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to F. HENRY ROYCE CLAUDE JOHNSON AND THE LATE HON.

CHARLES STUART ROLLS

IN GRATITUDE

FOR

MANY MEMORABLE MOTORING EXPERIENCES

AND

IN ADMIRATION

OF

THEIR ENDURING WORK WHICH HAS ADDED AN ENGINEERING HOUSE OF WORLD-WIDE RENOWN

TO THE HONOUR OF BRITISH INDUSTRY

AN ACHIEVEMENT DESTINED TO LIVE FROM GENERATION TO GENERATION

AND

TO BE OF EVER WIDENING SERVICE TO MANKIND THIS SLIGHT BUT SINCERE TRIBUTE IS OFFERED BY

THE AUTHOR

INSTITUTE

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CHAPTER ONE

BY FORCE OF CIRCUMSTANCE

Necessity-the dire need to make money-is the Mother of the most luxurious motor car in the world. During four decades the new industry of automobilism has been evolved with utterly unprecedented rapidity by many bold pioneers, but surely no other car came into being because of quite such a strange combination of circumstance and motive, since invariably those embarking on designing and building took it for granted that money would have to be lost to gain experience essential to profit winning. The plain fact, however, is that the sponsors of the Rolls-Royce car had no money to lose, and could not have come by any at that stage. Despite which the financial story of the firm has been one of consistently increasing output and profit from the time it took to car building.

Yet if German and American competition in the electrical industry had not rendered it impractical to compete with first class British goods the firm of Royce Ltd. of Cook Street, Manchester, would have been making giant electrical cranes and dynamos to-day, and the motor factoring firm of C. S. Rolls & Co., of London, would have been marketing many makes of cars, the name of none of which would have begun with the letter R. But before 1903 Mr F. Henry Royce had recognised the remoteness of the prospects of financial success arising from manufacturing large, high grade electrical cranes in England on a small scale of output.

The motor car appealed to him strongly. As a citizen of the world he recognised what a wide scope there could be for such a means of transportation, also that cars were not being designed then in a way of which a master engineer would approve. In the first instance he began pondering car problems in purely an academical way rather for change of that ceaseless mental occupation without which he could not endure to live. He had bought a

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Decauville car, a type I recall as a notably cleverly schemed machine of the period having, among other singular attractions, a direct drive, and also a live axle. Generally, during the week Mr Royce's car was in pieces at the Works for investigation, but it was reassembled in time for week-end runs. In 1903 Mr Royce also undertook repair and investigation work on various makes of cars belonging to friends or acquaintance who were not in a hurry for the return of their vehicles: in other words, that he might gain some first hand experience of the faults of cars as they were made then.

From fascination to "two-guinea-an-ounce jobs"

The possibilities appeared more and more clear to Mr Royce and the problems fascinated him. Therefore he began seriously to design a car-as-it-should-be with a view to building it. Incidentally, he engaged a draftsman who claimed to have much experience of foreign machines, which were then by far the best in the world. Alas! that sanguine fellow failed to come up to his employer's expectation, therefore his going was not delayed. Meantime Mr Royce undertook somewhat intensified testing on the road, choosing Mr Eric Platford (then one of his articled pupils and now the Company's Head Tester) to accompany him. Ever a miser of time, he put pen to paper, designed a car for which he ordered three sets of materials, and began manufacturing during the latter half of 1903 a nominal 10 h.p. vehicle, the engine of which had two vertical, water-cooled cylinders with overhead inlet valves to economise heat losses and obtain enhanced efficiency. From the outset Mr Royce laid down the policy that even these merely experimental cars must be made no less perfectly in their kind than the electrical apparatus which the firm manufactured and for which it enjoyed deservedly the highest repute. He even applied this rule to the making of the jigs and tools that were used for building the cars, with the result

that one Hulley, general superintendent of the Works, who was still gallantly trying to make a commercial success of the electrical branch of the enterprise, used to remark with rueful humour concerning any member of the staff taken off by Mr Royce to work on the cars, that the man was "doing a two-guinea-an-ounce job." In fact, the building of these cars was dovetailed into the other operations of the Works as opportunity could be made, hence at this period considerable discussion was always taking place between Mr Royce and Mr Hulley as to which operation should take precedence. The latter would put a man on electrical work, and the former would seek him for car work in order to make speedier progress.

By the spring of 1904 those three cars were built. The late Mr A. E. Claremont, then Chairman of Royce Ltd., subsequently Chairman of Rolls-Royce Ltd., had one; Mr Royce another; and the third was brought to the notice of the late Mr C. S. Rolls by Mr Henry Edmunds, the engineer, of the 'Henry Edmunds' Hillclimbing Trophy fame, a member of the Committee of the Royal Automobile Club and then a director of Royce Ltd.

The policy that governs every phase of the firm's enterprise to-day was put into practice during the building of those cars. Ever ready to do what he preached, Mr Royce would spend hours in fitting, assembling or machining parts that presented difficulties, those employed for such operations standing by to learn precisely the methods and type of work required. A mechanic having used the expression in his presence that he thought the job he had done on the car was "good enough," one then looking on recalls joyously that 'F. H. R.' "carried on in an alarming manner." He scrapped every piece that was not faultless from any point of view. He had no use for mechanics who did not aim at perfection. In design, as in production, he used to preach "Safety First." Thus when the first car was practically completed he scrapped the front axle because he found it had been bent a matter of half an inch

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to make it accord with drawing dimensions, everybody working on cars "getting a good sermon" on "this foul practice."

The hansom cab that followed the first car

The policy bore fruit, not in the after years merely when a tradition had been established-among the fine fruits of which was the first flight by aeroplane across the Atlantic in 1919 by means of Rolls-Royce aero engines-but even before the first car had been sold to the public. So it came about one day that Mr Royce ordered his tester to take Mr A. E. Claremont on his car to keep an important appointment: but on presenting the vehicle he discovered that the front axle pivot had cracked. He told the Chairman of the Company of the occurrence, and apologised for not being able to let him use the car that day. Mr Claremont was very insistent, but already Mr Royce's teaching had made such an impression that nothing would make the young man budge from his duty, though he was very crestfallen by the time he got the car back in the Works. On seeing the fault in question, Mr Royce, quite realising what he must have gone through, praised him. Later Mr Claremont sent for him, thanked him for saving his life, and praised him for his grasp of Mr Royce's principles and his loyalty to them. That Mr Claremont was an original man as well as an enterprising one may be judged from the fact that, from the outset, he sought to use his car for business purposes-but he always had his own hansom cab following him when he set out on a car to keep an engagement! His sense of humour may be judged from the fact that, his car being one of three experimental ones, improvements were naturally being incorporated in it continually; consequently several of the troubles experienced were due to that cause alone. Recognising this fact, he had a plate fixed on the dashboard, in plain view of any passenger he took with him, bearing the legend: "If the car breaks down, please do not ask a lot of silly questions." Again, Mr Royce would receive at the Works a telegram from him to announce that the car had stopped at such a place on such a road where it had been left all night—for the Works to collect.

I delight to record what I would call the human side of the inception of Rolls-Royce car building enterprise one-and-twenty years after my first experience of a make that was unique even in its first form, achieving repute as soon as it appeared. The first Royce car to figure publicly was run in April 1904. I consider myself peculiarly favoured to have ridden on it on the 18th of that month from London to Margate and back in the capacity of an Automobile Club Observer in a non-skid tyre trial organised by Mr Basil H. Joy, present secretary of the Institution of Automobile Engineers, because this remarkable performer in the 10 h.p. class of the period was not brought to the notice of Mr C. S. Rolls and Mr Claude Johnson until the autumn of that year. Yet already it did all its work with a splendid ease, and had no use for 'followers,' whether hansom cabs or cars. Once it was introduced to those gentlemen not many hours were lost in making a decision to enter into the first of a series of business agreements which has made British automobile engineering renowned throughout the world. It arose out of Mr Rolls, in a characteristically fine frenzy of fresh enthusiasm, calling for Mr Johnson rather early one morning than late one night and taking him at once for a run on the new found wonder car, the distinctive merits of which that well-known pioneer international racing motorist was as quick to recognise as Mr Johnson was from his own wide experience of motoring. While memory lasts I shall not forget my own delightful first impressions on trying a car that was thoroughbred even in the first phase of its purely experimental design. Needs one had never realised were herein anticipated and a new standard of performance

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set. The firm of C. S. Rolls & Co. exhibited one of these cars at the Paris Automobile Salon in December 1904, when it was awarded a special medal and diploma.

An historic decision

Thanks to Mr Johnson's organising inspiration, matters moved fast, and the original agreement between Royce Ltd. of Manchester and C. S. Rolls & Co. of London (founded in 1902) is dated 23 December 1904. One article of it makes remarkable reading, namely, that the firm of Rolls contracted to take all the cars built by the firm of Royce which, in turn, undertook to deliver within stipulated periods:

> Two-cylinder engined chassis of 10 h.p. rating. Three-cylinder engined chassis of 15 h.p. rating. Four-cylinder engined chassis of 20 h.p. rating. Six-cylinder engined chassis of 30 h.p. rating.

As illustrating the rare commercial courage and foresight exercised by Mr Claude Johnson it should be revealed that this agreement was carried through by him before the production of cars had reached the stage at which they were actually being delivered to customers, albeit a few machines had been sold through local reputation at Manchester.

When one considers that the aim of all motor manufacturers nowadays is to achieve as large an output of as few car types as possible, it seems almost like courting financial disaster to set out to build no fewer than four types in synchronism. The materials for each were ordered in batches of twenty, which approximates more to the scale on which experimental types are produced by certain manufacturers nowadays for final tests by their agents. But, to get the matter in proper perspective, it must be had in mind that at this period car manufacturers of established reputewere each offering the public, not four, but a dozen or more models. In fact their salesmen had to refer to the books to be quite sure of the precise differences in specification between one and another.

Having no financial reserves, and being in quest of experience, Mr Royce designed certain essentials common to each of the four engine types which were listed, admittedly in an endeavour to find a market. For his part Mr Rolls knew from personal experience that if in those days a manufacturer could not meet the purse and power requirements of a likely customer, then he would lose the order for a car to some other firm. Therefore his policy was to offer a comprehensive Royce range. Thus overhead inlet valves,then a very daring practice because of the damage that would be done to the engine if a stem broke-and the cylinder dimensions were common to the 10 h.p. 2-cylinder, the 15 h.p. 3-cylinder, the 20 h.p. 4-cylinder and to the 30 h.p. 6-cylinder engined cars. So the proposition was not quite so wild as it might appear. Mr Claude Johnson took every opportunity to feel the public pulse, hence what may be called the "multi-model" initial programme.

Nor was there any red tape, as you shall judge from the fact that the car features the Sales Department thought desirable were discussed at the Works, which were then on so modest a scale that it would be quite usual for a mechanic to walk into the office with part of an engine or of a car in his hand and askMr Royce, then in conference, how he would like that particular job done. Whereupon the now world-famous automobile engineer would break off the discussion, walk away rapidly with the man, and show him how to operate his machine and execute the work. Such dissipation of brilliant talent on the part of one who had no margin of health in reserve was nevertheless justified in the issue, because it was the only means to get a small organisation to do justice in the minimum time to Mr Royce's designs. It was BY FORCE OF CIRCUMSTANCE

enabled to build better cars than any of their size and price of that period, and to evolve them with unprecedented rapidity.

I have not yet forgotten my impressions of that initial experience of the 10 h.p. 2-cylinder engined Royce car which had balance and acceleration akin to a 4-cylinder type of the same rating and period. Moreover in spite of the use of overhead inlet valves, it ran with a degree of quietude which was memorable. Wherever it went even motorists who used powerful cars were desirous of taking the opportunity of a ride on it. Yet it was practically unheralded in the press. There were features of it that embodied degrees of engineering merit, therefore of riding qualities, not attained hitherto, and which were well worth any enthusiast's study—and which motorist in those days was not an enthusiast? To this hour I have never ridden on a better 2-cylinder engined car, though many have been introduced in the interval.

Indeed the owner of one of the first batch of cars brought it to the firm three years ago and explained that, as he could not afford a new car, he felt the proper place for this pioneer product of a now historic firm was in the museum at the Rolls-Royce works. He had driven all the way from Scotland, and parted with the vehicle almost with tears in his eyes for it had rendered him eighteen years of faithful service. The Company accepted it gratefully.

Apart from the machine shown in the Paris Salon of 1904, there were two demonstration cars outside. The late Mr James E. Vincent, of *The Times*, than whom there was no more delightful writer on motoring—or on any other subject to which he cared to devote his pen—recorded that he did not know anything about mechanics, but that he knew when he was comfortable in a carriage, and that this vehicle provided the most comfortable motoring he had experienced, therefore he thought it was his duty to inform the public accordingly.

Making friends

In fact, from the moment of the first appearance of the Royce car, as it was then named, there was never any question about its making friends wherever it went. Each car tried conquered, those who gained such envied experience not ceasing to sound its praises where motorists most did congregate.

For his part, Mr Rolls did a deal of demonstration with the first Royce car he secured, with the dual object of effecting sales with a view to financing the business and of ascertaining how broad the market would be for this new style British car. Among those to whom he gave rides were the Duke of Connaught, when taking part in military manœuvres, the King's uncle being the first member of the Royal Family to ride on a Royce car.

With neither spare money, accommodation, nor full facilities, in that the Manchester establishment had been designed for producing quite other wares than motor cars, it must be realised that the pioneer work of investigation and experiment was carried out under extremely difficult circumstances, particularly as some of the problems presented called for investigation work of an entirely pioneer nature.

The secret of unique success revealed

In spite of many drawbacks Mr Royce insisted on shirking nothing and on having things done thoroughly and successfully, "or," he would say, "give up the whole thing." His tester once expressed sympathy on his chief experiencing repeated failures in attempts to overcome a certain fault when the Works were struggling against time to give promised deliveries. "I am not upset at all: we are learning all the time," the engineer observed. "It is only through repeated failures that we can attain success," an undesigned variant of Sainte-Beuve's: "progress is lame."

'F. H. R.' was never satisfied with results : he felt that some improvement could be made always. His doctrine was that "your soul was not your own : it belonged to your work, which was the purpose for which you lived." Whatever you did—whether exercise or amusement—must be done only to enable you to do your work more thoroughly and efficiently. He even held the view that such recreations as golf, tennis and the like were "waste," because non-productive; and that if you must have exercise it should be productive as, for instance, gardening. From the inception of the enterprise until to-day his dearest pleasure was, and is, to see a job done well. About all arts and crafts his view has been always that whatever is correct and done well is beautiful and a joy for ever.

Scientific initial methods

On the technical side the courage of the man, who would rather have ruined himself than work for lower ideals, was manifest in the use of overhead valves-now increasingly widely employed and extended to aircraft engines-at a period when nobody could make this type without the risk of its breaking. But in this connection his previous characteristically thorough work in connection with electrical engineering stood him in right good stead. The automobile engineer was practically without the raw material requisite for such requirements. His own investigations into metallurgy, and his constant inspiration of metallurgists, however, soon enabled him to get the right metal for overhead valves and to treat that material properly in process of manufacture, as a result of which the unique record was achieved of the firm never having a broken overhead inlet valve. So he realised full early the extra efficiency and economy he had in desire and which are outstanding features of the overhead valve 6-cylinder engined 40/50 h.p. 'New Phantom' and 20 h.p. Rolls-Royce cars of to-day.

The tale of the first year in the car building enterprise of the Company may be concluded by stressing the fact that the first three cars were built primarily for the purpose of finding weak points in Mr Royce's ideas concerning how car design could be developed. Limited as were his resources, he realised the paramount need for the heat treatment of steel, for which purpose he installed a small furnace and carried out continuous and ambitious experiments, practically an unthought of undertaking in car building in those days. Undoubtedly, he was the pioneer in the industry of this scientific manner of approaching problems, such enterprise having been confined hitherto almost entirely to laboratory as distinct from production work. Mr Brayshaw, the tool maker of Manchester, used to collaborate with Mr Royce to the extent of carrying out the more ambitious experiments at his instigation with equipment at the former's establishment, which was more suitable than that at the Royce Works.

One day Mr Royce was so delighted at some results that had been obtained in the heat treatment of steel at his own establishment that he took Mr Claude Johnson up to the gallery and introduced to him one Wormald, a skilled tool maker who had been recruited from Westinghouse, and who was working at a bench. "This is the chap who did that job," Mr Royce said in his characteristically enthusiastic tones when praising any work which he found worthy, even as he could be quick to generate wrath matter, as the Chinese would say, when he saw work which in any way fell short of his ideal. Recalling this occasion, Mr Claude Johnson said: "I noticed Wormald's bright eye." The future Managing Director was taking stock of the characteristics of the personnel of the firm. Mr Wormald is the present Works Manager at Derby.

The ceaseless quest of perfection is the sure way to promotion that is a cardinal article in the unwritten but fixed policy of the firm.

II

CHAPTER TWO

CHALLENGE AND RENOWN

OLLS-ROYCE have specialised exclusively on the production of 6-cylinder engined cars and of 6- and 12-cylinder aero engines with such supreme success, and the stages of evolution necessary to achieve that are so numerous and intricate, that it seems as though the firm must have been designing and building 2-cylinder engined vehicles at some very remote motoring era. Nevertheless it is only one-and-twenty years since those 2-cylinder engined cars were making most enviable impressions wherever they appeared, what time nobody dreamed that a world war was coming when the firm should be a decade old only, nor that then it would be able to design and produce unprecedentedly efficient yet light engines each of which would develop, not tens, but hundreds of horse power; nor that seven years before it attained its majority engines of its building would be the means of achieving the first trans-Atlantic aeroplane flight in one stage, a performance which, though it was accomplished in 1919, is unmatched to-day.

Little by little—but rather quickly

While the buyers were being well satisfied by the first series of 2-cylinder engined Royce cars, their marked superiority in their kind merely served to urge Mr Royce to essay bigger things than anybody else could possibly accomplish with two cylinders only. For one thing he greatly wanted smoother functioning. As the selling experience of the Rolls organisation indicated that the cost involved in the achievement of this desideratum would be justified, it was decided to standardise 4-cylinder engined cars. The first series was called the 4-cylinder 'Heavy,' not because it was a lorry chassis but because it was designed specially to take the inevitably heavy bodies that in those days were deemed large. This car was not shewn until 1905, Mr Platford driving the first chassis from Manchester to London just in time for it to be fitted overnight with a Barker body with which Mr Rolls gave demonstrations during the Olympia Exhibition in February 1905. The immediate impression justified fully Mr Royce's quest of the evolution of a quiet and refined functioning car at a period when all others were noisy, the idea entertained generally by automobile engineers and car users being that you could not build an efficient machine unless it was very vocal. Here was the disproof and the contrast. It was stressed skilfully by the fact that the sales branch called this 4-cylinder engined 20 h.p. 'Heavy' car the 'Grey Ghost.'

The man who believed—and dared

This year was memorable for the decision of the Company to initiate a policy for testing its cars in first class public competition; also never to enter any vehicle except a standard model. Of course this involved expense, therefore it is a pleasure to put on record the important financial assistance that made possible this enterprise when others regarded the firm's future as still doubtful-an act of faith that constitutes no less than a milestone in the history of this great engineering organisation, since, unhappily in this world, vision without the sinews of finance can achieve nothing. This timely aid was rendered by Mr Arthur Harry Briggs, of Bradford, a shrewd Yorkshireman with a charming personality who bought the first of what were called the 'Heavy' cars, by contrast with the light type which was entered for the first Tourist Trophy race in September 1905. At a time when, assuredly, it was difficult to get anybody to believe in the prospects of a new firm entering the industry at relatively a late stage, he realised the possibility of the Rolls-Royce combination and provided the necessary finance at a critical juncture in its history, being therefore at once both the

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best friend of his country and of the firm. Though never a member of the motor trade, he was a pioneer car user who patronised nearly every successful make of vehicle and was vastly impressed with the 20 h.p. type. His enthusiasm even took the form of criticising every feature of it that he could in the course of talk with Mr Royce, who welcomed this unprejudiced revelation of a class of experience which he himself had neither the time nor the opportunity to acquire, and which was entirely distinct from the invaluable professional and racing experience which Mr Rolls possessed.

Continuous experiment on materials enabled relatively rapid progress to be made with what was a cardinal point of the policy Mr Royce had laid down before seeking a market for his carsthe building of relatively lighter vehicles. Therefore throughout the spring and summer of 1905 the 20 h.p. model went rapidly through many phases of evolution in detail, resulting in the early autumn in the 20 h.p. Tourist Trophy type. Considering that this was the firm's initial experience of competition, and the brief period during which it had been building cars of any sort, also that it was not confining its enterprise to the evolution of one type at a time, a very promising début was made by one of these cars, driven by Mr Percy Northey, which ran into second place, ahead of all other cars with engines having vertical cylinders in a $208\frac{1}{2}$ miles race up-hill and down-dale over ill-surfaced roads at a mean speed of $33\frac{1}{4}$ miles an hour on a petrol consumption of 24.8 miles per gallon. The type was introduced as a standard model, making its first public appearance as such at the Paris show that year, for nothing less than international reputation was what Mr Claude Johnson had in mind. He realised that the firm possessed an unique engineering talent and was convinced that nothing short of worldwide repute should be aimed at from the outset. His cleverness in introducing Rolls-Royce products to notice in circumstances calculated to impress individuals who counted in the

world of automobilism was shown, incidentally, by his sending a 6-cylinder 30 h.p. engined Rolls-Royce car over to the Isle of Man for the use of the Officials of the Automobile Club who organised that initial Tourist Trophy race. Something more than a merely favourable impression was created by the carriage.

The great adventure

The late Mr Ernest Claremont, Chairman of the Royce Company, whose conservative but constructional financial policy and wise guidance largely enabled such a degree of success to be attained with small means, became Chairman on the merging of the Rolls and the Royce interests into one Company in March 1906, the original directors including the aforementioned Mr Briggs.

The experience gained in the first Tourist Trophy race suggested the direction in which experiments might be carried out usefully, therefore further work on the heat treatment of metals, and so forth, resulted in designing the second Tourist Trophy cars, which were later to be standardised as what became known as 'Light Twenties,' by contrast with the original 'Heavy Twenties.' Again, not to live in a fool's paradise, in May of this year one of the 1906 T. T. type of car was driven down to Monte Carlo by Mr Rolls, with myself, in company with one of the 1905 'Heavy Twenties' as they were styled, at the wheel of which was Mr Percy Northey. The car record between the capital of the leading nation of the world and the metropolis of gambling was held then by a car of 70 h.p. rating. But on the way down I had little doubt that as far as the vehicle was concerned we could easily better this effort on the relatively little Rolls-Royce, whose running gave a new meaning to the phrase "romping up hills." Despite 'C. S. R.'s' being then in merry mood, giving frequent imitations of the sort of motorist he thought Harry Tate would make if he had such a car, and

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expatiating on the virtues of "good old genuine margarine," strawtea, and red chemical vinegar, *vin ordinaire* yclept, I was, however, in some slight doubt as regards the personal aspects of the enterprise because the greater part of our run would have to be undertaken during the night. The mechanic, as well as the Dunlop tyre man, were to sleep soundly while I attended to the route, and Mr Rolls drove. He was to leap out of his seat and change clothes during each halt for replenishment of fuel and lubricant, and tyre checking, which was to be undertaken by the men whom I was to awaken.

On the way south I was at particular pains to note landmarks that might be seen either at night, or in the daytime, when Mr Rolls, who never undertook racing or any other form of motoring or aerial enterprise on what may be called inspirational principleshe always made elaborate notes as to where he should change speed, and so forth-took an increasing interest in my jottings. For instance, I had the wild notion that the mere mountains that were to be seen on our left might be regarded as landmarks and that a broken aqueduct would be readily distinguishable. All which, however, did not in the least appeal to his sense of the practical. He wanted to know how many kilometres it was since the last Michelin tyre advertisement had been passed and when the next would be espied. Apparently nothing else was any use to him at all. If I said we had been over a level crossing he would accept that as being quite a reliable guide provided I would calculate the distance between that and the last tyre advertisement. I accommodated him by introducing tyre advertisements until I had record of several score of these what time we had still the bulk of the task to perform. There was nothing novel in this to me, because with him I had learned some of the Gordon-Bennett courses. Many times he would stop the car, shift the broken branch of a tree, and set it up at a point on a curving gradient, which was



A 10 h.p. two-cylinder Rolls-Royce car of the 1904 period



A 20 h.p. four-cylinder Rolls-Royce car of the 1905 Tourist Trophy type standing on a hill of 1 in 6.09 with nine passengers up

PLATE II



The Hon. C. S. Rolls, Winner of the Tourist Trophy in 1906



The late Lord Llangattock, with his 30 h.p. six-cylinder Rolls-Royce car to be a sign to him on the day of the race precisely where he was to change into a certain gear—provided a peasant passing meantime had not thought this tree likely fuel for the winter.

Chasing an elusive record

In checking over the provisions after 'C. S. R.' had gone to bed on the eve of the attempt, I discovered that there were two halfbottles of champagne and much cold tea. On enquiring the scheme of this Mr Rolls explained quite seriously that the champagne was for himself and that the tea was for the rest of us.

We had scarcely gone 10 kilometres after setting forth on record bent shortly before noon when the bulb-horn fell off. As we had not overrun it more than a quarter of a mile, I suggested that we should turn back and pick it up. But he was always very overstressed when undertaking jobs of this sort and said we must buy one later on. On passing through the first town of appreciable size he enquired the price of a horn and spent about ten minutes arguing over it, then drove off without one because the man wanted more money than it was worth. But the 20 h.p. Rolls-Royce sped along with clockwork regularity and I had every confidence of our bringing off the desired record. By contrast with the 1905 'Heavy' type, the gears of which I never knew Mr Rolls to change smoothly when hustling, he never made a fault with this 'Light' 1906 type. The acceleration was a revelation by comparison with the previous year's car.

In the middle of the night we ran into a driving rainstorm, which made the going heavy and greatly increased our difficulties in seeing the road. The car had no latter-day 'all-weather' equipment and I had to thrust the marked route in front of the oil side-lamp and try to make out my notes, which 'also ran,' the whole book becoming more and more pulp-like. At one level crossing, the

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gates of which we foreknew would have to be closed at the time we were timed to approach because an express train would also be due, we had speculated 10 francs on the way down as a tip to the man to be ready to open the gates instantly and momentarily at the sound of our horn-rather a dramatic effect. I had fondly hoped. Because of the storm, however, the wretch assumed we should not turn up, so kept snug in bed. It took us a quarter of an hour to rouse him. Having got him to open the gates, we had to look out for an important dividing of the ways a kilometre or so further on. The driver, however, who was so excited by the needless delay and the heavy going, feeling that all the trouble was for naught, forged ahead furiously. Soon we were unmistakably on the wrong road, having shot past the fork while I was struggling with the map under the feeble flicker of the lamp in a high wind and rain that fell like steel rods. We had better turn back. But C.S.R. would not do so, wherefore we drove on. It was impossible to read any road-signs, and at that speed it would have been even in a blaze of sunshine! I remember approaching Dijon towards dawn, when we were about two hours behind record.

But the car never faltered; nor did the British-made tyres let us down. At each stage at which we were due to replenish supplies we worked absolutely to programme, Mr Rolls jumping from his seat and rushing to an hotel where he washed, and changed his clothes, while I awakened the men, superintended the task of replenishment and sent Mr Johnson a telegram. Incidentally, Mr Rolls had wanted me to write a whole series before he had put in the first speed at Monte Carlo!

Of course, with the coming of sunlight and the passing of the stormy and chilly night we were all as blithe as birds. Thereafter everything went even better than our most sanguine expectations. To see that little car recover those lost two hours and begin beating the record a second time as the day advanced was a heartening revelation. We reached Boulogne-771 miles from the start, traversed in 28 hours 14 minutes, including all stops, loss of direction and the night storm—and had 3 hours 11 minutes to wait on Boulogne Quay before preparations for embarkation commenced.

All's well that ends well

All we had to do thereafter was to cross the water by the afternoon steamer and run at 20 miles an hour to London town. But the steamer was not due to depart for nearly two hours, therefore my task was to get the two men into an hotel for a bath and rest in bed that they might be ready to resume sleeping in the back of the car on landing in England. On the arrival of Mr Johnson he escorted Mr Rolls into a cabin where he enjoyed a wellearned sleep. I remember my principal concern was to get 'C. J.' to impress 'C. S. R.' with the fact that the latter had to go no faster than 20 miles an hour average towards London; in other words to dawdle. That was all in vain, however. He had scarcely got up the curving road from the harbour when he began giving the car full throttle. After the straight French roads of engineered gradients the tortuous ill-surfaced English ones of those days were easy to mistake one for another. I remember that during oncoming darkness, when it began to look as if we had thrown away all chance of the record, I told the driver that as we were miles off our proper road, and were going as fast as the car would run, we had better steer by the North Star, on the principle on which I advised a naval officer in charge of the navigation of the motor cruiser in which I was competing in the first cross-Channel race that, as we had gone many times the distance from France to England and back and the compass would not function intelligibly nor the sky clear, no land having been sighted for hours and

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the north coast of Scotland never having appeared on our port, "we had better turn to the right and go on until we ran into the south coast of England." Not being in command, that gallant but gravely insulted gentleman could not throw me overboard. Presently, by skilfully graduated, and therefore all but imperceptible degrees, he did turn the boat to starboard and we soon espied this our hitherto missing jewel set in a silver sea-or what on other days might appear so. We did this more or less with the car, too, coming presently in sight of the Crystal Palace, where we were met by a rehearsed driver on a 6-cylinder engined Rolls-Royce car to pilot us for the rest of the way. Mr Rolls' excited talk to the unfortunate man at the wheel of this big car, who was already sufficiently worried about our late arrival, seemed to overwhelm him with a sense of responsibility, with the result that the first thing he did was to run us into a road part of which was closed for repairs. Mr Rolls started to get to Blackfriars Bridge according to his own ideas of the whereabouts of a part of London with which he was not at all familiar. However, we drove up within a minute of midnight, so breaking the record, as it were in spite of our having imitated the conduct of Jehu across some of the south of England for several hours when there had never been the slightest need for us to exceed a mere 20 miles an hour-we had done all the record breaking planned in crossing Franceon a car that could travel nearly thrice as fast.

All's well that ends well. I remember being driven with dream-like smoothness and silence on that 6-cylinder engined Rolls-Royce up Regent Street, where I was quite able to read the names of every shop—but I could have touched the poplar trees lining the kerb.

Such is the inner history, related for the first time, of the Monte Carlo to London record put up by a car of small engine rating against others of the largest cylinder volumes of the period.

The battle of the cylinders

As to the 30 h.p. type Rolls-Royce, it was the only 6-cylinder engined car of its class out of seven entries to complete the route of the 1906 Scottish Reliability Trials, over a distance of $670\frac{1}{2}$ miles non-stop, in the hands of Mr Claude Johnson, over the most mountainous roads in the Highlands, being a revelation alike of efficiency, flexibility, quiet running, hitherto unattained comfort, and easy management. I think the fact that you could direct the course of the car with one finger only on the steering-wheel an amazing achievement at that period. These, and many more points were brought home to me by personal experience of this carriage.

On another example of this type, also taken from stock this year, Mr Claude Johnson won the 'Battle of the Cylinders,' a test over a distance of 1187 miles, marks being given for hill-climbing, speed on the level, changing gears, fuel consumption, reliability, silence and absence of vibration, the two cars selected being deemed the most representative of the 6- and of the 4-cylinder engined types respectively. Records on the first five points were certified by the Royal Automobile Club. The marks for 'Silence' and 'Absence of Vibration' were given by a committee of the members of the Stock Exchange after riding in both cars. The result was a victory for the 30 h.p. 6-cylinder engined Rolls-Royce, which won the contest by 396 marks.

The Tourist Trophy victory

Meantime the experience gained in connection with the Monte Carlo-London record led to the incorporation of one improvement after another in the 20 h.p. 4-cylinder engined car, two later built examples of which were taken out of the improved series in

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standard production and prepared for the second Tourist Trophy race. For example, in this series of cars Mr Royce incorporated a dual jet carburettor of his own designing with a hand control to obtain the economy with the power desired, the basic principle being a feature of the dual jet control of the Rolls-Royce carburettor of to-day. Of course, financial restrictions were still severe: but on the business side Mr Johnson was more firmly convinced than ever that he was associated with an engineer and a car that could challenge the world successfully, provided reasonable facilities were accorded. He was always interested in Mr Royce's fertile ideas for improvement. Thus one day the great engineer expressed the opinion that the car would have a better chance in the forthcoming Tourist Trophy race if it were run on wire wheels.

"Then why do you not put them on?" asked Mr Johnson.

"Because we could not afford the cost," answered Mr Royce.

Mr Johnson asked how much better performance was to be expected and what the cost would be. Mr Royce expressed the opinion that wire wheels would save half a minute a lap, and would cost $f_{.40}$ extra.

"Oh," said Mr Johnson, "then we (the Rolls Company) will provide the money for the wheels."

"If you are going to do that, I could tell you quite a number of things which could be done and each of which would improve our chances," said Mr Royce.

Mr Johnson asked for all the ideas. They were considered successively, the necessary finance was forthcoming, and on 27 September 1906 Mr Rolls, driving an example of the standardised second series of 'light weight' 20 h.p. 4-cylinder engined Rolls-Royce cars with overhead inlet valves, won the second 161 $\frac{1}{3}$ miles Tourist Trophy race at a mean speed of 39.4 m.p.h.—on a fuel consumption limited to 25 miles to the gallon, over a winding,

mountainous course and carrying the equivalent weight of four persons—by no less handsome a margin than 27 minutes less time than was taken to cover the course by the car which gained second place. 'C. S. R.' also made the fastest lap of the day and the fastest climb up Snaefell. In some respects I think it would be hard to match that performance to-day over those roads with those loads with so little fuel, because no car the firm ever entered for this, or other competitions, was other than a carriage that could be handed over to the public for its own use. Though the demands made by the given competition were studied in the minutest detail, no freakish design not suitable for general service was ever exploited even experimentally.

Mr Royce produced this 'light' 20 h.p. car by going through the details of the design from A to Z, applying all the knowledge he had gained in the heat treatment of metals; in regard to economical carburation; also concerning electrical ignition—then practically not understood by automobile engineers—to obtain his end. That might be summed up in the word 'efficiency,' which was his motto from the inception of his manufacturing enterprise, and remains so to this day. I remember asking him to what he mainly attributed this, the first of his really signal victories in international competition. "To a combination of 2 per cent. improvements in every feature of the car over the best corresponding feature of any other engaged, including the attainment of the quality of reliability," he replied.

A display of versatility

Meantime, anybody behind the scenes might have formed the impression that matters were working up to something of a climax. For instance, in the perpetual quest for efficiency, as represented by acceleration, engine balance, suspension, steering, and so forth, this year Mr Royce built a few 3-cylinder engined cars, the type

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making its *début* at the Paris show. It was put through the Works with the 4-cylinder engined type. It will further illustrate Mr Royce's method of investigation with the strictly limited means available to note that he had obtained his experience first with 2 cylinders, then with 4 cylinders in synchronism with experiment in regard to 3-cylinder engined cars, all with the predetermined object of producing the best 6-cylinder engined type. Indeed, his earliest ideas had been that that number was the least with which it would be possible presently to achieve a really perfect balance the combination of the highest degree of efficiency with smooth running and pronounced acceleration. To this end he could prove theories with three cylinders that could not be tested with either two or four, and so on.

Nor was that all. A dummy 8-cylinder chassis, with two V-set 4-cylinder blocks of quite a different design, and with a curved front, the driver sitting right over the power plant with no part of the vehicle visible in front of him, was shown at the Olympia exhibition this year, a few of these carriages being actually standardised. One buyer was the late Lord Northcliffe, the inspirer of this type, which was nicknamed 'The Legal Limit.'

It will not be surprising that undertaking all this in the small Works at Manchester caused everybody concerned to realise that there was every ground for assurance that success was to be achieved by abandoning the design and production of high grade, large, heavy electrical cranes and concentrating on car designing and building. To that the shops were devoted almost entirely at this period. Even so, plainly they were quite inadequate. Already the sales side of the business was in the happy position of experiencing greater demand than it could supply. As to-day, so then much of the policy in regard to evolving new types of cars derived from the selling organisation that was in the closest touch possible with the special public intended to be served.

How not to picnic with a Rolls-Royce

The method of Thomas Alva Edison's work when evolving a new idea in connection with an invention is much akin to the procedure of Mr F. Henry Royce at Manchester. At that period it was not extraordinary for him to work a day, a night and a second day without stopping, Mr Wormald, Mr Platford and a few others being with him all the time, the days seeming short for the sheer interest in them. Their chief could inspire so rare a form of enthusiasm in his assistants that they forgot fatigue in the keenness of the pursuit. Indeed, from the moment he devoted his attention to designing and building cars, time and meals seemed to have no apparent meaning for Mr Royce.

"He looked upon them as a confounded nuisance," says a colleague. Every time a hasty meal was snatched the problem was: How soon could they get back to the Works? Sometimes Mr Royce would ignore all regular hours for feeding for weeks at a spell; and he would treat the hours usually devoted to sleeping in the same way. Though engaged in multifarious activities elsewhere for the greater part of his time, nevertheless this phase of the situation did not escape the vigilant eye of Mr Claude Johnson, who began at an early stage greatly to exercise his mind concerning it. The Rolls-Royce car had not then established itself supreme in the world: its chances of attaining that intended position depended on Mr Royce's life line.

When it became imperative to arrange some scheme of meals Mr Royce's solution was not characteristically brilliant. Instead, it was the rough and ready one of sending out for sandwiches. He would sit on a bench with his workmen and rather gobble than eat. In fact, this form of feeding was looked upon by him as an opportunity for discussing the pros and cons of possible methods to attain the result had in desire at the moment. The Eskimo

saying—"conversation and food—each for itself"—had no meaning for him. So utterly oblivious did he become to the mere passage of time that one day he was quite astonished when told that work was to be discontinued on the morrow because it would be Christmas Day. It is worth recording that, though those working under him had been very much aware of the approach of Christmas, and longed for a rest, the boilerman was the only individual who said, in colloquial English, that he had no intention of devoting the annual festival to the further development of the Rolls-Royce car.

Moreover, though Royce Ltd. did not make bodies, nevertheless Mr Royce contributed not a little to designing coachwork, chiefly for local builders; albeit soon after the fortunes of the car business had been linked up with the Rolls Company old-established coachmakers, such as Barkers, Hoopers and others, began eagerly to take up the building of special bodies of their own design for these fine chassis.

But I have not accounted for all Mr Royce's duties in his capacity of Managing Director of the Royce Company. These involved signing cheques and letters, a burden that in any case would have been onerous, because foreign to his nature. Mr J. De Looze recalls that often he has spent more than an hour chasing Mr Royce round the Works to get his signature.

Too economical fuel consumption

From the moment the first Tourist Trophy race was won, the series of successes of Rolls-Royce cars in first class international competitions presents an unbroken record. Thus on the Empire City track, New York, the Hon. Charles S. Rolls won the five miles Silver Trophy with a 20 h.p. Rolls-Royce car fitted with a touring body and driven under conditions which were utterly foreign to his previous experience. He foreknew that his crack track competitors would endeavour to jockey him out of position at the corners, and so forth. I well recall his relish—there was never a man physically more plucky—when telling me how he intended to risk everything at the first ten corners and put the wind up on all and sundry who were minded to put it up on him! And he succeeded so effectively that no man tried to jockey him after that initial experience.

Fully to understand why the Rolls-Royce car is the Rolls-Royce car, in recording the history of this period it is necessary to bring the reader into the closest possible touch with what a man with a rare aptness for imaginative organisation, Mr Claude Johnson, was doing. This was a time when it became plain to him that a very different series of conditions would have to be created by the adoption of bold measures if Mr Royce's great endowment was to bear full fruit to the glory of British automobile engineering. Therefore imagine yourself with the ever studious Mr Johnson in the small Works at Manchester where, at 11 o'clock in the morning, it was the duty of a small boy to approach Mr Royce with a glass of warm milk. This child considered himself lucky if he could succeed in passing it to his employer's hand by noon-day-only to be rewarded by the observation that the milk was too cold to drink! Of course, the magnificent physique was being taxed beyond its strength, there being no repose, therefore the state of overstimulation was abnormal. 'F.H.R.' would always reach the office teeming with ideas which he was eager to put into practice without a moment's delay. It was characteristic of him that he would not even take off his overcoat on getting into the Works before plunging on his back under a car if, suddenly, it occurred to him that there was something there that it would be interesting to investigate. When he emerged, his coat more or less ruined with oil and dirt, somebody might succeed in tearing the garment off him-probably only to be rewarded by his request for the loan of the man's overalls.

Abnormally rapid car development

He never went home at night, or early the following morning which was just as often—without a bunch of knotty problems to solve, all which proves that he was developing the motor car at an abnormal rate.

He got his best ideas and clearest solutions in the early morning —hence the early rush. But the late Mr Claremont insisted that he should not visit the Works on Saturday mornings but have a rest during the week-ends. Therefore it was a common occurrence for him to turn up about five minutes to twelve o'clock when everybody was preparing to close. Seeing a bare car frame, he would say: "Now then, my lads, I am going home on that tonight, so let's get into it." He would run that chassis during the week-end.

Another striking contrast between his character and that of the average automobile engineer, or managing director, is that, instead of having half the staff tittivating his own car, whereby he could never learn what happened to one of his vehicles in the hands of the public, from the outset his regular practice was to go up to a newly assembled and quite untested chassis, order petrol and oil to be put into it, and—when his assistants protested that it had not even had a run in the tester's hands, and might let him down on the road—declare that that would not matter in the least. In consequence, it was no uncommon thing to see half-a-dozen men still hanging on to a chassis tightening nuts with spanners and busy with screwdrivers as he started off on a journey. Moreover, woe betide any fitter concerned on the Monday morning following if anything had been found wrong.

On week-days it was on the rarest occasions that he caught the last train home, his almost invariable practice being to take his tester with him on a car in course of being tried. Inevitably, it had to be driven back to the Works immediately because the time could not be afforded to leave it even for a night without further jobs being done on it. The factory was operating night shifts to meet demand and in the endeavour to provide, by increasing output to the maximum, the sinews of finance which would facilitate the still more rapid development of the Rolls-Royce car. But even on such short journeys Mr Royce got running experience, which he always regarded as invaluable. Generally he would send his tester back with a number of ideas to be carried out forthwith ready for him to try on the following day, which may lead you to enquire: "When did Mr Platford go to bed?" Well, he was young, extraordinarily enthusiastic, and of a physical sturdiness which was a match for the demands of any enthusiasm. That he was none the worse for this experience any may judge who sees this magnificent specimen of North British manhood to-day. Moreover could any pupil ask for better fortune than to work directly under the master engineer to whom he had been articled?

Jack of all trades and master of—all!

With his own hands Mr Royce can do anything on any machine that any employee in the Works to-day can undertake. When he was still so intimately associated with the factory, the employees had seen him handle machines, and agreed that none could do any one operation better, though a man whose special job it was to concentrate wholly on one operation could of course do that quicker. It was exactly the same in regard to what is technically called

fitting; that is assembling. He would file a hub cap so perfectly that it was better than if it had been done by machinery. The amazing thing is that he would spend time even with apprentices showing them how to use a file, thus creating a spirit which will

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continue for generations throughout the Works, because it has now become a tradition of Rolls-Royce to do everything perfectly.

If a car was found to fulfil all that was expected of it, immediately on his return to the Works he would go up to those concerned and give them just as much praise as, in the opposite case, he would have blamed them in that emphatic manner of which he is capable. A child princess exclaimed in like case: "Somebody has done this—I should like to know whobody." He would inquire even in the case of a man whose business it was merely to fill the radiator with water, being equally exact in praising and in blaming, in order that each man might realise his absolute responsibility to the factory as a whole.

Apart from designing engines and chassis, assisting coachmakers, and acting in this Crichton-like fashion, he designed every tool and spanner on the car even to the very screwdrivers, it being a joke in those days that a separate screwdriver had been planned for each screw in the chassis.

Do you not think that this is sufficient account for one man to render of his time? Know, then, that in addition to all this Mr Royce found time to plan a Works to be built at Derby, where big developments were toward.

But that story demands a chapter to itself.

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Such unprecedentedly successful car design and performance created a demand that it was impossible for the small Works at Manchester to satisfy. Mr Royce's extraordinary giftedness, already abundantly manifest, nevertheless left no manner of doubt that he had revealed a mere foretaste of what he was capable of accomplishing, given ample resources and scope. Up to this point the firm of C. S. Rolls & Co. had absorbed the whole of the car output of Royce Ltd., and still found supplies insufficient. A public company with $\pounds 200,000$ capital, under the style of Rolls-Royce Ltd., was floated in December 1906. It was announced in the prospectus that the purpose was to enlarge the existing Works at Manchester, or to build additional Works elsewhere; also to provide additional showrooms, repair shops and to establish agencies.

The document stated that Mr Royce had estimated the cost of the manufacture of the chassis and Mr Johnson had estimated "the cost of manufacture of bodies and completion of and selling the cars." It further set out that contracts had been arranged to secure the services of Mr Frederick Henry Royce as Engineer and Works Director; the Hon. Charles Stuart Rolls as Technical Managing Director; Mr Claude Goodman Johnson as Commercial Managing Director and Mr A. E. Claremont as Commercial Adviser. Mr Royce was to receive £1250 a year and 4 per cent. of the profits in excess of £10,000 a year; Mr Rolls and Mr Johnson £750 a year each and 4 per cent. of the surplus profits; and Mr Claremont £250 a year and 2 per cent. of the surplus profits.

Shortly after the issue of the company Lt.-Colonel Lord Herbert Scott, C.M.G., D.S.O., became an executive director. He was qualified admirably to undertake duties especially concerning the designing, manufacturing and finishing of carriage-work selected by buyers for fitting to Rolls-Royce chassis.

Why Derby gained the prize

Of course, before the prospectus was drawn up all the advantages and disadvantages of remaining and expanding at Manchester, or of removal to another centre, had been discussed and evaluated. Many towns had come under review as regards accessibility by rail to the sources of the production of the raw materials needed, also by rail to the principal cities of distribution. In the issue the choice was between Leicester and Derby. The latter Corporation offered better facilities, including a long term contract for electric power at a reasonable rate. One of the chief reasons for building new Works was to use electrical power. At Derby a site was available away from the ordinary labour market, so that Rolls-Royce would be able to expand its policy of training its own operatives under conditions that would offer reasonable assurance that, having done so, the men would not be lured away to other factories. Another point of vast importance as regards economical production under the most wholesome conditions was the natural level lie of the large expanse of land selected.

Mr Royce's and Mr Johnson's foresight is illustrated, incidentally, by the fact that as far back as 1906 the Company had acquired, or had firm options on, sufficient land to serve the needs of the company's war and post-war expansions. It may interest Rolls-Royce car owners to know, too, that the Engineer and Works Director designed both the original shops and the present ones at Derby, besides his ceaseless labour of designing engines, chassis and sundry accessories; assisting a number of ancillary trades on whose production Rolls-Royce was partly dependent, evolving many special tools, and even automatic machines to be made by specialists. Many of the most prized because efficient tools in use in the world's factories to-day owe their inception to his design,



A fleet of early Rolls-Royce types at Eaton Hall, Chester, on 15 July 1905



The 40/50 h.p. six-cylinder Rolls-Royce 'Silver Ghost'



The Rolls-Royce Works at Derby-1908



The Rolls-Royce Works at Derby—present day (Photograph by Aerofilms, Ltd, Hendon)

suggestions and instructions to the makers. He could show them why and how such desirable facilities should be evolved. In designing a new tool Mr Royce's object has been always to seek how to attain efficiency as represented, not by economical production merely, but also by perfection of workmanship.

The man who made ready betimes

Even when he was confining his enterprise to the electrical industry, from the outset he made it a cardinal point of policy that everything needed for manufacturing should be of British design and make. Therefore he urged our tool specialists to meet any demand that should be made on them, having as early an idea as any man in this country of the inevitability of a German war and of the urgency of rendering this nation absolutely independent of outside assistance for the vital means of manufacturing. Hence the production of electrical specialities first engaged his attention commercially, albeit it had to be abandoned for the reasons previously outlined.

But his remarkable genius as an electrical engineer has proved invaluable to automobile engineering. Most car users will be aware that before the war Germany had practically a world monopoly of the magneto. A few only have been able to realise that again and again Mr Royce endeavoured to get manufacturers to specialise on the design and making of magnetos. Failing to get the requisite article for the needs of his own car, he designed and made some magnetos himself. Indeed, this was one of the first of the auxiliary enterprises undertaken after the removal to Derby. But it seemed as though he were fated not to pursue electrical engineering commercially, for circumstances dictated that those magnetos should be used experimentally only, and not standardised. Even the capacity of the new factory was necessarily limited, and from the

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outset the demand on it for the actual production of chassis was always somewhat ahead of ability to supply, else there can be no manner of doubt that Mr Royce could have made as big a reputation for the firm in electrical enterprise as he achieved for it in engine and chassis building. For the rest, the British magneto to-day owes much to his guidance, especially in the critical period of the war. Anyone who imagines, however, that Mr Royce ever belittled the achievements of the foreigner fails utterly to understand the man's temperament. His view was that we ought to be able to do as well as any combination of designers and manufacturers abroad, and that it was matter for shame if we did not.

The first conquest of America

It is one thing to plan an ideal new Works, changing the very seat of an ambitious enterprise, and another guess matter to build and put them in production. During the transition period operations had to be carried on at the Manchester Works with as much concentration of purpose as if there were no intention of abandoning them as soon as the Derby ones could be made available. And the work of increasing the cars' reputation, by engaging in competition of the first class international sort calculated to arrest attention throughout the world with a view as well to expanding the market as to proving the product had to be pushed forward apace in synchronism.

That the cars were equal to the demand is instanced by the fact that at the Ormond Beach races, at Florida, U.S.A., in 1907 the 20 h.p. 4-cylinder Rolls-Royce broke the five miles record for all petrol cars of 60 h.p. or less. At the same race meeting that car, competing against others of far greater horsepower, won for Great Britain the Bronze Statue for the World's International Touring Car Championship over a distance of 20 miles. All which is interesting to recall in face of the fact that to-day Rolls-Royce is the only British car the demand for which in the United States is so great that it has to be built there for that market in a factory which is designed on the lines of the enterprise at Derby.

Nevertheless the experience with the 30 h.p. 6-cylinder engined Rolls-Royce car was such as to suggest long before 1907 that the firm would find its best market in this direction. Therefore Mr Royce actually designed the Derby factory for the production of 6-cylinder engined chassis only. No other type has ever been built there. Consequently these Works were planned, and operations were commenced in them early in 1907, on a principle which was in the most striking contrast conceivable with what may be called the foundation period of the Rolls-Royce car building enterprise at Manchester. That was characterised by the actual standardisation of cars having 2-cylinder, 4-cylinder, and 6-cylinder engines.

A master patent anticipated

Lest, however, anybody should imagine that this early Derby enterprise was in the nature of a lucky speculation, let me give an inkling of the fact that the Rolls-Royce characteristics of refined functioning had been manifest even in the earliest Manchester-built 6-cylinder 30 h.p. engined car. That had not only uncommonly luxurious springing and unprecedented road adhesive qualities because the design achieved a centre of gravity which we should not call high even in these post-war days when so much progress has been made in the evolution of cars having low centres of gravity; but also because the problem of crankshaft vibration had been noted and overcome in those first 6-cylinder engined cars. Of course crankshaft vibration was a fault which, though it was generally deemed inevitable, had only to be pondered by Mr Royce for him to consider it unpardonable. After sleepless nights and several

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attempts, each of which resulted in disappointment, ultimately he evolved the 'slipper fly-wheel' which was actually standardised on the 30 h.p. 6-cylinder engined cars which were issued to the public as far back as 1906, the engines of which ran with a smoothness hitherto unattained, and which proved a revelation to motor carriage users. Moreover, in these cars no crankshaft ever broke in service. This is put on record because some four years later a master patent was actually granted for a much discussed crankshaft vibration damper; whereas Mr Royce had found out that remedy, and applied it as a routine part of his factory programme, without ever troubling to patent the idea. So much for the history of automobile engineering and the mysteries of our Patent Laws.

The car type with the longest record—1906-1925

You are to imagine the shops being built at Derby with remarkable rapidity in face of the fact that the original buildings, like the latest ones, are of a substantialness that is unsurpassed in a country where, to the credit of industry, the greatest expense is not grudged to achieve really suitable factories. If you go over the vastly expanded Works to-day, save for the colour of a brick building here and there, you shall not know that the shops were not all planned to be built in synchronism, so perfect is the lay-out and so utter the absence of any evidence that any part has had to be adapted later or has been added as an afterthought. The mind which conceived these things is of course illustrated clearly in the Rolls-Royce chassis. While still working at Manchester, before operations began at Derby, Mr Royce had designed the 40/50 h.p. 6-cylinder side-valve engined still more silent functioning chassis which has been developed, month by month, from that day until the introduction of the 'New Phantom' overhead valve engined

type last June without sacrificing quiet functioning and to the gain of performance. Than that, nothing could be more difficult for an automobile engineer to undertake. The history of the industry teems with illustrations of the fact that the average engineering mind 'gets stale on a job' after developing it for three or four years consecutively.

As the history of our motor exhibitions and those abroad reveals, the Rolls-Royce method has never been to put on a new series of cars from season to season. Instead, when an improvement is found to be perfect from the point of view of commercial production, it is incorporated in the next series of the cars built, the word series being used to indicate the quantity in which orders are placed for batches of the raw materials requisite for production.

Mr Royce has felt always that it is possible to make improvements. It is for the user to find satisfaction but for himself always to find something better yet. As his mind is an abundantly fertile and extremely quick one, often ideas for engine and car evolution are born at a faster rate than it is possible to give them effect. In those early days on the occasion of important trials he would be fixing improvements on cars up to the last moment. Perhaps it will be news to him to know that, even in the case of the winning Tourist Trophy car in 1906, some improvements arrived so late that they were put under the bench and were never actually used. I think he could have produced really practical new ideas at the moment Mr Rolls' winning car was on the starting line. The same might have been said concerning the subsequent triumphs of Rolls-Royce cars in the Spanish Grand Prix, the Austrian Alpine trials of later years, and so on.

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When an 'R. R.' standard car engine ran the works

His sheer greed for experience ever enabled him to find fault with his best designs, by contrast with the average automobile engineer's fondness for dwelling on the excellence of his own achievement and conveniently ignoring its weak points. By contrast 'F. H. R.' would think nothing of starting home at 10 or 11 o'clock at night on a chassis fitted with experimental features, trouble with which would cause him to take some six hours to accomplish a 15 miles' journey. On such occasions he would take the wise precaution of sending messages to Mr Platford's people to tell them he *might* be late. If you should think that this was coddling the youth, let me add that on one occasion he had not been home for two days and two nights consecutively, had snatched sleep and food for a few hours on a bench, and that his mother had thought it necessary to go and see Mr Royce about the matter!

One day the 80 h.p. steam engine and dynamo that constituted the power unit at the Manchester Works broke down. Quite unperturbed, Mr Royce immediately saw a splendid opportunity to test the standard 40/50 h.p. 6-cylinder car engine. Therefore he rigged up one, and kept the shops at Manchester going night and day for about a month with the improvised power generator. Moreover, when overhauled this engine was found to be in excellent condition; no parts were replaced, and it is in a chassis that is running to this day after 19 years' service on the road.

Meantime Mr Royce's fertile brain was evolving break-down tests, alike for heavy initial loading and for fatigue, for all features of this developed 6-cylinder engined chassis. He designed all sorts of tackle and when he did succeed in getting a failure he obtained in a few hours that which might ordinarily take from 10,000 to 20,000 miles running to discover. Subsequently this method of procedure was applied always. Probably it explains in part why this chassis, as standardised, proved so successful when improvised for armoured car service during the world war.

When a Silver Ghost was seen night and day

Meantime how was the world to realise the new standards of performance, as unobtrusive as luxurious, accomplished by a genius working at such dangerously high pressure? Among features the combination of which had not been attempted hitherto were silence and smoothness in conjunction with superior efficiency and economy of functioning. Of course, it could be taken as a mere matter of course that a 6-cylinder engined Rolls-Royce car won the Gold Medal in its class in the 2000 miles' Scottish Reliability Trial of that time. The first of the 40/50 h.p. rating Rolls-Royce cars was easily capable of more than that. Therefore Mr Claude Johnson did a characteristically courageous thing by entering it for a 15,000 miles record under the observation of the Royal Automobile Club.

For this purpose he used the first car of this new series and which was called the 'Silver Ghost.' This was something new in the way of a test apart altogether from the unprecedented distance, in that it combined official observation of durability and trustworthiness with ascertaining and recording the cost of upkeep on a principle that called upon the car to be running day and night. This it did with one involuntary stop of 36 seconds' duration only—due to the accidental shutting of a petrol tap! In the issue, it was proved that the cost of running this luxury car continuously between London and Glasgow in 1907 was only $4\frac{1}{2}d$. a mile for petrol, oil, tyres and repairs. At the conclusion of the test the chassis was dismantled completely by the Club officials to ascertain the cost of replacing all worn parts. The total bill under this head sufficient

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to make the chassis equal to new to the satisfaction of the Royal Automobile Club's technical staff was $\pounds 2. 2s. 7d$. Small wonder that, at the season's end, the Club unanimously awarded the Dewar Trophy for the most meritorious long distance performance of the year in a trial under its official observation to Rolls-Royce Ltd., the drivers being the Hon. C. S. Rolls, and Messrs Claude Johnson, Eric Platford and Macready.

But that is not the end of the story of the 'Silver Ghost.' Later it was bought by Mr Dan Hanbury, who has used it since for a distance of over 350,000 miles and it is in service to-day running as sweetly as ever.

That trial, which was equivalent to three years' average service in private use, was the longest distance which the Royal Automobile Club would allow for any vehicle in any tests conducted by it. The car was driven over 400 miles a day, Sundays excepted. Its record beat the longest previous observed non-stop test by 100 per cent. As for the 'Silver Ghost's' behaviour, never did I ride in such comfort before. Steep hills appeared as slight gradients; and long distances seemed short. Never did one pass through the country in such leisurely fashion; never had one sat throughout the livelong day in as great comfort as if one were in an armchair in one's own home; and never had one known quietness like this.

Of course Mr Royce began carrying out a series of investigations and tests while the 'Silver Ghost' trial was in progress, continuing them thereafter, since he would never be content with any stage of evolution, but was ever engaged in preparing to achieve a fresh standard of excellence.

The firm's policy was to lay down the 40/50 h.p. Rolls-Royce type in batches of fifty on a programme originally schemed to produce four chassis a week, which was quite an ambitious scale of building at that period. Experience with the 30 h.p. 6-cylinder engined type had shown that such a venture would be justified commercially and, of course, the 'Silver Ghost' trial produced such a demand that assurance may be considered to have been made doubly sure. Thus it came about that the 40/50 h.p. Rolls-Royce type remained longer before the public than any car, not excluding the cheapest produced in any country in the world: instance the fact that the Ford car, which had 'tiller' steering then, came out when the 'Silver Ghost' trial was in progress.

But, alas! in connection with this manifold and magnificent enterprise it was easy to be a prophet: one bill was long overdue.

CHAPTER FOUR

THE PRICE OF VICTORY

M ROYCE'S health collapsed utterly. With characteristic foresight, managerial ability and moral courage Mr Claude Johnson never hesitated. Confronted with the problems of meeting an insistent demand, preparing for an increasing one, developing the commercial side what time design was still to be regarded as in a flexible state and the difficult work of transference from Manchester to Derby was yet in the main to do, nevertheless 'C. J.'s' immediate decision was that the great engineer's restoration to health must take precedence of all other calls on his time and thoughts. The issue saw him justified abundantly.

Mr Royce spent a spell at each of two nursing homes. One day he had recovered sufficiently for Mr Johnson to call and drive him away.

As they took the road Mr Royce asked where they were going, for by this time his faith in the guiding brains of Mr Johnson in all matters of the mere world was implicit.

"We had better wait and see how you feel as regards fatigue," said 'C. J.'

Soon they had crossed to France, touring through it to Italy, and elsewhere.

If you want an idea of pluck and grasp, picture that, besides the heart and brains of the engineering side of the business being now what Nelson called "laid by"; the brains and mainspring of the business side was likewise absent acting as nurse, guide, philosopher and friend, all which involved quitting the scenes of the battle for automobile supremacy that was being waged at London, Derby, and Manchester. 'C. J.' even accompanied 'F. H. R.' to Egypt with the aim of trying to find a suitable climate in which he might pass the winter. In the issue, nothing appealed to the patient there, so they came back to the South of France. Eventually, he discovered a valley where there was not much water—which he had found from experience at Nice, Cannes and elsewhere to be unsuitable to his case—so bethought him it would benefit that part of his illness which took the form of neuritis. Cooking was another important point. This he found to his liking, hence he built a villa at La Canoudal.

The master organiser takes over

This settled, Mr Johnson had to resume his activities in connection with the commercial side of the business and, of course, to extend them. The born organiser was in his element. He grasped the far-reaching nature of the preliminary work done so well and truly by the infinite skill and devotion of Mr Royce in his allimportant sphere. Already he had trained to his ways of thinking and working an admirable designing staff, and an equally praiseworthy Works staff. Furthermore, by his example and teaching he had led the employees of the Company in all its branches to understand that success could be achieved only by unceasing labour and scrupulous care. These were the material points on which Mr Johnson began to build his plans with a view to saving Mr Royce's health, which at that juncture was still absolutely essential to the very existence of the Company.

For many years the task of carrying on the Works at Derby on the tradition then established by Mr Royce has rested primarily on Mr Wormald, the Works Manager, under the general control of the Managing Director, Mr Claude Johnson, who for eleven years has been assisted by Mr Basil S. Johnson in the capacity of General Manager.

Some idea of the problems involved at the time of Mr Royce's first illness, however, may be had from the fact that Mr Wormald had remained at Manchester as late as June 1907, to finish off the production of the last fifty chassis, and to send to Derby each machine as it had done its last job on that work that it might be installed in the new shop because such machinery was quite up-todate for its purpose.

Among other things, Mr Johnson rapidly evolved a scheme whereby Mr Royce would not be required to work at Derby as he had been doing at Manchester. In a sense the problem of obtaining labour to start a highly skilled industry in a new centre was solved automatically because towards the end of the Manchester period Mr Royce's ceaseless quest of the best worker only for each job, achieved by pursuing a policy of exploiting both encouragement and elimination, had developed to a sufficient stage.

How super-skilled labour was recruited

Hitherto the principle had been to employ the best sort of toolmakers for tools; and, owing to the dictates of finance, the motor industry in general had had to train operatives in the way the cycle and ancillary industries had taught their own workers. Mr Royce, however, had had frequent occasion to be dissatisfied with the best work of which operatives so initiated were capable. Thus, whenever he had a difficult problem he took it from the floor of the Manchester factory to the gallery where Mr Wormald would be working with a few picked toolmakers. In this way he used to get his experimental parts made to his satisfaction. But he was always puzzled to discover why, once it had been proved that a job could be done, nevertheless it was not done always to his satisfaction when standardised in the Works proper. In tackling Mr Wormald about this one day in quite a casual way the idea emerged that the Rolls-Royce cars could be built satisfactorily only by departing from the practice of the motor car industry in general and confining the recruiting of skilled labour to the best sort of British mechanic, especially the type trained to such exact operations as the toolmaking industry called for. In face of the scanty

financial resources then available, this was more easy to suggest than to carry out. Therefore the policy was inaugurated gradually. In the issue it was found to be both the only practicable and the most economical one because it reduced waste enormously and achieved perfect workmanship.

Thus the nucleus personnel had been got together at Manchester and, despite the severe standards of criticism of all work done, already the tradition inspired the workers, with the result that the bulk of them sought to be transferred to Derby, where operations were to be conducted on a much more ambitious scale. Despite Mr Royce's exacting methods, the fact of his knowing the workers individually made them wishful to follow him always as a leader. Each man selected for transference to Derby soon found that he had one, or more, 'pals' working elsewhere who were desirous of becoming associated with an enterprise of which they could feel proud, and where they could gain an assured good livelihood.

While appreciating fully the need to study the facilities for rail and other means of transport, Mr Royce had also in mind the housing problem for his operatives, therefore the importance of establishing his Works in a centre away from that ordinarily exploited by the engineering industry, so that there would be no unsettling the industrial worker through his being tempted to shift from one factory to another, thereby gaining experience of different methods and unsettling his own.

As illustrating the strange destinies of industry, it may be recalled that, even as Ireland voluntarily threw away the opportunity of becoming the centre of the pneumatic tyre industry, so Leicester, having the opportunity of being the permanent home of the Rolls-Royce car, actually feared that such an enterprise would introduce severe local competition for skilled labour. By contrast, at Derby the authorities offered every inducement to the firm to establish itself in that town.

Ready, aye ready

Unfortunately recent history has taught us in most costly fashion that the time-honoured notion that the hour produces the man is a pleasant delusion. In fact, few things are more extraordinary than for a man suddenly to appear to deal with a crisis in such a fashion that it will be overcome and permanent success achieved. In the case of the Rolls-Royce enterprise the organising genius of Mr Claude Johnson had been proved in many other spheres during many years. It was a known quantity in the motoring world. But so far it had been concentrated chiefly on endeavouring to evolve the commercial side of the business in such fashion that it should be looked up to by the buying public as no less exemplary in its kind than the technical branch of the undertaking. From the inception of the enterprise Rolls-Royce business methods became known for probity and general trustworthiness.

In the course of establishing these facts characteristic originality was displayed by 'C. J.' in devising one hundred and one hitherto utterly novel methods of procedure, all which were no sooner put into operation than they met with prompt and ever widening appreciation. The firm never proceeded on the lines that characterised motor factoring in the early days of the movement, whereby generally the user was given the impression that, if anything went wrong, it was because himself, or his employees, were more or less fools. By contrast, Rolls-Royce owners received alike every consideration and every opportunity to understand their cars.

I recall, too, the delighted satisfaction of one owner, who informed his guests over port after dinner that he had that day received a cheque for 4s. 11d., being balance due as a result of the Company's auditing, whereby it appeared that an estimate that had been given for repair work resulting from damage sustained by his car, and which had been accepted as entirely satisfactory, had nevertheless represented that amount in excess of the actual cost, the item of difference being due to a mistake made by an operative in entering up his card. Details of this sort have built up complete confidence between the firm and its clients, who had had the opportunity when studying the results of the trials already mentioned of appreciating how this most luxurious of cars was nevertheless the most economical to maintain for its power, performance and accommodation.

Mr Johnson had come to the firm with a reputation for organisation of the highest character, that wherein imagination is exercised. Truth to tell, however, as long as he remained in charge of the commercial side of the business only, full use was not being made of his talent. His masterly handling of the situation when, otherwise, Mr Royce's illness would have created a crisis in the affairs of the Company is merely characteristic. The manifold problems were dealt with so promptly and effectively that, except the chief officers of the Company, nobody knew anything about the matter. The production and evolution of the car proceeded smoothly. This was due in part to 'C. J.' having always in hand proved developments which it would have taken at least a year to incorporate in the standard products. At a later stage sometimes there would be in hand sufficient improvements to take five years to exploit commercially. The firm does not take any chances.

CHAPTER FIVE

CONCENTRATION

The new Works at Derby were presenting a more complete form with the lapse of every week. It was plain that by the summer of 1908 the huge operation of transference from Manchester would be completed. This prospect, together with the state of Mr Royce's health, gave Mr Johnson serious food for reflection. He looked at catalogues issued by C. S. Rolls & Co. and found that the factoring Company had been selling, incidentally, eighteen different Panhard models. Even as far as Rolls-Royce production was concerned, the firm was still offering the public 2-, 4- and 6-cylinder engined cars. Of course, the Tourist Trophy victory made the 20 h.p. 4-cylinder engined type the premier one in the middle size class at that period.

Judge, then, the prevision and pluck of Mr Johnson in proposing to the Directors at a Board meeting on 13 March-let the superstitious note the date—1908 that the production of this 'sure seller' and all other Rolls-Royce models be abandoned and that the whole fortunes of the new Company be staked on producing and marketing one type of car only, the 'Silver Ghost' 40/50 h.p. 6-cylinder engined Rolls-Royce. When he had arrived at his decision that this was the right thing to do he found that not one of his colleagues on the Board, whom he sounded separately, had any such idea. He went into the matter with them one by one. During the discussion Mr Royce had been neutral, contenting himself with the mere expression of opinion that he did not understand why everything should be abandoned "like that." Mr Rolls was extremely dubious because he thought of the amount of business that would be missed by confining the programme to one model. Mr Claremont said that, as Mr Royce seemed to have no definite mind one way or the other, he thought he would vote with Mr Johnson. So it came about that thenceforth the whole efforts



The Rolls-Royce 'Tourist Trophy' car at Florida Beach



H.R.H. the Duke of Connaught, with Mr C. S. Rolls, in an early Rolls-Royce car

PLATE VI



The bronze statue of Mr Royce, by Professor Derwent Wood, R.A., exhibited at the Royal Academy of 1922, and subsequently erected in the Arboretum at Derby of the factory were concentrated on the production of the 'Silver Ghost'—and the next balance sheet proved the policy justified abundantly. Assuredly that Board meeting made motoring history in that it enabled the combination of the highest talents available in the automobile industry of that period to be concentrated on the production of the most ambitious type of car.

That the car was still in the process of making its reputation with the public, may be judged from the fact that in the 2000 miles combined Reliability Trial by the Royal Automobile and the Royal Scottish Automobile Clubs this year, which was admittedly the most severe that had been held in the United Kingdom up to that period and wherein it was entered in Class K of the former Club's trial, the Rolls-Royce won by 44 miles. It was the fastest car in ten out of the eleven timed hill climbs; was the most economical in petrol consumption of any vehicle in the trial, having run 40.98 ton miles to the gallon, and actually 20.1 car miles to the gallon, throughout the trial, up-hill and down-dale. It was also the car which lost fewer marks than any other of more than 21 h.p. in a test which included 20 miles of timed hills and a 200 miles race on the track at Brooklands, which latter was won by the margin already specified. Incidentally, Mr Eric Platford got permission from Mr Johnson to 'lose' himself and the car for a week before the day for facing the starter. The car was one taken from the series then in standard production, and was a later type chassis than the 'Silver Ghost,' having the higher compression engine that was standardised in 1908.

Entering the new home

I do not know whether there was any ceremony in connection with closing the Works at Manchester because I did not go there; but I attended the opening of the new Works at Derby about

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Midsummer, 1908. The ceremony was performed by Lord Montagu of Beaulieu, the speakers including the late Hon. Charles S. Rolls and Mr Johnson. Mr Royce made a presentation to Mr Platford, the driver of the winning car in the 2000 miles Trial. You are not to picture it as an imposing, stage-managed affair; but as a quite informal little gathering in a room, followed by an inspection of the Works, which were to other motor factories of the period what the 'Silver Ghost' was to contemporary cars.

Everything seemed laid out as though it were intended to go on building cars here for hundreds of years. I do not think the original buildings appear to-day any the worse for wear, though their exteriors have matured somewhat. My impression was that these shops were so solid that they would be the most costly in the world to adapt to any fresh purpose. But Mr Royce never laid plans that would be in need of adaptation: instead, his scheme permitted of expansion without dislocation. That nothing had been omitted was abundantly plain from the ordered growth of those Works when the great demand of war came and no 'distortion' was involved in 'turning over' to serve the great end.

The ideal conditions in which the most perfect car of its period could now be built, the return of Mr Royce to a practical state of health, the clearing of the issue by concentration on one car type, and its continued series of successes in competition all over the world, of course created a spirit of happiness and enthusiasm among all the operatives which was of the utmost benefit to the organisation and to the product. In other words here, on new ground, what was apparently quite a fresh enterprise nevertheless possessed a distinctive tradition and method of co-ordination which one would have expected to have been achievable only as the result of at least a generation of effort. I do not think the world of motoring realises the lightning speed at which the Rolls-Royce enterprise was evolved and consolidated. Why should it? That is about the last thing that one would expect in connection with such a quality proposition. The explanation is to be found in the utter self-forgetfulness of the captains of the enterprise, the quickness and completeness of their understanding of the successive problems for which each was responsible, and the amazing capacity of each to inspire everyone under him to realise that on the excellence of his own work depended the very welfare of the enterprise. Here is a really important lesson on the value of letting British workmen grasp the fact that each has a personal responsibility. If they see their best efforts result in renown for a British engineering product, they feel that they take home at the end of an honest week's work something more than mere wages.

Bold measures successful

In a brief chronicle of this sort it is not my purpose to note one competition in ten in which the firm engaged its products. I would merely suggest the ever-growing market for them by citing that in the Bombay-Kholapur Trial of this year, over a distance of 620 miles including the ascent of the Ghats (5000 feet) with neither spares nor tools carried, and with a locked and sealed bonnet, a standard 40/50 h.p. Rolls-Royce car came out first. It also won the Mysore Cup in the competition of that name; besides securing a Silver Medal, two Gold Medals, two Diplomas, and being awarded first prize for appearance at the Bombay Motor Show of 1908. Thus we may observe that the quest of elegance was no less carefully pursued than that of superior performance. The Board was prompt to recognise Mr Claude Johnson's remarkable foresight in deciding on a scheme of concentration. In March 1909, twelve months after his policy was accepted, the Board appointed him General Managing Director of Rolls-Royce Ltd., than which a more beneficial step was never taken in the interest of the Company.

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CONCENTRATION

The then new accomplishment of flying was fascinating the public the world over. Remarkable possibilities were being demonstrated in France. Devoting a deal of our energies to aviation at this time, Mr Rolls, Mr Griffith Brewer and I made an exhaustive tour of the flying-grounds of France before the first aviation meeting in the world was held at Rheims, going by a luxurious 40/50 h.p. Rolls-Royce to inspect all the military and other airship hangars and flying grounds and spending a spell with the brothers Wilbur and Orville Wright at Pau. In his purely personal capacity as a pioneer English flyer, 'C. S. R.' was the first man to make the double journey across the Channel on a Wright aeroplane. He was always lamenting the fact that nobody was building a dependable, reliable and sufficiently powerful aero engine. We knew that if he would give attention to it, Mr Royce could design and build one that could be depended on to continue developing its power when in the air.

Wby 'R.-R.' aero engine building was delayed

Naturally, such a problem had a fascinating personal appeal for Mr Royce. No less inevitably Mr Johnson had to school himself to develop the Rolls-Royce car business. He had experienced the risks of Mr Royce overtaxing himself. I recollect 'C. J.' asking me in an aside one day if I would deprecate the policy of trying to lure Rolls-Royce on to the production of aircraft engines because at that juncture it was desirable commercially that all work should be concentrated on the evolution of the 40/50 h.p. 6-cylinder engined car.

But nothing would stop Mr Rolls navigating the air by every means possible, including the use of spherical drifting balloons. The notable things he accomplished as a pioneer aviator were invaluable in inspiring public belief in the future of flying. But they absorbed so much of his time in a personal, as distinct from

an official capacity, that he ceased to be a Managing Director of Rolls-Royce in April 1910, becoming Technical Adviser to the Company then. Alas! it was for a brief period only. I saw him killed at the Bournemouth Flying Meeting. As a companion none was more amusing when he had not the weight of definite work on his mind. He was a man born to pioneer on the demonstrating, as distinct from the designing or manufacturing side. Happily he was spared long enough to have served a key purpose in the evolution of flying. I always felt he thought it more daring to light a cigarette than to glide before engines were available for fitting to aeroplanes. He had a quaint humour peculiar to himself. When in the mood he would keep us in gales of laughter. To see him arrive late at tea and not quit it until he had whittled away each round cake to a solitary slice was to realise this-also his digestive capacity. He was not greedy, but had the idea that when you were motoring, ballooning or flying you should never come near food without shipping all the supplies you could-"as you never know when you'll have the next opportunity." He was very clever at adapting imitations of music hall favourites to serve all purpose of criticism of car developments, instance his idea of conveying complete satisfaction concerning a new brake scheme. Pulling up the car dead in front of Mr Royce, in answer to the anxious engineer's enquiry for his opinion 'Charlie' Rolls began a recitative in the voice and action of the late Dan Leno, starting with the words: "Call that a brake?" On a much earlier occasion he was demonstrating an early Panhard to a prospective lady purchaser when the policeman on point duty at the circus end of Tottenham Court Road shot out his hand to stop the traffic and, on a wet asphalt surface, 'C. S. R.' jammed on the transmission brake. The car faced about, but he checked the skid in an instant and, accelerating as they proceeded back up the road, remarked casually, "You see these cars are so handy you can turn them on a sixpence."

The car passes from triumph to triumph

So it came about that Mr Royce was free to concentrate on the development of a single type of car for a number of years. Perhaps the progress made can be conveyed best by passing reference to a few public performances under officially observed conditions. Instance the demonstration of efficiency, flexibility and speed when in 1911 one of these cars was driven under Royal Automobile Club observation from London to Edinburgh and back on top gear on a petrol consumption of 24.32 miles to the gallon. To prove that the vehicle was not geared unusually low, at the end of the trial and without any alteration or adjustments, it was run on the Brooklands Automobile Racing Club's track at Weybridge where it attained a speed of 78.26 miles an hour. Of course, this was a revelation of standardised flexibility to the motoring public of the period, creating interest far outside these islands. It resulted in the necessity to expand the business in many directions. The Company's branch in India was founded this year. In May an English Company was incorporated, under the style Automobiles Rolls-Royce (France) Ltd., the shares of which were owned by the parent enterprise. Sales, repair and garage businesses were established under one roof in the very large premises in the Avenue Malakoff, within 100 yards of the Avenue du Bois, Paris, this being the first occasion on which an English car business had been established in the French capital. In October, Senor Carlos de Salamanca was appointed the Company's selling representative in Spain.

Something of the manner in which the endless fresh problems were approached and solved was indicated in a paper which Mr Royce was asked to read before the Royal Society at its meeting in Dublin about this time. Unfortunately, owing to a return of illness, he was unable to do so. Mr Claude Johnson read it in his stead. In this interesting paper Mr Royce showed the features it would be desirable to incorporate in a chassis, how the back axle ought to be built like a bridge in relation to the car frame, and so on, revealing many fresh ways of analysing and grouping the problems awaiting still more exhaustive study. Incidentally, he achieved for motoring formal recognition as an established branch of engineering, an honour which hitherto had not been accorded by this most historic of the world's scientific societies to the practising automobile engineer of a motor manufacturing firm. Therefore this paper is in a double sense a landmark in the evolution of motoring.

Mr Royce's second illness

You will observe, however, that unfortunately this man of parts enough to complete a whole jury of men had another bad illness. Four London specialists to whom he was taken successively gave him a month to live. Happily that period had not lapsed before it was proved that their opinions were wrong.

"Die, my dear doctor! that's the *last* thing I shall do," Palmerston declared.

"Life is courage," wrote Balzac.

'F. H. R.' also had the will to win through. Let me add with great pleasure that he enjoys good health now. But you may imagine the anxiety of his colleagues at this crisis in the life of an engineering genius who had a temperament as rare as were his abilities. Always receptive of ideas, he never objects to having his attention directed to this or that particular feature of an engine, or of a car, that might be improved in such a way, the opinions he expresses on such occasions being always utterly impersonal and revealing absolute absence of prejudice. He has none of that petty vanity to which all creative genius is supposed to be prone. But woe to anyone who puts before him an idea he has not pondered thoroughly before presentation.

CONCENTRATION

CONCENTRATION

Mr Royce will not be worded to weariness with nonsense. He expects to be paid the compliment that any idea offered for his consideration should have been thought out and criticised seriously beforehand, at least in all of its most obvious bearings. Of course that is the only practical way to proceed. He is a great reader. I have been impressed always with the extraordinary variety of his information; also with the fact that nobody is less a Mr Know-All. His knowledge never appears unless it is *à propos* something being said. Then his observation is always of the sort that is not obvious, but which advances the matter in hand. Evidently he has pursued learning throughout his life, as he does every other enterprise, to the end of producing practical results, "in comparison whereof all other knowledge is but cobweb learning."

Learning that is not applicable is not knowledge to him. Since the inception of the Rolls-Royce enterprise—I did not meet him before—he struck me always by the animation of his talk, the ever changing expression of his eyes and the fact that, even when dealing with a most abstruse technical point, his dauntless enthusiasm kindles into a smile. There is nothing frigid about the creator of the most flexible car in the world. It is the true child of its author.

The successful invasion of Austria

The design gained much from the fact that it was neither tested, nor used, wholly on our excellent English and Scottish roads. On the contrary, a deal of experiment was carried out on the Continent, especially in the mountain districts of the French Savoy and of Switzerland. This is important to note in face of signal service rendered by the car under the most severe conditions when the great war came. The system of suspension had been evolved so that the car should ride smoothly over *pavé*, or pothole surfaces, and so forth. Of course the brakes and cooling gained vastly from continuous testing under the severest Continental conditions.

The public knew little enough of the matter, however, until 1913, when four of these standard Rolls-Royce cars were entered for the Austrian Alpine contest wherein the pick of the world's machines took part. For that reason and because of the mountains that were traversed, it was the most severe test of any organised up to that period, being over a distance of 1654 miles, including nineteen Alpine passes, the course being from Vienna by way of Salzburg, Innsbruck, Riva, Toblach, Trieste, Klangenfurt and back to Vienna. The hills chosen included some gradients of I in 31/2. In many cases the roads were cut up by scores of caniveaux calculated to test the construction and design to the utmost, including the springs. It was under these conditions that Rolls-Royce cars were driven throughout the competition; finished first at the end of each day's run; showed a turn of speed on the steep climbs far superior to any other vehicle in the trial; demonstrated cooling efficiency so remarkable that no water was added to the radiators throughout the whole of the trial; revealed that they were luxurious touring carriages as distinct from racing cars; and that each of the four machines entered was capable of making a non-stop run under those conditions wherein, of course, the mechanism was necessarily stressed more highly than that of any other vehicle competing. Each Rolls-Royce car was awarded one, or more, prizes. Incidentally, the results achieved by running four cars, each as good as the others-allowance being made for the different coachwork fitted-proved to the world the ability of the firm to standardise efficiency and reliability.

Increasing demand everywhere

In Spain other standard Rolls-Royce cars also proved their superiority over all other makes in competitions wherein speed was combined with efficiency and trustworthiness, the firm winning the Spanish Grand Prix in 1913 at a mean speed of 54 miles

CONCENTRATION

CONCENTRATION

an hour over a distance of 194 miles, the test being confined to standard touring cars. The awards were based on speed on the flat, speed up hill, and on petrol consumption.

In America at this time the tariff was 60 per cent., therefore it was deemed practically insurmountable in the case of British built cars, nevertheless there was such a market for the 40/50 h.p. Rolls-Royce that this year Mr Robert Schuette was appointed the Company's selling representative in the United States.

All these results were attained by the constant incorporation of improved details in the design and construction of the car to the end of keeping it always in advance of any other large scale vehicle, as distinct from pursuing policies of embodying radical changes from year to year, or of switching over from the production of one type of car to another. In other words, it is by continuous advance in detail from day to day along definite lines towards a definite ideal that Rolls-Royce has become what it is and rides just as it looks.

I will illustrate this by but one further reference to pre-war public enterprise. It has a certain historic interest because it may be called a companion episode to that remarkable French Grand Prix race for specially built cars that took place on the Lyons circuit six weeks before the campaign. Those of us who witnessed it found that the Germans had re-entered for this competition after abstaining from it for many years, and carried the victory in what subsequently was proved to have been a trial by them of their preparations, as regards engine evolution, for the war.

Alpine triumph of the first of the R.-R. 'Eagles'

While it has been always contrary to the policy of Rolls-Royce to take part in any tests of that sort, nevertheless the firm gladly availed itself of the opportunity to take part in the severest of the Austrian contests, which was also organised that same year on lines which permitted of standardised cars being entered and run. In this case a British product was proved in an even more conclusive manner than in the former year; hence the contrast with the showing in the race on the Lyons circuit. The Austrian test lasted ten days. A solitary Rolls-Royce had to compete against machines having engines of far greater volume. It proved superior to all these over a course of 1818 miles planned among the Austrian Alps and including no fewer than twenty-seven Alpine passes having a combined height above sea level of 107,647 feet. On this occasion seventy-five cars competed. But there was only one Rolls-Royce. It had an engine of 7410 c.c. cylinder content against a Benz with 8496 c.c.; a Graft and Stitt with 8490 c.c.; and two Benz cars each with engines of 10,100 c.c. cylinder volume. Despite this the Rolls-Royce was the fastest and quietest car in the trial, easily achieving the speediest climb up the Katschberg. It also made the best time along the level between Lambach and Wels. Out of sixteen British built cars, it was the only one entered which lost no marks and which made a perfect record. Moreover, of the twenty-one large cars entered in the trial it was the only highpowered one which lost no marks in a test the value of which was enhanced, incidentally, by 'rotten' roads and mountain tracks, the long gradients of all varieties being calculated to test brakes, cooling and so forth, thoroughly.

Thus was the policy of concentration organised, conceived and carried to fruition. The time is now come to ring down the curtain on the era of peace, and to ring it up on a new activity, in connection with which Rolls-Royce enterprise was destined to contribute one of the relatively few satisfactory phases of human enterprise during a prolonged period of world tragedy.

ALARUMS AND EXCURSIONS

CHAPTER SIX

ALARUMS AND EXCURSIONS

WITH the outbreak of war in August 1914 came the greatest call in history. Because the foundations of Rolls-Royce had been well and truly laid it was not found wanting. As far as chassis were concerned, the 40/50 h.p. type could be readily adapted to unprecedented services. Therefore from the earliest period of the campaign these machines were supplied, not for Staff work merely, but for armoured car service with the British and Allied Forces on practically every front on which military operations were conducted alike in France, Flanders, East Africa, Egypt, Gallipoli, Mesopotamia, Palestine, Russia(with Commander Locker-Lampson), South-West Africa, and India. They were used in successful independent operations across the desert.

King of the desert

How promptly the work was undertaken may be judged from the fact that the first deliveries of these standard chassis for armoured car service were made in September 1914, a month after hostilities began. Building for the Services continued until June 1915, at which date the production of aero engines took precedence of all else at Derby. The Duke of Westminster took the first Squadron of armoured cars to France in March 1915; other Squadrons being sent to Gallipoli where, fitted with grapnels, one section started operations by reversing up to the Turkish wire, which it hooked, then went forward uprooting a stretch long enough for the infantry to go through. No less efficient work was done in the desert warfare against the Senussi, the Rolls-Royce armoured car type being styled 'King of the Desert.' These machines helped to make good the defences of the Suez Canal against the coming Turkish attack. A stirring story, too, is that of the rescue of the survivors of the British steamer Tara from their Arab captors by an armoured Rolls-Royce car detachment commanded by the Duke of Westminster in 1915.

In the late General Botha's campaign in German South-West Africa Rolls-Royce armoured cars made their *début* by playing a prominent part in repulsing a heavy enemy attack on the Brigade holding the railway line—a mere foretaste of their quality in a roadless territory of rock-strewn highlands and desert sands—no car being laid up for an hour save as the result of enemy fire. It was the same in East Africa: not a car was off duty save as a battle casualty.

The cars had to move, too. In one fight in Mesopotamia in the chase after an armoured Mercédès car a sporting speed of 52 miles an hour was attained before the Rolls-Royce overhauled and crippled the enemy, knocking her engine to pieces. It was the same in Palestine and Salonika: for operating in almost impossible country there was only one armoured car chassis that could withstand the terrific strain continually and successfully—the Rolls-Royce. In General Smuts' campaign none of these cars was ever off duty save for injury sustained in action. That was also the story in all the theatres of war in which they were engaged.

Grossly overloaded but unfailingly reliable

In retrospect, it is interesting to recall this successful service, which was achieved despite the fact that these standard chassis were loaded with more than double the weight they were designed to carry—another evidence of the extraordinarily great safety factor that has ever been a feature of Rolls-Royce design. Of course these vehicles had to negotiate surfaces that had been deemed impossible for mechanical transport to traverse before the war. Indeed, the fact that these pleasure vehicle chassis stood up to such overloaded and severe conditions was subject matter for amazement on the part of the officers and men in charge of them. This notable service continued to be rendered until the last stages of the campaign. Part of Mr W. T. Massey's despatch to *The Times* from Egyptian headquarters under date 29 December 1916 reads:

I have motored in the Desert....so perfect and reliable has the car supply service become that the vehicles move to a time table....the armoured cars used in Egypt are all Rolls-Royces. Notwithstanding the rough work they have done there has been no engine breakdown. The cars have run over thousands of miles of the roughest desert and the complete absence of engine trouble is a triumph for British workmanship.

In regard to the use of the 40/50 h.p. chassis for Staff work, the late Earl of Ypres set out with the 'Contemptibles,' not on a charger but in a Rolls-Royce limousine which served him faithfully throughout his term of command and in later years in his Viceregal capacity in Ireland. During the war, too, the Prince of Wales made acquaintance with the Rolls-Royce car under adverse conditions of service and has since become an owner of several carriages of this make. Thus *Ingenia principum fata temporum* has a latterday motoring application. His Royal Highness also used a 40/50 h.p. 'New Phantom' car throughout his recently concluded official visit to South America.

Earl Haig, Lord Allenby, the late Lord Rawlinson—in fact, all the great leaders—used Rolls-Royce cars in the campaign, many of the machines being privately owned carriages, as instance Lord Dalmeny's with which he himself acted as motorman to General J. E. B. Seely and others.

M. Millerand, then French War Minister, owned three, concerning a journey on one of which Marshal Joffre said, "I have never travelled quicker; but also I have never finished such a journey in better shape." Incidentally, M. Clemenceau, 'the Tiger,' was saved from the assassin's bullet by the speediness of his Rolls-Royce car. These chassis were also used extensively for ambulances, being specially suitable by reason of unsurpassedly excellent suspension.

The greater call

While the rendering of this right worthy service is well known, a chapter that has not yet been revealed to the world concerns the exceeding promptness with which Mr Claude Johnson realised the vital demand for power plant for aircraft. It will be recalled that his policy of concentration, which had had such remarkable results, involved the sacrifice of all other development along no matter how fascinating lines. Even before we had decided to enter the war, however, 'C. J.' set to work to get aero engine types designed, knowing full well that much of the experience gained in the course of evolving the Rolls-Royce car engine would prove valuable in this fresh form of enterprise. Nevertheless the herculean labour involved was scarcely comprehended by the average member of the Company's staff. Therefore the Directors subsequently printed, privately, the story of the first Rolls-Royce aero engine, which may be read only by consent of the Board and is: "For study and as an example to all grades of Rolls-Royce engineers, present and future," as it were, especially to prevent those who are "golden students, becoming silver bachelors and leaden masters."

This volume came to be known among the Staff as the Rolls-Royce Bible, the pages being 12 inches $\times 9\frac{3}{8}$ inches and no fewer than 301 in number. They open with extracts from letters written before our entry into the war by Mr Johnson, the General Managing Director, on the subject of the firm taking up aircraft engine work and, for the rest, contain a series of extracts from the letters which Mr Royce wrote from August 1914 to 4 March 1916 on the subject of the first Rolls-Royce 'Eagle' aircraft engine, the design and evolution of which was but one phase of the manifold activities in which he had to engage.

It must be had in mind that many types of aircraft engines were evolved and standardised by the firm during the war, each of

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which had to be developed by no less elaborate pains. This work is not straightforward like designing an engine for a chassis, both of which are absolutely under the control of the automobile engineer. By contrast, he has to fulfil far more severe and more complex conditions when designing and building an aircraft engine, because no sooner has he solved the engine problems as such than a number of most excellent achievements are set at naught by the necessity to consider the conditions in which such machinery will have to be used.

Designing with tied bands

Thus the design of each aircraft type requires a number of special conditions to be fulfilled by the engine maker, all which may present handicaps to him. These are but a few of the points which emerge when reading this correspondence concerning a type of engine which, of course, has long been superseded. Therefore a perusal is the more fascinating in that it reveals that, in embarking on this branch of automobile engineering, Mr Royce's foresight was at times almost uncanny. When one has in mind the amount of work and calculation that had to be done in connection with the writing of these letters-the extracts of which amount in volume to something like a novel by Scott or by Thackeray, every sentence having to be more accurately expressed than is perhaps needful to satisfy the demands of fiction-one realises what a lifelong habit of taking almost inconceivably conscientious pains, and what an amazingly wide knowledge of a number of subjects which the average automobile engineer would not consider the least necessary for him to possess, is brought to light. Yet the correspondence deals only with a portion of the calculations and experiments that had to be made.

Among the impressions given is the extraordinary caution exer-



A portrait of the late Sir John Alcock, by Ambrose McEvoy, A.R.A. The original painting was subscribed for by the staff of Rolls-Royce, Limited, and presented to the National Portrait Gallery



Rolls-Royce armoured cars in the Libyan Desert in April 1916



A Rolls-Royce armoured car convoy in the Egyptian sphere of operations, 1917

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cised to the very point of self-restraint that no step should be taken until experiment had proved the attainment of a given unprecedented degree of efficiency, as represented by lightness, economical fuel consumption, or what not, not possible merely, but dependable. The quickness with which designs were evolved is amazing, particularly in face of the innumerable and intricate calculations requisite, being in almost dramatic contrast with the resolute refusal to allow anything to go forward in standardised form until it had been tested to destruction in many ways. The indomitable engineer foresaw manufacturing difficulties, aircraft engineers' problems, also those of the Government Departments concerned, and suggested all manner of ingenious tests, even designing tackle, as well as directing every operation of manufacture. While he would spare no cost to get a thing right, nevertheless Mr Royce did and does not pursue expensive methods for expense's sake. On the contrary, many a time there occur in these letters suggestions for simpler, but not one whit less efficient and accurate methods of production. Frustra fit per plura, quod fieri potest per pauciora.

Pity the poor aero engine designer and builder

The basis of the story is the ceaseless pursuit of greater efficiency with unprecedented durability and lightness for horsepower output. Yet no sooner is one stage of advance achieved as far as the engine itself is concerned than weight begins to be piled up, and demands made for output that was never contemplated, say, a few weeks previously. Thus, to make ignition more dependable, numbers of magnetos, or batteries, begin to be added to the original equipment, and sparking plugs are duplicated—when you have striven to take fractions of ounces off the reciprocating parts of the engine! Next, four carburettors are suggested, instead of two; or the engine must develope power to operate wireless as well

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as to fly the machine. Now a mechanical starter must be provided for the engine; which is next called on to furnish the wherewithal to operate searchlights on the aircraft. Then, by reason of the propeller form, or what not, weighty because enormously strong reduction gear has to be designed and carried. When you get the power output right with the desired economy of fuel consumption it is only to discover that, despite their soundness, the very principles on which this achievement is based must be discarded because of the difficulty of finding accommodation in the hull of the given aircraft. Next for consideration is the question of safety in the event of carburettor flooding, involving the use of much longer, weightier and less efficient intake pipes.

When that was done, Mr Royce had to begin thinking out wellnigh all the problems afresh, adapting his engine to what seemed a perfectly impossible series of conditions; namely, to work out how it could be made to function if this, that, or the other part of the aircraft, or of the power-plant, or of its equipment, were shot away, or otherwise put out of action. The very petrol cannot be fed to the power-plant by simple means: it must be made to pursue devious ways to ensure a proper head of fuel being available, no matter what flying attitude the aircraft assumes, either at the will of its pilot or involuntarily.

To design, and re-design again and yet again, in the not-to-bebeaten endeavour to fulfil all these and other conflicting demands takes time, especially as each successive item of design in a seemingly innumerable series has to be subjected to varied and exhaustive tests. Moreover even experimental parts cannot be made without special tools.

Still more ideas were evolved by Mr Royce as the novel use of aircraft in the war suggested their desirability. From the outset we find our engineer in possession of knowledge the enemy had incorporated in his machines. He makes the fullest analysis of it, appreciating those features that are sound. His penetrating reasoning, combined with more than a spice of intuition, detects why such and such a thing has been done, and what has been attempted and abandoned, thereby saving time, talent and cost on unnecessary experiments. He grasps what line of investigation has led the Hun to a dead end in aircraft engine design, though to him the abandoned problem only presents difficulty of a sort easily overcome. Familiarising himself with all that is being done by British and French constructors, too, he himself works on entirely original lines, so that even the first of these Rolls-Royce aero engines was a distinctive design, and that perhaps in nothing so much as in the epicyclic reduction gear, which is the basic principle used for these engines to-day, remaining the finest and surest form.

Showing the reader 'how it is done'

Merely to read these letters makes one feel impatient at the positively irritating presentation of one fresh problem after another. As the work proceeds, so the difficulties seem never ending: but you shall look in vain for the slightest sign of irritation from Mr Royce, who seems to be fascinated by each problem as it is presented to him from no matter what quarter. What would wear out the patience of any lesser man seems to be a wholesome stimulus to him.

At the outset and for many months the firm contemplated laying down four of these engines a week only; thereby revealing characteristic caution and modesty. Herein is nothing to indicate that any thought was entertained of the vast numbers of very much more powerful aero engines the Company would be manufacturing before the war's end. Indeed, so urgent did that demand become that one ancillary factory after another was put under Rolls-Royce direction to expedite the production of parts. Mr Claude Johnson had

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actually to organise production in America, where some $f_{2,000,000}$ was expended. Incidentally, that gigantic task was destined to lead to an unprecedented form of British enterprise overseas.

These illuminating letters bear evidence that Mr Royce is a good fighter because he uses reason only—and wins with it. Moreover, his amazing foresight reveals him to be, what none would ever have guessed in association with Rolls-Royce, a cheap engineer. He evolved the first aero engine type quickly yet, comparatively, at surprisingly little cost. He made effective use of parts common to several experimental types to the end of expediting production. Against that he would never sanction saving in the cost of machine tools, or processes, unless it could be guaranteed that the most reliable and the speediest production could be assured, the time factor being dominant in war. His analyses of rival processes that present themselves for consideration, also of the points of different schools of design to achieve a given end, are each masterpieces of erudition and close, clear reasoning.

The ceaseless quest

Another valuable aspect of his many-sided character is his tendency always to make light of his own achievements being, nevertheless, absolutely businesslike whenever he has made quite sure a point is right. If something else is suggested which would seem to the ordinary mind serviceable enough, his penetration passes over many stages and, as it were by intuition, discovers the point at which it will not answer as expected. In short, he designs not for immediate needs alone, but on basic principles that are so sound that when later problems, never glimpsed by most, arise, it is found that, as far as the particular part is concerned, the duty they will add to it has been anticipated. I do not know an instance of any mind in any branch of business which has greater capacity for seeing all round and quite through every detail involved. Rarely do you come across a phrase in these hastily written letters in which you would want to correct the grammar. Though not penned with fine filed presciousness of phrase, but clearly, simply, and with no lost words, nevertheless the vocabulary is rich. Each sentence mirrors the crystal clarity of its author's perception. No ancillary subject seems to be unfamiliar to him, whether it be couplings, propeller speeds, installation problems, atmospheric conditions or what not. Indeed, in regard to ignition questions, including the use of magnetos the production of which presented seemingly insurmountable difficulties to British industry owing to that accessory having been a German monopoly, his knowledge of electrical engineering enabled many a thorny problem, which else it would have taken months to solve, to be dealt with right away.

Mr Royce might have been in every aerodrome at once, so readily did he envisage widely differing conditions of use. The manner in which he anticipated difficulties, or possible causes of failure instance steam pocket formations, and so forth—has to be followed in detail to be believed. Much of his designing, and even manufacturing, had to be done before the full conditions of installation and use were known. He is always on the look-out for better ideas than his own, if obtainable. Thus he will gladly employ a system, or an accessory not his own, if it can achieve the better results he wants.

Words worthy remembrance

Sometimes one discovers him building for experiment lighter than theory would lead one to design. Thus, to gain time and experience when seeking fresh avenues of achievement that present problems to solve which no sort of data exists that could be adapted as a guide, he will run parts possibly too weak, increasing any detail that searching test reveals to be too delicate.

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"Experiments produce the only safe results to follow," is a phrase that occurs in one of these letters. Time and again we find that experience the 40/50 h.p. standard car provides is helpful, when no other source of knowledge exists as a guide, to evolve the original 200 h.p. aircraft power plant. Electrical problems that puzzle Government Departments and engineers are all plain to 'F. H. R.' Yet so fertile is his invention that, when his opinion is asked, you shall find this phrase: "My suggestions are intended always to be taken in parallel rather than in series." He also has a very clear notion of the things that are known and the things that are unknown: instance an illustration of his argument in one of these letters: "In motor car work, especially in reference to axles, the stresses are quite unknown." Axles are not made inadequate for their work: it is merely that we do not know how light we might be able to make them.

The art of preparation

Many of the phrases occurring in these letters reveal how persistently the policy laid down at the inception of the enterprise is pursued; instance the following extracts from correspondence that was never intended for publication:

"We must spare no expense, or trouble, in getting the parts as perfect as possible. Economy must come in afterwards, in good workshop methods."

"We are not the people to put a high finish on parts unless it is necessary."

No knowledge seems to come amiss to him. Take an extraordinary, but successful, suggestion to overcome a certain trouble by using "a very, very mild iron": "this I mean to be of the same material as is used for horseshoe nails." After which he proceeds to show how the requisite hardness can be given to that material once it is shaped as desired. He goes cautiously, not plunging to get the utmost results first, but seeking rather that which is 'good enough' in the matter of horsepower, then increasing output stage by stage. When he is pleased with the test results reported, or with a part sent him for inspection from the Works, he always rewards those concerned. Thus: "This would appear to indicate we are on the verge of an excellent job," whereupon everybody concerned has his 'thumbs up' for the day. Failures in experiment do not discourage him: they rather interest and inspire him. He is quite tireless to achieve new degrees of efficiency. "There is no safe way of judging anything except by experiment," he writes on one occasion.

An almost startling phrase occurs in a letter written twelve months after aircraft work was begun: "We are of opinion that the air work is not nearly so exacting as car work," he writes in regard to problems of carburation. In many aspects that is true to-day.

Sometimes he does not like his own design at all, "due to this unfortunate feature": in other words, he has to design to accommodate the machine, or the installation, or something that is needed for other reasons than those merely concerned with the production of power plant as such. For instance, the intermittent gyrostatic action of large, two bladed propellers presents complex problems in connection with reduction gear, and so forth. But he weeds out one source of trouble after another with an amazing rapidity. When one reflects that over 2000 parts are assembled in a single engine, and that each has presented several problems, and is in turn presented with problems concerning its neighbours, as it were, it is amazing that so much work can be got through in so brief a spell.

"My lords, stay a little and we shall make an end the sooner," said Secretary Walsingham at the Council table where, on another occasion Secretary Cecil observed: "It shall never be said of me

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that I defer till to-morrow what I can do to-day." At first view those seem diametrically opposite pronouncements. But they are reconciled and explained by Mr Royce's method of work.

One of by no means the most difficult problems was to provide for these engines controls that could be wholly shot away without stopping the aircraft from travelling, by providing other wires, or pipes, so arranged that it would be possible to keep the engine going! Mr Royce solved this both economically and without involving undue weight.

Automobile history repeats itself

Thus one may realise how, under the exacting conditions of warfare, Rolls-Royce history in a sense repeats itself. I recall the manner in which thousands of pounds would be spent in a year with a view to lightening the engine or chassis each a few pounds only without prejudice to strength, merely for coachwork to be built without considering hundredweights. So in regard to aero engines, by the time the type originally designed was brought to the pitch at which it could be standardised, probably it developed 35 more horsepower than intended in the first instance; but more than all that was needed because this, that and the other instrument had been added to what was considered at first sufficient equipment for the given machine, which finally scaling much more than the figure originally estimated, demanded additional horsepower.

When Mr Royce hopes to get a magneto that is suitable for a special purpose, and certain experimental features are submitted to him by some specialist firm, his report contains the words: "And we ought to thank the winder for having produced such a neat winding of this model"—a characteristic wish to encourage an employee not even in his own firm. His practical nature is

revealed also in this sentence: "I do not think it is economical to run a long test until we have destroyed every piece possible by a short, high speed, mis-fire, pre-ignition test." Even in the earliest stages he calculates the amount of fuel that will have to be used to carry out some of the longer tests and, on those grounds alone, will not sanction them until everything that can be learnt by making less demands on the nation's fuel supply has been discovered—this too, before petrol was rationed to private motorists.

He was also firm in not letting anything be used which he did not approve, deeming it part of his duty to utter the final word even when the given thing was to have been undertaken by a Government Department, his attitude being summarised in this phrase: "We are the judges, not the Admiralty."

In the issue, an engine, designed originally to develope 200 h.p., produced 275 h.p. at 1600 crankshaft turns a minute. It became available in January 1916, in series production as an 'Eagle'—the 'Hawk' and the 'Falcon' I, II and III types had preceded it—at the latter rating, and of still greater power at higher crankshaft turns.

Of course, those methods led to success, as may be judged by the evolution of the Rolls-Royce 'Eagle' II to VIII (inclusive) aircraft engine types which were standardised during the war, and the demand for which was at an ever-increasing rate.

Mention has been made already of the fact that for the more rapid production of parts other engineering Works were put under the direction of the Company's engineers alike in this country and in the United States, the late President Wilson taking keen interest in the provision of more and yet more Rolls-Royce aircraft engines for the Allies.

The Works at Derby were expanded with a quickness equal to that with which the successive engine types were evolved, the

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development proving the pre-vision with which the site had been selected and the original shops designed, as any one may judge for himself who visits this great engineering enterprise to-day. The Germans had their eye on it, as instance the successive attempts made to raid it. Underground shelters were provided for the operatives by an ever-thoughtful management. No healthier, no better equipped, no more enduringly built shops exist in any branch of British automobile engineering than this well-ordered series at Derby.

But we are concerned here with the evolution of a British automobile engineering enterprise, as distinct from recapitulating the details of the campaign, the exigencies of space dictating that a mere glimpse of certain phases of Rolls-Royce activities must suffice to illustrate this period of its inspiring effort. Thus seventy-one 'S.S. Zero' type airships, fitted with Rolls-Royce 'Hawk' engines, patrolled the North Sea and many other critical waters. Reliability was essential when duty required the vessel to fly forty or fifty miles to leeward of its base in unfavourable weather; and the engines fulfilled their office. Other Rolls-Royce types were fitted to several sorts of airships, including the 'R 29,' a rigid type, which did $337\frac{1}{2}$ hours' flying in all sorts of weather without a moment's engine falter, yet the prime movers were only taken down for inspection at intervals of 250 hours' running, when the precautionary replacement of only two valves among a total of four engines was all that was needful.

Accounting for Zeppelins and 'U'-boats

It was a Rolls-Royce engined two-seat aeroplane that tackled the first Zeppelin engaged on the last serious attempt to raid England in August 1917, sending the vast hull down in flames towards a layer of thick clouds 5000 feet below. Rolls-Royce engined seaplanes and flying boats were employed continuously on long patrols over the North Sea hunting for enemy submarines, aircraft or other vessels which, when found, were attacked by bomb and machine gun, reports being wirelessed.

The pilot and observer on one Rolls-Royce engined flying boat over the North Sea sighted an 'U'-boat on the surface of the water and scored a hit on it with a bomb—only to find themselves being attacked by anti-aircraft gunfire from three other enemy submarines supported by as many destroyers. But the pilot held on his second run and dropped his bomb again on the 'U'-boat, which heaved and shivered. Her bows rolled upward momentarily showing her plates cracked and broken as she disappeared in boiling foam. At that moment the attacking pilot took a snapshot of her, then bethought him of the safety of his own aircraft, which had to make its way out of a region now resonant with counter-shelling.

Rolls-Royce engined aircraft were the means of sighting 'U'-boats by the hundred. Sometimes they engaged enemy patrols in the very Bight of Heligoland because Borkum, within it, was one of the bases of the German Air Fleet, 200 miles from our base-to which the Britishers returned in due course. In fact, our 'R.-R.' engined aircraft were everywhere where they should have been. In an action near the island of Vlieland in the North Sea in June 1917, a Rolls-Royce engined flying boat, which had been nearly four hours patrolling in patchy mist, suddenly 'spotted' a Zeppelin only 1500 feet above water. In turn, our aircraft was seen by the Hun look-out when yet 1000 yards away from, and 500 feet above, the airship. There was not a moment to lose, the alarm being given. Happily the gunner was able to "let go a couple of short bursts from his gun" as the little aircraft roared across the giant airship's course only 200 feet above her. The instant our men were past the pilot swung the flying boat round so that she was driving

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at the enormous airship first on a level with, then slightly below her. At the moment the gunner was waiting to pour in his second fire, however, a spurt of flame that flashed along the vast envelope showed that the good work had been done and that the only way for the approaching Britishers to avoid self-destruction was for the pilot to 'hoick' his boat hard up and over the flaming monster. He succeeded, and duly reported "all well"—one Zeppelin the less.

I might go on indefinitely telling tales from heroes' logs concerning Rolls-Royce engine triumphs. For machines so equipped became the very terror of the Rhine watchers, raiding Mannheim, Cologne, Coblenz, Stuttgart and other centres of enemy munition production or war bases, raiding as well by daylight as at night. The work done by Rolls-Royce engined aircraft increased in scope and effectiveness with the lapse of every month so that, in that sense, it may be said the campaign ended too soon, for we know that the Germans preferred invading to being invaded, bombing to being bombed.

THE CONQUEST OF THE ATLANTIC: HARNESSING UNIQUE TALENTS AND EXPERIENCE TO SERVE NEW NEEDS

EACE was declared the year after the granting of the armistice. 1919 also witnessed perhaps the most amazing accomplishment by Rolls-Royce aero engines, surpassing, as it did, even their wonderful performances in war service. Foremost among the post-war aviation enterprise to impress the public mind the world over was the unprecedented and still unparalleled feat of the late Sir John Alcock in flying a 360 h.p. Rolls-Royce 'Eagle' VIII engined Vickers 'Vimy' type bombing biplane-a land machine!-from Newfoundland direct to Ireland in 15 hours 57 minutes on June 14/15, 1919, with Sir A. Whitten Brown as navigator. In 1492 Christopher Columbus took 41 days to sail from Palos, Spain, to San Salvador in the Santa Maria; in 1838 the Sirius was the first steamship to make the voyage from Cork, without the aid of sails, to New York in 17 days; and in September 1909, the Mauretania made the fastest Atlantic trip between Fastnet Light and Ambrose Channel Light Vessel in 4 days 10 hours 41 minutes.

Yet there was still plenty of petrol left in the Rolls-Royce engined Vickers 'Vimy' biplane when it landed at Clifden, Galway, Ireland, for it to have continued the flight to London without replenishment. Unfortunately the gallant pilot had become so stiff that he was fain to alight in Ireland on the first expanse of Mother Earth he espied and in doing so on boggy soil the undercarriage of the Vickers-Rolls 'Vimy,' now in the South Kensington Museum, sustained trifling damage which, nevertheless, was sufficient to render it impossible for him to take off again after stretching himself; therefore the flight ended at the first point on which the machine alighted. That feat remains without precedent

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or eclipse. Stage-by-stage seaplane flights have been made across the Atlantic by other routes with frequent landings, the pilots being accompanied by escorts of destroyers carrying every means for rendering assistance, instance the aerial tour of the United States Navy seaplane by devious ways from Trepassey Bay, Newfoundland, on 16 May to Plymouth on 30 May 1919, an Odyssey lasting 15 days.

By air-and Rolls-Royce-from England to Australia

In regard to the Rolls-Royce post-campaign aerial enterprise, in this brief review mention must also be made of the epoch-making flight by the late Sir Ross Smith accompanied by Sir Keith Smith. This great pilot, with his brother and crew, made the first aeroplane flight stage-by-stage from the Mother Country to Australia on another Rolls-Royce 'Eagle' VIII engined Vickers 'Vimy' biplane in 28 days, between 12 November and 10 December 1920, representing a total distance of 11,130 miles covered in 135 hours, 55 minutes flying time under the most searching climatic conditions. This achievement gave a momentous stimulus to the cause of civil aviation in Australia, as well as to the Royal Australian Air Force, then in its infancy. In this connection it is of interest to recall that the Royal Aero Club has recently awarded the Britannic Trophy for the best flying achievement during the year 1924 to two officers of the R.A.A.F. who made an aerial survey of the whole coast of the Australian continent in a Rolls-Royce engined biplane.

And from London to South Africa

Two Rolls-Royce 'Eagle' engines were also used in making the first flight by aeroplane from this country to South Africa. On 4 February 1920, Sir Pierrie van Ryneveld and Squadron-Leader Sir C. J. Quintin-Brand left Brooklands, arriving at Bulawayo on 5 March. The distance of 6281 miles was completed in 92 hours 58 minutes flying time.

These are some of the more outstanding post-war demonstrations of the unmatched reliability, efficiency and economy of Rolls-Royce aero engines evolved during the war and developed since. Every year since the armistice has witnessed the introduction of more and yet more powerful and efficient Rolls-Royce aero engines. Big demands are being made on this department of the firm's enterprise to-day to supply the needs of the Air Ministry for new style equipment for that increasingly important service. Of course it would be contrary to regulations made in the national interest even to indicate the nature of this fresh accomplishment.

World-wide demand for the post-war chassis

Meanwhile the demand for this firm to resume chassis manufacture assumed unprecedented proportions. The problem of turning over, as it is styled, from aero engine to car building was rendered the more difficult by reason of a regrettable series of nation-wide strikes which, of course, affected the Rolls-Royce Works in common with others. The task was more than ordinarily complicated in the case of a firm whose vast war contracts were not of a character that could be abandoned straight away. The first war in the air had proved that we must have a very variously and increasingly well equipped flying service. The development of the power plant had been so great and rapid, that current contracts for large quantities of the latest Rolls-Royce aero engines had to be completed before there could be any question of resuming passenger-car production for sale to the public. Yet the first deliveries of post-war built 40/50 h.p. Rolls-Royce chassis were made to the public in October 1919. These differed from the pre-war chassis in having, among other details, electric engine starters.

Why manufacturing was undertaken in America

The request of the British Government to Mr Claude Johnson to organise in 1918 the manufacture of units and parts of Rolls-Royce aero engines in carefully selected factories in the United States under Rolls-Royce supervision had a remarkable sequel. The scheme stipulated that American materials should be supplied to Rolls-Royce specification. These operations being on a very large scale, the experience gained generally in connection with them led Mr Johnson seriously to consider the fact that there was available in the United States in 1919 a large number of operatives trained to Rolls-Royce methods, which, together with the unrivalled reputation which Rolls-Royce engines and cars had obtained in the United States, was resulting in a big demand there. All which led to the incorporation in October of that year of a Company, styled Rolls-Royce of America Inc., which acquired the rights to build and sell in North America, under the direction of the parent Company in England, Rolls-Royce cars and aero engines. The Works that were started presently at Springfield, Mass., were furnished by the parent Company with Derby trained experts to take charge of the various departments. As far as its finance is concerned, this American factory is an entirely selfcomplete enterprise; but the chassis made there have proved to the satisfaction of the parent Company's engineers to be as good in material, quality and functioning as those built at Derby, so faithfully have the same methods been reproduced in the New World.

Developments rendered possible by war experience

This was all the greater triumph because the post-war 40/50 h.p. Rolls-Royce chassis of course incorporated the fruit of experience gained in the work of fulfilling unprecedently severe and



The Rolls-Royce engined Handley-Page aeroplane which flew from England to India at the end of the war. The photograph was taken on its arrival at Delhi on 12 December 1918



Rolls-Royce armoured cars operating in German East Africa in 1918

PLATE X



H.R.H. the Prince of Wales leaving York House, St James's, to attend a demonstration of Boy Scouts. The Prince is an enthusiastic Rolls-Royce owner



A recent photograph of Mr Royce, working in his garden with Mr A. J. Rowledge, his chief aero engine assistant

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various campaign conditions; also of evolving aero engines. Full use was also made of the new style materials rendered available by the commercialisation of metallurgists' discoveries. Following the firm's traditional policy, each improvement was embodied in that series of cars the building of which was undertaken after the completion of the most exhaustive tests of the given new feature. It may not be realised that before being standardised the results of war experience had to be tested exhaustively under normal conditions.

Progress in detail illustrated

By way of illustration it may be mentioned that sundry components were built appreciably lighter. The specially designed aluminium alloy pistons enabled engine performance to be improved the more effectively because they were used in conjunction with connecting rods fashioned of high tension alloy steel. Of course the average horsepower developed at all engine speeds was higher than in the pre-war model. For instance, the improved form of camshaft and the slight modifications in the design of the valves and their seatings enabled more power to be developed without increase of cylinder volume. Again the new air system proved quite automatic in regard to maximum pressure, which is controlled solely by the capacity of the pump of developed design needing no relief valve. In the improved ignition system the trembler of the coil had been replaced by a single break mechanism. With its condenser, this coil represented a considerable reduction in bulk weight and ran much better. The improved magneto type was fitted in a more accessible position. The 'Silver Ghost' engine's increased output of power resulted in greatly enhanced car acceleration. The clutch fabric and design retained oil better, and the springing approximated still closer to perfection. RR

The test of perfect four wheel braking

Perhaps the greatest chassis development, however, was that announced in the autumn of 1923 that, as the result of about ten years' experimental investigation of the most searching character, thenceforth the 40/50 h.p. chassis would be equipped with no fewer than six brakes, two of which would operate on the front wheels and four on the rear wheels. My first experience of them is counted among the red letter days of my motoring life. They achieve the really difficult thing-the power 'to kill speed' in the minimum distance without causing any fore and aft motion in the chassis even when the car, travelling downhill at high speed, is pulled up dead. In no circumstances of use is there any tendency for the occupant of any seat to slide, far less to pitch, out of it. It is my experience that most of those who present cars with brakes on all four wheels are proud if "you can feel them come on, and no mistake about it." By contrast, when the Rolls-Royce brakes are applied, you feel nothing: you merely notice that the car has come to a stand, or that its speed has been reduced to any extent that the driver desires. Those are the supreme tests of merit in this connection. You should never be made aware that anything is happening. With the Rolls-Royce four wheel brakes the sense of rhythm is not lost for a second. What a contrast to my first experience of four wheel brakes nineteen years ago, when I promptly appreciated the advantages to be enjoyed when all went well with them-also that exciting, if not amusing, things happened when they did not. In other words, much has had to be learnt since primitive ideas were alone available on the subject.

Yet other chassis developments were possible by reason of the greater power and control available, hence the introduction in 1924 of a 'Silver Ghost' model with a longer wheel-base to accommodate still more commodious carriage work without prejudice to the remarkable range of performance and convenience of the turning circle.

A popular lower powered car

Judge, too, how bold a step was taken when, apart from launching an American factory after lengthy preparation, the Directorate decided, in October 1922, to accede to a worldwide demand for a lower powered 6-cylinder engined chassis by introducing the now well-proved, utterly distinctive 20 h.p. type, the monobloc engine of which has quiet operating overhead inlet and exhaust valves. Of course, at the time many thought it might spoil the market for the larger car. The clear discernment of the Management, however, was justified in the issue, which proved such guesses to be quite without foundation. Indeed, there are not lacking indications that presently the large public whose current needs are met admirably by the lesser type will require a larger one. Incidentally, to-day the demand for the latest 40/50 h.p. type is even greater than before the 20 h.p. model was put on the market, there being no overlapping.

The Directorate had been strengthened by Lord Wargrave (then the Rt. Hon. Sir Edward Goulding, Bart., M.P.), the present Chairman of the Company, joining the Board before these bold and so abundantly justified measures were adopted. It is a matter worth recording, too, in connection with an industry subject to such violent vicissitudes of fortune as is automobile engineering —than which no branch of manufacturing enterprise has been developed and is evolving more rapidly—that the finance of Rolls-Royce Ltd. has shown consistent progress for one-and-twenty years with the exception of one season only, wherein there was a slight contraction, instead of gain, in profit due wholly to the

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impossibility of operating the factory for a spell owing to conditions over which neither the Management, nor the operatives individually had any control; namely, nation-wide labour troubles.

Service that recognises human nature

Nor were developments confined entirely to manufacturing and marketing. On the contrary, the utterly original interpretation of the term service which Mr Claude Johnson had conceived, and the carrying out of which established the commercial side of the business in no less high repute than the purely engineering aspect of it, was further perfected as a result of his extraordinarily subtle understanding of human nature. Rolls-Royce service differs from ordinary motor car service because it is based on an appreciation of the fact that, while engine and chassis must be standardised absolutely, by contrast, owners and the drivers of their vehicles are not so many standardised human beings. Each has a right to be and is considered as an individual. In this country, and even abroad, territory is divided into areas, each allotted to an individual inspector-to the increasing satisfaction of owners. It is sought always to give personal attention to clients. Invaluable work has been done, too, in encouraging designers and builders of coachwork to appreciate the engineering possibilities of their ancient craft.

Derby's enduring tribute to all-conquering genius

At Derby, which has gained so enormously in repute throughout the world through its association with Rolls-Royce enterprise, there was unveiled in the Recreation Ground on Wednesday, 27 June 1923, Professor Derwent Wood's lifelike statue of Mr F. Henry Royce. The Duke of Sutherland; the present Secretary of State for India, the Earl of Birkenhead; and the ex-Colonial

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Secretary, Mr J. H. Thomas, were among the speakers. That day the world learnt that this foremost and most practical of British automobile engineers had had to conquer fate from early childhood. Owing to the death of his father leaving a widow and young family ill-provided, for a year this leader in the making delivered newspapers for the famous firm of W. H. Smith and Son. At the time, he was only 10 years old. Even so, however, his talent and determination won recognition quickly. After scarcely twelve months of this drudgery he found opportunities for learning, making the amplest use of them by attending night classes, and so forth.

No figure in the romantic story of engineering in either hemisphere has made a braver and more successful fight against adverse circumstances from the very outset of life; nor has any revealed more abundant genius. In no field of human endeavour can a wider variety of knowledge be demanded in conjunction with greater originality.

"The shadows will be behind you if -"

Like all pioneers, his secret is revealed by that legend on a sundial at Lee which reads: "The shadows will be behind you if you walk towards the light." The one thing he has never learnt is how to grudge pains, for he is of no mean rank of mind, but seems to have been blessed from boyhood with that rare, brave, self-helpful way of peering tensely through the twilight of the might-be until he makes out the very shall-be beyond. He did not struggle for wealth or fame; indeed, he was well content with "the wages of going on."

Check him for the twentieth time and he will track somewhere in the land of likelihood yet one more beginning of inspiration. That he will ponder and puzzle out with unsapped zest, even as I have seen the brothers of no time and no country—for is not their

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accomplishment ageless and the world's?—Wilbur and Orville Wright (who first proved in the United States of America that mechanical flight is), argue possible ways-how so exhaustively under the stress of scarcity of the sinews of finance that, presently, the elder would be urging the younger's suggestion on him. And the younger, having abandoned his own idea under destructive fraternal criticism, would have come round to endeavouring to persuade the elder that he was right in the opposite idea he had brought forward in the first instance and had himself now forsaken under counter-criticism.

Like those immortals, 'F. H. R.' has failed time and again, his main work still halting. But as long as he had a pencil and some paper, metal and wood to try withal, at the time it mattered little to him whether he took enough food to keep his unconquerable soul in his weakening body. For him life was full, therefore glorious. He could still feel he was striving after all the future, whose possibilities were none the less real to him despite the fact that, so far, he had failed in his immediate quest to wrest a detail of knowledge from the unknown. There is always a fineness in the most frantic failures of this sort that even the falling into forgetfulness cannot rob them of, because whoso forms his character builds lastingly. "Education," say the Danes, "is what is left after everything you have learnt has been forgotten."

A fairy tale come true

If any should chance to rake these pages from some neglected shelf in years to come when all we know and have to-day shall have been enlarged and bettered beyond our boldest guess, so that to them my words may appear too warm, let them be sure that this is a true tale of the measure of my gratitude now who cannot foreknow what is to be but who feels keenly how we have been raised by the grand work in metal and materials of great talents who have rid us of the tedium of horse-drawn coaches, having given us back all the joys of the road without any of the old-time drawbacks, and who have made us free of the highway of the air, hitherto denied. This scope is so newly granted that the contrast between the bygone limitations under which we chafed and the larger liberty we now enjoy kindles to an enthusiasm that must have all the force of freshness.

The description on the base of the statue—which is so real that the engineer might be speaking, to such a degree has Art counterfeited him in his habit as he lives—reads:

F. Henry Royce, Engineer, born 1863, at Alwalton, near Peterboro'. Owing to misfortunes in childhood he was almost entirely self-educated. His work included the design and production of the Rolls-Royce motor cars of world-wide reputation, which were used for most important work in the Great War; and also the design of the Rolls-Royce aero engines, of which a greater horsepower was employed by the Allies than of any other design. Aeroplanes with those engines made the first direct flight across the Atlantic in 16 hours, and the first flight from England to Australia. This statue was erected by the shareholders of Rolls-Royce Limited in 1923, at which date he was still serving the Company as Engineer-in-Chief.

Which unique, deserved but unsought tribute has incited him to surpass his earlier accomplishment. Hence in May last motorists all over the world learnt that he had evolved the 'New Phantom' overhead valve 40/50 h.p. version of the now nineteen years established and persistently perfected 6-cylinder engined chassis, the first version of which, built at Derby, had overhead inlet valves for efficiency. If you have driven or ridden in the 'New Phantom,' assuredly you will agree with me that it is the monarch of cars to-day.

Two months later, on July 28th last, Mr Royce had ready for introduction to the public a notably developed version of the overhead valve 6-cylinder engined 20 h.p. chassis with offside change speed and brake levers, a gearbox giving four speeds forward and the firm's distinctive, refined and uncommon efficient six-brake scheme wherein the servo-mechanism operates alike against forward and backward chassis movement.

"Fortifying and fiftifying"

Being charged by Bluff King Hal to erect a new fort at Calais watergate, and to see the town well fortified, Captain Talbot made blunt, loyal answer that he could "neither fortify nor fiftify without money." Nor could there be any 40/50 h.p. 'New Phantoms' unless the business side of the Rolls-Royce company had been managed as ably as the engineering part, for car evolution is impossible without cash in plenty.

During the last year of its chassis-building enterprise at Manchester the then newly merged Royce and Rolls undertakings had a joint capital of £104,112 on which they earned a profit of £5390 in 1907, four years from the time when the two-cylinder engined 10 h.p. car appeared. But on migrating to Derby and concentrating wholly on the production of one six-cylinder engined chassis type in a new works having 5325 square yards of shop floor-space the profit, £9063, was nearly doubled the following year despite the costliness of the transfer. The year before the War, 1913, the factory was increased to 29,838 square yards and the profit to £91,183. But in Armistice year, 1918, the works had a floor-space of 55,151 square yards, the profit being £153,262 on a capital of £400,000, a modest offset to the falling off to £44,171 in 1915 owing to the dislocation of business consequent on the outbreak of the campaign.

Since getting disentangled from all war obligations, however, progress has been unbroken under all heads. Thus in 1921 the Works area was 65,386 square yards, the issued capital being £811,202 and the profit £107,326; whereas last year the area was 66,758 square yards, the capital employed was increased by some £2650, and the profit rose to £163,673.

During the present year the work of factory extension has been continued, particularly to provide additional accommodation for aero engine building, in part for the re-equipment of our Air Force. Indeed, that department of the Works has never been so pressed for production. Nor does the flow of tributes to its prowess abate, one of the most recent being Captain Amundsen's testimony that the Rolls-Royce aero engines he used in his attempted flight to the North Pole "always went splendidly."

The cadet and the caput

As to car building, a company may evolve a chassis the design of which will fascinate automobile engineers. It may manufacture to those drawings with such supreme skill that the selected metals and alloys are fashioned into mazy parts having each the perfection of form to drawing that has to be attained in making the exact, intricate, small instruments by means of which scientists pursue their miscellaneous fascinating researches into the unknown. Yet a car so schemed and made may disappoint you sadly on the road. There full many a fine theory proves but a fault, as the history of automobilism makes plain. There, too, the very attainment of complete success in regard to some hitherto enigmatical feature may itself be the means of discovering, and even stressing annoyingly, some defect of a kind hitherto retired but which, once detected, is found to be common to all cars of the given period . of evolution. I have known such cases.

Again, many constructors make a success with one car type but fail relatively with all others of a series of various sizes and powers they also market. So, touching current Rolls-Royce chassis, the quære is this: whether the *cadet* is worthy the *caput* of the house?

Therefore I studied the 20 h.p. car with more than usual closeness on its initial appearance some three years ago. Then, to my judgment, it seemed to be an uncommon fine overhead valve, sixcylinder, three litre engined chassis for any maker to have produced in a category engaging the finest talents of the industry in Europe; but that it was not 100 per cent. Rolls-Royce. Nevertheless, even then it had in it sufficient character and qualities to leave no manner of doubt that the mere process of logical evolution in detail would presently make it so. I would try to recall the earliest impression given me by suggesting that poetry is, and must be always, much more machine-made than prose, yet in its first form that carriage discovered a further difference by giving me a greater idea of mechanical excellence than it did of the poetry of motion.

"A friend for all hours"

In the interval, improvements have been incorporated quite surprisingly quickly, notably concerning the smoother working of the engine; the provision of ampler body space, of an exceptionally compact, quiet right-hand controlled four-speed gearbox, and of the distinctive six-brake system, so that to-day I find this junior chassis exhibiting the real Rolls-Royce secret of design—an exact concinnity and evenness of excellencies.

This car is wholly individual now. It is so amenable as at times to appear self-accommodating in traffic: yet it has also become a carriage on which, at will, you can travel *an grand galop*. Its fleet hill-climbing is a recreation, not a toil; and the curbing of its speed is as subtle as it is sudden, the gamut of its performance having been enlarged fully to justify its illustrious pedigree. I esteem it, as Erasmus did Sir Thomas More, "a friend for all hours."

"A fair wrought car"

But to bring home to yourself the utmost that motoring offers at the end of the first quarter of the twentieth century—seven-andthirty years after Gottlieb Daimler, a workman in the Otto gas engine factory at Cologne, put a light, portable, liquid fuel, internal combustion engine on a tricycle and took the road with it—you must know the 'New Phantom' Rolls-Royce.

Here is a car of both harmony and counterpoint composed, each part being the most fit and best made for its duty, yet serving but to blend with and exhibit the rest. The whole is an instrument to fulfil your will on every highway. The puissance of the muted engine is balanced in the nicest proportion by the masterly bridling of the brakes on each wheel.

In this carriage your travel is never hurried, yet at the journey's end you shall discover that Time has been cheated. The car's passage is as silent as the fleet shadow of a cloud racing before a high wind. There is an engaging something of mystery, too, in the cunningly softened power of this cushioned touring that plays Puck with the senses, smoothing roads so wrinkled and holed as to be what the Sussex folk call "all bumblesome like," and causing the hills to seem as though they had being but to fall beneath you, so unabatedly swift and agreeably effortless is the act of cresting the steepest and most sickle-shaped of them, the revelation and regrouping of heights, depths, directions and distances quickening roundnesses, angles, colours, lights and shadows to fresh and nobler values.

The plain fact is it must be tried to be believed because it rides like the car of a dream. You wish—it satisfies. And, bating mischance, the 'New Phantoms' now building should be serving their owners silently when the House of Rolls-Royce shall be celebrating its jubilee.

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The story of automobilism is a tale of attempting the unprecedented, a few only succeeding. Mr Royce has imagined, experimented and achieved without pause even in dangerous illness. Maybe you know now why he has never devoted an hour of his life to unprofitable recreation or toil. Thus, to provide change of mind during the intense strain of his magnificent war-work he had a farm, of course seeking and attaining best-yet results in produce and showing that, with indomitable will, this type of mind will accomplish the utmost, no matter to what channel it is directed.

"One sees many things one thought of years ago," he mused in the course of our talk at the recent motor car show. "They were too early then. Perhaps now, however—."

There is no gainsaying that in automobile engineering he has found that phase of human enterprise in which his talents can be employed to the greatest gain to mankind. He had, too, the rare good fortune to become associated in endeavour with Mr Claude Johnson, who invented the Rolls-Royce business, and whose fertile brain has refreshed his master patent many times since 1904. Imagination pictures that grand work proceeding until this splendid enterprise shall be twenty-one years old for the second time and another tale of accomplishment, as marvellous as varied, shall await the telling. Though a young firm, Rolls-Royce is rarely rich in tradition and is established so firmly the world over that there can be no doubt as to its future, it matters not what temporary causes, national or international, may interrupt or divert the course of its activities.

L'envoi

When last autumn I proposed writing this brief chronicle I made three stipulations only. It was to be recorded that the idea of discovering to the public the human element, that alone can reveal why Rolls-Royce is Rolls-Royce, originated with me; that these memories were not to be used as an advertisement; and that the recognition of my self-imposed and to me delightful task should be confined to an unaccompanied expression of thanks.

Those conditions have been fulfilled with characteristic faithfulness and courtesy. Lord Wargrave, Chairman, and the Directors of Messrs Rolls-Royce Ltd., have been kind to give permanent form to this narrative that others may share my knowledge of the significance of so splendid an enterprise. I am in the debt of Captain F. H. Burgess, too, for his kind help in checking the facts recalled in the course of casting my mind backward for a few hours to a tale of the past of motoring worth rescuing from neglect. It has been a rare pleasure to write these pages and to pay a tribute alike to a great British firm and to the triumvirate who conceived, launched and piloted to success so noteworthy a venture. Many motoring experiences have given me the feeling that each was ahead of its time, but no other series has seemed to come consistently so near the ultimate of its kind. I feel indebted to the firm for having furnished me, in the conduct even of its first car, with abundant justification for believing in the ever-widening future of automobilism. There is more than a suggestion of the wonderful in this company having established itself within one-and-twenty years in the premier position in the industry. To have held that place without dispute for at least a dozen years during that period is matter for marvel. It is an attainment of which the British engineering industry in general has a right to be proud. It means, incidentally, that splendid work has been and is being done in providing employment for the best class of labour which it is so eminently desirable to retain in these islands.

If by the feeble light I have upheld perchance the reader has been enabled to see in the past of this all-British enterprise how the dreams and ungrudging toil of men of mark given solely and without break to the attainment of a single purpose have achieved that end fully, assuredly I am more than repaid.

CHRONOLOGICAL ABSTRACT OF ROLLS-ROYCE DEVELOPMENT DURING TWENTY-ONE YEARS 1904–1925

YEAR	ISSUED CAPITAL	PROFITS	WORKS PLACE AND SI	ZE	CAR TYPES		AERO ENGINE TYPES
1904 1905 1906	1904 Royce, Ltd., and C. S. 1905 Rolls & Co., sepa- 1906 rately organised		Manchester		10 h.p. two-cylinder 15 h.p. three-cylinder 20 h.p. four-cylinder 30 h.p. six-cylinder		
1907	£104,112	£5,390	Derby:		40/50 h.p. 'Silver Ghost'		
1908 1909 1910 1911 1912 1913 1914 1915 1916	£104,112 £116,673 £136,490 £200,000 £200,000 £200,000 £200,000 £200,000 £200,000	£9,063 £19,994 £37,761 £50,713 £71,062 £91,183 £76,850 £44,171 £82,640	5,325 sq. y 8,600 ,, 13,320 ,, 14,628 ,, 24,680 ,, 29,838 ,, 29,838 ,, 30,499 ,, 41,706 ,,	ds.	23 23 23 23 23 23 23 23 23 23	33 33 33 33 33 33 33 33 33 33	90 h.p. 'Hawk' 250 h.p. 'Eagle' I; 260 h.p. 'Eagle' II; 280 h.p. 'Eagle' III; 280 h.p.
1917	£,200,000	£142,056	42,221 ,,		>>	>>	220 h.p. 'Falcon' I 320 h.p. 'Eagle' VI and VII; 350 h.p. 'Eagle' VIII; 250 h.p.
1918	£,400,000	£153,262	55,I5I "		>>	>>	350 h.p. 'Eagle' VIII; 250 h.p. 'Falcon' III

CHRONOLOGICAL ABSTRACT (continued)

YEAR	ISSUED CAPITAL	PROFITS	WORKS PLACE AND SIZE		CAR TYPES		AERO ENGINE TYPES	
1919	£787,176	£192,777	Derby: 57,924 s	q. yds.	40/50 h.p.	'Silver Ghost	' 350 h.p. 'Eagle' VIII; 250 h.p.	
1920	£804,271	£202,835	65,183	"	>>	23	525 h.p. 'Condor' I & II; 350 h.p. 'Eagle' VIII; 250 h.p. 'Falcon' III	
1921	£811,202	£107,326	65,386	33	>>	>>	650 h.p. 'Condor' I A; 350 h.p. 'Eagle' VIII; 250 h.p. 'Falcon' III	
1922	£812,137	£149,209	65,386	"	40/50 h.p. and 20 h.	'Silver Ghost'	' 650 h.p. 'Condor' I B; 360 h.p. 'Eagle' IX; 250 h.p. 'Falcon' III	
1923	£813,519	£156,708	65,771	22	40/50 h.p. (with f.w 20 h.p.	[*] Silver Ghost [*] v. brakes) and	650 h.p. 'Condor' III; 360 h.p. 'Eagle' IX; 250 h.p. 'Falcon' III	
1924	£813,787	£163,673	66,758	>>	40/50 h.p. (with f.w 20 h.p.	'Silver Ghost' v. brakes) and	650 h.p. 'Condor' III; 360 h.p. 'Eagle' IX; 250 h.p. 'Falcon' III	
1925		-	68,038	33	40/50 h.p. tom' and f.w. brak	'New Phan- l 20 h.p. (with es)	650 h.p. 'Condor' III; 700 h.p. 'Condor' IV s; 360 h.p. 'Eagle' IX; 250 h.p. 'Falcon' III	