

## Featured Engine No. 41

### Rolls-Royce "Kestrel" - By Kim Siddon

*Several people were very kind about my presentation about Roll-Royce piston aero engines at the April club night, so I thought I'd split the text into several parts so that all our members can see it - Ed.*

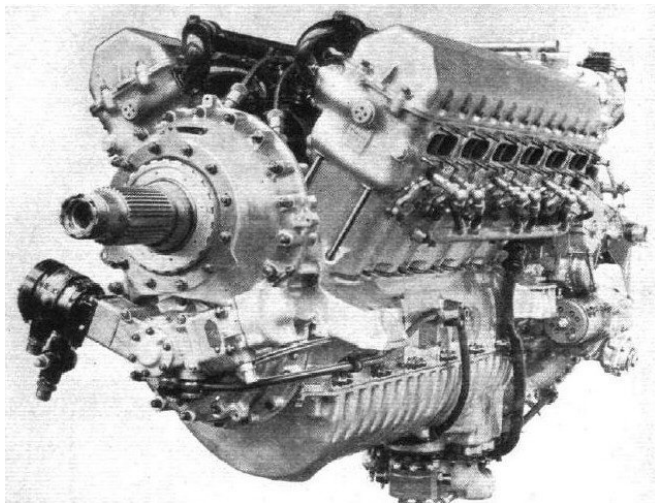
During the mid-1920s, Sir Richard Fairey (Fairey Aviation) spurred Rolls-Royce to make a renewed commitment to aero engines. He imported fifty Curtiss D12 engines in 1926, renaming them the "Fairey Felix". The D12 was one of a number of all aluminium cast block engines that appeared around that time. Other contenders were the Packard 1A-1500 built in 1924 with a swept volume of 24 litres, it produced around 520bhp. Test flown in the second prototype Douglas XO-2 it proved to be unreliable and there were only 29 built.

The Fiat AS.5 was a 25.5 litre Italian engine. Zerbi, the designer, pared away every bit of weight he could and he produced the 1,000bhp engine especially for the 1929 Schneider Trophy air race. In common with both the Packard & the Curtis, the Fiat's propeller was directly driven at crankshaft speed. In the lower power outputs, this didn't matter too much but the 1,000bhp Fiat needed careful handling and required a very carefully designed propeller. Curtis quickly produced a geared drive for the prop, allowing engine development to proceed.

Germany was rather out of the running, being somewhat hors de combat after the then recent Unpleasantness. I shall return to this thread in a moment.

Returning to the Curtis D12, it was first designed in 1922 as an 18.8 litre engine which produced 507bhp. It was designed by Arthur Nutt and used in the Curtiss CR-3 for the 1923 Schneider Trophy race.

Arthur Rowledge, one of Napier's chief engineers and the designer of the Napier Lion engine, became fed up with the Napier management and left, swiftly finding a job at Rolls-Royce. In this one move, Napier design effort stagnated with the Lion while Rolls-Royce surged ahead. Sir Richard Fairey dropped off one of his D12's at the Rolls-Royce factory and within a short space of time, the Kestrel was on the drawing board, from the first, a geared drive engine. Applying every known advance since the D-12 was introduced, Rowledge designed the new engine to use supercharging at all altitudes, allowing it to outperform



naturally-aspirated engines by as much as they were willing to increase the boost pressure.

The D12 utilised a cast-block design used, a single aluminium casting that was machined to form a six cylinder

block. An investment in new machining equipment was required, but the result was capable of a great deal of development and modification, assembly was simpler and lighter in use. It was the company's first cast-block engine and the pattern for most of their future piston-engine designs. Used during the interwar period it remains somewhat obscure, although it provided excellent service on no less than 36 different British aircraft, to say nothing of 7 German aircraft!

The ancillaries of the Curtis, the Packard & the Kestrel are driven off the gear case at the rear of the engine, the double overhead camshafts are gear driven from the rear and the twin magnetos are tucked neatly under the banks, also at the rear. This overall design concept was maintained right through Rolls-Royce V12 production with the exception of the Griffon where its larger swept volume and the pressing requirement to more or less fit in the same space occupied by a Merlin shifted magnetos and camshaft drives to the front of the banks.

The Kestrel or type F was first produced in 1927. It was a 21 litre engine initially rated at 450 bhp. As a matter of interest, a Kestrel was priced ex factory at £2,015 in 1934. Power output soon improved in the IB version to 525bhp and this variant saw widespread use in the Hawker Hart family, the mainstay of British air power during the early 1930s. Higher boost pressures & better cooling increased power dramatically; the Mk 5 provided 695bhp at 3,000 rpm with no basic change to the design, while the Mk 6 used in the Miles Master delivered 670bhp. The Mk 30, still in production in 1940, was producing 720bhp. The Kestrel was produced in forty distinct variants which can be divided into three main groups, normally aspirated, medium and fully supercharged. Apart from supercharging, the variant differences centred around varying compression ratios and propeller reduction gearing.



One key advance in the Kestrel was the use of a pressurised cooling system. Water boils at 100 °C at sea level, but this temperature decreases with altitude. Since the amount of heat carried out of the engine is a function of coolant temperature and volume, if the coolant has to be kept below boiling point an increasing amount of fluid has to be used, along with an increasingly large radiator to cool it. The solution was to pressurise the entire cooling system, thereby not only preventing the decrease in cooling performance with altitude, but in fact increasing the boiling point even on the ground. Thermostats maintained the Kestrel's cooling system at 150c. With Kestrel production well underway in the early '30's, Germany was looking for aero engines, but the Treaty of Versailles demanded that they could not build high power engines. In 1935, Messerschmitt tested its first Bf 109 V1 prototype bearing a German civilian registration. It was powered by a Kestrel engine and the Reich Air Ministry acquired four Kestrel VI engines by trading Rolls-Royce a Heinkel He 70 *Blitz* (above) as an engine test-bed. With a curious irony, it was the wing design of this aircraft which led to the design of the Spitfire's elliptical wing.

## Calendar of Events

- Key. Event – E. Club night - CN  
 June 2<sup>nd</sup> **E. (Wed evening). D-Day crankup.** At Cranmore Station. Bring something military if you can!  
 Phone Keith 01749 831229  
 June 12<sup>th</sup> **Collett Park**, Shepton Mallet.  
 Phone T. Davis 01373 464982  
 June 19<sup>th</sup> (Sat). **Southwick Scout** rally.  
 Phone T. Davis 01373 464982  
 June 19/20<sup>th</sup> **E. Wessex Midsummer Vintage Gathering**,  
 June 26/27<sup>th</sup> **E. 1000 Engine Rally**, Astle Park.  
 June 28<sup>th</sup> **CN. Member's Night**,  
 Other Hobbies / Guess The Object  
 July 26<sup>th</sup> CN. **Crank up** at the Court Hotel  
 Aug 14/15<sup>th</sup>. Beach Party in Trowbridge Park.  
 Wanted engines, driven machinery etc.  
 Contact Eric on 01225 754374  
 Aug 23<sup>rd</sup> CN. NOT BH Monday! Speaker: Henry Body  
**A Talk On Speed Records**  
 Sat 4<sup>th</sup> (only) Carnival Country Fair in Trowbridge Park  
 Contact Eric on 01225 754374  
 Sept. 18<sup>th</sup>. **E. Camerton Village Day.**  
 Sept 27<sup>th</sup> **CN Quiz Night**  
 Oct 9<sup>th</sup> **CN. Skittles & Supper Evening**, South Parade Club, Frome. Phone Diane Davis 01373 464982  
 Oct 17<sup>th</sup> **E. Robert's Open Day.**  
 Oct 16<sup>th</sup> **E. Vintage Sort Out** at Cranmore station yard.  
 Oct 25<sup>th</sup> **CN.** Guest Speaker, Roger Fowler.  
**The Burnham-On-Sea rescue hover craft**  
 Nov 13<sup>th</sup> **E. Enstone Sort Out**, Oxfordshire  
 Nov 29<sup>th</sup> **CN.** Guest Speaker:- Martin Phippard.  
**Parara Marble Extraction**, Italy. Illustrated  
 Dec 5<sup>th</sup> **E. Crank up** at Nunney Catch  
 Dec 27<sup>th</sup> **E. Mince Pie Crankup**:- Court Hotel  
**Dates and venues may change. Check before driving!**

### Chairman's report *(printed as received)*

By Brian Baker

The meeting at the Court Hotel on April 26<sup>th</sup> had our editor Kim giving a talk on "Rolls Royce Aero Engines". Kim always gives a good talk; this time illustrated with many pictures of Rolls Royce and other manufacturer's engines, mainly engines used in World War Two such as the famous Merlin engine. This was quite a technical presentation that I think passed over the heads of the female members present. I would personally like to thank Kim for once again giving us a really good evening's entertainment. The talk was followed by quite a lengthy questionnaire on the subject whom Kim answered admirably. The talk was followed by the usual raffle with numerous prizes on offer.

I have some good news at last, a member has put his name forward to serve on the committee, quite a rare event these days. His name has been submitted to the committee who will discuss his application and hopefully accept it. WE ARE STILL WITHOUT A SECRETARY.

**ENGINES WANTED** at Collett Park Shepton Mallet on June 12<sup>th</sup>. No need to book, just turn up. Collett Park day is an annual event that attracts a vast crowd to the most beautiful park in the Mendip area; the engines are situated around the perimeter

of a large lake so there is no need to bring water. If anyone requires more details give me a ring on 01749 342671

### Social news

Angela Gill was in hospital in April but is back home now and recovering well from what could have been a life-threatening condition. The club wishes her and Richard the best for a swift recovery.

### Westbury Gathering – 24/25<sup>th</sup> April

By Robin Lambert

It was to be my first time as an exhibitor at this event although it has been running for many years now and relocated several times the site now is situated right under the rolling hillside of Westbury white horse with fantastic views towards Trowbridge and Devizes. This was to be a very laid back event for the exhibitors, no entry forms, just turn up and find yourself a space which I did amongst several Wessex members already in situ. This was nice as being among people you know means the usual banter and leg pulling creates another chapter in the life of the W.S.E.C. Amongst our club members was some new exhibits I had not seen before – Don & Christine Rogers had a 4hp Detroit which ran really nice powering a water pump the engine must be very economical as it fired once and missed 15 revolutions which would make two gallons of fuel last all rally season. Another newly acquired exhibit was Les Rickets 3hp International 'm' type and Roly & Rose King had their faithful Crossley 1060 which as always runs beautifully. John Bullock brought along his tiny Stuart Model about half horse power, Just a nice size is this engine, easy to lift into a car boot, this is a really smart display complete with information boards.

Peter Cosins had his first time out Ruston & Hornsby 4hp AP, it ran nicely but needed a bit of fine tuning after what looked like a fuel blockage it ground to a halt. Peter had a notice advertising a 6hp AP for sale, so if anyone is interested give him a call. Trevor Wilcox had his Lister 'D' working well driving a sheep shearing clipper and also a vacuum pump complete with milking bucket, he did have a touch of the gremlins for a while when it stopped but was soon up and running again having changed its magneto. Club member Steve Payne brought along his second world war 1940,s Dodge army weapons carrier which enhanced the already in situ display of military vehicles.

I had stroll through the commercial vehicles and one that caught my eye was a 1952 Rutland Van about a one tonner, looking at the restoration photo's it was unbelievable that anyone could have restored this van as it had been found with trees growing up through it in a hedge row what a challenge it must have been. Several motor bikes here and quite alot of old cars, a nice selection of stalls and small rides etc for the young ones.

We took along our old Triumph Dolomite and a hot air fan, one chap asked me how the fan worked so I explained to him, he then wanted to know all

about Adrian Grants 3 mule team Amanco, we then moved on to Les, Roly, Trevor and Don's engine and at that point I had to give up as I am sure he would have gone all along the line. I have never met such an inquisitive person, perhaps he knew all along and was just testing me out !!!!!.

I must just mention a superb exhibit from the Forest of Dean area, it was a 2hp Petter M driving a 50 volt dynamo on a purpose built cast iron base with the words G.P.O embossed in the casting, complete with switch board, this was a prize winner if ever I have seen one. I said to its owner that would look really nice at the 1000 engine rally, 'I shall be there he said it's just one of the 36 events I do in a year'.

Well I usually chalk up about a dozen in a year but 36 must take some beating. Unfortunately, the event wound up about 3pm on Sunday when driving rain swept through the site and sent exhibitors and public running for cover. To sum up then, a nice two days at a nice show amongst nice people.

### Book Review By J.K. Siddorn

**"Negative Gravity"** A Life of Beatrice Shilling by Matthew Freudenberg. Published by Charlton Publications, Orchard House, Creech St Michael, TA3 5PF. Price, £13.99. Profusely illustrated, cardback, 135 pages. ISBN 0-9546165-0-2

Beatrice Shilling (1909-1990) was a celebrated aeronautical engineer and successful motorcycle racer. She made her mark in the male dominated world of engineering by correcting a serious defect in the Rolls-Royce Merlin engine during the Second World War. Once described by one of her colleagues as 'a flaming pathfinder of women's lib', Beatrice fought against any suggestion that as a woman she might be any man's inferior.

She was born in Waterlooville in 1909 and moved to Surrey with her family in 1914. After leaving school in 1926, the five foot two inches of determination that was Beatrice Shilling, entered the masculine world of engineering with energy, intuition and intelligence. Knowing what she wanted to do from an early age, she took up an apprenticeship with a small electricity company in Devon, in itself something of a rarity for a young woman at that time. In 1929 she began a degree in Electrical Engineering at Victoria University in Manchester, graduating in 1932 and went on to complete a Master of Science in Mechanical Engineering degree by the end of 1933. In the depressed job market of the early 1930s Beatrice initially struggled to find a permanent position, but worked for a time as research assistant to Dr Mucklow, who was investigating the behaviour of supercharged single cylinder engines.

A passion for motorcycles took her to Brooklands where, to the surprise of some, she often finished ahead of more experienced riders. She rebuilt and tuned her racing Norton herself & lapped the track at over 106 mph, faster than any other woman on 2 wheels.



Beatrice joined the Royal Aircraft Establishment at Farnborough in 1936 and soon became the leading specialist in aircraft carburettors. During the Second World War, she worked on a serious problem affecting the engines in both Hurricanes and Spitfires. As the aircraft pushed over into a dive, the negative gravity of the book's title forced the petrol in the float chambers to move away from the main jets, causing misfiring & if not swiftly corrected, cutting out. The ME109 that was the principal opposition had fuel injection and this gave the German pilots a distinct advantage. This was costing allied lives and Beatrice and her team worked tirelessly to find a solution. She came up with a simple, ingenious device, a small brass disc with a hole in the middle, which into the float chamber and kept sufficient petrol in the jet well to keep the engine running for the few seconds of negative G. It became known as 'Miss Shilling's orifice' and after testing demonstrated its effectiveness, was used on all carburetted allied aircraft. Rolls-Royce were not impressed that an engineer not on their books had solved a problem that had eluded them, but could not speak against such a simple and easily fitted solution.

When her husband, George Naylor left the RAE to become a bomber pilot they wrote to each other almost daily with complete disregard of security restrictions on subject matter. Their correspondence is much quoted in the book and gives an immediate feeling of the atmosphere of war-time Britain. It is insightful to read of the fears and thoughts of a couple separated by war.

After the war she was at the Royal Aircraft Establishment until her retirement in 1969. She worked on rocket fuels, ramjets and aircraft landing safety. Her appearance was usually austere yet concealed a dry and unusual sense of humour. She earned the respect, awe or terror of her colleagues depending on their point of view. She had high standards of work, a no nonsense attitude and a lack of respect for superiors whose outlook and energy were inferior to hers.

Beatrice Shilling reached a senior post and receiving an OBE for her efforts during the war. She held a doctorate from the University of Surrey, a Ceng. was a member of the Institution of Mechanical Engineers and the Women's Engineering Society.