

**CPC****COOPERATIVE PATENT CLASSIFICATION****F01L****CYCLICALLY OPERATING VALVES FOR MACHINES OR ENGINES**( valves in general [F16K](#) )**NOTE**

1. Groups [F01L 1/00](#) to [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](#) to [F01L 35/00](#).
3. Valve-gear arrangements specially adapted for machines or engines with variable working-fluid distribution are covered by groups [F01L 15/00](#) to [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 21/18](#), [F02B 53/06](#), [F03C 1/08](#), [F04B 1/18](#), [F04B 7/00](#), [F04B 39/08](#), [F04B 39/10](#), and [F04C 15/06](#), [F04C 29/12](#).

**Guidance heading:** Valve-gear for internal combustion piston engines or for other machines or engines with positive working-fluid displacement ( valve gear specially for steam engines or specially for other machines or engines with variable fluid distribution [F01L 15/00](#) to [F01L 35/00](#) )

**F01L 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](#) )

- [F01L 1/02](#) . Valve drive ( transmitting-gear between valve drive and valve [F01L 1/12](#) )
- [F01L 1/022](#) .. { Chain drive }
- [F01L 1/024](#) .. { Belt drive }
- [F01L 1/026](#) .. { Gear drive }
- [F01L 2001/028](#) .. Pre-assembled timing arrangement, e.g. located in a cassette
- [F01L 1/04](#) .. by means of cams, camshafts, cam discs, eccentrics or the like ( [F01L 1/10](#) takes precedence )
- [F01L 1/042](#) ... { Cam discs }
- [F01L 1/044](#) ... { Reciprocating cams }
- [F01L 1/047](#) ... Camshafts
- [F01L 2001/0471](#) .... Assembled camshafts, e.g. "gebaute Nockenwelle"
- [F01L 2001/0473](#) ..... Composite camshafts e.g. with cams or cam sleeve being able to move relative to the inner camshaft or a cam adjusting rod
- [F01L 2001/0475](#) .... Hollow camshafts ( [F01L 2001/0473](#) takes precedence )
- [F01L 2001/0476](#) .... Camshaft bearings
- [F01L 2001/0478](#) .... Torque pulse compensated camshafts
- [F01L 1/053](#) .... overhead type
- [F01L 1/0532](#) ..... { the cams being directly in contact with the driven valve }

|                |       |  |
|----------------|-------|--|
| F01L 2001/0535 | ..... | Single overhead camshafts (SOHC)   |
| F01L 2001/0537 | ..... | Double overhead camshafts (DOHC)   |
| F01L 2001/054  | ....  | Camshafts in cylinder block  |
| F01L 1/06      | ...   | the cams, or the like, rotating at a higher speed than that corresponding to the valve cycle, e.g. operating fourstroke engine valves directly from crankshaft                         |
| F01L 1/08      | ...   | Shape of cams  |
| F01L 1/10      | ..    | by means of crank-or eccentric-driven rods {( <a href="#">F01L 1/044</a> takes precedence )}   |
| F01L 1/12      | .     | Transmitting gear between valve drive and valve ( <a href="#">simultaneously operating two or more valves F01L 1/26</a> )  |
| F01L 1/14      | ..    | Tappets {( <a href="#">hydraulic tappets for automatically adjusting or compensating clearance F01L 1/24</a> )}; Push rods   |
| F01L 1/143     | ...   | { for use with overhead camshafts }  |
| F01L 1/146     | ...   | { Push-rods }  |
| F01L 1/16      | ...   | Silencing impact; Reducing wear  |
| F01L 1/18      | ..    | Rocking arms or levers   |
| F01L 1/181     | ...   | { Centre pivot rocking arms }  |
| F01L 1/182     | ....  | { the rocking arm being pivoted about an individual fulcrum, i.e. not about a common shaft }   |
| F01L 1/183     | ..... | { of the boat type }   |
| F01L 1/185     | ...   | { Overhead end-pivot rocking arms }  |
| F01L 2001/186  | ...   | Split rocking arms, e.g. rocker arms having two articulated parts and means for varying the relative position of these parts or for selectively connecting the parts to move in unison |
| F01L 2001/187  | ...   | Clips, e.g. for retaining rocker arm on pivot  |
| F01L 2001/188  | ...   | Fulcrums at upper surface  |
| F01L 1/20      | .     | Adjusting or compensating clearance  |
| F01L 1/205     | ..    | { by means of shims or the like }  |
| F01L 1/22      | ..    | automatically, e.g. mechanically   |
| F01L 1/24      | ...   | by fluid means, e.g. hydraulically   |
| F01L 1/2405    | ....  | { by means of a hydraulic adjusting device located between the cylinder head and rocker arm }  |
| F01L 1/2411    | ....  | { by means of a hydraulic adjusting device located between the valve stem and rocker arm }   |
| F01L 1/2416    | ....  | { by means of a hydraulic adjusting device attached to an articulated rocker }   |
| F01L 1/2422    | ....  | { by means or a hydraulic adjusting device located between the push rod and rocker arm }   |
| F01L 2001/2427 | ....  | by means of an hydraulic adjusting device located between cam and push rod   |
| F01L 2001/2433 | ....  | Self contained, e.g. sealed hydraulic lash adjusters   |
| F01L 2001/2438 | ....  | with means permitting forced opening of check valve  |
| F01L 2001/2444 | ....  | Details relating to the hydraulic feeding circuit, e.g. lifter oil manifold assembly (LOMA)  |
| F01L 1/245     | ....  | Hydraulic tappets  |
| F01L 1/25      | ..... | between cam and valve stem   |

|                 |       |   |
|-----------------|-------|---|
| F01L 1/252      | ..... | { for side-valve engines }  |
| F01L 1/255      | ..... | between cam and rocker arm  |
| F01L 2001/256   | ..... | between cam and push rod  |
| F01L 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 <a href="#">F01L 1/28</a> ) |
| F01L 1/262      | ..    | { with valve stems disposed radially from a centre which is substantially the centre of curvature of the upper wall surface of a combustion chamber ( <a href="#">F01L 1/265</a> takes precedence ) }                                 |
| F01L 1/265      | ..    | { peculiar to machines or engines with three or more intake valves per cylinder }   |
| F01L 1/267      | ..    | { with means for varying the timing or the lift of the valves }   |
| F01L 1/28       | .     | characterised by the provision of coaxial valves; characterised by the provision of valves co-operating with both intake and exhaust ports  |
| F01L 1/285      | ..    | { Coaxial intake and exhaust valves }   |
| F01L 1/30       | .     | characterised by the provision of positively opened and closed valves, i.e. desmodromic valves  |
| F01L 1/32       | .     | characterised by the provision of means for rotating lift valves, e.g. to diminish wear   |
| F01L 1/34       | .     | characterised by the provision of means for changing the timing of the valves without changing the duration of opening { and without affecting the magnitude of the valve lift }  |
| F01L 1/344      | ..    | changing the angular relationship between crankshaft and camshaft, e.g. using helicoidal gear   |
| F01L 1/34403    | ...   | { using helically teathed sleeve or gear moving axially between crankshaft and camshaft }   |
| F01L 1/34406    | ....  | { the helically teathed sleeve being located in the camshaft driving pulley }   |
| F01L 1/34409    | ...   | { by torque-responsive means }  |
| F01L 1/34413    | ...   | { using composite camshafts, e.g. with cams being able to move relative to the camshaft }   |
| F01L 1/34416    | ...   | { using twisted cams }  |
| F01L 1/3442     | ...   | { using hydraulic chambers with variable volume to transmit the rotating force }  |
| F01L 2001/34423 | ....  | Details relating to the hydraulic feeding circuit   |
| F01L 2001/34426 | ..... | Oil control valves  |
| F01L 2001/3443  | ..... | Solenoid driven oil control valves  |
| F01L 2001/34433 | ..... | Location oil control valves   |
| F01L 2001/34436 | ..... | Features or method for avoiding malfunction due to foreign matters in oil   |
| F01L 2001/3444  | ..... | Oil filters   |
| F01L 2001/34443 | ..... | Cleaning control of oil control valves  |
| F01L 2001/34446 | ..... | Fluid accumulators for the feeding circuit  |
| F01L 2001/3445  | ....  | Details relating to the hydraulic means for changing the angular relationship   |
| F01L 2001/34453 | ..... | Locking means between driving and driven members  |
| F01L 2001/34456 | ..... | Locking in only one position  |
| F01L 2001/34459 | ..... | Locking in multiple positions   |

|                  |       |  |
|------------------|-------|--|
| F01L 2001/34463  | ..... | Locking position intermediate between most retarded and most advanced positions  |
| F01L 2001/34466  | ..... | with multiple locking devices  |
| F01L 2001/34469  | ..... | Lock movement parallel to camshaft axis  |
| F01L 2001/34473  | ..... | Lock movement perpendicular to camshaft axis   |
| F01L 2001/34476  | ..... | Restrict range locking means   |
| F01L 2001/34479  | ..... | Sealing of phaser devices  |
| F01L 2001/34483  | ..... | Phaser return springs  |
| F01L 2001/34486  | ...   | Location and number of the means for changing the angular relationship   |
| F01L 2001/34489  | ....  | Two phasers on one camshaft  |
| F01L 2001/34493  | ....  | Dual independent phasing system (DIPS)   |
| F01L 2001/34496  | ....  | Two phasers on different camshafts   |
| F01L 1/348       | ...   | by means acting on timing belts or chains  |
| F01L 1/352       | ...   | using bevel or epicyclic gear  |
| F01L 2001/3521   | ....  | Harmonic drive of flexspline type  |
| F01L 2001/3522   | ....  | with electromagnetic brake   |
| F01L 1/356       | ...   | making the angular relationship oscillate, { e.g. non-homokinetic drive }  |
| F01L 1/36        | .     | peculiar to machines or engines of specific type other than four-stroke cycle  |
| F01L 1/38        | ..    | for engines with other than four-stroke cycle, e.g. with two-stroke cycle ( <a href="#">F01L 1/26</a> , <a href="#">F01L 1/28</a> take precedence )  |
| F01L 1/40        | ..    | for engines with scavenging charge near top dead centre position, e.g. by overlapping inlet and exhaust time ( <a href="#">scavenging aspects F02B</a> )   |
| F01L 1/42        | ..    | for machines or engines characterised by cylinder arrangements, e.g. star or fan   |
| F01L 1/44        | .     | Multiple-valve gear or arrangements, not provided for in preceding subgroups, e.g. with lift and different valves  |
| F01L 1/443       | ..    | { comprising a lift valve and at least one rotary valve }  |
| F01L 1/446       | ..    | { comprising a lift valve and at least one reed valve }  |
| F01L 1/46        | .     | Component parts, details, or accessories, not provided for in preceding subgroups  |
| F01L 1/462       | ..    | { Valve return spring arrangements }   |
| F01L 1/465       | ...   | { Pneumatic arrangements }   |
| F01L 2001/467    | ..    | Lost motion springs  |
| <b>F01L 3/00</b> |       | <b>Lift-valve, 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</b>                        |
| F01L 3/02        | .     | Selecting particular materials for valve-members or valve-seats; Valve-members or valve-seats composed of two or more materials  |
| F01L 3/04        | ..    | Coated valve members or valve-seats  |
| F01L 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 ( <a href="#">for rotating lift-valves F01L 1/32</a> ) |

- F01L 3/08 . Valves guides; Sealing of valve stem, e.g. sealing by lubricant
- F01L 3/085 . . { Valve cages }
- F01L 3/10 . Connecting springs to valve members
- F01L 2003/11 . Connecting valve members to rocker arm or tappet
- F01L 3/12 . Cooling of valves
- F01L 3/14 . . by means of a liquid or solid coolant, e.g. sodium, in a closed chamber in a valve
- F01L 3/16 . . by means of a fluid flowing through or along valve, e.g. air ( for sealing only [F01L 3/08](#) )
- F01L 3/18 . . . Liquid cooling of valve
- F01L 3/20 . Shapes or constructions of valve members, not provided for in preceding subgroups of this group
- F01L 3/205 . . { Reed valves }
- F01L 3/22 . Valve-seats not provided for in preceding subgroups of this group; Fixing of valve-seats
- F01L 3/24 . Safety means or accessories, not provided for in preceding sub- groups of this group
- F01L 2003/25 . Valve configurations in relation to engine
- F01L 2003/251 . . Large number of valves, e.g. five or more
- F01L 2003/253 . . configured parallel to piston axis
- F01L 2003/255 . . configured other than parallel or symmetrical relative to piston axis
- F01L 2003/256 . . configured other than perpendicular to camshaft axis
- F01L 2003/258 . . opening away from cylinder
- F01L 5/00** **Slide valve-gear or valve-arrangements ( with pure rotary or oscillatory movement [F01L 7/00](#) )**
- F01L 5/02 . with other than cylindrical, sleeve or part annularly shaped valves e.g. with flat-type valves
- F01L 5/04 . with cylindrical, sleeve, or part-annularly shaped valves
- F01L 5/045 . . { Piston-type or cylinder-type valves arranged above the piston and coaxial with the cylinder axis }
- F01L 5/06 . . surrounding working cylinder or piston
- F01L 5/08 . . . Arrangements with several movements or several valves, e.g. one valve inside the other ( with part-annularly shaped valves [F01L 5/12](#) )
- F01L 5/10 . . . with reciprocating and other movements of the same valve
- F01L 5/12 . . . Arrangements with part-annularly-shaped valves
- F01L 5/14 . characterised by the provision of valves with reciprocating and other movements ( surrounding working cylinder or piston [F01L 5/06](#) )
- F01L 5/16 . . with reciprocating and other movement of same valve, e.g. longitudinally of working cylinder and in cross direction

- F01L 5/18 . . with reciprocatory valve and other slide valve
- F01L 5/20 . specially for two-stroke engines ( [F01L 5/06](#) and [F01L 5/14](#) take precedence )
- F01L 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](#) )
- F01L 5/24 . Component parts, details or accessories, not provided for in preceding subgroups in this group
  
- F01L 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](#) )
  
- F01L 7/02 . with cylindrical, sleeve, or part-annularly shaped valves ( of disc type [F01L 7/06](#); of conical type [F01L 7/08](#) )
- F01L 7/021 . . { with one rotary valve }
- F01L 7/022 . . . { Cylindrical valves having one recess communicating successively with aligned inlet and exhaust ports }
- F01L 7/023 . . . { Cylindrical valves having a hollow or partly hollow body allowing axial inlet or exhaust fluid circulation }
- F01L 7/024 . . . { Cylindrical valves comprising radial inlet and axial outlet or axial inlet and radial outlet }
- F01L 7/025 . . . { Cylindrical valves comprising radial inlet and side outlet or side inlet and radial outlet }
- F01L 7/026 . . { with two or more rotary valves, their rotational axes being parallel, e.g. 4-stroke }
- F01L 7/027 . . { with two or more valves arranged coaxially } ( [F01L 7/045](#) takes precedence )]
- F01L 7/028 . . { having the rotational axis coaxial with the cylinder axis and the valve surface not surrounding piston or cylinder }
- F01L 7/029 . . { having the rotational axis of the valve parallel to the cylinder axis }
- F01L 7/04 . . Surrounding working cylinder or piston
- F01L 7/045 . . . { with two or more valves arranged coaxially }
  
- F01L 7/06 . with disc type valves
- F01L 7/08 . with conically or frusto-conically shaped valves
- F01L 7/10 . with valves of other specific shape, e.g. spherical
- F01L 7/12 . specially for two-stroke engines ( [F01L 7/04](#) takes precedence )
- F01L 7/14 . Multiple-valve arrangements ( with valves surrounding working cylinder or piston [F01L 7/04](#); specially for two-stroke engines [F01L 7/12](#) )
- F01L 7/16 . Sealing or packing arrangements specially therefor
- F01L 7/18 . Component parts, details, or accessories not provided for in preceding sub-groups of this group
  
- F01L 9/00 Valve-gear or valve arrangements actuated non-mechanically**

- F01L 9/02 . by fluid means, e.g. hydraulic
- F01L 9/021 .. { the action of a cam being transmitted to a valve by a fluid column, e.g. a fluid conduit }
- F01L 9/023 ... { Hydraulic lifters, i.e. fluid chamber comprised between a piston actuated by a cam and a piston acting on a valve stem }
- F01L 9/025 .... { the volume of the chamber being variable, e.g. for varying the lift or the timing of a valve }
- F01L 9/026 .. { Pneumatic }
- F01L 2009/028 .. Boost means, i.e. means for increasing initial opening force of the valve
  
- F01L 9/04 . by electric means
- F01L 2009/0401 .. Driving circuits therefor
- F01L 2009/0403 .. Electromagnetic actuators comprising one coil
- F01L 2009/0405 .. Electromagnetic actuators comprising two or more coils
- F01L 2009/0407 ... The two coils being disposed coaxially to the armature shaft
- F01L 2009/0409 ... The armature being articulated perpendicularly to the coils axes
- F01L 2009/0411 .. Electromagnetic actuators using a rotary motor
- F01L 2009/0413 .. Piezo electric actuators
- F01L 2009/0415 .. Moving coil actuators
- F01L 2009/0417 .. Floating actuators for varying the valve stroke
- F01L 2009/0419 .. Actuator position setting device, e.g. initial setting
- F01L 2009/0421 .. Mixed arrangement with both mechanically and electromagnetically actuated valves
- F01L 2009/0423 .. Electromagnetic actuators construction details
- F01L 2009/0425 ... Shaft and armature construction
- F01L 2009/0426 .... Arrangements for amplifying the armature stroke
- F01L 2009/0428 ... Core and coil construction
- F01L 2009/043 ... Casing construction
- F01L 2009/0432 ... Biasing means
- F01L 2009/0434 .... Helical springs
- F01L 2009/0436 ..... Two opposed springs for intermediate resting position of the armature
- F01L 2009/0438 .... Torsion springs
- F01L 2009/044 .... Pneumatic springs
- F01L 2009/0442 .... Means for varying the spring bias
- F01L 2009/0444 .... Means for connecting springs to valve or anchor
- F01L 2009/0446 ... Latching means
- F01L 2009/0448 .... using permanent magnet
- F01L 2009/0449 ... Means for varying the air gap
- F01L 2009/0451 ... Damping means
- F01L 2009/0453 ... Means for counteracting cylinder pressure
- F01L 2009/0455 ... Lash adjusting means
- F01L 2009/0457 ... Actor cooling means
- F01L 2009/0459 ... Means for facilitating assembly

|                |      |   |
|----------------|------|---|
| F01L 2009/0461 | ...  | Wiring  |
| F01L 2009/0463 | .... | Connectors  |
| F01L 2009/0465 | .... | Harnesses   |
| F01L 2009/0467 | ...  | Sensing means   |
| F01L 2009/0469 | .... | Position sensors  |
| F01L 2009/0471 | .... | Vibration sensors   |
| F01L 2009/0473 | .... | Temperature sensors   |
| F01L 2009/0474 | .... | Flux sensors  |
| F01L 2009/0476 | .... | Spring force sensors  |
| F01L 2009/0478 | ..   | Electromagnetic actuators; Method of operation thereof                                    |
| F01L 2009/048  | ...  | Engine starting   |
| F01L 2009/0482 | .... | in normal conditions  |
| F01L 2009/0484 | .... | Cold start  |
| F01L 2009/0486 | ...  | Soft landing, e.g. applying braking current; Levitation of armature close to core surface |
| F01L 2009/0488 | ...  | Fail safe, e.g. valve kept closed if not opening properly                                 |
| F01L 2009/049  | ...  | Determination of valve speed  |
| F01L 2009/0492 | ...  | Determination of valve timing during particular working conditions, e.g. deceleration     |
| F01L 2009/0494 | ...  | Engine stopping; Engine stall   |
| F01L 2009/0496 | ...  | relating to sticking duration   |
| F01L 2009/0498 | ...  | relating to gap between armature shaft and valve stem end                                 |

#### **F01L 11/00      Valve arrangements in working piston or piston-rod**

|            |     |  |
|------------|-----|--|
| F01L 11/02 | .   | in piston                              |
| F01L 11/04 | ..  | operated by movement of connecting-rod |
| F01L 11/06 | ... | operating oscillatory valve            |

#### **F01L 13/00      Modifications of valve-gear to facilitate reversing, braking, starting, changing compression ratio, or other specific operations**

|               |     |   |
|---------------|-----|---|
| F01L 13/0005  | .   | { Deactivating valves }   |
| F01L 2013/001 | ..  | Deactivating cylinders  |
| F01L 13/0015  | .   | { for optimising engine performances by modifying valve lift according to various working parameters, e.g. rotational speed, load, torque }                     |
| F01L 13/0021  | ..  | { by modification of rocker arm ratio }   |
| F01L 13/0026  | ... | { by means of an eccentric }  |
| F01L 13/0031  | ..  | { by modification of tappet or pushrod length }   |
| F01L 13/0036  | ..  | { the valves being driven by two or more cams with different shape, size or timing or a single cam profiled in axial and radial direction }                     |
| F01L 13/0042  | ... | { with cams being profiled in axial and radial direction }  |
| F01L 13/0047  | ... | { the movement of the valves resulting from the sum of the simultaneous actions of at least two cams, the cams being independently variable in phase in respect |



- of each other }
- F01L 2013/0052 . . . with cams provided on an axially slidable sleeve
- F01L 13/0057 . . { by splittable or deformable cams }
- F01L 13/0063 . . { by modification of cam contact point by displacing an intermediate lever or wedge-shaped intermediate element, e.g. Tourtelot }
- F01L 2013/0068 . . . with an oscillating cam acting on the valve of the "BMW-Valvetronic" type
- F01L 2013/0073 . . . with an oscillating cam acting on the valve of the "Delphi" type
- F01L 2013/0078 . . by modification of cam contact point by axially displacing the camshaft
- F01L 2013/0084 . . by modification of cam contact point by radially displacing the camshaft
- F01L 2013/0089 . . with means for delaying valve closing
- F01L 2013/0094 . . . with switchable clamp for keeping valve open
  
- F01L 13/02 . for reversing
  
- F01L 13/04 . for starting by means of fluid pressure
  
- F01L 13/06 . for braking
- F01L 13/065 . . { Compression release engine retarders of the "Jacobs Manufacturing" type }
  
- F01L 13/08 . for decompression, e.g. during starting; for changing compression ratio
- F01L 13/085 . . { the valve-gear having an auxiliary cam protruding from the main cam profile }
  
- F01L 2013/10 . Auxiliary actuators for variable valve timing
- F01L 2013/101 . . Electromagnets
- F01L 2013/103 . . Electric motors
- F01L 2013/105 . . Hydraulic motors
- F01L 2013/106 . . Pneumatic motors
- F01L 2013/108 . . Centrifugal force
  
- F01L 2013/11 . Sensors for variable valve timing
- F01L 2013/111 . . Camshafts position or phase
- F01L 2013/113 . . crankshafts position
- F01L 2013/115 . . Pressure
- F01L 2013/116 . . Temperature
- F01L 2013/118 . . Valve lift

**Guidance heading:** Valve-gear or valve arrangements, e.g. with reciprocatory slide valves, specially for steam engine, or specially for other machines or engines with variable working-fluid distribution

#### **NOTE**

The groups under this guide heading do not fully embrace subject matter restricted to rotary, oscillatory, or lift-valve-gear or valve arrangements, classified in groups [F01L 33/00](#) and [F01L 35/00](#). However, the present groups do embrace the following subject-matter thereof; valves drives 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

- F01L 15/00**      **Valve-gear or valve arrangements, e.g. with reciprocatory slide valves, other than provided for in groups [F01L 17/00](#) to [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](#) )**
- [F01L 15/02](#)      . with valves other than cylindrical, sleeve, or part-annularly-shaped, e.g. flat D-valves
- [F01L 15/04](#)      . . main valve being combined with auxiliary valve ( of drag valve type [F01L 15/10](#) )
- [F01L 15/06](#)      . . . of Meyer or Rider type, i.e. in which the expansion is varied at the expansion valve itself
- [F01L 15/08](#)      . with cylindrical, sleeve, or part-annularly-shaped valves; Such main valves combined with auxiliary valves
- [F01L 15/10](#)      . with main slide valve and auxiliary valve dragged thereby
- [F01L 15/12](#)      . characterised by having means for effecting pressure equilibrium between two different cylinder spaces at idling
- [F01L 15/14](#)      . Arrangements with several co-operating main valves, e.g. reciprocatory and rotary
- [F01L 15/16](#)      . . with reciprocatory slide valves only
- [F01L 15/18](#)      . Valves arrangements not provided for in preceding sub-groups of this main group
- [F01L 15/20](#)      . Component parts, details, or accessories, not provided for in preceding sub-groups of this main group
- F01L 17/00**      **Slide valve-gear or valve arrangements with cylindrical, sleeve, or part annularly-shaped valves surrounding working cylinder or piston**
- [F01L 17/02](#)      . Drive or adjustment during operation, peculiar thereto, e.g. for reciprocating and oscillating movements or for several valves one inside the other
- F01L 19/00**      **Slide valve-gear or valve arrangements with reciprocatory and other movement of same valve, other than provided for in [F01L 17/00](#), e.g. longitudinally of working cylinder and in cross direction**
- [F01L 19/02](#)      . Drive or adjustment during operation, peculiar thereto
- F01L 21/00**      **Use of working pistons or pistons-rods as fluid-distributing valves or a valve-supporting elements, e.g. in free-piston machines**
- [F01L 21/02](#)      . Piston or piston-rod used as valve members { [F01L 25/066](#) takes precedence }
- [F01L 21/04](#)      . Valves arranged in or on piston or piston-rod

- F01L 23/00** Valves controlled by impact by piston, e.g. in free-piston machines; { [F01L 25/063](#) takes precedence }
- F01L 25/00** Drive, or adjustment during the operation, or distribution or expansion valves by non-mechanical means
- F01L 25/02 . by fluid means
  - F01L 25/04 . . by working-fluid of machine or engine, e.g. free-piston machine
  - F01L 25/06 . . . Arrangement with main and auxiliary valves, at least one of them being fluid-driven
  - F01L 25/063 . . . . { the auxiliary valve being actuated by the working motor-piston or piston-rod }
  - F01L 25/066 . . . . { piston or piston-rod being used as auxiliary valve }
  - F01L 25/08 . by electric or magnetic means
- F01L 27/00** Distribution or expansion valve-gear peculiar to free-piston machines or engines and not provided for in [F01L 21/00](#) to [F01L 25/00](#)
- F01L 27/02 . the machine or engine having rotary or oscillatory valves
  - F01L 27/04 . Delayed-action controls, e.g. of cataract or dashpot type
- F01L 29/00** Reversing gear ( equally usable for control of degree of working-fluid admission and reversing being of secondary-importance [F01L 31/00](#) )
- F01L 29/02 . by displacing eccentric
  - F01L 29/04 . by links or guide rods
  - F01L 29/06 . by interchanging inlet and exhaust ports
  - F01L 29/08 . specially for rotary or oscillatory valves
  - F01L 29/10 . Details, e.g. drive
  - F01L 29/12 . . Powered reverse gear
- F01L 31/00** Valve drive, valve adjustment during operation, or other valve control, not provided for in groups [F01L 15/00](#) to [F01L 29/00](#) ( sensing elements measuring the variable or condition to be controlled or regulated [F01B](#) )
- F01L 31/02 . with tripping-gear ( for oscillatory valves [F01L 31/06](#) ); Tripping of valves
  - F01L 31/04 . . with positively-driven trip levers
  - F01L 31/06 . with tripping-gear specially for oscillatory valves; Oscillatory tripping-valves, e.g. of Corliss type
  - F01L 31/08 . Valve drive or valve adjustment, apart from tripping aspects; Positively-driven gear

- F01L 31/10 . . the drive being effected by eccentrics ( [F01L 31/14 takes precedence](#) )
- F01L 31/12 . . . Valve adjustment by displacing eccentric
- F01L 31/14 . . Valve adjustment by links or guide rods, e.g. in valve-gear with eccentric drive
- F01L 31/16 . . the drive being effected by specific means other than eccentric, e.g. cams; Valve adjustment in connection with such drives
- F01L 31/18 . . specially for rotary or oscillatory valves

**Guidance heading:** **Rotary or oscillatory slide valve-gear or lift-valve-gear or such valve arrangements specially for steam engines or specially for other machines or engines with variable working-fluid distribution** ( [drive adjustment during operation, tripping-gear, reversing-gear, use of working pistons or piston-rods as valves or as valves-supporting elements, valve-gear or valve arrangements peculiar to free-piston machines or engines F01L 15/00 to F01L 31/00](#) )

**F01L 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 to F01L 31/00](#) )

- F01L 33/02 . rotary
- F01L 33/04 . oscillatory

**F01L 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 to F01L 31/00](#) )

- F01L 35/02 . Valves
- F01L 35/04 . Arrangements of valves in the machine or engine, e.g. relative to working cylinder

**F01L 2101/00** **Using particular materials**

- F01L 2101/02 . Using ceramic materials

**F01L 2103/00** **Manufacturing of components used in valve arrangements**

- F01L 2103/01 . Tools for producing, mounting or adjusting, e.g. some part of the distribution
- F01L 2103/02 . Initial camshaft settings

**F01L 2105/00** **Valve arrangements comprising rollers**

- F01L 2105/02 . Mounting of rollers

**F01L 2107/00** **Preventing the rotation of tappets**

|                     |   |
|---------------------|---|
| <b>F01L 2109/00</b> | <b>Self-contained lash adjusters</b>  |
| <b>F01L 2111/00</b> | <b>Differential gears located between crankshafts and camshafts for varying the timing of valves</b>  |
| <b>F01L 2113/00</b> | <b>Rotary valve drives</b>  |
| <b>F01L 2201/00</b> | <b>Electronic control systems; Apparatus or methods therefor</b>  |
| <b>F01L 2250/00</b> | <b>Camshaft drives characterised by their transmission means</b>  |
| F01L 2250/02        | . the camshaft being driven by chains   |
| F01L 2250/04        | . the camshaft being driven by belts  |
| F01L 2250/06        | . the camshaft being driven by gear wheels  |
| <b>F01L 2710/00</b> | <b>Control of valve gear, speed or power</b>  |
| F01L 2710/003       | . Control of valve gear for two stroke engines  |
| F01L 2710/006       | . Safety devices therefor   |
| <b>F01L 2740/00</b> | <b>Control of slide-valve gear; Control pistons</b>   |
| F01L 2740/003       | . more than one slide-valve, e.g. for four stroke engines   |
| F01L 2740/006       | . more than one slide-valve, e.g. for two stroke engines  |
| <b>F01L 2750/00</b> | <b>Control of valve gear for four stroke engines directly driven by the crankshaft</b>  |
| <b>F01L 2760/00</b> | <b>Control of valve gear to facilitate reversing, starting, braking of four stroke engines</b>  |
| F01L 2760/001       | . for starting four stroke engines  |
| F01L 2760/002       | . for reversing or starting four stroke engines   |
| F01L 2760/003       | . for switching to compressor action in order to brake  |
| F01L 2760/004       | . . whereby braking is exclusively produced by compression in the cylinders   |
| F01L 2760/005       | . . in cooperation with vehicle transmission or brakes; devices to facilitate switching to compressor action by means of other control devices, e.g. acceleration pedal or clutch |
| F01L 2760/006       | . for reversing two stroke engines  |

F01L 2760/007 . for starting two stroke engines

F01L 2760/008 . for reversing and restarting two strocke engines

**F01L 2800/00      Methods of operation using a variable valve timing mechanism**

F01L 2800/01 . Starting

F01L 2800/02 . Cold running

F01L 2800/03 . Stopping; Stalling

F01L 2800/04 . Timing control at idling

F01L 2800/05 . Timing control under consideration of oil condition

F01L 2800/06 . Timing or lift different for valves of same cylinder

F01L 2800/08 . Timing or lift different for valves of different cylinders

F01L 2800/09 . Calibrating

F01L 2800/10 . Providing exhaust gas recirculation (EGR)

F01L 2800/11 . Fault detection, diagnosis

F01L 2800/12 . Fail safe operation

F01L 2800/13 . Throttleless

F01L 2800/14 . Determining a position, e.g. phase or lift

F01L 2800/15 . Balancing of rotating parts

F01L 2800/16 . Preventing interference

F01L 2800/17 . Maintenance; Servicing

F01L 2800/18 . Testing or simulation

F01L 2800/19 . Valves opening several times per stroke

**F01L 2810/00      Arrangements solving specific problems in relation with valve gears**

F01L 2810/01 . Cooling

F01L 2810/02 . Lubrication

F01L 2810/03 . Reducing vibration

F01L 2810/04 . Reducing noise

F01L 2810/05 . Related to pressure difference on both sides of a valve

**F01L 2820/00 Details on specific features characterising valve gear arrangements**

F01L 2820/01 . Absolute values

F01L 2820/02 . Formulas

F01L 2820/03 . Auxiliary actuators

F01L 2820/031 . . Electromagnets

F01L 2820/032 . . Electric motors

F01L 2820/033 . . Hydraulic engines

F01L 2820/034 . . Pneumatic engines

F01L 2820/035 . . Centrifugal forces

F01L 2820/04 . Sensors

F01L 2820/041 . . Camshafts position or phase sensors

F01L 2820/042 . . Crankshafts position

F01L 2820/043 . . Pressure

F01L 2820/044 . . Temperature

F01L 2820/045 . . Valve lift