

CPC COOPERATIVE PATENT CLASSIFICATION

F MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING (NOTE omitted)

ENGINES OR PUMPS

F01 MACHINES OR ENGINES IN GENERAL; ENGINE PLANTS IN GENERAL; STEAM ENGINES

F01L CYCLICALLY OPERATING VALVES FOR MACHINES OR ENGINES (valves in general [F16K](#))

NOTES

1. Groups [F01L 1/00](#) - [F01L 13/00](#) cover only valve-gear or valve arrangements without provision for variable fluid distribution.
2. Valve gear or valve arrangements specially adapted for steam engines are covered by groups [F01L 15/00](#) - [F01L 35/00](#).
3. Valve-gear arrangements specially adapted for machines or engines with variable working-fluid distribution are covered by groups [F01L 15/00](#) - [F01L 35/00](#).
4. Attention is drawn to the notes preceding class [F01](#), especially Note (3).
5. As regards the above-mentioned Note (3), attention is drawn to [F01B 3/10](#), [F01B 15/06](#), [F01C 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](#).

WARNINGS

1. The following IPC groups are not in the CPC scheme. The subject matter for these IPC groups is classified in the following CPC groups:

| | | |
|----------------------------|------------|---|
| F01L 31/20 | covered by | F01L 31/08 - F01L 31/18 |
| F01L 31/22 | covered by | F01L 31/08 - F01L 31/18 |
| F01L 31/24 | covered by | F01L 31/08 - F01L 31/18 |
2. In this subclass non-limiting references (in the sense of paragraph 39 of the Guide to the IPC) may still be displayed in the scheme.

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](#) - [F01L 35/00](#))

| | | | |
|---------------------------|---|---------------------------|--|
| 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) | 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} |
| | | 2001/0475 | {Hollow camshafts (F01L 2001/0473 takes precedence)} |
| | | 2001/0476 | {Camshaft bearings} |
| | | 2001/0478 | {Torque pulse compensated camshafts} |
| | | 1/053 | overhead type |
| | | 1/0532 | {the cams being directly in contact with the driven valve} |
| | | 2001/0535 | {Single overhead camshafts [SOHC]} |
| | | 2001/0537 | {Double overhead camshafts [DOHC]} |
| | | 2001/054 | {Camshafts in cylinder block} |
| 1/02 | . Valve drive (transmitting-gear between valve drive and valve F01L 1/12) | 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 |
| 1/022 | . . {Chain drive} | 1/08 | . . . Shape of cams |
| 1/024 | . . {Belt drive} | 1/10 | . . by means of crank-or eccentric-driven rods {(F01L 1/044 takes precedence)} |
| 1/026 | . . {Gear drive} | 1/12 | . Transmitting gear between valve drive and valve (simultaneously operating two or more valves F01L 1/26) |
| 2001/028 | . . {Pre-assembled timing arrangement, e.g. located in a cassette} | 1/14 | . . Tappets {(hydraulic tappets for automatically adjusting or compensating clearance F01L 1/24)}; Push rods |
| 1/04 | . . by means of cams, camshafts, cam discs, eccentrics or the like (F01L 1/10 takes precedence) | 1/143 | . . . {for use with overhead camshafts} |
| 1/042 | . . . {Cam discs} | 1/146 | . . . {Push-rods} |
| 1/044 | . . . {Reciprocating cams} | 1/16 | . . . Silencing impact; Reducing wear |
| 1/047 | . . . Camshafts | | |
| 2001/0471 | {Assembled camshafts} | | |

- 1/18 . . Rocking arms or levers
- 1/181 . . . {Centre pivot rocking arms}
- 1/182 {the rocking arm being pivoted about an individual fulcrum, i.e. not about a common shaft}
- 1/183 {of the boat type}
- 1/185 . . . {Overhead end-pivot rocking arms}
- 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}
- 2001/187 . . . {Clips, e.g. for retaining rocker arm on pivot}
- 2001/188 . . . {Fulcrums at upper surface}
- 1/20 . Adjusting or compensating clearance
- 1/205 . . {by means of shims or the like}
- 1/22 . . automatically, e.g. mechanically
- 1/24 . . . by fluid means, e.g. hydraulically
- 1/2405 {by means of a hydraulic adjusting device located between the cylinder head and rocker arm}
- 1/2411 {by means of a hydraulic adjusting device located between the valve stem and rocker arm}
- 1/2416 {by means of a hydraulic adjusting device attached to an articulated rocker}
- 1/2422 {by means of a hydraulic adjusting device located between the push rod and rocker arm}
- 2001/2427 {by means of an hydraulic adjusting device located between cam and push rod}
- 2001/2433 {Self contained, e.g. sealed hydraulic lash adjusters}
- 2001/2438 {with means permitting forced opening of check valve}
- 2001/2444 {Details relating to the hydraulic feeding circuit, e.g. lifter oil manifold assembly [LOMA]}
- 1/245 Hydraulic tappets
- 1/25 between cam and valve stem
- 1/252 {for side-valve engines}
- 1/255 between cam and rocker arm
- 2001/256 {between cam and push rod}
- 1/26 . characterised by the provision of two or more valves operated simultaneously by same transmitting-gear; peculiar to machines or engines with more than two lift-valves per cylinder (with coaxial valves F01L 1/28)
- 1/262 . . {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)}
- 1/265 . . {peculiar to machines or engines with three or more intake valves per cylinder}
- 1/267 . . {with means for varying the timing or the lift of the valves}
- 1/28 . characterised by the provision of coaxial valves; characterised by the provision of valves co-operating with both intake and exhaust ports
- 1/285 . . {Coaxial intake and exhaust valves}
- 1/30 . characterised by the provision of positively opened and closed valves, i.e. desmodromic valves
- 1/32 . characterised by the provision of means for rotating lift valves, e.g. to diminish wear
- 1/34 . characterised by the provision of means for changing the timing of the valves without changing the duration of opening {and without affecting the magnitude of the valve lift}
- 1/344 . . changing the angular relationship between crankshaft and camshaft, e.g. using helicoidal gear
- 1/34403 . . . {using helically teathed sleeve or gear moving axially between crankshaft and camshaft}
- 1/34406 {the helically teathed sleeve being located in the camshaft driving pulley}
- 1/34409 . . . {by torque-responsive means}
- 1/34413 . . . {using composite camshafts, e.g. with cams being able to move relative to the camshaft}
- 1/34416 . . . {using twisted cams}
- 1/3442 . . . {using hydraulic chambers with variable volume to transmit the rotating force}
- 2001/34423 {Details relating to the hydraulic feeding circuit}
- 2001/34426 {Oil control valves}
- 2001/3443 {Solenoid driven oil control valves}
- 2001/34433 {Location oil control valves}
- 2001/34436 {Features or method for avoiding malfunction due to foreign matters in oil}
- 2001/3444 {Oil filters}
- 2001/34443 {Cleaning control of oil control valves}
- 2001/34446 {Fluid accumulators for the feeding circuit}
- 2001/3445 {Details relating to the hydraulic means for changing the angular relationship}
- 2001/34453 {Locking means between driving and driven members}
- 2001/34456 {Locking in only one position}
- 2001/34459 {Locking in multiple positions}
- 2001/34463 {Locking position intermediate between most retarded and most advanced positions}
- 2001/34466 {with multiple locking devices}
- 2001/34469 {Lock movement parallel to camshaft axis}
- 2001/34473 {Lock movement perpendicular to camshaft axis}
- 2001/34476 {Restrict range locking means}
- 2001/34479 {Sealing of phaser devices}
- 2001/34483 {Phaser return springs}
- 2001/34486 . . . {Location and number of the means for changing the angular relationship}
- 2001/34489 {Two phasers on one camshaft}
- 2001/34493 {Dual independent phasing system [DIPS]}
- 2001/34496 {Two phasers on different camshafts}
- 1/348 . . . by means acting on timing belts or chains
- 1/352 . . . using bevel or epicyclic gear
- 2001/3521 {Harmonic drive of flexspline type}
- 2001/3522 {with electromagnetic brake}
- 1/356 . . . making the angular relationship oscillate {, e.g. non-homokinetic drive}
- 1/36 . peculiar to machines or engines of specific type other than four-stroke cycle
- 1/38 . . for engines with other than four-stroke cycle, e.g. with two-stroke cycle (F01L 1/26, F01L 1/28 take precedence)

| | | | |
|-------------|--|-------------|---|
| 1/40 | . . for engines with scavenging charge near top dead centre position, e.g. by overlapping inlet and exhaust time (scavenging aspects F02B) | 5/045 | . . {Piston-type or cylinder-type valves arranged above the piston and coaxial with the cylinder axis} |
| 1/42 | . . for machines or engines characterised by cylinder arrangements, e.g. star or fan | 5/06 | . . surrounding working cylinder or piston |
| 1/44 | . Multiple-valve gear or arrangements, not provided for in preceding subgroups, e.g. with lift and different valves | 5/08 | . . . Arrangements with several movements or several valves, e.g. one valve inside the other (with part-annularly shaped valves F01L 5/12) |
| 1/443 | . . {comprising a lift valve and at least one rotary valve} | 5/10 | with reciprocating and other movements of the same valve |
| 1/446 | . . {comprising a lift valve and at least one reed valve} | 5/12 | . . . Arrangements with part-annularly-shaped valves |
| 1/46 | . Component parts, details, or accessories, not provided for in preceding subgroups | 5/14 | . characterised by the provision of valves with reciprocating and other movements (surrounding working cylinder or piston F01L 5/06) |
| 1/462 | . . {Valve return spring arrangements} | 5/16 | . . with reciprocating and other movement of same valve, e.g. longitudinally of working cylinder and in cross direction |
| 1/465 | . . . {Pneumatic arrangements} | 5/18 | . . with reciprocating valve and other slide valve |
| 2001/467 | . . {Lost motion springs} | 5/20 | . specially for two-stroke engines (F01L 5/06 and F01L 5/14 take precedence) |
| 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 | 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) |
| 3/02 | . Selecting particular materials for valve-members or valve-seats; Valve-members or valve-seats composed of two or more materials | 5/24 | . Component parts, details or accessories, not provided for in preceding subgroups in this group |
| 3/04 | . . Coated valve members or valve-seats | 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) |
| 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) | 7/02 | . with cylindrical, sleeve, or part-annularly shaped valves (of disc type F01L 7/06 ; of conical type F01L 7/08) |
| 3/08 | . Valves guides; Sealing of valve stem, e.g. sealing by lubricant | 7/021 | . . {with one rotary valve} |
| 3/085 | . . {Valve cages} | 7/022 | . . . {Cylindrical valves having one recess communicating successively with aligned inlet and exhaust ports} |
| 3/10 | . Connecting springs to valve members | 7/023 | . . . {Cylindrical valves having a hollow or partly hollow body allowing axial inlet or exhaust fluid circulation} |
| 2003/11 | . {Connecting valve members to rocker arm or tappet} | 7/024 | . . . {Cylindrical valves comprising radial inlet and axial outlet or axial inlet and radial outlet} |
| 3/12 | . Cooling of valves | 7/025 | . . . {Cylindrical valves comprising radial inlet and side outlet or side inlet and radial outlet} |
| 3/14 | . . by means of a liquid or solid coolant, e.g. sodium, in a closed chamber in a valve | 7/026 | . . {with two or more rotary valves, their rotational axes being parallel, e.g. 4-stroke} |
| 3/16 | . . by means of a fluid flowing through or along valve, e.g. air (for sealing only F01L 3/08) | 7/027 | . . {with two or more valves arranged coaxially (F01L 7/045 takes precedence)} |
| 3/18 | . . . Liquid cooling of valve | 7/028 | . . {having the rotational axis coaxial with the cylinder axis and the valve surface not surrounding piston or cylinder} |
| 3/20 | . Shapes or constructions of valve members, not provided for in preceding subgroups of this group | 7/029 | . . {having the rotational axis of the valve parallel to the cylinder axis} |
| 3/205 | . . {Reed valves} | 7/04 | . . surrounding working cylinder or piston |
| 3/22 | . Valve-seats not provided for in preceding subgroups of this group; Fixing of valve-seats | 7/045 | . . . {with two or more valves arranged coaxially} |
| 3/24 | . Safety means or accessories, not provided for in preceding sub- groups of this group | 7/06 | . with disc type valves |
| 2003/25 | . {Valve configurations in relation to engine} | 7/08 | . with conically or frusto-conically shaped valves |
| 2003/251 | . . {Large number of valves, e.g. five or more} | 7/10 | . with valves of other specific shape, e.g. spherical |
| 2003/253 | . . {configured parallel to piston axis} | 7/12 | . specially for two-stroke engines (F01L 7/04 takes precedence) |
| 2003/255 | . . {configured other than parallel or symmetrical relative to piston axis} | 7/14 | . Multiple-valve arrangements (with valves surrounding working cylinder or piston F01L 7/04 ; specially for two-stroke engines F01L 7/12) |
| 2003/256 | . . {configured other than perpendicular to camshaft axis} | 7/16 | . Sealing or packing arrangements specially therefor |
| 2003/258 | . . {opening away from cylinder} | | |
| 5/00 | Slide valve-gear or valve-arrangements (with pure rotary or oscillatory movement F01L 7/00) | | |
| 5/02 | . with other than cylindrical, sleeve or part annularly shaped valves, e.g. with flat-type valves | | |
| 5/04 | . with cylindrical, sleeve, or part-annularly shaped valves | | |

| | | | |
|-------------|--|--------------|---|
| 7/18 | . Component parts, details, or accessories not provided for in preceding subgroups of this group | 2009/0473 | {Temperature sensors} |
| | | 2009/0474 | {Flux sensors} |
| 9/00 | Valve-gear or valve arrangements actuated non-mechanically | 2009/0476 | {Spring force sensors} |
| 9/02 | . by fluid means, e.g. hydraulic | 2009/0478 | . . {Electromagnetic actuators; Method of operation thereof} |
| 9/021 | . . {the action of a cam being transmitted to a valve by a fluid column, e.g. a fluid conduit} | 2009/048 | . . . {Engine starting} |
| 9/023 | . . . {Hydraulic lifters, i.e. fluid chamber comprised between a piston actuated by a cam and a piston acting on a valve stem} | 2009/0482 | {in normal conditions} |
| 9/025 | {the volume of the chamber being variable, e.g. for varying the lift or the timing of a valve} | 2009/0484 | {Cold start} |
| 9/026 | . . {Pneumatic} | 2009/0486 | . . . {Soft landing, e.g. applying braking current; Levitation of armature close to core surface} |
| 2009/028 | . . {Boost means, i.e. means for increasing initial opening force of the valve} | 2009/0488 | . . . {Fail safe, e.g. valve kept closed if not opening properly} |
| 9/04 | . by electric means | 2009/049 | . . . {Determination of valve speed} |
| 2009/0401 | . . {Driving circuits therefor} | 2009/0492 | . . . {Determination of valve timing during particular working conditions, e.g. deceleration} |
| 2009/0403 | . . {Electromagnetic actuators comprising one coil} | 2009/0494 | . . . {Engine stopping; Engine stall} |
| 2009/0405 | . . {Electromagnetic actuators comprising two or more coils} | 2009/0496 | . . . {relating to sticking duration} |
| 2009/0407 | . . . {The two coils being disposed coaxially to the armature shaft} | 2009/0498 | . . . {relating to gap between armature shaft and valve stem end} |
| 2009/0409 | . . . {The armature being articulated perpendicularly to the coils axes} | | |
| 2009/0411 | . . {Electromagnetic actuators using a rotary motor} | 11/00 | Valve arrangements in working piston or piston-rod |
| 2009/0413 | . . {Piezo electric actuators} | 11/02 | . in piston |
| 2009/0415 | . . {Moving coil actuators} | 11/04 | . . operated by movement of connecting-rod |
| 2009/0417 | . . {Floating actuators for varying the valve stroke} | 11/06 | . . . operating oscillatory valve |
| 2009/0419 | . . {Actuator position setting device, e.g. initial setting} | 13/00 | Modifications of valve-gear to facilitate reversing, braking, starting, changing compression ratio, or other specific operations |
| 2009/0421 | . . {Mixed arrangement with both mechanically and electromagnetically actuated valves} | 13/0005 | . {Deactivating valves} |
| 2009/0423 | . . {Electromagnetic actuators construction details} | 2013/001 | . . {Deactivating cylinders} |
| 2009/0425 | . . . {Shaft and armature construction} | 13/0015 | . {for optimising engine performances by modifying valve lift according to various working parameters, e.g. rotational speed, load, torque} |
| 2009/0426 | {Arrangements for amplifying the armature stroke} | 13/0021 | . . {by modification of rocker arm ratio} |
| 2009/0428 | . . . {Core and coil construction} | 13/0026 | . . . {by means of an eccentric} |
| 2009/043 | . . . {Casing construction} | 13/0031 | . . {by modification of tappet or pushrod length} |
| 2009/0432 | . . . {Biasing means} | 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} |
| 2009/0434 | {Helical springs} | 13/0042 | . . . {with cams being profiled in axial and radial direction} |
| 2009/0436 | {Two opposed springs for intermediate resting position of the armature} | 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} |
| 2009/0438 | {Torsion springs} | 2013/0052 | . . . {with cams provided on an axially slidable sleeve} |
| 2009/044 | {Pneumatic springs} | 13/0057 | . . {by splittable or deformable cams} |
| 2009/0442 | {Means for varying the spring bias} | 13/0063 | . . {by modification of cam contact point by displacing an intermediate lever or wedge-shaped intermediate element, e.g. Tourtelot} |
| 2009/0444 | {Means for connecting springs to valve or anchor} | 2013/0068 | . . . {with an oscillating cam acting on the valve of the "BMW-Valvetronic" type} |
| 2009/0446 | . . . {Latching means} | 2013/0073 | . . . {with an oscillating cam acting on the valve of the "Delphi" type} |
| 2009/0448 | {using permanent magnet} | 2013/0078 | . . {by modification of cam contact point by axially displacing the camshaft} |
| 2009/0449 | . . . {Means for varying the air gap} | 2013/0084 | . . {by modification of cam contact point by radially displacing the camshaft} |
| 2009/0451 | . . . {Damping means} | 2013/0089 | . . {with means for delaying valve closing} |
| 2009/0453 | . . . {Means for counteracting cylinder pressure} | 2013/0094 | . . . {with switchable clamp for keeping valve open} |
| 2009/0455 | . . . {Lash adjusting means} | | |
| 2009/0457 | . . . {Actor cooling means} | | |
| 2009/0459 | . . . {Means for facilitating assembly} | | |
| 2009/0461 | . . . {Wiring} | | |
| 2009/0463 | {Connectors} | | |
| 2009/0465 | {Harnesses} | | |
| 2009/0467 | . . . {Sensing means} | | |
| 2009/0469 | {Position sensors} | | |
| 2009/0471 | {Vibration sensors} | | |

| | |
|----------|---|
| 13/02 | . for reversing |
| 13/04 | . for starting by means of fluid pressure |
| 13/06 | . for braking |
| 13/065 | . . {Compression release engine retarders of the "Jacobs Manufacturing" type} |
| 13/08 | . for decompression, e.g. during starting; for changing compression ratio |
| 13/085 | . . {the valve-gear having an auxiliary cam protruding from the main cam profile} |
| 2013/10 | . {Auxiliary actuators for variable valve timing} |
| 2013/101 | . . {Electromagnets} |
| 2013/103 | . . {Electric motors} |
| 2013/105 | . . {Hydraulic motors} |
| 2013/106 | . . {Pneumatic motors} |
| 2013/108 | . . {Centrifugal force} |
| 2013/11 | . {Sensors for variable valve timing} |
| 2013/111 | . . {Camshafts position or phase} |
| 2013/113 | . . {crankshafts position} |
| 2013/115 | . . {Pressure} |
| 2013/116 | . . {Temperature} |
| 2013/118 | . . {Valve lift} |

Valve-gear or valve arrangements, e.g. with reciprocating 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

| | |
|--------------|--|
| 15/00 | Valve-gear or valve arrangements, e.g. with reciprocating slide valves, other than provided for in groups F01L 17/00 - F01L 29/00 (valve drive or external valve-adjustment during operation, see the relevant groups, e.g. F01L 31/00; tripping-gear or tripping of valves F01L 31/00) |
| 15/02 | . with valves other than cylindrical, sleeve, or part-annularly-shaped, e.g. flat D-valves |
| 15/04 | . . main valve being combined with auxiliary valve (of drag valve type F01L 15/10) |
| 15/06 | . . . of Meyer or Rider type, i.e. in which the expansion is varied at the expansion valve itself |
| 15/08 | . with cylindrical, sleeve, or part-annularly-shaped valves; Such main valves combined with auxiliary valves |
| 15/10 | . with main slide valve and auxiliary valve dragged thereby |
| 15/12 | . characterised by having means for effecting pressure equilibrium between two different cylinder spaces at idling |
| 15/14 | . Arrangements with several co-operating main valves, e.g. reciprocating and rotary |
| 15/16 | . . with reciprocating slide valves only |
| 15/18 | . Valves arrangements not provided for in preceding subgroups of this main group |

| | |
|--------------|---|
| 15/20 | . Component parts, details, or accessories, not provided for in preceding subgroups of this main group |
| 17/00 | Slide valve-gear or valve arrangements with cylindrical, sleeve, or part annularly-shaped valves surrounding working cylinder or piston |
| 17/02 | . Drive or adjustment during operation, peculiar thereto, e.g. for reciprocating and oscillating movements or for several valves one inside the other |
| 19/00 | Slide valve-gear or valve arrangements with reciprocating and other movement of same valve, other than provided for in F01L 17/00, e.g. longitudinally of working cylinder and in cross direction |
| 19/02 | . Drive or adjustment during operation, peculiar thereto |
| 21/00 | Use of working pistons or pistons-rods as fluid-distributing valves or as valve-supporting elements, e.g. in free-piston machines |
| 21/02 | . Piston or piston-rod used as valve members {(F01L 25/066 takes precedence)} |
| 21/04 | . Valves arranged in or on piston or piston-rod |
| 23/00 | Valves controlled by impact by piston, e.g. in free-piston machines {(F01L 25/063 takes precedence)} |
| 25/00 | Drive, or adjustment during the operation, or distribution or expansion valves by non-mechanical means |
| 25/02 | . by fluid means |
| 25/04 | . . by working-fluid of machine or engine, e.g. free-piston machine |
| 25/06 | . . . Arrangements with main and auxiliary valves, at least one of them being fluid-driven |
| 25/063 | {the auxiliary valve being actuated by the working motor-piston or piston-rod} |
| 25/066 | {piston or piston-rod being used as auxiliary valve} |
| 25/08 | . by electric or magnetic means |
| 27/00 | Distribution or expansion valve-gear peculiar to free-piston machines or engines and not provided for in F01L 21/00 - F01L 25/00 |
| 27/02 | . the machine or engine having rotary or oscillatory valves |
| 27/04 | . Delayed-action controls, e.g. of cataract or dashpot type |
| 29/00 | Reversing gear (equally usable for control of degree of working-fluid admission and reversing being of secondary-importance F01L 31/00) |
| 29/02 | . by displacing eccentric |
| 29/04 | . by links or guide rods |
| 29/06 | . by interchanging inlet and exhaust ports |
| 29/08 | . specially for rotary or oscillatory valves |
| 29/10 | . Details, e.g. drive |
| 29/12 | . . Powered reverse gear |
| 31/00 | Valve drive, valve adjustment during operation, or other valve control, not provided for in groups F01L 15/00 - F01L 29/00 (sensing elements measuring the variable or condition to be controlled or regulated F01B) |

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

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 valve-supporting elements, valve-gear or valve arrangements peculiar to free-piston machines or engines [F01L 15/00](#) - [F01L 31/00](#))

- 33/00 Rotary or oscillatory slide valve-gear or valve arrangements, specially adapted for machines or engines with variable fluid distribution** (drive, adjustment during operation, tripping-gear, reversing-gear, use of working pistons or piston-rods as valves or as valve-supporting elements, valve-gear or valve arrangements peculiar to free-piston machines or engines [F01L 15/00](#) - [F01L 31/00](#))
 - 33/02 . rotary
 - 33/04 . oscillatory
- 35/00 Lift valve-gear or valve arrangements specially adapted for machines or engines with variable fluid distribution** (drive, adjustment during operation, tripping-gear, reversing-gear, use of working pistons or piston-rods as valves or as valve-supporting elements, valve-gear or valve arrangements peculiar to free-piston machines or engines [F01L 15/00](#) - [F01L 31/00](#))
 - 35/02 . Valves
 - 35/04 . Arrangements of valves in the machine or engine, e.g. relative to working cylinder

-
- 2201/00 Electronic control systems; Apparatus or methods therefor**
 - 2250/00 Camshaft drives characterised by their transmission means**
 - 2250/02 . the camshaft being driven by chains
 - 2250/04 . the camshaft being driven by belts
 - 2250/06 . the camshaft being driven by gear wheels
 - 2301/00 Using particular materials**
 - 2301/02 . Using ceramic materials
 - 2303/00 Manufacturing of components used in valve arrangements**
 - 2303/01 . Tools for producing, mounting or adjusting, e.g. some part of the distribution

- 2303/02 . Initial camshaft settings
- 2305/00 Valve arrangements comprising rollers**
 - 2305/02 . Mounting of rollers
- 2307/00 Preventing the rotation of tappets**
- 2309/00 Self-contained lash adjusters**
- 2311/00 Differential gears located between crankshafts and camshafts for varying the timing of valves**
- 2313/00 Rotary valve drives**
- 2710/00 Control of valve gear, speed or power**
 - 2710/003 . Control of valve gear for two stroke engines
 - 2710/006 . Safety devices therefor
- 2740/00 Control of slide-valve gear; Control pistons**
 - 2740/003 . more than one slide-valve, e.g. for four stroke engines
 - 2740/006 . more than one slide-valve, e.g. for two stroke engines
- 2750/00 Control of valve gear for four stroke engines directly driven by the crankshaft**
- 2760/00 Control of valve gear to facilitate reversing, starting, braking of four stroke engines**
 - 2760/001 . for starting four stroke engines
 - 2760/002 . for reversing or starting four stroke engines
 - 2760/003 . for switching to compressor action in order to brake
 - 2760/004 . . whereby braking is exclusively produced by compression in the cylinders
 - 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
 - 2760/006 . for reversing two stroke engines
 - 2760/007 . for starting two stroke engines
 - 2760/008 . for reversing and restarting two stroke engines
- 2800/00 Methods of operation using a variable valve timing mechanism**
 - 2800/01 . Starting
 - 2800/02 . Cold running
 - 2800/03 . Stopping; Stalling
 - 2800/04 . Timing control at idling
 - 2800/05 . Timing control under consideration of oil condition
 - 2800/06 . Timing or lift different for valves of same cylinder
 - 2800/08 . Timing or lift different for valves of different cylinders
 - 2800/09 . Calibrating
 - 2800/10 . Providing exhaust gas recirculation [EGR]
 - 2800/11 . Fault detection, diagnosis
 - 2800/12 . Fail safe operation
 - 2800/13 . Throttleless
 - 2800/14 . Determining a position, e.g. phase or lift
 - 2800/15 . Balancing of rotating parts
 - 2800/16 . Preventing interference
 - 2800/17 . Maintenance; Servicing
 - 2800/18 . Testing or simulation
 - 2800/19 . Valves opening several times per stroke
- 2810/00 Arrangements solving specific problems in relation with valve gears**
 - 2810/01 . Cooling
 - 2810/02 . Lubrication

F01L

- 2810/03 . Reducing vibration
- 2810/04 . Reducing noise
- 2810/05 . Related to pressure difference on both sides of a valve

2820/00 Details on specific features characterising valve gear arrangements

- 2820/01 . Absolute values
- 2820/02 . Formulas
- 2820/03 . Auxiliary actuators
- 2820/031 . . Electromagnets
- 2820/032 . . Electric motors
- 2820/033 . . Hydraulic engines
- 2820/034 . . Pneumatic engines
- 2820/035 . . Centrifugal forces
- 2820/04 . Sensors
- 2820/041 . . Camshafts position or phase sensors
- 2820/042 . . Crankshafts position
- 2820/043 . . Pressure
- 2820/044 . . Temperature
- 2820/045 . . Valve lift