

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

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](#).

**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 {(F01L 1/044 takes precedence)}
- F01L 1/12 . Transmitting gear between valve drive and valve (simultaneously operating two or more valves F01L 1/26)
- F01L 1/14 . . Tappets {(hydraulic tappets for automatically adjusting or compensating clearance F01L 1/24)}; 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 F01L 1/28)
- 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 (F01L 1/265 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 (F01L 1/26, F01L 1/28 take precedence)
F01L 1/40	. . . . .	for engines with scavenging charge near top dead centre position, e.g. by overlapping inlet and exhaust time (scavenging aspects F02B)
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}

**F01L 3/00**      **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**

- 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 (for rotating lift-valves [F01L 1/32](#))
- 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 reciprocating 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 reciprocating 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 subgroups 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}

**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

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|----------------------------|---|
| <b>F01L 15/00</b>          | <b>Valve-gear or valve arrangements, e.g. with reciprocatory slide valves, other than provided for in groups <a href="#">F01L 17/00</a> to <a href="#">F01L 29/00</a> (valve drive or external valve-adjustment during operation, see the relevant groups, e.g. <a href="#">F01L 31/00</a>; tripping-gear or tripping of valves <a href="#">F01L 31/00</a>)</b> |
| <a href="#">F01L 15/02</a> | <ul style="list-style-type: none"> <li>• with valves other than cylindrical, sleeve, or part-annularly-shaped, e.g. flat D-valves</li> </ul>  |
| <a href="#">F01L 15/04</a> | <ul style="list-style-type: none"> <li>• . main valve being combined with auxiliary valve (of drag valve type <a href="#">F01L 15/10</a>)</li> </ul>  |
| <a href="#">F01L 15/06</a> | <ul style="list-style-type: none"> <li>• . . of Meyer or Rider type, i.e. in which the expansion is varied at the expansion valve itself</li> </ul>   |
| <a href="#">F01L 15/08</a> | <ul style="list-style-type: none"> <li>• with cylindrical, sleeve, or part-annularly-shaped valves; Such main valves combined with auxiliary valves</li> </ul>  |
| <a href="#">F01L 15/10</a> | <ul style="list-style-type: none"> <li>• with main slide valve and auxiliary valve dragged thereby</li> </ul>   |
| <a href="#">F01L 15/12</a> | <ul style="list-style-type: none"> <li>• characterised by having means for effecting pressure equilibrium between two different cylinder spaces at idling</li> </ul>  |
| <a href="#">F01L 15/14</a> | <ul style="list-style-type: none"> <li>• Arrangements with several co-operating main valves, e.g. reciprocatory and rotary</li> </ul>   |
| <a href="#">F01L 15/16</a> | <ul style="list-style-type: none"> <li>• . with reciprocatory slide valves only</li> </ul>  |
| <a href="#">F01L 15/18</a> | <ul style="list-style-type: none"> <li>• Valves arrangements not provided for in preceding sub-groups of this main group</li> </ul>   |
| <a href="#">F01L 15/20</a> | <ul style="list-style-type: none"> <li>• Component parts, details, or accessories, not provided for in preceding sub-groups of this main group</li> </ul>   |
| <b>F01L 17/00</b>          | <b>Slide valve-gear or valve arrangements with cylindrical, sleeve, or part annularly-shaped valves surrounding working cylinder or piston</b>  |
| <a href="#">F01L 17/02</a> | <ul style="list-style-type: none"> <li>• Drive or adjustment during operation, peculiar thereto, e.g. for reciprocating and oscillating movements or for several valves one inside the other</li> </ul>   |
| <b>F01L 19/00</b>          | <b>Slide valve-gear or valve arrangements with reciprocatory and other movement of same valve, other than provided for in <a href="#">F01L 17/00</a>, e.g. longitudinally of working cylinder and in cross direction</b>  |
| <a href="#">F01L 19/02</a> | <ul style="list-style-type: none"> <li>• Drive or adjustment during operation, peculiar thereto</li> </ul>  |
| <b>F01L 21/00</b>          | <b>Use of working pistons or pistons-rods as fluid-distributing valves or a valve-supporting elements, e.g. in free-piston machines</b>   |
| <a href="#">F01L 21/02</a> | <ul style="list-style-type: none"> <li>• Piston or piston-rod used as valve members {(<a href="#">F01L 25/066</a> takes precedence)}</li> </ul>   |

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 catarract 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

Valve-gear or valve arrangements, e.g. with reciprocatory slide valves, specially for steam engine, or specially for other machines or...

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[F01L 31/18](#) . . specially for rotary or oscillatory valves

**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

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**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

**F01L 2109/00** Self-contained lash adjusters

**F01L 2111/00** Differential gears located between crankshafts and camshafts for varying the timing of valves

**F01L 2113/00** Rotary valve drives

**F01L 2201/00** Electronic control systems; Apparatus or methods therefor

**F01L 2250/00** Camshaft drives characterised by their transmission means

[F01L 2250/02](#) . the camshaft being driven by chains

F01L 2250/04	<ul style="list-style-type: none"> <li>the camshaft being driven by belts</li> </ul>
F01L 2250/06	<ul style="list-style-type: none"> <li>the camshaft being driven by gear wheels</li> </ul>
<b>F01L 2710/00</b>	<b>Control of valve gear, speed or power</b>
F01L 2710/003	<ul style="list-style-type: none"> <li>Control of valve gear for two stroke engines</li> </ul>
F01L 2710/006	<ul style="list-style-type: none"> <li>Safety devices therefor</li> </ul>
<b>F01L 2740/00</b>	<b>Control of slide-valve gear; Control pistons</b>
F01L 2740/003	<ul style="list-style-type: none"> <li>more than one slide-valve, e.g. for four stroke engines</li> </ul>
F01L 2740/006	<ul style="list-style-type: none"> <li>more than one slide-valve, e.g. for two stroke engines</li> </ul>
<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	<ul style="list-style-type: none"> <li>for starting four stroke engines</li> </ul>
F01L 2760/002	<ul style="list-style-type: none"> <li>for reversing or starting four stroke engines</li> </ul>
F01L 2760/003	<ul style="list-style-type: none"> <li>for switching to compressor action in order to brake</li> </ul>
F01L 2760/004	<ul style="list-style-type: none"> <li> <ul style="list-style-type: none"> <li>whereby braking is exclusively produced by compression in the cylinders</li> </ul> </li> </ul>
F01L 2760/005	<ul style="list-style-type: none"> <li> <ul style="list-style-type: none"> <li>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</li> </ul> </li> </ul>
F01L 2760/006	<ul style="list-style-type: none"> <li>for reversing two stroke engines</li> </ul>
F01L 2760/007	<ul style="list-style-type: none"> <li>for starting two stroke engines</li> </ul>
F01L 2760/008	<ul style="list-style-type: none"> <li>for reversing and restarting two stroke engines</li> </ul>
<b>F01L 2800/00</b>	<b>Methods of operation using a variable valve timing mechanism</b>
F01L 2800/01	<ul style="list-style-type: none"> <li>Starting</li> </ul>
F01L 2800/02	<ul style="list-style-type: none"> <li>Cold running</li> </ul>
F01L 2800/03	<ul style="list-style-type: none"> <li>Stopping; Stalling</li> </ul>
F01L 2800/04	<ul style="list-style-type: none"> <li>Timing control at idling</li> </ul>
F01L 2800/05	<ul style="list-style-type: none"> <li>Timing control under consideration of oil condition</li> </ul>
F01L 2800/06	<ul style="list-style-type: none"> <li>Timing or lift different for valves of same cylinder</li> </ul>
F01L 2800/08	<ul style="list-style-type: none"> <li>Timing or lift different for valves of different cylinders</li> </ul>
F01L 2800/09	<ul style="list-style-type: none"> <li>Calibrating</li> </ul>
F01L 2800/10	<ul style="list-style-type: none"> <li>Providing exhaust gas recirculation [EGR]</li> </ul>
F01L 2800/11	<ul style="list-style-type: none"> <li>Fault detection, diagnosis</li> </ul>
F01L 2800/12	<ul style="list-style-type: none"> <li>Fail safe operation</li> </ul>
F01L 2800/13	<ul style="list-style-type: none"> <li>Throttleless</li> </ul>
F01L 2800/14	<ul style="list-style-type: none"> <li>Determining a position, e.g. phase or lift</li> </ul>
F01L 2800/15	<ul style="list-style-type: none"> <li>Balancing of rotating parts</li> </ul>
F01L 2800/16	<ul style="list-style-type: none"> <li>Preventing interference</li> </ul>
F01L 2800/17	<ul style="list-style-type: none"> <li>Maintenance; Servicing</li> </ul>

- 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