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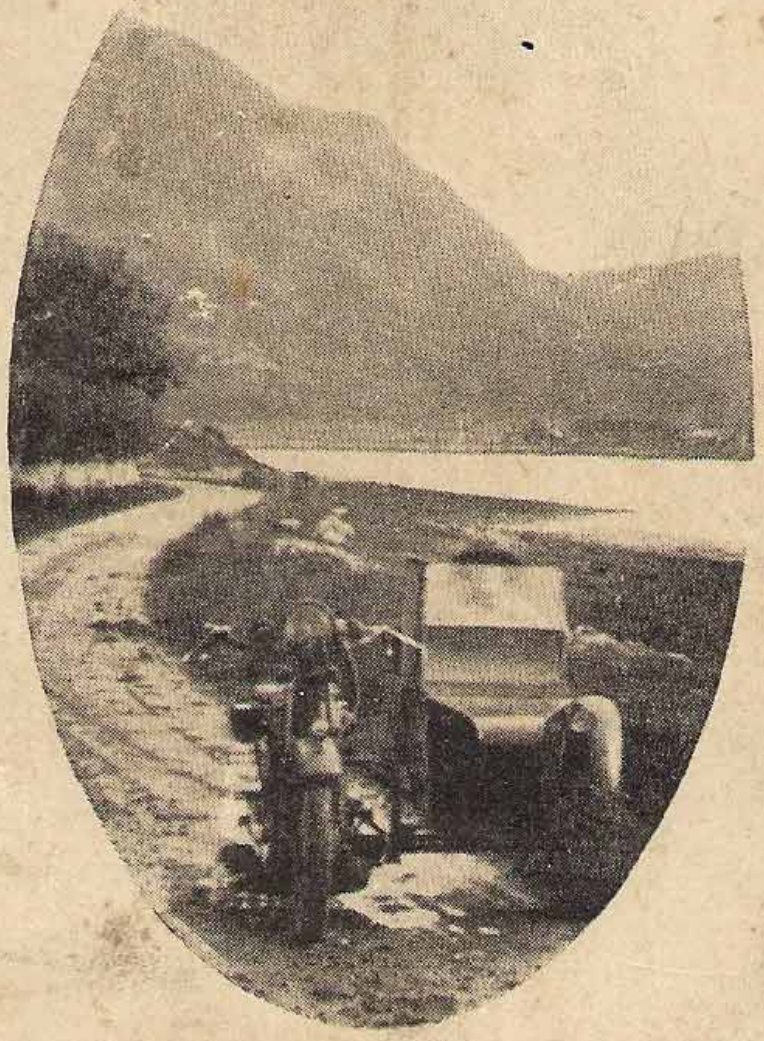
Note this is the 1928 Book of the A.J.S. which is indentical to the 1927 First Edition, but with the 1928 Suppliment at the end of the book. The Index page is also updated. (Rob H.)



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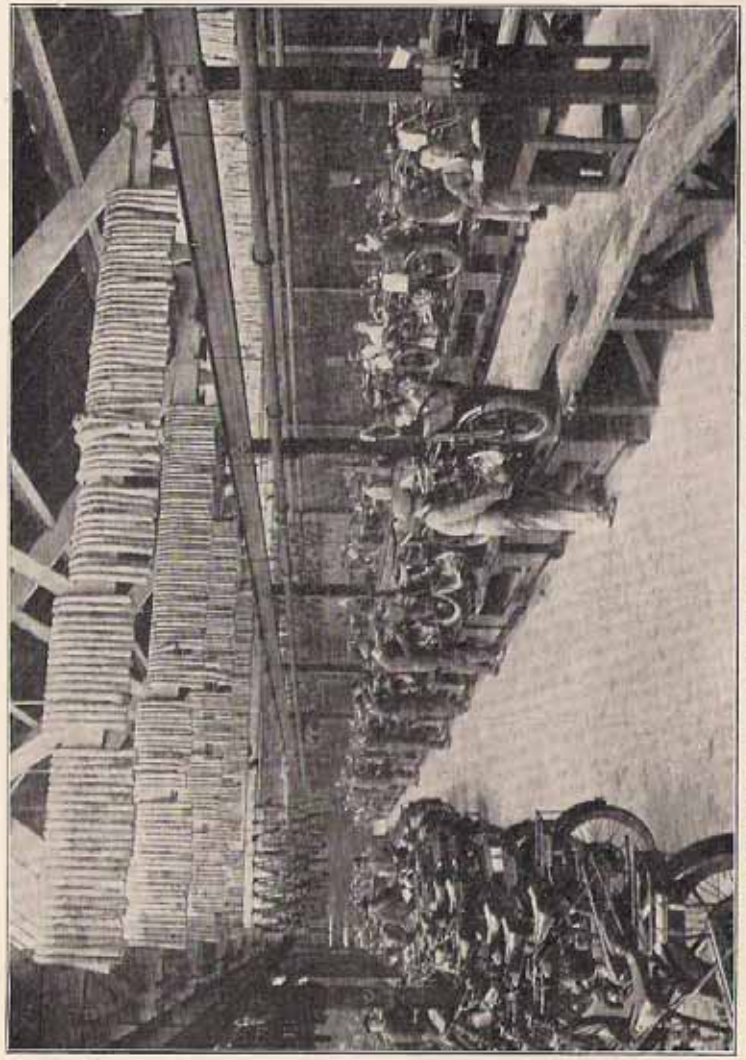


SECTION OF THE A.J.S. ERECTING SHOP, SHOWING TRUCK SYSTEM [*Frontispiece*

(5301A)

THE MOTOR-CYCLIST'S LIBRARY

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, LEGAL MATTERS, INSURANCE, TRACING FAULTS, AND OVERHAULING

LONDON
SIR ISAAC PITMAN & SONS, LTD.
PARKER STREET, KINGSWAY, W.C.2
BATH, MELBOURNE, TORONTO, NEW YORK
1928

PREFACE

THIS handbook is intended as a work of reference for all owners and prospective buyers of A.J.S. motor-cycles. It is also hoped that the book will have an appeal to all interested in the latest products of A. J. Stevens & Co. (1914), Ltd., Wolverhampton.

While primarily written to meet the needs of the novice who has had absolutely no previous experience with motor-cycles, this handbook contains much information that should be of general interest to the most experienced of drivers.

It will be readily apparent that much of the information is of a general character, and applies equally well to other makes. Carburation, for instance, is a subject on which information cannot be said to apply to any one make—it applies, of course, to all internal combustion engines—but where details of practice and design differ, those details applicable to the A.J.S. machines are dealt with separately.

The novice is recommended to read through carefully the chapters on preliminaries and driving, and also the chapter dealing with the principle of the four-stroke engine before taking the highway.

The author has dealt fairly extensively with the descriptions of the various A.J.S. mounts, for very often a man who buys a certain type of machine will purchase a more expensive machine of the same make later on, when he can afford it, and then a detailed and illustrated summary of the A.J.S. machines will come in handy for purposes of reference and comparison. Does not every S.V. owner want to turn over to the O.H.V. class when he has the opportunity?

The chapter dealing with overhauling has been dealt with at greater length than any other subject in this book. The information contained therein should meet the needs of both experienced and inexperienced motorists. The various operations involved in overhauling A.J.S. machines have all been fully dealt with, and no difficulty should be experienced in this connection. After all, overhauling is one of the most important subjects. The novice soon becomes an expert in most matters, but doubtful points connected with overhaul crop up every now and then. It is here that an authoritative work of reference is invaluable. The information in this chapter has been compiled in close collaboration with the manufacturers as well as from practical experience, and the information contained therein is therefore absolutely trustworthy and up to date.

Some space in this book has also been devoted to the buying and selling of an old mount. Sooner or later the reader will wish to dispose of his machine, and the advice given in this chapter may be of some assistance.

The chapter dealing with faults and their remedies has been written from practical experience gained from many years of riding on A.J.S. and other machines.

Should any special difficulties arise, a letter addressed W. C. Haycraft, c/o the Publishers, will receive prompt attention.

It is only fair to conclude by saying that the author has no present or past connection or interest with the manufacturers of A.J.S. machines, to whom, however, he is deeply indebted for generous assistance and for many photographs in the compilation of this small handbook.

W. C. HAYCRAFT.

CONTENTS

ILLUSTRATIONS

THE BOOK OF THE A.J.S.

CHAPTER I

THE A.J.S. SERIES

How many people, when they see on the road or in the shop window a motor-cycle whose tank bears the monogram "A.J.S.," realize what a vast organization the letters A.J.S. stand for?

Wolverhampton. A visit to the works of A. J. Stevens & Co., Ltd., at Wolverhampton, leaves a very vivid and lasting impression on the memory—and a very pleasing one. Mass production is in evidence everywhere, and the ingenuity displayed to secure the same is something to marvel at.

Firstly, one enters the machine shops, alive with the incessant hum of overhead shafting and lathes. The thousand and one parts that go to make up a motor-cycle are here being shaped to precision by hundreds of skilled mechanics.

In a well-lighted and spacious shop adjoining, the engine components are being assembled and trued up, and rows of engines are beginning to take shape. Right in front of all these are scores of finished engines waiting patiently to emit their terrifying screams on the dynamometer. In another shop the bicycle parts are under erection, engine plates being fitted ready to receive the motors as soon as they leave the test bench.

In sudden contrast to all these places, a visit is now paid to the sandblasting room, where certain metal work receives a special finish. At the entrance is pinned a warning notice, "DO NOT LEAVE THIS DOOR OPEN." Slightly opening the door and peering in, an amazing sight—almost uncanny—confronts the eyes. The interior is almost void of light, caused by dense whirling steam and sand blocking out all natural illumination. Amidst this ghastly atmosphere a weird phantom-like figure, clothed in what looks like a diving suit, is bending over and attending to something that one cannot define in the intense gloom. Indeed, this room reminds one of nothing so much as a place in the next world, whither some of us are expected to go! Some of the modern applications of science are extraordinary, and grimly fascinating to watch.

The last of these shops contains hundreds of finished motor-cycles, which in rotation are tried out and tuned on the road by crack riders at Wolverhampton before being finally handed over to the Sales Department, whence they are distributed throughout the world.

Racing and Design. A.J.S. machines have gained a world-wide reputation for general all round efficiency. This outstanding efficiency has been won largely through racing experience. Into every searching endurance test, international or otherwise, the A.J.S. company sends along a challenger. The names Simpson and Longman are predominant in this connection.

It has been generally accepted that high speed racing subjects a machine to the most exhaustive tests conceivable, and the experience gained thereby is of incalculable value, and has a direct bearing on the performance of machines sold to the public. The latter purchase a machine that is, in many cases, almost a replica of the racing model, embodying at the same time those characteristics insisted on by the ordinary touring motor-cyclist. Thus, when a racing mount suffers a mechanical failure while hurtling along the track at close on 100 m.p.h., the cause is fully investigated and, more often than not, the modified component is incorporated in the next machine of the same type sold to the public. And so the evolutionary business continues. The net result is that the factor of safety of each part steadily rises, with consequent increased reliability of the whole.

What shall I Buy? The 1927 models (officially known as series H) are, indeed, wonderful creations, and no man need hesitate to buy on the score of unreliability, noisiness, complexity, or in fact, any reason, for they do to-day represent the high-water mark of British design and construction. All A.J.S. motor-cycles belong to the four-stroke type, and prices range from £44 to £95.

The prospective motor-cyclist is often bewildered by the vast number of types of machines sold to the public. This bewilderment, however, is short lived. Later on he begins to realize that the reason is that the trade recognizes that all men have individual temperaments, fads, and so forth, and caters to the public accordingly. Temperament plays a great part in the selection of a mount. If the would-be purchaser has an adventurous, excitement-loving disposition, only a sports mount will give him genuine satisfaction. Cravings for speed and thrills can then be met as they arise! If, on the other hand, the purchaser regards with scorn the question so many young enthusiasts ask first, namely, "What can she do?" and places comfort and reliability without much attention foremost, then the touring models are "the goods" (to use a rather slang but clear expression).

Owing to their greater popularity we will endeavour to describe the sports models first.

The Sporting Models. All these models have very rakish and sporty lines, and should satisfy the most exacting in this respect. Their low riding position and centre of gravity render them peculiarly stable when the speedometer needle is creeping forward. Those catalogued are as follows—H5, H4, H6, and H8, and their respective prices are £44, £48 10s., £53, and £62. It should be mentioned here that there are two other models not catalogued, namely, the H7 and the H10, that can be supplied to order. These machines are special racing editions of the Models H6 and H8 respectively.

Models H4 and H5 have side valve engines, while the remainder have overhead valve engines. Sufficient it is to state now that the essential difference between the two types is (as might be expected) that the S.V. engine has its valves placed side by side with stems towards the crankcase, and in consequence not directly over the piston, while the O.H.V. engine has its valves in the detachable head directly over the piston. Their respective merits may be considered later; but it should be understood that really fast machines invariably have engines of the overhead valve type.

A mile a minute is about the top speed that can reasonably be expected from the S.V. range. This speed is ample for the average sportsman who uses his machine on the road for pleasure only; but the man who has a weakness for record smashing and competition will literally frown at it and, of necessity, must turn to the O.H.V. class, where there are machines capable of about 90 m.p.h., when specially tuned. The overhead valve engine is deliberately designed for high speed and fierce acceleration; but this type of engine is invariably more expensive than its side valve brother of the same cubic capacity—probably some £10 or more.

From the foregoing remarks it is not to be inferred that the A.J.S. O.H.V. engines belong to that type of engine which can with difficulty be held in restraint, and is only in its element when on the open straight with flames belching out of its exhaust; on the contrary, the A.J.S. engines all possess that indefinable smooth "tick over" so beloved by the enthusiast; and are very flexible even at low revolutions, while they can, at a few seconds' notice, pull out that vicious 60 m.p.h. roar.

The side valve sports models are modified touring mounts, the modifications comprising a specially tuned engine, "T.T." handlebars and footrests in lieu of tourist bars and footboards respectively.

THE 3·49 H.P. STANDARD SPORTING MODEL H5

This machine (shown by Fig. 1) is probably the most popular of the sports range. A very similar machine is the De Luxe Sporting Model H4 (shown by Fig. 2), fitted, unlike the H5, with mechanical lubrication and quickly detachable rear wheel. It seems well advisable to pay the extra £4 10s. involved to include in the specification these items, together with other refinements. However, at the cost of £1, mechanical lubrication can be fitted to order on Model H5. 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

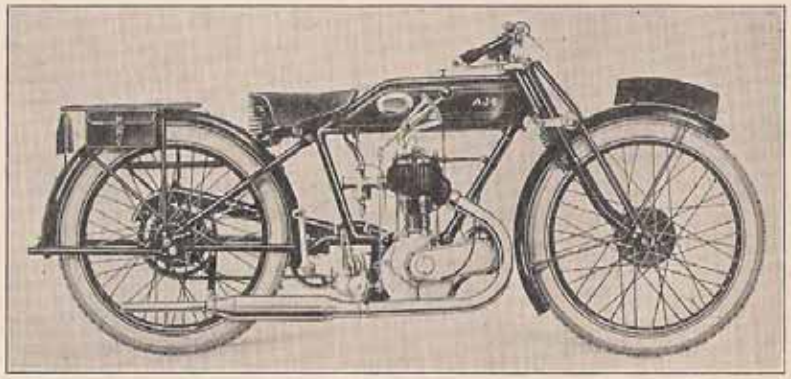


FIG. 1. THE 3·49 H.P. STANDARD SPORTING MODEL H5

the score of economy in engine oil. Moreover, correct lubrication ensures the minimum production of carbon deposits on the cylinder head 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 " becomes manifest.

The Standard Sporting Model H5 is a general-purpose, medium-power sports machine, capable of maintaining high average speed under normal conditions. Owing to the extremely low figure at which it is catalogued, namely, £44, it makes a very strong appeal to the man of limited means who desires a lively mount with a good all round performance. Its specification, which applies also to all the other 3·49 h.p. machines, with certain modifications, 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, vertical 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 vertically finned detachable head, both being held down by a bridge piece and two long bolts. The head on the H5 cylinder departs from G5 (1926 model) practice in that it is provided with a finned and extended exhaust port, thereby giving superior cooling ; and the exhaust pipe has its connection via union nut instead of being a push-on fit (seen clearly in Fig. 3). In this

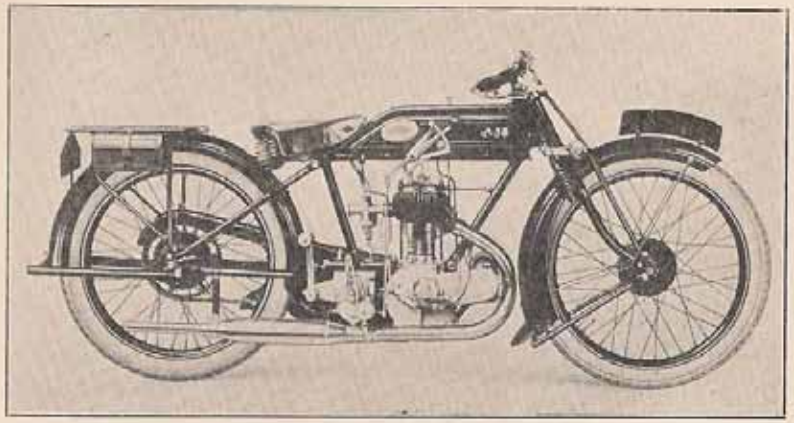


FIG. 2. THE 3·49 H.P. DE LUXE SPORTING MODEL H4

head two large interchangeable and mechanically operated valves of heat-resisting alloy steel are placed side by side in deep removable 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. The tappets operating these valves have, of course, adjustable heads to give correct clearances of ·006 in. and ·008 in. in the case of the inlet and the exhaust valves respectively ; and all 1927 tappet guides have external oil retaining cups in order to counteract the undue excretion of lubricating oil from these guides over the crankcase. New type valve springs are employed.

Within the cast aluminium crankcase is the crankshaft assembly, comprising two heavy rimmed cast-iron flywheels, with their main shafts running in roller bearings, and the crankpin upon which the big end roller bearing of the connecting rod is mounted.

The timing gear is extraordinarily simple, and therefore 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. Tappet and valve stem centres are slightly offset, so as to produce automatic rotary

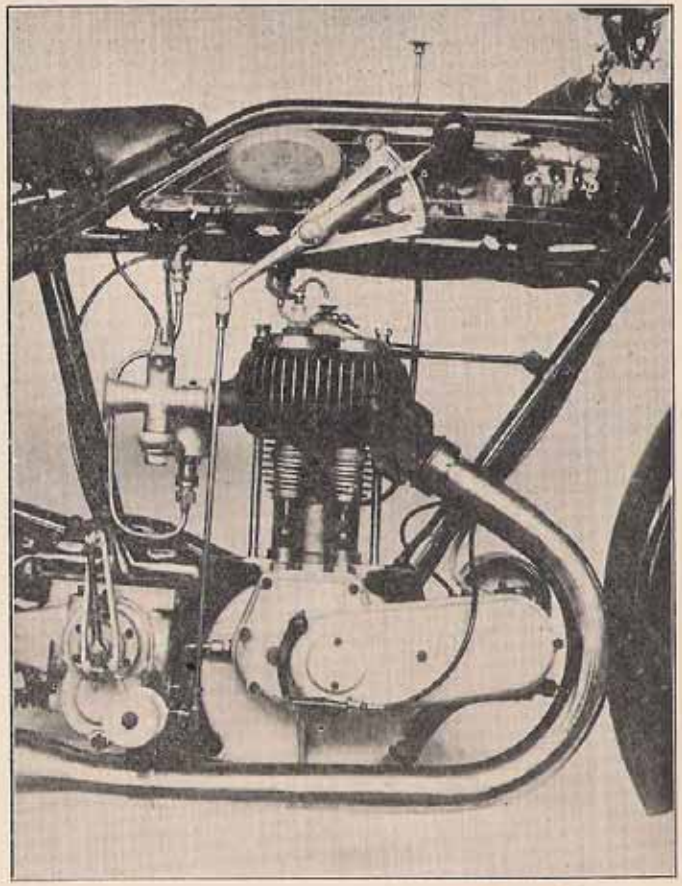


Fig. 3. The 3·49 h.p. Side Valve Model H5

movement and even wear of the surfaces in periodic contact when the engine is running.

The new type cylindrical silencer is 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 with the H4, H5, and H6 engines, and it was found that the resultant back pressure was negligible. Both silencer and exhaust pipes are heavily plated. A union nut now replaces a clip-fastening on the induction pipe for the carburettor.

Carburettor. A No. 344 Binks, 2 jet, 2 lever, semi-automatic carburettor with bottom petrol feed is fitted, and the respective jet sizes are—pilot jet, 1; main jet, 6; with spares, 0 and 5. This combination gives fierce acceleration and perfect slow running.

Ignition. The current is generated by a H.T. Lucas, variable ignition, type K.S.A.1 magneto, chain driven off a sprocket keyed to the exhaust camshaft. The other sprocket is a push-on taper fit on the armature shaft, and has a vernier adjustment for securing accurate timing. Actually, the flash across the plug electrodes is timed to occur $\frac{7}{8}$ in. before the top of the compression stroke, on full advance. The sparking plug used is of the single point type. The magneto is a well-protected instrument, and has, of course, a clockwise armature rotation, viewed from the contact-breaker side.

Lubrication. This is effected by a semi-automatic hand-pump. Oil is pumped into the crankcase about every 5 miles. The flywheels splash it on to the cylinder walls, and oil mist also finds its way into the timing case, and thence back to the crankcase. Mechanical lubrication can be fitted to order at £1 extra (as previously indicated). The makers recommend the use of only the highest quality oil for lubrication.

Frame and Forks. These two supplementary units have been designed to give, together, a wheel base of 4 ft. $5\frac{1}{2}$ in., and a saddle height of 28 in. Special care has been taken to ensure good general stability at speed and on treacherous road surfaces. The A.J.S. forks are of very robust construction, and efficient shock absorbers are incorporated at the forward end of the lower fork links. The links are adjustable for side play. Integral with one of the fork spindle casings are two sockets which permit of a lamp being bracketed in a very low position that greatly enhances the appearance. The diameter of the steering head has been considerably increased for 1927, and large ball bearings are included. This produces excellent steering without looseness, and, if a proprietary steering damper were indulged in, the machine would be absolutely perfect in this respect. The forks are provided with grease-gun lubrication. The frame itself is of orthodox triangular form of high tensile steel.

Gear-box. The gear-box is an A.J.S. countershaft three-speed gear, fitted throughout with ball bearings, and is standard for all

models. It is operated by a right-hand gate change lever, affixed to the tank (as shown in Fig. 3); and it gives gear ratios of 5·5, 9·3, and 14 to 1. A close ratio gear-box can be had if desired.

Intermediate gear is by pinion engagement, and the remainder by dog clutch engagement. Moving the lever forward from rear to front position, the consecutive gears engaged are—low; neutral; middle; top. On to an extension of the new splined main shaft, which has a redesigned thrust bearing on the driving side, are fitted two sprockets—one small and one large—for primary and secondary drive, respectively. The larger sprocket, incidentally, is part of the clutch (actually the teeth are on the periphery of the centre disc), which is of the multiple plate and cork insert type, and has handlebar control on the left-hand side. Adjacent to the clutch and pegged to the outside clutch plate is a ratchet wheel with which the kick-starter quadrant engages. The kick-starter lever (seen in Fig. 1) is in a position such that ample leverage can be exerted upon it with the foot while astride the saddle. Only a high grade oil made by a firm of repute should be used for gear-box lubrication, and the oil level is indicated by a small shutter on the side of gear-box.

TRANSMISSION. Both primary and secondary drive is by substantial ½ in. pitch by $\frac{5}{16}$ in. wide Hans Reynold roller chain. The chain of the former is covered by a guard, while that of the latter has a protecting guard on the upper half only, gives easy access to the chain for inspection and lubrication purposes. These guards are designed to protect both rider and chains from dirt.

An efficient shock absorber on the engine mainshaft allows the power to be absorbed gradually, and thereby eliminates "snatch," which soon ruins any chain. As things stand, 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 happens.

BRAKES, WHEELS, AND TYRES. Large diameter, internal expanding, brakes are fitted to both front and rear wheels, which are tyred with 26 in. by 2·375 in., wired-on, heavy type non-skid Dunlops 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 same side. Both brakes are very smooth and powerful in action.

TANK. A handsome, black enamelled, and bulbous nosed tank is secured by two tank straps to the bottom frame tube, and has a capacity of 1½ gallons of petrol and 1 quart of oil. The filler caps are of large screw-on type. On to two special tank projections are rigidly attached good quality rubber knee-grips.

MISCELLANEOUS DETAILS. The semi- "T.T." racing type handlebars have celluloid grips; and just below the gear-box are two rubber footrests, adjustable for position. This combination gives a very comfortable and natural riding position. The saddle itself is a Terry Spring Seat No. 3. Non-valenced racing mudguards are fitted. Over the rear mudguard is a strong 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. At its sides are secured two pannier bags with a full kit of tools. A rear kick-up stand only is fitted. 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 can be fitted to order at £6 15s. solo, and at £7 5s. extra for a combination. This applies to all A.J.S. mounts.

WEIGHT. Approximately 210 lb.

MAXIMUM SPEED. Approximately 60 m.p.h.

THE 3·49 H.P. DE LUXE SPORTING MODEL H4

The specification of this machine is identical to that of model H5, other than the following—

The engine is specially tuned, and mechanical lubrication is fitted in place of the hand pump; the rear wheel is quickly detachable; better type valenced mudguards and saddle are provided; there are stands for both front and rear wheels.

THE 3·49 H.P. OVERHEAD VALVE SPORTING MODEL H6

Next in order of popularity is the O.H.V. 349 c.c. Model H6 (see Fig. 4). This machine, which is a fast mount possessing an admirable competition record, embodies all those improvements incorporated on the 1927 Model H4. It is, in fact, a replica of this mount with certain important modifications.

ENGINE. The power unit is of the overhead valve type. Two large diameter, alloy steel, tulip valves, hollowed out for lightness, are symmetrically placed at 82½° 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.

The valves are operated by polished duralumin rockers, mounted on the spindles between the two massive steel rocker plates, and carrying at their extremities grub screws and lock-nuts, which

enable tappet adjustment to be effected at the top of the push rods, instead of at the bottom, as previously. The cylinder holding down bolts are in a position different from that of the S.V. cylinder retaining bolts (as may be seen by comparing Fig. 3 with Fig. 5, which shows the 3·49 O.H.V. engine). Clearance between inlet valve and rocker is ·006 in., and the exhaust valve clearance is ·008 in. Grease gun lubrication is provided for these rockers, which have large area plain bearings. The crankcase valve actuating mechanism is, of course, the same as on the H4 engine. The valve springs are noteworthy, being of the two-in-one variety. The valve movement slightly overlaps the piston stroke, and in

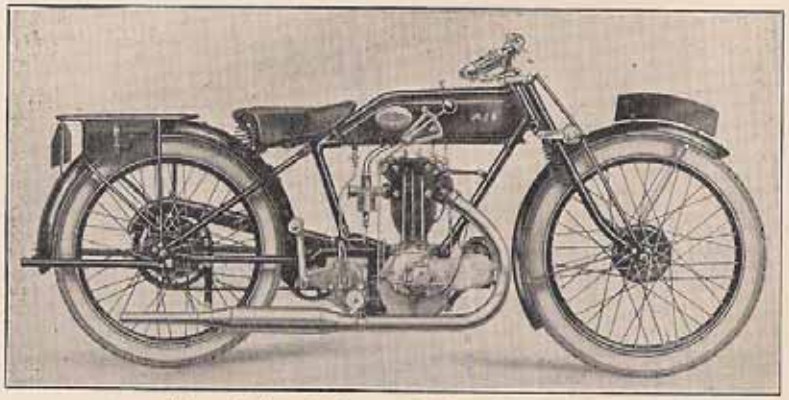


FIG. 4. THE 3·49 H.P. O.H.V. MODEL H6

consequence two small segments are cut out of the piston head dome 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 ingress of oil into the combustion chamber. The gudgeon pin is hollow, and is secured in position by two small springs. This piston, unlike many of its type, does not suffer from that distressing malady, "piston slap." An alternative high compression piston can be obtained from the makers by those desiring to get the last ounce out of the engine for racing purposes. The magneto is a Lucas type K.L.1. Ignition timing is $\frac{9}{16}$ in. before before T.D.C. on full advance.

CARBURETTOR. The carburettor is a No. 448 Binks, 2 jet, 2 lever, semi-automatic model with bottom petrol feed and twist grip control. Jet sizes are—main jet, 10; pilot jet, 3; spares, 1 and 7. If Discol P.M.S. II is used on the H6 or H7, use jets 4 and 16.

GEAR-BOX. This is a close ratio type of gear-box giving ratios of 5·52, 6·8, and 10·3 to 1, with a 21-tooth sprocket; but a wide ratio type of box may be had if required.

Beyond the fact that mudguards are of the racing pattern, Model H6 does not further differ materially from Model H4 in specification.

WEIGHT. About 220 lb.

MAXIMUM SPEED. Close on 70 m.p.h.

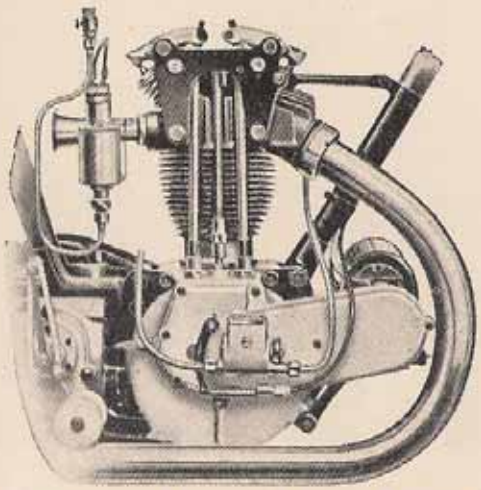


FIG. 5. THE 3·49 H.P. O.H.V. ENGINE MODEL H6

THE 4·98 H.P. OVERHEAD VALVE MODEL H8 (Fig. 6)

This machine is the last of the sports range. Owing to its great speed and immense power reserve, this model essentially belongs to the sports class; but it is not, however, a pure sports mount. It is rather a dual purpose machine suitable also for long distance high speed touring. To this end ample mudguarding is provided. A racing version of this machine, the H10 (as previously mentioned), is obtainable. A Mr. Karmody, on one of these machines, attained a speed of 93 m.p.h. on the Mourabra Speedway, Sydney, New South Wales, on 6th February, 1926.

Model H8 has a wheel-base slightly greater than that of any of the models hitherto described. It is 4 ft. 8 in. The saddle height remains unaltered, namely, 28 in., while the ground clearance is 4½ in. 1927 modifications to this mount, which was introduced in 1926, include larger sized tyres (26 in. by 3·25 in.), strengthened forks, the substitution of a gate change speed lever

for the bell crank system previously employed, valve clearance adjustment at upper ends of push-rods instead of at lower ends, new type of engine bearings, and a splined main shaft and redesigned thrust bearing in the gear-box. These gear-box improvements apply to all models.

ENGINE. The general lay-out of this engine, which has performed so creditably in the Tourist Trophy Races, is similar to that of the 3·49 h.p. O.H.V. engine; some parts are actually interchangeable, chief among which are valves, valve actuating mechanism, magneto drive and main shafts. It is of 84 by 90 mm. bore and stroke, giving 498 c.c. capacity. Like Model H6

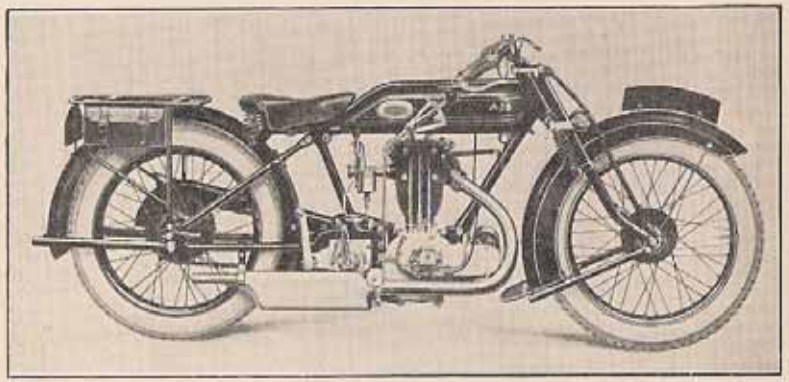


FIG. 6. THE 4·98 H.P. O.H.V. MODEL H8

engine, it is fitted with a detachable cylinder head, enclosed valve lifter mechanism, an aluminium alloy piston with non-segmented dome, 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, $\frac{7}{128}$ in. before T.D.C. The big end bearing, having regard to the high stresses that it can be subjected to under full throttle on this machine, is of compound type. A large box type of silencer is fitted in the same position as the cylindrical ones on the 3·49 h.p. models. The plated exhaust system is thus very imposing.

LUBRICATION. A Pilgrim, type "F" sight mechanical oil pump, supplemented by an auxiliary hand-pump, is provided.

GEAR-BOX AND TRANSMISSION. The gear-box, of the same type as mounted on all the other machines, gives ratios of 4·6, 8·4, and 15 to 1. A close ratio gear-box may be fitted as an alternative. Transmission is by $\frac{5}{8}$ in. pitch by $\frac{3}{8}$ in. wide, Hans Reynold chains.

FRAME AND TANK. The frame is of best quality steel tubing, scientifically constructed, with sidecar lugs integral. The tank holds 1$\frac{3}{4}$ gallons of petrol, and 3 pints of oil.

The remainder of the equipment specification is identical with that of the 3·49 h.p. O.H.V. model.

WEIGHT. Approximately 274 lb.

MAXIMUM SPEED. Roughly 70 to 75 m.p.h.

THE TOURING MODELS

These are models H3, H9, H2, and H1, and their respective prices are, £48 10s., £56, £80, and £95. The first two are solo

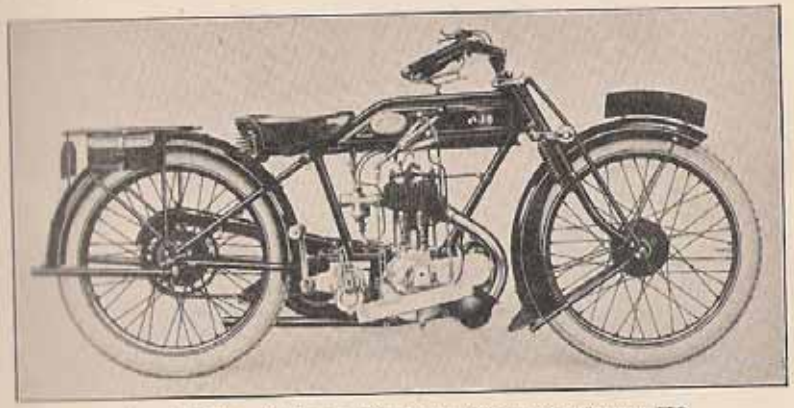


FIG. 7. THE 3·49 H.P. DE LUXE TOURING MODEL H3

mounts, while the remainder are twin cylinder sidecar outfits. Besides these combinations there are listed several attractive sporting and touring sidecars that may be attached to any of the A.J.S. models, and some that can be fitted to certain models only. We will deal briefly with the solo mounts first, and the sidecars afterwards in the above-placed order.

The 3·49 h.p. De Luxe Touring Model H3. This machine (shown in Fig. 7) differs from the De Luxe Sporting Model H4 only in that the engine is not specially tuned for speed; footboards replace footrests; touring pattern handle-bars are fitted; the silencer is fitted in front of the engine.

The 4·98 h.p. De Luxe Touring Model H9 (Fig. 8). This 4·98 h.p. S.V. model, which made its debut at Olympia in 1926, is exactly the same as the 4·98 h.p. O.H.V. model with the overhead valve mechanism replaced by side valves. Thus marketed, Model H9 has exactly the same weight as Model H8, while the former is cheaper than the latter by £6 10s. The speed of the S.V. machine

is appreciably lower than that of the O.H.V. machine (which is best described as concentrated " pep "), but its performance is, nevertheless, very remarkable.

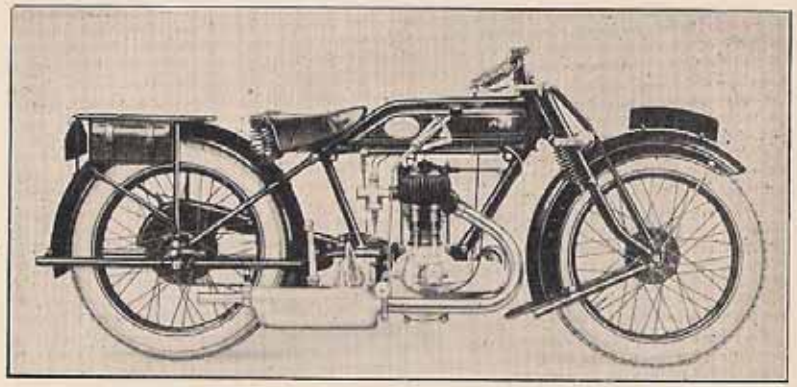


FIG. 8. THE 4·98 H.P. DE LUXE TOURING MODEL H9

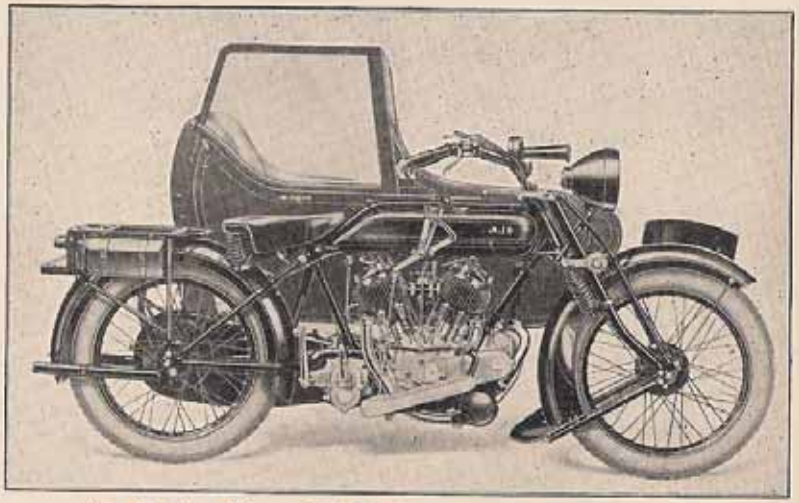


FIG. 9. THE MODEL H1 DE LUXE COMBINATION, 7·99 H.P.

THE 7·99 H.P. DE LUXE PASSENGER COMBINATION MODEL H1

This combination, a luxurious outfit (shown in Fig. 9), should satisfy, not the man who wants room for an occasional " flapper,"

but the man whose " flapper " has " come to stay "—in other words, the family man. Owing to its high horse-power and low bottom gear, this machine is capable of going practically anywhere. At the same time it has a good turn of speed. Comfort and reliability have been taken as the primary considerations in its design.

The " Vee " twin cylinder engine, which provides the motive power, is fitted to this model and the standard passenger combination model H2 alone. This engine closely follows general A.J.S. practice, but it has several noteworthy features. The specification is as follows—

ENGINE. Rated at 7·99 h.p., this S.V. engine, with cylinders placed at 50° to each other, and provided with detachable heads, has a 74 mm. bore and 93 mm. stroke. The cylinders, of similar type to those fitted on the small S.V. engines, have a common induction manifold to which the carburettor is attached. They are held down in position in a very neat manner by three bolts, one of which is a compound bolt of " Vee " form (clearly shown in Fig. 10), and two bridge-pieces. Cylinder gaskets are fitted to this engine alone. Pistons are of aluminium alloy and valves are of standard pattern, having clearances of ·006 and ·008 in the case of the inlet and exhaust valves respectively. Ignition timing is $\frac{3}{8}$ in. before T.D.C. on full advance. The connecting rods, to which the pistons are attached, are mounted independently, side by side, on the crankpin. There is no fork-ended master connecting rod (see Fig. 32). This is rather unorthodox practice ; but results have justified its adoption. Roller bearings are fitted to connecting rods big ends and main shafts. The valve timing gear comprises the small main shaft pinion, two half-time exhaust camwheels driven off the same, and a double inlet cam wheel driven off the front exhaust cam wheel. One toggle only is used, this being interposed between the double cam wheel and front inlet tappet. On this engine, owing to the increased load on the drive, the " Magdyno " sprocket is keyed to the armature shaft ; on all the others it is a friction fit. The other sprocket is splined to the exhaust camshaft. A large cylindrical silencer is fitted below the magneto platform. All external engine details are well illustrated by Fig. 10.

CARBURETTOR. This is a No. 426 Binks. Jet sizes—pilot jet, 2 ; main jet, 6 ; spares, 0, 2, and 5.

IGNITION. Lucas magneto with vernier timing adjustment. Lodge H.C.1 sparking plugs.

LUBRICATION. Pilgrim mechanical oil pump with sight feed, and auxiliary hand pump.

TRANSMISSION. $\frac{5}{8}$ in. pitch by $\frac{3}{8}$ in. wide, Hans Reynold chain, totally-enclosed chain cases, 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 three-speed bottom bracket type with ratios of 5, 9, and 16 to 1.

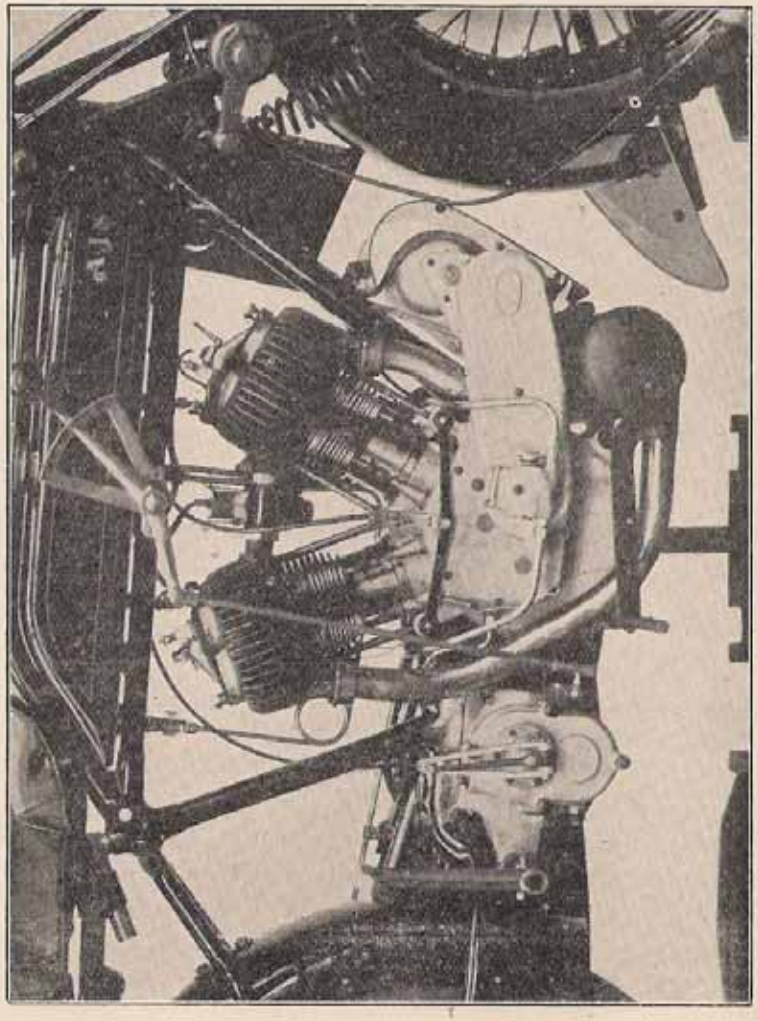


FIG. 10. THE MODEL H1 TWIN CYLINDER ENGINE, 7·99 H.P.

WHEELS, TYRES, AND BRAKES. All three wheels quickly detachable and interchangeable, with 26 in. by 3·25 in. wired on, heavy type, non-skid Dunlop cord tyres. Brakes of internal expanding type Both brakes are operated by foot pedals

situated on the left and right-hand sides respectively, that on the left controlling the rear.

TANK. This has capacity for 2¼ gallons of petrol and 1 quart of oil. Petrol injectors to cylinders.

MUDGUARDS. Well valenced and fitted with drip channels. Rear : 7 in. wide.

MISCELLANEOUS. Included in specification are—Terry Spring Seat No. 3 De Luxe, rubber foot rests with deep tread and heel rest, stands to front and rear wheels, and a complete set of tools.

WEIGHT. Approximately 336 lb.

Here is the sidecar specification—

BODY. Constructed of steel panelling and beautifully upholstered. Seat and back fitted with springs. Standard equipment includes windscreen, sidescreens, storm proof apron and luggage carrier.

CHASSIS AND SUSPENSION. Special underslung type chassis with duplex axle tubes. Back and front are laminated " Cee " leaf springs.

COLOUR. Black. No deviation from this colour.

FURTHER PASSENGER MODELS

The 7·99 h.p. Standard Passenger Combination, Model H2. This machine, which sells £15 cheaper than Model H1, is a less luxuriously equipped edition of the same machine. It has no lighting set, and no electric horn. Only the motor-cycle wheels are interchangeable and quickly detachable.

The above are the principal points on which the specification differs from that of the previously described machine. Model H2 (which is illustrated by Fig. 11) weighs 316 lb.

The maximum speed of both machines is approximately 50 m.p.h.

The 7·99 h.p. Two-seater Sidecar Combination. This sidecar, which can be fitted in place of the single-seater body on Models H1 and H2, at the cost of £10 and £5 extra, respectively, incorporates (as seen in Fig. 12) all the well-known design features of the latter body, plus the fitting of the extra seat. The two seats are arranged tandem fashion, the extra or front one being remarkably comfortable and spacious enough for an adult. The back rest is cleverly formed by utilizing the hinged dash of the rear seat, which is shaped and upholstered. The seat itself is attached to the sidecar body on the right-hand side, and can be folded back when entrance or exit is being made by the rear passenger. Access to either front or rear is by a single door, and by lifting up the hinged dash. The inclusion of the extra seat has been effected without in any way detracting from the general appearance, and

the overall length of body is but 6 ft. 6 in. The standard equipment includes two windscreens and two aprons.

The Occasional Two-seater Sidecar. As its name implies, this

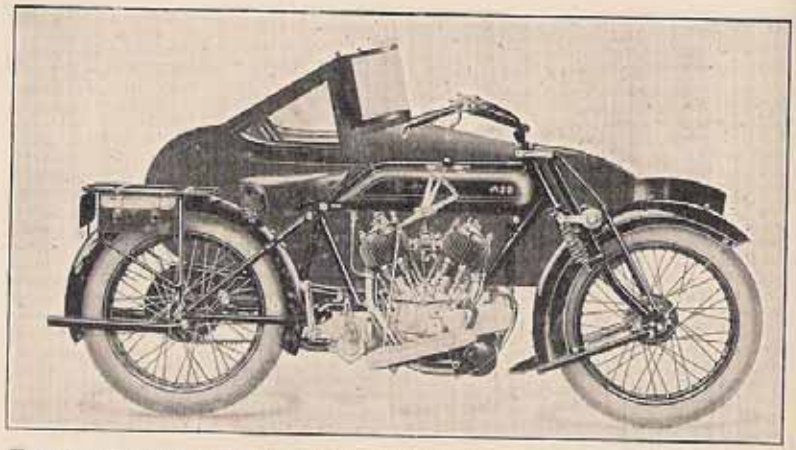


FIG. 11. THE MODEL H2, 7·99 H.P. STANDARD PASSENGER COMBINATION

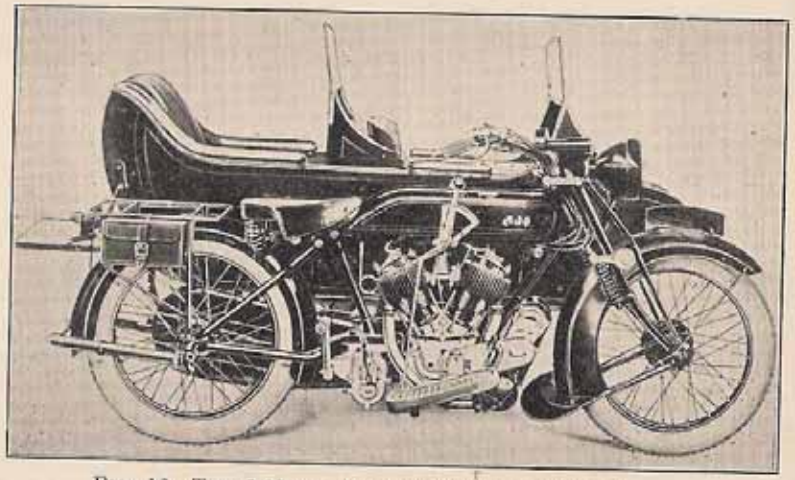


FIG. 12. THE 7·99 H.P. DE LUXE TANDEM TWO-SEATER

sidecar (illustrated by Fig. 13) has been designed to meet the requirements of those who desire a body which can, if required, be called into requisition to accommodate a second passenger, or

it can be used as luggage space. The sidecar illustrated will be found to be ideal for this purpose. The second seat is housed in the extension at the rear of the body, and when not in use is folded up so compactly that the appearance is that of a single-seater body only. The seat will hold an adult with ease, and ample leg room is afforded by a well in the floor of the body. Specification includes windscreen and storm-proof apron. Fitted to Model H1 machine and chassis, it sells at £98, and to Model H2 machine at £85.

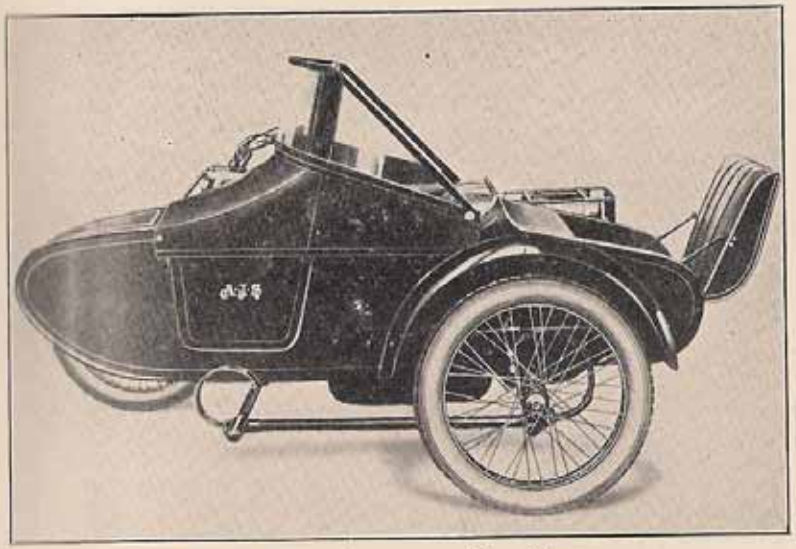


FIG. 13. THE OCCASIONAL TWO-SEATER

Sidecar with Child's Seat. Many attempts have been made to devise a safe and compact compartment in which the younger generation of the family can be carried ; and the sidecar shown by Fig. 14 supplies a long-felt want in this direction. To anyone seeing this sidecar with the seat closed up, the existence of such a fitment would not be suspected, as the whole folds down into the body of the locker when not in use. The seat is provided with side panels, so that the child is as well protected as its parents.

This type of body can be fitted to either the H1 machine or H2 and chassis at £96 and £83.

The Lightweight Touring Sidecar, shown in Fig. 15, is a very useful little sidecar that can be fitted to Models H3, H4, H5, H6, and H8, at £15 extra.

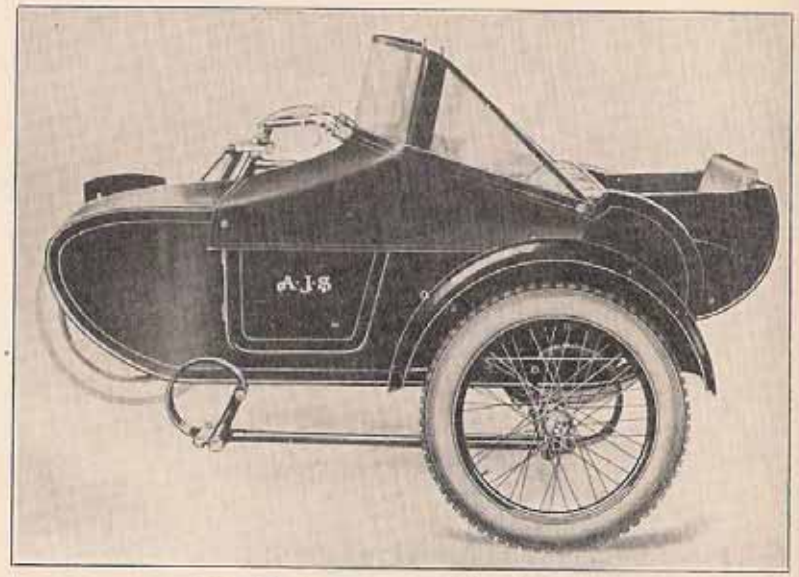


FIG. 14. SIDECAR WITH CHILD'S SEAT

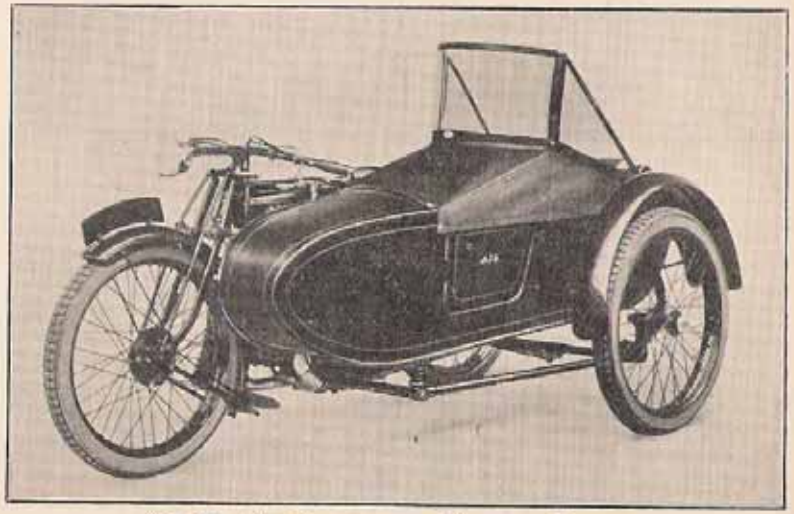


FIG. 15. THE LIGHTWEIGHT TOURING SIDECAR

The 4·98 h.p. Sidecar Combination. The A.J.S. company have introduced a special touring sidecar for use with their 4·98 h.p. model, which is illustrated by Fig. 16. The workmanship and

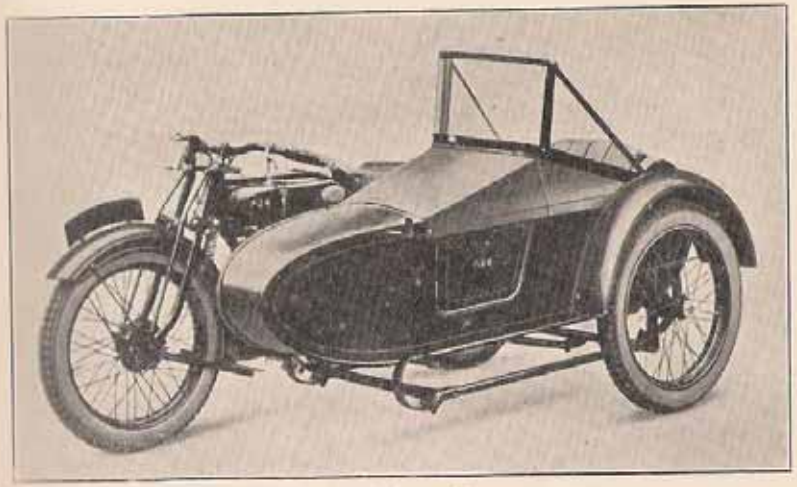


FIG. 16. THE 4·98 H.P. COMBINATION

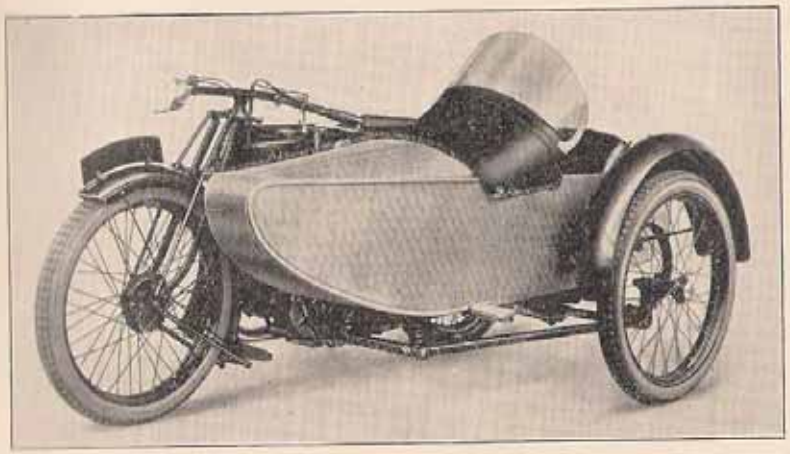


FIG. 17. STANDARD ALUMINIUM SPORTS SIDECAR

materials are of the very best quality, and the graceful lines are apparent from the illustration. A large locker is provided. The H8 combination costs £79, while the H9 combination costs £72 10s.

The Standard Aluminium Sports Sidecar. Fig. 17 illustrates the Standard Aluminium Sports sidecar attached to the 7·99 h.p. machine. The body is coach built, and covered with aluminium

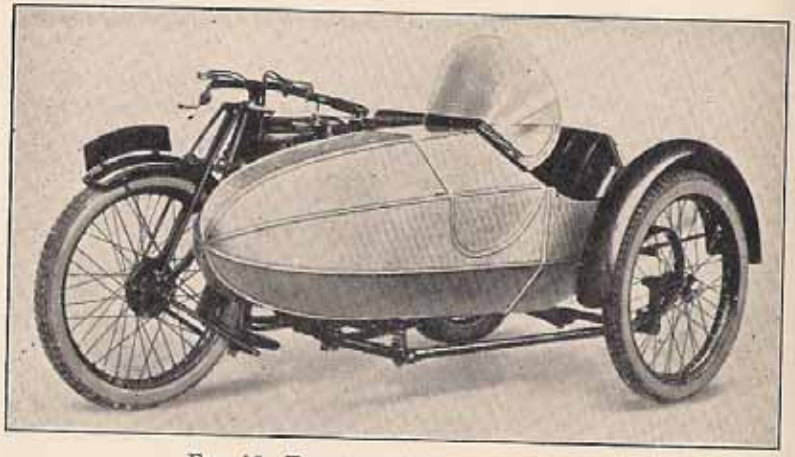


FIG. 18. THE SUPER SPORTS SIDECAR

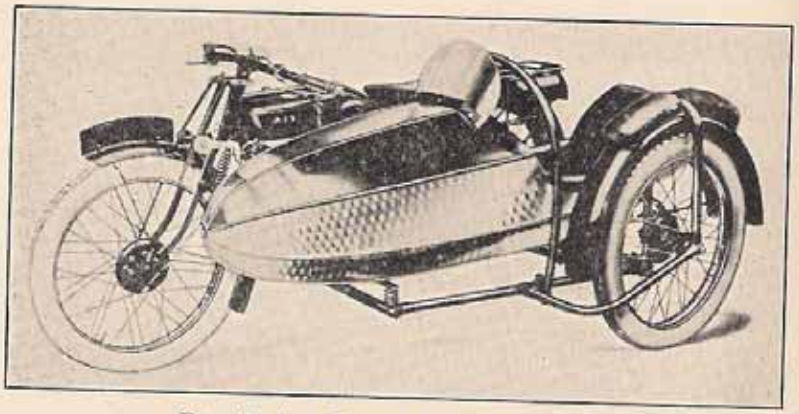


FIG. 19. THE SPECIAL RACING SIDECAR

panels with special " frosted finish." It is roomy and comfortable, fitted with spring back, and upholstered in fine quality material. A large locker is fitted at the rear. The chassis is of great strength with duplex axle tubes. " Cee " spring suspension is provided at front and rear.

This sidecar can be fitted as an alternative to the standard touring type at little or no extra cost on Models H1, H2, and H8. It can also be fitted on a lightweight chassis to Models H8, H6, H5, H4, H3, at inclusive prices ranging from £60 to £70.

The Super-Sports Aluminium Sidecar. Owing to its correct stream line, the sidecar shown in Fig. 18 is suitable for track, road racing, or the sportsman on tour. It represents the last word in sporting outfits. The body is coach built with special " frosted finish " aluminium panels. The lift-up dash also forms the door. This sidecar can be fitted to all models, including lightweight chassis.

The Special Racing Sidecar. This sidecar (see Fig. 19) is very similar to the Super-Sports type, but it is intended for serious business. Four point attachment is provided to the motor-cycle. There are also special cushions on the top of the mudguard, and a loop frame over the passenger for cornering purposes. It can be fitted to all the A.J.S. models at prices ranging from £71 in the case of Models H5 and H3 to £100 in the case of Model H1, which is a magnificent outfit.

This concludes what it is hoped may be an interesting and useful summary of all A.J.S. machines manufactured and catalogued for 1927.

CHAPTER II

LICENCES, EQUIPMENT, AND INSURANCE

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. agents are scattered widely throughout the United Kingdom, and no difficulty should be experienced in this connection. One of the largest and most conveniently situated agents in the Metropolitan area is H. Taylor & Co., Ltd., of 49-53 Sussex Place, South Kensington. A list of other agents is appended at the end of this volume. Spare parts, as well as general service, are obtainable from all these places. If the procedure suggested is adopted, it will be necessary first to supply the agent with the registration licence before the machine can be delivered.

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 not on horse-power, but on 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. If it is reintroduced, the motor-cyclist will benefit considerably thereby.

A licence application form 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 agent, if the machine has not been delivered by rail. On page 26 a portion of the 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.[1] 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, must be handed over to the new owner, and the registration book must be sent to the registration authority, who pass it on to the new owner. 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.

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

[1] Recent legislation now enables the motor-cyclist to obtain a quarterly, six-monthly, or annual licence dated from the first of any month in the year. A rebate on an unexpired portion may also be obtained.

can tell at a glance when an annual licence is out of date. Fourteen days' grace, however, is allowed between the expiry and renewal of an annual licence.

Driving Licence. Before any person is legally entitled to ride a motor-cycle on the public highway, he must hold a driving licence. This is obtained, either by postal or by personal application, from the town council or corporation of the county borough in which the prospective motor-cyclist resides, or from the county council, if he resides outside a county borough. The fee is 5s., and the licence remains in force for twelve months from the date of issue. It may be renewed from time to time at the same charge. As the law stands up to the moment of going to press, there is no qualification needed for one to obtain a driving licence other than age. Marked physical infirmities do not bar a person from driving on the highway. No licence is issued to anyone under 14 years of age. A person over 17 years of age can obtain at the same fee a licence entitling him to drive either a car or a motor-cycle. It therefore always pays to fill up a licence form to include both items. This licence is strictly non-transferable, and must be produced immediately on demand by any police officer. Failure to do this always entails a summons. It 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

I apply for a licence expiring on 192 , for a :	Annual Licences expiring on 31st December	Quarterly licences expiring on 24th March, 30th June, 30th Sept. or 31st December
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.	Duty £ s. d.	Duty £ s. d.
(*a*) Bicycle—		
Weight unladen, not exceeding 200 lb.	1 10 –	8 3
Weight unladen, not exceeding 200 lb. with right to draw trailer or sidecar	2 10 –	13 9
Weight unladen exceeding 200 lb., but not exceeding 8 cwt.	3 – –	16 6
Weight unladen exceeding 200 lb. with right to draw trailer or sidecar . .	4 – –	1 2 –
(*b*) Tricycle (not exceeding 8 cwt. in weight unladen)	4 – –	1 2 –

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.

Number Plates. It is not sufficient to merely have a number plate on the machine. The number plate must be in accordance with a definite scheme and definite dimensions laid down as standard. This scheme is shown by Fig. 20, and the number plate must be of the design of one of the patterns illustrated. No other form will be recognized by the police. The numbers must be painted white on a black background on each side of the plate,

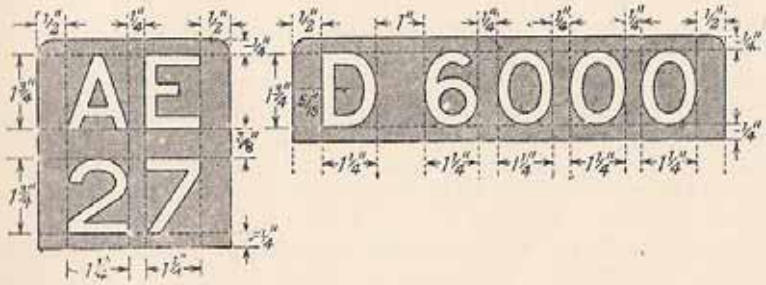


FIG. 20. NUMBER PLATE DIMENSIONS

and must always be kept in such a condition that they may easily be read at a reasonable distance.

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 or bulb type horn. Both have their merits. For touring purposes a bulb type is preferable : but for the sports rider, mounted on a fast and perhaps slightly noisy machine, a mechanical horn, mounted on the top frame tube, is invaluable. The ideal is to have both. But do not buy one of those cheap horns which begin by sliding 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.

Lamps. During the period between one hour after sunset and one hour before dawn it is compulsory to show a white light in front of a solo machine, and, in the case of a sidecar outfit, a red rear lamp also. The sidecar lamp must be fitted on the left side so as to indicate the entire width of the vehicle. At present it is not compulsory to fit a rear lamp on solo machines. It seems

likely, however, that in the near future it will be so. In any case, either a red reflector or a lamp ought to be fitted.

Lighting sets are either of the acetylene or electric type. Electric lighting is now becoming exceedingly popular, and bids fair to revolutionize 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.

Other legal aspects affecting, chiefly the conduct of the driver, will be considered in Chapter IX. 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 assists you to keep to definite time schedules.

All speedometers work on one of two principles—the centrifugal or the magnetic—and the average cost of an instrument is about £3. 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 "Bonniksen" time speedometer, which registers both time and distance, thereby elucidating the average speed. The fitting of such an instrument, however, is likely to deliver a rude shock to the man who credits himself with 40 or 50 m.p.h. averages.

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.

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,
89–91 Pall Mall,
London, S.W.1.

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

and

7 and 8 New Coventry Street,
London, W.1.

Insurance. It is the bounden duty of every motor-cyclist to insure against third party risks. If he does not do so, he is behaving in a selfish and irresponsible manner. Whether he insures the machine itself against damage, fire, and theft, is a secondary consideration (though apparently many individuals do not think so). Think what might happen if you permanently crippled a man while driving. You might be found not guilty of criminal negligence, but guilty of civil negligence. You would be acquitted on the criminal charge, but later on you might be sued for a considerable sum in a civil court. Perhaps, if the man were the bread winner, and a sympathetic jury were persuaded to return a verdict against you, about £2,000 damages might be awarded; probably an extended order for payment would be made, and your life would henceforth become a burden. Bankruptcy through a motor smash may come to quite a prosperous man in a twinkling of an eye. Worse to some men than crippling or bankruptcy would be the consciousness that helpless women and children were reduced to poverty and suffering because the delinquent had been unwilling to spare the paltry premium for an insurance policy. Indeed, in view of the large number of accidents that now occur daily, a strong agitation is being made to make insurance against third party risks compulsory.

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, and third party risks alone for about £3. Insurance companies raise the premium when pillion riding is indulged in. 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.

CHAPTER III

DRIVING

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 manual, 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 improperly handled. Then place the machine on its stand by releasing the latter from its clip with a smart blow of the foot and by dragging the machine upwards and backwards upon it. Pump up the tyres if they need it (they probably don't), and replenish the tanks. When filling the petrol tank, which is the rear of the two, take care to use a good size funnel with gauze filter ; 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. 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. The gear-box oil level should be ascertained by opening the small shutter provided for that purpose on the left-hand side (see Fig. 48). The chamber should be nearly full. Open the petrol cock by pushing the press button forward, as indicated on the cock itself.

Lubrication. All A.J.S. machines, with one exception, now have mechanical lubrication, so that, once the correct setting has been obtained, no further attention is necessary beyond occasionally glancing at the sight glass to see that everything is working O.K. Remember that *lubrication is the most important thing*, and, when in doubt as to whether the engine is being starved or not, increase the supply by rotating the regulating disc on the side of the pump in a clockwise direction $\frac{1}{16}$ in. at a time, or give a separate charge of oil from the auxiliary hand pump. AN ENGINE SHOULD BE LUBRICATED SO THAT ON ACCELERATING A PUFF OF BLUE SMOKE ISSUES FROM THE EXHAUST. Once this ideal is obtained, leave the pump alone. If the novice's machine has been delivered by road, we may assume that the lubrication is about right for present purposes. However, 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, 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 crank-case. 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 a 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 the next chapter. 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 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 from his pastime.

Motor-cycle controls are of two types—(1) engine controls,

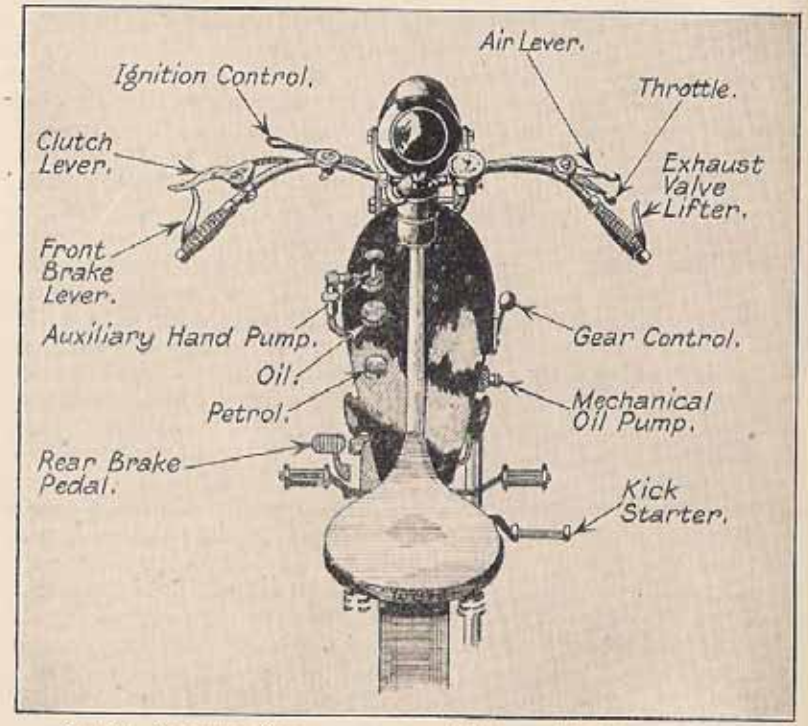


Fig. 21. Showing Controls of the 3·49 h.p. S.V. Model A.J.S.

(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 A.J.S. controls is shown in Fig. 21. The engine controls are all mounted on the handlebars and comprise four

levers—(1) throttle, (2) air lever, (3) lever for advancing and retarding spark, (4) exhaust valve lifter. The two carburettor levers are placed (unless twist-grip control is fitted) on top of the right-hand bar, the longer of the two being the throttle which regulates the supply of gas to the engine, and the shorter one the air lever, which likewise controls the air supply. Both controls open inwards. They will be dealt with in greater detail in that section of Chapter IV dealing with the Binks carburettor. The exhaust valve lifter, which may be seen underneath the bar, is primarily intended as a decompressor for facilitating starting. The magneto lever (the reason for whose existence is also made clear in the next chapter) advances the spark by inward movement. For all normal purposes it may be left on ¾ advance, except for starting, when it should be somewhat retarded to prevent the engine back-firing, and thereby delivering a nasty blow to the foot operating the kick-starter. The novice may therefore practically disregard this lever.

The cycle controls consist of the clutch, the gear-box lever, and the two brakes. The front brake is seldom used, and for the present may also be disregarded. 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 pressure 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 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 wonderful weapon of war—the tank—is a good example of how great mechanical 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 mechanical features of the A.J.S. three-speed gear-box will be dealt with later. The novice is recommended to experiment with gear changes on the stand with the engine cut 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.

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 levers right back. Now open the throttle about one quarter of its travel or less. In the case of twist-grip control the air lever is a separate fitment. The twist-grip is operated by turning inwards to open and outwards to shut. Shut the twist-grip right back, and then open by a movement of one quarter the circumference of the rubber twist-grip. 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 lift 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 (the one nearest the cylinder). Leave the air lever slightly open, unless the engine is stone cold, when it may be necessary to close it completely. The ignition lever 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. Now raise the exhaust lifter and engage the starter with the right foot (using the instep of the boot). Turn the engine over several times with the exhaust lifter up, 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 the engine 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. Raising the valve lifter will facilitate priming. 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 will then fire instantly. No carburation difficulty is experienced once the engine warms up. When the engine has just started, never leave it 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 Binks carburettor on pages 59 and 60) 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. 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 taking here 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.

Standing on the left-hand side of the machine, run it gently off the stand with the engine still revving and the gear in neutral, and swing the stand up into place. The machine will 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 low gear position. Then 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 low 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 practice going back into "neutral" without stopping the engine. After getting accustomed to driving on low 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 farther, 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 38). 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

It is a good plan now to draw the machine up by the side of the road, light a cigarette, and have a short rest during which you may give some thoughts to the subject of gear changing, and allow the engine to cool before starting on the homeward journey, which you will assuredly accomplish quite easily. On the way back try and change gear without looking down at the quadrant.

When putting the machine away in its lair, be sure to leave the gear lever in "neutral," and turn off petrol and oil cocks.

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.

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 low 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 low 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. Strictly speaking, tyres should always be pumped up to a definite pressure by consulting a pressure gauge. On the Dunlop tyres, used on all A.J.S. machines, Schräder valves are fitted, and a Schräder pressure gauge is obtainable. We lazy motor-cyclists, however, seldom think about pressure gauges, let alone use them. The normal procedure is to give a kick on the rear tyre, or press the thumb against it. When on the ground, the tyre should bulge slightly. This practice seems to give quite satisfactory results; for after all, a tyre in good condition only needs pumping up about once a fortnight. The driver can soon tell what is the best pressure, having regard to comfort. The tyres, however, 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. It is best to choose the "happy medium." 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. Experience is the best guide for tyre inflation.

"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 Wolverhampton 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 200 to 300 miles on the road have been covered.

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 considered by most experienced drivers to be atrociously bad practice; 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 inevitably ensue.

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 30 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 ¾ 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 all fast drivers, is to incline the machine inwards and the body outwards. Using this method one may practically corner 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 (as shown in Fig. 22). 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. A passenger may assist the driver by leaning in towards the centre of the bend; but do not adopt

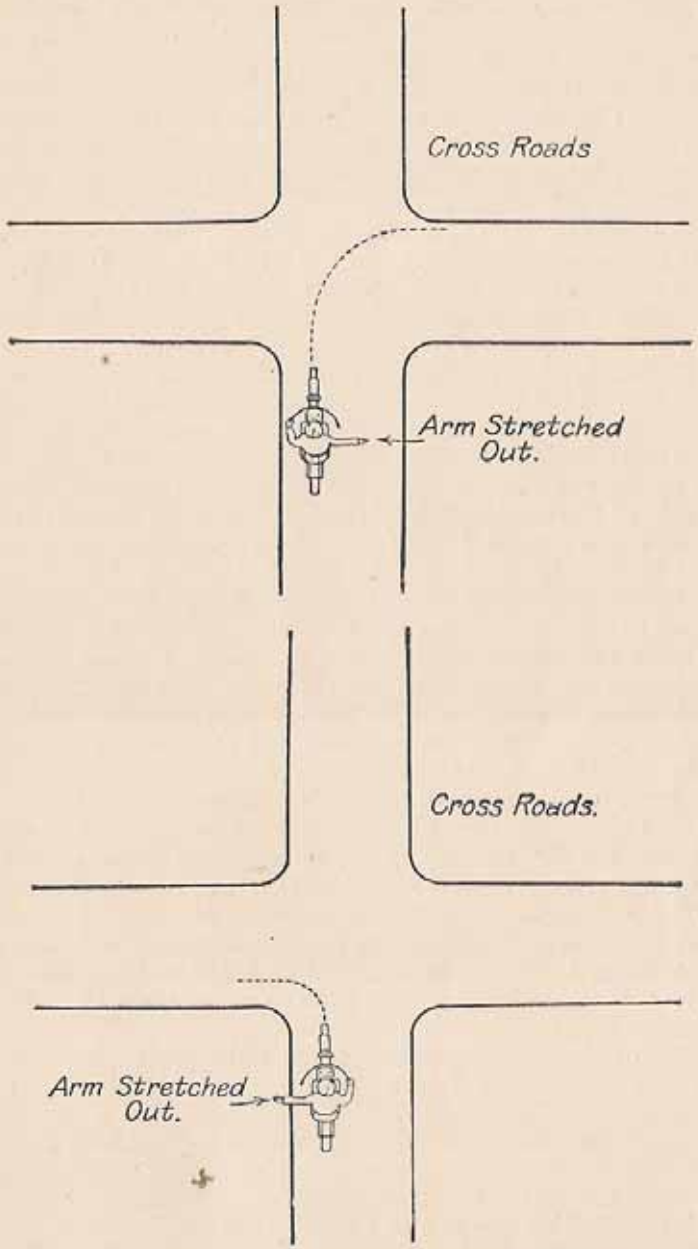


FIG. 22. TRAFFIC SIGNALS TO USE AT CORNERS

" 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. 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.

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 give an extra pumpful of oil from the auxiliary pump. 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.

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.

Pillion Riding. We will not enter into the question as to 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, it cannot be prohibited, and, moreover, is very popular. 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.
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. 23, 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 will 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.

FIG. 23. SIGNAL INDICATING THAT YOU ARE ABOUT TO STOP

3. Never hesitate. Do the wrong thing rather than run amock. 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. 24).

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 engine and gear-box are properly lubricated.

ROAD DANGERS

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

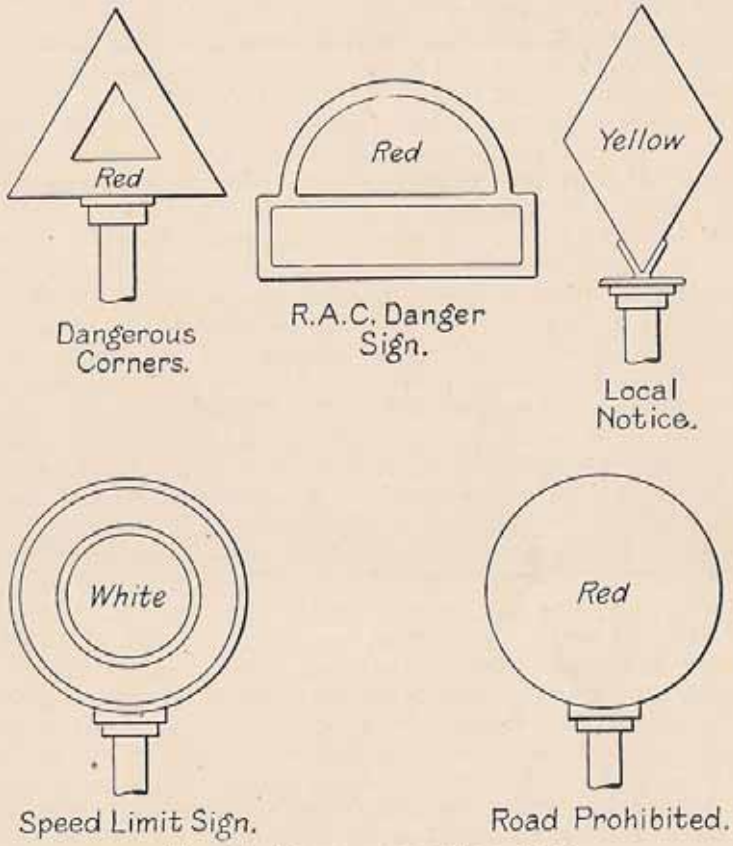


FIG. 24. CONVENTIONAL ROAD SIGNS

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.

Speedman's wobble.
Sudden brake failure.
Snap of a throttle cable.
Attempted suicide by dogs, poultry, drunken men, old ladies.
Skid of a motor-cycle in front.
Passengers dismounting from tramcars.
Pedestrian stepping off the kerb with eyes skywards.
Man 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.

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 are usually the causes. 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 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.

Fog. Only one other man fears fog more than the motorist or motor-cyclist, and that is the air pilot. To him fog is truly appalling, and he always chooses a landing ground instantly he realizes that fog is accumulating. The motor-cyclist, however, need have no such qualms—at the worst he can garage his mount and complete the journey by bus or rail—for he can throttle down to the merest crawl. 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 air 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.

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.

CHAPTER IV

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 mechanicalizing 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 Convertor—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. 25, 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

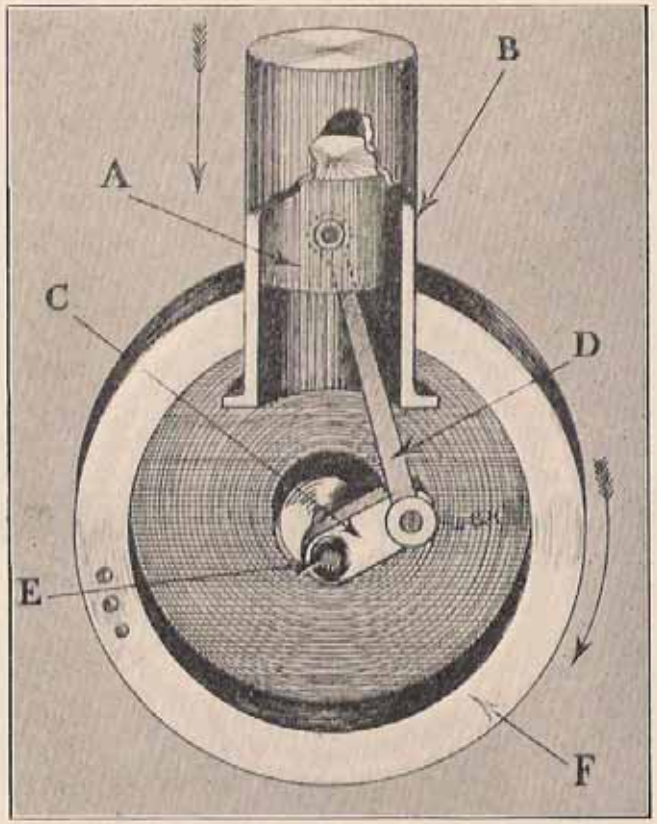


FIG. 25. DIAGRAM ILLUSTRATING HOW A PISTON (*A*), SLIDING IN A CYLINDER (*B*), ROTATES THE FLYWHEEL (*F*)

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. 26, 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

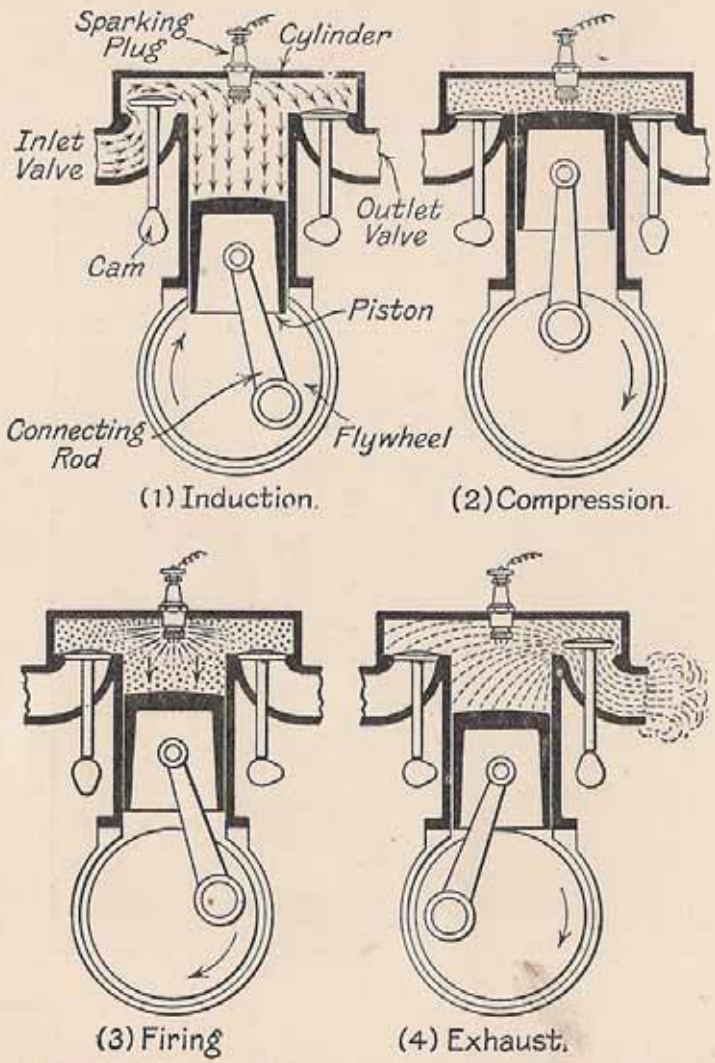


Fig. 26. The Principles of the Four-Stroke Engine

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 such 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. 27 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. 46.

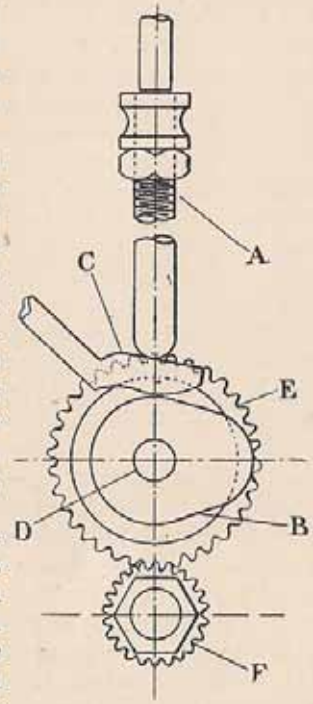


Fig. 27. Cam Valve Action

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 petro 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.

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

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 Binks carburettor (see page 59), 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. 28, 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. 30). 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 Binks)

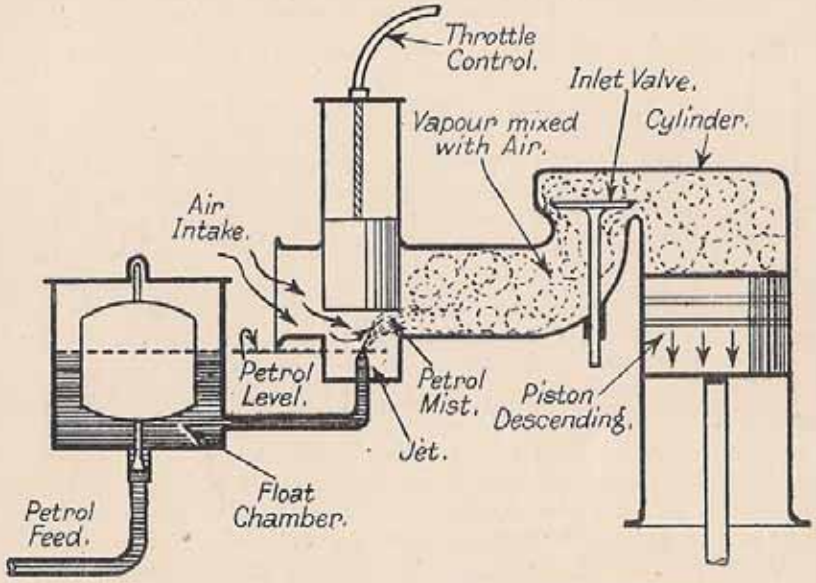


FIG. 28. ILLUSTRATING PRINCIPLE OF THE CARBURETTOR

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 HIGH TENSION MAGNETO

The high tension magneto (a Lucas in the case of 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 78), 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 such 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 exhaust camshaft by sprockets and chain (see Fig. 45) 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 79), it must also be timed to occur at the moment when the bobbin is having the greatest effect on the magnetic field (see Fig. 29).

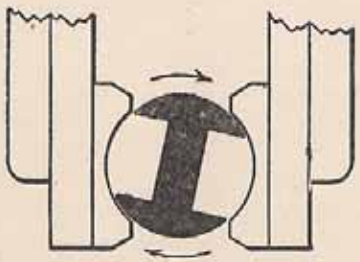


FIG. 29. POSITION OF MAGNETO ARMATURE WHEN CONTACTS SHOULD OPEN

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 collecting the H.T. current off the *slip-ring* (which is connected to the secondary) and distributing it to the H.T. plug leads.

The foregoing should give a good general idea of how the "mag" works.

SOME MECHANICAL DETAILS

The Binks Carburettor. The carburettor (see Fig. 30) consists of a vertical barrel divided into two vertical chambers. The main airway through the carburettor passes at right angles through these two chambers, first through the main jet chamber and then through the pilot jet chamber and onwards into the engine. The pilot jet chamber contains a " D " shaped throttle working up and down, the main jet chamber is like a keyhole containing a plunger to vary its area, and the plunger is operated from the handlebar. The two jets, having their orifices at the bottom instead of at the top, are of the non-spilling type, and are very difficult to choke up. The outlet of the main jet is considerably above the petrol level, consequently its action is delayed until the pilot jet has effectually started the engine going. The pilot jet is situated underneath the " D " shaped throttle, so that as the throttle is closed the area in which the jet is placed is reduced. A ribbon of air passes under the throttle and across the jet, so it is easy to see that as the throttle is closed the rush of air across the jet, instead of being lessened in intensity, is maintained ; the volume, however, is reduced. The more the throttle is opened the bigger is the area in which the pilot jet finds itself, and consequently the suction is lessened, because the throttle has receded from the jet plate. The air proceeding to the pilot jet goes through the main choke tube, but at small throttle openings the velocity of air around the main jet is so slow that the jet is scarcely affected. However, as the throttle is opened wider and the suction is increased, the main jet comes into operation automatically. Again, the wider the throttle is opened the bigger is the air blast on the main jet, yet the intensity of the suction on the pilot jet is lessened.

A see-saw action takes place on the two jets, because the closing of the throttle lessens the suction on the main jet and increases

it on the smaller jet, and vice versa. The pilot jet, however, is always in action if the engine is running. Two suitable jets in the carburettor, the pilot jet being much the smaller, give a practically automatic range of mixture. The air lever operating

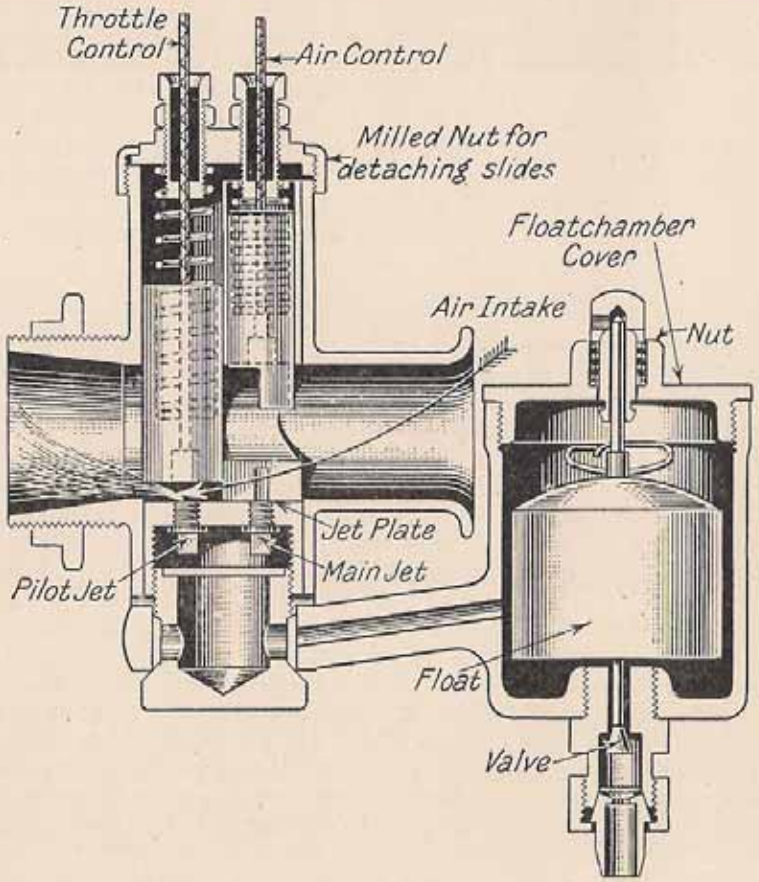


FIG. 30. SECTIONAL VIEW OF BINKS CARBURETTOR

the plunger in the main choke tube rectifies the mixture as necessity arises. A few minutes' thought about the functioning of the carburettor reveals the secret of slow running, namely, the fact that a minute quantity of air is drawn at a very high velocity across a tiny jet, thus ensuring that the petrol supplied is properly atomized. Power is obtained independently by having a big jet in the large choke tube, so that there is no sacrifice in having obtained good slow running. One of the many convenient

features of this carburettor is that when closing the throttle to run in traffic the mixture is practically automatic, and there is no need to fiddle about with the air lever to keep the engine running evenly and quietly when declutched.

The Three-Speed Countershaft Gear. Fig. 31 illustrates the gear-box used on the 3-49 h.p. machines. A similar type of gear-box is employed on the whole of the A.J.S. range. On the heavier machines, however, the gear-boxes are slightly more robust, likewise the clutches; otherwise they are identical.

Suppose the clutch sprocket (12) (driven off the engine sprocket) to be in motion, and the clutch plates pressed up against the

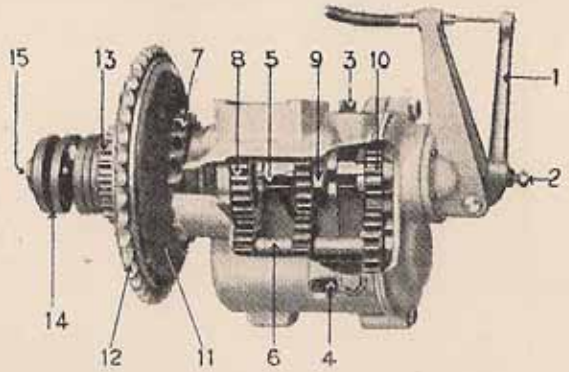


FIG. 31. THE A.J.S. GEAR-BOX

1. Clutch operating lever
2. Clutch push rod adjusting screw
3. Oil filler cap
4. Oil level indicator
5. Mainshaft
6. Layshaft
7. Sprocket for transmitting drive to rear wheel
8. High gear dog wheel
9. Sliding sleeve
10. Low gear dog wheel
11. Clutch fixed plate
12. Clutch sprocket receiving drive from engine
13. Footstarter ratchet wheel
14. Clutch spring
15. Clutch spring adjusting nut

cork inserts by the pressure of the clutch spring (14). Let us consider what happens. The high gear dog wheel (8) and the gear-box sprocket (7) cannot move relatively to one another, but both are free to rotate by means of a common sleeve upon the *mainshaft* (5). Then clearly no positive motion is imparted to either of them by the mainshaft itself. At the other end of the mainshaft is the low-gear dog wheel (10), free to rotate upon the shaft and in constant mesh with a pinion which, together with two others, is rigidly fixed to the *layshaft* (6). Now the layshaft pinion is also in constant mesh with the high gear dog wheel, and (the two pinions being of the same size) the gear-box sprocket will

rotate at layshaft speed whenever the layshaft is in motion. This is equivalent to saying that the ratio of the speed of the gear-box sprocket to that of the clutch sprocket is proportional to the ratio of the mainshaft to layshaft speed. It is perfectly obvious that in the case illustrated, assuming the sliding pinion to be moved slightly to the right, the layshaft is not set in motion, the mainshaft alone revolves carrying with it one pinion alone, namely, the sliding pinion on the splined mainshaft, which is not

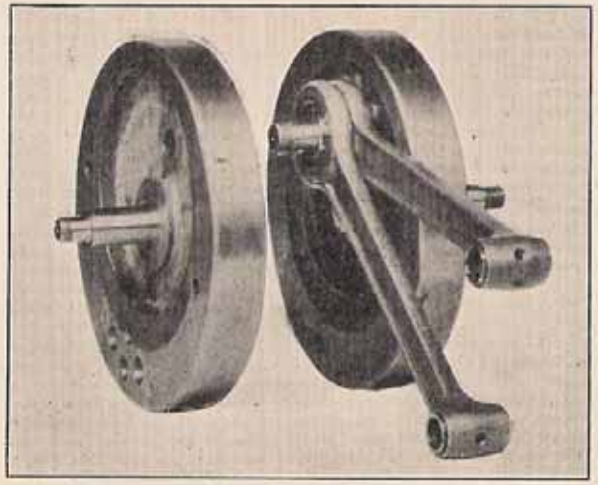


FIG. 32. CONNECTING-ROD MOUNTING OF TWIN CYLINDER 7·99 H.P. MODELS

in mesh with any other pinion. This means that we are in *neutral* or that no gears are engaged.

It will be observed that all pinions on the mainshaft have *dog clutches* which can be engaged by the sliding pinion; also it may be noted that the sliding pinion may be put into mesh with one pinion on the layshaft. Take the case now of the dog on the sliding pinion being engaged with that of the low-gear dog wheel. Then clearly the layshaft will come into action, and, of course, the gear-box sprocket will rotate at layshaft speed. In this case the difference in diameter of the low-gear dog wheel and the layshaft pinion will bring about a considerable reduction of speed to the layshaft relative to that of the mainshaft. This means that the clutch sprocket will revolve much faster than the gear-box sprocket (whence the main drive is taken), or, in other words, we are in *low gear*.

Let us now assume that the sliding pinion is moved to the left and put into mesh with the central layshaft pinion, as actually

illustrated in Fig. 31. Then a reduction in gear also takes place, but not so great; that is to say, we are in *middle gear*.

Suppose, finally, the sliding pinion is brought right across until the dog engages with the dog on the high-gear dog wheel. Here again the lay-shaft remains idle, and the gear-box sprocket becomes locked to the mainshaft, which, of course, involves their simultaneous rotation at the same speed; there is no gear reduction in the gear-box at all, and so we have *high gear*.

The foregoing should leave no doubt as to how the varying gear ratios are obtained. The illustration also clearly demonstrates the clutch operation (see also Fig. 48); the lever (1), controlled from the handlebars by Bowden cable, operates a plunger which relieves the pressure exerted by the coil spring 14 against the clutch plate, thereby freeing the clutch sprocket, which can then rotate independently of anything else. The actual control of the sliding pinion is not shown, but follows orthodox practice. The ratchet wheel 13, between the clutch and clutch spring, is for engagement with the kick-starter quadrant.

The Shock-Absorber. A metallic shock-absorber is fitted on the engine shaft to "smooth-out" the engine torque at low revolutions. If such a device were not fitted the periodic impulses that would occur in the drive when the engine was firing at low speed on top gear—in fact, all gears—would result in great harshness and serious wear throughout the transmission, quite apart from the unpleasantness of driving such a machine. In the case of belt driven machines a shock-absorber is not required, for the flexibility of the belt itself satisfies all requirements in this direction.

The following is a brief outline of the principle. On that portion of the engine shaft inside the chain case two members are fitted, incorporating dogs or cams. The outside member is keyed to the engine shaft, and is held up to its work by a spring and lock nut. The member consisting of the chain sprocket is free on the shaft, and can move in either direction; but in doing so, it naturally tries to force the outer member away by reason of the doglike formation of the two respective faces. Thus the "bite" of each engine impulse is partly absorbed in compressing this spring when the load is very great, as in the case of starting off or when travelling at low speed on top gear. In other words, it smoothes out the engine torque.

It is obvious that the shock-absorber functions mostly at low speed and least at high speed, which, naturally, is what is wanted. The amount of "back-lash" is, of course, limited by a stop Needless to say, the clutch also functions as a shock-absorber, its effectiveness in this respect depending largely upon its adjustment and manipulation.

CHAPTER V

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 balls, cones, and cups, 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.

Gears. Condition of teeth on sprockets and pinions, damaged ball races and loose parts generally.

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

An *ordinary overhaul* should be undertaken about every 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. 33), and odd adjustments made as they are needed. The rider who callously runs a machine until " something happens " is asking for trouble and,

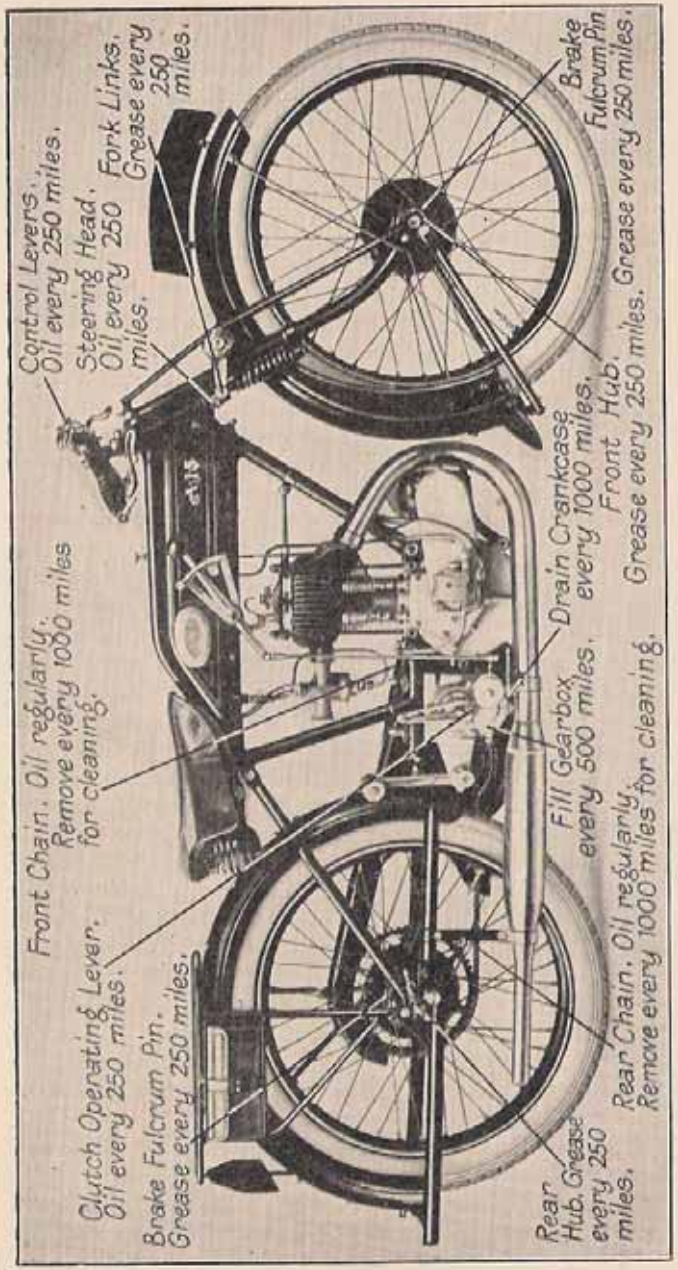


Fig. 33. The Important Parts Requiring Lubrication (Model H4)

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 Clearance. 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 pins 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 clearance will increase until the engine has been thoroughly run-in. Fig. 34 illustrates the point where the clearance should exist (*C*) and the means of adjustment (*X*) 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. This is equivalent roughly to the thickness of the paper of which this book is made. 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 pin. 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 rockers in the timing case will not be resting on their cams. If the valve clearances are not correct this must be rectified. In the case of the S.V. engine, hold the tappet head with a spanner and loosen the lock-nut below with another spanner; now screw up or unscrew the tappet head until the correct clearance is obtained, and retighten the lock-nut. On the 7·99 h.p. twin cylinder engine the front inlet tappet will be found to have a hole drilled in that portion of the stem which protrudes above the guide. This is done to allow a small tommy-bar to be inserted to prevent the tappet rotating while adjustment is being made. Check again after tightening the nut. In the case of the O.H.V. engine, loosen the nut at the side of the split rocker boss securing the adjustable grub screw, 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.

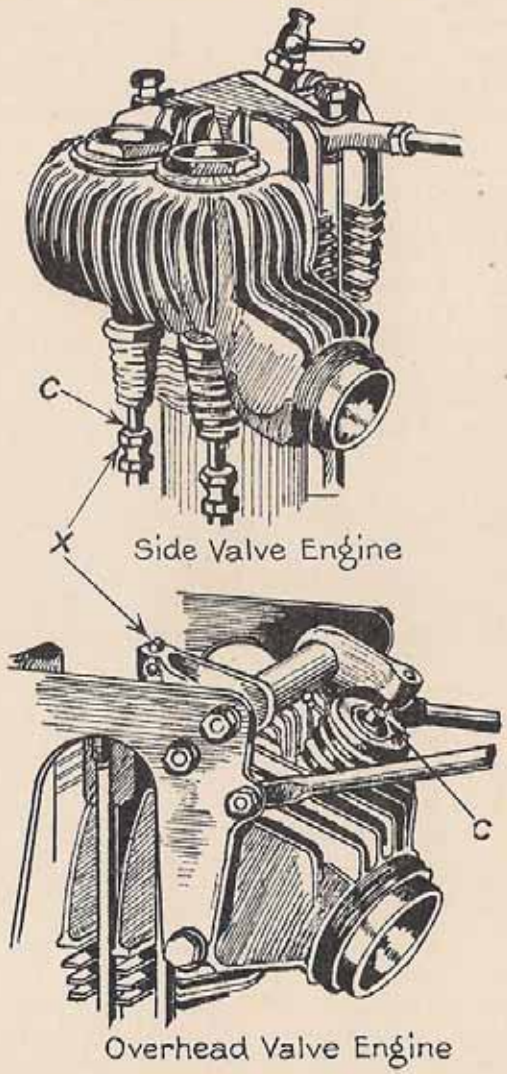


FIG. 34. SHOWING VALVE CLEARANCE ADJUSTMENT

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 grind in the valves if necessary. In any case removal of the valves enables the combustion chamber and also the parts 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. single 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, unlike many of their contemporaries, 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, for the head can be removed complete with valve mechanism.

Removal of Cylinder. Firstly, disconnect the H.T. lead from the sparking plug terminal and remove the plug itself. Disconnect the inlet and exhaust pipes, and get them and the gadgets attached to them well out of the way. Both the induction pipe of the carburettor and the exhaust pipe have union nut connections, and these nuts can be undone by means of special "hook" spanners in the tool kit. In the case of the twin cylinder engine, these operations—in fact, most operations—will have to be performed, of course, on each cylinder. If the reader's mount is of the O.H.V. type, it will now be necessary to remove the tappet tubes or push rods, and to this end the special extractor tool must be used. One end of this tool forms the spanner fitting the exhaust pipe nut and hub bearing. The other end is arranged to fit underneath the rocker (see Fig. 35) in such a way that by pressing the spanner end down it compresses the valve spring. Press down on the spanner end and seize the base of the tappet tube with the other hand. The tappet tube may then be withdrawn by lifting it off its hollow cup. Repeat this operation to remove the other tappet tube. Now disconnect the cylinder steady bolt found anchored to the front down tube. Unscrew the nuts (on the S.V. engines). 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 the head carefully off the barrel on both sides. Great care must be taken to avoid damaging the radiating fins; the head should, therefore, be prised upwards, and not downwards. When quite free, the head may be lifted off (see Fig. 36).

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

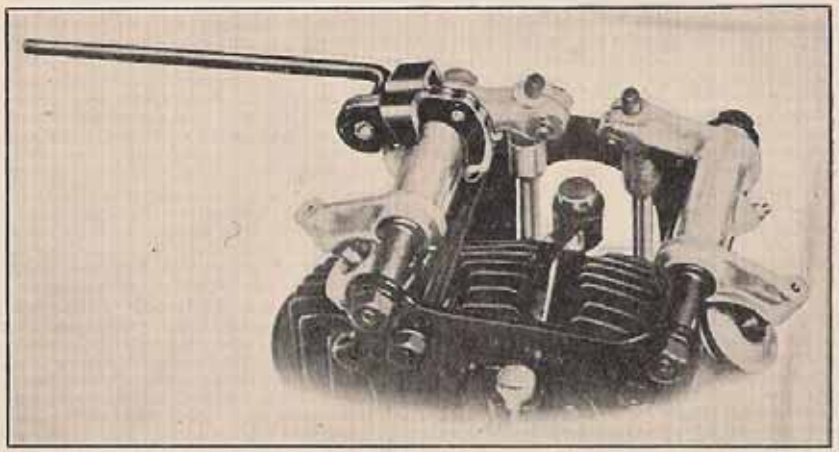


Fig. 35. The A.J.S. Tappet Tube Extractor

piston falling sharply against the connecting-rod which might damage or distort the piston skirt. 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! The simplest way to drop a nut into the crankcase is to spin a loose nut off a bolt by hand directly over it without first blocking up the entrance with a rag. 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 being replaced in exactly the same position on the connecting rod.

Piston Removal. 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

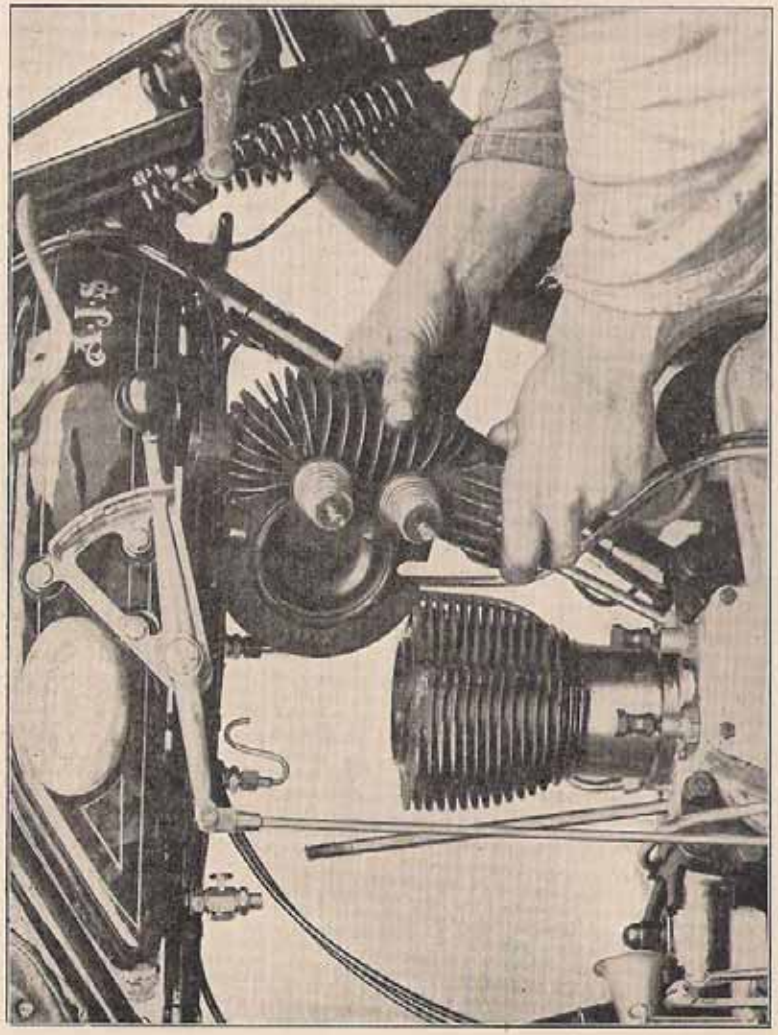


Fig. 36. Removing Cylinder Head of the S.V. Engine.

gudgeon-pin may be pushed out from the driving 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 either the cylinder head

or cylinder. All that has to be done is to take out the valve cups 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 via the valve cap aperture. Remove the other valve similarly. Remember that valve caps are most readily removed with the cylinder head in situ.

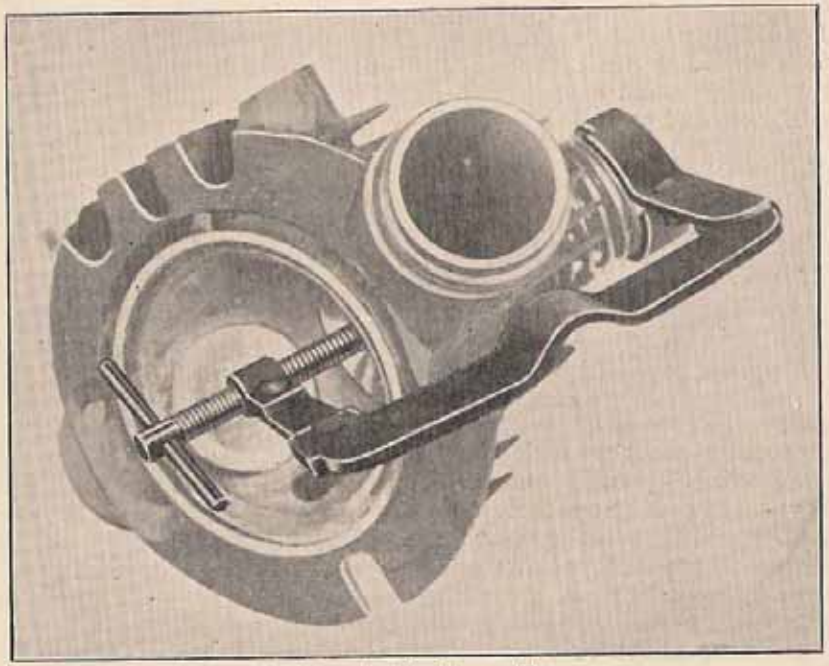


Fig. 37. The A.J.S. Valve Extractor

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 to be used, but it is quite unnecessary to interfere with the rocker mechanism. For portability the tool is made to fold up. Unfold it and place the end opposite the screw over the valve spring, as shown in Fig. 37, after pushing the rocker back out of the way. Screw up until it 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, but it is best not to change them about unless necessary.

Removing the Carbon. Procure an old screw-driver, or similar tool, and scrape off all carbon from the piston head. The latter may then be polished with very fine emery cloth, but do not touch the sides of the piston at all. 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 deeply scratch 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

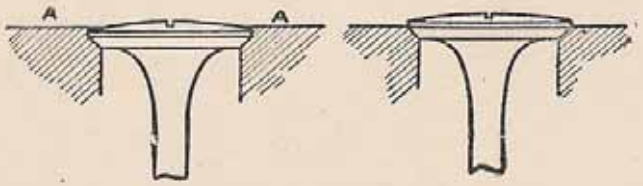


FIG. 38. DIAGRAM ILLUSTRATING HOW VALVES BECOME POCKETED AFTER FREQUENT REGRINDING

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 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. The valve seats and faces should now be inspected.

Grinding-in the Valves. Should the valves or valve seats show signs of " pitting," the valves will have to be ground-in. This requires considerable patience and care. We will deal first with the S.V. type of cylinder head. Stuff a rag into the combustion chamber to prevent dirt getting in, and then place the head firmly on a bench with valve seats uppermost. The best preparation for valve-grinding is one of the ready-made compounds such as Carborundum. This is supplied in two grades, coarse and fine. Smear the valve face lightly with a little 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

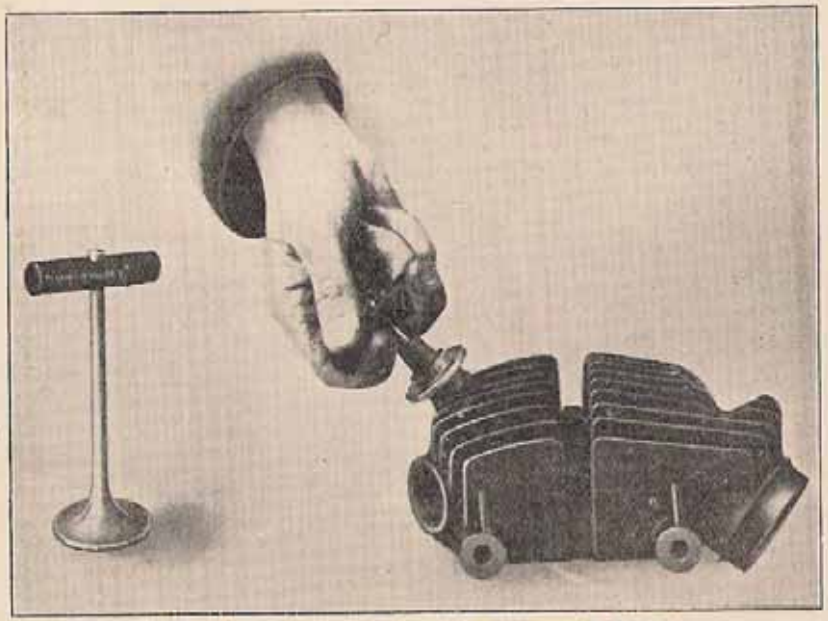


FIG. 39. THE A.J.S. VALVE GRINDING TOOL

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 (see Fig. 38).

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. 39).

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 or rocker mechanism, as the case may be. When replacing

valve caps, smear a jointing medium, such as "Metalestine," 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

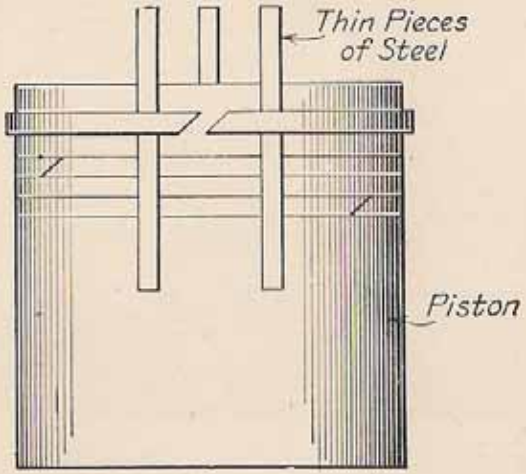


Fig. 40. How to Remove Piston Rings

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. 40. 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.

Dismantling O.H.V. Mechanism. Remove the rocker plates, and the various spindles and distance pieces can then be removed. Now take off the rockers (see Fig. 41). After reassembly use the grease gun on the rocker nipples. "Tecalemit" lubricant is best suited for this and fork lubrication.

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.

Cleaning Out the Crankcase. When the cylinder is off it is advisable to clean out the crankcase. For this purpose a drain plug is fitted at the bottom of the crankcase on the chain case side. Having drained out the old oil, swill out the crankcase with paraffin. In doing this it is best to reinsert the plug and fill up with paraffin, afterwards rotating the flywheels. Replace plug securely after very thorough redraining, and inject five full charges of fresh oil from the hand pump.

The Sparking Plug. Thoroughly clean the sparking plug with petrol and scrape the electrode points lightly with a sharp pocket-knife, afterwards checking the gap between them, which should be about $\frac{1}{50}$ in. The reach of the sparking plug is also of importance. It should be set as shown by Fig. 42. The sparking plug should be frequently inspected. It is susceptible to oiling-up.

Reassembly of Engine. After all this has been done, the engine may be reassembled. Care should be taken to replace all paper washers, if fitted, and in the case of the twin cylinder engines, the packing washers, when replacing the cylinders. The piston should be oiled before being attached to the connecting rod with the gudgeon pin. Do not forget the retaining springs. 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 head on to the barrel, remember that the head must be tightened down before the steady is again attached to the

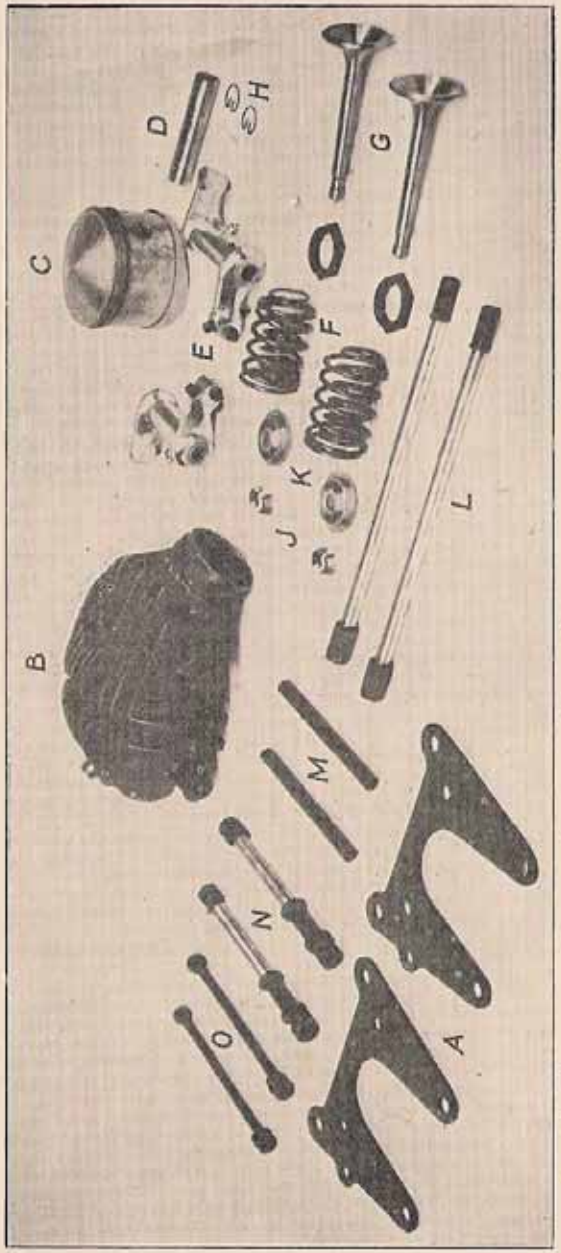


FIG. 41. COMPONENT PARTS OF OVERHEAD VALVE MECHANISM OF THE 3-49 H.P. AND 4-98 H.P. MODELS

A = Rocker plates
B = Cylinder head
C = Piston
D = Gudgeon pin
E = Rockers
F = Valve springs
G = Valves
H = Gudgeon pin retaining spring
J = Cotters
K = Valve spring caps
L = Tappet tubes
M = Distance tubes
N = Rocker spindles
O = Security bolts

down tube. When the cylinder has been finally tightened down, then the length of 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 $\frac{1}{128}$ in. when the exhaust lifter is raised. If the valve lifter lifts the valve, say, $\frac{1}{8}$ in., the inlet and exhaust valves will foul each other with disastrous consequences when the engine is restarted.

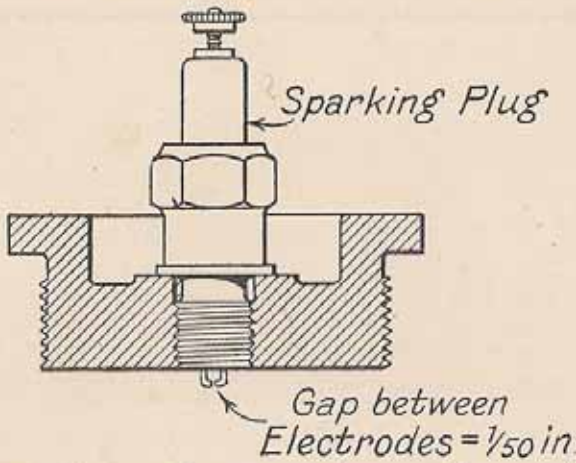


FIG. 42. DIAGRAM ILLUSTRATING REACH OF SPARKING PLUG

After assembly, test the engine compression by standing on the kick-starter. 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 rebedded themselves again. The machine is now ready for the road again.

Concerning Engine Lubrication. During the first 100 miles, when the new engine should be quietly run in, the rider 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 pointer on the side of the mechanical pump to the right, moving $\frac{1}{128}$ 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. Over-oiling will sometimes cause the exhaust valve to stick or move sluggishly in its guide, especially when the engine is cold. Should this happen the valve stem and guide must be cleaned with petrol, necessitating, of course, the removal of the valve. It is not necessary to keep the engine continually smoking. 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.

Care of the Magneto. The Lucas magneto is provided with ball bearings throughout, which are packed with grease before

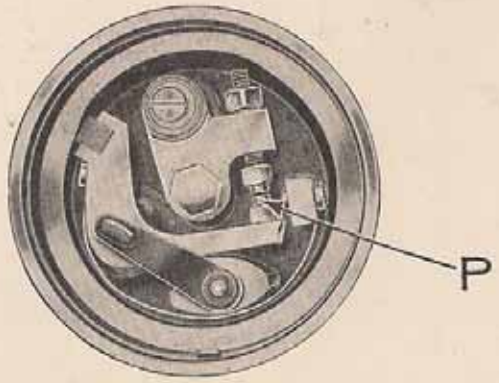


FIG. 43. THE MAKE-AND-BREAK PORTION OF THE MAGNETO
P = CONTACT POINTS

leaving the manufacturers. Fresh lubricant should not be required under normal circumstances until the machine has covered some 12,000 miles.

The platinum contacts of the contact breaker should be examined about every 1,000 miles and, if the " break " should be more than the thickness of a visiting card, they should be adjusted. The proper distance of the gap is ½ mm. (see Fig. 43). 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 the contact breaker scrupulously clean.

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.

Retiming the Magneto. If the magneto has been removed from the machine, or the drive disturbed, it will be necessary to see that it is retimed 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. 44), 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.

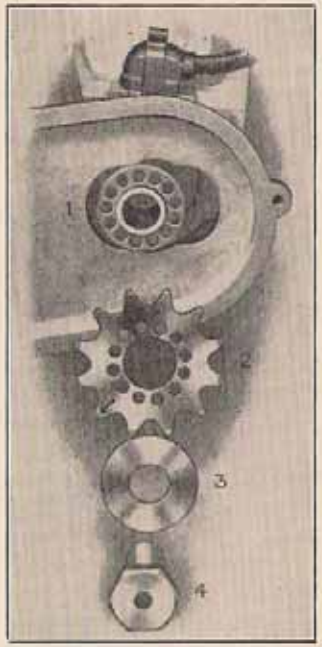


FIG. 44. THE VERNIER TIMING ADJUSTMENT

Keyed to the armature shaft of the magneto (in the case of the twin-cylinder engines only—in other cases 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 timing up 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 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 arises on the inclined plane of the steel segment sufficiently to just separate the platinum point. 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 of the two. 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 cylinders corresponding with these numbers.

Magneto Chain Adjustment. Examine the driving chain occasionally by removing the chain case cover, complete with mechanical pump (see Fig. 45), and, if slack, tighten it by moving the magneto along the platform in a forward direction after slacking off the four pins underneath. When the correct tension has been obtained (there should be just no droop) screw the pins up again

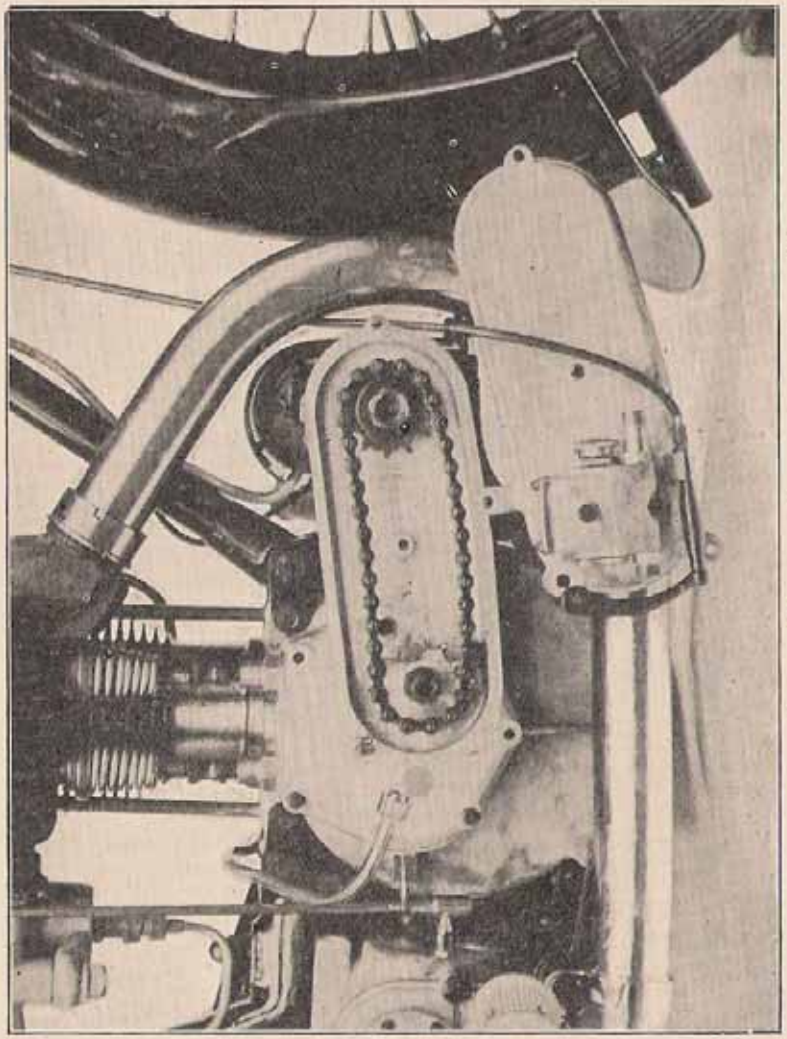


Fig. 45. The 3-4½ h.p. Magneto Drive. Chain Cover Removed (Showing also the drive for the mechanical oil pump)

tightly. Examine also the nuts securing the chain sprockets. After adjustment, oil the chain before replacing the cover. Before coupling up the oil pipes to the mechanical pump, open oil cock and allow oil to expel all air from the delivery pipe ; otherwise,

on starting the engine, air will be pumped in, instead of lubricating oil, for some minutes.

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

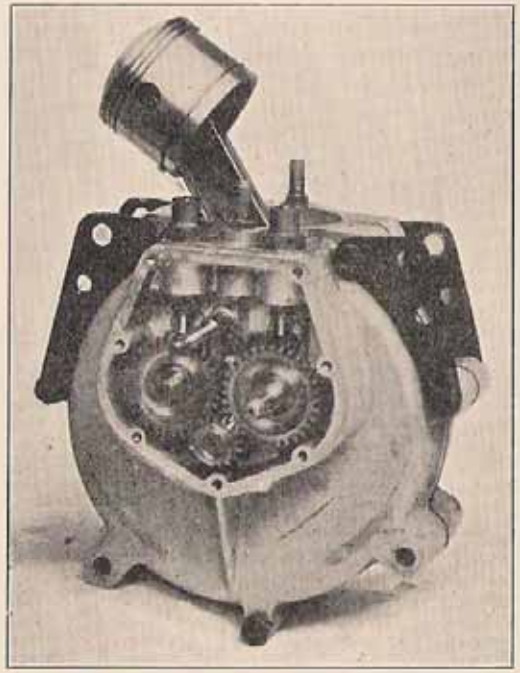


FIG. 46. THE 3·49 H.P. MODEL H6 ENGINE
Cylinder removed, showing connecting-rod and piston. The timing gears can also be clearly seen

the setting to be always kept. On the small timing pinion (see Fig. 46) 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 the 7·99 h.p. engines, 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.

Maintaining Compression. If piston rings and valves are in

good condition, the only other possible sources of leakage are the valve caps, the compression cock, 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 plug, cock, or cap, as the case may be. Test for compression leakage by putting thick oil on the sides of the joints and observing whether bubbles occur when the engine is running. Sometimes the compression cock itself may leak. If so, it will have to be ground-in.

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 jump on 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 repeat the "jumping business," 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. Open the throttle about $\frac{1}{8}$ in. so that when the engine is turning over you can hear a hiss of the air rushing through. Lower the air shutter over the main jet, flood the carburettor, and get the engine started. When the engine has run two or three minutes on what appears to be a rich mixture, open the air lever to about $\frac{3}{4}$ wide open; then get the engine to run as slowly as possible. If the engine runs on what is apparently too weak a mixture, increase the size of the pilot jet by one size. If the engine hunts and does not run better, try one size smaller. The range of the pilot jet alone is about $\frac{1}{16}$ in. movement of the throttle. While running with the throttle about $\frac{1}{8}$ in. open you can tell if the mixture is weak or strong by lowering or raising the air shutter over the main jet; if the engine runs better in the closed position it shows that the pilot jet is too small. When you have found the pilot jet that will run steadily with the air valve $\frac{3}{4}$ open, that is $\frac{3}{4}$ of its movement above the main jet, you can proceed to tune the main jet,

Mount the machine and open up the throttle to about $\frac{1}{4}$ of its opening. If the machine gets away all right with the air shutter $\frac{3}{4}$ open, and runs better as you proceed to open the air valve wide, the main jet is probably too large, and you should try one jet smaller. If, on the other hand, when the throttle is opened $\frac{1}{4}$, you cannot get away without a lot of spluttering and back-firing which disappears if you close the shutter, this shows that the main jet is too small, and you should try a larger one.

The jets can be removed by undoing the large square or hexagon adaptor, which is also a filter underneath the barrel. The jet key supplied with the spares will remove the jets. Twin cylinder owners should make sure that both cylinders are firing. Try running the engine on each cylinder separately by shorting one plug at a time with a screw-driver. From time to time take the carburettor to pieces and thoroughly clean all parts, especially the float-chamber and filters.

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. Induction pipe air leaks are usually caused by forcibly man-handling the pipe instead of coaxing it into position.

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 Sooted 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.

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 from the acetylene generator may be utilized. Petrol pipes should never be coiled so that the coils have horizontal axes. This tends to create air locks.

Removing Tight Studs. Fig. 47 shows how obstinate studs may be removed for the purposes of replacement. Two nuts are

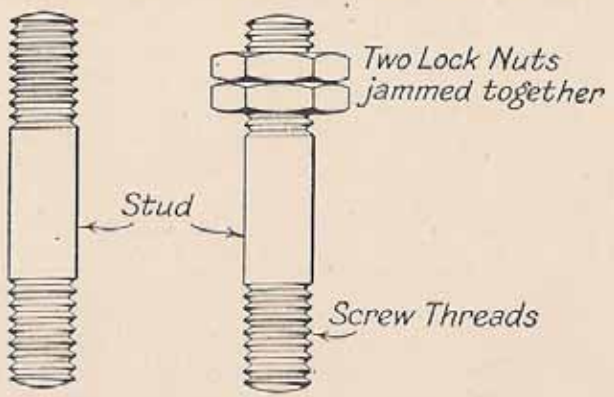


FIG. 47. HOW TO REMOVE TIGHT STUDS

locked together, and a spanner used on the bottom one to unscrew the stud.

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 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 head in place. It may strain or distort the cylinder.

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.

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 is 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 gear-box needs no attention whatever with the exception of replenishing with oil every 500 to 800 miles. Oil as used for the engine is suitable, but in any case a thick oil is the most suitable. It will facilitate the entry of oil into the box if the back wheel is slowly revolved (with gear lever in neutral) while pouring in the oil. An oil level indicator is provided in the form of a small shutter on the left-hand side of gear-box, looking at it from the front (see Fig. 48). When pouring in oil leave the shutter open, and as soon as oil begins to overflow, close it. This is the correct level, and no more oil need be inserted.

Adjusting Chain from Engine to Gear-box. To adjust this chain it is only necessary to slack off the two nuts on top of bracket and slide the box bodily backwards by means of the adjusting bolt (also seen in Fig. 48) 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.

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

First 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

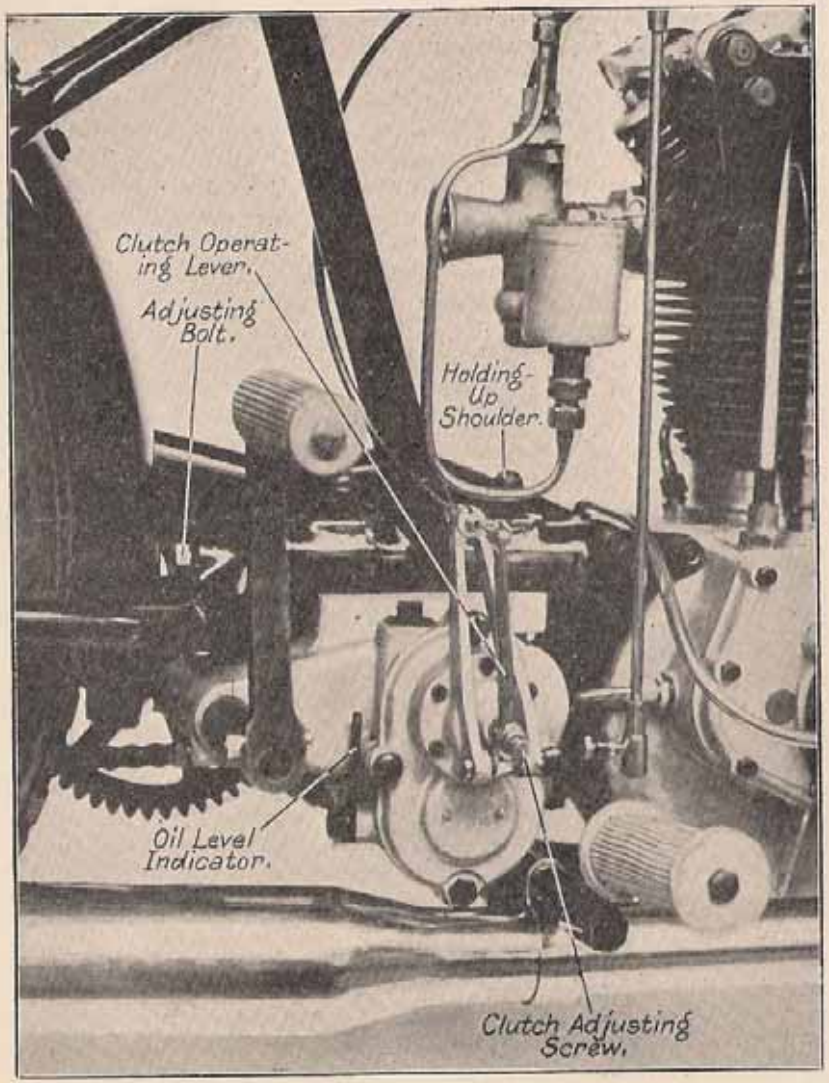


FIG. 48. SHOWING GEAR-BOX AND CLUTCH OPERATION
This shows the 3·49 h.p. O.H.V. Model, but is identical on all other models

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 right; 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 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 re-assemble simply reverse these operations.

Attention to Clutch. If the clutch 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. To take up excessive backlash in the Bowden lever on the handlebar adjust by means of the operating shaft adjusting screw shown in Fig. 48 (also in Fig. 31). A further adjustment is also provided at the point through which the cable passes. However, always allow a little backlash in the lever, or the clutch spring cannot exert all its pressure on the plates. If the clutch slips without any external 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 clutch plate (No. 2, Fig. 49) 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 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.

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 93). The

chain adjustment should be such that it can be depressed with the finger in the centre about ¾ 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. To dismantle the 7-99 h.p. clutch take off the front portion of chain case. Unscrew the clutch spring adjusting nut (No. 7, Fig. 49) and remove the spring (No. 8). Take out the cotter pin of the foot starter crank, and remove crank. This will allow the starting quadrant with the spindle

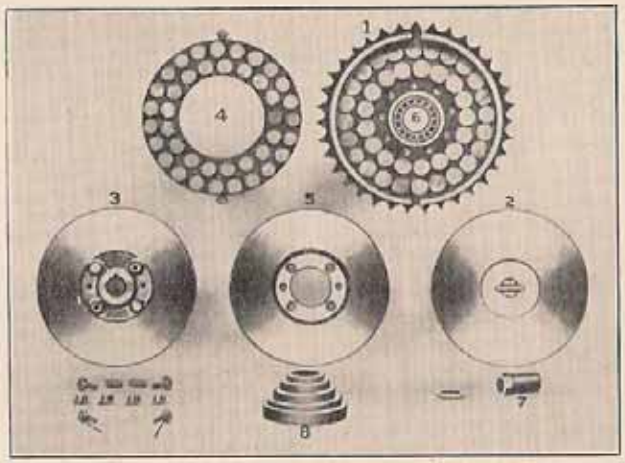


FIG. 49. THE 7·99 H.P. A.J.S. CLUTCH PARTS

to be withdrawn until it can pass the stop on the chain stay. The quadrant can then be swung clear of the clutch allowing the 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. 49) 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.

The 3·49 h.p. clutch parts are similarly dismantled and re-assembled, the only difference being that there are two less plates involved. In the case of the 7·99 h.p. and 4·98 h.p. clutch parts there are included some adjusting pins on the fixed plate. These rarely need attention. They are designed to counteract clutch "drag," but "drag" seldom occurs, and only after great and excessive wear of the clutch.

Care of Chains. Chain adjustment hitherto described is very important. If a chain is too slack, it is apt to "whip," which intensifies the wear and tends to break the rollers, especially in the case of the front chain. If, on the other hand, it is too light, a crushing effect is produced on the rollers, and the whole chain is stressed unduly.

As the chains on all A.J.S. models, except the 7·99 h.p. ones, are only partially enclosed, it is a good plan to make a point of oiling the chains every day before starting out. One oiling will suffice for a day's riding, whatever mileage is done. An oil gun is the best means of oiling the chains. With this instrument draw a charge of oil from the oil compartment of the tank, and insert spout of oiler into the chain case oil plug hole, which will be found on top of the part of the chain case above the front chain. Lift the exhaust valve, and while pressing down plunger of oil gun, slowly turn the engine over with the foot starter, being careful to see that the oil from the oil gun is falling on the chain. This ensures the whole chain being well lubricated. Treat the rear chain in the same way by revolving the back wheel. Long life, less need of adjustment, and complete satisfaction with the transmission is assured if the rider will make a point of oiling his chain frequently. From time to time the chains should be removed and thoroughly cleaned in a paraffin bath.

Coupling up a Chain. Always reconnect a chain with the spring link on the sprocket. This makes it perfectly easy, as all tension can be resisted by the teeth, and not by stretching the chain by hand.

Removing Chain Guard. On all 3·49 h.p. and 4·98 h.p. models the following procedure is necessary for removal of chain guard. First disconnect the rod from the foot pedal by undoing the yoke end pin. Then remove the two bolts found on the forward end of the guard, then the rear bolt on chain stay clip and the anchorage to carrier stay. The rear portion of guard can be removed independently of the front by means of the carrier stay anchorage previously referred to. It will be found, however, unnecessary to remove brake rod.

Chain Repairs. Chain repairs are rarely necessary. When they

are, they may be readily effected with the aid of a box of spare links, and the rivet extractor in the tool kit.

Play in Steering Head. All play in steering head should be taken up by means of the spring collar 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.

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 heads on the left-hand side until all slack is taken up. Afterwards tighten up lock-nuts.

Removing Rear Wheel. The rear wheel on all A.J.S. machines, with the exception of the standard sporting model (H5) is of the quickly detachable type. It can be removed in 30 seconds! In the case of the model 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. Remove the brake drum anchor pin, 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: Put the machine on the stand, 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 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 sprocket (see Fig. 50). 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 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 centre pin a few turns. 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

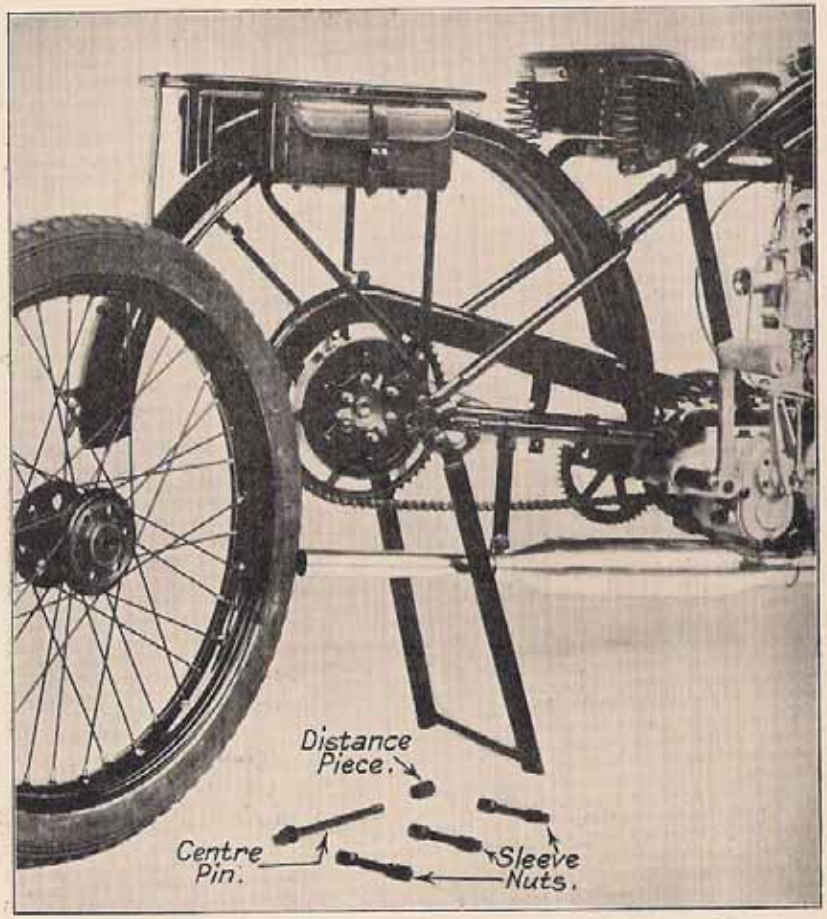


Fig. 50. The Rear Detachable Wheel on the 3·49 h.p. Model
The same system is adopted on all models with the exception of the H5

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 model H5. In the case of the sidecar outfits all three wheels are interchangeable, and the rear wheel can be interchanged with the front without disturbing in any way the speedometer drive.

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. 51). 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.

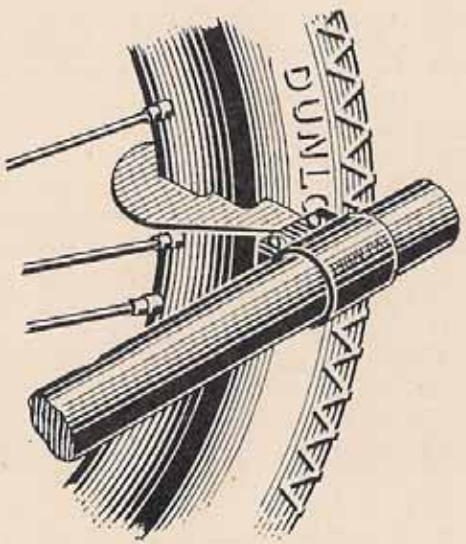


Fig. 51. Rear Wheel Alinement

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 or 3,000 miles.

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 slacking 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 yoke end, after detaching same from the operating lever of the brake drum. The front brake adjustment is carried out by screwing the cable adjuster until all slack is taken up. The adjuster will be found on a lug on the front fork, left-hand side.

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 expcsed 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 opening the compression cock slightly in the manner of a decompressor, closing instantly the engine fires. 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 chalk marks 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.

Maintenance of Lamps. Acetylene generators must be kept thoroughly clean throughout if proper gas generation is to be effected. Also the burner must be pricked out with fine wire frequently. An acetylene lamp must not be allowed to burn out, but should be blown out ; otherwise the burner will very soon become choked with carbon. Never use a metal tube for gas conveyance. Some metals, especially copper, form a very explosive mixture when brought in contact with acetylene gas. Should the rider's lamp blow out when no matches are available, the sparking plug may be used to light the lamp.

When a machine has a " Magdyno " lighting set, the accumulators should always be kept on charge, or they will rapidly deteriorate and become useless. When not in use, alternate slow

charging and discharging keeps them in good condition. Two accumulators should be fitted, so that one may be kept on charge while the other is not in use.

Tyre Maintenance. Tyre inflation has already been dealt with in Chapter III. Never run even a short distance on a deflated cover. It seriously strains the fabric and shortens the effective tyre life very considerably. Make a practice of occasionally going over the tyres and pricking out all small flints with the aid of a sharp pen-knife. Never leave the machine standing days on end unjacked. This is very bad for both wheels and tyres. Also be careful not to allow oil to get on the rubber, it will soon cause rotting. When one is riding in a blazing sun on a hot summer day the air in the tubes expands very greatly, due to the tyres getting hot after a time owing to their contact with the scorched roads, and the pressure should be relieved now and again by touching the Schräder valve pin.

Re-enamelling. While on the job of overhaul the owner can, if he likes, tackle the job of enamelling. But he cannot expect to get really lasting results, because he does not possess the means for stove-hardening the enamel like the manufacturers do. It is therefore best, if possible, to get the whole business done at Wolverhampton for quite a moderate charge. But remember the manufacturers cannot be expected to furnish an exact estimate until they have stripped the machine and know exactly how things stand. Therefore, do not inundate the repairs manager with queries regarding cost of plating and enamelling. Send the machine along and get an estimate afterwards. However, if the amateur decides to do it himself, the machine should be completely stripped and the old enamel scraped off to the metal with a knife, and then polished smooth with fine emery cloth. A coat of good quality enamel should then be applied with a brush. When dry it should be rubbed down with glass paper, and then another coat applied. This should be repeated until at least five coats have been applied, and then finish off with a coat of special varnish. When thoroughly dry the machine can be reassembled, and is now again ready to take the road. Black enamel gives the best service and, on the whole, the best appearance.

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 in the engine must be a perfect fit, dead true, with no friction or play. Experiments must be made with various ignition timings, and the carburettor tuned for speed. Gear ratios must 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 the 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.

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.

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.

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.

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.

Crossed Wires

Symptoms. Usually the engine 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.

Slipped Magneto Timing

Symptoms. Very sudden stoppage after running perfectly. If the sleeve lock-nut on the armature shaft works loose, the timing may slip, but it rarely happens, and cannot possibly happen on the 7·99 h.p. engines. Symptoms are unmistakable.

Remedy. Re-time and do up nut securely.

Defective Carbon Brush

Symptoms. Rank 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, inflexibility of engine and pronounced tendency to knock at the least provocation. If over retarded, great loss of power with explosions in exhaust.

Remedy. Re-time magneto with vernier adjustment.

Broken Ignition Cable

Symptoms. Those of incorrect timing in the direction of lateness, producing loss of power.

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 83).

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.

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.

Needle Valve not Closing Properly

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

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

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

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

Remedy. Bind with adhesive rubber 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 tuning 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 previous 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. More oil or better quality oil.

Loose Gudgeon Pin Bearing

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

Remedy. Fit a new bush (see page 86).

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

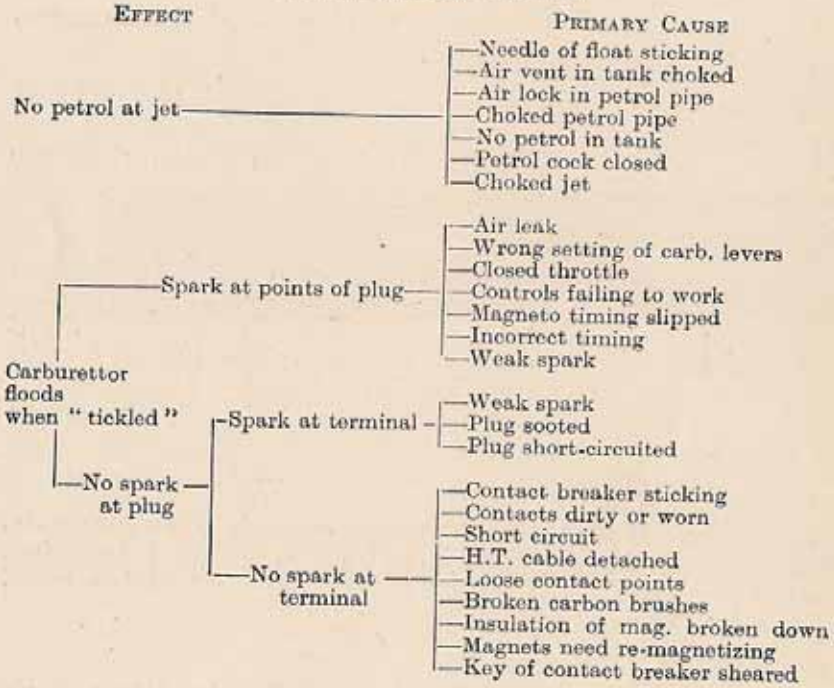


TABLE II

ENGINE STOPS

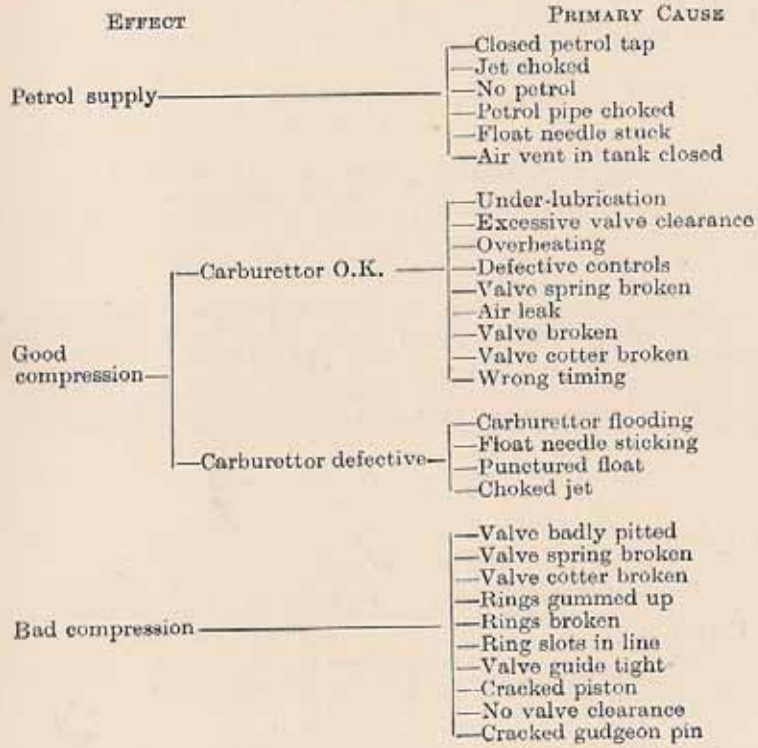


TABLE III

ENGINE RUNS BADLY

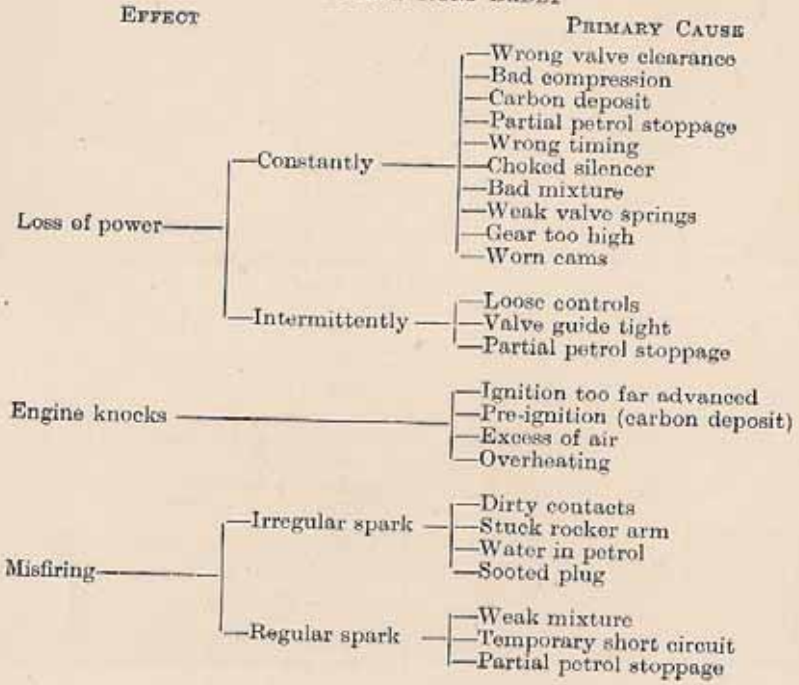
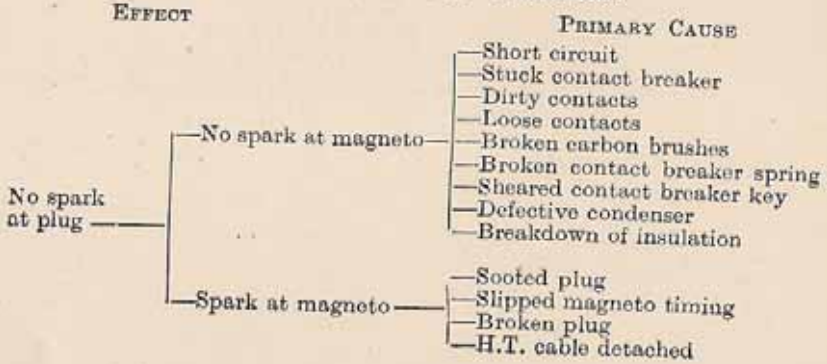


TABLE IV

ENGINE STOPS DUE TO IGNITION



CHAPTER VII

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. Every motor-cyclist, sooner or later, has a desire to extend his field of activities. He becomes tired of constantly wandering over his old routes, which are usually confined to a radius of about 50 miles from his home, and he wishes 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.

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 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 £7 or £8, and, of course, it will last indefinitely.

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, a 2¾ h.p. or 3½ h.p. machine should have a full consumption of at least 80 m.p.g., and when specially tuned should do about 90 to 100 miles on a gallon of spirit. A 4 h.p. machine should do at least 60 m.p.g., and an 8 h.p. machine at least 40 m.p.g. with sidecar. Ridden solo, these two last-mentioned machines should have a still smaller petrol consumption.

Oil Consumption. One quart of oil should suffice for a mileage of at least 500, with considerate driving of a solo machine up to 3½ h.p., and at least 350 in the case of the higher powered machines.

Tyres. Tyres, when well inflated, should have a useful life of from 4,000 to 8,000 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 have already been given in Chapters III and V. When buying new tyres it always pays to get the best, and nothing but the best.

Sparking Plugs. Quality here again is important. Cheap plugs give poor service, and soon want renewal. Buy plugs as recommended by the makers. These should only need annual renewal.

Buying Carbide. Always purchase carbide in 14 lb. lots; it is infinitely cheaper than buying it 1 lb. at a time. After using the lamp, rake out the solid particles and use again. Failure to do this results in great wastage. As previously mentioned, the cost of maintaining electric lighting sets (Magdyno) is negligible.

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 Béret. 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.

Goggles. Regarding goggles, the first consideration is the question of splinter-proof glass. One never knows when his machine is going to be involved in a smash, and the worst conceivable disaster would be irreparable damage to an eye or both eyes. Is it worth risking blindness for the sake of a few shillings? No, of course not. Therefore, buy either "Triplex" goggles or some type guaranteed unsplinterable. There are many designs of goggles on the market. It is best to select a type giving the widest range of vision, that is to say, the glasses must be close to the eyes. Rubber type goggles are apt to be rather offensive in hot weather; otherwise they are very good. We will leave the selection of goggles to the reader's discretion. Some riders detest goggles, and no printed words will ever induce them to use them. If no ill effects are produced to the eyes, there certainly seems no reason why goggles should be used, but when very high speeds are indulged in neglect to wear goggles is dangerous. Apart from the question of seeing at very high speed, a stone thrown up, or a fly entering the eye, at 70 m.p.h. can cause excruciating agony, and will probably result in the rider being thrown.

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 underclothing! 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 tripliques, 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.

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 triplique, referred to previously, enables the owner to travel in Finland, France, Italy, Holland, Belgium, Rumania, 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-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 7¼ m.p.h.

CHAPTER VIII

BUYING AND SELLING AN OLD MOUNT

Buying a Second-hand Machine. The inexperienced hand must proceed warily when contemplating the purchase of a second-hand motor-cycle. Preferably he, or she, should get the assistance and advice of an experienced driver when examining a machine with a view to its purchase. He should buy nothing but the best and most modern that can be afforded. There are plenty of first-rate bargains to be had, but at the same time there are numerous machines offered for sale at prices out of all proportion to their real values, and not a few absolute "fakes." It is worth while, therefore, making a fairly thorough examination and test of the machine.

Year of Make. First ascertain the year of make of the machine (this may be verified by referring to the registration book) by noting the engine and frame numbers. Also find out whether spare parts are obtainable by ascertaining whether the manufacturers are still in business or whether they have shared the fate of so many motor firms, i.e. been driven out of business by competition. A perusal of the advertising columns of one of the leading motor-cycle papers should give a fair estimate of the average sale price of a machine similar to what the prospective purchaser contemplates buying.

Examining the Machine. First take a general survey of the machine, noting the condition of the plating and enamel, but remember the machine may be in sound mechanical condition, even though its appearance is decidedly forlorn. Now scrutinize the frame carefully for the existence of cracks, rusting, and damage. Should the frame show signs of having met with an accident, turn the machine down at once. Now examine the forks for similar defects, and test their springiness; also note whether there is excessive play in the forks, and if so, whether it can be taken up. Carefully examine the condition of the wheel bearings, tyres, accessories, and tools. If the machine is a sidecar outfit, examine the points of attachment, and state of sidecar springs. Do not be influenced by the owner's assertion that everything is O.K. Examine everything yourself, and verify his statements. Having satisfied yourself that the machine is in very fair condition, proceed to test the engine.

Testing the Engine. Begin by turning the engine over compression and noting the resistance offered. If the engine has

perfect compression, it should be possible for the kick-starter pedal (if such is fitted) to bear the weight of an average man for several seconds on full compression. Carefully note the result of this test, and if the compression is found to be bad, ascertain why it is so. Remember that some engines are designed for low compression (especially those of the horizontal twin type), and therefore negative results from this test will prove nothing. Now rotate the engine several times with the exhaust lifter raised, and see whether the engine sounds tight. If there is any suggestion of clanking or rattling, the bearings are not in good, in fact, probably very bad, condition. Ask permission to remove the exhaust valve, and examine the faces of both valve and seat. Note whether the valve is pocketed (refer back to Fig. 38). If it is so, it indicates either carelessness or old age, or both, and your views about other parts should be tempered accordingly. The valve gear mechanism should be exposed, and the wheels and cams carefully examined. If worn, they will require renewal.

The condition of the piston and cylinder can only be gauged by experience, but if detected (piston will " slap " in cylinder when engine is running), the price of the machine should be carefully weighed, for piston " slap " is by no means a minor defect—it is usually indicative of an oval cylinder, necessitating regrinding of the cylinder and a new (over size) piston. Unless all other parts are in exceptionally nice condition, it is best not to purchase. Remember, however, that an alloy piston is loosely fitting when cold, and this must not be mistaken for the bad fitting of a cast-iron piston in its cylinder.

Trial Run. After the preliminary inspection the purchaser should insist on a trial run. In the case of a combination, the owner will probably ride in the sidecar ; otherwise he will probably demand a deposit to ensure a *bona fide* transaction. On this run the behaviour of the engine should be observed when running idle, accelerating, running at top speed, and last, but not least, when hill climbing. After a short run the crankcase should be felt. If hot it denotes serious gas leakage past the piston rings. Carefully note whether any noise beyond that of the tappets and valves is audible. If so, do not buy.

A Warning. The reader is advised to make quite sure that the vendor is the real owner of the machine, for if he purchases and subsequently the machine is claimed by the real owner, he must return the machine to the lawful owner, and has no redress except the doubtful one of suing the vendor if he has not already decamped.

Selling a Second-hand Mount. The foregoing information indicates roughly the questions likely to be asked in the disposal of a second-hand machine, and before attempting to sell the

machine it should be put into reasonably good order both externally and internally. As such it will command a higher price than if the defects are left unremedied, and will avoid irritating correspondence between the parties concerned in the transaction.

Selling Through an Agency. Several firms undertake to sell second-hand machines, the procedure in most cases being to value the machine and to allow the agent a commission on that price. Such agents usually sell the machine at a higher price than the owner would obtain privately, so that it is usually well worth while to adopt this procedure, so long as only a reliable firm is dealt with.

Selling by Advertising in Trade Paper. This is usually an excellent method of selling, because the trade papers classify the machines, so that an intending purchaser of an A.J.S. machine has only to glance down the small advertisement columns of one of the motor-cycling papers (as previously mentioned) to see comparative prices. The fact cannot be ignored that a prospective purchaser of a second-hand machine buys either *Motor-cycling*, *the Motor-Cyclist Review*, or the *Motor-Cycle*, and this method of selling is advocated.

Advertising in the daily or local press is also an excellent method of selling.

The reader is reminded of the rules given in Chapter II (regarding the registration book) which apply when the machine changes hands. Do not let the machine pass hands until the purchase price is handed over. Beware of those who require a trial run upon part payment.

CHAPTER IX

LEGAL NOTES

THE legal matters regarding licensing and registration having been disposed of in Chapter II, 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 44.

Endorsement of Licence. All convictions under the Motor Car Act, 1903, may be endorsed on the back of the licence, except a conviction for obstruction, and the first and second convictions for exceeding the speed limit. 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.

Furious Driving. A person driving furiously renders himself liable to conviction for the following offences—

1. Driving to the common danger.
2. Exceeding the speed limit.
3. If anyone injured, indictment for causing bodily harm.
4. If anyone killed, indictment for manslaughter.
5. Arrest by any person, whether constable or not, who sees the offence committed, under the Highways Acts.

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 driving to the common danger, 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) mark.

Rules Regarding Number Plate. The driver of a motor-cycle is guilty of an offence if the number plate is not properly fixed, or if it is 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, or

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.

Staying Proceedings. For certain minor offences, such as using a motor-cycle with an expired licence, a Council may sometimes under the Roads Act, 1920, write to the offender saying that they will stay proceedings provided the delinquent hands over a certain sum, usually equivalent to the fine that would be imposed. Unless the motor-cyclist is sure of his case it is best to fall in with such an arrangement.

Time Limit for Summons. Unless previously warned at the time the offence is committed, notice of an intending prosecution for exceeding the speed limit 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 any offence under the Motor Car Act, 1903, has the right of appeal to next Court of General Quarter Sessions, provided he did not plead "Guilty," in Courts other than Metropolitan. A right of appeal lies against an order disqualifying any person from obtaining a driver's licence.

Speed Limit. Many riders believe that the speed limit has been abolished, but, at the present, at any rate, this is not so; and, according to the strict letter of the law, no vehicle may be driven at a speed exceeding 20 miles per hour on the highway. Special limits of 8 or 10 miles per hour are fixed in certain towns and villages. These must be strictly observed.

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

1928 SUPPLEMENT

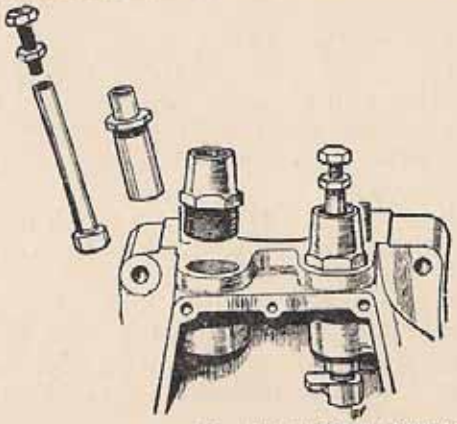
THE 1928 A.J.S. range is designated by the letter K. There are ten models marketed this year, three of which, viz., K.12, K.10, and K.7 are entirely new productions and were introduced to the general public at the 1927 Olympia Exhibition. These three models are of special interest and are deserving of description in some detail. Model K.12 is the "baby" of the A.J.S. range, while Model K.10 represents the opposite extreme. The first mentioned machine has a 248 c.c. engine installed, and is a perfect miniature in all respects of the 348 c.c. model.

The introduction of this lightweight model heralds the entry of the firm of A. J. Stevens & Co. (1914), Ltd., into a new field, while the production of the camshaft models represents nearly the last word in high efficiency racing machines, and they should have a strong appeal to all sporting riders. In view of the fact that the other models have specifications differing only in minor details from the 1927 ones, we shall not deal with them at length. On the table overleaf will be found interesting and useful abridged specifications of the whole of the 1928 range. Before dealing with Models K.12, K.10, and K.7, we will describe the detail improvements in design which are common to all models.

DETAIL IMPROVEMENTS IN DESIGN

Engines. All the A.J.S. power plants have been redesigned to a certain extent. The new cylinders and heads are more heavily

FIG. 52.—THE 1928 3·49 H.P. A.J.S. OVERHEAD VALVE ENGINE



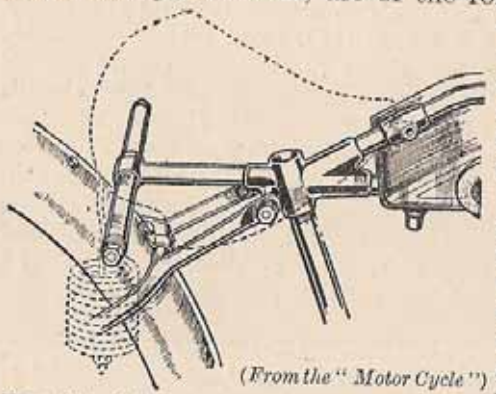
(From the "Motor Cycle")

FIG. 53.—NEW OILTIGHT TAPPET GUIDES MADE IN TWO PARTS

finned than were previous examples, and this results in considerably cooler running engines owing to the more rapid dissipation of heat which occurs with these extra heat-radiating surfaces.

The familiar bridge-pieces, turn-buckles and long bolts formerly used on all A.J.S. engines for holding down the cylinder barrel and cylinder head to the crankcase have now been discarded in favour of the more orthodox form, where four studs and nuts bolt the cylinder base firmly to the crankcase. The head is attached to the cylinder by the same method. This applies both to overhead and side-valve engines throughout the range.

On all except the overhead camshaft machines plain main bearings are now provided, the experience of the last year or so having shown their undisputed supremacy for this purpose. Big-end bearings, however, are of the roller pattern, long rollers of very small diameter being used, a type of bearing which, after a long course of experimental and research work, has been found to function excellently.



(From the "Motor Cycle")

FIG. 54.—SPECIAL SADDLE FIXING ON ALL A.J.S. MODELS

On the push-rod O.H.V. engines the overhead gear has been modified. Larger bearings are provided for the rockers, which are fitted with grease gun nipples, and the rocker standard plates are wider as may be seen by comparing Figs. 5 and 52, which illustrate last year's 3·49 h.p. engine (H.6) and this year's model (K.6). Oil-tight tappet guides of the type shown in Fig. 53 are now fitted and they are very effective in preventing pollution of the crankcase exterior.

Frames. These remain unaltered, except in that the chain-line has on the higher-powered machines been widened to permit of larger section tyres being fitted and a lower saddle position has been provided for. The new form of saddle mounting is illustrated in Fig. 54.

The saddle used on all models is the Terry with three-point suspension. The front is hinged to the top frame tube, and the springs are attached to what is virtually an extension of the lower tank tube, no underframe or seat pillar according to usual position being used.

Gear Ratios. Gear ratios on the 7·99 h.p. passenger outfits remain the same as for 1927. On other models, however, the

TABLE SHOWING PARTICULARS OF 1928 MODELS

Model	C.C.	Bore and stroke	Valves	Lubrication	Gear ratios	Tyre sizes	Unladen weight solo	Price solo	Price with sidecar
		mm.				in.	lb.	£ s. d.	£ s. d.
K.12	248	65 × 75	S.S.	Auto.	6, 10, 3, 15·8	25 × 3	191	41 15 –	—
K.5	348	74 × 81	S.S.	Auto.	6, 10, 15	26 × 2·75	215	45 15 –	60 15 –
K.3	348	74 × 81	S.S.	Mech.	6, 10, 15	26 × 3	230	49 5 –	64 5 –
K.6	348	74 × 81	O.H.	Mech.	5·5, 6·75, 10·5	26 × 3	226	52 10 –	67 10 –
K.9	498	84 × 90	S.S.	Mech.	4·3, 8·6, 15	26 × 3·25	275	57 15 –	74 5 –
K.8	498	84 × 90	O.H.	Mech.	4·3, 8·6, 15	26 × 3·25	275	62 10 –	79 – –
K.7	348	74 × 81	O.H.C.	Dry S	5·5, 6·75, 10·5	26 × 3	225	65 – –	80 – –
K.2	799	74 × 93	S.S.	Mech.	5, 9, 16	26 × 3·5	336	66 – –	84 – –
K.1	799	74 × 93	S.S.	Mech.	5, 9, 16	26 × 3·5	326	76 – –	84 – –
K.10	498	84 × 90	O.H.C.	Dry S.	4·65, 5·64, 9·16	26 × 3·25	265	76 15 –	93 5 –

S.S. = Side-by-side ; O.H. = Overhead ; O.H.C. = Overhead camshaft ; Dry S. = Dry sump.

ratios have been altered slightly. In some cases they have been raised, in others lowered.

Full particulars with regard to the new ratios are given in the table on the previous page.

Tyres. Larger size tyres are now fitted. On the passenger models in place of 26 in. by 3·25 in. tyres, tyres measuring 26 in. by 3·5 in. are now provided. These are the largest size tyres used on A.J.S. machines. Next in order of size come covers 26 in. by 3 in. which are fitted to models K.3, K.6, K.7. The remaining models, with the exception of K.5, K.12; are equipped with 26 in. by 3·25 in. tyres. Model K.5 has tyres 26 in. by 2·75 in., while the lightweight model, K.12, has tyres measuring only 25 in. by 3 in.

Lubrication. Mechanical oil pumps with auxiliary hand pumps are now fitted to all models except K.5, where the fitting of a mechanical pump is optional. In the case of the overhead camshaft machines a new lubrication system working on the " dry sump " principle is employed. This system is described elsewhere.

THE 2·48 h.p. LIGHTWEIGHT MODEL K.12

This newcomer to the A.J.S. range has a specification as follows—

ENGINE. A.J.S. design and manufacture. Single Cylinder (65 × 75 mm. bore and stroke, 248 c.c. capacity), fitted with detachable head, aluminium piston, roller bearing big end of connecting rod. Mechanically-operated side-by-side valves. Adjustable valve tappets. Efficient cooling. Enclosed valve lifter.

CARBURETTOR. Binks.

TANK. 1¼ gallons petrol, 3 pints oil.

LUBRICATION. Semi-automatic hand pump. (Mechanical lubrication, as illustrated, can be fitted to order at £1 extra.)

IGNITION. Lucas magneto. Handlebar control.

CHAINS. " Hans Renold," ½ in. pitch × $\frac{3}{16}$ in. wide. An efficient shock absorber is fitted to the engine shaft.

CHAIN GUARDS. Semi-enclosed type, giving easy access to the transmission.

GEAR-BOX. A.J.S. Counter-shaft three-speed gear, fitted throughout with ball bearings. Operated by an improved gate-change. Ratios 6·1, 10·3, and 15·8 to 1.

CLUTCH. Hand-controlled.

TYRES. 25 in. by 3 in. wired-on, Dunlop cord heavy non-skid.

MUDGUARDS. Improved design, affording excellent protection.

BRAKES. Front and rear internal expanding type. Rear operated by pedal on left-hand side of the machine. Front by lever on handlebar. Both are extremely powerful and smooth acting.

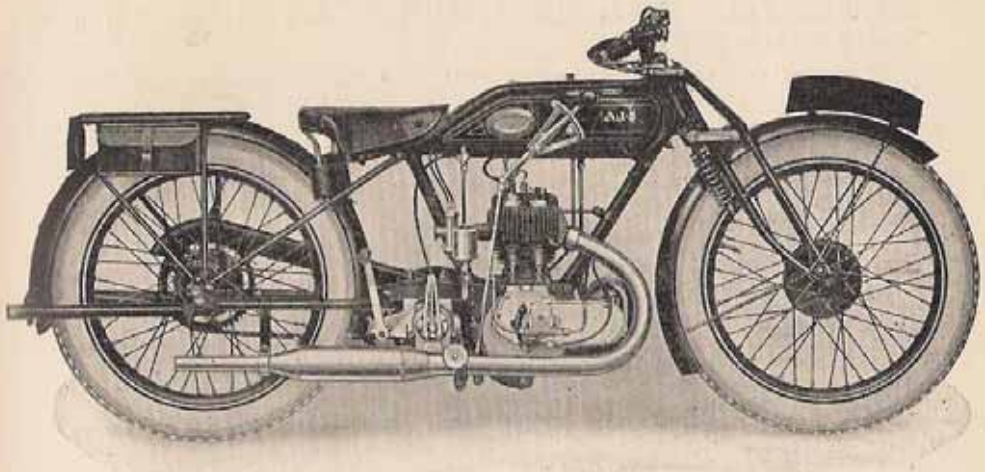


FIG. 55.—THE 2·48 H.P. LIGHTWEIGHT MODEL K.12

This machine has been produced in response to an insistent and widespread demand for a smaller version of the now famous 3·49 h.p. model. It should prove a popular mount for those who desire a light, reliable and economical machine with a good performance and low price. It is priced at £41 15s. only.

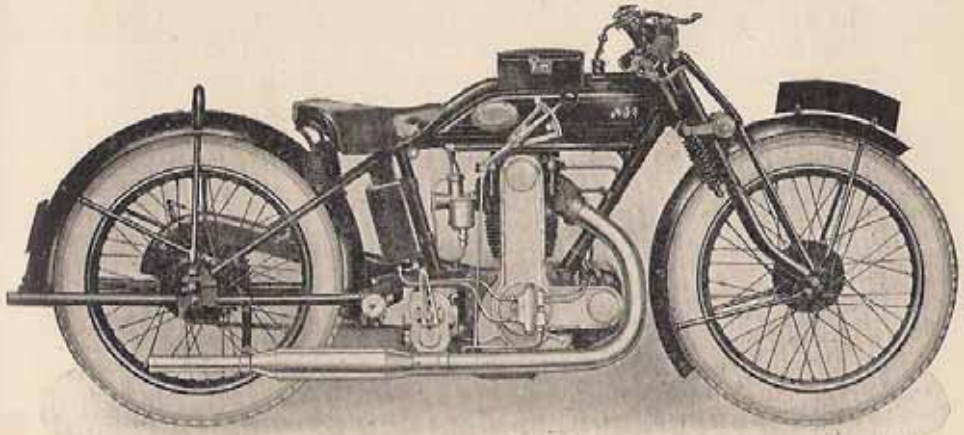


FIG. 56.—THE 4·98 H.P. OVERHEAD CAMSHAFT MACHINE, MODEL K.10

The above machine is the higher powered of the two new camshaft models marketed this year. Owing to minor defects in the early design it did not do itself justice in the last T.T. races, but since then it has been perfected. The machine is now capable of a phenomenal speed, and extended trials have elucidated the fact that it possesses a very high degree of reliability.

FORKS. Latest A.J.S. design. All links are adjustable for taking up side play.

HANDLEBARS. Semi T.T. pattern.

FOOTRESTS. Adjustable, allowing the rider to procure the most suitable riding position.

STAND. Fitted to rear wheel.

TOOL CASES. Two pannier bags, with full kit of tools.

STARTING. Improved design foot-starter gives very easy starting.

SADDLE. Terry spring seat No. 2.

MEASUREMENTS. Wheel base 4 ft. 2¼ in. Height of saddle 26 in.

TAX. 30s.

THE A.J.S. OVERHEAD CAMSHAFT MODELS

Two overhead camshaft machines are listed for 1928, Models K.10 and K.7, the former being of 4·98 h.p., and the latter 3·49 h.p., and their prices solo are £76 15s. and £65 respectively.

The overhead camshaft machine was first introduced in the 1927 T.T. races, and since then has given proof of its efficiency by winning such important Continental events as the 350 c.c. Grand Prix d'Europe, the Belgian Grand Prix, the Swiss Grand Prix, the Austrian Grand Prix, the Brooklands Grand Prix; and it has also figured conspicuously in the Grand Prix de Nations and the Ulster Grand Prix.

The 1928 camshaft engines are the latest development of the original T.T. design and retain all the outstanding features.

The overhead camshaft is chain-driven and fitted with a patent leaf spring tensioning device and a re-action damper is added to steady the drive, which after exhaustive tests has proved to be the last word in reliability and is undoubtedly the most efficient, simplest and most silent form of drive for an overhead camshaft.

The automatic mechanical lubrication of the engine is on the "dry sump" principle. A gear-driven double Pilgrim pump draws oil from the tank on the down-tube and supplies a pre-determined quantity to the cam box and to the big end. After lubricating the cams and rocker gear, the oil flows into the chain-case and lubricates the chain and half-time gears, and then falls into the sump by gravity. Oil is pumped to the connecting rod big end via passages in the driving-side main shaft and web of fly-wheel, and oil thrown from the big end by centrifugal force lubricates the cylinder walls and the small end of the connecting rod. Surplus oil flows by gravity into the sump, whence it is pumped back into the tank, so that oil is constantly being circulated throughout all the working parts of the engine. Every moving part of the engine is enclosed, and automatically and mechanically lubricated. It is interesting to note that with this

system ¾ gall. of oil passes through the big end bearing every hour when running at a road speed of 60 m.p.h. For very high, continuous all-out speeds, a pre-determined quantity of oil may be passed direct to the cylinder walls by the turn of a needle valve.

Other than periodically draining the sump and tank, and cleaning the filter, instructions *re* lubrication are—"Fill the

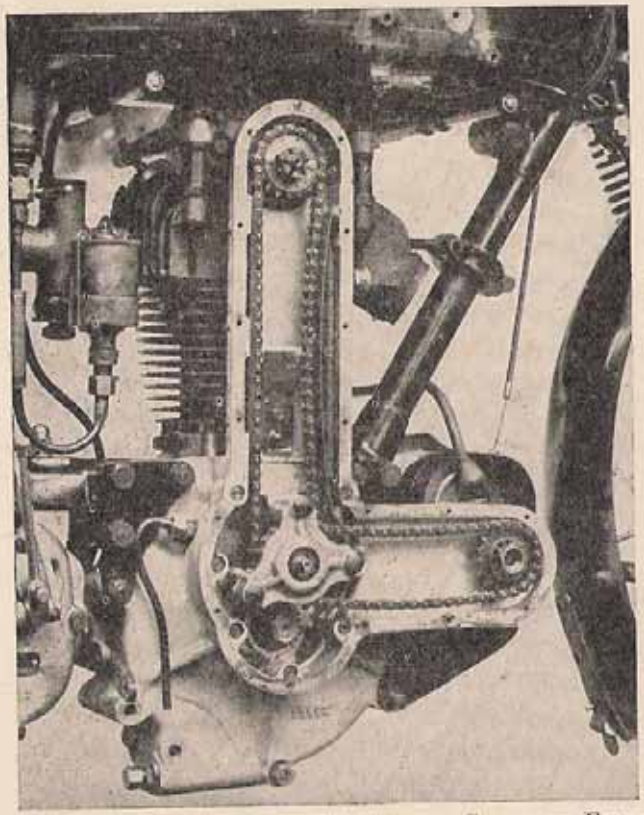


FIG. 57. VIEW OF 4·98 H.P. OVERHEAD CAMSHAFT ENGINE
The timing case covers are removed to expose the chain drive to the camshaft and magneto and also the special tensioning device

oil tank with oil, then forget lubrication until the tank requires replenishing."

THE 4·98 H.P. OVERHEAD CAMSHAFT MACHINE. MODEL K.10

The specification of this machine is as follows—

ENGINE. A.J.S. design and manufacture. 84 × 90 mm. bore

and stroke. 498 c.c. capacity. Overhead valves operated by chain-drive camshaft with patent tensioning device and re-action damper. Detachable head. Aluminium piston. Roller bearings to big end, ball races to main shafts, ball-bearing timing shafts.

CARBURETTOR. Binks special two-jet racing type with twist grip control.

TANK. 2 gallons petrol.

LUBRICATION. Dry sump. Separate oil compartment holding ½ gall., fitted to rear down-tube.

IGNITION. Lucas magneto. Handlebar control.

CHAINS. "Hans Renold" Extra-strong ⅝ in. pitch by ⅜ in. wide. A shock absorber is fitted to the engine shaft.

CHAIN GUARDS. Semi-enclosed type giving easy access to transmission and clutch.

GEAR-BOX. A.J.S. Counter-shaft three-speed gear fitted with ball-bearings throughout. Operated by an improved gate-change.

GEAR RATIOS. 4·65, 5·64 and 9·16 to 1.

CLUTCH. Multiple plate. Hand-controlled.

REAR WHEEL. Fitted with specially light hub and large diameter brake drum.

TYRES. Dunlop cord wired-on. 26 in. by 3·25 in.

MUDGUARDS. Narrow racing type.

BRAKES. Front and rear internal-expanding pattern. Extremely powerful and smooth acting. Rear operated by pedal on left-hand side footrest, and front by lever on left handlebar.

FORKS. A.J.S. design and make. Links adjustable for taking up side-play. Lower links fitted with shock absorbers.

TOOL CASE. Fitted on top of tank.

SADDLE. Terry spring-seat. No. 1 largest size.

HANDLEBARS. "T.T." type.

FOOTRESTS. Adjustable, allowing the rider to procure the most suitable riding position.

STAND. Fitted to rear wheel only.

MEASUREMENTS. Wheel base, 4 ft. 6½ in. Height of saddle, 28 in.

THE 3·49 H.P. OVERHEAD CAMSHAFT MACHINE. MODEL K.7

This model is a smaller replica of the 4·98 h.p. O.H.C. machine, and the general specification of this model as regards equipment is the same as Model K.10 other than the following—

ENGINE. 74 × 81 mm. bore and stroke. 349 c.c. capacity.

TANK. 1¾ gallons petrol.

CHAINS. ½ in. pitch × $\frac{5}{32}$ in. wide.

GEAR RATIOS. 5·52, 6·78, and 10·31 to 1.

TYRES. 26 in. by 3 in. Dunlop cord wired-on.

WHEEL BASE. 4 ft. 5¾ in.

CHAPTER XII

USEFUL INFORMATION

TABLE OF GRADIENTS

Gradient	Per Cent	No. of Feet Rise or Fall in 1 Mile
1 in 2	50	2640
1 „ 2½	40	2112
1 „ 3	34	1760
1 „ 3½	28	1508
1 „ 4	25	1320
1 „ 5	20	1056
1 „ 6	17	880
1 „ 7	14	754
1 „ 8	12½	660
1 „ 9	11	587
1 „ 10	10	528
1 „ 11	9	480
1 „ 12	8	440
1 „ 13	7¾	406
1 „ 14	7	377
1 „ 15	6½	352
1 „ 16	6¼	330
1 „ 17	6	311
1 „ 18	5½	293
1 „ 19	5	278
1 „ 20	5	264
1 „ 25	4	211
1 „ 30	3·3	176
1 „ 35	2·8	154
1 „ 40	2½	132

EQUIVALENT SPEEDS

Speeds in M.P.H.	Time Taken to Cover 1 Mile.
10	6 minutes
15	4 „
20	3 „
25	2 „ 24 seconds
30	2 „
35	1 „ 42⅞ „
40	1 „ 30 „
50	1 „ 12 „
60	1 „

APPROXIMATE ENGINE REVOLUTIONS

At Different Speeds—Miles per Hour

Gear Ratio. / Speed in Miles Hour	4	4¼	4½	4¾	5	5¼	5½	5¾	6	6¼	6½	6¾	7
5	260	276	292	309	325	346	358	374	388	404	420	437	453
10	520	552	584	618	650	692	716	748	775	808	840	875	905
15	780	828	876	927	975	1038	1074	1122	1160	1210	1260	1310	1360
20	1040	1104	1168	1236	1300	1384	1432	1496	1550	1615	1680	1750	1810
25	1300	1380	1460	1545	1625	1730	1790	1870	1940	2020	2100	2180	2265
30	1560	1656	1752	1854	1950	2076	2148	2244	2320	2420	2520	2620	2720
35	1820	1932	2044	2163	2275	2422	2506	2618	2710	2830	2950	3060	3170
40	2080	2208	2336	2472	2600	2768	2864	2992	3100	3230	3370	3490	3620
45	2340	2484	2628	2781	2925	3114	3222	3366	3490	3640	3790	3940	4070
50	2600	2760	2920	3090	3250	3460	3580	3740	3880	4040	4310	4370	4530
55	2860	3036	3212	3399	3575	3806	3938	4114	4270	4440	4630	4800	4980
60	3120	3312	3504	3709	3900	4152	4296	4488	4650	4850	5040	5240	5440

Diameter of Driving Wheels, 26 in.
For 24 in. Wheels, multiply revolutions by 1·08. For 28 in. Wheels, multiply by 0·93.

CYLINDER BORES AND STROKES IN MILLIMETRES AND INCHES

An Approximate Guide for Comparison

A Cylinder Measuring— Millimetres		Is Equal to— Inches
80 × 80	=	3⅛ × 3⅛
80 × 86	=	3⅛ × 3⅜
83 × 83	=	3¼ × 3¼
83 × 86	=	3¼ × 3⅜
86 × 86	=	3⅜ × 3⅜
84 × 90	=	3 5/16 × 3 9/16
90 × 90	=	3 9/16 × 3 9/16
90 × 110	=	3 9/16 × 4 5/16
95 × 115	=	3¾ × 4 9/16
100 × 115	=	3 15/16 × 4 9/16
105 × 118	=	4⅛ × 4⅝
108 × 120	=	4¼ × 4¾
110 × 125	=	4 5/16 × 4 15/16
112 × 128	=	4 7/16 × 5 1/16
114 × 130	=	4½ × 5⅛
116 × 134	=	4 9/16 × 5 5/16
118 × 138	=	4⅝ × 5 7/16
120 × 140	=	4¾ × 5½
122 × 143	=	4 13/16 × 5⅝
124 × 146	=	4⅞ × 5¾
126 × 148	=	4 15/16 × 5 13/16
128 × 150	=	5 1/16 × 5 15/16

FORMULAE FOR H.P.

S = Stroke in centimetres
D = Diameter of cylinder in centimetres
R = Revolutions per minute
N = Number of cylinders

R.A.C. Formula H.P. $= \dfrac{D^2 \times N}{16{\cdot}13}$

A.C.U. Formula = 100 c.c. = 1 h.p.

A more accurate formula is the Dendy Marshall, in which—

$$\text{H.P.} = \frac{D^2 \times S \times N \times R}{200{,}000}$$

TYRE SIZE EQUIVALENTS

65 Millimetres	= 2½ in.	650 Millimetres	= 26 in.
80 ,,	= 3 ,,	700 ,,	= 28 ,,
85 ,,	= 3¼ ,,	750 ,,	= 30 ,,
90 ,,	= 3½ ,,	800 ,,	= 32 ,,
100 ,,	= 4 ,,	870 ,,	= 34 ,,
105 ,,	= 4¼ ,,	910 ,,	= 36 ,,
120 ,,	= 5 ,,	1010 ,,	= 40 ,,

LIGHTING-UP TIME TABLE, 1928 and 1929

(Summer Time Allowed for)

January				July			
1	4.31 p.m.	19	4.55 p.m.	4	9.49 p.m.	24	9.32 p.m.
5	4.35 ,,	23	5.2 ,,	8	9.47 ,,	28	9.26 ,,
9	4.40 ,,	27	5.9 ,,	12	9.44 ,,	31	9.22 ,,
13	4.46 ,,	31	5.16 ,,	16	9.41 ,,		
17	4.52 ,,			20	9.37 ,,		
February				**August**			
2	2.50 p.m.	22	5.56 p.m.	3	9.16 p.m.	23	8.39 p.m.
6	5.27 ,,	26	6.2 ,,	7	9.9 ,,	27	8.30 ,,
10	5.34 ,,	27	6.5 ,,	11	9 2 ,,	31	8.21 ,,
14	5.41 ,,			15	8.54 ,,		
18	5.49 ,,			19	8.47 ,,		
March				**September**			
2	6.11 p.m.	22	6.45 p.m.	4	8.12 p.m.	24	7.26 p.m.
6	6.18 ,,	26	6.52 ,,	8	8.3 ,,	28	7.17 ,,
10	6.24 ,,	30	6.58 ,,	12	7.54 ,,	30	7.12 ,,
14	6.31 ,,			16	7.45 ,,		
18	6.38 ,,			20	7.36 ,,		
April				**October**			
1	7.1 p.m.	21	8.35 p.m.	4	6.3 p.m.	24	5.20 p.m.
5	7.8 ,,	27	8.45 ,,	8	5.55 ,,	28	5.12 ,,
9	7.15 ,,	30	8.49 ,,	12	5.46 ,,	31	5.7 ,,
13	8.21 ,,			16	5.37 ,,		
17	8.28 ,,			20	5.29 ,,		
May				**November**			
1	8.51 p.m.	19	9.20 p.m.	3	5.1 p.m.	23	4.42 p.m.
5	8.58 ,,	23	9.25 ,,	7	4.55 ,,	27	4.28 ,,
9	9.4 ,,	27	9.30 ,,	11	4.48 ,,	30	4.26 ,,
13	9.10 ,,	31	9.35 ,,	15	4.42 ,,		
15	9.14 ,,			19	4.37 ,,		
June				**December**			
4	9.39 p.m.	24	9.51 p.m.	3	4.24 p.m.	23	4.24 p.m.
8	9.43 ,,	28	9.51 ,,	7	4.22 ,,	27	4.27 ,,
12	9.46 ,,	30	9.51 ,,	11	4.21 ,,	31	4.30 ,,
16	9.49 ,,			15	4.21 ,,		
20	9.50 ,,			19	4.22 ,,		

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	GB	Gt. Britain & Ireland	NL	The Netherlands
B	Belgium	GR	Greece	P	Portugal
BG	Bulgaria	H	Hungary	R	Russia
CH	Switzerland	I	Italy	RM	Rumania
D	Germany	MC	Monaco	S	Sweden
E	Spain	MN	Montenegro	SB	Servia
F	France			US	U.S.A.

LIST OF A.J.S. AGENTS AND SERVICE

ENGLAND

Town	Agent
Accrington	A. & W. N. Jepson, Whalley Road
Albrighton	A. A. Lockley, Hayfield Garage
Alford, Lincs	H. H. Harrison
Alston, Cumberland	J. H. Henderson, The Garage
Alcester	The Alcester Motor Co., The Priory
Aldershot	Phillips Bros., Birchett Road
Alfreton	J. H. Raynes, Station Garage
Ambleside	(see R. Smith, Windermere)
Amersham	(see R. Newitt, High Wycombe)
Alnwick	Messrs. Blackshaw & Co.
Andover	W. J. Randall, 3 High Street
Anstey, nr. Leicester	W. Naylor, The Garage
Appleby	W. Atkinson, Market Place
Ashby de la Zouch	W. Hemsley, 63 Market Street
Ashington	J. W. Gibson, West End Garage
Ashton-under-Lyne	Hurst & Co., Scotland Street
Ashton-in-Makerfield	Andrews, Ltd.
Askrigg	Messrs. Kettlewell
Ashover	(see H. Robotham, Clay Cross)
Aston	Cox's Garage, Lichfield Road
Axbridge	(see J. Pruen, Weston-super-Mare)
Aycliffe	(see Duplex Motor Co., Darlington)
Aylesbury	Eborn's Garage, 44 Walton Street
Aylesham	Cooper Bros., Red Lion Street
Bagby	(see Duplex Motor Co., Darlington)
Baldock	(see J. Chalkley, Hitchin)
Banbury	G. L. Ginger, 17 Parsons Street
Barnard Castle	E. Watson, Galgate
Barnsley	Carr & Waterhouse, 23 Peel Street
Barnstaple	A. S. Jones, 70 High Street
Barrow-in-Furness	J. H. Keat, West Mount Garage
Barton-on-Humber	T. H. Grassby, King Street
Bath	Pike, 15 St. James's Parade
Battle	(see Ray & Sons, Hastings)
Beckingham	(see Portland Motor Co., Mansfield)
Bedford	Imperial Cycle Co., 58 St. Loyes
Belford	T. H. Dixon, South Garage
Berkeley	(see Phillips & Son, Dursley)
Berwick-on-Tweed	T. Lilburn, Motor Agent
Bewdley	T. Jenks, Wribbenhall
Bexhill-on-Sea	E. J. Hilder, 22 Sackville Road
Bexley Heath	Clock Tower Garage
Billingham	(see R. Archdale, Stockton-on Tees)

Town	Agent
Bingley	R. Hall, 106 Main Street
Birkenhead	J. H. Marston, 50 Argyle Street
Birmingham	P. J. Evans, Ltd., John Bright Street
"	Premier Motor Co., Aston Road
"	F. Whitworth, Ltd., New Street
"	F. Hallam, 88 Bristol Street
"	The Highgate Motor Co., 6 Highgate Road
Bishop's Stortford	H. G. Green, 72 South Street
Blackburn	J. Walsh, Waltham Garage, Randall Street
Blackpool	John Hall, 143 Church Street
Blakeney, Norfolk	H. J. Pye, Marston Road Garage
Bodmin, Cornwall	P. Jane, Breeshute Lane
Bolton	Horrockses Motor House, Bradshawgate
Bolsover	(see Portland Motor Co., Mansfield)
Boston, Lincs	Holland Bros., Wide Bargate
Bournemouth	A. G. H. Alsford, 41 Palmerston Road, Boscombe
Bradford	E. G. Merrick, 174 Listerhills Road
"	A. Hodgson, 10 Horton Road
"	C. Sidney, 140 Manningham Lane
Bradford-on-Avon	E. W. Stone, Station Garage
Braintree	G. Cox, Motor Agent
Brampton, Cumb	J. & S. C. Shipley, 25 High Cross Street
Brentwood	Rippon Bros., 26 High Street
Bridgnorth	S. Minshall, Falcon Garage
Bridgwater	F. A. Pine, Taunton Road
Bridlington	J. T. Kilvington, Hilderthorpe
Brierley Hill	A. W. Bastock & Co., Ltd.
Brigg	G. H. Layne & Co., The Garage
Brighton	F. T. Turpin, 29 Preston Road
Bristol	S. J. Fair, 201 Cheltenham Road
Bromley, Kent	T. L. Love & Co., Ltd., 21 Park Road
Bromsgrove	W. H. Chapman, 119 High Street
Brough, Westmorland	F. Allison, George Garage
Brownhills	G. Clarge & Co., Premier Garage, High Street
Broxton	(see Marston's, Ltd., Chester)
Bruton	(see J. Moffat, Yeovil)
Buckley	(see Marston's, Ltd., Chester)
Burgess Hill	(see F. T. Turpin, Brighton)
Burnham-on-Sea	(see R. H. Tucker & Co., Highbridge)
Burnley	J. Hobden & Sons, St. James' Street
Burscough Bridge	(see J. L. Balmforth, Ormskirk)
Burslem	F. Lycett, Market Place
Burton Agnes	(see Holtby, White & Co., Bridlington)
Burton-on-Trent	S. A. Morecroft
Bury	J. Pilling, Rock Street
Bury St. Edmunds	R. Hawkes, Motor Agent
Caldwell	(see Duplex Motor Co., Darlington)
Callington	Glover & Uglow, Kelly Bray
Calne	Calne Auto Co., London Road Garage
Camborne	A. T. Wasley, 115 Trelowarren Street
Cambridge	King & Harper, Bridge Street
Camelford	G. Braund, Motor Engineer
Cannock	Bird & Yates, Crown Garage, Walsall Road
Canterbury	E. J. Philpot, Ltd., 34 St. George's Street
Cardigan	The Bridgend Foundry & Eng. Co.
Carlisle	J. J. A. Dias, 36 Warwick Road

Town	Agent
Castle Hedingham, Essex	Tills V. Smith
Castleford	J. H. Briggs, Bridge Street
Catterick Bridge, Yorks	J. Fawsett & Sons
Chatteris, Cambs	J. F. Wilderspin, High Street
Chelmsford	Cleale & Hadler, Ltd., London Road
Cheltenham	H. E. Steel, Ltd., High Street
Chester	Marston's (Chester) Ltd., Bridge Street
Chesterfield	Jervis, Horns Garage
Chichester	Reeve's Garage, North Street
Chippenham	(see A. Smith & Sons, Stanton)
Chipping Norton	J. H. Hartwell, 19 High Street
Chorlton-cum-Hardy	Nicholson Smith, 156 Barlow Moor Road
Churchill, nr. Bristol	F. W. Owen
Cirencester	C. F. Edwards, Castle Street
Clacton-on-Sea	J. Derrett, Orwell Road
Clay Cross, Derbys.	H. Robotham, Thanet Street
Clevedon	(see J. Pruen, Weston-super-Mare)
Clitheroe	J. F. Bentham, Market Place
Clowne, Chesterfield	E. Sherwin, 35 North Road
Coalville	Midland Cycle Co., High Street
Colchester	Motor Cycle and Light Car Depot, 119 High St.
Coleford, Glos.	Higgs & Niblett, Newland Street Garage
Consett	J. W. Crawford, Motor Engineer
Coventry	W. Brandish & Sons, 65 Foleshill Road
Craven Arms	J. C. Harper, Motor Eng.
Cresswell, nr. Mansfield	H. C. Crossfield, Sheffield Road
Crewe	F. Wooldridge, High Street
Cromer	Messrs. The East Coast Garage
Crook, Co. Durham	Gill Bros., 23 Hope Street
Croydon	Allen Bennett Motor Co., 9-10 Royal Parade
Cullompton	Batton Bros., Motor Engineers
Darlington	Duplex Motor, Grange Road
Dartford	J. C. Beadle, Ltd., Spital Street
Darwen	J. Duxbury, 4 Blackburn Road
Daventry	Cheshire & Berwick, Sheaf Street
Derby	H. Palin, Ltd., Bourne Street
Dereham (East)	Clarke and Sorrell
Devizes	G. Howley, 14 Estcourt Street
Didsbury	T. Spann, 29 Barlow Moor Road
Dinnington	J. Drabble & Sons, 73 Doe Quarry Lane
Diss	J. Aldrich & Co., Ltd., Market Hill
Doncaster	T. Stott & Sons, Westfield Park Garage
Dorchester	W. G. Churchill, "Top-o'-Town"
Dorking	Meeton Motors, 41 South Road
Dover	W. J. George, 192 Snargate Street
Downham Market	P. D. Watson, Bridge Road
Driffield	A. E. Hillaby, Middle Street
Droitwich	Hunt Bros., Hanbury Road
Dudley	Whorton & Christopher, Wolverhampton Street
Dunmow, Essex	A. Archer, Motor Cycle Agent
Durham	Smith Ltd., 73 New Elvet
Dursley	Phillips & Sons, Silver Street
Eastbourne	F. Ray & Sons, 47 Seaside Road
East Grinstead	Foster's Garage, 32 Cantelupe Road
East Kirkby, Notts	W. J. Cresswell, Kingsway

Town	Agent
Eastwood	Clifford Motories, 21 Nottingham Road
Egham	Egham Motor Co., 157 High Street
Egremont, Cumb	Stout's Garages
Ellesmere, Salop	J. R. Hughes, Victoria Garage
Ely, Cambs	The Walbro Cycle & Motor Cycle Co.
Enfield	Howards, 72 Chase Side
Evesham	F. Morrall, Motor Agent
Ewell	W. E. Line, Ewell Motors, High Street
Exeter	P. Pike & Co., 7 Bath Road
Fakenham	Southgates Ltd. Motor Tractors
Falmouth	Easom & Co., Market Street, Penryn, Cornwall
Fareham	Bennett & Righton
Fazeley, Staffs	B. Fidgeon, Motor Engineer
Felixstowe	Rose Bros. (F'stowe) Ltd., Motor Engineers
Fence Houses	Sanderson's Garage
Framlingham	A. G. Potter, The Garage, Station Road
Frodsham	T. Booth
Frome	P. Difazio, Motor Engineer
Gainsborough	Baines Bros., Motor Engineers
Gateshead-on-Tyne	O. Carmichael, 81-83 High West Street
Gilberdyke, Yorks	W. Clayton, Motor Cycle Agent
Gillingham	E. McGrath, Motor Engineer
Gloucester	W. B. Gibb, 100 Northgate Street
Goole	N. A. de Cobain, Bridge Street
Grantham	Campion Cycle Co., 26 High Street
Great Yarmouth	St. John's Yarmouth (Motors) Ltd., 96 Regent Road, Great Yarmouth
Grimsby	G. Hildred (Motors) Ltd., Hainton Square
Guildford	Crow Bros., High Street
Gunnislake	Slocombe's Garage
Hale, Ches.	C. R. Alexander, Ashley Road
Halesowen	Shaw Bros., Hagley Street
Halifax	The Halifax Motor Ex., Horton Street
"	L. H. Carter, 14 Powell Street
Hartland	Huggins Bros.
Harrogate	Baines Bros., 23 Commercial Street
Hastings	F. Ray & Sons, Ltd., 29 Havelock Road
Heemondwike	James Martin, 9 Westgate
Helmsdale	George Palmer
Helston	R. Lory & Son, 16 Wendron Street
Henley-on-Thames	Talbot Bros., Motor Cycle Agents
Hereford	Hereford Motor Co., Ltd., Eign Street
"	J. Fryer, Dragon Garage
"	Sidney Jones, Clehouger
Hexham	T. W. Forster, Motor Engineer
Highbridge, Som.	R. H. Tucker & Co., Auto. Engineers
High Littleton, Som.	James & Sons, Auto. Engineers.
High Wycombe	R. Newitt, 67 Easton Street
Hinckley	R. White & Son, Central Motor Garage
Hitchin, Herts	F. Chalkley & Son, Brand Street
Holsworthy	G. Earnshaw, Cloth Hall Street
Honiton	Moor's Garage, Motor Engineers
Horncastle, Lincs	J. T. Friskney, Motor Agent
Horsham	Rice Bros., Springfield Road

Town	Agent
Houghton Regis	H. A. Tompkins
Hoyland, nr. Barnsley	G. Neil, Motor Cycle Agent
Huddersfield	J. P. Whitlock & Sons, The Garage
Hull	H. Welburn, Saner Street
"	J. Kennington & Sons, 54 Jameson Street
"	N. Jordan, 20a Story Street
Huntingdon	Nurkett Bros.
Ilfracombe	G. Labett, 55 High Street
Ilkeston	Premier Garage, Market Street
Ipswich	W. Popplewell & Son, Woodbridge Road
Ironbridge	E. Brown, Dale End Motor Garage
Ivybridge	W. H. Bowden & Sons, 23 Western Street
Keighley	A. Jackson, Motor Agent
Kelsall	(see Marston's Ltd., Chester)
Kelvedon, Essex	T. F. Glover, Motor Engineer
Kendal	J. Parker & Sons, Longpool
Keswick	Edmondson & Sons
Kettering	Harry Taylor, Montagu Street
Kidderminster	T. Saunders, 50 New Road
Kingsbridge	Oke Bros., The Garage
King's Langley	E. McMillan, High Street
King's Lynn	W. J. Johnson & Sons, St. James's Street
" "	A. M. Ewen, 25 Broad Street
Kingston-on-Thames	Kingston Services Garages, Ltd., 24-28 High Street
Kirkby Lonsdale	S. Morris, 37 Main Street
Kirkbymoorside	W. Hodgson & Sons, Motor Agents
Knutsford	J. Butterworth, 35 King Street
Lancaster	A. & W. N. Jepson, Penney Street
Launceston	J. Wooldridge, Western Road
Leamington	D.R.'s Motor Cycle Depot, 20 The Parade
Ledbury	G. Hopkins & Son, New Street
Leeds	A. I. Greenwood, 39 Guildford Street
Leek	Charles Barnett
Leicester	W. Chapman, 113 Belgrave Road
"	W. Pye & Co., London Road
"	W. Warwick, 72a Hinckley Road
"	Colmore Depot, High Street
Leigh	Gerrard & Sons, 142 Chapel Street
Leighton Buzzard	A. Stratford, Motor Engineer
Leominster	Scandrett & Phelps, Mill Street
Lichfield	D. R. Fox
Lincoln	Lincoln Cycle Co., Corporation Street
"	W. Wilson, 29 Canwick Road
Liphook	Moss, Son and Bro., Motor Engineers
Littlehampton	Progress Motor Works
Liverpool	O. Wade, 9 Camden Street
London	H. Taylor & Co., Ltd., 49-53 Sussex Place, S.W.
"	W. Whiteley, Ltd., Queen's Road, Bayswater, W.2
"	Reys Ltd., 173 Great Portland Street, W.1
"	Wauchope's, 9 Shoe Lane, E.C.
"	A. G. Daw, 114 Brixton Hill, S.W.2
"	Lamb's Ltd., opp. Hoe St. Station, Walthamstow, opp. Great Portland Street Station, 50 High Road, Wood Green

Town	Agent
London	E. F. Morris & Co., Ltd., Marmet House, Finchley Road, N.W.3
,,	Selfridge & Co., Ltd., Oxford Street, W.1
,,	Sprosen's, Ltd., 111 Gt. Portland Street, S.W.1
,,	W. Whitby & Son, 7 The Vale, Acton, W.3
,,	Burlington Motors, Ltd., Clapham Common, S.W
,,	Cleare & Co., 125 High Street, Woolwich, S.E.
,,	Lovetts, Ltd., 418 Romford Road, Forest Gate, E.7, and 61 Holborn Viaduct, E.C.
,,	T. J. Ross, 84-86 High Road, Lee, S.E.
,,	F. Parks & Son, 10 Langley Road, Catford, S.E.6
,,	Ratcliffe Bros., 200 Great Portland Street, W.1
,,	Godfreys, Ltd., 208 Great Portland Street, W.1
,,	Homae's, 243 Lower Clapton Road, E.5
,,	Ralph & Co., 28-29 Spring Street, Paddington, W.2
,,	S. E. Clapham, 27 Stockwell Street, Greenwich, S.E.10
,,	Longman Bros., 17 Bond Street, Ealing Broadway, W.5
,,	Maude's Motor Mart, 100 Great Portland Street, W.
,,	Rideezi Sales, Ltd., 5 Victoria Street, S.W.1
,,	C. A. Blay, 192 Heath Road, Twickenham
,,	The Crystal Garage, Church Road, Upper Norwood
,,	Harrow Motor & Eng. Co., Station Bridge
,,	Turner Bros., Green Lane, Palmers Green
,,	Naylors, 406 Garratt Lane, Earlsfield
,,	L. Stevens, 151 Goldhawk Road, Shepherd's Bush
,,	A. Rivett, 236 High Road, Leytonstone
,,	H. Nash, 391 King Street, Hammersmith
,,	The Service Co. Ltd., High Holborn
,,	Eagles & Co., 275 High Street, Acton
,,	Studer Cycle Co., 157 Walton Road, E. Molesey
,,	Heckford Eng. Co., Coldharbour Lane
,,	South Eastern Motor Works, Peckham Rye
,,	Foster's Ltd., 74 Highbury Park, Highbury Barn.
,,	Eton Street Motors, Richmond
,,	Kirk & Co., Praed Street, Paddington
,,	Pearson Motor Depot, 7 Cambridge Place
,,	W. J. Reynolds, 157 High Street, North East Ham
,,	J. Grose, Ltd., Euston Road, N.W.1
,,	Recorder Cycle Co., 325 Fore Street, Edmondham
,,	Broadway Garage, 75 High Street, Hounslow
,,	B. B. Clark, 223 Hammersmith Road, W.6
,,	J. F. Temple, 11 Edgware Road, Marble Arch
,,	Barty's Motor Works, Central Garage, Gravesend
,,	Jones Garage, 79 Stroud Green Road, Finsbury Park
,,	Pneumo Motors, Lower Clapton Road
,,	Watford Motor Co., High Street, Watford
,,	P.A.S. Motors, Upper Richmond Road
,,	Pratleys Garage, Grays, Essex
Long Eaton	A. H. Moore, College Street
Longton	Leese's Garage, Meir Lane, Meir
Louth, Lincs.	L. T. Hill and J. C. Farrow
Lowestoft	Taylor Brothers
Ludlow	Messrs. Larcombe, Market Place
Lymington	C. S. Barrow, 79 High Street

Town	Agent
Macclesfield	T. Simister, 24 Jordangate
Maidenhead	Heybourne & Co., Wellington Garage
Maidstone	Rootes, Ltd., Len Engineering Works
Maldon, Essex	Bate's Motor Works, Ltd.
Maltby	A. and H. Brown, Rotherham Road
Manchester	Colmore Depot, 200 Deansgate
Manningtree	The S.X. Garage, High Street
Mansfield	Portland Motor Co., 58 Leeming Street
March	Henry Rose, High Street
Mareham-le-Fen	Gosling & Sons, Motor Engineers
Market Drayton	Hallaway Bros.
Market Harboro'	T. J. Marriott, Coventry Road
Market Rasen	Topliss & Co.
Market Weighton	Robertson & James
Marlboro', Wilts	F. C. Harcombe, Bells Garage
Maryport	Ritchie Bros., The Garage
Melton Mowbray	Garner & Son, 5 Cheapside
Mexborough	G. Smith, 52 Main Street
Middlesbrough	William Armstrong, 242 Linthorpe Road
Millom, Cumb	J. H. Bennett, Holborn Hill
Minehead	Perry & Co., North Road Motor Works
Monkwearmouth	Byers & Sons, Ltd., 23 Roker Ave., Sunderland
Morecambe	Morecambe Motors, Ltd., Harbour Garage
Nelson	J. Hebden & Sons, 71 Scotland Road
Newark-on-Trent	Pratt & Gelsthorpe, Balderton Road
Newbury, Berks	E. C. Wheeler, The Broadway
Newcastle-on-Tyne	Percy Motor Co., 68 Northumberland Street
Newcastle, Staffs	T. P. Moorley, Ironmarket
Newmarket	N. V. Golding, Park Lane
Newport, Salop	E. P. Everest, High Street
Newton Abbot	Western Garage and Eng. Works
Ninfield, Sussex	B. Mepham
Northampton	F. J. Bull, 228 Wellingboro' Road
North Shields	Thomas Wakefield, Albion Road
Norwich	H. Chapman, 42 Duke Street
Nottingham	Widdowson & Co., 87 Arkwright Street
Oakham	H. Rimmington, 51 Brooke Road
Okehampton	Glass & Sons, Motor Engineers
Oldbury	Watson & Sons, Birmingham Street
Oldham	J. P. Parry, 68 George Street
Old Leake	T. W. Sergeant, Motor Engineer, Lincs
Olney	F. Soul, High Street South
Ormskirk	R. Bamber & Co.
Oswestry	Messrs. L. J. Gittens, 35 Church Street
Oundle, Northants	Ashworth Bros., Motor Engineers
Oxford	F. E. Wootten, Ltd., High Street
Oxted	Rice Bros., Station Road
Peasmarsh, near Rye	E. E. Farley, Motor Engineer
Penrith	J. B. Milburn, Ltd., Middlegate
Penryn	Easom & Co., Market Street
Penzance	Taylor's Garage, Greenmarket
Peterborough	Turnill, North & Co., 55 Broad Bridge Street
Petersfield	W. J. Tew & Sons, 20 Lavant Street
Pleasley, nr. Mansfield	A. A. Palfreman, Motor Agent

Town	Agent
Plymouth	T. D. A. Chapman, 83 Old Town Street
,,	P. Pike & Co., Ltd., 35 Union Street
Pontefract	G. W. Shepherd, Corn Market
Potters Bar	Charles Burnet, North End
Prescott	J. Frodsham, Whiston
Preston	Merigold Bros., Church Street
,,	Marks & Baron, 215 Lancaster Road
Pulborough	Gray & Rowsell, Bury Gate
Radstock	E. & L. Wallace, Partesque Road
Rainford	E. Burrill, Star Inn Garage
Raunds, Northants	Masters Bros., Motor Agents
Reading	H. Julian, 84 Broad Street
Redhill	Linter & Sons, 42 London Road
Redruth	W. E. Jones, A1 Cycle Depot
Retford, Notts	H. Rule, North Road
Redditch	A. L. Pitts, Evesham Street
Reigate	E. Knight, 51a High Street
Ripley, Yorks	W. Ingle
Ripon	Fraser Simpson, North Street
Robertsbridge	T. B. Croft, 12 Station Road
Rochdale	A. E. Stott, 393 Manchester Road
Ross-on-Wye	Longford and Hicks, Cantelupe Road
Rotherham	E. Cross, Effingham Square
Rugby	S. Robbins, Ltd., Bilton Road
Saffron Walden	The Walbro Cycle Co., High Street
Salisbury	Longman's Garage, 97 Fisherton Street
Sandbach, Ches.	J. Cooke, Crewe Road
Scunthorpe	H. G. and G. A. Betts, Ashby Corner, Brumby Road
Seaham Harbour	Harrison Bros.
Selby	J. Gotch, Bridge Foot
Settle	R. Haygarth & Sons, Station Road
Sevenoaks	St. John's Motor Depot
Sheffield	F. B. Roper, 166 London Road
Shepshed	F. Woolley, Motor Engineer
Shipley	T. Jefferies, 120 Haltshire Road
Shirebrook	C. Nicholson, Central Garage
Shrewsbury	H. C. Pickering, 49 Mardol
Sidcup	F. J. Sargent, 91 Main Road
Skelmanthorpe	C. Bradbury, Commercial Road
Skegness	L. H. Parker, 36 High Street
Skipton	G. D. Medd
Sleaford, Lincs	Holland Bros., Motor Cycle Agents
Smethwick	E. Cope & Sons, 15 Upper Hadley Road
Soham, Cambs	Pollard & Son, Pratt Street
Southampton	B. B. Tebbut, 24 Commercial Road
Southport	R Bamber & Co., Ltd., 2 Eastbank Street
,,	W. L. Adlison, 116a Portland Street
Southsea	P. Kiln, 30 Elm Grove
South Shields	J. Teesdall & Co.
Spalding	E. Blackburn & Sons, Station Garage
Spenborough	Spenborough Motor Agency
Spilsby, Lincs.	L. S. Dodds, Ltd., Market Place
St. Albans, Herts	Clark's Garage, 98 London Road
St. Austell	A. Assheton-Salton, White Hart Garage
St. Helens, Lancs	A. Rudd, Baldwin Street

Town	Agent
St. Helens, Lancs	H. Burrill
St. Ives	Parker & Sons
St. Neots, Hunts	Ireland Bros., Motor Engineers
Stafford	H. T. Hussey, 4 Vine Street
Stamford, Lincs	J. Fancourt, 36 St. Paul's Street
Stanton, near Chippenham	A. Smith & Sons, Motor Engineers
Starbeck	G. E. Threefall, High Street
Steyning	C. F. Wood, High Street
Stockport	F. Ingle, 197 Wellington Road
Stockton-on-Tees	Hickson, Dovecot Street
Stoke-on-Trent	Broadway Motors, 34 Liverpool Street
Stone	Attwood & Co.
Stourbridge	North Worcestershire Garage
,,	H. S. Gardner, The Premier Garage
Stowmarket, Suffolk	Stannard & Co.
Stratford-on-Avon	Messrs. Young & Somers, 21 Wood Street
Street, Som.	N. Locke & Sons, Motor Engineers
Stretford	1073 Chester Street
Sudbury, Suffolk	S. M. Segers, East Street
Sunderland	Dunn & Jameson, Hylton Road
Sutton-in-Ashfield	Wilfred Henstock, Station Road
Sutton	W. J. Robins, Carshalton
Swadlincote	Parkes' Garage, High Street
Tadcaster	Shearsmith & Walker, Motor Engineers
Tarporley	Cluett's Motor Cycle Accessory House
Taunton	W. P. Edwards, East Street
Tavistock	R. Carr, Drake Road
Teignmouth	H. Williams & Co., 16 Bitton Street
Thetford	W. & G. Lambert, Ltd., Motor Engineers
Tiverton	Batten Bros., Motor Engineers
Torquay	J. Harris, 111 Union Street
Totnes	H. Jordan, 94 High Street
Towbridge	C. Baker, 130 High Street
Towcester	A. Edwards, High Street
Tring, Herts	Robbins & Marriott, High Street
Truro	S. Hicks & Son, 10 River Street
Tunbridge Wells	R. Carey, Crescent Road
Tuxford, Notts	G. H. Clark, Clark's Garage, Eldon Street
Uttoxeter	J. T. Shaw
Uxbridge, Middlesex	T. S. Rose & Sons, New Windsor Street
Wakefield	T. F. Manby, Kirkgate
Walsall	Maude's Motor Mart, Wolverhampton Street
Wantage	Wantage Motor Co., Mill Street
Warminster	A. J. Dale, 7 Silver Street
Warrington	F. A. Crabtree, Bridge Foot Garage
Warsop, Notts	E. Poynton, Central Garage
Warwick	B. Warner, Market Place
Wednesbury	Taylor's Garage
Wellingborough	W. H. Mason, Midland Road
Wellington, Salop	S. J. Ferriday, Park Street Garage
Wellington, Som.	(see W. P. Edwards, Taunton)
Wem, Salop	Moss Bros., Motor Engineers
West Bromwich	The Speedaway Garage, 19-27 Bull Street
Westcliff-on-Sea	J. Costin & Sons, 237 London Road
West Hartlepool	Gales Motor & Eng. Co., York Road

Town	Agent
Weston-super-Mare	J. Pruen, Oxford Street
Wethersby	H. Rose
Weybridge	E. Rogers & Sons, 56 High Street
Weymouth	Dan Guy, The Esplanade
Whitley Bay	R. Wilson
Whitchurch, Salop	A. J. Taylor, High Street
Wigan	H. H. Timberlake, Ltd., King Street
Wigton	H. I. Moore, 18 New Street
Willenhall	M. C. Jobborn, New Road
Winchcomb	W. H. Harding, Cross Garage
Winchester	Martin & Smith, High Street
Windermere	R. Smith, The Garage
Wingate	J. R. Howe, Front Street, Station Town
Windsor	Surplice, 37 Street St.
Winterton	G. W. Waterlow & Son, Motor Engineers
Wisbech	Palmer Bros., The Cannon Garage
Witham	J. E. Glover
Woking	Conway West Eng. Works, High Street
Wolverhampton	Cyril Williams, Chapel Ash
Woodbridge, Suffolk	Whisstock and Lingley, Motor Engineers
Wooler	H. Scott
Worcester	Eric Williams Ltd., Lowesmoore
Worksop	E. Poynton
Worthing	Bridge Cycle and Motor Mart, 114 Chapel Road
Yeovil	J. Moffatt, Town Hall, Garage
York	C. S. Russell, Lawrence Street
Yoxford, Suffolk	F. Andrews, The Garage

SCOTLAND

Aberdeen	G. Cumming, 3 Alford Place
"	Alexander & Co., 339 Union Street
Aberfeldy	A. McKercher, Motor Engineer
Aberlour	J. Forsyth
Airdrie	R. Aitken & Sons, 20 South Bridge Street
Alloa	J. Binnie, Shillinghill Street
Arbroath	James Law & Son, Motor Agents
Ayr	J. B. Niel, 22 New Road
Banff	A. Morrisson, 23 Bridge Street
Barrhead	G. McDiamid, 17 Cross Arthurlie Street
Bathgate	Archibald, South Bridge Street
Bellshill	J. Potts & Co., Station Garage
Blairgowrie	J. Hraper, Perth Street
Brechin	W. S. Leslie, Motor Agent
Caithness	W. Begg, Castletown
Catrine	W. Fisher, The Square
Cumbernauld	J. Smith & Co.'s Station
Dumfries	E. C. Grierson, 36 Church Crescent
Dundee	Mann & Scott, The Esplanade
"	Johnston Bros., 73 Nethergate
Dufftown	J. McConnachie
Dingwall	J. R. McLeod, Burns's Palace
Dunfermline	Campbell & Semple, 56 Pettencrieff Street

Town	Agent
Edinburgh	Rossleigh, Ltd., 32 Shandwick Place
"	A. Downie Ltd., Haymarket Terrace
"	J. A. Porter, 25-27 Greenside Place
Elgin	G. Muir, 31 High Street
Evanton	K. McKenzie
Falkirk	David Morrison, Camelon
Fearn	T. J. Braxill
Fettercairn	F. Walker
Fort William	J. & W. Fraser
Forfar	B. Ballingall, 118-120 East High Street
Forres	A. M'Leay, Bridge Street
Fraserburgh	A. Park, 65 Broad Street
Girvan	R. Dickie, Old Street
Glasgow	Bell Bros., 250 Gt. Western Road
Grantown-on-Spey	Ross & Sons
Golspie	Campbell & Sons, Engineers
Hawick, Co. Roxburgh	A. & J. Guthrie, 61 High Street
Inverness	A. Munro, Falcon Square
Inverurie	J. Benzil, High Street
Keith	E. Robertson, Central Garage
Kilmarnock	Dick Bros.
Kilsyth	J. Millar
Kirktinilloch	T. Tennent, 61 Townhead
Kirriemuir	D. F. Watson, 124 Glengate
Lairg	Sutherland Transport Co.
Lanark	D. Wilson, 1 St. Leonard's Street
Lockerbie	Baird & Sons
Lochgelly	J. Mitchell, 120 Main Street
Mauchline	Campbell and Anderson, Motor Agents
Montrose	Duthie & Son, 52 High Street
Munlochy	C. Fraser, The Garage
Nairn	Knowles and Cumming, 9-11 Bridge Street
Newton Stuart	J. Kevan, 42 Albert Street
Paisley	Messrs. Hamilton Bros., Marshall's Lane
Peebles	Kidd & Veitch, 3 Old Town
Perth	Valentine's Motor Depot, City Hall Square, King Edward Street
Pitlochry	A. Beedie, Main Street
Prestwick	Allen & Sons, St. Cuthbert Garage, Main Street
Selkirk	Paterson Bros., Victoria Works
St. Andrews	Christie Bros., Bridge Street
Strandaer	A. Sloss, 2 Queen Street
Stirling	Rossleigh, Ltd., 31 Dumbarton Road
Tongland	J. Aitkin, Tongland Garage
Turriff	Wm. Dickie, 10 Balmelli Street
Wick	A. Robertson & Co.

Town	Agent
IRELAND	
Armagh	J. J. Millar, Thomas Street
Ballymena	W. Cameron, Ballymoney Street
Belfast	W. J. Chambers, 106 Donegall Pass
Coleraine	T. MacFarlane & Sons, Kingsgate Street
Cookstown	David Slane, William Street
Dungannon	Hill Bros., Henry Street
Enniskillen	J. Jeffers, 36 East Bridge Street
Limavady	Hutchinson Bros., Catherine Street
Londonderry	S. Taggart, John Street
Magerafelt	Wm. Crossett, Queen Street
Middletown	J. McKenna, Cycle Agent
Newry	S. Lockhart & Co., 96 Hill Street
Omagh	S. Steele, 55 High Street
Portadown	R. Hewitt, Armagh Road
Rathfriland	A. A. Weir, Newry Street
Strabane	P. M. McGrath, Bridge Street
WALES	
Aberdare	Parker Bros., Motor Agents
Abergavenny	H. Powell, Brecon Road
Aberystwyth	Messrs. Jones Bros., The Garage, North Parade
Ammanford	A. J. Waldron, The Arcade
Bala	H. Williams
Bangor	R. E. Grice, 305 High Street
Beaufort	J. Elson & Co.
Berriew	W. R. Davies
Blackwood, Mon.	A. Chaston, Pentwyn Road
Brecon	Fryer Bros., Motor Agents
Bridgend	J. Board & Co., Molton Street
Brynmawr	Carter & Co.
Builth Wells	A. Colcombe
Caerphilly	Messrs. Morgan Bros., Central Garage
Cardiff	R. Bevan, 31 Castle Street
Carmarthen	W. Edwards & Sons, Towy Garage
Carnarvon	E. Jones, 26 Bangor Street
Chepstow, Mon	S. E. Hanbury's Garage
Chivilog	O. A. Griffiths, Fourcrosses
Colwyn Bay	The Colwyn Bay Eng. Co., Ltd., Prince's Garage
Corwen	W. J. Astley, Bridge Street
Cowbridge	A. T. Mills, High Street
Cross Keys	T. Rowley, Risca Road
Crymmych Arms	J. W. Edwards, Motor Engineer
Denbigh	W. Edwards, The Garage
Dolgelly	J. R. Thomas

Town	Agent
Garnant	H. Davies
Glynceiriog	H. Phillips
Haverfordwest	Greens Motors Ltd.
Llanbrymair	J. Davies, Dolgoch
Llandrindod Wells	Tom Norton, Ltd., The Automobile Palace
Llanelly	Holloway Bros.
Llanfair	W. Jones, Motor Mart, Gryn Salem
Llangefni, Anglesey	T. R. Jones, 28 High Street
Llangollen	Jones Bros. (Llangollen) Ltd., The Garage
Llantrisant	Llantrisant Motor Co., Talbot Garage
Llanybyther	J. M. Jones & Co., Tryal Garage, Cribyn
Machynlleth	J. Evans, Maengwyn Stores
Merthyr Tydvil	J. Lewis, 46 Morla's Buildings
Monmouth	Love & Son, Monnow Street
Montgomery	R. H. Bunner
Neath	J. Thomas, Cimla Street
Newport, Mon	V. T. Waite, 79 Commercial Street
New Tredegar	W. Williams & Sons, Motor Engineers
Pembroke & Pembroke Dock	W. L. Silcox & Sons, Water Street, Pembroke Dock
Pontypool	A. Jelley, Osborne Road
Pontypridd	Pontypridd Auto. Co., Station Square
Portmadoc	L. H. Thomas, Madoc Square
Pwllheli	R. J. Jones, Efailnewydd
Raglan	W. L. Hampshire, Chestnut Works
Rhaydber	Andrews Garage, East Street
Rhyl	H. G. Nelson, 39 Queen Street
Ruthin	R. Beech & Sons, Market Place
St. Clears	Williams, Carm.
Swansea	I. L. Roberts, 223 Oxford Street
Talgarth	H. A. Evans, The Garage
Tenby	George Ace
Trawsfyndd	David Jones
Tredegar	A. Morgan, 49 Commercial Street
Welshpool	J. H. Thomas
Wrexham	North Wales Motor Exchange, Holt Street
ISLE OF MAN	
Douglas	J. H. Cubbon, Finch Road
CHANNEL ISLANDS	
Jersey	F. P. & W. Le Sueur, 26 Halkett Place
Guernsey	W. Green, Progressive Motor and Cycle Works, Smith Street
ISLE OF WIGHT	
Ryde	M. J. Rumsey, 160 High Street

GLOSSARY OF MOTOR-CYCLING TERMS

(Numbers in brackets refer to pages in text)

A.A. The Automobile Association, Fanum House, New Coventry Street, W.1, a road organization offering many benefits to motor-cyclists who are members.

Accelerate. To quicken the speed of the machine by opening the throttel.

Accessory. Any part of the equipment of the machine not essential to its running.

Accumulator. Cells for storing electricity. Each cell consists of a set of lead plates and a set of peroxide plates, immersed in diluted sulphuric acid and contained in a celluloid case, fitted with terminals.

Acetylene. A gas (C_2H_2) used for lighting acetylene lamps, generated by allowing water to drip on to calcium carbide.

Acid. Familiar term used for the diluted sulphuric acid used in an accumulator. The correct proportions are one part of sulphuric acid to five parts of distilled water.

A.C.U. The Auto-Cycle Union, 83 Pall Mall, S.W.1, which is the governing body of the sporting side of motor-cycling, such as speed and reliability trials.

Adaptor. A fitting enabling a tyre pump of given size to fit any size valve.

Addendum. The height of a gear tooth above the pitch line.

Advance. Term used in relation to the timing of the spark. It is the distance at which spark occurs before piston reaches the top of its stroke or the number of degrees before the crankshaft reaches its highest position.

Air Leak. The connection from the carburettor to the inlet port may be loose, causing an air leak (p. 84).

Air Lock. Air may find its way into the petrol pipe, its pressure preventing petrol from finding its way into the float chamber of the carburettor.

Air Slide. The sliding valve in the carburettor which controls the supply of air to the engine.

Alcohol. An organic hydro-carbon compound (C_2H_6O); in liquid form it is capable of being used to operate the engine in place of petrol, but owing to the high tax on it it is not generally used.

Ammeter. An instrument which indicates the number of amps. in an electrical circuit.

Amp. Abbreviation for ampere, the unit of measurement of the amount of current in an electrical circuit. The current produced by one volt in a circuit having a resistance of one ohm is one ampere.

Annealing. Various metal parts of a motor-cycle are annealed; this is done by heating the part and allowing it to cool very slowly.

Apron. The waterproof cloth between the windscreen and the sidecar body.

Armature. The iron core of the magneto; it is wound with insulated fine wire and rotates between the poles of the magnet.

Auto-ignition. Particles of carbon on the inside of the combustion chamber may become red-hot, thereby igniting the gas before the spark occurs and causing auto-ignition.

Automatic Valve. An inlet valve which is opened by the suction exerted by the descending piston, a light spring being fitted to close it again when the suction ceases. This type of valve is not used on the A.J.S. motor-cycle, both the valves being mechanically operated.

Backfire. When starting the engine the momentum of the fly-wheel may be insufficient to overcome the increase in compression ratio caused by an early spark setting. The piston will be forced in the opposite direction and the rotation violently reversed.

Back Pressure. A choked silencer, or exhaust pipe of too small a diameter, hinders the burnt gases in their efforts to escape, causing back-pressure and overheating.

Baffle Plates. In some forms of silencer, plates with perforations are placed. These baffle plates cause the gases to make less noise when leaving the silencer.

Balance Weights. Weights formed of metal and attached to the crankshaft, to counterbalance the weight of the connecting rod and piston.

Ball Bearing. A bearing in which balls are inserted to allow the two surfaces to roll on the balls instead of sliding on each other. This decreases friction and heat, and increases life of bearing.

Ball Race. The grooved part of a ball bearing where the balls track.

Bearing. Where one piece of metal has to revolve inside or outside another, such as a wheel on its axle, the parts of the two metals which touch are termed a bearing. This may be a plain ball, or roller bearing.

Bell Crank Lever. A right-angled piece of metal, used for transmitting push or pull at right-angles to the original line.

Benzole. A by-product of coal gas, benzole (C_6H_6) may be used as a substitute for petrol.

Big End. The bearing at the lower end of the connecting rod.

Bore. The internal diameter of the cylinder, usually measured in millimetres. The bore forms the basis of the R.A.C. horse-power rating formula.

Bowden Wire. Wire composed of several strands and possessing greater flexibility and strength than a single wire of the same diameter.

Brake Drum. The drum attached to the rear wheel on which the brake operates.

Brake Horse-Power. The actual power developed at the pulley of the engine, found by applying a brake to the pulley. It may be calculated by the various formulae given in Chapter X.

Brush. Usually refers to the piece of carbon held lightly by a spring to part of the rotating armature in the magneto, to collect the current.

Bush. The lining of a bearing, usually made of phosphor-bronze or white metal. When excessive wear has taken place it may be renewed.

Butt-End Tube. To replace an endless tube in a tyre it is necessary to remove the wheel. To save time and trouble, butt-end tubes are made, so that they may be inserted without removing the wheel.

Butterfly Nut. (See Wing Nut.)

Calcium Carbide. (CaC_2), when water is allowed to drip on to it, gives off acetylene gas.

Cam. A pear-shaped piece of metal rotating on a shaft, so that the projection will raise the valve at the correct moment (p. 53).

Camber. The amount of vertical curve, or "hump," in the road.

Camshaft. The shaft to which the cam is secured.

Capacity. The capacity of an engine is usually reckoned in cubic centimetres and may be ascertained by the following formula—

$$\text{c.c.} = D^2 \times .7854 \times S \times N$$

(D = diameter of cylinder in centimetres; S = stroke in centimetres N = number of cylinders).

Carbide. Familiar term for calcium carbide.

Carbon. The deposit formed inside the cylinder, caused by burnt particles of dust and oil. Another form of carbon is the material of which the carbon brush of the magneto is made.

Carburation. The work of transforming liquid petrol into a gas, performed by the carburettor (p. 55.)

Decarbonize. To decarbonize an engine is to remove the carbon which collects on the inside of the cylinder walls and top of the piston (p. 68).

De-coke. Familiar term for decarbonize.

Distilled Water. The water which should be used for filling an accumulator, as it contains less impurities than common water. It is made by turning water into steam, which is then condensed, i.e. turned into water again, leaving its impurities behind.

Distributor. A piece of apparatus whereby one magneto may supply sparks to more than one sparking plug on a multi-cylinder engine. A revolving part makes contact at the correct moment with a terminal leading to the particular sparking plug which needs a spark. Different terminals lead to different plugs, so that each may be supplied in turn.

Dog Clutch. A form of positive drive whereby two members, each having jaws, slide together and are interlocked.

Double Clutching. When changing from a high gear to a lower one, the gear is put in neutral and the clutch let in, thus speeding up the layshaft and ensuring a gear-change which is more silent and involves less wear on the gear-box. This is hardly necessary on a motor-cycle and refers more to car practice.

Down Tube. The tube of the frame leading from beneath the head lug to the crankcase.

Drain Plug. The plug at the bottom of the crankcase which may be removed to drain off oil.

Drip Feed. An arrangement whereby the oil is fed to the engine drip by drip, thus ensuring a more even supply than when a charge is injected by a pump at intervals.

Dynamo. A machine for generating electricity. The working is similar to that of a magneto (q.v.) except that a continuous charge of current is given and the primary circuit is not broken for the purpose of procuring a spark.

Dynamometer. An instrument used for measuring power, used to test the power given out by engines before they are assembled in the frames.

Earth. In many electrical and telegraph systems the earth is used as a return path for the current, for the sake of economy and simplicity. In the case of a motor-cycle the frame is used as a return path for the current from the sparking plug back to the magneto, and is termed an "earth."

Electrolyte. The mixture of sulphuric acid and distilled water contained within the cells of an accumulator.

Endorsements. The record of convictions entered on the back of a driving licence (p. 117).

Exhaust. The burnt gases which are expelled from the engine.

Exhaust Lifter. A lever which lifts the exhaust valve and keeps it raised, with the result that the gas escapes from the cylinder through the exhaust valve port before it is exploded.

Exhaust Pipe. The pipe connecting the exhaust port to the silencer.

Exhaust Port. The passage round the exhaust valve through which the burnt gases escape from the cylinder.

Exhaust Stroke. The stroke during which the piston is travelling upwards in the cylinder while the exhaust valve is open to expel the burnt gases.

Exhaust Valve. The valve which is mechanically operated to open and liberate the burnt gases after they have been exploded in the cylinder.

Explosion Stroke. The stroke during which the piston is forced downwards in the cylinder by the power of the explosion of gas (p. 54.)

Feeler Gauge. On the side of a magneto spanner is a thin strip of steel termed the feeler gauge, and used for gauging the distance between the platinum points of the contact breaker.

Ferodo Inserts. To enable the plates of a clutch to grip each other more securely, inserts of Ferodo are placed in the alternate plates. Cork is sometimes used for this purpose.

Filament. The wire, usually of platinum or tungsten, inside the electric bulb of the lamp which glows white-hot when an electric current is passed along it.

Filler Cap. The caps screwed on the petrol and oil tanks.

Filters. The fine gauze meshes placed to catch dirt in the petrol on its way from petrol tank to carburettor.

Fins. To assist cooling, the cylinder is cast with fins on it, to increase the area of its surface and thus assist radiation of heat.

Fishtail. The attachment to the extreme end of the exhaust pipe, so that the gas escapes through a narrow slot instead of from the circular pipe.

Flapper-bracket. Familiar term for the carrier.

Flashpoint. The degree of heat at which oil burns. A good oil possesses a higher flashpoint than one of low grade.

Flexible Shaft. Usually refers to the flexible cable which forms the drive for the speedometer.

Float. The hollow and air-tight piece of metal inside the float chamber of the carburettor. It floats on the petrol, and when sufficient petrol is admitted to the chamber raises the needle and cuts off further supply, preventing flooding.

Float Chamber. The part of the carburettor containing the float.

Flooding. If the needle in the carburettor does not effectively control the supply of petrol, flooding will take place. In starting the engine, the carburettor may be purposely flooded to ensure a full supply of petrol to the engine.

Fly-wheel. The heavy wheel secured to the crankshaft. Its momentum carries the engine over the three strokes on which no power is transmitted (p. 50).

Footboards. The boards fitted on the sidecar outfits, on which the rider rests his feet.

Footrests. Supplied on solo mounts for the same purpose as footboards. They give a more positive grip of the machine.

Forced Circulation. The action of a piece of apparatus such as the A.J.S. mechanical pump, forcing the oil through engine, as opposed to oiling which depends on gravity.

Four-stroke Engine. The type of engine which has one power stroke in every four strokes of the piston. The strokes are named in order—inlet stroke, compression stroke, power stroke, and exhaust stroke (q.v.).

Frame. The tubular part of the motor-cycle carrying the engine, petrol tank, gear-box, etc.

French Chalk. White chalk used for preventing the tube sticking to the cover after a patch has been stuck on the tube and it has been replaced in the cover. It is also generally used inside the cover to prevent friction and wear on the tube.

Fulcrum. A lever which works on a pivot, such as the gear-change lever.

Fuse. A piece of fine wire included in an electrical circuit, so that in the event of a short-circuit or too much current being put through the circuit the fuse will break down and thus save lamps, etc., from damage.

Gadget. Familiar term applied to anything.

Gas. Term used for the explosive mixture used in the engine.

Gate Change. A gear-change lever which has positive stops in each position.

Gear-box. The mechanism for increasing or decreasing the proportion of the engine speed in relation to wheel speed. On a low gear the engine speed is greater in proportion than on a high gear at the same wheel speed (p. 33).

Gear Ratio. The proportion of engine revolutions to wheel revolutions. Thus, if the wheel performs 500 revolutions per minute and the engine 2,500, the gear ratio is said to be 5 to 1.

Generator. The vessel used to mix water with calcium carbide, forming acetylene gas for lighting purposes.

Gradient. Term used in describing the slope of a hill. A hill which rises 1 ft. in 5 ft. of travel is said to have a gradient of 1 in 5.

Gravity Feed. A supply of petrol to the carburettor is ensured by placing the petrol tank above the carburettor, thus depending on the action of gravity.

Grinding-in. After much use valves become worn and do not fit their seatings so well as formerly. They have then to be "ground-in," to restore their non-leaking properties (p. 72).

Ground Clearance. The distance from the lowest point of the machine (except the wheels) to the ground.

Grub Screw. A small screw without any head, but merely a slot cut in it.

Gudgeon Pin. The pin in the piston to which the little end of the connecting rod is attached. Usually it is free to rotate both in the piston and the little end (p. 76).

Guides. The tubes in which the valves and tappets slide up and down.

Gusset Plate. A flat metal plate placed at junctions of the frame and crankcase to strengthen the frame and prevent side-to-side play.

Hairpin. Familiar term for a sharp corner shaped like a hairpin.

Half-time Shaft. Term used for the cam shaft, which rotates at half engine speed.

Head. The part of the frame where the steering column is housed.

High Gear. The gear on which the number of wheel revolutions compared with engine revolutions is higher than when it is on other gears.

Horse-power. Strictly speaking, 1 horse-power is the energy required to raise 33,000 lb. 1 ft. high in 1 min. For calculating motor-cycle engine horse-power, a unit of power is used, termed "brake horse-power" (q.v.).

H.T. Wire. The wire which conveys the electric current from the magneto to the sparking plug.

Hub Gear. A type of gear, now obsolete, working on the epicyclic principle, and contained in the hub of the rear wheel.

Ignition. Term used to describe the act of exploding the charge of gas in the cylinder.

Inlet Pipe. The pipe through which gas passes on its way from the carburettor to the inlet port.

Inlet Port. The passage round the inlet valve through which the gas passes into the cylinder.

Inlet Stroke. The stroke during which the downward movement of piston exerts suction which draws in a fresh charge of gas through the inlet valve and port (p. 53).

Inlet Valve. The valve which is mechanically operated at the correct moment to allow gas to pass into the cylinder.

Inner Tube. Term applied to the tube of a tyre.

Insulation. To prevent electric current from escaping from a wire, the latter is wrapped round with insulating tape or some non-conducting material such as rubber.

Internal Combustion Engine. Term used to describe the motor-cycle engine, so-called because heat is applied inside the cylinder, as opposed to an external combustion engine, such as the steam engine, where the heat is applied outside the cylinder.

Internal Expanding Brake. A brake which works by means of pressure being applied to the inner circumference of a drum, as opposed to an external contracting brake, which works on the outside circumference of the drum.

Jack. An implement for lifting heavy weights, used for cars and usually unnecessary for motor-cycles, although useful when repairing a sidecar wheel puncture.

Jet. One of the finely-bored tubes through which petrol passes in the carburettor. Its object is to pass the petrol in a fine stream, thereby assisting vaporization.

Journal. The surface of the inner member of a bearing, or, more strictly, the entire inner member.

Juice. Familiar term for petrol, or, electrically speaking, for electricity.

Key. A tapered piece of metal which secures a fly-wheel, for instance, on its shaft.

Key-way. The groove in which a key fits.

Kick-starter. The arm attached to the gear-box for the purpose of rotating the engine.

Knee-grips. Rubber pads attached to the sides of the petrol tank to assist the rider in controlling and gripping the machine.

Knocking. The metallic noise heard when an engine is running slowly and is overloaded (p. 36).

Lap. One circuit of a race-track is termed a lap.

Lateral Thrust. Pressure applied at the side, such as the pressure a cam would apply to a valve were no rocker-arm interposed.

Lay-shaft. The shaft of the gear-box to which the two sprockets are not connected; the shaft which runs idly when the machine is in neutral gear.

Leg-shields. Shields of pressed metal attached to the frame to keep the elements, road-dust, etc., from the rider's legs.

Liquid Brazing. To ensure perfect junction at the angles of the frame they are immersed in a bath of molten brass, which forms a more perfect joint than with ordinary brazing.

Little End. The end of the connecting rod which is attached, by means of the gudgeon pin, to the piston.

Lock-nut. A nut placed over another on the same thread to prevent the original nut working loose.

Low Gear. The gear in which wheel revolutions in proportion to engine revolutions are at their lowest.

Machining. After various parts of a motor-cycle have been cast they are carefully machined down to their correct size and weight. The cylinder, for instance, when cast may weigh 17 lb. and after machining 13 lb.

Magdyno. A special form of dynamo which generates current for the electric lighting system as well as for the ignition system (p. 94).

Magnet. A horse-shoe shaped piece of metal in the magneto which exerts a magnetic influence.

Magnetic Field. The space over which the magnetic influence of the magnet is exerted.

Magneto. A form of dynamo which supplies electricity for the magneto. The armature revolves within the magnetic field, causing a current of electricity to flow in its primary winding. This is broken by the contact breaker, and by induction this causes a current to flow in the secondary circuit, which passes on to the sparking plug, causing a spark which ignites the gas (p. 57).

Make-and-break. Another term for the contact breaker.

Misfire. Term used when the gas is not exploded for some reason. It enters and leaves the cylinder without being exploded.

Mixture. Term used to denote the gas formed from petrol and vapour and air being mixed.

Mm. Abbreviation for millimetre.

M.P.G. Miles per gallon.

M.P.H. Miles per hour.

Muffler. Term for silencer.

Multiple Disc Clutch. A clutch such as that in the A.J.S. gear, which consists of a number of plates.

Naphtha. A volatile bituminous liquid, a by-product of coal gas, which can be used instead of petrol.

Needle. The part in the carburettor float chamber which shuts off the supply of petrol when the float chamber is full.

Negative Pole. The lead plates of the accumulator form the negative side, and is the side to which the current returns after passing through lamps.

Nickel Steel. An alloy of nickel and steel, usually about 4 per cent of nickel to 96 per cent of steel, used for valve manufacturing purposes owing to its hardness and capabilities for withstanding metallic "fatigue."

Nipple. Special attachments to the forks, etc., to which the grease gun is affixed for lubrication purposes.

O.H.V. Term for overhead valve.

Oil Ducts. Grooves cut in bearings to assist lubrication.

Otto Cycle. Term for the four-stroke engine (q.v.).

Outer Cover. Term used to denote the cover of a tyre.

Outfit. Term applied to a combination.

Overhead Valve. A valve which is placed above the cylinder, opposed to side-by-side valves at the side of the cylinder (p. 67).

Overheating. Term used when the engine has become too hot, due to lack of lubrication, overload, or other causes (p. 97).

Oxygen Process. The process of decarbonization whereby the carbon is removed by an oxygen flame being directed on it. This process is quite unnecessary where motor-cycles are concerned. The usual method (see p. 72) is the best, and there is no likelihood of damaging the piston by local overheating.

Packing. Material placed between the two surfaces of a joint, such as the copper asbestos washer placed between a cylinder and cylinder head.

Parallel Wiring. Term used when the lamps are taken from a battery in parallel, i.e. each lamp is on a separate circuit, as opposed to series winding, when the circuit goes from one lamp to the next. The advantage is that if one lamp fails, with parallel wiring, the others keep working.

Parking Place. A special stand in a crowded area where a motor-cycle may be left.

Pawl. A catch, held by a spring, which allows a ratchet to rotate in one direction only, used on a motor-cycle in conjunction with the kick-starter.

Petrol. A liquid distilled from mineral oil, used generally for motor-cycles. It has a specific gravity of about .7 ; 1 gall. of petrol weighs about 7½ lb. and 1 cu. in. of petrol yields about 275 cu. in. of petrol gas. Its freezing point is – 180° Fahrenheit, and when exploded in the cylinder reaches a temperature often over 1,000° Centigrade.

Phosphor Bronze. An alloy of bronze used in bearings.

Pillion Rider. Term used for a passenger riding on the carrier (p. 43).

Pin. Term referring to gudgeon-pin, crank-pin, taper-pin, or split-pin, all of which are used in various parts of a motor-cycle.

Pinion. When two gear wheels are in mesh the smaller is termed the pinion. Also used with reference to any small gear-wheel.

Pinking. Familiar term for knocking.

Piston. The medium through which the expansion of the gas is conveyed to the connecting rod and thence converted to a rotary motion. It is usually of cup-shaped formation, lightly constructed of cast-iron or aluminium alloy.

Piston Ring. A cast-iron ring fitting in groove round the piston to ensure a tight fit in the cylinder walls and to prevent gas blowing downwards past the piston. A.J.S. pistons have four rings.

Piston Speed. May be calculated by multiplying the number of engine revolutions per minute by two and then by the length of the stroke. This gives the speed per minute. If an engine has a stroke of 88 mm., this is approximately 3½ in., so that if the engine is running at 5,000 revolutions per minute, the number of inches travelled in 1 min. will be 35,000—nearly 34 miles per hour. This is, of course, the total distance travelled by the piston—not the uniform speed, as it has to "stop and turn" twice in each revolution.

Pitch. The pitch of a chain is the distance from the centre of one link to the centre of the next ; on a gear-wheel the distance from a point on one tooth to a corresponding point on the next.

Pitting. The holes which appear on the surface of valves are termed pitting.

Plain Bearing. One where the two surfaces slide over each other, as opposed to a ball or roller bearing.

Plate Clutch. A clutch such as the A.J.S., which consists of plates running concentrically.

Platinum Points. As platinum is able to withstand heat great and is a good conductor of electricity, it is used for the points of the contact breaker.

Plug. Familiar term for sparking plug.

Plug Points. Term for the points of the sparking plug where the spark occurs (p. 77).

Pocketed Valves. After excessive grinding-in, the valves become what is known as "pocketed" (see p. 72).

Poles. The term applied to the ends of a horse-shoe magnet ; also to the terminals of a battery.

Poppet Valve. Another term for mushroom valve.

Popping. Term used when the gas explodes or pops back into the carburettor.

Ports. The passages where the inlet and exhaust valves of the engine are housed.

Positive Pole. The lead peroxide plates of the accumulator form the positive side, from which the current flows to the lamps.

Pot-holes. Familiar term applied to large holes made in the road surface by heavy traffic.

Power Stroke. The stroke during which the exploding gas sends the piston forcibly to the bottom of its stroke.

Pre-ignition. Carbon deposits on the piston and cylinder heads become red-hot and ignite the gas before the spark occurs. May also be caused by unsuitable plug, the points of which become incandescent.

Premium. The amount paid to the insurance company to secure a policy.

Primary Battery. A battery capable of generating electricity by chemical action, as opposed to a secondary battery, such as an accumulator, which can merely store electricity.

Primary Circuit. The circuit of the magneto in which the current is first induced (p. 58).

Primary Drive. Term applied to the drive from engine to gear-box.

Priming. Term applied to injection of petrol through the compression tap into the cylinder to effect easy starting (p. 34).

Push Rod. The rod which operates an overhead valve, situated between the tappet and the valve rocker.

R.A.C. The Royal Automobile Club, Pall Mall, S.W.1, which offers many advantages to motor-cyclists who are members (p. 29).

Race. Term used to denote running an engine at excessive speeds when not under load. It is harmful to the engine, as undue vibration is caused.

Ratchet. A toothed wheel cut so that a pawl can be used in conjunction with it, to permit its revolving in one direction only.

Re-faced Valves. After valves have been worn through their case-hardened surface, it is advisable to send them back to the works to be "re-faced."

Registration. The act of giving the authorities the necessary particulars regarding a motor-cycle, for the purpose of issuing a licence and number, etc.

Registration Book. The book in which these particulars are entered. One book is issued for each motor-cycle (p. 117).

Retard. When the spark is timed to occur behind its normal time it is said to be retarded.

Revving. Familiar term for an engine running at great speed.

Rocker. The arm, pivoted in the centre, which transmits the power from the push rod to the stem of the valve. This is used in conjunction with overhead valves only. Also the lever between the cam and the base of the valve stem, interposed to prevent excessive wear and side-thrust (p. 76).

Roller Bearing. Similar to a ball bearing, but one in which rollers are used in place of balls.

Roller Chain. A motor-cycle driving chain consists of links and rollers which turn when in contact with the sprocket teeth, thus eliminating friction.

R.P.M. Revolutions per minute.

Run-in. An engine is said to be "run-in" after it has run about 300 miles; by this time the bearings have acquired a glass-hard surface (p. 38).

Scoring. The cylinder walls may be "scored," if a piston or piston-ring breaks, by the sharp edges scraping grooves in the walls. Scoring may also result from the entry into the cylinder of any foreign particles.

Seating. The base on which the valve face rests.

Seat-pillar. The tube supporting the saddle which enters the frame of the motor-cycle.

Secondary Battery. A battery, such as an accumulator, which is not capable of generating electricity, but only of storing it, as opposed to a primary battery, which is capable of generating electricity.

Secondary Circuit. The circuit of the magneto into which the current is induced when the primary circuit is broken by the contact breaker. The secondary circuit supplies the current directly to the sparking plug.

Security Bolts. Bolts, usually two in number, sometimes placed through the rim of the wheel for the purpose of holding the cover more securely on the rim.

Seizing. When a piston or bearing becomes overheated from lack of lubrication or other cause it binds and is said to have seized (p. 102).

Selector Rod. The rod inside the gear-box which changes the positions of the gear-wheels to engage different gears.

Semi-sports Model. A machine designed for use as a sporting mount as well as a touring mount. Usually considered faster than a touring machine, but not claiming to be equal to a sports model (p. 12).

Series Wiring. The system when the electric current runs from the accumulator to each lamp in turn and then back to the accumulator, as opposed to parallel wiring, when it runs to each lamp separately.

Shock Absorber. A device which takes up any jerkiness in the drive, usually consisting of rubber buffers incorporated in the clutch sprocket, or rear wheel.

Short-circuit. A current short-circuits when it is able to return to its source without passing along its proper path, as when the insulation of a wire is rubbed through and it touches the frame or another wire.

Shunt Wiring. Another term for parallel wiring.

Side-by-Side Valves. Valves which are placed at the side of the cylinder are said to be side-by-side valves, as opposed to overhead valves, which are over the cylinder.

Sight Feed. An oil feed which allows the rate of flow to be visible, usually through a cylinder of glass.

Silencer. A pressed steel or aluminium box through which the exhaust gases pass, to lessen the noise of their explosion (p. 6).

Skirt. The lower cylindrical wall of a piston is termed the skirt.

Slides. The valves in the carburettor which control the amount of air and petrol gas admitted to the cylinder.

Slip Ring. The ring on the armature connected to the "secondary" upon which the H.T. "collector" brush bears.

Small End. The end of the connecting rod connected to the piston by means of the gudgeon pin.

Solder. An alloy of two parts of lead to one of tin, used for joining various metals where great strength is not needed.

Solo. A motor-cycle without a sidecar attached.

Sooting-up. Term used to denote an engine in which excessive carbon accumulation is forming.

Sparking Plug. The device by which a spark is made to occur inside the cylinder. It consists of a metal centre-piece surrounded by insulation, usually porcelain or mica, which is also surrounded by another metal core. Points from the outside core nearly touch the central electrode, leaving a small gap across which the spark jumps (p. 77).

Speedometer. An instrument for measuring the distance travelled by a motor-cycle and the number of miles per hour at which it travels.

Spigot. The lower end of the cylinder which fits inside the crankcase.

Splash Lubrication. The system whereby lubrication is effected by oil being splashed on to the moving parts. In the case of the motor-cycle engine, the big end bearing dips into oil which is forced into the crankcase by the mechanical oil pump and splashes it on to the cylinder walls and piston.

Sports Model. A motor-cycle designed essentially for speed.

Sprayer. The circular piece of metal inside the carburettor which further breaks up the petrol vapour and helps mixture.

Spring Washer. A washer, of spiral shape, which exerts pressure on the nut above it and so prevents the nut from working loose.

Sprocket. A toothed wheel designed for a chain-drive, as opposed to a gear-wheel, which is designed to engage with other gear-wheels.

Staggered Spokes. The motor-cycle wheel spokes are staggered, i.e. do not run directly from the centre of the axle, but run tangentically from the sides of the hub.

Stamping. A stamping is a small motor-cycle component part, such as the hub, which is stamped from a piece of sheet steel.

Stands. The tubular legs by which a motor-cycle wheel may be held off the ground.

Steering Column. The tubular column connecting the handlebar to the front fork, enabling the front wheel to be turned to the right or left.

Stoving. In order to harden enamel and to give it a fine polished appearance, enamel is "stoved" in ovens after being applied.

Stripping. A bolt is said to be stripped when its thread has been forcibly torn off it. A nut can also be stripped in the same manner.

Stroke. The length of travel of the piston.

Stunt. A feat involving skill, nerve and luck.

Sulphuric Acid. An acid which, when mixed with distilled water, forms the electrolyte of an accumulator.

Sump. A trough which holds oil, into which some moving part dips. In the A.J.S. engines cylinder lubrication is effected by oil being thrown off by centrifugal force from the fly-wheels which dip into the crankcase oil sump.

Tappet. A metal rod raised by a rotating cam, or rocker, conveying the latter's movement to the valve.

Tappet Guide. The bush or sleeve in which the tappet moves up and down.

Tension. Is direct pulling stress, such as that applied to a motor-cycle chain.

Throttle. The slide in the carburettor which controls the supply of petrol vapour to the engine.

Tickling. To assist easy starting the needle of the carburettor may be raised or depressed to cause the petrol to overflow the top of the jet. This operation is known as tickling, or flooding.

Timing Gear. Name given to the gear-wheels which operate the cams and magneto, causing the valves to open and close and the spark to occur at the correct moments (p. 82).

Top Dead Centre. When the piston is exactly at the top of its stroke, it is said to be at top dead centre.

Top Gear. The same as high gear.

Top Tube. The tube of the frame above the tank.

Torque. The turning effect on a shaft.

Touring Model. A motor-cycle in which speed is not the only consideration, general efficiency, economy, and comfort being also catered for.

Transmission. Term applied to the parts of the machine embodying the drive from engine sprocket to gear-box and thence to the back wheel.

Tube. The inside part of a tyre, often needlessly named the "inner" tube.

Tulip Valve. The hollowed head type of valve used on A.J.S. O.H.V. engines.

Tuning. The art of obtaining maximum efficiency from an engine (p. 95).

Twin. A motor-cycle engine with two cylinders.

Twistgrip. A form of control by means of which the throttle is operated and the ignition advanced and retarded by means of handlebar grips which can be twisted. A popular form of control in the Colonies and abroad.

Two-stroke Engine. An engine in which one power stroke is delivered every second stroke, as opposed to the four-stroke principle on which all A.J.S. engines work.

Tyre Gauge. An instrument for measuring, in lbs., pressure to the square inch, the air pressure inside the tube (p. 37).

Union. Usually applied to the joint of the carburettor and inlet port, but may refer to any joint.

Valances. The flaps on the sides of the mudguard to prevent mud from being splashed on to the rider.

Valves. Usually made of nickel steel and provided to permit the ingress and egress of the gases to and from the combustion chamber.

Valve Face. The surface of the valve which comes in contact with the seating.

Valve Grinding. After considerable use the valve face becomes pitted and needs to be "ground-in," i.e. trued up exactly to fit its seating (p. 72).

Valve Guide. The bushed part of the valve port in which the valve slides up and down.

Valve Lift. The distance a valve is raised from its seating.

Valve Port. The part of the cylinder containing the valve.

Valve Rocker. A piece of case-hardened metal, pivoted in its centre, which transmits the action of the push rod to the stem of the valve, in an overhead-valve engine.

Valve Seating. The surface of the valve port which comes in contact with the valve face.

Variable Jet. A jet adjustment, so that it will pass a greater or lesser amount of petrol at the rider's will.

Volt. The unit of electrical pressure. One volt is needed to cause a current of one ampere in a circuit having a resistance of one ohm. One accumulator cell, when charged, should give at least 1·8 volts, and when it falls below this figure needs recharging.

Voltmeter. An instrument for measuring voltage.

V-rim. The rim on the front wheel in which the brake shoe operates. It also applies to the belt-pulley on the rear wheel.

Vulcanizing. A form of tyre repairing. Rubber and sulphur are mixed in correct proportions and applied to the tube to be repaired and subjected to heat and pressure.

Watt. Volts multiplied by amperes give watts. Thus a dynamo giving a current of 6 volts at 3 amps. causes a current of 18 watts; 760 watts equal 1 horse-power.

Welding. The process of heating metals to melting point, so that the two parts will unite.

Winding. The wire wound round the armature of a magneto is termed the primary winding. The other circuit in the magneto is termed the secondary winding.

Wing Nut. A nut having wings to enable it to be screwed with the fingers.

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