

**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**

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

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-, deldic, 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**