# SECTION F — MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING

## F01 MACHINES OR ENGINES IN GENERAL; ENGINE PLANTS IN GENERAL; STEAM ENGINES

**F01B MACHINES OR ENGINES, IN GENERAL OR OF POSITIVE-DISPLACEMENT TYPE, e.g. STEAM ENGINES** (of rotary-piston or oscillating-piston type F01C; of non-positive-displacement type F01D; combustion engines F02; internal-combustion aspects of reciprocating-piston engines F02B 57/00, F02B 59/00; machines for liquids F03, F04; crankshafts, crossheads, connecting-rods F16C; flywheels F16F; gearings for interconverting rotary motion and reciprocating motion in general F16H; pistons, piston-rods, cylinders, for engines in general F16J)

**Note(s)**

1. This subclass covers, with the exception of the matter provided for in subclasses F01C-F01P:
   - engines for elastic fluids, e.g. steam engines;
   - engines for liquids and elastic fluids;
   - machines for elastic fluids;
   - machines for liquids and elastic fluids.
2. Attention is drawn to the Notes preceding class F01, especially as regards the definitions of "steam" and "special vapour".

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**1/00 Reciprocating-piston machines or engines characterised by number or relative disposition of cylinders or by being built-up from separate cylinder-crankcase elements** (F01B 3/00, F01B 5/00 take precedence) **[1, 2, 2006.01]**

1/01 • with one single cylinder **[2, 2006.01]**

1/02 • with cylinders all in one line **[1, 2006.01]**

1/04 • with cylinders in V-arrangement **[1, 2006.01]**

1/06 • with cylinders in star or fan arrangement **[1, 2006.01]**

1/08 • with cylinders arranged oppositely relative to main shaft and of "flat" type **[1, 2006.01]**

1/10 • with more than one main shaft, e.g. coupled to common output shaft (combinations of two or more machines or engines F01B 21/00) **[1, 2006.01]**

1/12 • Separate cylinder-crankcase elements coupled together to form a unit **[1, 2006.01]**

**3/00 Reciprocating-piston machines or engines with cylinder axes coaxial with, or parallel or inclined to, main shaft axis [1, 2006.01]**

3/02 • with wobble-plate **[1, 2006.01]**

3/04 • the piston motion being transmitted by curved surfaces **[1, 2006.01]**

3/06 • • by multi-turn helical surfaces and automatic reversal **[1, 2006.01]**

3/08 • • • the helices being arranged on the pistons **[1, 2006.01]**

3/10 • Control of working-fluid admission or discharge peculiar thereto (suitable for more general application F01L) **[1, 2006.01]**

**5/00 Reciprocating-piston machines or engines with cylinder axes arranged substantially tangentially to a circle centred on main shaft axis [1, 2006.01]**

**7/00 Machines or engines with two or more pistons reciprocating within same cylinder or within essentially coaxial cylinders** (in opposite arrangement relative to main shaft F01B 1/08) **[1, 2006.01]**

7/02 • with oppositely reciprocating pistons **[1, 2006.01]**

7/04 • • acting on same main shaft **[1, 2006.01]**

7/06 • • • using only connecting-rods for conversion of reciprocatory into rotary motion or vice versa **[1, 2006.01]**
7/08 • • • • with side rods **[1, 2006.01]**
7/10 • • • • having piston-rod of one piston passed through other piston **[1, 2006.01]**
7/12 • • • using rockers and connecting-rods **[1, 2006.01]**
7/14 • • acting on different main shafts **[1, 2006.01]**
7/16 • with pistons synchronously moving in tandem arrangement **[1, 2006.01]**
7/18 • with differential piston (F01B 7/20 takes precedence) **[1, 2006.01]**
7/20 • with two or more pistons reciprocating one within another, e.g. one piston forming cylinder of the other **[1, 2006.01]**

**9/00** **Reciprocating-piston machines or engines characterised by connections between pistons and main shafts and not specific to groups F01B 1/00-F01B 7/00** (connections disengageable during idling F01B 31/24) **[1, 2006.01]**
9/02 • with crankshaft **[1, 2006.01]**
9/04 • with rotary main shaft other than crankshaft **[1, 2006.01]**
9/06 • • the piston motion being transmitted by curved surfaces **[1, 2006.01]**
9/08 • • with ratchet and pawl **[1, 2006.01]**

**11/00** **Reciprocating-piston machines or engines without rotary main shaft, e.g. of free-piston type [1, 2006.01]**
11/02 • Equalising or cushioning devices **[1, 2006.01]**
11/04 • Engines combined with reciprocatory driven devices, e.g. hammers (with pumps F01B 23/08; predominating aspects of driven devices, see the relevant classes for the devices) **[1, 2006.01]**
11/06 • • for generating vibration only **[1, 2006.01]**
11/08 • with direct fluid transmission link (F01B 11/02 takes precedence) **[1, 2006.01]**

**13/00** **Reciprocating-piston machines or engines with rotating cylinders in order to obtain the reciprocating-piston motion** (machines or engines of flexible-wall type F01B 19/00) **[1, 2, 2006.01]**
13/02 • with one cylinder only **[1, 2006.01]**
13/04 • with more than one cylinder **[1, 2006.01]**
13/06 • • in star arrangement **[1, 2006.01]**

**15/00** **Reciprocating-piston machines or engines with movable cylinders other than provided for in group F01B 13/00** (with movable cylinder sleeves for working-fluid control F01L) **[1, 2006.01]**
15/02 • with reciprocating cylinders (with one piston within another F01B 7/20) **[1, 2006.01]**
15/04 • with oscillating cylinder **[1, 2006.01]**
15/06 • • Control of working-fluid admission or discharge peculiar thereto **[1, 2006.01]**

**17/00** **Reciprocating-piston machines or engines characterised by use of uniflow principle [1, 2006.01]**
17/02 • Engines **[1, 2006.01]**
17/04 • • Steam engines **[1, 2006.01]**

**19/00** **Positive-displacement machines or engines of flexible-wall type [1, 2006.01]**
19/02 • with plate-like flexible members **[1, 2006.01]**
19/04 • with tubular flexible members **[1, 2006.01]**

**21/00** **Combinations of two or more machines or engines** (F01B 23/00 takes precedence; combinations of two or more pumps F04; fluid gearing F16H; regulating or controlling, see the relevant groups) **[1, 2006.01]**
21/02 • the machines or engines being all of reciprocating-piston type **[1, 2006.01]**
21/04 • the machines or engines being not all of reciprocating-piston type, e.g. of reciprocating steam engine with steam turbine **[1, 2006.01]**

**23/00** **Adaptations of machines or engines for special use; Combinations of engines with devices driven thereby** (F01B 11/00 takes precedence; fluid gearing F16H; aspects predominantly concerning driven devices, see the relevant classes for these devices; regulating or controlling, see the relevant groups) **[1, 2006.01]**
23/02 • Adaptations for driving vehicles, e.g. locomotives (arrangements in vehicles, see the relevant classes for vehicles) **[1, 2006.01]**
23/04 • • the vehicles being waterborne vessels **[1, 2006.01]**
23/06 • Adaptations for driving, or combinations with, hand-held tools or the like **[1, 2006.01]**
23/08 • Adaptations for driving, or combinations with, pumps **[1, 2006.01]**
23/10 • Adaptations for driving, or combinations with, electric generators **[1, 2006.01]**
23/12 • Adaptations for driving rolling mills or other heavy reversing machinery **[1, 2006.01]**

**25/00** **Regulating, controlling, or safety means** (regulating or controlling in general G05) **[1, 2006.01]**
25/02 • Regulating or controlling by varying working-fluid admission or exhaust, e.g. by varying pressure or quantity (distributing or expansion valve gear F01L) **[1, 2006.01]**
25/04 • • Sensing elements **[1, 2006.01]**
25/06 • • • responsive to speed **[1, 2006.01]**
25/08 • • Final actuators **[1, 2006.01]**
25/10 • • • Arrangements or adaptations of working-fluid admission or discharge valves (valves in general F16K) **[1, 2006.01]**
25/12 • • Devices dealing with sensing elements or final actuators or transmitting means between them, e.g. power-assisted (sensing elements alone F01B 25/04; final actuators alone F01B 25/08) **[1, 2006.01]**
25/14 • • peculiar to particular kinds of machines or engines **[1, 2006.01]**
25/16 • Safety means responsive to specific conditions (against water hammer or the like in steam engines F01B 31/34) **[1, 2006.01]**
25/18 • • preventing rotation in wrong direction **[1, 2006.01]**
25/20 • Checking operation of safety devices **[1, 2006.01]**
25/22 • Braking by redirecting working fluid **[1, 2006.01]**
25/24 • • thereby regenerating energy **[1, 2006.01]**
25/26 • Warning devices **[1, 2006.01]**

**27/00** **Starting of machines or engines** (starting combustion engines F02N) **[1, 2006.01]**
27/02 • of reciprocating-piston engines **[1, 2006.01]**
27/04 • • by directing working-fluid supply, e.g. by aid of by-pass steam conduits **[1, 2006.01]**
27/06 • • • specially for compound engines **[1, 2006.01]**
27/08 • • Means for moving crank off dead-centre (turning-gear in general F16H) **[1, 2006.01]**

**29/00** **Machines or engines with pertinent characteristics other than those provided for in main groups F01B 1/00-F01B 27/00 [1, 2006.01]**

29/02 • Atmospheric engines, i.e. atmosphere acting against vacuum **[1, 2006.01]**

29/04 • characterised by means for converting from one type to a different one **[1, 2006.01]**

29/06 • • from steam engine into combustion engine **[1, 2006.01]**

29/08 • Reciprocating-piston machines or engines not otherwise provided for **[1, 2006.01]**

29/10 • • Engines (refrigeration machines F25B) **[1, 2006.01]**

29/12 • • • Steam engines (toy steam engines A63H 25/00) **[1, 2006.01]**

**31/00** **Component parts, details, or accessories not provided for in, or of interest apart from, other groups** (machine or engine casings, other than those peculiar to steam engines, F16M) **[1, 2006.01]**

31/02 • De-icing means for engines having icing phenomena **[1, 2006.01]**

31/04 • Means for equalising torque in reciprocating-piston machines or engines (compensation of inertial forces, suppression of vibration in systems F16F) **[1, 2006.01]**

31/06 • Means for compensating relative expansion of component parts **[1, 2006.01]**

31/08 • Cooling of steam engines (cooling of fluid machines or engines in general F01P); Heating; Heat insulation (heat insulation in general F16L 59/00) **[1, 2006.01]**

31/10 • Lubricating arrangements of steam engines (of fluid machines or engines in general F01M) **[1, 2006.01]**

31/12 • Arrangements of measuring or indicating devices (warning apparatus F01B 25/26; measuring instruments or the like per se G01) **[1, 2006.01]**

31/14 • Changing of compression ratio **[1, 2006.01]**

31/16 • Silencers specially adapted for steam engines (arrangements of exhaust pipes or tubes on steam engines F01B 31/30; gas-flow silencers or exhaust silencers for machines or engines in general F01N) **[1, 2006.01]**

31/18 • Draining **[1, 2006.01]**

31/20 • • of cylinders **[1, 2006.01]**

31/22 • Idling devices, e.g. having by-passing valves **[1, 2006.01]**

31/24 • • Disengagement of connections between pistons and main shafts **[1, 2006.01]**

31/26 • Other component parts, details, or accessories, peculiar to steam engines **[1, 2006.01]**

31/28 • • Cylinders or cylinder covers **[1, 2006.01]**

31/30 • • Arrangements of steam conduits **[1, 2006.01]**

31/32 • • Arrangements or adaptations of vacuum breakers **[1, 2006.01]**

31/34 • • Safety means against water hammer or against the penetration of water (steam traps F16T) **[1, 2006.01]**

31/36 • • • automatically cutting-off steam supply **[1, 2006.01]**

**F01C** **ROTARY-PISTON OR OSCILLATING-PISTON MACHINES OR ENGINES** (combustion engines F02; internal-combustion aspects F02B 53/00, F02B 55/00; machines for liquids F03, F04)

**Note(s)**

1. This subclass covers:
   - rotary-piston or oscillating-piston engines for elastic fluids, e.g. steam;
   - rotary-piston or oscillating-piston engines for liquids and elastic fluids;
   - rotary-piston or oscillating-piston machines for elastic fluids;
   - rotary-piston or oscillating-piston machines for liquids and elastic fluids.
2. In this subclass, the following expression is used with the meaning indicated:
   - "rotary-piston machine" includes the German expressions "Drehkolbenmaschinen", "Kreiskolbenmaschinen", and "Umlaufkolbenmaschinen".
3. Attention is drawn to the Notes preceding class F01, especially as regards the definitions of "rotary-piston machine", "oscillating-piston machine", "rotary piston", "co-operating members", "movement of co-operating members", "teeth or tooth-equivalents" and "internal-axis".

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**1/00** **Rotary-piston machines or engines** (with axes of co-operating members non-parallel F01C 3/00; with the working-chamber walls at least partly resiliently deformable F01C 5/00; with fluid ring or the like F01C 7/00; rotary-piston machines or engines in which the working fluid is exclusively displaced by, or exclusively displaces, one or more reciprocating pistons F01B 13/00) **[1, 2006.01]**

**Note(s)**

Group F01C 1/30 takes precedence over groups F01C 1/02-F01C 1/24.

1/02 • of arcuate-engagement type, i.e. with circular translatory movement of co-operating members, each member having the same number of teeth or tooth-equivalents **[1, 2006.01]**

1/04 • • of internal-axis type **[1, 2006.01]**

1/06 • • of other than internal-axis type (F01C 1/063 takes precedence) **[1, 2006.01]**

1/063 • • with coaxially-mounted members having continuously-changing circumferential spacing between them **[3, 2006.01]**

1/067 • • • having cam-and-follower type drive **[3, 2006.01]**

1/07 • • • having crankshaft-and-connecting-rod type drive **[3, 2006.01]**

1/073 • • • having pawl-and-ratchet type drive **[3, 2006.01]**

1/077 • • • having toothed-gearing type drive **[3, 2006.01]**

1/08 • of intermeshing-engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing **[1, 2006.01]**

1/10 • • of internal-axis type with the outer member having more teeth or tooth-equivalents, e.g. rollers, than the inner member **[1, 2006.01]**

1/107 • • • with helical teeth **[3, 2006.01]**

1/113 • • • the inner member carrying rollers intermeshing with the outer member **[3, 2006.01]**

1/12 • • of other than internal-axis type **[1, 2006.01]**

1/14 • • • with toothed rotary pistons **[1, 2006.01]**

1/16 • • • • with helical teeth, e.g. chevron-shaped, screw type **[1, 2006.01]**

1/18 • • • • with similar tooth forms (F01C 1/16 takes precedence) **[1, 2006.01]**

1/20 • • • • with dissimilar tooth forms (F01C 1/16 takes precedence) **[1, 2006.01]**

1/22 • of internal-axis type with equidirectional movement of co-operating members at the points of engagement, or with one of the co-operating members being stationary, the inner member having more teeth or tooth-equivalents than the outer member **[1, 2006.01]**

1/24 • of counter-engagement type, i.e. the movement of co-operating members at the points of engagement being in opposite directions **[1, 2006.01]**

1/26 • • of internal-axis type **[1, 2006.01]**

1/28 • • of other than internal-axis type **[1, 2006.01]**

1/30 • having the characteristics covered by two or more of groups F01C 1/02, F01C 1/08, F01C 1/22, F01C 1/24 or having the characteristics covered by one of these groups together with some other type of movement between co-operating members **[1, 2006.01]**

1/32 • • having both the movement defined in group F01C 1/02 and relative reciprocation between the co-operating members **[1, 2006.01]**

1/324 • • • with vanes hinged to the inner member and reciprocating with respect to the outer member **[3, 2006.01]**

1/328 • • • • and hinged to the outer member **[3, 2006.01]**

1/332 • • • with vanes hinged to the outer member and reciprocating with respect to the inner member **[3, 2006.01]**

1/336 • • • • and hinged to the inner member **[3, 2006.01]**

1/34 • • having the movement defined in group F01C 1/08 or F01C 1/22 and relative reciprocation between the co-operating members **[1, 2006.01]**

1/344 • • • with vanes reciprocating with respect to the inner member **[3, 2006.01]**

1/348 • • • • the vanes positively engaging, with circumferential play, an outer rotatable member **[3, 2006.01]**

1/352 • • • • the vanes being pivoted on the axis of the outer member **[3, 2006.01]**

1/356 • • • with vanes reciprocating with respect to the outer member **[3, 2006.01]**

1/36 • • having both the movements defined in groups F01C 1/22 and F01C 1/24 **[1, 2006.01]**

1/38 • • having the movement defined in group F01C 1/02 and having a hinged member (F01C 1/32 takes precedence) **[1, 3, 2006.01]**

1/39 • • • with vanes hinged to the inner as well as to the outer member **[3, 2006.01]**

1/40 • • having the movement defined in group F01C 1/08 or F01C 1/22 and having a hinged member **[1, 2006.01]**

1/44 • • • with vanes hinged to the inner member **[3, 2006.01]**

1/46 • • • with vanes hinged to the outer member **[3, 2006.01]**

**3/00 Rotary-piston machines or engines with non-parallel axes of movement of co-operating members** (with the working-chamber walls being at least partly resiliently deformable F01C 5/00) **[1, 2006.01]**

3/02 • the axes being arranged at an angle of 90° **[1, 2006.01]**

3/04 • • with axially-sliding vanes **[1, 2006.01]**

3/06 • the axes being arranged otherwise than at an angle of 90° **[1, 2006.01]**

3/08 • • of intermeshing-engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing **[1, 2006.01]**

**5/00 Rotary-piston machines or engines with the working-chamber walls at least partly resiliently deformable [1, 2006.01]**

5/02 • the resiliently-deformable wall being part of the inner member, e.g. of a rotary piston **[1, 2006.01]**

5/04 • the resiliently-deformable wall being part of the outer member, e.g. of a housing **[1, 2006.01]**

5/06 • the resiliently-deformable wall being a separate member **[1, 2006.01]**

5/08 • • of tubular form, e.g. hose **[1, 2006.01]**

**7/00 Rotary-piston machines or engines with fluid ring or the like [1, 2006.01]**

**9/00 Oscillating-piston machines or engines [1, 2006.01]**

**11/00 Combinations of two or more machines or engines, each being of rotary-piston or oscillating-piston type** (F01C 13/00 takes precedence; combinations of two or more pumps F04; fluid gearing F16H) **[1, 2006.01]**

**13/00 Adaptations of machines or engines for special use; Combinations of engines with devices driven thereby** (aspects predominantly concerning driven devices, see the relevant classes for these devices) **[1, 2006.01]**

13/02 • for driving hand-held tools or the like **[1, 2006.01]**

13/04 • for driving pumps or compressors **[1, 2006.01]**

**17/00 Arrangements for drive of co-operating members, e.g. for rotary piston and casing [1, 2006.01]**

17/02 • of toothed-gearing type (F01C 1/077 takes precedence) **[1, 3, 2006.01]**

17/04 • of cam-and-follower type (F01C 1/067 takes precedence) **[1, 3, 2006.01]**

17/06 • using cranks, universal joints, or similar elements (F01C 1/07 takes precedence) **[1, 3, 2006.01]**

**19/00 Sealing arrangements in rotary-piston machines or engines** (sealings in general F16J) **[1, 2006.01]**

19/02 • Radially-movable sealings for working fluids **[1, 2006.01]**

19/04 • • of rigid material **[1, 2006.01]**

19/06 • • of resilient material **[1, 2006.01]**

19/08 • Axially-movable sealings for working fluids **[1, 2006.01]**

19/10 • Sealings for working fluids between radially and axially movable parts **[1, 2006.01]**

19/12 • for other than working fluid **[1, 2006.01]**

**20/00 Control of, monitoring of, or safety arrangements for, machines or engines [2006.01]**

20/02 • specially adapted for several machines or engines connected in series or in parallel **[2006.01]**

20/04 • specially adapted for reversible machines or engines **[2006.01]**

20/06 • specially adapted for stopping, starting, idling or no-load operation **[2006.01]**

20/08 • characterised by varying the rotational speed **[2006.01]**

20/10 • characterised by changing the positions of the inlet or outlet openings with respect to the working chamber **[2006.01]**

20/12 • • using sliding valves **[2006.01]**

20/14 • • using rotating valves **[2006.01]**

20/16 • • using lift valves **[2006.01]**

20/18 • characterised by varying the volume of the working chamber (by changing the positions of inlet or outlet openings F01C 20/10) **[2006.01]**

20/20 • • by changing the form of the inner or outer contour of the working chamber **[2006.01]**

20/22 • • by changing the eccentricity between cooperating members **[2006.01]**

20/24 • characterised by using valves regulating pressure or flow rate, e.g. discharge valves (F01C 20/10 takes precedence) **[2006.01]**

20/26 • • using bypass channels **[2006.01]**

20/28 • Safety arrangements; Monitoring **[2006.01]**

**21/00 Component parts, details, or accessories, not provided for in groups F01C 1/00-F01C 20/00 [1, 2006.01]**

21/02 • Arrangements of bearings (bearing constructions F16C) **[1, 2006.01]**

21/04 • Lubrication (of machines or engines in general F01M) **[1, 2006.01]**

21/06 • Heating; Cooling (of machines or engines in general F01P); Heat insulation (heat insulation in general F16L) **[1, 2006.01]**

21/08 • Rotary pistons (reciprocating pistons in general F16J) **[1, 2006.01]**

21/10 • Outer members for co-operation with rotary pistons; Casings (casings for rotary engines or machines in general F16M) **[1, 2006.01]**

21/18 • Arrangements for admission or discharge of the working fluid, e.g. constructional features of the inlet or outlet **[2006.01]**

**F01D NON-POSITIVE-DISPLACEMENT MACHINES OR ENGINES, e.g. STEAM TURBINES** (combustion engines F02; machines or engines for liquids F03, F04; non-positive-displacement pumps F04D)

**Note(s)**

1. This subclass covers:
   - non-positive-displacement engines for elastic fluids, e.g. steam turbines;
   - non-positive-displacement engines for liquids and elastic fluids;
   - non-positive-displacement machines for elastic fluids;
   - non-positive-displacement machines for liquids and elastic fluids.
2. Attention is drawn to the Notes preceding class F01, especially as regards the definitions of "reaction type", e.g. with airfoil-like blades, and "impulse type", e.g. bucket turbines.

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**1/00 Non-positive-displacement machines or engines, e.g. steam turbines** (with working-fluid flows in opposite axial directions for balancing axial thrust F01D 3/02; with other than pure rotation F01D 23/00; turbines characterised by their use in special steam systems, cycles, or processes, regulating devices therefor F01K) **[1, 2006.01]**

1/02 • with stationary working-fluid guiding means and bladed or like rotor (F01D 1/24 takes precedence; without working-fluid guiding means F01D 1/18) **[1, 5, 2006.01]**

1/04 • • traversed by the working-fluid substantially axially **[1, 2006.01]**

1/06 • • traversed by the working-fluid substantially radially **[1, 2006.01]**
1/08 • • • having inward flow **[1, 2006.01]**
1/10 • • having two or more stages subjected to working-fluid flow without essential intermediate pressure change, i.e. with velocity stages (F01D 1/12 takes precedence) **[1, 2006.01]**
1/12 • • with repeated action on same blade ring **[1, 2006.01]**
1/14 • • • traversed by the working-fluid substantially radially **[1, 2006.01]**
1/16 • • characterised by having both reaction stages and impulse stages **[1, 2006.01]**
1/18 • without working-fluid guiding means (F01D 1/24, F01D 1/32, F01D 1/34 take precedence) **[1, 5, 2006.01]**
1/20 • • traversed by the working-fluid substantially axially **[1, 2006.01]**
1/22 • • traversed by the working-fluid substantially radially **[1, 2006.01]**
1/24 • characterised by counter-rotating rotors subjected to same working-fluid stream without intermediate stator blades or the like **[1, 2006.01]**
1/26 • • traversed by the working-fluid substantially axially **[1, 2006.01]**
1/28 • • traversed by the working-fluid substantially radially **[1, 2006.01]**
1/30 • characterised by having a single rotor operable in either direction of rotation, e.g. by reversing of blades (combinations of machines or engines F01D 13/00) **[1, 2006.01]**
1/32 • with pressure/velocity transformation exclusively in rotor, e.g. the rotor rotating under the influence of jets issuing from the rotor **[1, 2006.01]**
1/34 • characterised by non-bladed rotor, e.g. with drilled holes (F01D 1/32 takes precedence; sirens G10K 7/00) **[1, 5, 2006.01]**
1/36 • • using fluid friction **[1, 2006.01]**
1/38 • • of the screw type **[5, 2006.01]**

**3/00 Machines or engines with axial-thrust balancing effected by working fluid [1, 2006.01]**
3/02 • characterised by having one fluid flow in one axial direction and another fluid flow in the opposite direction **[1, 2006.01]**
3/04 • axial thrust being compensated by thrust-balancing dummy piston or the like **[1, 2006.01]**

**5/00 Blades; Blade-carrying members** (nozzle boxes F01D 9/02)**; Heating, heat-insulating, cooling, or antivibration means on the blades or the members [1, 2006.01]**
5/02 • Blade-carrying members, e.g. rotors (rotors of non-bladed type F01D 1/34; stators F01D 9/00) **[1, 2006.01]**
5/03 • • Annular blade-carrying members having blades on the inner periphery of the annulus and extending inwardly radially, i.e. inverted rotors **[6, 2006.01]**
5/04 • • for radial-flow machines or engines **[1, 2006.01]**
5/06 • • Rotors for more than one axial stage, e.g. of drum or multiple-disc type; Details thereof, e.g. shafts, shaft connections **[1, 2006.01]**
5/08 • • Heating, heat-insulating, or cooling means **[1, 2006.01]**
5/10 • • Antivibration means **[1, 2006.01]**
5/12 • Blades (blade roots F01D 5/30; rotors with blades adjustable in operation F01D 7/00; stator blades F01D 9/02) **[1, 2006.01]**
5/14 • • Form or construction (selecting particular materials, measures against erosion or corrosion F01D 5/28) **[1, 2006.01]**
5/16 • • • for counteracting blade vibration **[1, 2006.01]**
5/18 • • • Hollow blades; Heating, heat-insulating, or cooling means on blades **[1, 2006.01]**
5/20 • • • Specially-shaped blade tips to seal space between tips and stator **[1, 2006.01]**
5/22 • • Blade-to-blade connections, e.g. by shrouding **[1, 2006.01]**
5/24 • • • using wire or the like **[1, 2006.01]**
5/26 • • Antivibration means not restricted to blade form or construction or to blade-to-blade connections **[1, 2006.01]**
5/28 • • Selecting particular materials; Measures against erosion or corrosion **[1, 2006.01]**
5/30 • Fixing blades to rotors; Blade roots **[1, 2006.01]**
5/32 • • Locking, e.g. by final locking-blades or keys **[1, 2006.01]**
5/34 • Rotor-blade aggregates of unitary construction **[1, 2006.01]**

**7/00 Rotors with blades adjustable in operation; Control thereof** (for reversing F01D 1/30) **[1, 2006.01]**
7/02 • having adjustment responsive to speed **[1, 2006.01]**

**9/00 Stators** (non-fluid guiding aspects of casings, regulating, controlling, or safety aspects, see the relevant groups) **[1, 2006.01]**
9/02 • Nozzles; Nozzle boxes; Stator blades; Guide conduits **[1, 2006.01]**
9/04 • • forming ring or sector **[1, 2006.01]**
9/06 • Fluid supply conduits to nozzles or the like **[1, 2006.01]**

**11/00 Preventing or minimising internal leakage of working fluid, e.g. between stages** (sealings in general F16J) **[1, 2006.01]**
11/02 • by non-contact sealings, e.g. of labyrinth type (for sealing space between rotor blade tips and stator F01D 11/08) **[1, 2006.01]**
11/04 • • using sealing fluid, e.g. steam **[1, 2006.01]**
11/06 • • • Control thereof **[1, 2006.01]**
11/08 • for sealing space between rotor blade tips and stator (specially-shaped blade tips therefor F01D 5/20) **[1, 2006.01]**
11/10 • • using sealing fluid, e.g. steam **[1, 2006.01]**
11/12 • • using a rubstrip, e.g. erodible, deformable or resiliently biased part **[6, 2006.01]**
11/14 • • Adjusting or regulating tip-clearance, i.e. distance between rotor-blade tips and stator casing (rotors with blades adjustable in operation F01D 7/00) **[6, 2006.01]**
11/16 • • • by self-adjusting means (F01D 11/12 takes precedence) **[6, 2006.01]**
11/18 • • • • using stator or rotor components with predetermined thermal response, e.g. selective insulation, thermal inertia, differential expansion **[6, 2006.01]**
11/20 • • • Actively adjusting tip-clearance **[6, 2006.01]**
11/22 • • • • by mechanically actuating the stator or rotor components, e.g. moving shroud sections relative to the rotor **[6, 2006.01]**
11/24 • • • • by selectively cooling or heating stator or rotor components **[6, 2006.01]**

**13/00 Combinations of two or more machines or engines** (F01D 15/00 takes precedence; combinations of two or more pumps F04; fluid gearing F16H; regulating or controlling, see the relevant groups) **[1, 2006.01]**

13/02 • Working-fluid interconnection of machines or engines **[1, 2006.01]**

**15/00 Adaptations of machines or engines for special use; Combinations of engines with devices driven thereby** (regulating or controlling, see the relevant groups; aspects predominantly concerning driven devices, see the relevant classes for the devices) **[1, 2006.01]**

15/02 • Adaptations for driving vehicles, e.g. locomotives (arrangement in vehicles, see the relevant vehicle classes) **[1, 2006.01]**

15/04 • • the vehicles being waterborne vessels **[1, 2006.01]**

15/06 • Adaptations for driving, or combinations with, hand-held tools or the like **[1, 2006.01]**

15/08 • Adaptations for driving, or combinations with, pumps **[1, 2006.01]**

15/10 • Adaptations for driving, or combinations with, electric generators **[1, 2006.01]**

15/12 • Combinations with mechanical gearing (driven by multiple engines F01D 13/00) **[1, 2006.01]**

**17/00 Regulating or controlling by varying flow** (for reversing F01D 1/30; by varying rotor blade position F01D 7/00; specially for starting F01D 19/00; shutting-down F01D 21/00; regulating or controlling in general G05) **[1, 2006.01]**

17/02 • Arrangement of sensing elements (sensing elements per se, see the relevant subclasses) **[1, 2006.01]**

17/04 • • responsive to load **[1, 2006.01]**

17/06 • • responsive to speed **[1, 2006.01]**

17/08 • • responsive to condition of working fluid, e.g. pressure **[1, 2006.01]**

17/10 • Final actuators (valves in general F16K) **[1, 2006.01]**

17/12 • • arranged in stator parts **[1, 2006.01]**

17/14 • • • varying effective cross-sectional area of nozzles or guide conduits **[1, 2006.01]**

17/16 • • • • by means of nozzle vanes **[1, 2006.01]**

17/18 • • • varying effective number of nozzles or guide conduits **[1, 2006.01]**

17/20 • Devices dealing with sensing elements or final actuators or transmitting means between them, e.g. power-assisted (sensing elements alone F01D 17/02; final actuators alone F01D 17/10) **[1, 2006.01]**

17/22 • • the operation or power assistance being predominantly non-mechanical **[1, 2006.01]**

17/24 • • • electrical **[1, 2006.01]**

17/26 • • • fluid, e.g. hydraulic **[1, 2006.01]**

**19/00 Starting of machines or engines; Regulating, controlling, or safety means in connection therewith** (warming-up before starting F01D 25/10; turning or inching gear F01D 25/34) **[1, 2006.01]**

19/02 • dependent on temperature of component parts, e.g. of turbine casing **[1, 2006.01]**

**21/00 Shutting-down of machines or engines, e.g. in emergency; Regulating, controlling, or safety means not otherwise provided for [1, 2006.01]**

21/02 • Shutting-down responsive to overspeed **[1, 2006.01]**

21/04 • responsive to undesired position of rotor relative to stator, e.g. indicating such position **[1, 2006.01]**

21/06 • • Shutting-down **[1, 2006.01]**

21/08 • • Restoring position **[1, 2006.01]**

21/10 • responsive to unwanted deposits on blades, in working-fluid conduits, or the like **[1, 2006.01]**

21/12 • responsive to temperature **[1, 2006.01]**

21/14 • responsive to other specific conditions **[1, 2006.01]**

21/16 • Trip gear **[1, 2006.01]**

21/18 • • involving hydraulic means **[1, 2006.01]**

21/20 • Checking operation of shut-down devices **[1, 2006.01]**

**23/00 Non-positive-displacement machines or engines with movement other than pure rotation, e.g. of endless-chain type [1, 2006.01]**

**25/00 Component parts, details, or accessories, not provided for in, or of interest apart from, other groups [1, 2006.01]**

25/02 • De-icing means for engines having icing phenomena **[1, 2006.01]**

25/04 • Antivibration arrangements **[1, 2006.01]**

25/06 • • for preventing blade vibration (means on blade-carrying members or blades F01D 5/00) **[1, 2006.01]**

25/08 • Cooling (of machines or engines in general F01P); Heating; Heat insulation (of blade-carrying members, of blades F01D 5/00) **[1, 2006.01]**

25/10 • • Heating, e.g. warming-up before starting **[1, 2006.01]**

25/12 • • Cooling **[1, 2006.01]**

25/14 • • Casings modified therefor (double casings F01D 25/26) **[1, 2006.01]**

25/16 • Arrangement of bearings; Supporting or mounting bearings in casings (bearings per se F16C) **[1, 2006.01]**

25/18 • Lubricating arrangements (of machines or engines in general F01M) **[1, 2006.01]**

25/20 • • using lubrication pumps **[1, 2006.01]**

25/22 • • using working fluid or other gaseous fluid as lubricant **[1, 2006.01]**

25/24 • Casings (modified for heating or cooling F01D 25/14); Casing parts, e.g. diaphragms, casing fastenings (casings for rotary machines or engines in general F16M) **[1, 2006.01]**

25/26 • • Double casings; Measures against temperature strain in casings **[1, 2006.01]**

25/28 • Supporting or mounting arrangements, e.g. for turbine casing **[1, 2006.01]**

25/30 • Exhaust heads, chambers, or the like **[1, 2006.01]**

25/32 • Collecting of condensation water; Drainage **[1, 2006.01]**

25/34 • Turning or inching gear **[1, 2006.01]**

25/36 • • using electric motors **[1, 2006.01]**

**F01K STEAM ENGINE PLANTS; STEAM ACCUMULATORS; ENGINE PLANTS NOT OTHERWISE PROVIDED FOR; ENGINES USING SPECIAL WORKING FLUIDS OR CYCLES** (gas-turbine or jet-propulsion plants F02; steam generation F22; nuclear power plants, engine arrangements therein G21D)

**Note(s)**

Attention is drawn to the Notes preceding class F01, especially as regards the definitions of "steam" and "special vapour".

**Subclass index**



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**1/00 Steam accumulators** (use of accumulators in steam engine plants F01K 3/00) **[1, 2006.01]**

1/02 • for storing steam otherwise than in a liquid **[1, 2006.01]**

1/04 • for storing steam in a liquid, e.g. Ruth type (in alkali to increase steam pressure F22B 1/20) **[1, 2006.01]**

1/06 • • Internal fittings facilitating steam distribution, steam formation, or circulation (acting during charging or discharging F01K 1/08; fittings facilitating circulation through multiple accumulators F01K 1/14) **[1, 2006.01]**

1/08 • Charging or discharging of accumulators with steam (peculiar to multiple accumulators F01K 1/12) **[1, 2006.01]**

1/10 • specially adapted for superheated steam **[1, 2006.01]**

1/12 • Multiple accumulators; Charging, discharging, or regulating peculiar thereto **[1, 2006.01]**

1/14 • • Circulation **[1, 2006.01]**

1/16 • Other safety or regulating means **[1, 2006.01]**

1/18 • • for steam pressure **[1, 2006.01]**

1/20 • Other steam-accumulator parts, details, or accessories **[1, 2006.01]**

**Steam engine plants**

**3/00 Plants characterised by the use of steam or heat accumulators, or intermediate steam heaters, therein** (regenerating exhaust steam F01K 19/00) **[1, 2006.01]**

3/02 • Use of accumulators and specific engine types; Regulating thereof **[1, 2006.01]**

3/04 • • the engine being of multiple-inlet-pressure type **[1, 2006.01]**

3/06 • • the engine being of extraction or non-condensing type **[1, 2006.01]**

3/08 • Use of accumulators, the plant being specially adapted for a specific use **[1, 2006.01]**

3/10 • • for vehicle drive, e.g. for accumulator locomotives **[1, 2006.01]**

3/12 • having two or more accumulators **[1, 2006.01]**

3/14 • having both steam accumulator and heater, e.g. superheating accumulator (steam superheaters per se F22G) **[1, 2006.01]**

3/16 • • Mutual arrangement of accumulator and heater **[1, 2006.01]**

3/18 • having heaters (having both steam accumulator and heater F01K 3/14; steam heaters per se F22) **[1, 2006.01]**

3/20 • • with heating by combustion gases of main boiler **[1, 2006.01]**

3/22 • • • Controlling, e.g. starting, stopping **[1, 2006.01]**

3/24 • • with heating by separately-fired heaters **[1, 2006.01]**

3/26 • • with heating by steam **[1, 2006.01]**

**5/00 Plants characterised by use of means for storing steam in an alkali to increase steam pressure, e.g. of Honigmann or Koenemann type [1, 2006.01]**

5/02 • used in regenerative installation **[1, 2006.01]**

**7/00 Steam engine plants characterised by the use of specific types of engine** (F01K 3/02 takes precedence)**; Plants or engines characterised by their use of special steam systems, cycles, or processes** (reciprocating-piston engines using uniflow principle F01B 17/04)**; Regulating means peculiar to such systems, cycles, or processes; Use of withdrawn or exhaust steam for feed-water heating [1, 2006.01]**

7/02 • the engines being of multiple-expansion type (the engines being only of turbine type F01K 7/16; the engines using steam of critical or over-critical pressure F01K 7/32; the engines being of extraction or non-condensing type F01K 7/34) **[1, 2006.01]**

7/04 • • Regulating means peculiar thereto **[1, 2006.01]**

7/06 • the engines being of multiple-inlet-pressure type (F01K 7/02 takes precedence; the engines being only of turbine type F01K 7/16; the engines using steam of critical or over-critical pressure F01K 7/32; the engines being of extraction or non-condensing type F01K 7/34) **[1, 2006.01]**

7/08 • • Regulating means peculiar thereto **[1, 2006.01]**

7/10 • characterised by the engine exhaust pressure (the engines being only of turbine type F01K 7/16; the engines using steam of critical or over-critical pressure F01K 7/32; the engines being of extraction or non-condensing type F01K 7/34) **[1, 2006.01]**

7/12 • • of condensing type **[1, 2006.01]**

7/14 • • • Regulating means peculiar thereto **[1, 2006.01]**

7/16 • the engines being only of turbine type (the engines using steam of critical or over-critical pressure F01K 7/32; the engines being of extraction or non-condensing type F01K 7/34) **[1, 2006.01]**

7/18 • • the turbine being of multiple-inlet-pressure type **[1, 2006.01]**

7/20 • • • Regulating means peculiar thereto **[1, 2006.01]**

7/22 • • the turbines having inter-stage steam heating **[1, 2006.01]**

7/24 • • • Regulating or safety means peculiar thereto **[1, 2006.01]**

7/26 • • the turbines having inter-stage steam accumulation **[1, 2006.01]**

7/28 • • • Regulating means peculiar thereto **[1, 2006.01]**

7/30 • • the turbines using exhaust steam only **[1, 2006.01]**

7/32 • the engines using steam of critical or over-critical pressure **[1, 2006.01]**

7/34 • the engines being of extraction or non-condensing type; Use of steam for feed-water heating (feed-water heaters in general F22D) **[1, 2006.01]**

7/36 • • the engines being of positive-displacement type **[1, 2006.01]**

7/38 • • the engines being of turbine type **[1, 2006.01]**

7/40 • • Use of two or more feed-water heaters in series **[1, 2006.01]**

7/42 • • Use of desuperheaters for feed-water heating **[1, 2006.01]**

7/44 • • Use of steam for feed-water heating and another purpose **[1, 2006.01]**

**9/00 Steam engine plants characterised by condensers arranged or modified to co-operate with the engines** (by condensers structurally combined with engines F01K 11/00; steam condensers per se F28B) **[1, 2006.01]**

9/02 • Arrangements or modifications of condensate or air pumps **[1, 2006.01]**

9/04 • with dump valves to by-pass stages **[1, 2006.01]**

**11/00 Steam engine plants characterised by the engines being structurally combined with boilers or condensers [1, 2006.01]**

11/02 • the engines being turbines **[1, 2006.01]**

11/04 • the boilers or condensers being rotated in use **[1, 2006.01]**

**13/00 General layout or general methods of operation, of complete steam engine plants [1, 2006.01]**

13/02 • Regulating, e.g. stopping or starting **[1, 2006.01]**

**15/00 Adaptations of steam engine plants for special use [1, 2006.01]**

15/02 • for driving vehicles, e.g. locomotives (arrangements in vehicles, see the relevant vehicle classes) **[1, 2006.01]**

15/04 • • the vehicles being waterborne vessels **[1, 2006.01]**

**17/00 Use of steam or condensate extracted or exhausted from steam engine plant** (for heating feed-water F01K 7/34; returning condensate to boiler F22D) **[1, 2006.01]**

17/02 • for heating purposes, e.g. industrial, domestic (F01K 17/06 takes precedence; domestic- or space-heating systems, e.g. central-heating systems, in general F24D 1/00, F24D 3/00, F24D 9/00) **[1, 3, 2006.01]**

17/04 • for specific purposes other than heating (F01K 17/06 takes precedence) **[1, 2006.01]**

17/06 • Returning energy of steam, in exchanged form, to process, e.g. use of exhaust steam for drying solid fuel of plant **[1, 2006.01]**

**19/00 Regenerating or otherwise treating steam exhaust from steam engine plant** (plants characterised by use of means for storing steam in an alkali to increase steam pressure F01K 5/00; returning condensate to boiler F22D) **[1, 2006.01]**

19/02 • Regenerating by compression **[1, 2006.01]**

19/04 • • in combination with cooling or heating **[1, 2006.01]**

19/06 • • in engine cylinder **[1, 2006.01]**

19/08 • • compression done by injection apparatus, jet blower, or the like **[1, 2006.01]**

19/10 • Cooling exhaust steam other than by condenser; Rendering exhaust steam invisible **[1, 2006.01]**

**21/00 Steam engine plants not otherwise provided for [1, 2006.01]**

21/02 • with steam generation in engine cylinders **[1, 2006.01]**

21/04 • using mixtures of steam and gas; Plants generating or heating steam by bringing water or steam into direct contact with hot gas (direct-contact steam generators in general F22B) **[1, 2006.01]**

21/06 • Treating live steam, other than thermodynamically, e.g. for fighting deposits in engine **[1, 2006.01]**

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**23/00 Plants characterised by more than one engine delivering power external to the plant, the engines being driven by different fluids [1, 2006.01]**

23/02 • the engine cycles being thermally coupled **[1, 2006.01]**

23/04 • • condensation heat from one cycle heating the fluid in another cycle **[1, 2006.01]**

23/06 • • combustion heat from one cycle heating the fluid in another cycle **[1, 2006.01]**

23/08 • • • with working fluid of one cycle heating the fluid in another cycle **[1, 2006.01]**

23/10 • • • with exhaust fluid of one cycle heating the fluid in another cycle **[1, 2006.01]**

23/12 • the engines being mechanically coupled (F01K 23/02 takes precedence) **[1, 2006.01]**

23/14 • • including at least one combustion engine **[1, 2006.01]**

23/16 • • all the engines being turbines (F01K 23/14 takes precedence) **[1, 2006.01]**

23/18 • characterised by adaptation for specific use **[1, 2006.01]**

**25/00** **Plants or engines characterised by use of special working fluids, not otherwise provided for; Plants operating in closed cycles and not otherwise provided for [1, 2006.01]**

25/02 • the fluid remaining in the liquid phase **[1, 2006.01]**

25/04 • the fluid being in different phases, e.g. foamed **[1, 2006.01]**

25/06 • using mixtures of different fluids (plants using mixtures of steam and gas F01K 21/04) **[1, 2006.01]**

25/08 • using special vapours **[1, 2006.01]**

25/10 • • the vapours being cold, e.g. ammonia, carbon dioxide, ether **[1, 2006.01]**

25/12 • • the vapours being metallic, e.g. mercury **[1, 2006.01]**

25/14 • • using industrial or other waste gases **[1, 2006.01]**

**27/00** **Plants for converting heat or fluid energy into mechanical energy, not otherwise provided for [1, 2006.01]**

27/02 • Plants modified to use their waste heat, other than that of exhaust, e.g. engine-friction heat **[1, 2006.01]**

## F01L CYCLICALLY OPERATING VALVES FOR MACHINES OR ENGINES (valves in general F16K)

**Note(s) [2009.01]**

1. Groups F01L 1/00-F01L 13/00 cover only valve-gear or valve arrangements without provision for variable fluid distribution.
2. Valve gear or valve arrangements specially adapted for steam engines are covered by groups F01L 15/00-F01L 35/00.
3. Valve-gear or valve arrangements specially adapted for machines or engines with variable working-fluid distribution are covered by groups F01L 15/00-F01L 35/00.
4. Attention is drawn to the Notes preceding class F01, especially Note (3).
5. As regards the above-mentioned Note (3), attention is drawn to F01B 3/10, F01B 15/06, F01C 20/20, F01C 21/18, F02B 53/06, F03C 1/08, F04B 1/18, F04B 7/00, F04B 39/08, F04B 39/10, F04C 14/00, F04C 15/06, F04C 28/00and F04C 29/12.

**Subclass index**



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**Valve-gear or valve arrangements for positive-displacement machines or engines other than steam engines, e.g. for internal-combustion piston engines, without provision for variable fluid distribution**

**1/00** **Valve-gear or valve arrangements, e.g. lift-valve gear** (lift valve and valve seat assemblies per se F01L 3/00; slide-valve gear F01L 5/00; actuated non-mechanically F01L 9/00; valve arrangements in working piston or piston-rod F01L 11/00; modifications of valve-gear to facilitate reversing, braking, starting, changing compression ratio, or other specific operations F01L 13/00) **[1, 2006.01]**

1/02 • Valve drive (transmitting-gear between valve drive and valve F01L 1/12) **[1, 2006.01]**

1/04 • • by means of cams, camshafts, cam discs, eccentrics, or the like (F01L 1/10 takes precedence) **[1, 2006.01]**

1/047 • • • Camshafts **[6, 2006.01]**

1/053 • • • • overhead type **[6, 2006.01]**

1/06 • • • the cams, or the like, rotating at a higher speed than that corresponding to the valve cycle, e.g. operating four-stroke engine valves directly from crankshaft **[1, 2006.01]**

1/08 • • • Shape of cams **[1, 2006.01]**

1/10 • • by means of crank- or eccentric-driven rods **[1, 2006.01]**

1/12 • Transmitting-gear between valve drive and valve (simultaneously operating two or more valves F01L 1/26) **[1, 2006.01]**

1/14 • • Tappets; Push-rods **[1, 2006.01]**

1/16 • • • Silencing impact; Reducing wear **[1, 2006.01]**

1/18 • • Rocking arms or levers **[1, 2006.01]**

1/20 • Adjusting or compensating clearance, i.e. lash adjustment **[1, 2006.01]**

1/22 • • automatically **[1, 2006.01]**
1/24 • • • by fluid means, e.g. hydraulically **[1, 2006.01]**
1/245 • • • • Hydraulic tappets **[6, 2006.01]**
1/25 • • • • • between cam and valve stem **[6, 2006.01]**
1/255 • • • • • between cam and rocker arm **[6, 2006.01]**
1/26 • characterised by the provision of two or more valves operated simultaneously by same transmitting-gear; peculiar to machines or engines with more than two lift valves per cylinder (with coaxial valves F01L 1/28) **[1, 2006.01]**
1/28 • characterised by the provision of coaxial valves; characterised by the provision of valves co-operating with both intake and exhaust ports **[1, 2006.01]**
1/30 • characterised by the provision of positively opened and closed valves, i.e. desmodromic valves **[1, 2006.01]**
1/32 • characterised by the provision of means for rotating lift valves, e.g. to diminish wear **[1, 2006.01]**
1/34 • characterised by the provision of means for changing the timing of the valves without changing the duration of opening **[1, 2006.01]**
1/344 • • changing the angular relationship between crankshaft and camshaft, e.g. using helicoidal gear **[6, 2006.01]**
1/348 • • • by means acting on timing belts or chains **[6, 2006.01]**
1/352 • • • using bevel or epicyclic gear **[6, 2006.01]**
1/356 • • • making the angular relationship oscillate **[6, 2006.01]**
1/36 • peculiar to machines or engines of specific type other than four-stroke cycle **[1, 2006.01]**
1/38 • • for engines with other than four-stroke cycle, e.g. with two-stroke cycle (F01L 1/26, F01L 1/28 take precedence) **[1, 2006.01]**
1/40 • • for engines with scavenging charge near top dead-centre position, e.g. by overlapping inlet and exhaust time (scavenging aspects F02B) **[1, 2006.01]**
1/42 • • for machines or engines characterised by cylinder arrangement, e.g. star or fan **[1, 2006.01]**
1/44 • Multiple-valve gear or arrangements, not provided for in preceding subgroups, e.g. with lift and different valves **[1, 2006.01]**
1/46 • Component parts, details, or accessories, not provided for in preceding subgroups **[1, 2006.01]**

**3/00 Lift valves, i.e. cut-off apparatus with closure members having at least a component of their opening and closing motion perpendicular to the closing faces; Parts or accessories thereof [1, 2006.01]**

3/02 • Selecting particular materials for valve members or valve seats; Valve members or valve seats composed of two or more materials **[1, 2006.01]**
3/04 • • Coated valve members or valve seats **[1, 2006.01]**
3/06 • Valve members or valve seats with means for guiding or deflecting the medium controlled thereby, e.g. producing a rotary motion of the drawn-in cylinder charge (for rotating lift valves F01L 1/32) **[1, 2006.01]**
3/08 • Valve guides; Sealing of valve stem, e.g. sealing by lubricant **[1, 2006.01]**
3/10 • Connecting springs to valve members **[1, 2006.01]**
3/12 • Cooling of valves **[1, 2006.01]**
3/14 • • by means of a liquid or solid coolant, e.g. sodium, in a closed chamber in a valve **[1, 2006.01]**
3/16 • • by means of a fluid flowing through or along valve, e.g. air (for sealing only F01L 3/08) **[1, 2006.01]**
3/18 • • • Liquid cooling of valve **[1, 2006.01]**
3/20 • Shapes or constructions of valve members, not provided for in preceding subgroups of this group **[1, 2006.01]**
3/22 • Valve seats not provided for in preceding subgroups of this group; Fixing of valve seats **[1, 2006.01]**
3/24 • Safety means or accessories, not provided for in preceding subgroups of this group **[1, 2006.01]**

**5/00 Slide-valve gear or valve arrangements** (with pure rotary or oscillatory movement F01L 7/00) **[1, 2006.01]**

5/02 • with other than cylindrical, sleeve, or part-annularly-shaped valves, e.g. with flat-type valves **[1, 2006.01]**
5/04 • with cylindrical, sleeve, or part-annularly-shaped valves **[1, 2006.01]**
5/06 • • surrounding working cylinder or piston **[1, 2006.01]**
5/08 • • • Arrangements with several movements or several valves, e.g. one valve inside the other (with part-annularly-shaped valves F01L 5/12) **[1, 2006.01]**
5/10 • • • • with reciprocating and other movement of same valve **[1, 2006.01]**
5/12 • • • Arrangements with part-annularly-shaped valves **[1, 2006.01]**
5/14 • characterised by the provision of valves with reciprocating and other movements (surrounding working cylinder or piston F01L 5/06) **[1, 2006.01]**
5/16 • • with reciprocating and other movement of same valve, e.g. longitudinally and in cross direction of working cylinder **[1, 2006.01]**
5/18 • • with reciprocatory valve and other slide valve **[1, 2006.01]**
5/20 • specially for two-stroke engines (F01L 5/06, F01L 5/14 take precedence) **[1, 2006.01]**
5/22 • Multiple-valve arrangements (with valves surrounding working cylinder or piston F01L 5/06; with reciprocatory and other slide valves F01L 5/18; specially for two-stroke engines F01L 5/20) **[1, 2006.01]**
5/24 • Component parts, details, or accessories, not provided for in preceding subgroups of this group **[1, 2006.01]**

**7/00 Rotary or oscillatory slide-valve gear or valve arrangements** (slide valves with combined rotary and non-rotary movements, combinations of rotary and non-rotary slide valves F01L 5/00) **[1, 2006.01]**

7/02 • with cylindrical, sleeve, or part-annularly-shaped valves (of disc type F01L 7/06; of conical type F01L 7/08) **[1, 2006.01]**
7/04 • • surrounding working cylinder or piston **[1, 2006.01]**
7/06 • with disc-type valves **[1, 2006.01]**
7/08 • with conically- or frusto-conically-shaped valves **[1, 2006.01]**
7/10 • with valves of other specific shape, e.g. spherical **[1, 2006.01]**
7/12 • specially for two-stroke engines (F01L 7/04 takes precedence) **[1, 2006.01]**
7/14 • Multiple-valve arrangements (with valves surrounding working cylinder or piston F01L 7/04; specially for two-stroke engines F01L 7/12) **[1, 2006.01]**

7/16 • Sealing or packing arrangements specially therefor **[1, 2006.01]**

7/18 • Component parts, details, or accessories, not provided for in preceding subgroups of this group **[1, 2006.01]**

**9/00 Valve-gear or valve arrangements actuated non-mechanically [1, 2006.01]**

9/02 • by fluid means, e.g. hydraulic **[1, 2006.01]**

9/04 • by electric means **[1, 2006.01]**

**11/00 Valve arrangements in working piston or piston-rod [1, 2006.01]**

11/02 • in piston **[1, 2006.01]**

11/04 • • operated by movement of connecting-rod **[1, 2006.01]**

11/06 • • • operating oscillatory valve **[1, 2006.01]**

**13/00 Modifications of valve-gear to facilitate reversing, braking, starting, changing compression ratio, or other specific operations [1, 2006.01]**

13/02 • for reversing **[1, 2006.01]**

13/04 • for starting by means of fluid pressure **[1, 2006.01]**

13/06 • for braking **[1, 2006.01]**

13/08 • for decompression, e.g. during starting; for changing compression ratio **[1, 2006.01]**

**Valve-gear or valve arrangements specially adapted for steam engines, or specially adapted for other positive-displacement machines or engines with variable working-fluid distribution**

**Note(s)**

1. Groups F01L 15/00-F01L 31/00cover:
   - valve drive or means external to valves for adjustment during operation;
   - tripping-gear;
   - reversing-gear;
   - use of pistons or piston-rods as valves or as valve-supporting elements;
   - valve-gear or valve arrangements peculiar to free-piston machines or engines.
2. Groups F01L 15/00-F01L 31/00do not fully cover subject matter restricted to rotary, oscillatory, or lift-valve gear or valve arrangements, which is covered by group F01L 33/00 or F01L 35/00.

**15/00 Valve-gear or valve arrangements, e.g. with reciprocatory slide valves, other than provided for in groups F01L 17/00-F01L 29/00** (valve drive or external valve-adjustment during operation, see the relevant groups, e.g. F01L 31/00; tripping-gear or tripping of valves F01L 31/00) **[1, 2006.01]**

15/02 • with valves other than cylindrical, sleeve, or part-annularly-shaped, e.g. flat D-valves **[1, 2006.01]**

15/04 • • main valve being combined with auxiliary valve (of drag-valve type F01L 15/10) **[1, 2006.01]**

15/06 • • • of Meyer or Rider type, i.e. in which the expansion is varied at the expansion valve itself **[1, 2006.01]**

15/08 • with cylindrical, sleeve, or part-annularly-shaped valves; Such main valves combined with auxiliary valves **[1, 2006.01]**

15/10 • with main slide valve and auxiliary valve dragged thereby **[1, 2006.01]**

15/12 • characterised by having means for effecting pressure equilibrium between two different cylinder spaces at idling **[1, 2006.01]**

15/14 • Arrangements with several co-operating main valves, e.g. reciprocatory and rotary **[1, 2006.01]**

15/16 • • with reciprocatory slide valves only **[1, 2006.01]**

15/18 • Valve arrangements not provided for in preceding subgroups of this group **[1, 2006.01]**

15/20 • Component parts, details, or accessories, not provided for in preceding subgroups of this group **[1, 2006.01]**

**17/00 Slide-valve gear or valve arrangements with cylindrical, sleeve, or part-annularly-shaped valves surrounding working cylinder or piston [1, 2006.01]**

17/02 • Drive, or adjustment during operation, peculiar thereto, e.g. for reciprocating and oscillating movements or for several valves one inside the other **[1, 2006.01]**

**19/00 Slide-valve gear or valve arrangements with reciprocatory and other movement of same valve, other than provided for in group F01L 17/00, e.g. longitudinally and in cross direction of working cylinder [1, 2006.01]**

19/02 • Drive, or adjustment during operation, peculiar thereto **[1, 2006.01]**

**21/00 Use of working pistons or piston-rods as fluid-distributing valves or as valve-supporting elements, e.g. in free-piston machines [1, 2006.01]**

21/02 • Piston or piston-rod used as valve member **[1, 2006.01]**

21/04 • Valves arranged in or on piston or piston-rod **[1, 2006.01]**

**23/00 Valves controlled by impact of piston, e.g. in free-piston machines [1, 2006.01]**

**25/00 Drive, or adjustment during operation, of distribution or expansion valves by non-mechanical means [1, 2006.01]**

25/02 • by fluid means **[1, 2006.01]**

25/04 • • by working fluid of machine or engine, e.g. free-piston machine **[1, 2006.01]**

25/06 • • • Arrangements with main and auxiliary valves, at least one of them being fluid-driven **[1, 2006.01]**

25/08 • by electric or magnetic means **[1, 2006.01]**

**27/00 Distribution or expansion-valve gear peculiar to free-piston machines or engines and not provided for in groups F01L 21/00-F01L 25/00 [1, 2006.01]**

27/02 • the machine or engine having rotary or oscillatory valves **[1, 2006.01]**

27/04 • Delayed-action controls, e.g. of cataract- or dash-pot-type **[1, 2006.01]**

**29/00 Reversing-gear** (equally usable for control of degree of working fluid admission, and reversing being of secondary importance F01L 31/00) **[1, 2006.01]**

29/02 • by displacing eccentric **[1, 2006.01]**

29/04 • by links or guide rods **[1, 2006.01]**

29/06 • by interchanging inlet and exhaust ports **[1, 2006.01]**

29/08 • specially for rotary or oscillatory valves **[1, 2006.01]**

29/10 • Details, e.g. drive **[1, 2006.01]**

29/12 • • Powered reverse gear **[1, 2006.01]**

**31/00** **Valve drive, valve adjustment during operation, or other valve control, not provided for in groups F01L 15/00-F01L 29/00** (sensing elements measuring the variable or condition to be controlled or regulated F01B) **[1, 2006.01]**

31/02 • with tripping-gear (for oscillatory valves F01L 31/06); Tripping of valves **[1, 2006.01]**

31/04 • • with positively-driven trip levers **[1, 2006.01]**

31/06 • with tripping-gear specially for oscillatory valves; Oscillatory tripping-valves, e.g. of Corliss type **[1, 2006.01]**

31/08 • Valve drive or valve adjustment, apart from tripping aspects; Positively-driven gear **[1, 2006.01]**

31/10 • • the drive being effected by eccentrics (F01L 31/14 takes precedence) **[1, 2006.01]**

31/12 • • • Valve adjustment by displacing eccentric **[1, 2006.01]**

31/14 • • Valve adjustment by links or guide rods, e.g. in valve-gears with eccentric drive **[1, 2006.01]**

31/16 • • the drive being effected by specific means other than eccentric, e.g. cams; Valve adjustment in connection with such drives **[1, 2006.01]**

31/18 • • specially for rotary or oscillatory valves **[1, 2006.01]**

31/20 • • • Valve adjustment **[1, 2006.01]**

31/22 • • specially for lift valves **[1, 2006.01]**

31/24 • • • Valve adjustment **[1, 2006.01]**

**Rotary or oscillatory slide-valve gear or lift-valve gear or such valve arrangements specially adapted for steam engines, or specially adapted for other positive-displacement machines or engines with variable working-fluid distribution**

**33/00** **Rotary or oscillatory slide-valve gear or valve arrangements, specially adapted for machines or engines with variable fluid distribution** (drive, adjustment during operation, tripping-gear, reversing-gear, use of working pistons or piston-rods as valves or as valve-supporting elements, valve-gear or valve arrangements peculiar to free-piston machines or engines F01L 15/00-F01L 31/00) **[1, 2006.01]**

33/02 • rotary **[1, 2006.01]**

33/04 • oscillatory **[1, 2006.01]**

**35/00** **Lift-valve gear or valve arrangements specially adapted for machines or engines with variable fluid distribution** (drive, adjustment during operation, tripping-gear, reversing-gear, use of working pistons or piston-rods as valves or as valve-supporting elements, valve-gear or valve arrangements peculiar to free-piston machines or engines F01L 15/00-F01L 31/00) **[1, 2006.01]**

35/02 • Valves **[1, 2006.01]**

35/04 • Arrangements of valves in the machine or engine, e.g. relative to working cylinder **[1, 2006.01]**

## F01M LUBRICATING OF MACHINES OR ENGINES IN GENERAL; LUBRICATING INTERNAL-COMBUSTION ENGINES; CRANKCASE VENTILATING [2]

**Note(s) [2006.01]**

1. Attention is drawn to the Notes preceding class F01, especially as regards Note (3).
2. Attention is drawn to the following places, which cover lubrication of specific machines or engines:
   - F01B 31/10.....Steam engines
   - F01C 21/04.....Rotary-piston or oscillating-piston machines or engines
   - F01D 25/18.....Non-positive-displacement machines
   - F02C 7/06.....Gas-turbine plants
   - F02F 1/20.....Cylinders of combustion engines
   - F04B 39/02.....Pumps for elastic fluids
   - F04C 29/02.....Rotary-piston or oscillating-piston pumps for liquids
   - F04D 29/04.....Non-positive-displacement pumps

**Subclass index**



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**1/00** **Pressure lubrication [1, 2006.01]**

1/02 • using lubricating pumps **[1, 2006.01]**

1/04 • using pressure in working cylinder or crankcase to operate lubricant-feeding devices **[1, 2006.01]**

1/06 • Lubricating systems characterised by the provision therein of crankshafts or connecting-rods with lubricant passageways, e.g. bores **[1, 2006.01]**

1/08 • Lubricating systems characterised by the provision therein of lubricant-jetting means **[1, 2006.01]**

1/10 • Lubricating systems characterised by the provision therein of lubricant venting or purifying means, e.g. of filters (mounting of, connecting of, or constructional details of lubricant purifying means F01M 11/03) **[1, 2006.01]**

1/12 • Closed-circuit lubricating systems not provided for in groups F01M 1/02-F01M 1/10 **[1, 2006.01]**

1/14 • Timed lubrication (F01M 1/08 takes precedence) **[1, 2006.01]**

1/16 • Controlling lubricant pressure or quantity **[1, 2006.01]**

1/18 • Indicating or safety devices (concerning lubricant level F01M 11/06, F01M 11/12) **[1, 2006.01]**

1/20 • • concerning lubricant pressure **[1, 2006.01]**
1/22 • • • rendering machines or engines inoperative or idling on pressure failure **[1, 2006.01]**
1/24 • • • • acting on engine fuel system **[1, 2006.01]**
1/26 • • • • acting on engine ignition system **[1, 2006.01]**
1/28 • • • • acting on engine combustion-air supply **[1, 2006.01]**

**3/00 Lubrication specially adapted for engines with crankcase compression of fuel-air mixture, or for other engines in which lubricant is contained in fuel, combustion air, or fuel-air mixture** (separating lubricant from air or fuel-air mixture before entry into cylinder F01M 11/08) **[1, 2006.01]**
3/02 • with variable proportion of lubricant to fuel, lubricant to air, or lubricant to fuel-air mixture **[1, 2006.01]**
3/04 • for upper cylinder lubrication only **[1, 2006.01]**

**5/00 Heating, cooling, or controlling temperature of lubricant** (arrangement of lubricant coolers in engine cooling system F01P 11/08)**; Lubrication means facilitating engine starting [1, 2006.01]**
5/02 • Conditioning lubricant for aiding engine starting, e.g. heating **[1, 2006.01]**
5/04 • • Diluting, e.g. with fuel **[1, 2006.01]**

**7/00 Lubrication means specially adapted for machine or engine running-in [1, 2006.01]**

**9/00 Lubrication means having pertinent characteristics not provided for in, or of interest apart from, groups F01M 1/00-F01M 7/00 [1, 2006.01]**
9/02 • having means for introducing additives to lubricant **[1, 2006.01]**
9/04 • Use of fuel as lubricant **[1, 2006.01]**
9/06 • Dip or splash lubrication **[1, 2006.01]**
9/08 • Drip lubrication **[1, 2006.01]**
9/10 • Lubrication of valve gear or auxiliaries **[1, 2006.01]**
9/12 • Non-pressurised lubrication, or non-closed-circuit lubrication, not otherwise provided for **[1, 2006.01]**

**11/00 Component parts, details, or accessories, not provided for in, or of interest apart from, groups F01M 1/00-F01M 9/00 [1, 2006.01]**
11/02 • Arrangements of lubricant conduits **[1, 2006.01]**
11/03 • Mounting or connecting of lubricant purifying means relative to the machine or engine; Details of lubricant purifying means **[3, 2006.01]**
11/04 • Filling or draining lubricant of or from machines or engines **[1, 2006.01]**
11/06 • Means for keeping lubricant level constant or for accommodating movement or position of machines or engines **[1, 2006.01]**
11/08 • Separating lubricant from air or fuel-air mixture before entry into cylinder **[1, 2006.01]**
11/10 • Indicating devices; Other safety devices **[1, 2006.01]**
11/12 • • concerning lubricant level **[1, 2006.01]**

**13/00 Crankcase ventilating or breathing [2, 2006.01]**
13/02 • by means of additional source of positive or negative pressure **[2, 2006.01]**
13/04 • having means for purifying air before leaving crankcase, e.g. removing oil **[2, 2006.01]**
13/06 • specially adapted for submersible engines, e.g. of armoured vehicles **[2, 2006.01]**

**F01N GAS-FLOW SILENCERS OR EXHAUST APPARATUS FOR MACHINES OR ENGINES IN GENERAL; GAS-FLOW SILENCERS OR EXHAUST APPARATUS FOR INTERNAL-COMBUSTION ENGINES** (arrangements in connection with gas exhaust of propulsion units in vehicles B60K 13/00; combustion-air intake silencers specially adapted for, or arranged on, internal-combustion engines F02M 35/00; protecting against, or damping, noise in general G10K 11/16)

**Note(s)**

Attention is drawn to the Notes preceding class F01, especially as regards Note (3).

**1/00 Silencing apparatus characterised by method of silencing [1, 2006.01]**
1/02 • by using resonance **[1, 2006.01]**
1/04 • • having sound-absorbing materials in resonance chambers **[1, 2006.01]**
1/06 • by using interference effect **[1, 2006.01]**
1/08 • by reducing exhaust energy by throttling or whirling **[1, 2006.01]**
1/10 • • in combination with sound-absorbing materials **[1, 2006.01]**
1/12 • • using spirally- or helically-shaped channels (F01N 1/10 takes precedence; cyclones B04C) **[1, 2006.01]**
1/14 • by adding air to exhaust gases **[1, 2006.01]**
1/16 • by using movable parts **[1, 2006.01]**
1/18 • • having rotary movement **[1, 2006.01]**
1/20 • • having oscillating or vibrating movement (the parts being resilient walls F01N 1/22) **[1, 2006.01]**
1/22 • • the parts being resilient walls **[1, 2006.01]**
1/24 • by using sound-absorbing materials (F01N 1/04, F01N 1/06, F01N 1/10, F01N 1/14, F01N 1/16 take precedence) **[1, 2006.01]**

**3/00 Exhaust or silencing apparatus having means for purifying, rendering innocuous, or otherwise treating exhaust** (electric control F01N 9/00; monitoring or diagnostic devices for exhaust-gas treatment apparatus F01N 11/00) **[1, 4, 2006.01]**
3/01 • by means of electric or electrostatic separators **[7, 2006.01]**
3/02 • for cooling, or for removing solid constituents of, exhaust (by means of electric or electrostatic separators F01N 3/01) **[1, 7, 2006.01]**
3/021 • • by means of filters **[7, 2006.01]**
3/022 • • • characterised by specially adapted filtering structure, e.g. honeycomb, mesh or fibrous **[7, 2006.01]**
3/023 • • • using means for regenerating the filters, e.g. by burning trapped particles **[7, 2006.01]**
3/025 • • • • using fuel burner or by adding fuel to exhaust **[7, 2006.01]**
3/027 • • • • using electric or magnetic heating **[7, 2006.01]**
3/028 • • • • • using microwaves **[7, 2006.01]**

3/029 • • • • by adding non-fuel substances to exhaust **[7, 2006.01]**
3/031 • • • having means for by-passing filters, e.g. when clogged or during cold engine start **[7, 2006.01]**
3/032 • • • • during filter regeneration only **[7, 2006.01]**
3/033 • • • in combination with other devices **[7, 2006.01]**
3/035 • • • • with catalytic reactors **[7, 2006.01]**
3/037 • • by means of inertial or centrifugal separators, e.g. associated with agglomerators **[7, 2006.01]**
3/038 • • by means of perforated plates defining expansion chambers associated with condensation and collection chambers **[7, 2006.01]**
3/04 • • by means of liquids **[1, 2006.01]**
3/05 • • by means of air, e.g. by mixing exhaust with air (silencers working by addition of air to exhaust F01N 1/14; arrangements for the supply of additional air for the thermal or catalytic conversion of noxious components of exhaust F01N 3/30) **[7, 2006.01]**
3/06 • for extinguishing sparks **[1, 2006.01]**
3/08 • for rendering innocuous (using electric or electrostatic separators F01N 3/01; chemical aspects B01D 53/92) **[1, 7, 2006.01]**
3/10 • • by thermal or catalytic conversion of noxious components of exhaust **[1, 3, 2006.01]**
3/18 • • • characterised by methods of operation; Regulation **[3, 2006.01]**
3/20 • • • • specially adapted for catalytic conversion (F01N 3/22 takes precedence) **[3, 2006.01]**
3/22 • • • • Regulation of additional air supply only, e.g. using by-passes or variable air pump drives **[3, 2006.01]**
3/24 • • • characterised by constructional aspects of converting apparatus (filtering in combination with catalytic reactors F01N 3/035) **[3, 7, 2006.01]**
3/26 • • • • Construction of thermal reactors **[3, 2006.01]**
3/28 • • • • Construction of catalytic reactors **[3, 2006.01]**
3/30 • • • • Arrangements for supply of additional air (regulation, e.g. using by-passes or variable air pump drives, F01N 3/22) **[3, 2006.01]**
3/32 • • • • • using air pumps (using jet air pumps F01N 3/34; pumps in general F04) **[3, 2006.01]**
3/34 • • • • • using air conduits or jet air pumps, e.g. near the engine exhaust port **[3, 2006.01]**
3/36 • • • • Arrangements for supply of additional fuel **[3, 2006.01]**
3/38 • • • • Arrangements for igniting **[3, 2006.01]**

**5/00 Exhaust or silencing apparatus combined or associated with devices profiting by exhaust energy** (using kinetic or wave energy of exhaust gases in exhaust systems for charging F02B; predominant aspects of such devices, see the relevant classes for the devices) **[1, 2006.01]**
5/02 • the devices using heat **[1, 2006.01]**
5/04 • the devices using kinetic energy **[1, 2006.01]**

**9/00 Electrical control of exhaust gas treating apparatus** (monitoring or diagnostic devices for exhaust-gas treatment apparatus F01N 11/00; conjoint electrical control of two or more combustion engine functions F02D 43/00) **[4, 2006.01]**

**11/00 Monitoring or diagnostic devices for exhaust-gas treatment apparatus [7, 2006.01]**

**13/00 Exhaust or silencing apparatus characterised by constructional features [2010.01]**
13/02 • having two or more separate silencers in series **[2010.01]**
13/04 • having two or more silencers in parallel, e.g. having interconnections for multi-cylinder engines **[2010.01]**
13/06 • specially adapted for star-arrangement of cylinders, e.g. exhaust manifolds **[2010.01]**
13/08 • Other arrangements or adaptations of exhaust conduits **[2010.01]**
13/10 • • of exhaust manifolds **[2010.01]**
13/12 • specially adapted for submerged exhausting **[2010.01]**
13/14 • having thermal insulation **[2010.01]**
13/16 • Selection of particular materials **[2010.01]**
13/18 • Construction facilitating manufacture, assembly or disassembly **[2010.01]**
13/20 • having flared outlets, e.g. of fish-tail shape **[2010.01]**

**99/00 Subject matter not provided for in other groups of this subclass [2010.01]**

**F01P COOLING OF MACHINES OR ENGINES IN GENERAL; COOLING OF INTERNAL-COMBUSTION ENGINES** (arrangements in connection with cooling of propulsion units in vehicles B60K 11/00; heat-transfer, heat-exchange or heat-storage materials C09K 5/00; heat-exchange in general, radiators F28)

**Note(s)**

1. In this subclass, the following terms or expressions are used with the meanings indicated:
   - "air" also includes other gaseous cooling fluids;
   - "liquid cooling" also includes cooling where liquid is used as the heat-transferring fluid between parts to be cooled and the air, e.g. using radiators;
   - "air cooling" means direct air cooling and thus excludes indirect air cooling occurring in liquid cooling systems as explained under liquid cooling above;
   - "cooling-air" includes directly- or indirectly-acting cooling-air.
2. Attention is drawn to the Notes preceding class F01, especially as regards Note (3).
3. Cooling by lubricant is classified in subclass F01M when the lubrication aspect predominates, and in subclass F01P when the cooling aspect predominates.

**Air cooling; Liquid cooling**

**1/00** **Air cooling** (propelling cooling-air or liquid coolants F01P 5/00; controlling supply or circulation of coolants F01P 7/00) **[1, 2006.01]**

1/02 • Arrangements for cooling cylinders or cylinder heads, e.g. ducting cooling-air from its pressure source to cylinders or along cylinders **[1, 2006.01]**

1/04 • Arrangements for cooling pistons **[1, 2006.01]**

1/06 • Arrangements for cooling other engine or machine parts **[1, 2006.01]**

1/08 • • for cooling intake or exhaust valves **[1, 2006.01]**

1/10 • • for cooling fuel injectors or sparking-plugs **[1, 2006.01]**

**3/00** **Liquid cooling** (propelling cooling-air or liquid coolants F01P 5/00; controlling supply or circulation of coolants F01P 7/00) **[1, 2006.01]**

3/02 • Arrangements for cooling cylinders or cylinder heads **[1, 2006.01]**

3/04 • • Liquid-to-air heat-exchangers combined with, or arranged on, cylinders or cylinder heads **[1, 2006.01]**

3/06 • Arrangements for cooling pistons **[1, 2006.01]**

3/08 • • Cooling of piston exterior only, e.g. by jets **[1, 2006.01]**

3/10 • • Cooling by flow of coolant through pistons **[1, 2006.01]**

3/12 • Arrangements for cooling other engine or machine parts **[1, 2006.01]**

3/14 • • for cooling intake or exhaust valves **[1, 2006.01]**

3/16 • • for cooling fuel injectors or sparking-plugs **[1, 2006.01]**

3/18 • Arrangement or mounting of liquid-to-air heat-exchangers (such arrangements on cylinders or cylinder heads F01P 3/04; relative to vehicles B60K 11/04) **[1, 2006.01]**

3/20 • Cooling circuits not specific to a single part of engine or machine (F01P 3/22 takes precedence) **[1, 2006.01]**

3/22 • characterised by evaporation and condensation of coolant in closed cycles (other cooling by evaporation F01P 9/02); characterised by the coolant reaching higher temperatures than normal atmospheric boiling-point **[1, 2006.01]**

**Pumping cooling-air or liquid coolants; Controlling circulation or supply of coolants**

**5/00** **Pumping cooling-air or liquid coolants** (controlling circulation or supply of coolants by influencing drive of pumps F01P 7/00) **[1, 2006.01]**

5/02 • Pumping cooling-air; Arrangements of cooling-air pumps, e.g. fans or blowers **[1, 2006.01]**

5/04 • • Pump-driving arrangements **[1, 2006.01]**

5/06 • • Guiding or ducting air to or from ducted fans **[1, 2006.01]**

5/08 • • • Use of engine exhaust gases for pumping cooling-air **[1, 2006.01]**

5/10 • Pumping liquid coolant; Arrangements of coolant pumps **[1, 2006.01]**

5/12 • • Pump-driving arrangements **[1, 2006.01]**

5/14 • Safety means against, or active at, failure of coolant-pump drives, e.g. shutting engine down; Means for indicating functioning of coolant pumps **[1, 2006.01]**

**7/00** **Controlling of coolant flow [1, 2006.01]**

7/02 • the coolant being cooling-air **[1, 2006.01]**

7/04 • • by varying pump speed, e.g. by changing pump-drive gear ratio **[1, 2006.01]**

7/06 • • by varying blade pitch **[1, 2006.01]**

7/08 • • by cutting in or out of pumps **[1, 2006.01]**

7/10 • • by throttling amount of air flowing through liquid-to-air heat-exchangers **[1, 2006.01]**

7/12 • • • by thermostatic control **[1, 2006.01]**

7/14 • the coolant being liquid **[1, 2006.01]**

7/16 • • by thermostatic control **[1, 2006.01]**

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**9/00** **Cooling having pertinent characteristics not provided for in, or of interest apart from, groups F01P 1/00-F01P 7/00** (profiting from waste heat of combustion-engine cooling F02G 5/00) **[1, 2006.01]**

9/02 • Cooling by evaporation, e.g. by spraying water on to cylinders (evaporation and condensation of liquid coolant in closed cycles F01P 3/22) **[1, 2006.01]**

9/04 • by simultaneous or alternative use of direct air cooling and liquid cooling (F01P 9/02 takes precedence) **[1, 2006.01]**

9/06 • by use of refrigerating apparatus, e.g. of compressor or absorber type **[1, 2006.01]**

**11/00** **Component parts, details, or accessories, not provided for in, or of interest apart from, groups F01P 1/00-F01P 9/00 [1, 2006.01]**

11/02 • Liquid-coolant overflow, venting, or draining devices (automatic draining during freezing conditions F01P 11/20) **[1, 2006.01]**

11/04 • Arrangements of liquid pipes or hoses **[1, 2006.01]**

11/06 • Cleaning (in general B08B); Combating corrosion (in general C23F) **[1, 2006.01]**

11/08 • Arrangements of lubricant coolers (in lubrication apparatus F01M) **[1, 2006.01]**

11/10 • Guiding or ducting cooling-air to or from liquid-to-air heat-exchangers **[1, 2006.01]**

11/12 • Filtering, cooling, or silencing cooling-air **[1, 2006.01]**

11/14 • Indicating devices; Other safety devices **[1, 2006.01]**

11/16 • • concerning coolant temperature (F01P 11/20 takes precedence) **[1, 2006.01]**

11/18 • • concerning coolant pressure, coolant flow, or liquid-coolant level **[1, 2006.01]**

11/20 • • concerning atmospheric freezing conditions, e.g. automatically draining or heating during frosty weather **[1, 2006.01]**