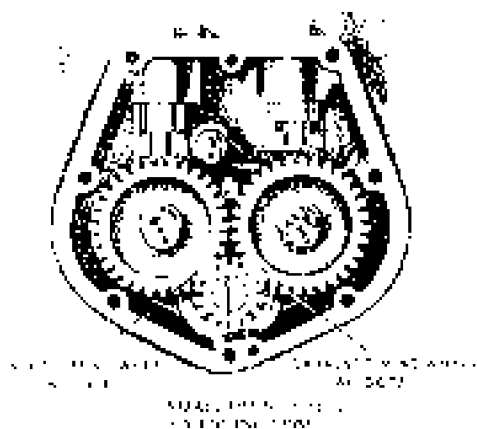
It can be understood that so long as the sleeve (No. 1) has not been removed (i.e. its position relative to the armature shaft altered), all components can be replaced exactly as taken off, and therefore the timing is unaltered, but it should be checked. The taper on the sleeve is very gradual, and hence the sleeve will remain firm even with the lock-nut removed. Should the sleeve have to be taken off, the magneto will have to be timed in the usual way, and the correct sleeve position on the armature shaft found afterwards. In the case where the sleeve is keyed the Vernier adjustment always holds good.

In the case of the "Vee" twin, the "Magdyno" must be timed on No. 1 cylinder, that is, the one that fires first. This is the back cylinder nearest which is No. 1 cam. On 1933 twins no vernier adjustment is provided, the armature sprocket being merely a friction tapered fit without key.

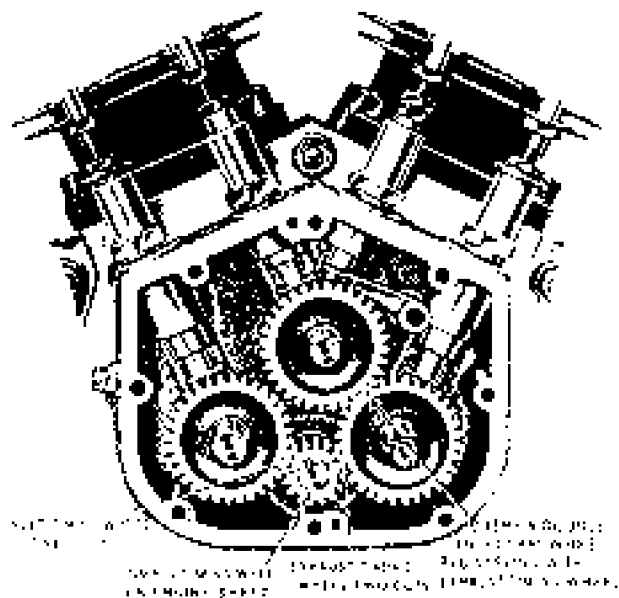
The magneto terminals are numbered on the body of the instrument, and care must be taken to see that the H.T. leads are connected to the corresponding cylinders.

The Lucas "Maglita." Vernier timing is not used in conjunction with the Lucas "Maglita," which is fitted to Models T5 and TB6 and driven by a special duplex chain off the inlet camshaft. On these two models, if electric lighting is provided, ignition timing is slightly more difficult to set with accuracy.

Magneto Chain Adjustment. Examine the driving chain occasionally and, if slack, tighten it by tilting from the forward end the magneto on the platform (see Fig. 8), in an upward direction after unscrewing the front and rear bolts a turn or two. To do this it is unnecessary to remove the cover, a door being provided at the front. When the correct tension has been obtained (there should be just no droop) screw the bolts up again tightly. Should the chain cover be removed, oil the chain before replacing the cover. Examine also the nuts securing the chain sprockets. Before coupling up the oil pipes to the mechanical pump (1926-28



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models), open oil cock and expel all air from the delivery pipe; otherwise, on starting the engine, air will be pumped in for some minutes. Be careful to replace the pump connection.

Engine Timing. No useful results can be obtained by tampering with the valve timing. On the contrary, all results following such action are likely to have a negative value, if they do not completely spoil the engine performance. The makers have arrived at the setting after very careful consideration, and have marked the pinions with a dot system of identification to enable the setting to be always kept. On the small timing pinion (see page 127) will be found a single dot and a double dot. These dots correspond to similar marks on the inlet and exhaust valve timing pinions. To set the inlet valve, place the single dot found stamped thereon in register with the single dot on the small pinion, and similarly in the case of the exhaust wheel which has two dots stamped on it. In the case of 1927-31 Big Twins, the system is very similar, but the double inlet cam wheel has a dash registering mark to coincide with a dash on one of the exhaust cam wheels. 1932-33 Big Twins which have only one camwheel (see Fig. 19) have a single mark on the engine pinion registering with one mark on the camwheel.

An unusual feature about the 33/2 engine is that the timing gears run submerged in oil, and if the timing cover is removed for any purpose, a dish or some other receptacle should be used to catch the oil. It is unnecessary to fill the timing chest before replacing the cover, as a special feed is carried from the oil pump to the timing gear chamber for this purpose, and after the engine has been started up the correct level is quickly obtained.

Maintaining Compression. If piston rings and valves are in good condition, the only other possible sources of leakage are the valve caps, the cylinder head joint, and the sparking plug. The washers belonging to all these parts should be renewed as soon as they become at all distorted or uneven, and a jointing medium should be used when screwing up the valve caps. Test for compression leakage by putting thick oil on the sides of the joints and observing whether bubbles occur when the engine is running.

Testing for Spark at the Plug. The accepted method of doing this is to place a wooden-handled screw-driver with steel blade across the terminal and just touching the cylinder fin. Now depress the kick-starter and see if there is any sparking at the blade tip. It is just possible that the plug insulation is defective if the foregoing experiment produces a "juicy" spark, and yet the engine refuses to fire, assuming there are no carburation troubles. In this case take the plug out and lay it on the cylinder head, taking care that the terminal is insulated from the cylinder, and reconnect the H.T. lead. Now again depress the kick starter

and see if anything happens. If no spark occurs now, we may take it that the plug is faulty, and it should be scrapped.

TUNING THE CARBURETTOR

The Standard Amal Carburettor. The standard setting is usually entirely satisfactory, but better results and more power may sometimes be obtained by the use of a slightly larger main jet or by making other adjustments. Various sized jets are obtainable from A.J.S. spare parts stockists, or from the manufacturers.

Should the setting of this instrument not give entire satisfaction for particular requirements, there are four separate ways of rectifying matters as given herewith, and the adjustments should be

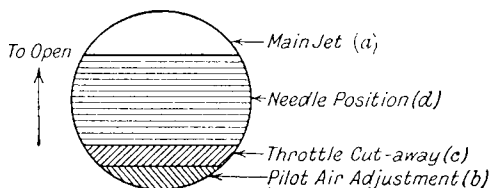


FIG. 56. RANGE AND SEQUENCE OF AMAL ADJUSTMENTS

made in this order: (a) Main jet ($\frac{3}{4}$ to full throttle); (b) pilot air adjustment (closed to $\frac{1}{8}$ throttle); (c) throttle valve cut-away on the air intake side ($\frac{1}{8}$ to $\frac{1}{4}$ throttle); and (d) needle position ($\frac{1}{4}$ to $\frac{3}{4}$ throttle). The diagram (Fig. 56) clearly indicates the part of the throttle range over which each adjustment is effective.

(a) To obtain the correct main jet size, several jets should be experimented with, and that selected should be the *one which gives maximum power and speed* on full throttle with the air lever three-quarters open. If maximum speed is the chief consideration, the jet size should be selected with the air lever fully open. For touring, to determine whether the jet is too large or too small, with throttle fully open, gradually close the air lever. If an increase in power is noticed, the jet is on the small size. If, however, when the air lever is opened fully, an increase of power is obtained, the jet is too large.

(b) To weaken slow-running mixture, screw pilot air adjuster outwards, and to enrich, screw pilot air adjuster inwards.

Screw pilot air adjuster home in a clockwise direction. Place gear lever in "neutral." Slightly flood the float chamber by gently depressing the tickler, unless the latest Amal "pump" device is provided. Set magneto at half advance, throttle approximately one-eighth open, close the air lever, start the engine, and warm up.

After warming up, reduce the engine revolutions by gently throttling down. The slow-running mixture will prove over-rich unless air leaks exist. Very gradually unscrew the pilot jet adjuster. The engine speed will increase, and must again be reduced by gently closing the throttle until, by a combination of throttle positions and air adjustment, the desired "idling" is obtained. It is occasionally necessary to retard the magneto completely before getting a satisfactory tick-over, especially when early ignition timing is used. If it is desired to make the engine idle with the throttle quite closed, the position of the throttle valve must be set by means of the throttle stop screw, the throttle lever during this adjustment being pushed right home. Alternatively, if the screw is adjusted clear of the throttle valve, the engine will be shut off in the normal way by the control lever.

(c) Given satisfactory "tick-over," set the magneto control at half-advance with the air lever fully open. Very slowly open the throttle valve, when, if the engine responds regularly up to one-quarter throttle, the valve cut-away is correct.

A weak mixture is indicated by spitting back through the air intake, with blue flames, and hesitation in picking up, which disappears when the air lever is closed down. This can be remedied by fitting a throttle valve with less cut-away. A rich mixture is shown by a black, sooty exhaust, and the engine falters when the air valve is closed. The remedy for this is a throttle valve with greater cut-away. Each Amal valve is stamped with two numbers, the first indicating the type number of the carburettor, and the second figure the amount of cut-away on the intake side of the valve in sixteenths of an inch, e.g. 6/4 is a type 6 V. with a 4/16 in. —i.e. a $\frac{1}{4}$ in. cut-away.

(d) Open air lever fully and the throttle half-way. Note if the exhaust is crisp and the engine flexible. Close the air valve slightly below the throttle, when the exhaust note and engine revolutions should remain constant. Should popping back and spitting occur with blue flames from the intake, the mixture is weak, and the needle should be slightly raised. Test by lowering the air valve gently. The engine revolutions will rise when the air valve is lowered slightly below the throttle valve.

If the engine speed does not increase progressively with raising of the throttle, and a smoky exhaust is apparent with heavy, laboured running, and tendency to eight-stroke, the mixture is too rich and the needle should be lowered in the throttle valve. Having found the correct needle position, the carburettor setting is now complete, and it will be found that the driving is practically automatic once the engine is warmed up. For speed work the main jet may be increased by 10 per cent, when the air lever should be fully open on full throttle.

Tuning the Bowden Carburettor. For tuning purposes the Bowden carburettor is supplied with one pilot jet and two main jets, smaller than those fitted. As explained on page 81, the pilot jet *G* delivers the petrol mixture for starting, and at small throttle openings; the main jet *B* delivers the mixture for all driving requirements. The Bowden carburettor can be tuned very easily, and the best way to do it is as follows.

Starting from Cold. Screw the adjusting screw *M* (Fig. 37) right in. Open the throttle slightly, about $\frac{1}{16}$ in., with the twist-grip, so that the suction on pilot jet *G* is very great. Set the mixture control lever to the closed or starting position, thus closing the air intake at *P*, and start the engine. By closing this air passage, the mixture delivered by the pilot jet *G* is considerably enriched, and ensures easy starting. This mixture control lever corresponds to the corrector or choke generally used on carburettors. It is not necessary to flood the carburettor.

Wait until the engine is warmed up, and then put the mixture control lever to the normal position (open) and close the throttle by the twist-grip; then reduce the engine speed by slowly unscrewing the throttle setting screw until the engine runs at an appreciably slow speed for idle running. In the majority of cases the mixture will then be too rich, and the engine will "hunt." Unscrewing the adjusting screw *M* will cause an air intake at *N*, which will weaken the mixture to the desired degree, and make the engine gather speed and run evenly. *Screw M should never be unscrewed more than necessary to fully uncover the air intake.* No advantage can be gained by unscrewing it further. If the engine "hunts," with air intake *N* fully opened, a smaller pilot jet should be fitted, and adjusting screw *M* screwed in until the engine runs evenly.

Tuning for Power. If the test on the road shows plenty of power, try a smaller main jet. But if a power decline is noted, the jet immediately larger than the one causing the loss of power is the jet which will give the lowest fuel consumption and best performance. Where economy is essential a smaller size main jet can be fitted, but don't forget that often too weak a mixture will overheat the engine. Excellent acceleration and more power when required can be obtained by closing the mixture control partly or fully, while overheating will be eliminated also, but this control must be put back to the normal position when the engine is idling.

Except for changing the main jet, and in rare cases the pilot jet, the tuning of the Bowden carburettor is limited to the setting of the throttle stop screw, and slow-running adjusting screw *M* (Fig. 37). The total jet *F* and full jet *A* are definitely fixed by the carburettor manufacturers, and should not be altered on any

A.J.S. machine. Similarly, the petrol level should also be left untouched.

Air Leaks in Induction System. The chief source of air leaks, apart from leaks at induction pipe connections and carburettor, is at the inlet valve guide. Should this guide become badly worn it must be renewed or the engine will run irregularly at low speeds. It is sound practice to fit one of the proprietary valve attachments, such as the "F.E.W." or "Flexekas." These devices enable the valve stems to be continually and amply lubricated, thereby ensuring long life for the valve guides, and at the same time they eliminate all air leaks on S.V. engines.

Absence of Compression after Valve Grinding. This temporary phenomenon is common to all engines. Usually it is due to some foreign particles existing between the valve seats and faces. After a short mileage the engine regains its full compression.

Cleaning Dirty Exhaust Valves. Sometimes, when an exhaust valve is removed, the portion of the bevel face which does not bear on the seat is found to be thickly carbonized (due usually to running on an over-rich mixture). This deposit should be cleaned off before the part of the face which beds on the seat is attended to; otherwise the upper portion of the valve face may be damaged and in any case it will prevent the valve head from taking a central bearing on its seat during the operation of valve-grinding. Such carbon is fairly easy to remove when it has been soaked in paraffin for an hour, after which a stiff brush will scour it off. A knife, file, or emery cloth should not be used to effect its removal, as damage to faces would probably result.

Synchronizing Twin Cylinder Magneto. See that the cams on the contact breaker are of equal height, as shown by measuring the gap between the platinum points at each "break." For this purpose use the "feeler" gauge. If the gaps differ, get them both to the exact distance recommended by the makers ($\frac{1}{2}$ mm.) shown by the gauge on the magneto spanner.

"Magdyno" Lubrication. The lubrication is the same as for the ordinary magneto. Generally, ample grease percolates through from the gear wheel casing to lubricate all bearings on the driving end. The dynamo commutator end-bearing can readily be lubricated by removing the hexagon nut securing the end cover and placing a small quantity of grease or a few drops of oil in the bearing housing. The magneto bearing, at the contact-breaker end, should run perfectly without attention owing to the effective manner in which it is protected. Should the gears run completely dry they may be packed with a high melting point grease.

A small greaser is fitted for the driving gears of the Magdyno. This is fitted to the casing of the Magdyno instrument and is really a screwed on grease cap. Care should be taken not to overdo

the greasing at this point, otherwise some of the grease might find its way to the slip ring and brush holder.

Cleaning out Silencer. The A.J.S. silencer seldom needs cleaning, but if back-pressure through choking is suspected, strip the silencer and prick out all holes and carefully clean with paraffin and stiff brushes.

Handling Petrol Pipes. Petrol pipes should be handled more gingerly than any other details on the machine. They are easy to twist, and their soldered unions are easily rent asunder. Therefore, spanners should not be used as wrenches on the union nuts. Should a union spring a leak, soap will make as good a caulking medium as anything. If a pipe is split, rubber tubing will serve temporarily to stop the leak. For this purpose a piece of rubber tubing used for acetylene generators may be utilized. Petrol pipes should never be coiled so that the coils have horizontal axes. This tends to create air locks.

Paper Washers. These are useful in preventing leakage, and may be made by placing a sheet of paper over the part for which the washer is intended and rubbing round the edge. A clear impression is thus made on the paper, and the portions not required may be then cut away. The washer should be well oiled before insertion.

Removing a Tight Valve Cap. A valve cap that has resisted ordinary methods of removal may sometimes be removed by the introduction of a little cold water in the hollow of the cap when the engine is hot, the spanner being applied immediately. The remaining method of removal, if absolutely necessary, is to drill a series of holes across the diameter of the cap. Also soak in paraffin. Never use excessive force with the cylinder in place. It may strain or distort it.

Removing Tight Nuts. If a nut is very stiff indeed, try heating a spanner or pair of pliers and grip the nut firmly when the spanner is nearly red hot. The heat will be conducted to the nut and it will expand, thereby becoming a looser fit on the bolt which is still comparatively cold. Care must be used not to apply excessive force except as a last resort, for it is apt to strip the thread right off. Should partial stripping occur, employ a packing washer, or, if possible, renew both nut and bolt.

A Tip for 1927 A.J.S. Owners. Those who have 1927 O.H.V. engined models can reduce valve gear noise in a simple manner by fitting springs to hold the push rods against the rockers. About $\frac{7}{8}$ in. from the lower end of each rod there is a shoulder against which a $\frac{7}{16}$ in. washer may be placed. This constitutes a support for a light spring about 1 in. long, the bottom end of which rests against the tappet guide. If the above modification be carried out, it will be found that because the valve clearance

occurs at the lower end of the push rods, noise is greatly decreased and wear reduced, for the lower ends of the push rods are lubricated.

Fitting New Small End Bush. Amateurs sometimes drive out these bushes with disastrous results. The correct procedure is as follows: Get an old bush slightly smaller than the one which is to be extracted and a larger one for it to fit into. An iron bolt is then run through the connecting rod, and the two bushes placed one on each side of the latter. By slowly tightening a nut on the bolt with a long spanner, the bush in the connecting rod can be slowly pressed out. A new bush may be fitted in like manner, and if a trifle large externally can be eased off with emery cloth. See that oil grooves are provided on the new bush.

Assembling Flywheels. Strictly speaking, a lathe and dial indicator are required for this job, but it can be done with a vast amount of patience. The final test of truth is the absolute free running of the wheels when the crankcase is bolted up. The slightest suspicion of binding indicates that the wheels are not true. A straight-edge will be useful in testing for alinement.

Attention to Gear-box. The three- or four-speed gear-box needs no attention whatever with the exception of regular lubrication. During the summer months use Wakefield "Castrolase Light," and during the winter Castrol "D." The use of "Castrolase" in winter is apt to cause sluggish gear changing.

With all three-speed heavyweight models, after preliminary charging of the gear-box with $\frac{1}{2}$ lb. of "Castrolase Light" (mixed with $\frac{1}{2}$ pint of engine oil), or $\frac{1}{2}$ pint of Castrol "D" according to the time of year, recharge with $\frac{1}{4}$ lb. or $\frac{1}{4}$ pint, respectively, every 1,000-1,500 miles. With the three-speed lightweights charge with $\frac{1}{4}$ lb. or $\frac{1}{4}$ pint and recharge with $\frac{1}{8}$ lb. or $\frac{1}{8}$ pint (i.e. about two grease-gunfuls) every 1,000 miles.

With the heavyweight 4-speed gear-box the correct level is such that the layshaft is half submerged (i.e. the gear-box is nearly one-third full). Charge with $\frac{3}{4}$ lb. or $\frac{3}{4}$ pint, and recharge every 1,000 miles with $\frac{1}{4}$ lb. or $\frac{1}{4}$ pint.

It will facilitate the entry of oil into the box if the back wheel is slowly revolved while pouring in the oil. A lubricator is provided in the form of a plug on the side of the gear-box. It is important to see that the above instructions are carried out faithfully. No harm is done by an additional charge of grease, but a lot of gear-box trouble is attributed to under lubrication or the use of an unsuitable lubricant. Do not use thick grease, as this may interfere with the action of the kickstarter pawl. Oil various joints in the gear changing mechanism regularly.

Primary Chain Adjustments (1933 Big Twins). To adjust the primary chain, it is possible to swing the gear-box bodily on its

lower pivot bolt, and to carry out this adjustment the following instructions should be observed.

The offside nut on the top gear-box fixing bolt must be slackened off. In tightening the front chain first slack off the nut on the adjuster bolt nearest the engine and turn the nut on the other side

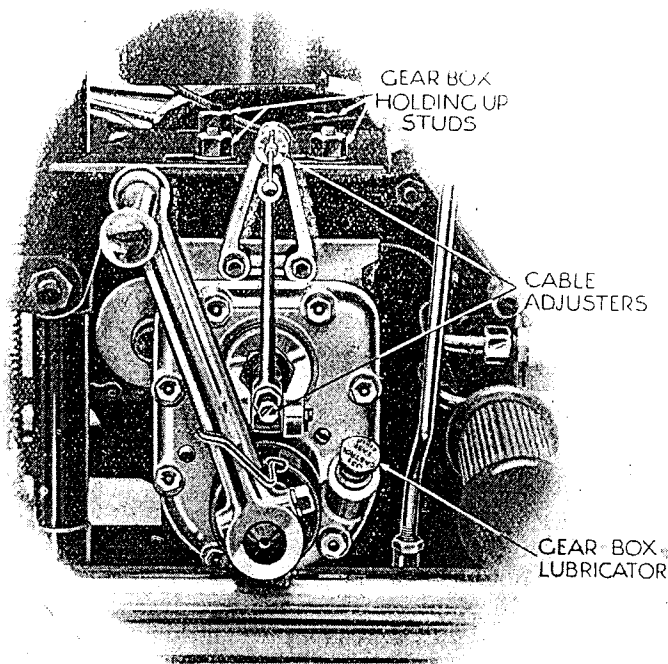


FIG. 57. THE HEAVYWEIGHT 3-SPEED GEAR-BOX (MODELS TB8, T9)

The clutch operation is identical on all models, but lighter boxes are used on Models T5 and TB6, with the layshaft at the side, not below the mainshaft.

of the anchorage in the same direction, i.e. anti-clockwise, until a correct chain tension is obtained. To ascertain this, remove the small inspection disc on the chain cover; the tension of the chain can then be felt with the fingers. It is most important to leave about $\frac{3}{8}$ in. or $\frac{1}{2}$ in. up-and-down movement. When the correct chain tension has been arrived at, re-tighten the nut nearest the engine on the adjuster and also the top gear-box fixing bolt. Always adjust the primary chain before the secondary.

Adjusting the Primary Chain (1928-33 Models). To adjust this chain, except on the 33/2, slack off the nuts on top of bracket and slide the box bodily backwards by means of the adjusting bolt situated at the rear of bottom bracket. It is important that the nuts are screwed tightly again after adjustment. The chain should be adjusted, and kept adjusted, so that it can be pressed down in the centre with the finger about $\frac{3}{8}$ in. After primary chain adjustment it is usually necessary slightly to alter the adjustment of the gear control, as described on page 139.

Dismantling Gear-box (1929). To dismantle the box, the following procedure must be carried out—

First disconnect the speedometer drive by unscrewing the lock ring of the cable at the gear-box end. Then detach the Bowden cable from the clutch operating lever on gear-box, and also external connections to gear lever. To remove the cable mentioned press the lever inwards sufficiently to allow the nipple of the cable to be slipped out of the slotted end. Next unscrew the six small pins round the cap, which hold this to the gear-box cover. The clutch operating mechanism can now be taken off entirely. Take care when doing this not to lose the short push-rod. It will be found that on the end of the mainshaft a thrust lock-nut is fitted. This has a left-hand thread, and the punch provided in the tool kit should be used to unfasten it. An arrow will be found on this nut pointing towards the left; this is the direction in which the nut must be unscrewed. Behind this will be found the ball thrust nut; remove this and the thrust washer. To take this out, push the mainshaft back a little so as to allow the washer to be withdrawn. This washer fits down on a dowel peg, and considerable care should be taken when replacing to ascertain that this is correctly in place. Now take out all the bolts round the cover of the box, and pull the cover off. The low gear dog wheel and layshaft can then be taken out, also the sliding sleeve. The mainshaft, complete with clutch, etc., can be drawn out from the opposite side of the box. To reassemble simply reverse these operations.

To Remove and Assemble Gear-box End Plate. First remove the kickstarter crank, after which the return spring and cover, together with the tubular sleeve, may be withdrawn. In the case of all models with four-speed gear-boxes (including the Big Twins), after slackening off the nut on the small clutch actuating lever (17, Fig. 42), the nipple can be slipped out of the arm. Next unscrew the cable adjuster from the top of the V bracket, after which all the end plate fixing nuts may be removed, leaving same free to be withdrawn. In the actual withdrawal process, pressure must be applied to the kickstarter axle end in order to prevent same, and also possibly the layshaft upon which it is mounted, being drawn out of position. The reassembly must be made in

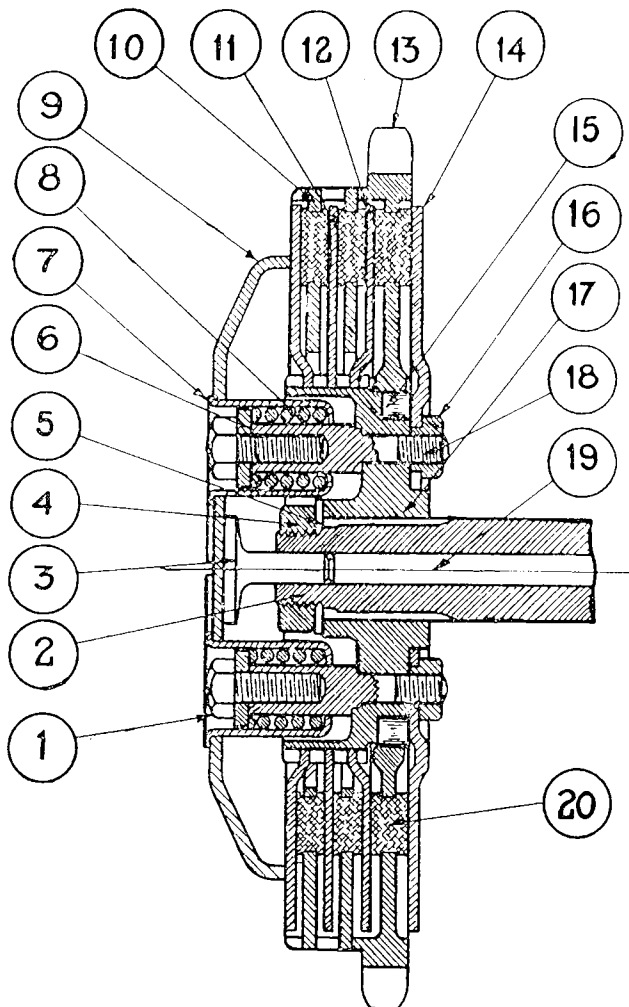


FIG. 58. SECTIONAL VIEW OF A.J.S. HEAVYWEIGHT MULTI-PLATE CLUTCH (3- AND 4-SPEED HEAVYWEIGHT MODELS)

The lightweight clutch (T5, TB6) is of similar design but one central spring only is employed (see Fig. 60)

- | | |
|--------------------------------------|---------------------------------|
| 1 = Clutch spring screw | 11 = Clutch centre plate dished |
| 2 = Main shaft | 12 = Clutch outer plate |
| 3 = Clutch thrust pin | 13 = Clutch sprocket |
| 4 = Main shaft nut | 14 = Clutch back plate |
| 5 = Locking washer for mainshaft nut | 15 = Roller bearings |
| 6 = Clutch spring screw washer | 16 = Clutch spring stud nut |
| 7 = Clutch spring box | 17 = Clutch centre |
| 8 = Clutch spring | 18 = Clutch spring stud |
| 9 = Clutch spring box plate | 19 = Clutch rod |
| 10 = Friction plate | 20 = Cork inserts |

the reverse order, and particular care must be taken to securely tighten down the end plate fixing nuts. A tubular box spanner will be found most convenient for this purpose.

Dismantling and Assembling Four-speed Gear-box. To dismantle completely it is necessary to remove the gear-box from the machine. Disconnect the primary chain and clutch wire, and before slackening the pivot mounting pins and adjuster, disconnect the gear control.

Then remove the gear-box cover nuts and the fork shaft lock nut, and draw off the gear-box cover. If this proves stiff give a few gentle taps on the inner side of the kickstarter crank with a mallet. Do not use a screwdriver to part the joint or oil may leak afterwards. The mechanism will now be exposed.

The kickstarter wheel can be lifted out, the low gear pinion must be drawn off the splined end of the axle, and the fork shaft should be unscrewed (it is formed with square head for this purpose). Then turn the striking forks to disengage them from the operating cam and lift them out with the next two pinions from each shaft. The layshaft and its splined-on pinion can also be lifted out.

If it should be necessary to dismantle the cam gear, first unscrew the plunger stud, then the two set screws outside the box. This releases all the internal parts. Be careful to reassemble in the same relative positions.

The clutch must be dismantled and the clutch centre pulled off the splined end of the axle before the axle itself can be taken out. Then the sprocket locking plate screw may be removed with the locking plate, and the sprocket lock nut unscrewed (L.H. thread on H.W. gear, used only on 1932-33 models). The rear drive sprocket fits over splines on the main gear wheel and can now be pulled off, so that the main gear wheel may be withdrawn from the inside of the box.

When reassembling, the operating cam must be in position first. Then fit the main gear wheel and axle sprocket and the axle with thrust washer. Next assemble the clutch. Now fit one of the forks to the axle sliding pinion and slip both over the axle and turn the fork to engage its peg in the cam.

Next fit the fork rod, and place the gear-box cover in position and test to make sure that the axle slider moves freely. Place the lever in top gear position, then remove the gear-box cover and note that the cam plunger is engaging the gear position correctly. The fork rod must now be removed and the cam turned to the second gear notch. Fit the layshaft dog gear on the layshaft and push on the layshaft pinion right up to its shoulder on the shaft. The recessed side of this pinion faces outwards to the bronze bush in the shell. Make sure that the dog gear revolves freely and fit the end of the layshaft in its bearing bush. Now

fit the second fork to the layshaft slider and slip both into position and screw in the fork rod. Note that the cam must be in second gear to admit of the fork peg being turned into the cam slot. Next fit the axle dog gear and the low gear pinion. Push the latter down as far as the shoulder on the axle splines and again see that the dog gear revolves freely. Then fit the kickstarter wheel and gear-box cover and again test the gear operation. Place the outside lever in low gear this time, and then remove the cover and note that the low gear dogs are fully in mesh with the kickstarter wheel and that the cam plunger is correctly engaging the low gear notch. Finally, after complete assembly, test the gear control adjustment.

When referring to the gear-box cover in the preceding paragraph, the cover with all the kickstarter parts assembled should be inferred. The assembling of these parts in the cover does not call for any special notes. This cover can now be finally fitted up, the spring washers placed over the studs and the cover nuts screwed up. These nuts should be screwed up finger tight only at first, then proceed to tighten them up a few turns at a time, going all round every one before finally tightening any one fully.

Gear Control Adjustment. Both the Sturmey-Archer three-speed and four-speed gear-boxes have a system of internal indexing of the various gear positions. On the four-speed gear-boxes a spring indexing plunger engages grooves on the periphery of the cam plate (Fig. 42B) and with the rod connecting the gear-box lever and the gate change quadrant lever disconnected the resistance of the plunger can be definitely felt. The same applies in the case of the three-speed boxes which have a somewhat different system of indexing.

To check the gear control adjustment on four-speed models proceed as follows: Remove the split-pin securing the gear rod to the gear lever and then, while rocking the rear wheel gently to and fro so as to rotate the layshaft dog wheels, place the gear lever into *bottom* (1st) gear position. Having done this, remove the upper gear rod yoke end pin, from which the split-pin has already been removed, and while still rocking the rear wheel to and fro, exert a downward push on the gear rod to ensure that the bottom gear dogs are in full engagement. The resistance of the plunger should be felt. Now slack off the locking-nut securing the upper gear rod yoke end, and screw this yoke end up or down the rod as required, until while holding the gear lever back against the rearmost end of the bottom gear quadrant notch, the rod is about $\frac{1}{16}$ in. too long to permit the pin being inserted. Now insert this pin, and while rocking the rear wheel to and fro, work the gear lever through the gate until the top (4th) gear position is reached. Once again remove the yoke end pin, and while

still gently rocking the rear wheel to and fro, pull the gear rod upwards this time to ensure the top gear dog wheel being in full engagement with the mainshaft sliding dog wheel (also feel plunger resistance). Then, while holding the gear lever against the foremost end of the top gear quadrant notch, try fitting to it the gear rod end yoke, and take careful note whether the rod is as much too short to permit of the entry of the yoke end pin as it was too long at the bottom gear position. If this is not so the length of the rod requires adjusting.

It may be mentioned here that the designer has purposely made the movement of the gear lever between the extreme ends of the gate greater than is necessary in order to provide for wear that may in time develop in the various gear joints, although with proper lubrication this wear is extremely slow. It is absolutely essential, therefore, that at all times this excess movement should be equally divided at each end of the gate, that is to say, *the gear rod length must be adjusted to be as much too long in the bottom gear position as it is too short in the top gear position*, in each case while the gear lever is held against the respective extreme ends of the gate.

On the three-speed lightweight Sturmey-Archer gear-boxes, adjustment of the gear control is extremely simple. All that it is necessary to do to check the adjustment is to place the gear lever in neutral and note whether, when the rear wheel is gently rocked to and fro, it is possible to grate the dogs of the bottom (1st) gear and middle gear (2nd) by moving the gear lever *an equal distance either side of the neutral position*. If the distances are not equal, the gear rod should be adjusted as required. Check by placing lever in 2nd, removing pin, and feeling "index" resistance.

Attention to Clutch. If the clutch on models prior to 1930 should slip when climbing steep hills, tighten up the clutch spring a little by means of the adjusting nut on the end of the clutch shaft, and adjust the Bowden cable until there is a little play in the lever. Do not tighten up the spring more than necessary to obtain a perfect grip, or unnecessary strain will be put upon the Bowden control, etc., when the clutch is disengaged. Under no circumstances put oil into the clutch.

1930-33 models have no provision for adjusting the spring tension and the pins must always be screwed up dead tight, but the rider should always see that there is a little backlash in the handlebar lever so that the clutch springs can always exert their full pressure. To give the correct (about $\frac{1}{16}$ in.) backlash in the Bowden lever on the handlebar, adjust by means of the operating shaft adjusting screw shown in Fig. 57. A further adjustment is also provided at the arm through which the cable passes. If the clutch slips without any obvious reason, take it apart and

ascertain whether any portion of the mechanism is fouling another, and so keeping the plates apart.

If the key in boss of a 1929 clutch plate (No. 2, Fig. 59) should foul the end of the slot in the shaft it would prevent the clutch engaging. If it becomes difficult to disengage the clutch, smear a little oil on that portion of the shaft on which the outer plate slides. To those riders who prefer a light adjustment of the clutch, the following hint may be useful. A clutch that is lightly adjusted will sometimes slip for a time after changing gear, but the slip will cease if the throttle is momentarily closed when the slip takes

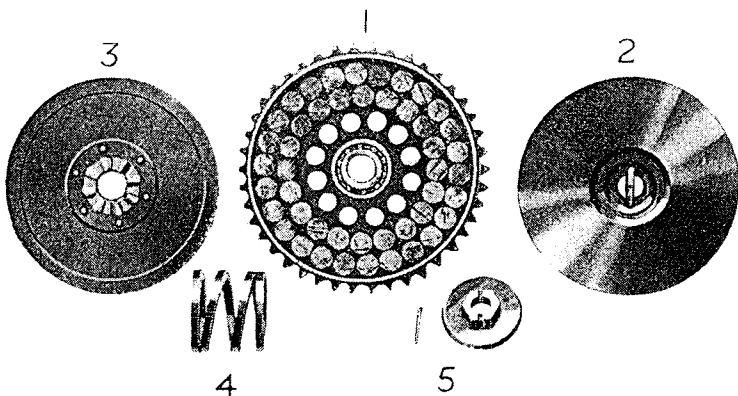


FIG. 59. LIGHTWEIGHT CLUTCH PARTS (1927-29)

- 1 = Clutch sprocket
- 2 = Front plate with key
- 3 = Back plate

- 4 = Clutch spring
- 5 = End cap

place. This is explained by the fact that for the moment the drive is taken off the clutch and allows the plates to settle down to their work. Oil the clutch operating lever occasionally on all models.

Adjusting Chain from Gear-box to Rear Wheel. Slack off the nuts on each side of back hub spindle, and move the wheel backwards by means of the adjusting screws in fork ends. Care must be taken to adjust each side equally, or the wheel will be out of alinement (see notes on rear wheel alinement, page 149). The chain adjustment should be such that it can be depressed with the finger in the centre about $\frac{3}{4}$ in. Screw the spindle nuts up tightly again after the chain is properly adjusted. It may be found that moving the wheel has caused the brake to be "on." This is easily rectified by means of the brake adjustment.

Dismantling Clutch (1929). To dismantle a 1929, 3.49 h.p. clutch, unscrew the clutch spring adjusting nut on the end of

the shaft, and remove the spring, after first removing the split cotter passing through the nut. This will allow the clutch plates to be drawn off the clutch shaft. Before replacing, wipe the clutch plates clean, and smear a thin film of oil on the portion of shaft on which the front clutch plate slides. Also, before replacing, examine the lock-nut which holds the fixed plate in position. If loose, see that it is carefully tightened up again. It is, of course, necessary to take the chain off the clutch sprocket before the latter can be removed. It will be found that a flat key passes through a slot in the end of the clutch shaft, and fits in the boss of front of sliding sleeve. Great care must be exercised to see that this key is in its proper position, or the clutch plate cannot be disengaged. To fit this key (No. 2, Fig. 59) when reassembling the clutch, turn the shaft till the slot is perfectly horizontal. Then put the key in the slot with each end projecting equally on each side of the shaft. The sliding plate should then be slipped on its shaft with its keyway in a corresponding horizontal position.

Dismantling Clutch (1930-33). The Sturmey-Archer clutches used with the three-speed and four-speed gear-boxes are of the single and multiple spring pattern. Dismantling of either type is a comparatively simple matter.

In the case of a single spring clutch, first unscrew the end cap, using either a special spanner or a hammer and punch. Note should be taken that it has a R.H. thread and must be unscrewed in an anti-clockwise direction. Now unscrew the clutch adjuster nut which is exposed and has also a R.H. thread. The clutch spring and collar can then be removed, allowing the clutch plates to be withdrawn. Be most careful when doing this to note the exact position of each plate so as to ensure their being replaced correctly. If the clutch inserts are thin but otherwise sound, extra spring tension may be obtained by removing one of the washers placed under the clutch adjuster nut. After reassembly be quite sure that the end cap is screwed up thoroughly tight.

With a multi-spring clutch unscrew the six screws which hold the clutch springs and then remove the springs and their boxes. It is then possible to lift off the spring box plate and withdraw the other plates as in the case of the single spring clutch. After reassembly it is important to tighten up fully each of the screws holding the springs so as to ensure the springs maintaining an even pressure all round. If this is not done some clutch "drag" may occur.

Removing 1932 Front Chain Cover. To carry this out it is only necessary to remove the footrest arm and distance pieces, brake rod, yoke end pin and brake pedal and then the securing pin in the aluminium band round the chain cover, after which it is possible to take away the outside half of the front chain cover.

The remainder of the engine is made up of a crankshaft and the main bearings which are mounted between the crankpins and the cylinder walls and are secured in position by means of a main bearing cap which is bolted to the crankpin supports. (Fig. 10.)

Care of Chains. Chains of the type that the Journal has very much to say about are the chain drive for a cylinder with a piston that is driven by a crankshaft. The chain is especially at the base of the crankshaft. It is a very important part of the engine.

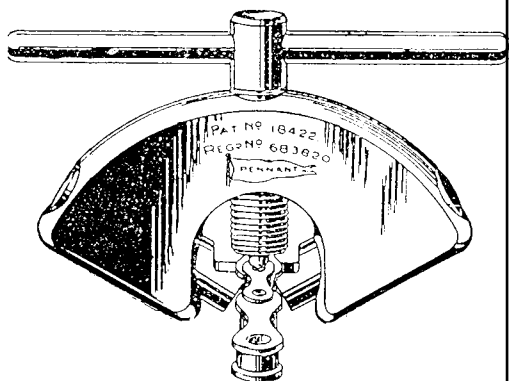
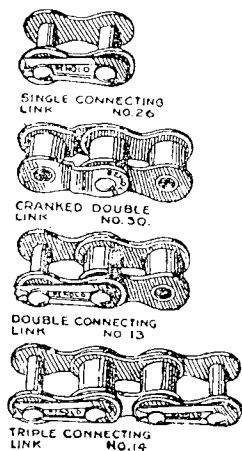


normalizing effect is produced on the rollers, and the whole chain is stressed evenly.

As the new chain on all Ailes models is only partially enclosed, it is a good plan to make a part of oiling it every day, but a starting oil. The oiling will suffice for a day's riding, whatever mileage is done. An oil gun is the best means of oiling this chain. With this instrument draw a charge of oil from the oil compartment of the tank, and insert spout of oil gun into the chain case oil plug hole, which will be found on the top part of the chain case. Place gun in neutral, and, while pressing down, plunger on oil gun, slowly turn the back wheel over by hand. When you are able to see that the oil from the oil gun is falling on the chain. The engine, the whole chain being well lubricated. Then, after the need of adjustment, and complete satisfaction with the chain, mission are secured if the rider will make a point of oiling his chain every day. When time comes the chain should be removed and thoroughly cleaned in a warm, dry place. A method of testing a chain for serious wear is to remove it and ride. The amount of lateral flexion that can be given to it when extended to its full length. If the teeth of a sprocket have become badly hooked, the sprocket should be replaced or much damage to the chain will ensue.

The front chain should be examined periodically and oil added if necessary. The oil level can be seen upon removing the inspection disc on the front chain bath. It should reach the bottom of the disc. On 1930 models the front chain is automatically lubricated by the engine, and on 1931 models by a separate feed from the oil tank with semi-automatic action.

Coupling up a Chain. Always reconnect a chain with the spring link on the sprocket. This makes it perfectly easy, as all tension



FIGS. 61, 62. CHAIN REPAIR PARTS AND RIVET EXTRACTOR

can be resisted by the teeth, and not by stretching the chain by hand. Also see that the open end of the spring faces the opposite direction of chain rotation. Also fit the plate and spring clip so that they are on the inside of the chain.

Chain Repairs. Chain repairs are rarely necessary, but broken rollers may occasionally be found. When they are, they may be readily repaired with the aid of a box of chain repair parts and a "Pennant" chain rivet extractor. Fig. 61 illustrates all the parts necessary to repair any fracture. To shorten a chain having an even number of pitches, replace by parts No. 30 and 26. To shorten a chain containing an odd number of pitches, replace by parts No. 13. To repair a chain with a broken roller or faulty inside link, replace by parts No. 14. For joining up lengths with inside ends, use part No. 26.

The "Pennant" rivet extractor is shown in Fig. 62, where the outer link of a chain is shown ready for rivet removal, the rivet which is case-hardened and incapable of being filed down, being forced through the bush by screw pressure. Before attempting

to extract a rivet, compress the ends of the jaws to obtain a grip on the chain roller. To remove complete links, screw down the punch on to the head of each rivet in turn through the top plate (Fig. 62). Both rivets should be pushed out from the same side of the chain. To remove broken links, insert the chain roller between the jaws and then screw down the punch until the rivet head is pressed through the top plate. On removing the extractor the link will fall out.

Play in Steering Head. All play in steering head should be taken up by means of the split lug and lock-nut adjustment. The adjustment should not be too tight, or the balls in the steering head may be damaged. Keep this bearing well lubricated. To take up slack in the steering head, turn the large hexagon nut to the right. It is advisable in all cases when adjusting the steering head to place a box or some other article beneath the engine so as to take the weight off the front wheel and allow the forks to move freely.

Handlebar Adjustment. All A.J.S. machines are fitted with adjustable handlebars. If the rider wishes to make any adjustments, slacken off the bolts which pass through the split lugs which connect handlebars to forks. It is important, however, that these bolts are carefully tightened up after this operation.

With a 248 c.c. model (1929) unscrew the bolt which will be found in the centre of the handlebars about four or five turns and give this a sharp tap with a hammer. Slacken the nut of the bolt which passes through the split lug round steering head and the bars can be raised or lowered as desired. Afterwards tighten up the bolt. To adjust for any play in the ball head, slack off the split lug referred to and adjust by the large hexagon head nut on top of steering column, turning to the right to take up slack and vice versa. Afterwards tighten up the bolt of split lug.

How to Adjust the Saddle Position. To adjust the position of the saddle, the pin and nut at the front (see Fig. 2) should be unscrewed, and the nut that fastens the top of the coil springs to the undercarriage should be slacked off enough to allow the saddle to be moved into whichever of the three positions the rider desires. Afterwards the pin and nut must be tightened up and the rear spring again securely fastened down.

Spring Fork Adjustment. To take up any play that 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), and turn the spindles by means of the adjusting bolts seen in Fig. 63 on the left-hand side until all slack is taken up. Afterwards tighten up lock-nuts. Use the grease gun on the five nipples every 300 miles. 1933 models have adjustable dampers.

Removing Rear Wheel. The rear wheel on all A.J.S. machines, with the exception of the two lightweights T5, TB6, is of the quickly detachable type. It can be removed in 30 seconds! In

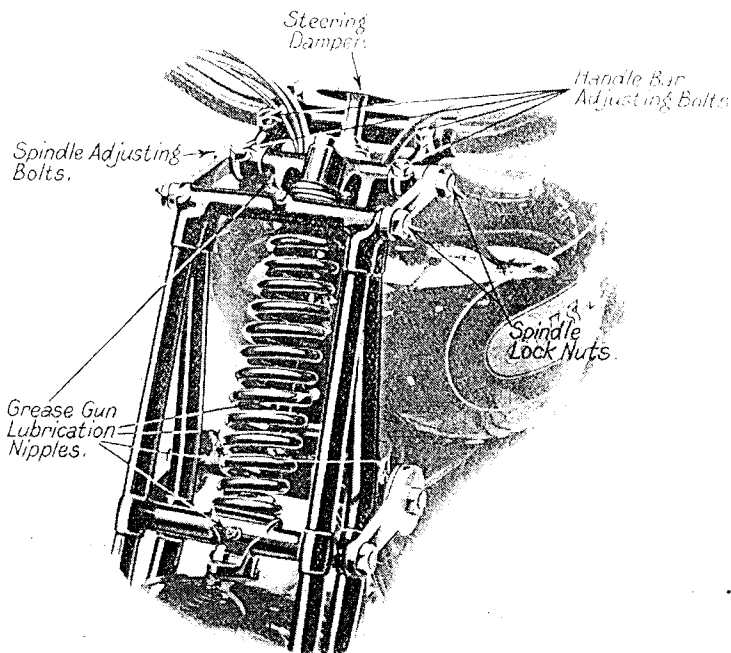


FIG. 63. SPRING FORK ADJUSTMENT.

the case of the models just mentioned, the wheel and driving sprocket are permanently bolted together. To remove the wheel it is necessary to detach the rear portion of the chain cover by unfastening the chain stay fixing. Unscrew the brake drum anchor pin sufficient to clear the fork ends, and disconnect the yoke end of the brake pedal rod. Next unfasten the chain by means of the spring clip coupling, finally slacking off the spindle nuts on either side of the fork ends, when the wheel can be dropped out. The chain must, of course, be removed first.

To remove the detachable wheel proceed as follows: On machines with the detachable wheel put the machine on the stand and unscrew the two pins, holding the stays of the hinged portion of the rear mudguard to the frame. This hinged portion can then be swung out of the way. Now put the machine in gear to prevent the wheel rotating, and with the box spanner provided first unscrew the three sleeve-nuts which pass through the hub flanges.

These three sleeve-nuts extend right through the wheel and rear hub flange, and screw on to the three threaded studs on the driving sprocket. There are also three plain studs on the sprocket which

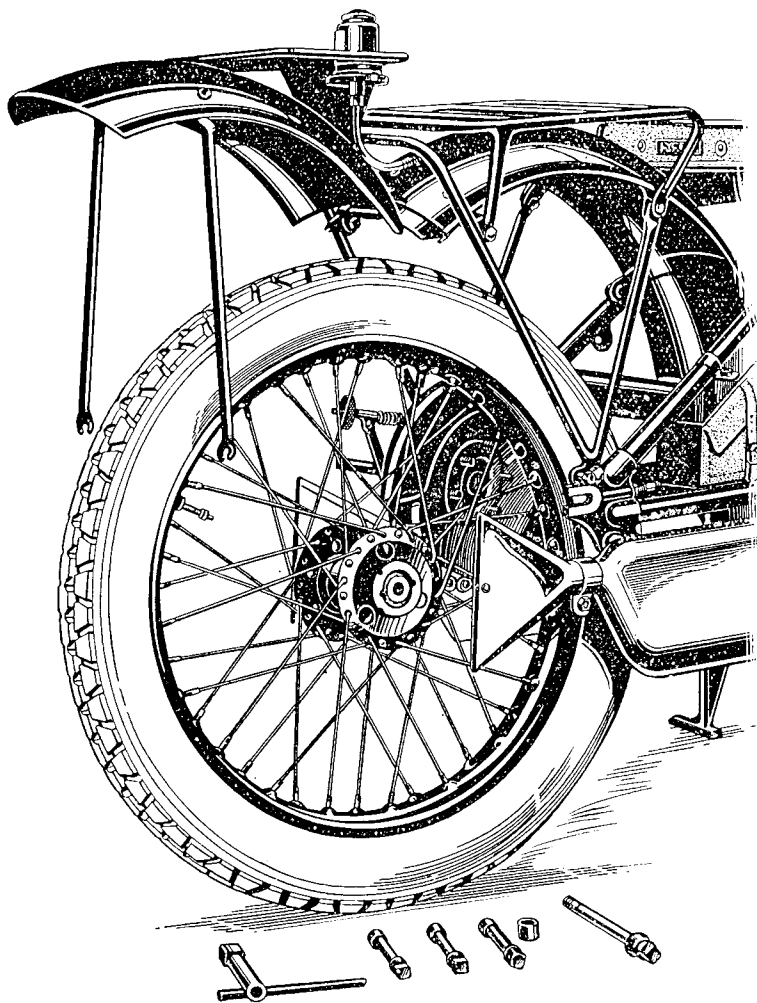


FIG. 64. REAR DETACHABLE WHEEL REMOVAL

act as dummy drivers. These fit into the three remaining holes in the hub flange. After the sleeve-nuts have been unscrewed, then unscrew the centre pin and draw it out completely, together with distance piece. The space now left by the distance piece

will enable the wheel to be drawn off the driving studs on the sprocket.

To replace the wheel, push it squarely on to the driving studs and next (with the distance piece in position) screw up the centre pin moderately tight. The three sleeve-nuts can now be screwed up tightly, afterwards giving a final turn to the centre-pin. It

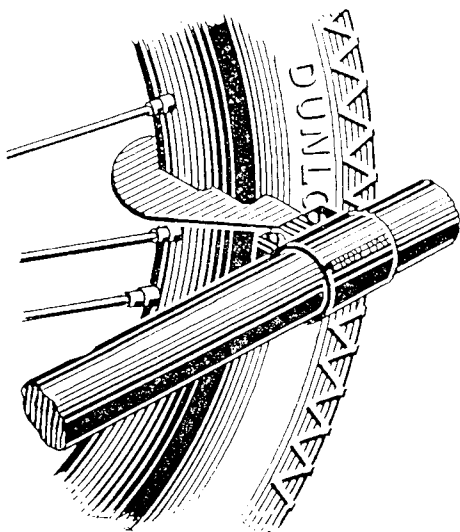


FIG. 65. REAR WHEEL ALIGNMENT GAUGE (T9, T6, T8, TB8)

is exceedingly important to point out that when the centre pin is removed, the wheel is hanging on one fork only, so any rough treatment must be carefully avoided, or there is great danger of straining or breaking the fork end. UNDER NO CIRCUMSTANCES MUST THE CENTRE PIN BE REMOVED UNTIL THE MACHINE IS JACKED UP, and the pin must always be in position before the machine is run off the stand. If the wheel is difficult to pull off the driving studs, screw in the centre pin a few turns (with out distance piece). This will steady the wheel while drawing off the driving studs. Periodically test the centre pin and sleeve-nuts with a spanner and keep them tight. If the sleeve-nuts are loose a dull hammering is perceptible at low speeds. If this is noticed, tighten instantly. If desired, of course, the wheel can be taken out complete with chain sprocket and brake drum, as in the case of Models T5, TB6. All wheels are now disc-adjusting. Don't allow the hubs to run loosely, but see also that they are not over tight (page 149). Sidecar outfits have all three wheels interchangeable.

1929 Kickstarter Spring. The kickstarter shaft upon which the crank is mounted is splined, and the crank is split at its lower end and provided with a bolt which tightens the crank on the splined shaft. The return spring is carried around outside the shaft bearing tube, one end being anchored to the bolt. If this return spring has been removed, to refit pass a piece of cord under hook of the spring and pull it down until it is again hooked round the bolt. Afterwards tighten up the bolt. Should the kickstarter crank be removed, refit so that it is just over vertical, i.e.

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inclined slightly to the rear of the machine. On pre-1929 models a cotter fixing is used.

1932-1933 Kick-starter Return Spring. If any difficulty is experienced with the return of the kickstarter crank after starting up the engine, this would be due to the spring not having enough tension. To overcome this difficulty, the kickstarter crank should be removed and also the cover for the spring. You will then notice that the end of the spring is fitted into the first of a series of holes to the right. To get additional tension, the end of the spring should be fitted into one or more holes farther to the right, which should produce the desired effect. Under no circumstances whatever should the spring be given an additional complete turn.

Rear Wheel Alinement. On the right-hand side of the bottom chain stay is a piece of sheet metal, held in position by a clip, which passes round the tube. In the tool kit will be found a flat gauge that can be fitted round the rim (see Fig. 65). When replacing the rear wheel after removal, or after making a chain adjustment, place the gauge on the rim with the extension to the right, and set the wheel so that the edge of the gauge just touches the plate that is held in position by the clip on the chain stay. This ensures the wheel being correctly alined, and must be done before finally tightening up the spindle nuts. Do not attempt to unscrew the clip from the chain stay, as the position of the plate is set correctly before the machine leaves the factory. It is important that the gauge should bed properly on to the rim on both sides; the best method of ensuring this is to see that the hooked end is properly encircling the bead of the rim. Then pull the gauge end into place firmly. Some pressure is necessary to apply the gauge when the tyre is highly inflated.

Care of Wheel Bearings. Periodically shake and pull the road wheel sideways with machine on the stand to see if there is any shake. If any side play exists, adjust disc until *all* play disappears. Then slacken disc one quarter of a turn and retighten nut. The wheel should be free enough for the weight of the valve to determine its position. Lubricate the hubs with special hub lubricant every 2,000 to 2,500 miles.

Dismantling and Re-assembling Taper Roller Bearings. To dismantle, release the locking-nut and screw out the adjusting ring. The dished plate containing felt washer and plain plate will then drop out. Take out spring ring from the opposite side of hub and remove felt washer and holder consisting of two plates and retaining ring, the latter being between the two plates. The spindle can now be pressed or driven out from either end, bringing with it one of the outer races. The other race can then be driven out.

To re-assemble, press in outer race on fixed or plain end of hub, *taking great care that it goes in square.* This race is pressed in about $\frac{1}{16}$ in. beyond its actual position, to enable the felt washer and its retaining ring together with the two plates to be put in, and the spring ring to snap into its groove. *Care must be taken to put the plate with the larger hole in last. This is most important.* This outer race can now be forced back until the plates are tight on the spring ring. The spindle can now be inserted, the short end being placed in first. *The long end of the spindle must be on the adjusting side.* The other race can now be pressed in until there is about $\frac{1}{16}$ in. end play in the spindle. Insert plain plate and dished plate with felt washer, screw in adjusting ring, and *gradually screw down until there is just a fraction of end play in the spindle.* This should be .001 of an inch.

It is of the utmost importance that the bearings are not adjusted too tight, as this would ruin them in a few miles. Having got this adjustment correct, the locking ring can be put on and tightened up, *again taking care that the adjusting ring does not creep forward and make the bearings too tight.*

Removing Front Wheel (3·49, and 4·98 H.P. Models). Disconnect cable yoke end from brake operating lever, remove anchor plate bolt from fork end, and after slackening off spindle nuts the wheel will fall out of the slots in the fork ends.

Brake Adjustments. The brakes require no attention, with the exception of occasional adjustment of the control mechanism. In the case of the rear brake, this is effected by giving a few turns to the adjusting disc. The front brake adjustment is carried out in a similar manner by finger adjustment on top of the fork girder, except on the lightweights, where a milled nut is at the bottom of the fork. If the ratchet rear brake on an "Export" model does not operate correctly, it is due to the brake adjustment being either too fine or the reverse. Move the adjuster at the end of the brake rod backwards or forwards until the position in which the ratchet device functions perfectly is found.

Speedometer Lubrication. The speedometer requires no attention other than occasionally uncoupling the flexible drive and pouring some engine oil down between it and its casing.

Frayed Control Wires. As soon as control wires show signs of bad fraying, renew. Once they start to wear badly their end is imminent, and should this take place while out on a long run great inconvenience may be caused. Always keep cables well lubricated at exposed places and where they bind. Before inserting a cable in its casing it should be liberally greased. If an exhaust lifter cable breaks, the engine may be started by placing the engine on compression and easing the machine backwards a short distance before using the starter. Should a throttle control cable pull

out of its nipple at the lever end, the cable should be splined out over the end of the casing, fixed up in a convenient position, and the few remaining miles of the journey completed by using the air lever and pulling on the cable casing when required. If possible get a mechanic to cut the frayed portion off and resolder after adjusting for length. This operation should only take about fifteen minutes. It is rarely advisable to do the soldering at home. Very hard solder must be used, and the job done thoroughly, otherwise the cable will be an endless source of worry and trouble.

Loose Spokes. If spokes work loose in either wheel, retighten with a spoke key. Be careful while doing this to maintain the truth of the wheels. All spokes should be equally tensioned. On plucking with the finger they should all emit a note of the same pitch. The alinement gauge should assist truing the rear wheel, if this is required. Perhaps the best method of truing is to hold a piece of chalk against the rotating rim and observe by the chalkmarks the evenness of contact, adjusting spokes accordingly.

Sidecar Wheel Alinement. This is highly important, having regard to tyre wear. Check by means of straight-edges placed across the wheels. Needless to say the axes of all three wheels must be parallel. The method of procedure is self-evident (Fig. 66). The cycle should be fixed so that it is dead upright. (See also page 149.)

Tuning for Speed Work. The task before the aspirant to coveted speed honours, apart from the physical aspects of riding, may be summed up as coaxing an engine to "rev" as fast as possible. To do this friction must be reduced to the absolute minimum, and all moving parts reduced to the lowest weight consistent with reliability. As much gas as possible must be charged into the cylinder, and the burnt products must be expelled as completely and rapidly as possible. Therefore, the valves must work with clock-like precision. The valves must seat properly and their spring pressure must be exact, and the valves should glide frictionlessly in their guides. Valve timing must be correct to a hair. All cylinder head gas passages and chambers must be burnished by hand until they offer no "skin friction" to the incoming and outgoing gases. Every shaft and bush

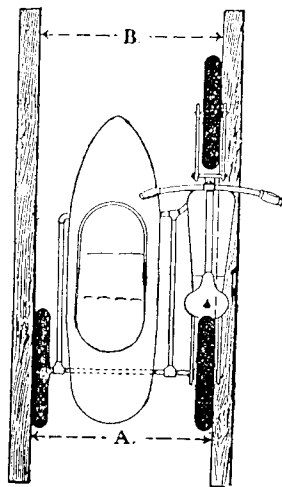


FIG. 66. SIDECAR ALINEMENT
The distances A and B must be equal

in the engine must be a perfect fit, dead true, with no friction or play. Experiments should be made with various ignition timings, and the carburettor tuned for speed. Gear ratios should receive the most careful consideration, and finally the machine must be put into condition suitable to house so worthy an engine.

It is all a question of having real mechanical aptitude, plenty of courage, a good workshop, and making the best use of all of them. Hours of laborious work are needed to put a machine into real racing trim, that is to say, to be prepared for seriously challenging machines of the same class holding speed records. Another point to remember is this. Out of a batch of, say, 100 engines, one engine will be singled out as having an exceptional performance. This engine will be installed in one of a firm's crack racing machines. Obviously, then, the amateur speedman is up against a tough proposition. In spite of this, however, many young amateur enthusiasts are very successful.

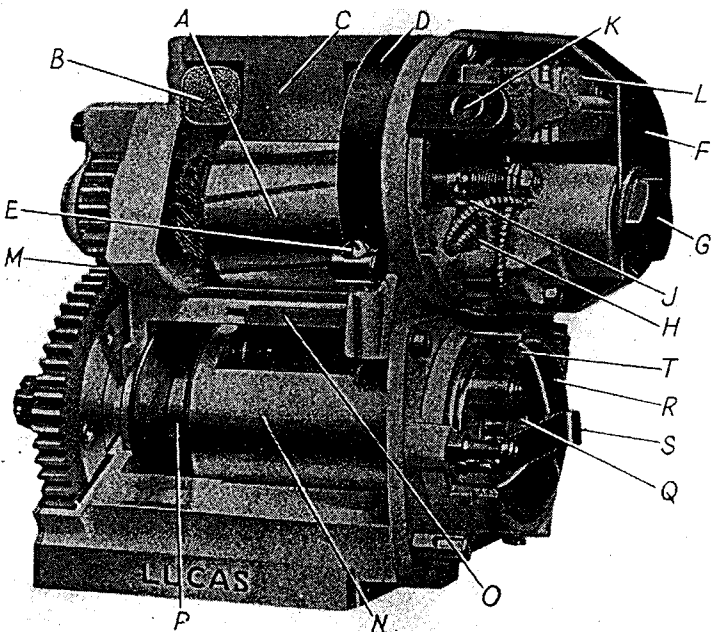
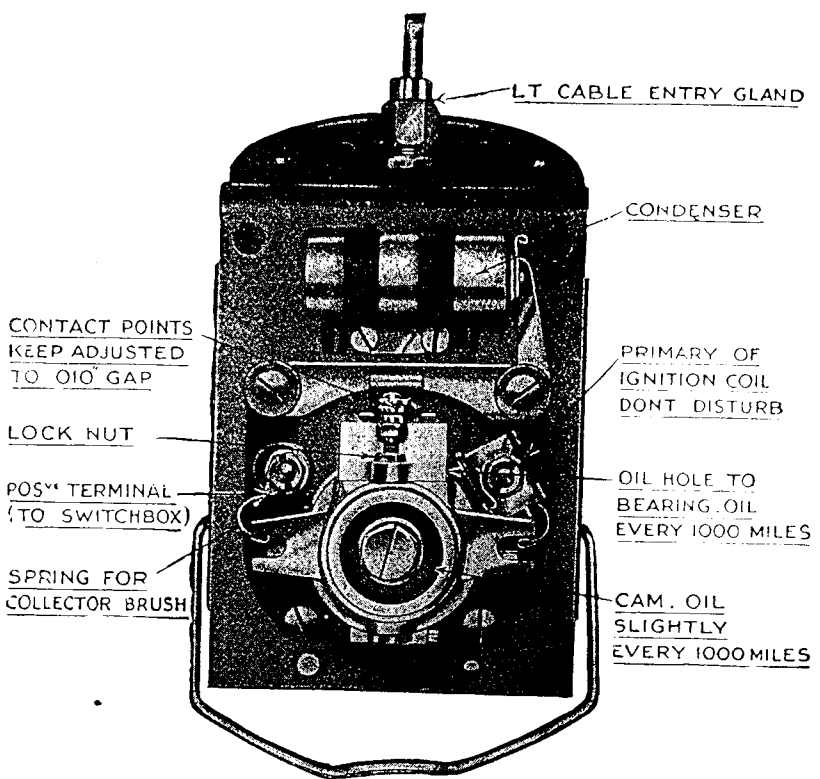
Warning to "Camshaft" Owners. Speed merchants who own "camshaft" models, and who wish to raise the compression ratio beyond the normal, should note that it is not possible to do so by lowering the effective length of the cylinder barrel by removing metal from either end, as this alters the chain centre. Similarly, the compression ratio cannot be lowered by the insertion of a cylinder gasket. Special pistons are available for Models 33/7, 33/10.

CARE OF ELECTRICAL EQUIPMENT

As mentioned on page 2, Lucas electric lighting is available for all A.J.S. machines, the generator used on single-cylinder heavy-weight machines being the M.S.1 "Magdyno" (with detachable dynamo portion) and the F.D. 20 watt "Maglita"; on the Big Twins a type M.S.D. "Magdyno" is specified. With the "Magdyno" a 12 amp.-hr. battery is used with an S.51 headlamp (instrument panel models), or an H.52 headlamp (no panel). With the "Maglita" an 8 amp.-hr. battery and an M.40 headlamp are provided.

Bulb Replacements. The S.51 and H.52 lamps take a double-filament No. 624 DVMC main bulb and a B.A.S. No. 8S pilot. The M.40 lamp takes a 612 DVMC main bulb, and a similar B.A.S. pilot. For both sidecar and tail lamps use 3-watt bulbs.

Care of Lamps. When replacing a headlamp bulb, screw it out two or three turns in an anti-clockwise direction. This releases the pressure on the bulb contacts and enables the bulb to be readily withdrawn. *Be sure the bulb is fitted with the dipped beam filament above the centre filament.* When cleaning reflectors, use a soft cloth or chamois leather. On no account use metal polish, but instead a good furniture or car polish.



FIGS. 67, 68. SHOWING (ABOVE) CONTACT-BREAKER SIDE OF LUCAS "MAGLITA" AND (BELOW) SECTIONAL VIEW OF LUCAS "MAGDYNQ"

Battery Maintenance. Always keep the battery (which is of the lead-acid type) well charged. When running by day keep the headlamp or panel switch in the "C" position (half full charge) for at least one hour daily, and if much night riding is undertaken or the specific gravity of the acid solution is 1.210 or below, increase this period. Periodically test the S.G. with a hydrometer. On full charge the "Magdyno" should give an ammeter reading of 4-5 amp., and the "Maglita" a reading of $3\frac{1}{2}$ amp. *Never leave the battery fully discharged*, or the battery will suffer. Overcharging only results in loss of acid by "gassing." After stopping the engine always turn the switch to the "Off" position to prevent possible discharge due to a sticking cut-out. At least once a month remove the vent plugs and examine the acid level. If this is below $\frac{1}{4}$ in. above the top of the plates, top-up with *distilled* water. If acid has been lost by spilling or "gassing," replenish with distilled sulphuric acid solution of 1.285 S.G. *Once a year renew the whole of the acid.* If your machine is laid up during the winter, charge the battery once a fortnight at a garage or wireless shop.

Running with Battery Disconnected. If this is done on a "Magdyno" machine *it is essential to keep the switch in the "OFF" position.* On "Maglita" models the lamps can in an emergency be run direct off the dynamo by disconnecting the battery and turning the switch to the "L" position, but engine speed should not exceed 2,500 r.p.m., and the dimming switch should not be used or the bulbs may be burnt out.

Commutator Brushes. Before removing the dynamo cover for inspecting the brushes or for any other reason, disconnect the positive battery terminal lead to avoid reversing the dynamo polarity or causing a short circuit. Examine the brushes (Fig. 68) every 300 miles. Clean with a petrol-damped rag if necessary and see that they bed down on the commutator segments. Test for freedom of movement by holding back each spring lever and gently pulling on its flexible lead. It should return to its original position immediately the lead is released. If the springs are weak, renew.

The Commutator. This must be kept free from oil and carbon dust. Clean occasionally by removing a brush from its holder and inserting part of a fine duster held by a suitable piece of wood against the commutator surface while rotating the armature.

The Cut-out. This prevents the battery discharging through the dynamo by opening with solenoids the charging circuit as soon as the dynamo voltage falls below the battery voltage. Similarly, when the dynamo voltage exceeds battery voltage it closes the circuit. Never interfere with the cut-out except to correct dynamo polarity, in which case run the engine slowly with the switch in the "C" position and the cut-out contacts pressed together.

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