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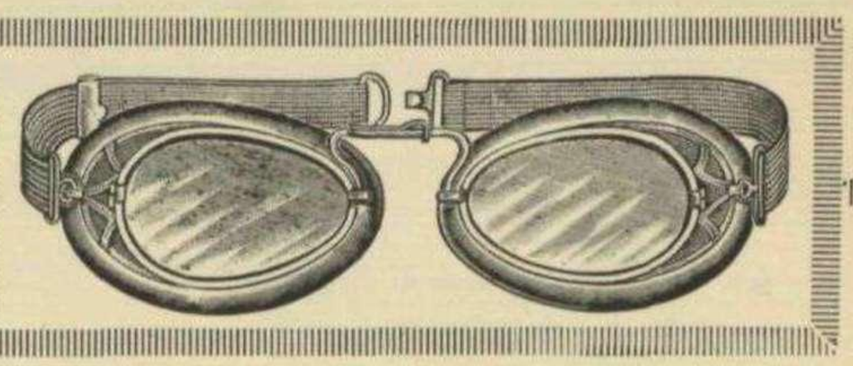
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The BROOKLANDS GAZETTE

No. 9 MARCH, 1925 VOL.

The only Organ devoted entirely to the Sport of Motor Car and Motor Cycle Racing and Competitions.

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CONTENTS.

	PAGE
Editorial Notes	331
The Evolution of the Sporting Car. By LIONEL MARTIN	332–334
The Monte Carlo Automobile Rally (*Illustrations*) ...	334
Motoring Sportsmen: Capt. Malcolm Campbell ...	335–336
With the Hounds on a Motor Cycle. By ARNOLD RADCLYFFE	338–339
The Record Breaking "Lanchester"	340–343
Motor Racing Past and Present (*Illustrations*) ...	344–345
Motor Cycle Speedmen: R. E. Humphreys	346
Facts about Brooklands. By Capt. A. W. PHILLIPS, M.C.	347–348
How Special Camshafts are Made. By F. T. BERSEY, M.I.A.E.	349–351
Sporting Machines on Test: The "680" Zenith. By A.A.R.	352–353
"Hotting-Up" a Standard Model—Part II	354–356
Remedies for Front Wheel Oscillation. By "THE CHARGE HAND"	357–358
Round the Clubs...	359–360

NOTICE TO CONTRIBUTORS.

All contributions, whether literary, artistic or photographic, will be carefully considered by the Editor. A stamped, addressed envelope should be sent with every contribution, and the Editor will endeavour to return all matter he is unable to accept. Neither the Editor nor the proprietors are responsible for the loss of any contributions.

NOTICE TO CLUB SECRETARIES.

Club Secretaries are specially invited to send the Editor paragraphs about the activities of their Clubs, and, in particular, notice of forthcoming events. All reports of competitions, meetings and other events should be sent to the Editor as early as possible, and must be received by the 20th of the month, to ensure attention for the next issue. Address contributions to: The Editor, THE BROOKLANDS GAZETTE, 65, *Victoria Street, London, S.W.*1.

Our Editorial Notes this month must be very brief, thanks to the contributors who have supplied the interesting articles included in this issue. Besides, who wants to read Editorial Notes, anyhow?

* * * *

We have received many interesting communications from correspondents, and thank those who have written to us; but here again pressure on our pages prevents the inclusion of their letters. We hope to devote some space to correspondence in the April issue.

* * * *

The inclusion of the special articles on "The Evolution of the Sporting Car," "Facts about Brooklands," and "How Special Camshafts are Made" will, we feel sure, appeal to many of our readers. They are written by acknowledged authorities on the subjects, and reveal many things which hitherto have been more or less regarded as secret.

* * * *

We understand that the old question of the noise at Brooklands is about to come to a head, for it appears that several Weybridge residents and the St. George's Hill Estate are bringing an action on the grounds that the noise of the racing machines constitutes a public nuisance, and causes deterioration in the value of the property near by. While many motorists will have their views on this particular subject, we will refrain from making any comments at present, but in due course the matter will receive proper attention in our columns.

* * * *

Everything seems to indicate that the 1925 racing season will be one of extraordinary interest, both on the Brooklands and Continental tracks. Club events and hill climbs will attract very large entries. As usual, THE BROOKLANDS GAZETTE will report all events in full.

["THE BROOKLANDS GAZETTE" *will deal with all matters pertaining to motoring sport in all its forms in an impartial manner. Consequently, the Editor does not necessarily associate himself with the opinions expressed by his contributors.*]

THE EVOLUTION OF THE SPORTING CAR.

By LIONEL MARTIN

(Designer of the Aston-Martin Car).

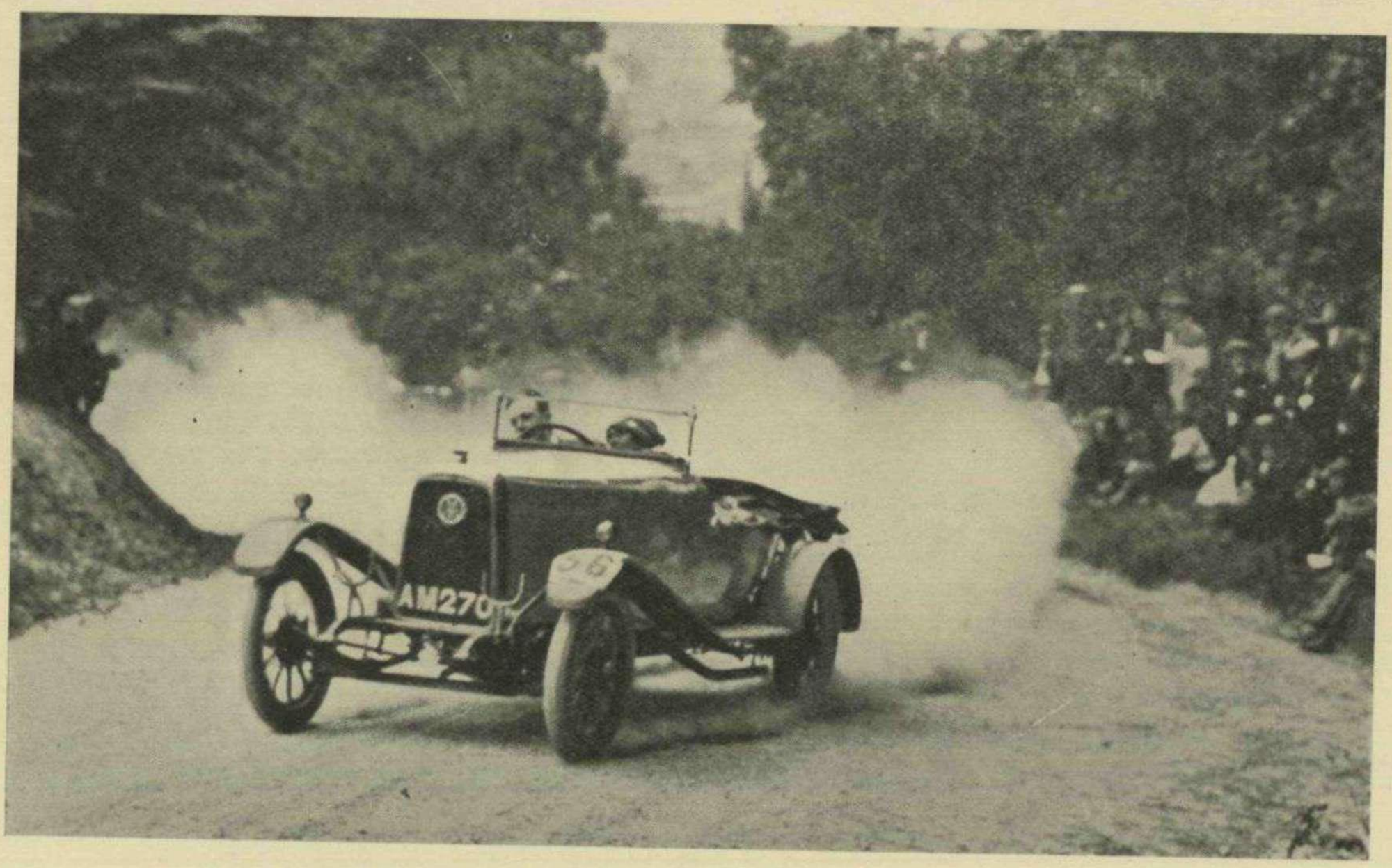
FROM a purely historical point of view the story of the evolution of the sporting car is soon told, as it is a comparatively recent introduction into the world of wheels. Racing cars have undergone various phases of construction since long distance records were first established by vehicles boasting engines of 1½ h.p. There have been huge machines with grotesquely powerful engines, spidery built concerns with safety factors expressed in negative quantities, and all sorts and conditions of machines constructed for the express purpose of annihilating existing speed records. No one would venture to suggest that even the most weird of racing machines failed to have a beneficial influence upon design in some way or another, and while this influence may be traced in the modern sporting car, readers should not fall into the too prevalent impression that a real sporting car is something in the nature of a camouflaged racing machine.

Speed is certainly one of its principal attractions, but whereas the racing car has speed as its main *raison d'etre*, many other qualities are called for in the genuine sporting machine.

Since the year 1914, my firm has been engaged in the production of sporting cars, not on a very extensive scale perhaps, for the simple reason that the market happens to be a small one, and at the request of the Editor I am happy to give my personal views as to the evolution of this particular class of vehicle.

The Advent of the Sports Car.

Looking back to the year 1912, we saw the advent of the Prince Henry type of Vauxhall car, which put up some very remarkable performances for its power. About this time a gentleman required a very powerful but comparatively small engine for use in a hydroplane, and, purchasing a Prince Henry Vauxhall engine, proceeded to doctor it. The cylinders were bored out to 98 mm., various reciprocating parts were lightened and the increase of power was so remarkable that this engine was taken by the Vauxhall Company as a model upon which the now famous 30–98 was built. In the year 1913 the 30–98 achieved many successes in competitions, and in the following year was introduced as a sporting model—the first genuine sporting model to be placed in the hands of the public.



An Aston-Martin Touring Car on South Harting Hill in J.C.C. Event.

This particular car, though eminently successful, could only be placed on the market at a comparatively high figure, and it therefore became a matter of interest to see whether examples of smaller cars could not be treated so as to enhance their normal performances. At this time the number of competitions open to small cars exceeded those for which larger vehicles were eligible, and my attention became centred in changing the habits of an ordinary 10 h.p. Singer. At first this particular car would only attain a speed of 40 m.p.h. by a considerable amount of persuasion, and it flatly refused to climb Westerham Hill at all.

THE EVOLUTION OF THE SPORTING CAR—continued.

Various internal improvements were brought about until eventually it could do 80 miles per hour as a regular thing, and sailed over the Brooklands Test Hill at a speed of 22 m.p.h. My firm being agents for Singer cars, then began to specialise in the conversion of standard models into sports cars, and it soon became obvious that there existed a demand for a specially fast type of vehicle, which would be largely used by the sporting motorist in hill-climbing trials and club events of various kinds.

With the exception of the 30–98 Vauxhall, which was rather on the large side, there appeared to be nothing to meet the growing demand except the Bugatti, and, therefore, I decided to start in on the production of a British-built fast touring car which would enable patriotic sportsmen to buy British goods, and that was the beginning of the Aston–Martin, which has always been a car built up to the high ideals demanded by a small but extremely discriminating class of motorist.

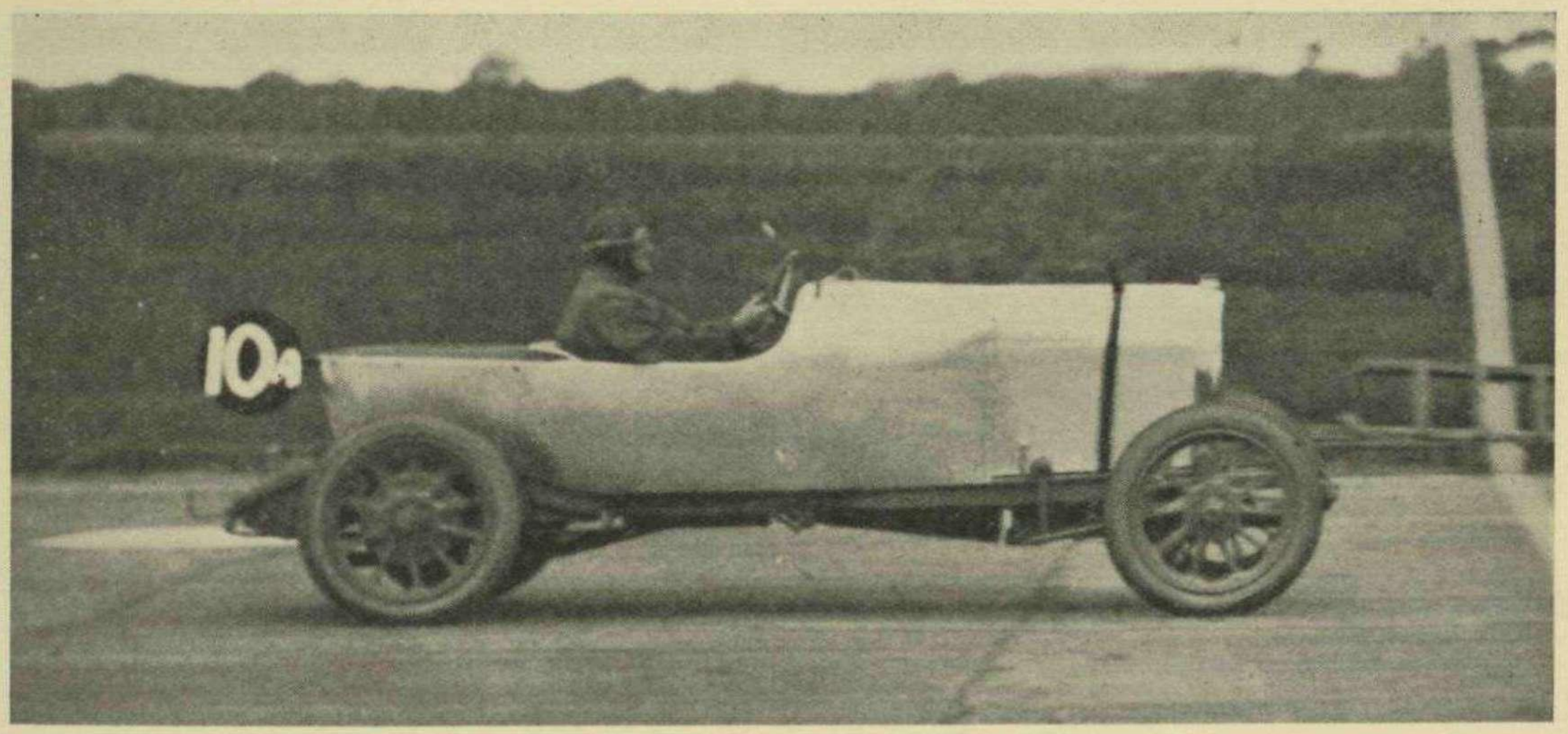
The Cost of Competition Work.

Many motoring sportsmen, after participating in a season or two of strenuous competition work, have eventually relinquished it as being too expensive a form of hobby; but in many cases the bulk of the expense has been traced to the cost of keeping unsuitable machines tuned up to a high pitch of efficiency and repairs resulting from the overstressing of certain components. Wear on competition machines is undoubtedly much higher than that on identical cars used for ordinary purposes, and the costs can only be kept down within reasonable amounts by purchasing a vehicle of high grade in the first place. It is the old, old story of spoiling the ship for a ha'p'orth of tar, and fifty or even a hundred pounds added to the purchase price of a new sporting machine will go far to ensuring success, as well as immunity from certain after expenses.

Factors in Initial Cost.

As to external appearance, a sporting model may show very few alterations in chassis design from other models, and one naturally enquires what there is to account for the extra money demanded as the purchase price. A good deal can be explained by the extra high grade materials of construction, but the most notable increase in production costs is due to the meticulous care with which every part of the engine and transmission mechanism is balanced. If, indeed, a small firm were to acquire the machines and instruments for doing the whole of the work under its own roof, the cost of the sporting car would be absolutely prohibitive. It is only by taking advantage of the scientific equipment of specialists in such jobs as balancing that the high grade sports car can be produced as a commercial proposition.

Then again, in the manufacturers own testing house a very high standard of efficiency is insisted upon, and, before an engine finally passes test, it may be necessary



An Aston-Martin Winning Its First Race at Brooklands, Lionel Martin Driving.

How Competition Work Influences Design.

In the evolution of the sports car of to-day I have no hesitation in stating that the sporting owner who indulges in public competition work has conferred immense benefits upon the manufacturer and designer alike. It is often said, with a fair degree of truth, that the designer produces drawings for cars which can only be handled to the best effect by experts, and that manufacturers sometimes lose sight of the many little problems confronting the owner driver.

During the course of a single competition an owner driver may gain more experience than would come his way in a year of ordinary motoring; and, therefore, I find the policy of keeping closely in touch with all competition events of the greatest importance in our endeavours to keep apace with, if not ahead of, normal progress.

THE EVOLUTION OF THE SPORTING CAR—continued.

to dismantle it wholly or in part once or twice, which naturally costs money.

In the case of commercially erected chassis a rough road test will suffice to show whether the machine is up to standard, but not so with the sporting machine, every example of which is built individually and tested individually, the tests often including several laps on Brooklands track in order that a guaranteed speed may be reached.

Endless Experiments.

The evolution of the sporting car is a thing concerning which no man can say " It is finished," and sit down to contemplate the latest thing in design and construction. Every month brings forth some fresh idea for improving the breed ; perhaps it may be a new carburettor, a solution to one of the known difficulties connected with the application of supercharging, or the introduction of some new metallic alloy promising an improved weight-strength ratio. The ordinary car manufacturer can stand aside, for these things do not interest him greatly, but the producer of sporting cars must give such matters his attention, and must, incidentally, spend money in substantiating the claims for himself, or proving them to be unsupported, as the case may be.

Then again, many people regard improvements in design as something in the nature of additions to existing engines, whereas real improvement should always tend in the direction of simplicity in design rather than in extra complications. Anyone can effect a so-called improvement by adding a new component or accessory, but it needs a clever engineer to make a machine more efficient by reducing its complication. Yet the latter line is being followed by earnest seekers after improved sporting car efficiency.

The Fallacy of Mere Speed.

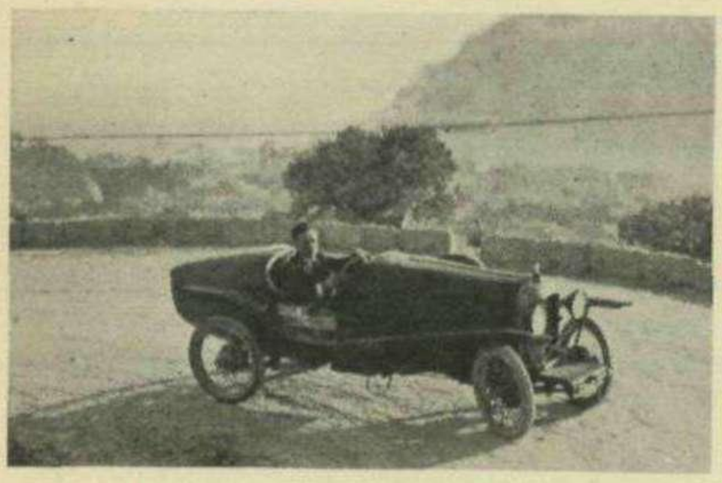
As a sub-title this may sound ill-chosen by one whose interests lie in the making of sporting cars, and yet speed alone will not bring success to any make of car. Technically there is no reason why sporting cars could not be sold with a speed guarantee of 150 miles per hour, but no one would be so sanguine as to suggest it could be held on a road at such a speed, or that it could be stopped within a reasonable distance of a cross-road ! What is essential, however, on a sports car, is a high *average* speed, ultra-rapid acceleration, road-holding qualities, and efficient braking. A well-designed sports car with a maximum speed of 75 m.p.h. can more than hold its own with a faster machine, which is difficult to hold on corners and hard to retard when travelling all out.

In my opinion the sports car of the future will have a four-cylinder super-charged engine, with side valves (the latter for the sake of simplicity), a four-speed gear box, a final drive with differential gear, four-wheel braking, and some well tried form of suspension by means of which the chassis will be able to hold the road with rock steadiness at all speeds on any kind of curve. The complete car, as a four-seater sports model, will weigh approximately 15 cwt., and be capable of a road speed of 75 miles per hour, without over-exertion.

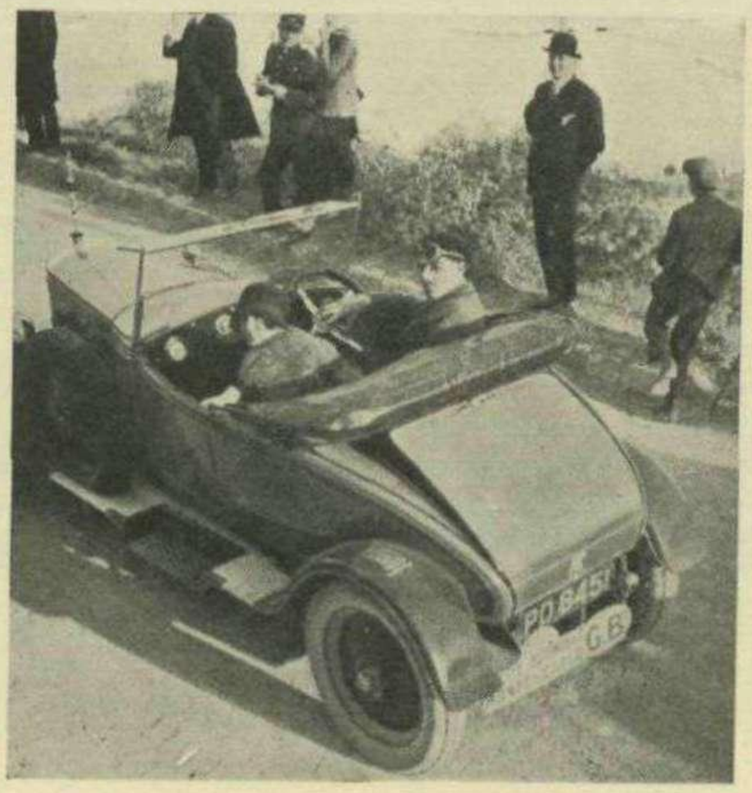
Dionel Rawtin

THE MONTE CARLO AUTOMOBILE RALLY.

COTE DU MONT DES MULES.

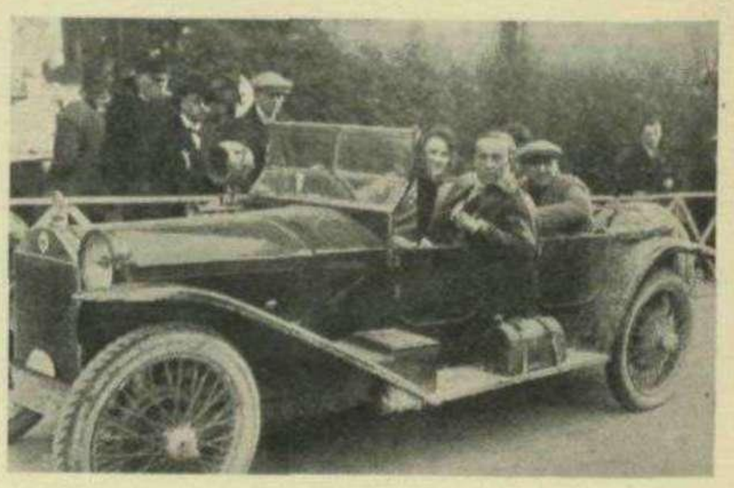


GREGOIRE ON AMILCAR SPORTS.



THE HON. V. A. BRUCE WINS 2,000 C.C. CLASS.

COTE DU MONT DES MULES.



MME. MAERTENS MAKES FASTEST CLIMB.

Motoring Sportsmen

by the Editor

Capt. MALCOLM CAMPBELL.



IF a whole issue of THE BROOKLANDS GAZETTE were available for this article, and Capt. Campbell could be persuaded to recount a tithe of his experiences in connection with motoring, there would be no room either for "Editorial Notes" or "Correspondence"; but, as such is not the case, our notes on this famous motoring sportsman must necessarily be very much abridged.

Although there are few who have not heard of Capt. Campbell's exploits with the monster Sunbeam and other racing cars, it is not generally known that he is almost as prominent in the flying world. As early as the year 1909 he was flying a twin cylinder monoplane in which even the most courageous aviator of to-day would hesitate to take the air. From that date his interest in flying never flagged, and during the war his services were called upon by the Royal Air Force, and subsequently used to very good effect.

Capt. Campbell was certainly one of the pioneers of motoring, and no enthusiast has ever kept in closer touch with all sides of the pastime from the time when he took delivery of his first car till the hour at which he accomplished the fastest land speed ever recorded by man. British motorists all over the world should be glad and proud of the fact that Capt. Campbell, a British amateur, holds the premier place in the world of speed.

Though part of his present activities are employed in controlling the business of Messrs. Malcolm Campbell (London), Ltd., the subject of our sketch is an amateur motor racer, his now prosperous business being a by-product of his interest in the sport of motor racing.

In the year 1919 Capt. Campbell decided to enlarge the sphere of his hobby, and in a way to make it pay for itself, so he opened the motor business at Albemarle Street, which he has lately moved to South Kensington. It is probable that had Capt. Campbell desired to keep out of the motor business altogether he would have been practically forced into it owing to his willingness to advise friends, who naturally looked to him for assistance on all motoring matters. We have seldom met a busier man than Capt. Campbell, who, in addition to breaking world's records here, there, and everywhere, finds time to control every detail of his motor business, fulfil various duties connected with his membership of Lloyds and the Stock Exchange, write books about flying, and build monster racers in his private workshop at his country house.

Those who maintain the theory that enthusiasm is 99.9 per cent. of success will be glad to know that Capt. Campbell takes just as keen an interest and pleasure in selling a car as he does in putting up some fresh "bonne bouche" for the benefit of Parry Thomas or Eldridge.

Naturally his successes on the track prove a great business asset, as people who come to view one or another of his racing cars cannot resist the temptation to become car owners themselves when they hear the pastime recommended by one who may be termed the leading advocate of motoring.

Thus racing helps the business, and business helps the racing, and when Capt. Campbell holds the reins anything but success is out of the question.

Even if one is not in search of the latest thing in the car line, a visit to the showrooms in Sussex Place is a thing to be remembered, for it would be difficult to equal the unique collection of photographs which decorate the walls. Press photographers simply refuse to leave Capt. Campbell alone, and examples of their persistence show him in innumerable incidents of his motoring career. These pictures, by the way, do not merely consist in the conventional poses beloved by the

MOTORING SPORTSMEN—continued.

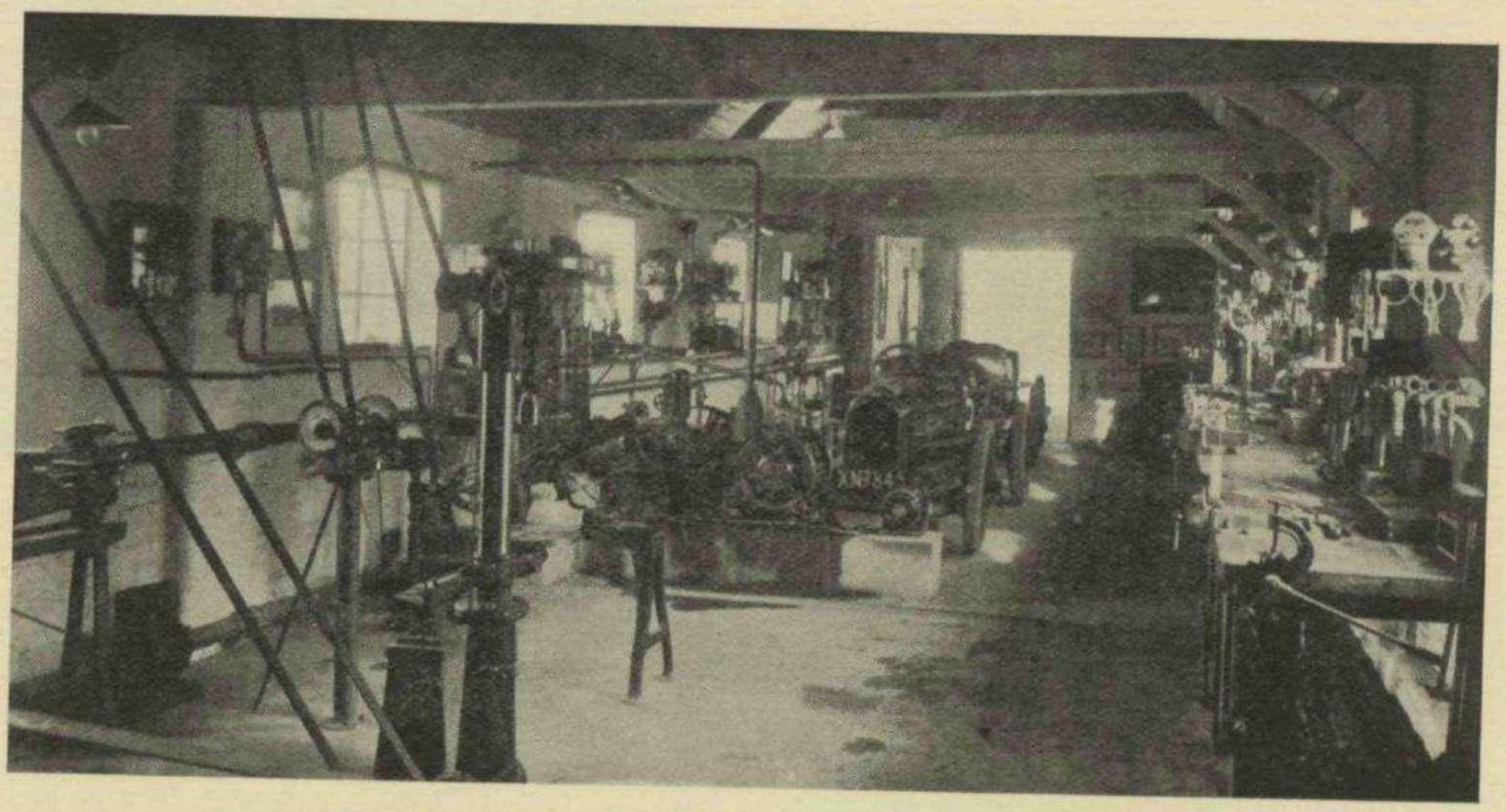
car-proud owner, but depict one who has many hair-breadth escapes to look back upon. To converse with Capt. Campbell one would imagine it was the easiest thing in the world to right a car that had lost a couple of tyres when travelling at over 100 miles an hour; but actually his remarkable skill has brought him safely through a hundred incidents that would be sufficient to frighten an ordinary man at the very sight of a car.

Capt. Campbell goes about any particular job he happens to have on hand in a quiet, persistent sort of way, before which all obstacles have a habit of vanishing discreetly. Take the education of the twelve-cylindered Sunbeam for example. Reared and nourished with every care at Wolverhampton, it tried hard to carve out a career for itself, but somehow or other met with no luck. Practically every driver of repute took its wheel, and still the machine failed to justify its existence, until Kenelm Guinness managed to make it realise the responsibility of being the largest car in the world. Then eventually it came into the possession of Capt. Campbell, who felt its pulse, looked at its cam-shaft, and proceeded to turn a somewhat refractory leviathan into the most docile of record breakers that ever sauntered along Pendine Sands at a gentle 150.25 miles per hour. We are sure the Sunbeam did not want to get that particular world's record, for it was only by the aid of planks placed under the wheels that it was prevented from digging itself in, but Malcolm Campbell was out for making world's records, and not for demonstrating how racing Sunbeams could make entrenchments, so the Sunbeam gave in, and eventually shone brilliantly.

Some time last spring Capt. Campbell told us that he had definitely decided to give up racing, but, calling at his office a few days later, he explained how his decision had been affected by a new record Eldridge had established on the Fiat, and we predict that the next fifteen years or so will still find him in the front rank of motoring "aces," whatever he may think about the matter at the moment.

At the time of writing, Capt. Campbell is working on a mighty machine built with the intention of travelling at the speed of three miles a minute, and immediately we are given the word our readers may be assured of full details of this "Mystery Bus," which, apart from many unique mechanical features, will be a revelation in the direction of scientific streamlining.

If this line is not censored we may state that Capt. Campbell has won the respect and affection of everyone of his subordinates in his business. On the track the name of Campbell is synonymous with fair play, to his large circle of friends he is a real friend, and to the motoring public he is the personification of the highest ideals of Motoring Sport.



EXPERIMENTAL WORKSHOP AT CAPT. CAMPBELL'S RESIDENCE.

To show that Capt. Campbell is not merely a man with a single sporting interest, it may be mentioned that he is a good horseman, and used to follow the hounds regularly, pilots a fast motor boat on occasions, and is something out of the ordinary as an amateur boxer. He has a strong and quick left, besides being able to throw out a shower of right hands that would make many a professional sit up and take notice.

During our interview, the subject of the danger of motor racing was briefly discussed, and Capt. Campbell is under no delusions as to the risks incurred when driving at ultra high speeds. But it may be some consolation to the less experienced, or neophyte, speed-men to know that he does not consider the element of danger in the ordinary Brooklands or hill-climbing events anything to constitute a deterrent to followers of the Spirit of Speed.

He suggests the best course for the beginner to adopt is that of acquiring some seasoned racing car which

(*Continued on page* 353.)

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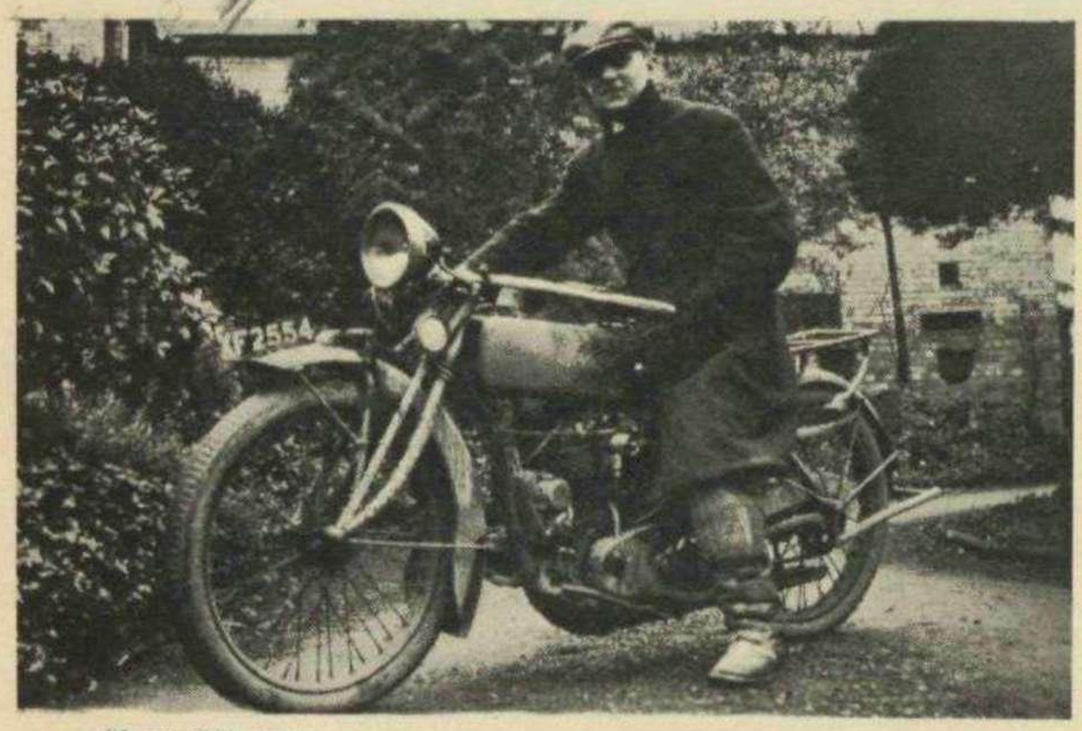
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WITH THE HOUNDS ON A MOTOR CYCLE.

By ARNOLD RADCLYFFE.



THE WRITER OF THE ARTICLE ON HIS "INDIAN."

MUCH has been written lately concerning the relations between motorists and huntsmen, every motoring sportsman, by his very title as such, should be in a position to see fair play where hounds are involved.

No one would like a pack of hounds, or even one hound, to make a sudden appearance on the track in front of him during a race ; it would spoil all sport and perhaps end in disaster.

In the same manner, when a car, motor-cycle, or worse still a line of such evil-smelling machines, crosses the trail of a fox or heads it off, a whole day's sport may be spoiled for the field in some counties, where foxes do not abound in every covert.

Nevertheless by the use of a little common sense and in some cases a half minute's conversation with a local keeper, it is easy to see nearly everything of the run almost without the field being aware of one's existence.

I remember one day a friend and I both crocked our horses in the same manner, namely they over-reached and cut their pasterns and we were without a mount for the meet on the morrow.

I proposed following on foot, but as this was in Lincolnshire and very open country we would soon have been lost, so eventually we decided to take out our iron steeds, a Douglas and an Indian. At the last minute the Douglas developed symptoms of magneto trouble so we both turned up at the meet on my Indian.

Two coverts were drawn before a fox was found and by the time we were back to the machine, hounds and horsemen had screamed away across country towards Wellingore. We knew pretty well the line the fox ought to take and getting astride the Indian, off we went, taking care to keep on the high ground and on the side into which the fox would be least likely to turn owing to the wind.

After making a detour we found that the road was no longer any use as it was taking us too far away from the likely run of the hunt, so finding a muddy turning to the right we proceeded up it only to find a cul-de-sac and a ploughed field. On stopping the engine we were, however, overjoyed to hear a horn in the far distance. That field had to be crossed, so slipping in bottom gear we tackled the dark Lincolnshire loam and had covered about a hundred and fifty yards of this when we reached a broad deep ditch through which we went only to find more ploughed land.

It was uphill all the time, but after negotiating one more field and a hedge, we came out on top to some pasture land, and on the other side of the valley below we saw the whole field in full cry streaming out across the hillside, brown and white, red and black, a gorgeous sight.

We knew we would have to make for the road as they would more likely follow the line of the valley for some time.

It was a delightful descent over grass, but on reaching the foot of the hill we noticed that hounds had veered round to the north again and then they disappeared over the rise and we contemplated the return journey over the hill. At that moment, however, hounds again appeared on the crest and then seemed to be at a loss for some minutes.

We were both standing on a gate when my friend let off a strident "View Holloa," and turning round I just caught sight of Reynard crossing the road some two hundred yards back. I joined in the cry and in a few seconds huntsmen and hounds were tearing back down the hill and passing us went galloping down the road. The dogs soon got the scent again and were off to the south.

We, quite forgetting the machine, dashed after the huntsmen and had a few minutes breathless run well in front of the rest of the hunt.

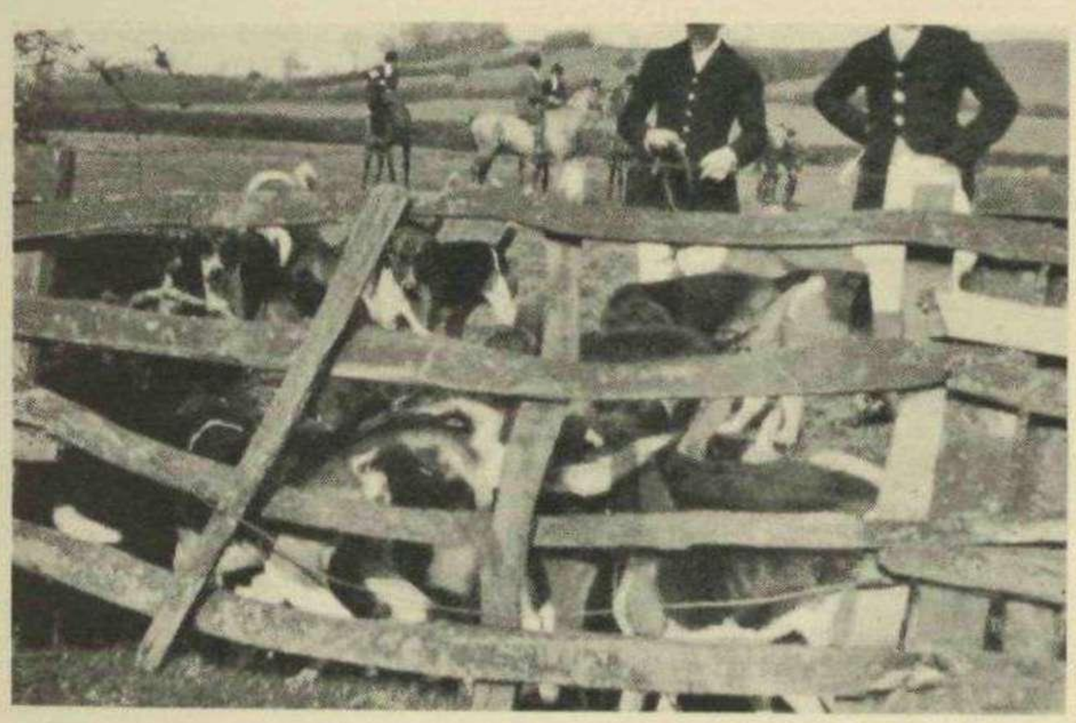
It was not to last long, however, for the fox went to earth near a small stream and just before the railway lines.

A few minutes wait and men appeared as they always do on these occasions, armed with spades. Blocking all leads except two, the terrier was sent down and in a very short time—the earth was a small shallow one—the fox was away again and after the requisite time had expired, the pack was after him. We followed and were thankful that he was doubling on his previous course.



PART OF THE BELVOIR PACK.

WITH THE HOUNDS ON A MOTOR CYCLE—continued.



THE KILL: THE END OF THE HUNTSMAN'S PERFECT DAY.

For some reason or other the hounds got him before we had gone very far, so we were able to be right in at the kill, and to obtain one or two photos of a kill, quite a rare occurrence.

We decided to return, as we had not filled up before we came out, and the way the hunt had gone did not lead to a garage.

On our way home we were, however, lucky enough to meet them again, but their luck had been out with the last fox, as scent was bad.

Drawing three more coverts proved fruitless, so we set our beast's nose for home again.

The Indian was a noisy machine, we were using Castrol R, and the master was noted for his objection to motorists, but we did not even get a scowl from him that day; we had a good morning's sport and we were instrumental in bringing the fox to the kill, yet I do not think we made ourselves objectionable in any way.

I would not advise steeple chasing on motor-bikes as a general practice, but if you want to follow hounds on car or bike, it is possible to do so without causing any inconvenience to anyone, only *don't go ahead of the hounds* and don't move away till the whole hunt is at least a quarter mile away, as you will have plenty of time to catch up if necessary and also it will give you time to see which way the fox is going to run.

He often goes out of a covert in a certain direction because he has to, and it is very probable unless the wind is in his favour that he will turn after a short run.

Don't rev. your engines, and stop them when you stop the car.

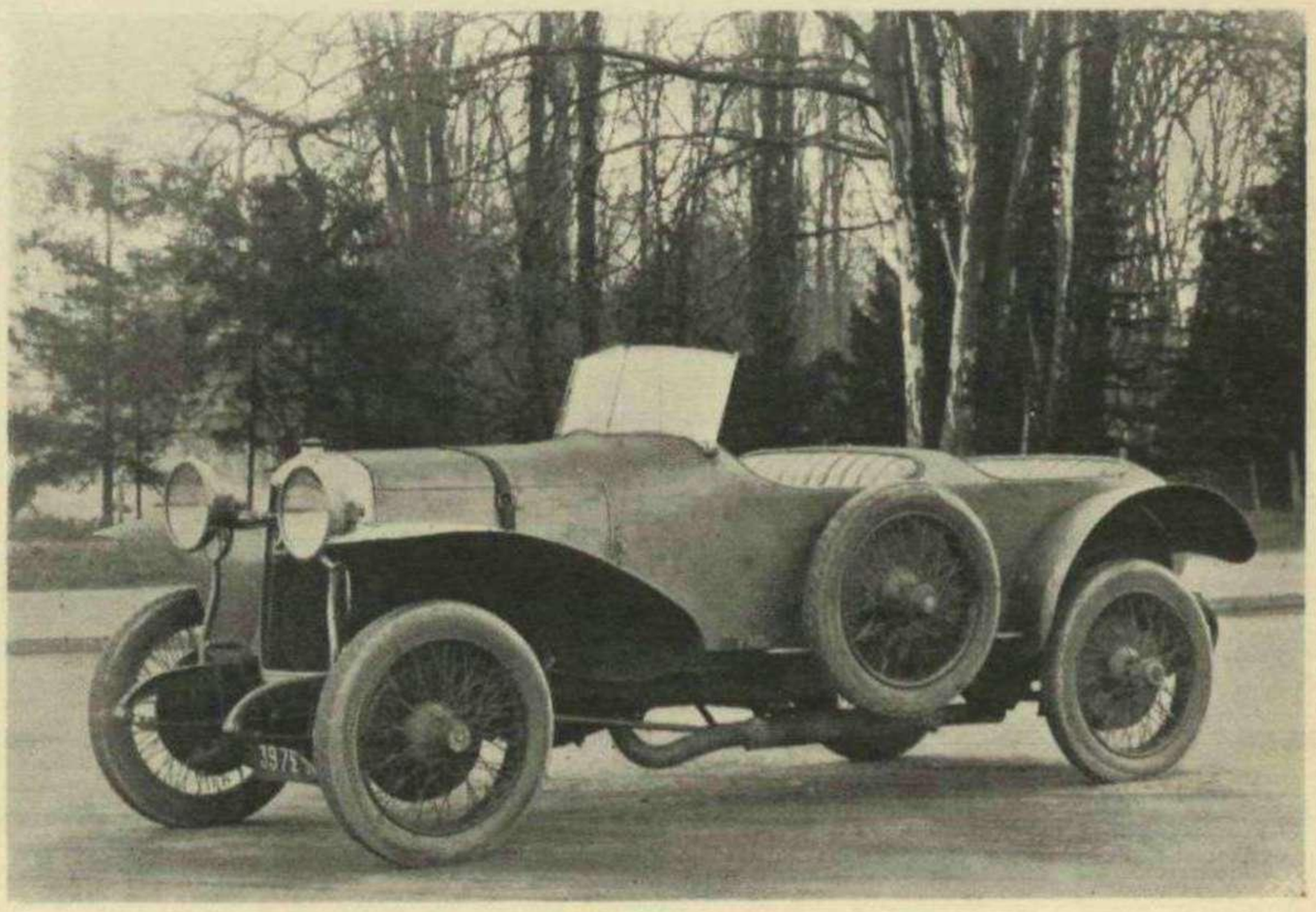
If you happen to live in the South, it is generally possible to pick a pack that is meeting near some big woods. This is very often the case on Saturdays and great fun can be had by following hounds on foot, as they seldom get the fox out in the open for very long, and it is possible to keep right in the thick of it at least for a few hours in the morning. Your car or motor-cycle can generally be left at a nearby hotel, and you will be able to get a great amount of sport and yet never be very far from your machine.



THE FIELD ABANDONS A TENANTLESS COVER.



RENE DE KNYFF IN THE PARIS-AMSTERDAM RACE OF 1898.



A PANHARD SPORTS OF 1925.

PANHARD PROGRESS.

THE RECORD-BREAKING LANCHESTER.

Details of a Remarkable Chassis.

OF the many startling records established during last year, those set up by the Lanchester car, described in the following notes, are among the most remarkable, principally on account of the few modifications made to the standard chassis used for this famous racing car.

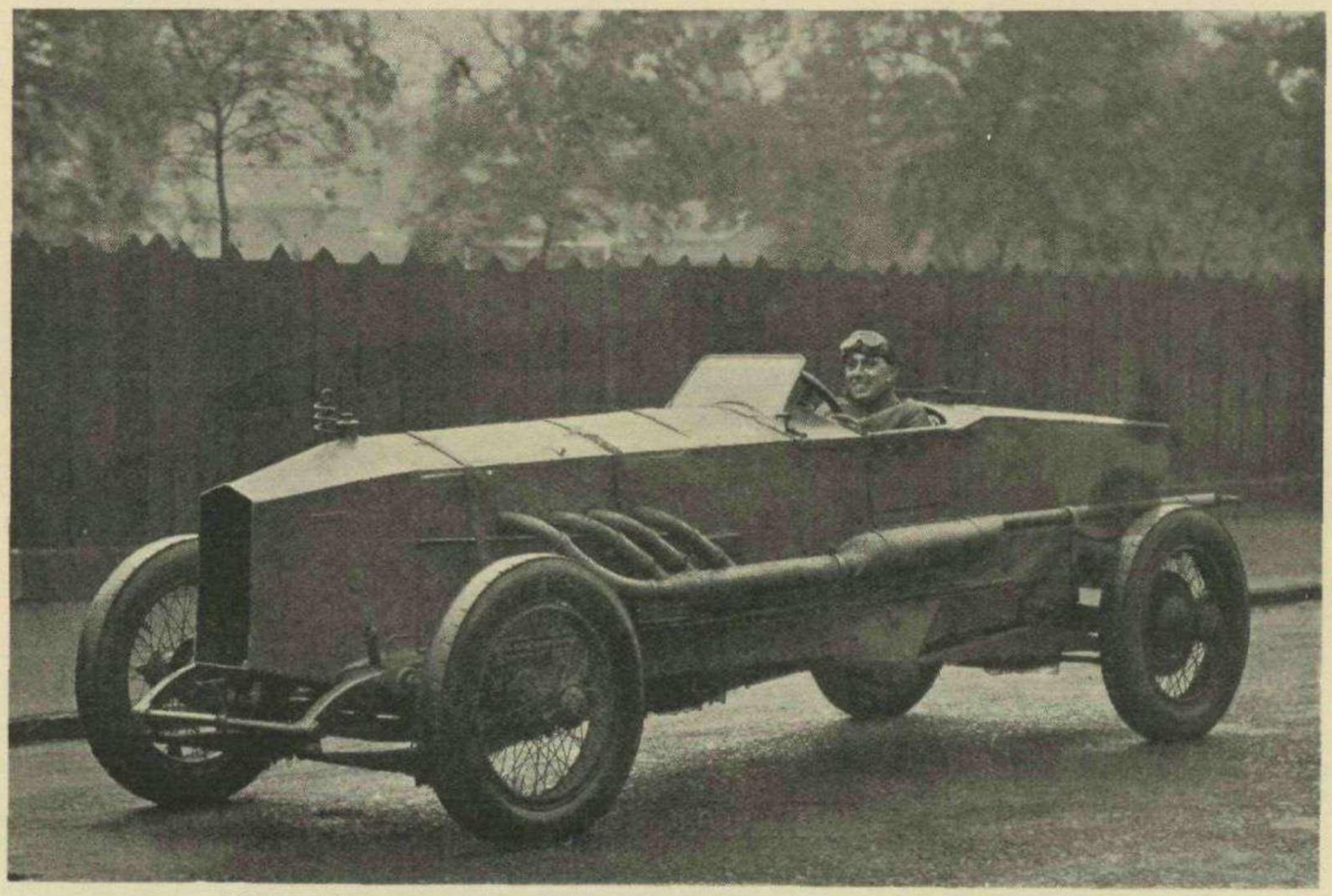
Many standard touring models, altered to suit racing conditions, are known to followers of the sport of motor racing ; but in the majority of cases no secret has been made of the fact that many radical departures from the original design are included, whereby great extra speed has been attainable ; so that when a practically standard chassis is fitted with a racing body and put to work on the track, the general public, not unnaturally, assumes that a considerable amount of " faking " has been done.

The writer recently had the opportunity of making a close examination of the racing Lanchester and, furthermore, was given every facility for comparing the actual details of construction with those of the standard 40 h.p. chassis.

The Lanchester " Forty " differs very materially from the earlier types of Lanchester vehicles, and in many respects follows what is now accepted as orthodox practice. In looking back some twenty odd years or so, when the writer was one of the fortunate youths privileged to undergo a course of workshop training at the Birmingham factory, it is difficult to recognise the Lanchester principles of to-day with those in vogue so long ago. But, nevertheless, many of the constructional features are the same in principle and the workmanship is still as excellent as in the days when hours and hours were spent in scraping all the joints of the engine by the exacting hand process.

The Frame Construction.

While being normal as far as appearance is concerned, the Lanchester chassis possesses many features of interest. The side members themselves are partially tubular in construction and have a maximum depth of 6 in., and a width of $4\frac{1}{4}$ in. At the upswept portion near the rear of the frame, the side members are braced transversely by a tubular cross member 8 in. in diameter. A smaller tubular cross member is used in front of the engine, the middle cross member being a steel pressing of channel section with exceptional width.



THE LANCHESTER RACER AS IT FIRST APPEARED AT BROOKLANDS.

Mr. A. W. Bird, Test Shop Superintendent of the Lanchester Factory, at the wheel.

Front Axle and Suspension.

The front axle calls for no special comment, and has underslung semi-elliptic springs of generous dimensions, but for track work it is fitted with wind resisting shielding.

The rear suspension is of the Lanchester cantilever design in which the full cantilever springs are pivotted at their centre on bearings with a floating phosphor bronze bush. In the place of the usual shackles, the ends of the springs are carried in bronze trunnions, which are provided with a rectangular aperture for the reception of the spring extremities. Rollers are provided in these apertures and the spring passes between them to serve as a guide for the leaves.

To this system of suspension, aided by Hartford shock absorbers for the front and rear axles, the

THE RECORD-BREAKING LANCHESTER—continued.

Lanchester racer owes its extreme steadiness on the track at high speeds, a factor which has materially contributed to its successes.

Steering Mechanism.

The standard mechanism of the steering column needed no modification, but for the streamline effect of the single seater, the column has been moved and mounted on the gear box, the column being shortened to give the correct position for racing. An ingenious system of combined worm, nut and trunnion gear is adopted for actuating the steering drop arm and the car is extremely light to handle in all conditions.

The Lanchester Power Unit.

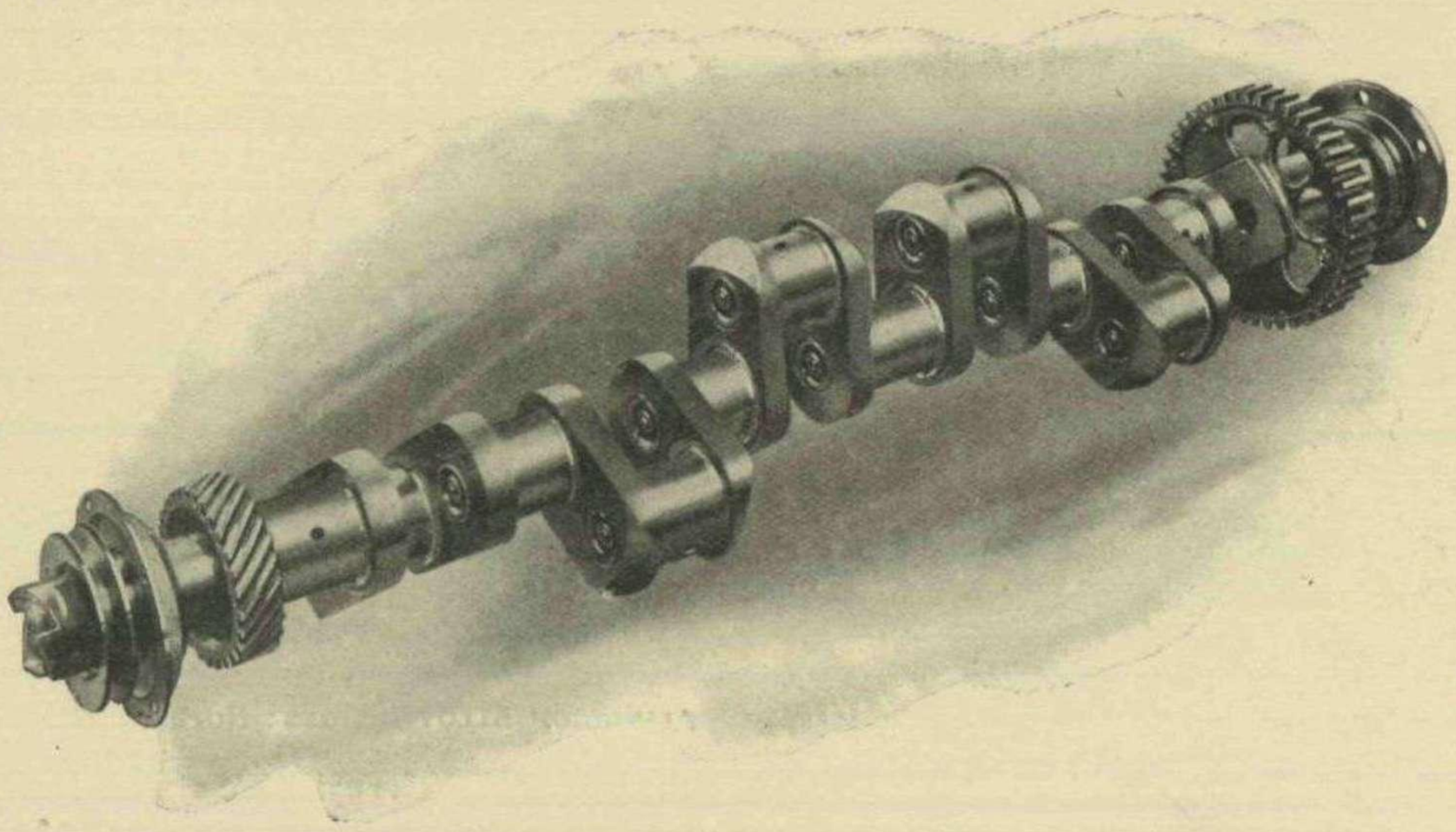
One of the remarkable points concerning the Lanchester racing car is that the only alteration from standard consists in a modified form of induction pipe to carry two Zenith carburettors, the ordinary design and production methods permitting the rapid acceleration and high engine speed for record breaking. The six cylinder engine is cast with two blocks of three cylinders each, of which the combustion heads and valve chambers are integral parts of the castings, thus ensuring an unrestricted circulation of the cooling water and eliminating the possibility of water and cylinder pressure leakages, to which some heavily stressed engines with detachable heads are susceptible.

The combustion spaces are partly spherical and machined all over, a very important point in arranging for the free passages of the gases. This feature also contributes towards efficiency in other directions, such as evading defects in combustion, which frequently occur in engines with untreated combustion chambers, where slight irregularities in the surface of the metal impede the gases and produce local " hot-spots."

Aluminium castings are employed for the crankcase and base chamber, the former taking a stiff girder-like construction, the strength of which is further increased by wide flanged oil joints and the large number of bolts securing the two portions together.

The power unit, together with the housing for the change speed gear, is mounted in the frame by means of two arms extending from the forward portion of the crankcase and at the rear by a pair of brackets carrying the weight at the rear of the unit. Although unit construction has been adopted, attention has been paid to the matter of accessibility and all the external components are arranged so as to avoid difficulties should dismantling be necessary at any time. This point, of course, becomes important to the racing man, who may need to dismantle his engine from time to time for various reasons.

Seven bearings are used for the support of the crankshaft, which is of exceptionally robust construction, and balanced to the finest possible limit of accuracy. The crankshaft is of hollow construction, the shaft and crank pins being bored to effect a saving in weight and suitable ducts are drilled for the distribution of oil, which is pressure fed.



THE LANCHESTER CRANKSHAFT REPRESENTS SOME FINE MACHINE WORK.

Aluminium Alloy Pistons.

In view of the controversy among racing motorists concerning aluminium pistons, it may be of interest to remark that this type was adopted in 1919 as standard practice on the Lanchester car after successful tests extending over a period of six years. The pistons are of the design allowing the dissipation of the heat.

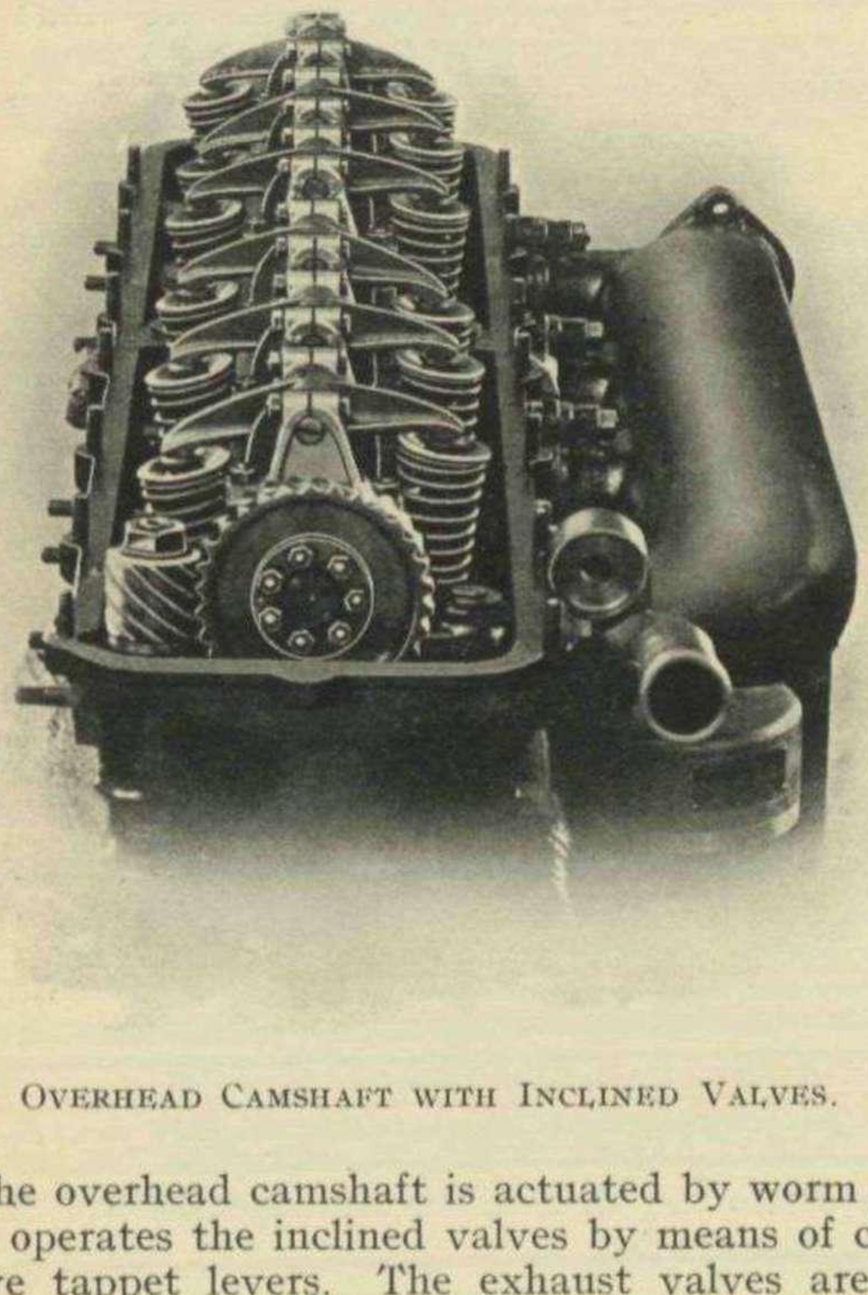
The tubular connecting rods used on the earlier Lanchesters have now given place to high tensile drop forgings of the " H " pattern, these being machined all over to reduce weight and for balance equalising purposes. A specially selected specification is employed for the white metal used for the die-cast big-end bearings and the oil channels are cut so as to prevent the formation of any ridges on the crankshaft journals, which so

THE RECORD-BREAKING LANCHESTER—continued.

often happens if this detail of design is overlooked. To ensure proper lubrication for the floating gudgeon pins, which work in phosphor bronze bushes, an oil pipe is fitted to each connecting rod, allowing for the passage of the oil under pressure from the crankshaft journal to the gudgeon pins.

The Overhead Valve Gear.

Were it not for the fact of the Lanchester being designed as a high-class touring car, one might almost imagine it to be the product of a racing enthusiast, as far as the lay-out of the overhead valve gear is concerned, for even in such details as the valve spring, the ordinary form of valve washer and cottar, long discarded for high speed engines, is replaced by a neat and effective form of cone attachment fitting into the spring collars.



OVERHEAD CAMSHAFT WITH INCLINED VALVES.

The overhead camshaft is actuated by worm gearing and operates the inclined valves by means of compact valve tappet levers. The exhaust valves are seated direct into the cylinder heads to ensure effective cooling, removable cages being adopted for the inlet valves. By the formation of the hollow valve spindles, the engine is very sensitive and the use of light valves assists very considerably in quick acceleration.

Ignition System.

Though two separate systems are employed, *i.e.*, magneto and Delco battery ignition, it is interesting to remark that for many of its record runs, the racing Lanchester employed the magneto alone.

Two plugs are fitted to each cylinder, the exact position having been selected with due consideration in the matter of flame propagation in relation to power output.

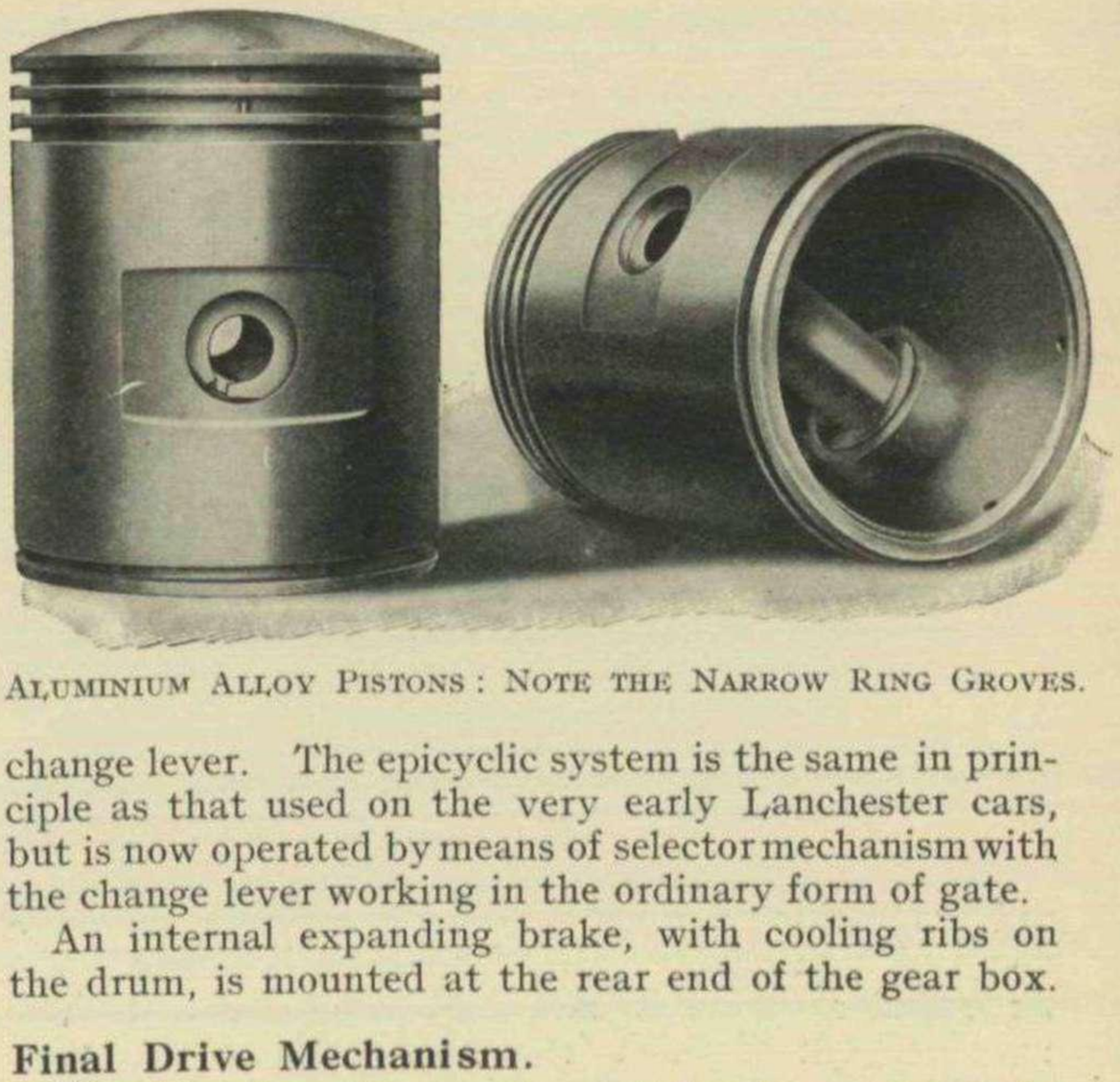
Water Cooling Arrangements.

This part of the engine is perfectly standard, except for the removal of the fan and the addition of a cowling extending some eighteen inches beyond the radiator and reducing the apparent ventage to about one-third the area of the radiator.

The Epicyclic Gear Change.

Since the first introduction of motor cars, inventors have spent much time and money in endeavouring to perfect the epicyclic form of gearing, but the Lanchester change speed mechanism provides the only practical solution to the problem, and it is even more remarkable that this type of gearing should stand up satisfactorily under the abnormal stresses imposed by racing conditions.

Contained in the gear box, which externally is of normal appearance, are three epicyclic trains of gear, the epicyclic clutches and the main, or direct drive clutch. A peculiarity of the latter is that normally the frictional members are disengaged, the engagement being effected by means of two alternative cams mounted on the gear



ALUMINIUM ALLOY PISTONS : NOTE THE NARROW RING GROVES.

change lever. The epicyclic system is the same in principle as that used on the very early Lanchester cars, but is now operated by means of selector mechanism with the change lever working in the ordinary form of gate.

An internal expanding brake, with cooling ribs on the drum, is mounted at the rear end of the gear box.

Final Drive Mechanism.

The drive from the gear box is taken by a universally jointed cardan shaft, enclosed in a tubular torque member, of which the forward end is secured to a spherical housing carried on the central transverse member of the chassis. No special comments are called for in connection with the rear axle, which is of the well-known Lanchester high-efficiency worm type, though in this particular case a special high gear ratio has been incorporated.

Body Work and Details.

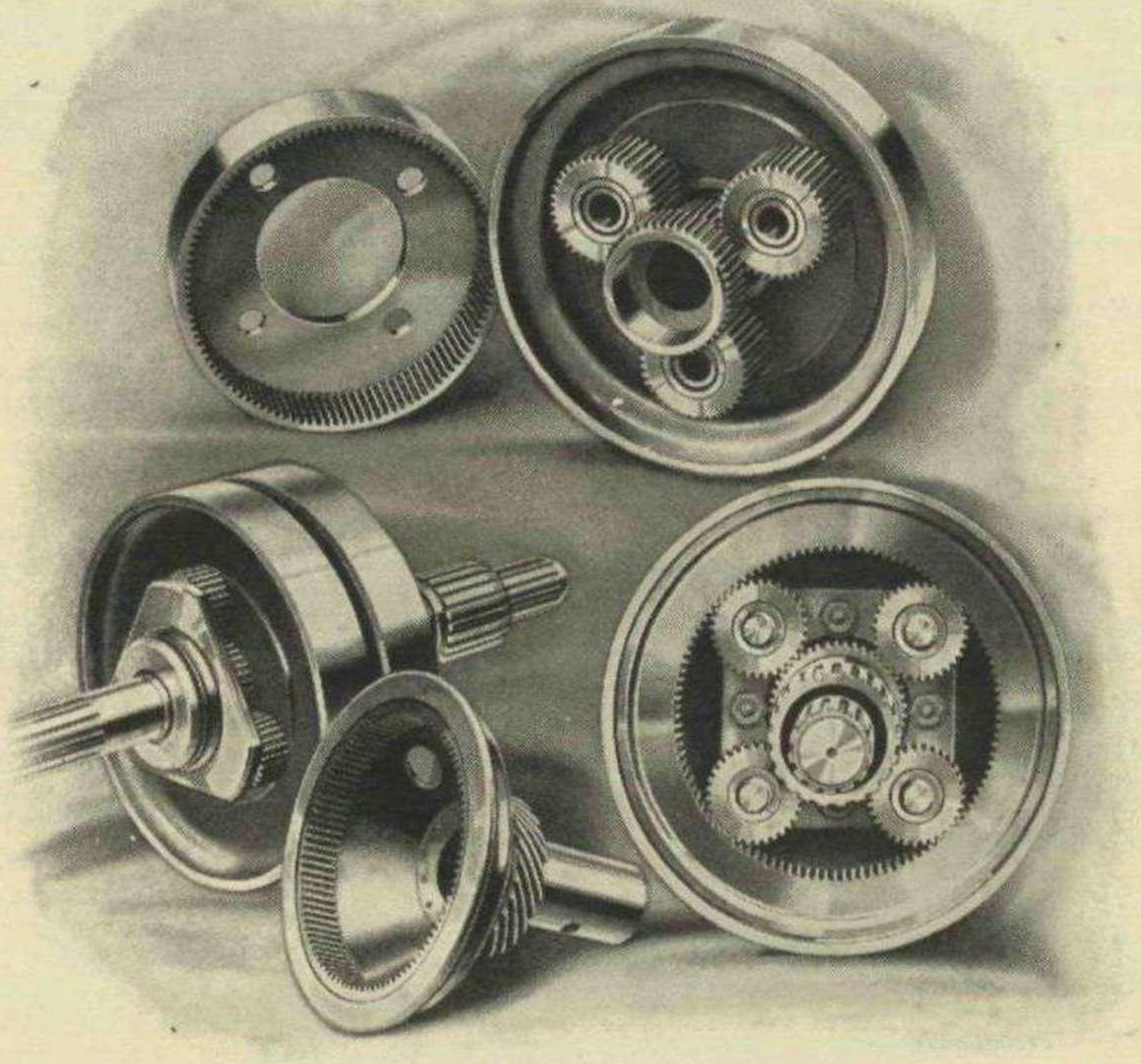
As will be seen from the accompanying photograph, the form of body used for racing is built on somewhat unique lines, and while not conforming with the beauty of many racing cars, careful attention has been paid to

THE RECORD-BREAKING LANCHESTER—continued.

the matter of wind resistance. It appears as though the designers of the body were more concerned with utility than symmetry, but though the racing Lanchester can hardly be described as a thing of beauty in external appearance, the engineer who holds that a thing can be efficient without being ugly, will find his views confirmed by a close inspection of all the mechanical details of this remarkable chassis.

Performance.

During last season this car captured forty-one records, and on September 12th covered 1,148 miles 843 yards in twelve hours, being driven in stages by Messrs. Rapson, Thomas and Duller. Another outstanding performance was its run of 10,000 miles at an average speed of fifty miles per hour.



Details of the Lanchester Epicyclic Gear.

"Automobile Engines." By Arthur W. Judge.

The above-mentioned book, published by Messrs. Chapman & Hall, Ltd., at 4/-, is the first of a series intended to present, in a simple and non-technical manner, the elementary aspects of each branch of the subject, and is prepared for the use of motor owners, engineers, students and others.

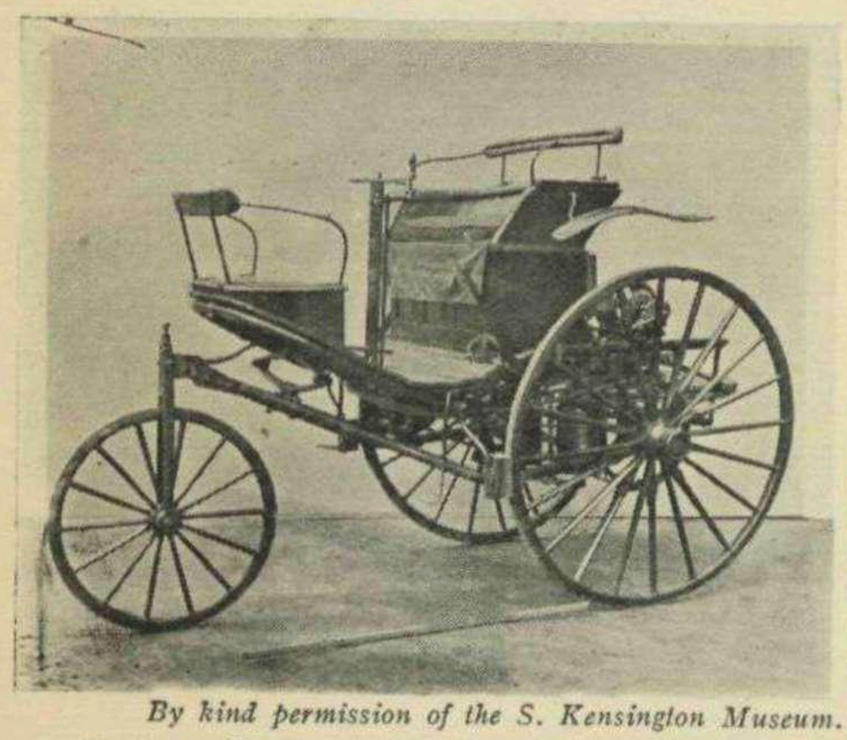
The subject matter of Volume I. has been selected carefully, being presented by the author in a clear and precise manner, which is easy to read, in addition to being informative.

While the majority of the illustrations are excellent, some of the line drawings lose part of their value by the smallness of reproduction. Chapter I. deals with "The Combustion Process in Theory and Practice," and the reader has the opportunity of studying such matters as fuels, the elements of combustion, detonation, cylinder pressures, horse power and supercharging. Chapter II. is devoted to descriptions of the various components of typical petrol engines, and has the added virtue of being thoroughly up to date. Various types of automobile engines are discussed in Chapter III., including air-cooled motor cycle power units, engines with sleeve and other forms of valve gear, while balancing devices and superchargers receive due attention. Chapters IV. and V. deal with lubrication and cooling respectively, these subjects being treated in considerable detail. The two last chapters on "Testing and Tuning" appear to be unduly abridged, but serve to whet the appetite of the reader for the other volumes, which, we understand, are in course of preparation.

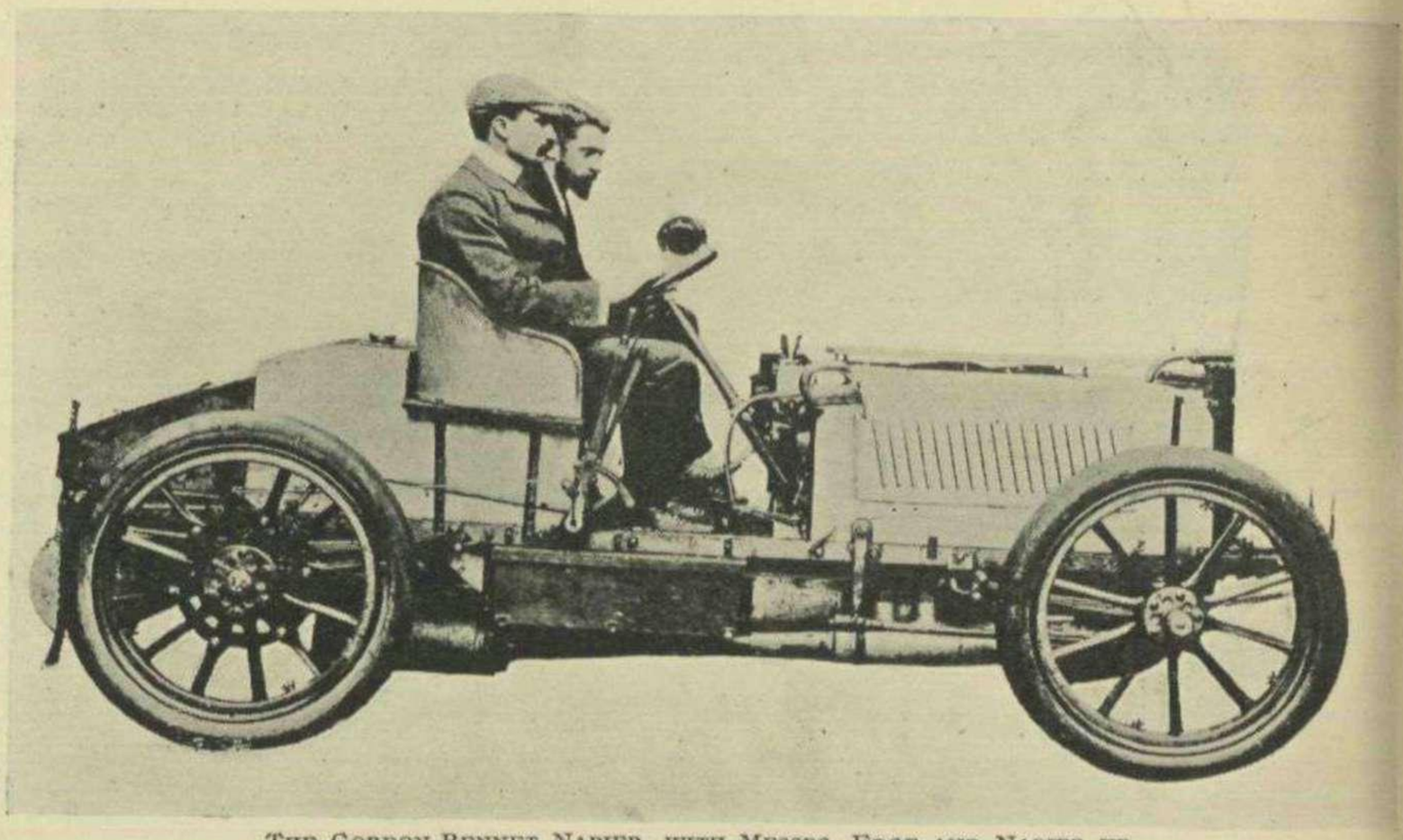
A Four-Wheel Driven Racer.

It is well known that for several years Miller, the American motor constructor and racer, has specialised in the production of racing cars which have been sold to amateur and professional speedmen; but we learn that his latest experiments lie in the direction of a four-wheel driven racer, which, it is hoped, will make its appearance on the American tracks this season.

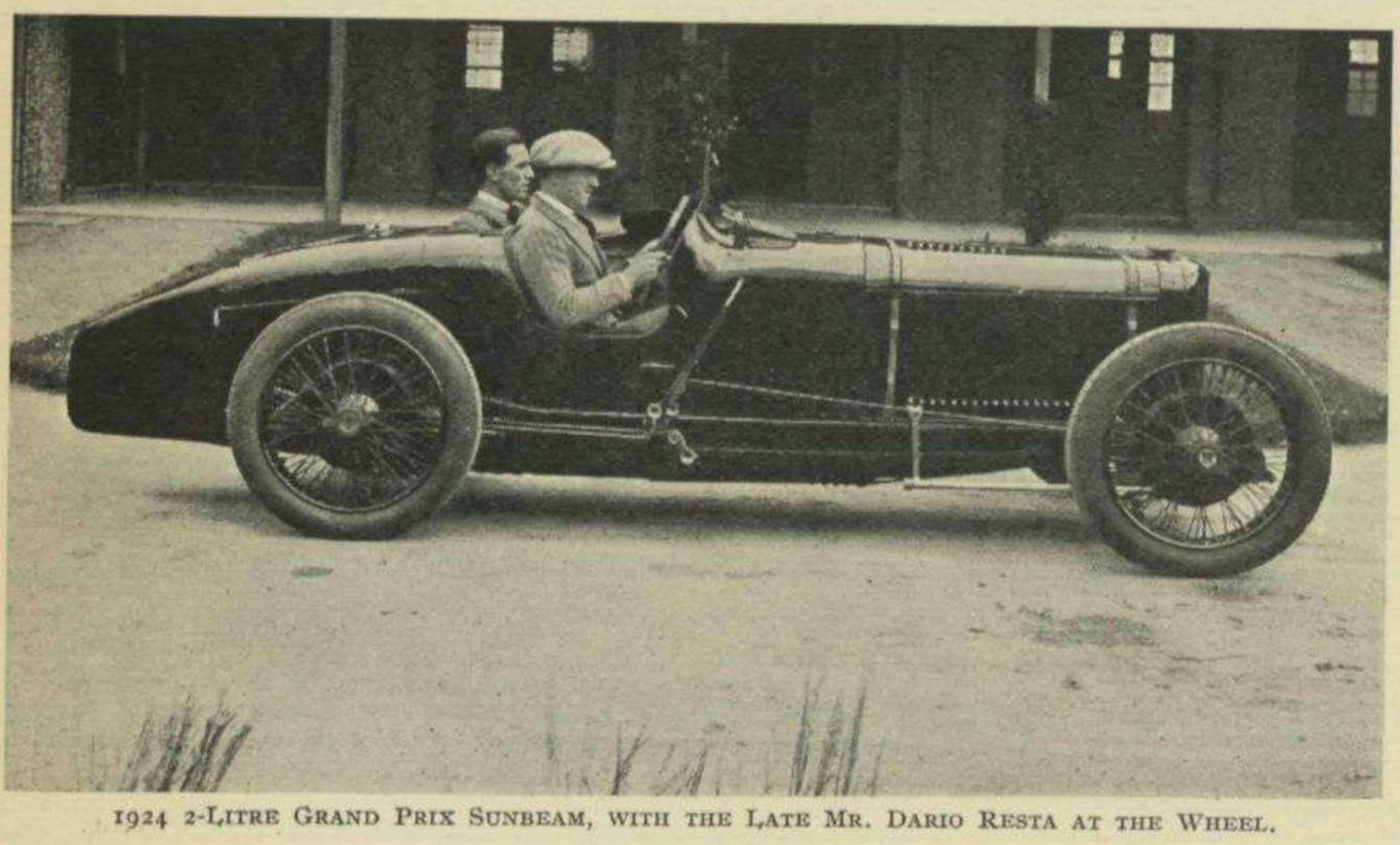
MOTOR RACING PA



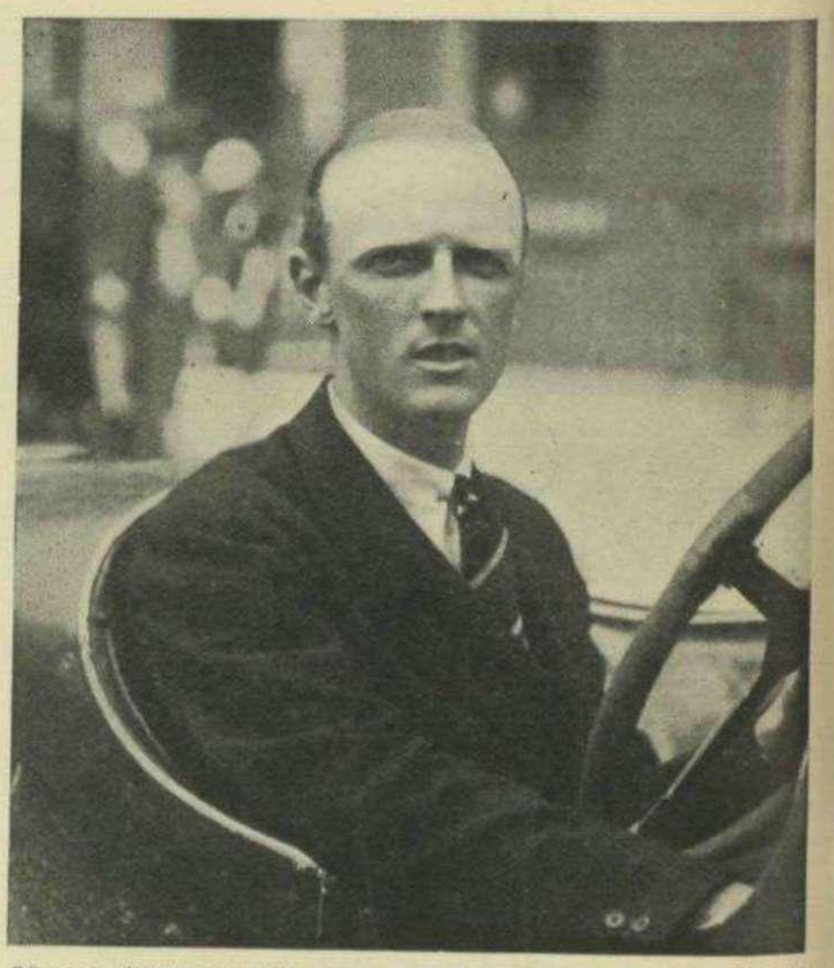
By kind permission of the S. Kensington Museum.
A 1½ H.P. BENZ, WHICH MADE RECORDS IN 1884.



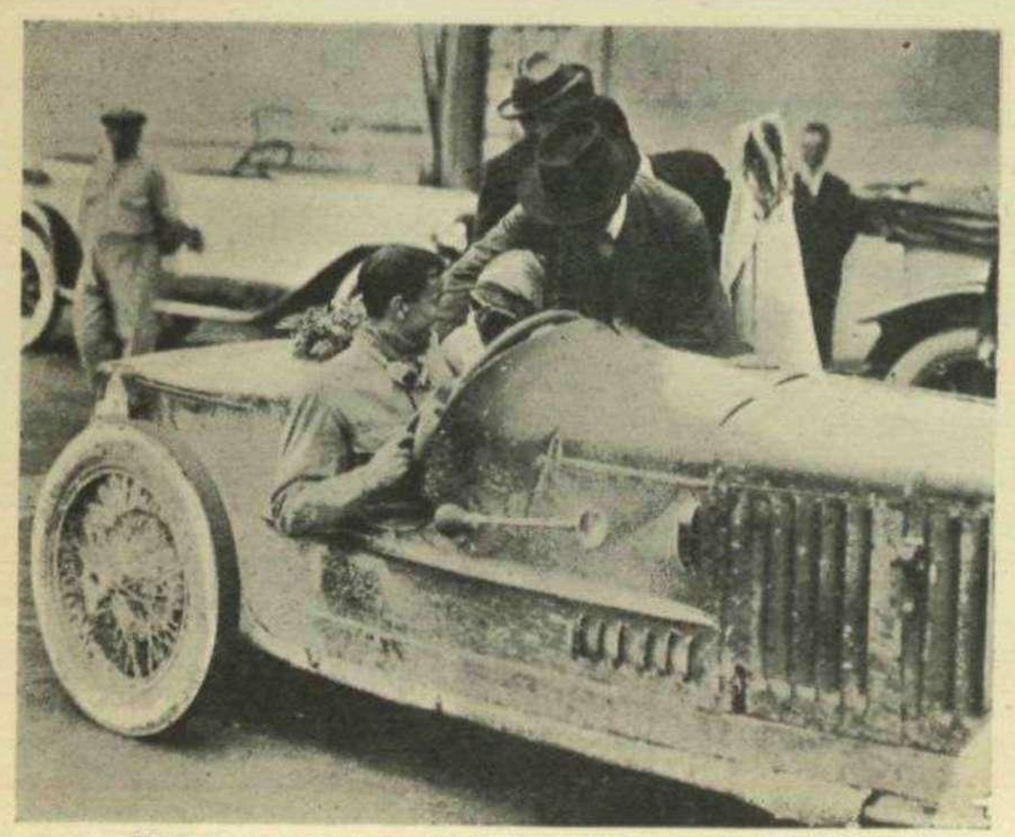
THE GORDON-BENNET NAPIER, WITH MESSRS. EDGE AND NAPIER UP.



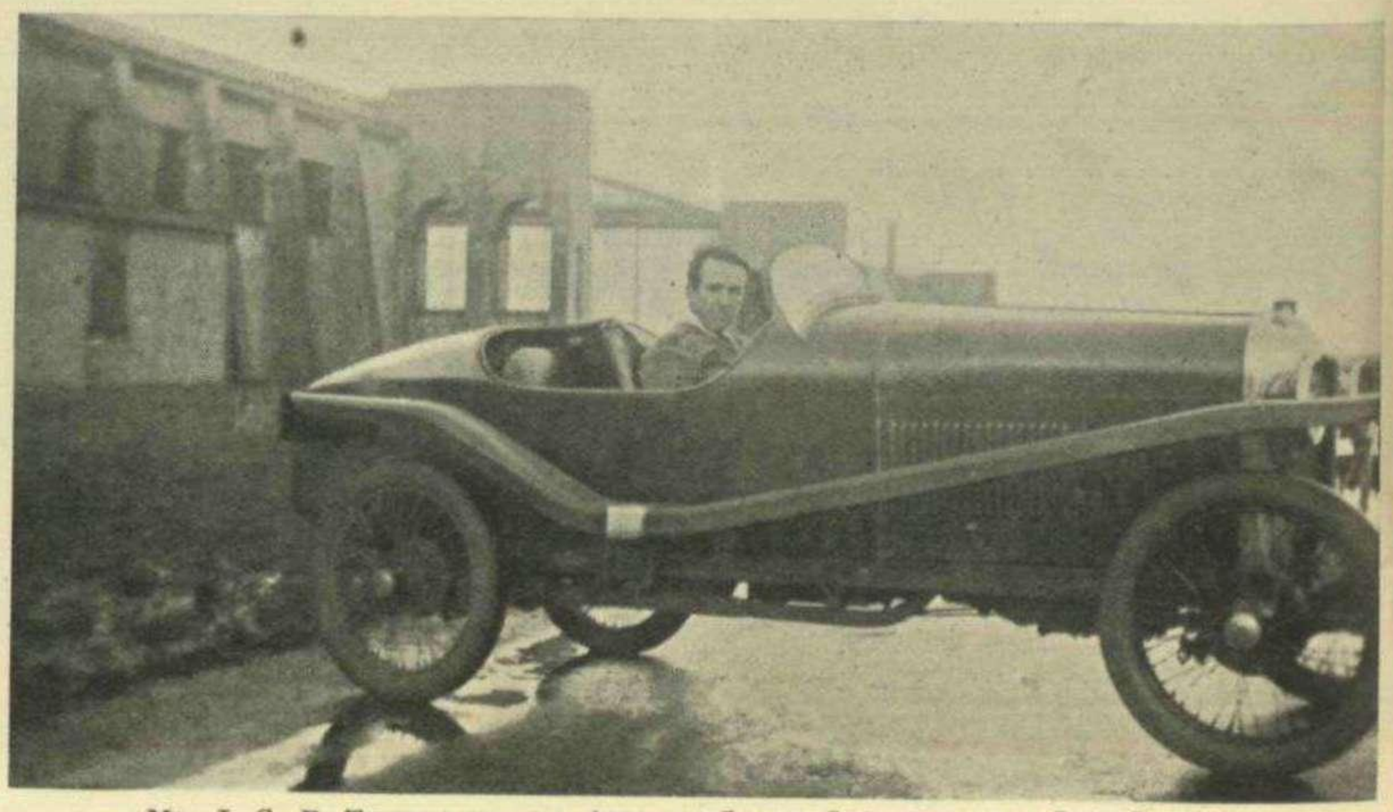
1924 2-LITRE GRAND PRIX SUNBEAM, WITH THE LATE MR. DARIO RESTA AT THE WHEEL.



MAJOR SEAGRAVE BEFORE HIS ATTACK ON THE 24-HOUR ATTEMPT AT MONTLHÉRY ON FEB. 22.

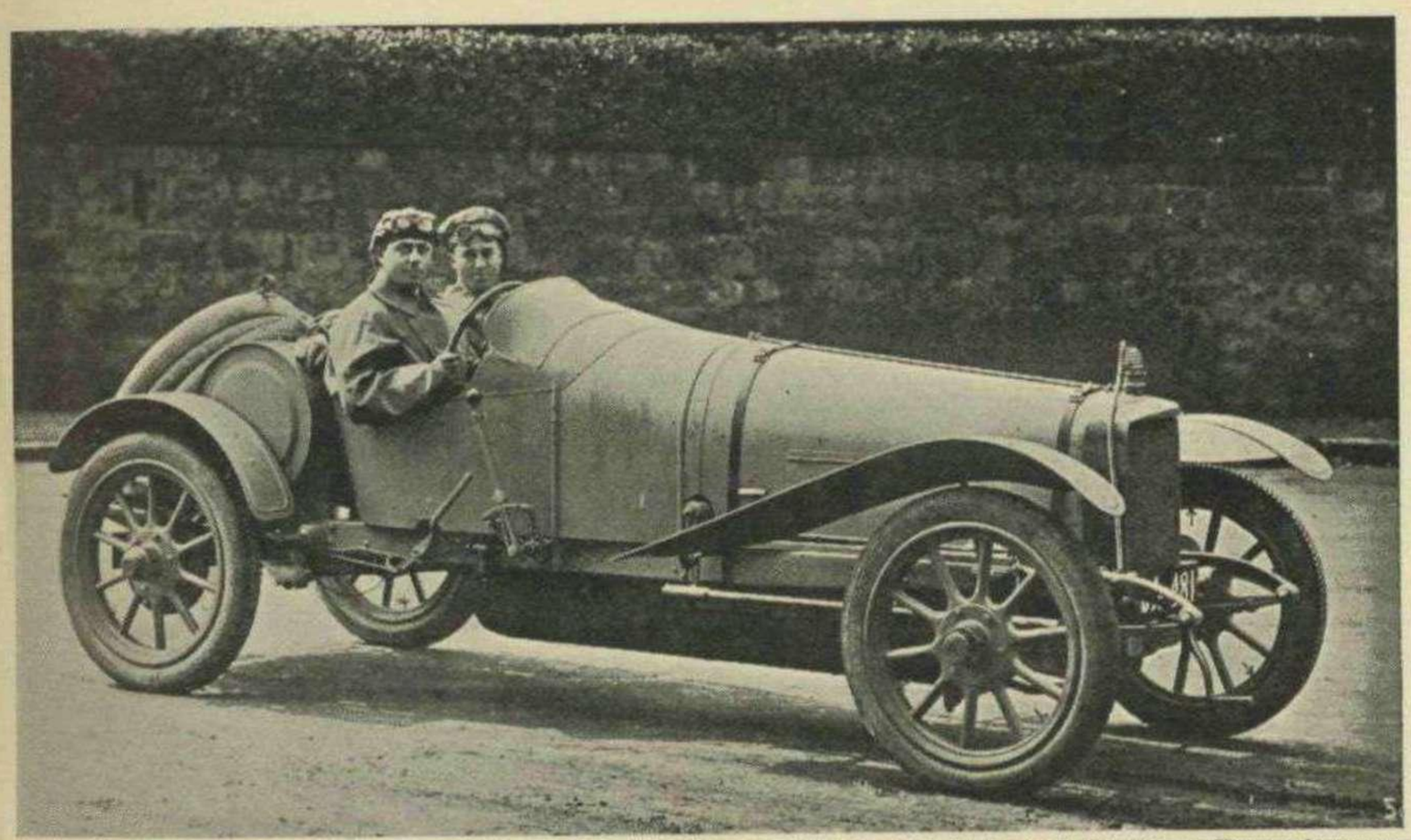


THE MUD-BESPATTERED VICTOR IN A RECENT EVENT.

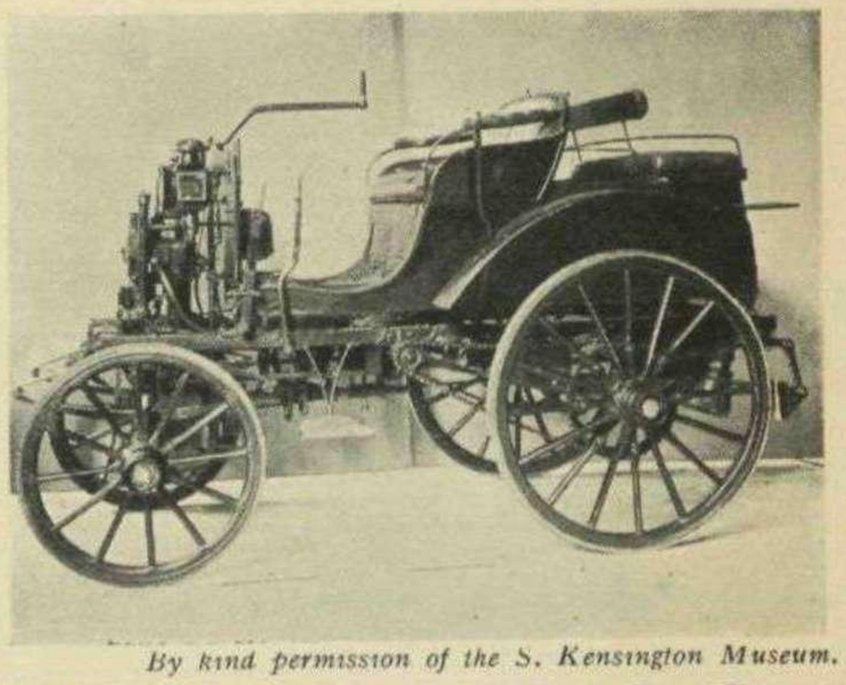


MR. J. G. P. THOMAS ON THE AMILCAR GRAND SPORTS HE HAS JUST BOUGHT.

ST AND PRESENT.



THE 1913 GRAND PRIX SUNBEAM RACER: MR. L. COATALEN AT THE WHEEL AND THE LATE MR. DARIO RESTA ALONGSIDE.

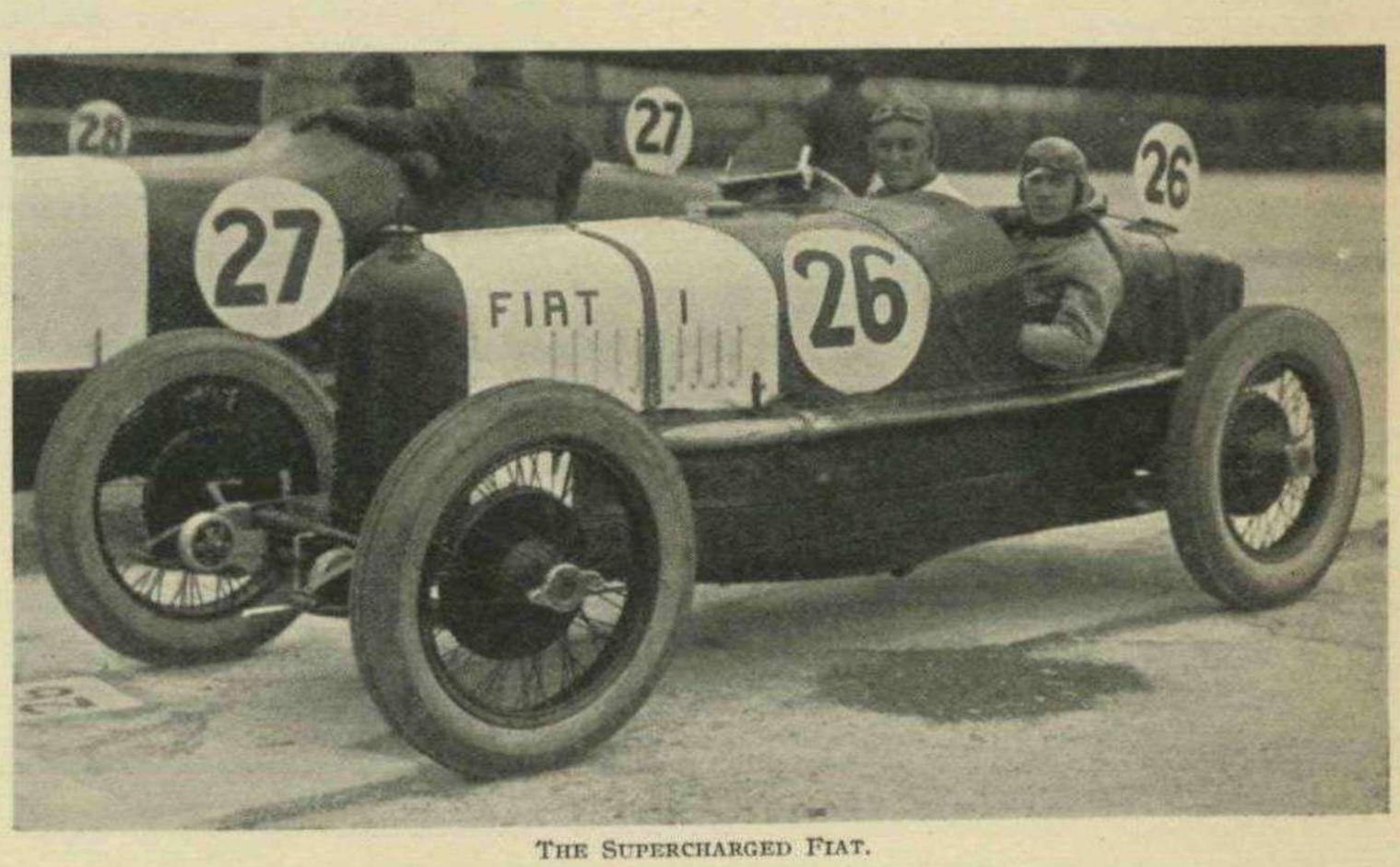


By kind permission of the S. Kensington Museum.

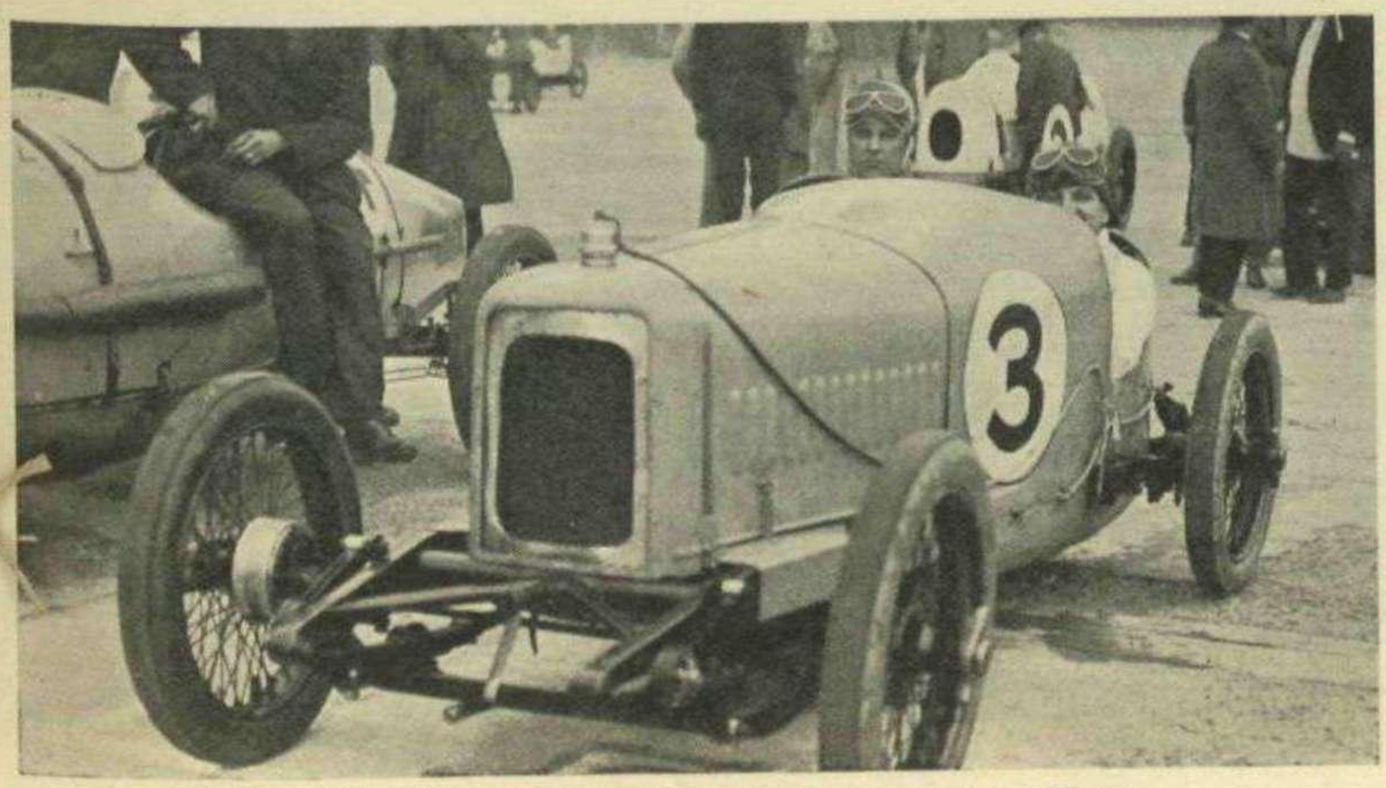
THE 4 H.P. PANHARD OF 1888 WON MANY ROAD RACES.



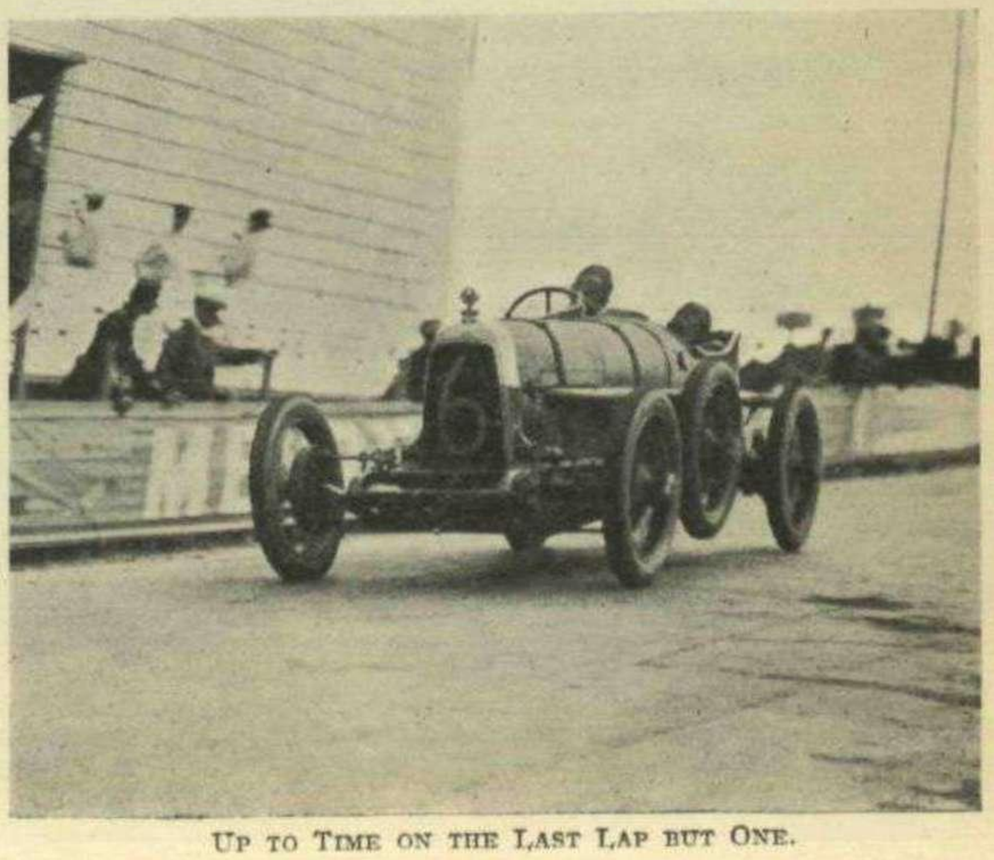
MR. J. G. P. THOMAS, WHO, WITH MAJOR SEAGRAVE, DROVE A SUNBEAM IN THE 24-HOUR ATTEMPT AT MONTLHÉRY.



THE SUPERCHARGED FIAT.



THE ALVIS RACING CAR, WITH MAJOR HALFORD AT THE WHEEL.



UP TO TIME ON THE LAST LAP BUT ONE.

MOTOR CYCLE SPEEDMEN.

R. E. HUMPHREYS.



R. E. Humphreys, a Welshman by birth, hailing from Montgomeryshire, is one of the new-comers in the ranks of prominent motor cyclists, but has nevertheless achieved such successes as to merit his inclusion in the first flighters.

At the beginning of his motor cycling career he graduated at the best possible school, namely, the workshop bench, and took his degrees under Professor Experience. Actually his early training took place with Messrs. Godfreys, Ltd., Motor Cycle Agents, of Great Portland Street, and for some time Humphreys was engaged in testing new machines prior to their delivery to customers.

Later he was employed in the London shops of Messrs. Harley Davidson as a motor cycle mechanic, but at that time was so useful in the shops that there he seemed likely to remain on repairing and tuning touring machines until Mr. W. H. Wells, then the managing director of the Indian Motor Cycle Company, gave him his first chance on the track with an Indian 1,000 c.c. solo machine.

One can imagine the delight with which Humphreys took this opportunity, especially as it was proposed that he should have charge of one of these big machines in the 200 Miles Race of 1923.

The whole arrangement was fixed up at rather short notice, so we find Humphreys coming up to the starter for the big event after having had no more than seven practice laps as his track experience. It is considerably to his credit that on this occasion he fought his way to the third position at the finish. His personal experiences of his first big race are interesting, for he explains that, though he let the machine go fairly well during the practice spins, it was only the stimulus of the actual race that brought out all the desire for the maximum speed. Humphreys explained that when he opened the throttle of the highly tuned Indian he experienced very great surprise at the way the machine seemed to shoot out from under him ; and, instead of feeling that he was riding it in the ordinary way, he seemed to be something quite unimportant attached to the ends of the handle bars, which by some strange circumstance managed to follow the machine round the track.

Another thing that proved somewhat trying at first was the bumping of the machine when passing over the uneven parts of the track. " The bumps were shocking," said Humphreys, " and at the end of the race my chest was absolutely black and blue." The worst of the bumps, we were informed, are located at the end of the railway straight, across the fork, and on the banking near the members' bridge.

Humphreys could not give us any details of spills from racing machines for the simple reason that he has been fortunate enough to avoid them, but on one occasion, during a B.M.C.R.C. meeting, the diagonal stay of a combination collapsed, and the machine " folded up," causing the rider to cross the track, but without personal injury. He noticed the mishap for some time prior to his retirement from the race, and was using his knee to act in place of the broken stay, but the pain when riding thus was so intense that he had to move his leg, with the result that the sidecar collapsed.

In the 200 Miles Sidecar Race he was running in the third position after having completed 170 miles, when his petrol pipe broke, and the starved carburettor " popped back " and caught fire. Humphreys failed to pull up at the pits, as he intended to get more petrol, but he did not actually know the machine was alight until this fact was discovered by his passenger.

Humphreys' other successes include the first place in the 1924 Sidecar Race at 69.66 m.p.h., which was run in the rain, and as he had four stops for petrol his time compares very favourably with that accomplished on a Brough Superior when running in fine weather.

In the 200 Miles Solo Race of the same year he came in third at 82.18 m.p.h., and as the frame of his machine was found to be twisted slightly before the race, the riding was rather tricky, though the whole distance was covered with but one stop for petrol.

In the Belgium Grand Prix of last year, Humphreys was riding a Belgium-made Sheffield Henderson, but as insufficient time was allowed for tuning up and practising, the engine was not in fit condition for the event, and when running close behind the two leaders, C. W. Johnston and F. A. Longman, at 3 hrs. 39 min., valve trouble developed which caused his retirement.

Humphreys is a sturdily built man, with all the physical qualities for handling powerful machines, and hopes during the coming season to demonstrate his abilities by putting up some more very fast times.

FACTS ABOUT BROOKLANDS.

By CAPT. A. W. PHILLIPS, M.C.

THE idea of the Track was conceived by Mr. Locke King, who, himself an ardent motorist, watched the growth of the automobile industry both in England and abroad, and saw that our manufacturers were handicapped in their struggle to progress by the lack of any real testing ground for new productions. The 20 m.p.h. speed limit, which was strictly enforced at that time, precluded any idea of high speeds on the road, and so Mr. Locke King allocated a large portion of his Weybridge estate as a site for Brooklands Track. At that time speeds of 60 m.p.h. were almost unheard of, but, thanks to the foresight of the designers, the Track is still safe for speeds of more than double the mile a minute pace which everybody struggled so hard to attain in the early days. Indeed, it is a moot point as to whether Brooklands, which is one of the oldest motordromes in the world, is not still the fastest. Certainly the maximum speed which can be attained down the Railway Straight is greater than that possible on any other track, though speed is admittedly lost up the rise on to the Members' Banking, and possibly on the curve past Vicker's Sheds.

Characteristics of the Track.

In shape the Track is not circular, as so many people fondly imagine, but it rather takes the shape of a pear, with the stalk somewhere about the tunnel at the Members' Entrance. The actual length of a complete circuit measured on the centre line is 2 miles 1,350 yards, or approximately two and three quarter miles. When it is remembered that it would take a normal person about three-quarters of an hour to once walk round, some conception can be formed of its size. Incidentally Mr. J. G. P. Thomas has lapped it on his Leyland-Thomas in 1 minute 18 seconds, which rather puts one off the idea of walking round! The width is 100 feet, and this applies to the whole Track save at the Fork, where the lead-in of the Finishing Straight naturally increases the width somewhat. The curves of the Track are struck at a radius of 1,000 feet and 1,500 feet respectively, the smaller, or sharper, being that round the Hill to the beginning of the Railway Straight. The bankings on the curves were naturally provided to enable cars and cycles to take them without diminution of speed, and the maximum height is on the Members' Banking, where it reaches to 28 feet 8 inches. One of the most amusing sights the Track can offer is to watch anybody attempting to climb the banking on foot. They start so boldly, and usually finish by turning hurriedly round and slithering down again. As the concrete which comprises the surface is decidedly slippery I should say it would be practically impossible for anybody to climb the banking at its steepest point unless equipped with rubber soles, and even then it would be no easy task.

How to Use the Track.

Providing there are no races in progress, the track can be used by anybody between the hours of opening and closing, which vary according to the season of the year, on payment of the standard charges. To a Member of the Brooklands Automobile Club it is free, whether with a car or motor cycle. Members of the British Motor Cycle Racing Club have the same privilege, but only with a motor cycle, whilst to ordinary members of the public the charge is ten shillings for a car and five shillings for a motor cycle per day. And it is well worth the money, for I know of no finer tonic when one feels clogged with the stale atmosphere of London town than to flit down to Brooklands and, with the wick turned well up, speed round the Track for a while amid the scent of pines and the sight of the heather.

In order to become a Member of the B.A.R.C., affectionately known as the "Bark," it is necessary to be proposed and seconded by two members. The entrance fee is five guineas, and the annual subscription the same. For this amount one is provided with a most pleasing badge, together with two ladies' brooches, the latter much coveted as hat ornaments. This small badge is the open sesame to Brooklands at all times, admits to all race meetings, passes in one's car, takes one on to the Track, into the Members' Bar, and generally gives one a feeling of ownership and homeliness. The ladies' brooch, which is transferable, as regular visitors to the Track must have noticed, admits the wearer in the same way as will the *pukka* Members' badge, but is not a pass on to the Track itself. The B.M.C.R.C. specially caters for the motor cyclist, and for three guineas gives him admission to and the right to use the Track and free admission to B.A.R.C. and B.M.C.R.C. race meetings.

The next thing to consider is what to do when one is there. Starting at the bottom of the scale, and going up, there is first the non-race day, when one turns up for a "blind," either to work off the effects of a previous one the night before or to do a spot of serious work in testing out a new car or accessory. For either of these the procedure is simple. One arrives and, after presenting one's badge or paying the admission fee, is entitled to use the Track. But remember, when leaving the Paddock, not to dash out into the Straight and get on to the Track *via* the Fork. One slips through the iron gate by the Shell depot and up the slope, joining the Track where it emerges from behind the Hill. And it is as well to join it cautiously, for it is apt to shake one a little to drive boldly on to the Track and narrowly escape a collision with some 100 m.p.h. monster engaged in testing tyres to destruction, or committing some other form of mild insanity. One leaves the Track by coming down the Finishing Straight, and so into the Paddock again. If a stop is intended on the way round, bays are provided for the purpose, and at the end of the run the bar will be found up the stairs at the corner of the Paddock! If it is desired to weigh the car or its contents, a most excellent weigh-bridge is provided, and Mr. Walker will gladly operate the scale for a charge of one shilling. Petrol and oil

FACTS ABOUT BROOKLANDS—continued.

can be obtained in the Paddock; the charges are normal, and the petrol must be paid for!

Hints for Racing Novices.

Here is a sport which for pure unalloyed excitement beats anything I know. And, withal, it need not be expensive. Of course, if one intends to run a fleet of cars, with a battalion of mechanics and advisers to look after them and tune them, then motor racing becomes a rich man's game. But the owner of a sports model car or motor cycle can put in quite a lot of racing at Brooklands, and, considering the fun he has had, be very little out of pocket. It is, perhaps, advisable for the beginner not to enter one of the open B.A.R.C. meetings for his first venture, although there is nothing to prevent him from doing so, but to try his 'prentice hand with one of the Clubs such as the Essex or the M.C.C. or the Surbiton, all of which run mixed car and motor cycle meetings during the season. At any of these a novice will be able to get the hang of the business at a lower cost than he would were he to enter right off in the biggest events of the year. In order to compete in races organized by the Clubs mentioned, however, it is necessary to become a Member, as they are all closed meetings, but the B.A.R.C. meetings, being open, do not require any preliminary membership, all and sundry being welcome on payment of the entry fee.

There are, however, certain rules and regulations to be observed, no matter by whom a race is organized. These are set out *in extenso* for car drivers in the Racing Rules of the B.A.R.C., and for motor cyclists in the Racing Rules and Supplementary Regulations of the B.M.C.R.C., both of which can be obtained at the Track. Other Clubs promoting meetings naturally make their own regulations, but they follow closely the standard rules adopted by the two premier racing bodies. In addition to the accepted rules referred to, there are a few matters which it is as well to bear in mind. Do not make humorous remarks when filling up your entry form. Remember the handicapper depends on the information you supply to a certain extent, and if you attempt to be funny or to mislead him it usually ends in your being rated at about half as fast again as you really are. Handicappers cannot afford to take chances. Besides, if you do once contrive to get a gift in the way of a handicap, your lap speeds will rapidly reveal the true state of affairs, and though you may win that particular race, it will be a long time before you win another. For all open meetings both entrant and driver must be on the Competitors' Register of the R.A.C. or the A.C.U., according to whether the race is for cars or cycles. No cars or motor cycles equipped with metal-studded tyres are allowed to compete in any race. Motor cycles must be provided with metal discs, 12 inches in diameter, and so fixed as to be plainly visible at right angles when the machine is being ridden. It is as well to own a pair of these discs, but they can be borrowed at the Track. Car drivers would also be well advised to arrange for a detachable disc for their numbers to be painted on, otherwise they may be put to the agony of watching the ubiquitous Dicker doing his best to completely ruin their beautiful paintwork. Brakes are essential, and every car must be equipped with a bonnet strap at least 1½ inch wide and ⅛ inch thick. Finally, there are very definite silencing regulations in force at the Track, and these are rigidly enforced. Every car or motor cycle must be equipped with a standard Brooklands silencer, failing which it will not be permitted to race. Even with the standard silencer fitted, if the car or cycle is still noisy it will be ignominiously bundled from the Track and consigned to outer darkness. Just one more point on the question of racing. There are two black lines painted on Brooklands Track. One is at the end of the Finishing Straight; it commences in the last 50 yards of the pull up, and curves round on to the main Track. It is called the Limit Line, and all riders or drivers must keep inside it when pulling up at the end of a race, as failure to do so may involve disqualification. It may also involve a trip over the top of the banking into the bushes. The other black line is close to the outside edge of the Track at the end of the Byfleet Banking, and is for the guidance of drivers in getting off the banking and negotiating the curve at Vickers' Sheds. This line should be kept on the right hand, otherwise it may prove extremely difficult to get off the banking properly, with consequences that may prove rather terrible.

Record Breaking.

The final outlet for one's activities at Brooklands is in attempting to break records, but as this is a job for the expert with a really hot stuff car or cycle, this is hardly the place in which to offer hints as to what to do and when to do it. One little point, however. It is generally accepted that the object of breaking records is to advertise a particular car, cycle or accessory; the more publicity that can be obtained, therefore, the better. What is the object, then, in getting up in the shivery dawn and, without telling a single soul of your intentions, save the official timekeeper, to sneak out on to the Track and break about ten world's records before the ordinary world has finished its morning struggle with the bacon and egg question? Nobody knows, of course, but there is a Press Secretary attached to the Track, part of his duties being the dissemination of news relating thereto. But the Press Secretary cannot send out reports of things he does not know are happening.

It is difficult to define the subtle fascination of the Track, although rude folk might suggest it is the brand of beer sold there. I think it is the suggestion of speed and adventure that lurks elusive in the wide sweeps of the Track, or possibly it is the startling contrast of the quiet green pine trees that fringe the Track with the hurly-burly of a close-fought race; or, perhaps, it is the kaleidoscopic crowds that throng the Hill and Paddock on a big day; or, perhaps, it is just the wonderful Brooklands ladies. I do not know. It may be any, all, either or none; but the appeal is there, and, once it has gripped you, to Brooklands you belong for ever, and ever, and ever!

HOW SPECIAL CAMSHAFTS ARE MADE.

By F. T. BERSEY, M.I.A.E.

(Managing Director of the Laystall Motor Engineering Works, Ltd.)

IF the modern sporting motorist were to be asked what supreme quality he would desire for his engine he would probably reply, "Why, all the revs. in the world, of course," and more than likely he would supplement this modest wish by a request for a few more revs. still.

In the continual search for increased engine efficiency the sporting car owner is ever on the alert to discover fresh improvements, and will maintain the desirability for increased compression ratios, the more accurate balancing of reciprocating and rotary components, and in some cases such parts as pistons and connecting rods are so greatly lightened that the machinist expert trembles for the owner when the car is first submitted to its road tests.

The methods whereby improvements are effected in any of the above-mentioned directions are more or less known to the technically minded motorist, who, indeed, may be equally familiar with special features relating to camshaft designs, but immediately this class of work is contemplated the owner is confronted with serious practical difficulties.

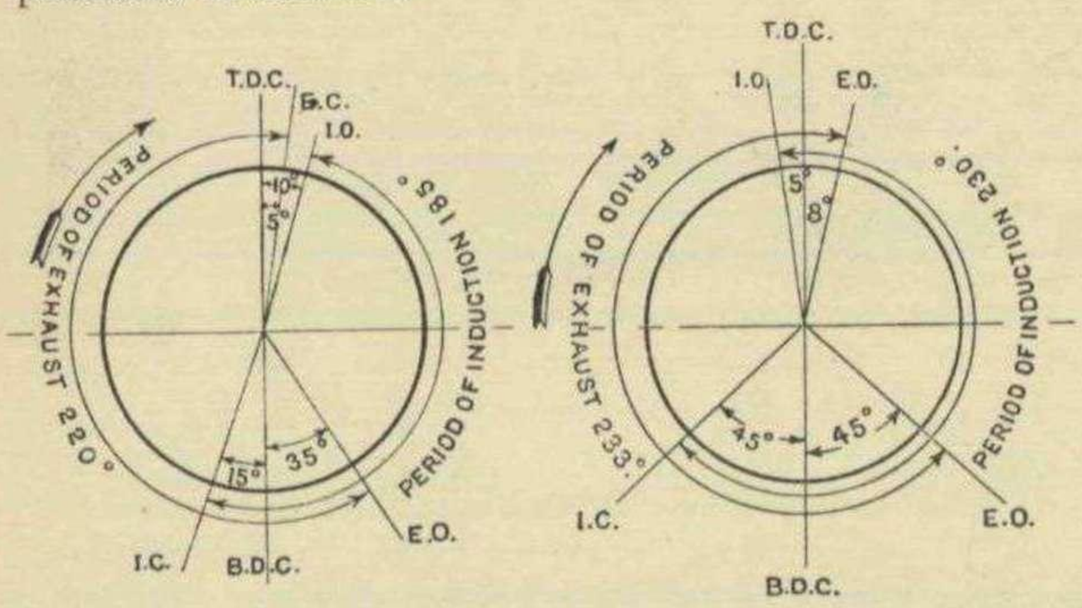


FIG. 1. ILLUSTRATING STANDARD AND MODIFIED CAM SETTINGS.

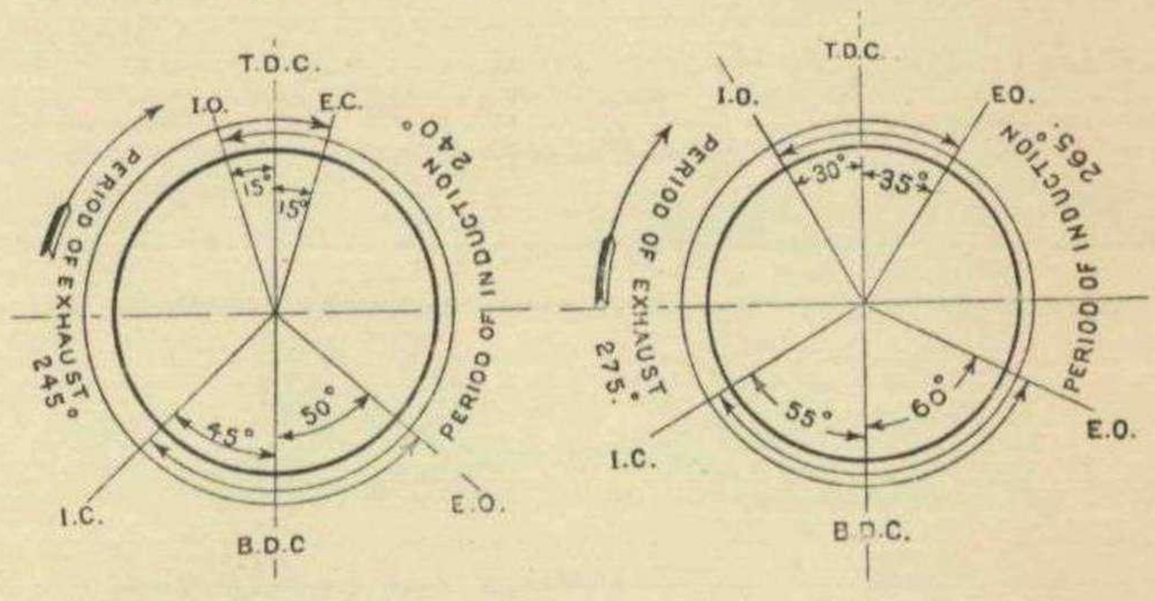


FIG. 1A. VARYING SETTINGS FOR TWO ENGINES OF SIMILAR CAPACITY.

While it is common knowledge that most racing cracks and successful competitors in hill-climbing events use non-standard camshafts which give widely differing valve timing, the exact process by which the alterations are made is more or less shrouded in obscurity.

At the request of the Editor of THE BROOKLANDS GAZETTE the writer, having had long and somewhat unique experience in this class of automobile engineering, now has pleasure in lifting the veil to explain the entire process.

The First Steps to Improved Timing.

At the very outset it must be stated that the exact setting adopted by various racing men is the result of long and expensive experimental work, and is, therefore, guarded most jealously; but, without betraying any confidence, the general lines upon which the improvements are obtained may be disclosed.

For example, if a man comes to the Laystall Works, he may either give very definite instructions as to the camshaft setting he requires, or, on the other hand, he may merely ask for a new setting, giving so much extra lift, with rough indications as to other alterations considered to be beneficial.

By the aid of modern machinery and a close theoretical study of this particular problem, one can usually meet the requirements; but, obviously, when no definite data are supplied, the customer must be prepared to take some degree of risk as to the actual improvements effected.

Making the Cam Model.

In cases where the re-grinding of the cams is merely intended to eliminate wear or ridging on the working surface, the process of correction is very simple, for the re-grinding does not, as some people imagine, have any effect whatever, either on the normal setting or the existing lift of the valves, provided no alterations have been made to the design of tappets.

This is done on a special machine, to be described later in connection with camshaft alterations. Fig. 1 illustrates a standard cam setting, as well as the modified setting to give extra power, and the way in which the work is carried out is explained as follows. By the aid of the fixture shown in Fig. 2 the original setting is noted down, the camshaft being mounted between the centres as shown, and the opening and closing position for both inlet and exhaust valves is checked with the aid of a special recording instrument, which is very sensitive. Supposing the inlet opens at 5° after top centre, this instrument shows the exact position, which is noted on the large graduated disc shown on the left-hand side, other characteristics of opening and closing being noted in a similar way.

Take the case of the tabulated settings shown on p. 351. It may be possible to reduce the cam contour by a grinding process, without any need for a new camshaft, though with very wide variations the latter course is desirable, and in such a case the first part of the process consists in making a camshaft model, largely by hand. By successively removing metal from the cam contours the desired opening and closing is eventually obtained, and, needless to say, this part of the operation calls for the greatest accuracy.

HOW SPECIAL CAMSHAFTS ARE MADE—continued.

The cam model is first ground on the circular part of the contour by means of an extremely ingenious work-shop method, then the pre-determined amount of lift is gained, also by machinery ; thus only the sides of the cam require treatment by hand.

In making the cam model it is only necessary to evolve the contours of one inlet cam and one exhaust cam, which means that the cost of the hand work is kept down to a minimum, this work being entrusted to an engineer whose skill almost amounts to legerdemain.

Forming the Camshaft from the Model.

The next part of the process of camshaft construction is equally mysterious to those unacquainted with the technical details. In a few words, what happens is this :—The model camshaft is formally introduced to the cam copying machine, which immediately sets about to cut two large formers, of which the contours are an exact reproduction of the cam model. As with all other parts of the process, save that of shaping the sides of the two cams on the model, the possible element of human error is absolutely eliminated. For the benefit of those unversed in the arts and mysteries of modern machine shop practice, the details of this peculiar process may be described as follows :—

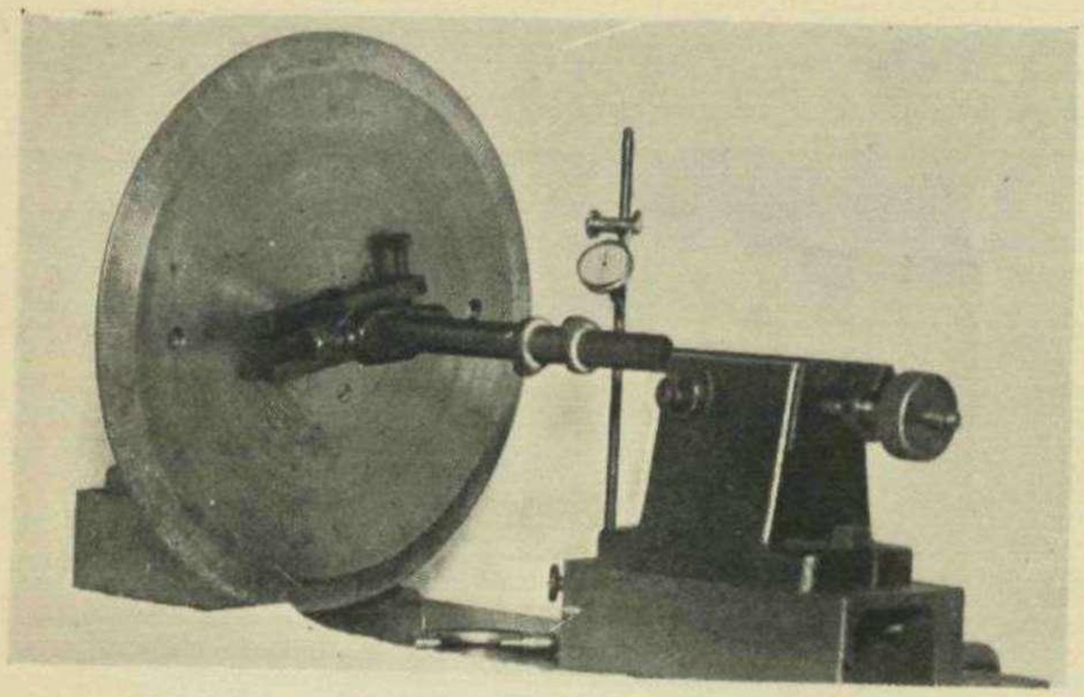


FIG. 2. CONTOUR RECORDING INSTRUMENT.

First of all the cam model is mounted between the centres of the copying machine (shown in Fig. 3), and a large circular disc is brought into contact with the contour of the first cam. As the machine is set in motion the holder for the disc moves transversely to and fro. By the aid of cutting tools mounted on the moving holder two large metallic discs are cut to the exact contours of the cam model so as to form master cams, and when the second cam is copied in the same way the first part of the process is terminated. In the meantime a blank camshaft with circular collars, representing the embryo camshaft, has been prepared on another machine, in this case an ordinary centre lathe or automatic lathe, according to whether the order is for a single camshaft or a quantity. Following the turning operation, the new camshaft is milled roughly to shape in readiness for the second process on the cam-copying machine. For this purpose a change is made on the moving holder, a grinding wheel taking the place of the rolling disc, the latter being so mounted as to follow the contour of the newly made master cams. On the machine being set in motion the camshaft is ground by treating each cam separately until the shaft is *nearing* completion, when the hardening of the cams is undertaken.

Hardening the Camshaft.

All new camshafts are made from a carefully selected case-hardening chrome-nickel steel, the hardening process being effected by placing the shaft in a steel box which is packed with a chemical compound. The whole is then placed in a muffle, the heat of which is controlled by a pyrometer, the effect being that the surface of the shaft absorbs a high carbon content, and, when cooled out, presents a glass hard surface with excellent wearing qualities.

Ensuring Final Accuracy.

If the hardening is carried out carefully the shaft will not suffer distortion ; but if any slight distortion should take place it can be corrected by the use of a special appliance designed for the purpose, and then the final accuracy of the cam contours is ensured by further grinding on the cam-copying machine. Thus, in addition to the high degree of accuracy inseparable from such a system of manufacture, well made special—or even "freak" camshafts, if you like—can be relied upon as possessing good wearing qualities.

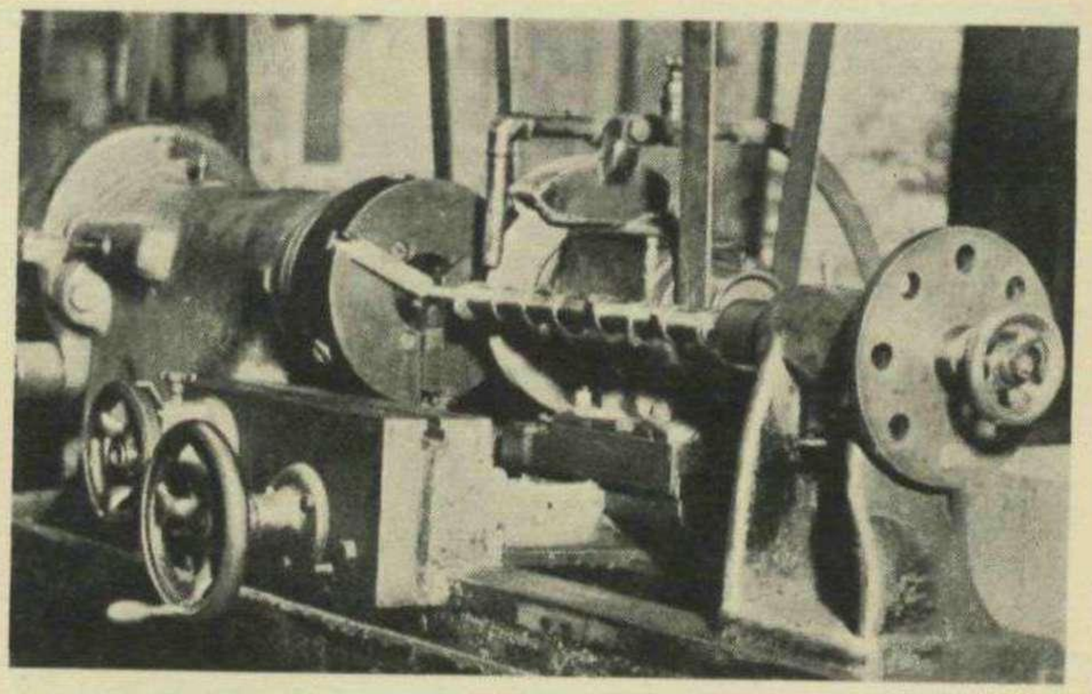


FIG. 3. CAM COPYING MACHINE.

Camshaft Fallacies.

Recent experience with the modern high speed high efficiency engine has had the effect of throwing much interesting light on camshaft design, and while one could continue discussing so fascinating a subject almost indefinitely, the writer must bring the article to an end with a few general remarks.

At one time the cry was for quick lift cams, then some wanted slow opening and quick closing ; but the general tendency is in the direction of slow lift cams both for inlet and exhaust valves, and mushroom tappets in place of those of the roller variety, which cannot possibly follow any fast moving cam without risk of valve dither.

HOW SPECIAL CAMSHAFTS ARE MADE—continued.

A Camshaft Danger.

When members of the public see a car suddenly burst into flames at Brooklands, the cause of the outbreak is usually attributed to a choked jet, a stuck valve, or similar occurrence, but, as a matter of fact, racing drivers have cut down valve-timing to such a degree that the safety line is often overstepped.

A 50 to 1 chance of a fire is long odds compared with other risks forming part and parcel of the racer's calling, but the public should know of this, so that their ideas on the safety of ordinary touring models need not be disturbed.

TABLE NO. 1.

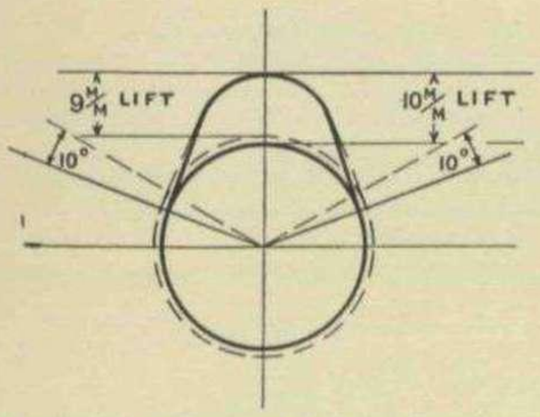
COMPARATIVE VALVE SETTINGS ON A HIGH EFFICIENCY ENGINE.

Before Alteration of Camshaft.

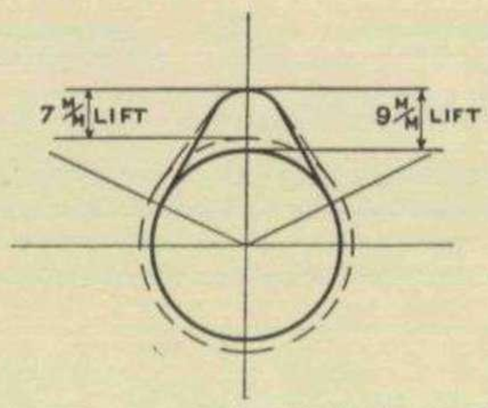
Inlet valve opens	...	10° after top centre.
Inlet valve closes	...	15° after bottom centre.
Exhaust valve opens	...	30° before bottom centre.
Exhaust valve closes	...	5° after top centre.

After Alteration of Camshaft.

Inlet opens	... ...	5° before top centre.
Inlet closes	... ...	45° after bottom centre.
Exhaust opens	... ...	45° before bottom centre.
Exhaust closes	... ...	8° after top centre.



Dotted lines show cam before alteration. Full lines show cam after alteration with period increased by 20° and lift by 1 mm.



Shape of cam after alteration to retain original opening and closing, but giving increase of 2 mm. lift.

SPECIAL VALVE SETTINGS.

TABLE NO. 2.

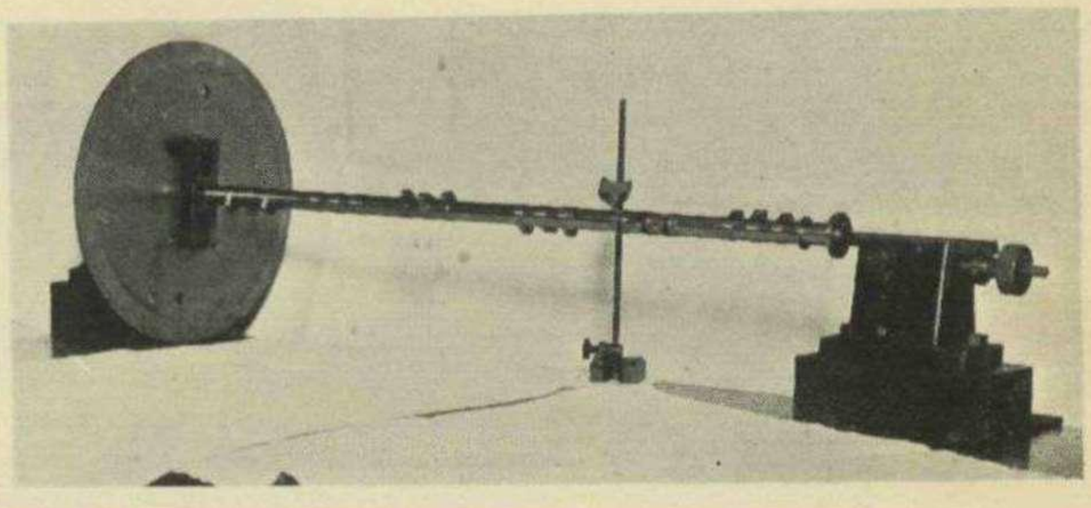
Inlet valve opens	...	30° before top centre.
Inlet valve closes	...	60° after bottom centre.
Exhaust valve opens	...	65° before bottom centre.
Exhaust valve closes	...	35° after top centre.

9 mm. lift on all valves.

TABLE NO. 3.

Inlet valve opens	...	10° before top centre.
Inlet valve closes	...	50° after bottom centre.
Exhaust valve opens	...	45° before bottom centre.
Exhaust valve closes	...	20° after top centre.

The two extreme timings both give equally good results on engines of similar capacity.



CHECKING THE SETTING OF A RACING CAMSHAFT.

F. T. Bersey



MR. ELDRIDGE IN HAPPY MOOD.

This "Automobile Trotinette" laps Montlhery 2·5 km. in 5 min. ·005 seconds.

Attack on the 24-hour World's Record.

On the 22nd inst. Major H. O. D. Seagrave and Mr. J. G. P. Thomas made an attempt to reduce the world's 24-hour record established by MM. Martin and Gros on a Bignan car. This record was put up at Montlhery on October 10th, 1924, when the average of 122.083 kilometres per hour was accomplished.

Messrs. Seagrave and Thomas drove a 2-litre Grand Prix Sunbeam, and based their running table on an average speed of 160 km. per hour, but at the moment of going to press the official result is not available.

The Amilcar Grand Sports Model.

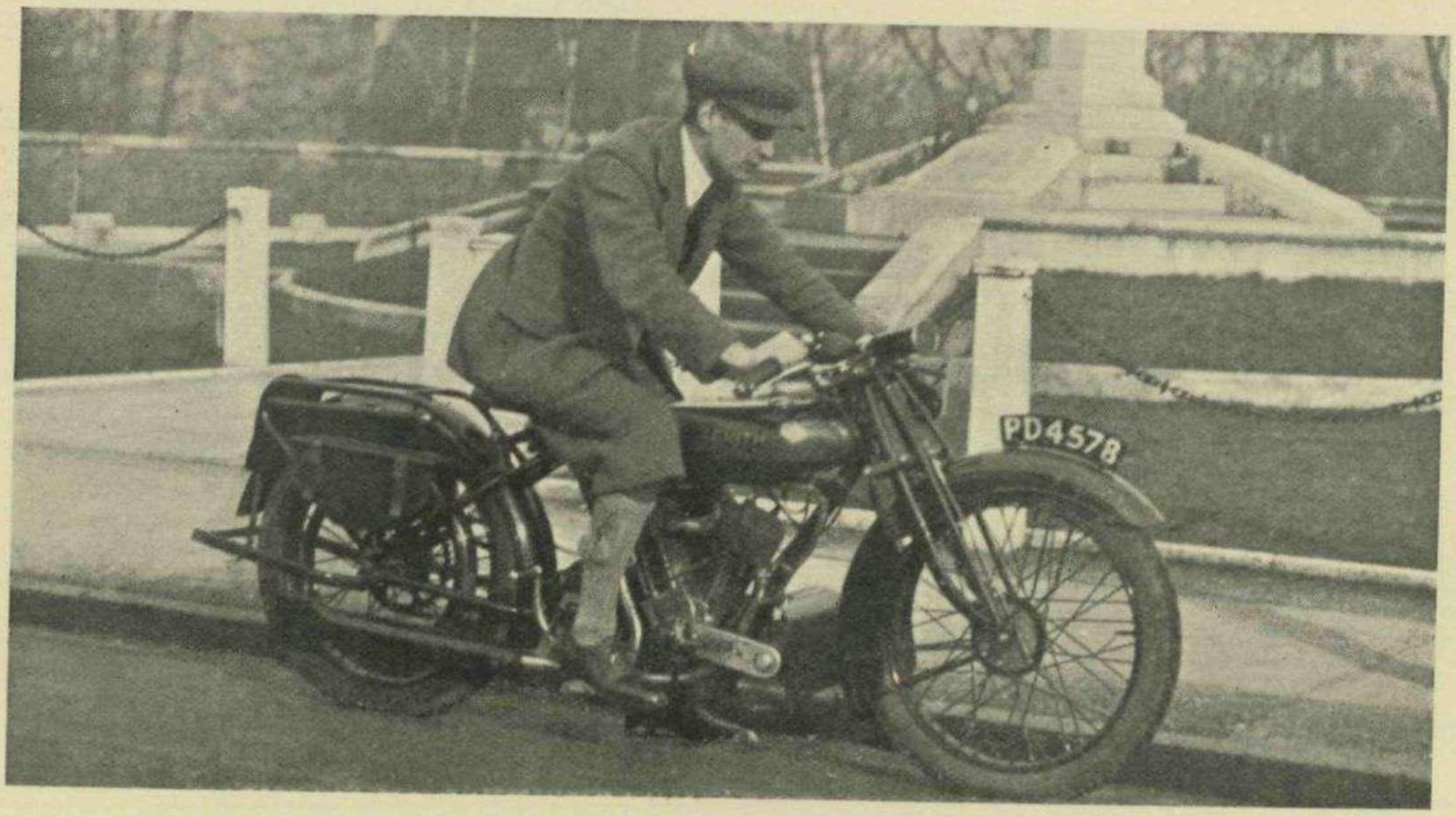
We learn that Mr. Vernon Balls, of 25, High Street, Fulham, S.W., has recently supplied Grand Sports Model Amilcars to Mr. J. G. P. Thomas, Major H. O. D. Seagrave, and Capt. D. Shipwright. It is probable that in the near future other well-known racing men will be acquiring these wonderful little machines, which are expected to give good accounts of themselves in forthcoming race meetings at Brooklands and elsewhere.

SPORTS MACHINES ON TEST.

A RUN ON A 680 c.c. ZENITH.

By A.A.R.

I AM going to permit myself to indulge in a complete eulogy on this machine, for it is impossible to criticize any important point in the performance or structural details of the bike. One can usually indulge in a mild grouse concerning such things as front brakes, tool-bags and the like, but even here I am stumped. I tried to persuade myself that the general finish was not so perfect as it is on other machines, but then I looked up the price, regarded the shapely tank and polished handle-bar lug. No ; for the price the finish could not be improved upon. The saddle, perhaps ? Well, a Terry or Lycett would certainly be a refinement ; but, then, some people like a hard saddle—I do for one.



THE 680 ZENITH MOTOR CYCLE SNAPPED DURING OUR TEST RUN.

Suddenly I am inspired. Those greasers seem too small ; and I make a mental note to mention them in my report, only to find that in all probability the next batch will be fitted with grease gun lubrication.

Performance on the Road.

On being introduced to the " 680 " Zenith for the first time one is struck by the fact that the handlebars, tank and saddle are all in the same latitude, and one wonders—in these days of dropped frames and riding positions, such as that of the Cotton—whether this will give as comfortable a position as the lower riding attitude affords. Let me say at once that it does—on the Zenith, at any rate ; in fact it is preferable unless one has very short arms.

Before I tell of its behaviour on the road, let me explain to my readers that the 680 c.c. Zenith—or at least its predecessor, the 5–6 h.p.—was my first love amongst twin machines, and I have never ridden a bike that runs more sweetly than the old belt-driven Zenith with its $3\frac{1}{2}$ to 1 top gear. Fashions alter, and my lady must needs don a chain if she is to be in the vogue ; but to be completely up to date, however, she must adopt a $4\frac{1}{2}$ to 1 top ratio, and since the 680 c.c. J.A.P. is a faster " revver " than its forerunner, this does not detract from the maximum speed attainable. The maximum speed, by the way, is in the region of 62 or 63 m.p.h., and there is no difference in controllability at this pace than there is at 30 if you are steadied by the weight of a passenger on the back. Without the passenger it would certainly be desirable to invest in a shock absorber and a steering damper, and though these are not essentials, they should check any tendency to " buck " owing to the long wheelbase of this machine.

While on the subject I must mention that the wheelbase is considerably shorter than that of the Gradua model, and the bugbear of skidding which was ever present with the old machine has been entirely eliminated ; in fact it would be hard to find a machine which behaves better on greasy tram-lines and similar privileges for which we pay the County Councils.

I could write a lot about the engine, but suffice it to say that one can walk beside the machine when it is proceeding on top gear, and from 5 miles an hour to its maximum speed the acceleration is as smooth as anyone could desire. With a flying-helmet on one cannot hear the engine at all, and this, combined with the absence of vibration, gives one the impression of riding a motor cycle driven by steam.

To test the long journey comfort a distance of 100 miles was accomplished on full throttle, and neither

SPORTS MACHINES ON TEST—continued.

my passenger, the engine, or I seemed any the worse at the finish. Second gear was not needed for any main road hill, and the machine acquitted itself admirably on test gradients.

Constructional Details.

26 × 3 Avon tyres were fitted, and their size helped materially towards the comfort, especially as they were inflated on the soft side.

The well-known three-speed Sturmey Archer gear-box is incorporated, and there is no need for the fourth speed, which is indispensable on a single cylinder machine. The gears were quiet, the clutch was perfectly adjusted and efficient in action; the gear lever was inclined to be in the way of one's knee until the top speed position was reached, but this can be altered by an adjustment on the end of the gear handle. Gear changing could be accomplished quite easily with the knee, a practice which some people prefer, as it leaves both hands free for the bars and helps one to change quicker.

The magneto is well shielded, and although I took the machine through several hundred yards of road flooded to a depth of nearly a foot, the engine fired perfectly all the time.

A strong and reliable mechanical pump is fitted, with an auxiliary hand-pump in the tank. Although the latter was used freely during the course of my test, I could not prevail upon the engine to smoke.

The Druid forks are of stout design, and the front brake is of the internal expanding type, and, incidentally, the most efficient front brake I have ever tried.

The back brake is of the belt rim type, and efficient to the last degree. In fact it saved the life of an elderly lady who made a determined attempt to perish under our front wheel. A policeman, who witnessed the effort, commented on the fact that if all brakes were as good as mine accidents would be very rare.

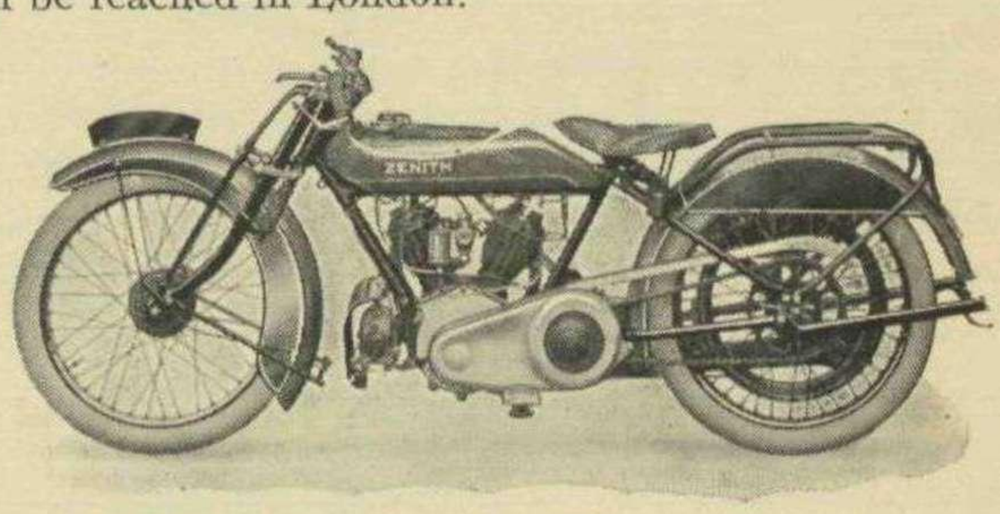
The Amac carburettor gave very good results, acceleration being very even, with plenty of " pick-up "; but, at the same time, fierce acceleration was not possible without the use of the gear-box.

The Zenith frame still retains its characteristic points, in spite of the fact that many modifications were necessary when chain-drive was adopted. The old design of placing the stand just behind the engine has been superseded by the more orthodox method adopted, the stand clip being simple and substantial.

Closing Remarks.

Although some may disagree with me (that is until they have ridden the " 680 "), I honestly feel that this model of the Zenith can be accurately described as the ideal mount.

It has sufficient power to pull a sporting sidecar smoothly without feeling that one is being cruel, and 55 m.p.h. should be attainable with a combination. Kept in good tune, and after a little running in, 64 m.p.h. would be the maximum speed of the solo machine, which means 50–55 all day long, should one be so " dispoged," with an absolute lack of vibration and complete absence of noise. At the same time, travelling in traffic is a joy, second gear being employed nearly all the time, as one can work on the clutch on this gear, and it is not unpleasant to use up to any speed which can be reached in London.



The Zenith is built at Hampton Court by Messrs. Zenith Motors, Ltd.

MOTORING SPORTSMEN—*continued from p.* 336.

has been adapted to the conditions of the track, and to let the car teach the driver, rather than be forced by him into attempts on impossible feats. He explained that the car and its driver should be one unit so to speak, and then, when the necessary understanding between the twain has been gained by consistent practice, one may go out for really fast driving.

Space does not permit the inclusion of many useful and interesting pieces of information we derived during the course of our interview, but Capt. Campbell was very clear in pointing out the wonderful opportunities presented by the Brooklands and other race tracks to the student of automobile design.

As may be expected, Capt. Campbell has his own ideas as to the essential features of a successful racing car, and at an early date we hope to give our readers an intellectual treat in the form of an article from his pen on this very fascinating subject.

The BROOKLANDS GAZETTE.

Contents for April.

MOTORING SPORTSMEN: J. G. P. THOMAS.

SUPERCHARGING IN THEORY AND PRACTICE. By *H. Hagens.*

SPORTING CARS ON TEST: THE SUPER-SPORTS ALVIS.

THE LIFE STORY OF " MEPHISTOPHOLES."

MAKING A BOOK AT BROOKLANDS. By " *Long Tom.*"

SPORTING EVENTS OF THE MONTH (*Illustrated*).

MOTOR CYCLE SPEEDMEN.

THE 3½ H.P. SUNBEAM ON TEST.

THE INTER-'VARSITY HILL CLIMB AT ASTON CLINTON.

ROUND THE CLUBS.

And other articles of topical interest.

"HOTTING-UP" A STANDARD MODEL FOR COMPETITION WORK. (PART II).

NOTES ON THE TREATMENT OF BEARINGS.

ONE of the most curious things connected with refitting a set of bearings is the fact that the actual scraping of the surfaces is by no means the most important part of the business. Indeed, with the exercise of care and skill, it is quite possible to take up a set of bearings without having to resort to scraping at all, the latter often consisting in little more than correcting faults consequent upon lack of judgment when letting the halves of the bearings together.

A Safe Working Axiom.

Before commencing any work on a set of bearings, one is well advised in assuming nothing to be absolutely correct, and thus attention will be directed to all the details of the business from the very fundamentals. Unless this is done there is the danger of overlooking something likely to upset the proceedings as they advance. In the previous article the matter of journal accuracy was discussed, so that we will assume that we are now starting operations with a true crankshaft and a set of bearings which are characterised by a certain amount of wear but no other damage, such, for example, as loose or broken white metal, badly scored or "picked-up" surfaces, or badly distorted shells. If any of the latter defects exist, the amateur will be well advised to invest in a new set of bearings, rather than undertake the process of re-metalling the old shells, as this will mean constructing some form of re-metalling jig, which, for a single set of bearings, is hardly worth while.

Locating the Looseness in Bearings.

Contrary to what one might suppose, the looseness in a bearing is often occasioned by other factors than wear between the bearing surface and that of the journal, and the mere letting together of the halves without reference to other conditions which may exist will not be sufficient to ensure a sound and workmanlike job. The bearing shells may be loose in their keeps, or they may be adjusted so that, while gripped, they lack proper support, and are thus liable to distortion of the kind which rapidly causes the white metal to break away from the shells. These are mentioned as two defects, though there are a number of others liable to produce equally serious results.

Our first step, therefore, must consist in locating the looseness of the bearing, which can be done by the simple and effective method of using *marking*. Mechanics have various fancies as to the composition of marking, but for bearing work a mixture of lampblack powder and thin oil, reduced to a thin paste, will be found quite suitable. This should be applied to (*a*) the crankshaft journal, (*b*) the edges of the bearing shells, (*c*) the edges of the bearing keep, and (*d*) the inside of the keep housing. To make the explanation quite clear to beginners at bearing work, these points are shown by the shaded areas in Fig. 1.

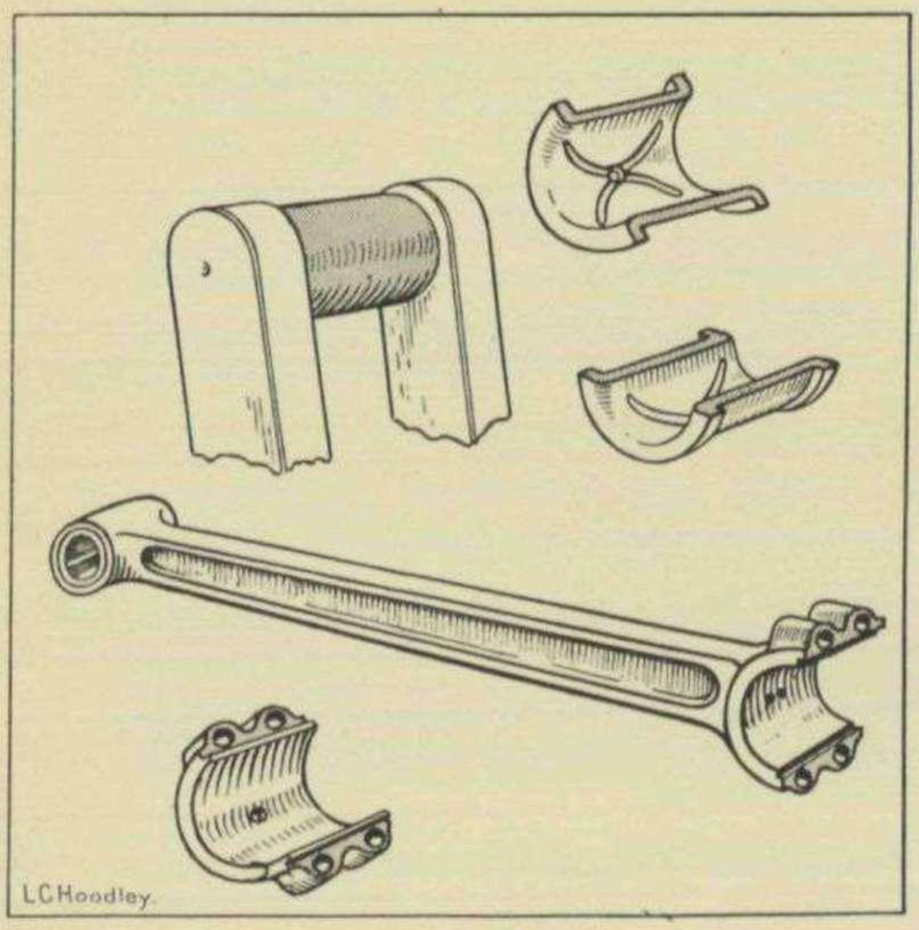


FIG. 1. SHOWS WHERE THE MARKING SHOULD BE APPLIED.

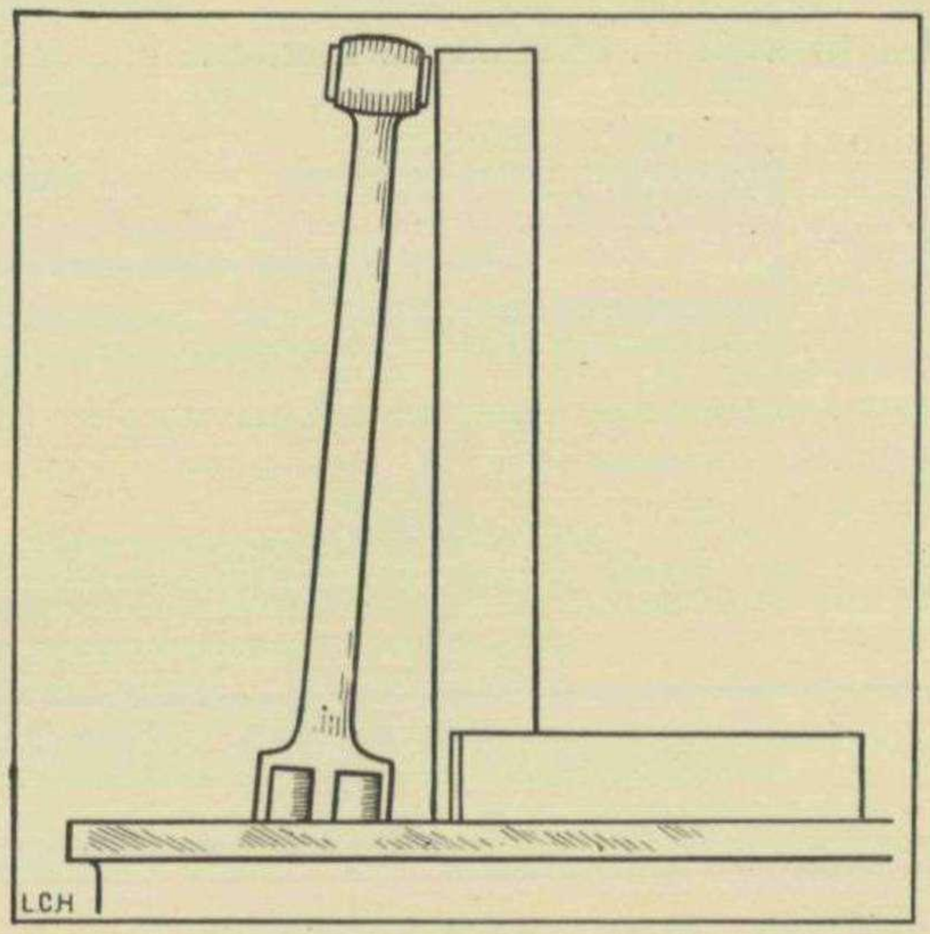


FIG. 2. PERFECT ALIGNMENT OF THE RODS IS ESSENTIAL.

The next step is to fix the bearing in place on the journal, tightening up the bolts to the fullest extent, during which process the marking will be transferred so as to indicate how the various surfaces make contact with each other. On removing the bearing and separating the shells from the keeps, we may now proceed to examine the condition of the fit, for by the mottled appearance of the marking it will be easy to distinguish those surfaces that have been pressed together by the action of the bolts from those which have

"HOTTING-UP" a STANDARD MODEL for COMPETITION WORK—cont.

either come into contact but lightly, or possibly not at all.

In the first place we shall probably find that the marking has been transferred from the journal to the inner surface of the bearing as an irregular smear, which need not concern us at the moment. What we really want to know is: Does the keep grip the shell? And, if so: Is the grip free from distorting stresses?

Three Examples.

To explain matters more clearly let me refer to the diagrams reproduced as Fig. 3, which shows three examples of big-end fitting A, B and C. A represents a correctly fitted bearing, for it will be observed that the two halves of the shell butt together, as do the cap and body of the connecting rod respectively. Here no distortion is possible, for the whole is held together by the bolts as a solid mass.

At B, however, things are different, for while the bolts clamp the two parts of the connecting rod together, it will be noticed that a gap exists between the halves of the shell. This condition permits the latter to hammer under the repeated thumps of the explosion, which loosens the metal, distorts the shell, and soon causes the journal itself to wear oval if the defect is not brought to light sooner by a collapse of the bearing.

The state of affairs depicted at C is just as serious as those described, for while the shell is kept to its work, and cannot get loose, the gap between the joint of the connecting rod throws a great deal of extra load on the bolts, and, in addition, imposes considerable stresses upon the shell, which it is not designed to withstand. The inevitable result is distortion, loosening of the metal, possibilities of fractured connecting-rod caps, and sheared bolts.

From the above remarks it will be appreciated that scraping does not by any means constitute the whole art of fitting bearings.

Means of Adjustment.

Referring again to B in Fig. 3, the means for adjustment is obviously to ease away a certain amount of metal to reduce the gap. If the amount is so great as to call for the use of a file, special care will be needed, and on no account should the faces of the body of the rod be touched, for, as shown in Fig. 2, a very slight irregularity in removing the metal will throw the rod considerably out of square. In easing away any metal from the faces of the shells or caps particular attention must be paid to the important matter of alignment, and constant checking, during the whole process, will be necessary by means of a surface plate and scribing block, as shown in Fig. 4.

In bringing a bearing from either condition shown at B and C in Fig. 3 to that of A, it is necessary to make alternative use of the file or emery sheet, with the process of marking as described above, but the process may be complicated by the introduction of yet another factor, *i.e.* the gripping of the bearing on the journal, which brings us to the subject of scraping.

The Development of a Bearing Surface.

As remarked earlier in the article, the first transference of the marking from the journal to its shell will probably take the form of an irregular smear, but now that the pressure is increased, the marking will become more regularly defined. Instead of easing away the high places indiscriminately, this part of the work should be done so that the finished surface shall comprise a number of evenly distributed bearing areas, which, when run for a while, will merge into one even and accurate bearing surface.

The production of a good bearing surface depends almost entirely upon the manner in which the scraper is used. If the strokes follow semi-circles spaced from one end of the bearing to the other, the bearing surface will be formed in annular corrugations, and a large proportion of the bearing area will be lost. The proper way to use a scraper is to work the cuts diagonally from one corner of the bearing to the other, changing the direction of the stroke at frequent intervals by working from the opposite corners. Fig. 5 shows how this method produces a regular and evenly distributed bearing surface.

For high speed engine work it is advisable to ease away the edges of the bearings to the extent of a few

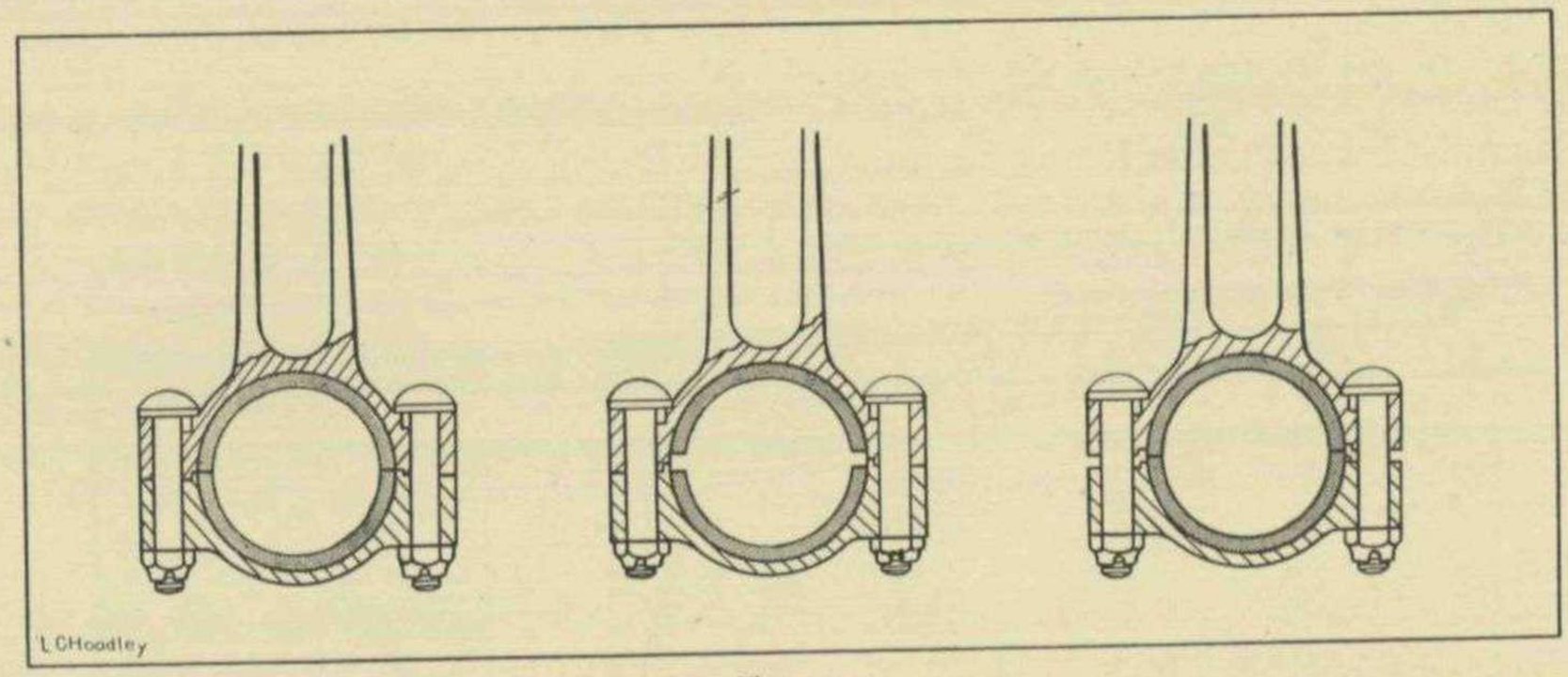


FIG. 3.

A—CORRECT FITTING. B—GAP BETWEEN SHELLS. C—GAP IN ROD.

"HOTTING-UP" a STANDARD MODEL for COMPETITION WORK—cont.

thousandths of an inch to provide a clearance. As an example, on a 2 in. diameter bearing this clearance should be about $\frac{1}{2}$ in. on either side, or $\frac{1}{4}$ in. at each edge of the shells. This can be cleared away before the bearing is finally fitted by the aid of a heavy scraper.

Final Adjustments.

Many people seem to be under the impression that the nuts on bearing bolts require careful adjustment, which is a very great mistake. These nuts must be dead tight, and nothing else will do. If the last quarter turn on the last nut causes the bearing to grip, then the surface must be scraped a little more, slacking the nut back one castellation is nothing more or less than a criminal act.

If a bearing is fitted properly, blows on its side with a hammer will not ease it should it happen to be tight. I was once working in a shop with a first class bearing fitter, and when he had completed a set of connecting rods one day he called the foreman to inspect them. The foreman thought one was a little tight, picked up a hammer, and struck the rod a blow on the side. In a flash the fitter seized the hammer from the foreman's hand and threw it through the window. I thought he was going to throw the foreman after it, but the timely intervention of the works manager prevented the more serious assault. The fitter did not get the "sack," as it happened the works manager was a practical engineer, and appreciated the action of a man who knew his job thoroughly, and resented ill-treatment of his handiwork.

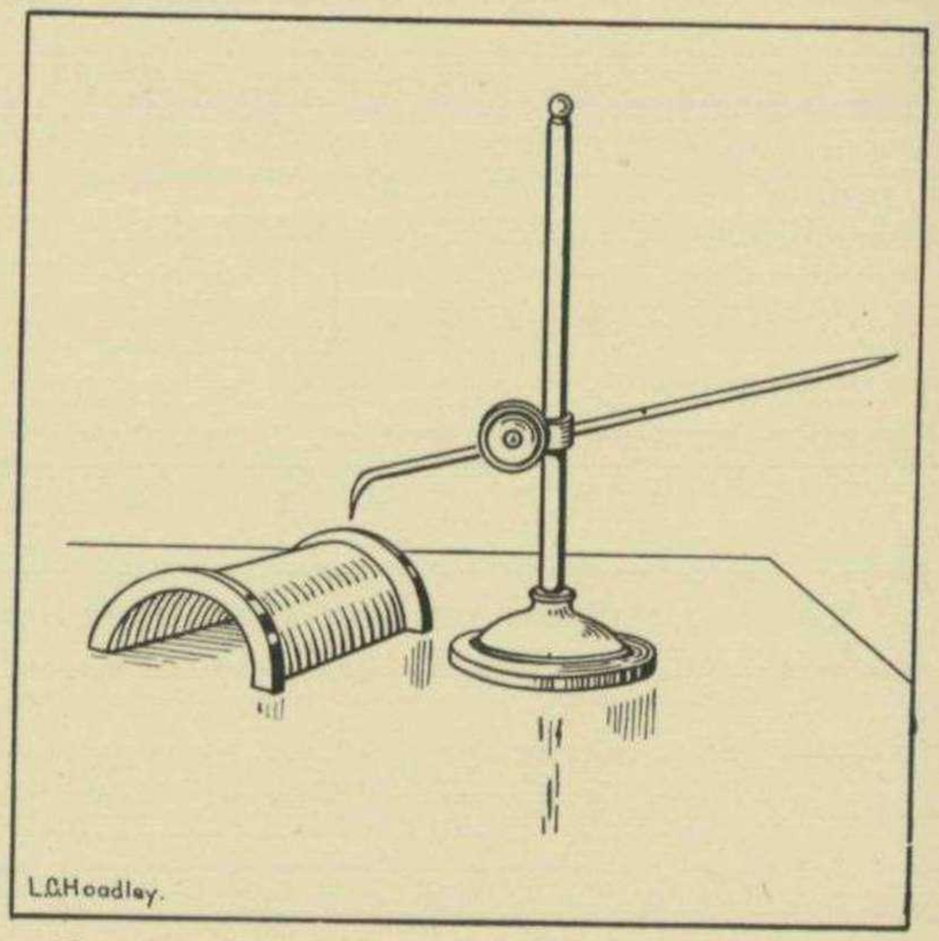


FIG. 4. CHECKING THE SHELL AFTER FILING.

(To be continued.)

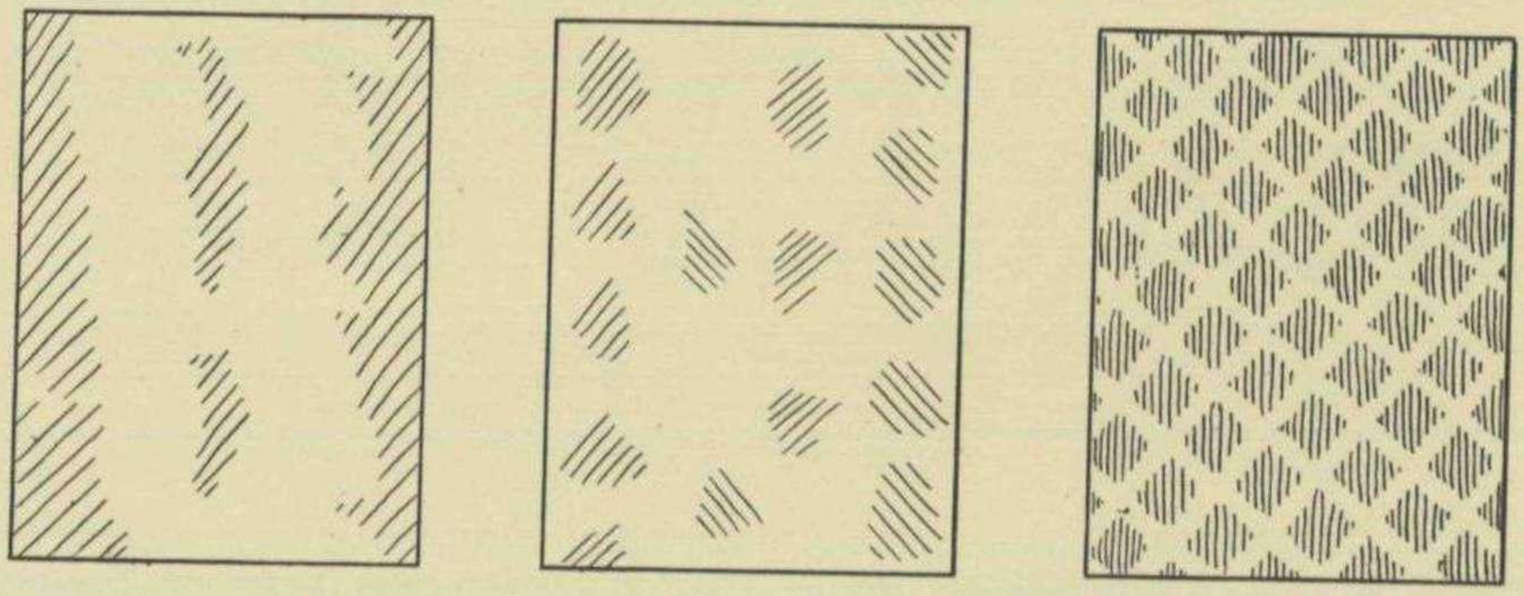


FIG. 5. THE DEVELOPMENT OF A BEARING SURFACE.

A 1,500 c.c. Straight Eight.

The new Thomas Special, which has a 1,500 c.c. straight eight engine, with a supercharger, has been entered for the Grand Prix of the Automobile Club de France. J. G. P. Thomas is establishing an extensive racing stable at Linas-Montlhery, and accommodation has been fixed for seven different types of machine.

A Good Performance by an Alfa Romeo.

On 25th January an Alfa Romeo car, driven by Massias, put up an excellent performance by climbing the redoubtable Cote du Pailladou from a standing start at a speed of 73 kilometres per hour. The car was fully equipped for touring, and a new record was established for all touring classes.

A "P. & M." Appointment.

Mr. C. T. Ashby, the winner of the 500 c.c. class of the Championship Meeting at Brooklands, and fourth in the 1924 Junior T.T., has been engaged to ride the Panther in all races for the 1925 season. Captain F. C. Townshend is remaining in charge of the company's experimental and tuning staff at Brooklands.

A Notable "Triumph" Success.

In the French Six Days' Winter Trial, over a course of 1,149 miles, which took place on the 3rd–8th inst. M. Pinney, riding the recently introduced Type "P" 4.94 h.p. Triumph, completed the most difficult course without loss of marks. By the fourth day all riders had retired with the exception of M. Pinney, in the 500 c.c. class.

REMEDIES for FRONT WHEEL OSCILLATION.

By "THE CHARGE HAND."

[This article is from the pen of a new contributor with wide experience of workshop methods, and is submitted to our readers as representing the views of a practical expert, who can rarely be persuaded to commit them to paper.—EDITOR.]

ONE of the troubles in tackling the job of correcting front wheel oscillation, or "wobble," as we usually term it, is the difficulty in deciding whether it is due to wear on the steering gear, to some kind of impact, or a defect in the design of the car; for all these causes are sometimes blamed for the irritating and dangerous action set up when the front wheels begin to oscillate, irrespective of anything the driver may do in trying to correct matters.

The subject is one that interests the practical mechanic as much as it does the sports driver, and, generally speaking, both have to work very much in the dark when dealing with bad cases; though, perhaps in a way, a really bad case is easier to remedy than one where the wobble is only slight and altogether intermittent.

Wheel wobble is sometimes put down to too much backlash in the various joints of the steering system, but I am not sure that this kind of looseness is an actual cause. Of course, excessive backlash has the effect of exaggerating the complaint, but it generally begins somewhere else. On sports cars, the wobble is seldom allowed to reach a very bad state, but I recently had a case of a touring car in which the wobble was so bad that, on a rough road, it was actually necessary to come to a complete stop, before the control of the front wheels could be regained.

Tilting the Front Axle.

It will be noticed that with most of the easy steering cars the front axle has a decided tilt, which brings the two steering pivots out of the vertical plane, to help the wheels to "castor," and when this tilt is produced by packing pieces between the axle palms and the springs, it is easy to put them in the wrong way round, for owing to their wedge shape, they can cause the steering pivot to tilt backwards at the bottom, instead of forward in the proper way. This misplacing of the wedge packing pieces is quite sufficient to account for a tremendous amount of wheel wobble; but, of course, the mistake can be easily cured.

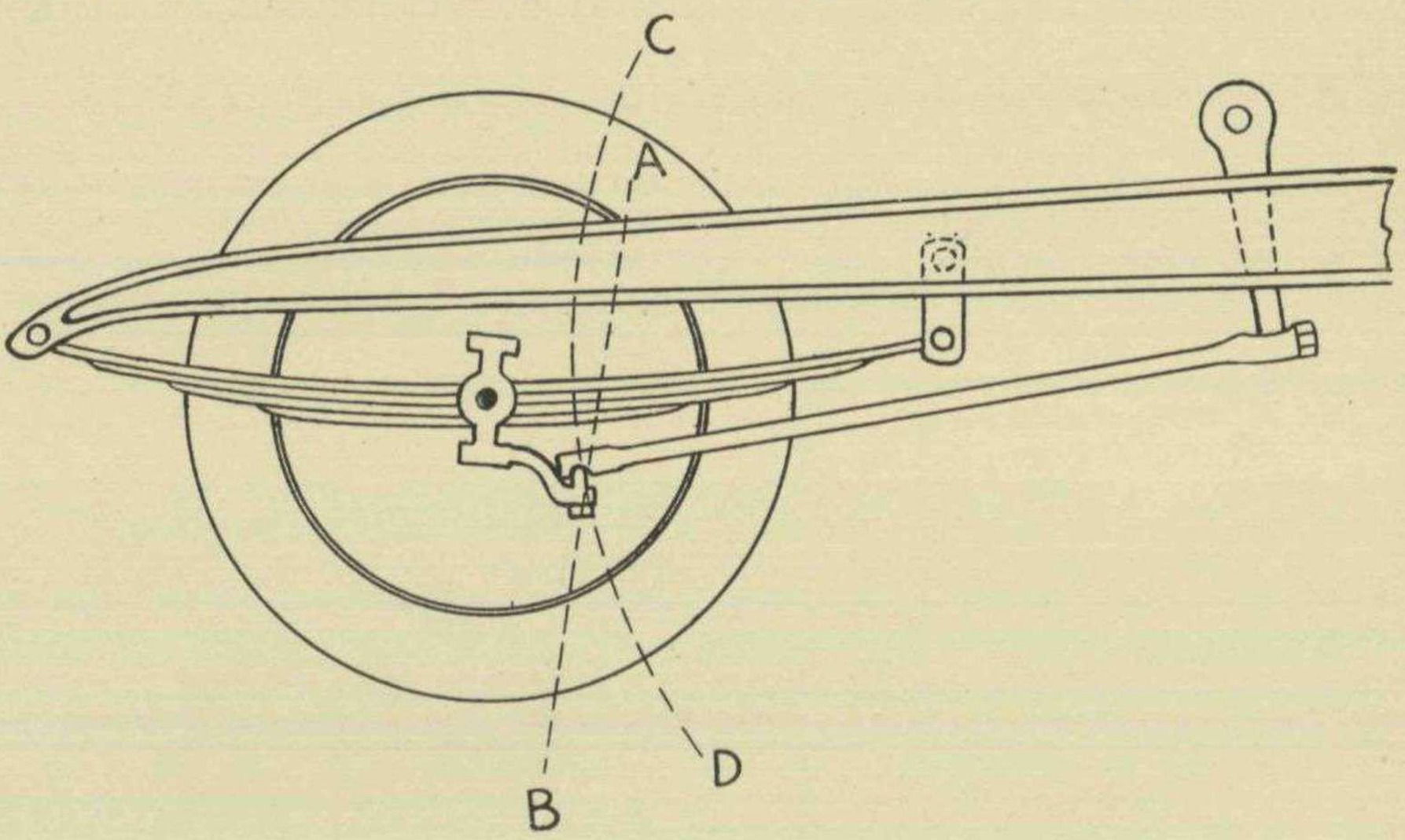


Fig. 1. SHOWING HOW INCORRECT DESIGN CREATES WHEEL WOBBLE.

When fitting new packing pieces, it is advisable to try tilting the axle little by little with temporary strips until trial on the road shows that the right amount of tilt is secured. Then permanent wedges should be fitted with the taper indicated by the road tests.

Incorrect Steering Lay-out.

With some designs of cars that have come into my hands for repair, there is no doubt that the drawing office has been largely to blame for wheel wobble and the accompanying sketch shows what happens when a mistake has been made in design.

REMEDIES FOR FRONT WHEEL OSCILLATION—continued.

The diagram shows the lay-out of an ordinary steering gear, together with the theoretical movements of the front axle and steering arms, which control wheel wobble. When ordinary springs are used, the rise and fall of the front axle is not truly vertical, owing to the flexing of the front springs. Thus the actual path of the hub spindle may be taken as roughly following in the line A–B, omitting factors which may influence it to some slight degree. The end of the steering arm to which the steering side rod is attached, naturally follows the same path, being formed on the same swivel as the wheel spindle, but the forward end of the steering side rod has a tendency to follow a slightly different course, shown by the curve C—D. This is explained by the fact that it moves in an arc struck from the bottom of the steering drop arm on the column and consequently as the axle rises and falls, when the car is passing over rough ground, the difference sets up a series of jerks, with continually reversing directions, on the lever of the swivel axle.

Now if the length of the drop arm is such that the side rod inclines downward towards the front, the difference between the two paths A—B and C—D is increased, and the wobble will become very pronounced, but as the side rod in most designs has a certain amount of *upward* tilt, wheel wobble from this cause is rather rare.

On more than one occasion, however, I have been unable to get over the trouble except by scrapping the existing drop arm and forging a new one, long enough to give a correct lay for the side rod, which has also entailed certain alterations to regulate the amount of lock for the front wheels.

Besides taking up slight road shocks, the springs on the ball and socket connections help to absorb any slight irregularities in the two paths shown in the diagram, so it is important that these parts should be attended to carefully when making the adjustments.

Personally, I believe that we shall see modifications of the accepted form of steering gear for high speed work, and it is even possible that we may go back to the old system of mounting the drop arm on the front axle, as in the case of the early Wolseleys, or at least to some idea embodying the principles of that lay-out. Then, of course, the practice of arranging the pull and push rod across the chassis instead of along the side, helps to do away with wheel wobble as the movement at the end of the rod corresponds exactly with the rise and fall of the axle.

Correct setting of the front wheels, freedom of backlash, alignment of the two axles and wheel balance are all important things in accurate and sensitive steering, but even if one takes every conceivable precaution, it is sometimes necessary to try the car at high speeds on the road or track, during the course of the adjustments, to secure the accurate steering so essential on a fast car.



THE D'YRSAN CYCLECAR—*A description of which appeared in our January Issue.*



Round the Clubs



ULSTER M.C.C.

The annual meeting of the Ulster M.C.C. is always an event of outstanding importance in motor cycling trials in Northern Ireland, and this year there was an added interest by reason of the phenomenal success of the club during the past season.

The membership of the club is now 160, compared with 140 a year ago; and the following figures speak for themselves: Funds at inauguration of club in January, 1921, nil; balance at end of first year, £19 5s. 5d.; balance at end of second year, £87 15s. 8d.; yearly profit, £68 10s. 3d.; balance at end of 1923, £234 3s., yearly profit, £146 7s. 4d.; balance at end of present season, £426 18s. 2d., yearly profit, £192 15s. 2d.

The president, in moving the adoption of the reports, said that from whatever point of view they regarded them they were very striking documents, and were great tributes to the vitality of the organisation and conspicuous testimonials to the way in which the club had been managed during the year.

Referring to the balance sheet, Mr. Moles mentioned the fact that the profit from one of the Magilligan events alone was as big as he remembered the whole turnover of the Ulster Centre in the old days, while the profit on the Grand Prix would more than run the Centre for a whole year. The revenue from the Grand Prix from various sources was £727 odd, while the total income of the club was over £1,297. What was most gratifying of all was that there stood to the credit of the club a balance of £426 odd. The reports were then passed.

Mr. A. V. Buttress was re-elected Secretary, Mr. T. Ainslie, Financial Secretary, and Mr. F. Shepherd was elected Captain.

Another addition to the Club's trophies was a cup presented by Mr. Geoffrey Liddle in memory of his son, who was killed motor cycling last year, the trophy to be known as the "G. M. Liddle Memorial Cup," and to be the premier prize in a reliability trial for novices.

NEWCASTLE & NORTHERN MOTOR CLUB.

The above Club reports a successful season's work and a substantial financial balance. The Secretary attended several meetings of the R.A.C., to which the Club is affiliated, and different matters put before that body by the Club received careful consideration.

The following officials were elected for the 1925 Season:—

President: J. T. Morrison.
Patron: W. B. Ellis. *Chairman:* W. J. Martin.
Hon. Sec.: E. Willan. *Treasurer:* C. G. Urwin.
Sports' Secretary: J. K. Morrison.

The programme of events is in course of preparation, and will be announced in a later issue.

MIDDLESBROUGH & DISTRICT MOTOR CLUB.

The financial report presented at the annual meeting of the Middlesbrough and District Motor Club showed that the balance had increased from £119 to £223.

Mr. John Gjers was re-elected President, and it was intimated that he had presented a gold cup to be won outright for a 50-mile handicap race at Saltburn next year.

THE BRITISH MOTOR CYCLE RACING CLUB.

The report of the Annual Meeting of the above Club reached us too late for inclusion in the February issue. The meeting was held at the Royal Automobile Club on January 26, and was very well attended. Full details of the Club's progress and activities during the past season were included in the Secretary's report, the principal events being the 200 Mile Races and the B.M.C. R.C. Championships. During the season 65 races had attracted 777 entries, the total prize value amounting to nearly £400.

It was remarked that as 68 per cent. of the membership represented private owner membership, it could not be actually considered as a trade or professional membership.

Part of the proceedings were occupied by the presentation of the Bates Cup, for the best One Hour Record performance, this being awarded to Mr. H. le Vack, who replied with an expression of thanks to Messrs. W. and A. Bates and the Club.

Discussion then took place in regard to the events and dates for the ensuing season. Mr. A. V. Ebblewhite announced that several valuable cups had been offered to the Club for competition during the season, and, in addition to these, Col. F. Lindsay Lloyd offered four silver cups on behalf of the Brooklands proprietors.

The following dates were announced for the 1925 meetings:—

March 21, April 11, May 16, June (Mid-Week Meeting), July 18, August 15, September 19 and October 10.

NORTHAMPTON M.C.C.

At the annual dinner and prize distribution, members made a present of a handsome mahogany clock to Mr. and Mrs. George Alderson in recognition of their services as hon. secretary and assistant hon. secretary respectively.

Mr. W. K. Hanning gave a glowing report of the club and its progress. The membership, he said, was 110, of which number nearly 80 per cent. had supported the sporting events during the season.

ROUND THE CLUBS—continued.

ESSEX M.C.

Fixtures have been made for 1925 as follows:—March 28th, Kop hill-climb; May 9th, Brooklands meeting; May 23rd, Aston hill-climb; August 29th, Brooklands meeting; September 5th, Kop hill-climb. In addition there will be a one-day sporting trial in April, and speed trials in July.

THE LEEDS MOTOR UNION.

March 29. Opening Test Run.
April 26. Reliability Trial for Richmond Cup.
May 10. Hill Climb.

BRISTOL MOTOR CYCLE & LIGHT CAR CLUB.

1925 *PROGRAMME.*

Sat., May 2nd.
Sat., May 9th. Second Aggregate Trial, Speed Judging (as first).
Sat., May 16th. Torquay 12 Hours Trial (S. Hodges, A. Tozer, F. Wiltshire).
Sat., May 23rd. Second Wessex Centre League Trial.
Sat., May 30th. Whitsun. Socials to be arranged.

BROOKLANDS AUTOMOBILE RACING CLUB.

PROVISIONAL LIST OF FIXTURES.

Saturday, March	21st	...	B.M.C.R.C. Meeting.
Saturday, April	4th	...	West Kent M.C. Meeting.
Saturday, April	11th	...	B.M.C.R.C. Meeting.
Monday, April	13th	...	B.A.R.C. EASTER OPEN MEETING.
Saturday, April	25th	...	S.E. Centre, Surbiton Club.
Saturday, May	2nd	...	Junior Car Club Spring Meeting.
Saturday, May	9th	...	Essex M.C. Meeting.
Saturday, May	16th	...	B.M.C.R.C. Meeting.
Saturday, May	23rd	...	Ealing & District M.C.
Monday, June	1st	...	B.A.R.C. WHITSUN OPEN MEETING.
Saturday, June	6th	...	Sutton Coldfield A.C.
Saturday, June	20th	...	Sunbeam Motor Cycle Club.
Saturday, June	27th	...	B.A.R.C. OPEN MEETING.
Saturday, July	4th	...	Sydenham & District M.C.

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AUTO-CYCLE UNION.

LIST OF MOTOR CYCLE FIXTURES, 1925.

DATE.		PROMOTER.		EVENT.
		APRIL.		
4th Sat.	...	Western Centre	...	Reliability Trial or Hill Climb.
10th–11th Fri.-Sat.	...	M.C.C. ...	...	London–Land's End Reliability Trial.
11th Sat.	...	B.M.C..R.C. ...	...	Members' Meeting
11th Sat.	...	Yorkshire Centre	...	Reliability Trial.
18th Sat.	...	Wessex Centre	...	Hill Climb.
13th Easter Monday		Northern ...	...	Hill Climb.
25th Sat.	...	East Midland Centre		Speed Trial.
26th Sun. to 2nd May, Sat.		A.C.U. ...	...	Standard Stock Motor Cycle Trial.
		MAY.		
2nd Sat.	...	North Eastern Centre	...	Travers Trophy Trial.
2nd Sat.	...	South Eastern Centre	...	Surbiton Amateur Inter-Club Team Trial.
9th Sat.	...	South Eastern Centre	...	Reliability Trial.
16th Sat.	...	North Wales M.C.C.	...	Hill Climb or Speed Trial.
16th Sat.	...	B.M.C.R.C. ...	...	Members' Meeting.
17th Sun.	...	Budapest (Hungary)	...	Tourist Trophy.
21st Thurs.		Barcelona (Spain)	...	24 Hours.
22nd–23rd Fri.–Sat.		Southern Centre (M.C.U.I).		24 Hour Trial.
23rd Sat.	...	Yorkshire Centre	...	Reliability Trial.
29th–30th		M.C.C.	...	London–Edinburgh.
		JUNE.		
1st	...	T.T. practising commences, I.O.M.		
6th Sat.	...	B.M.C.R.C.		Members' Meeting.
15th, 17th, 19th		A.C.U. ...	...	Tourist Trophy Races.
27th Sat.	...	M.C.C.	...	Inter-Club Team Trial.
27th Sat.	...	Cheshire Centre	...	Speed Trial or Hill Climb.
30th to 3rd July Tues. to Fri.		M.C.C. ...	...	Land's End to John o' Groats Reliability Trial.

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