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

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

F01L CYCLICALLY OPERATING VALVES FOR MACHINES OR ENGINES

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 28/00 and F04C 29/12.

Subclass index

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 **[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 **[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 5/08; 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 [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, 2021.01]

9/10 • by fluid means, e.g. hydraulic **[2021.01]**

9/11 • • in which the action of a cam is being transmitted to a valve by a liquid column **[2021.01]**

9/12 • • • with a liquid chamber between a piston actuated by a cam and a piston acting on a valve stem **[2021.01]**

9/14 • • • • the volume of the chamber being variable, e.g. for varying the lift or the timing of a valve **[2021.01]**

9/16 • • Pneumatic means **[2021.01]**

9/18 • • Means for increasing the initial opening force on the valve **[2021.01]**

9/20 • by electric means **[2021.01]**

9/21 • • actuated by solenoids **[2021.01]**

9/22 • • actuated by rotary motors **[2021.01]**

9/24 • • Piezoelectric actuators **[2021.01]**

9/26 • • Driving circuits therefor **[2021.01]**

9/30 • Arrangements for setting the actuator position, e.g. the initial position **[2021.01]**

9/40 • Methods of operation thereof; Control of valve actuation, e.g. duration or lift **[2021.01]**

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 31/00 cover:
   - 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 31/00 do 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, 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 [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 25/04) **[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]**