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 teethed sleeve or gear moving axially between crankshaft and camshaft }
F01L 1/34406 . . . . { the helically teethed 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 symetrical relative to piston axis

F01L 2003/256 . . configured other than perpendicular to camshaft axis

F01L 2003/258 . . opening away from cylinder

F01L 5/00 **Slide valve-gear or valve-arrangements** (with pure rotary or oscillatory movement F01L 7/00)

F01L 5/02 . with other than cylindrical, sleeve or part annularly shaped valves e.g. with flat-type valves

F01L 5/04 . with cylindrical, sleeve, or part-annularly shaped valves

F01L 5/045 . . { Piston-type or cylinder-type valves arranged above the piston and coaxial with the cylinder axis }

F01L 5/06 . . surrounding working cylinder or piston

F01L 5/08 . . . Arrangements with several movements or several valves, e.g. one valve inside the other (with part-annularly shaped valves F01L 5/12)

F01L 5/10 . . . . with reciprocating and other movements of the same valve

F01L 5/12 . . . Arrangements with part-annularly-shaped valves

F01L 5/14 . characterised by the provision of valves with reciprocating and other movements (surrounding working cylinder or piston F01L 5/06)

F01L 5/16 . . with reciprocating and other movement of same valve, e.g. longitudinally of working cylinder and in cross direction

F01L 5/18 . . with reciprocatory valve and other slide valve

F01L 5/20 . specially for two-stroke engines (F01L 5/06 and F01L 5/14 take precedence)

F01L 5/22 . Multiple-valve arrangements (with valves surrounding working cylinder or piston F01L 5/06; with reciprocatory and other slide valves F01L 5/18; specially for two-stroke engines F01L 5/20)

F01L 5/24 . Component parts, details or accessories, not provided for in preceding subgroups in this group

F01L 7/00 **Rotary or oscillatory slide valve-gear or valve arrangements** (slide valves with combined rotary and non-rotary movements, combinations of rotary and non-rotary slide valves F01L 5/00)

F01L 7/02 . with cylindrical, sleeve, or part-annularly shaped valves (of disc type F01L 7/06; of conical type F01L 7/08)

F01L 7/021 . . { with one rotary valve }

F01L 7/022 . . . { Cylindrical valves having one recess communicating successively with aligned inlet and exhaust ports }

F01L 7/023 . . . { Cylindrical valves having a hollow or partly hollow body allowing axial inlet or exhaust fluid circulation }

F01L 7/024 . . . { Cylindrical valves comprising radial inlet and axial outlet or axial inlet and radial outlet }

F01L 7/025 . . . { Cylindrical valves comprising radial inlet and side outlet or side inlet and radial outlet }

F01L 7/026 . . { with two or more rotary valves, their rotational axes being parallel, e.g. 4-stroke }

F01L 7/027 . . { with two or more valves arranged coaxially } (F01L 7/045 takes precedence)]

F01L 7/028 . . { having the rotational axis coaxial with the cylinder axis and the valve surface not surrounding piston or cylinder }

F01L 7/029 . . { having the rotational axis of the valve parallel to the cylinder axis }

F01L 7/04 . . Surrounding working cylinder or piston

F01L 7/045 . . . { with two or more valves arranged coaxially }

F01L 7/06 . with disc type valves

F01L 7/08 . with conically or frusto-conically shaped valves

F01L 7/10 . with valves of other specific shape, e.g. spherical

F01L 7/12 . specially for two-stroke engines (F01L 7/04 takes precedence)

F01L 7/14 . Multiple-valve arrangements (with valves surrounding working cylinder or piston F01L 7/04; specially for two-stroke engines F01L 7/12)

F01L 7/16 . Sealing or packing arrangements specially therefor

F01L 7/18 . Component parts, details, or accessories not provided for in preceding sub-groups of this group

F01L 9/00 **Valve-gear or valve arrangements actuated non-mechanically**

F01L 9/02 . by fluid means, e.g. hydraulic

F01L 9/021 . . { the action of a cam being transmitted to a valve by a fluid column, e.g. a fluid conduit }

F01L 9/023 . . . { Hydraulic lifters, i.e. fluid chamber comprised between a piston actuated by a cam and a piston acting on a valve stem }

F01L 9/025 . . . . { the volume of the chamber being variable, e.g. for varying the lift or the timing of a valve }

F01L 9/026 . . { Pneumatic }

F01L 2009/028 . . Boost means, i.e. means for increasing initial opening force of the valve

F01L 9/04 . by electric means

F01L 2009/0401 . . Driving circuits therefor

F01L 2009/0403 . . Electromagnetic actuators comprising one coil

F01L 2009/0405 . . Electromagnetic actuators comprising two or more coils

F01L 2009/0407 . . . The two coils being disposed coaxially to the armature shaft

F01L 2009/0409 . . . The armature being articulated perpendicularly to the coils axes

F01L 2009/0411 . . Electromagnetic actuators using a rotary motor

F01L 2009/0413 . . Piezo electric actuators

F01L 2009/0415 . . Moving coil actuators

F01L 2009/0417 . . Floating actuators for varying the valve stroke

F01L 2009/0419 . . Actuator position setting device, e.g. initial setting

F01L 2009/0421 . . Mixed arrangement with both mechanically and electromagnetically actuated valves

F01L 2009/0423 . . Electromagnetic actuators construction details

F01L 2009/0425 . . . Shaft and armature construction

F01L 2009/0426 . . . . Arrangements for amplifying the armature stroke

F01L 2009/0428 . . . Core and coil construction

F01L 2009/043 . . . Casing construction

F01L 2009/0432 . . . Biasing means

F01L 2009/0434 . . . . Helical springs

F01L 2009/0436 . . . . . Two opposed springs for intermediate resting position of the armature

F01L 2009/0438 . . . . Torsion springs

F01L 2009/044 . . . . Pneumatic springs

F01L 2009/0442 . . . . Means for varying the spring bias

F01L 2009/0444 . . . . Means for connecting springs to valve or anchor

F01L 2009/0446 . . . Latching means

F01L 2009/0448 . . . . using permanent magnet

F01L 2009/0449 . . . Means for varying the air gap

F01L 2009/0451 . . . Damping means

F01L 2009/0453 . . . Means for counteracting cylinder pressure

F01L 2009/0455 . . . Lash adjusting means

F01L 2009/0457 . . . Actor cooling means

F01L 2009/0459 . . . Means for facilitating assembly

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

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

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

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

F01L 13/0005 . { Deactivating valves }
F01L 2013/001 . . Deactivating cylinders

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

of each other }

F01L 2013/0052 . . . with cams provided on an axially slidable sleeve

F01L 13/0057 . . { by splittable or deformable cams }

F01L 13/0063 . . { by modification of cam contact point by displacing an intermediate lever or wedge-shaped intermediate element, e.g. Tourtelot }

F01L 2013/0068 . . . with an oscillating cam acting on the valve of the "BMW-Valvetronic" type

F01L 2013/0073 . . . with an oscillating cam acting on the valve of the "Delphi" type

F01L 2013/0078 . . by modification of cam contact point by axially displacing the camshaft

F01L 2013/0084 . . by modification of cam contact point by radially displacing the camshaft

F01L 2013/0089 . . with means for delaying valve closing

F01L 2013/0094 . . . with switchable clamp for keeping valve open

F01L 13/02 . for reversing

F01L 13/04 . for starting by means of fluid pressure

F01L 13/06 . for braking

F01L 13/065 . . { Compression release engine retarders of the "Jacobs Manufacturing" type }

F01L 13/08 . for decompression, e.g. during starting; for changing compression ratio

F01L 13/085 . . { the valve-gear having an auxiliary cam protruding from the main cam profile }

F01L 2013/10 . Auxiliary actuators for variable valve timing

F01L 2013/101 . . Electromagnets

F01L 2013/103 . . Electric motors

F01L 2013/105 . . Hydraulic motors

F01L 2013/106 . . Pneumatic motors

F01L 2013/108 . . Centrifugal force

F01L 2013/11 . Sensors for variable valve timing

F01L 2013/111 . . Camshafts position or phase

F01L 2013/113 . . crankshafts position

F01L 2013/115 . . Pressure

F01L 2013/116 . . Temperature

F01L 2013/118 . . Valve lift

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

NOTE

The groups under this guide heading do not fully embrace subject matter restricted to rotary, oscillatory, or lift-valve-gear or valve arrangements, classified in groups F01L 33/00 and F01L 35/00. However, the present groups do embrace the following subject-matter thereof; valves drives or means external to valves for adjustment during operation, tripping-gear, reversing-gear, use of pistons or piston-rods as

valves or as valve-supporting elements, valve-gear or valve arrangements peculiar to free-piston machines or engines

F01L 15/00 **Valve-gear or valve arrangements, e.g. with reciprocatory slide valves, other than provided for in groups F01L 17/00 to F01L 29/00** (valve drive or external valve-adjustment during operation, see the relevant groups, e.g. F01L 31/00; tripping-gear or tripping of valves F01L 31/00)

F01L 15/02 . with valves other than cylindrical, sleeve, or part-annularly-shaped, e.g. flat D-valves

F01L 15/04 . . main valve being combined with auxiliary valve (of drag valve type F01L 15/10)

F01L 15/06 . . . of Meyer or Rider type, i.e. in which the expansion is varied at the expansion valve itself

F01L 15/08 . with cylindrical, sleeve, or part-annularly-shaped valves; Such main valves combined with auxiliarly valves

F01L 15/10 . with main slide valve and auxiliary valve dragged thereby

F01L 15/12 . characterised by having means for effecting pressure equilibrium between two different cylinder spaces at idling

F01L 15/14 . Arrangements with several co-operating main valves, e.g. reciprocatory and rotary

F01L 15/16 . . with reciprocatory slide valves only

F01L 15/18 . Valves arrangements not provided for in preceding sub-groups of this main group

F01L 15/20 . Component parts, details, or accessories, not provided for in preceding sub-groups of this main group

F01L 17/00 **Slide valve-gear or valve arrangements with cylindrical, sleeve, or part annularly-shaped valves surrounding working cylinder or piston**

F01L 17/02 . Drive or adjustment during operation, peculiar thereto, e.g. for reciprocating and oscillating movements or for several valves one inside the other

F01L 19/00 **Slide valve-gear or valve arrangements with reciprocatory and other movement of same valve, other than provided for in F01L 17/00, e.g. longitudinally of working cylinder and in cross direction**

F01L 19/02 . Drive or adjustment during operation, peculiar thereto

F01L 21/00 **Use of working pistons or pistons-rods as fluid-distributing valves or a valve-supporting elements, e.g. in free-piston machines**

F01L 21/02 . Piston or piston-rod used as valve members { F01L 25/066 takes precedence }

F01L 21/04 . Valves arranged in or on piston or piston-rod

F01L 23/00 **Valves controlled by impact by piston, e.g. in free-piston machines;** { F01L 25/063 takes precedence }

F01L 25/00 **Drive, or adjustment during the operation, or distribution or expansion valves by non-mechanical means**

F01L 25/02 . by fluid means

F01L 25/04 . . by working-fluid of machine or engine, e.g. free-piston machine

F01L 25/06 . . . Arrangement with main and auxiliary valves, at least one of them being fluid-driven

F01L 25/063 . . . . { the auxiliary valve being actuated by the working motor-piston or piston-rod }

F01L 25/066 . . . . { piston or piston-rod being used as auxiliary valve }

F01L 25/08 . by electric or magnetic means

F01L 27/00 **Distribution or expansion valve-gear peculiar to free-piston machines or engines and not provided for in F01L 21/00 to F01L 25/00**

F01L 27/02 . the machine or engine having rotary or oscillatory valves

F01L 27/04 . Delayed-action controls, e.g. of cataract or dashpot type

F01L 29/00 **Reversing gear** (equally usable for control of degree of working-fluid admission and reversing being of secondary-importance F01L 31/00)

F01L 29/02 . by displacing eccentric

F01L 29/04 . by links or guide rods

F01L 29/06 . by interchanging inlet and exhaust ports

F01L 29/08 . specially for rotary or oscillatory valves

F01L 29/10 . Details, e.g. drive

F01L 29/12 . . Powered reverse gear

F01L 31/00 **Valve drive, valve adjustment during operation, or other valve control, not provided for in groups F01L 15/00 to F01L 29/00** (sensing elements measuring the variable or condition to be controlled or regulated F01B)

F01L 31/02 . with tripping-gear (for oscillatory valves F01L 31/06); Tripping of valves

F01L 31/04 . . with positively-driven trip levers

F01L 31/06 . with tripping-gear specially for oscillatory valves; Oscillatory tripping-valves, e.g. of Corliss type

F01L 31/08 . Valve drive or valve adjustment, apart from tripping aspects; Positively-driven gear

F01L 31/10 . . the drive being effected by eccentrics (F01L 31/14 takes precedence)

F01L 31/12 . . . Valve adjustment by displacing eccentric

F01L 31/14 . . Valve adjustment by links or guide rods, e.g. in valve-gear with eccentric drive

F01L 31/16 . . the drive being effected by specific means other than eccentric, e.g. cams; Valve adjustment in connection with such drives

F01L 31/18 . . specially for rotary or oscillatory valves

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

F01L 33/00 **Rotary or oscillatory slide valve-gear or valve arrangements, specially adapted for machines or engines with variable fluid distribution** (drive, adjustment during operation, tripping-gear, reversing-gear, use of working pistons or piston-rods as valves or as valve-supporting elements, valve-gear or valve arrangements peculiar to free-piston machines or engines F01L 15/00 to F01L 31/00)

F01L 33/02 . rotary

F01L 33/04 . oscillatory

F01L 35/00 **Lift valve-gear or valve arrangements specially adapted for machines or engines with variable fluid distribution** (drive, adjustment during operation, tripping-gear, reversing-gear, use of working pistons or piston-rods as valves or as valve-supporting elements, valve-gear or valve arrangements peculiar to free-piston machines or engines F01L 15/00 to F01L 31/00)

F01L 35/02 . Valves

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

F01L 2101/00 **Using particular materials**

F01L 2101/02 . Using ceramic materials

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

F01L 2103/01 . Tools for producing, mounting or adjusting, e.g. some part of the distribution

F01L 2103/02 . Initial camshaft settings

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

F01L 2105/02 . Mounting of rollers

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

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 strocke engines

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

F01L 2800/01 . Starting

F01L 2800/02 . Cold running

F01L 2800/03 . Stopping; Stalling

F01L 2800/04 . Timing control at idling

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

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

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

F01L 2800/09 . Calibrating

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

F01L 2800/11 . Fault detection, diagnosis

F01L 2800/12 . Fail safe operation

F01L 2800/13 . Throttleless

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

F01L 2800/15 . Balancing of rotating parts

F01L 2800/16 . Preventing interference

F01L 2800/17 . Maintenance; Servicing

F01L 2800/18 . Testing or simulation

F01L 2800/19 . Valves opening several times per stroke

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

F01L 2810/01 . Cooling

F01L 2810/02 . Lubrication

F01L 2810/03 . Reducing vibration

F01L 2810/04 . Reducing noise

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

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

F01L 2820/01 . Absolute values

F01L 2820/02 . Formulas

F01L 2820/03 . Auxiliary actuators
F01L 2820/031 . . Electromagnets
F01L 2820/032 . . Electric motors
F01L 2820/033 . . Hydraulic engines
F01L 2820/034 . . Pneumatic engines
F01L 2820/035 . . Centrifugal forces

F01L 2820/04 . Sensors
F01L 2820/041 . . Camshafts position or phase sensors
F01L 2820/042 . . Crankshafts position
F01L 2820/043 . . Pressure
F01L 2820/044 . . Temperature
F01L 2820/045 . . Valve lift