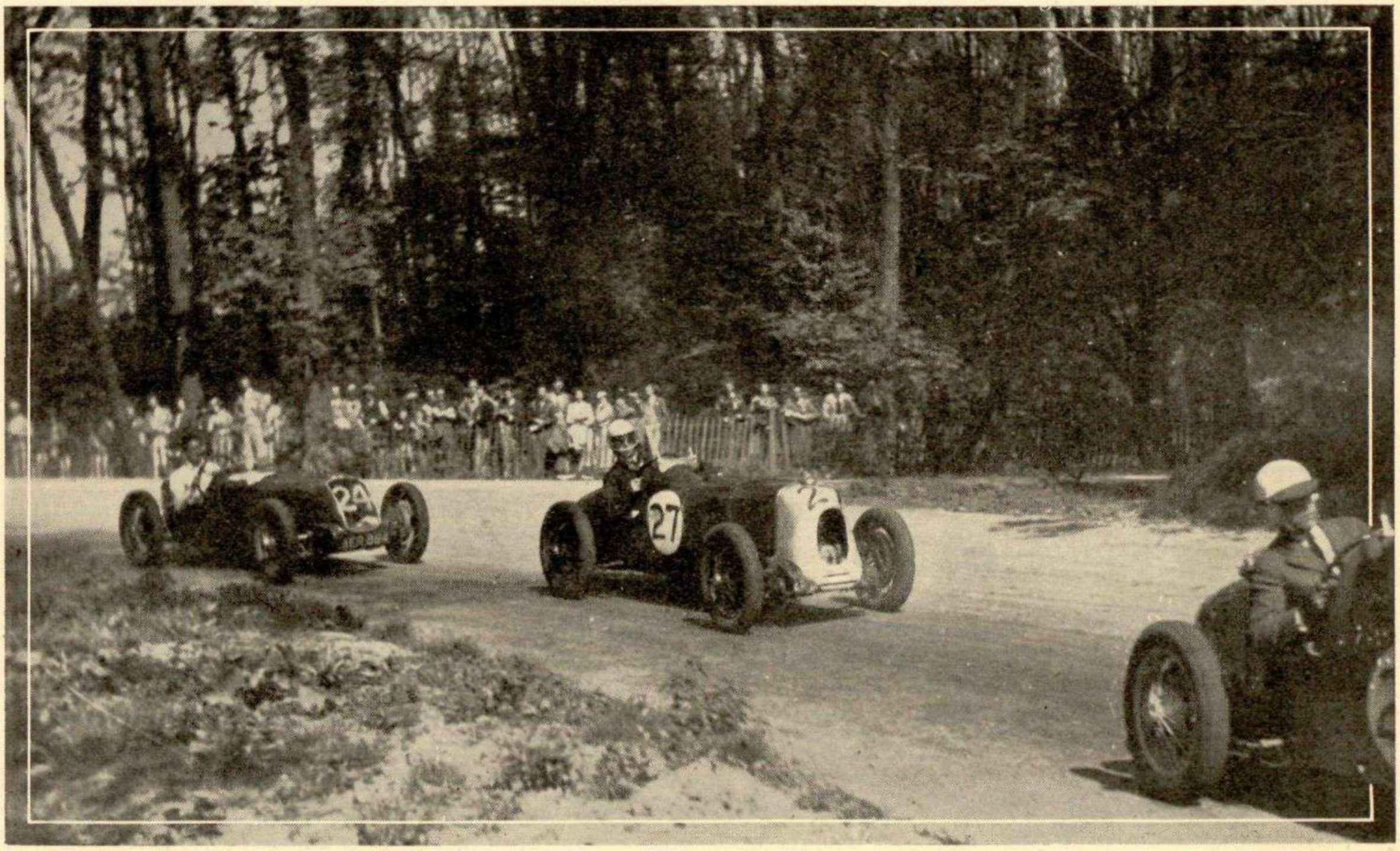
Vol. XXI No. 6 **DESIGN FOR A 1½-LITRE FORMULA RACING CAR** *June, 1945*

MOTOR SPORT

INCORPORATING **Speed**

ONE SHILLING MONTHLY



CONTENTS

Smiths of England

MILESTONES SERIES No 4

Captain Scott's Ship, the "Discovery"

Today, mention of the polar expeditions of Scott and Shackleton from 1899 to 1917, recalls first the courage and heroism of these leaders and their men ; but the purpose of their voyages was purely scientific.

The "Discovery" and the "Terra Nova" sailed in quest of news and exact knowledge, to gain which they were equipped with instruments as advanced in design and construction as contemporary skill made available. No wonder the great "Smith" family had a part to play in these historic British enterprises. Captain Scott relied upon "Smith" instruments for all his observations : by means of a "Smith" recorder he would measure the distances travelled by a sledge, and "Smith" watches helped to standardise time for his party.

Both Scott and Shackleton spent many a profitable hour at that mecca of explorers, the famous Fenchurch Street shop of Henry Hughes & Son Ltd., now one of the "Smith" group of enterprises.

S. SMITH & SONS (ENGLAND) LTD

MOTOR : Smiths Motor Accessories Ltd. K.L.G. Sparking Plugs Ltd., British Jaeger Instruments Ltd., Smiths Jacking Systems Ltd. CLOCKS & WATCHES : Smiths English Clocks Ltd., Enfield Clock Co. (London) Ltd., English Clock Systems Ltd., A.B.E.C. Ltd., British Precision Springs Ltd. AIRCRAFT & MARINE : Smiths Aircraft Instruments Ltd., Henry Hughes & Son Ltd., Marine Instruments Ltd., Furzehill Laboratories Ltd. INDUSTRIAL : Smiths Industrial Instruments Ltd., A.T. Instruments Ltd.

Scientific S.E.41

VOL. XXI. No. 6 JUNE, 1945 PRICE ONE SHILLING

SUBSCRIPTION RATE 13/6 PER ANN. POST PAID

MOTOR SPORT

OFFICIAL JOURNAL OF THE BRITISH RACING DRIVERS' CLUB

INCORPORATING **SPEED** AND
THE BROOKLANDS GAZETTE

EDITORIAL OFFICES
15-17, CITY ROAD, LONDON, E.C.1
Telephone: MONarch 8944

ADVERTISEMENT OFFICES
54, BLOOMSBURY STREET, BEDFORD SQUARE, W.C.1
Telephone: MUSeum 0522

Capt. John Moon presents

A DESIGN FOR A 1½-LITRE FORMULA CAR

In September, 1943, Capt. Moon described his ideal sports car, which aroused widespread interest. Now he outlines a most intriguing design for a 1½-litre Formula G.P. car—it seems likely that if there is any more International Formula racing the 1½-litre limit will be used, and certainly 1½-litre racing may be expected in this country, so John Moon's design, intended to beat anything known before the war, has a topical appeal, and the details of his proposed straight-eight, four-wheel-drive car will repay careful study.—Ed.

HAVING no motoring to do and not even any motoring literature to read—a few precious copies of MOTOR SPORT that have travelled round with me for the last two years have had to be weeded out in an endeavour to reduce my kit to the weight laid down—I have been passing a few enforced idle hours in hospital in considering what sort of racing car we may see when new cars are produced after the war, and it now occurs to me that these ideas may possibly interest other readers of MOTOR SPORT, and may invoke criticism that will make interesting reading.

I have confined my notes to a proposed 1½-litre car, as *voiturette* racing was progressing from strength to strength before the war and there was every indication that the next Grand Prix Formula would take the form of a 1½-litre capacity limit. There is considerable reason to believe that things will continue in the same direction when racing recommences after the war. Incidentally, if all the 1939 and 1940 *voiturettes* have avoided the blitz (which I fear they will not have done) there is some very fine racing in prospect as soon as activities recommence, with the new E.R.A., the little Mercédès-Benz, and the 1940 editions of the Alfette and the Maserati, all of about the same performance and so far largely unmatched.

Of course, as John Bolster told the London graduates of the I.A.E., the racing car of the future may be driven by an internal combustion or a closed-circuit mercury vapour turbine with independent electric or hydraulic transmission to each road wheel, and with a system of regenerative braking, but as I do not understand these things I have left them out of my deliberations. In any case, however, I feel that these things will not be with us just yet.

And now to the racing car of 194 ?

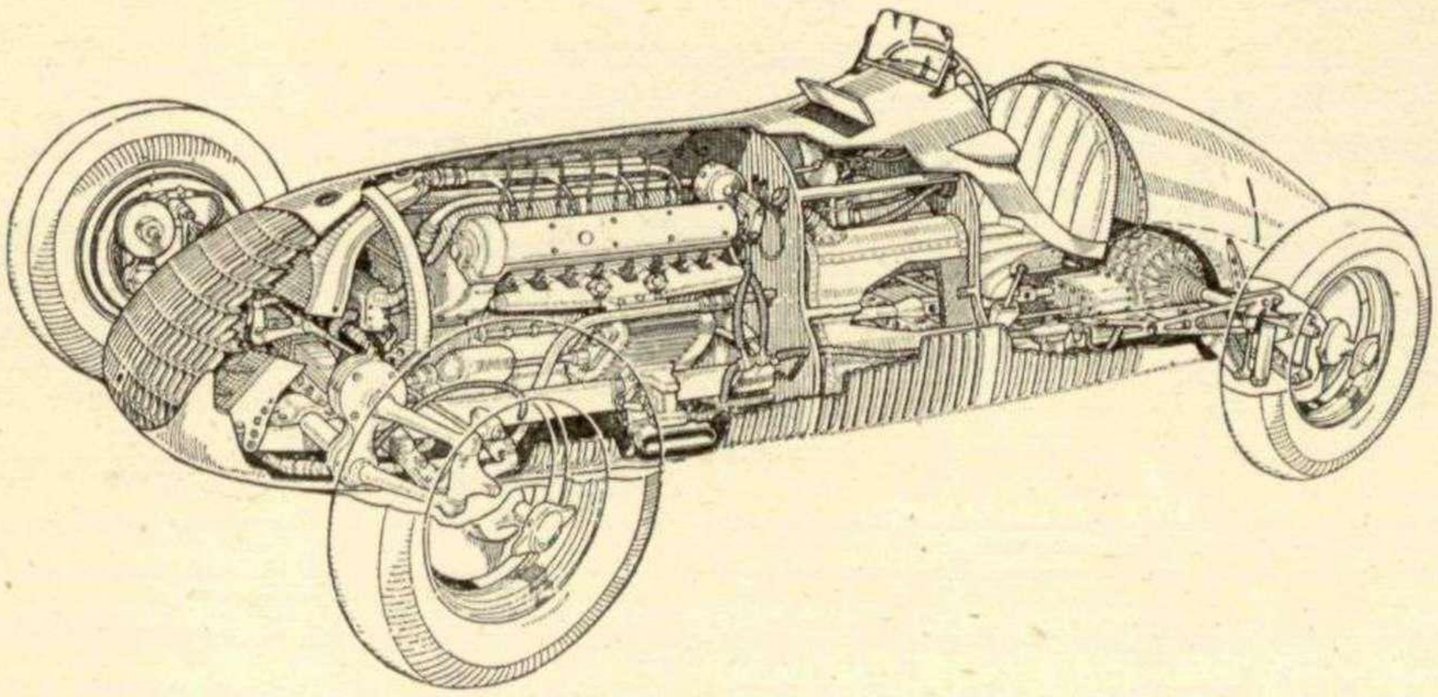
Engine.—As the power unit is the heart and soul around which the rest of the car is built, it is logical to deal with it first of all.

Present-day 1½-litre engines are generally reckoned to develop about 250 h.p. in long-distance racing tune, and they will probably be developed in a year or so, so that an output of 200 h.p. per litre, already exceeded by the E.R.A. for short events, can be sustained throughout a race of 200–300 miles' duration. This being so, it appears that their successor will have to produce a sustained output of about 350 h.p., or some 233 h.p. per litre. This sounds a pretty terrific output, but Laurence Pomeroy has shown us, in an article some two years ago, that an output of 450 h.p., or 300 h.p. per litre could be attained from a 12-cylinder 1½-litre engine without exceeding boost, mean effective pressures or piston speeds that are already used in present-day high-output engines. Fortunately, for an output of 350 h.p., it is possible to avoid the complications of 12 cylinders, by using eight cylinders with heads and porting based on the layout of M. Lory's 1926 1½-litre Delage, with a modified bore/stroke ratio.

The Delage, which still remains one of the most efficient engines produced, has a bore and stroke of 55.8 mm. by 76 mm., and as modified by Ramponi for Richard Seaman in 1936, produced 185 b.h.p. at 8,000 r.p.m. with a boost of only 7.5 lb./sq. in., which is equivalent to an unblown brake mean effective pressure of 134 lb./sq. in. If this engine is redesigned with a bore and stroke of 60.5 mm. by 65 mm. (which gives 1,495-c.c. swept volume) the cylinder heads, ports and valves can be enlarged in proportion to the increase in the cylinder bore (particularly as the sparking plug and the valve seat widths do not need to increase in size). This will mean that the gas speed through the inlet port will bear the same relationship to the piston speed as previously, and if the same piston speed is used, then the gas speed, which has an important bearing on the efficiency of the top half, will also be the same. The piston speed of the Delage is 4,000 ft. per min., and with the reduced stroke of 65 mm., the corresponding crankshaft speed comes up to 9,350 r.p.m. With the increased engine speed and with the slightly larger combustion chamber, which may not be quite so favourable in shape, due to the reduced stroke/bore ratio of 1.08, it is reasonable to suppose that the equivalent unblown b.m.e.p. will fall off somewhat from the Delage's excellent figure of 134 lb./sq. in. to somewhere about 120 lb./sq. in.

To produce 350 h.p. from 1,495 c.c. at 9,350 r.p.m. requires that the brake mean effective pressure be 326 lb./sq. in., and to produce this the induction pressure must be boosted over atmospheric in the same proportion as this figure is in excess of the equivalent unblown b.m.e.p. of 120 lb./sq. in., which indicates that an absolute induction pressure of 40 lb./sq. in. or a supercharge of 25 lb./sq. in. is required.

Summing up, then, our 60.5 mm. by 65 mm. 8-cylinder engine boosted at



The 1½-litre straight-eight Alfa-Romeo of 1938. *If these cars reappear after the war they are expected to be more powerful than ever and may appear in rear-engined form. Moon would seem to have devised something to beat them, however.*

25 lb./sq. in. develops 350 h.p. at 9,350 r.p.m., at a piston speed of 4,000 ft. per min. Horse-power per sq. in. of piston area is 9.8, a high figure, but lower than that of many racing engines operating satisfactorily. The horse-power per sq. in. of inlet valve area is again high at 32, but without figures to support me, I think that this is lower than the 1938 2-litre E.R.A., an eminently satisfactory performer. The maximum engine speed will probably be about 10,500 r.p.m., corresponding to a piston speed of 4,490 ft. per min.

General Construction.—The keynote of the whole engine layout must be the necessity for obtaining as rigid a structure as possible in the interest of bearing life and in keeping friction to a minimum by reducing distortion. There is little justification for using a V-form of construction unless the number of cylinders makes it necessary, as lubricating oil is notoriously difficult to retain in these engines at high speeds—witness the troubles that afflicted Mercédès-Benz throughout 1938 with their Formula cars. The horizontally-opposed engine is a good proposition from the point of view of rigidity, but is rather difficult to install in a racing car, and may be no better than the V-type for retaining its oil. Thus one is left with the well-tried straight-eight construction, which has been used, I think, for more racing engines than any other type. Because it happens to suit the proposed chassis layout rather than because of any anticipated difficulties with the crankshaft design, I propose to copy the arrangement of the 1940 V16 Alfa-Romeo 3-litre, designed by H. R. Ricardo, in which the drive is taken to the clutch by a downward extension of the central timing gears and a shaft passing underneath the crankcase. In my case, however, the drive is taken out sideways to a gearbox mounted alongside the crankcase. Incidentally, provided that a form of coupling is used that definitely prevents the transmission of torsional vibration between the two halves of the crankshaft, this arrangement, which is virtually the mounting of two engines end to end, offers immense possibilities in the multiplication of numbers of cylinders. For instance, a 24-cylinder 1½-litre, consisting of a double V12, is presumably a practical proposition, and with its 62-c.c. cylinders, 300 h.p. per litre should be easily surpassed. On the other hand, it would be rather a handful to dismantle !

Cylinder Blocks and Heads.—The primary consideration in the layout of the cylinder block and heads is the arrangement of the porting. Efficient porting layout seems to me to necessitate the head being integral with the cylinder block. Study of a cross-sectional drawing of the Delage engine makes it quite clear that a detachable head could not be incorporated in the design without spoiling in a large measure the beautiful sweep of the ports. At the same time, use of a fixed head eliminates the possibilities of gasket troubles and does away with inconvenient stud bosses, and so on, that may cause distortion. In view of the high power output the head-cum-block must be made up of high-conductivity material—cast iron served admirably for the 1½-litre Delage, but in spite of the excellent water spacing, it would crack, I am sure, if subject to the heat flow resulting from a 25 lb./sq. in. boost. As the cylinder blocks represent quite a mass of metal, light alloy castings are indicated, and these satisfy the previous condition also, as well as being quite easy to cast. It does, however, raise difficulties with regard to cylinder bores, to which there are three alternative solutions.

Firstly, dry ferrous liners can be pressed in from the bottom and locked into place. Secondly, wet liners spigotting into the cylinder head and sealed at the top by a Wills pressure ring (an annular ring filled with inert gas), and with a flange at the bottom, possibly separate from the liner, bolting to the underface of the water jacket, can be used. Finally, there is the Cross linerless cylinder in which the piston runs on special iron rings which bottom in their grooves without allowing the piston skirt to touch the cylinder bore. Of these alternatives, I am inclined to favour the second, as the first involves an extra joint face in the heat path, and the third is untried on engines of ultra high output.

A further disadvantage of light alloy is that this material is much less rigid than cast iron. This can be mitigated by extending a method of construction used by Bugatti, combining the cylinder block-cum-head with the crankcase as far down as the crankshaft, or even lower. That this renders it impossible to grind-in a valve without removing crankshaft and pistons is, of course, not unexpected in a design by M. le Patron, nor need it be considered a great disadvantage in a racing engine that is probably rebuilt between every three or four events.

Reverting to the general construction, two cylinder block-cum-crankcase assemblies would be used, with a timing case made in two halves, each of which would be bolted to its respective cylinder block and the two halves then bolted and spigotted together when the timing gear train had been assembled. The two crankshaft halves, already connected together with the driving gear, would then be fitted up into the main bearings. The bottom will be closed by a sump which can be a ribbed electron casting, either in one piece or in two halves bolted together. The final power take-off gear which would be driven through an intermediate idler gear from the crank gear, will be carried in its bearings in a separate casting bolted to the side of the timing case. If a further tie between the two cylinder blocks is required at the top of the engine, single piece valve chests and covers can be employed.

Crankshaft, Connecting Rods and Bearings.—In order that the largest possible proportion of the power developed in the cylinder head reaches the clutch, roller bearings are used for both main and big-end bearings, since the increase in mechanical efficiency resulting from their use compared with plain bearings is apparently quite appreciable, particularly at high rotational speeds. In view of the short stroke which helps towards a rigid crank, three main bearings for each will be sufficient, making a total of six. As there is no external thrust at all on the crankshaft, lips on both sides of one main bearing will be quite sufficient to locate the crank endways. By taking the power from the centre of the crank, slight reduction in the size of the journals can be made, slightly reducing bearing friction.

As a certain amount of wangling is already necessary in assembling the engine, I think that pity had better be taken on the mechanic to the extent of specifying split big-ends and mains, with removable caps, rather than a built-up shaft with solid connecting rods, which would be a real jigsaw to assemble into the cylinder blocks.

One difficulty arising with roller big-ends is supplying oil for piston-cooling. With the high power output it is desirable to oil-cool the underpart of the piston head, and this is most satisfactorily achieved by a jet in the top of the connecting rod to which oil is fed from the crankshaft up through a rifle drilling in the rod. Obviously, though, oil in sufficient quantity cannot be fed radially through a roller-bearing big-end. The only solution appears to be to widen the big-end until there is room for two sets of narrow rollers side by side, in cages with very little radial clearance, and to pump oil through the space between the two races. The problem of delivering oil into a crank carried on roller main bearings can be solved by feeding it in through pressure bushes at the two ends.

As the induction arrangements make it desirable to treat the engine as two 4-cylinder units, the 4-4 crankshaft

arrangement has to be employed. The resultant unbalanced secondary couple is of no importance in a racing engine. I believe that all Alfa-Romeo racing eights have used this construction, and so does the Isotta Fraschini tourer.

Valves and Valve Gear.—In writing this, so far I have assumed that the normal form of poppet-valve gear, as we know it, will be employed. It may well be, however, that by the time this car is laid down, a satisfactory rotary valve system will have been evolved, or that the Aspin rotary head arrangement will be in common use on racing cars. The latter, at any rate, now appears to have reached the stage at which a car incorporating it could give most unblown cars a run for their money.

However, in the absence of a more satisfactory alternative, there is little doubt that poppet valve gear can quite satisfactorily cope with the conditions envisaged. Valves with sodium-filled stems will obviously be used, and it may be they will be large enough (33.5 mm. diameter inlet and 31.5 mm. diameter exhaust) to enable the heads to be hollow as well. A further dodge towards easy elimination of heat from the valves is to follow the modern German aero engine practice of allowing the coolant direct access to the outside of the valve guide.

Valves will, of course, be operated directly, by the usual twin overhead camshafts. A possibility that occurs to me is that the thick stem of the modern sodium-filled valve may have sufficient bearing area in the valve guide to take the side thrust if the cam operates directly on the hardened end of the valve. This would mean that the usual sliding tappet or swinging finger could be eliminated, so reducing reciprocating weight and cutting down the spring pressure required. A further artifice for reducing reciprocating weight is the use of hairpin valve springs so commonly found on high performance motor-cycle engines, and for which there is plenty of room on a twin-cam engine. With these springs the only reciprocating weight is one-third of the top arms of the hairpin, whereas with the normal coil spring one-third of the total weight is reciprocating. Due to this, surge is practically eliminated with hairpin springs.

Induction System.—We have already determined the supercharge pressure required as 25 lb./sq. in., or possibly a little more to allow for contingencies. This pressure is rather more than can be effectively generated by a single-stage Roots blower, which becomes inefficient at over about 18 lb./sq. in. This leaves us with the alternatives of a single-stage vane-type compressor, which can easily handle pressures far greater than that required, or else a two-stage Roots blower. Just at present there appears to be a strong tendency towards the use of two-stage Roots blowers rather than high-pressure vane-type compressors. Quite why this should be is not readily apparent, and it would appear that the vane compressor is the more efficient alternative. It is possible that the two-stage Roots blowers give a better performance low down in the speed range (this is a characteristic of the single-stage Roots blown E.R.A.) and, of course, it is possible to adopt a measure of inter-cooling at the intermediate pressure of the two-stage arrangement. On the other hand, it may be that efficient vane-type compressors are only manufactured in this country. Perhaps one of our more technical readers can give us a few words on the subject or, maybe, someone would care to raise the question at the next Motor Racing Brains Trust? [The Zoller originated in Germany and the Cozette in France, of course.—Ed.]

Anyway, until I am given a good reason for adopting the alternative, I am suggesting the use of vane-type, one per block to keep them within manageable dimensions, mounted rather high up on the near side and delivering directly into the four adjacent ports, with the usual blow-off valves in the manifolds. As vane-type compressors have objections to ultra high speeds, they will be driven at 60–70 per cent. crankshaft speed, either from the timing gears or by chain from the front end of the power-take-off shaft, which will be directly underneath the blowers and will itself run at less than crankshaft speed (although I am not very keen on chain drives in high-speed engines).

The S.U. constant-vacuum carburetter has given excellent service on nearly all high-output engines produced in this country—so much so that a blown engine without an S.U. seems almost wrong—and there is every reason for specifying these instruments. One per blower would be used, of the type most convenient to fit in the available space.

Cooling.—For the cooling system, the use of glycol, or some other fluid having a higher boiling point than water, in a pressure-tight system, will permit the engine to run at a rather more efficient temperature than with water, and also permits of a reduction in radiator dimensions and so cuts down head resistance. Directed cooling from internal ducts on to the plugs and exhaust valve seats will be employed, water pumps being mounted on the camshaft ends or on the outer ends of the blowers. The radiator would be situated low down in front of the front suspension assembly, maybe with a separate header tank.

Ignition.—There is little to improve upon one or two magnetos of the Scintilla "Vertex" type, driven from the camshaft ends. When he designed the Delage, Lory had no alternative to the 18-mm. plug, which he fitted deeply masked. Nowadays 14-mm. and 12-mm. plugs are usual practice, and there will be room in the head for these to be fitted without masking.

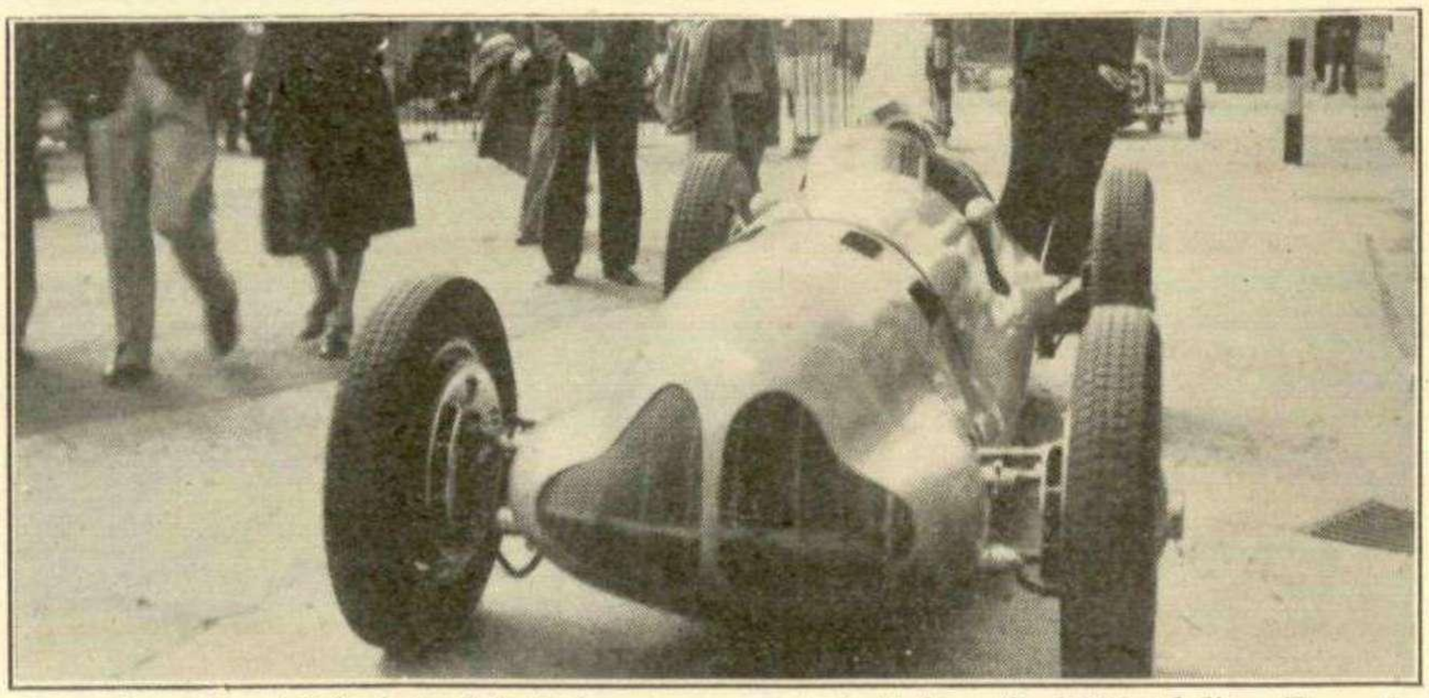
Lubrication.—An engine fitted throughout with anti-friction bearings is comparatively easily satisfied with quite a simple lubrication system. In this case the principal requirement is an adequate oil radiator to dissipate the heat collected from the piston crowns. A dry-sump system is desirable, I think. The pressure and scavenge pumps, of gear-type, can be located under the two centre main bearings, and their common shaft driven by yet another gear from the main driving gear on the crankshaft. A very high oil pressure is not required.

Clutch.—The conventional dry-plate clutch is perfectly satisfactory and there is no reason for departing from the usual design except that, with the power take-off alongside the crankcase, diameter is somewhat restricted and the multi-plate variety may prove more compact.

Four-Wheel Drive.—As the transmission layout and, indeed, the chassis layout in general is largely influenced by the adoption of four-wheel drive, it is relevant to insert here a few words of explanation of the whys and wherefores of this system.

It is pretty clear that the next big advance in roadholding must come from the reduction of unsprung weight by the removal of the braking mechanism to the sprung portion of the chassis and connecting the wheels thereto by universally-jointed half-shafts. Having thus bridged the most difficult gap, so to speak, there seems very little reason for not going a little further and connecting all four wheels to the engine in view of the important advantages to be gained thereby.

What are these advantages? They can be demonstrated mathematically, but only approximately, owing to the impossibility of allowing for time lost in gear changes, for the fact that gear ratios are only correct at one speed, and for air resistance. However, taking the ideal case and assuming a 350-h.p. car weighing 1,800 lb., with a weight distribution of 40 per cent. front, 60 per cent. rear, then with rear-wheel drive the back wheels can be spun up to 122 m.p.h., and not until it reaches that speed can the full power of the engine be used for acceleration. With four-wheel drive, the wheels can be spun up to 73 m.p.h., and above



The Moon-Special is intended to be even more potent than the 1939 1½*-litre Formula E.R.A., two of which, incidentally, are said to have been assembled at Bourne, one since the outbreak of war.*

that speed all available engine power can be used. These two speeds are not affected by air resistance.

Another way of explaining the advantages accruing from four-wheel drive is as follows: In the case of the rear-driven car mentioned above, acceleration up to 122 m.p.h. is limited by wheel adhesion to a rate of about 60 per cent. of g (the acceleration due to gravity), or some 13 m.p.h. per second. The four-wheel-driven car's acceleration is also limited by wheel adhesion up to 73 m.p.h., but, owing to all wheels being used for driving, the maximum acceleration will be about equal to g, or 22 m.p.h. per second. Between 73 m.p.h. and 122 m.p.h. the acceleration will be limited by the engine power and will therefore fall off. At 122 m.p.h. it will be equal to that of the rear-driven car, and thereafter acceleration of both will fall away equally. Thus the four-wheel-driven car has an advantage up to 122 m.p.h., the order of the advantage being such that about two seconds can be gained in attaining 70 m.p.h. from rest. These figures, although approximate, do give an indication of the advantages accruing from the use of four-wheel drive, particularly on a circuit with many slow corners connected by fast straights.

What about the history of four-wheel drive for racing? The first four-wheel-driven racing car was a Belgian Spyker, constructed in the Edwardian era. I have read its description in the *Motor Car Journal* of that date, but do not recall anything of its subsequent history. It was evidently not such as to cause a clamour amongst rival manufacturers anxious to copy its design and reap the reward of its advantages.

Next on the scene, in 1932, I think, appears the four-wheel-drive Bugatti, built in an endeavour to obtain full benefit from the urge of the supercharged 4.9-litre engine. In this it was not over successful—after one or two appearances on the Continent it was brought over to Shelsley Walsh, where it crashed in the hands of Jean Bugatti. As far as I know, it was then carted back to Molsheim and probably decently interred—anyway, I do not think that it has been heard of since. In passing, it is of interest as being at least one example of a Bugatti with independent suspension, the two front stub axles being supported by two transverse leaf springs.

From about the same time right up to the beginning of the war, four-wheel-drive cars were being made in America by Miller, who already had considerable experience with front drive, and in view of their continued manufacture they were presumably at least moderately successful, though, like most American cars, they are rather of the track-racing variety. However, full details regarding them would be of great interest.

Possibly the most promising four-wheel-drive car to date made its appearance in, I think, 1935. R. Waddy's "Fuzzi," which embodied two 500-c.c. J.A.P. engines, each driving one axle through motor-cycle transmissions. Like most amateur-built "specials," its rather short career was beset by mechanical troubles, but in one or two ascents of Shelsley Walsh it did prove that its constructor had the right idea.

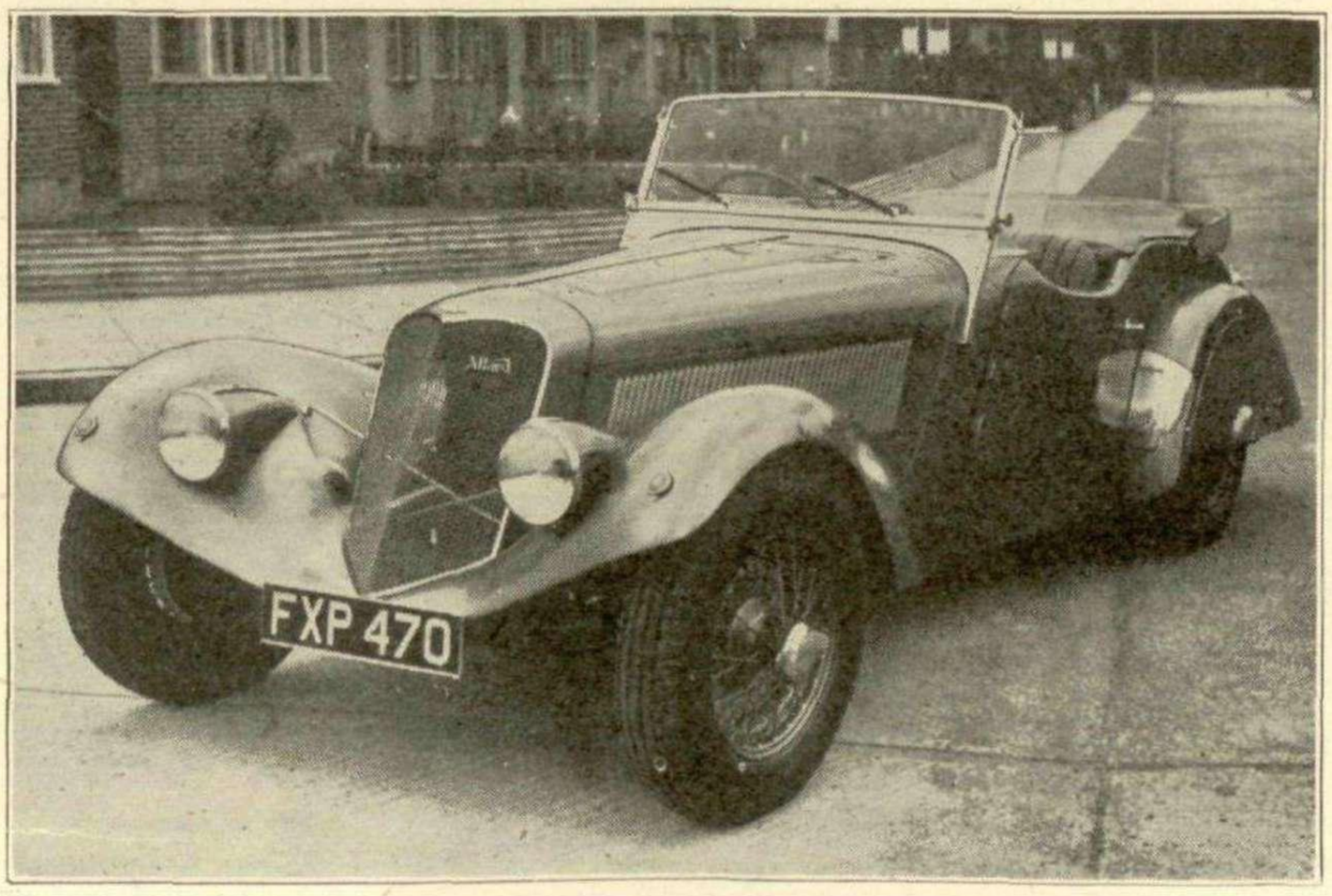
Since then, of course, John Cobb's Railton, the present holder of the Land Speed Record, has been built, embodying the four-wheel-drive arrangement, but that is rather outside the scope of these notes.

It has been suggested that a four-wheel-drive car will require some sort of torque-apportioning device so that the torque applied to the front wheels can be suitably reduced when conditions render it desirable—whether this device is to be automatic or controllable by the driver I am not sure. "Fuzzi" did, in fact, embody such a device in an arrangement whereby the proportionate opening and closing of the two throttles could be varied, and according to Waddy it was very useful. However, I still remain unconvinced that such a device is essential. In parenthesis, I am quite prepared to admit that this view may be influenced because I cannot see how this torque apportioner can be worked except hydraulically or electrically, and I am not too keen on having the efforts of my car's horses transmitted either by a stream of oil or of electrons! I think that no racing driver would demand a little lever in the cockpit to switch off the braking effort on the front

THROUGH the arduous and trying years of war we have kept before us this one aim—VICTORY. Now we prepare, with the same enthusiasm, for PEACE.

ADLARDS MOTORS LTD.

Manufacturers of Allard Cars



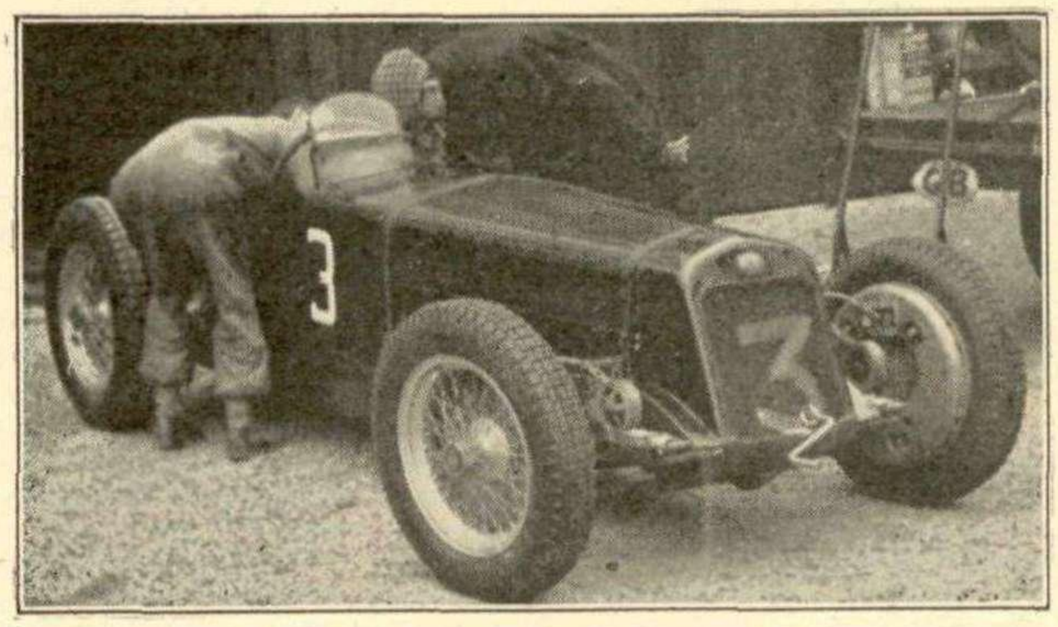
Branches at PUTNEY, BRIXTON *and* FULHAM

wheels when he wants to do a spot of steering—on the Multi-Union he is lucky enough to get such a lever, but it is a refinement and is not used for the above purpose, anyway. The driver is given a fixed proportion of braking torque, front and rear, and if it does not please him, then he has to "lump" it, at any rate, until the next race. In the same way, I think that he should be given a fixed proportion for the driving torque, and if it does not suit him, then he must make the best of a bad job. My view is that satisfactory results with a four-wheel-drive car will come from the driver adapting his technique to the new transmission—it may even take a driver who has never driven anything else to show us the final polished result, just as it took Rosemeyer to show us how the unorthodox central-engined Auto-Union could perform. I must say one word in sympathy for the poor driver. Progress has taken away the "side brake" with which he was wont to control the "dreaded side-slip," and now it is proposed to deny him the aid of the engine in achieving the same end. . . .

Reverting to my previous remarks, I can see no reason why the torque proportion between the front and rear should be variable, but it is quite clear that the torque should not be equally divided between the two axles, partly because the rear axle will be more heavily laden and partly because of the rearward transfer of weight which occurs on acceleration. The proportion, I suggest, should be somewhere about 40 per cent. to the front axle and 60 per cent. to the rear. Fortunately, this fixed proportioning presents no difficulties, as it can be done by quite a simple adaptation of the common differential which is described later.

General Chassis Layout.—It is now possible to describe, very roughly, the general layout of the transmission and chassis. The engine is mounted in the normal position, offset slightly right, with the drive coming out on the left-hand side from the centre of the crankcase. The drive passes through the clutch to the upper shaft of the all-indirect-type gearbox mounted between the rear half of the crankcase and the left-hand frame member, with the upper driving shaft on or just above crankshaft level. Universally-jointed propeller shafts take the drive, front and rear, from the ends of the lower driven gearbox shaft to the frame-mounted final drive units, which are also offset left. On the right of these and connected to the differential cage are the brake units, so that braking torque is equally divided by the differential. Universally-jointed half shafts connect the differential pinion shafts to the road wheels. The driver sits behind the engine, offset right, and with the rear propeller-shaft on his left. It will be noted that I have fallen into the same trap as Lory with the 1925 Delage, in that I have placed the driver's feet in rather close proximity to the rear exhaust stub, but as in my case the feet can be dropped down to the level of the undertray, I am hoping to get away with it, without having to turn the cylinder block round.

The alternative is to rearrange the components along the same lines as on the Auto-Union, with the engine behind the driver, but still retaining the gearbox alongside the engine and the transmission along the left-hand side.



Moon bases his calculations as to engine efficiency largely on the results the late R. J. B. Seaman obtained from the famous modified 1926 1½-litre straight-eight Delage

Gearbox.—This has already been described as being of the all-indirect variety mounted alongside the engine. It consists merely of two parallel shafts, one driving and one driven, on which rotate on needle roller bearings five pairs of meshing gears, one for each forward ratio, and one pair of gears connected by an intermediate gear to provide reverse. Each gear train is then connected to the upper and lower shafts by dogs which slide on splines on the shafts to provide the different gear ratios. Each train of gears is so mounted as to be alongside bearings in either the end wall of the box or one of the two internal transverse partitions. By allowing both gears of each train to run free when not transmitting the drive, instead of only one, churning losses in the gearbox oil are reduced. Each train of gears as it is selected by the selector mechanism is lubricated by an oil jet delivered from a small gear-type pump on the rear end of the driving shaft. The driven shaft is hollow to permit the front axle driving shaft to pass from the centre differential, which is behind the gearbox, to the universal joint of the front propeller-shaft just in front of the gearbox.

Centre Differential.—This device is required to compensate for the extra distance covered by the front wheels when rounding a bend and also to act as a torque apportioner. This latter end is achieved by making the driven gears of differing diameters in proportion to the amount of torque that they are required to transmit, instead of being equal in diameter, as in normal construction. With a bevel differential, this involves machining the differential cage so that the planet pinion pins are not at right angles to the main axis, and also involves machining bevel gears whose axes are not at right angles. This is not a complicated process, but is probably not possible with the gear-cutting machines normally available in an automobile factory. On the other hand, if a spur-gear differential is used, all axis pins are parallel to the main axis and all gears have straightforward spur teeth, so that this is a much simpler manufacturing proposition.

The differential is mounted at the rear end of the gearbox and is enclosed in an extension of the gearbox casing. The cage is driven from the hollow driven shaft on the back end of which it is mounted, and as has already been explained, the drive passes from the forward driven gear through the hollow driven shaft of the gearbox to a universal joint in front of the gearbox casing, and the drive is taken from the rear driven pinion to the rear propeller-shaft universal joint just behind the differential casing.

If considered desirable, the centre differential can be fitted with the self-locking device described in connection with the axle differentials.

Final Drives.—The final drives are of normal straight bevel-and-pinion variety and call for no particular comment.

Obviously, some form of self-locking differential must figure in the axle assembly. The type so far almost exclusively used in racing cars is the German Z.F. mechanism, which operates on a cam principle. It is clear, though, from a recent series of articles by Raymond Mays, that this device is not entirely free from snags, particularly a tendency to lock itself rather suddenly when wheelspin does develop.

It appears that rather better results may be obtained by using the form of self-locking differential patented by L. M Ballamy. This device consists of a normal differential of spur or bevel type, with the addition of a multi-lobed cam mounted on either the inner end of a half shaft or an extension of the differential driven gear. This cam operates spring-loaded pistons in radial closed cylinders in a casing attached to the side of the differential cage. The space in the ends of the cylinders is filled with oil admitted through a bi-directional valve arranged so that the oil enters easily, but is only released slowly. The result is that slow relative movement between one half shaft and the differential cage, such as occurs during normal cornering, is unchecked, but faster relative movement (*i.e.*, wheelspin) meets with rapidly increasing resistance.

The universally-jointed half shafts, at any rate at the front end, will need to embody some form of constant-velocity joint, of which there are now several types available, all tested by arduous war service. One point that requires to be borne in mind in connection with these joints is that whereas with the Hooke's joint the floating shaft is located through the joint from the fixed shaft, with a C.V. joint this is generally not the case, and the free shaft requires supporting radially, and in some cases axially as well by a spherical casing surrounding the joint.

Brakes.—When the drastic step of mounting the brakes inboard has been

taken, it is clear that the brake mechanism will require considerable modification, particularly in the method to be adopted in getting rid of the heat generated.

To give some idea of the heat flow involved, the amount of energy converted into heat in stopping a 1,800 lb. car from 150 m.p.h. is about 970 Centigrade heat units, and if the car stops with a negative acceleration of half "g," which is well under maximum deceleration, this heat is produced in only 14 seconds. Some of this energy will be used in overcoming air resistance, but only a small part. What is to be done with the rest? If it is passed directly to air moving over the brakes and the air is heated 10° C. in doing so, then 400 lb. or 5,100 cu. ft. of air is required—quite a large amount to have passing through the body, and it will warm the cockpit unduly, too. An alternative is to use some form of liquid cooling, connecting it up with the engine cooling system. A third possibility is to use an evaporative cooling system. The amount of heat mentioned above can be absorbed in evaporating one pound of water, and the steam so formed could be condensed in quite a small condenser in the airstream or, maybe, in a surface-type condenser forming part of the body panelling. The only mechanical complication needed is a very small pump to force the water to where it is to be evaporated.

Having reached the conclusion that either liquid or evaporative cooling is to be used, it remains to decide what form the braking mechanism will take, as obviously the conventional drum and expanding shoes are ill adapted to anything but air cooling. Some form of Eddy brake in which energy is converted into heat by magnetically-induced internal electric currents, or a hydraulic arrangement in which energy is converted into heat by churning oil, may provide the eventual solution, but as I see it, the most practical solution at present is a disc-brake similar to those used on Capt. Eyston's "Thunderbolt."

The brake linings, circular in form like a clutch lining, are carried on a light rotating member not unlike a clutch plate. The brakes are applied by clamping these plates between two stationary iron plates cast with internal cooling passages, to which the coolant is led through flexible pipes. The relatively small amount of heat that is conducted through the heat-resistant liners can be dissipated by spacing the liners apart somewhat and inducing a radial air flow by means of suitably-shaped vanes between them.

For the actual engaging and disengaging of the plates I do not think that a hydraulic mechanism can be bettered. Any required degree of self-servo action can be provided by arranging for the pressure plates to move together along helical guides instead of axially.

One brake unit per axle, working on the differential cage, would give automatic compensation between the wheels, limited by the self-locking action of the differential. This would also give a considerable measure of braking on one wheel even if one half shaft parted.

Front Suspension.—For taking the thrusts caused by driving, braking and cornering with a minimum of whip, there is no system to improve upon the twin transverse wishbone arrangement for the independent front suspension. At the same time, accurate steering geometry can be arranged without undue complication, and if equal wishbones are used with the universal joints in the same planes as the hinges, the use of heavily-loaded splined couplings in the front half shafts can be avoided. In order to reduce the number of joints involved, the stub axles can be ball-jointed to the wishbones, so that motions due to steering and to suspension are confined to only two joints on each side. Wishbones may be steel forgings or pressings or light-alloy forgings.

Rear Suspension.—The most satisfactory system of rear suspension for racing cars so far discovered is undoubtedly the De Dion-type axle. I think, however, that instead of the usual arrangement of longitudinal radius arms which set up a steering effect at the back end when one wheel rises independently of the other, more satisfactory results may be obtained by shackling the axle by a very wide shackle, to a wide-ended transverse wishbone-link on each side. This arrangement would, however, not be capable of taking brake torque reactions when a normal brake layout is used. Whichever system of fore-and-aft location for the axle is used, a means of transverse location is also required, and this can be arranged in many ways. Mercédès-Benz racing cars used a ball pin engaging in a vertical slot, and their tourers had two wishbones ball-jointed together at their apices for their tourers, while other alternatives are a transverse radius rod or a transverse system of rods giving a straight-line motion.

Springing.—Springing may be by hydraulo-pneumatic struts combining the elastic media with a damping system, like the oleo legs of an aircraft, but for convenience of installation on the chassis, torsion bars connected to the suspension wishbones, with large piston-type hydraulic shock-absorbers built into the mounting of the same link, would be hard to improve upon. Driver control of shock-absorber adjustment is desirable.

Steering.—Modern sports cars have demonstrated that with a well-laid-out steering geometry completely reversible steering mechanism can be used, with a consequent gain in lightness, and it is probable that the same can apply to our racing car. Otherwise, any of the modern proprietary steering gears will give excellent results. Owing to the mass of mechanism forward, the steering box will have to be mounted behind the cylinder block over the driver's feet, motion being transmitted by a long push-and-pull rod.

Wheels and Tyres.—If the tyre designer will permit it, there are several advantages to be gained from a reduction in wheel rim diameter. There is a reduction in unsprung weight of the wheel and tyre and a slight reduction in weight throughout the transmission, due to the lower torque transmitted at a slightly higher rotational speed. The reduction at the final drive can also be rather less. Probably most important of all is the reduction in wind resistance resulting from the smaller wheels. All this is rendered possible by taking the large diameter (and very hot) brake drum away from the wheel rim. On the other hand, the same weight of tread rubber must be provided, and centrifugal effects on the tread, for the same peripheral speed, increase as the radius is decreased.

Frame.—While, in theory, a stressed skin or geodetic form of construction for the combined body/chassis may be ideal, I think that by the time the points of attachment of the suspension and power unit have been suitably strengthened and the holes for the insertion of the driver and removal of the power unit have been reinforced, the saving in weight or rigidity over a rectangular frame welded up from large-diameter thin-walled tubing, will be quite negligible. Certainly the latter mode of construction offers considerable advantages in the way of accessibility.

Body.—I am not too sure whether the all-enveloping type of body enclosing the wheels is suitable for a road-racing car, though it is true to say that this car, with fluid-cooled enclosed brakes, is as suitable as any for this type of body, which will give very considerable advantages in maximum speed and acceleration in the higher speed ranges. Probably the enveloping body will be used on very fast circuits and an alternative with unenclosed wheels on circuits where maximum speed is limited.

When the latter form of body is used, I hope that the squat appearance of the 1939 1½- and 3-litre Mercédès will be avoided, as from photographs these cars seem very ugly, although the new E.R.A. looks to be one of the handsomest cars yet built. Maybe this is just racial prejudice.

As regards the actual construction of the body, a light-alloy, tubular framework with panels held on by pop rivets and aircraft-type fasteners will combine lightness with accessibility.

Fuel Tankage.—On the car with the enclosed wheel form of body there will be adequate fuel accommodation in tanks in the space between the wheels, and even in the alternative body, a considerable proportion of the fuel can be carried in tanks in fairings between the front and rear suspensions, in the scuttle and over the transmission on the driver's left so that the quantity in the tail tank, where weight distribution varies as the tank empties, is kept to a minimum.

Performance and Dimensions.—The engine and transmission layout that I have described could be accommodated in a chassis with a wheelbase and track of about 8 ft. 8 in. by 4 ft. 6 in. Height to the top of the scuttle would be about 32 in., and frontal area some 8.5–9 sq. ft. for the body with unenclosed wheels and about 20 per cent. more with wheels enclosed. Weight one would anticipate to be about 1,500 lb. bare and 1,850 lb. in racing trim with driver and full tanks.

As regards performance, I think that without being unduly optimistic one could expect about 180 m.p.h. in the less streamlined form and about 30 m.p.h. more with the more aerodynamic body. Acceleration from rest to 100 m.p.h. might take about 7½ sec. with either form of body.

It is, of course, on the type of circuit with slow corners connected by fast straights that one would expect such a car to perform brilliantly.

Some Cars in War-Time

S. H. Statham reminds us that, war or no war, you can't quench enthusiasm for the Sport.—Ed.

IF taken merely as a matter of miles, my motoring during the war has not been appreciably less than what it was in peace-time. This motoring has, however, been practically all of what one describes as "of an official nature," and not by any means the type of thing one would bother to describe in print, except that these have been times, and there have been cars, that have just made the difference between everyday routine and something that philosophers are pleased to call "the good life." Let me make it clear that it is not my intention to try to compete with those who may tell a tale of long drives from El Alamein to Italy, or of driving a Jeep on the Imphal Plateau. No, this is an account of making the best of things in this country under war conditions, and enjoying driving and working on a number of interesting cars.

The early part of the war I spent in the dock area of London, as my work was connected with the design and organisation of various defence measures. The car I was using for this work was a very sober but very serviceable Austin "Big Seven." This car saw noble service during the whole of the blitz on the East End of London, often being driven more as a tractor than a car, over hills of smoking rubble and broken glass. As a great admirer of the Austin Seven in all its many forms, I have always felt that when it made its final bow as the "Big Seven" the weak points of the earlier designs were at last removed. The Girling brakes really would pull the car up dead without throwing it all over the road. The tendency of all other Austin Sevens had always been to oversteer, but here again this fault was corrected on the "Big Seven." Moreover, a fault that must have irritated thousands of owners of Sevens was at last rectified. This was the constant rattling from the fixed starting handle, a noise that had heralded the approach of the Austin Seven ever since its introduction. The long-stroke engine which the maker's catalogue gave as developing 23 h.p. would certainly push the little car along when required. I am sorry to dwell on such a standard type in such an exacting journal as MOTOR SPORT, but I do feel that when the "Big Seven" has aged a little more, and examples begin to find their way to the breaker's, the impecunious "Special" builder will find that the chassis and engine will form a better basis for an Austin "Special" than many of the other Seven models. The slightly-inclined tulip vales, for example, are one of the more "sporting" features of the design. I believe, too, that I am right in saying that the works did enter a team of these cars in one or two trials before the war, in which they were driven by Hadley and company, so it *has* some competition tradition! The main disadvantage of such a "Special" would be that the car would come into the up-to-1,100-c.c. class, as the long stroke of the "Big Seven" engine brings the cubic capacity to something over 900 c.c.

About the middle of 1941 I was moved from the London area to the coast of South Wales in connection with the invasion that threatened at that time. Some little time before this move took place I had bought a J2 M.G., under rather amusing circumstances. I do not suppose that any car has had more hard words written about it than the J2, and also I am not what one might call a M.G. "fan," in spite of having owned and experienced a number of cars of this make. It happened, however, that I was invited to a friend's wedding, where, shortly before the happy pair departed, I noticed a rather heated discussion in progress between the bridegroom and best man. This continued in undertones until "the happy pair" left the house, when, as the bridal chariot drove away, the best man, instead of the usual good wishes, called out, "Anyway, what in the hell did you do with the gear lever?" The bridegroom's reply was carried away on the wind. On asking the best man the reason for this last-minute enquiry, I learnt that as the owner of a J2 M.G., he had lent his friend the car for a few weeks before the wedding. The reception being the first meeting the two had had since the loan, the owner now wished to collect the car. However, during the reception he had learnt in easy stages from the bridegroom all the things that had happened to the car while it had been on loan. As these incidents included a number of items, such as two big-ends run, a half-pint bottle of acid broken on top of the bonnet, and the gear-lever broken off short at the gate, one could hardly blame the owner of the car if he felt a little irate. When the time came to leave I walked round to the garage where the J2 was housed, and the car certainly presented a sorry spectacle, as it looked more like the result of a local salvage drive than a car. The owner's anger now having turned to acute depression, he turned to me and said, "Just look at it, whatever value is she to me now?" In reply, more to console him than anything else, I made him an offer for the car, which, to my surprise and horror, he accepted, and thus I became the owner of an M.G. J2.

When I had been in Wales for a few weeks I found that the work I had to do involved a considerable amount of driving, and wondered what chance there might be of using a more interesting car than the Austin. My brother was using the 1,100-c.c. Alta we owned for leave runs, etc., when in the Army, so I decided to have the J2 sent to me from home to see if I could do anything with it. Having rented a garage near my billet I started extensive reconstruction work, mainly with the object of having something to do in my spare time. A preliminary examination of the engine and chassis revealed that the car was not in such bad condition as its external appearance indicated. The engine played the "Anvil Chorus" rather tunefully when running at under 1,500 r.p.m., but I traced this to the fact that the pistons had been replaced in the wrong order when the two big-ends had been re-metalled. I renewed the vertical camshaft drive, together with bearings and sleeve, and also the camshaft bevel gears. To cure the usual oil leak from the camshaft drive down into the dynamo, I bored out and cut a return oil drain to allow the oil that seeped down the bearing housing to run back into the oil flow. I have found this the only means of curing this trouble on the older M.G.s—and provided that the head is replaced carefully, and the dynamo flexible coupling reassembled in line.

After a really good clean inside and out, plus a respray and new hood (this latter very necessary in Wales!), I put the car on the road. I was given permission to run it on an O.H.M.S. licence, more on the strength that it was only 8 h.p. than anything else. Thus I started to cover the first of what turned out to be many thousands of miles on that car. I will admit that I drove very sedately at first, as I had in the back of my mind the many things that contributors to the "Cars I Have Owned" series have experienced with J2s. Also, I remembered the tales my friend John MacLagan, of "Scuderia Chemvamo," had told me of the crankshafts he had broken when he had owned a similar model to mine. Familiarity breeds contempt, however, and I soon found that I was taking the revs. up, and, in fact, getting quite dashing. One evening I opened up to pass a corporation dust-cart liberally adorned with clinging dustmen. My maximum was 55, and I lost it! Some days the car would go perfectly, and other times, just when I needed power, she would not pull, or she would just fail to exceed 55 m.p.h. Needless to say, I tried everything I knew to trace the fault. I checked the carburetter and ignition. The wiring was checked by every known electrical device in the hope of tracing an obscure short. Plugs and jet needles were changed as often as if the car was the most temperamental of all Grand Prix machines. The annoying part was that when the car was stationary she would rev. right up without a spit or a flutter, and even after going to considerable trouble to obtain a test on a Stromberg tester, the readings given were all that could be expected from a car of that size and type. Enough, though, for the moment of this irritating motor car.

Following one of my several moves round Wales, I was billeted near an aerodrome, where I met that great enthusiast, Pat Yates. Seeing me struggling one evening with the J2 he introduced himself, and our conversation soon turned to the Sport. He had known most of the cars and racing people in Southern England before the war, and had himself owned and experienced many interesting cars. When I met him he was deporting himself in a highly-polished 2½-litre S.S. "Jaguar." His heart, however, was with the Molsheim product. He just dreamed, talked, and thought Bugatti. In fact, a really advanced case. The result was

that no car would satisfy him for any length of time, and in the first few weeks I knew him he changed the S.S. for a Riley " Kestrel," and then this in turn for a J2 M.G. with the long wings.

Not long after the change to the J2, Pat burst in on me one day, asked if he could use my 'phone, picked it up, and got through to a haulage contractor in Cardiff. Before I could open my mouth he had bought a 3-litre Bentley. As he replaced the receiver with a smile of satisfaction on his face, he explained that, while in Cardiff the previous day, he had unearthed the car, and now, as both he and I seemed to be settled for a while, it might be good fun rebuilding the old car.

A 'phone call some days later from the local railway station informed us that " an old racing car was waiting collection." As Pat was flying, I could see I had a solo job on my hands, so after arranging for a lorry to meet me at the goods siding, I departed with a light heart and a large collection of tools.

Now, I imagine there are not many readers of Motor Sport who have not, at some time or other, experienced the horrors of collecting a car from a railway siding. Whether they have had to compete with half an American armoured division for a turn on the unloading ramp is, however, another thing. On presenting myself, complete with wagon number, to an aged railway official, I was greeted with a mocking laugh, and a statement to the effect that if I had come half an hour earlier I might have been lucky, but now the wagon I wanted was over on track nine, in the middle of " that lot." With a wave of his hand he indicated that " that lot " was a great sea of mixed railway rolling stock, containing everything from coal to Sherman tanks. I will not describe the miserable hours I spent at that siding watching the wagon I wanted being shunted up and down the tracks, but it was certainly a trying time. One moment one would see the elusive wagon rumble by on the track next to the unloading ramp and one's spirits would rise, only to drop again as the next couple of shuffles sent it nearly out of sight to stand alone and stationary for another half an hour. Eventually, with the co-operation of the American Army, the wagon reached the unloading ramp, where by now a large number of troops and railway men had gathered to see the important car that had caused so much excitement. They were certainly not disappointed. As I pushed open the doors of the wagon, a gasp went up from the company, and with good cause, for there, resting in the wagon, with her radiator towards the door, was one of the most impressive-looking 3-litre Bentleys I have seen. To start with, compared with the Jeeps and " utilities " that surrounded us, she seemed so big. That, of course, was merely a matter of comparison, but as the whole of the car was in polished aluminium, and liberally adorned with lamps, stone-guards, horns, etc., she was an inspiring sight among the drab vehicles of war.

The intensive work that was carried out on the Bentley revealed that although the car was of 1924 vintage, and of " Blue Label " origin, a great deal of modification must have been undertaken by former owners. The engine was fitted with twin S.U.s bolted to a specially made-up manifold, and when the head was removed, dome-topped, high-compression pistons were revealed. This last feature explained the arm-breaking tendencies of the starting handle. Electric S.U. petrol pumps were also fitted. The chassis, too, had obviously received a lot of attention. This was of the " Red Label " short-chassis type, with 4-wheel brakes, and fitted with low-pressure oversize tyres all round. Twin shock-absorbers, one set hydraulic, one Hartfords, were fitted, which proved more than adequate when on the road. As already mentioned, the body was polished aluminium. The cycle-type wings which usually spoil a Bentley, in this case did not look out of place with the short chassis. The radiator was the pattern with the built-in stone-guard.

Apart from a general overhaul, including a considerable amount of rewiring, only the starboard M.L. magneto needed any extensive attention. As all our efforts refused to produce a spark from this component, it was sent away and completely rewound, a job that, under war-time conditions, and with no priority, took twice as long as all the other work on the car. A nasty clank in the propeller shaft was traced to wear in the bolt holes at the flexible coupling, but a little brazing and redrilling was all that was required to rectify that fault.

A little careful welding on some of the flywheel teeth, coupled with a lot of hard filing, brought the self-starter back into action, but even so, a tow was necessary to bring the old car to life after lying idle for so long.

It may be that in the past I have been unfortunate in my association with 3-litre Bentleys, for although I have admired their solid roadholding qualities, all the cars I have driven, or been driven in, have always left me with a feeling of lumbering power, and the necessity of having a long, clear road to creep up into the early 70's. This reaction, of course, may have been brought on by the fact that I am unashamedly biassed towards the " 30/98 " Vauxhall as a vintage motor car, but all the same I think I have been unlucky in not having driven any of the better 3-litres.

The Yates-Bentley, however, certainly changed my views. It was obvious from the hard thump of the engine that we had more power than was usual on this model, and our first run when leave petrol was available confirmed this in no small measure. The steering was definitely heavy, and the springing with the double shockers unnecessarily hard, but the flood of solid power which really flung the car forward, gave us one of the most exhilarating drives I have yet experienced. Knowing the havoc that maximum speeds quoted in print can create, I should refrain from writing of m.p.h., but I do think I should record that on one glorious occasion 92 m.p.h. came up on the clock, with very favourable conditions—and something other than pump fuel in the tank. As most " Blue Labels," in spite of modification, usually find between 75 to 80 their genuine maximum, most people will agree that this particular model is a pretty good example.

Most enthusiasts might be content to enjoy motoring in the Bentley manner when it could be carried out with such a car as described above, but then they would not have been bitten by the Bugatti bug, the effect of which can only be cured by owning one of the most temperamental cars for some time ; and even then the symptoms are sure to reoccur after a lapse of time. It was, therefore, with no surprise that one day in early spring I found Pat deeply engrossed in the study of the Bugatti Owners' Club handbook. It needed but just a spark to turn him from the Bentley. This was provided a few days later when one of our far-flung spies reported that he had seen a " small racing-car with a funny little horseshoe-shaped radiator " in a works up in one of the Welsh valleys. It was, I will admit, more than a coincidence that made an official journey to that particular part the very next day ! An exhilarating run in my J2—it was one of its good days—brought us to a remote part of one of the most obscure mining valleys. Enquiries at a rather derelict-looking works led us to a building that turned out to be the works garage, which at first appeared to contain nothing more exciting than laid-up Austin Twelves. A low shape, however, covered with a filthy tarpaulin, looked more interesting. And so it was. Beneath the dust-laden covering was a Full G.P. 1½-litre Type 37 Bugatti, together with a number of spares.

Following this discovery Pat at once started a chain of enquiries in order to find the owner of the car, and after a few weeks of hectic letter-writing, he was traced, and the car purchased. Collection was quickly arranged with the help of a friendly haulage contractor, and in due course the Bugatti joined the Bentley and the two M.G.s.

Further letter-writing to previous owners and taxation offices revealed the car was reputed originally to have been driven by Chiron (but what Bugatti isn't !), and was the car owned and driven by R. Carey at Shelsley Walsh and in other sprint events. She had been tuned entirely for sprint work, and had at one time run with four Amal motor-cycle carburetters and a full-length, 4-pipe external exhaust system. At the beginning of the war, however, preparatory to laying up, which eventually landed the car in the works where we found her, the engine had been stripped and entirely rebuilt. The original Bugatti exhaust had been refitted, together with twin Solex carburetters instead of the standard single Solex. Ignition was by a Scintilla " Vertex " magneto driven from the rear of the camshaft and at right angles to it. Unlike most Bugattis the car would not start on a pull-up of the handle, in fact, it was soon pretty obvious that something was out of adjustment in the engine, as it would not run at less than 2,000 r.p.m. Fortunately, the trouble was soon traced to the carburetter butterflies, which were not properly synchronised. Most writers when describing a Bugatti usually say " the steering and roadholding were all one expects from a Bugatti," etc. At first this particular car fell far short of such a description. In fact, it felt positively horrible. A careful examination of the front suspension revealed a distinct curve in the track rod, which I imagine must have been produced by careless jacking. This was straightened and no

further trouble was experienced. It was then possible to enjoy to the full that incomparable Bugatti feeling.

When far from one's base it is not easy to scatter sports cars all over other people's property, and therefore we very reluctantly decided that the Bentley would have to be sold. Pat, being very busy on flying duties at that time, left the advertising, etc., to me.

I always claim that I have never sold a car but made a friend, and this case was no exception. From an even remoter part of Wales than my war-time abode, I received a charming letter from a gentleman who expressed surprise that there was another enthusiast in that part of the world, as he imagined he was the only "mad one." A drive down to his home to negotiate the sale was worked in on an official run.

It is gratifying to remember that it was on that journey that I finally traced the irritating trouble to which my J2 had been subject for so long. My friend, Sir Clive Edwards, came with me for the run, and no doubt it was due to his encouragement that I was using rather more revs. than might be considered wise on an ageing J2. Anyway, on one of those long Carmarthenshire hills I had my foot hard down in third gear, when the most expensive-sounding clatter emerged from the engine. I pulled up at once, and looked back along the road expecting to see a trail of oil and the contents of the crankcase. It was with great relief that the noise was found to have been caused by the front dumb-iron cover coming adrift and dragging along under the sump. On opening the bonnet to see if any damage had been done, I noticed the slightest trace of petrol just drying out on the rear carburetter. As obviously I was getting flooding when under way with a full throttle opening, but not when the car was stationary, it appeared that there must be some slight trouble in the float mechanism which was only brought on when the car was under way, and under full throttle. Later, a careful check failed to reveal anything wrong with the float chambers, and I was just about to replace them, once more depressed by the fact that the trouble seemed to have beaten me again, when I decided to take the float out of the other carburetter to see if I could see any difference between the two. Both seemed identical, but a chance thought made me decide to weigh the two chambers, and it was then I found that one was slightly heavier than the other. A replacement of the heavier one cured the trouble for good. That I had never been able to counteract the richness by adjustment on the slide I can only account for by the fact that probably the vibration of the car when on the road was just sufficient to cause the heavier chamber to sink slightly under certain conditions.

But to return to the Bentley. My correspondent turned out to be that veteran motor-cycle and car enthusiast, Dr. Alec Lindsay. It was satisfying to know that the old 3-litre was going to a good home. Living in a charming part of Carmarthenshire, the last place one would expect to find a collection of sports machinery, Lindsay's stable consisted at that time of a Lancia "Augusta," a 3-litre open 2-seater "Blue Label" Bentley, an old 2-litre Lagonda, and a 1½-litre S.S. "Jaguar." Added to these he had six or seven motor-cycles ranging from an Ariel Square Four to an old F.N., and the old Norton he rode in the T.T.s of the early twenties. The stories he can tell of the races and trials he had ridden in, and the number of different cars he has owned would fill a book. His experiences as medical officer to the R.A.C. for the record attempts at Pendine alone warrant a high place in motoring history. I only hope that one day he will find time to at least send a contribution to the "Cars I Have Owned" series. [It would be very welcome.—ED.] When the doctor took the Bentley over he decided to rebuild it entirely, and working with advice from Mr. McKenzie, he finally combined parts from his existing "Blue Label" to produce a really first-rate car. The engine in the Yates-Bentley was No. 353, and Lindsay's engine No. 1632. An engine being so late in the 3-litre range contained all the improvements that were made on the model through the period of production. This engine, together with the differential, which was the four-star type, compared with the two-star type of the older car, was reconditioned and put in the short chassis. The steering gear and front axle were also changed over, as the earlier 3-litres were slightly higher geared on the steering than the later models which had the low-pressure tyres. This was a great improvement, as the car had always been very heavy to handle when backing and turning, etc. Although it

meant sacrificing the built-in stone-guard, Dr. Lindsay also decided to change radiators on the two cars, as his " Blue Label " had the larger header tank, which is a definite aid to cooling when running in traffic or negotiating a Carmarthenshire town on market day. When these alterations had been made the car was run for a short while, but subsequently further improvements were made. The twin S.U.s and manifold from the high-compression engine had been retained when the engines were changed, but after the change over petrol consumption was not all that it might be. As the carburetters were found to be only 35 mm. they were changed for a pair of the older type of 42-mm. S.U.s, with the barrel-type pistons set at an angle. The electric pumps were replaced by an autovac and an improvement of 3 m.p.g. resulted. Kigass was also fitted by the industrious doctor, but this is not really necessary, as the car starts very easily in all weathers. The result of all this labour is an exceptionally fine Bentley. The car has not the thumping power as with the old high-compression engine, but a sweeter running or more reliable car could not be found anywhere. [We published a picture of this car in our issue of last February.—Ed.]

During this period I spent a lot of time making journeys round South Wales and Anglesey, and used a number of different cars for these runs, varying from a Lincoln V12 to my wife's 1929 Morris-Oxford. It is amusing to remember how the owner of the Lincoln used to tell of how he could drive over the Horse Shoe Pass in " high " when extolling the virtues of American cars, and then to remember how my father-in-law took the old Morris out and went over in top three up and with a load of luggage.

Another car I have driven a great deal during the past two years is my father-in-law's Hillman Fourteen. The 1938 model had one great weakness, the gearbox in which the thrust race washer used to break up every 15,000 miles, and either a new washer or a new gearbox was required. It just depended where and when it broke. This car, in my opinion however, is the best of its kind that has ever been made, and is the type of car that British manufacturers should aim at producing after the war. I think we have no hope of competing with the Americans with a cheap large horse-power car, but the British motoring public should be weaned away from the Morris Eight/Ford Eight complex to a car of the size and power of the Hillman Fourteen. A speedometer reading of 80 m.p.h. is easily obtained, as the Editor of Motor Sport found when road-testing a second-hand example in 1941. The independent front suspension is as good as most types, and the general finish is all that is required for utility motoring.

I cannot claim to have had more than just a taste of the joys of the H.R.G., but I had one short run in Clive Edwards's 1½-litre model with the Singer engine. This is the ex-works car, GPE 607, that ran in the Three-Hour Sports Car race. A very good motor car, that should be even better if Clive carries out the modifications he has in mind for after the war.

It should be borne in mind that during the period of which I have been writing, I had been experiencing with Pat Yates all the joys and worries that go with a Type 37 Bugatti. In one of his wilder moments Pat decided to use the Bugatti for his R.A.F. duties. As this meant driving up to the 'drome, a distance of about 4½ miles, at all hours of the day and night in order to keep to a flying rota, I think it will be agreed that even as an avid Bugatti enthusiast he was carrying things a little far. With unrelenting energy, wings, lamps, and other road equipment were fitted to the car. Eventually, technically at least, she was ready for the road. It was soon found, however, that we were on to too much of a good thing, as sometimes a whole afternoon would be spent getting the car running on four cylinders, and more often than not just as long a period getting her running at all. The journey to the 'drome was usually made in the M.G. In spite of all that has been said by some writers about the unreliability of the Type 37, in this case I am not blaming the car, or the design, as this particular model was quite definitely a sprint car. It was asking rather a lot to expect to use it as a utility car, even when its various inconveniences were countered by a short exhilarating drive. The car could not be enjoyed to the full even on these short runs, as only very little throttle could be used, the engine requiring a long period of warming up before anything like full throttle could be given. With the shortage of petrol and the car's thirst for this desirable liquid, such warming up was more than an embarrassment

Thus handicapped, it was obvious that another change would soon take place in the Yates' stable, and therefore I was not surprised when one day I heard that the Bugatti and M.G. were to go in part-exchange for a 1½-litre Squire. When the deal was finally completed, Pat collected the car in London and drove it on side lights down to West Wales in the black-out. Such is true enthusiasm.

This particular, car was the one illustrated in the centre spread in the December, 1943, Motor Sport, and is therefore familiar to most readers. A superb-looking vehicle completely reconditioned externally, including re-spraying and re-chromiuming. The Squire has been written up several times during the war in various motoring journals, so I will not describe it in detail, apart from saying this was one of the earlier models fitted with the 1½-litre twin-cam Anzani engine with a Zoller blower. As with others who have had experience with this make of car, we experienced somewhat of a shock when we first heard the engine running, as at low speed it sounded like an ageing agricultural vehicle. This was caused by the design of the rocker arms and tappets. I believe that on some of the last models made this fault was cured ; if so, it must have made a big difference to the appeal of the car from the sales angle. Actually, when on the road at any speed over about 35 m.p.h. the noise settled down to a muffled roar, and was carried away with the wind. When road-tested by Motor Sport the Squire was timed at over the 100 mark, but I am unable to say that this was our experience, as a speedometer 90 was the best that could be obtained. This, however, I think, can be accounted for by the fact that the car tested by Motor Sport was probably only just run-in in 1936, and that the Yates car, in spite of its showroom condition, had done a good thousand miles by the end of 1943. In connection with the Squire it is a useful argument to have at the back of one's mind if one is supporting the use of blowers on small-capacity road-cars, to note that with careful driving on a fairly good road (I am thinking of the road between Swansea and Cardiff) it was possible to get 28 m.p.g.

I seem to have covered most of the cars that I have owned, driven, or messed about with during the war years, but before concluding this article there are some other interesting cars that I have encountered that should be included to complete the story. First, there was the 1906 Daimler and the " Silver Ghost " Rolls-Royce I came across when in Llandudno. I think the former had already been unearthed, as I later saw a letter referring to it in the *Motor*. Whether it or the Rolls has been bought by an enthusiast I do not know. Then there were the two Singers I discovered buried under piles of debris during blitz clearance work in Swansea. These two cars were fitted with light detachable aluminium bodies of the Le Mans pattern (tank at the back, etc.), and seemed to have been used for racing or trials at one time, as numbers could be seen under the paint and dirt on the bodies and radiators. The garage proprietor to whom they belonged was eventually traced, and he said he thought the cars were two of the Red, White and Blue Singer team which ran in trials and sports events in 1933–4. He also said he thought they were fitted with straight-cut crown wheels and pinions, and that a maximum near the century had been possible at one time. Unfortunately, the owner adopted a rather " dog-in-the-manger " attitude with the cars, and it was not possible to save them.

Another Bugatti I discovered was an old Type 22 in a breaker's yard in the Gower Peninsula. This car had more or less " had it," as it was nearly in pieces and seized solid. It might be useful to someone for spares, and I will be only too glad to pass on the address of the yard to anyone who is interested. In this same yard there is a 1917 Clement Talbot, also disintegrating fast, but which still might be saved.

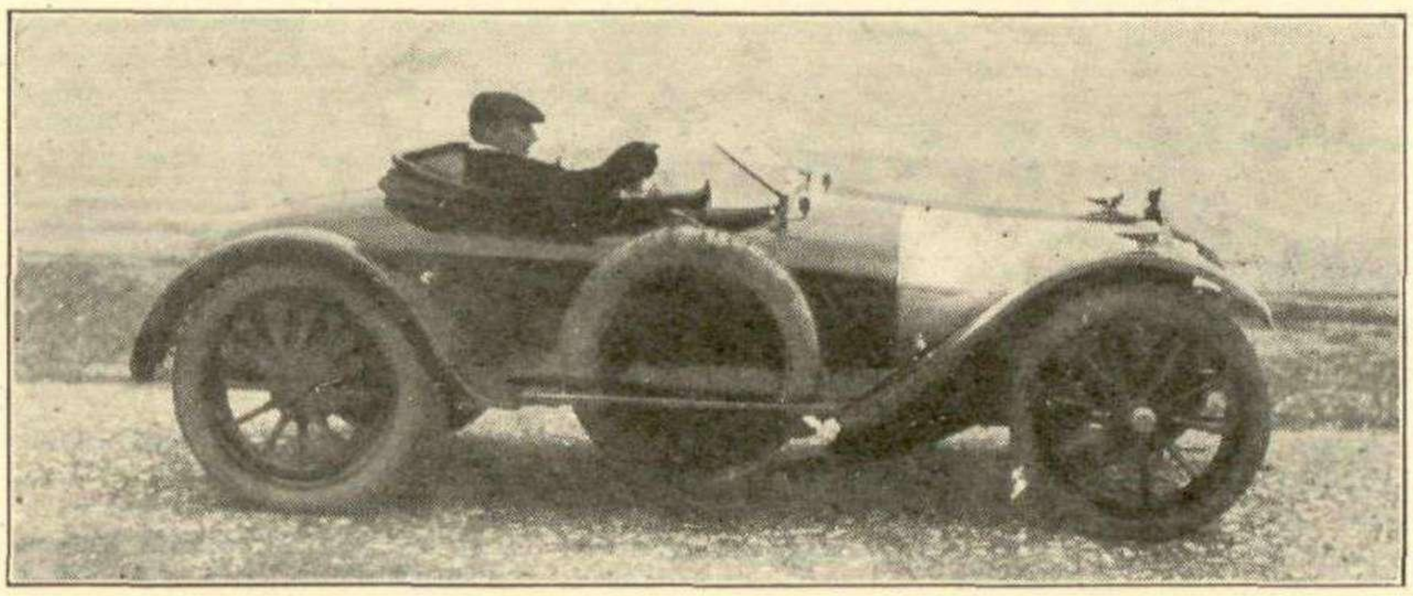
There have been others, but not of any real interest. At the moment, following an unsuccessful search for a fairly respectable Frazer-Nash, I am running a very sleek, but under-powered and over-bodied, Triumph " Gloria Vitesse." A pleasant car—yes, but containing all that was bad and good in pre-war British motor-car design. Good fittings, nice body, good quality upholstery, Lockheed brakes, free wheel, automatic chassis lubrication, and many other features. But, then, what's the good of all that if one has no real performance, which one hasn't simply because it's asking too much to expect a 10.8-h.p. engine to push along a car of the size and weight of many a 16 or even 20-h.p.

But why complain when there are still so many interesting cars to be driven, or rediscovered ? What could be more intriguing than following a chain of clues, as I am at the time of writing, which I hope will lead me to a 1903 Panhard, reputed to have been laid up for 30 years in a disused foundry ?

Old Racing Cars In Retirement

In pursuance of its policy of tracing old racing motor cars which are laid up in various parts of the country " Motor Sport " has discovered two more veterans of which some particulars are given here.

WE of MOTOR SPORT have devoted much time and labour to tracing old racing cars which have ended their active careers. Not without reason did we observe, some time ago, that there can be very few, if any, more such cars to be discovered. It is true that some of the more famous have yet to be written-up in the " Veteran Types " series, Heal's 1921 straight-eight G.P. Sunbeam amongst them, but that is merely because it has become a matter of tradition to include in these articles observations on a drive in the car in question, so that it seems as well to await the return of the basic ration before describing the remaining warriors. Meanwhile, a little more information has come in appertaining to this fascinating study.

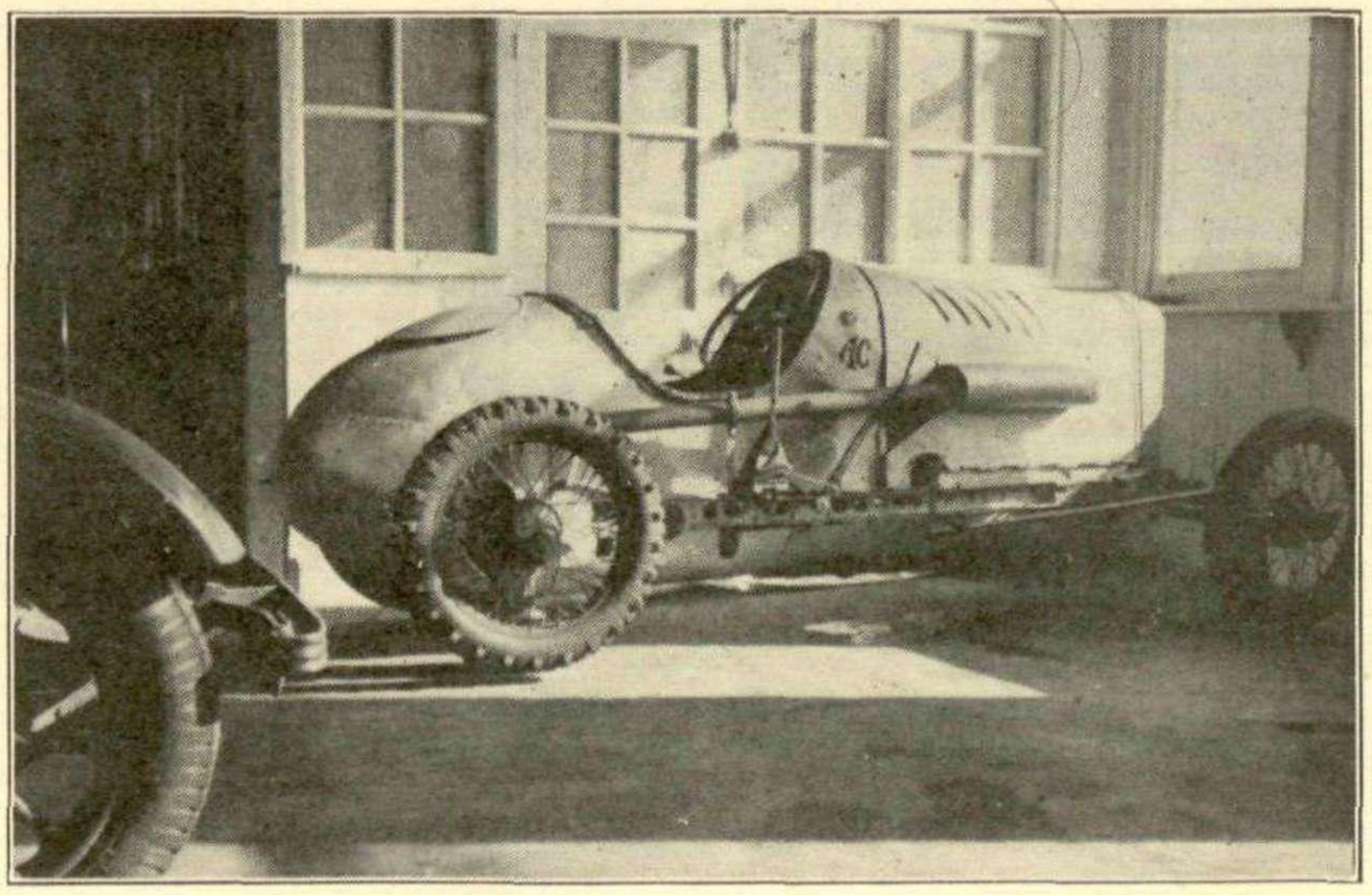


" Germaine " with new body.

In the first place, we had been worried for some time about a pre-1914 G.P. Germaine reputed to be owned by the H.E. designer, R. J. Sully. Not unnaturally, when Major Sully wrote to us recently, we asked him what had become of this car. His reply establishes that he saw this car at a garage in Bicester while buying petrol in 1919. It was hidden beneath old mudguards and greasy overalls, and turned out to be one of the 1907 Belgian G.P. cars, with two bucket seats and a bolster tank behind. Sully was told it had finished third in this race. The seals from tank to carburetter were, incidentally, still in place, the fuel-consumption limit being imposed for this contest. The engine was a 4-cylinder of 100 by 100 mm., rated at 24.8 h.p., with T-heads and brass water jackets. Engine speed was varied by altering the lift of the inlet valves. The 3-speed gearbox had a right-hand quadrant change and an open shaft drove the rear axle, which had a ratio of 2.0 to 1. The brake shoes were machined all over and liberally drilled, and the entire car was beautifully made. Sully bought it for £50 and fitted a 2-seater body with hood and screen. He scrapped the variable valve-lift and used normal control by fitting a Longumare carburetter. It then did 70 m.p.h. After three years' fun with it Sully sold it, in 1922, to Allen & Simmonds (now Gt. Western Motors), of Reading. We have contacted this firm, but they have no record as to whom they sold the Germaine. Can anyone carry its history further?

Another interesting discovery we made recently is that the old single-seater A.C. with which J. A. Joyce took so many sprint-course records in the early twenties, is now owned by J. S. Aked and reposes safely in his garage at St. Annes-on-Sea. Early A.C. history is very complex, as many racing, record-breaking and sprint cars were built, but Aked's is similar to the 1922 200-Mile Race cars, but with single-seater body. This A.C. has a 4-cylinder, 1½-litre, 16-valve engine, o.h. camshaft valve actuation, and the Weller exposed-driving-shafts rear axle. It came into Aked's hands 16 years ago, and he had considerable success with it at Southport for some five seasons. He remarks that usually, if the car was in good form, it would get at least halfway down the Southport mile before being overtaken by larger and much more modern cars. Often bad conditions made the organisers shorten the course to three-quarters of a mile, and then the old A.C. would usually scramble over the line first at some 85–90 m.p.h., to be passed within a second or so by modern, large, blown cars doing their 100–110 m.p.h. The car certainly displayed remarkable acceleration and used to wag its tail in a manner somewhat disconcerting to other competitors.

Amongst its successes in Aked's hands were three " 3rds " at the Southport Championship meeting in 1930, a 2nd and a 3rd at the previous meeting. In 1931, at the August Southport meeting, the A.C. was 1st in the 1½- and 2-litre classes, and 3rd, behind two G.P. Bugattis, in the 3-litre category. In 1932 the A.C. was 2nd in a Southport 1½-litre flying-kilo. race, averaging 81.05 m.p.h., and 1st, ahead of Hutchison's Bugatti and Stephenson's rapid Austin Seven, in the 1½-litre mile race, also being 2nd, behind a 2-litre Bugatti, in the 2-litre class, and 3rd, behind a " 2.3 " Bugatti and Jackson's 3-litre Sunbeam, in the 3-litre and unlimited classes. On this occasion Aked used competition tyres on the rear wheels. Other Southport successes included a 2nd and a 3rd at one meeting, behind Bugattis, and 1st place in the 1½-litre class, beating a Riley and an M.G. All these successes were in " straight mile " events. It is excellent news that such an historic car is safe and sound. Then, over in America, two Peugeot racing cars, in poor condition, have come to light. They are said to have o.h.c. engines with dry-sump lubrication, so they may quite well be two of the 1914 G.P. cars. Perhaps someone will now amuse themselves by compiling a list of historic ex-racing cars definitely known still to exist?



The ex-Joyce sprint A.C., later raced by Aked, and now in retirement, at his garage at St. Annes-on-Sea.

THE MODEL CAR POSITION

THE model car position in this country is in a healthier state than it has ever been, thanks mainly to the lead given by D. A. Russell, M.I.Mech.E., the tireless managing editor of the *Aeromodeller*. Largely due to his influence, many British enthusiasts are constructing fast petrol-driven model cars, and r.t.p. meetings are held once a month in London by the British Model Car Club. Nevertheless, although model-car racing is now properly organised over here, as it has been in America for some time, racing folk have not yet taken up the pastime as an antidote to the petrol-less era, which has put paid to the real thing. The B.M.C.C. recognises two classes : Class I for models of up to 6 c.c., the wheelbase of which does not exceed 15 in. and track 9 in., and Class II, for models of 6 to 10 c.c., the wheelbase not exceeding 20 in. and track 11 in. *The Model Engineer* has organised a competition for designs for working model racing cars, limited to a maximum length of 2 ft, a track of 1 ft., and a weight of 10 lb. The first prize was £5 5s., and the result should have been announced by the time these words are in print.

Up to now non-scale models seem to predominate, the most notable exceptions being Mr. Russell's excellent enclosed-cockpit, record-breaking Auto-Union and S.S. "100" stripped sports 2-seater. In the main the non-scale models are quite decently proportioned and look far more like the real thing than the average American model ; we sincerely hope the new definitions recognised by the B.M.C.C. and referred to in " Club News " will not encourage the entry of mechanised trucks. Speeds here appear to be around 45–55 m.p.h., compared with 90–100 m.p.h. reported from America. "Solid " transmission, necessitating a push-start, is apparently usual in America, but in this country the centrifugal clutch is freely used, making proper starts (and coasting after the engine has cut) the order of the day. Two designers have decided that even this is not ideal, because it is not possible to run the engine up to full-bore on test without the clutch coming in, so they propose to use dashpot clutch control, the dashpot giving gradual engagement of the friction surfaces when all is well in the engine department.

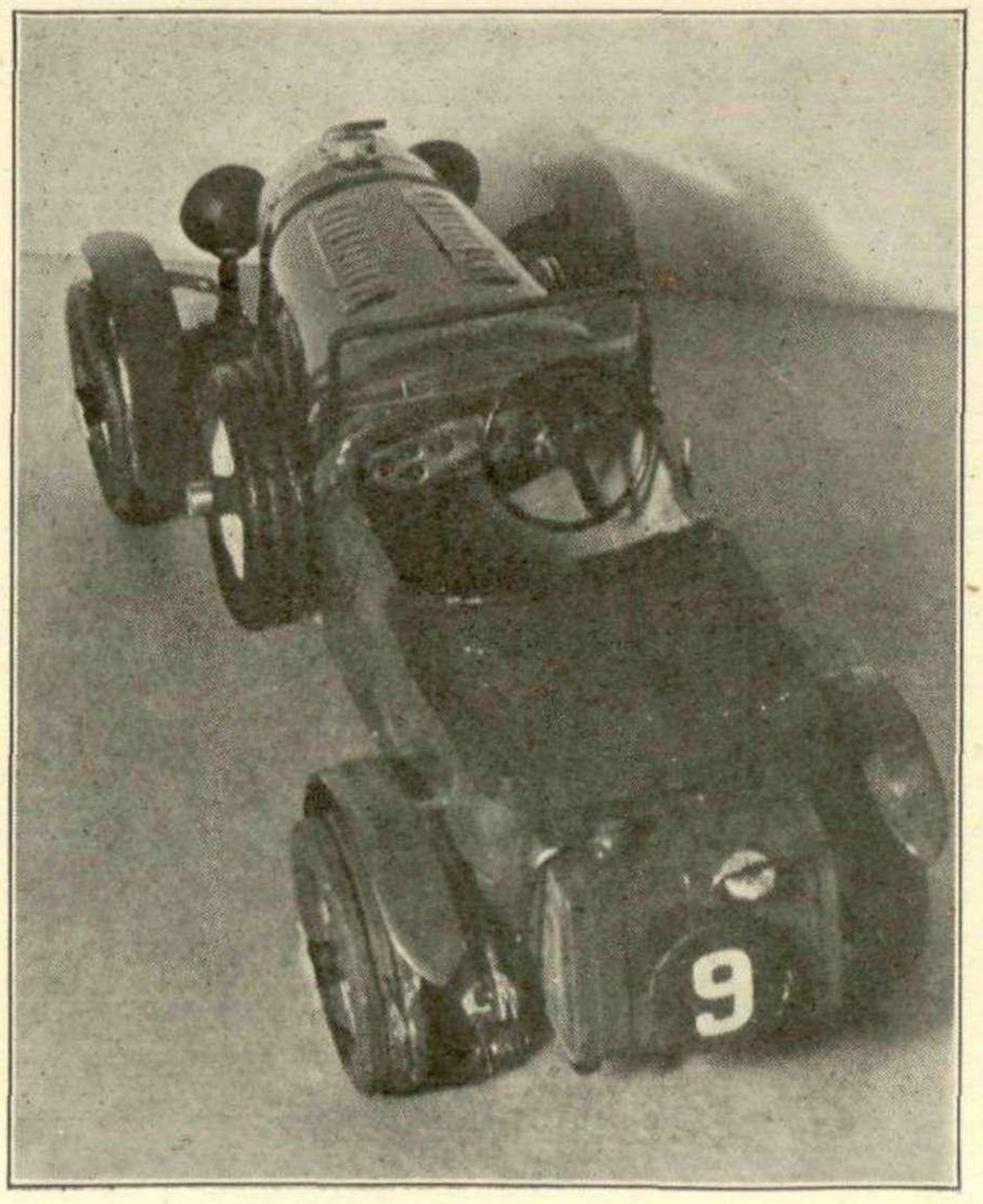
Most people seem to prefer modern-type cars as a subject, but the possibilities of old-style, track-type cars should not be overlooked, especially as they often used disc wheels and were well cowled, making for easy modelling. Moreover, external chain drive should be a fascinating plaything and would provide a ready means of altering the ratio of the final drive. Admittedly, the recent scrapping of an " unlimited " class by the B.M.C.C. may somewhat discourage such types. We would like to see banked tracks in the future, as adding to the interest and, perhaps, offering better running conditions. And we hope soon that duration records will be recognised—Edgar Westbury has assured us that tiny i.c. engines will function indefinitely, if properly designed and lubricated. The B.M.C.C. already has an electrical timing set, although this, T. W. Loughborough pointed out in *The Model Engineer* of April 12th last, can only hope to be accurate to about 1 part in 100, *i.e.*, to the nearest 2 m.p.h.

Although petrol-driven models are at last flourishing, the non-working small-scale model still presents a pretty problem. Rex Hays, of Steyning, has been modelling small racing cars for his own and his friends' amusement since 1921. During the war professional modelling for the Admiralty has kept him busy, but recently he indulged in a few more racing-car models, which particularly pleased Capt. Robert Fellowes. These included E.R.A., Mercédès-Benz, Auto-Union, Maserati and Alfa-Romeo G.P. cars, etc., and the interest aroused has been stupendous. Hays has been working 14 hours a day on official modelling and on orders for racing cars. He has supplied eight models to one well-known Bugatti driver, a model of a 1938 Mercédès-Benz for Mrs. Seaman, and has on order a " 3.3 " Bugatti, while models of touring and saloon cars are also in demand. His models cost, on the average, £2 2s. each with driver.

Then C. Porthumus, of Walton-on-Thames, has been working on a detailed model of a " Monoposto " Alfa-Romeo, with a view to publishing plans and building instructions. Finally, G. H. Deason, of Wylam-on-Tyne, has made some very effective small models in wood, to 1/30th scale, notably of the 4½-litre ex-Birkin Bentley 4-seater and E.R.A. cars. This is in addition to a 10-c.c. petrol-driven model of the Leyland-Thomas, designs for which, we understand, will duly appear in *Practical Mechanic*. Deason hopes to follow this up with a petrol model of the famous 4-cylinder Thomas-Special. So far as his " solid " models go, we can do no better than publish in full his own remarks on how they are built, and thank him for allowing us to do so. He writes :

Let it be said at the outset that the following notes on model-car construction are not intended for the expert and experienced model engineer, but rather for ordinary folk like the writer, with but mediocre skill and very limited equipment, whose enthusiasm for cars engenders the urge to reproduce them in miniature. It matters little whether the model be a small " solid " or a power-driven competition job, there is a satisfaction in viewing the result in three dimensions that the finest picture cannot give. And since interest in this branch of model-making seems to be growing rapidly, as well it may, a few ideas may not be out of place.

Let us deal with the " solid," or static scale type. The smallest practical scale would seem to be around 1/30th, giving models some 4½ in. long, into which a surprising amount of detail can be built. Some very excellent drawings to this scale have appeared from time to time in *The Motor*, in Laurence Pomeroy's " Milestones of Speed " series, giving accurate side and front elevations which are of immense value. But no great difficulty should be experienced in producing one's own drawings from photographs, given some known dimension such as tyre sizes or wheelbase.



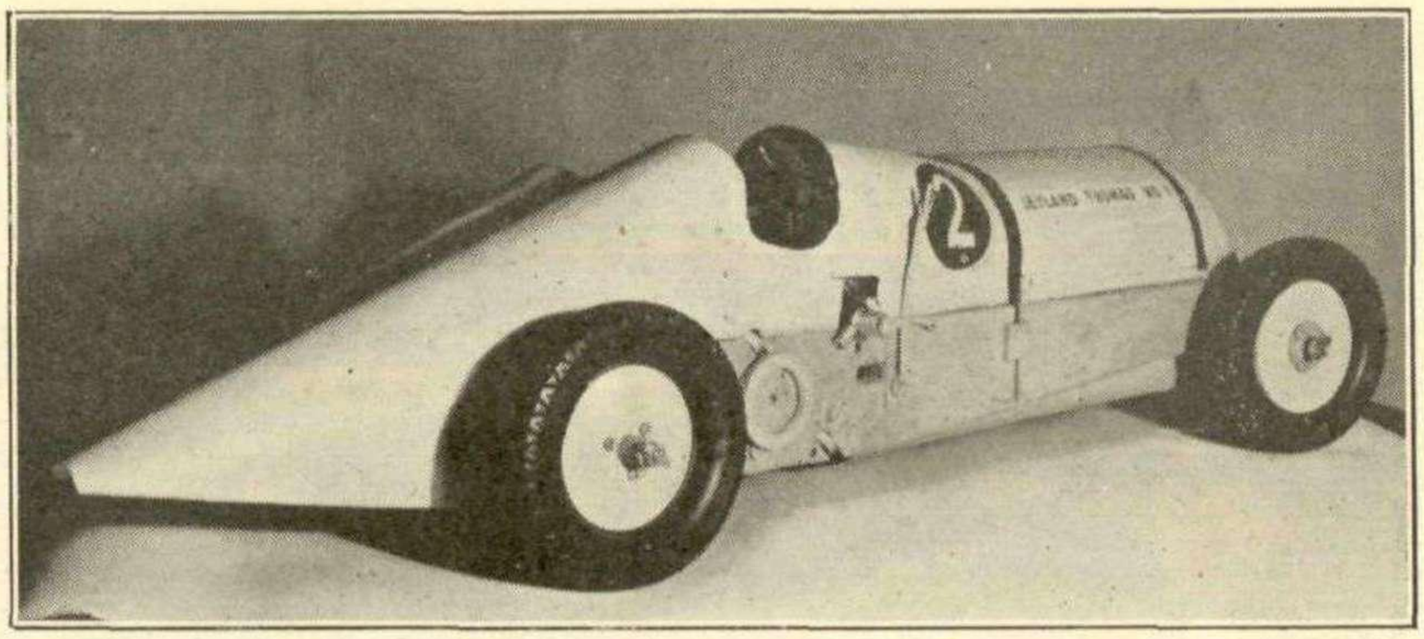
A 1/30th scale " solid " model by G. H. Deason of the ex-Birkin blower Bentley. It was not finished when this photograph was taken.

The bogey of all scale car modelling is definitely wheels of the Rudge variety. It is held by some constructors that disc wheels are permissible, but the writer has never held this view, and is still struggling to produce something nearer realism. Tyre sizes in the 1/30th scale class are around 1-in. to 1⅛-in. diameter, and a visit to the nearest Singer sewing machine shop will produce rubber rings of these sizes very cheaply. More realism can, however, be achieved by building up the wheels from discs of 1 mm. ply, or similar material, cutting two main discs full size (*i.e.*, maximum tyre diameter) and spacing them with a ring of slightly smaller diameter. Additional rings of alternating diameters are cemented on either side, thus building up a tyre with a ribbed tread, the final tyre walls being of balsa, which can be turned simply by mounting the wheel in a drill chuck and sanding to shape. Alternatively the main wheel discs can be of scrap side-screen material, through which the brake-drums can be seen, and upon which spokes can be scored and Indian inked. This method is satisfactory for larger sizes, sheet rubber inserts being employed for power-driven models to give a non-skid tread. (Incidentally, the writer saved himself much labour by constructing an adjustable cutter for these experiments, on the lines of a joiner's expanding bit.)

Wheels apart, there are no snags in "solid" model car building. The sleek "one-place" racing car is obviously jam to anyone who has produced, say, a 1/72nd scale Spitfire. A note or two follows, however, on a simple method of producing a 4-seater of the Bentley type.

Avoid, like the plague, any direction which tells you to "take a piece of yellow pine," or any other fancy timber. You won't find any nowadays, and your enthusiasm will be blunted. Take, rather, a block of wood of suitable size, avoiding the more obvious knots, and take heart from the thought that a good grain-filler will cover a multitude of sins if ever you reach the painting stage. Mark it out in profile, plan and end elevation, including in the profile the full depth of chassis and the radiator. Saw out with a fret-saw or coping-saw, and then carve and sand-paper the block to conform to the curvature of the body-lines. The radiator can be partially finished at this stage, at any rate, in general outline, and be parted-off later for finishing. If the prototype has a normal unvalanced chassis and ½-elliptic springing, cut side members of light-gauge brass, drill for spring anchorages, tie-bars, etc., and screw to the main block, which can be recessed to take them if necessary.

The body can now be hollowed out. For quick results use a ½-in. bit, bore through the block at suitable points behind the scuttle, and remove the surplus with a chisel. A ply or card floor can be fitted later. At the scuttle section, bore about 4/5ths through from the underside, leaving the arch of the scuttle intact. Cut away the bonnet portion completely between scuttle and radiator, down to the side members, and keep the cutaway portion as a former for the metal bonnet. A platform is thus left to support the dummy engine. Springs and axles can be assembled at this stage. Springs can be made from laminations of thin brass, or scrap watch-spring, the master leaves softened at the ends and turned over to form loops for the shackle pins. Bind with thread and coat with glue or shellac. Spring shackles are made from thin brass bent up in one piece, roughly in the form of the letter P, pinned with shortened domestic pins.



Although G. H. Deason builds excellent "solid" car models he does not neglect the petrol-engined working models. Here is a model of the Leyland-Thomas he is building for the Editor of MOTOR SPORT.

The amount of detail built into the engine must depend on the builder's skill and inclination, but it is worth noting that some beautiful 1/48th scale aero engines have been described in recent numbers of the *Aeromodeller*, in which it has been found possible to include accurate representations of camshafts and timing covers, carburetters, superchargers, and even plugs and leads.

Details generally can be left to the individual, and a good rule is "If in doubt, leave it out." One is, after all, doing the job to please oneself, and a bold and characteristic outline can be very pleasing in itself, even if it doesn't satisfy the super-scale fans. It is amazing, however, what odds and ends can be utilised to obtain effects. Radiator honeycombs, for example, may be made from the coarse gauze used for protecting the sticky side of corn-plasters! A perfect Bugatti radiator can be made in 15 minutes from ⅛-in. plywood cut to the classic shape, bound round the edge with silver foil, faced with gauze blacked with Indian ink, and the red medallion cut from the shiny cover of the February MOTOR SPORT! Spring-spoked steering wheels have a copper-wire rim soldered to a brass "X," with centre boss cemented over the head of the upholsterer's pin forming the column. Your wife's adjustable leather punch cuts various holes in instrument boards very neatly, behind which is a layer of cellophane and white or black card suitably "calibrated." Hoods, tonneau covers, etc., are cut from the matt black paper used for wrapping photographic paper, and very expensive-looking upholstery can be produced by covering the card or metal seats with overlapping strips of black or coloured *passe partout*, the kind with a grained finish. The Bentley's headlamps were the ends cut from the rubber bulbs of "Ephedrine" droppers, with wire rims and gauze stoneguards, and the twin klaxons were small brass wood screws with the heads cut off, screwed into short lengths of dowel.

One final word. Do not attempt to paint letters or racing numbers by hand. The model shops sell transfers in all sizes which add greatly to the look of the job.

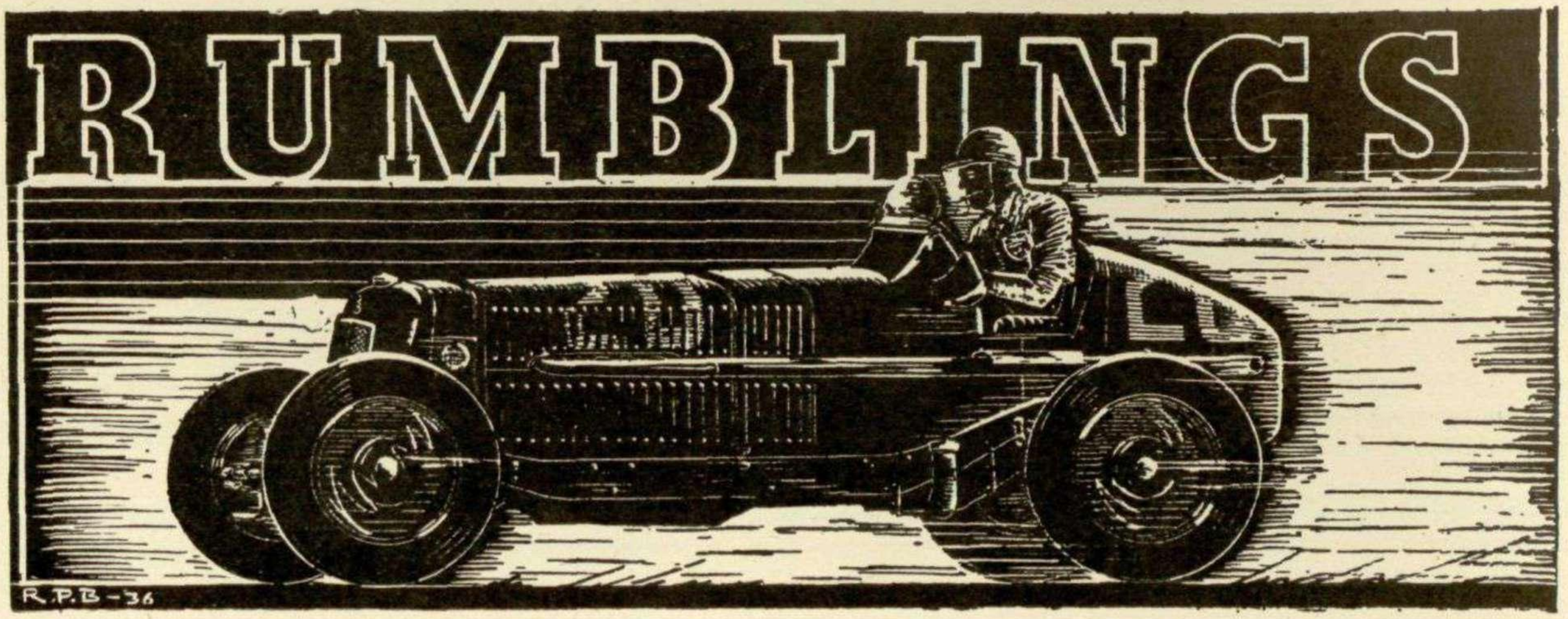
There is much to be said for building to a single scale, and choosing subjects to a plan. Thus a collection of one marque, or a historical series of Grand Prix types or Outer Circuit cars, can be built up progressively, which will be easy to house and ten times more interesting than a scrap-book in later years. One of the writer's unrealised ambitions is to own a complete collection of 200-Mile Race competitors, in miniature, if ever sufficient data could be collected.

Enough has been said to show that no great skill or cash outlay is necessary to construct these intriguing models, at least to one's own satisfaction, if not to exhibition standards, and photographic fans will find they open up a new avenue for table-top photography with a motoring flavour. It is greatly to be hoped that some attention will be given to this branch of modelling by the newly-formed British Model Car Club, and that a corner might be found in MOTOR SPORT to depict readers' efforts from time to time.—G. H. D.

OUT OF PRINT

To avoid unnecessary correspondence, those subscribers desiring back numbers are informed that the following issues are unobtainable :—

1924 : June, July, Aug., Sept., Oct., Nov., Dec. ; **1925 :** Feb., April, Aug. ; **1926 :** Aug., Sept., Oct. ; **1927 :** April, June ; **1928 :** Jan., Feb., Mar., April, May, June, July, Sept., Dec. ; **1929 :** Jan., Feb., Mar., April, June, July, Aug., Sept., Oct., Nov. ; **1930 :** Mar., June, July, Aug., Oct., Dec. ; **1931 :** Jan., Mar., July, Nov. ; **1932 :** Jan., Mar., May, July, Aug., Oct. ; **1933 :** Jan., May, June, Aug., Nov. ; **1934 :** Jan. ; **1935 :** Mar., May, Sept., Oct., Dec. ; **1936 :** Jan., April ; **1937 :** April, May ; **1938 :** July, Nov. ; **1940 :** Feb., Sept., Oct. ; **1941 :** Sept. ; **1943 :** July, Oct., Nov. ; **1945 :** Mar., April.



Wanted—A Utility Sports Car

Taxation of the over-burdened (*i.e.*, the motorist) is to remain stable for some time to come. The German war may be over by the time these words appear. Enthusiasts, many of them returning from the Forces, will be eager to resume sports-car motoring and many will be able to do so. But they have a not inconsiderable problem to face. The cost of living will be high—sufficiently high to depress those whose war-time occupations have ceased and to discourage casual expenditure of gratuities. Tyres will be difficult to buy and expensive. Secondhand car prices have risen to absurd levels. Even now seven-year-old cars fetch twice their cost when new, vintage sports cars command four and five times pre-war prices and, just recently, even the really old second-handers are priced at upwards of £40, when once the owners would have gladly accepted a "tenner." It seems almost impossible to obtain anything which works, and has soundish tyres, for under £50. The impecunious enthusiast will, more than ever before, have to devise his own sports car. We once suggested a three-car stable as being an excellent means of embracing a wide variety of motoring at minimum expense. The plot was to own a saloon, a sports 2-seater and a trials car, all of the same make, for which tyres and spares would be interchangeable, the saloon being taxed continuously, but the trials car only in the winter and the 2-seater only during the summer. There still seems much to be said for this scheme, even if modified to a two-car stable embracing, perhaps, an open and a closed car.

In buying his post-war car the impecunious enthusiast will do well to choose something which is in fairly wide supply, so that eventually he can add a second car for which wheels and various parts will be interchangeable. Austin Seven, Riley Nine, early Morris Minor and M.G., etc., come to mind. Certainly it is worth while to consider how easily the main components of a range of models interchange one with another—the Alvis is notable in this respect—as ownership of two cars can be a means of "keeping motoring," while still spending enough time in the workshop to eventually produce something worth while from the unpromising and depleted stock found at present-day dealers and breakers. However, this is not the sole solution to a problem that will confront many enthusiasts any day now. Not all of us have workshop facilities. Not everyone wants to own an out-of-date car, especially if it smacks of a "boy's motor car," because it has had to be contrived from an oddment of parts or from a poor basis.

Everyone will not be able to buy new sports cars, especially at post-war prices. The sports cars which really sold in any numbers before the war—T-type M.G. and "4/4" Morgan—cost under £250 new. With the higher cost of living and general disruption which the war has caused, half this price will probably be all that many people will be prepared to spend. And it will be quite impossible, for many years yet, to produce *utility* cars at this figure, let alone brisk, well-handling sports cars. If the prospective sports-car owner is not the sort to enthuse over an indifferent, secondhand vintage car, which way can he turn? The answer is: at present, nowhere. But the question we would put to the Trade, particularly to persons like Peter Monkhouse, Sidney Allard, L. M. Ballamy and others who have helped the enthusiast to motor properly in the past, is: "Can a 'utility' sports car be developed from existing parts?" The requirements would seem to be a maximum R.A.C. h.p. of eight or ten; a respectable, if simple, 2/4-seater open body; reasonable, if not sensational, steering and road-holding; a maximum of 70–75 m.p.h.; a fuel consumption of around 35 m.p.g., and, most essential of all, an engine which would retain its tune and remain dependable over big mileages. Spares should be readily available and the cost as low as possible. Can it be done? We cannot supply the complete answer. But we *can* observe that engines like the Ford Ten function very well and give a power output which would result in quite decent performance in a car weighing, say, 8 or 9 cwt. Unfortunately, the later Fords have combined body and chassis structure, which virtually precludes open bodywork and weight reduction. This is tantalising, because the original Ford Ten saloon weighed 15½ cwt., and the weekly Press credited it with nearly 70 m.p.h. Nigel Orlebar

has advocated a Ford Eight engine in an Austin Seven chassis for amateur sprint-work or racing, and something on these lines might be the basis of a road car, although braking and roadholding would constitute a pretty pother.

Then one has not forgotten the successful trials exploits of Paul Meyrat with his bored-out L.M.B. Ford Eight saloon. Incidentally, a "Ten" engine replaces the "Eight" in a Ford Chassis without necessity for any alterations, and the weight increase involved is a mere 8 lb. in respect of the engine and an additional 3 lb. in the gearbox department, the early 10-h.p. engine/gearbox unit turning the scales at 202 lb. The solution to the utility sports-car problem seems at times to be just around the corner, but how difficult is this corner to negotiate we must leave to experts in the Trade.

Certainly there would seem to be two lines of approach. One would be to lay in a stock of used cars of the type ultimately decided on as the basis of conversion, and to overhaul such chassis before carrying out alterations, as Haining intended to do with "12/50" Alvis. This would probably put up the cost prohibitively. As so many people buy secondhand sports cars and use them without troubling to fit new kingpins, or propeller-shaft universals or even new tyres, or to rebore the engine, it can be argued that it would be satisfactory to allow the customer to submit his own car of the specified type for conversion, on the understanding that he took full responsibility for snags arising due to poor mechanical condition. It might be that a firm would feel that, even so, its name would be too closely associated with indifferent machinery and that it would be wiser merely to get out a design for a utility sports car and to supply the components needed to construct it—as blower sets for popular cars could be bought before the war, and as Ballamy offered a simple means of cornering more securely on transverse suspenders. Certainly the introduction of a sound utility sports car, composed of secondhand parts and with a simple, open body shell, would be welcomed by many, and we do not think the instigators would lose money on the project.

* * *

Ban the Hun?

Just lately people have been debating whether German drivers should be excluded from any international racing which happens post-war, or whether, as in art and music, politics should not interfere with the Sport. Our own feelings on this matter have, we frankly confess, been materially influenced by the reports of German atrocities. The individual German may have had no association with the fearful, completely uncivilised happenings in German concentration camps, but, nevertheless, it is difficult to see how such atrocities can ever be forgotten. Who will want to cheer to victory, and congratulate, a man whose country on the one hand builds unequalled racing motor cars, but on the other, resorts to deeds so foul that it is with difficulty that one realises they have happened in our time—and would be happening still if we had not won the war? It is possible that the national memory will be short-lived and that we shall forget—but it is improbable; and it will be to our ultimate disadvantage if we do forget. Germany must be prevented for all time from promoting another war, so it is unlikely that Mercédès-Benz and Auto-Union will ever again be in a position to build racing cars regardless of cost. It is hard to have to support such a wish, but it is a question of humanity before the selfish interests of motor-racing enthusiasts. However, we fail to see why the yardstick-value of the 1½-litre and 3-litre Mercédès-Benz and Auto-Union cars should be lost. If such cars are discovered by the Allies intact in safe storage, by all means let us press for them to be brought over here and raced by British drivers. We shall then have the pleasure of again watching such perfect machinery racing round Donington without having to congratulate a driver who knows that his place in the cockpit is not so indirectly connected with visions of world domination as he hopes we will believe.

Announcement

"MARSHALL" SUPERCHARGERS

SIR GEORGE GODFREY AND PARTNERS LTD. of Hampton Road, Hanworth, Middlesex, are glad to announce that they are about to recommence the production of their famous "Marshall" Blowers for all types of cars.

When the full story of the "Marshall" war effort can be released, we shall be able to publish some startling increases in efficiencies, brought about by war-time research.

A priority order list is now being established, and details covering standardised sets and prices will follow.

WE HEAR

Lt. Ames, R.N.V.R., contemplates following in Cyril Peacock's footsteps and trying to find a 27-h.p. Hispano-Suiza for post-war motoring. He reports meeting Mountjoy, who used to race M.G.s, in India, and believes Comdr. C. R. Whitcroft to be in Ceylon. F. W. Roberts is also restoring a "Hyper" Lea-Francis. Cpl. C. P. M. Green has added an unblown "Ulster" Austin Seven to his stable, which includes the sprint G.N. "Grasshopper," a G.P. Amilcar, and sundry Salmsons. He recently attended the Belfast "Brains Trust," but reports that the only interesting cars which he saw in Ireland were a 3-litre Bentley and a modern Alvis saloon. Alan Shipley, tiring of his 1937 Singer Le Mans 4-seater, has acquired a 1930 T.T. "Hyper" Lea-Francis with No. 8 Cozette supercharger, which he is now in process of overhauling. V. N. Scott proposes to install a 2-stroke 3SM Scott engine in a T-type M.G. he is modifying and rebuilding. H. J. N. Turner seeks a large vintage sports car, and says that an R.A.F. colleague has acquired an old 1½-litre supercharged Mercédès chassis, which had lain in a barn on a Wiltshire farm for many years, but which now motors very well. He would be interested in joint ownership of an old sports car with a fellow enthusiast. Birkett hoped to have had his Type 30 Bugatti functioning ere now. K. N. Hutchison has bought a farmer.

The post-war Allard is likely to be a most interesting motor-car. H. L. Biggs has given up his Fiat "500" and is now using a 1937 open Austin Seven. Macdermid is now a Commander, and has left for India. He spent his embarkation leave at his mother's house at Sidmouth, reading two years' back numbers of MOTOR SPORT. F/Lt. T. A. D. Crook has had a spell in hospital, but has managed to stable a very nice Type 320 B.M.W. and a 2-litre A.C. drophead coupé, beside the famous "2.9" Alfa-Romeo, ex-Thomas 328 B.M.W., and 1,100-c.c. Fiat. Graham Dix has acquired an open 1930 twin-cam 1¾-litre Alfa-Romeo. Congratulations to Hubert Hardy on his recent marriage. Shapley has his R-type M.G. and a Type 57 Bugatti stored, and uses a Lancia "Aprilia." Stuart Wilton motors these days in a Renault "Eight," but seeks something which will open, like a D.K.W., and also a car for post-war sports car races. There is a rough, open "12/50" Alvis 4-seater for sale for about £20 in London, with six sound tyres and two hoods, and we know of a good rear-engined Trojan tourer for £35, a Clyno for £12, and a sound Morris-Cowley 1925 saloon, with good tyres, for £20. J. A. Cooper is sharing with Bill Gibson a 4-cylinder Amilcar with o.h.v. conversion, said to have been raced by Noel Jupp in the 1929 "500." He might dispose of it to a kind home. Baldwin-Teleki, in the Army, saw many early motor-cycles in Italy, and knows of a 1915 Triumph for sale in Ireland. He is seeking a "30/98."

Club News

★

R.S.M.C.

The Robin Sporting Motor Club was formed in 1921, but has been dormant since the outbreak of war. It is now becoming active again and is holding social meetings and technical discussions at the "Hand and Spear," Weybridge, members being drawn from about a 20-mile radius of Weybridge. Motor-cycle as well as car enthusiasts are catered for, and full particulars are available from the secretary, J. D. Hanman, "Cheltenham," Woburn Hill, Addlestone, Surrey.

★

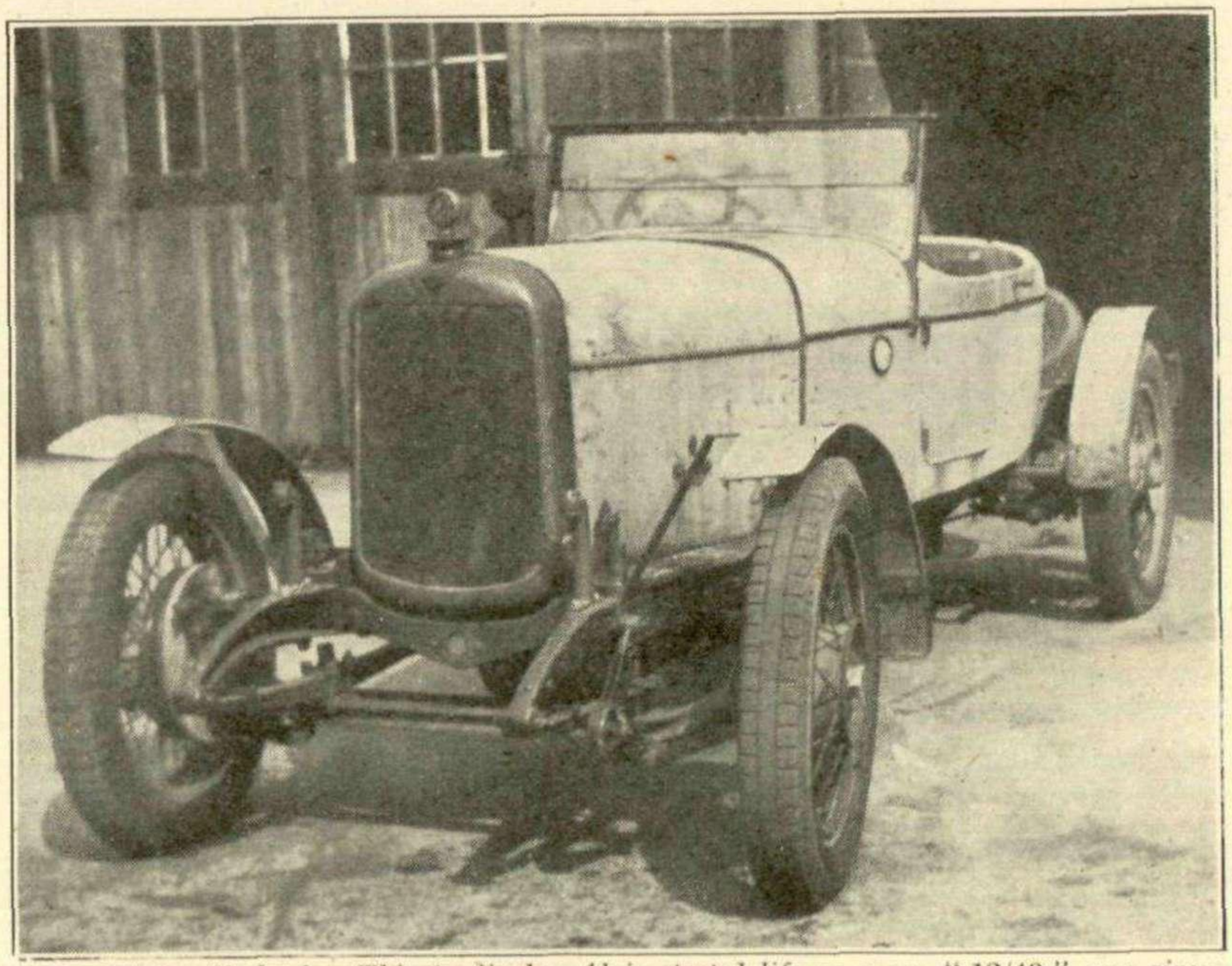
W. & D.M.C. AND L.C.C.

The Watford and District Motor Cycle and Light Car Club, formed towards the end of 1944, now holds regular meetings at the "King's Head," Watford, at 7.30 p.m. on the first Wednesday of each month, at which discussions, "brains trusts," lectures, film shows, and social activities occur. Membership is open to motor-cycle and car enthusiasts in all the southern counties, and motor-cycle and car members are about equally represented on the committee. Later on trials, rallies and more ambitious events, together with events of interest to the family motorist, will be planned. Secretary, D. A. Wilcocks, The Cottage, Fair Way, St. Albans, Herts.

★

B.M.C.C.

The British Model Car Club held another meeting on April 8th, in London. Cruickshank's M.G. lapped at 45–47 m.p.h. with an experimental silencer intended to limit its speed, as the track is too rough for faster motoring. Curwen's Curwen-Special crashed badly after covering five laps at about 55 m.p.h., due to the pole moving. It broke loose, hit an iron stand and was flung against a brick wall, suffering considerable damage, although the engine and f.w.d. unit appeared to have escaped. Weaver's E.R.A. was run-up in the pits, but wasn't ready to go on the track, but Russell's S.S. "100," Wright's Wright-Special (in chassis form), Gascoigne's M.G. and Morgan's Ohlsonn-engined Morgan-Special, all came out. The last-named car weighs only 3¾ lb. less batteries, and lapped at around 30 m.p.h. During the lunch hour the extraordinary general meeting was held, attended by 14 members, with D. A. Russell in the chair. It was unanimously approved that two car types be recognised by the club, "orthodox" and "open," the first being "a model such that the general public would recognise as a car," and "not have the engine or other mechanical parts projecting beyond the profile of the bodywork (except such parts as project in normal full-size practice)." All other models would automatically come in the "open" class. This we consider to be a retrograde move. *All* models, surely, should be such that the general public would recognise them as car-models, otherwise we shall get horrid powered-trucks such as disgraced the clockwork car races held before the war at the Metropolis Garage. A far better recommendation would be for the classes to comprise scale-models and non-scale-models, the first to include models based on a particular prototype, and the second for remaining models, albeit these should conform to full-size dimensioning of track, wheelbase and tyre size. We hope the club will reconsider its decision on this matter—even



"12/50" Duck's-back.—This particular Alvis started life as a s.v. "12/40," was given an o.h.v. "12/50" engine by Lacy, rebuilt by Jenkinson for Boddy with an engine from Needel's special "12/50," and afterwards sold to Axel-Berg. Quite recently it was sold to a Flt./Lt. who drove it from Hampshire to Scotland, and has promised us an account of the journey.

if the fitting of apparently streamline bodies does slow the models. Otherwise this club is doing excellent work for the model-car movement. Hon. secretary, J. Gascoigne, 91, Stamford Court, London, W.6.

★

COVER PICTURE

This month's cover picture depicts more of the sort of thing we hope to be able to enjoy again fairly soon—after the Jap is vanquished. The scene is Donington Park in England. Car No. 27 is J. H. T. Smith's M.G. Magnette, and we believe No. 24 is Peter Whithead's 1,100-c.c. Alta. Happy days!

★

N.L.E.C.C.

The April meeting of the North London Enthusiasts' Car Club saw some 30 members gathered together to listen to F. J. Findon, editor of *The Light Car*, deliver a very informative talk on "A Marshal's Job." On June 15th another meeting will be held at John Keble Small Hall, Deans Lane, Edgware, at 7.30 p.m., when a talk on sports cars for the impecunious will be given—a topical subject. Hon. secretary, G. Bance, 15, King's Drive, Muswell Hill, N.10.

★

750 CLUB

In last month's issue we published correspondence that has passed between the present secretary, S. H. Capon, and W. Boddy, who originated this club, on the subject of reviving its activities. Since then nothing further has been heard from Capon, so it can be assumed that it is not his intention to take any part in reviving the club at the present time. This being the case, Boddy and Mallock would like to hear from existing members direct, with a view to establishing contact and deciding whether it will be possible to re-issue club bulletins. Will those concerned please send their names and addresses to W. Boddy, 123, Bilton Lane, Harrogate, Yorks, stating when they last paid a subscription to the club? It may be possible to issue the *Bulletin* by asking a nominal subscription from members, even if the club duplicator is not available, and if this is so, Mrs. Boddy has kindly offered to keep the membership book and to help generally. If any opposition is forthcoming, F/Lt. Mallock humorously suggests starting a new club, called the 747 Club—the capacity of the Austin Seven, for which it is intended to cater, being, of course, 747 c.c.!

★

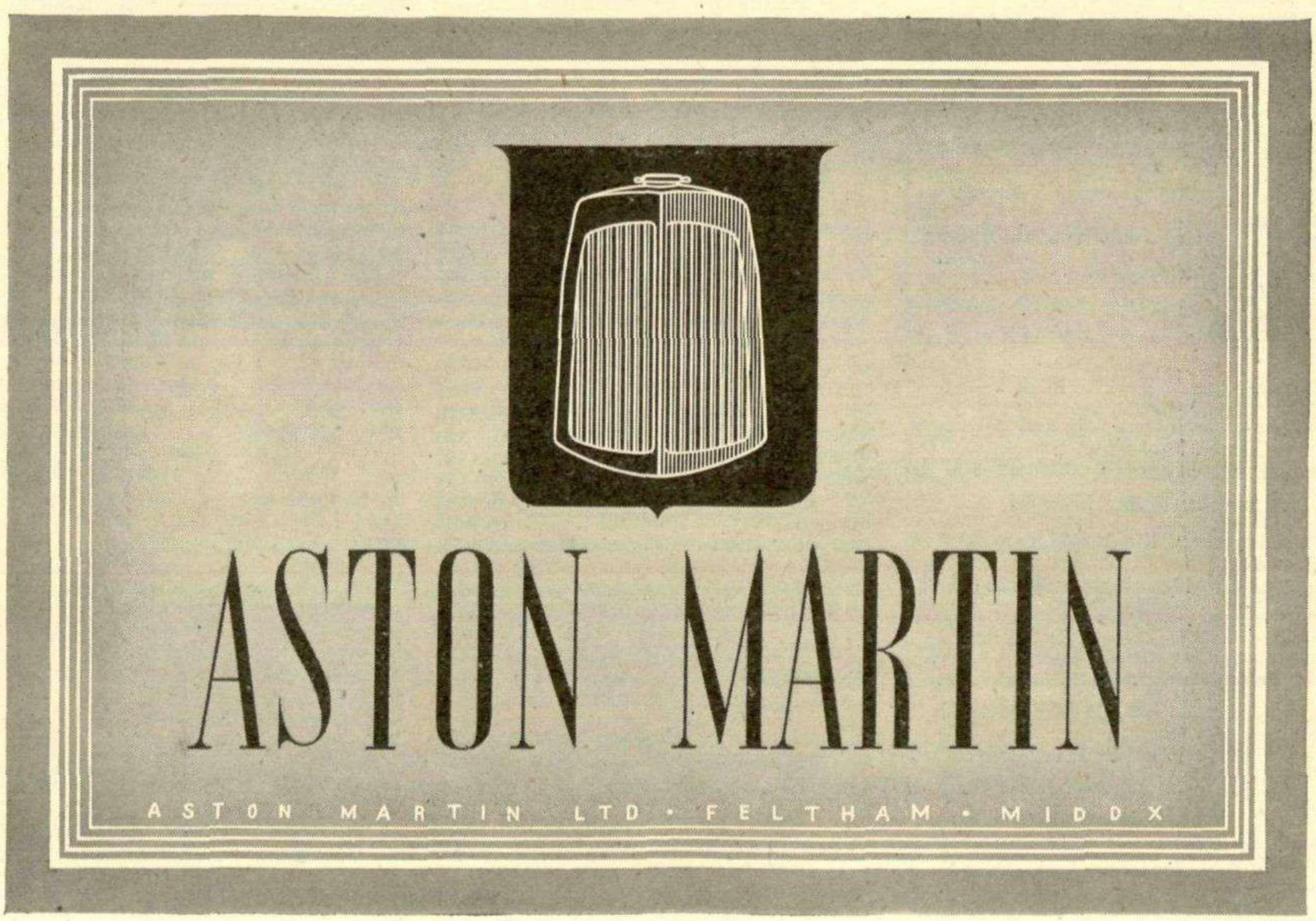
INSTRUCTION BOOK LIBRARY

By the generosity of readers and manufacturers the Library has recently considerably increased its scope. New books cover "4/4" Morgan, Ford Ten, 30-h.p. Ford V8, early 4-cylinder Salmson, Sports and "Le Mans" Singer Nine, and Singer Six "Speed Model," 3½-litr Talbot, etc. Large, stamped envelope *must* be sent when requesting loans.

★

S.C.C. OF A.

The January-February *Sportswagen* is to hand. The Sports Car Club of America celebrated its first birthday on February 26th. Its membership now stands at 67 members with 113 cars, including 22 Mercers, 14 Mercédès, 13 Stutz, 12 Packards, 11 Rolls-Royce and 9 Duesenbergs. At the end of 1944 club funds stood at 94.49 dollars. The *Sportswagen* this time contains excellent photographs of members' "33/180" Mercédès-Benz, Bentley, Mercer, Stutz and Rolls-Royce cars; an article by Frank Mayer on how he took the New York–San Antonio record in 1931 with a 1929 Stutz, "re-babbited after 55,000 miles"; and an effective reprint of an advertisement for the Type 55 Bugatti. Of the Stutz, Mayer writes: "It didn't roll; it glided, for all its 4,600 lb. In traffic, the perfect ratios of its four speeds and its boosted brakes made New York taxi-drivers look like babies. On the road, it walked away from the 106-h.p. Packards and the Chrysler Imperials of the time. It cruised in the middle 70's, and the cut-out door and centre arm rest made 14 hours in the seat as easy as a solo in a feather bed." Secretary, A. H. Engborg, 20, Bedford Street, Lexington, 73, Mass., U.S.A.



RP-188E

Letters from Readers

Sir,

I should like to congratulate S/Ldr. Marris on his article on suspension in the April issue, but there is one statement he makes that I would like to correct.

He says that " When a rapidly rotating wheel is tilted, gyroscopic action introduces a force which tends to oppose tilting." *This is not quite true.* When a rotating wheel is tilted, so as to rotate about a fore-and-aft axis, a torque is produced about an axis mutually at right angles to both this axis and the axis about which the wheel is spinning, that is to say, about the axis of the king-pin. This torque will, of course, tend to affect the steering, but if it is completely resisted, then there will be no torque tending to resist the tilt about the fore-and-aft axis. If, however, the wheel is allowed to turn about the steering axis, due to reversibility of the steering gear, or spring in the steering linkage, there will be a torque produced tending to oppose the tilt of the wheel in bump. If irreversible steering and a well-designed linkage system is used, this effect becomes negligible.

I have never seen any figures for the magnitude of the torque tending to upset the steering for swinging axles in bump, so I thought I would work out an example.

The general formula for gyroscopic torque is $T = I\omega\Omega$, where I is the moment of inertia of the wheel and tyre about its axle, ω is the angular velocity of the wheel spinning about its axle, and Ω is the angular velocity about the axis of precession.

If the speed of the car is V ft./sec. and the rolling radius of the wheel is 15 in., then the angular velocity about the axle will be $V\frac{12}{15}$ radians/sec.

If the radius of gyration of the wheel and tyre is 10 in., and the weight 40 lb., then—

$$I = 40 \times \left(\frac{10}{12}\right)^2 = 27.8 \text{ lb. ft.}^2.$$

If the wheel meets a bump, causing it to rise H inch in one foot travel, then the vertical velocity of the wheel will be $\frac{HV}{12}$ ft./sec., assuming it to be uniform. If the length of the swinging axle, from the wheel to the pivot, is 2 ft., then the angular velocity of the wheel will be $\frac{HV}{12 \times 2}$ rad./sec. (Provided that H is small compared with 2 ft.)

Therefore the torque on the steering is—

$$27.8 \times \frac{12}{15} V \times \frac{HV}{24} = 0.927\ HV^2 \text{ poundals ft.}$$

To bring this to lb. ft., we divide by g=32 (approx.)

Therefore the torque $= 0.029HV^2$ lb. ft.

(Incidentally, S/Ldr. Marris's torques should be expressed in lb. in. rather than in lb./in.) [This was a typographical error.—Ed.]

Now, if H=2 in., and V=44 ft./sec.=30 m.p.h., the torque will be $0.029 \times 2 \times 44^2 = 112$ lb. ft., thus it can be seen that the torque, even at this speed, is by no means negligible, but if the speed is raised to 90 m.p.h., the torque will become 1,000 lb. ft. approx. This means that if the steering arm is 9 in. long, there will be a force applied to the end of the track rod of about 150 lb. at 30 m.p.h., and about 1,300 lb., or over half-a-ton, at 90 m.p.h.

Now let us assume that we have irreversible steering, but that there is some spring in the steering linkage, so that a torque of 100 lb. ft. on the wheel causes an angular movement of 0.005 radian, which is reasonable. That is to say, the angular rate of the wheel in the steering plane is 20,000 lb. ft./radian. (Analogous to the vertical rate of the suspension spring.)

Assuming that the wheel takes the same time to turn about the steering axis as it does to turn about the bump axis, then the mean angular velocity about the steering axis, at 30 m.p.h., will be $\frac{112V}{20,000}$ for the given bump. (This is not strictly true, but will be good enough to give the right order of answer.)

Then torque on wheel tending to oppose bump $= 27.8 \times \frac{12}{15} V \times \frac{112V}{20,000} \times \frac{1}{32} = 0.0039V^2$ lb. ft.

Therefore resistive force at the wheel $= \frac{0.0039}{2} \times (44)^2 = 3.8$ lb.

Now the force necessary to accelerate the mass of the wheel and tyre vertically, due to its inertia, will be about

$$40 \times \frac{(44)^2}{3} \times \frac{1}{32} = 800 \text{ lb.}$$

This force will be almost independent of the type of i.f.s., and so the extra force due to the gyroscopic effects of the swinging axle is only equivalent to increasing the mass of the wheel and tyre to

$$40\left(1 + \frac{3.8}{800}40\right) = 40.19 \text{ lb.}$$

Throughout the above, the weight of the brakes, axle and so on has been neglected, and several approximations have been made, but I think it goes to show that with swinging axle front suspension the kick on the steering when going over a bump is very considerable, so as to rule out the system for high speeds, and that the apparent increase in unsprung weight is very small unless there is excessive spring or reversibility in the steering.

I am, Yours, etc.,
MICHAEL CROWLEY MILLING.

Spode Green,
Cheshire.

[We have received many letters expressing appreciation of S/Ldr. Marris's article. —Ed.]

* * *

Sir,

The racy-looking, but not, I think, very fast " Continental Road-Equipped Special " seen in the picture on page 72 of the April issue, is called, believe it or not, a " Poloka-Skol."

I saw it standing outside the head post-office in Sheffield, Yorks, some time before September, 1938. It was painted a bright red, and the following few details, I remember, helped by a rough sketch I took of the thing at the time.

Overall height and ground clearance about the same as a 4½ Invicta, wheelbase somewhat longer than the short-chassis " 100 m.p.h." job by the same firm. Engine appeared to be a very tame Yankee-looking straight-six or eight side-valve of between 3 and 4 litres.

I concentrated mainly on the driving side, which is the opposite side to that shown in the picture. I am afraid I *cannot explain the large air scoop in the* side of the bonnet, unless it be to keep the passengers' legs cool, as there most certainly was no bulkhead between the engine and the " office." The gauge seen on the scuttle is to record temperature of the oil tank mounted there. Gear-change was by short lever in a visible gate (4-speed), but whether the "swopper" was mounted centrally or outside I forget. Behind the " office " came the usual slab tank with spare wheel mounted on it.

Later in the day I saw it motoring out of Sheffield in a south-westerly direction, the exhaust emitting many more phons than the very modest speed allowed.

It is rather a coincidence that I spotted your picture when travelling to Sheffield once again in one of the British railways' horrible alternative means of transport.

I must say Motor Sport is managing to keep up a really excellent standard, the only thing I do not like being the occasional slightly derogatory cracks about motor-cycles. Take £80 worth of motor-cycle in the shape of a Tiger " 100 " Triumph and see if there's anything costing under £800 in the 4-wheel world to touch it on acceleration up to 70. Or match a Vincent H.R.D. " Rapide " against a " 2.9 " Alfa-Romeo for a standing ½-mile, and I am afraid the latter would get rather left, for all its eight pots plus " promoter."

I am, Yours, etc.,
ALAN T. SAYERS.

Dagenham, Essex.

* * *

Sir,

I am intrigued with your review of my book " Wheelspin," particularly the suggestion for more careful editing. In this connection may I draw your attention to a paragraph at the foot of the same page, and also ask you to count up the number of photographs again !

Forgive my having a " dig " at you, but you do lay yourself wide open. [Agreed !—Ed.] Anyway, thanks for the nice remarks, which seem to be in excess of the criticisms.

You were a bit hard about the " bleeding knuckles " ; I know you review the book from the point of view of the informed enthusiast, and had the work been written for publication only in a specialised paper, a lot of this stuff would

have been left out, including the first three or four pages. But as this was a book for the open market the publishers pressed particularly for "human interest" stuff. Even if dramatic, the description was not an exaggeration; that is why the incident has remained so clearly in my mind after so many years.

I still stick to my observations about Widlake. Speed is mostly relative, and Brooklands is a big place with lots of space round it. On the few occasions that I have driven there I have been surprised, even disappointed, how *relatively* slow 100 m.p.h. seems. Widlake is narrow, extremely rough, has a high bank on the off side, and a tree-lined drop on the near side and ruts tend to take charge of the steering, added to which rear tyre pressures were usually reduced to under 10 lb.

As regards the "knobs" I can only claim "poetic licence"; sorry!

A second edition is already being printed, but there will be no index because of paper and print and labour problems. I should have liked one, and some more photographs.

I am, Yours, etc.,
C. A. N. MAY.

Alvechurch, Worcs.

[It isn't so much how fast a car appears to be going up Widlake/around Brooklands, as how *relatively* unpleasant seems the possibility of going over the edge, and the probable consequences thereof!—ED.]

* * *

Sir,

With reference to your soft, whispering response to the N.L.E.C.C.'s journal-leader, of which I am the author, I would make three comments:—

(1) The N.L.E.C.C. does not cater intentionally for policemen—mobile or otherwise. (2) We claim close acquaintance with the "ordinary" Riley, travelling at speeds less than those favoured by Mr. Frederick Dixon. (3) I own an Alvis, and mine wheezes, if yours doesn't!

In conclusion, my congratulations on your publication. It certainly gets right down to the spirit of motoring, and articles such as "Breadline Motoring" and "Enthusiastus Extinctus" are superb.

May you continue to receive the support you deserve.

I am, Yours, etc.,
DENIS R. PHILLIPS,
(Hon. Treas., N.L.E.C.C.)

London, N.8.

* * *

Sir,

Allow me to associate myself wholeheartedly with Tony Rolt's trenchant article in your March issue on "The Ethics of the Quality Car." I fear it is too optimistic to hope that either the Industry or car users generally will take much notice. During the past couple of years I have splashed a number of polemics in your weekly contemporaries with much the same object in mind and on much the same theme, but the response has been disappointing. Your anonymous contributor in the February issue, dealing with the sinister influence of our lady friends on car design, suggests at least one plausible reason. Conscienceless publicity playing on the generally low standard of popular taste and mechanical appreciation is another.

But there must be a large body of non-vocal enthusiasts. Is there really no demand among them for reasonably-priced quality cars on which everything *does* something (no birdcages, chromium streaks, fairings that conceal but do not protect) and is accessible without grovelling or recourse to tin-openers? I imagine there is; and I believe that given the facilities I could produce such a car, and that as a sideline for a large firm it would more than repay in prestige any possible losses of money in production.

Meanwhile, those enthusiasts who are less fortunate in their choice of a mate than I have been had better make the most of what is left from the Vintage Era and take comfort from that classic aphorism: "*Varium et mutabile semper femina*, but a good car will always give you a ride."

I am, Yours, etc.,
J. R. EDISBURY.

Bebington, Cheshire.

* * *

Sir,

As one who has never found any fascination in the very small, high-revving, highly and usually over-stressed engine, I wonder, after reading Captain Moon's informative article on the Austin "Nippy," just where lies this fascination.

On his own showing he and other owners of the type were seldom out of trouble, or could ever hope to be. All the "Nippies" he has ever known "suffer from the frequent loss of big-ends and have the main bearing races work loose on the crank . . . it is advisable to lift the head and re-grind the exhaust valves every thousand miles," and so on.

Finally, even putting up with all this, and after a tremendous amount of hard work, the resultant performance is admitted to be negligible.

Then, again, if we turn to C. A. N. May's entertaining book we find the small M.G. brigade as often in mechanical trouble as out of it. True they were savaging their cars, but what is the use of a sports car if it cannot be used for sport without perpetual breakage?

Their only advantage seems to be that, on paper, they are economical *when they are running*, but does the few pounds a year saved in petrol, tax and insurance really add up to the cost and inconvenience of continually having the device in pieces? I doubt it.

In the halcyon pre-war years, before the motor Trade became the province of pseudo enthusiastic get-rich-quick speculators, one could buy a 2-litre Lagonda, "12/50" Alvis, old-time Lea-Francis or similar, for considerably less than a sports Austin or M.G., and drive the thing indefinitely with no trouble, superior performance and all the advantages of a larger car—and no one *really* prefers a small car, do they?

This, dear Editor, is written in no spirit of carping criticism, but from a genuine desire to discover just what is this something that can arouse enthusiasm of the calibre of the 750 Club; for, if the Chancellor of the Exchequer continues on his dreary way, quite a few of us had better start finding out.

I am, Yours, etc.,
ANTHONY PHELPS.

Liverpool, 19.

READERS' SALES AND WANTS

To meet the repeated demands for something on the lines of the old Spare Parts Announcements, we have instituted a system of inexpensive advertisements. Each announcement must be limited to twelve words, plus the advertiser's sufficient postal address, and the charge will be 1s. 6d. per announcement, payable at time of posting.

FOR SALE

GRAND PRIX BUGATTI SPARES AND SERVICE
F. O. CLEVELAND HARMER
Bugatti Specialist
83, Old Oak Road, Acton, W.3
Shepherds Bush 5022

6-IN. Rev. Counter and 6-in. Speedo and Clock, Jaeger, £5 pair, or separate. Riley Nine c/wheels and pinion, 6–1, 5½–1, 1933 onwards, £3 each. C. Garlick, 61, Leighton Road, London, N.W.5.

PAIR 140 by 40 R.L.P. Michelins (good condition), tubes, knock-on wheels (need painting), £5. 79a, Bromley Common, Kent.

1933 Hornet Special, all parts for sale. Wanted, low-type Riley Nine radiator. 79a, Bromley Common, Kent.

£25. 1926 8.9-h.p. Grand Sport Amilcar (open 2-seater). Good running order, ready to drive away. 50, Trafalgar Street, Healey, Batley.

TALBOT "10/23" 2/4-seater, excellent condition, but requires small repairs, £17 10s. Kimber, 17, Abbey Road, Darlington.

COMPLETE front axle for supercharged "1750" Alfa-Romeo. Large finned drums, £5. L. Good, 26, Somerset Waye, Heston, Middlesex.

DELAGE D.I. model, D.H. coupé, cracked block, good chassis and appearance, £15. D. F. Ward, 6, Arcadia Avenue, Bournemouth.

150-c.c. New Imperial, rebored, new tyres and bearings, 18-in. Brooklands wheel, electric drill. 'Phone Pollards 4385.

12-v. Delco horn, two 5.50 by 20 Dunlops and tubes, good. "Full Throttle," "Motor Racing and Record Breaking." 'Phone Pollards 4385.

RILEY Nine: B.T.H. magneto, £4 10s.; five new chromium hub caps, 35s.; small powerful fog lamp, 35s. 208, Chester Road North, Sutton Coldfield.

P.100 D.B. headlamp, Ford V8 ignition distributor, 4-cyl. mag. for Meadows, etc. All as new. 8a, Warwick Road, Kenilworth.

WANTED

BUGATTI, 1½, 2 or 2.3-litre Grand Prix, complete, or parts for same. F. O. Cleveland Harmer, 83, Old Oak Road, Acton, W.3.

INVICTA 1½-litre engine, unblown, in good condition. S/Ldr. L. Bernstein, R.A.F., Eastbury Park, Northwood, Middx.

MODEL "T" Ford 2-seater, preferably in good condition. Good price paid for suitable car. 86, Radnor Drive, Southport.

ENGINE, not over 2½ litres giving minimum 80 b.h.p. 308, Alcester Road, Moseley, Birmingham.

ULSTER, Nippy, or Speedy parts, or car cheap. BM/LNFB/LONDON/W.C.1.

SALMSON *San Sebastian engine and gearbox.* Leadley, Sunholme, Moira Road, Ashby-de-la-Zouch, Leics.

AUTOCAR or *Motor* from 22/11/44 to date and all subsequent numbers. Banes, Tudor Cottage, Basbury, Nr. Ledbury, Herefordshire.

Spares Section, MOTOR SPORT, 15/17, City Road, London, E.C.1

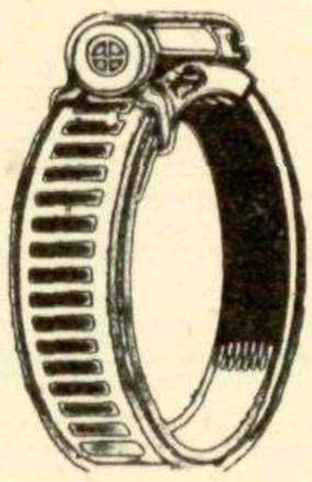
Blakes BOOK

IT'S HERE!
Received with thanks from His Majesty's Government: permission to indulge (sparingly) our joy in victory by purchasing a few gallons of the precious juice that enables us to take the road again "as a free man may do". Boy, oh, boy! (if we may borrow an expression from our allies) what a tinkering and touching-up, what a cleaning and adjusting there's going to be for a while! This little note is just to assure you that if you come up against any problems of repair or adjustment which seem to need a bit of help, we're here to give it. We have the equipment in our shops, and chaps on our staff who have exactly your own affection for high-performance jobs, chaps who take a pride in getting the last ounce out of an engine ... But give us what time you can, won't you? The way it looks to us, there's going to be something of a rush!

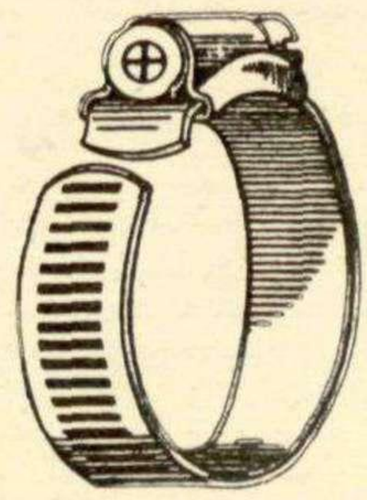
110 BOLD STREET. LIVERPOOL 1: Royal 6622

JUBILEE WORM-DRIVE CLIPS

THE BEST POSSIBLE TO GET



MAKE SURE YOU HAVE THEM FITTED ON YOUR RADIATOR JOINTS, LEATHER COVERS, ON UNIVERSAL JOINTS, AIR, OIL & WATER HOSE JOINTS.



ALL IN ONE PIECE.
EASY TO FIT.

NO PARTS TO LOSE.
GUARANTEED NEVER TO LEAK.

A KEEN MOTORIST WRITES: *"I cannot understand anyone using any other pattern, as yours are the last word in satisfaction and efficiency."*

STOCKED BY ALL GARAGES & ACCESSORY DEALERS

MANUFACTURERS
L. ROBINSON & Co.,
2, London Chambers
GILLINGHAM, KENT.

H·R·G

"1½-LITRE"		"1,100 C.C."	
85 m.p.h., and with same carburetter setting	32 m.p.g.	75 m.p.h., and with same carburetter setting	37 m.p.g.
0-50 m.p.h.	11.0 secs.	0-50 m.p.h.	11.3 secs.
Standing Start, ¼-mile	19.2 secs.	Standing Start, ¼-mile	21.8 secs.

★ **The above figures have been proved many times in events by amateur owners** ★

Extract from "An Owner's Impressions" (*Motor*, 1945):

"The handling of the car is quite remarkably good, and makes it possible to indulge in the sport of baiting the owners of larger and faster cars. On anything but a dead straight road the little H.R.G. is apt to prove very hard to shake off. In the normal course of events it seems to steer itself, with just a little persuasion from two fingers of one hand, while on corners extreme liberties can be taken, the road-holding being quite outstanding."

H.R.G. ENGINEERING CO., LTD., SURBITON, SURREY - - Telephone: Elmbridge 4489

CLASSIFIED ADVERTISEMENT SECTION

Advertisement Offices :
54, BLOOMSBURY STREET, BEDFORD SQUARE, W.C.1
Telephone : MUSeum 0522

RATES (prepaid) 1/3 per line
Minimum 3 lines
6 Words to line
Copy required by 20th of the month

FOR SALE

MONOMARK Service. Permanent London address. Letters redirected. Confidential. 5s. p.a. Royal patronage. Keytag 9d. Write Monomark, BM/MONO6V, W.C.1.

12/50 Alvis open tourer, 1931, wire wheels, rear tank, new hood, £35. "14/75" Alvis sports tourer, original wings, in good running order, needs battery, £40. W.B., 123, Bilton Lane, Harrogate, Yorks.

MAGNETTE N-type, 2-seater body, engine fitted competition modifications, and whole car in most perfect condition. Tyres, hood, and side curtains as new, low mileage. Price £250. Box No. 179, MOTOR SPORT, 15, City Road, E.C.1.

TYPE 37 G.P. Bugatti, rebuilt as new, spare engine, wheels, tyres, etc., fully road-equipped, £400. "Golden Cross," Bath Road, Colnbrook.

ASTON-MARTIN spares, including cylinder block with H.C. pistons, crankshaft, reground, polished and re-balanced with re-metalled rods and mains, also 1½-litre Coventry Climax engine, brand new and unused. Gath, Woodcroft, Brandon, Coventry.

1927 Vauxhall "14/40" tourer. Mechanically perfect, excellent tyres. £50, or exchange something more sporting. Axel-Berg, Beauchamp Court, Alcester.

INMAN special chassis 1,100-c.c. modified "10/23" Talbot, rebored, new bearings, Hepworth pistons. Two heads—original o.h.v. and experimental rotary. Rear tank, Hartford shockers, oversize wire wheels. Described, MOTOR SPORT, December, 1938. Offers, 12, Fairfield Avenue, Twickenham.

M.G. 4-speed E.N.V. gearbox with remote control, £6; M.G. 4-speed J11 gearbox with remote control, £5; M.G. 8/41 crown/pinion assembly, £6 10s.; M.G. "F" Magna engine, complete with special manifold, carbs., polished rods, starter, distributor, dynamo, £10; M.G. Marshall supercharger installation for "P" Midget, £30. Choice of two. M.G. "J11" chassis, axle, springs, brakes, £9; M.G. "F" chassis, axle, springs, brakes, £6. Donald C. Pitt, Rodborough Crest Cottage, Rodborough Common, nr. Stroud, Glos.

NORTON 490 International, completely rebuilt, perfect mechanical condition, excellent tyres and battery. Taxed, £95. Consider exchange. Williamson, Fern Bank, South Milford, Leeds, York.

REASONABLE offers wanted for: starter, dynamo, petrol pump, Solex carb., muff, starting handle, Fiat "1,100" distributor, carb., dynamo, Ford Eight: Solex carb., as new, Standard Eight: Zenith carb., Austin Eight: 3 new 12v. coils. Fairhurst, 90, Birkbeck Road, Enfield, Middx.

BENTLEY 1925 "Red Label" 4-seater. Standard condition except 4.25 axle. Spares include flywheel with perfect starter ring. £150. S/Ldr. W. W. Topper, No. 2 Mess, R.A.F., Woodhall Spa, Lincs.

1936 Austin "Speedy" engine, less manifolds and carburetter, £18; less head, £14; less block pistons, £9; less accessories, £6 10s. Mallock, 3, Pannalash Crescent, Harrogate.

LAYSTALL

for

CRANKSHAFTS

CHARLES FOLLETT
LIMITED

Will always pay top cash prices for really first-class low-mileage second-hand cars of all types.

★

Showroom : **18 BERKELEY STREET W.1**
Mayfair 6266

Service, Works & Stores : 124 King Street, Hammersmith, W.6. Riverside 1413.

FOR SALE—*continued*

1935 Riley Falcon 15-h.p. pre-selector box, complete less body. Ideal base for special, £60. Offers. Box No. 177, MOTOR SPORT, 15, City Road, London, E.C.1.

BLOWER, Roots type, for ten million series 1,750 Alfa-Romeo. Excellent condition. Box No. 178, MOTOR SPORT, 15, City Road, London, E.C.1.

1½-litre, 6-cylinder o.h.c. Invicta engine, complete; also 4-speed gearbox with remote control. Nearest £25. 26, Tontine Street, Blackburn.

WANTED

WANTED TO BUY
CARS OF GOOD MAKE
Low Mileage and Quality ; 1938 upwards
BROOKLAND MOTORS
103, New Bond Street, London, W.1

SPORTS CARS. T. & T. interested in purchase of good sports cars. Thomson & Taylor (Brooklands) Ltd., Portsmouth Road, Cobham, Surrey.

AUSTIN "Ulster" gearbox, 5.625 C.W. and pinion. "Nippy" or "Ulster" inlet manifold. Mallock, 3, Pannalash Crescent, Harrogate.

SPORTS car, any make, mechanically sound, with 20 by 5.50 or 6.00 tyres. Not over 21 h.p. Kramers, Thorington, Saxmundham, Suffolk.

ZAGATO Alfa-Romeo, condition immaterial, must be cheap. Would consider any other sports car except M.G.; preference for Aston-Martin. Full particulars to BM/LNFB/London, W.C.1.

SUPERCHARGER, small Roots pattern T.T. Scott motor-cycle, engine or parts. Experimental purposes. Graham Kirk, Heathside Road, Norwich.

SOLEX downdraught for Austin Seven. Beavis, 5, Tower Hill Works, Witney, Oxon.

8.10-h.p. M.G., Singer, Riley, or similar sports car. Engine must be in perfect condition. Body immaterial. J. Martin, 151, Canterbury Road, N. Harrow, Middx.

WANTED urgently, Riley Imp. 1937 Morgan 4-4, 1934-5 9-h.p. Alta "P" Midget. Reasonable condition. Write, Sgt. Kendrick, 41, Romberg Road, London, S.W.17.

AUSTIN Seven "Ulster" or "Speedy." Any age or condition. State price and particulars. 9, Station Road, Parkgate, Wirral, Ches.

WILL someone please sell copies of MOTOR SPORT Jan., 1940, to Dec., 1941. Highest price given. Major Cliff McCulloch, Stoke Mandeville Hospital, Aylesbury, Bucks.

CONTINENTAL CARS LTD.

Directors : R. E. CLARKE, L. POTTER

SPECIALISTS IN THE UNUSUAL

Streamline 1938 Steyr-Daimler
Bugatti type 57 "Ventoux" coupe, 1935
Bugatti type 57 Berline Airline saloon, 1939
Bugatti type 55 Drop-head two-seater
Bugatti type 57 Foursome Drop-head, 1937

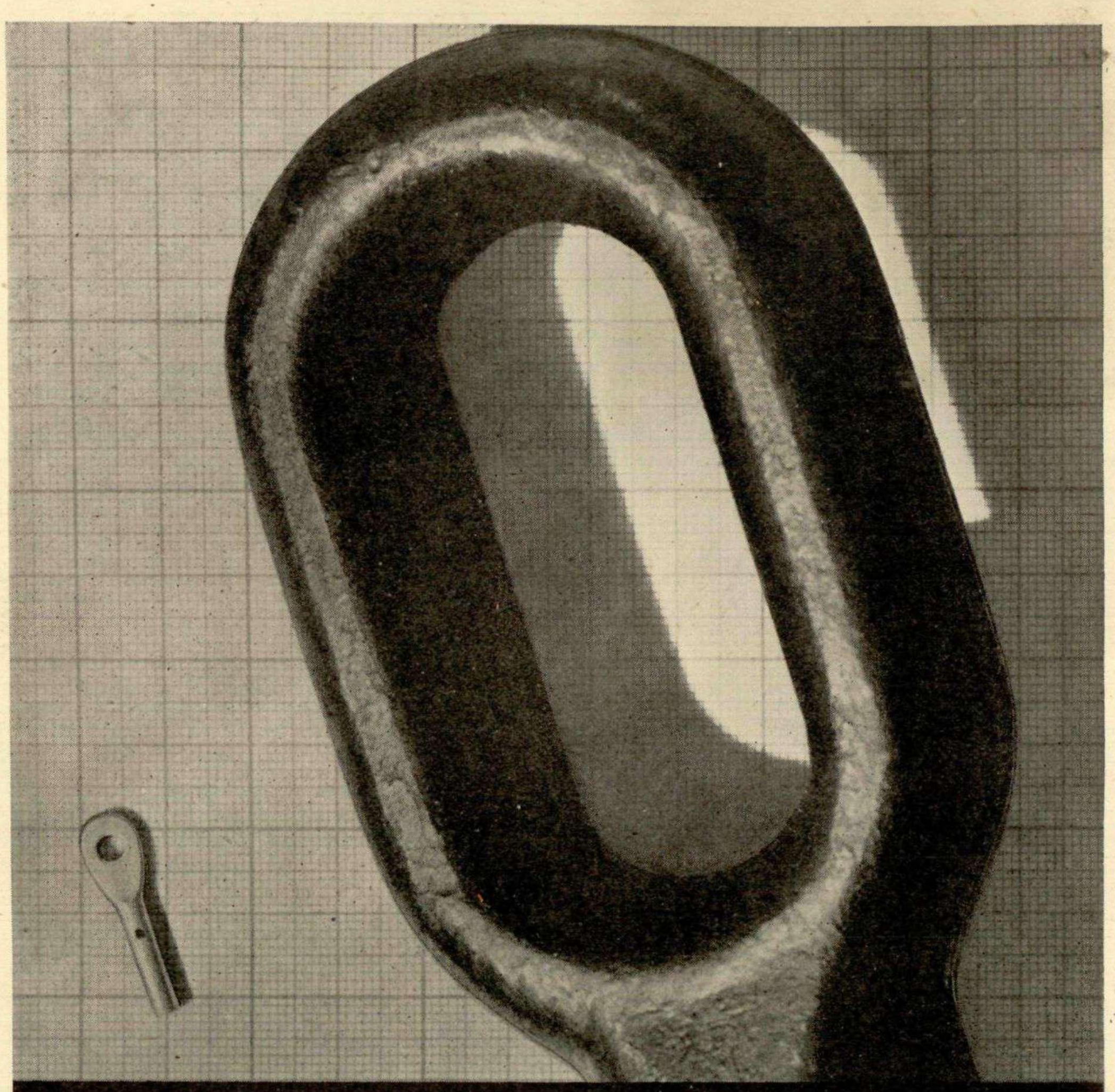
★

Bugatti type 49 Sports Tourer
Bugatti Type 55 Roadster
1941 Registration D.K.W. Saloon
1940 Tatra two-seater
1940 Fiat 1500 Drop-head foursome

Tel.: Chobham 131

Full Stock List on application

CENTRAL GARAGE CHOBHAM, nr. WOKING



A FITTING COMPARISON This photograph (actual size) shows the smallest and largest "TRU-LOC" fittings now on active service. "TRU-LOC" compression fittings and "TRU-LAY" pre-formed wire rope combine to give the strongest, lightest and cheapest cables for aircraft, automobiles, and for numerous other industrial and commercial applications.

B ✳ W ✳ P

The Trade Marks **"TRU-LAY"** & **"TRU-LOC"** *are used for the purpose of indicating that the goods in respect of which they are used are goods complying in all respects with the specifications and directions of the* **AMERICAN CHAIN & CABLE COMPANY, INC.,** *the proprietors of the Trade Marks.*

All enquiries in the United Kingdom & Northern Ireland to:

BRITISH WIRE PRODUCTS LIMITED, WORCESTER ROAD, STOURPORT-ON-SEVERN

Printed by Tee & Whiten and J. Mead, Ltd., 21, City Road, London, E.C.1, and Published by the Teesdale Publishing Co., Ltd., 15/17, City Road, London, E.C.1. Trade Agents for the United Kingdom : Horace Marshall & Son, Ltd., Temple House, Tallis St., London, E.C.4. Agents for Australasia : Gordon & Gotch (Australasia) Ltd.