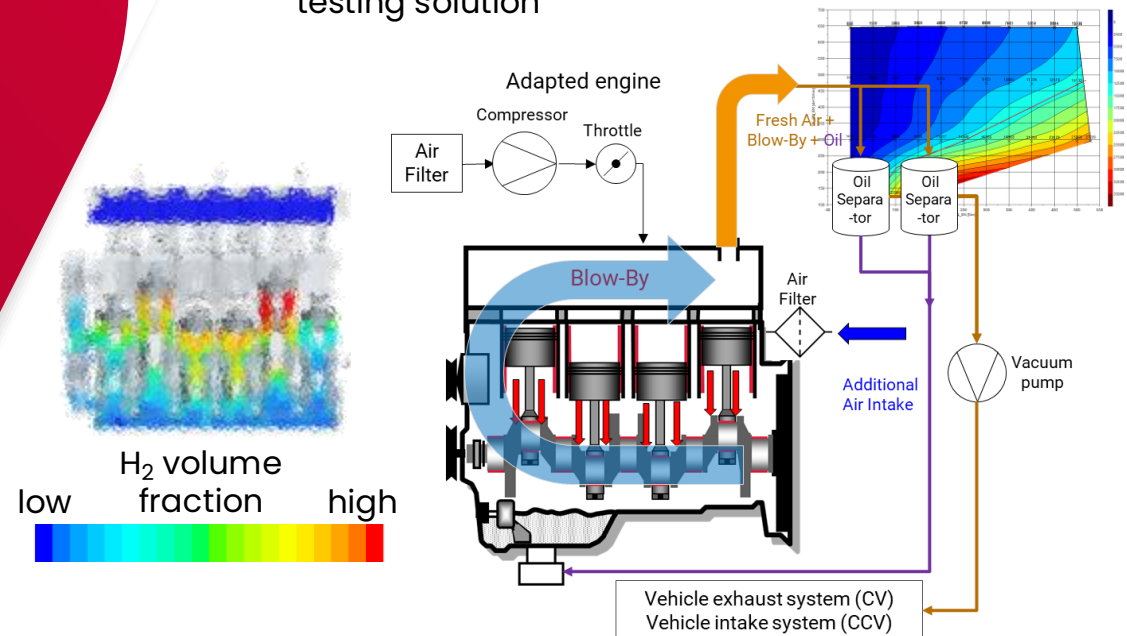


H₂ emission and safety Active Crankcase Ventilation

H₂/air mixing in crankcase to comply with emission regulations and ensure component protection

FEV offers

- ▶ Benchmark of ventilation system for specific applications
- ▶ CFD layout and optimization of ventilation design for better blow-by/fresh air mixture
- ▶ Reduction of required ventilation air flow and down-sizing of ventilation components for various extraction locations
- ▶ Setup of complete crank case ventilation system in prototype stage to assess general functionality
- ▶ Refinement of system layout based on a combination of test bench results and CFD optimization
- ▶ Innovative ventilation layouts and concepts developed in-house



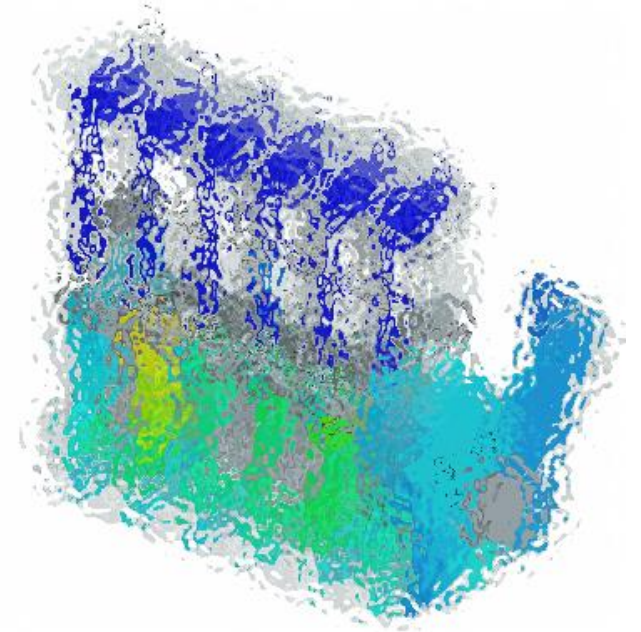
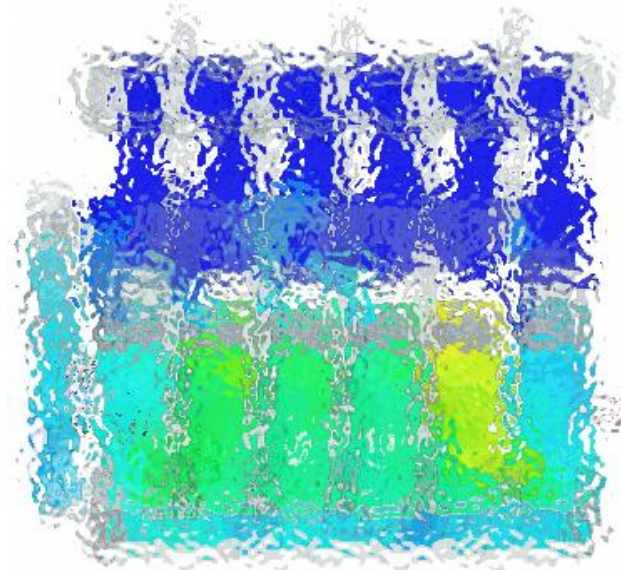
Reference project hydrogen crankcase ventilation

Layout of crankcase ventilation system for OEM to be emissions and safety compliant

- ▶ Substantial development support for different engine applications
- ▶ Continuous CAE development

FEV responsibility

- ▶ Providing benchmark consultancy on ventilation system and solutions
- ▶ Development of system layout and CFD simulation verification

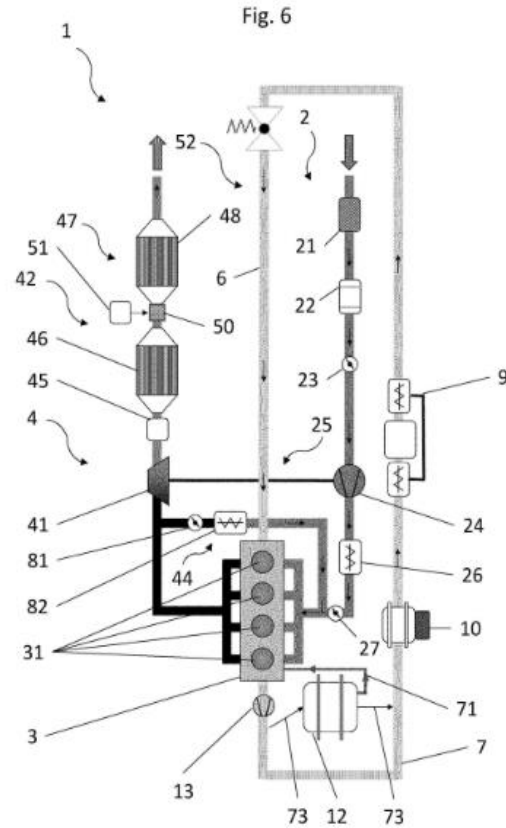


FEV's innovative CCV system designs for efficient ventilation

Internal combustion engine with a crankcase ventilation means

Various ventilation concepts presented: by fresh air, exhaust gas, or inert gas

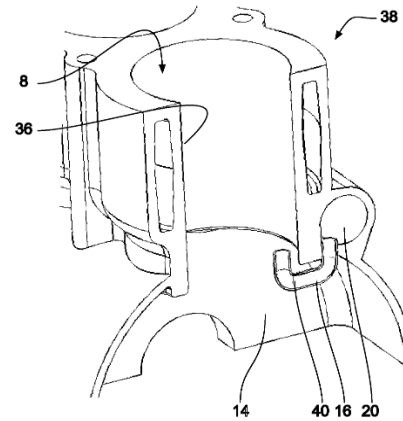
EHRLY, BIWER, BEY, BICK, JANS
DE102022133464A1 (Pat. Appl.),
US11939895B2 (Patent),
CN219431914U (Utility Model)



Crankcase ventilation for hydrogen engines

Localized ventilation concept: injection/suction in the vicinity of the cylinders

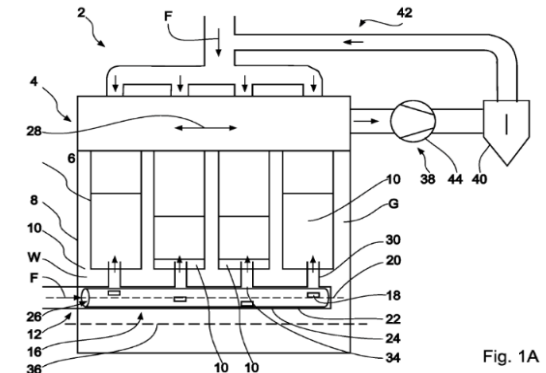
VIRNICH, TENSING
DE102024103933A1 (Pat. Appl.)



Discontinuous ventilation of the crankcase

Synchronized ventilation concept: ventilation intensity coupled to cylinder position, realized with rotating tube whose rotation is coupled to crankshaft rotation

VIRNICH, TENSING
DE102024110790A1 (Pat. Appl.)



Efficient and reliable development with CFD simulation

CFD CRANKCASE INVESTIGATION

Crankcase blow-by

Cylinder blow-by into crankcase for H₂ engines needs special care during development due to high inflammability of H₂

Crankcase ventilation solution

Almost any engine application is most likely to need an active ventilation to dilute the H₂ content inside the crankcase during engine operation

Safety and regulations

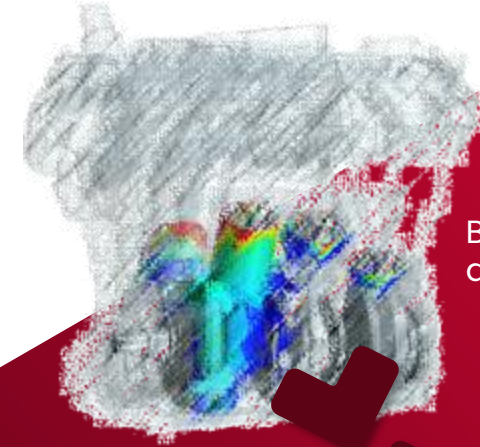
The H₂ concentration inside the crankcase is to be monitored not only for safety reasons (risk for explosion) but also for homologation purposes (H₂ content limit)

CFD support during development

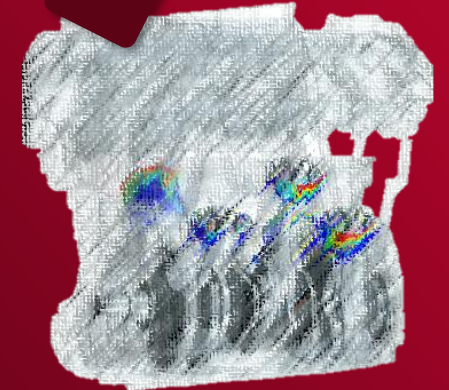
FEV CFD methodology is a unique tool to best support crankcase layout during development

CFD optimization of fresh air vents and suction

Within a limited time, CFD is able to solve where the best positioning of fresh air ducts and suction point in crankcase are to be located



High H₂ concentration area strongly reduced



Get in touch with us for further information



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signature-solutions](http://www.fev.com/en/signature-solutions)