

# 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](#).

|                |                                                                                                                                                                                                                        |                 |                                                                                                                       |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------------------------------------------------------------------------------------------------------------------|
| <b>1/00</b>    | <b>Hot gas positive-displacement engine plants</b>                                                                                                                                                                     | <b>2242/10</b>  | . . . . having mechanically actuated valves, e.g. "Gifford" or "McMahon engines"                                      |
| 1/02           | . of open-cycle type                                                                                                                                                                                                   | <b>2242/30</b>  | . . having variable working volume                                                                                    |
| 1/04           | . of closed-cycle type                                                                                                                                                                                                 | <b>2242/32</b>  | . . . 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 | <b>2242/40</b>  | . Piston-type engines                                                                                                 |
| 1/0435         | . . . {the engine being of the free piston type}                                                                                                                                                                       | <b>2242/42</b>  | . . having a single piston regenerative displacer attached to the piston, e.g. "Gifford-McMahon" engines              |
| 1/044          | . . . having at least two working members, e.g. pistons, delivering power output                                                                                                                                       | <b>2242/44</b>  | . . having two pistons and reverse flow regenerators                                                                  |
| 1/0445         | . . . . {Engine plants with combined cycles, e.g. Vuilleumier}                                                                                                                                                         | <b>2243/00</b>  | <b>Stirling type engines having closed regenerative thermodynamic cycles with flow controlled by volume changes</b>   |
| 1/045          | . . . Controlling                                                                                                                                                                                                      | <b>2243/02</b>  | . having pistons and displacers in the same cylinder                                                                  |
| 1/047          | . . . . by varying the heating or cooling                                                                                                                                                                              | <b>2243/04</b>  | . . Crank-connecting-rod drives                                                                                       |
| 1/05           | . . . . by varying the rate of flow or quantity of the working gas                                                                                                                                                     | <b>2243/06</b>  | . . . Regenerative displacers                                                                                         |
| 1/053          | . . . Component parts or details                                                                                                                                                                                       | <b>2243/08</b>  | . . . External regenerators, e.g. "Rankine Napier" engines                                                            |
| 1/0535         | . . . . {Seals or sealing arrangements}                                                                                                                                                                                | <b>2243/20</b>  | . . each having a single free piston, e.g. "Beale engines"                                                            |
| 1/055          | . . . . Heaters or coolers                                                                                                                                                                                             | <b>2243/202</b> | . . . resonant                                                                                                        |
| 1/057          | . . . . Regenerators                                                                                                                                                                                                   | <b>2243/204</b> | . . . non-resonant                                                                                                    |
| 1/06           | . Controlling                                                                                                                                                                                                          | <b>2243/206</b> | . . . externally excited                                                                                              |
| <b>3/00</b>    | <b>Combustion-product positive-displacement engine plants</b>                                                                                                                                                          | <b>2243/22</b>  | . . with oscillating cylinders                                                                                        |
| 3/02           | . with reciprocating-piston engines                                                                                                                                                                                    | <b>2243/24</b>  | . . with free displacers                                                                                              |
| <b>5/00</b>    | <b>Profiting from waste heat of combustion engines, not otherwise provided for</b>                                                                                                                                     | <b>2243/30</b>  | . having their pistons and displacers each in separate cylinders ( <a href="#">two-piston machines F02G 2244/00</a> ) |
| 5/02           | . Profiting from waste heat of exhaust gases                                                                                                                                                                           | <b>2243/32</b>  | . . Regenerative displacers having parallel cylinder, e.g. "Lauberau" or "Schwartzkopf" engines                       |
| 5/04           | . . in combination with other waste heat from combustion engines                                                                                                                                                       | <b>2243/34</b>  | . . Regenerative displacers having their cylinders at right angle, e.g. "Robinson" engines                            |
| <b>2242/00</b> | <b>Ericsson-type engines having open regenerative cycles controlled by valves</b>                                                                                                                                      | <b>2243/36</b>  | . . with twin-expansion cylinders, e.g. "Rainbow" engines                                                             |
| 2242/02        | . Displacer-type engines                                                                                                                                                                                               | <b>2243/38</b>  | . . External regenerators having parallel cylinders, e.g. "Heinrici" engines                                          |
| 2242/04        | . . having constant working volume                                                                                                                                                                                     | <b>2243/40</b>  | . . with free displacers                                                                                              |
| 2242/06        | . . . with external drive displacers                                                                                                                                                                                   | <b>2243/50</b>  | . . having resonance tubes                                                                                            |
| 2242/08        | . . . . having gas actuated valves, e.g. "Bush engines"                                                                                                                                                                | <b>2243/52</b>  | . . . acoustic                                                                                                        |

|                |                                                                                                                                                                     |                |                                                                                                      |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------------------------------------------------------------------------------------------------|
| 2243/54        | . . . thermo-acoustic                                                                                                                                               | 2256/04        | . Cooler tubes                                                                                       |
| <b>2244/00</b> | <b>Machines having two pistons</b>                                                                                                                                  | 2256/50        | . with coolant circulation                                                                           |
| 2244/02        | . Single-acting two piston engines                                                                                                                                  | <b>2257/00</b> | <b>Regenerators</b>                                                                                  |
| 2244/04        | . . of rotary cylinder type, e.g. "Finkelstein" engines                                                                                                             | 2257/02        | . rotating                                                                                           |
| 2244/06        | . . of stationary cylinder type                                                                                                                                     | <b>2258/00</b> | <b>Materials used</b>                                                                                |
| 2244/08        | . . . having parallel cylinder, e.g. "Rider" engines                                                                                                                | 2258/10        | . ceramic                                                                                            |
| 2244/10        | . . . having cylinders in V-arrangement                                                                                                                             | 2258/20        | . having heat insulating properties                                                                  |
| 2244/12        | . . . having opposed pistons                                                                                                                                        | 2258/50        | . having frictional properties                                                                       |
| 2244/50        | . Double acting piston machines                                                                                                                                     | 2258/80        | . having magnetic properties                                                                         |
| 2244/52        | . . having interconnecting adjacent cylinders constituting a single system, e.g. "Rinia" engines                                                                    | 2258/90        | . Processing of materials                                                                            |
| 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 | <b>2260/00</b> | <b>Recuperating heat from exhaust gases of combustion engines and heat from cooling circuits</b>     |
| <b>2250/00</b> | <b>Special cycles or special engines</b>                                                                                                                            | <b>2262/00</b> | <b>Recuperating heat from exhaust gases of combustion engines and heat from lubrication circuits</b> |
| 2250/03        | . Brayton cycles                                                                                                                                                    | <b>2270/00</b> | <b>Constructional features</b>                                                                       |
| 2250/06        | . Beau de Rochas constant volume cycles                                                                                                                             | 2270/005       | . Shells, e.g. a sealed or sealing shell for a Stirling engine                                       |
| 2250/09        | . Carnot cycles in general                                                                                                                                          | 2270/02        | . Pistons for reciprocating and rotating                                                             |
| 2250/12        | . Malone liquid thermal cycles                                                                                                                                      | 2270/04        | . Roller assemblies connecting opposed pistons                                                       |
| 2250/15        | . Sabathe mixed air cycles                                                                                                                                          | 2270/10        | . Rotary pistons                                                                                     |
| 2250/18        | . Vuilleumier cycles                                                                                                                                                | 2270/15        | . Rotating cylinders                                                                                 |
| 2250/21        | . Cooke Yarborough engines                                                                                                                                          | 2270/20        | . Plural piston swash plates                                                                         |
| 2250/24        | . Ringbom engines, the displacement of the free displacer being obtained by expansion of the heated gas and the weight of the piston                                | 2270/30        | . Displacer assemblies                                                                               |
| 2250/27        | . Martini Stirling engines                                                                                                                                          | 2270/40        | . Piston assemblies                                                                                  |
| 2250/31        | . Nano- or microengines                                                                                                                                             | 2270/42        | . Displacer drives                                                                                   |
| <b>2253/00</b> | <b>Seals</b>                                                                                                                                                        | 2270/425       | . . the displacer being driven by a four-bar mechanism, e.g. a rhombic mechanism                     |
| 2253/01        | . Rotary piston seals                                                                                                                                               | 2270/45        | . Piston rods                                                                                        |
| 2253/02        | . Reciprocating piston seals                                                                                                                                        | 2270/50        | . Crosshead guiding pistons                                                                          |
| 2253/03        | . Stem seals                                                                                                                                                        | 2270/55        | . Cylinders                                                                                          |
| 2253/04        | . Displacer seals                                                                                                                                                   | 2270/60        | . Counterweights for pistons                                                                         |
| 2253/06        | . Bellow seals                                                                                                                                                      | 2270/70        | . Liquid pistons                                                                                     |
| 2253/08        | . Stem with rolling membranes                                                                                                                                       | 2270/80        | . Engines without crankshafts                                                                        |
| 2253/10        | . Piston with rolling membranes                                                                                                                                     | 2270/85        | . Crankshafts                                                                                        |
| 2253/50        | . Liquid seals                                                                                                                                                      | 2270/90        | . Valves                                                                                             |
| 2253/60        | . Sealing of the lubrication circuit                                                                                                                                | 2270/95        | . Pressurised crankcases                                                                             |
| 2253/80        | . Sealing of the crankcase                                                                                                                                          | <b>2275/00</b> | <b>Controls</b>                                                                                      |
| <b>2254/00</b> | <b>Heat inputs</b>                                                                                                                                                  | 2275/10        | . for vibration reduction                                                                            |
| 2254/05        | . by air                                                                                                                                                            | 2275/20        | . for preventing piston over stroke                                                                  |
| 2254/10        | . by burners                                                                                                                                                        | 2275/30        | . for proper burning                                                                                 |
| 2254/11        | . . Catalytic burners                                                                                                                                               | 2275/40        | . for starting                                                                                       |
| 2254/12        | . by ejectors                                                                                                                                                       | <b>2280/00</b> | <b>Output delivery</b>                                                                               |
| 2254/15        | . by exhaust gas                                                                                                                                                    | 2280/005       | . Medical applications, e.g. for prosthesis or artificial hearts                                     |
| 2254/18        | . using deflectors, e.g. spirals                                                                                                                                    | 2280/10        | . Linear generators                                                                                  |
| 2254/20        | . using heat transfer tubes                                                                                                                                         | 2280/20        | . Rotary generators                                                                                  |
| 2254/30        | . using solar radiation                                                                                                                                             | 2280/50        | . Compressors or pumps                                                                               |
| 2254/40        | . using heat accumulators                                                                                                                                           | 2280/60        | . Heat pumps                                                                                         |
| 2254/45        | . by electric heating                                                                                                                                               | 2280/70        | . Clutches                                                                                           |
| 2254/50        | . Dome arrangements for heat input                                                                                                                                  | <b>2290/00</b> | <b>Engines characterised by the use of a particular power transfer medium, e.g. Helium</b>           |
| 2254/60        | . using air preheaters                                                                                                                                              |                |                                                                                                      |
| 2254/70        | . by catalytic conversion, i.e. flameless oxydation                                                                                                                 |                |                                                                                                      |
| 2254/90        | . by radioactivity                                                                                                                                                  |                |                                                                                                      |
| <b>2255/00</b> | <b>Heater tubes</b>                                                                                                                                                 |                |                                                                                                      |
| 2255/10        | . dome shaped                                                                                                                                                       |                |                                                                                                      |
| 2255/20        | . Heater fins                                                                                                                                                       |                |                                                                                                      |
| <b>2256/00</b> | <b>Coolers</b>                                                                                                                                                      |                |                                                                                                      |
| 2256/02        | . Cooler fins                                                                                                                                                       |                |                                                                                                      |