ARThUR JOHN ROWLEDGE
1876-1957

ARThUR JOHN ROWLEDGE was born on 30 July 1876, at Peterborough. His father had a small building business which had been inherited from his grandfather who had worked on the building of the Crystal Palace at Sydenham. He was quite good at most trades and could sketch and make plans.

His mother came from farming stock in Lincolnshire. There were three brothers and one sister in the family, Arthur John being the youngest of the four children.

In his early boyhood he used to spend a good deal of his time at his maternal grandfather's farm in Whaplode Fen, but he had to give this up when he started to attend school. His father interested him in sketching and the arts, taking him to the National Gallery. He also explained many scientific and mechanical things to him so that, for example, he knew how the steam engine worked when he was quite a small boy.

He received his schooling at St Peter's College School, Peterborough, where Mr Seabrook was Headmaster. There was also a school of science and art in the Minster yard which he attended whilst he was at the college school and also during his apprenticeship. He first studied art there, but later on, when he started work, concentrated on mechanical and scientific subjects, and in May 1891 obtained a Queen's prize in the examination of the Science Schools.

He was apprenticed to Barford & Perkins, Engineers, of Peterborough, and Mr Perkins who was then Works Manager, taught him a great deal. Although the works plant was crude, the fundamentals of many modern developments were there, particularly in the foundry and in the jig methods used.

He took a keen interest in the technical press and at that time a paper by a Scots professor on the properties of similar structures and machines started a line of study which was to be of the greatest use to him in later years.

On the completion of his apprenticeship in 1898, he went as a draughtsman to R. Hoe & Co., the London branch of the American printing machine makers. This was his first introduction to intricate mechanism and made quite an impression on him, as he would often quote in later life the practices used in printing machinery.

In 1900 he went for a short time to Easton, Anderson and Goolden at Erith, where he obtained experience of what he felt was real engineering, and in the next year he obtained a post as designer with D. Napier & Sons,
who were then building motor cars in a factory near Waterloo Station. He was with them from 1901 to 1904 and during this period the Napier car won the Gordon Bennett road race. They also built what was, perhaps, the first six cylinder motor car.

In 1905 he joined the Wolseley Company and in June of that year he married Alice, daughter of H. H. Blincko, Esq., and Louisa Blincko, at St Philip’s Church, Kennington. There were three children of the marriage: Jeanie Louise, born 23 January 1907—studied art and obtained her A.R.C.A. diploma; John William, born 17 August 1908—now a chartered accountant; Donald Henry, born 28 September 1911—studied architecture and qualified A.R.I.B.A.

There is little record of what he did at the Wolseley Company but, over a large part of the time he was there, he held the position of Chief Designer.

In November 1913 he went back to the Napier Company as Chief Draughtsman and later became Chief Designer. He was responsible for the design of a number of Napier cars which could be regarded as the forerunners of the modern motor car.

During World War I the Napier Company was initially engaged in building aircraft engines which had been designed in the Royal Aircraft Factory and also by the Sunbeam Company. As a result of experience gained in building these engines, Rowledge commenced in 1916 the design of the famous ‘Lion’ engine in which the cylinders were water-cooled and arranged in three banks in a broad arrow formation. He had arrived at this configuration as the result of a study of the requirements of the military fighter of that day, and this also led to the use of a propeller driven by a spur reduction gear and placed roughly at the centre of area of the frontal aspect of the engine, in order to give a good faired shape to the nose of the aircraft. We see here the first manifestation of his belief in the necessity to treat the engine-aircraft problem as an entity, a practice which he was to follow with great thoroughness throughout his later designs.

Development of this engine eventually led in 1918 to the Lion series II 450 b.h.p. engine which, although it arrived too late to see much war service, was to become one of the standard engines of the Royal Air Force for many years. The Lion was the first to reach a height of six miles; winner of the 1919 Aerial Derby race; first to fly non-stop from London to Madrid, covering the 900 miles in a record 7½ hours; first to carry a load of 1½ tons to 13 999 ft.; and holder of 24 British records for speed, duration and load-carrying. It was also the lightest aero-engine for h.p. of any previously produced. For his work on these projects he was awarded the M.B.E. at the end of World War I.

To satisfy the heavy bomber requirements of that day he designed a further engine in 1919 known as the ‘Cub’. This had 16 cylinders arranged in four banks in an X formation and is worthy of specific mention because it was the first aircraft engine to develop 1000 b.h.p. in a single unit. This engine, because of the changing circumstances and recession after World War I, was not produced beyond the first six prototypes, but Rowledge was to
return to this configuration in later years in the Rolls-Royce ‘Exe’ engine.

In 1921 he resigned from the Napier Company and joined Rolls-Royce Limited as Chief Assistant to Mr F. H. Royce. By this time the large proportion of the firm’s man-power engaged on aero-engine work during the 1914-1918 war had shrunk to relatively small numbers and Rowledge was brought in as the first step towards a resuscitation of effort in this field.

The political and economic background which was to be his greatest obstacle over the next few years was only just taking shape. Economy in government circles was the order of the day and the prospect of adequate government support for the aircraft and aero-engine industries was far from bright.

He was now 45 years of age and in his prime. His tall loose-limbed figure was soon well known throughout the Company. Never in a hurry, he yet moved quickly, and what he saw he remembered. He assessed the equipment available in the factory, the potential of the organization and adapted his designs to use both to their fullest capacity. Where shortages were apparent he would good-humouredly suggest expediencies.

His first job was to assess the development potentialities of the existing Rolls-Royce Condor and Eagle aero-engines. At the end of a few months he emerged with a project, that of redesigning the Condor engine to make it suitable for both military and civil applications. He obtained a small staff of three designers to put his ideas into practice and into them, as indeed into all who were afterwards in intimate contact with him, he implanted the seeds of his own genius which ultimately again raised the Rolls-Royce aero-engine to its World War I pre-eminence. The immediate target he set was to raise the brake horse power of the Condor from 540 to 650, to reduce the weight drastically, to reduce the overall dimensions and to improve the reliability.

Basic knowledge was necessary to provide progress in many directions and he forthwith set out by rig testing and other means to establish without doubt that his estimates and claims for the new and improved features of the engine were capable of attainment.

The following year saw the Condor III design completed and the first engine built. The objectives of increased power, reduced weight and size were reached and development continued for reliability under his guiding hand. Much of the early development work on lead bronze bearings was carried out on this engine, a material which was to replace white metal on all the later engines to be developed by the Company.

The Condor III was eventually to engine the famous Hawker ‘Horsley’ bomber which was produced in what was, for those times, fairly large numbers. This aircraft came very near to establishing a world long distance flight record.

Two other items are worthy of mention during this period. In order to improve take-off and cruise performance, he designed a two-speed propeller reduction gear for the Eagle engine. This was a remarkable achievement as
it was accomplished with little extra complication and increase in weight over the existing gear. Although the gear was made and flown and did the job that it was intended to do with eminent satisfaction, it came at a time when the requirements of supercharging were beginning to force the development of the variable pitch airscrew and, once this was established, the need for a two-speed gear did not again arise until piston-engined fighter aircraft were reaching speeds approaching 500 m.p.h.

The other item was the application of an exhaust driven supercharger to the revised Condor engine in order to improve its performance at high altitudes. This was unique at this time in that a two-stage supercharger unit was used in order to keep down the overall dimensions and so enable it to be installed in the vee between the cylinder banks.

During this period he also found time to devote attention to the braking problem on the Rolls-Royce motor car. Four-wheel brakes were being introduced and, in order to provide the deceleration required on a fast and heavy car with light pedal pressures and small pedal movement, it became necessary to introduce servo assistance. He produced a design for this using a low speed friction clutch driven from the gearbox, the design being such that braking loads were exactly proportional to pedal pressure and were equally effective in reverse. This basic design is still in use on the Rolls-Royce motor car today and no greater tribute to its effectiveness can be made than this statement.

The effort to develop the existing series of aero-engines showed up some inherent weaknesses in the type of engine using separate steel jacketed cylinders. At about this time the American Curtiss engine, which was a water-cooled twelve cylinder of vee formation, using monoblock cylinder castings in light alloy, was meeting with considerable success.

In order to meet this competition a design for a completely new twelve cylinder 5 in.-bore engine, known as the ‘F’ engine, using monoblock cylinders was put in hand. This engine was much smaller in overall dimensions than the Eagle engine which it replaced and was more powerful. It had a beauty and simplicity of line which exemplified his saying: 'If it looks right, it is right.' This engine eventually became known as the Kestrel and was among the most successful of its time. It was extensively used in the Royal Air Force in a series of well-known Hawker fighter biplanes.

In pursuance of his practice of looking at the aircraft-engine problem as a whole, he gave considerable attention to improved engine cooling methods which would at the same time result in reduced radiator area and drag. This resulted in the evaporative cooling system which, although it never found its way into extensive Service use because of certain difficulties, nevertheless paved the way for the use of increased coolant temperatures and special coolants, both of which were to become common features of all future liquid cooled engines.

He also paid considerable attention to supercharging and produced a design for a gear driven supercharger for the Kestrel engine which was
eminently successful and which formed the design basis of what was to become an integral part of all future Rolls-Royce piston engines.

During 1927 the need for a more powerful engine for flying boat applications led to a design for a 6 in.-bore engine generally following the lines of the Kestrel. This engine was known as the ‘H’ or Buzzard engine and became the basis of the ‘R’ engine of Schneider Trophy fame, the development of which over the next few years was to become Rowledge’s chief pre-occupation.

Following on the decision to enter a Supermarine aircraft for the Schneider Trophy contests to be held in 1929, work started on the ‘R’ engine in 1928. Co-operation with Royce was maintained at frequent intervals and the combined efforts of Rowledge’s small design staff and part of Royce’s design staff resulted in the design being completed and the first engine ready for test in an incredibly short period.

During the design period and indeed over the whole period of the exercise there was very close co-operation between Rowledge and Mitchell, the designer of the Supermarine contender for the trophy, with the result that the engine was meticulously tailored to suit the aircraft. For the first time the engine intake, at Ellor’s suggestion, was designed to take advantage of the speed of the aircraft to boost the engine output by ram effects, a feature to be incorporated later on in practically every aircraft engine. Something like double the power output of the Buzzard was the target.

Under Rowledge’s guidance, development testing of existing engine components had been initiated early so that the designers were able to incorporate features found necessary by the increased loading. Crankshafts broke, connecting rods bent, cylinders and valves gave trouble and pistons disintegrated, but Rowledge showed his calibre and capacity by never being pushed off his balance however catastrophic the failure. He just guided and inspired his team of which he said: ‘Nowhere in the world was there such a band of workers and enthusiasts.’ A number of new problems relating to fuels and lubrication had to be solved and he brought in experts from the oil companies to deal with these.

The result was a triumph of performance, an engine of 1900 b.h.p., 1530 lb. weight (0·805 lb./b.h.p.) or 0·75 lb. b.h.p. for the maximum power of 2040 b.h.p. achieved on the test bed. The Schneider Trophy contest was won on 7 September 1929, at a speed of 328·63 m.p.h. and the world speed record obtained on 12 September 1930, at 357·7 m.p.h. Britain had at long last regained world leadership in the aircraft sphere, and tributes to Royce and Mitchell were loud and long. Of Rowledge, it is appropriate to quote here an extract from *The Aeroplane* of 18 September 1929.

‘But there is one other man whose name, so far as one can remember, has not been mentioned in the praises which have been poured so deservedly on all who have had a hand in our victory, that is Mr A. J. Rowledge the Chief of the Design Staff of Rolls-Royce Ltd. He cannot be allowed to pass unhonoured and unsung.'
Mr Rowledge is in the curious position of having been intimately concerned with the designs of both the Napier "Lion" and the new Rolls-Royce engine.

He is such a retiring individual and so seldom appears in public that he is nothing like as well-known as he deserves to be. But on such an occasion as this he deserves full acknowledgment for his share in developing what are probably the two finest water-cooled engines in the world.

The year 1931 saw Rowledge at the peak of his career. His Condor III engine was doing good work in the Iris flying boat and other aircraft; the Kestrel was setting new standards in aircraft like the Hawker 'Fury', and the pre-eminence of the designs to which he had applied his genius was recognized the world over.

The government had decided on economy grounds not to participate in the Schneider Trophy race for that year. However, participation was made possible by a private donation of £100,000 from Lady Houston and in January 1931 a decision was made to enter a development of the same basic aircraft and engine which had won the trophy in 1929. This left little time in which to prepare for the race. However, by working 'round the clock' the engine power was boosted to 2350 b.h.p., and on the day the Schneider Trophy was won outright for Britain at a speed of 340.8 m.p.h. A little later on, 29 September, with the same aircraft and engine, the world speed record of 407.5 m.p.h. was established. The highest recorded power during the 'R' engine development in 1931 was 2783 b.h.p.

His work on this project was recognized in 1931 by the presentation to him, by the Institution of Automobile Engineers of the Institution Medal 'for the prominent part he took in the development of the design of the "R" engine fitted to the winner of the Schneider Trophy in 1931', and in 1932 by the presentation, from the same Institution, of the Simms Gold Medal 'for his work on design and research of outstanding merit in connexion with internal combustion engines as applied to high speed aircraft.' In 1936 he was presented with the British Silver Medal of The Royal Aeronautical Society 'for your scientific achievements in the development of aircraft engines'.

In after years the 'R' engine formed the basis of the Griffon engine which was eventually to power the later marks of Supermarine Spitfire fighters during World War II and the Avro Shackleton marine reconnaissance aircraft. However, it was considered at that time too large for the next generation of fighters and in 1932 Rowledge turned his attention to an intermediate size engine of 5.4 in. bore. This followed the same lines as the Kestrel and the 'R' engine except that, in order to improve the pilot's view in fighter aircraft, he inverted the engine. Although this proposal did not receive much favour from the British aircraft designers, it is interesting to note that the inverted arrangement was used by the Germans for both the Junkers and Daimler-Benz water-cooled twelve-cylinder vee engines during World War II. This engine subsequently reverted to the upright configuration and in this form became the famous Merlin.
The exacting demands of the development of the 'R' engine over the previous years had taken its toll and soon after Sir Henry Royce died in 1933, Rowledge had a serious illness and was absent from his work for some time. On his return after his recovery, he was appointed Chief Consultant to the Company, and in this capacity he began to look round as to what the next aero engine development could be.

He had been a consistent champion of the water-cooled engine over the years for a number of reasons, but a survey of the achievements and potentialities of the air-cooled engine at that date, together with certain difficulties which had never been completely solved in the water-cooled engine, convinced him that air cooling properly and efficiently carried out offered greater advantages. In addition a further weakness of the poppet valve type engine had been shown up in failure of the exhaust valve, particularly with the more general use of special fuels to deal with detonation. He had for some time been watching keenly the development of the single sleeve valve on the Bristol engines and the achievement here led him to recommend the use of this type of valve.

After careful consideration of all possible configurations he recommended an engine of X form with 24 cylinders arranged in four banks of six, directly air-cooled and using single sleeve valves. The air entry duct for cooling purposes was between the vee of the lower cylinder banks, the air cooling outlet being taken from the side vees which contained the exhaust pipes. He retained the use of an offset spur propeller reduction gear which brought the cooling air duct entry in line with the position of maximum slipstream velocity from the propeller and made the cooling effect more closely related to power output.

His recommendations were accepted, and a separate small design and development team was established. Designs were put in hand for a 1000 h.p. 4 1/2 in.-bore × 4 in. stroke engine known as the 'Exe' and the first prototype was built in 1936.

A number of difficult mechanical problems had to be solved on such an engine, for example, the design of the big end which had to carry four connecting rods; in accordance with previous practice, he designed a number of test rigs in order to solve the various mechanical problems cheaply and quickly.

He also evolved a further improved cooling scheme for the cylinders and with this and other improvements, the engine was developed to be an extremely reliable and smooth running power unit. A prototype engine was installed in a Fairey 'Battle' at the Company's flight establishment at Hucknall and proved to be so trouble free that it was used as an aerial taxi for a period of two years.

The 'Exe' engine was roughly of the same power output as the Merlin which was being concurrently developed by the Company, and at the outbreak of hostilities in World War II in 1939 the difficult decision had to be made as to whether the development of the 'Exe' should proceed. In view of
the aircraft commitments tied up with the Merlin and other considerations, the decision was made to drop work on the ‘Exe’. This type of engine was in fact revived after World War II in a scaled-up form as a transport aircraft engine. It was known as the Pennine, designs were completed and a few prototype engines were built and tested. However, at that time the gas turbine was beginning to evolve in a practical form as an aircraft power plant, and the decision was made to concentrate the Company’s activities in this direction, with the result that work was stopped on the Pennine.

Rowledge retired in January 1945, at the age of 69. He lived in quiet retirement in Derby for many years but increasing deafness was a great handicap. He died on 12 December 1957, after a long illness.

Rowledge was essentially a kindly, modest and quiet, self-effacing man, neither seeking nor welcoming publicity. In consequence he had no prominent activity apart from his chosen profession.

He took a great interest in the training and the problems facing young engineers and for some years served on the Rolls-Royce Selection Board for apprentices. He was always very willing to help the young engineer to many of whom he became a valued friend and counsellor. This educational interest extended outside his Company and he was a member of the Derby Corporation Higher Education Committee with special reference to the Technical College.

For many years he held office in the Derby Branch of the Institution of Automobile Engineers (later incorporated into the Institution of Mechanical Engineers) and it is very largely due to his efforts that the Branch became fully established and maintained an activity comparable with any other provincial centre.

He was a Fellow of The Royal Aeronautical Society and a Foreign Fellow of the Institute of Aeronautical Sciences N.Y.

He served on two sub-committees of the Aeronautical Research Committee and on several British Engineering Standards Association Committees.

Rowledge had an interest in Local Government Health matters and was a member of the Management Committee of the Derbyshire Royal Infirmary. This interest was actively shared by Mrs Rowledge who did much good work in visiting the sick in local hospitals.

His early interest in art and architecture continued throughout his life and this no doubt influenced the careers chosen by two of his children. He himself was fond of painting in water colours.

He was a music lover and theatre goer. The Gilbert and Sullivan light operas in particular afforded him great pleasure. He read extensively and enjoyed poetry.

Moderately religious he attended Derby Cathedral regularly with his family. He was essentially a home lover being devoted to his wife and children.

With this background of family life it was not unexpected that he should be a kindly, understanding man, particularly open minded and willing to
listen to and appreciate the point of view of the succeeding generation. Always ready to give advice based on his own experience, by constant observation he kept himself fully up to date with changing conditions and views.

A. A. Rubbra