

CPC COOPERATIVE PATENT CLASSIFICATION

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

ENGINES OR PUMPS

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

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

NOTES

1. Groups [F01L 1/00](#) - [F01L 13/00](#) cover only valve-gear or valve arrangements without provision for variable fluid distribution.
2. Valve gear or valve arrangements specially adapted for steam engines are covered by groups [F01L 15/00](#) - [F01L 35/00](#).
3. Valve-gear arrangements specially adapted for machines or engines with variable working-fluid distribution are covered by groups [F01L 15/00](#) - [F01L 35/00](#).
4. Attention is drawn to the notes preceding class [F01](#), especially Note (3).
5. As regards the above-mentioned Note (3), attention is drawn to [F01B 3/10](#), [F01B 15/06](#), [F01C 21/18](#), [F02B 53/06](#), [F03C 1/08](#), [F04B 1/18](#), [F04B 7/00](#), [F04B 39/08](#), [F04B 39/10](#), and [F04C 15/06](#), [F04C 29/12](#).

WARNINGS

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

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

Valve-gear for internal combustion piston engines or for other machines or engines with positive working-fluid displacement (valve gear specially for steam engines or specially for other machines or engines with variable fluid distribution [F01L 15/00](#) - [F01L 35/00](#))

1/00	Valve-gear or valve arrangements, e.g. lift-valve gear (lift-valve and valve-seat assemblies per se F01L 3/00 ; slide-valve gear F01L 5/00 ; actuated non-mechanically F01L 9/00 ; valve arrangements in working piston or piston rod F01L 11/00 ; modifications of valve-gear to facilitate reversing, braking, starting, changing compression ratio, or other specific operations F01L 13/00)	2001/0473	. . . . . {Composite camshafts, e.g. with cams or cam sleeve being able to move relative to the inner camshaft or a cam adjusting rod}
		2001/0475	. . . . . {Hollow camshafts (F01L 2001/0473 takes precedence)}
		2001/0476	. . . . . {Camshaft bearings}
		2001/0478	. . . . . {Torque pulse compensated camshafts}
		1/053	. . . . . overhead type
		1/0532	. . . . . {the cams being directly in contact with the driven valve}
		2001/0535	. . . . . {Single overhead camshafts [SOHC]}
		2001/0537	. . . . . {Double overhead camshafts [DOHC]}
		2001/054	. . . . . {Camshafts in cylinder block}
1/02	. Valve drive (transmitting-gear between valve drive and valve F01L 1/12)	1/06	. . . the cams, or the like, rotating at a higher speed than that corresponding to the valve cycle, e.g. operating fourstroke engine valves directly from crankshaft
1/022	. . {Chain drive}	1/08	. . . Shape of cams
1/024	. . {Belt drive}	1/10	. . by means of crank-or eccentric-driven rods {(F01L 1/044 takes precedence)}
1/026	. . {Gear drive}	1/12	. Transmitting gear between valve drive and valve (simultaneously operating two or more valves F01L 1/26)
2001/028	. . {Pre-assembled timing arrangement, e.g. located in a cassette}	1/14	. . Tappets {(hydraulic tappets for automatically adjusting or compensating clearance F01L 1/24)}; Push rods
1/04	. . by means of cams, camshafts, cam discs, eccentrics or the like (F01L 1/10 takes precedence)	1/143	. . . {for use with overhead camshafts}
1/042	. . . {Cam discs}	1/146	. . . {Push-rods}
1/044	. . . {Reciprocating cams}	1/16	. . . Silencing impact; Reducing wear
1/047	. . . Camshafts		
2001/0471	. . . . {Assembled camshafts}		

1/18	. .	Rocking arms or levers	1/34	. .	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}
1/181	. . .	{Centre pivot rocking arms}			
1/182	. . . .	{the rocking arm being pivoted about an individual fulcrum, i.e. not about a common shaft}	1/344	. .	changing the angular relationship between crankshaft and camshaft, e.g. using helicoidal gear
1/183	. . . . .	{of the boat type}	1/34403	. . .	{using helically teathed sleeve or gear moving axially between crankshaft and camshaft}
1/185	. . .	{Overhead end-pivot rocking arms}	1/34406	. . . .	{the helically teathed sleeve being located in the camshaft driving pulley}
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}	1/34409	. . .	{by torque-responsive means}
2001/187	. . .	{Clips, e.g. for retaining rocker arm on pivot}	1/34413	. . .	{using composite camshafts, e.g. with cams being able to move relative to the camshaft}
2001/188	. . .	{Fulcrums at upper surface}	1/34416	. . .	{using twisted cams}
1/20	. .	Adjusting or compensating clearance	1/3442	. . .	{using hydraulic chambers with variable volume to transmit the rotating force}
1/205	. .	{by means of shims or the like}	2001/34423	. . . .	{Details relating to the hydraulic feeding circuit}
1/22	. .	automatically, e.g. mechanically	2001/34426	. . . . .	{Oil control valves}
1/24	. . .	by fluid means, e.g. hydraulically	2001/3443	. . . . .	{Solenoid driven oil control valves}
1/2405	. . . .	{by means of a hydraulic adjusting device located between the cylinder head and rocker arm}	2001/34433	. . . . .	{Location oil control valves}
1/2411	. . . .	{by means of a hydraulic adjusting device located between the valve stem and rocker arm}	2001/34436	. . . . .	{Features or method for avoiding malfunction due to foreign matters in oil}
1/2416	. . . .	{by means of a hydraulic adjusting device attached to an articulated rocker}	2001/3444	. . . . .	{Oil filters}
1/2422	. . . .	{by means of a hydraulic adjusting device located between the push rod and rocker arm}	2001/34443	. . . . .	{Cleaning control of oil control valves}
2001/2427	. . . .	{by means of an hydraulic adjusting device located between cam and push rod}	2001/34446	. . . . .	{Fluid accumulators for the feeding circuit}
2001/2433	. . . .	{Self contained, e.g. sealed hydraulic lash adjusters}	2001/3445	. . . .	{Details relating to the hydraulic means for changing the angular relationship}
2001/2438	. . . .	{with means permitting forced opening of check valve}	2001/34453	. . . . .	{Locking means between driving and driven members}
2001/2444	. . . .	{Details relating to the hydraulic feeding circuit, e.g. lifter oil manifold assembly [LOMA]}	2001/34456	. . . . .	{Locking in only one position}
1/245	. . . .	Hydraulic tappets	2001/34459	. . . . .	{Locking in multiple positions}
1/25	. . . . .	between cam and valve stem	2001/34463	. . . . .	{Locking position intermediate between most retarded and most advanced positions}
1/252	. . . . .	{for side-valve engines}	2001/34466	. . . . .	{with multiple locking devices}
1/255	. . . . .	between cam and rocker arm	2001/34469	. . . . .	{Lock movement parallel to camshaft axis}
2001/256	. . . . .	{between cam and push rod}	2001/34473	. . . . .	{Lock movement perpendicular to camshaft axis}
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)	2001/34476	. . . . .	{Restrict range locking means}
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)}	2001/34479	. . . . .	{Sealing of phaser devices}
1/265	. .	{peculiar to machines or engines with three or more intake valves per cylinder}	2001/34483	. . . . .	{Phaser return springs}
1/267	. .	{with means for varying the timing or the lift of the valves}	2001/34486	. . .	{Location and number of the means for changing the angular relationship}
1/28	. .	characterised by the provision of coaxial valves; characterised by the provision of valves co-operating with both intake and exhaust ports	2001/34489	. . . .	{Two phasers on one camshaft}
1/285	. .	{Coaxial intake and exhaust valves}	2001/34493	. . . .	{Dual independent phasing system [DIPS]}
1/30	. .	characterised by the provision of positively opened and closed valves, i.e. desmodromic valves	2001/34496	. . . .	{Two phasers on different camshafts}
1/32	. .	characterised by the provision of means for rotating lift valves, e.g. to diminish wear	1/348	. . .	by means acting on timing belts or chains
			1/352	. . .	using bevel or epicyclic gear
			2001/3521	. . . .	{Harmonic drive of flexspline type}
			2001/3522	. . . .	{with electromagnetic brake}
			1/356	. . .	making the angular relationship oscillate {, e.g. non-homokinetic drive}
			1/36	. .	peculiar to machines or engines of specific type other than four-stroke cycle
			1/38	. .	for engines with other than four-stroke cycle, e.g. with two-stroke cycle (F01L 1/26, F01L 1/28 take precedence)

1/40	. . for engines with scavenging charge near top dead centre position, e.g. by overlapping inlet and exhaust time (scavenging aspects F02B)	5/045	. . {Piston-type or cylinder-type valves arranged above the piston and coaxial with the cylinder axis}
1/42	. . for machines or engines characterised by cylinder arrangements, e.g. star or fan	5/06	. . surrounding working cylinder or piston
1/44	. Multiple-valve gear or arrangements, not provided for in preceding subgroups, e.g. with lift and different valves	5/08	. . . Arrangements with several movements or several valves, e.g. one valve inside the other (with part-annularly shaped valves F01L 5/12)
1/443	. . {comprising a lift valve and at least one rotary valve}	5/10	. . . . with reciprocating and other movements of the same valve
1/446	. . {comprising a lift valve and at least one reed valve}	5/12	. . . Arrangements with part-annularly-shaped valves
1/46	. Component parts, details, or accessories, not provided for in preceding subgroups	5/14	. characterised by the provision of valves with reciprocating and other movements (surrounding working cylinder or piston F01L 5/06)
1/462	. . {Valve return spring arrangements}	5/16	. . with reciprocating and other movement of same valve, e.g. longitudinally of working cylinder and in cross direction
1/465	. . . {Pneumatic arrangements}	5/18	. . with reciprocating valve and other slide valve
2001/467	. . {Lost motion springs}	5/20	. specially for two-stroke engines (F01L 5/06 and F01L 5/14 take precedence)
3/00	Lift-valve, i.e. cut-off apparatus with closure members having at least a component of their opening and closing motion perpendicular to the closing faces; Parts or accessories thereof	5/22	. Multiple-valve arrangements (with valves surrounding working cylinder or piston F01L 5/06 ; with reciprocating and other slide valves F01L 5/18 ; specially for two-stroke engines F01L 5/20)
3/02	. Selecting particular materials for valve-members or valve-seats; Valve-members or valve-seats composed of two or more materials	5/24	. Component parts, details or accessories, not provided for in preceding subgroups in this group
3/04	. . Coated valve members or valve-seats	7/00	Rotary or oscillatory slide valve-gear or valve arrangements (slide valves with combined rotary and non-rotary movements, combinations of rotary and non-rotary slide valves F01L 5/00)
3/06	. Valve members or valve-seats with means for guiding or deflecting the medium controlled thereby, e.g. producing a rotary motion of the drawn-in cylinder charge (for rotating lift-valves F01L 1/32)	7/02	. with cylindrical, sleeve, or part-annularly shaped valves (of disc type F01L 7/06 ; of conical type F01L 7/08)
3/08	. Valves guides; Sealing of valve stem, e.g. sealing by lubricant	7/021	. . {with one rotary valve}
3/085	. . {Valve cages}	7/022	. . . {Cylindrical valves having one recess communicating successively with aligned inlet and exhaust ports}
3/10	. Connecting springs to valve members	7/023	. . . {Cylindrical valves having a hollow or partly hollow body allowing axial inlet or exhaust fluid circulation}
2003/11	. {Connecting valve members to rocker arm or tappet}	7/024	. . . {Cylindrical valves comprising radial inlet and axial outlet or axial inlet and radial outlet}
3/12	. Cooling of valves	7/025	. . . {Cylindrical valves comprising radial inlet and side outlet or side inlet and radial outlet}
3/14	. . by means of a liquid or solid coolant, e.g. sodium, in a closed chamber in a valve	7/026	. . {with two or more rotary valves, their rotational axes being parallel, e.g. 4-stroke}
3/16	. . by means of a fluid flowing through or along valve, e.g. air (for sealing only F01L 3/08)	7/027	. . {with two or more valves arranged coaxially (F01L 7/045 takes precedence)}
3/18	. . . Liquid cooling of valve	7/028	. . {having the rotational axis coaxial with the cylinder axis and the valve surface not surrounding piston or cylinder}
3/20	. Shapes or constructions of valve members, not provided for in preceding subgroups of this group	7/029	. . {having the rotational axis of the valve parallel to the cylinder axis}
3/205	. . {Reed valves}	7/04	. . surrounding working cylinder or piston
3/22	. Valve-seats not provided for in preceding subgroups of this group; Fixing of valve-seats	7/045	. . . {with two or more valves arranged coaxially}
3/24	. Safety means or accessories, not provided for in preceding sub- groups of this group	7/06	. with disc type valves
2003/25	. {Valve configurations in relation to engine}	7/08	. with conically or frusto-conically shaped valves
2003/251	. . {Large number of valves, e.g. five or more}	7/10	. with valves of other specific shape, e.g. spherical
2003/253	. . {configured parallel to piston axis}	7/12	. specially for two-stroke engines (F01L 7/04 takes precedence)
2003/255	. . {configured other than parallel or symmetrical relative to piston axis}	7/14	. Multiple-valve arrangements (with valves surrounding working cylinder or piston F01L 7/04 ; specially for two-stroke engines F01L 7/12)
2003/256	. . {configured other than perpendicular to camshaft axis}	7/16	. Sealing or packing arrangements specially therefor
2003/258	. . {opening away from cylinder}		
5/00	Slide valve-gear or valve-arrangements (with pure rotary or oscillatory movement F01L 7/00)		
5/02	. with other than cylindrical, sleeve or part annularly shaped valves, e.g. with flat-type valves		
5/04	. with cylindrical, sleeve, or part-annularly shaped valves		

7/18	. Component parts, details, or accessories not provided for in preceding subgroups of this group	2009/0473	. . . . {Temperature sensors}
		2009/0474	. . . . {Flux sensors}
9/00	Valve-gear or valve arrangements actuated non-mechanically	2009/0476	. . . . {Spring force sensors}
9/02	. by fluid means, e.g. hydraulic	2009/0478	. . {Electromagnetic actuators; Method of operation thereof}
9/021	. . {the action of a cam being transmitted to a valve by a fluid column, e.g. a fluid conduit}	2009/048	. . . {Engine starting}
9/023	. . . {Hydraulic lifters, i.e. fluid chamber comprised between a piston actuated by a cam and a piston acting on a valve stem}	2009/0482	. . . . {in normal conditions}
9/025	. . . . {the volume of the chamber being variable, e.g. for varying the lift or the timing of a valve}	2009/0484	. . . . {Cold start}
9/026	. . {Pneumatic}	2009/0486	. . . {Soft landing, e.g. applying braking current; Levitation of armature close to core surface}
2009/028	. . {Boost means, i.e. means for increasing initial opening force of the valve}	2009/0488	. . . {Fail safe, e.g. valve kept closed if not opening properly}
9/04	. by electric means	2009/049	. . . {Determination of valve speed}
2009/0401	. . {Driving circuits therefor}	2009/0492	. . . {Determination of valve timing during particular working conditions, e.g. deceleration}
2009/0403	. . {Electromagnetic actuators comprising one coil}	2009/0494	. . . {Engine stopping; Engine stall}
2009/0405	. . {Electromagnetic actuators comprising two or more coils}	2009/0496	. . . {relating to sticking duration}
2009/0407	. . . {The two coils being disposed coaxially to the armature shaft}	2009/0498	. . . {relating to gap between armature shaft and valve stem end}
2009/0409	. . . {The armature being articulated perpendicularly to the coils axes}		
2009/0411	. . {Electromagnetic actuators using a rotary motor}	11/00	Valve arrangements in working piston or piston-rod
2009/0413	. . {Piezo electric actuators}	11/02	. in piston
2009/0415	. . {Moving coil actuators}	11/04	. . operated by movement of connecting-rod
2009/0417	. . {Floating actuators for varying the valve stroke}	11/06	. . . operating oscillatory valve
2009/0419	. . {Actuator position setting device, e.g. initial setting}	13/00	Modifications of valve-gear to facilitate reversing, braking, starting, changing compression ratio, or other specific operations
2009/0421	. . {Mixed arrangement with both mechanically and electromagnetically actuated valves}	13/0005	. {Deactivating valves}
2009/0423	. . {Electromagnetic actuators construction details}	2013/001	. . {Deactivating cylinders}
2009/0425	. . . {Shaft and armature construction}	13/0015	. {for optimising engine performances by modifying valve lift according to various working parameters, e.g. rotational speed, load, torque}
2009/0426	. . . . {Arrangements for amplifying the armature stroke}	13/0021	. . {by modification of rocker arm ratio}
2009/0428	. . . {Core and coil construction}	13/0026	. . . {by means of an eccentric}
2009/043	. . . {Casing construction}	13/0031	. . {by modification of tappet or pushrod length}
2009/0432	. . . {Biasing means}	13/0036	. . {the valves being driven by two or more cams with different shape, size or timing or a single cam profiled in axial and radial direction}
2009/0434	. . . . {Helical springs}	13/0042	. . . {with cams being profiled in axial and radial direction}
2009/0436	. . . . . {Two opposed springs for intermediate resting position of the armature}	13/0047	. . . {the movement of the valves resulting from the sum of the simultaneous actions of at least two cams, the cams being independently variable in phase in respect of each other}
2009/0438	. . . . {Torsion springs}	2013/0052	. . . {with cams provided on an axially slidable sleeve}
2009/044	. . . . {Pneumatic springs}	13/0057	. . {by splittable or deformable cams}
2009/0442	. . . . {Means for varying the spring bias}	13/0063	. . {by modification of cam contact point by displacing an intermediate lever or wedge-shaped intermediate element, e.g. Tourtelot}
2009/0444	. . . . {Means for connecting springs to valve or anchor}	2013/0068	. . . {with an oscillating cam acting on the valve of the "BMW-Valvetronic" type}
2009/0446	. . . {Latching means}	2013/0073	. . . {with an oscillating cam acting on the valve of the "Delphi" type}
2009/0448	. . . . {using permanent magnet}	2013/0078	. . {by modification of cam contact point by axially displacing the camshaft}
2009/0449	. . . {Means for varying the air gap}	2013/0084	. . {by modification of cam contact point by radially displacing the camshaft}
2009/0451	. . . {Damping means}	2013/0089	. . {with means for delaying valve closing}
2009/0453	. . . {Means for counteracting cylinder pressure}	2013/0094	. . . {with switchable clamp for keeping valve open}
2009/0455	. . . {Lash adjusting means}		
2009/0457	. . . {Actor cooling means}		
2009/0459	. . . {Means for facilitating assembly}		
2009/0461	. . . {Wiring}		
2009/0463	. . . . {Connectors}		
2009/0465	. . . . {Harnesses}		
2009/0467	. . . {Sensing means}		
2009/0469	. . . . {Position sensors}		
2009/0471	. . . . {Vibration sensors}		

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

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

NOTE

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

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

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

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

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

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

- 33/02 . rotary
- 33/04 . oscillatory

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

- 35/02 . Valves
- 35/04 . Arrangements of valves in the machine or engine, e.g. relative to working cylinder

2101/00 Using particular materials

- 2101/02 . Using ceramic materials

2103/00 Manufacturing of components used in valve arrangements

- 2103/01 . Tools for producing, mounting or adjusting, e.g. some part of the distribution
- 2103/02 . Initial camshaft settings

2105/00 Valve arrangements comprising rollers

- 2105/02 . Mounting of rollers

2107/00 Preventing the rotation of tappets

2109/00 Self-contained lash adjusters

2111/00 Differential gears located between crankshafts and camshafts for varying the timing of valves

2113/00 Rotary valve drives

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

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

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- 2810/02 . Lubrication
- 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