THE J.A.P. BOOK

THE HOME OF THE J.A.P. ENGINE.—*"British and Best."*

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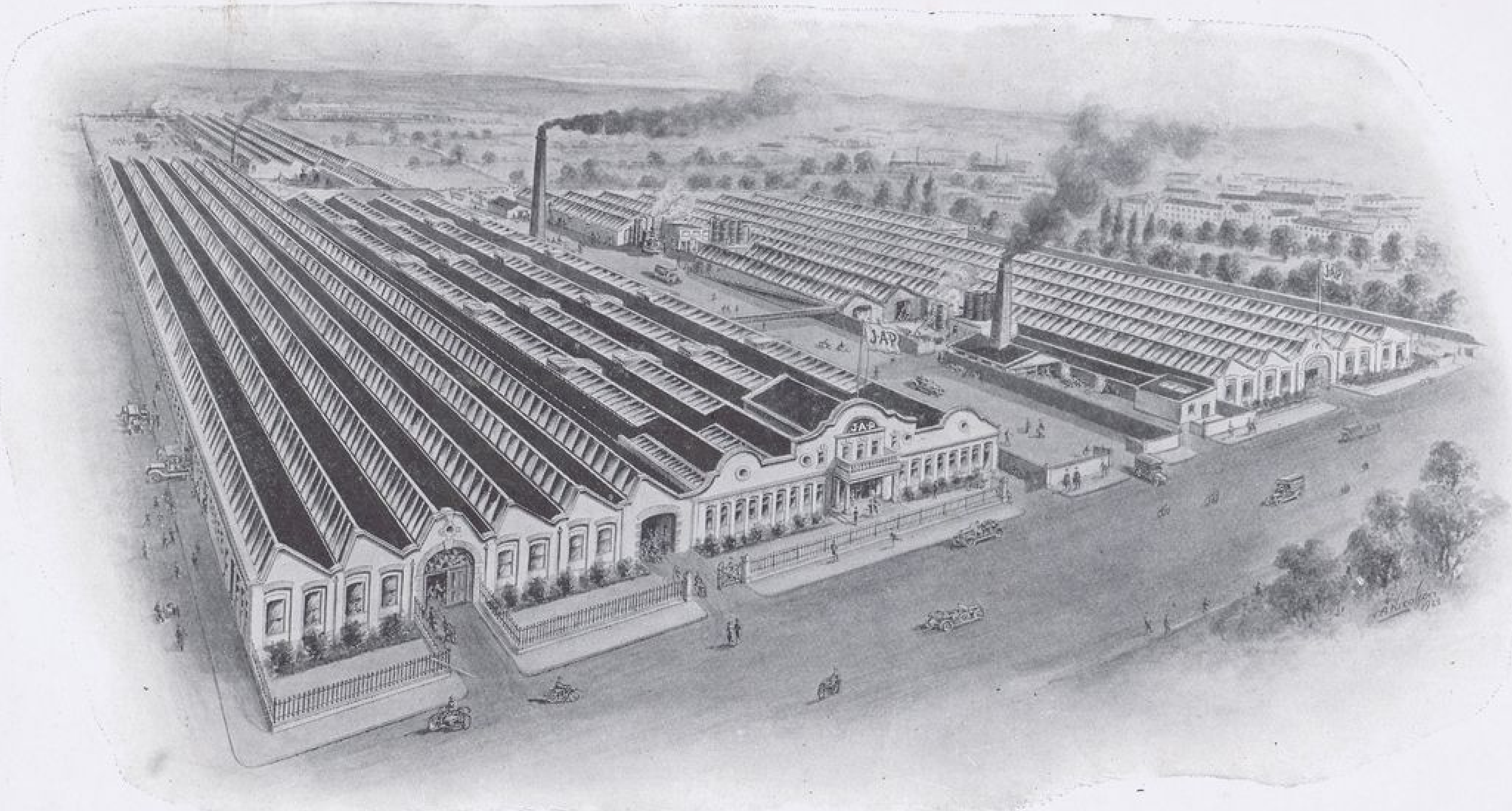


J. A. PRESTWICH & Co., Ltd. (ESTABLISHED 1895.) NORTHUMBERLAND PARK TOTTENHAM, LONDON, N.17.

JAP MOTORS

J.A.P. ENGINES.

IT is now almost thirty years since there was formed in Tottenham the nucleus of "JAP'S." The size of the Firm at the present day can be gathered from the adjoined view of the Works and Offices; and after seeing these a contemplative reader might well say, "From such a source surely the product must be unequalled." This is, in fact, our constant aim, backed by long manufacturing experience, by careful research, and by stringent experiment.

Historically, the growth of the J.A.P. engine—ever in the forefront of the industry—would make interesting reading: but space prevents the description of the numerous earlier engine types and of the innumerable successes gained by them on road and track, and in the air. For the same reason it is not possible here to describe the special processes of manufacture, the fruit of experienced ingenuity, which uphold the J.A.P. reputation for first-class workmanship, and which ensure, for instance, the interchangeability of spare parts.

At the present day the trend of motor cycle engine design is becoming fairly clearly marked. It is not so much the obvious alterations—such as the general substitution of aluminium for cast iron as a piston material—that are significant; but there is a growing tendency to multiply engine types and sizes to suit the various conditions of use, rather than to design one engine type to meet several sets of conditions. This tendency, which is well reflected in the J.A.P. range of engines, is, of course, right, as it is the road to greater Efficiency; and too much stress can hardly be laid on the necessity of selecting an engine of correct type for the particular work which it must perform. A standard engine, intended for ordinary touring, cannot be tuned to give the same results as a sports engine; while conversely the sports or racing units should be treated with the care due to such types.

J.A.P. engines, then, are now supplied in various well graded sizes, and in three distinct ranges—Standard, Sports and Racing models. The Sports types give more power than the Standard engines, and are suitable for both touring and local competitions. The engines in the Racing range, however, should be used only for Racing; and are designed to perform well without special tuning in important events at Brooklands and elsewhere. The very fullest information about any particular model can always be obtained on application, but the descriptions in this book will convey a clear impression of the distinctions between types referred to earlier.

THE J.A.P. RANGE.

Standard Engines.

SINGLE CYLINDER TYPE.

TYPE.	A.C.U. H.P.	BORE. M/M.	STROKE. M/M.	C.C.	WEIGHT. LB.	REFERENCE LETTER.
175 C.C.	1·736	60	62	173·6	28	V.
250 C.C.	2·49	64·5	76	249	39	B.
250 C.C.O.H.V.	2·45	62·5	80	245	47	PO.
300 C.C.	2·988	70	78	298·8	36	A.
350 C.C.LIGHT	3·449	70	90	344·9	47	IY.
350 C.C.	3·449	70	90	344·9	49	I.
350 C.C.O.H.V.	3·449	70	90	344·9	55	IO.
500 C.C.	4·90	85·7	85	490	70	K.
500 C.C.O.H.V.	4·90	85·7	85	490	76	KO.
600 C.C.	6·00	85·7	104	600	71	U.

TWIN CYLINDER TYPE (Angle between cylinders, 50°).

680 C.C.	6·744	70	88	674·4	70	GT.
680 C.C.O.V.H.	6·744	70	88	674·4	80	GTO.
750 C.C.	7·46	70	97	746	70	MT/1.
980 C.C.	9·81	85·7	85	981	90	KT.
980 C.C. W.C.	9·81	85·7	85	981	90	KTW.
1100 C.C. O.H.V. W—C	10·96	85·7	95	1096	128	LTOW.

Sports Engines.

SINGLE CYLINDER TYPE.

TYPE.	A.C.U. H.P.	BORE. M/M.	STROKE. M/M.	C.C.	WEIGHT. LB.	REFERENCE LETTER.
350 C.C.O.H.V.	3·437	74	80	343·7	56	SOC.
500 C.C.O.H.V.	4·90	85·7	85	490	80	KOC.

TWIN CYLINDER TYPE (Angle between cylinders, 50°).

980 C.C.	9·81	85·7	85	981	90	KTC.
980 C.C. 8/30 H.P. DOUBLE CAM	9·81	85·7	85	981	99	KTCY.

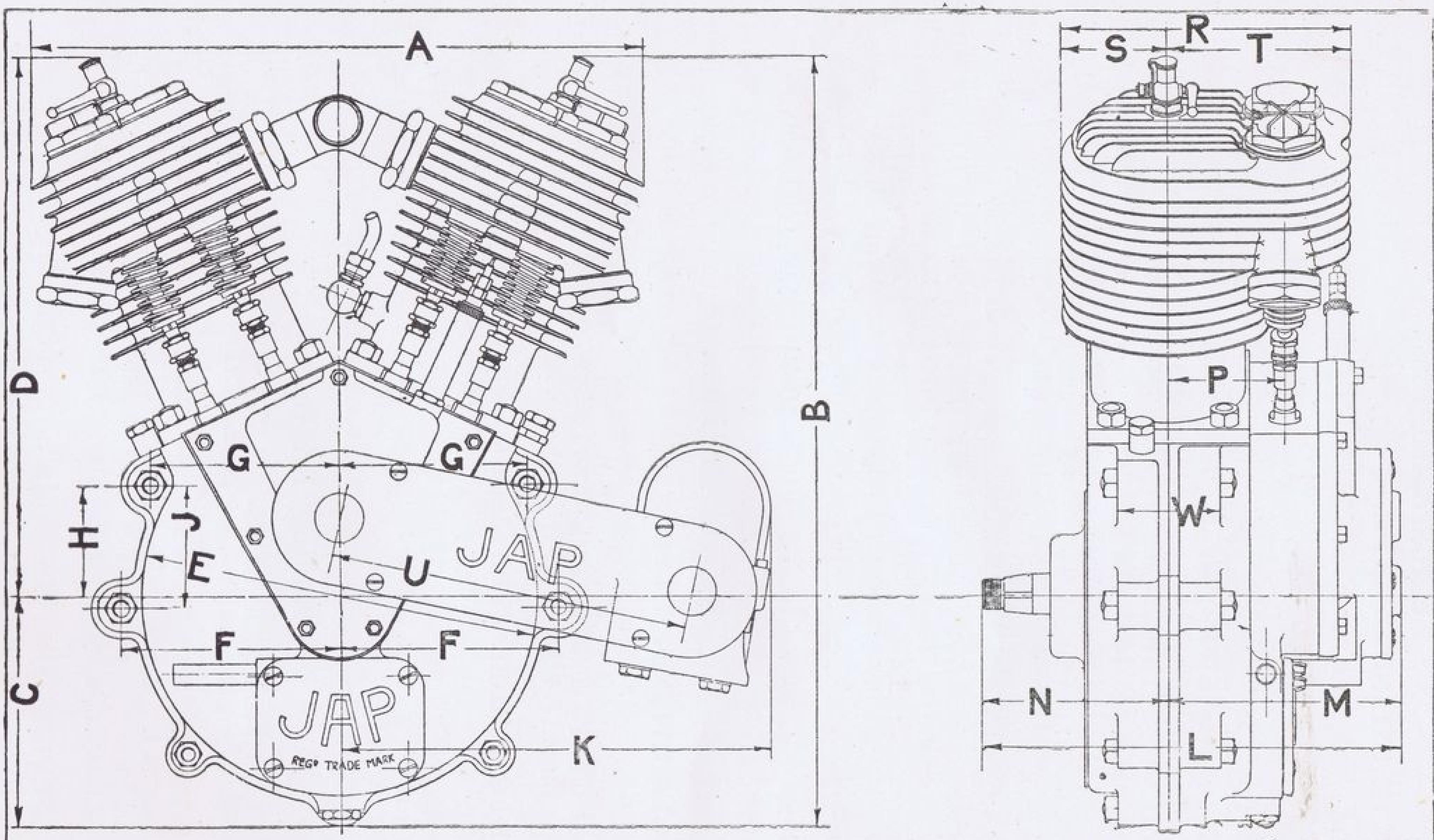
Racing Engines.

SINGLE CYLINDER TYPE.

TYPE.	A.C.U. H.P.	BORE. M/M.	STROKE. M/M.	C.C.	WEIGHT. LB.	REFERENCE LETTER.
250 C.C.O.H.V.	2·49	62·5	80	249	58	POR.
350 C.C.O.H.V.	3·437	74	80	343·7	63	SOR.
500 C.C.O.H.V.	4·90	85·7	85	490	80	KOR.
600 C.C.O.H.V.	6·00	85·7	104	600	82	UOR.

TWIN CYLINDER TYPE (Angle between cylinders, 50°).

750 C.C.O.H.V.	7·30	74	85	730	133	ETOR.
980 C.C.O.H.V. (8/45 H.P.)	9·81	85·7	85	981	110	KTOR


A
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REGD TRADE MARK
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P
W
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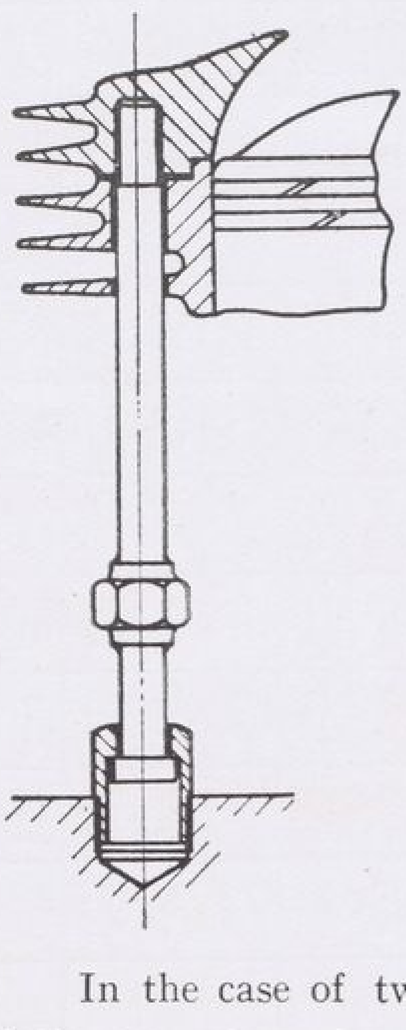
L
M

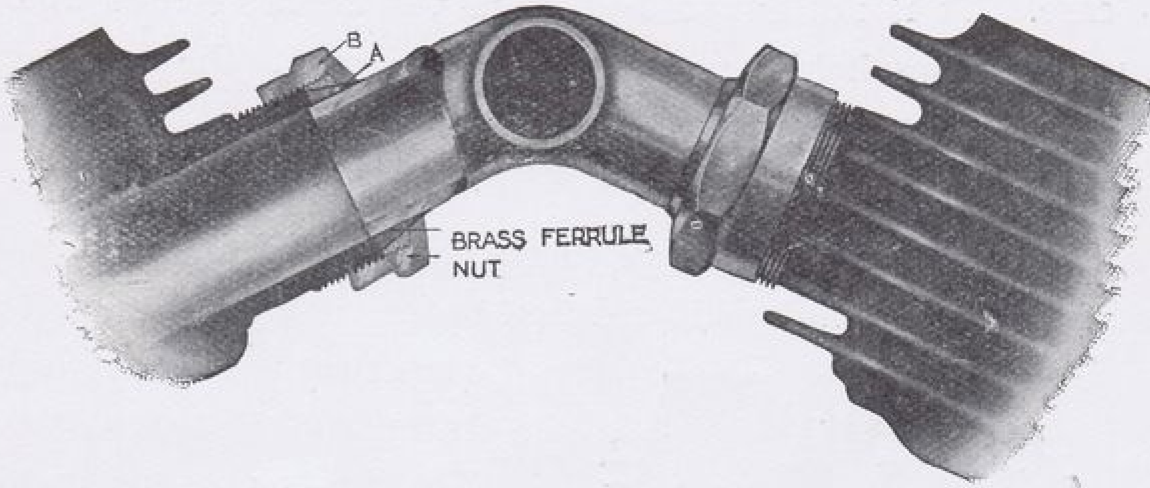
ACU. RATING	2·49	2·93	3·00	3·45	3·45	4·90	5·96	6·80	9·80	3·44	9·80	2·49	3·44	4·90	9·80	9·80
NOMINAL H.P.	2 1/2	2 3/4	2 3/4	2 3/4	2 3/4 o.h.v.	4	4 1/2	5	8	2 3/4 o.h.v.	8	2 1/2 o.h.v.	2 3/4 o.h.v.	4 o.h.v.	8/30	8/45 o.h.v.
SYMBOL.	B.	F.	A.	I.	IO.	K.	U.	GT.	KT.	SOC.	KTC.	POR.	SOR.	KOR.	KTR.	KTOR.
REFERENCE INDEX.																
A.								14 7/8	15 1/4		16 5/8				16 5/8	19"
B.	18 1/8"	15 7/16	15 3/4	17 3/8	20 1/16	18 1/8	19 3/8	17 1/16	17 7/8	19 1/16	20 15/16	19 1/16	19 1/16	21"	21 3/4	21 7/16"
C.	4 3/8"	4 3/8	4 3/8	4 11/16"	4 13/16	4 3/4	4 3/4	5 1/16	5 7/16	4 5/16	5 5/8	4 5/16	4 5/16	4 3/4	5 7/16	5 7/16"
D.	13 3/4	11 1/16	11 3/8	12 11/16	15 1/4	13 3/8	14 5/8	12"	12 7/16	14 3/4	15 5/16	14 3/4	14 3/4	16 1/4	16 5/16	16"
E.	7 7/16	7 7/16	7 7/16	7 7/8	7 7/8	9 1/16	9 1/16	8 5/16"	9 9/16	7 7/8	9 9/16	7 7/8	7 7/8	9 1/16	9 9/16	9 9/16
F.	3 3/4"	3 3/4	3 3/4	4 3/8	4 3/8	4·857	4·857	4·398	5 9/32	4 3/8	5 9/32	4 3/8	4 3/8	4·857	5 9/32	5 9/32"
G.	4 1/8"	4 1/8	4 1/8	2 13/16	2 13/16	2·828	2·828	4·145	4 9/16	2 13/16	4 37/64	2 13/16	2 13/16	2·828	4 37/64	4 37/64"
H.	1 11/32"	1 11/32	1 11/32	3 13/32	3 13/32	4 1/8	4 1/8	2 3/16	2 21/32	3 13/32	2 5/8	3 13/32	3 13/32	4 1/8	2 5/8	2 5/8"
J.	2 9/32	2 9/32"	2 9/32	2 29/32	2 29/32	2 15/16	2 15/16	3 13/16	2 15/16"	2 29/32	2 29/32	2 29/32	2 29/32	2 15/16	2 29/32	2 29/32"
K.	9	9 1/4	9 3/8	9 5/8	9 5/8	9 1/4	9 1/4	9 3/4	9 7/8	9 3/4	10	9 3/4	9 3/4	9	10 5/8	10 5/8
L.	7 31/32	7 23/32	8 9/32	8 23/32"	8 23/32	9 21/32	9 21/32	9 1/16	10 7/32	8 15/32	10 7/32	8 15/32	8 15/32	9 29/32	10 9/16	10 9/16"
M.	4 1/8	4 1/8	4 7/16	4 7/8"	4 7/8	5 5/8	5 5/8	5	5 19/32	4 3/8	5 19/32	4 3/8	4 3/8	5 5/8	5 15/16	5 15/16"
N.	3 27/32"	3 19/32"	3 27/32	3 27/32"	3 27/32	4 1/32	4 1/32	4 1/16	4 5/8	4 3/32	4 5/8	4 3/32	4 3/32	4 9/32	4 5/8	4 5/8"
P.	2 5/32	2 7/32	2 7/32	2 5/16	2 5/16	2 27/32	2 27/32	2 1/4	2 27/32	/	2 27/32	/	/	2 27/32	2 27/32	2 27/32
R.	6 3/32	6 3/32	6 3/32	6 1/2	5 7/8	7 19/32	7 19/32	6 1/8	7 13/32	6	7 19/32	6	6	6 3/4	8 3/32	6 3/4
S.	2 1/4	2 1/4	2 1/4"	2 3/8	2 15/16	2 3/4	2 3/4	2 1/4	2 11/16	3	2 3/4	3	3	3 3/8	3	3 3/8
T.	3 27/32	3 27/32	3 27/32	4 1/8	2 15/16	4 27/32	4 27/32	3 7/8	4 23/32	3	4 27/32	3	3	3 3/8	5 3/32	3 3/8
U.	7 1/8	7 1/8"	7 1/8	7 1/2	7 1/2	7 1/2	7 1/2	8"	8 1/2	7 1/2	8 1/2	7 1/2	7 1/2	7 1/2	8 1/2	8 1/2"
W.	2 1/2"	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2"

CYLINDERS, Comparison of present day designs for cylinders with those of 1920, or earlier, illustrates very clearly the search for efficiency mentioned on a previous page. But apart from the progress in cooling gained by deeper finning brought low down the barrel, a less obvious improvement lies inside the modern J.A.P. cylinder head, which is carefully shaped to promote gas turbulence and as a result, better petrol consumption and higher power. On the side-valve engines the cylinders are carefully machined from a one-piece casting, and are held to the crankcase by four cylinder holding down nuts screwing on to studs passed through the cylinder base flange. The valve ports and chambers are very carefully designed to minimise gas friction, and are covered by the registered J.A.P. design of aluminium fir cone valve cap.



On the O.H.V. engines the cylinder barrel and cylinder head are separate castings, between which a wide copper gasket ensures a perfect joint. The head and barrel are drawn tightly down on to the crankcase by special flanged bolts screwing into the cylinder head, and their operation can easily be seen from the accompanying illustration. The cylinder head contour is hemispherical, each valve axis being inclind some 35° from the verical; and very particular care has been paid to the disposition of metal round the ports, valves and sparking plug, so that there shall be no possibility of distortion.

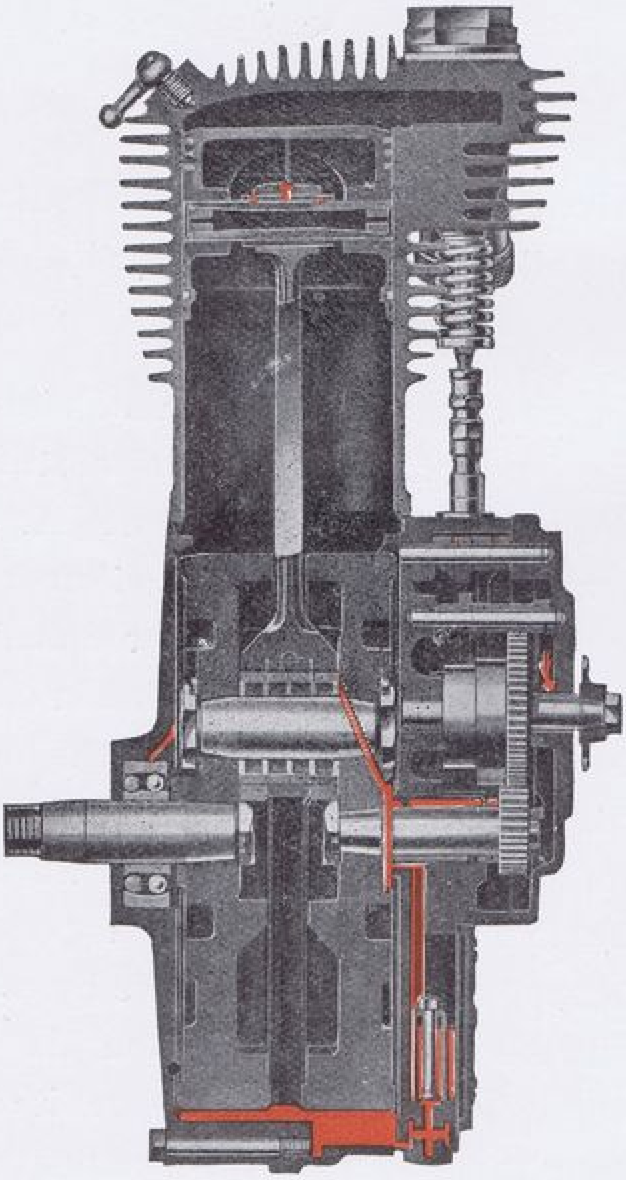
In the case of twin cylindered engines a special design of induction pipe union is employed. The inlet pipe is of the same diameter throughout, and the brass ferrule A, is a sliding fit on this. The union nut B, is tapered to correspond with the bevel of the



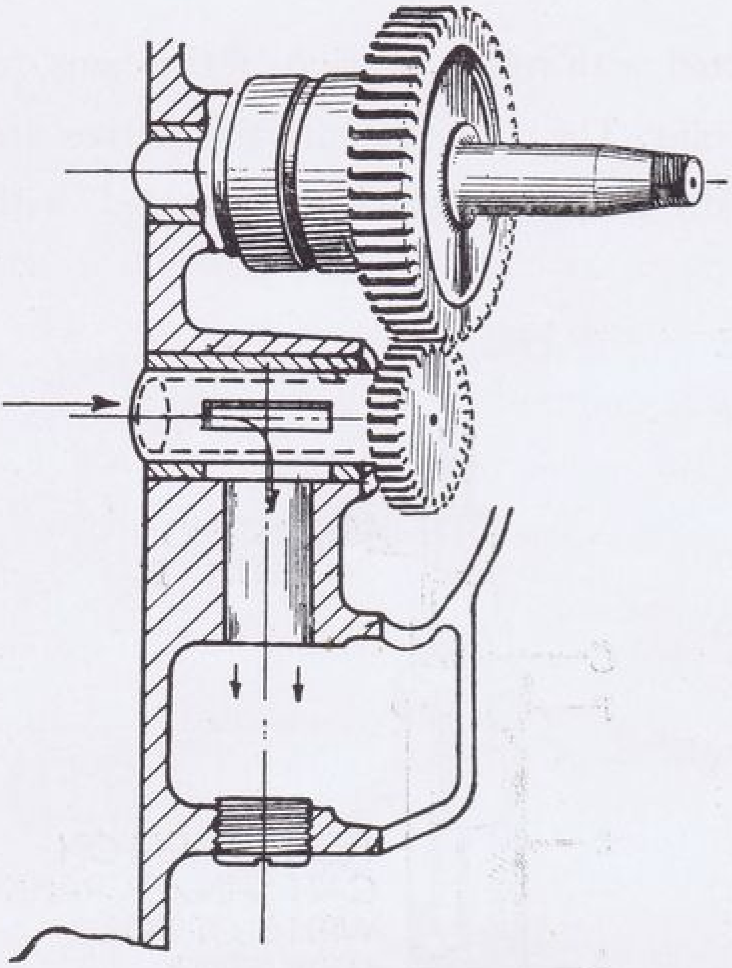
ferrule. and thus tightens it down on to the pipe when screwed to the port. An air-tight joint, which yet allows for cylinder expansion, is in this way obtained.

CRANKCASES are cast in dies from a special aluminium alloy, particular attention being given to the design to ensure stiffness of the walls. In every crankcase is embodied the patent J.A.P. lubrication system, which ensures a full supply of oil under considerable pressure to all moving parts. There are three main variations of this patent system which have been embodied in our engines at various periods. On engines from 1913 to 1922 the oil is delivered to the engine either through a union at the apex of the crankcase or else at the back of the cylinder neck, a spot where normally little is thrown by the flywheels. After lubricating the piston skirt it drops to the oil sump, and is forced thence by the pressure generated on the downward stroke of the piston via a non-return valve of the disc type, into an oil box, where it is stored under pressure. From here it passes up a pipe leading to the timing side main bearing bush, and thence through the drilled flywheel and crankpin to the big-end. The timing gear is lubricated by oil escaping from the main bearing and also by oil issueing from a non return vacuum valve, situated in the inner wall of the timing case. This valve relieves any excess of pressure in the crank-case, and actually sets up a partial vacuum, so that any oil which may tend to work out of the joints or bearings is drawn back into the case. It is not advisable to remove the two screws which, on most engines, hold the non-return valve seats to the crankcase, as these are burred over on the inside.

On engines built in the years 1923 and 1924 this system was modified; the oil beink delivered first to the timing case, and the non-return valves being transferred to the oil box. The timing case and crank-case are in free communica-tion, so that oil is pumped liberally over the highly stressed cam gear. The oil then drops into the oil box, where it is trapped by vacuum valves, and is kept at atmospheric pressure by a relief pipe. The suction caused by the upward stroke of the piston closes the non-return valves, and draws oil up a pipe leading to the gear side main bearing, whence it is thrown by cen-trifugal force, through a duct in the flywheel, to the big-end rollers.



A large number of 1927 model engines is now provided with a more positive pressure supply throughout the whole speed range. A vertical passage between the timing case and oil



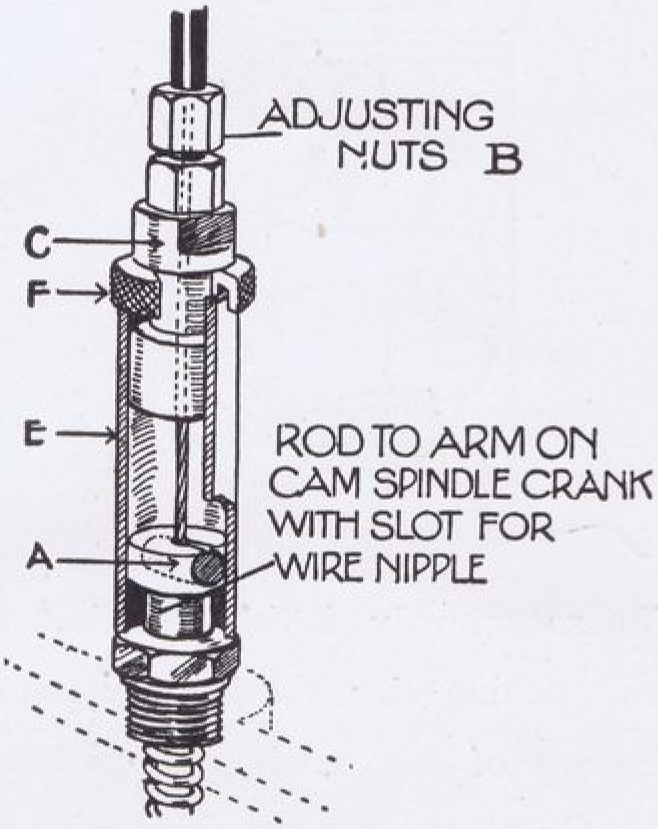
box is closed at its upper end by an horizontal sleeve, which is rotated at engine speed by the cam wheel, and is blanked off at the driven end. The inner end of this sleeve communicates with the crankcase, and when a slot in the sleeve comes into line with the vertical passage, oil is forced through into the oil box by the descending piston. The rotary valve is timed so that the slot has just passed the oil box opening when the front piston is at bottom dead centre; or, in the case of singles, when the piston is 25° past bottom dead centre.

On all engines provided with the rotary valve, a new system of lubrication is employed, whereby oil is delivered from the mechanical pump through a hollow gear side shaft, direct to the big end bearing of the connecting rod, thus ensuring an ample supply of lubricant to what is undoubtedly the most highly stressed bearing in the engine and at the same time the most difficult to lubricate.

On old type J.A.P. engines the MAIN TIMING PINION is screwed on to the gear spindle with a left-hand thread, and can only be removed satisfactorily by means of a special tool. On models since 1920, however, a tapered and keyed shaft is used, on to which the pinion is locked by a left-hand threaded nut. Three keyways are cut in the pinion taper on the "Vernier" system, so that the use of each keyway varies the valve timing by one-third of a tooth On all racing engines the tappets and push rods, are of tubular steel;

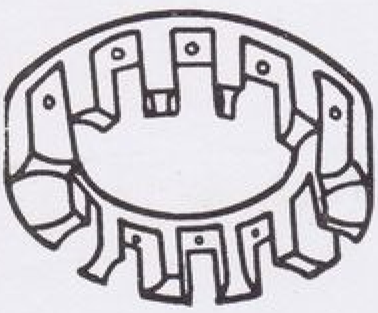
while the cam levers are fitted with rollers bearing on the cams, to lessen the friction at this point. The cam contours themselves are carefully calculated to obtain maximum efficiency coupled with minimum stress.

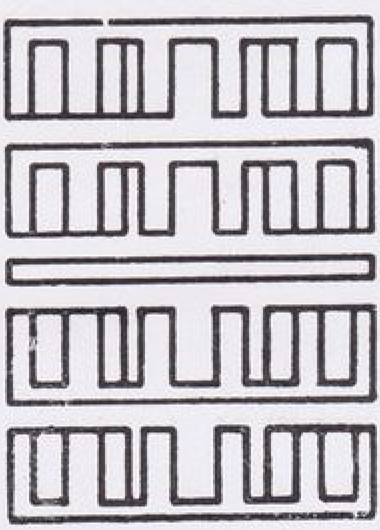
The EXHAUST VALVE LIFTER is screwed into the timing case cover, and its method of working can easily be understood from a glance at the sketch at the side. When the cable has to be detached, the Bowden adjuster must be pulled up until the knurled collar can be removed: the spacing sleeve is then slid up the wire until the nipple can be removed from the brass yoke piece.



PISTONS. In few parts of an engine has there been a greater advance in design within the last few years than in pistons. Cast iron was once the only material contemplated for such a use on standard engines, but at the present day aluminium is generally much to be preferred. On all our engines we now use pistons of a special alloy of aluminium, the outcome of much research work both in the laboratory and on the Track. They are die-cast, since this produces a finer grain of metal, and have shown themselves singularly free from growth and distortion. The hollow steel gudgeon pin fitted with aluminium end caps, is a floating fit both in the piston bosses and small end bush.

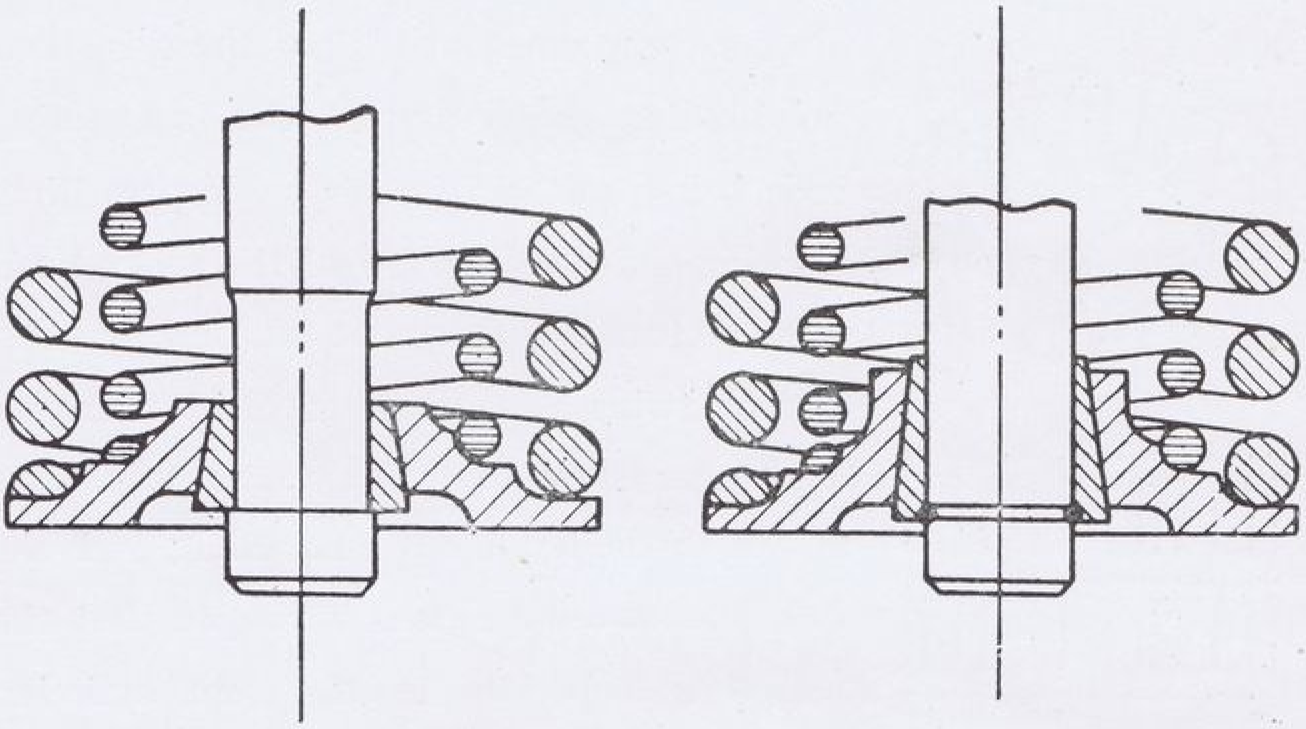
The CONNECTING RODS are steel stampings, of ample strength. They are, however, already as light as possible, and no attempt, therefore, should be made to drill them. On the twin cylinder models the forked and centre rod principle has always been employed, since there is then no binding strain due to the connecting rods being out of the piston centre line. The big-end bearings are of the roller type, manufactured throughout at our Works; and on twins a quadruple race is employed. The cages should always be assembled as shown in the adjoined illustration; and the rods should always be so arranged that the forked rod operates in the front cylinder; partly for technical reasons, but mainly so that a request for a "front connecting rod" may never be mistaken for anything other than a forked rod.





Inside FLYWHEELS are employed on all J.A.P. engines, since there is thus no possibility of crankshaft whip and probable fracture. They are of large diameter, and great care is taken to see that each individual wheel is perfectly balanced and paired with its fellow. The spindles are all specially hardened and ground, and are a taper fit in the wheels, being held tight by means of a lock nut and check screw.

VALVES. On almost every J.A.P. engine the inlet and exhaust valves, working in press-in guides, are interchangeable, but on certain types, even though the actual size of each valve is the same, the composition of the steel is very different. Every valve is stamped on the head with a number, which indicates the material; and if the inlet valve bears a different marking from the exhaust, the valves must on no account be interchanged. Racing valves are of larger diameter than the standard type, to allow more gas to enter and escape from the cylinder; while the steel



from which they are made is specially selected in our metallurgical department, and is given most careful heat treatment to minimise the risk of breakage. On the O.H.V. engines this risk of breakage is still further lessened by the special fixing for the valve spring.

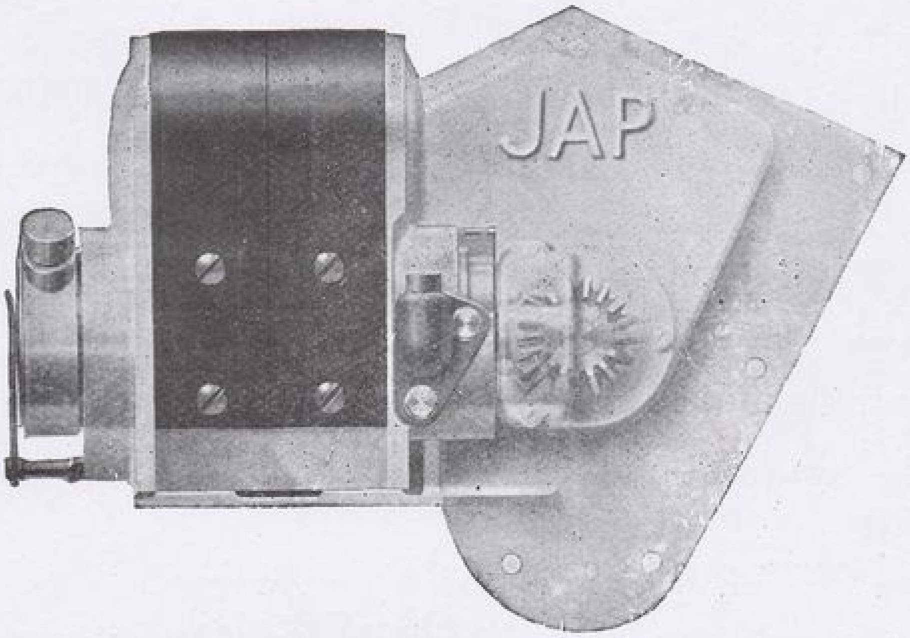
On Standard and Sports model O.H.V. engines the valve stem is not drilled for a cotter, but is recessed near the end, and a split taper collar lodged here bears the pressure of the valve spring collar, this being tapered inside to correspond.

On all O.H.V. Racing engines for both triple and multiple springs a slightly different design is used. This has a narrow groove turned in the valve stem. In this is fitted a spring ring which retains the tapered split collar in position.

Both designs are clearly shown in the above illustrations

J.A.P. engines are always sent out complete with inlet pipe, exhaust union nut, compression tap, magneto driving sprockets and chain; but we do not supply sprockets for the main shaft.

A wide choice of magneto mountings is provided: any engine can be fitted with a timing case cover embodying in the same casting a chain case and platform, to give a magneto position in front of the engine; while on most models a similar casting can be fitted



giving a rearward magneto position. Alternatively all engines can be supplied with a plain timing case cover, known as the "Open Drive" type, so that the magneto can be fitted wherever the customer wishes. In any case, provision for driving the magneto is made by extending the cam wheel spindle through the timing cover, and securing on to the tapered end a 10 tooth sprocket of ½ in. pitch. When the magneto chain case is employed, the chain is lubricated by oil passing through an oilway cut in the cam wheel bush. There is also a third type of magneto mounting, especially suitable for a twin cylinder engine that is to be fitted to a cyclecar. This is known as the bevel drive type, and is shown in the illustration above.

SPARES AND REPAIRS.

A large portion of our extensive Works is devoted to holding a stock of replacement parts for all types of J.A.P. power units; and to the repair and overhaul of customers' engines at the hands of an expert Staff.

In order to facilitate delivery of SPARES the following points should be observed.

1. The engine number should ALWAYS be quoted, WITH ALL ITS SYMBOLS; thus:—$\frac{\text{KTC/U}}{\text{1001/S}}$ This number will be found stamped either on top of the timing case, or else on the top front crankcase bolt lug.

2. All correspondence should be conducted under one name only; and since, according to the usual business methods, we must be in receipt of a remittance before despatching any parts, time will be saved by sending the correct amount with the order. All spare lists can be supplied on demand.

3. Customers claiming free replacement of parts under our guarantee, MUST return the alleged defective parts for our examination, carriage paid; and must, in addition to the engine number, quote also the date of purchase. All parts returned from customers abroad must be accompanied by a certificate of origin; *i e.*, a copy of the original invoice.

4. In the case of old type engines (prior to 1918), it is most advisable to send in the old parts as patterns, when replacements are required. Often engines of early type have since been brought up to date by fitting parts of recent design and manufacture.

It should be noted that standard tappets sent out as spares are not hardened, but are left long in the stem so that they may be cut to suit any particular engine. After this the end of the stem must be hardened by heating it to bright red and quenching in oil. Sports and Racing tappets and push rods, being made of tubular steel, are sent out with body and stem separated. The open end of the latter must be ground back as required, and must then be pressed up into the tappet body. No heat treatment is necessary.

REPAIRS are always executed as speedily as possible consistent with good workmanship. When sending an engine to us for an overhaul or repair, full instructions should always be sent in advance stating definitely whether work is to be put in hand, or whether an estimate only is required. In the latter case, the engine is stripped upon receipt, carefully examined, and a full report and estimate of cost sent. This estimate may be treated as an invoice, and a remittance to cover the amount will save any delay when the engine is ready for despatch. If an estimate has been asked for, work is not commenced until we are in receipt of definite instructions to proceed. In despatching repaired engines, unless we are instructed to the contrary, we return by goods train, carriage forward. In the case of urgent repairs, however, or where we have received instructions, engines are sent by passenger train, carriage paid. A further invoice is then sent for the carriage charge, or else an approximate amount is included in the estimate, and any balance is returned later, after the account has been received from the Railway Company.

The following points should be noted:—

1. In the event of damage to one side of a crankcase, it is essential for the other side to be returned to us with the order since the two halves have to be machined up together, in order to secure correct alignment of the two cylinder faces.

2. An order for a flywheel must always be accompanied either by a description of the marks and letters on the rim, or,

if these are obliterated, by the opposite wheel to that required. All flywheels have to be balanced most carefully and paired up with each other.

3. It is impossible for us to supply a crankcase or crankcase half, other than complete with all cylinder holding down studs, bushes, and other fittings.

4. Carriage in all cases is to be paid by the customer. Packing material is free, but cases are charged for and are credited if they are returned to us in good conition, carriage paid.

5. The name of the Sender should ALWAYS be attached to any parts sent in to us, quite irrespective of any correspondence that may have taken place.

Guarantee

WE GUARANTEE, subject to the conditions mentioned below, that all precautions which are usual and reasonable have been taken by us to secure excellence of materials and workmanship; but this guarantee is to extend and be in force for three months only from date of purchase, and the damages for which we make ourselves responsible under this guarantee are limited to the replacement of any part which may have proved defective.

WE UNDERTAKE, subject to the conditions mentioned below, to make good at any time within three months any defects in these respects. As motor engines are easily liable to derangement by neglect or misuse, this guarantee does not apply to defects caused by wear-and-tear, misuse or neglect.

CONDITIONS OF GUARANTEE.—If a defective part should be found in our motor engines, it must be sent to us, carriage paid, and accompanied by an intimation from the sender that he desires to have it repaired free of charge, under our guarantee, and he must also furnish us at the same time with the number of the Engine, the name of the Agent from whom he purchased, and the date of the purchase. Failing compliance with the above, no notice will be taken of anything which may arrive, but such articles will lie here at the risk of the senders, and this guarantee, or any implied guarantee shall not be enforceable.

CARE AND MAINTENANCE.

It is not too much to say that the whole life of an engine depends mainly upon the way in which it is treated during the first 500 miles running. The bearings at first have all to be bedded in, and for this process a constant load maintained for some time, coupled with a generous supply of oil, is very necessary.

Even after the engine is thoroughly run in however, lubrication is still a vital question. and it is essential that the rider should select the correct grade of one of the well known brands of oil, such as CASTROL. Our advice on the most suitable oil for any particular set of conditions can always be had by return; but it may be as well to remark that engines used for racing purposes should preferably be lubricated with a vegetable oil. The quantity of lubricant to be supplied to an engine must obviously depend upon the work which it is performing; but normally a single cylinder engine will require a half pumpful every three or four miles, a twin every two-and-a-half to three-and-a-half miles. These quantities correspond roughly to a drip feed flow of some 30 drops per minute, where mechanical oil pumps without a sight feed are fitted the correct setting can only be found by experiment. But it is useful to remember that practically all the pumps now marketed are capable of delivering much more oil than the engine is likely to consume; and therefore, that for normal conditions the correct supply will probably be given when the reguluting pointer is only some three or four notches open.

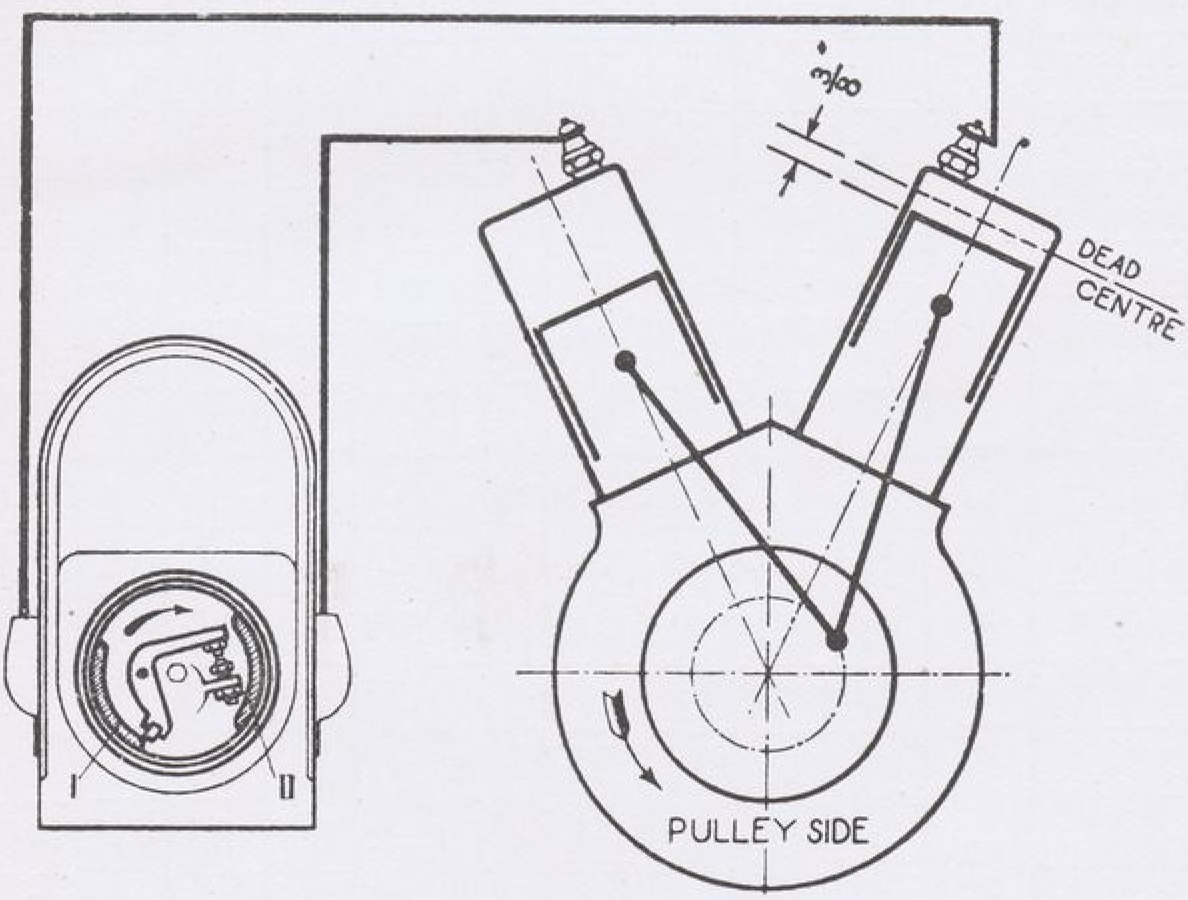
If the machine runs indifferently, failing on hills preaiously climbed with ease, one of the first points to attend to is the compression, as good compression is one of the first essentials for satisfactory running. Leakage can occur at the valve seatings, valve caps, piston rings or compression tap. Leakage of gas past a valve seating can be verified by covering the port with a piece of paper well coated with oil, when any loss of compression will be shown by the paper lifting. If this occurs, and if the tappet is not holding the valve off its seating, it should be removed and examined, probably the seating will be pitted slightly, and in the case of the exhaust valve may appear burnt. It should at once be "ground in" with fine emery powder mixed with oil, until the seating is smooth and free frcm pits. Graphite should be smeared on the valve stem before re-fitting it into the cylinder.

Leakage at the valve caps can probably be detected by ear; but a definite test is to smear oil round the joint, and test the compression again bubbles will appear if there is any leakage, and a new copper-asbestos washer should effect a cure. Graphite should be smeared on valve cap threads, and also on exhaust union nut threads, to prevent them from seizing in the cylinder. To verify piston ring leakage, inject a small quantity of thick lubricating oil into the cylinder through the sparking plug hole; replace the plug and test the compression again. The oil effects a tight joint, but only for a short time; and if the slots in the piston rings have not moved round into line, new rings should be fitted. The rings should first be tried in the cylinder, and the clearance at the gap verified, this should be ·003 in. per inch diameter of the piston.

As mentioned above there is a possibility that through being adjusted to closely a TAPPET may prevent a valve from seating properly, and may thus cause loss of compression, overheating and pitting or burning of the valve seatings. It is however, just as necessary to guard against an excessive clearance between the valve stem and tappet head; since through this the valve timing is considerably altered, causing a loss of power. This alteration to the timing has a further serious effect; for cam contours are so plotted that the valves are at first lifted gently from their seatings, and are returned in the same manner. With too great a tappet clearance a hammering effect is set up, owing to the swiftly moving tappet striking the stationary valve stem, and this causes excessive wear on all parts. The TAPPET CLEARANCES, then, should be checked over frequently WHEN THE ENGINE IS HOT, and THE CORRECT GAP OF ·004 in. on the inlet and ·006 in. on the exhaust should be maintained.

Valve and Magneto Timings seem to the beginner to bristle with difficulties. There is however, no real reason for this, as timing an engine is by no means hard, the main point to remember is that the exhaust valve should be almost closed, and the inlet valve just opening, when the piston is at top dead centre. This point can be found by inserting a stiff wire through the compression tap hole. Any engine timed in this manner is bound to run. provided nothing else is out of order. At the same time, for best results, an exact setting of the valve timing is essential and this can be obtained, as described on a previous page, by the use of a different keyway on the mainshaft pinion. A list of correct Valve and Magneto timings for our engines is given on page 22.

In setting the magneto timing the following method should be adopted. The engine should be turned forward until the piston—in the case of twins, the REAR piston—is $\frac{3}{8}$ in. or so before the top dead centre of the compression stroke. (The correct amount before T.D.C. is given on page 22.) The contact-breaker on the magneto should then be placed in the fully advanced position, and the armature rotated until the platinum points are just being separat-



ed by the cam. The cam for the REAR cylinder is marked No. 1 and is the one following the shorter space between the two cams, when considered in the direction of armature rotation. (*See* diagram). The magneto sprocket must then be pushed on to the armature spindle, and locked with the nut, care being taken not to move the armature while so doing. The timing should then be verified. In modern magnetos a high standard of reliability has been attained

VALVE AND MAGNETO TIMINGS.

FOR J.A.P. ENGINES.

Type of ENGINE		Inlet Opens before T.D.C. Ins.	Inlet Opens before T.D.C. Degs.	Inlet Closes after B.D.C. Ins.	Inlet Closes after B.D.C. Degs.	Exhaust Opens before B.D.C. Ins	Exhaust Opens before B.D.C. Degs.	Exhaust Closes after T.D C. Ins	Exhaust Closes after T.D C. Degs	Magneto Advance before T.D.C. Ins.	Magneto Advance before T.D.C. Degs.
175 c/c V	STANDARD	1/64	5	9/32	45	9/16	65	5/64	15	9/32	35
250 c/c B	STANDARD	1/64	8	1/2	52	41/64	60	1/8	20	13/32	40
250 c/c P.O O H.V.	STANDARD	1/32	8	7/16	52	5/8	60	1/8	20	7/16	40
300 c/c A	STANDARD	1/32	8	7/16	52	9/16	60	3/32	20	11/32	35
350c/c I.Y. Light	STANDARD	1/32	8	9/16	52	23/32	60	1/8	20	7/16	35
350 c/c I	STANDARD	1/32	8	9/16	52	23/32	60	1/8	20	7/16	35
350 c/c I.O. O.H V.	STANDARD	1/32	8	9/16	52	23/32	60	1/8	20	1/2	40
500 c/c K	STANDARD	1/32	10	1/2	50	11/16	60	1/8	20	7/16	40
500 c/c K.O, O.H V.	STANDARD	3/32	15	11/16	60	3/4	62½	7/32	22½	7/16	40
600 c/c U	STANDARD	1/32	10	19/32	50	7/8	60	5/32	20	1/2	35
680 c/c G.T.	STANDARD	0	0	3/16	30	1/2	50	5/32	20	7/16	38
680 c/c G T.O. O.H.V.	STANDARD	1/32	10	5/16	40	19/32	55	3/16	25	1/2	40
750 c/c M.T/I	STANDARD	1/64	5	11/32	40	17/32	50	7/32	25	15/32	38
980 c/c K.T.	STANDARD	1/32	10	1/2	50	23/32	60	1/8	20	7/16	40
980 c/c K.T.W. W/C	STANDARD	1/32	10	1/2	50	23/32	60	1/8	20	7/16	40
1,100 c/c L.T.O.W. O H.V. W/C	STANDARD	3/32	15	25/32	60	13/16	62½	5/32	22½	1/2	40
350 c/c SOC. O H.V.	SPORTS	1/16	15	35/64	55	3/4	65	11/64	25	1/2	42
500 c/c KOC. O.H.V.	SPORTS	3/32	15	11/16	60	3/4	62½	3/16	22½	9/16	44
980 c/c KTC.	SPORTS	1/32	10	1/2	50	23/32	60	1/8	20	7/16	40
980 c/c KTCY. 8.30 h.p. dbl.cam	SPORTS	5/64	15	23/32	60	25/32	62½	5/32	22½	7/16	40
250c/c POR O.H.V.	RACING	1/16	15	35/64	55	3/4	65	11/64	25	15/32*	40
350 c/c SOR. O.H.V.	RACING	1/16	15	35/64	55	3/4	65	11/64	25	15/32*	40
500 c/c KOR. O H.V.	RACING	3/32	15	11/16	60	3/4	62½	3/16	22½	11/16	49
600 c/c UOR. O.H.V.	RACING	3/32	15	13/16	60	7/8	62½	3/16	22½	11/16	49
750 c/c ETOR. O.H.V.	RACING	3/32	15	11/16	60	3/4	62½	3/16	22½	1/2 †	42
980 c/c KTOR. O-H.V. (8.45 h.p. twin)	RACING	3/32	15	11/16	60	3/4	62½	3/16	22½	1/2 †	42

* [illegible]/8 for Racing. † 11/16 for Racing.

but in case of any loss of power due to this Instrument it should be returned to the makers.

Every 500 to 1,000 miles the crankcase should be drained of all oil, flushed out with paraffin, and re-charged with approximately half-a-pint of fresh oil. Care should be taken to circulate this round the engine before starting up. The silencer should be cleaned periodically, roughly every 1,000 miles in order to secure full power and cool running. Decarbonisation should be undertaken at least every 1000–1500 miles, with cast iron pistons, but can be allowed to run very considerably in excess of this with aluminium pistons. It is much the best way to carry out this work with the engine out of the frame and on the bench. Absolute cleanliness is the essential point in dismantling and reassembling a power unit, and all parts should be thoroughly washed in clean paraffin. When removing the cylinders care is necessary to prevent the piston skirt falling over and cracking against the connecting rod; while the valve side of the piston should be marked if it is to be removed from the rod. If the crankcase is parted it is advisable to verify that the flywheels are running perfectly true. When re-assembling, it is necessary to make sure that the piston rings are free in their grooves; while the slots must be spaced evenly round the piston. It is not necessary to fit a paper washer at any joint, as all faces are carefully machined to fit; but a film of seccotine will make oil leakage still more unlikely. The cylinder holding down nuts must be tightened down alternately, a little at a time, as otherwise the cylinder neck may be strained.

It is impossible for us to recommend any particular brand of sparking plugs, but as a result of extensive tests we advise that only single point sparking plugs of a well-known make—such as K.L.G. "H.S.1."—should be used in J.A.P. engines. Overheating, knocking and lack of power, as well as apparent seizures, can frequently be traced to the use of an incorrect plug, which has caused pre-ignition. Other causes, however, are often alteration of the standard gear ratios to a higher ratio, or the use of an incorrect jet in the carburetter, or too tight a primary chain. Carburetters should always be left as sent out by the Makers, or their advise obtained if any alteration is contemplated.

Slow running is perhaps the quality which most gives rise to pride of Ownership, and when striving after a good "tick over" the following points should be noted. The induction system should be examined for all possible air leaks, and each should be eliminated. A slightly smaller jet can thus be fitted without loss of power. Proper tension of the valve springs, and in the case of twins equal tension should be maintained. The springs must seat squarely in the collars at both ends. The sparking plug points should be carefully adjusted to a gap, of approximately $\frac{1}{32}$in., and the contact-breaker points should be given attention. All oil, grease, or dirt, should be removed from this point. To secure even firing on twins, everything appertaining to each cylinder must be the same, including contact-breaker gap, sparking plug gap, and spark strength.

The foregoing notes apply in their essentials to all J.A.P. engines; but since the side valve type has been indicated in the language used, it seems advisable to give here a few hints which apply particularly to our range of O.H.V. engines. There is no doubt that at present the O.H.V. machine demands slightly more skilled and more frequent attention from its rider than the side valve type. In lubrication, for instance, more judgment is required, as the presence of an excessive quantity of oil in the crankcase will probably cause the sparking plug to oil up. This is all the more likely as it is essential to use a sports type of sparking plug with a good central electrode capable of getting rid of the heat imparted to it. The O.H.V. engine, again, is very sensitive to carburation and no attempt should be made to run with a very small jet in the carburetter, as this causes serious overheating of the exhaust valve.

With regard to O.H. valve gear, the clearance between the rocker face and the valve stem should be adjusted to ·002 in., when the engine is cold; while the lubricating cups should be filled with engine oil as often as possible—say every 50 to 100 miles. At the same time the cups at the top of the push rods should be oiled liberally. As the load here is heavy, a constant oil film is essential, and graphite or grease are of little use.

The Chart on page 26, will probably be found very useful in diagnosing obscure troubles but if customers are in any doubt or difficulty, we are always ready to place our experience at their disposal, and to give them all the attention and help possible.

J.A.P. MOTORS

NOTES ON RACING ENGINES.

At the beginning of this booklet it was pointed out that for any particular conditions of work the correct type of engine should be selected. We wish to emphasize this in connection with our range of Racing engines, and we disapprove strongly of these being used under touring conditions; such a practice would be just as unfair as the use of a racehorse for driving.

Our racing engines are designed to develop their maximum power at a very high rate of revolutions per minute and to this end not only are racing timing gear and light reciprocating parts fitted, but the compression ratio is raised to such a point that petrol can no longer be used as a fuel. In the case of the O.H.V. engines we can supply washers to fit beneath the base of the cylinder, in order to vary the compression ratio slightly to suit the different conditions of road and track racing. In the latter case, if the engine is to be run without these washers, it is essential to use one of the special racing fuels now availaible, since these alone will prevent detonation and consequent harm to the engine. With the maximum number of washers in position—this implies raising the cylinder barrel $\frac{5}{32}$ in. and in consequence longer valve push rods—the compression ratio is reduced to a point where the engine can safely be run on a mixture of 50% pure benzol, and 50% of either Aviation or Number 1 petrol.

The remarks on previous pages concerning sparking plugs apply with even greater force to the Racing Engine, If more speed is sought by using the highest compression ratio, all advantage will be nullified unless the correct type of plug is used. A plug specially designed for racing, and capable of resisting the high compression such as K.L.G. 348, or 396 types, MUST be fitted. For O.H.V. engines, full details of the plugs we recommend are given in our booklet—"The Care of the O.H.V. Engine."

In other respects racing engines conform on the whole to the maintenance instructions already given. To retain the original speed, however, or to increase it, much time spent in careful work—such as the reduction of friction everywhere—is necessary. If the rider desires to raise the compression ratio beyond our standard limit one point should always be borne in mind: that there must be a clearance of fully $\frac{5}{32}$ in. between the valve heads and piston crown on O.H.V. engines when the piston is at top dead centre.

JAP MOTORS

FAULT FINDING CHART.

- **ENGINE WILL NOT START**
  - Controls sticking
  - Incorrect timing
  - Air leakage
  - Carburettor floods on depressing float needle
    - Spark at plug
      - Spark too weak to fire under compression
      - Short in plug, terminal or lead
    - No spark at plug
      - Spark at terminal
        - Faulty plug
        - Sooted plug points
        - Weak spark
        - Short circuit
      - No spark at terminal
        - Breaker arm sticking
        - Magneto contact Breaker arm free
          - Dirty platinum points
          - Faulty contacts
          - Failure in magneto insulation
          - Broken carbon brushes
  - No petrol at carburettor
    - Petrol tap closed
    - Petrol tap open
      - Choked Pipe
      - Pipe clear
        - Dirt in jet
        - Air lock pipe
        - Float needle sticking
        - No air vent to tank
- **ENGINE RUNS IMPERFECTLY**
  - Lacks power
    - Constantly
      - Controls out of order
      - Controls in order
        - Poor compression
        - Valves need grinding
        - Valve spring weak
        - Stretched exhaust valve
        - Choked silencer
        - Incorrect valve timing
        - Ignition too far retarded
        - Gear too high
        - Bad air adjustment
        - Obstruction in petrol pipe
        - Excessive carbon deposit
    - At intervals
      - Partial obstruction of petrol
      - Carburettor too sensitive
      - Sticking valve
  - Engine knocks
    - Pre-ignition
    - Overheating
  - Misses fire
    - Spark irregular
      - Sooted plug
      - Dirty magneto breaker points
      - Occasional short
    - Spark regular
      - Mixture too weak
      - Water in petrol
      - Starved carburettor
      - No air vent to petrol tank
- Fails on hills
  - Too high a gear
  - Correct gear ratio
    - Engine carbonized
    - Engine clean
      - Stretched valve
      - Sooted plug
      - Ignition too far advanced
      - Too much air
- Fails, and after a momentary rest will re-start quite well
  - UNSUITABLE TYPE OF SPARKING PLUG.
- **ENGINE STOPS**
  - No petrol, or tap turned off
  - Petrol
    - Spark at plug points
      - Compression
        - Carburettor working
          - Broken valve remaining on seat
          - Broken valve spring
          - Controls not working
          - Overheating
          - Insufficient lubrication
          - Air leakage
          - Stripped timing gears
        - Carburettor not working
          - Choked jet or pipe
          - Punctured float
          - Flooded float chamber
          - Air lock
          - Binding needle
      - No Compression
        - Broken valve
        - Broken piston rings
        - Piston ring slots in line
        - Piston rings gummed
        - Valve sticking in guide
        - Broken piston, connecting rod or crankshaft
        - Burnt valve face
    - No spark at plug points
      - No spark at magneto
        - Sticking breaker arm
        - Breaker arm free
          - Platinums require attention
          - Broken brushes
          - Failure in condenser
          - Internal shorting due to wet
          - Failure of insulation
          - Dirty contacts
      - Spark at magneto
        - Faulty wiring
        - Dirty plug
        - Broken plug
        - Wrong timing