

# 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>	. . . . Camshafts
		<b>2001/0471</b>	. . . . {Assembled camshafts}
		<b>2001/0473</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>2001/0475</b>	. . . . . {Hollow camshafts}
		<b>2001/0476</b>	. . . . . {Camshaft bearings}
		<b>2001/0478</b>	. . . . . {Torque pulse compensated camshafts}
		<b>1/053</b>	. . . . . overhead type
		<b>1/0532</b>	. . . . . {the cams being directly in contact with the driven valve}
		<b>2001/0535</b>	. . . . . {Single overhead camshafts [SOHC]}
<b>1/02</b>	. Valve drive (transmitting-gear between valve drive and valve <a href="#">F01L 1/12</a> )	<b>2001/0537</b>	. . . . . {Double overhead camshafts [DOHC]}
<b>1/022</b>	. . {Chain drive}	<b>2001/054</b>	. . . . . {Camshafts in cylinder block}
<b>1/024</b>	. . {Belt drive}	<b>1/06</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>1/026</b>	. . {Gear drive}	<b>1/08</b>	. . . Shape of cams
<b>2001/028</b>	. . {Pre-assembled timing arrangement, e.g. located in a cassette}	<b>1/10</b>	. . by means of crank-or eccentric-driven rods
<b>1/04</b>	. . by means of cams, camshafts, cam discs, eccentrics or the like ( <a href="#">F01L 1/10</a> takes precedence)		
<b>1/042</b>	. . . {Cam discs}		
<b>1/044</b>	. . . {Reciprocating cams}		

### 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.

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

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	• • 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)	5/02	• with other than cylindrical, sleeve or part annularly shaped valves, e.g. with flat-type valves
1/40	• • for engines with scavenging charge near top dead centre position, e.g. by overlapping inlet and exhaust time	5/04	• with cylindrical, sleeve, or part-annularly shaped valves
1/42	• • for machines or engines characterised by cylinder arrangements, e.g. star or fan	5/045	• • {Piston-type or cylinder-type valves arranged above the piston and coaxial with the cylinder axis}
1/44	• Multiple-valve gear or arrangements, not provided for in preceding subgroups, e.g. with lift and different valves	5/06	• • surrounding working cylinder or piston
1/443	• • {comprising a lift valve and at least one rotary valve}	5/08	• • • 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> )
1/446	• • {comprising a lift valve and at least one reed valve}	5/10	• • • • with reciprocating and other movements of the same valve
1/46	• Component parts, details, or accessories, not provided for in preceding subgroups	5/12	• • • Arrangements with part-annularly-shaped valves
1/462	• • {Valve return spring arrangements}	5/14	• characterised by the provision of valves with reciprocating and other movements ( <a href="#">surrounding working cylinder or piston F01L 5/06</a> )
1/465	• • • {Pneumatic arrangements}	5/16	• • with reciprocating and other movement of same valve, e.g. longitudinally of working cylinder and in cross direction
2001/467	• • {Lost motion springs}	5/18	• • with reciprocating valve and other slide valve
<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	• specially for two-stroke engines ( <a href="#">F01L 5/06</a> , <a href="#">F01L 5/14</a> take precedence)
3/02	• Selecting particular materials for valve-members or valve-seats; Valve-members or valve-seats composed of two or more materials	5/22	• Multiple-valve arrangements (with valves <a href="#">surrounding working cylinder or piston 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> )
3/04	• • Coated valve members or valve-seats	5/24	• Component parts, details or accessories, not provided for in preceding subgroups in this group
3/06	• Valve members or valve-seats with means for guiding or deflecting the medium controlled thereby, e.g. producing a rotary motion of the drawn-in cylinder charge ( <a href="#">for rotating lift-valves F01L 1/32</a> )	<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	• Valves guides; Sealing of valve stem, e.g. sealing by lubricant	7/02	• 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> )
3/085	• • {Valve cages}	7/021	• • {with one rotary valve}
3/10	• Connecting springs to valve members	7/022	• • • {Cylindrical valves having one recess communicating successively with aligned inlet and exhaust ports}
2003/11	• {Connecting valve members to rocker arm or tappet}	7/023	• • • {Cylindrical valves having a hollow or partly hollow body allowing axial inlet or exhaust fluid circulation}
3/12	• Cooling of valves	7/024	• • • {Cylindrical valves comprising radial inlet and axial outlet or axial inlet and radial outlet}
3/14	• • by means of a liquid or solid coolant, e.g. sodium, in a closed chamber in a valve	7/025	• • • {Cylindrical valves comprising radial inlet and side outlet or side inlet and radial outlet}
3/16	• • by means of a fluid flowing through or along valve, e.g. air	7/026	• • {with two or more rotary valves, their rotational axes being parallel, e.g. 4-stroke}
3/18	• • • Liquid cooling of valve	7/027	• • {with two or more valves arranged coaxially ( <a href="#">F01L 7/045</a> takes precedence)}
3/20	• Shapes or constructions of valve members, not provided for in preceding subgroups of this group	7/028	• • {having the rotational axis coaxial with the cylinder axis and the valve surface not surrounding piston or cylinder}
3/205	• • {Reed valves}	7/029	• • {having the rotational axis of the valve parallel to the cylinder axis}
3/22	• Valve-seats not provided for in preceding subgroups of this group; Fixing of valve-seats	7/04	• • surrounding working cylinder or piston
3/24	• Safety means or accessories, not provided for in preceding sub- groups of this group	7/045	• • • {with two or more valves arranged coaxially}
2003/25	• {Valve configurations in relation to engine}	7/06	• with disc type valves
2003/251	• • {Large number of valves, e.g. five or more}	7/08	• with conically or frusto-conically shaped valves
2003/253	• • {configured parallel to piston axis}	7/10	• with valves of other specific shape, e.g. spherical
2003/255	• • {configured other than parallel or symmetrical relative to piston axis}	7/12	• specially for two-stroke engines ( <a href="#">F01L 7/04</a> takes precedence)
2003/256	• • {configured other than perpendicular to camshaft axis}		
2003/258	• • {opening away from cylinder}		
<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

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- 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