

CPC**COOPERATIVE PATENT CLASSIFICATION****F02F****CYLINDERS, PISTONS OR CASINGS, FOR COMBUSTION ENGINES; ARRANGEMENTS OF SEALINGS IN COMBUSTION ENGINES**

(specially adapted for rotary-piston or oscillating-piston internal-combustion engines [F02B](#); specially adapted for gas-turbine plants [F02C](#); specially adapted for jet-propulsion plants [F02K](#))

NOTE

1. Attention is drawn to the notes preceding class [F01](#).
2. In considering the relationship between class [F16](#) and subclass [F02F](#), class [F16](#) will take precedence unless the subject-matter is specific to combustion engines.

F02F 1/00**Cylinders; Cylinder heads (in general [F16J](#))**[F02F 1/002](#)

. {Integrally formed cylinders and cylinder heads}

[F02F 1/004](#). {Cylinder liners ([F02F 1/08](#), [F02F 1/16](#) take precedence)}[F02F 2001/006](#)

. {having a ring at the inside of a liner or cylinder for preventing the deposit of carbon oil particles, e.g. oil scrapers}

[F02F 2001/008](#)

. {Stress problems, especially related to thermal stress}

[F02F 1/02](#). having cooling means ([cylinder heads F02F 1/26](#))[F02F 1/04](#)

.. for air cooling

[F02F 1/045](#)

... {Attachment of cylinders to crankcase}

[F02F 1/06](#)

... Shape or arrangement of cooling fins; Finned cylinders

[F02F 1/065](#)

.... {with means for directing or distributing cooling medium}

[F02F 1/08](#)

.... running-liner and cooling-part of cylinder being different parts or of different material

[F02F 1/10](#)

.. for liquid cooling

[F02F 1/102](#)

... {Attachment of cylinders to crankcase}

[F02F 2001/104](#)

... {using an open deck, i.e. the water jacket is open at the block top face}

[F02F 2001/106](#)

... {using a closed deck, i.e. the water jacket is not open at the block top face}

[F02F 1/108](#)

... {Siamese-type cylinders, i.e. cylinders cast together}

[F02F 1/12](#)

... Preventing corrosion of liquid-swept surfaces

[F02F 1/14](#)

... Cylinders with means for directing, guiding or distributing liquid stream

[F02F 1/16](#)

... Cylinder liners of wet type

[F02F 1/163](#)

.... {the liner being midsupported}

[F02F 1/166](#)

.... {Spacer decks}

[F02F 1/18](#)

. Other cylinders

[F02F 1/183](#)

.. {Oval or square cylinders}

[F02F 1/186](#).. {for use in engines with two or more pistons reciprocating within same cylinder (such engines per se [F02B 75/28](#))}

- F02F 1/20 .. characterised by constructional features providing for lubrication
- F02F 1/22 .. characterised by having ports in cylinder wall for scavenging or charging
- F02F 1/24 . Cylinder heads
- F02F 2001/241 .. {specially adapted to pent roof shape of the combustion chamber}
- F02F 1/242 .. {Arrangement of spark plugs or injectors}
- F02F 1/243 .. {Cylinder heads and inlet or exhaust manifolds integrally cast together}
- F02F 2001/244 .. {Arrangement of valve stems in cylinder heads}
- F02F 2001/245 ... {the valve stems being orientated at an angle with the cylinder axis}
- F02F 2001/246 {and orientated radially from the combustion chamber surface}
- F02F 2001/247 ... {the valve stems being orientated in parallel with the cylinder axis}
- F02F 2001/248 .. {Methods for avoiding thermal stress-induced cracks in the zone between valve seat openings}
- F02F 2001/249 .. {with flame plate, e.g. insert in the cylinder head used as a thermal insulation between cylinder head and combustion chamber}
- F02F 1/26 .. having cooling means
- F02F 1/28 ... for air cooling
- F02F 1/30 Finned cylinder heads
- F02F 1/305 {the cylinder heads being of side valve type}
- F02F 1/32 the cylinder heads being of overhead valve type
- F02F 1/34 with means for directing or distributing cooling medium ([F02F 1/32 takes precedence](#))
- F02F 1/36 ... for liquid cooling
- F02F 1/365 {the cylinder heads being of side valve type}
- F02F 1/38 the cylinder heads being of overhead valve type
- F02F 1/40 Cylinder heads with means for directing, guiding, or distributing liquid stream ([F02F 1/38 takes precedence](#))
- F02F 1/42 .. Shape or arrangement of intake or exhaust channels in cylinder heads
- F02F 2001/4207 ... {Arrangements with one conduit connected with two valves; Arrangements connecting one valve with two conduits}
- F02F 1/4214 ... {specially adapted for four or more valves per cylinder}
- F02F 1/4221 {particularly for three or more inlet valves ([mechanisms for driving such valves F01L 1/265](#))}
- F02F 1/4228 ... {Helically-shaped channels ([F02B 31/00 takes precedence](#))}
- F02F 1/4235 ... {of intake channels}
- F02F 1/4242 {with a partition wall inside the channel}
- F02F 1/425 {with a separate deviation element inside the channel}
- F02F 1/4257 {with an intake liner}
- F02F 1/4264 ... {of exhaust channels}
- F02F 1/4271 {with an exhaust liner}
- F02F 2001/4278 {Exhaust collectors}
- F02F 1/4285 ... {of both intake and exhaust channel}
- F02F 1/4292 {with liners ([F02F 1/4257](#), [F02F 1/4271 take precedence](#))}

F02F 3/00**Pistons (in general [F16J](#))**

- F02F 2003/0007 . {Monolithic pistons; One piece constructions; Casting of pistons}
- F02F 3/0015 . {Multi-part pistons}
- F02F 3/0023 .. {the parts being bolted or screwed together}
- F02F 3/003 .. {the parts being connected by casting, brazing, welding or clamping}
- F02F 2003/0038 ... {by brazing}
- F02F 2003/0046 ... {by crimping}
- F02F 2003/0053 ... {by soldering}
- F02F 2003/0061 ... {by welding}
- F02F 3/0069 .. {the crown and skirt being interconnected by the gudgeon pin}
- F02F 3/0076 . {the inside of the pistons being provided with ribs or fins}
- F02F 3/0084 . {the pistons being constructed from specific materials}
- F02F 3/0092 .. {the material being steel-plate}
- F02F 3/02 . having means for accomodating or controlling heat expansion
- F02F 3/022 .. {the pistons having an oval circumference or non-cylindrical shaped skirts, e.g. oval ([F02F 3/025](#), [F02F 3/027](#) take precedence)}
- F02F 3/025 .. {having circumferentially slotted piston skirts, e.g. T-slots}
- F02F 3/027 .. {the skirt wall having cavities}
- F02F 3/04 .. having expansion-controlling inserts
- F02F 3/042 ... {the inserts consisting of reinforcements in the skirt interconnecting separate wall parts, e.g. rods or strips}
- F02F 3/045 ... {the inserts being located in the crown}
- F02F 3/047 ... {the inserts being located around the gudgeon pin bearings}
- F02F 3/06 ... the inserts having bimetallic effect
- F02F 3/08 ... the inserts being ring-shaped
- F02F 3/10 . having surface coverings ([F02F 3/02](#) takes precedence)
- F02F 3/105 .. {the coverings forming a double skirt}
- F02F 3/12 .. on piston heads
- F02F 3/14 ... within combustion chambers
- F02F 3/16 . having cooling means
- F02F 3/18 .. the means being a liquid or solid coolant, e.g. sodium, in a closed chamber in piston
- F02F 3/20 .. the means being a fluid flowing through or along piston
- F02F 3/22 ... the fluid being liquid
- F02F 3/225 {the liquid being directed into blind holes}
- F02F 3/24 . having means for guiding gases in cylinders, e.g. for guiding scavenging charge in two-stroke engines
- F02F 3/26 . having combustion chamber in piston head ([the surface thereof being covered \[F02F 3/14\]\(#\)](#))
- F02F 3/28 . Other pistons with specially-shaped head

F02F 3/285 . . {the head being provided with an insert located in or on the combustion-gas-swept surface}

F02F 5/00 **Piston rings, e.g. associated with piston crown** {(not used see [F16J 9/00](#))}

F02F 7/00 **Casings, e.g. crankcases** (engine casings in general [F16M](#)) {or frames}

- F02F 7/0002 . {Cylinder arrangements}
- F02F 7/0004 . . {Crankcases of one-cylinder engines}
- F02F 7/0007 . . {Crankcases of engines with cylinders in line}
- F02F 7/0009 . . {Crankcases of opposed piston engines}
- F02F 7/0012 . . {Crankcases of V-engines}
- F02F 7/0014 . . {Crankcases of W-, deltidic, or quadratic engines, or the like}
- F02F 7/0017 . . {Crankcases of radial engines}
- F02F 7/0019 . . {Cylinders and crankshaft not in one plane (deaxation)}
- F02F 7/0021 . {Construction}
- F02F 7/0024 . . {Casings for larger engines}
- F02F 7/0026 . . . {Casings for horizontal engines}
- F02F 7/0029 . . {Space-frames}
- F02F 7/0031 . . {Construction kit principle (modular engines)}
- F02F 7/0034 . . {Built from sheet material and welded casings}
- F02F 7/0036 . . {Casings for two-stroke engines with scavenging conduits}
- F02F 7/0039 . . {Casings for small engines, especially with crankcase pumps}
- F02F 2007/0041 . . {Fixing Bolts}
- F02F 7/0043 . {Arrangements of mechanical drive elements}
- F02F 7/0046 . . {Shape of casings adapted to facilitate fitting or dismantling of engine parts}
- F02F 7/0048 . . {Tunnel-type frames}
- F02F 7/0051 . . {Crankcase pump engines}
- F02F 7/0053 . . {Crankshaft bearings fitted in the crankcase}
- F02F 2007/0056 . . . {using bearing beams, i.e. bearings interconnected by a beam or multiple beams}
- F02F 7/0058 . . {Longitudinally or transversely separable crankcases}
- F02F 7/006 . {Camshaft or pushrod housings (oil sumps [F01M 11/0004](#))}
- F02F 2007/0063 . . {Head bolts; Arrangements of cylinder head bolts}
- F02F 7/0065 . {Shape of casings for other machine parts and purposes, e.g. utilisation purposes, safety}
- F02F 7/0068 . . {Adaptations for other accessories}
- F02F 7/007 . . {Adaptations for cooling}
- F02F 7/0073 . . {Adaptations for fitting the engine, e.g. front-plates or bell-housings}
- F02F 2007/0075 . . . {Front covers}
- F02F 2007/0078 . . . {Covers for belt transmissions}
- F02F 7/008 . . {Sound insulation (see also [F02B 77/13](#))}
- F02F 7/0082 . {Mounting of engine casings}

- F02F 7/0085 . {Materials for constructing engines or their parts}
- F02F 7/0087 . . {Ceramic materials}
- F02F 2007/009 . . {Hypereutectic aluminum, e.g. aluminum alloys with high Si content}
- F02F 2007/0092 . . {Transparent materials}
- F02F 7/0095 . {Constructing engine casings (welded casings [F02F 7/0034](#))}
- F02F 2007/0097 . {for large diesel engines}

F02F 11/00

Arrangements of sealings in combustion engines (piston rings [F02F 5/00](#) {not used, see [F16J 9/00](#)} ; sealings per se [F16J](#))

- F02F 11/002 . {involving cylinder heads}
- F02F 11/005 . {involving cylinder liners}
- F02F 11/007 . {involving rotary applications}

F02F 2200/00**Manufacturing**

- F02F 2200/02 . Riveting
- F02F 2200/04 . Forging of engine parts
- F02F 2200/06 . Casting ([casting of pistons](#) [F02F 2003/0007](#))
- F02F 2200/08 . . using a lost model, e.g. foam casting
- F02F 2200/11 . using wrought materials, e.g. wrought steels

F02F 2547/00