

Note 24



Grand Prix 2-strokes

The only serious attempt to build a car GP 2-stroke engine was made by FIAT in 1925 with their type 451 IL6 1.5 L twin-crankshaft opposed-piston pressure-charged design aimed at the 1926 formula. This developed well over 100 HP/L on the test bed but overheating problems (burnt exhaust pistons and premature ignition of the charge) could not be overcome (66). See Fig. N24A.

A pointed comparison between 4-stroke and 2-stroke engines was made by Joe Craig, racing engineer of Norton, for 1938 motorcycles racing in the Isle of Man TTs:- his 500 cc naturally-aspirated 4-stroke had won the Senior TT of 264 miles at 89.1 MPH and 30 miles per gallon (MPG); whereas the supercharged 250 cc 2-stroke DKW won the Lightweight TT over the same distance at 78.5 MPH and 20 MPG (12B)!

It can be observed, however, that in Grand Prix motorcycle racing some 4 decades later the 2-stroke supplanted completely the 4-stroke in all NA capacity classes by 1975. This was due largely to extra porting plus water-cooling and a highly-tuned exhaust system which were pioneered by Walter Kaaden of the East German firm of MZ in the late '50s and early '60s. By 1995 continuing development, (eg. of the Aprilia RSV250) had achieved the long-sought aim of a BMEP equal to that of the best 4-stroke -14 Bar – at similar MPS – 23 m/s – (762). While this development had overcome the quadruple 2-stroke problems of:-“breathing through its bottom-end”; limited inlet opening duration; mixing of inlet charge with exhaust residuals; and cooling difficulties with a power stroke each revolution, it was by using sharply-tuned resonant inlet and especially exhaust systems which so limited the useful range of RPM that the result would have been hopeless in a car. The exhaust emissions from a large 2-stroke would have been unacceptable in any case.

In 2001 the premier class of motorcycle racing (re-named “MotoGP”) allowed 990 cc 4-strokes to compete with 500 cc 2-strokes and at that capacity ratio of 1.98 the former quickly re-established its supremacy.

An article on ["Grand Prix Motorcycle Engine Development, 1949 - 2008"](#) which goes into the 4-stroke versus 2-stroke battle in more detail now available on this website.

Fig. N24A
1925 FIAT T451
2-Stroke
Opposed IL6 = 12 cylinders $52/58.5 = 0.889$ 1,491
DASO 66

