Mass-produced Aero Engines

The amazing achievement of the new million-pounds Rolls-Royce aero engine factory at Crewe, Cheshire, outlined

by

William Courtenay

Lathes, shapers, drills and other workshop machines widely spaced in orderly rows on the floor of the new Rolls-Royce factory at Crewe, where Merlin aero engines are produced in rapid sequence for the R.A.F. and for export to France.

A NEAR-MIRACLE has been achieved at Crewe, Cheshire, where within twelve months of the hay being garnered in from quiet by-passed fields a vast aero engine works has arisen, built to Air Ministry orders by Rolls-Royce, Ltd.

In June, 1938, the Air Ministry, looking ahead for future aero-engine requirements for the large numbers of bombers and fighters now under construction, decided to entrust Rolls-Royce, of Derby, with the task of building a vast new plant at Crewe for the production of the liquid-cooled Merlin engine which develops 1,000 h.p. to 1,300 h.p. This is the engine which enables our single-seater Hawker Hurricane fighters to achieve speeds of 330 m.p.h., and our single-seater Supermarine Spitfires to reach 367 m.p.h.

Over a million pounds were expended by the Air Ministry on the project, but Rolls-Royce designed and built it and are managing it for the Government. Only Rolls-Royce aero engines will be built there.

On July 6, 1938, the first sod of the new site was turned, and four months later the first section of the 400-foot main workshop was put into operation. So cinematic has been the building—almost "while you wait"—of this giant modern factory, that by May of this year the first Merlin engines were completed and were being bench-tested.

Within twelve months of the hay being gathered from the 65-acre site, flow production of high-powered aero engines had set in. Not only has the speed of erection of the factory been phenomenal. Other records achieved worth mentioning are the following :—

Nearly all the machines and jigs which are used for construction of the various parts of the engines and accessories are British-built. Two years ago a walk through an aircraft factory revealed that our machine tool trade was sadly behind other parts of the re-armament business. Machines had to be imported from America and Germany. The intricate and costly machines and jigs are the foundations without which production cannot be built up.

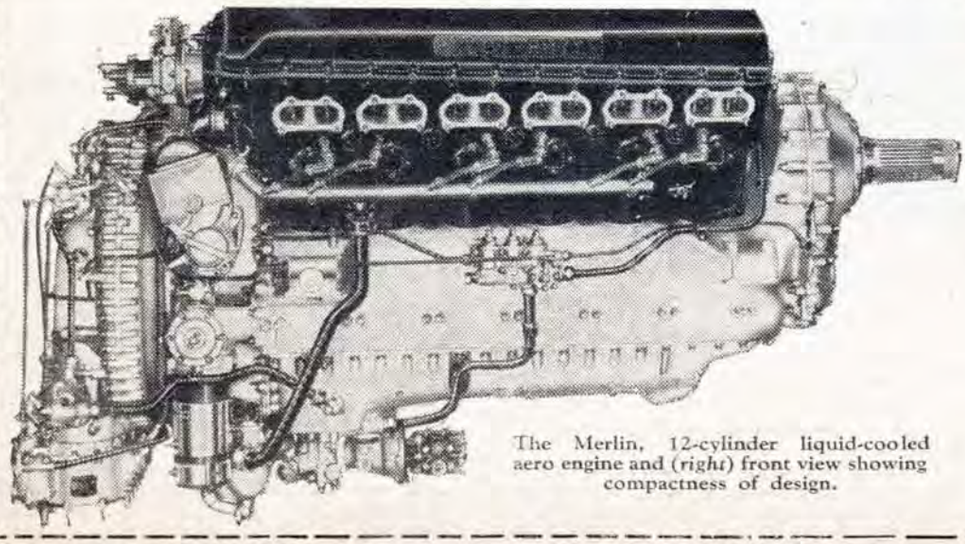
Mass-production of aero-engines is now possible almost for the first time. Yet precision of workmanship, so essential with aero-engines, and always the secret of Rolls-Royce world-wide reputation, has not been sacrificed.

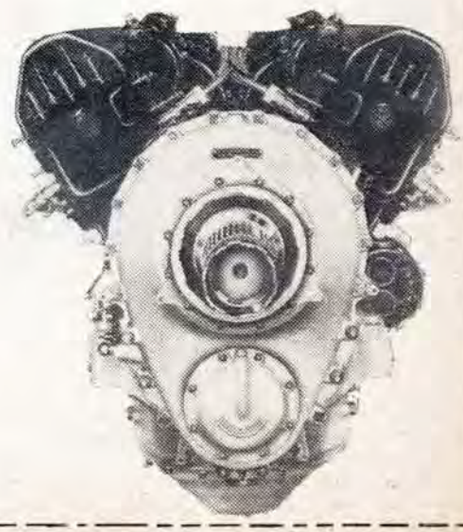
Not a single engine has so far required replacements or adjustments after the gruelling two hours' running at full bore on the test beds. The factory has been planned on the most scientific lines yet adopted for an aero-engine works.

This has been possible because it has been laid out for the one particular task, whereas some other aero-engine works have grown with the passing of the years, portions being added as business increased and as space could be secured.

The vast floor space is of such generous size that it would be possible, were there no machinery embedded in the concrete, to use it as a miniature aerodrome. An aeroplane could take-off at one end and would be in the air before reaching the other end of the concrete floor. It could alight with ease and with plenty of space to spare in which to pull up without overshooting the floor-space.

Flow production has been organised in such a manner that components needed at various stages in the building up of the aero-engine are to hand for the workers just at the stage required, and are available at stages in the shop which avoid long walks and consequent uneconomic use of man-hours.





The Merlin, 12-cylinder liquid-cooled aero engine and (*right*) front view showing compactness of design.

The raw material may be said literally to enter the shops at one end and to pass out at the other as the finished throbbing living engine. Long lines of machines in serried rows fill the vast area of the auditorium of concrete. Busy workmen take and mould and fashion the first assembly pieces and pass them on with precision to workers in the next line of the advance, where the assembled pieces are fitted to new jigs for the second stage of production.

So they pass down the lines, until a point is reached where assembled components are ready for cylinders and accessories. The long wave of engines passes gradually down the great shop, becoming more recognisable as each stage is completed, until the finished row is ready for the test-bed.

A row of test-beds has been built on ample floor-space outside the main factory. So great are the ear-splitting noises emitted by each powerful Merlin engine that the throbbing waves of air cause disturbance to the stomach if one stands too near for too long. To protect observers at the engines, a great glass-panelled room has been built opposite the engines. Test-bed engineers may take refuge inside, from where engine noises are damped out. Instrument panels in front of them reveal all the performance data of the engines.

Each engine must remain on the test-bed for two hours, as soon as assembled. The first twenty minutes are used to enable the working parts to bed down comfortably inside the engine, and by the end of twenty minutes full throttle revs. are reached. For two hours the engine must stand up to a far more gruelling performance than it will ever meet on active service in an R.A.F. machine. This running-in is equal to a flight of over 700 miles in a high-speed fighter.

At the end of this first test, the Merlin is stripped and every part is microscopically examined to determine how each has stood up to the ordeal. Not a single fracture of material has yet been detected; not a replacement has been needed; and no adjustments have yet had to be made to any of the engines mass-produced at Crewe since May.

Every one on reassembly appears as if new. A further thirty minutes' test at full bore is then given each engine, before Rolls-Royce engineers will pass it as O.K. for the Air Ministry.

Aeronautical Inspection Directors of the Air Ministry examine all material as it arrives at the works. Laboratory tests for strength, hardness, etc., are applied and every part must be up to the specification standard before it may be used for the first process in engine construction.

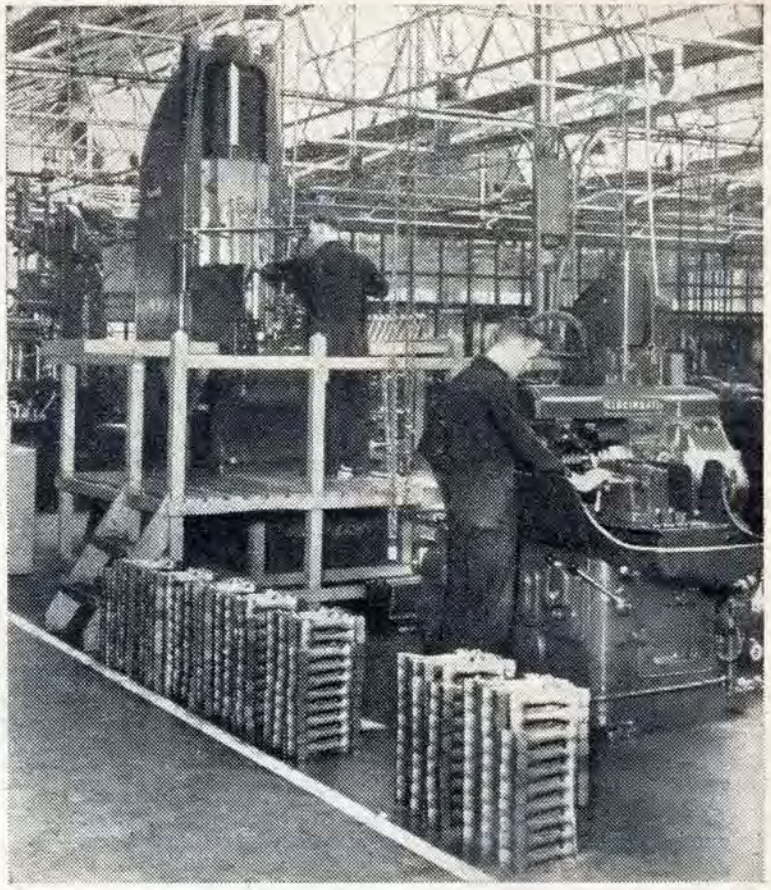
It is here that faulty material is detected and rejected, and the material which passes the eye of the A.I.D. Inspector is marked with special-coloured paints according to its duty.

Thus we have arrived at as near mass-production for aero engines as it is possible to reach in work calling for the highest precision and where accuracy in terms of thousandth-parts of an inch is sternly insisted on.

The factory has been laid out with a generous allowance of space per worker, more so than in any other similar plant in the world. Here, when production reaches the top of the curve, thousands of Rolls-Royce aero-engines will be turned out each year. As I spent four hours tramping round this new world-wonder on the occasion of Sir Kingsley Wood's visit, I could not help but admire the skill which had created in twelve months this vast plant which is helping to keep the R.A.F. on top of the world.

Soon, too, the Crewe factory will be duplicated by another, just started near Glasgow.

Right.—**Merlin connecting rods in the machine shop at Crewe on their way to the assembly lines.**



Below.—**Rear end of the Merlin. Provision is made for a very complete range of auxiliary drives, including electrical generator, two air compressors, retractable undercarriage pump, dual fuel pumps, engine speed indicator, electric and hand starting gear, vacuum pump, and constant speed unit for infinitely variable-pitch airscrew.**