

## Note 80



### The FVA and DFV and 'Tumble Swirl'

It is not surprising that the initial published descriptions of the FVA and DFV did not mention 'Tumble Swirl' (TS). However, it is significant that, in various interviews with Keith Duckworth (KD) over the years of front-line service by the engines the words 'Tumble Swirl' never crossed his lips (eg January 1970 (853), early 1971 (60), July 1982 (850, 851)). In particular, ref (60) has a frank exposition of his design approach plus a review of DFV development to early 1971, but KD says of the cylinder head (port shapes) only that he wished to keep his philosophy to himself as he thought it obvious that most people had not thought the problem through. Ref (853) states that KD always made the prototypes of a new inlet port/combustion chamber shape himself, with hand tools. The actual parts of the engines were not then secret, of course, since Cosworth sold them to all comers - egs the Japanese trading company Mitsui bought a pair of DFVs in 1968, and Mercedes-Benz bought one in 1969 (60). Undoubtedly, every engine maker obtained one in some way over the years. They would have been failing in their duty if they did not!

There was a detailed description of the FVA in the March 1968 *Automobile Engineer* (583)- almost certainly at Ford's request - which gave a section of the engine with the crucial inlet port shape needed to optimise TS - for those with eyes to see (see [Note 26](#)) - but TS was not mentioned in the text. This author is not aware of any published section of the DFV - in fact its debut, after the early descriptions, marks the demise of the detailed analyses of racing engines which used to be common in the *Motor* and *Autocar* magazines.

This 'black-out' on TS leads this author to conclude that it was probably the most important feature in producing the superior FVA and DFV performances, and KD did not wish this to be known.

It is not clear when TS was recognised generally as a critical element in obtaining high BMEP (> 13 Bar) at high MPS (> 20 m/s). The 1964 (pre-FVA design) Weslake 4 v/c Shell 375 cc twin did not have the necessary port shape (836). Of post-FVA racing engines where cross- sections have been published, the 1970 Ferrari 312B did (187), the 1976 Renault CHI F2 did not have the 'TS shape' (485), nor did the destroked TurboCharged (TC) version, the 1977 EFl (638). The Honda RA168E, dominant in the last TC season of 1988, did not have it (20) but the 1992 Honda RA122E/B did (69). The 1991 Mercedes M291 sports racing engine did not - in fact, it reverted to the axial inlet port, which prevents TS (468) (see [Note 26](#)).

In August 1997 Ian Bamsey, Editor of *Race Tech* magazine, interviewed Nick Hayes, then F1 Programme Director of Cosworth, and put it to him that TS was "*an integral part of the concept*" of the DFV. Hayes accepted that (419).