CPC COOPERATIVE PATENT CLASSIFICATION

F MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING
(NOTE omitted)

ENGINES OR PUMPS

F02 COMBUSTION ENGINES; HOT-GAS OR COMBUSTION-PRODUCT ENGINE PLANTS

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.

1/00 **Hot gas positive-displacement engine plants**
1/02 . of open-cycle type
1/04 . of closed-cycle type
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 engines
1/0435 . . . {the engine being of the free piston type}
1/044 . . . having at least two working members, e.g. pistons, delivering power output
1/0445 . . . . {Engine plants with combined cycles, e.g. Vuilleumier}
1/045 . . . Controlling
1/047 . . . . by varying the heating or cooling
1/05 . . . . by varying the rate of flow or quantity of the working gas
1/053 . . . Component parts or details
1/0535 . . . . {Seals or sealing arrangements}
1/055 . . . . Heaters or coolers
1/057 . . . . Regenerators
1/06 . Controlling

3/00 **Combustion-product positive-displacement engine plants**
3/02 . with reciprocating-piston engines

5/00 **Profiting from waste heat of combustion engines, not otherwise provided for**
5/02 . Profiting from waste heat of exhaust gases
5/04 . . in combination with other waste heat from combustion engines

2242/00 **Ericsson-type engines having open regenerative cycles controlled by valves**
2242/02 . Displacer-type engines
2242/04 . . having constant working volume
2242/06 . . . with external drive displacers
2242/08 . . . . having gas actuated valves, e.g. "Bush engines"
2242/10 . . . . having mechanically actuated valves, e.g. "Gifford" or "McMahon engines"
2242/30 . . having variable working volume
2242/32 . . . Regenerative displacers with independent pistons
2242/40 . Piston-type engines
2242/42 . . having a single piston regenerative displacer attached to the piston, e.g. "Gifford-McMahon" engines
2242/44 . . having two pistons and reverse flow regenerators

2243/00 **Stirling type engines having closed regenerative thermodynamic cycles with flow controlled by volume changes**
2243/02 . having pistons and displacers in the same cylinder
2243/04 . . Crank-connecting-rod drives
2243/06 . . . Regenerative displacers
2243/08 . . . External regenerators, e.g. "Rankine Napier" engines
2243/20 . . each having a single free piston, e.g. "Beale engines"
2243/202 . . . resonant
2243/204 . . . non-resonant
2243/206 . . . externally excited
2243/22 . . with oscillating cylinders
2243/24 . . with free displacers
2243/30 . having their pistons and displacers each in separate cylinders (two-piston machines F02G 2244/00)
2243/32 . . Regenerative displacers having parallel cylinder, e.g. "Lauberau" or "Schwartzkopff" engines
2243/34 . . Regenerative displacers having their cylinders at right angle, e.g. "Robinson" engines
2243/36 . . with twin-expansion cylinders, e.g. "Rainbow" engines
2243/38 . . External regenerators having parallel cylinders, e.g. "Heinrici" engines
2243/40 . . with free displacers
2243/50 . . having resonance tubes
2243/52 . . . acoustic

2243/54 . . . thermo-acoustic

2244/00 Machines having two pistons
2244/02 . Single-acting two piston engines
2244/04 . . of rotary cylinder type, e.g. "Finkelstein" engines
2244/06 . . of stationary cylinder type
2244/08 . . . having parallel cylinder, e.g. "Rider" engines
2244/10 . . . having cylinders in V-arrangement
2244/12 . . . having opposed pistons
2244/50 . Double acting piston machines
2244/52 . . having interconnecting adjacent cylinders constituting a single system, e.g. "Rinia" engines
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

2250/00 Special cycles or special engines
2250/03 . Brayton cycles
2250/06 . Beau de Rochas constant volume cycles
2250/09 . Carnot cycles in general
2250/12 . Malone liquid thermal cycles
2250/15 . Sabathe mixed air cycles
2250/18 . Vuilleumier cycles
2250/21 . Cooke Yarborough engines
2250/24 . Ringbom engines, the displacement of the free displacer being obtained by expansion of the heated gas and the weight of the piston
2250/27 . Martini Stirling engines
2250/31 . Nano- or microengines

2253/00 Seals
2253/01 . Rotary piston seals
2253/02 . Reciprocating piston seals
2253/03 . Stem seals
2253/04 . Displacer seals
2253/06 . Bellow seals
2253/08 . Stem with rolling membranes
2253/10 . Piston with rolling membranes
2253/50 . Liquid seals
2253/60 . Sealing of the lubrication circuit
2253/80 . Sealing of the crankcase

2254/00 Heat inputs
2254/05 . by air
2254/10 . by burners
2254/11 . . Catalytic burners
2254/12 . by ejectors
2254/15 . by exhaust gas
2254/18 . using deflectors, e.g. spirals
2254/20 . using heat transfer tubes
2254/30 . using solar radiation
2254/40 . using heat accumulators
2254/45 . by electric heating
2254/50 . Dome arrangements for heat input
2254/60 . using air preheaters
2254/70 . by catalytic conversion, i.e. flameless oxydation
2254/90 . by radioactivity

2255/00 Heater tubes
2255/10 . dome shaped
2255/20 . Heater fins

2256/00 Coolers
2256/02 . Cooler fins
2256/04 . Cooler tubes
2256/50 . with coolant circulation

2257/00 Regenerators
2257/02 . rotating

2258/00 Materials used
2258/10 . ceramic
2258/20 . having heat insulating properties
2258/50 . having frictional properties
2258/80 . having magnetic properties
2258/90 . Processing of materials

2260/00 Recuperating heat from exhaust gases of combustion engines and heat from cooling circuits

2262/00 Recuperating heat from exhaust gases of combustion engines and heat from lubrication circuits

2270/00 Constructional features
2270/005 . Shells, e.g. a sealed or sealing shell for a Stirling engine
2270/02 . Pistons for reciprocating and rotating
2270/04 . Roller assemblies connecting opposed pistons
2270/10 . Rotary pistons
2270/15 . Rotating cylinders
2270/20 . Plural piston swash plates
2270/30 . Displacer assemblies
2270/40 . Piston assemblies
2270/42 . Displacer drives
2270/425 . . the displacer being driven by a four-bar mechanism, e.g. a rhombic mechanism
2270/45 . Piston rods
2270/50 . Crosshead guiding pistons
2270/55 . Cylinders
2270/60 . Counterweights for pistons
2270/70 . Liquid pistons
2270/80 . Engines without crankshafts
2270/85 . Crankshafts
2270/90 . Valves
2270/95 . Pressurised crankcases

2275/00 Controls
2275/10 . for vibration reduction
2275/20 . for preventing piston over stroke
2275/30 . for proper burning
2275/40 . for starting

2280/00 Output delivery
2280/005 . Medical applications, e.g. for prosthesis or artificial hearts
2280/10 . Linear generators
2280/20 . Rotary generators
2280/50 . Compressors or pumps
2280/60 . Heat pumps
2280/70 . Clutches

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