

CPC**COOPERATIVE PATENT CLASSIFICATION****F02G**

HOT GAS OR COMBUSTION-PRODUCT POSITIVE-DISPLACEMENT ENGINE PLANTS (steam engine plants, special vapour plants, plants operating on either hot gas or combustion-product gases together with other fluid [F01K](#); gas-turbine plants [F02C](#); jet-propulsion plants [F02K](#)); **USE OF WASTE HEAT OF COMBUSTION ENGINES; NOT OTHERWISE PROVIDED FOR**

NOTE

Attention is drawn to the notes preceding class [F01](#).

F02G 1/00

Hot gas positive-displacement engine plants (positive-displacement engine plants characterised by the working gas being generated by combustion in the plant [F02G 3/00](#))

F02G 1/02

. of open-cycle type

F02G 1/04

. of closed-cycle type

F02G 1/043

.. the engine being operated by expansion and contraction of a mass of working gas which is heated and cooled in one of a plurality of constantly communicating expansible chambers, e.g. Stirling cycle type engine

F02G 1/0435

... {the engine being of the free piston type}

F02G 1/044

... having at least two working members, e.g. pistons, delivering power output

F02G 1/0445

.... {Engine plants with combined cycles, e.g. Vuilleumier}

F02G 1/045

... Controlling

F02G 1/047

.... by varying the heating or cooling

F02G 1/05

.... by varying the rate of flow or quantity of the working gas

F02G 1/053

... Component parts or details

F02G 1/0535

.... {Seals or sealing arrangements}

F02G 1/055

.... Heaters or coolers

F02G 1/057

.... Regenerators

F02G 1/06

. Controlling

F02G 3/00

Positive-displacement engine plants characterised by the working gas being generated by combustion in the plant

F02G 3/02

. with reciprocating-piston engines

F02G 5/00

Profiting from waste heat of combustion engines, not otherwise provided for

F02G 5/02

. Profiting from waste heat of exhaust gases

F02G 5/04

.. in combination with other waste heat from combustion engines

F02G 2242/00 Ericsson-type engines having open regenerative cycles controlled by valves

- F02G 2242/02 . Displacer-type engines
- F02G 2242/04 .. having constant working volume
- F02G 2242/06 ... with external drive displacers
- F02G 2242/08 having gas actuated valves, e.g. "Bush engines"
- F02G 2242/10 having mechanically actuated valves, e.g. "Gifford" or "McMahon engines"
- F02G 2242/30 .. having variable working volume
- F02G 2242/32 ... Regenerative displacers with independent pistons

- F02G 2242/40 . Piston-type engines
- F02G 2242/42 .. having a single piston regenerative displacer attached to the piston, e.g. "Gifford-McMahon" engines
- F02G 2242/44 .. having two pistons and reverse flow regenerators

F02G 2243/00 Stirling type engines having closed regenerative thermodynamic cycles with flow controlled by volume changes

- F02G 2243/02 . having pistons and displacers in the same cylinder
- F02G 2243/04 .. Crank-connecting-rod drives
- F02G 2243/06 ... Regenerative displacers
- F02G 2243/08 ... External regenerators, e.g. "Rankine Napier" engines
- F02G 2243/20 .. each having a single free piston, e.g. "Beale engines"
- F02G 2243/202 ... resonant
- F02G 2243/204 ... non-resonant
- F02G 2243/206 ... externally excited
- F02G 2243/22 .. with oscillating cylinders
- F02G 2243/24 .. with free displacers

- F02G 2243/30 . having their pistons and displacers each in separate cylinders (**two-piston machines R02G 44/00**)
- F02G 2243/32 .. Regenerative displacers having parallel cylinder, e.g. "Lauberau" or "Schwartzkopff" engines
- F02G 2243/34 .. Regenerative displacers having their cylinders at right angle, e.g. "Robinson" engines
- F02G 2243/36 .. with twin-expansion cylinders, e.g. "Rainbow" engines
- F02G 2243/38 .. External regenerators having parallel cylinders, e.g. "Heinrici" engines
- F02G 2243/40 .. with free displacers
- F02G 2243/50 .. having resonance tubes
- F02G 2243/52 ... acoustic
- F02G 2243/54 ... thermo-acoustic

F02G 2244/00 **Machines having two pistons**

- F02G 2244/02 . Single-acting two piston engines
- F02G 2244/04 .. of rotary cylinder type, e.g. "Finkelstein" engines
- F02G 2244/06 .. of stationary cylinder type
- F02G 2244/08 ... having parallel cylinder, e.g. "Rider" engines
- F02G 2244/10 ... having cylinders in V-arrangement
- F02G 2244/12 ... having opposed pistons

- F02G 2244/50 . Double acting piston machines
- F02G 2244/52 .. having interconnecting adjacent cylinders constituting a single system, e.g. "Rinia" engines
- F02G 2244/54 .. having two-cylinder twin systems, with compression in one cylinder and expansion in the other cylinder for each of the twin systems, e.g. "Finkelstein" engines

F02G 2250/00 **Special cycles or special engines**

- F02G 2250/03 . Brayton cycles
- F02G 2250/06 . Beau de Rochas constant volume cycles
- F02G 2250/09 . Carnot cycles in general
- F02G 2250/12 . Malone liquid thermal cycles
- F02G 2250/15 . Sabathe mixed air cycles
- F02G 2250/18 . Vuilleumier cycles
- F02G 2250/21 . Cooke Yarborough engines
- F02G 2250/24 . Ringbom engines, the displacement of the free displacer being obtained by expansion of the heated gas and the weight of the piston
- F02G 2250/27 . Martini Stirling engines
- F02G 2250/31 . Nano or micro engines

F02G 2253/00 **Seals**

- F02G 2253/01 . Rotary piston seals
- F02G 2253/02 . Reciprocating piston seals

- F02G 2253/03 . Stem seals
- F02G 2253/04 . Displacer seals
- F02G 2253/06 . Bellow seals
- F02G 2253/08 . Stem with rolling membranes
- F02G 2253/10 . Piston with rolling membranes
- F02G 2253/50 . Liquid seals
- F02G 2253/60 . Sealing of the lubrication circuit
- F02G 2253/80 . Sealing of the crankcase

F02G 2254/00 Heat inputs

- F02G 2254/05 . by air
- F02G 2254/10 . by burners
- F02G 2254/11 . . Catalytic burners
- F02G 2254/12 . by ejectors
- F02G 2254/15 . by exhaust gas
- F02G 2254/18 . using deflectors, e.g. spirals
- F02G 2254/20 . using heat transfer tubes
- F02G 2254/30 . using solar radiation
- F02G 2254/40 . using heat accumulators
- F02G 2254/45 . by electric heating
- F02G 2254/50 . Dome arrangements for heat input
- F02G 2254/60 . using air preheaters
- F02G 2254/70 . by catalytic conversion, i.e. flameless oxydation
- F02G 2254/90 . by radioactivity

F02G 2255/00**Heater tubes**

- F02G 2255/10 . dome shaped
- F02G 2255/20 . Heater fins

F02G 2256/00**Coolers**

- F02G 2256/02 . Cooler fins
- F02G 2256/04 . Cooler tubes
- F02G 2256/50 . with coolant circulation

F02G 2257/00**Regenerators**

- F02G 2257/02 . rotating

F02G 2258/00**Materials used**

- F02G 2258/10 . ceramic
- F02G 2258/20 . having heat insulating properties
- F02G 2258/50 . having frictional properties
- F02G 2258/80 . having magnetic properties
- F02G 2258/90 . Processing of materials

F02G 2260/00**Recuperating heat from exhaust gases of combustion engines and heat from cooling circuits****F02G 2262/00****Recuperating heat from exhaust gases of combustion engines and heat from lubrication circuits**

F02G 2270/00**Constructional features**

- F02G 2270/005 . Shells, e.g. a sealed or sealing shell for a Stirling engine
- F02G 2270/02 . Pistons for reciprocating and rotating
- F02G 2270/04 . Roller assemblies connecting opposed pistons
- F02G 2270/10 . Rotary pistons
- F02G 2270/15 . Rotating cylinders
- F02G 2270/20 . Plural piston swash plates
- F02G 2270/30 . Displacer assemblies
- F02G 2270/40 . Piston assemblies
- F02G 2270/42 . Displacer drives
- F02G 2270/425 . . the displacer being driven by a four-bar mechanism, e.g. a rhombic mechanism
- F02G 2270/45 . Piston rods
- F02G 2270/50 . Crosshead guiding pistons
- F02G 2270/55 . Cylinders
- F02G 2270/60 . Counterweights for pistons
- F02G 2270/70 . Liquid pistons
- F02G 2270/80 . Engines without crankshafts
- F02G 2270/85 . Crankshafts
- F02G 2270/90 . Valves
- F02G 2270/95 . Pressurised crankcases

F02G 2275/00**Controls**

- F02G 2275/10 . for vibration reduction
- F02G 2275/20 . for preventing piston over stroke
- F02G 2275/30 . for proper burning

F02G 2275/40 . for starting

F02G 2280/00 Output delivery

F02G 2280/005 . Medical applications, e.g. for prosthesis or artificial hearts

F02G 2280/10 . Linear generators

F02G 2280/20 . Rotary generators

F02G 2280/50 . Compressors or pumps

F02G 2280/60 . Heat pumps

F02G 2280/70 . Clutches

F02G 2290/00 Engines characterised by the use of a particular power transfer medium, e.g. Helium