

## 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 (valves in general F16K)

##### Note(s)

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.

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##### VALVE-GEAR OR VALVE ARRANGEMENTS IN GENERAL

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##### VALVE-GEAR OR VALVE ARRANGEMENTS FOR VARIABLE WORKING-FLUID DISTRIBUTION

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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)
- 1/02 • Valve drive (transmitting-gear between valve drive and valve F01L 1/12)
- 1/04 • • by means of cams, camshafts, cam discs, eccentrics, or the like (F01L 1/10 takes precedence)

- 1/047 • • • Camshafts [6]
- 1/053 • • • • overhead type [6]
- 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
- 1/08 • • • Shape of cams
- 1/10 • • by means of crank- or eccentric-driven rods
- 1/12 • Transmitting-gear between valve drive and valve (simultaneously operating two or more valves F01L 1/26)
- 1/14 • • Tappets; Push-rods
- 1/16 • • • Silencing impact; Reducing wear
- 1/18 • • Rocking arms or levers
- 1/20 • Adjusting or compensating clearance, i.e. lash adjustment
- 1/22 • • automatically

- 1/24 • • • by fluid means, e.g. hydraulically
- 1/245 • • • • Hydraulic tappets [6]
- 1/25 • • • • • between cam and valve stem [6]
- 1/255 • • • • • between cam and rocker arm [6]
- 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)
- 1/28 • characterised by the provision of coaxial valves; characterised by the provision of valves co-operating with both intake and exhaust ports
- 1/30 • characterised by the provision of positively opened and closed valves, i.e. desmodromic valves
- 1/32 • characterised by the provision of means for rotating lift valves, e.g. to diminish wear
- 1/34 • characterised by the provision of means for changing the timing of the valves without changing the duration of opening
- 1/344 • • changing the angular relationship between crankshaft and camshaft, e.g. using helicoidal gear [6]
- 1/348 • • • by means acting on timing belts or chains [6]
- 1/352 • • • using bevel or epicyclic gear [6]
- 1/356 • • • making the angular relationship oscillate [6]
- 1/36 • peculiar to machines or engines of specific type other than four-stroke cycle
- 1/38 • • for engines with other than four-stroke cycle, e.g. with two-stroke cycle (F01L 1/26, F01L 1/28 take precedence)
- 1/40 • • for engines with scavenging charge near top dead-centre position, e.g. by overlapping inlet and exhaust time (scavenging aspects F02B)
- 1/42 • • for machines or engines characterised by cylinder arrangement, e.g. star or fan
- 1/44 • Multiple-valve gear or arrangements, not provided for in preceding subgroups, e.g. with lift and different valves
- 1/46 • Component parts, details, or accessories, not provided for in preceding subgroups
- 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**
- 3/02 • Selecting particular materials for valve members or valve seats; Valve members or valve seats composed of two or more materials
- 3/04 • • Coated valve members or valve seats
- 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)
- 3/08 • Valve guides; Sealing of valve stem, e.g. sealing by lubricant
- 3/10 • Connecting springs to valve members
- 3/12 • Cooling of valves
- 3/14 • • by means of a liquid or solid coolant, e.g. sodium, in a closed chamber in a valve
- 3/16 • • by means of a fluid flowing through or along valve, e.g. air (for sealing only F01L 3/08)
- 3/18 • • • Liquid cooling of valve
- 3/20 • Shapes or constructions of valve members, not provided for in preceding subgroups of this group
- 3/22 • Valve seats not provided for in preceding subgroups of this group; Fixing of valve seats
- 3/24 • Safety means or accessories, not provided for in preceding subgroups of this group
- 5/00 Slide-valve gear or valve arrangements** (with pure rotary or oscillatory movement F01L 7/00)
- 5/02 • with other than cylindrical, sleeve, or part-annularly-shaped valves, e.g. with flat-type valves
- 5/04 • with cylindrical, sleeve, or part-annularly-shaped valves
- 5/06 • • surrounding working cylinder or piston
- 5/08 • • • Arrangements with several movements or several valves, e.g. one valve inside the other (with part-annularly-shaped valves F01L 5/12)
- 5/10 • • • • with reciprocating and other movement of same valve
- 5/12 • • • Arrangements with part-annularly-shaped valves
- 5/14 • characterised by the provision of valves with reciprocating and other movements (surrounding working cylinder or piston F01L 5/06)
- 5/16 • • with reciprocating and other movement of same valve, e.g. longitudinally and in cross direction of working cylinder
- 5/18 • • with reciprocating valve and other slide valve
- 5/20 • specially for two-stroke engines (F01L 5/06, F01L 5/14 take precedence)
- 5/22 • Multiple-valve arrangements (with valves surrounding working cylinder or piston F01L 5/06; with reciprocating and other slide valves F01L 5/18; specially for two-stroke engines F01L 5/20)
- 5/24 • Component parts, details, or accessories, not provided for in preceding subgroups of this group
- 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)
- 7/02 • with cylindrical, sleeve, or part-annularly-shaped valves (of disc type F01L 7/06; of conical type F01L 7/08)
- 7/04 • • surrounding working cylinder or piston
- 7/06 • with disc-type valves
- 7/08 • with conically- or frusto-conically-shaped valves
- 7/10 • with valves of other specific shape, e.g. spherical
- 7/12 • specially for two-stroke engines (F01L 7/04 takes precedence)
- 7/14 • Multiple-valve arrangements (with valves surrounding working cylinder or piston F01L 7/04; specially for two-stroke engines F01L 7/12)
- 7/16 • Sealing or packing arrangements specially therefor
- 7/18 • Component parts, details, or accessories, not provided for in preceding subgroups of this group
- 9/00 Valve-gear or valve arrangements actuated non-mechanically**
- 9/02 • by fluid means, e.g. hydraulic
- 9/04 • by electric means
- 11/00 Valve arrangements in working piston or piston-rod**
- 11/02 • in piston
- 11/04 • • operated by movement of connecting-rod
- 11/06 • • • operating oscillatory valve
- 13/00 Modifications of valve-gear to facilitate reversing, braking, starting, changing compression ratio, or other specific operations**
- 13/02 • for reversing
- 13/04 • for starting by means of fluid pressure

- 13/06 • for braking
- 13/08 • for decompression, e.g. during starting; for changing compression ratio

**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, see the relevant groups, e.g. F01L 31/00; tripping-gear or tripping of valves F01L 31/00)

- 15/02 • with valves other than cylindrical, sleeve, or part-annularly-shaped, e.g. flat D-valves
- 15/04 • • main valve being combined with auxiliary valve (of drag-valve type F01L 15/10)
- 15/06 • • • of Meyer or Rider type, i.e. in which the expansion is varied at the expansion valve itself
- 15/08 • with cylindrical, sleeve, or part-annularly-shaped valves; Such main valves combined with auxiliary valves
- 15/10 • with main slide valve and auxiliary valve dragged thereby
- 15/12 • characterised by having means for effecting pressure equilibrium between two different cylinder spaces at idling
- 15/14 • Arrangements with several co-operating main valves, e.g. reciprocatory and rotary
- 15/16 • • with reciprocatory slide valves only
- 15/18 • Valve arrangements not provided for in preceding subgroups of this group
- 15/20 • Component parts, details, or accessories, not provided for in preceding subgroups of this group

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

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

**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**

- 19/02 • Drive, or adjustment during operation, peculiar thereto

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

- 21/02 • Piston or piston-rod used as valve member
- 21/04 • Valves arranged in or on piston or piston-rod

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

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

- 25/02 • by fluid means
- 25/04 • • by working fluid of machine or engine, e.g. free-piston machine
- 25/06 • • • Arrangements with main and auxiliary valves, at least one of them being fluid-driven
- 25/08 • by electric or magnetic means

**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**

- 27/02 • the machine or engine having rotary or oscillatory valves
- 27/04 • Delayed-action controls, e.g. of cataract- or dash-pot-type

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

- 29/02 • by displacing eccentric
- 29/04 • by links or guide rods
- 29/06 • by interchanging inlet and exhaust ports
- 29/08 • specially for rotary or oscillatory valves
- 29/10 • Details, e.g. drive
- 29/12 • • Powered reverse gear

**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)

- 31/02 • with tripping-gear (for oscillatory valves F01L 31/06); Tripping of valves
- 31/04 • • with positively-driven trip levers
- 31/06 • with tripping-gear specially for oscillatory valves; Oscillatory tripping-valves, e.g. of Corliss type
- 31/08 • Valve drive or valve adjustment, apart from tripping aspects; Positively-driven gear
- 31/10 • • the drive being effected by eccentrics (F01L 31/14 takes precedence)
- 31/12 • • • Valve adjustment by displacing eccentric
- 31/14 • • Valve adjustment by links or guide rods, e.g. in valve-gears with eccentric drive
- 31/16 • • the drive being effected by specific means other than eccentric, e.g. cams; Valve adjustment in connection with such drives
- 31/18 • • specially for rotary or oscillatory valves
- 31/20 • • • Valve adjustment
- 31/22 • • specially for lift valves
- 31/24 • • • Valve adjustment

**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)

- 33/02 • rotary
- 33/04 • oscillatory

**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)

- 35/02 • Valves
- 35/04 • Arrangements of valves in the machine or engine, e.g. relative to working cylinder