

# CPC COOPERATIVE PATENT CLASSIFICATION

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

### ENGINES OR PUMPS

## F02 COMBUSTION ENGINES (cyclically operating valves therefor, lubricating, exhausting, or silencing engines F01); 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.

<b>1/00</b>	<b>Hot gas positive-displacement engine plants</b> (positive-displacement engine plants characterised by the working gas being generated by combustion in the plant F02G 3/00)	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"
1/02	. of open-cycle type	2242/30	. . having variable working volume
1/04	. of closed-cycle type	2242/32	. . . Regenerative displacers with independent pistons
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	2242/40	. Piston-type engines
		2242/42	. . having a single piston regenerative displacer attached to the piston, e.g. "Gifford-McMahon" engines
1/0435	. . . {the engine being of the free piston type}	2242/44	. . having two pistons and reverse flow regenerators
1/044	. . . having at least two working members, e.g. pistons, delivering power output	<b>2243/00</b>	<b>Stirling type engines having closed regenerative thermodynamic cycles with flow controlled by volume changes</b>
1/0445	. . . . {Engine plants with combined cycles, e.g. Vuilleumier}	2243/02	. having pistons and displacers in the same cylinder
1/045	. . . Controlling	2243/04	. . Crank-connecting-rod drives
1/047	. . . . by varying the heating or cooling	2243/06	. . . Regenerative displacers
1/05	. . . . by varying the rate of flow or quantity of the working gas	2243/08	. . . External regenerators, e.g. "Rankine Napier" engines
1/053	. . . Component parts or details	2243/20	. . each having a single free piston, e.g. "Beale engines"
1/0535	. . . . {Seals or sealing arrangements}	2243/202	. . . resonant
1/055	. . . . Heaters or coolers	2243/204	. . . non-resonant
1/057	. . . . Regenerators	2243/206	. . . externally excited
1/06	. Controlling	2243/22	. . with oscillating cylinders
<b>3/00</b>	<b>Positive-displacement engine plants characterised by the working gas being generated by combustion in the plant</b>	2243/24	. . with free displacers
3/02	. with reciprocating-piston engines	2243/30	. having their pistons and displacers each in separate cylinders (two-piston machines F02G 2244/00)
<b>5/00</b>	<b>Profiting from waste heat of combustion engines, not otherwise provided for</b>	2243/32	. . Regenerative displacers having parallel cylinder, e.g. "Lauberau" or "Schwartzkopff" engines
5/02	. Profiting from waste heat of exhaust gases	2243/34	. . Regenerative displacers having their cylinders at right angle, e.g. "Robinson" engines
5/04	. . in combination with other waste heat from combustion engines	2243/36	. . with twin-expansion cylinders, e.g. "Rainbow" engines
<b>2242/00</b>	<b>Ericsson-type engines having open regenerative cycles controlled by valves</b>	2243/38	. . External regenerators having parallel cylinders, e.g. "Heinrich" engines
2242/02	. Displacer-type engines	2243/40	. . with free displacers
2242/04	. . having constant working volume		

- 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**