

Note 106



Single-cylinder engine testing and its drawbacks

Aero engine makers were using 1-cylinder rig test engines in the '20s, the object being of course to obtain data, especially on performance, more quickly and cheaply than building and running complete engines.

Rolls-Royce were slower than others to adopt this experimental practice* but in mid-1929 a set of 1-cyl. units was authorised to cover their product range (1016).

*Slow on 1-cyl. engines, but actually Henry Royce had built in 1918 a 60V-2-cylinder rig test engine to prove the novel compound-angle valve gear and fork-and-blade con.-rod system of the new large 60V12 just designed, which became the *Condor*.

R-type 1-cyl. testing

However, R-R recorded that their 1931 1-cyl. rig, representing the Schneider Trophy R-type engine and planned for fuel and sparking-plug tests, proved very unreliable mechanically, giving far more trouble than the same parts in a complete engine (1015 Appendix). Quite likely this was the result of greater vibration.

PV12 1-cyl. testing

In mid-1934 the 1-cyl. rig representing the R-R PV12 (the base of the *Merlin*) was tried with a new cylinder head layout in place of the standard 'flat' head which had 4 valves/cyl. at VIA = 0 and no squish. This new 'Ramp' head had a pair of exhaust valves in line with the cylinder axis and a pair of inlet valves at VIA = 42°, i.e. inclined inwards and it had some squish. An improvement in performance was observed and so the main engine was redesigned in the same way. On test of this engine, no benefit was found, the heads cracked and exhaust valves failed rapidly. Eventually a 100 Hour Type Test could only be passed with a concession to allow valve changes at part-time (328), although production of this Mark 1 *Merlin* had already been authorised. Because of the problems the General Manager, Ernest Hives (previously head of Experimental for many years), had in the meantime ordered a reversion to the 'flat' head. This remained unaltered in valve layout throughout *Merlin* and enlarged *Griffon* production. See Fig. N106A.

The 172 Mark 1s produced were fitted in early *Fairey Battles* (a type which unfortunately proved in 1940 to be fatally useless for its light bombing role when without fighter escort and in the face of German 37 mm and 20 mm *flak*. No blame attached to the engines).

It was decided later that the 1-cyl. performance gain was due to a favourable airflow ramming effect of its inlet tract which was not reproducible in the main engine (901).

The need for caution

The uses of History are "*To inform, inspire – and warn!*". The above cautionary accounts certainly fulfil the last purpose. It is perhaps not necessary to go as far as Admiral of the Fleet Lord Fisher's dictum "*The best scale for an experiment is 12 inches to a foot!*" ("*Memories and Records*", 1920). [Those were the days when "*The Royal Navy always travelled 1st class!*".]

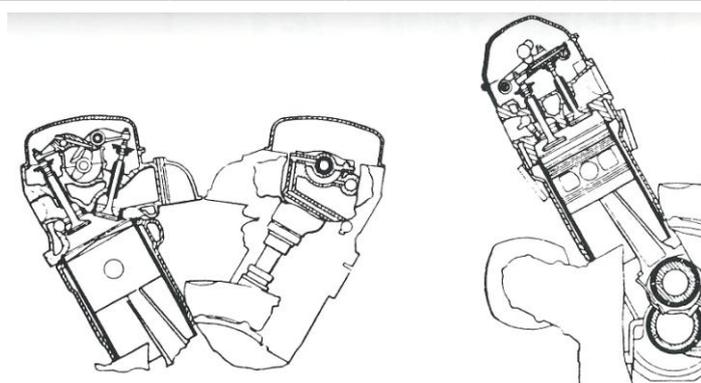


Fig.N 106A

LHS. The "Ramp" head had squish plateaux fore-and-aft of the 4 valves. The inlet valve was inclined at 42° to the exhaust to ease the inflow.

RHS. The "Flat" head

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