

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 {(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 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
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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	. the camshaft being driven by belts
F01L 2250/06	. the camshaft being driven by gear wheels
F01L 2710/00	Control of valve gear, speed or power
F01L 2710/003	. Control of valve gear for two stroke engines
F01L 2710/006	. Safety devices therefor
F01L 2740/00	Control of slide-valve gear; Control pistons
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
F01L 2750/00	Control of valve gear for four stroke engines directly driven by the crankshaft
F01L 2760/00	Control of valve gear to facilitate reversing, starting, braking of four stroke engines
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 stroke 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