

**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 <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 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

**Guidance heading:**

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

- F01L 2101/02 . Using ceramic materials

**Guidance heading:**

**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

<b>F01L 2105/00</b>	<b>Valve arrangements comprising rollers</b>
F01L 2105/02	. Mounting of rollers
<b>F01L 2107/00</b>	<b>Preventing the rotation of tappets</b>
<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
<b>F01L 2800/00</b>		<b>Methods of operation using a variable valve timing mechanism</b>
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
<b>F01L 2810/00</b>		<b>Arrangements solving specific problems in relation with valve gears</b>

- 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