

# 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

### 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](#).

### WARNING

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

|                            |            |   |
|----------------------------|------------|---|
| <a href="#">F01L 31/20</a> | covered by | <a href="#">F01L 31/08</a> - <a href="#">F01L 31/18</a> |
| <a href="#">F01L 31/22</a> | covered by | <a href="#">F01L 31/08</a> - <a href="#">F01L 31/18</a> |
| <a href="#">F01L 31/24</a> | covered by | <a href="#">F01L 31/08</a> - <a href="#">F01L 31/18</a> |

### Valve-gear or valve arrangements for positive-displacement machines or engines other than steam engines, e.g. for internal-combustion piston engines, without provision for variable fluid distribution

|                 |  |                  |   |
|-----------------|--|------------------|---|
| <b>1/00</b>     | <b>Valve-gear or valve arrangements, e.g. lift-valve gear (lift-valve and valve-seat assemblies <a href="#">per se</a> <a href="#">F01L 3/00</a>; slide-valve gear <a href="#">F01L 5/00</a>; actuated non-mechanically <a href="#">F01L 9/00</a>; valve arrangements in working piston or piston rod <a href="#">F01L 11/00</a>; modifications of valve-gear to facilitate reversing, braking, starting, changing compression ratio, or other specific operations <a href="#">F01L 13/00</a>)</b> | <b>1/047</b>     | <b>. . . . Camshafts</b>  |
|                 |  | <b>2001/0471</b> | <b>. . . . {Assembled camshafts}</b>  |
|                 |  | <b>2001/0473</b> | <b>. . . . . {Composite camshafts, e.g. with cams or cam sleeve being able to move relative to the inner camshaft or a cam adjusting rod}</b>                               |
|                 |  | <b>2001/0475</b> | <b>. . . . . {Hollow camshafts}</b>   |
|                 |  | <b>2001/0476</b> | <b>. . . . . {Camshaft bearings}</b>  |
|                 |  | <b>2001/0478</b> | <b>. . . . . {Torque pulse compensated camshafts}</b>   |
|                 |  | <b>1/053</b>     | <b>. . . . . overhead type</b>  |
|                 |  | <b>1/0532</b>    | <b>. . . . . {the cams being directly in contact with the driven valve}</b>   |
|                 |  | <b>2001/0535</b> | <b>. . . . . {Single overhead camshafts [SOHC]}</b>   |
| <b>1/02</b>     | <b>. Valve drive (transmitting-gear between valve drive and valve <a href="#">F01L 1/12</a>)</b>   | <b>2001/0537</b> | <b>. . . . . {Double overhead camshafts [DOHC]}</b>   |
| <b>1/022</b>    | <b>. . {Chain drive}</b>   | <b>2001/054</b>  | <b>. . . . . {Camshafts in cylinder block}</b>  |
| <b>1/024</b>    | <b>. . {Belt drive}</b>  | <b>1/06</b>      | <b>. . . 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</b> |
| <b>1/026</b>    | <b>. . {Gear drive}</b>  | <b>1/08</b>      | <b>. . . Shape of cams</b>  |
| <b>2001/028</b> | <b>. . {Pre-assembled timing arrangement, e.g. located in a cassette}</b>  | <b>1/10</b>      | <b>. . by means of crank-or eccentric-driven rods</b>   |
| <b>1/04</b>     | <b>. . by means of cams, camshafts, cam discs, eccentrics or the like (<a href="#">F01L 1/10</a> takes precedence)</b>   |                  |   |
| <b>1/042</b>    | <b>. . . {Cam discs}</b>   |                  |   |
| <b>1/044</b>    | <b>. . . {Reciprocating cams}</b>  |                  |   |

### WARNING

Group [F01L 1/044](#) is impacted by reclassification into group [F01L 1/10](#).

Groups [F01L 1/044](#) and [F01L 1/10](#) should be considered in order to perform a complete search.

### WARNING

Group [F01L 1/10](#) is incomplete pending reclassification of documents from group [F01L 1/044](#).

Groups [F01L 1/044](#) and [F01L 1/10](#) should be considered in order to perform a complete search.

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|-------------|--|
| <b>1/12</b> | <b>. Transmitting gear between valve drive and valve (<a href="#">simultaneously operating two or more valves</a> <a href="#">F01L 1/26</a>)</b> |
|-------------|--|

|           |   |            |  |
|-----------|---|------------|--|
| 1/14      | . . Tappets { <a href="#">hydraulic tappets for automatically adjusting or compensating clearance F01L 1/24</a> }; Push rods  | 1/285      | . . {Coaxial intake and exhaust valves}  |
| 1/143     | . . . {for use with overhead camshafts}   | 1/30       | . characterised by the provision of positively opened and closed valves, i.e. desmodromic valves   |
| 1/146     | . . . {Push-rods}   | 1/32       | . characterised by the provision of means for rotating lift valves, e.g. to diminish wear  |
| 1/16      | . . . Silencing impact; Reducing 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} |
| 1/18      | . . Rocking arms or levers  | 1/344      | . . changing the angular relationship between crankshaft and camshaft, e.g. using helicoidal gear  |
| 1/181     | . . . {Centre pivot rocking arms}   | 1/34403    | . . . {using helically teathed sleeve or gear moving axially between crankshaft and camshaft}  |
| 1/182     | . . . . {the rocking arm being pivoted about an individual fulcrum, i.e. not about a common shaft}  | 1/34406    | . . . . {the helically teathed sleeve being located in the camshaft driving pulley}  |
| 1/183     | . . . . . {of the boat type}  | 1/34409    | . . . {by torque-responsive means}   |
| 1/185     | . . . {Overhead end-pivot rocking arms}   | 1/34413    | . . . {using composite camshafts, e.g. with cams being able to move relative to the camshaft}  |
| 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}  | 1/34416    | . . . {using twisted cams}   |
| 2001/187  | . . . {Clips, e.g. for retaining rocker arm on pivot}   | 1/3442     | . . . {using hydraulic chambers with variable volume to transmit the rotating force}   |
| 2001/188  | . . . {Fulcrums at upper surface}   | 2001/34423 | . . . . {Details relating to the hydraulic feeding circuit}  |
| 1/20      | . Adjusting or compensating clearance   | 2001/34426 | . . . . . {Oil control valves}   |
| 1/205     | . . {by means of shims or the like}   | 2001/3443  | . . . . . {Solenoid driven oil control valves}   |
| 1/22      | . . automatically, e.g. mechanically  | 2001/34433 | . . . . . {Location oil control valves}  |
| 1/24      | . . . by fluid means, e.g. hydraulically  | 2001/34436 | . . . . . {Features or method for avoiding malfunction due to foreign matters in oil}  |
| 1/2405    | . . . . {by means of a hydraulic adjusting device located between the cylinder head and rocker arm}   | 2001/3444  | . . . . . {Oil filters}  |
| 1/2411    | . . . . {by means of a hydraulic adjusting device located between the valve stem and rocker arm}  | 2001/34443 | . . . . . {Cleaning control of oil control valves}   |
| 1/2416    | . . . . {by means of a hydraulic adjusting device attached to an articulated rocker}  | 2001/34446 | . . . . . {Fluid accumulators for the feeding circuit}   |
| 1/2422    | . . . . {by means or a hydraulic adjusting device located between the push rod and rocker arm}  | 2001/3445  | . . . . . {Details relating to the hydraulic means for changing the angular relationship}  |
| 2001/2427 | . . . . {by means of an hydraulic adjusting device located between cam and push rod}  | 2001/34453 | . . . . . {Locking means between driving and driven members}   |
| 2001/2433 | . . . . {Self contained, e.g. sealed hydraulic lash adjusters}  | 2001/34456 | . . . . . {Locking in only one position}   |
| 2001/2438 | . . . . {with means permitting forced opening of check valve}   | 2001/34459 | . . . . . {Locking in multiple positions}  |
| 2001/2444 | . . . . {Details relating to the hydraulic feeding circuit, e.g. lifter oil manifold assembly [LOMA]}   | 2001/34463 | . . . . . {Locking position intermediate between most retarded and most advanced positions}  |
| 1/245     | . . . . Hydraulic tappets   | 2001/34466 | . . . . . {with multiple locking devices}  |
| 1/25      | . . . . . between cam and valve stem  | 2001/34469 | . . . . . {Lock movement parallel to camshaft axis}  |
| 1/252     | . . . . . {for side-valve engines}  | 2001/34473 | . . . . . {Lock movement perpendicular to camshaft axis}   |
| 1/255     | . . . . . between cam and rocker arm  | 2001/34476 | . . . . . {Restrict range locking means}   |
| 2001/256  | . . . . . {between cam and push rod}  | 2001/34479 | . . . . . {Sealing of phaser devices}  |
| 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 ( <a href="#">with coaxial valves F01L 1/28</a> ) | 2001/34483 | . . . . . {Phaser return springs}  |
| 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 takes precedence</a> )}                                 | 2001/34486 | . . . . {Location and number of the means for changing the angular relationship}   |
| 1/265     | . . {peculiar to machines or engines with three or more intake valves per cylinder}   | 2001/34489 | . . . . {Two phasers on one camshaft}  |
| 1/267     | . . {with means for varying the timing or the lift of the valves}   | 2001/34493 | . . . . {Dual independent phasing system [DIPS]}   |
| 1/28      | . characterised by the provision of coaxial valves; characterised by the provision of valves co-operating with both intake and exhaust ports  | 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        | <ul style="list-style-type: none"> <li>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)</li> </ul>   | 5/02        | <ul style="list-style-type: none"> <li>with other than cylindrical, sleeve or part annularly shaped valves, e.g. with flat-type valves</li> </ul>   |
| 1/40        | <ul style="list-style-type: none"> <li>for engines with scavenging charge near top dead centre position, e.g. by overlapping inlet and exhaust time</li> </ul>   | 5/04        | <ul style="list-style-type: none"> <li>with cylindrical, sleeve, or part-annularly shaped valves</li> </ul>   |
| 1/42        | <ul style="list-style-type: none"> <li>for machines or engines characterised by cylinder arrangements, e.g. star or fan</li> </ul>   | 5/045       | <ul style="list-style-type: none"> <li>{Piston-type or cylinder-type valves arranged above the piston and coaxial with the cylinder axis}</li> </ul>  |
| 1/44        | <ul style="list-style-type: none"> <li>Multiple-valve gear or arrangements, not provided for in preceding subgroups, e.g. with lift and different valves</li> </ul>  | 5/06        | <ul style="list-style-type: none"> <li>surrounding working cylinder or piston</li> </ul>  |
| 1/443       | <ul style="list-style-type: none"> <li>{comprising a lift valve and at least one rotary valve}</li> </ul>  | 5/08        | <ul style="list-style-type: none"> <li>Arrangements with several movements or several valves, e.g. one valve inside the other (with part-annularly shaped valves <a href="#">F01L 5/12</a>)</li> </ul>  |
| 1/446       | <ul style="list-style-type: none"> <li>{comprising a lift valve and at least one reed valve}</li> </ul>  | 5/10        | <ul style="list-style-type: none"> <li>with reciprocating and other movements of the same valve</li> </ul>  |
| 1/46        | <ul style="list-style-type: none"> <li>Component parts, details, or accessories, not provided for in preceding subgroups</li> </ul>  | 5/12        | <ul style="list-style-type: none"> <li>Arrangements with part-annularly-shaped valves</li> </ul>  |
| 1/462       | <ul style="list-style-type: none"> <li>{Valve return spring arrangements}</li> </ul>   | 5/14        | <ul style="list-style-type: none"> <li>characterised by the provision of valves with reciprocating and other movements (surrounding working cylinder or piston <a href="#">F01L 5/06</a>)</li> </ul>  |
| 1/465       | <ul style="list-style-type: none"> <li>{Pneumatic arrangements}</li> </ul>   | 5/16        | <ul style="list-style-type: none"> <li>with reciprocating and other movement of same valve, e.g. longitudinally of working cylinder and in cross direction</li> </ul>   |
| 2001/467    | <ul style="list-style-type: none"> <li>{Lost motion springs}</li> </ul>  | 5/18        | <ul style="list-style-type: none"> <li>with reciprocating valve and other slide valve</li> </ul>  |
| <b>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>  | 5/20        | <ul style="list-style-type: none"> <li>specially for two-stroke engines (<a href="#">F01L 5/06</a>, <a href="#">F01L 5/14</a> take precedence)</li> </ul>   |
| 3/02        | <ul style="list-style-type: none"> <li>Selecting particular materials for valve-members or valve-seats; Valve-members or valve-seats composed of two or more materials</li> </ul>  | 5/22        | <ul style="list-style-type: none"> <li>Multiple-valve arrangements (with valves surrounding working cylinder or piston <a href="#">F01L 5/08</a>; with reciprocating and other slide valves <a href="#">F01L 5/18</a>; specially for two-stroke engines <a href="#">F01L 5/20</a>)</li> </ul> |
| 3/04        | <ul style="list-style-type: none"> <li>Coated valve members or valve-seats</li> </ul>  | 5/24        | <ul style="list-style-type: none"> <li>Component parts, details or accessories, not provided for in preceding subgroups in this group</li> </ul>  |
| 3/06        | <ul style="list-style-type: none"> <li>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 <a href="#">F01L 1/32</a>)</li> </ul> | <b>7/00</b> | <b>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 <a href="#">F01L 5/00</a>)</b>  |
| 3/08        | <ul style="list-style-type: none"> <li>Valves guides; Sealing of valve stem, e.g. sealing by lubricant</li> </ul>  | 7/02        | <ul style="list-style-type: none"> <li>with cylindrical, sleeve, or part-annularly shaped valves (of disc type <a href="#">F01L 7/06</a>; of conical type <a href="#">F01L 7/08</a>)</li> </ul>   |
| 3/085       | <ul style="list-style-type: none"> <li>{Valve cages}</li> </ul>  | 7/021       | <ul style="list-style-type: none"> <li>{with one rotary valve}</li> </ul>   |
| 3/10        | <ul style="list-style-type: none"> <li>Connecting springs to valve members</li> </ul>  | 7/022       | <ul style="list-style-type: none"> <li>{Cylindrical valves having one recess communicating successively with aligned inlet and exhaust ports}</li> </ul>  |
| 2003/11     | <ul style="list-style-type: none"> <li>{Connecting valve members to rocker arm or tappet}</li> </ul>   | 7/023       | <ul style="list-style-type: none"> <li>{Cylindrical valves having a hollow or partly hollow body allowing axial inlet or exhaust fluid circulation}</li> </ul>  |
| 3/12        | <ul style="list-style-type: none"> <li>Cooling of valves</li> </ul>  | 7/024       | <ul style="list-style-type: none"> <li>{Cylindrical valves comprising radial inlet and axial outlet or axial inlet and radial outlet}</li> </ul>  |
| 3/14        | <ul style="list-style-type: none"> <li>by means of a liquid or solid coolant, e.g. sodium, in a closed chamber in a valve</li> </ul>   | 7/025       | <ul style="list-style-type: none"> <li>{Cylindrical valves comprising radial inlet and side outlet or side inlet and radial outlet}</li> </ul>  |
| 3/16        | <ul style="list-style-type: none"> <li>by means of a fluid flowing through or along valve, e.g. air</li> </ul>   | 7/026       | <ul style="list-style-type: none"> <li>{with two or more rotary valves, their rotational axes being parallel, e.g. 4-stroke}</li> </ul>   |
| 3/18        | <ul style="list-style-type: none"> <li>Liquid cooling of valve</li> </ul>  | 7/027       | <ul style="list-style-type: none"> <li>{with two or more valves arranged coaxially (<a href="#">F01L 7/045</a> takes precedence)}</li> </ul>  |
| 3/20        | <ul style="list-style-type: none"> <li>Shapes or constructions of valve members, not provided for in preceding subgroups of this group</li> </ul>  | 7/028       | <ul style="list-style-type: none"> <li>{having the rotational axis coaxial with the cylinder axis and the valve surface not surrounding piston or cylinder}</li> </ul>  |
| 3/205       | <ul style="list-style-type: none"> <li>{Reed valves}</li> </ul>  | 7/029       | <ul style="list-style-type: none"> <li>{having the rotational axis of the valve parallel to the cylinder axis}</li> </ul>   |
| 3/22        | <ul style="list-style-type: none"> <li>Valve-seats not provided for in preceding subgroups of this group; Fixing of valve-seats</li> </ul>   | 7/04        | <ul style="list-style-type: none"> <li>surrounding working cylinder or piston</li> </ul>  |
| 3/24        | <ul style="list-style-type: none"> <li>Safety means or accessories, not provided for in preceding sub- groups of this group</li> </ul>   | 7/045       | <ul style="list-style-type: none"> <li>{with two or more valves arranged coaxially}</li> </ul>  |
| 2003/25     | <ul style="list-style-type: none"> <li>{Valve configurations in relation to engine}</li> </ul>   | 7/06        | <ul style="list-style-type: none"> <li>with disc type valves</li> </ul>   |
| 2003/251    | <ul style="list-style-type: none"> <li>{Large number of valves, e.g. five or more}</li> </ul>  | 7/08        | <ul style="list-style-type: none"> <li>with conically or frusto-conically shaped valves</li> </ul>  |
| 2003/253    | <ul style="list-style-type: none"> <li>{configured parallel to piston axis}</li> </ul>   | 7/10        | <ul style="list-style-type: none"> <li>with valves of other specific shape, e.g. spherical</li> </ul>   |
| 2003/255    | <ul style="list-style-type: none"> <li>{configured other than parallel or symmetrical relative to piston axis}</li> </ul>  | 7/12        | <ul style="list-style-type: none"> <li>specially for two-stroke engines (<a href="#">F01L 7/04</a> takes precedence)</li> </ul>   |
| 2003/256    | <ul style="list-style-type: none"> <li>{configured other than perpendicular to camshaft axis}</li> </ul>   |             |   |
| 2003/258    | <ul style="list-style-type: none"> <li>{opening away from cylinder}</li> </ul>   |             |   |
| <b>5/00</b> | <b>Slide valve-gear or valve-arrangements (with pure rotary or oscillatory movement <a href="#">F01L 7/00</a>)</b>   |             |   |

|             |  |              |   |
|-------------|--|--------------|---|
| 7/14        | . Multiple-valve arrangements ( <a href="#">with valves surrounding working cylinder or piston F01L 7/04; specially for two-stroke engines F01L 7/12</a> ) | 9/22         | . . actuated by rotary motors   |
| 7/16        | . Sealing or packing arrangements specially therefor   | 9/24         | . . Piezo-electric actuators  |
| 7/18        | . Component parts, details, or accessories not provided for in preceding subgroups of this group   | 2009/25      | . . {Mixed arrangement with both mechanically and electromagnetically actuated valves}  |
| <b>9/00</b> | <b>Valve-gear or valve arrangements actuated non-mechanically</b>  | 9/26         | . . Driving circuits therefor   |
| 9/10        | . by fluid means, e.g. hydraulic   | 9/30         | . Arrangements for setting the actuator position, e.g. the initial position   |
| 9/11        | . . in which the action of a cam is being transmitted to a valve by a liquid column  | 9/40         | . Methods of operation thereof; Control of valve actuation, e.g. duration or lift   |
| 9/12        | . . . with a liquid chamber between a piston actuated by a cam and a piston acting on a valve stem   | 2009/408     | . . {Engine starting}   |
| 9/14        | . . . . the volume of the chamber being variable, e.g. for varying the lift or the timing of a valve   | 2009/4082    | . . . {in normal conditions}  |
| 9/16        | . . Pneumatic means  | 2009/4084    | . . . {Cold start}  |
| 9/18        | . . Means for increasing the initial opening force on the valve  | 2009/4086    | . . {Soft landing, e.g. applying braking current; Levitation of armature close to core surface}   |
| 9/20        | . by electric means  | 2009/4088    | . . {Fail safe, e.g. valve kept closed if not opening properly}   |
| 9/21        | . . actuated by solenoids  | 2009/409     | . . {Determination of valve speed}  |
| 2009/2103   | . . . {comprising one coil}  | 2009/4092    | . . {Determination of valve timing during particular working conditions, e.g. deceleration}   |
| 2009/2105   | . . . {comprising two or more coils}   | 2009/4094    | . . {Engine stopping; Engine stall}   |
| 2009/2107   | . . . . {being disposed coaxially to the armature shaft}   | 2009/4096    | . . {relating to sticking duration}   |
| 2009/2109   | . . . . {The armature being articulated perpendicularly to the coils axes}   | 2009/4098    | . . {relating to gap between armature shaft and valve stem end}   |
| 2009/2115   | . . . {Moving coil actuators}  | <b>11/00</b> | <b>Valve arrangements in working piston or piston-rod</b>   |
| 2009/2117   | . . . {Floating actuators for varying the valve stroke}  | 11/02        | . in piston   |
| 2009/2125   | . . . {Shaft and armature construction}  | 11/04        | . . operated by movement of connecting-rod  |
| 2009/2126   | . . . . {Arrangements for amplifying the armature stroke}  | 11/06        | . . . operating oscillatory valve   |
| 2009/2128   | . . . {Core and coil construction}   | <b>13/00</b> | <b>Modifications of valve-gear to facilitate reversing, braking, starting, changing compression ratio, or other specific operations</b>   |
| 2009/213    | . . . {Casing construction}  | 13/0005      | . {Deactivating valves}   |
| 2009/2132   | . . . {Biasing means}  | 2013/001     | . . {Deactivating cylinders}  |
| 2009/2134   | . . . . {Helical springs}  | 13/0015      | . {for optimising engine performances by modifying valve lift according to various working parameters, e.g. rotational speed, load, torque}   |
| 2009/2136   | . . . . . {Two opposed springs for intermediate resting position of the armature}  | 13/0021      | . . {by modification of rocker arm ratio}   |
| 2009/2138   | . . . . {Torsion springs}  | 13/0026      | . . . {by means of an eccentric}  |
| 2009/214    | . . . . {Pneumatic springs}  | 13/0031      | . . {by modification of tappet or pushrod length}   |
| 2009/2142   | . . . . {Means for varying the spring bias}  | 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}                                       |
| 2009/2144   | . . . . {Means for connecting springs to valve or anchor}  | 13/0042      | . . . {with cams being profiled in axial and radial direction}  |
| 2009/2146   | . . . {Latching means}   | 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} |
| 2009/2148   | . . . . {using permanent magnet}   | 2013/0052    | . . . {with cams provided on an axially slidable sleeve}  |
| 2009/2149   | . . . {Means for varying the air gap}  | 13/0057      | . . {by splittable or deformable cams}  |
| 2009/2151   | . . . {Damping means}  | 13/0063      | . . {by modification of cam contact point by displacing an intermediate lever or wedge-shaped intermediate element, e.g. Tourtelot}   |
| 2009/2153   | . . . {Means for counteracting cylinder pressure}  | 2013/0068    | . . . {with an oscillating cam acting on the valve of the "BMW-Valvetronic" type}   |
| 2009/2155   | . . . {Lash adjusting means}   | 2013/0073    | . . . {with an oscillating cam acting on the valve of the "Delphi" type}  |
| 2009/2157   | . . . {Actuator cooling means}   | 2013/0078    | . . {by modification of cam contact point by axially displacing the camshaft}   |
| 2009/2159   | . . . {Means for facilitating assembly}  | 2013/0084    | . . {by modification of cam contact point by radially displacing the camshaft}  |
| 2009/2161   | . . . {Wiring}   |              |   |
| 2009/2163   | . . . . {Connectors}   |              |   |
| 2009/2165   | . . . . {Harnesses}  |              |   |
| 2009/2167   | . . . {Sensing means}  |              |   |
| 2009/2169   | . . . . {Position sensors}   |              |   |
| 2009/2171   | . . . . {Vibration sensors}  |              |   |
| 2009/2173   | . . . . {Temperature sensors}  |              |   |
| 2009/2174   | . . . . {Flux sensors}   |              |   |
| 2009/2176   | . . . . {Spring force sensors}   |              |   |



|           |   |
|-----------|---|
| 2013/0089 | . . {with means for delaying valve closing}                                       |
| 2013/0094 | . . . {with switchable clamp for keeping valve open}                              |
| 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 specially adapted for steam engines, or specially adapted for other positive-displacement machines or engines with variable working-fluid distribution**

**NOTES**

- Groups [F01L 15/00](#) - [F01L 31/00](#) cover:
  - valve drive 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.
- Groups [F01L 15/00](#) - [F01L 31/00](#) do not fully cover subject matter restricted to rotary, oscillatory, or lift-valve gear or valve arrangements, which is covered by group [F01L 33/00](#) or [F01L 35/00](#).

|              |  |
|--------------|--|
| <b>15/00</b> | <b>Valve-gear or valve arrangements, e.g. with reciprocatory slide valves, other than provided for in groups <a href="#">F01L 17/00</a> - <a href="#">F01L 29/00</a> (valve drive or external valve-adjustment during operation, tripping-gear or tripping of valves <a href="#">F01L 31/00</a>)</b> |
| 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 <a href="#">F01L 15/10</a> )  |
| 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. reciprocatory and rotary  |

|              |   |
|--------------|---|
| 15/16        | . . with reciprocatory 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  |
| <b>17/00</b> | <b>Slide valve-gear or valve arrangements with cylindrical, sleeve, or part annularly-shaped valves surrounding working cylinder or piston</b>  |
| 17/02        | . Drive or adjustment during operation, peculiar thereto, e.g. for reciprocating and oscillating movements or for several valves one inside the other   |
| <b>19/00</b> | <b>Slide valve-gear or valve arrangements with reciprocatory and other movement of same valve, other than provided for in <a href="#">F01L 17/00</a>, e.g. longitudinally of working cylinder and in cross direction</b>  |
| 19/02        | . Drive or adjustment during operation, peculiar thereto  |
| <b>21/00</b> | <b>Use of working pistons or pistons-rods as fluid-distributing valves or as valve-supporting elements, e.g. in free-piston machines</b>  |
| 21/02        | . Piston or piston-rod used as valve members {( <a href="#">F01L 25/066</a> takes precedence)}  |
| 21/04        | . Valves arranged in or on piston or piston-rod   |
| <b>23/00</b> | <b>Valves controlled by impact by piston, e.g. in free-piston machines</b>  |
| <b>25/00</b> | <b>Drive, or adjustment during the operation, or distribution or expansion valves by non-mechanical means</b>   |
| 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   |
| <b>27/00</b> | <b>Distribution or expansion valve-gear peculiar to free-piston machines or engines and not provided for in <a href="#">F01L 21/00</a> - <a href="#">F01L 25/00</a></b>   |
| 27/02        | . the machine or engine having rotary or oscillatory valves   |
| 27/04        | . Delayed-action controls, e.g. of cataract or dashpot type   |
| <b>29/00</b> | <b>Reversing-gear</b>   |
| 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  |
| <b>31/00</b> | <b>Valve drive, valve adjustment during operation, or other valve control, not provided for in groups <a href="#">F01L 15/00</a> - <a href="#">F01L 29/00</a> (sensing elements measuring the variable or condition to be controlled or regulated <a href="#">F01B 25/04</a>)</b> |

- 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

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**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