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THE BOOK OF THE MATCHLESS

Fully illustrated and containing much valuable data concerning the construction, intelligent handling, maintenance, and overhaul of Matchless machines, with general advice also on engine tuning, lubrication, trouble diagnosis, touring, and legal matters.

BY

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THE BOOK OF THE MATCHLESS

CHAPTER I

THE MATCHLESS MODELS

IN this chapter the full Matchless programme is described in considerable detail for general reference purposes, and also to assist those contemplating buying a Matchless.

On looking at the table below, the reader will immediately see that there are exactly nine different models listed, and from this range the prospective buyer should have very little difficulty in selecting a model suitable for his own special requirements and marketed at a price within his means. Prices vary from £37 to £75.

THE RANGE AT A GLANCE

Model	c.c.	Bore and Stroke (m.m.)	Valves	No. Cyl.	Lubri- cation	Gear Ratios (Solo)	Tyres (in.)
A/2	397	54 × 86	S.V.	2	D.S.	17.5, 11.6, 7.8, 5.9	26 × 3.25
B	593	50.8 × 73.02	O.H.C.	4	D.S.	17.0, 12.4, 6.9, 5.7	26 × 3.25
R7	246	62.5 × 80	S.V.	1	D.S.	16.8, 9.4, 6.1	25 × 3
D	347	69 × 93	S.V.	1	D.S.	17.5, 9.3, 5.8	25 × 3
D/S	246	62.5 × 80	O.H.V.	1	D.S.	17.5, 9.3, 5.8	25 × 3
C	586	85.5 × 101.6	S.V.	1	D.S.	14.6, 10.6, 6.5, 4.9	26 × 3.25
C/S	495	85.5 × 85.5	O.H.V.	1	D.S.	14.6, 10.6, 6.5, 4.9	26 × 3.25
X/3	990	85.5 × 85.5	S.V.	2	D.S.	12.8, 9.3, 5.7, 4.3	26 × 3.25
X/R3	990	85.5 × 85.5	S.V.	2	D.S.	11.3, 8.2, 5.0, 3.8	26 × 3.25

The spring frame "Silver Hawk," which is the chief addition to last year's range, has its valves operated by a single overhead camshaft and has *coil ignition*. New type numbers have been allocated to the whole range, but the 246 c.c., 400 c.c., and 990 c.c. side-valve models remain substantially as hitherto, although certain detail alterations have been made. The principal Matchless innovations this year, apart from the introduction of the "Hawk,"

are the marketing of four inclined engine models with duplex loop frames, the provision of two-port cylinder heads on two of the new overhead-valve inclined engines, and the fitting of Sturmev-Archer *four-speed* gearboxes to all machines over 350 c.c.

The use of a splined kick-starter shaft and split crank enables the crank to be fixed in alternative positions. The last-mentioned detail improvement is illustrated by Fig. 2.

Deferred Payments. For the benefit of those who do not wish to pay cash down for a new model, a most convenient hire-purchase system has been arranged by The Matchless Motor-Cycles (Colliers), Ltd., in conjunction with The Roadways

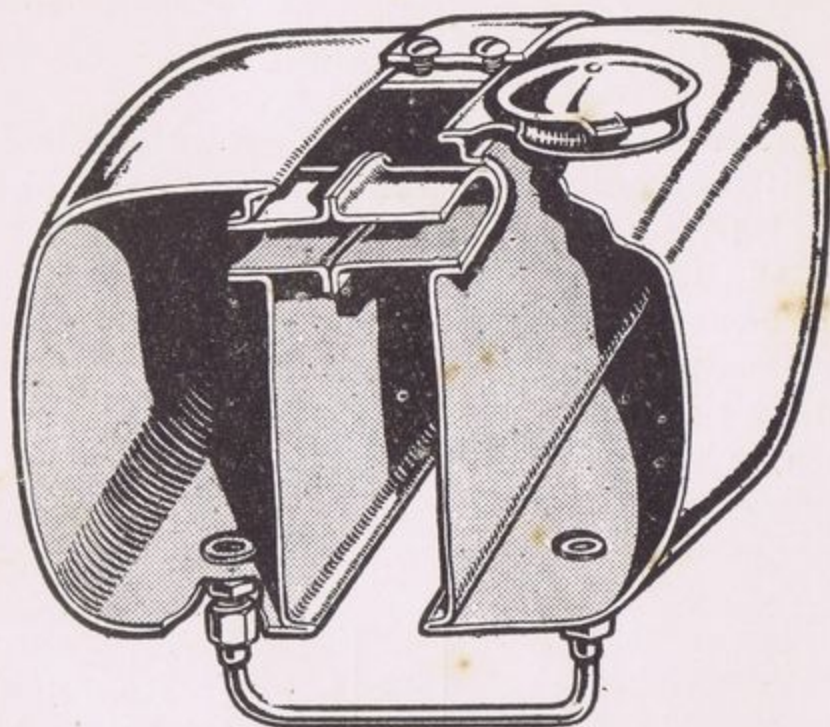


FIG. 1. CUT-AWAY VIEW OF PETROL TANK (ALL MODELS)

Transport Development, Ltd. A deposit of approximately one-quarter of the cash price secures delivery, the balance being payable in twelve equal monthly instalments. Attention is directed to the fact that a Matchless model does not become the property of the purchaser until the absolutely final instalment has been paid off. All Matchless solo motor-cycles or sidecar outfits delivered direct from the factory, or from one of their approved dealers, carry with them a guarantee against defective workmanship or material for a period of six months subject to certain conditions.

Lighting and De Luxe Equipment. For an extra charge of a few pounds, an acetylene gas or electric lighting set can be fitted to most machines, P. & H. and Lucas equipment being used respectively. It is the cheapest and wisest policy to specify a complete electric set, including an electric horn, in the first instance, as this gives infinitely better results.

The six-volt, 20-watt Lucas M-L "Maglita" (type FD), or the latest six-volt, 30-watt "Magdyno" (type MS), with the dynamo portion detachable, are the generators used on all single- and twin-cylinder Matchless machines, and they are driven off the engine camshaft or by chain off the engine mainshaft, according to the type of machine. The equipment used on all de luxe models, i.e. all except R/7, is priced at approximately £9. It comprises, in addition to the Lucas "Magdyno" or "Maglita" in the case of D and D/S, dipping beam headlamp, tail lamp, battery, and Lucas high-frequency "six-volt" electric horn with new mountings, a most handsome improved pattern instrument panel placed immediately above the centre of the handlebars, and housing the gearbox-driven Smith chronometric speedometer, the ammeter, the D.S. lubrication sight-feed opposite, the steering damper knob, and the lighting switch. In the case of some panels this year, a magneto cut-out switch is also included, and on the "Hawk" a tell-tale ignition switch. The sight-feed, ammeter, and speedometer are indirectly illuminated as on modern car instrument panels, the illumination being controlled by a small button switch on the panel.

For the sum of five guineas a Lucas M.L. "Maglita" lighting set, with 8 amp.-hr. battery, can be fitted to models R/7, D, and D/S, and a "Magdyno" set alone with 12 amp.-hr. battery to models C and C/S. No instrument panel is provided, the ammeter and switch being mounted on the top and back of the headlamp itself. This is, of course, an alternative to the slightly more expensive de luxe equipment, which cannot, however, be fitted to R/7. Two types of six-volt electric horns are obtainable. The battery is mounted over the gearbox on a raised part of the magneto platform.

No sight-feed can, of course, be provided on standard models without a panel, and when a speedometer is specified it has the usual handlebar clip fixing. All de luxe models, except C, D, and D/S, include an air filter, all have twist-grip throttle control, and models D and D/S de luxe have heavyweight tyres.

The Twin-cylinder S.V. Models. These comprise models A/2 (The "Silver Arrow"), X/3, and X/R3, and their prices are £55,

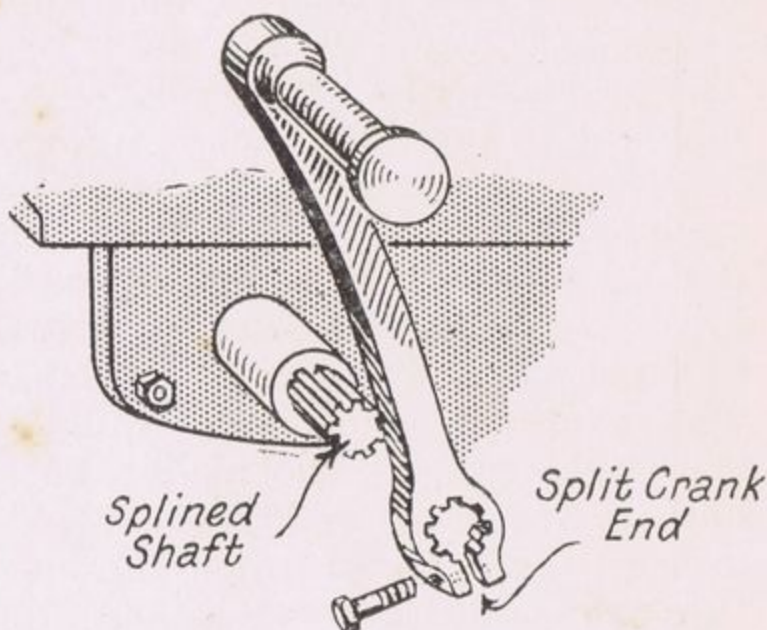


FIG. 2. THE NEW KICK-STARTER CRANK ATTACHMENT

£60, and £62 10s. without de luxe equipment, respectively. All three machines make admirable touring mounts, especially the last two which are designed for carrying two or three persons including the driver.

Model A/2 is a magnificent general purpose utility mount of unusual layout. At the present time this is one of the most popular Matchless models, and mainly for this reason the author has in the following specifications dealt with it in considerable detail. Its very robust construction and design gives it road-holding qualities considerably above the average; the spring frame entirely eliminates rear wheel bounce and spin, in addition to giving a degree of comfort unobtainable with the normal rigid type frame. The provision of a "prop" stand, centrally positioned, enables the machine to be easily jacked up.

Perhaps the most commendable feature of all is the extraordinary ease with which the engine can be started. One gentle depression (with the foot or hand) usually suffices to produce a low-revolution "tick-over." Starting troubles due to a faulty exhaust valve lifter are non-existent, for no lifter is provided. The machine is exceedingly quiet. The only audible sounds being the slight hiss at the air-intake and the swish of the primary chain. Acceleration is very rapid, though somewhat deceptive owing to absence of much exhaust noise. Fuel and oil consumption are good, the former exceeding 75 m.p.g. at a touring speed. There are no appreciable vibration periods above 12 m.p.h., and the interconnected brakes render rapid retardation on treacherous road surfaces both practicable and safe. Fast touring does not "tire" the engine, and a comfortable cruising speed of 40-50 m.p.h. can be maintained over long distances. With the throttle wide open a maximum speed of 65 m.p.h. is attainable—a creditable performance for a 400 c.c. machine weighing just over 3 cwt.

Reliability, low maintenance costs, and general accessibility of this machine are quite above the average, and the monobloc engine can readily be decarbonized.

Models X/3 and X/R3 are the latest versions of the standard Matchless Big Twins, suitable for long distance high speed, solo or sidecar touring, or week-end family runs. Both machines which have duplex loop frames are finished in de luxe style. Their engines, though remarkably quiet and docile are, in some respects, akin to sports engines, acceleration and speed being excellent.

The specification of model X/R3 is identical to that of model X/3, with the exception that a sports engine having polished ports with nickel-plated cylinders is fitted; chromium-plated wheels are standardized, and slightly different gear ratios are used. It is about 5 m.p.h. faster than the standard model.

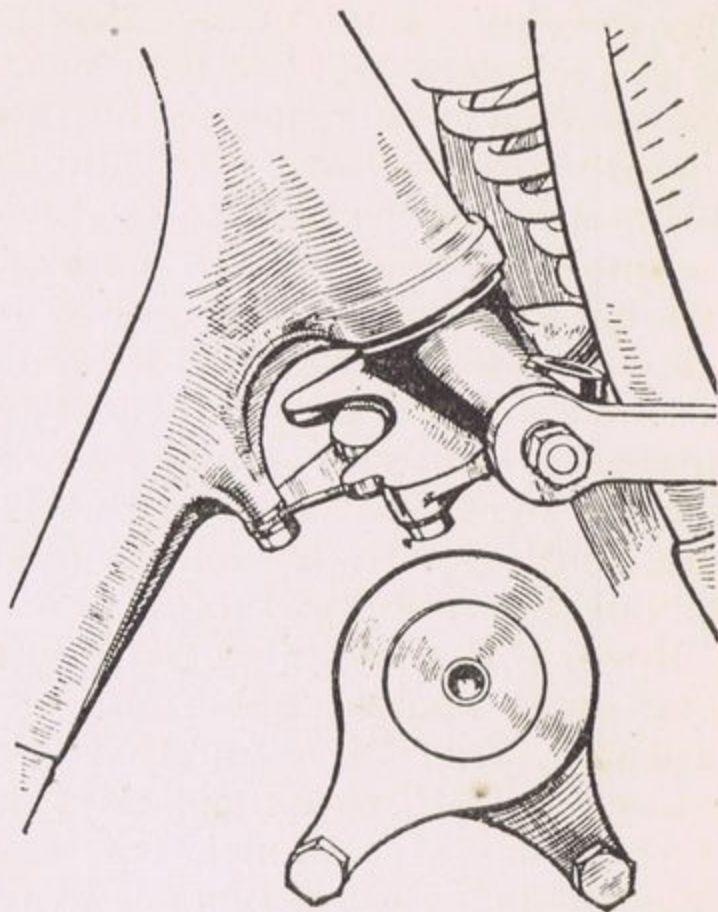
The Single-cylinder S.V. Models. These are models R/7, D,

and C, listed at £37, £38 10s., and £47 10s., respectively. The performance of all the side-valve machines is decidedly snappy. They are, perhaps, a shade more reliable than the overhead-valve type, but there is practically nothing to choose between the two types if the machines be carefully driven and looked after. All have detachable cylinder heads, except model D, and enclosed valve gear.

Model R/7 is the cheapest of the Matchless range. It is a smart looking lightweight qualifying (with complete "Maglita" electric lighting equipment) for the 30s. per annum tax, and embodying all the latest features and refinements of Matchless design. It has ample power for solo or pillion riding, and is a most handy machine for the man who wants economical and efficient motor-cycling with a small initial outlay. Its fuel consumption is remarkably low, and it has a most useful turn of speed. Its specification remains substantially the same as for 1930.

Model D is also a lightweight eligible, with "Maglita" electric lighting but without de luxe equipment, for the 30s. tax, and though costing only a trifle more than R/7, has an extra 100 c.c. engine capacity, and its design is entirely new from stem to stern. With its duplex loop frame and inclined power unit, with decompressor for easy starting, it is a remarkably sturdy and handsome piece of work, with, of course, a somewhat superior performance to Model R/7.

Model C is a new duplex frame machine with a high-powered inclined engine with decompressor, having sufficient stamina to undertake fast solo or sidecar work, and a four-speed gearbox. Its performance should satisfy those who drive really hard, and are in the habit of maintaining more than usually high average speeds, and do not confine their activities to comparatively flat districts.



(From the "Motor Cycle")

FIG. 3. STEERING HEAD, FORK STOPS AND STEERING DAMPER

The above type steering damper is fitted as standard to all models over 350 c.c., and control on *de luxe* models is by a knob on the instrument panel (Fig. 45)

The Single-cylinder O.H.V. Models. Two models belong to this class, namely, D/S and C/S. Their prices are £42 and £52, respectively. Acceleration, speed, and general liveliness are the characteristics of these mounts, and they will appeal particularly to the sporting type of rider. Numerous detail improvements have been made recently to the overhead-valve engines, and, although they develop a huge brake-horse-power and are capable of almost vicious acceleration, yet they are very silent and, without exception, have a steady, low-revolution "tick-over," a matter of considerable importance. In addition, improved rocker-gear and automatic push-rod and inlet valve guide lubrication renders them absolutely reliable. Both overhead-valve models have decompressors and magnetos mounted behind the engine.

Model D/S is similar to the entirely new Model D design, but this machine has an overhead-valve two-port cylinder head, and automatic inlet valve-guide and rocker-box lubrication. With the inclined overhead-valve engine it is most attractive and a real "hot-stuff" sports model. It qualifies with *acetylene* lighting for the 30s. per annum tax.

Model C/S, also, is an overhead-valve replica of Model C with a two-port sports engine and similar lubrication. As might be expected, this "five-hundred" is phenomenally fast, and can "show its tail" to almost anything on the road. As in the case of the side-valve model, this machine has four speeds and, in consequence, close ratios are available.

The Four-cylinder Overhead Camshaft Model. Model B, or the "Silver Hawk" as it is more usually called, is one of the few "V" fours in existence, and its price is £75. In many respects it resembles the "Arrow," and has a similar spring frame with a 6 in. ground clearance. Its salient features are its coil ignition giving very easy starting, the peculiar arrangement of the monobloc cylinders, the overhead camshaft, and the duplex primary transmission with fixed four speed gearbox. It is a real de luxe solo machine, and a mount *par excellence* for the long distance sidecar tourist and those who travel abroad. Although docile and quiet at touring speeds, it is capable of a speed greater than any other Matchless model, and probably equal to that of any machine on the road.

MODEL A/2 (THE "SILVER ARROW")

This original, and yet in many ways orthodox, twin has the following specification—

The 3·97 h.p. S.V. Vee-twin Engine. The "A/2" power unit is a narrow angle Vee-twin with a bore and stroke of 54 mm. × 86 mm. respectively, giving a cubic capacity of 397 c.c. It is not so unconventional as might at first be supposed from a casual

exterior examination which gives one the impression that there are four cylinders in line. This illusion is caused mainly by the fact that, although the cylinder bores are set at an acute angle to each other, a monobloc car-type cylinder and cylinder head is employed with horizontal finning together with a similarly finned exhaust manifold. The net result is an engine of most pleasing appearance and extreme neatness.

Excellent torque regularity is obtained by the use of a small *firing angle* in the case of a Vee-twin, and in this instance an extraordinarily small angle (26 degrees) is employed, so small indeed that the provision of a monobloc casting becomes imperative. Apart from this practical consideration, a monobloc cylinder casting has been deliberately decided upon as affording the best means of overcoming several inherent disadvantages of the separate cylinder type.

The general arrangement of the engine is well shown by Fig. 4. Although the firing angle is only 26 degrees, the actual angle between the cylinders is but 18 degrees, which means that with the crankpin and connecting rod on top dead centre in the firing position, there is approximately 4 degrees inclination of each piston inwards relative to the connecting rod. This point can be understood by reference to Fig. 4, where the angularity is quite noticeable. Another unusual feature of this engine is the sloping of the piston heads so as to enable the normal form of combustion chamber to be used in spite of the bore angularity. Other noteworthy features are the arrangement of the valves, the longitudinally placed camshaft, the dry sump lubrication system, and the positively driven magneto or "Magdyno."

Dealing with the crankcase first, this is a massive cast aluminium structure of box-like formation split vertically in the usual manner. Separation of the two halves is not recommended to be undertaken by inexperienced amateurs. If complete dismantling is decided upon, care must be taken in regard to the oil pump which is housed in a rectangular crankcase projection immediately below the large rectangular box housing the camshaft and drive, which has a neat and readily removed cover of pressed steel. Right at the base of the crankcase on the offside is a large drain plug. An efficient crankcase pressure release valve of the diaphragm type maintains a uniform pressure within the crankcase, and serves as a means of lubricating the primary chain.

The crankshaft assembly is exceedingly robust, well balanced, and stiff, and the more important parts are clearly shown at Fig. 5. It comprises two webbed flywheels having very heavy rims, closely united by a large diameter, hardened steel crankpin whose gently tapered ends are friction fits in the flywheels. The

flywheel mainshafts are also friction fits in the bosses, but are keyed to give extra security. That on the driving side, which is subject to heavy transmission thrusts, has a double row caged

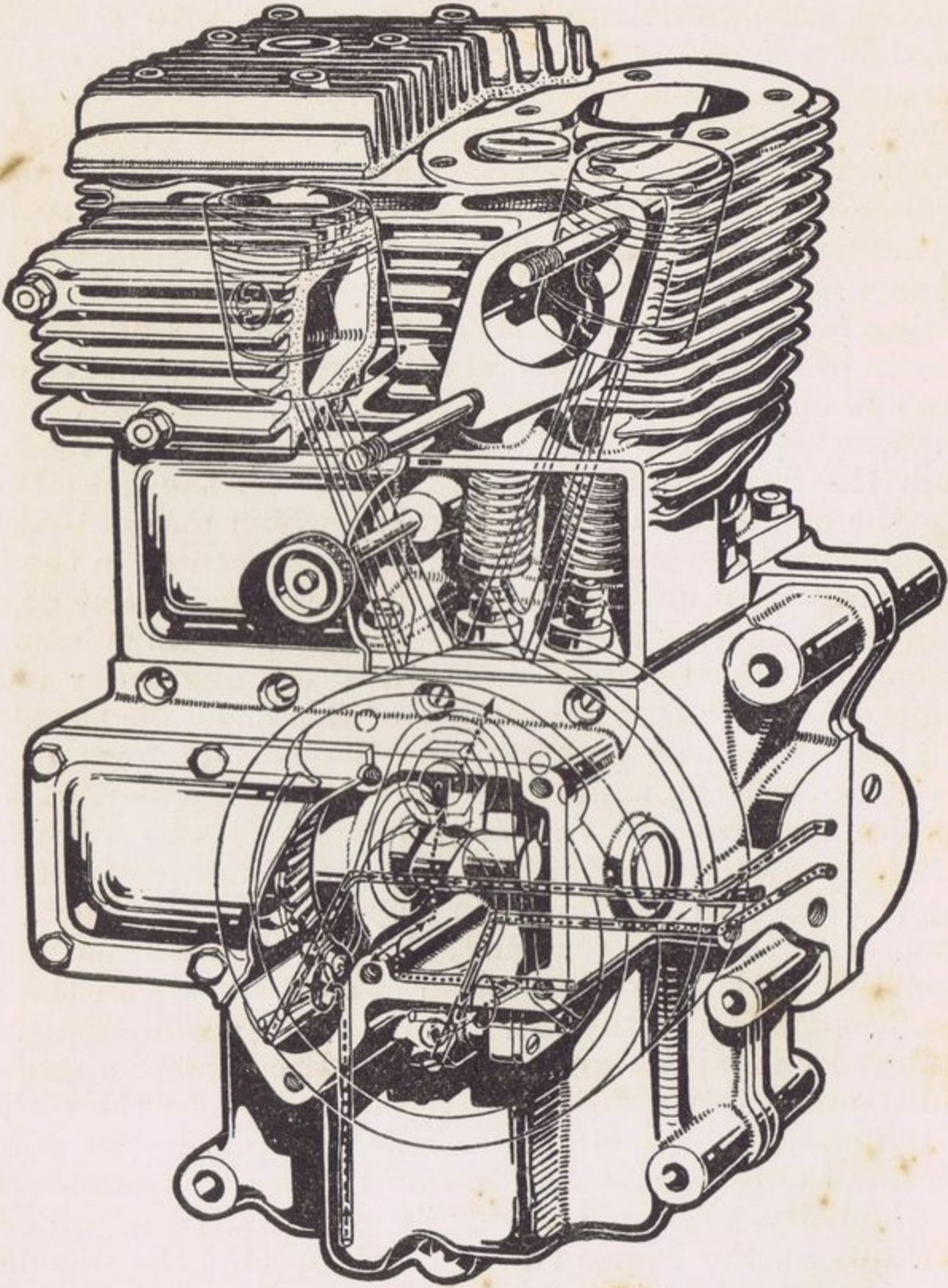


FIG. 4. GENERAL ARRANGEMENT OF THE "SILVER ARROW" ENGINE

Various parts have been cut away or sectioned to show the method of construction

roller bearing, while that on the timing side, which incidentally carries the pump driving worm and the skew gear for the camshaft, has a plain phosphor-bronze bush into which the whole oil supply is fed before distribution. These two bearings are capable of

withstanding very hard work indeed. Upon the central and enlarged portion of the crankpin are the two double row big-end bearings of the "H" section connecting rods which work side by side. There are no bushes pressed into the slightly eccentric eyes of the connecting rods, but the crankpins can readily be renewed

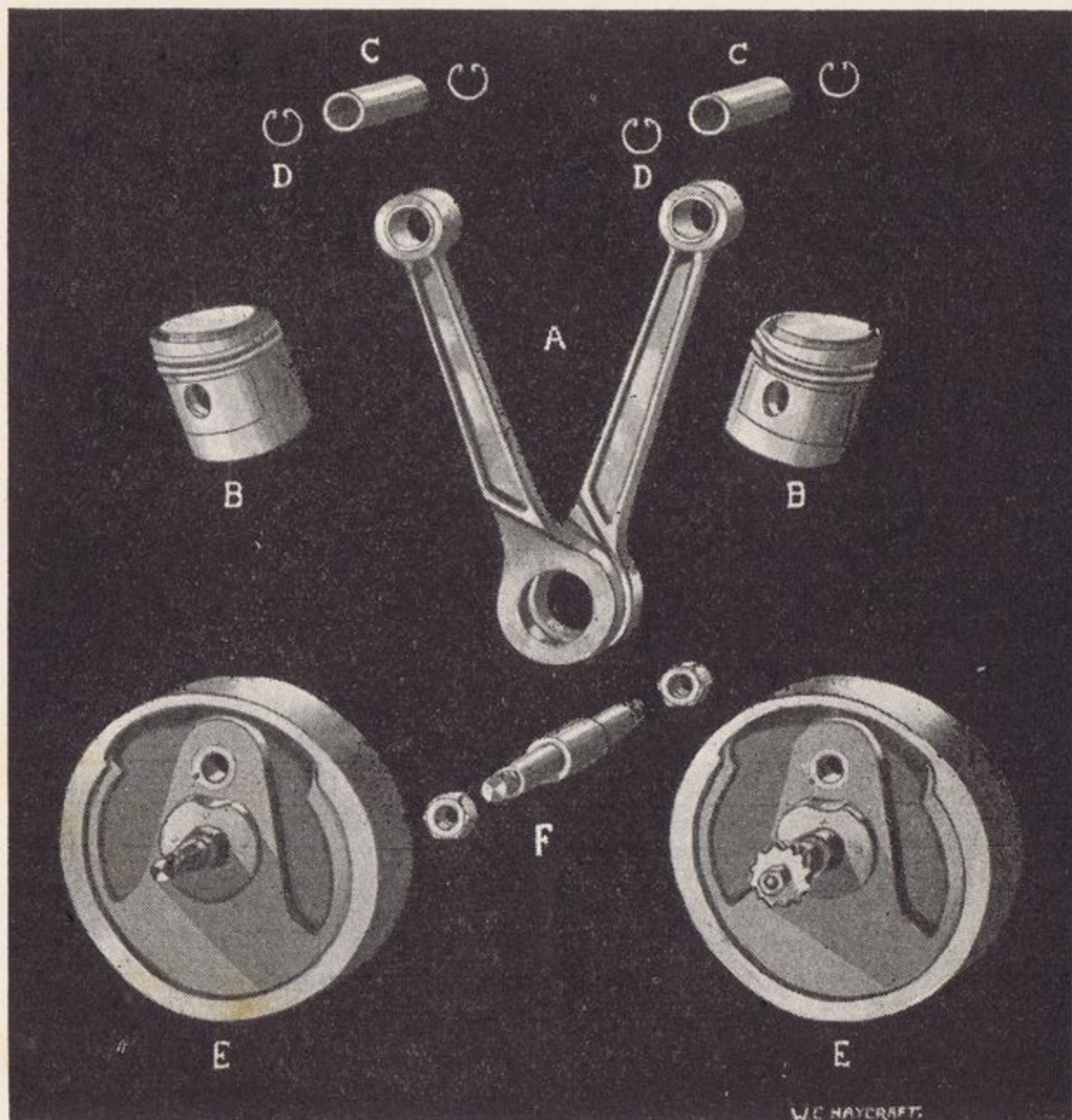


FIG. 5. THE "SILVER ARROW" CRANKSHAFT ASSEMBLY

A—Connecting rods with small-end bushes
 B—Pistons (complete with rings)
 C— $\frac{11}{16}$ -in. dia. gudgeon pins

D—Gudgeon pin circlips
 E—Flywheels and mainshafts
 F—Crankpin and nuts.

when necessary. The small end bearings are of the usual plain phosphor-bronze bush type, but the fully floating gudgeon pins measure no less than $\frac{1}{16}$ in. across their diameters. Such large size pins as these obviously have an excellent life due to their large bearing surfaces. Spring circlips prevent scoring of the cylinder walls.

The pistons themselves (B, Fig. 5) are of aluminium alloy, and of normal construction except in regard to their heads which for reasons already mentioned are sloping. The skirts on one side are split diagonally (see Fig. 30A), so as to allow for the very

considerable expansion that occurs with this metal. Two rings only are used, the lower of which acts as a scraper ring, and with a *cold* engine and new rings the correct gap is .004 in. to .006 in. A fairly high compression ratio is used (5.6 to 1).

The two pistons reciprocate in a cast-iron monobloc cylinder unit, the general design of which may be gathered by reference to Fig. 4. This unit has a one-piece detachable cast-iron cylinder head, secured in position by twelve small studs with two separate copper-asbestos gaskets inserted between, one for each cylinder. The foremost and rearmost bolts are also used as anchorages for two short steel struts which run to the front and rear frame down-tubes respectively, for the purpose of damping out any tendency for vibration and securing greater rigidity. As on the standard Matchless range, the sparking plugs are located approximately centrally above the semi-turbulent combustion chambers. Removal of the cylinder head bloc (see page 128) exposes to view both valves and pistons, the former having their seatings in the lower cylinder casting. Thus a top overhaul is enormously simplified, and the valves may be ground in and carbon deposits removed without disturbing the cylinder bloc itself. "Heeltite" is recommended as a means of obtaining a perfect joint.

The cylinder bloc is perhaps one of the most interesting features of the whole design. The two cylinders on the driving side of the engine are joined by a web, and on the timing side the casting below the horizontal cylinder finning is shaped to form a rectangular, oil-tight valve chest (Fig. 4) with a pressed steel cover. The valves and their springs thus operate under ideal conditions. The shape of the cylinder bases ensures the bloc being truly located, and a large washer prevents any tendency for oil leakage. The mouths of the cylinder bores are, incidentally, very generously chamfered to allow of safe and easy replacement of the piston rings. On the driving side of the engine bolted in an extraordinarily accessible position is the flanged fitting carburettor. No induction pipe is used, the instrument being attached direct to the cylinder bloc and the vaporized fuel supplied to the two inlet ports via a cored passage running between the cylinders. There is thus no possibility of air leaks or condensation occurring.

On the timing side a large and detachable horizontally-finned exhaust manifold is bolted to two flanges projecting from the cylinder bloc. The products of combustion pass from this manifold into a long sweeping exhaust pipe which is heavily chromium plated and of large diameter with a push-in exhaust pipe connection. Thence the exhaust gases pass through the silencer and fish-tail into the atmosphere. The silencer is of unusual design

and highly efficient. With the engine turning over at 4,000 r.p.m., there is no appreciable back-pressure in spite of the fact that a complete reversal of direction of the gas stream is caused by two parallel and diagonally placed sheet metal baffles (see Fig. 6) which, for practical purposes, divide the expansion chamber into three compartments. Before passing through the fish-tail, the gases are compelled to enter a perforated and blind-ended tube. This tubular baffle which further splits up the gas stream, is detachable, but the other baffles obviously cannot and are not required to be disturbed. Owing to the fact that a spring frame is used it is not possible, obviously, to attach the silencer to the

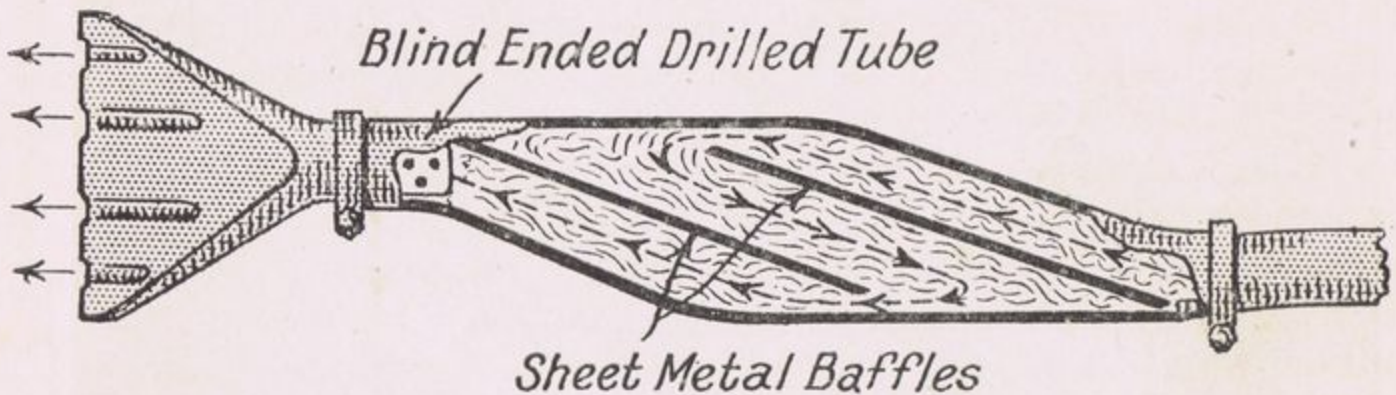


FIG. 6. DIAGRAM SHOWING PRINCIPLE OF MATCHLESS SILENCER

The above type is fitted to all machines and is amazingly efficient. Note the reversal of the gas stream indicated by arrows

offside chain stay in the usual manner, and recourse is had to a kind of triangular outrigger plate bolted to the gearbox cradle.

The valve gear (Figs. 4 and 7) is extremely simple and unusually quiet, due to the use of a single camshaft driven by helical bevels off the mainshaft, and to complete enclosure and adequate lubrication of all working parts. The camshaft, which is a one-piece high tensile steel stamping with the cam profiles accurately ground after hardening, is mounted upon three plain bearings (Fig. 7) across the crankshaft axis, the large centre bush being housed in a vertical crankcase web situated slightly ahead of the mainshaft axis. The two other bushes are fixed at the front and rear of the camshaft, the former being pressed into a housing end cap, and the latter into a special housing cover plate whose removal by undoing four screws enables the complete camshaft to be withdrawn from this end (see page 140). Securely fitted to a slight taper and keyed to the camshaft immediately behind the large centre bush is a large diameter helical bevel drive pinion meshing with the helical bevel fitted in a similar manner, but secured by a locking nut (right-hand thread) to the engine mainshaft. The diameter of the smaller pinion is, of course, exactly half that of the larger one, so as to give the 2 to 1 reduction

necessary on a four-stroke engine. Both pinions are marked so that correct replacement and non-interference with the valve timing is ensured. The rear end of the camshaft is made use of to drive the magneto, or "Magdyno," as the case may be, a very simple and most efficient flexible coupling being provided. The design of this coupling is made clear by an examination of the

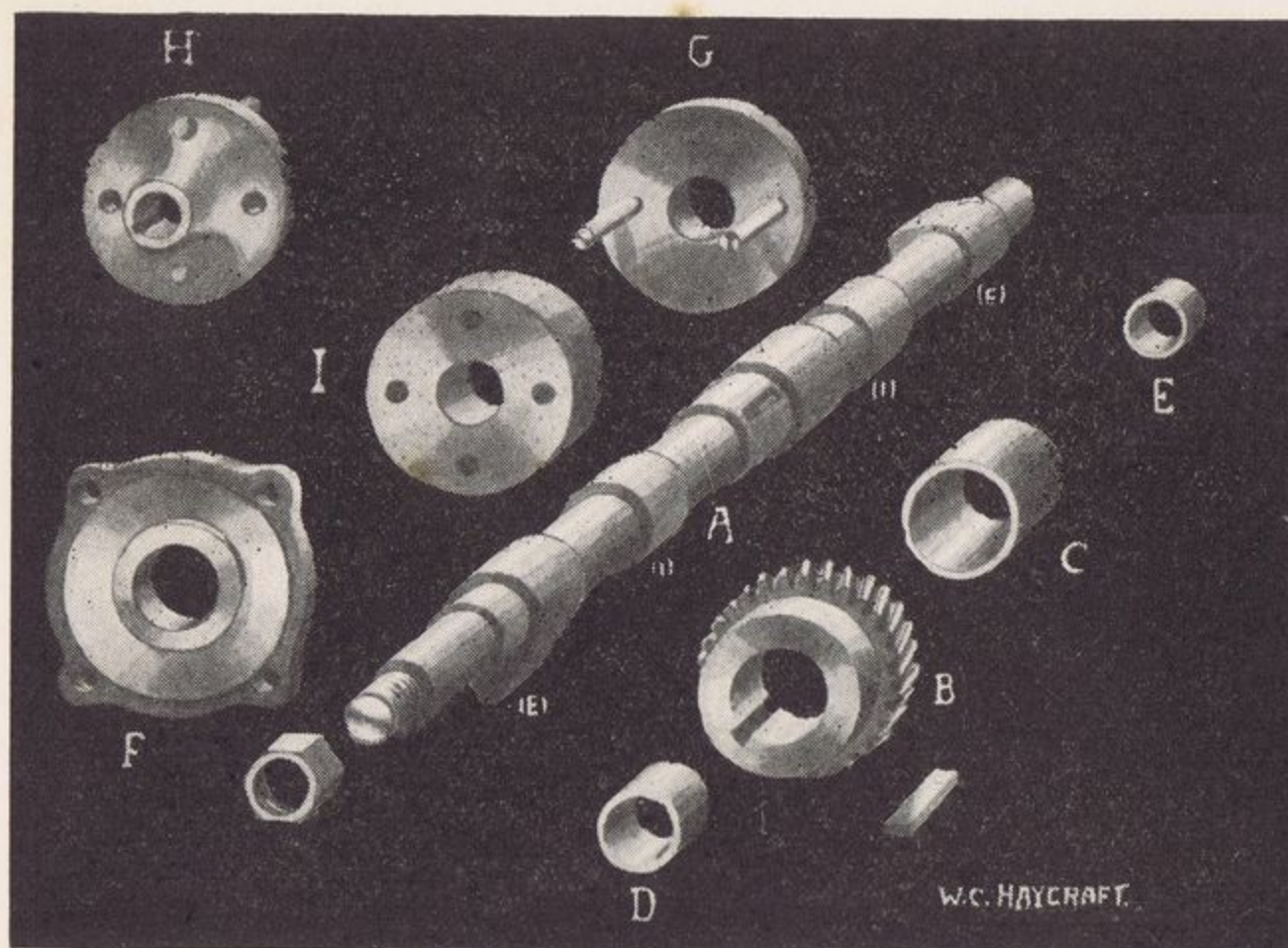


FIG. 7. THE CAMSHAFT, CAMSHAFT BEARINGS AND MAGNETO COUPLING

- | | |
|--------------------------------------|--------------------------------|
| A—Camshaft | E—Small bush (front end) |
| B—Helical bevel-drive pinion and key | F—Camshaft housing cover plate |
| C—Large central bush | G—Camshaft magneto drive disc |
| D—Small bush (rear end) | H—Magneto armature drive disc |
| I—Flexible rubber disc. | |

components shown dismantled in Fig. 7. It will be seen that they comprise two steel pegged discs fitted upon the tapered ends of the camshaft and magneto armature. The magneto disc *H* is keyed, but the camshaft disc *G* is a friction fit only (to allow of the magneto timing being altered), and is held firmly in position by a nut (left-hand thread) on the end of the camshaft. The two discs each have two holes spaced at 180 degrees into which two keys on the opposite disc fit. Between the two metal discs is a rubber disc which provides a certain amount of flexibility. The whole camshaft runs submerged in oil, and the life of the bearings and worms is very great indeed.

No valve rockers are provided, the round ends of the non-

rotating tappets resting direct upon the cams and reciprocating in chilled cast-iron guides. These tappets are unusual in that they have two flats, and are not of round section. They do not, therefore, rotate in the guides. The guides themselves are light push-fits in the crankcase, and may readily be removed after loosening the four locking screws and wedge-shape collar washers engaging with grooves on the guides (see *M* in Fig. 8). The tappets have the usual type adjustable heads (*H*, Fig. 8) secured by lock-nuts. The valves themselves are of the familiar mushroom pattern with very long stems and small heads. The heads are slightly convex, and have the usual slots for screwdriver insertion when valve

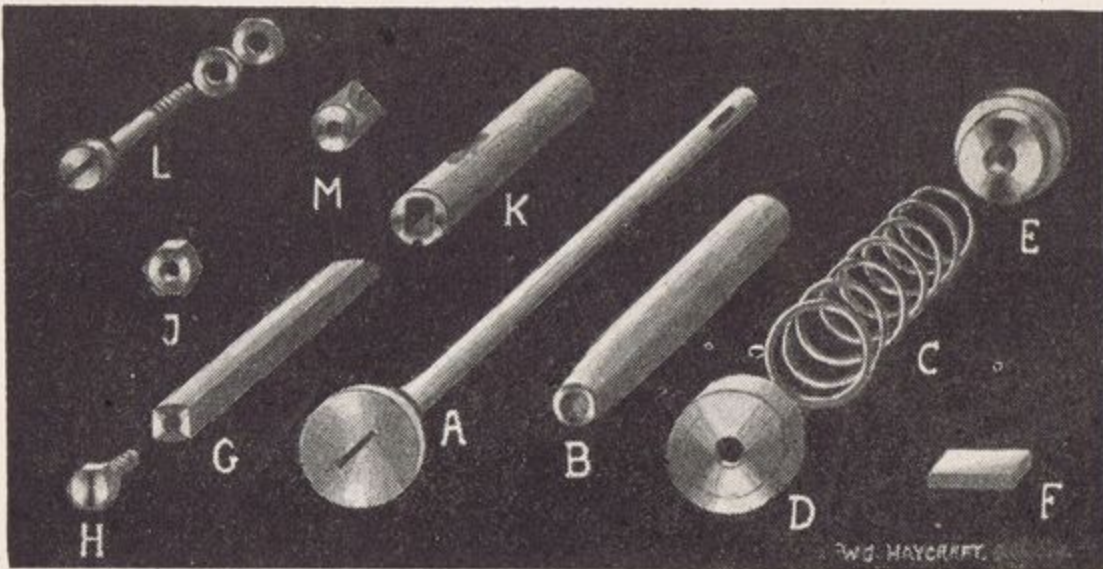


FIG. 8. SHOWING SOME COMPONENTS OF THE VALVE GEAR DISMANTLED

- | | |
|-----------------------------------|---------------------------------------|
| A—Valve (inlet or exhaust) | G—Tappet |
| B—Valve guide (inlet or exhaust) | H—Tappet adjusting head |
| C—Valve spring (inlet or exhaust) | J—Lock-nut |
| D—Valve spring cap (upper) | K—Tappet guide |
| E—Valve spring cap (lower) | L—Tappet guide lock screw and washers |
| F—Cotter | M—Tappet guide locking collar. |

grinding. Single coil compression springs are used, the lower of the spring caps being anchored to the valve stem by means of a flat cotter passing through a slot in the stem. Inlet and exhaust valves and valve springs are interchangeable, but when the engine has had considerable usage it is very inadvisable to interchange the valves themselves as the faces and seatings wear slightly differently, and a perfect gas-tight seal is of supreme importance. As previously mentioned, there is no exhaust valve lifter.

- | | |
|--|---|
| Lubricating oil recommended (all S.V. engines) | Castrol XL |
| Sparking plugs recommended (all S.V. engines) | K-L-G. K.1, or Lodge T.S.3 |
| Tappet clearances (warm) | .004 in. inlet and exhaust |
| Magneto advance | $\frac{3}{8}$ in. before T.D.C. on full advance, or T.D.C. on full retard |

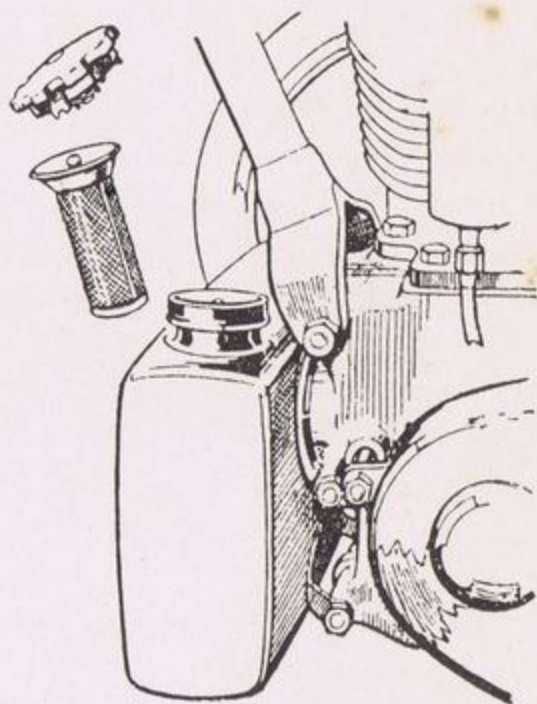
The Dry Sump Lubrication System (All Models). The general design of the engine lubrication system is the same for all Matchless models. It is of the force-feed, constant circulation type with dry sump. Briefly its working is as follows: Oil is *sucked* from the tank, distributed throughout the engine, and finally returned to the tank by a duplex internal pump. This comprises a single double-acting, steel plunger (Fig. 51) housed in the crankcase casting below the timing case between two rectangular end caps horizontally and at right angles to the crankshaft axis, and able simultaneously to rotate and reciprocate. This dual action of the plunger is obtained, as is more fully explained on page 73, by the fact that while a positive rotation at one-fifteenth engine speed is effected by direct engagement of a central hobbled portion with a worm cut on the mainshaft, an endwise movement is secured by having an annular cam groove cut in the plunger body in permanent contact with the hardened end of a fixed guide screw. The actual oil circulation is brought about by alternate displacements and suction at the two ends of the reciprocating plunger, one end being of greater diameter than the other to ensure complete scavenging of the sump and the return of all surplus oil to the tank. Two segments cut in the plunger body constitute the main ports which regulate the circulation. There is no adjustment, however. A point worthy of notice here is that the crankcase cannot safely be split until the pump plunger has first been removed.

With regard to the actual oil distribution, the system adopted is made clear by reference to Fig. 4, and also to Fig. 50. The small end of the plunger (i.e. the front one) forces oil up into the timing case to a predetermined level, such that the camshaft bearings and drive are adequately lubricated. In the case of the "Silver Arrow," the oil level in the timing case is just below the camshaft itself, so that each cam dips into a bath of oil at every revolution. All surplus oil overflows into the flywheel chamber and is eventually returned to the sump, although some of it is caught up by the flywheels and splashed upon the big-ends and the cylinders. Splash lubrication, however, is not relied upon to any extent owing to the small volume of oil remaining at any time in the sump. Oil is forced under pressure direct to the big-end bearings and to the crankshaft bearing on the timing side by means of carefully drilled passages in the flywheel and mainshaft concerned, respectively. Oil is also fed to three points on each of the cylinder walls in such a position that the bulk of the oil is discharged on to that part of the thrust side of the cylinder walls where the maximum cooling effect upon the pistons is required.

The Matchless D.S. lubrication system is simplicity itself, and

it guarantees a continual supply of clean, cool oil to the engine whenever the latter is running. The oil circulation should be verified occasionally by removing the oil tank filler cap and noting whether oil is being ejected from the return pipe orifice. This check upon the oil circulation should be made preferably upon starting up the engine from cold. Remember the fact that when the engine has been left stationary for some time, oil from various parts of the engine has drained to the sump and, until this surplus has been cleared, the return to the tank is very positive, whereas normally it is somewhat spasmodic and, perhaps, mixed with air bubbles due partly to the fact that the capacity of the return part of the sump is greater than that of the delivery portion, and partly to the fact that there are considerable variations in the amount of oil held in suspense in the crankcase. For example, upon suddenly accelerating the return flow may decrease entirely for a time only, of course, to resume at a greater rate than before when decelerating. It may be mentioned, however, that on all de luxe models the provision of a sight-feed on the instrument panel, illuminated at night, obviates the necessity for removing the filler cap, the oil supply to the timing-box or rocker-box on the overhead-valve engines being first by-passed up to the panel. It is important that no air leaks occur in this system, the effect of which would tend to cause the sight-feed bowl to fill up even at moderate speeds. Should the sight-feed window be accidentally broken the ends of the two pipes may be connected by a piece of rubber tubing, when the oil will merely flow up one pipe and down the other. All oil returned to the tank is immediately filtered. It is important for several reasons (see page 61) that the oil level in the tank be maintained approximately correct. Beyond this no attention is necessary.

A minimum amount of exterior piping is used, and in the case of Models A/2 and B, the oil tank, which is a welded unit of pressed steel and immensely strong, is bolted direct to the front of the crankcase as shown in Fig. 9. A circular face on the tank abuts against a corresponding face on the crankcase, and two holes in the latter coincide with the orifices of the two oil pipes



(From "The Motor-Cycle")

FIG. 9. THE OIL TANK
BOLTED TO THE ENGINE

in the tank—the suction and discharge pipes. The former is led nearly to the bottom of the tank, and the latter is visible on removing the filler cap.

Carburettor. A special semi-automatic, two-lever, flange fitting Amal pilot jet instrument is used. Its type number is 4/014, and it has a bottom petrol feed. It is bolted direct on to the near side of the cylinder block at the end of the cored passage between the two cylinders. The usual two-lever control is used, but, if desired, twist-grip control of the throttle may be specified. A throttle stop limits the closing of the throttle slide, and enables a very low revolution tick-over on the pilot jet to be obtained. The main jet fitted as standard is a No. 55, with a $\frac{4}{4}$ throttle valve

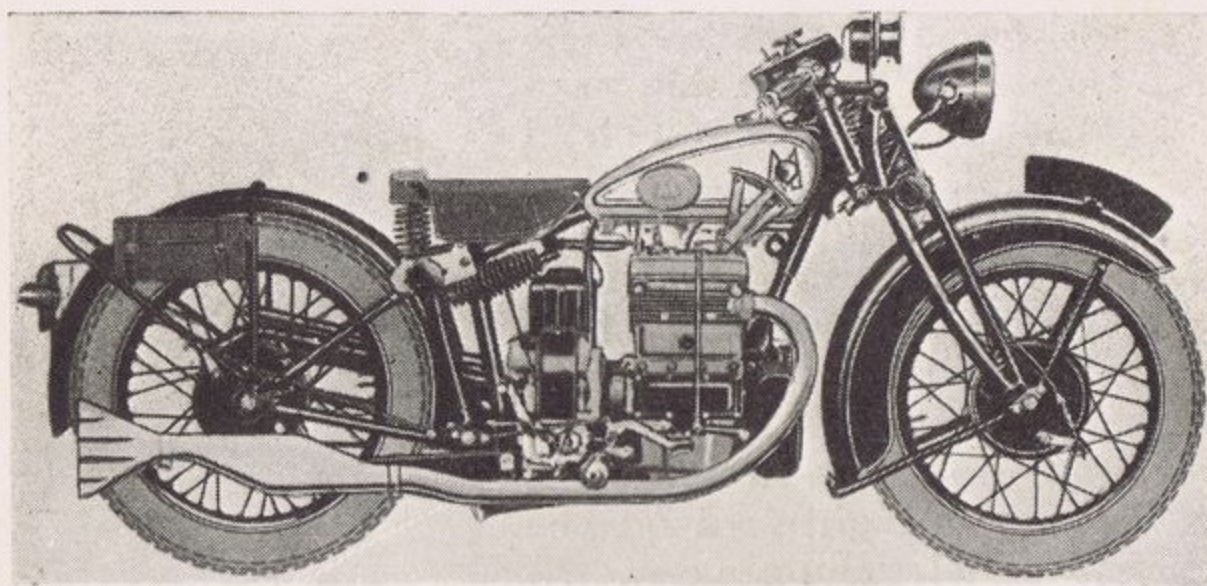


FIG. 10. MODEL A/2 (THE "SILVER ARROW") DE LUXE

in position 3. This combination provides a low fuel consumption (90–105 m.p.g.), good acceleration, and high maximum speed. On de luxe models a special air cleaner is fitted to the intake. This effectively prevents the ingress of dust and dirt into the cylinder. It should be noticed that when an air filter is fitted to a carburettor, the main jet size may usually advantageously be reduced by 10 to 15 per cent.

Ignition. Lodge type T.S.3, single-point, mica-insulated sparking plugs are standardized on the 1931 side-valve range, and the recommended gap at the electrodes is $\cdot 020$ in. ($\frac{1}{50}$ in. or, approximately, $\frac{1}{2}$ mm.).

The current is generated, unless a Lucas "Magdyno" unit be specified, by a Lucas type K.L.V. high-tension magneto, secured by four bolts to a platform above the gearbox, and driven by a flexible coupling straight off the camshaft, and, of course, has anti-clockwise rotation (seen from C.B. side). On this machine and on the Big Twins, there are two cams on the cam ring since the armature is driven at one-half engine speed. No. 1 cam, which is responsible for the spark at the plug of the rear firing cylinder,

is situated on the right-hand side of the cam ring. Above the contact-breaker is the rotating distributor arm driven by spur gearing off the armature at one-half engine speed. The correct "break" at the contacts should be $\cdot 012$ in.; a small carbon brush in the bakelite contact-breaker cover enables the primary circuit to be broken by a magneto cut-out switch mounted on the handlebars or instrument panel. Further details and an illustration of a Lucas magneto without distributor will be found on page 79.

Frame and Forks. The Matchless spring frame is one of the

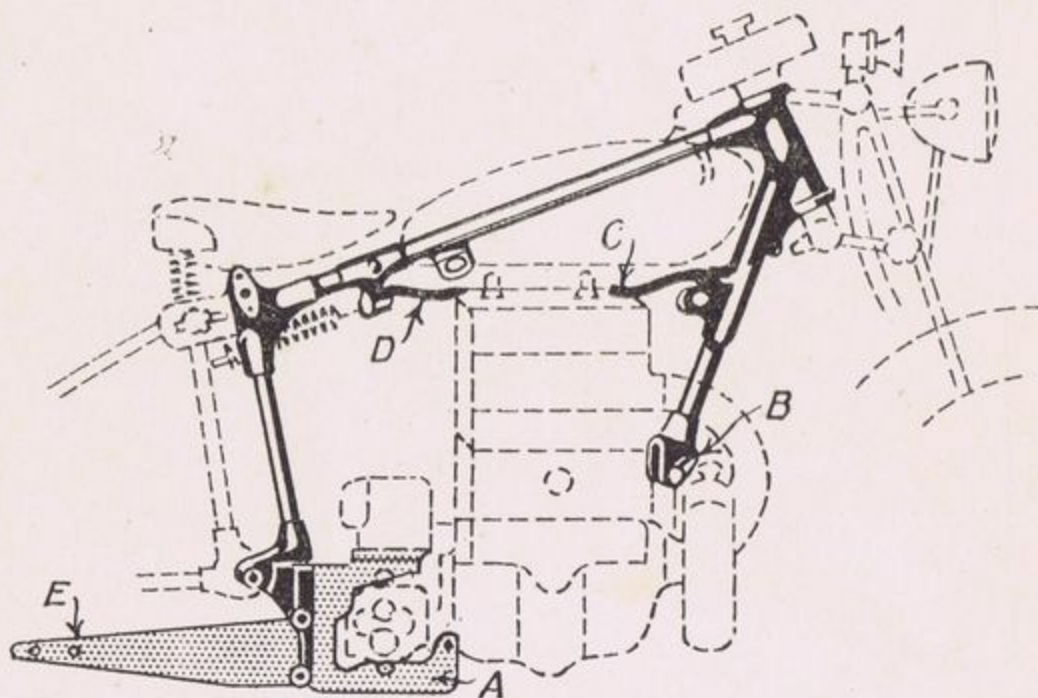


FIG. 11. THE FRONT PORTION OF THE SPRING FRAME

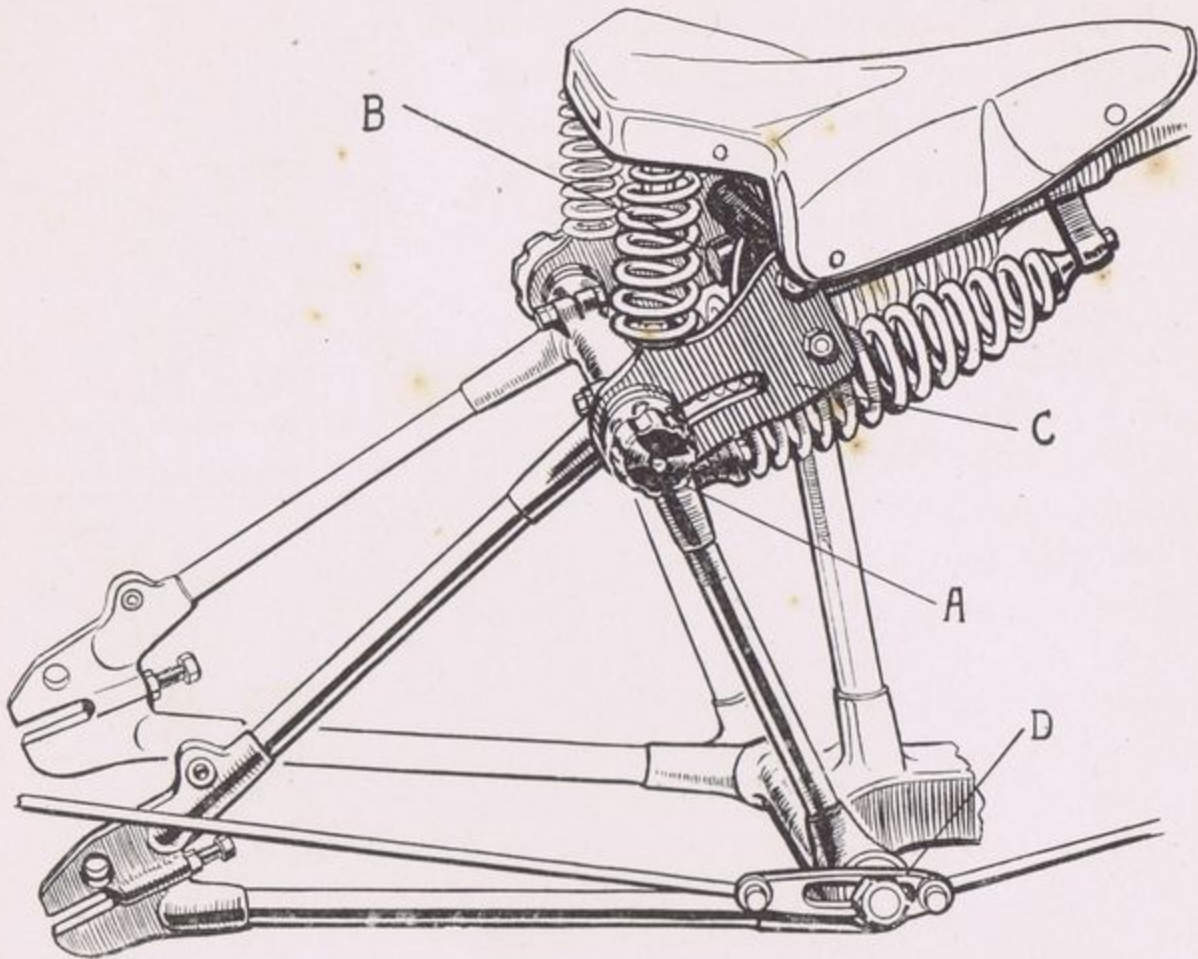
The engine, gearbox, magneto, etc., are shown dotted to indicate their location and method of fixing

most interesting features of the machine, and effectively damps out all road shocks. It also possesses absolute lateral rigidity. It comprises two distinct members—the front main portion and the rear portion which is sprung and pivots at a point just behind the base of the saddle tube.

The front portion of the frame is of the diamond type, and is constructed of three high-grade seamless steel tubes pinned and brazed to two heavy lugs, the steering head lug being particularly massive. Fig. 11 shows how the power unit is installed. A pair of rear engine plates, shown at *A*, serves the triple purpose of providing a cradle mounting for the engine, housing the four-speed gearbox and supporting the platform for the electrical generator. Forward, the engine crankcase is bolted to a substantial lug *B* at the end of the front down tube. In addition, two short stays, *C* and *D*, run from this tube and the tank tube, respectively, to the cylinder head. At *E* will be observed the

special silencer outrigger plate necessary to counteract the deflection that would otherwise be caused by the sprung portion of the frame.

The design of the rear portion of the frame is made clear by reference to Fig. 12. It consists of what is in effect a triangular girder of immense strength. This portion pivots freely at the point of attachment to the main frame at the base of the saddle tube on two indestructible "Silent-bloc" rubber bearings, which



(From "The Motor Cycle")

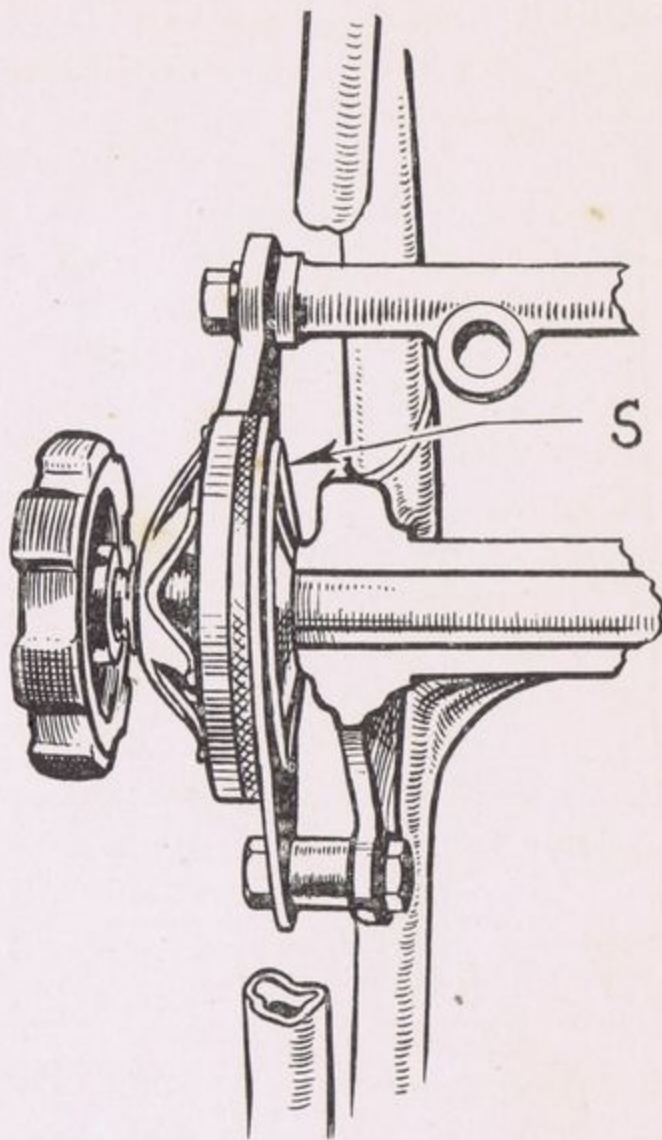
FIG. 12. THE REAR PORTION OF THE SPRING FRAME

A—Adjustable dampers C—Damper side plate
B—Rubber buffer stops D—Brake compensating link

require no lubrication and cannot wear. Three years is regarded as a normal life. Right at the end of the tank tube is a massive "T" lug which carries two rubber buffer stops to prevent the suspension springs closing up solid when negotiating extremely rough ground, and two steel plates bolted to the frame seat lug. These steel plates (C, Fig. 12), which each have a radius slot cut in them, serve as saddle spring anchorages, and the slots themselves act as guides for the two upper transverse spindles which are both clamped so as to enable an adjustment to be made, in the top bridge lug, and at their ends have adjustable shock-absorbing dampers (A, Fig. 12) which can be manipulated by hand from the saddle with the machine in motion. Two fibre

friction discs are brought into direct contact with each stationary side plate at the required pressure by rotating the handwheels clockwise the necessary amount to suit varying road conditions. Two metal discs are employed and one spring washer. The main purpose of these friction dampers is to delay the recoil of the two powerful compression springs which take the loading, and which are placed between the rear frame and the tank tube. The rear fork ends are of the usual type with screws between the chain stays for correctly tensioning the secondary chain and aligning the rear wheel. In this connection it is interesting to note that the pivot of the rear frame is not concentric with the rear driving sprocket. In practice, however, the alteration in chain tension consequent upon the movement of the rear portion of the frame is of negligible effect, provided that the chain tension be adjusted with the hinged portion of the frame in its normal position (page 112). In order that the action of the spring frame shall not interfere with the brake mechanism, an extension of the offside "silent-bloc" pin serves as a guide for a slotted link plate which can move in a fore and aft direction only.

The Matchless forks (fitted to all models with slightly different dimensions) comprise a strong brazed up girder assembly of "D" section seamless steel tubes, the two front tubes being of very small section. Suspension is by a single compression spring fitted between the top rear transverse lug and the lower front lug. A good degree of flexibility is thus obtained. Two large adjustable shock absorbers are provided of the type illustrated by Fig. 13. Adjustment may be made, as in the case of the spring frame dampers, with the machine in motion, and this course is the best one. The correct degree of friction is obtained by rotating the ebonite hand-adjusting nut on the off-side the required amount.



(From "The Motor Cycle")

FIG. 13. PARTLY SECTIONED VIEW OF THE LARGE ADJUSTABLE SHOCK ABSORBERS FITTED TO THE FRONT FORKS

Note the large spherical seating of the back plate S, which remains permanently effective

The back plate of each shock absorber, as may be seen from the illustration, has a spherical seating so that it remains effective throughout the whole life of the machine. Provision is made for correcting lateral play in the fork spindle bearings independently of the damper adjustment and for lubricating the spindles. The fibre washers fitted between the spindle lug ends and the spindle side plates are not intended for frictional purposes, but solely to prevent actual seizure in the event of the hexagon-ended spindles being tightened excessively. Grease-gun nipples are provided for lubrication of the spindle bearings, the lubricants advocated being Tecaletmit Grease or Wakefield's "Castrolase Light."

An efficient steering damper with the friction surfaces at the base of the steering head lug (see Fig. 3) is controlled by an ebonite handwheel on the instrument panel or, where this is not fitted, in the centre of the handlebars. Two useful fork stops are also included.

Gearbox and Clutch. The gearbox is the latest four-speed, lightweight Sturmey-Archer, similar in construction and action to the four-speed heavyweight boxes of the same make fitted to the higher powered models. The solo gear ratios are as follows—

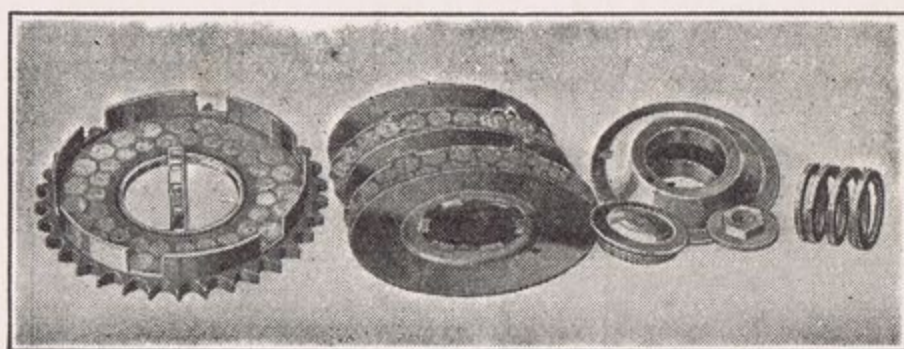
First, 17·5 to 1 ; second, 11·6 to 1 ; third, 7·8 to 1 ; fourth, 5·9 to 1. Gear control is by a neat gate-change quadrant bolted to the tank itself, and a straight pattern gear lever connected to the gearbox striker lever by two rods running at right angles to each other, and joined by a neat duplex lever mounted on a shaft just behind the oil tank. The gear lever positions from rear to front are 1st, N, 2nd, 3rd, 4th. The gearbox lubricant recommended is Mobiloil "O" or Mobilgrease. Provision is made in the design of the gearbox for a speedometer drive, which, when fitted, communicates with a Smith chronometric instrument mounted on the panel or on the handlebars.

Further details are given elsewhere. Sufficient it is here to mention its principal characteristics. The lightweight gearbox on Model A/2 is held in place by two bolts between the rear engine plates, which have slotted holes and a draw bolt adjustment for the primary chain. It is of very sturdy construction, embodying a carefully selected series of gear ratios to suit all requirements.

Four pairs of gears are used and of these two are always in mesh. Two of the gears, one on the mainshaft and one on the layshaft, have dog-clutch teeth formed on both faces. They are slidably mounted on splined shafts and engage with four gears which revolve freely on their axles, but do not slide endwise. The two slidable clutch gears are grooved to engage the striking forks which are supported on a separate spindle. The lateral movement of the clutches is obtained by pegs on the striking forks which engage in slots in a cam plate on the periphery of

which are cut notches (Fig. 58) to engage a spring-loaded plunger. It will thus be realized that the various gear positions are automatically indexed in the gearbox as well as by the gate-change quadrant notches. The cam plate itself is operated by a lever on the front of the box, and is geared up to reduce the movement of the operating lever.

The kick-starter drive is taken through the low gear train as on the three-speed boxes. An extra long substantial bearing is provided for the kick-starter axle, so that there is no possibility of the layshaft getting out of line with the main axle. A pawl fitted on the axle and engaging with a ratchet on the inside of the layshaft pinion provides the necessary "free-wheel" coupling.



(Sturmey-Archer Gears, Ltd.)

FIG. 14. THE THREE-PLATE STURMEY-ARCHER CLUTCH

A similar type clutch with Ferodo inserts and six springs instead of one is fitted to all other models having 4-speed S.-A. gearboxes

The kick-starter crank is attached to the axle by serrations (Fig. 2), so it can be placed in any desired position.

The clutch used is a single-spring, three-plate type, and is controlled by a lever on the left side of the handlebars which actuates a Bowden cable transmitting its pull to a small upright lever having its fulcrum just above the kick-starter axle housing. When this lever is pulled towards the engine a ball-ended adjustable screw, at its base, pushes a short rod which pushes a long spindle floating in the hollow mainshaft back until its end pushes against the outer clutch boss and so releases the clutch spring pressure. A dual adjustment is provided in the form of a Bowden wire adjustable casing stop, and a pinch-bolt fixing of the small lever to the worm itself. Fig. 4 shows the parts of the three-plate clutch fitted to the "Silver Arrow," and it will be observed that it comprises a main body secured by a nut to the splined mainshaft and three driven plates separated by three cork and Ferodo insert discs, the rearmost of which constitutes the clutch sprocket, and is free to rotate on a brass cage roller bearing. Whenever the clutch sprocket is rotating, the other two friction discs also rotate, since they engage at their peripheries with eight deep tongues and slots in the sprocket. A single coil spring, whose pressure can

be adjusted by a nut on the mainshaft, presses the friction discs against the driven discs. Advice on adjustment and dismantling will be found on pages 108 and 144.

Transmission. Coventry "Ultimate" chains are employed for both primary and secondary transmission, the dimensions of the former being $\frac{7}{16}$ in. \times .265 in., and of the latter $\frac{1}{2}$ in. \times .305 in., and adjustment is by gearbox and rear wheel thrust screws, respectively. The primary chain is automatically lubricated by

a short pipe leading from the crankcase disc breather. The secondary chain requires to be lubricated by the rider from time to time. Adequate protection from road dust and mud is given by means of two efficient guards. The rear guard protects the upper half of the chain only, and allows of an eye being kept on chain tension and lubrication. A shock absorber is not fitted owing to the exceptionally even engine torque.

Brakes. Internal expanding brakes of 8 in. diameter \times $\frac{3}{4}$ in. are fitted to both wheels. They are smooth in action, but very powerful. A special interconnecting gear renders rapid retardation safe when driving in heavy traffic, and little effort is required to exert full pressure. The brake pedal itself is mounted on the off-side on a shaft fixed to the rear engine plates. In addition to the single pedal control of the two brakes,

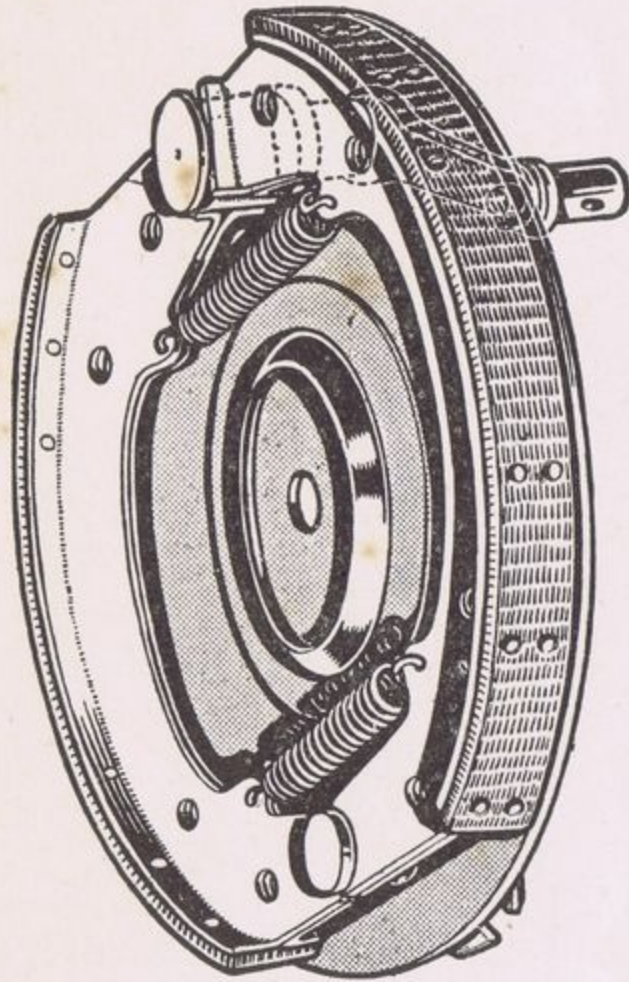


FIG. 15. THE FRONT BRAKE ANCHOR PLATE WITH SHOES IN POSITION

independent handlebar control for the front brake is provided.

The Matchless brakes do not include separate drums, for these are integral with the hubs, being forced and sweated on. Fig. 15 shows the front anchor plate which is almost identical to the rear one. Two flanged steel brake shoes, to which are riveted the Don friction linings, are pivoted at the top and held together normally out of contact with the drum by two strong tension springs. A "square" type of cam at the opposite side forces the shoes apart when pressure is applied to the brake pedal or handlebar lever. The simple method of interconnecting the two brakes is made clear by reference to Fig. 16, which shows the peculiar shape of the brake pedal mounted on a shaft fixed to the rear

engine plates. From the upper end of the pedal lever, a rod with split-pin attachment runs direct to one end of the slotted link mounted on the extremity of the "silent-bloc" bearing spindle (see Fig. 12), and from the other end another rod runs to the lever on the rear brake anchor plate where a spring and knurled nut provide a hand adjustment. From the lower end of the pedal lever a Bowden cable runs to the lever on the front brake anchor plate. Here also a similar hand adjustment is provided. In addition, hand adjustment of the independent handlebar control is

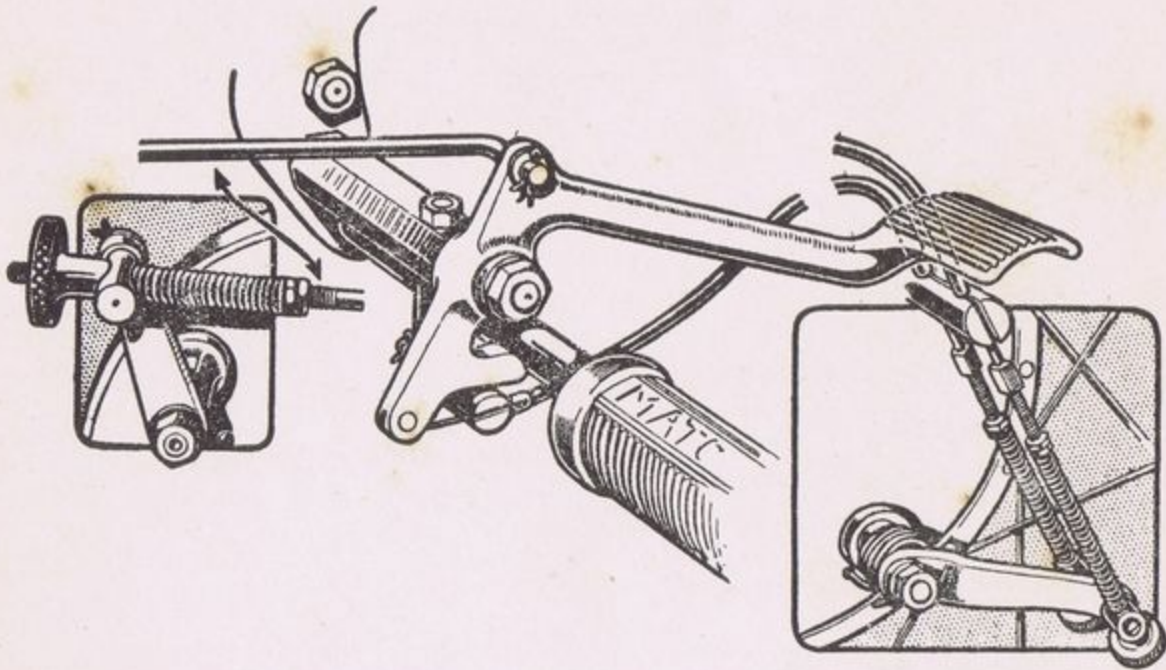


FIG. 16. SHOWING THE MATCHLESS BRAKE INTER-CONNECTING GEAR AND FINGER-TIP ADJUSTMENT

Left inset shows rear brake adjustment and right inset the foot and hand control adjustment for the front brake

also to be found, a common stop for the ends of the two cable casings being used. Considerable care is required in adjusting the brakes to a nicety (see page 115).

Wheels and Tyres. Both wheels are of massive build. Timken taper roller bearings are used throughout, a type of bearing which in order to avoid damage requires exactly the right amount of play (see page 115). Large diameter axles are used and the left-hand cones are adjustable, being secured by thin lock-nuts (Fig. 17).

Dunlop 26 in. \times 3.25 in. heavy cord, wired-on tyres are fitted, and they have Schrader valves to enable correct tyre pressures to be maintained. The inflation pressures advised for solo use on the "Silver Arrow" are 15-16 lb. per sq. in., and 21-22 lb. per sq. in. for front and rear tyres, respectively. If a pillion passenger be carried the pressure of the rear tyre should be raised to 26-28 lb. per sq. in. Where a sidecar is used pressures may remain the same as for pillion riding. The sidecar tyre should be inflated to

18 lb. per sq. in. If desired, 27 in. \times 4 in. tyres may be specified for an extra 10s.; this applies to all machines over 350 c.c. In this case the solo pressures for front and rear tyres should be 13-14 lb. per sq. in. and 18-20 lb. per sq. in., respectively.

Tanks. The fuel tank (fitted to all models except R/7) is constructionally the same as last year's tank, but it is of vastly improved shape and appearance with a more bulbous nose. It is finished in untarnishable chromium plating with white side panels

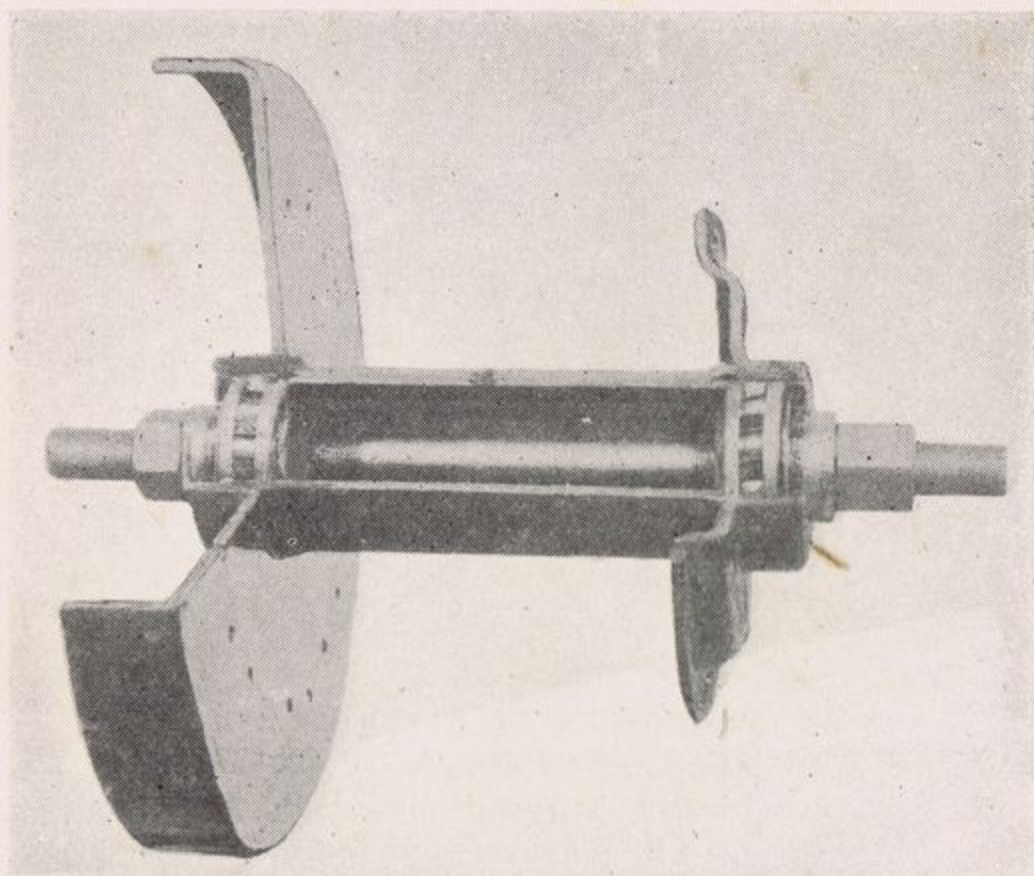


FIG. 17. MATCHLESS FRONT HUB AND BRAKE ANCHOR PLATE SECTIONED TO SHOW CONSTRUCTION

The adjustable cone for the roller bearings is the one shown on the right of the illustration

and black lining. Right at the front of each panel is a very handsome "M" in chromium plating vividly contrasting with the white background. The word "Matchless" now appears only on the centre tank strips and rear guards. A leak-proof and quickly detachable filler cap is used, and the fuel capacity of the tank is approximately $2\frac{1}{2}$ gal. Two very neat rubber knee grips are provided. The tank is attached to the frame at the base by three bolts, two at the front and one at the rear, with rubber buffers interposed to damp out vibration, and at the top has a strip fixing plate. The tank is immensely strong, being constructed of heavy gauge steel pressings welded together (Fig. 1). Even the petrol pipe union sockets are welded in position, so that there is no danger of the tank developing a leak even after many

years service, or after a few minor crashes. A "U" pipe connects the two parts of the tank, thereby balancing the level of petrol therein.

The oil tank also of pressed steel, is bolted direct to the front of the crankcase, there being no exterior piping whatever. This tank, shown at Fig. 9, has a capacity of 6 pints. The oil consumption is 1,600–1,800 m.p.g.

Miscellaneous Equipment. Chromium plated adjustable handle-bars of semi-sports type are fitted. The saddle is a large Lycett "Aero." Particularly robust footrests are attached to a square spindle passing right through the two rear engine plates.

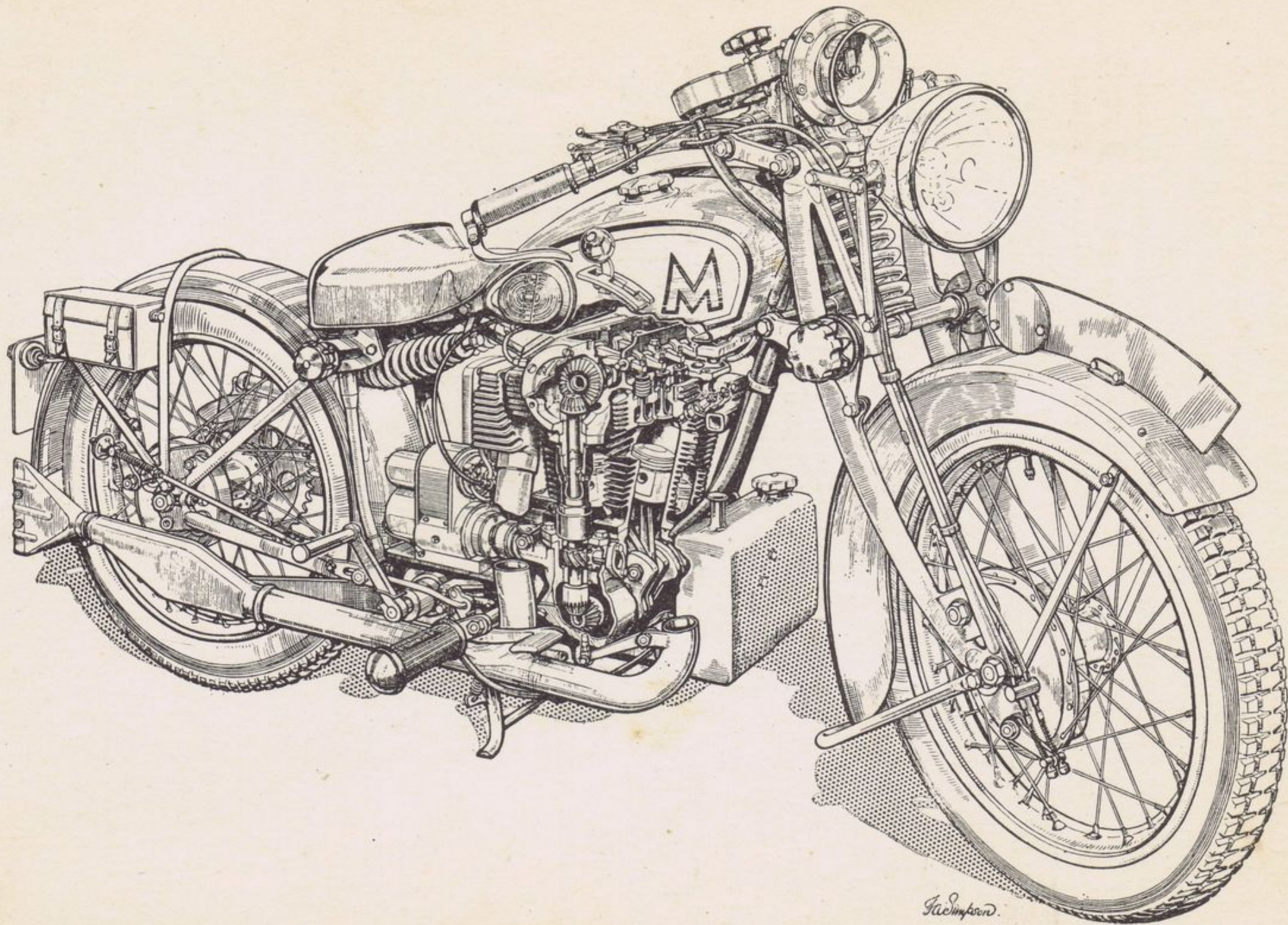
Large "D" section mudguards with deep valances are provided. The rear guard is split below the saddle to enable the rear portion, complete with stays, to be quickly detached when tyre repairs are necessary. The rear stays are extended to form a convenient lifting handle by which the machine can be eased back on to its stand, which is a spring-up type fitted below the gearbox, so designed that the machine can be lifted on to it practically without effort. When tyre repairs are undertaken, small extensions to the stand feet can be fitted to give the necessary ground clearance. A carrier is not a standard fitment, but can be had as an extra if desired. A comprehensive tool outfit is contained in one of the two metal pannier bags slung between the mudguard stays. All parts not enamelled or chromium plated are rustless black gun finished.

Maximum speed (solo), 60–66 m.p.h. Weight (without lighting), 320 lb.

MODEL B (THE "SILVER HAWK")

This fascinating machine, which has an astonishingly high road performance and attracted such attention at the 1930 Olympia Show when it was first shown to the public, is, with the exception of the power unit and transmission, an almost exact replica of the popular "Silver Arrow," already described in detail, although most of the dimensions are greater. It has complete de luxe equipment, however, and also a handsome nickel-plated, high-frequency electric horn. The engine and transmission will be dealt with in the following specification—

The 5.93 h.p. O.H.C. Vee-four Engine. As in the case of the A/2 engine, the B power unit is not what it seems on cursory inspection; it is not a vertical "four." Actually it is a very neat and compact monobloc design equivalent to two "Silver Arrow" small-angle Vee twins, set side by side with the crankshaft lying across the frame. Exactly the same firing angle (26 degrees) is employed, and there are many other features in common. The



J. Simpson.

BARNSTORMERS.CO.NZ ("The Motor Cycle" copyright)

FIG. 18. PARTLY SECTIONED VIEW OF THE 593 C.C. O.H.C. NARROW ANGLE VEE-FOUR
SPRING FRAME MATCHLESS "SILVER HAWK"

bore and stroke are 50.8 mm. \times 73.02 mm., giving a cubic capacity of 593 c.c.

The crankcase is sturdy but very compact, and houses a built-up, two-throw crankshaft which is carried in three bearings to prevent whip, the centre one being a heavy roller pattern mounted

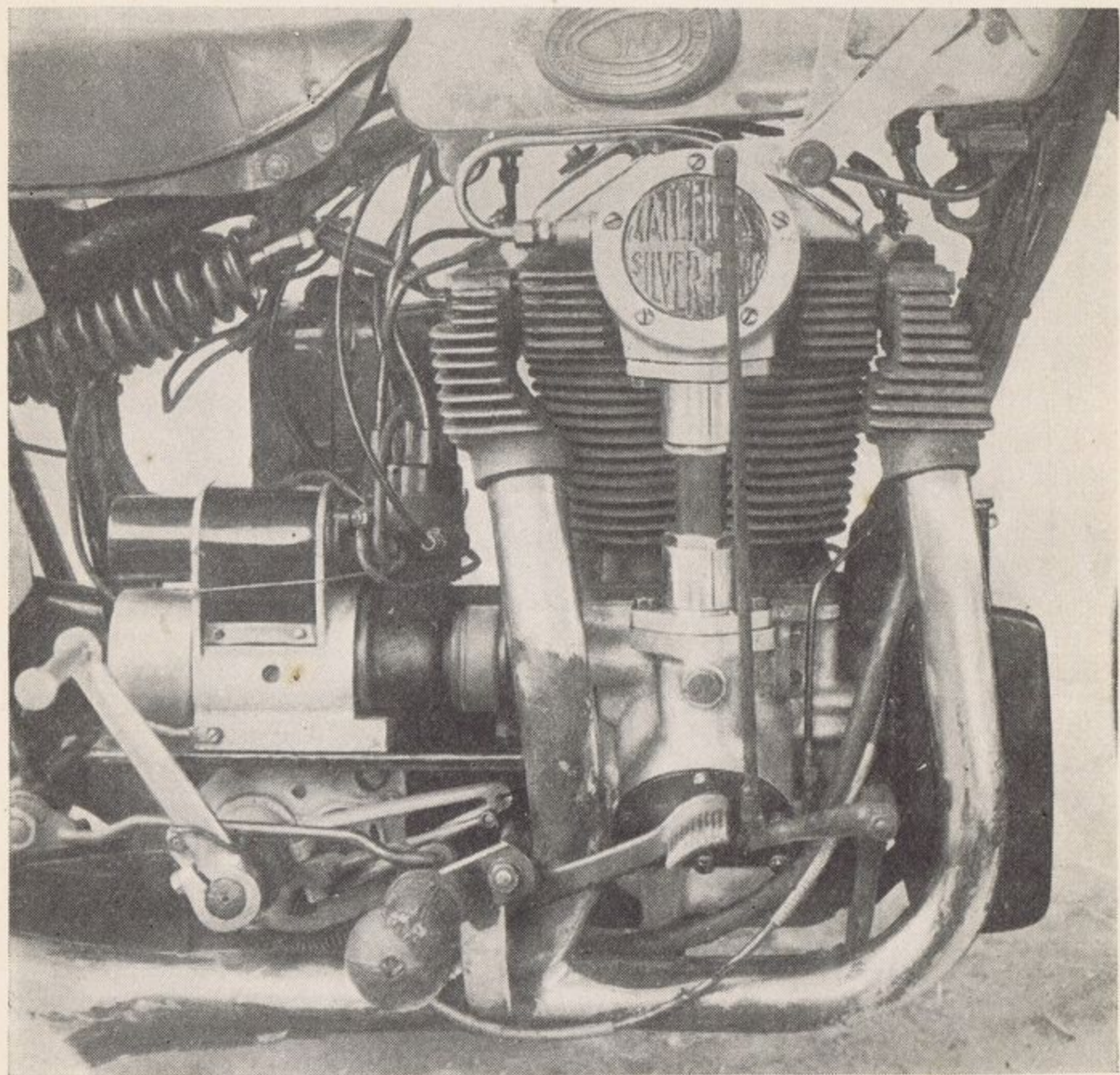


FIG. 19. CLOSE-UP VIEW OF 5.93 H.P. O.H.C. VEE-FOUR ENGINE

Showing arrangement of the vertical camshaft drive, exhaust manifolds and dynamo-coil-distributor unit

in a large steel plate which forms a partition between the two crankcase halves, by which it is firmly held in position. Phosphor-bronze bushes, pressure fed from the D.S. pump to ensure longevity, are fitted on both the driving and timing side of the crankshaft. Four bobweights and heavy crank cheeks are substituted for flywheels. Fig. 20 illustrates the complete crankshaft assembly, and it may be observed that "Silver Arrow" connecting rods and big-end assembly are used. Aluminium alloy is, of

course, used for the pistons, which have unusually long split skirts and have two rings, the lower one acting as a scraper ring. The piston ring gap is .004 in. to .006 in. The gudgeon pins are fully floating and of $\frac{1}{8}$ in. diameter. Spring circlips retain them in the piston bosses. In connection with the big-end bearings, it should be mentioned that the eyes of the "H" section connecting rods, as on the "Arrow," are very slightly eccentric and narrowed in depth to permit of slight overlapping. Shouldered

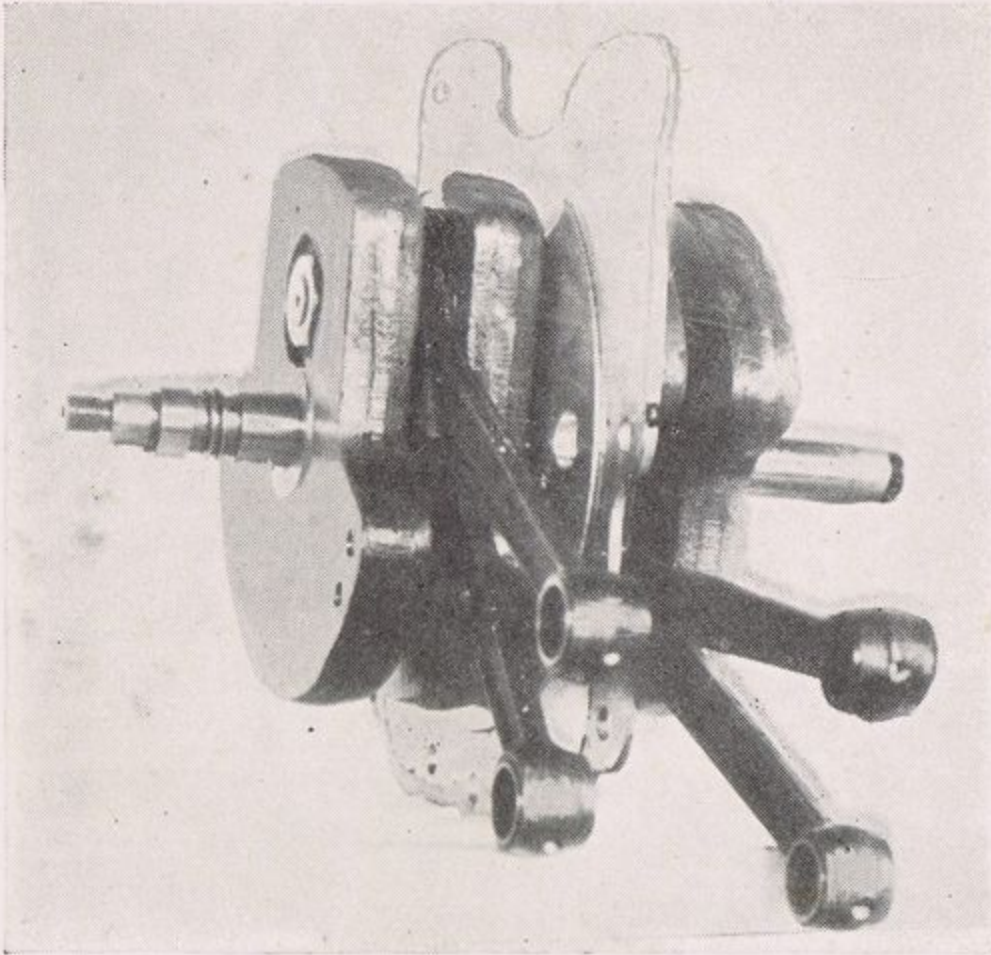
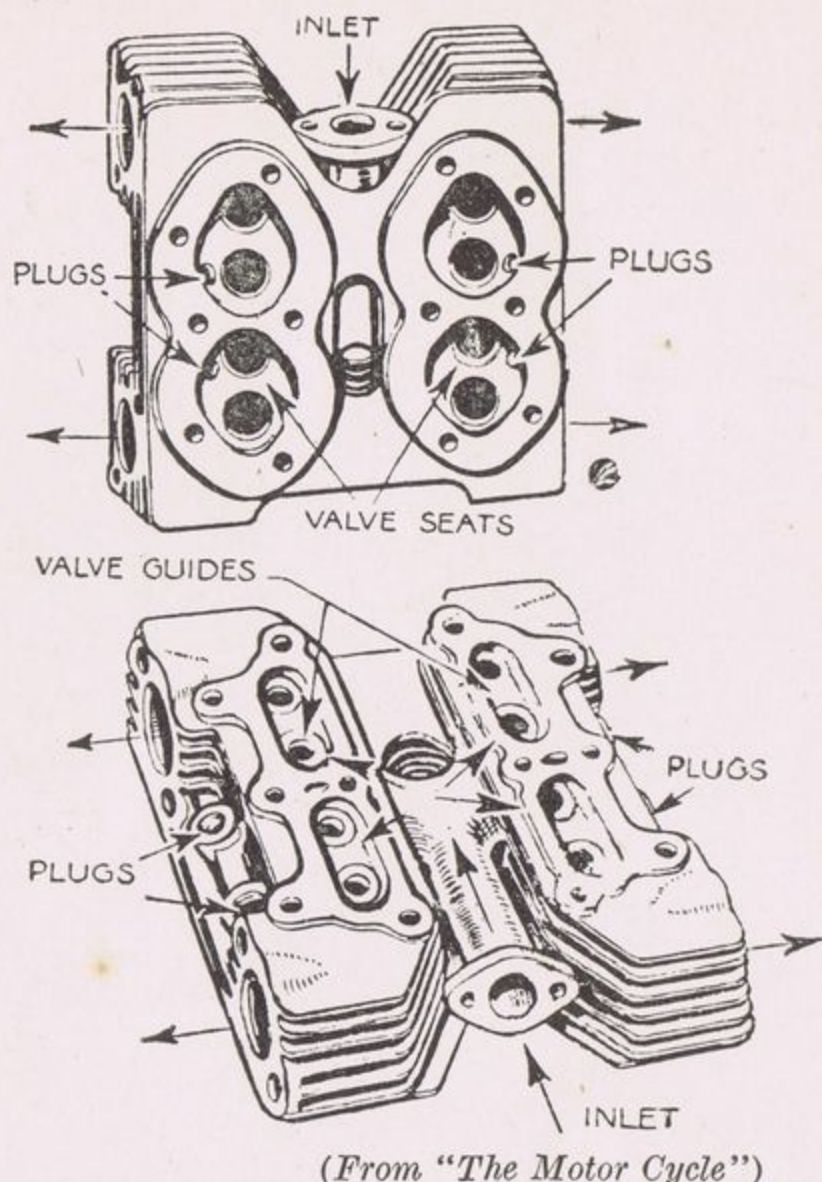


FIG. 20. THE "SILVER HAWK" CRANKSHAFT ASSEMBLY

crankpins are used and a set of rollers (without bush) for each connecting rod.

The angle between each pair of cylinders is 18 degrees, as in the case of the "Arrow" engine, and all four are cast integral in a monobloc casting well finned horizontally and with a large air space between the cylinder banks. This block has a four-bolt attachment to the crankcase, and its upper surface is machined to receive the detachable cylinder head. A gas-tight joint is ensured by the use of a copper-asbestos washer. The compression ratio is 6 to 1. The head itself, which is an intricate monobloc casting containing all four combustion chambers, is held down together with the cam box by twelve bolts. In plan view it is approximately square (Fig. 21), and contains the valve seats, the induction passages, and the exhaust passages. The valves, which have $\frac{5}{16}$ in. stems and $1\frac{1}{8}$ in. heads, reciprocate in chilled cast-iron

guides pressed into the cylinder head vertically, and, since the cylinder bores are 2 in. approximately (50.8 mm.), it becomes necessary to use combustion chambers that in plan view are roughly oval. The tops of the cylinder barrels are cut away to conform with this shape. To ensure perfect gas distribution to each cylinder and effective mixture pre-heating, a cored passage leads from the flanged carburettor on the near-side to a central



(From "The Motor Cycle")

FIG. 21. SHOWING THE CONSTRUCTION OF THE ONE-PIECE CYLINDER HEAD

position in the head, and from here four passages of *equal length* communicate with the respective combustion chambers. Referring to the upper sketch in Fig. 21, it may be noted that the four valves at the corners of the unit deal with the exhaust, and the four in the centre with the induction. Bolted to the front and rear sides of the cylinder head are two finned cast-iron manifolds, from which the products of combustion from each pair of cylinders are conveyed to two separate large diameter ports, both inclined slightly forward, whence the gases are led by two chromium-plated exhaust pipes to a single large capacity silencer of standard Matchless design.

The top of the cast-iron cylinder head is faced to receive the neat aluminium cam box (Fig. 19) which completely encloses the overhead camshaft and the valves and their rockers, and enables the parts to be well lubricated and kept silent. The aluminium cam box, which is integral with the bevel box, is held down by the same long bolts which retain the cylinder head itself to the main cylinder bloc. Two detachable cover plates give instant access to the valves and their rockers, so that correct valve clearances can readily be maintained. The single piece camshaft runs across the centre of the rocker-box parallel to the crankshaft, and is supported by long plain phosphor-bronze bearings at each end. It is driven clockwise from the vertical shaft by straight bevels

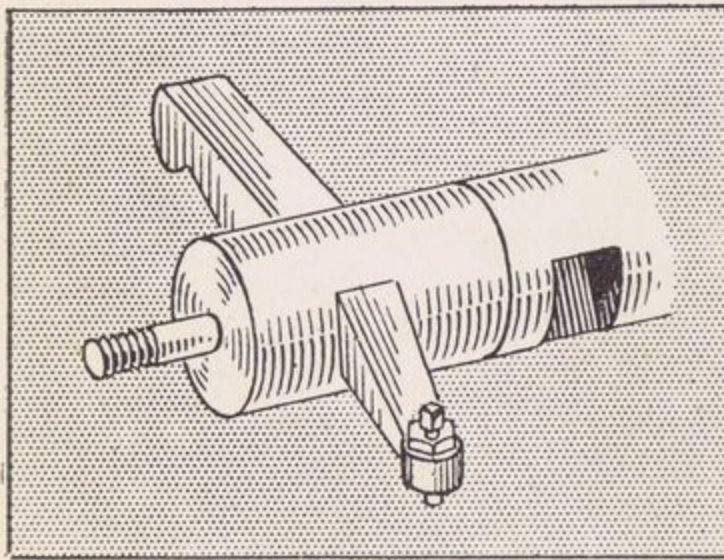


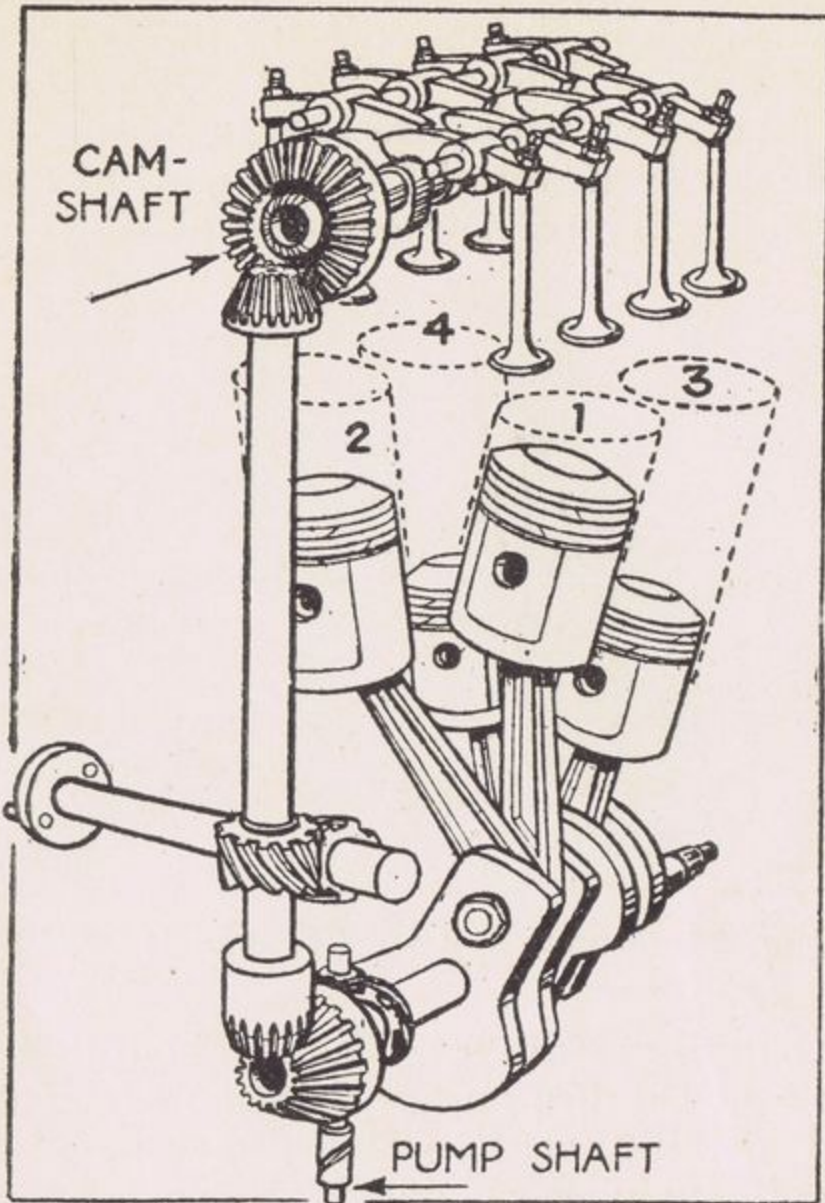
FIG. 22

A "FLOATING" ROCKER FULCRUM

which can be adjusted for mesh by shims and are marked for correct replacement. The vertical driving shaft is supported by five plain bearings and has two Oldham couplings. Each set of four rockers is not mounted on a single bearing spindle in the usual manner. Instead, what might be termed "floating" fulcrums are used. For each rocker there is a small steel barrel with a square hole across its axis (see Figs. 18 and 22) in which the rocker fits. There are thus four such "floating fulcrums" on each side of the camshaft, and they are mounted on a long $\frac{3}{16}$ in. steel bolt running across the cam-box, and they are spaced out with springs. Valve clearances are adjusted in the usual way by grub screws and lock-nuts. The valves themselves are of nickel-chrome steel and have mushroom heads. Single springs of normal pressure are used and these have a split collet anchorage for the lower caps. No exhaust valve lifter is fitted.

With regard to lubrication, the system closely follows "Arrow" practice. Some of the oil is sucked from the tank at the front of the engine by the double-acting pump housed in the base of the crankcase and driven by skew gears off the crankshaft, and forced through drilled oil passages to the main bearings, big-ends, and piston skirts, while the remainder passes, via a sight-feed in the instrument panel, to the top of the bevel-box. Incidentally, the oil return may be verified, as on the "Arrow," by removing the oil tank filler cap. At a predetermined level the oil in the bevel-box overflows into the cam-box, and thoroughly lubricates

the camshaft, rocker gear, and inlet valve guide. Both sets of bevels and the vertical shaft are entirely submerged in oil which makes for long life and quiet running. There is a separate drain passage from the cam-box down through the cylinder block casting to the crankcase whence all oil is returned to the tank. A



(From "The Motor Cycle")

FIG. 22A. SEMI-DIAGRAMMATIC VIEW SHOWING THE CYLINDER ARRANGEMENT OF THE "HAWK" AND THE CAMSHAFT, PUMP, AND MAGNETO DRIVES. THE FIRING ORDER IS 1, 4, 2, 3

crankcase pressure-release disc valve serves to lubricate the primary chain.

Sparking plugs recommended (all O.H.V. and O.H.C. engines)	Lodge, H.1. or K.L.G., K.5
Valve clearances (cold)	As near nil as possible
Magneto advance	9/16 in. before T.D.C. on full advance

Carburettor. A special semi-automatic, twist-grip control, flange-fitting, pilot jet Amal instrument is used of very similar design to that fitted to the "Silver Arrow," except that a top petrol feed is used. Its type number is 4/004, and it is bolted direct

to the near side of the cylinder head between the finning (Fig. 21). Twist-grip control is standard, but lever control is obtainable. A throttle stop for slow running is included. The jet fitted as standard is a No. 75, with a $\frac{4}{5}$ throttle valve in position 2. The pilot outlet measures $\cdot 020$ in. An Amal air cleaner is fitted.

Ignition. Lodge H.1 sparking plugs, which are pocketed, are fitted as standard, while the current for ignition and lighting is generated by a special Lucas D.F.V.4 dynamo-coil-distributor unit, mounted on a platform above the gearbox with the dynamo itself, driven clockwise (from distributor end) at engine speed by helical bevels indirectly off the vertical shaft (Fig. 19) with a

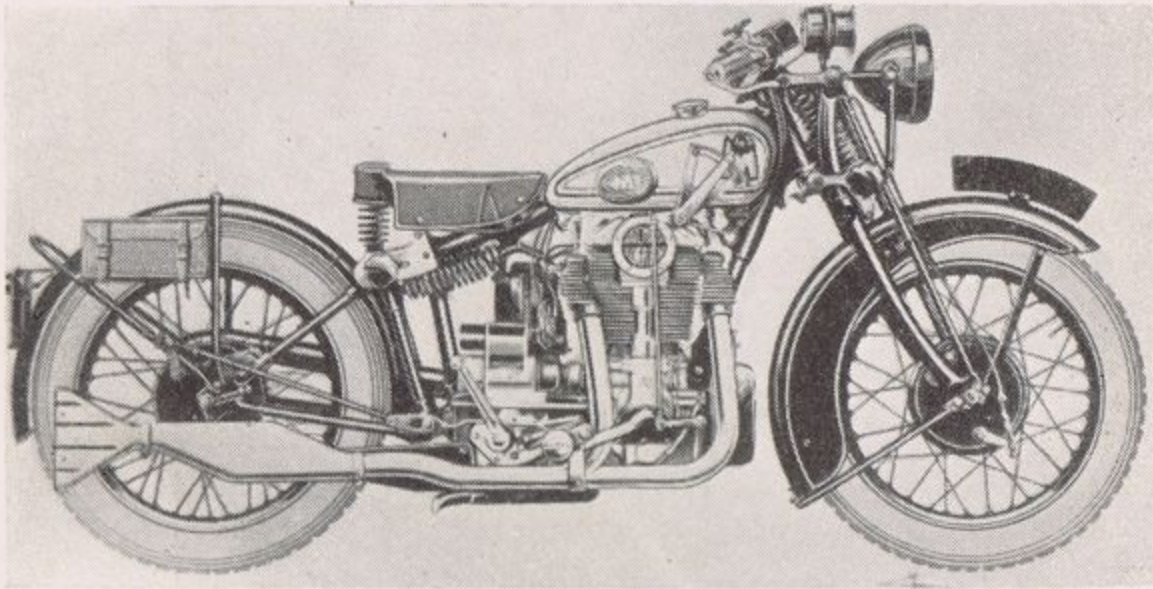
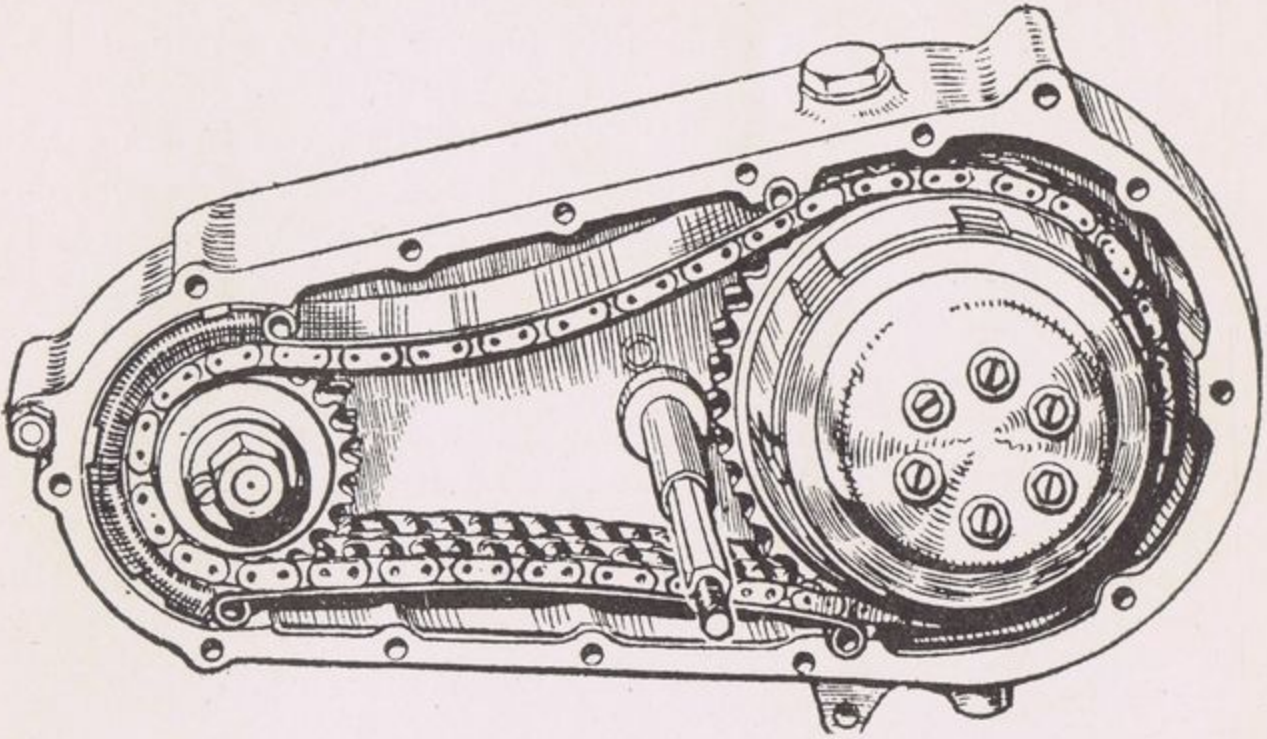


FIG. 23. MODEL B (THE "SILVER HAWK")

flexible rubber coupling similar to the A/2 coupling (Fig. 7) interposed between a metal disc on the dynamo armature and one on the horizontal driving shaft. The dynamo, above which is mounted the coil, includes an enclosed electro-magnetic cut-out to prevent overcharging of the battery or discharge through the dynamo, whilst the timing is advanced by cable control from the handlebars which rotates the contact-breaker rocker arm and distributor moulding, from whose four terminals heavily insulated high-tension cables lead up to the plugs. The distributor shaft, whose bearings require periodic lubrication, is driven anti-clockwise at half engine speed by helical bevel gearing off the dynamo shaft, and has a four-lobe cam operating the single-lever contact-breaker housed in the lower half of the distributor body (Fig. 55). The correct gap at the contacts is $\cdot 015$ in. To the top of the distributor shaft is fixed the rotating distributor arm, whose outer tip has a metal electrode which passes sufficiently close to the four metal segments in the distributor moulding to enable the high-tension current to jump the gaps and fire each plug consecutively. The recommended gap at the plugs is approximately

.027 in. A ballast resistance is incorporated in the primary circuit to limit the flow of current from the battery to the coil when the engine is running slowly or is stationary; of course, when the ignition is switched off no current can flow through the primary coil. To guard against the possibility of the battery being allowed to exhaust itself when the machine is left stationary with the switch "on," a tell-tale warning lamp is fixed on the instrument panel and in such circumstances gives a red light. It will also light, however, when the engine is running very slowly, due to



(From "The Motor Cycle")

FIG. 24. THE DUPLEX PRIMARY CHAIN AND AUTOMATIC TENSIONING DEVICE

The chain is shown slack to illustrate more clearly the action of the two steel springs

the fact that the dynamo is generating a current of insufficient voltage to actuate the cut-out. The battery itself which supplies low-tension current to the coil of this very compact lighting-ignition unit, and also to the lamps, is mounted adjacent to this unit and held by a strap.

Gearbox and Clutch. A four-speed, heavyweight Sturmey-Archer gearbox is mounted *rigidly* between the rear engine plates and a three-plate clutch is used in conjunction with it. This clutch closely resembles the lighter pattern employed on the "Silver Arrow," but it is of heavier design in order to bear the greater transmission loads on this higher powered machine. The complete clutch runs in oil, including all the friction plates, which are tongued and slotted and rotate as one with the clutch sprocket. For the same reason, six coil springs instead of one are used to press the three driving plates against the friction insert

plates. The pressure of these springs which are spaced radially is adjustable by means of bolts whose slotted heads are counter-sunk in the outer clutch boss. A lever type of hollow mainshaft plunger spring release control is used. The solo gear ratios are as follows—

Solo: first, 17.0 to 1; second, 12.4 to 1; third, 6.9 to 1;
fourth, 5.7 to 1

The gear lever positions, rear to front, are 1st, N, 2nd, 3rd, 4th.

Transmission. There is considerable novelty displayed in regard to the primary transmission which is at once apparent on removing the front chain case (see Fig. 24). A special $\frac{3}{8}$ in. \times .250 duplex Coventry "Ultimate" chain is used, necessitating the use of extra wide sprocket teeth. This chain runs in an oil bath, and is kept automatically tensioned by a very clever form of spring loading produced under Weller patents. It comprises two spring steel strips on each side of the chain. These keep the chain permanently taut even when a considerable degree of stretch develops. The chain case may be replenished with oil from time to time by pouring it through the plug hole at the rear. The dimensions of the secondary chain are $\frac{5}{8}$ in. \times .380 in. There is, of course, no shock absorber. Tyre pressures for sidecar use are the same as for the "Arrow." When running solo, 18, 24 lb. per sq. in. are recommended for front and rear, respectively.

Maximum speed (solo), 80–85 m.p.h. Weight, 370 lb.

MODEL X/3

The standard Matchless Big Twin has the following specification—

The 9.90 h.p. S.V. Vee-twin Engine. This engine has a bore and stroke of 85.5 mm. \times 85.5 mm., giving a cubic capacity of 990 c.c. The two cylinders are set at 50 degrees to each other, and the bores, being "square" with the cylinder castings, the firing angle is also 50 degrees. Fig. 25 shows the general design and construction of the power unit.

The crankcase itself is a very neat aluminium casting split longitudinally in the usual manner. An extension immediately below the annular timing case, which has a readily detachable cover, houses the D.S. pump plunger, and if separation of the crankcase halves is contemplated care is necessary in respect of this unit. A disc breather maintains atmospheric pressure in the crankcase, and also serves to lubricate the primary chain. The crankshaft assembly is an ordinary single-throw type built up of two flywheels, to which are keyed the friction fitting mainshafts, and a shouldered crankpin upon which with two sets of rollers interposed, but no bushes, are mounted a pair of "H" section

connecting rods having $\frac{7}{8}$ in. (I-D) phosphor-bronze small end bearings. With regard to the crankshaft bearings, that on the driving side has a heavy double-row caged roller bearing, while the other one is of the plain bush type. The pistons themselves are of aluminium alloy and have two rings each, the lower acting

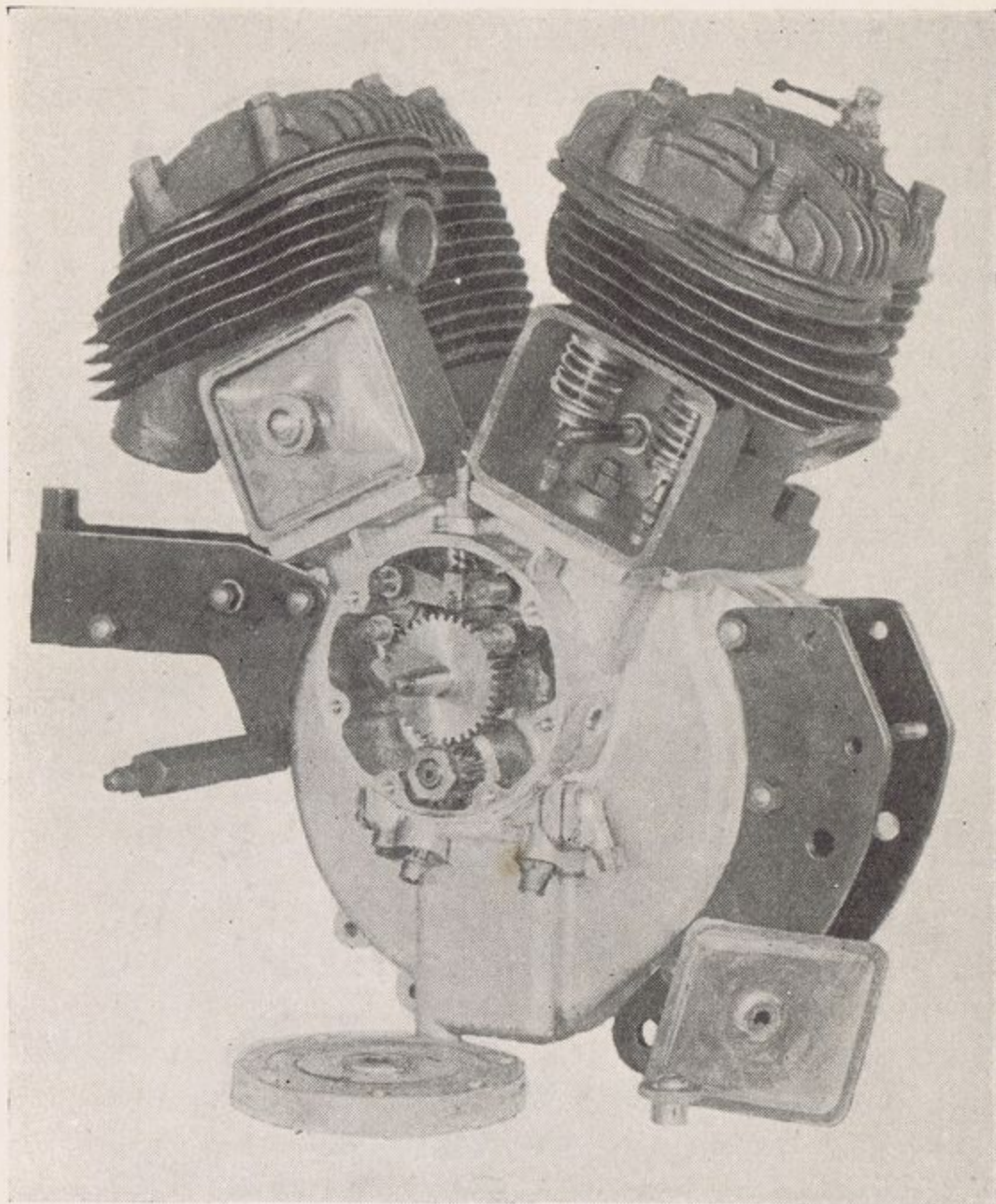


FIG. 25. CLOSE-UP VIEW OF THE 9.90 H.P. S.V. VEE-TWIN ENGINE

The timing case cover and one valve cover plate have been removed to show the valves and timing gear

as a scraper ring. They are split diagonally across the skirts to allow for expansion, and they have fully floating gudgeon pins secured by small spring circlips to prevent scoring. With a *cold* engine, the correct gap at the piston ring slots is .006 in. to .010 in.

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

integral with two very neat valve chests which entirely enclose and protect the valves and their springs, two pressed steel cover plates held firm by centrally placed knurled nuts giving instant access to the valves. The barrels are deeply spigoted at their bases and paper washers are used; C. and A. gaskets are fitted between the barrels and heads which are of semi-turbulent design. The sparking plugs are centrally located, and a useful compression cock is provided for each cylinder head for priming purposes in cold weather. The two cylinders are interconnected by a horizontal induction manifold with screw-in unions.

The valves themselves are of large diameter and of the mushroom type with single springs and slotted valve stems for the flat cotters used for anchorage. They reciprocate in chilled cast-iron guides which are readily detached for renewal. Round section tappets are used, and the adjustable heads screw into the tappet bodies and are secured by lock-nuts. The timing gear is extremely simple. It comprises a single cam wheel having three cams, one each for the exhaust and one for the inlet valves, driven off the engine pinion, and four rockers mounted on pivot pins and separated from the back of the timing case by $\frac{2}{8}\frac{9}{4}$ in. distance collars. The arrangement of these rockers is shown by Fig. 25, and the neat exhaust valve lifter mechanism in the centre is also clearly illustrated; the timing pinions are marked for mesh. The products of combustion are swept out from the exhaust ports into an imposing and exceedingly quiet exhaust system comprising two $1\frac{3}{4}$ in. diameter chromium plated pipes, each terminating in a standard Matchless silencer and fish-tail.

The magneto, or "Magdyno," as the case may be, which is mounted on a platform above the gearbox, is driven by chain and sprockets direct off the camshaft. The camshaft sprocket fits on a slight taper, is keyed, and held firmly by a nut screwed to the threaded end of the shaft. Chain tension is adjusted by sliding the magneto platform along the engine cradle plates by a special adjuster. A black-enamelled pressed steel chain case protects the chain.

The lubrication of the engine is carried out by a D.S. system similar to that described on page 14. The double-acting oil pump forces oil under pressure to the big ends of the connecting rods, the mainshaft bearings and the camshaft bearings, while the whole of the timing gear runs submerged in oil, and oil mist penetrates into the valve chests, the surplus being returned to the timing case via grooves cut in the tappet guides longitudinally.

Tappet clearances (all S.V. engines
except A/2)

Magneto Advance (X/3 and X/R3)

·004 in. inlet and ·006
exhaust (warm)

$\frac{7}{16}$ in. before T.D.C. on full
advance

Carburettor. This is a two-lever, semi-automatic clip-fitting, pilot jet Amal instrument, having a top petrol feed and fitted with a slow running throttle stop. The type number of the carburettor is 6/012. A size 110 jet is used in conjunction with a 6/4 throttle valve in position 3. This combination, which provides a fuel consumption of 70-80 m.p.g., is found to give very satisfactory running for general purposes. On Model X/3 an Amal air cleaner is fitted. Twist-grip control of the throttle is optional, but standard on Model X/3 de luxe.

Ignition. Lucas equipment is used throughout, the K.L.V. magneto, as stated above, being driven from the camshaft. It has, therefore, a clockwise rotation, seen from the contact-breaker

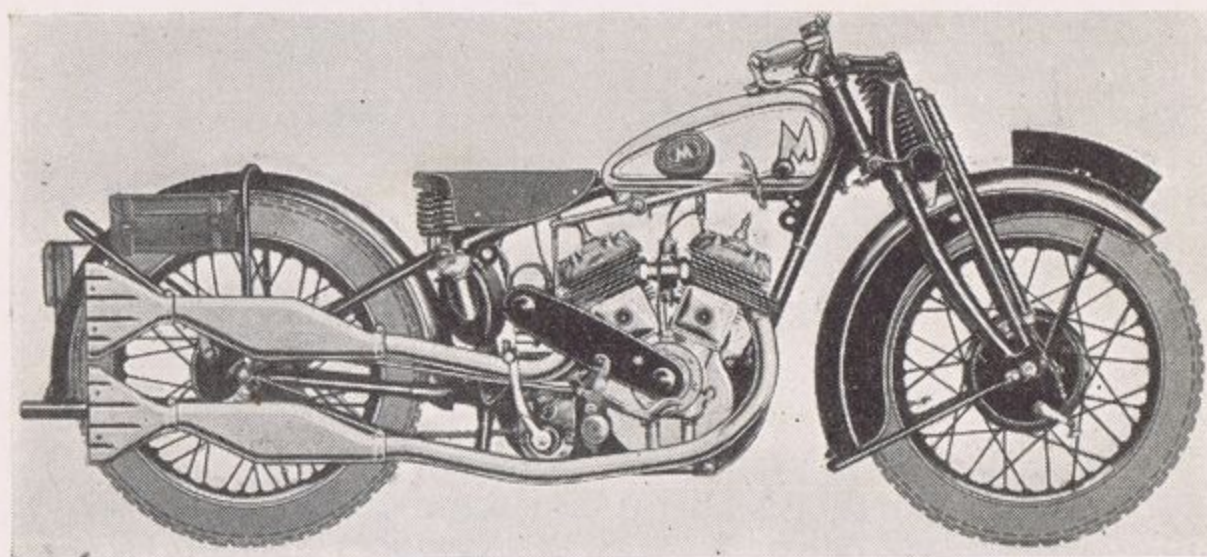


FIG. 26. MODEL X/3

side. The contact-breaker, incidentally, has two cams, No. 1 cam being nearest to the rear firing cylinder. Lodge T.S.3 plugs are used.

Frame and Forks. The frame used on the 9.90 h.p. models is immensely strong. It is of the trussed loop pattern with duplex torque stays. Four large engine plates and a pair of torque tubes constitute a rigid and inflexible cradle mounting for the power unit. The two rear plates, incidentally, form a bracket for the four-speed gearbox which has the usual drawbolt for primary chain adjustment and a two-bolt fixing. The forks are of the standard Matchless pattern, with a single central compression spring, fork stops, and hand-adjusted shock absorbers.

Gearbox and Clutch. The gearbox is the latest heavyweight, four-speed Sturmey-Archer as fitted to the "Silver Hawk," mention of which is made on page 33, and a sectional view of which appears on page 84. It has a bottom bracket and stud type of mounting, and a very similar type of four-plate clutch with Ferodo inserts and multiple springs. In this case, however, the arrangement of the gear lever control results in a reversal of the

gear lever positions. From rear to front they are: 4th, 3rd, 2nd, N., 1st. The gear ratios are as follows—

Solo X/3, sidecar X/R3	First, 12·8 to 1; second, 9·3 to 1; third, 5·7 to 1; fourth, 4·3 to 1.
Sidecar X/R3	First, 14·2 to 1; second, 10·4 to 1; third, 6·4 to 1; fourth, 4·8 to 1.

A Smith chronometric speedometer with 80 m.p.h. dial is driven by gearing from the near side of the gearbox.

Transmission. The dimensions of the primary and secondary chains, which are both Coventry "Ultimates," are $\frac{1}{2}$ in. \times .305 in. and $\frac{5}{8}$ in. \times .380 in., respectively. Both are adequately protected by steel guards, the primary chain being totally enclosed and lubricated from the crankcase disc breather. There is no shock absorber.

Brakes. 8 in. \times $\frac{3}{4}$ in. brakes are used on both wheels, and they are coupled together by the special interconnecting gear (page 23). There is, of course, no slotted link as on the spring frame models. Separate control by handlebar lever is retained for the front brake, and finger tip adjustment for both brakes is provided.

Wheels and Tyres. Both wheels have Timken roller bearings, with adjustable cones on the near side (Fig. 17). On Model X/R3 chromium-plated wheels are standard. The tyres used are 26 in. \times 3·25 in. heavy cord, wired-on Dunlops, with Schrader valves. Oversize covers measuring 27 in. \times 4 in. are available. The recommended inflation pressures for solo use with standard covers are: front, 18 lb. per sq. in., rear, 24 lb. per sq. in. When a sidecar is used the pressure of the rear tyre should be increased to 26 lb. per sq. in. The tyre on the sidecar wheel itself should be inflated to 20 lb. per sq. in.

Tanks. The new type fuel tank has a capacity of 2½ gal., and with its chromium "M" and rubber knee grips is exceedingly handsome. The oil tank which has a capacity of 4 pints is strapped to the saddle tube and has a quick release filler cap, on removal of which may be observed the return pipe from the D.S. pump situated just above the filter as on the "Silver Arrow" tank. The oil consumption is 1,000–1,200 m.p.g. solo.

Miscellaneous Equipment. Standard equipment includes a detachable rear mudguard, adjustable handlebars, a Lycette "Aero" spring seat, stands to both wheels, rubber-covered footrests (foot boards optional), a steering damper, lifting handle, pannier tool bags, and a complete set of tools with pump attached to the front forks.

Maximum speed (Solo)	70–75 m.p.h.
Maximum speed (Sidecar)	60–65 m.p.h.
Weight (without lighting)	360 lb.

MODEL R/7

The specification of the smallest lightweight side-valve Matchless is as follows—

The 2.46 h.p. S.V. Engine. The power unit is practically identical to the 1930 version. It has a bore and stroke of 62.5 mm. \times 80 mm., giving a cubic capacity of 246 c.c. A crankcase of similar design to that used on all single cylinder side-valve models is used. The crankshaft assembly comprises two flywheels, a shouldered crankpin, and two mainshafts, all of similar pattern to those used on the 9.90 h.p. engine already described. A caged roller bearing is fitted on the transmission side, and a plain phosphor-bronze bearing on the timing side. The connecting rod of "H" section, and a set of 30 hardened rollers is placed between the crankpin shoulder and the eye of the rod. No connecting rod bush is used. The small-end bearing is of the plain bush type with fully floating $\frac{1}{16}$ in. diameter gudgeon pin secured by circlips. The piston which is of aluminium alloy has a split skirt and two rings. The compression ratio is 4.43 to 1.

The design of the well finned cylinder and cylinder head may be gathered from Fig. 27; the barrel, spigoted at the base and held down by three bolts, is cast integral with the valve chest, and the detachable turbulent cylinder head, which has a gasket, is secured to the upper face by four bolts. The sparking plug is located centrally over the combustion chamber behind the valves which are totally enclosed and lubricated, a quickly detachable valve chest cover giving immediate access to them. Mushroom valves with single compression springs and flat cotters for spring cap anchorage are used.

With regard to the timing gear (Fig. 27), this is the essence of simplicity. A single cam wheel, marked for mesh and having two cams, is driven off the small engine pinion and transmits the necessary reciprocating motion to the tappets and valves by two rockers mounted on a single shaft. The tappet bodies have the usual screwed-in adjustable heads and lock-nuts. An exhaust valve lifter is provided. The whole of the timing gear runs submerged in oil at a level automatically built up by the oil pump, which cannot be exceeded or reduced. The exhaust noise is negligible.

The magneto on this engine is bolted on a platform at the front of the engine and protected by a shield; it is driven off the engine shaft at half engine speed in a clockwise (C.B. side) direction by a $\frac{1}{2}$ in. \times $\frac{3}{16}$ in. chain and sprockets in the manner shown by Fig. 28. The chain is totally enclosed and runs in an oil-bath. The magneto can be slid on its platform for chain tensioning purposes. When a "Maglita" is fitted, it is driven at *engine* speed.

A dry sump lubrication system is used, as described on pages 14 and 73. Oil is force fed by the duplex horizontal reciprocating rotary plunger pump to three points on the cylinder wall, the big-end bearing, mainshaft bearings, and camshaft bearings. Surplus oil is sucked from the crankcase sump and returned to the

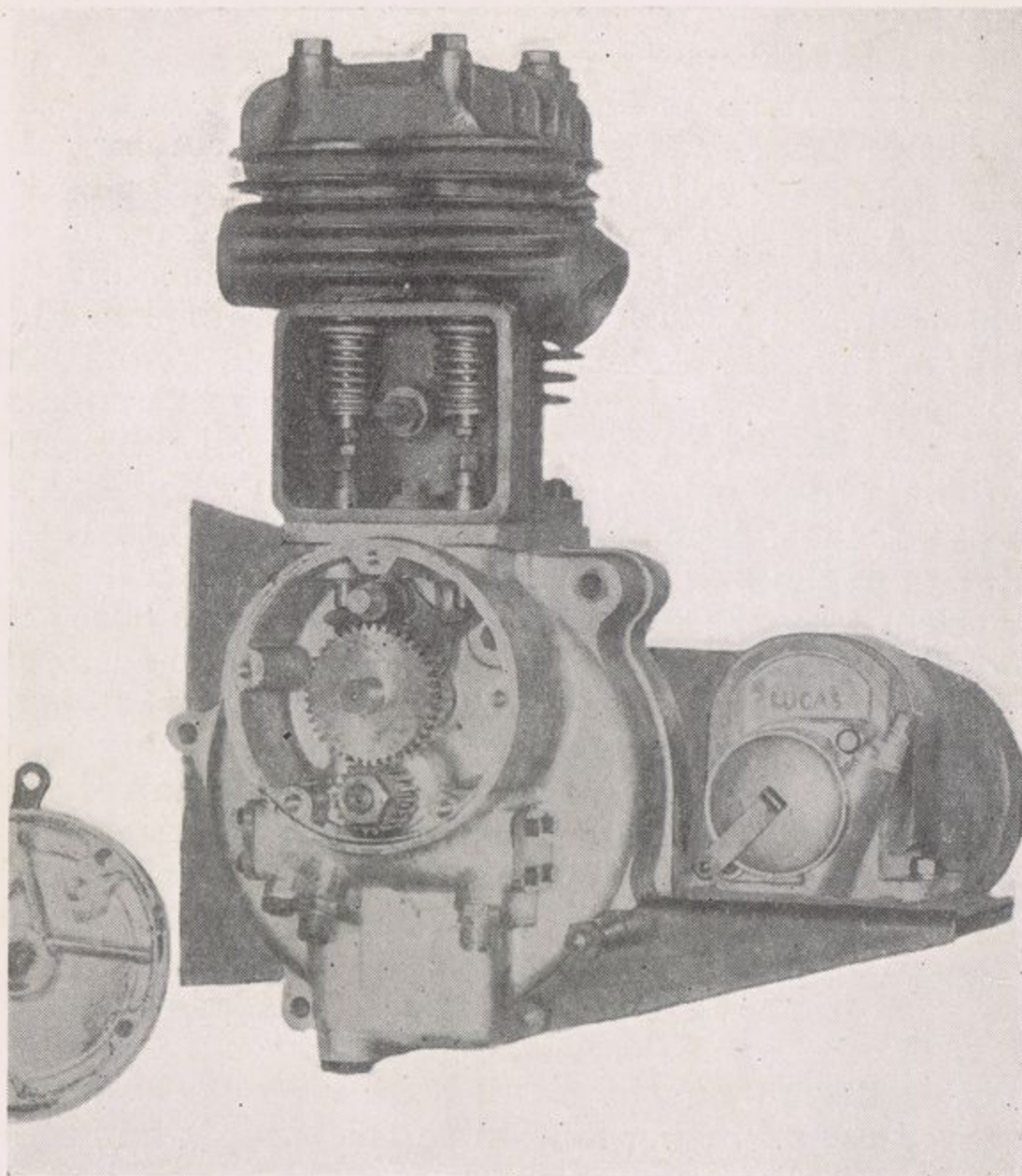


FIG. 27. THE 2.46 H.P. S.V. ENGINE WITH TIMING COVER AND VALVE COVER PLATE REMOVED

oil tank. Its return can be verified at the return pipe orifice. No sight feed can be fitted.

Magneto advance: $\frac{2}{64}$ in. before T.D.C. on full advance, or T.D.C. on full retard

Carburettor. The carburettor used is a semi-automatic, two-lever, pilot jet Amal, with top petrol feed and a screw-in connection. Its type number is 4/114. A size 70 jet is used in conjunction with a $\frac{4}{4}$ throttle valve in position 3, giving a fuel consumption of approximately 125 m.p.g. solo. Good slow

running is ensured by the use of a throttle stop. Twist-grip throttle control is extra.

Ignition. The forwardly placed magneto is a type M.A.1. Lucas, and it runs at half engine speed. Where electric lighting is specified, an F.D. type "Maglita" set only can be fitted. A "Magdyno" lighting set cannot be specified. The sparking plug fitted as standard is a Lodge T.S.3.

Frame and Forks. The frame is a strong welded-up structure

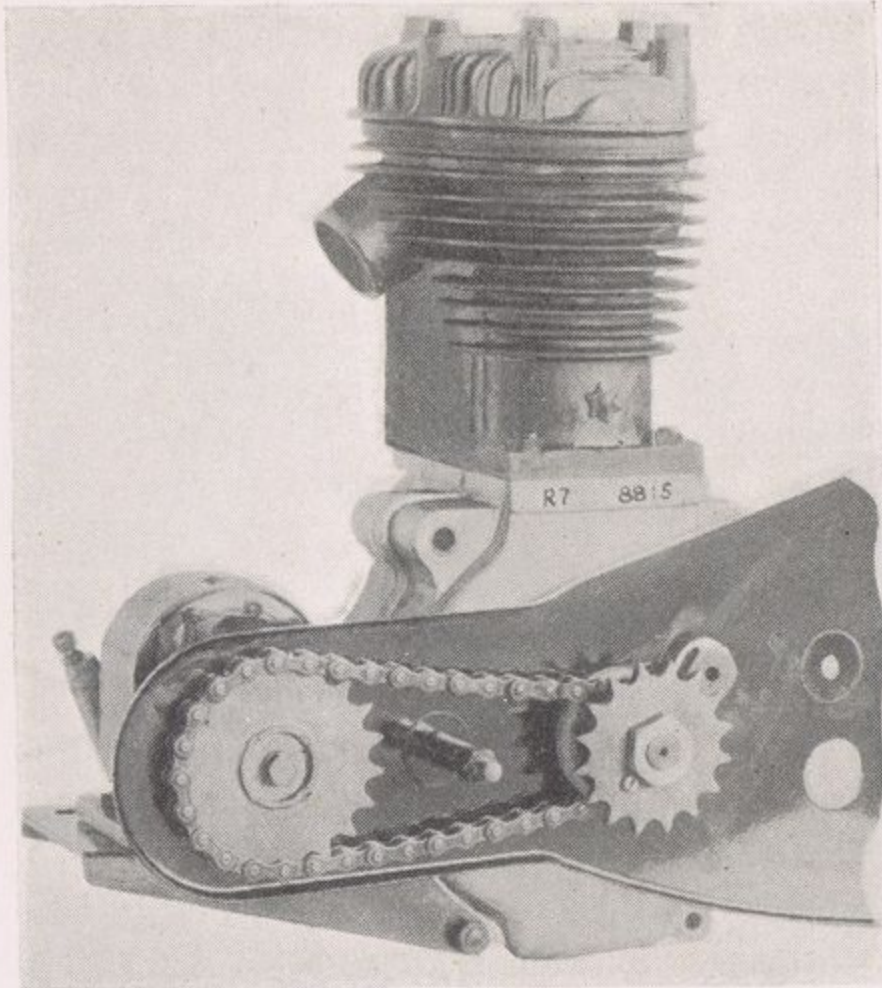


FIG. 28. VIEW OF 2.46 H.P. S.V. ENGINE FROM TRANSMISSION SIDE SHOWING MAGNETO DRIVE

It will be observed that the magneto is driven at half engine speed off a sprocket on the engine main shaft.

of the diamond type arranged to give a low C.G. and a low and comfortable saddle position. The wheelbase is only 4 ft. 4½ in. Standard Matchless forks with shock absorbers and forkstops are specified, but no steering damper is included.

Gearbox and Clutch. The three-speed gearbox used is an F.W. (featherweight) type, constant mesh Sturmey-Archer, specially designed for engines up to 250 c.c. This gearbox has the same gearing arrangement as the B.S. type box fitted last year, and control is by a neat elliptical quadrant fixed at the front of the fuel tank with the adjustable connecting rod running diagonally

at about 45 degrees to the gearbox striker lever. The gearbox has a two-stud fixing, and can be slid fore and aft between the rear engine plates by a thrust screw. The gear lever positions, front to rear, are 1st, N., 2nd, 3rd, and the ratios are—

First, 16·8 to 1. Second, 9·4 to 1. Third, 6·1 to 1.

The gearbox lubricant recommended is Wakefield's "Castrolase Light," or Speedwell "Crimsangre Light." Provision is not made for a speedometer drive.

The gearbox is a constant-mesh, countershaft gear, having a totally enclosed kickstarter mechanism, and three pairs of pinions only are used. The low gear wheel on the layshaft includes a "free wheel" ratchet operated by a pawl on the kickstarter,

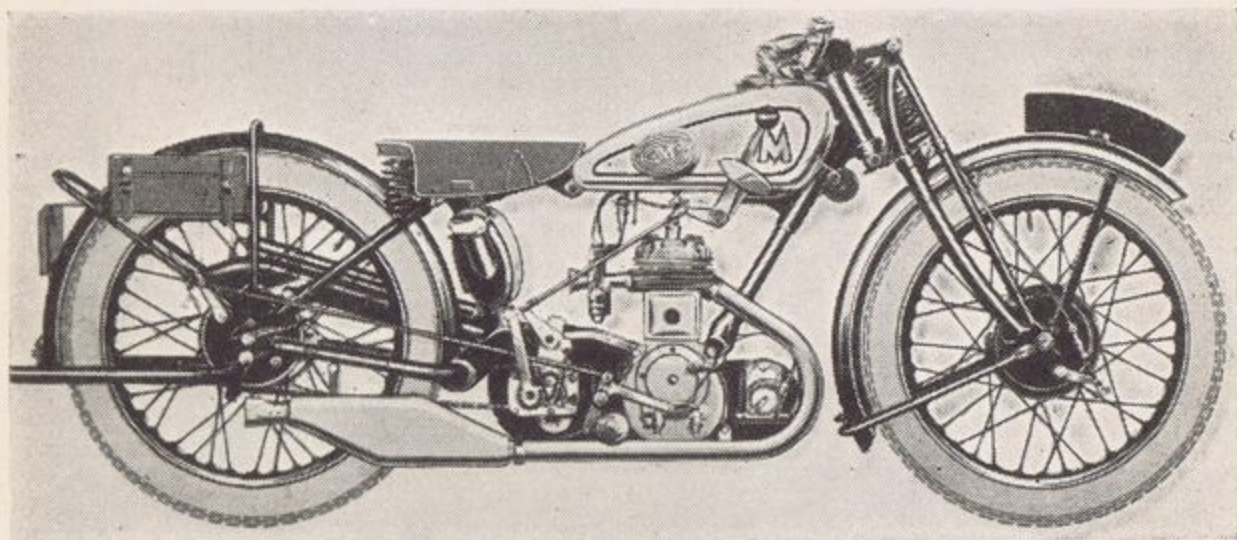


FIG. 29. MODEL R/7

which has a steel shaft, having as its bearing the layshaft axle bush. When the kickstarter return spring brings the crank back to its normal vertical position, a projection on the pawl engages with a fixed cam in the gearbox cover, and positively depresses the pawl out of action. All gear changes are effected by dogs and two sliding pinions simultaneously moved by a striker plate at the end of a horizontal rack which receives lateral movement from a rocking segment.

The clutch used in conjunction with the gearbox is a single plate type with cork inserts and the usual plunger type control. A single compression spring is used to provide the necessary degree of friction.

Transmission. A $\frac{1}{2}$ in. \times .205 in. Coventry "Ultimate" chain is used for both primary and secondary transmission with efficient steel guards. There is no shock absorber. The primary chain is lubricated from the engine breather.

Brakes. $6\frac{1}{2}$ in. internal expanding brakes with the special Matchless interconnecting gear, finger tip adjustment, and dual control of the front brake, are specified.

Wheels and Tyres. "Timken" roller bearings with adjustable cones (page 24) are used for both wheels, which are shod with 25 in. \times 3 in. Dunlop cord tyres. Oversize covers *cannot* be fitted. The correct inflation pressures are 16 lb. per sq. in. and 20 lb. per sq. in. for front and rear tyres, respectively.

Tanks. The fuel tank is made of pressed steel sections welded together (Fig. 1), and has a capacity of $2\frac{1}{4}$ gal. which is sufficient for about 250 miles at normal speeds. It is handsomely finished with the new panel and chromium "M." The oil tank strapped to the saddle tube holds 3 pints, sufficient for about 500 miles, the consumption being 1,800–2,000 m.p.g.

Miscellaneous Equipment. This includes sports or semi-sports adjustable handlebars at option. A Lycett "Aero" spring seat, knee-grips, strong non-valanced mudguards, a spring-up rear stand and a front one also, lifting handle, rubber-covered foot rests, two pannier toolbags, and a pump inflator.

Maximum speed (Solo)	.	.	.	48–52 m.p.h.
Weight (with "Maglita")	.	.	.	218 lb.

MODEL C

The specification of the larger of the two entirely new side-valve inclined engine models is as follows—

The 5.86 h.p. S.V. Engine. This inclined power unit, although embodying a large number of standard Matchless features, is an entirely new design. The bore and stroke are 85.5 mm. \times 101.6 mm., giving a cubic capacity of 586 c.c. The compression ratio is 4.8 to 1. As may be seen in Fig. 30, the crankcase differs from previous side-valve models chiefly in respect of the housing for the timing gear. The crankshaft itself, which comprises two heavy rimmed flywheels, a shouldered crank pin, and two sturdy mainshafts, has a roller bearing on the transmission side and a plain bush bearing on the timing side. A needle roller bearing is also used for the "H" section connecting rod big-end. The small-end receives a $\frac{7}{8}$ in. gudgeon pin, which is fully floating and is prevented from moving in the piston boss excessively by spring circlips. The piston itself (see Fig. 30A) is of aluminium alloy, with two rings and the usual diagonal split in the skirt. A high degree of finish is noticeable throughout the engine. The usual Matchless design of cylinder with the valve chest cast integral is used. The head itself is detachable. The large diameter valves and the adjustable mushroom tappets both have detachable press-fit, cast-iron guides and work under ideal conditions, the detachable valve chest cover plate precluding all dirt and noise and enabling the parts to be well lubricated. The exploded gases after ignition by a plug placed over the middle of the combustion

chamber, are conveyed to a standard silencer and fish-tail by a chromium-plated exhaust pipe. In spite of the fact that the engine has a stroke of just 4 in., there is practically no back-pressure.

The valve gear (see Fig. 30) departs from usual single-cylinder Matchless practice in that, instead of employing a single camshaft having two cams, two separate camshafts are used, and both cam wheels which run submerged in oil are driven off the engine

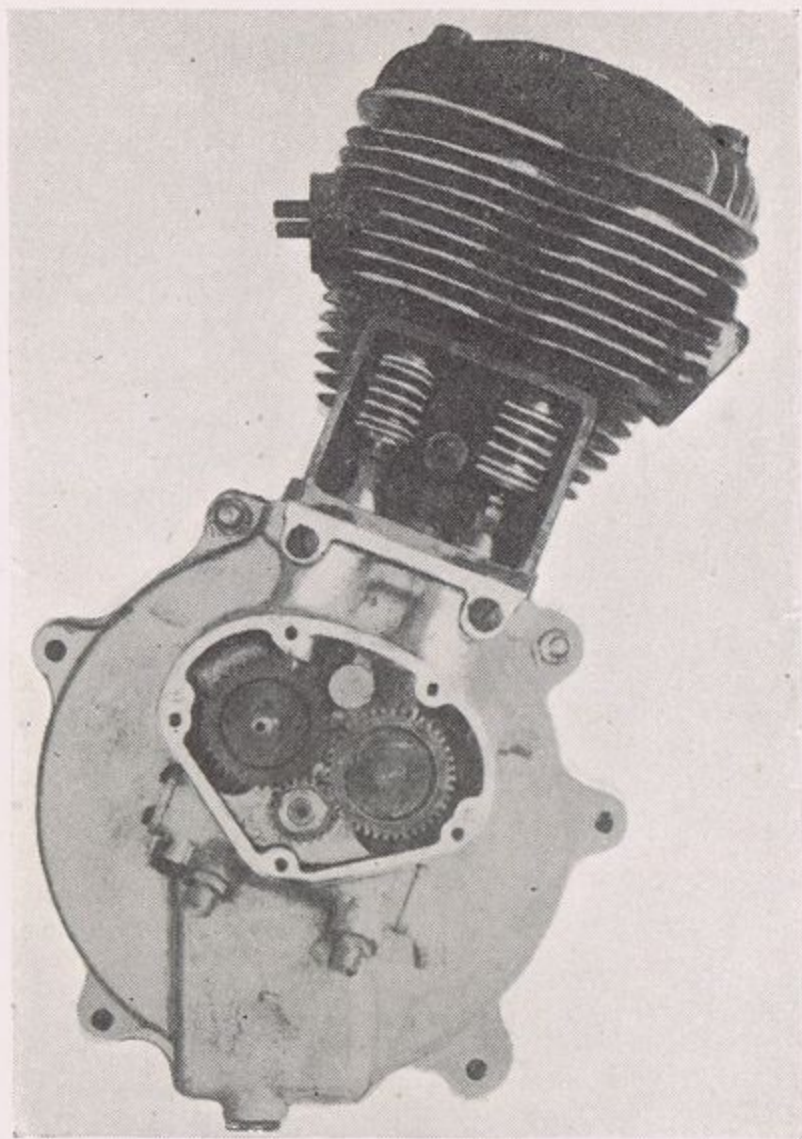


FIG. 30. THE 5.86 H.P. S.V. ENGINE

The timing and valve covers have been removed to show the valve gear of this new inclined power unit

pinion. No rockers are interposed between the cams and mushroom tappets and, to facilitate starting, a decompressor lever acting direct on the tappet is made to lift the exhaust valve slightly off its seat during the compression strokes. It is controlled by a small lever on the timing case. The magneto or magneto-dynamo unit is mounted at the back of the engine, and is driven at half engine speed by chain and sprockets off the inlet camshaft. The chain is enclosed in an oil-tight chain case and lubricated from the timing case. Lubrication throughout the engine is effected by the Matchless dry sump system (page 14),

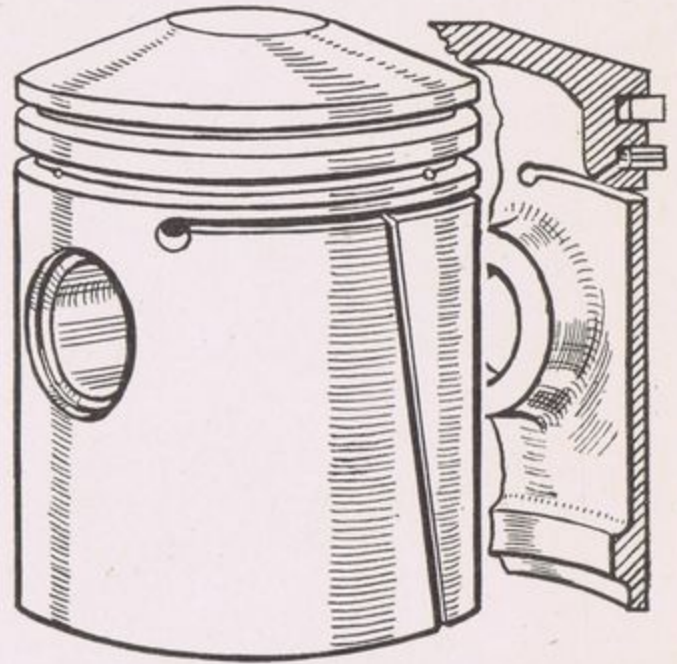
and all working parts, in addition to three points on the cylinder wall, are pressure fed. On de luxe models an oil indicator on the instrument panel enables the oil circulation at all times to be observed. On standard models removal of the oil tank filler cap enables a momentary inspection to be made at the oil return pipe orifice.

Magneto advance (C, C/S): $\frac{1}{2}$ in. before T.D.C. on full advance
(or $\frac{1}{16}$ in. before T.D.C., full retard)

Carburettor. A two-lever, semi-automatic pilot jet Amal is used with a top petrol feed and flange fixing to the induction pipe. An air cleaner cannot be fitted. The instrument has the usual throttle stop for "tick-over" adjustment. Twist grip for the throttle is optional, but standard on the de luxe model. The type number of the carburettor is 6/014, and it differs only slightly from the standard Amal described on page 76. The jet size is 150, with a throttle valve 6/5 in position 3. This combination should give a fuel consumption of about 85-95 m.p.g.

Ignition. A Lucas type KSA1 magneto placed behind the engine is driven clockwise off the inlet camshaft at half engine speed. The sparking plug is a Lodge T.S.3.

Frame and Forks. The frame is an entirely new design, having exceptional structural strength and possessing with its duplicated tubes perfect lateral rigidity. It is a welded-up job of high grade steel tubing, and has a single tank tube and twin front down tubes which are trapped at the bottom ends, where they are bolted to two tubes running on either side of the crankcase to the rear fork ends. Only two engine plates are used, and the neat manner in which the power unit is bolted parallel to the front down tubes may be gathered from Fig. 32. The rear portion of the plates, it will be observed, form with the aid of two transverse spindles a pivot mounting for the four-speed gearbox, which can be slid backwards or forwards by turning a small thrust-screw located at the top of the off-side plate. The forks themselves show no differentiation from the standard type, and adjustable shock absorbers are included.



(From "The Motor Cycle")

FIG. 30A

STANDARD MATCHLESS PISTON

Note the split skirt and the thick section at the crown

Gearbox and Clutch. The gearbox is a pivot-mounted, four-speed, heavyweight Sturmey-Archer, semi-constant mesh type, as fitted to the "Silver Hawk," with totally-enclosed kickstarter mechanism. It provides the following gear ratios—

Solo (C and C/S): First, 14.6 to 1; second, 10.6 to 1; third, 6.5 to 1; fourth, 4.9 to 1.

Side-car (C and C/S): First, 16.0 to 1; second, 11.7 to 1; third, 7.2 to 1; fourth, 5.4 to 1.

The speedometer drive is included within the gearbox, a sectional view of which appears on page 84. The clutch is a dry three-plate, multiple spring type with Ferodo inserts, and has a Bowden

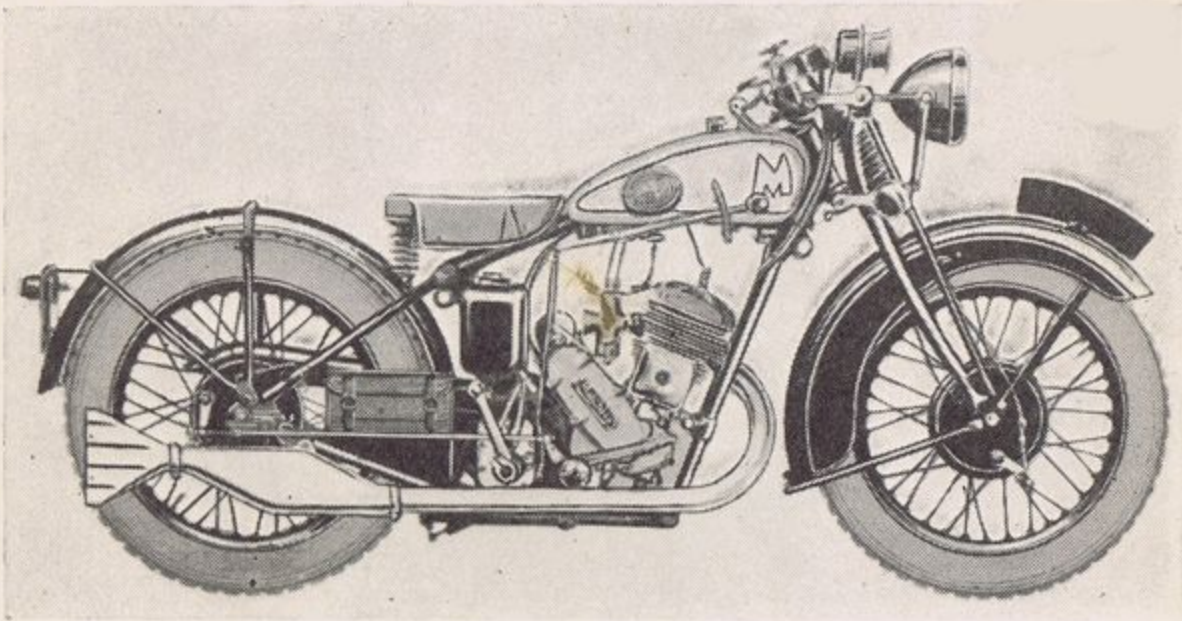


FIG. 31. MODEL C DE LUXE

control giving a straight pull on the plunger in the hollow mainshaft.

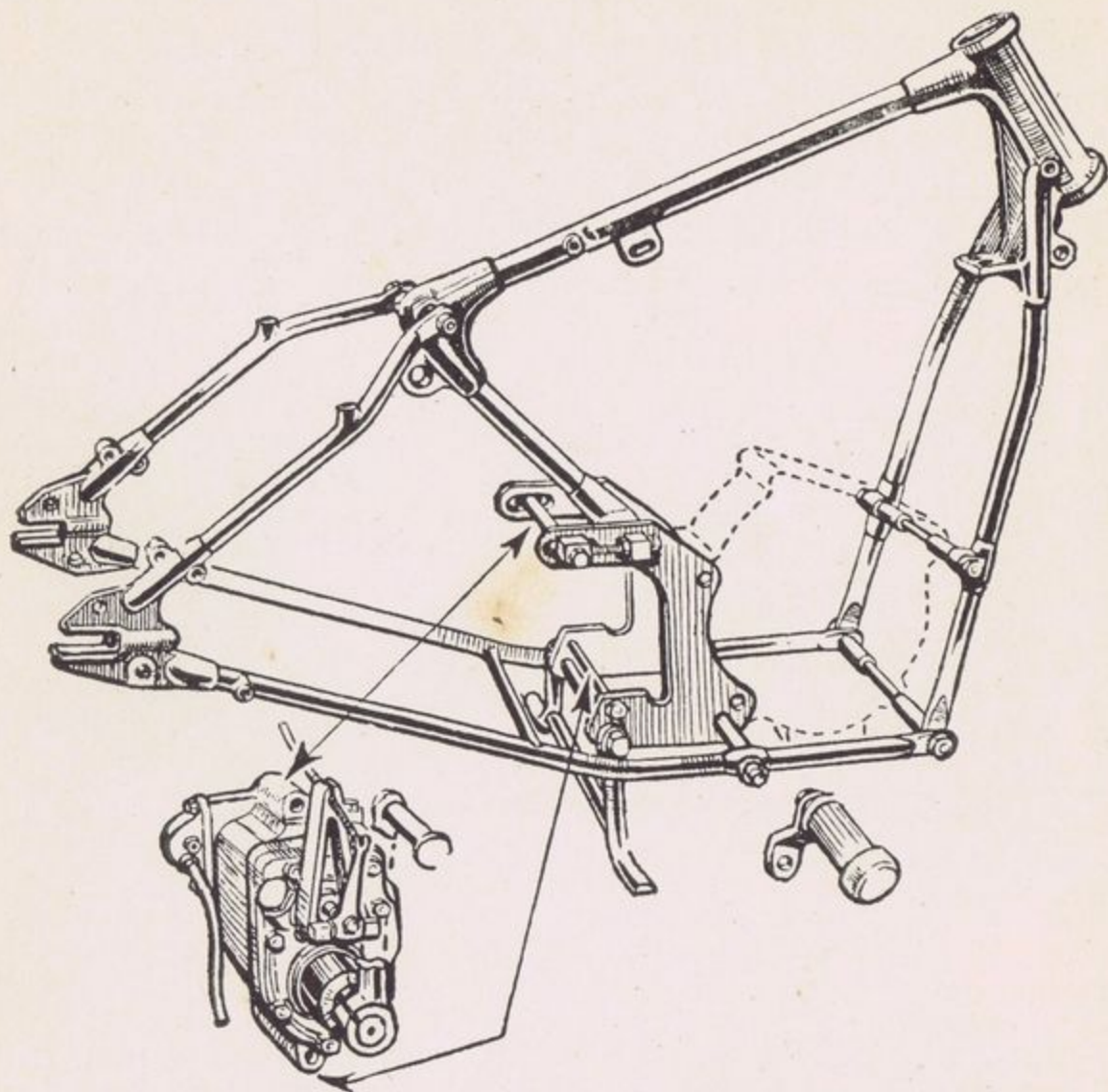
Transmission. Coventry "Ultimate" chains are used front and rear, and the respective dimensions are $\frac{1}{2}$ in. \times .305 in. and $\frac{5}{8}$ in. \times .380 in. Both chains are well protected, and the front one is lubricated by the disc type engine breather.

Brakes. 8 in. \times $\frac{3}{4}$ in. internal expanding brakes with special interconnecting gear are fitted to both wheels, so arranged that application of the pedal puts a braking effect on both wheels simultaneously and uniformly. A handlebar lever provides independent control of the front brake. Finger tip adjustment is used for all controls.

Wheels and Tyres. Timken adjustable roller bearings and heavy gauge butted spokes are used for both wheels, and the tyres are 26 in. \times 3.25 in. wired-on heavy cord Dunlops with Schrader valves. Oversize 27 in. \times 4 in. tyres may be obtained

for an extra charge. The correct inflation pressures for the standard tyres are 15-16 lb. per sq. in. for the front tyre, and 21-22 lb. per sq. in. for the rear tyre when driving solo, and 26 lb. per sq. in. for the rear and 18 lb. per sq. in. for the side wheel when a sidecar is used.

Tanks. The new design bulbous fuel tank is used, and has a capacity of $2\frac{1}{2}$ gal., sufficient for at least 200 miles. The oil tank



(From "The Motor Cycle")

FIG. 32. THE NEW DUPLEX CRADLE FRAME USED FOR THE INCLINED ENGINE MODELS

is of new design also, and is almost rectangular in shape. It is mounted vertically above the gearbox and holds 4 pints. A large cylindrical filter is included. The oil consumption is 1,200-1,400 m.p.g.

Miscellaneous Equipment. Semi-sports handlebars, adjustable for angle, and a large Lycett "Aero" spring seat ensure a comfortable riding position, while large "D" section mudguards protect the rider from all dirt. The front guard is deeply valanced, while the rear one is hinged to facilitate rear wheel removal and tyre repairs. Included also in the specification are fork stops, knee-grips, an adjustable steering damper, comfortable footrests, a

spring-up central stand with ordinary front stand, lifting handle, pump inflator, and two large pannier tool bags placed between the top and bottom chain stays.

Maximum speed (Solo)	60-65 m.p.h.
Weight (without lighting)	330 lb.

MODEL D

The specification of the smaller side-valve inclined engine model, which is eligible for the 30s. per annum tax with "Maglita" electric lighting, is very similar to that of model C, the chief differences being as follows—

The 3.47 h.p. Inclined S.V. Engine. This closely resembles the 5.86 h.p. engine, but there are some important variations in its

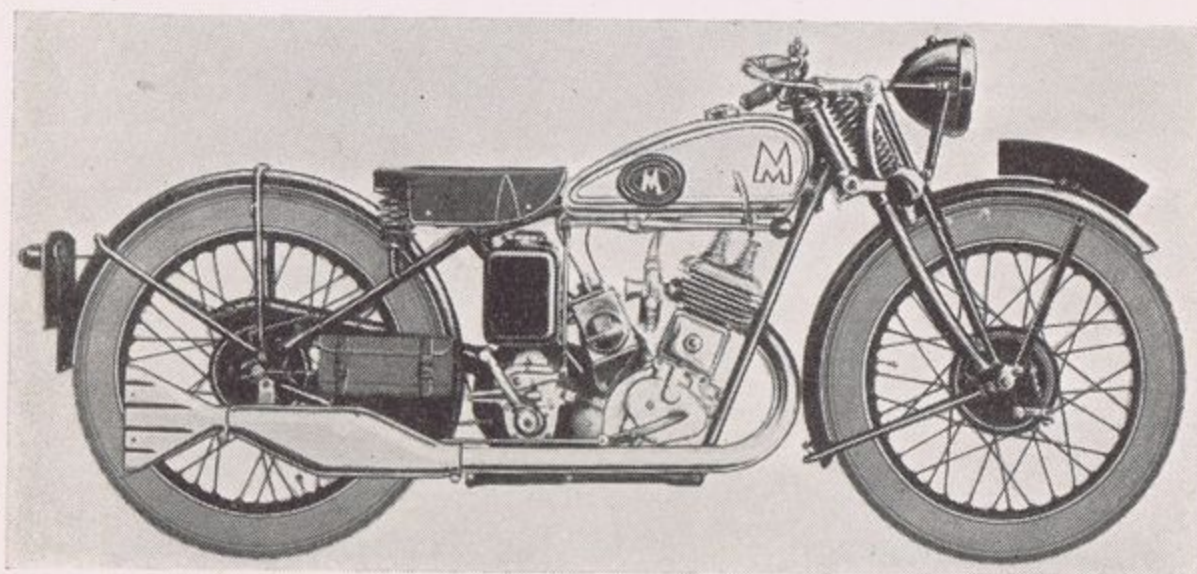


FIG. 33. MODEL D

design. The bore and stroke are 69 mm. \times 93 mm., giving a cubic capacity of 347 c.c., and a similar decompressor is fitted.

In order to save weight the cylinder head and barrel are cast integral on this engine only. The magneto drive is taken by chain and sprockets off the transmission side mainshaft. The engine, which has a compression ratio of 4.7 to 1, develops roughly 10 b.h.p. at 5,000 r.p.m. on the bench. A road speed of 60 m.p.h. is equivalent to about 4,500 r.p.m.

Carburettor. A two-lever, type 4/024 Amal, semi-automatic, pilot jet instrument is used. It has a flange fixing and a top petrol feed. A size 80 jet is used in conjunction with a 4/5 throttle valve in position 3. This combination gives good slow running (a throttle stop is included) and a fuel consumption of 95-115 m.p.g. An air cleaner cannot be fitted.

Ignition (D and D/S). Unless an F.D. type "Maglita" lighting set is installed, the current is generated by a Lucas M-L type

NA1 magneto with laminated pole shoes and a pair of arched-shape cobalt steel magnets. It weighs about $4\frac{1}{2}$ lb., and differs from most well-known types in regard to the contact-breaker mechanism (Fig. 54), where the action of a face cam and vertical plunger causes the contacts to open and close in a direction at right angles to the usual motion. The timing is variable to the extent of about 20 degrees from full retard and a self-contained spring control is provided. The magneto setting (D and D/S) is T.D.C. on full retard, or $\frac{3}{8}$ in. before T.D.C., full advance.

Gearbox and Clutch. The gearbox used is a B.W. type three-speed Sturmey-Archer with a special swivel fixing and special design of casing. It gives the gear positions, rear to front, in this order: 1st, N., 2nd, 3rd; and the gear ratios are—

First, 17.5 to 1; second, 9.3 to 1; third, 5.8 to 1

The B.W. gear, which is specially designed for engines up to 350 c.c., follows standard Sturmey-Archer practice in that only six pinions are used to provide three speeds and a kickstarter. The gears are constantly in mesh for the full width of the teeth.

The special feature of this gear consists in the design of the control mechanism. The various gear positions are automatically indexed inside the box, and the whole mechanism completely enclosed. The gear operating spindle is placed on the front of the cover, and a short lever to which the long rod is attached is fixed to this by serrations. An internal stop is provided for arresting the return stroke of the kickstarter crank.

The clutch is a dry, two-plate type with cork inserts and a hollow mainshaft and plunger type control. It has a single compression spring.

Transmission. $\frac{7}{16}$ in. \times .265 in. and $\frac{1}{2}$ in. \times .205 in. Coventry "Ultimate" chains are used for primary and secondary transmission, respectively. There is no shock absorber. The primary chain is automatically lubricated.

Tanks. The capacity of the fuel tank is 2 gal., and the capacity of the oil tank 3 pints. The oil consumption is 1,800–2,000 m.p.g.

Wheels and Tyres. The wheels which have $6\frac{1}{2}$ in. non-coupled brakes are shod with 25 in. \times 3 in. wired-on Dunlop cord tyres, and the recommended inflation pressures (solo) are 15–16 lb. per sq. in. and 21–22 lb. per sq. in. for front and rear tyres, respectively. Oversize tyres are fitted to Model D de luxe.

Maximum speed (Solo)	55–60 m.p.h.
Weight (with "Maglita" set)	Approx. 215 lb.

MODEL C/S

This model, illustrated by Fig. 34, has a specification identical to Model C except in regard to the engine, which has overhead

valves and a decompressor and, of course, a dual exhaust system.

The 4.95 h.p. O.H.V. Two-port Engine. Only in so far as that part of the engine above the crankcase is concerned, does this inclined power unit differ from the 5.86 h.p. side-valve version to any extent. The bore and stroke are 85.5 mm. \times 85.5 mm., giving a capacity of 495 c.c. The compression ratio is 6.6 to 1.

For racing purposes a special high compression piston giving a ratio of 11.5 to 1 is available.

The two-port cylinder head (Fig. 35) is very neat, and forms a hemi-spherical combustion chamber with the sparking plug dead

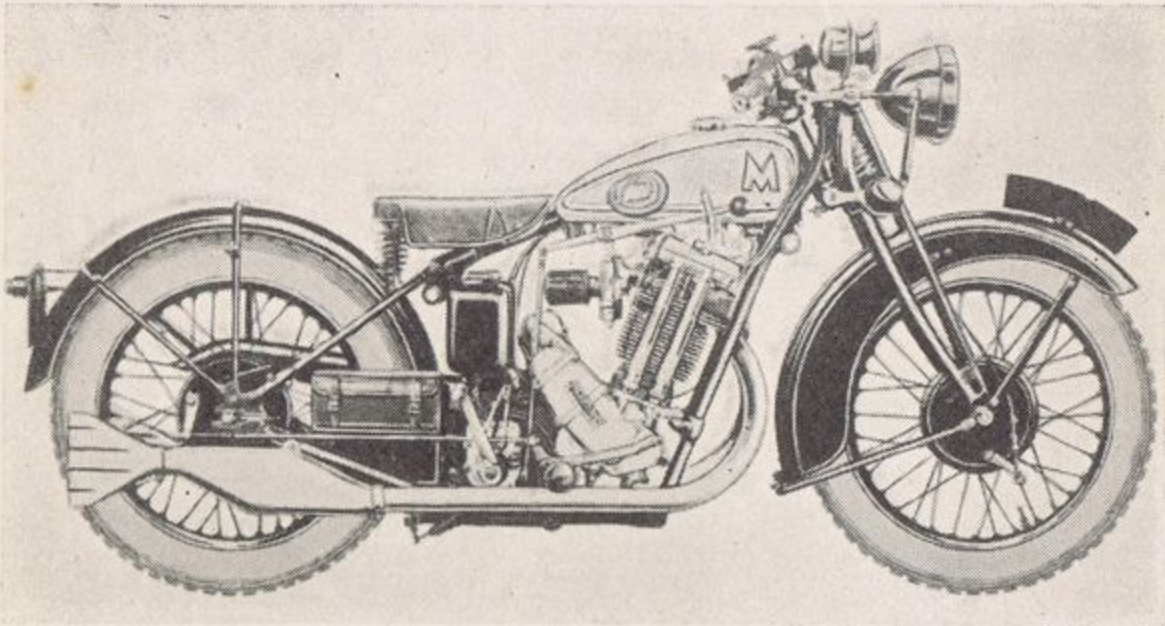


FIG. 34. MODEL C/S DE LUXE.

in the centre. A spigot on the barrel face provides a gas-tight joint. The exhaust ports into the outlets of which the exhaust pipes are a push-in fit, converge on Model C/S at an angle of 46 degrees to a point just above the inlet valve. On the opposite side of the head is a flange for carburettor attachment. Hollow headed, tulip pattern valves with detachable hardened end caps are used, and they reciprocate in detachable cast-iron guides pressed into the head at 70 degrees to each other. These valves are quickly removed by a special tool as shown on page 131. Duplex valve springs with split collet anchorages are used. The entire rocker gear is of new design as illustrated by Fig. 36, where the rectangular-shaped, two-piece aluminium rocker box is shown divided. It is raised clear of the cylinder head finning, and secured by three stout bolts arranged triangular about the rocker axes thrust centre, the two outer ones screwing into special distance sleeve bolts fixed to the cylinder head extensions, and the centre one to a cylinder head retaining sleeve bolt. There is in addition a small tiebar connecting the front support bolt

to the frame. A rigid mounting is thus provided. The upper half of the rocker-box is secured to the lower by four bolts, in addition to the three special bolts already mentioned which pass right through the rocker-box. One-piece rockers are used and they are each housed in two pairs of roller bearings (*E*, Fig. 36), which can readily be removed with the rockers after removing the upper half of the rocker-box, and their races afterwards slipped off the rocker arms if necessary. Grease-gun lubrication of the rocker bearings is provided, a special chamber *F* to which is attached a grease-gun

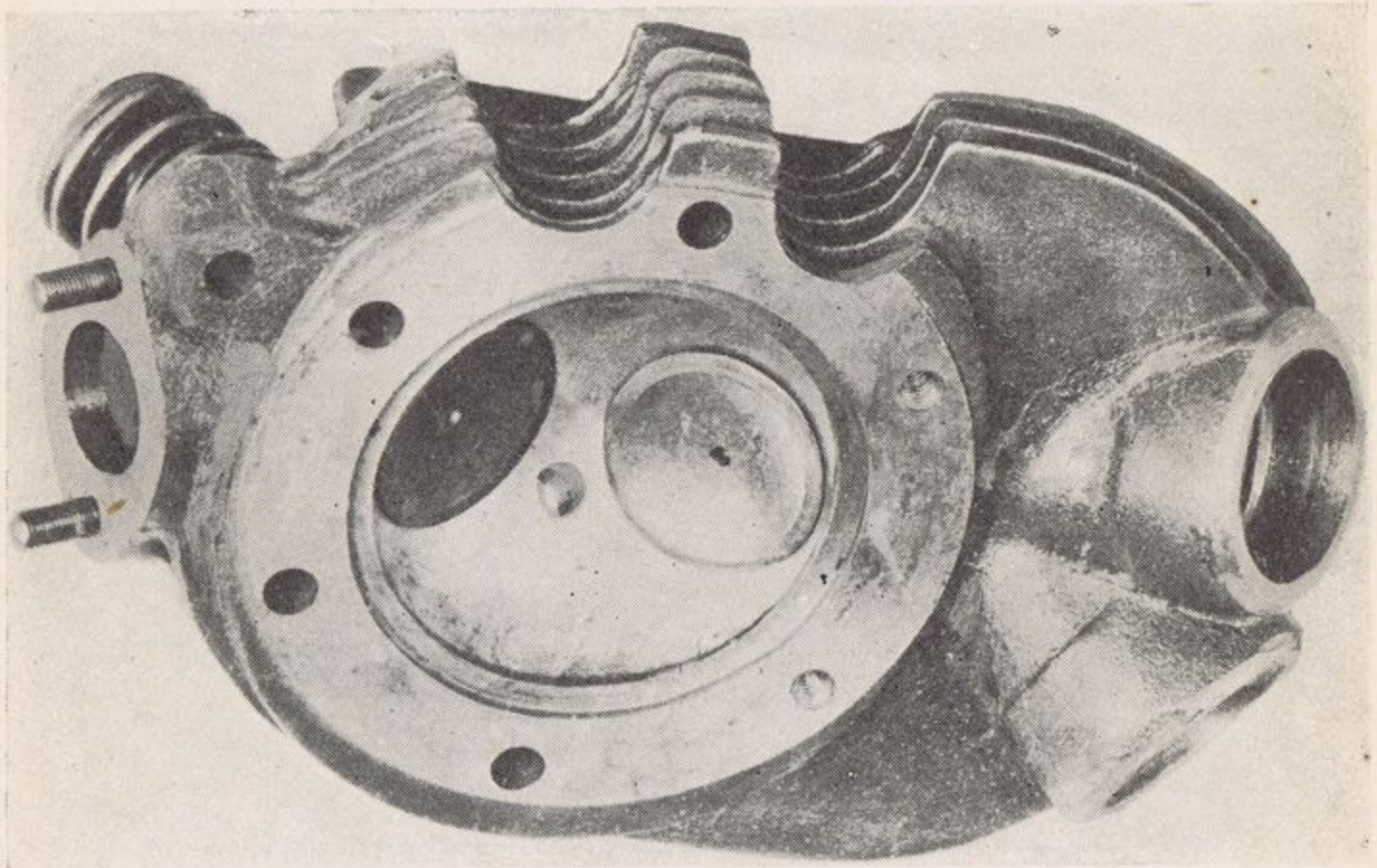


FIG. 35. UNDERNEATH VIEW OF TWO-PORT CYLINDER HEAD SHOWING HEMI-SPHERICAL COMBUSTION CHAMBER AND VALVES

nipple *G* communicating with the two pairs of roller bearings by small channels cut in the lower housing. Oil is fed from the sight-feed chamber on de luxe models, or direct from the pump on standard models to a "T" piece on the top of the rocker-box and filling up the two smaller chambers *H*, positively lubricates the cupped ends of the push rods, and also the inlet valve guide, the supply to which may be regulated by a pointed screw in the "T" piece. Clockwise rotation cuts down the supply, and adjustment should only be made in the event of any shortage or excess being made apparent by inlet valve squeaking or, alternatively, excessive leakage of oil. All surplus oil afterwards drains to the timing case down through the telescopic push-rod covers which have internal springs and fit closely into the rocker-box at their upper

ends. These covers may be kept raised for tappet inspection by means of a small spring plunger at the top engaging a hole at the bottom of each cover.

The push-rods themselves are of steel tubing with hardened steel ball ends fitting into the cupped rocker arm ends at the top and resting upon the adjustable tappet heads at the bottom.

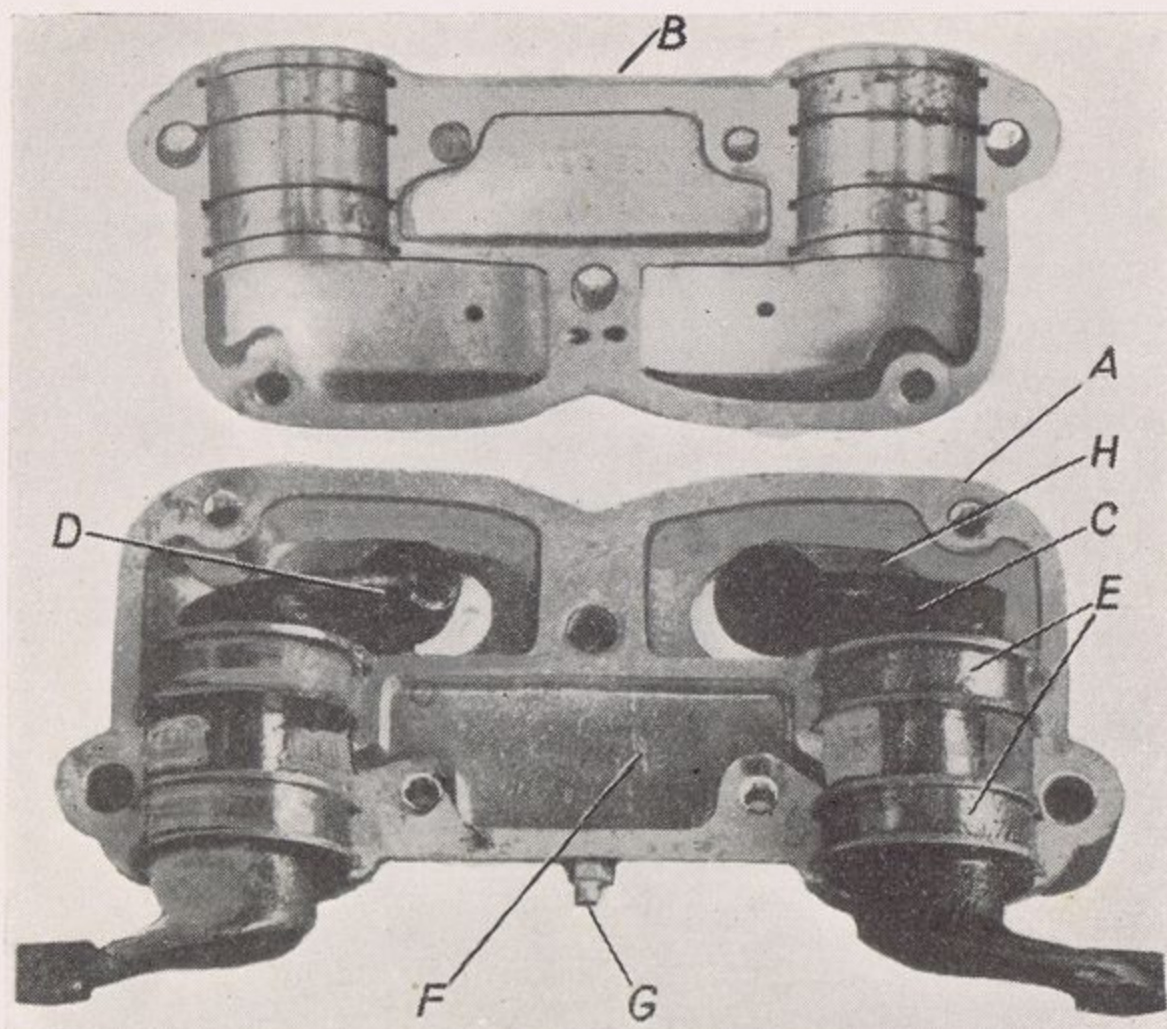


FIG. 36. THE O.H.V. ROCKER BOX WITH COVER REMOVED

- | | |
|----------------------------|---------------------|
| A—Lower half of rocker box | E—Roller bearings |
| B—Upper half of rocker box | F—Grease chamber |
| C—Inlet valve rocker | G—Grease-gun nipple |
| D—Exhaust valve rocker | H—Oil compartments |

The tappets are of the mushroom pattern, and rest direct upon the cams as on the 5.86 h.p. side-valve engine.

Lubrication is by the D.S. system. (Page 14.)

Carburettor. A two-lever, semi-automatic pilot jet Amal, type 6/024, is used, and it has a flange fixing, is provided with a top petrol feed, and has twist-grip throttle control and an air filter as standard on the de luxe model. The jet size is 120 with a throttle valve $6/4$ in position 3. The fuel consumption is 85–100 m.p.g. For further details see page 76.

Lubricating oil recommended (C/S and D/S)

Sparking plugs recommended (C/S and D/S)

Touring: Castrol XL. Racing: Castrol R

Lodge H.1. or K.L.G. K.5.

D/B/T/S/G/O/M/N/S/CO/UK

Tappet clearances (C/S and D/S)002 in. inlet and .004 in. exhaust (warm)
Weight (without lighting)	330 lb.
Tyre pressures (Solo)	Front, 18; rear, 24 lb. per sq. in.
Maximum speed (Solo)	Approx. 75 m.p.h.

MODEL D/S

As in the case of Model C/S, this model differs from Model D in regard to the engine valve gear and the gear ratios, cubic capacity and exhaust system only. It has a similar type decompressor on the timing case.

The 2.46 h.p. O.H.V. Two-port Engine. The bore and stroke

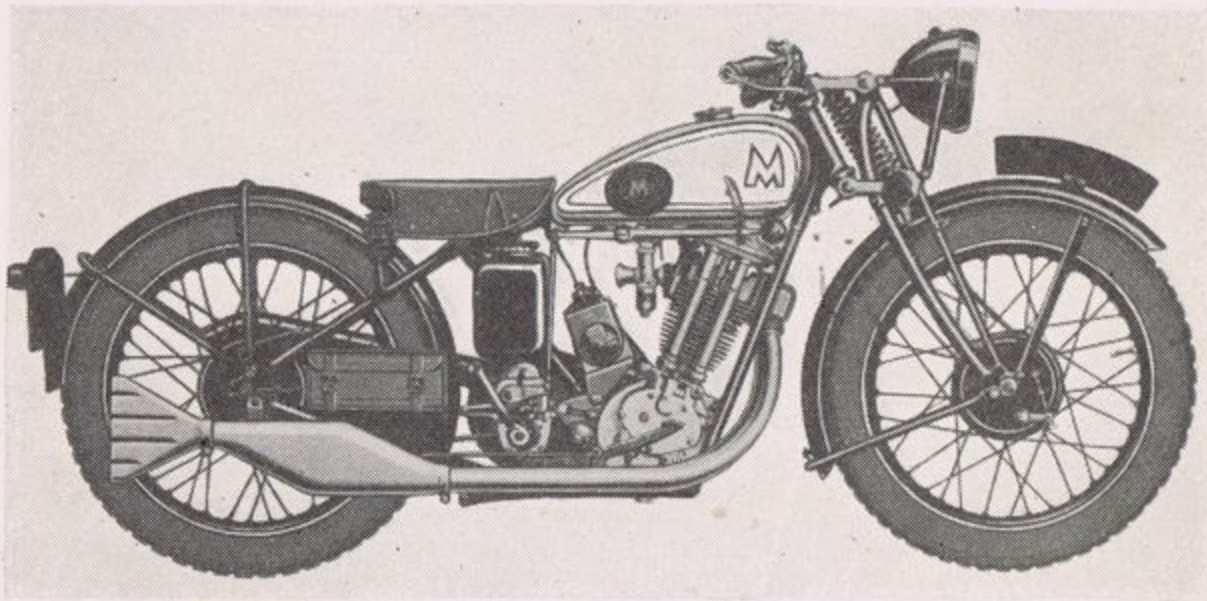


FIG. 37. MODEL D/S

of this inclined engine are 62.5 mm. \times 80 mm., giving a capacity of 246 c.c. The compression ratio is 5.5 to 1. The power unit is identical to the 3.47 h.p. side-valve engine but for the fact that a detachable two-port cylinder head with overhead-valve gear, including telescopic push-rod covers and aluminium rocker-box with adjustable, automatic inlet valve guide lubrication, replaces the non-detachable side-valve cylinder head, and the cylinder capacity is less. The overhead valve gear is fully described in the C/S specification, and on this engine is the same except that the valves are placed at 68 degrees to each other and that some of the dimensions are less.

Carburettor. This is a two-lever, semi-automatic pilot jet, type 4/014 Amal with flange fixing and top petrol feed; an air filter is included on the de luxe model. A size 70 jet is used in conjunction with a 4/4 throttle valve in position 3. The fuel consumption is 100-120 m.p.g.

Weight (without lighting)	215 lb.
Tyre pressures	Front, 16; rear, 22 lb. per sq. in.
Maximum speed (Solo)	60-65 m.p.h.

THE MATCHLESS SIDECARS

A very handsome range of sidecars is marketed, and Matchless owners and prospective owners should have little difficulty in selecting a sidecar suitable for their requirements. Of the present range, six are designed for private purposes and seven for commercial use. The private sidecars are designed for attachment to all except Models R/7, D, D/S. Prices vary from £15 to £32. A

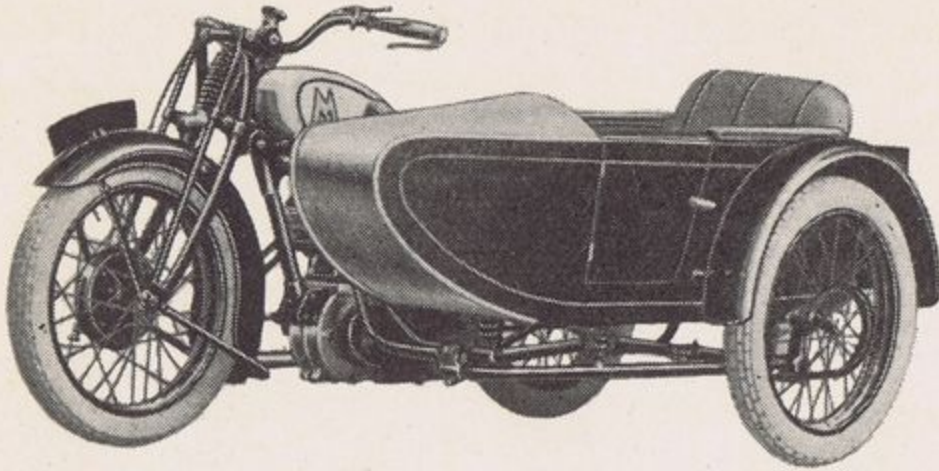


FIG. 38. NO. 1 SIDECAR

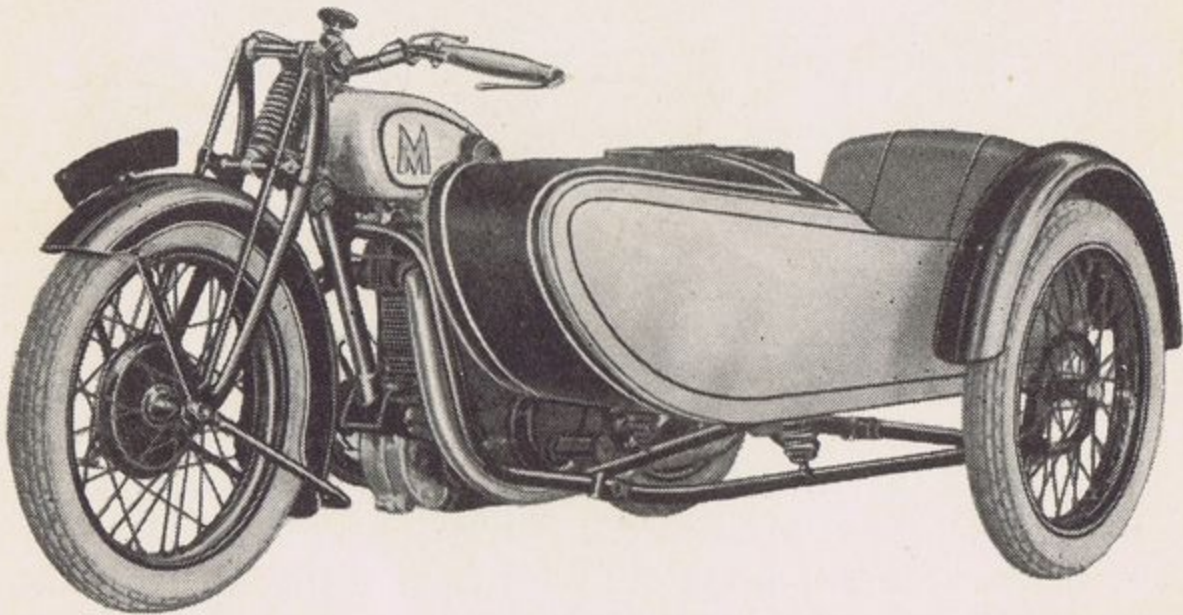


FIG. 39. NO. 2 SPORTS SIDECAR

special spring frame chassis for use with the "Arrow" or "Hawk" is available.

No. 1 Sidecar. This is the standard touring sidecar, fitted with a body giving an exceptional amount of accommodation and of sporting appearance. A large locker at the rear has a lift-up lid, which is covered with aluminium matting and adapted for use as a luggage grid. The sidecar is finished in stoved black enamel with white lines and aluminium beading, and has a 26 in. \times 3.25 in. Dunlop cord tyre. A 27 in. \times 4 in. tyre is extra for all sidecars.

No. 2 Sports Sidecar. This very attractive sports sidecar is fitted with a handsome body with black nose panel with white

lines and polished aluminium side panels with black lines. A six-foot passenger can readily be accommodated. Equipment includes a hammock seat with spring upholstered cushion and a fixed luggage grid. It is fitted with a 26 in. \times 3.25 in. Dunlop cord tyre.

No. 4a Sunshine Saloon Two-seater. This sidecar is suitable for two adults, and is built on the lines of a sunshine saloon car with sloping windscreen, fixed side windows, one of which opens with the door, and a fabric-covered back panel in which is a

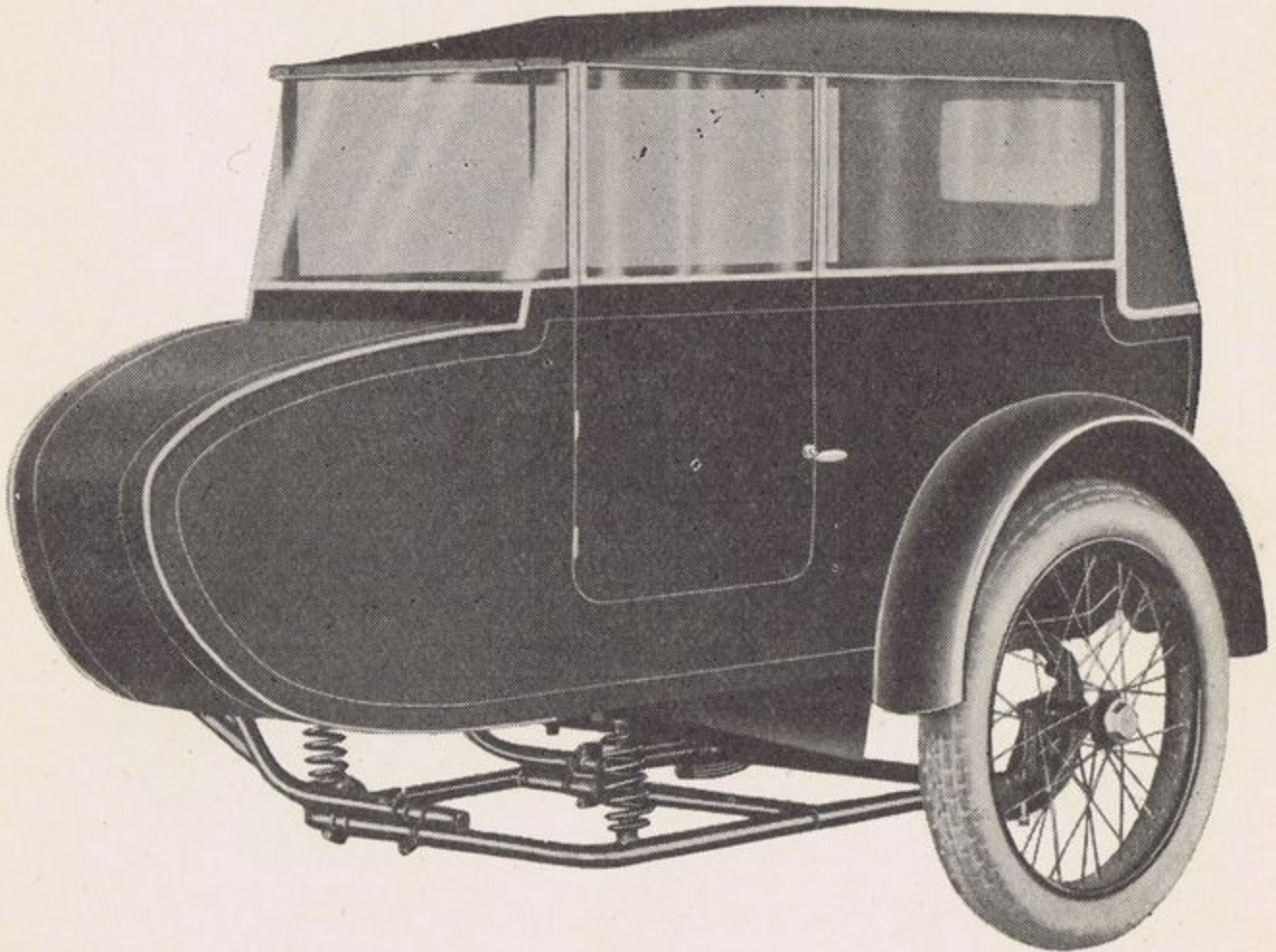


FIG. 40. NO. 4A SUNSHINE SALOON TWO-SEATER

spacious window. When the roof is in position (as shown in Fig. 40), the body is absolutely weatherproof. In fine weather the roof can instantly be rolled up. The whole roof is then open, but the passengers are protected from draughts by the fixed windows. The finish throughout is black with white lines, and the chassis has a 26 in. \times 3.25 in. Dunlop tyre.

No. 4 Two-seater. This is similar to the above model but minus the all-weather equipment.

No. 13 Occasional Two-seater. The "occasional" type of body is designed for those who require accommodation for two adults only occasionally. When only one passenger is carried, the back of the sidecar folds up, hiding the rear seat, and the body then has the appearance of a luxurious single-seater. The windscreen shown (see page 56) is extra.

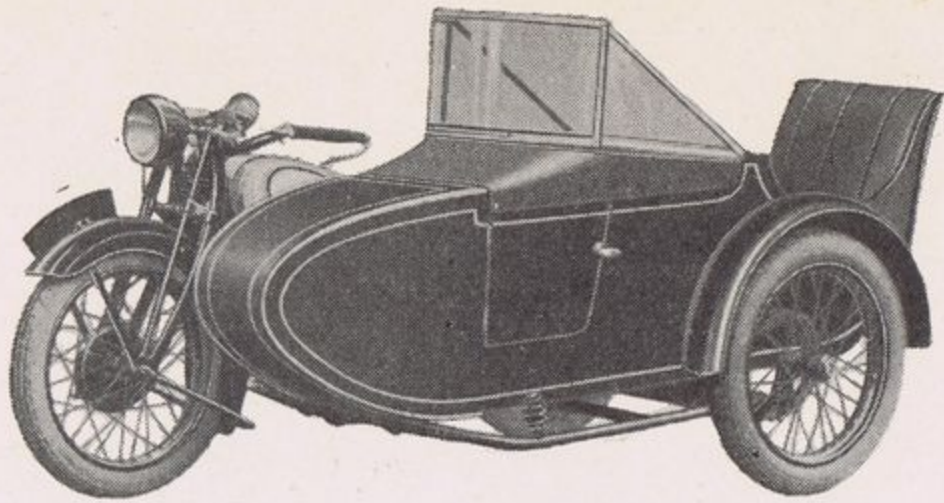


FIG. 41. NO. 13, OCCASIONAL TWO-SEATER

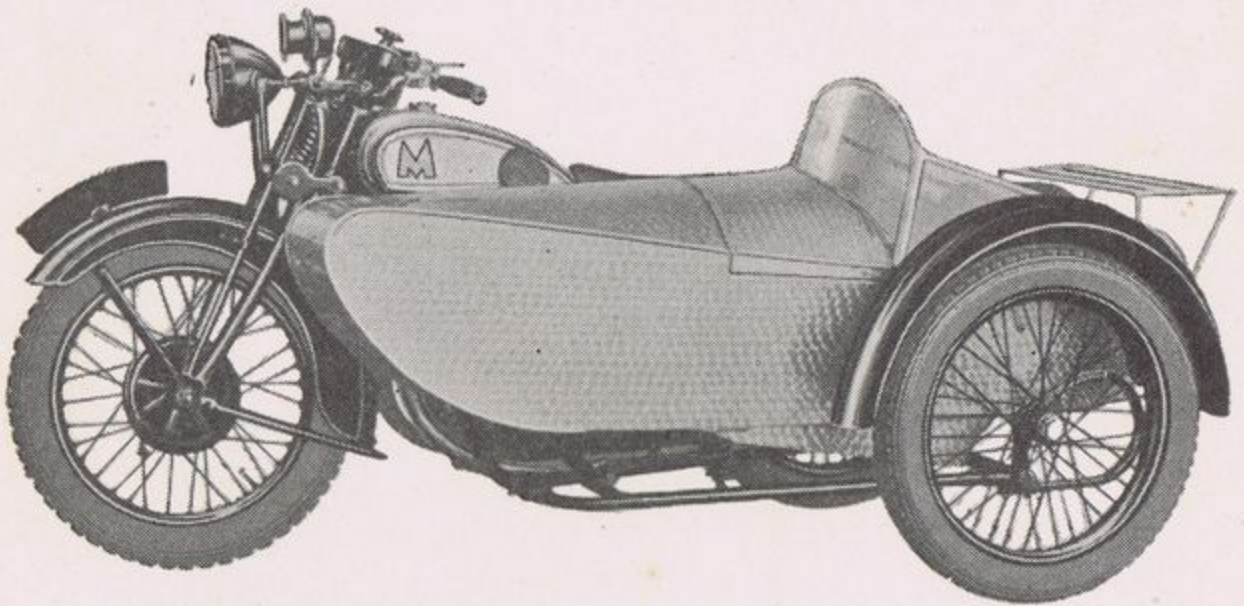


FIG. 42. NO. 16, SPECIAL SPORTS SIDECAR

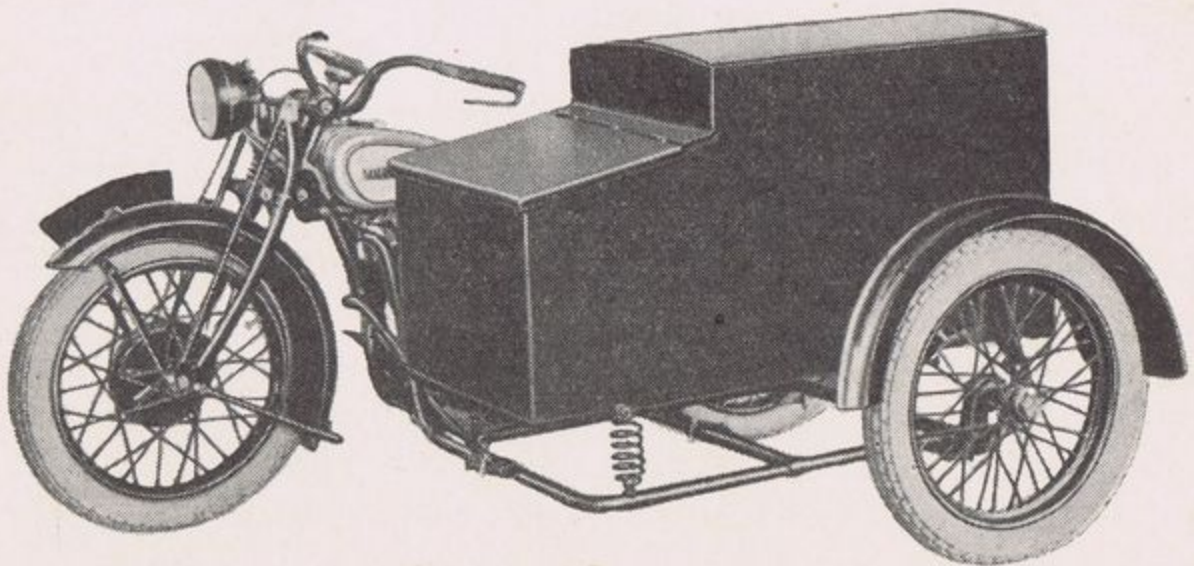


FIG. 43. "AIR MAIL" BOX SIDECAR

No. 16 Special Sports Sidecar. This sidecar is a real de luxe sports type with a deep well seat and remarkably comfortable upholstery, including arm-rests. The body is finished throughout in aluminium. The windscreen is mounted on a hinged scuttle-dash, providing exceptional weather protection. The luggage grid at the rear is chromium plated.

Commercial Sidecars (C, X/3, X/R3, and B). The same high quality of material and finish noticeable in the private sidecar bodies and chassis is here in evidence also. Fig. 43 illustrates a typical example. The illustration shows the well-known "Air-Mail" type, first introduced for carrying urgent mails between the G.P.O. and Croydon aerodrome. Shelves can be fitted to order in the rear part of the body. Another commercial type is a truck sidecar intended for the carriage of agricultural produce. It is also suitable for dairymen, since it will carry two churns. The normal load is 3 cwt. The body is 3 ft. 10 in. long and 2 ft. 2 in. wide. Besides the type illustrated there are five others which are modifications of this type. In short, a remarkably fine range of sidecars as well as solo machines is offered to the public at very moderate prices.