

CPC COOPERATIVE PATENT CLASSIFICATION

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

ENGINES OR PUMPS

F04 POSITIVE - DISPLACEMENT MACHINES FOR LIQUIDS; PUMPS FOR LIQUIDS OR ELASTIC FLUIDS (NOTE omitted)

F04B POSITIVE-DISPLACEMENT MACHINES FOR LIQUIDS; PUMPS (machines for liquids, or pumps, of rotary-piston or oscillating-piston type [F04C](#); non-positive-displacement pumps [F04D](#); pumping of fluid by direct contact of another fluid or by using inertia of fluid to be pumped [F04F](#))

NOTES

1. In this subclass, the following term is used with the meaning indicated:
 - "piston" also covers a plunger.
2. Attention is drawn to the Notes following the titles of class [B81](#) and subclass [B81B](#) relating to "microstructural devices" and "microstructural systems".
3. Attention is drawn to the Notes preceding class [F01](#), especially as regards the definitions of "machines", "pumps", and "positive displacement".
4. Machines, pumps or pumping installations having flexible working members are classified in groups [F04B 43/00](#) or [F04B 45/00](#).

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:

[F04B 35/02](#)

covered by

[F04B 9/08](#)

Pumps for liquids or for liquid and elastic fluids; Positive-displacement machines for liquids

- 1/00 Multi-cylinder machines or pumps characterised by number or arrangement of cylinders (machines or pumps with pistons coacting within one cylinder [F04B 3/00](#))**

WARNING

Group [F04B 1/00](#) is impacted by reclassification into group [F04B 1/03](#).

Groups [F04B 1/00](#) and [F04B 1/03](#) should be considered in order to perform a complete search.

- 1/005 . {Pumps with cylinder axis arranged substantially tangentially to a circle centred on main shaft axis}
- 1/02 . having two cylinders (in V-arrangement [F04B 1/04](#))
- 1/03 . with cylinder axis arranged substantially tangentially to a circle centred on main shaft axis

WARNING

Group [F04B 1/03](#) is incomplete pending reclassification of documents from group [F04B 1/00](#).

Groups [F04B 1/00](#) and [F04B 1/03](#) should be considered in order to perform a complete search.

- 1/04 . having cylinders in star- or fan-arrangement
- 1/0404 . . Details or component parts

- 1/0408 Pistons
- 1/0413 Cams
- 1/0417 consisting of two or more cylindrical elements, e.g. rollers
- 1/0421 Cylinders
- 1/0426 Arrangements for pressing the pistons against the actuated cam; Arrangements for connecting the pistons to the actuated cam
- 1/043 Hydraulic arrangements
- 1/0435 Arrangements for disconnecting the pistons from the actuated cam
- 1/0439 Supporting or guiding means for the pistons
- 1/0443 Draining of the housing; Arrangements for handling leaked fluids
- 1/0448 Sealing means, e.g. for shafts or housings (for pistons [F04B 1/0408](#) {; Stuffing boxes [F04B 53/164](#)})
- 1/0452 Distribution members, e.g. valves (machines or pumps with cam-actuated distribution members at the outer ends of the cylinders [F04B 1/0472](#); machines or pumps with cam-actuated distribution members at the inner ends of the cylinders [F04B 1/0531](#); the piston-driving cams being provided with inlets and outlets [F04B 1/0535](#))
- 1/0456 Cylindrical
- 1/0461 Conical
- 1/0465 plate-like

- 1/047 . . . with actuating or actuated elements at the outer ends of the cylinders
- 1/0472 . . . with cam-actuated distribution members
- 1/0474 . . . with two or more serially arranged radial piston-cylinder units
- 1/0476 located side-by-side
- 1/0478 Coupling of two or more cylinder-barrels
- 1/053 . . . with actuating or actuated elements at the inner ends of the cylinders
- 1/0531 . . . with cam-actuated distribution members
- 1/0533 each machine piston having channels that coact with the cylinder and serve as distribution members for another piston-cylinder unit
- 1/0535 . . . the piston-driving cams being provided with inlets and outlets
- 1/0536 . . . with two or more serially arranged radial piston-cylinder units
- 1/0538 located side-by-side
- 1/06 . . Control

WARNING

Group [F04B 1/06](#) is incomplete pending reclassification of documents from groups [F04B 49/12](#) - [F04B 49/14](#), and [F04B 49/18](#).
All groups listed in this Warning should be considered in order to perform a complete search.

- 1/063 . . . by using a valve in a system with several pumping chambers wherein the flow-path through the chambers can be changed, e.g. between series and parallel flow

WARNING

Group [F04B 1/063](#) is incomplete pending reclassification of documents from groups [F04B 49/12](#) - [F04B 49/14](#), and [F04B 49/18](#).
All groups listed in this Warning should be considered in order to perform a complete search.

- 1/066 . . . by changing the phase relationship between the actuating cam and the distributing means

WARNING

Group [F04B 1/066](#) is incomplete pending reclassification of documents from groups [F04B 49/12](#) - [F04B 49/14](#), and [F04B 49/18](#).
All groups listed in this Warning should be considered in order to perform a complete search.

- 1/07 . . . by varying the relative eccentricity between two members, e.g. a cam and a drive shaft

WARNING

Group [F04B 1/07](#) is incomplete pending reclassification of documents from groups [F04B 49/12](#) - [F04B 49/14](#), and [F04B 49/18](#).
All groups listed in this Warning should be considered in order to perform a complete search.

- 1/08 . . . regulated by delivery pressure

WARNING

Group [F04B 1/08](#) is incomplete pending reclassification of documents from groups [F04B 49/12](#) - [F04B 49/14](#), and [F04B 49/18](#).
All groups listed in this Warning should be considered in order to perform a complete search.

- 1/10 . . the cylinders being movable, e.g. rotary {[F04B 3/006](#) takes precedence}

WARNING

Group [F04B 1/10](#) is incomplete pending reclassification of documents from groups [F04B 1/20](#) - [F04B 1/24](#).
All groups listed in this Warning should be considered in order to perform a complete search.

- 1/107 . . . with actuating or actuated elements at the outer ends of the cylinders

WARNING

Group [F04B 1/107](#) is incomplete pending reclassification of documents from groups [F04B 1/20](#), [F04B 1/2007](#), [F04B 1/2014](#), [F04B 1/2021](#), [F04B 1/2028](#), [F04B 1/2035](#), [F04B 1/2042](#), [F04B 1/205](#), [F04B 1/2057](#), [F04B 1/2064](#), [F04B 1/2071](#), [F04B 1/2078](#), [F04B 1/2085](#), [F04B 1/2092](#), [F04B 1/22](#), and [F04B 1/24](#).
All groups listed in this Warning should be considered in order to perform a complete search.

- 1/1071 with rotary cylinder blocks

WARNING

Group [F04B 1/1071](#) is incomplete pending reclassification of documents from groups [F04B 1/20](#) - [F04B 1/24](#).
All groups listed in this Warning should be considered in order to perform a complete search.

- 1/1072 with cylinder blocks and actuating cams rotating together (in two or more series radial piston-cylinder units [F04B 1/1075](#))

WARNING

Group [F04B 1/1072](#) is incomplete pending reclassification of documents from groups [F04B 1/1078](#), [F04B 1/20](#) - [F04B 1/24](#).
All groups listed in this Warning should be considered in order to perform a complete search.

1/1074 with two or more serially arranged radial piston-cylinder units

WARNING

Groups [F04B 1/1074](#) - [F04B 1/1078](#) are incomplete pending reclassification of documents from groups [F04B 1/20](#) - [F04B 1/24](#).

All groups listed in this Warning should be considered in order to perform a complete search.

1/1075 with cylinder blocks and actuating cams rotating together (in two or more series radial piston-cylinder units directly located side-by-side [F04B 1/1078](#))

1/1077 located side-by-side

1/1078 with cylinder blocks and actuating cams rotating together

1/113 . . . with actuating or actuated elements at the inner ends of the cylinders

WARNING

Groups [F04B 1/113](#) - [F04B 1/1136](#) are incomplete pending reclassification of documents from groups [F04B 1/20](#) - [F04B 1/24](#).

All groups listed in this Warning should be considered in order to perform a complete search.

1/1133 with rotary cylinder blocks

1/1136 with a rotary cylinder with a single piston reciprocating within the cylinder

1/12 . . . having cylinder axes coaxial with, or parallel or inclined to, main shaft axis

1/122 . . Details or component parts, e.g. valves, sealings or lubrication means (for machines or pumps having rotary cylinder blocks [F04B 1/2014](#))

1/124 . . . Pistons

1/126 Piston shoe retaining means

1/128 . . Driving means

1/14 . . . having stationary cylinders

1/141 . . . Details or component parts

1/143 Cylinders

1/145 Housings

1/146 Swash plates; Actuating elements

1/148 Bearings therefor

1/16 . . . having two or more sets of cylinders or pistons

1/18 . . . having self-acting distribution members, i.e. actuated by working fluid

1/182 Check valves

1/184 Cylindrical distribution members

1/186 Conical distribution members

1/188 Plate-like distribution members

1/20 . . . having rotary cylinder block

WARNING

Group [F04B 1/20](#) is impacted by reclassification into groups [F04B 1/10](#) - [F04B 1/1136](#).

All groups listed in this Warning should be considered in order to perform a complete search.

1/2007 . . . Arrangements for pressing the cylinder barrel against the valve plate, e.g. by fluid pressure

WARNING

Group [F04B 1/2007](#) is impacted by reclassification into groups [F04B 1/10](#) - [F04B 1/1136](#).

All groups listed in this Warning should be considered in order to perform a complete search.

1/2014 . . . Details or component parts

WARNING

Groups [F04B 1/2014](#) - [F04B 1/2085](#) are impacted by reclassification into groups [F04B 1/10](#) - [F04B 1/1136](#).

All groups listed in this Warning should be considered in order to perform a complete search.

1/2021 characterised by the contact area between cylinder barrel and valve plate

1/2028 Bearings

1/2035 Cylinder barrels

1/2042 Valves

1/205 Cylindrical

1/2057 Conical

1/2064 Housings

1/2071 Bearings for cylinder barrels

1/2078 Swash plates

1/2085 Bearings for swash plates or driving axles

1/2092 . . . Means for connecting rotating cylinder barrels and rotating inclined swash plates

WARNING

Group [F04B 1/2092](#) is impacted by reclassification into groups [F04B 1/10](#) - [F04B 1/1136](#).

All groups listed in this Warning should be considered in order to perform a complete search.

1/22 . . . having two or more sets of cylinders or pistons

WARNING

Groups [F04B 1/22](#) and [F04B 1/24](#) are impacted by reclassification into groups [F04B 1/10](#) - [F04B 1/1136](#).

All groups listed in this Warning should be considered in order to perform a complete search.

1/24 inclined to the main shaft axis

1/26 . . Control

1/28 . . . of machines or pumps with stationary cylinders

1/29 by varying the relative positions of a swash plate and a cylinder block

1/295 by changing the inclination of the swash plate

- 1/30 . . . of machines or pumps with rotary cylinder blocks

WARNING

Group [F04B 1/30](#) is impacted by reclassification into group [F04B 1/328](#).

Groups [F04B 1/30](#) and [F04B 1/328](#) should be considered in order to perform a complete search.

- 1/303 by turning the valve plate
 1/306 by turning the swash plate, e.g. with fixed inclination
 1/32 by varying the relative positions of a swash plate and a cylinder block
 1/322 by moving the swash plate in a direction perpendicular to the axis of rotation of the cylinder barrel
 1/324 by changing the inclination of the swash plate
 1/326 using wedges
 1/328 by changing the inclination of the axis of the cylinder barrel relative to the swash plate

WARNING

Group [F04B 1/328](#) is incomplete pending reclassification of documents from group [F04B 1/30](#).

Groups [F04B 1/30](#) and [F04B 1/328](#) should be considered in order to perform a complete search.

- 1/34 . Control not provided for in groups [F04B 1/02](#), [F04B 1/03](#), [F04B 1/06](#) or [F04B 1/26](#)
- 3/00 Machines or pumps with pistons coacting within one cylinder, e.g. multi-stage**
- 3/003 . {with two or more pistons reciprocating one within another, e.g. one piston forming cylinder of the other}
- 3/006 . . {with rotating cylinder block}
- 5/00 Machines or pumps with differential-surface pistons**
- 5/02 . with double-acting pistons
- 7/00 Piston machines or pumps characterised by having positively-driven valving**
- 7/0003 . {the distribution member forming both the inlet and discharge distributor for one single pumping chamber ([F04B 7/0208](#) takes precedence)}
- 7/0007 . . {and having a rotating movement}
- 7/0011 . . {and having an oscillating movement}
- 7/0015 . . {and having a slidable movement}
- 7/0019 . {a common distribution member forming a single discharge distributor for a plurality of pumping chambers ([F04B 7/0233](#) takes precedence)}
- 7/0023 . . {and having a rotating movement}
- 7/0026 . . {and having an oscillating movement}
- 7/003 . . {and having a slidable movement}
- 7/0034 . . {and having an orbital movement, e.g. elbow-pipe type members}
- 7/0038 . {the distribution member forming a single inlet for a plurality of pumping chambers or a multiple discharge for one single pumping chamber}

- 7/0042 . {with specific kinematics of the distribution member ([F04B 7/0003](#), [F04B 7/0019](#) take precedence)}
- 7/0046 . . {for rotating distribution members}
- 7/0049 . . {for oscillating distribution members}
- 7/0053 . . {for reciprocating distribution members}
- 7/0057 . {Mechanical driving means therefor, e.g. cams}
- 7/0061 . . {for a rotating member}
- 7/0065 . . . {being mounted on the main shaft}
- 7/0069 . . {for a sliding member}
- 7/0073 . {the member being of the lost-motion type, e.g. friction-actuated members, or having means for pushing it against or pulling it from its seat}
- 7/0076 . {the members being actuated by electro-magnetic means}
- 7/008 . {the distribution being realised by moving the cylinder itself, e.g. by sliding or swinging ([F04B 7/0291](#) takes precedence)}
- 7/0084 . {Component parts or details specially adapted therefor}
- 7/0088 . . {Sealing arrangements between the distribution members and the housing}
- 7/0092 . . . {for oscillating distribution members}
- 7/0096 . . . {for pipe-type distribution members}
- 7/02 . the valving being fluid-actuated
- 7/0208 . . {the distribution member forming both the inlet and discharge distributor for one single pumping chamber}
- 7/0216 . . . {and having an oscillating movement}
- 7/0225 . . . {and having a slidable movement}
- 7/0233 . . {a common distribution member forming a single discharge distributor for a plurality of pumping chambers}
- 7/0241 . . . {and having an oscillating movement}
- 7/025 . . . {and having a slidable movement}
- 7/0258 . . . {and having an orbital movement, e.g. elbow-pipe type members}
- 7/0266 . . {the inlet and discharge means being separate members}
- 7/0275 . . . {and being deformable, e.g. membranes}
- 7/0283 . . . {and having a rotating movement}
- 7/0291 . . {the distribution being realised by moving the cylinder itself, e.g. by sliding or swinging}
- 7/04 . in which the valving is performed by pistons and cylinders coacting to open and close intake or outlet ports
- 7/045 . . {Two pistons coacting within one cylinder}
- 7/06 . . the pistons and cylinders being relatively reciprocated and rotated
- 9/00 Piston machines or pumps characterised by the driving or driven means to or from their working members**
- 9/02 . the means being mechanical
- 9/025 . . {Driving of pistons coacting within one cylinder}
- 9/04 . . the means being cams, eccentrics or pin-and-slot mechanisms
- 9/042 . . . {the means being cams}
- 9/045 . . . {the means being eccentrics}
- 9/047 . . . {the means being pin-and-slot mechanisms}
- 9/06 . . the means including spring- or weight-loaded lost-motion devices
- 9/08 . the means being fluid
- 9/10 . . the fluid being liquid

- 9/103 . . . having only one pumping chamber
- 9/1035 {the movement of the pump piston in the two directions being obtained by two single-acting liquid motors each acting in one direction}
- 9/105 reciprocating movement of the pumping member being obtained by a double-acting liquid motor
- 9/1053 {one side of the double-acting liquid motor being always under the influence of the liquid under pressure}
- 9/1056 {with fluid-actuated inlet or outlet valve (mechanically controlled F04B 7/00)}
- 9/107 rectilinear movement of the pumping member in the working direction being obtained by a single-acting liquid motor, e.g. actuated in the other direction by gravity or a spring
- 9/1073 {with actuation in the other direction by gravity}
- 9/1076 {with fluid-actuated inlet or outlet valve (mechanically controlled F04B 7/00)}
- 9/109 . . . having plural pumping chambers
- 9/1095 {having two or more pumping chambers in series}
- 9/111 with two mechanically connected pumping members
- 9/1115 {the movement of the pumping pistons in only one direction being obtained by a single-acting piston liquid motor, e.g. actuation in the other direction by spring means}
- 9/113 reciprocating movement of the pumping members being obtained by a double-acting liquid motor
- 9/115 reciprocating movement of the pumping members being obtained by two single-acting liquid motors, each acting in one direction
- 9/117 the pumping members not being mechanically connected to each other
- 9/1172 {the movement of each pump piston in the two directions being obtained by a double-acting piston liquid motor}
- 9/1174 {with fluid-actuated inlet or outlet valve (mechanically controlled F04B 7/00)}
- 9/1176 {the movement of each piston in one direction being obtained by a single-acting piston liquid motor}
- 9/1178 {the movement in the other direction being obtained by a hydraulic connection between the liquid motor cylinders}
- 9/12 . . the fluid being elastic, e.g. steam or air
- 9/1207 . . . {using a source of partial vacuum or sub-atmospheric pressure}
- 9/1215 {the return stroke being obtained by a spring}
- 9/1222 {the return stroke being obtained by an elastic fluid under pressure}
- 9/123 . . . having only one pumping chamber
- 9/1235 {the movement of the pump piston in the two directions being obtained by two single-acting piston fluid motors, each acting in one direction}
- 9/125 reciprocating movement of the pumping member being obtained by a double-acting elastic-fluid motor
- 9/1253 {one side of the double-acting piston fluid motor being always under the influence of the fluid under pressure}
- 9/1256 {with fluid-actuated inlet or outlet valve (mechanically controlled F04B 7/00)}
- 9/127 rectilinear movement of the pumping member in the working direction being obtained by a single-acting elastic-fluid motor, e.g. actuated in the other direction by gravity or a spring
- 9/1273 {with actuation in the other direction by gravity}
- 9/1276 {with fluid-actuated inlet or outlet valve (mechanically controlled F04B 7/00)}
- 9/129 . . . having plural pumping chambers
- 9/1295 {having two or more pumping chambers in series}
- 9/131 with two mechanically connected pumping members
- 9/1315 {the movement of the pumping pistons in only one direction being obtained by a single-acting piston fluid motor, e.g. actuation in the other direction by spring means}
- 9/133 reciprocating movement of the pumping members being obtained by a double-acting elastic-fluid motor
- 9/135 reciprocating movement of the pumping members being obtained by two single-acting elastic-fluid motors, each acting in one direction
- 9/137 the pumping members not being mechanically connected to each other
- 9/1372 {the movement of each pump piston in the two directions is obtained by a double-acting piston fluid motor}
- 9/1374 {with fluid-actuated inlet or outlet valve (mechanically controlled F04B 7/00)}
- 9/1376 {the movement of each piston in one direction being obtained by a single-acting piston fluid motor}
- 9/1378 {the movement in the other direction being obtained by an hydraulic connection between the fluid motor cylinders}
- 9/14 . Pumps characterised by muscle-power operation {(hand-held spraying or dispensing apparatus using pumps or bulbs B05B 11/00)}
- 11/00 Equalisation of pulses, e.g. by use of air vessels; Counteracting cavitation**
- 11/0008 . {using accumulators}
- 11/0016 . . {with a fluid spring}
- 11/0025 . . . {the spring fluid being in direct contact with the pumped fluid}
- 11/0033 . . {with a mechanical spring}
- 11/0041 . {by piston speed control (F04B 11/0058 takes precedence)}
- 11/005 . {using two or more pumping pistons}
- 11/0058 . . {with piston speed control}
- 11/0066 . . . {with special shape of the actuating element}
- 11/0075 . . {connected in series}

11/0083	. . . {the pistons having different cross-sections}	19/06	. . Pumps for delivery of both liquid and elastic fluids at the same time (wet gas pumps F04B 37/20)
11/0091	. {using a special shape of fluid pass, e.g. throttles, ducts}	19/08	. Scoop devices
13/00	Pumps specially modified to deliver fixed or variable measured quantities	19/10	. . of wheel type
13/02	. of two or more fluids at the same time	19/12	. . of helical or screw-type
15/00	Pumps adapted to handle specific fluids, e.g. by selection of specific materials for pumps or pump parts	19/14	. . of endless-chain type, e.g. with the chains carrying pistons co-operating with open-ended cylinders
15/02	. the fluids being viscous or non-homogeneous	19/16	. Adhesion-type liquid-lifting devices
15/023	. . {supply of fluid to the pump by gravity through a hopper, e.g. without intake valve}	19/18	. . Adhesion members therefor
2015/026	. . {with a priming plunger or piston ahead of the pumping piston and connected on the same piston rod}	19/20	. Other positive-displacement pumps
15/04	. the fluids being hot or corrosive (for liquids near their boiling point, e.g. under subnormal pressure, F04B 15/06)	19/22	. . of reciprocating-piston type
15/06	. for liquids near their boiling point, e.g. under subnormal pressure	19/24	. . Pumping by heat expansion of pumped fluid
15/08	. . the liquids having low boiling points	23/00	Pumping installations or systems (pumps characterised by combination with, or adaptation to, specific driving engines or motors F04B 17/00)
2015/081	. . . {Liquefied gases}	23/02	. having reservoirs
2015/0812	. . . . {Air}	23/021	. . {the pump being immersed in the reservoir}
2015/0814	. . . . {Argon}	23/023	. . . {only the pump-part being immersed, the driving-part being outside the reservoir}
2015/0816	. . . . {Carbon monoxide}	23/025	. . {the pump being located directly adjacent the reservoir}
2015/0818	. . . . {Carbon dioxide}	23/026	. . . {a pump-side forming a wall of the reservoir}
2015/082	. . . . {Helium}	23/028	. . . {the pump being mounted on top of the reservoir}
2015/0822	. . . . {Hydrogen}	23/04	. Combinations of two or more pumps
2015/0824	. . . . {Nitrogen}	23/06	. . the pumps being all of reciprocating positive-displacement type
2015/0826	. . . . {Oxygen}	23/08	. . the pumps being of different types
17/00	Pumps characterised by combination with, or adaptation to, specific driving engines or motors	23/10	. . . at least one pump being of the reciprocating positive-displacement type
17/003	. {driven by piezo-electric means (F04B 43/046 and F04B 43/095 take precedence)}	WARNING	
17/006	. {Solar operated}		Group F04B 23/10 is impacted by reclassification into groups F04B 23/12 and F04B 23/14 .
17/02	. driven by wind motors		Groups F04B 23/10 , F04B 23/12 , and F04B 23/14 should be considered in order to perform a complete search.
17/03	. driven by electric motors		
17/04	. . using solenoids		
17/042	. . . {the solenoid motor being separated from the fluid flow}	23/103	. . . . {being a radial piston pump}
17/044	. . . . {using solenoids directly actuating the piston}	WARNING	
17/046	. . . {the fluid flowing through the moving part of the motor}		Group F04B 23/103 is impacted by reclassification into groups F04B 23/12 and F04B 23/14 .
17/048	. . . {the fluid flowing around the moving part of the motor}		Groups F04B 23/103 , F04B 23/12 , and F04B 23/14 should be considered in order to perform a complete search.
17/05	. driven by internal-combustion engines		
17/06	. Mobile combinations		
19/00	Machines or pumps having pertinent characteristics not provided for in, or of interest apart from, groups F04B 1/00 - F04B 17/00	23/106	. . . . {being an axial piston pump}
19/003	. {free-piston type pumps}	WARNING	
19/006	. {Micropumps (F04B 43/043 and F04B 43/095 take precedence)}		Group F04B 23/106 is impacted by reclassification into groups F04B 23/12 and F04B 23/14 .
19/02	. having movable cylinders		Groups F04B 23/106 , F04B 23/12 , and F04B 23/14 should be considered in order to perform a complete search.
19/022	. . {reciprocating cylinders}		
19/025	. . {cylinders rotating around their own axis}		
19/027	. . {cylinders oscillating around an axis perpendicular to their own axis}		
19/04	. Pumps for special use		

- 23/12 . . . at least one pump being of the rotary-piston positive-displacement type

WARNING

Group [F04B 23/12](#) is incomplete pending reclassification of documents from groups [F04B 23/10](#), [F04B 23/103](#), and [F04B 23/106](#).

All groups listed in this Warning should be considered in order to perform a complete search.

- 23/14 . . . at least one pump being of the non-positive-displacement type

WARNING

Group [F04B 23/14](#) is incomplete pending reclassification of documents from groups [F04B 23/10](#), [F04B 23/103](#), and [F04B 23/106](#).

All groups listed in this Warning should be considered in order to perform a complete search.

Pumps specially adapted for elastic fluids**25/00 Multi-stage pumps**

- 25/005 . {with two cylinders}
25/02 . of stepped piston type
25/04 . having cylinders coaxial with, or parallel or inclined to, main shaft axis

27/00 Multi-cylinder pumps specially adapted for elastic fluids and characterised by number or arrangement of cylinders (multi-stage pumps specially adapted for elastic fluids [F04B 25/00](#))

- 27/005 . {with two cylinders}
27/02 . having cylinders arranged oppositely relative to main shaft
27/04 . having cylinders in star- or fan-arrangement
27/0404 . . {Details, component parts specially adapted for such pumps}
27/0409 . . . {Pistons}
27/0414 . . . {Cams}
27/0418 {consisting of several cylindrical elements, e.g. rollers}
27/0423 . . . {Cylinders}
27/0428 . . . {Arrangements for pressing or connecting the pistons against the actuated cam}
27/0432 {hydraulically}
27/0437 . . . {Disconnecting the pistons from the actuated cam}
27/0442 . . . {Supporting and guiding means for the pistons}
27/0446 . . . {Draining of the engine housing; Arrangements dealing with leakage fluid}
27/0451 . . . {Particularities relating to the distribution members ([F04B 27/0472](#), [F04B 27/0531](#) and [F04B 27/0535](#) take precedence)}
27/0456 {to cylindrical distribution members}
27/046 {to conical distribution members}
27/0465 {to plate like distribution members}
27/047 . . with an actuating element at the outer ends of the cylinders
27/0472 . . . {with cam-actuated distribution members}

- 27/0474 {with two or more series radial piston-cylinder units}
27/0476 {directly located side-by-side}
27/0478 {Coupling of several cylinder-barrels}
27/053 . . with an actuating element at the inner ends of the cylinders
27/0531 {with cam-actuated distribution members}
27/0533 {each machine piston being provided with channels, which are coaxing with the cylinder and are used as a distribution member for another piston-cylinder unit}
27/0535 {the piston-driving cam being provided with an inlet or an outlet}
27/0536 {with two or more series radial piston-cylinder units}
27/0538 {directly located side-by-side}
27/06 . . the cylinders being movable, e.g. rotary ([F04B 27/08](#) takes precedence)}
27/0606 {having cylinders in star- or fan-arrangement, the connection of the pistons with an actuating element being at the outer ends of the cylinders}
27/0612 {rotary cylinder block}
27/0619 {cylinder block and actuating cam rotating together ([F04B 27/0631](#) and [F04B 27/0644](#) take precedence)}
27/0625 {with two or more series radial piston cylinder units}
27/0631 {cylinder block and actuating cam both rotating ([F04B 27/0644](#) takes precedence)}
27/0638 {directly located side by side}
27/0644 {cylinder block and actuating cam both rotating}
27/065 {having cylinders in star- or fan-arrangement, the connection of the pistons with an actuating element being at the inner ends of the cylinders}
27/0657 {rotary cylinder block}
27/0663 {the rotary cylinder being provided with only one piston, reciprocating within this cylinder}
27/067 . . Control
27/0673 {by using a valve in a system with several pumping chambers, wherein the flow-path through the chambers can be changed, e.g. series-parallel}
27/0676 {by changing the phase relationship between the actuating cam and the distribution means}
27/073 by varying the relative eccentricity between two members, e.g. a cam and a drive shaft
27/08 . . having cylinders coaxial with, or parallel or inclined to, main shaft axis
27/0804 . . . {having rotary cylinder block}
27/0808 . . . {having two or more sets of cylinders or pistons}
27/0813 {inclined to main shaft axis}
27/0817 {arrangements for pressing the cylinder barrel against the valve plate, e.g. by fluid pressure}
27/0821 {component parts, details, e.g. valves, sealings, lubrication}
27/0826 {particularities in the contacting area between cylinder barrel and valve plate}
27/083 {bearing means}

27/0834	. . . . {cylinder barrel}	27/20	. . . of pumps with rotary cylinder block
27/0839	. . . . {valve means, e.g. valve plate}	27/22	. . . . by varying the relative positions of a swash plate and a cylinder block
27/0843	. . . . . {cylindrical valve means}	27/24	. Control not provided for in a single group of groups F04B 27/02 - F04B 27/22
27/0847	. . . . . {conical valve means}		
27/0852	. . . . . {machine housing}	29/00	{Other pumps with movable, e.g. rotatable cylinders}
27/0856	. . . . . {cylinder barrel bearing means}	31/00	Free-piston pumps specially adapted for elastic fluids; Systems incorporating such pumps (muscle-driven pumps in which the stroke is not defined by gearing F04B 33/00)
27/086	. . . . . {swash plate}		
27/0865	. . . . . {swash plate bearing means or driving axis bearing means}	33/00	Pumps actuated by muscle power, e.g. for inflating
27/0869	. . . {connection between rotating cylinder barrel and rotating inclined swash plate}	33/005	. {specially adapted for inflating tyres of non-motorised vehicles, e.g. cycles, tricycles}
27/0873	. . {Component parts, e.g. sealings; Manufacturing or assembly thereof}	33/02	. with intermediate gearing
27/0878	. . . {Pistons}	35/00	Piston pumps specially adapted for elastic fluids and characterised by the driving means to their working members, or by combination with, or adaptation to, specific driving engines or motors, not otherwise provided for
27/0882	. . . . {piston shoe retaining means}	35/002	. {driven by internal combustion engines}
27/0886	. . . . {Piston shoes}	35/004	. {driven by floating elements}
27/0891	. . . {casings, housings}	35/006	. {driven by steam engines}
27/0895	. . . {driving means}	35/008	. {the means being a fluid transmission link}
27/10	. . having stationary cylinders	35/01	. the means being mechanical
27/1009	. . . {Distribution members}	35/04	. the means being electric
27/1018	. . . . {Cylindrical distribution members}	35/045	. . {using solenoids}
27/1027	. . . . {Conical distribution members}	35/06	. Mobile combinations
27/1036	. . . {Component parts, details, e.g. sealings, lubrication}	37/00	Pumps having pertinent characteristics not provided for in, or of interest apart from, groups F04B 25/00 - F04B 35/00
27/1045	. . . . {Cylinders}	37/02	. for evacuating by absorption or adsorption
27/1054	. . . . {Actuating elements}	37/04	. . Selection of specific absorption or adsorption materials
27/1063	. . . . . {Actuating-element bearing means or driving-axis bearing means}	37/06	. for evacuating by thermal means
27/1072	. . . . . {Pivot mechanisms}	37/08	. . by condensing or freezing, e.g. cryogenic pumps
27/1081	. . . . {Casings, housings}	37/085	. . . {Regeneration of cryo-pumps}
27/109	. . . . {Lubrication}	37/10	. for special use (for evacuating by absorption or adsorption F04B 37/02 ; for evacuating by thermal means F04B 37/06)
27/12	. . . having plural sets of cylinders or pistons	37/12	. . to obtain high pressure
27/14	. . Control	37/14	. . to obtain high vacuum
27/16	. . . of pumps with stationary cylinders	37/16	. . . Means for nullifying unswept space
27/18	. . . . by varying the relative positions of a swash plate and a cylinder block	37/18	. . for specific elastic fluids
27/1804	. . . . . {Controlled by crankcase pressure}	37/20	. . . for wet gases, e.g. wet air
2027/1809	. . . . . {Controlled pressure}	39/00	Component parts, details, or accessories, of pumps or pumping systems specially adapted for elastic fluids, not otherwise provided for in, or of interest apart from, groups F04B 25/00 - F04B 37/00
2027/1813	. . . . . {Crankcase pressure}	39/005	. {adaptations of pistons}
2027/1818	. . . . . {Suction pressure}	39/011	. . {Liquid pistons}
2027/1822	. . . . . {Valve-controlled fluid connection}	39/016	. . {with valve arranged in the piston}
2027/1827	. . . . . {between crankcase and discharge chamber}	39/022	. . {piston rods}
2027/1831	. . . . . {between crankcase and suction chamber}	39/027	. {Pulsation and noise damping means}
2027/1836	. . . . . {between crankcase and working chamber}	39/033	. . {with encapsulations}
2027/184	. . . . . {Valve controlling parameter}	39/038	. . . {of inlet or outlet channels}
2027/1845	. . . . . {Crankcase pressure}	39/044	. . {with vibration damping supports}
2027/185	. . . . . {Discharge pressure}	39/005	. . {with direct action on the fluid flow using absorptive materials}
2027/1854	. . . . . {External parameters}		
2027/1859	. . . . . {Suction pressure}		
2027/1863	. . . . . {with an auxiliary valve, controlled by}		
2027/1868	. . . . . {Crankcase pressure}		
2027/1872	. . . . . {Discharge pressure}		
2027/1877	. . . . . {External parameters}		
2027/1881	. . . . . {Suction pressure}		
2027/1886	. . . . . {Open (not controlling) fluid passage}		
2027/189	. . . . . {between crankcase and discharge chamber}		
2027/1895	. . . . . {between crankcase and suction chamber}		

- 39/0055 . . {with a special shape of fluid passage, e.g. bends, throttles, diameter changes, pipes}
- 39/0061 . . . {using muffler volumes}
- 39/0066 . . . {using sidebranch resonators, e.g. Helmholtz resonators}
- 39/0072 . . . {characterised by assembly or mounting}
- 39/0077 . . {by generating oil foam}
- 39/0083 . . {using blow off silencers}
- 39/0088 . . {using mechanical tuned resonators}
- 39/0094 . {crankshaft}
- 39/02 . Lubrication (of machines or engines in general [F01M](#))
- 39/0207 . . {with lubrication control systems}
- 39/0215 . . {characterised by the use of a special lubricant}
- 39/0223 . . {characterised by the compressor type (swash-plate compressors [F04B 27/109](#))}
- 39/023 . . . {Hermetic compressors}
- 39/0238 {with oil distribution channels}
- 39/0246 {in the rotating shaft}
- 39/0253 {using centrifugal force for transporting the oil}
- 39/0261 {with an auxiliary oil pump}
- 39/0269 {with device for spraying lubricant or with mist lubrication}
- 39/0276 . . . {the pump being of the reciprocating piston type, e.g. oscillating, free-piston compressors}
- 39/0284 . . {Constructional details, e.g. reservoirs in the casing (swash-plate compressors [F04B 27/0878](#), [F04B 27/109](#))}
- 39/0292 . . . {Lubrication of pistons or cylinders}
- 39/04 . Measures to avoid lubricant contaminating the pumped fluid
- 39/041 . . {sealing for a reciprocating rod (sealing in general [F16J](#))}
- 39/042 . . . {sealing being provided on the piston}
- 39/044 . . . {sealing with a rolling diaphragm between piston and cylinder}
- 39/045 . . . {Labyrinth-sealing between piston and cylinder}
- 39/047 . . . {Sealing between piston and carter being provided by a bellow}
- 39/048 . . . {Sealing between piston and carter being provided by a diaphragm}
- 39/06 . Cooling; Heating; Prevention of freezing
- 39/062 . . {Cooling by injecting a liquid in the gas to be compressed}
- 39/064 . . {Cooling by a cooling jacket in the pump casing}
- 39/066 . . {Cooling by ventilation}
- 39/068 . . {prevention of freezing}
- 39/08 . Actuation of distribution members
- 39/10 . Adaptations or arrangements of distribution members
- 39/1006 . . {the members being ball valves}
- 39/1013 . . {the members being of the poppet valve type}
- 39/102 . . {the members being disc valves}
- 39/1026 . . . {without spring ([F04B 39/1033](#) takes precedence)}
- 39/1033 . . . {annular disc valves}
- 39/104 . . {the members being parallel flexible strips}
- 39/1046 . . {Combination of in- and outlet valve}
- 39/1053 . . {the members being Hoerbigen valves}
- 39/106 . . {the members being parallel non-flexible strips}
- 39/1066 . . {Valve plates}

- 39/1073 . . . {the members being reed valves}
- 39/108 {circular reed valves}
- 39/1086 {flat annular reed valves}
- 39/1093 . . {the members being low-resistance valves allowing free streaming}
- 39/12 . Casings; Cylinders; Cylinder heads; Fluid connections
- 39/121 . . {Casings}
- 39/122 . . {Cylinder block}
- 39/123 . . {Fluid connections}
- 39/125 . . {Cylinder heads}
- 39/126 . . {Cylinder liners}
- 39/127 . . {Mounting of a cylinder block in a casing}
- 39/128 . . {Crankcases}
- 39/14 . Provisions for readily assembling or disassembling
- 39/16 . Filtration; Moisture separation

41/00 **Pumping installations or systems specially adapted for elastic fluids** (free-piston pumps specially adapted for elastic fluids or systems incorporating such pumps [F04B 31/00](#); piston pumps specially adapted for elastic fluids and characterised by the driving means to their working members, or by combination with, or adaptation to, specific driving engines or motors, not otherwise provided for [F04B 35/00](#))

- 41/02 . having reservoirs
- 41/04 . Conversion of internal-combustion engine cylinder units to pumps
- 41/06 . Combinations of two or more pumps

Machines or pumps having flexible working members

43/00 **Machines, pumps, or pumping installations having flexible working members** (pumps or pumping installations specially adapted for elastic fluids [F04B 45/00](#))

- 43/0009 . {Special features}
- 43/0018 . . {the periphery of the flexible member being not fixed to the pump-casing, but acting as a valve}
- 43/0027 . . {without valves}
- 43/0036 . . {the flexible member being formed as an O-ring}
- 43/0045 . . {with a number of independent working chambers which are actuated successively by one mechanism}
- 43/0054 . . {particularities of the flexible members}
- 43/0063 . . . {bell-shaped flexible members}
- 43/0072 . . . {of tubular flexible members}
- 43/0081 . . {systems, control, safety measures}
- 43/009 . . . {leakage control; pump systems with two flexible members; between the actuating element and the pumped fluid}
- 43/02 . having plate-like flexible members, e.g. diaphragms ([F04B 43/14](#) takes precedence)

WARNING

Groups [F04B 43/02](#) - [F04B 43/0736](#) are impacted by reclassification into group [F04B 43/14](#).

All groups listed in this Warning should be considered in order to perform a complete search.

- 43/021 . . {the plate-like flexible member is pressed against a wall by a number of elements, each having an alternating movement in a direction perpendicular to the plane of the plate-like flexible member and each having its own driving mechanism}
- 43/023 . . {double acting plate-like flexible member}
- 43/025 . . {two or more plate-like pumping members in parallel}
- 43/026 . . . {each plate-like pumping flexible member working in its own pumping chamber}
- 43/028 . . {with in- or outlet valve arranged in the plate-like flexible member (valve arranged in the piston [F04B 53/12](#))}
- 43/04 . . Pumps having electric drive
- 43/043 . . . {Micropumps}
- 43/046 {with piezo-electric drive}
- 43/06 . . Pumps having fluid drive
- 43/067 . . . the fluid being actuated directly by a piston
- 43/073 . . . the actuating fluid being controlled by at least one valve
- 43/0733 {with fluid-actuated pump inlet or outlet valves; with two or more pumping chambers in series}
- 43/0736 {with two or more pumping chambers in parallel}
- 43/08 . . having tubular flexible members ([F04B 43/12](#) takes precedence)
- 43/082 . . {the tubular flexible member being pressed against a wall by a number of elements, each having an alternating movement in a direction perpendicular to the axes of the tubular member and each having its own driving mechanism}
- 43/084 . . {the tubular member being deformed by stretching or distortion}
- 43/086 . . {with two or more tubular flexible members in parallel ([F04B 43/1136](#) takes precedence)}
- 43/088 . . {with two or more tubular flexible members in series ([F04B 43/1133](#) takes precedence)}
- 43/09 . . Pumps having electric drive
- 43/095 . . . {Piezo-electric drive}
- 43/10 . . Pumps having fluid drive
- 43/107 . . . the fluid being actuated directly by a piston
- 43/113 . . . the actuating fluid being controlled by at least one valve
- 43/1133 {with fluid-actuated pump inlet or outlet valves; with two or more pumping chambers in series}
- 43/1136 {with two or more pumping chambers in parallel}
- 43/12 . . having peristaltic action
- 43/1207 . . {the actuating element being a swash plate}
- 43/1215 . . {having no backing plate (deforming of the tube only by rollers)}
- 43/1223 . . {the actuating elements, e.g. rollers, moving in a straight line during squeezing}
- 43/123 . . {using an excenter as the squeezing element}
- 43/1238 . . {using only one roller as the squeezing element, the roller moving on an arc of a circle during squeezing}
- 43/1246 . . . {the roller being placed at the outside of the tubular flexible member}
- 43/1253 . . {by using two or more rollers as squeezing elements, the rollers moving on an arc of a circle during squeezing}

- 43/1261 . . . {the rollers being placed at the outside of the tubular flexible member}
- 43/1269 . . . {the rotary axes of the rollers lying in a plane perpendicular to the rotary axis of the driving motor}
- 43/1276 . . . {Means for pushing the rollers against the tubular flexible member}
- 43/1284 . . . {Means for pushing the backing-plate against the tubular flexible member}
- 43/1292 . . . {Pumps specially adapted for several tubular flexible members}
- 43/14 . . having plate-like flexible members

WARNING

Group [F04B 43/14](#) is incomplete pending reclassification of documents from groups [F04B 43/02](#), [F04B 43/021](#), [F04B 43/023](#), [F04B 43/025](#), [F04B 43/026](#), [F04B 43/028](#), [F04B 43/04](#), [F04B 43/043](#), [F04B 43/046](#), [F04B 43/06](#), [F04B 43/067](#), [F04B 43/073](#), [F04B 43/0733](#), and [F04B 43/0736](#).

All groups listed in this Warning should be considered in order to perform a complete search.

45/00 Pumps or pumping installations having flexible working members and specially adapted for elastic fluids

- 45/02 . . having bellows
- 45/022 . . {with two or more bellows in parallel}
- 45/024 . . {with two or more bellows in series}
- 45/027 . . having electric drive
- 45/033 . . having fluid drive
- 45/0333 . . . {the fluid being actuated directly by a piston}
- 45/0336 . . . {the actuating fluid being controlled by one or more valves}
- 45/04 . . having plate-like flexible members, e.g. diaphragms ([F04B 45/10](#) takes precedence)

WARNING

Group [F04B 45/04](#) - [F04B 45/0536](#) are impacted by reclassification into group [F04B 45/10](#).

All groups listed in this Warning should be considered in order to perform a complete search.

- 45/041 . . {double acting plate-like flexible pumping member}
- 45/043 . . {two or more plate-like pumping flexible members in parallel}
- 45/045 . . {with in- or outlet valve arranged in the plate-like pumping flexible members}
- 45/047 . . Pumps having electric drive
- 45/053 . . Pumps having fluid drive
- 45/0533 . . . {the fluid being actuated directly by a piston}
- 45/0536 . . . {the actuating fluid being controlled by one or more valves}

- 45/06 . having tubular flexible members ([F04B 45/02](#), [F04B 45/08](#) take precedence)

WARNING

Group [F04B 45/06](#) is impacted by reclassification into groups [F04B 45/08](#) and [F04B 45/085](#).

Groups [F04B 45/06](#), [F04B 45/08](#), and [F04B 45/085](#) should be considered in order to perform a complete search.

- 45/061 . . {with fluid drive}

WARNING

Groups [F04B 45/061](#) - [F04B 45/064](#) are impacted by reclassification into groups [F04B 45/08](#) and [F04B 45/085](#).

All groups listed in this Warning should be considered in order to perform a complete search.

- 45/062 . . . {the fluid being actuated directly by a piston}
 45/064 . . . {the actuating fluid being controlled by one or more valves}
 45/065 . . {with electric drive}

WARNING

Group [F04B 45/065](#) is impacted by reclassification into groups [F04B 45/08](#) and [F04B 45/085](#).

Groups [F04B 45/065](#), [F04B 45/08](#), and [F04B 45/085](#) should be considered in order to perform a complete search.

- 45/067 . . Pumps having electric drive

WARNING

Group [F04B 45/067](#) is impacted by reclassification into groups [F04B 45/08](#) and [F04B 45/085](#).

Groups [F04B 45/067](#), [F04B 45/08](#), and [F04B 45/085](#) should be considered in order to perform a complete search.

- 45/073 . . Pumps having fluid drive

WARNING

Groups [F04B 45/073](#) - [F04B 45/0736](#) are impacted by reclassification into groups [F04B 45/08](#) and [F04B 45/085](#).

All groups listed in this Warning should be considered in order to perform a complete search.

- 45/0733 . . . {the fluid being actuated directly by a piston}
 45/0736 . . . {the actuating fluid being controlled by one or more valves}
 45/08 . having peristaltic action

WARNING

Group [F04B 45/08](#) is incomplete pending reclassification of documents from groups [F04B 45/06](#) - [F04B 45/0736](#).

All groups listed in this Warning should be considered in order to perform a complete search.

- 45/085 . . {the actuating element being a swash plate}

WARNING

Group [F04B 45/085](#) is incomplete pending reclassification of documents from groups [F04B 45/06](#) - [F04B 45/0736](#).

All groups listed in this Warning should be considered in order to perform a complete search.

- 45/10 . having plate-like flexible members

WARNING

Group [F04B 45/10](#) is incomplete pending reclassification of documents from groups [F04B 45/04](#) - [F04B 45/0536](#).

Groups [F04B 45/04](#) - [F04B 45/0536](#) and [F04B 45/10](#) should be considered in order to perform a complete search.

- 47/00 Pumps or pumping installations specially adapted for raising fluids from great depths, e.g. well pumps (by using positive or negative pressurised fluid medium acting directly on the liquid to be pumped [F04F 1/00](#))**

- 47/005 . {Sand trap arrangements}
 47/02 . the driving mechanisms being situated at ground level ([F04B 47/12](#) takes precedence)
 47/022 . . {driving of the walking beam}
 47/024 . . {actuated by muscle power}
 47/026 . . {Pull rods, full rod component parts}
 47/028 . . {details of the walking beam}
 47/04 . . the driving means incorporating fluid means
 47/06 . having motor-pump units situated at great depth
 47/08 . . the motors being actuated by fluid
 47/10 . . . the units or parts thereof being liftable to ground level by fluid pressure
 47/12 . having free plunger lifting the fluid to the surface
 47/14 . Counterbalancing
 47/145 . . {with fluid means}

- 49/00 Control {, e.g. of pump delivery, or pump pressure} of, or safety measures for, machines, pumps, or pumping installations, not otherwise provided for, or of interest apart from, groups [F04B 1/00](#) - [F04B 47/00](#)**

NOTE

The classification symbols in group [F04B 49/00](#) and subgroups can be followed by additional symbols preceded by the sign "+". The symbols are applied in subgroups [F04B 49/06](#), [F04B 49/08](#), [F04B 49/16](#) and [F04B 49/225](#). The symbols have the meanings as listed below:

+C specially adapted for pumps for elastic fluids,
 e.g. compressors
+P specially adapted for pumps for liquids

- 49/002 . {Hydraulic systems to change the pump delivery}
 49/005 . {changing the phase relationship of two working pistons in one working chamber or the phase-relationship of a piston and a driven distribution member}

- 49/007 . {Installations or systems with two or more pumps or pump cylinders, wherein the flow-path through the stages can be changed, e.g. from series to parallel (centrifugal pumps [F04D 15/0072](#))}
- 49/02 . Stopping, starting, unloading or idling control
- 49/022 . . {by means of pressure}
- 49/025 . . by means of floats
- 49/03 . . by means of valves
- 49/035 . . . Bypassing
- 49/04 . Regulating by means of floats ([F04B 49/025](#) takes precedence)
- 49/06 . Control using electricity (regulating by means of floats actuating electric switches [F04B 49/04](#))
- 49/065 . . {and making use of computers}
- 49/08 . Regulating by delivery pressure
- 49/10 . Other safety measures
- 49/103 . . {Responsive to speed}
- 49/106 . . {Responsive to pumped volume}
- 49/12 . by varying the length of stroke of the working members

WARNING

Groups [F04B 49/12](#) - [F04B 49/14](#) are impacted by reclassification into groups [F04B 1/06](#) - [F04B 1/08](#).

All groups listed in this Warning should be considered in order to perform a complete search.

- 49/121 . . {Lost-motion device in the driving mechanism}
- 49/123 . . {by changing the eccentricity of one element relative to another element}
- 49/125 . . . {by changing the eccentricity of the actuation means, e.g. cams or cranks, relative to the driving means, e.g. driving shafts ([F04B 49/128](#) takes precedence)}
- 49/126 {with a double eccenter mechanism}
- 49/128 . . . {by changing the eccentricity of the cylinders, e.g. by moving a cylinder block}
- 49/14 . . Adjusting abutments located in the path of reciprocation
- 49/16 . by adjusting the capacity of dead spaces of working chambers
- 49/18 . by changing the effective cross-section of the working surface of the piston

WARNING

Group [F04B 49/18](#) is impacted by reclassification into groups [F04B 1/06](#) - [F04B 1/08](#).

All groups listed in this Warning should be considered in order to perform a complete search.

- 49/20 . by changing the driving speed
- 49/22 . by means of valves ([F04B 49/03](#) takes precedence)
- 49/225 . . {with throttling valves or valves varying the pump inlet opening or the outlet opening}
- 49/24 . . Bypassing
- 49/243 . . . {by keeping open the inlet valve}
- 49/246 . . . {by keeping open the outlet valve}

51/00 Testing machines, pumps, or pumping installations**53/00 Component parts, details or accessories not provided for in, or of interest apart from, groups [F04B 1/00](#) - [F04B 23/00](#) or [F04B 39/00](#) - [F04B 47/00](#)**

- 53/001 . {Noise damping}
- 53/002 . . {by encapsulation}
- 53/003 . . {by damping supports}
- 53/004 . . {by mechanical resonators}
- 53/005 . {Adaptations or arrangements of valves used as foot valves, of suction strainers, or of mud-boxes}
- 53/006 . {Crankshafts}
- 53/007 . {Cylinder heads}
- 53/008 . {Spacing or clearance between cylinder and piston}
- 53/02 . Packing the free space between cylinders and pistons
- 53/04 . Draining
- 53/06 . Venting
- 53/08 . Cooling; Heating; Preventing freezing
- 53/10 . Valves; Arrangement of valves
- 53/1002 . . {Ball valves}
- 53/1005 . . . {being formed by two closure members working in series}
- 53/1007 . . . {having means for guiding the closure member}
- 53/101 . . . {having means for limiting the opening height}
- 53/1012 {and means for controlling the opening height}
- 53/1015 . . . {Combinations of ball valves working in parallel}
- 53/1017 . . . {Semi-spherical ball valves}
- 53/102 . . {Disc valves}
- 53/1022 . . . {having means for guiding the closure member axially}
- 53/1025 {the guiding means being provided within the valve opening}
- 53/1027 {the guiding means being provided at both sides of the disc}
- 53/103 . . . {Flat-annular type disc valves}
- 53/1032 . . . {Spring-actuated disc valves ([F04B 53/1022](#), [F04B 53/103](#) take precedence)}
- 53/1035 . . . {with means for limiting the opening height}
- 53/1037 . . {Flap valves}
- 53/104 . . . {the closure member being a rigid element oscillating around a fixed point}
- 53/1042 {by means of a flexible connection}
- 53/1045 {the valve being formed by two elements}
- 53/1047 . . . {the valve being formed by one or more flexible elements}
- 53/105 {one flexible element oscillating around a fixed point}
- 53/1052 {two flexible elements oscillating around a fixed point}
- 53/1055 {more than two flexible elements oscillating around a fixed point}
- 53/1057 {the valve being a tube, e.g. normally closed at one end}
- 53/106 {the valve being a membrane}
- 53/1062 {fixed at two or more points at its periphery}
- 53/1065 {fixed at its centre}
- 53/1067 {fixed at its whole periphery and with an opening at its centre}
- 53/107 {the opening normally being closed by a fixed element}

53/1072	. . {the valve being an elastic body, the length thereof changing in the opening direction}	2201/0201	. . Position of the piston
53/1075	. . {the valve being a flexible annular ring}	2201/02011	. . . Angular position of a piston rotating around its own axis
53/1077	. . {Flow resistance valves, e.g. without moving parts}	2201/0202	. . Linear speed of the piston
53/108	. . {Valves characterised by the material}	2201/0203	. . Acceleration of the piston
53/1082	. . . {magnetic}	2201/0204	. . Power on the piston
53/1085	. . {having means for limiting the opening height (F04B 53/101 and F04B 53/1035 take precedence)}	2201/0205	. . Piston ring wear
53/1087	. . {Valve seats}	2201/0206	. . Length of piston stroke
53/109	. . {inlet and outlet valve forming one unit}	2201/0207	. . Number of pumping strokes in unit time
53/1092	. . . {and one single element forming both the inlet and outlet closure member}	2201/02071	. . . Total number of pumping strokes
53/1095	. . {Valves linked to another valve of another pumping chamber}	2201/0208	. . Leakage across the piston
53/1097	. . {with means for lifting the closure member for pump cleaning purposes}	2201/0209	. . Duration of piston stroke
53/12	. . arranged in or on pistons	2201/021	. . Rotational speed of a piston rotating around its own axis (F04B 7/06)
53/121	. . . {the valve being an annular ring surrounding the piston, e.g. an O-ring}	2201/04	. . Carter parameters
53/122	. . . {the piston being free-floating, e.g. the valve being formed between the actuating rod and the piston}	2201/0401	. . Carter pressure
53/123	. . . {Flexible valves}	2201/0402	. . Lubricating oil temperature
53/124	. . . {Oscillating valves}	2201/0403	. . Carter housing temperature
53/125	. . . {Reciprocating valves}	2201/0404	. . Lubricating oil condition
53/126	. . . . {Ball valves}	2201/0405	. . Leakage
53/127	. . . . {Disc valves}	2201/0406	. . Pressure change across an oil filter
53/128	. . . . . {Annular disc valves}	2201/06	. . Valve parameters
53/129	. . . . . {Poppet valves}	2201/0601	. . Opening times
53/14	. . Pistons, piston-rods or piston-rod connections	2201/06011	. . . of the inlet valve only
53/141	. . {Intermediate liquid piston between the driving piston and the pumped liquid (F04B 43/06 and F04B 43/10 take precedence)}	2201/06012	. . . of the outlet valve only
53/142	. . {Intermediate liquid-piston between a driving piston and a driven piston (F04B 9/10, F04B 43/06, F04B 43/10 and F04B 53/141 take precedence)}	2201/0602	. . Valve acceleration
53/143	. . {Sealing provided on the piston}	2201/0603	. . Valve wear
53/144	. . {Adaptation of piston-rods}	2201/0604	. . Valve noise
53/145	. . . {Rod shock absorber}	2201/0605	. . Leakage over a valve
53/146	. . . {Piston-rod guiding arrangements}	2201/0606	. . Opening width or height
53/147	. . . {Mounting or detaching of piston rod}	2201/06061	. . . of the inlet valve
53/148	. . {the piston being provided with channels which are coacting with the cylinder and are used as a distribution member for another piston-cylinder unit}	2201/06062	. . . of the outlet valve
53/16	. . Casings; Cylinders; Cylinder liners or heads; Fluid connections	2201/08	. . Cylinder or housing parameters
53/162	. . {Adaptations of cylinders}	2201/0801	. . Temperature
53/164	. . . {Stuffing boxes}	2201/0802	. . Vibration
53/166	. . . {Cylinder liners}	2201/0803	. . Leakage
53/168	. . . . {Mounting of cylinder liners in cylinders}	2201/0804	. . Noise
53/18	. . Lubricating	2201/0805	. . Rotational speed of a rotating cylinder block
53/20	. . Filtering	2201/0806	. . Resonant frequency
53/22	. . Arrangements for enabling ready assembly or disassembly	2201/0807	. . Number of working cylinders
		2201/0808	. . Size of the dead volume
		2201/12	. . Parameters of driving or driven means
		2201/1201	. . Rotational speed of the axis
		2201/1202	. . Torque on the axis
		2201/1203	. . Power on the axis
		2201/1204	. . Position of a rotating inclined plate
		2201/12041	. . . Angular position
		2201/1205	. . Position of a non-rotating inclined plate
		2201/12051	. . . Angular position
		2201/1206	. . Rotational speed of a rotating inclined plate
		2201/1207	. . Wear of the bearings
		2201/1208	. . Angular position of the shaft
		2201/1209	. . Radial force on the bearings
		2201/121	. . Load on the sucker rod
		2201/1211	. . Position of the walking beam
		2201/1212	. . Oil pressure in the bearings
		2201/1213	. . Eccentricity of an outer annular cam
		2201/124	. . Coupling parameters
		2201/1241	. . . Engagement
		2201/127	. . Braking parameters
2201/00	Pump parameters	2203/00	Motor parameters
2201/02	. . Piston parameters		

2203/02	. of rotating electric motors	2205/065	. . between two stages in a multi-stage pump
2203/0201	. . Current	2205/07	. Pressure difference over the pump
2203/0202	. . Voltage	2205/08	. Pressure difference over a throttle
2203/0203	. . Magnetic flux	2205/0801	. . the throttle being a filter
2203/0204	. . Frequency of the electric current	2205/09	. Flow through the pump
2203/0205	. . Temperature	2205/10	. Inlet temperature
2203/0206	. . Vibration	2205/11	. Outlet temperature
2203/0207	. . Torque	2205/111	. . after a throttle
2203/0208	. . Power	2205/112	. . between two stages in a multi-stage pump
2203/0209	. . Rotational speed	2205/12	. Pressure pulsations before the pump
2203/021	. . Lubricating-oil temperature	2205/13	. Pressure pulsations after the pump
2203/0211	. . Noise	2205/14	. Viscosity
2203/0212	. . Amplitude of the electric current	2205/15	. By-passing over the pump
2203/0213	. . Pulses per unit of time (pulse motor)	2205/151	. . Opening width of a bypass valve
2203/0214	. . Number of working motor-pump units	2205/16	. Opening or closing of a valve in a circuit
2203/04	. of linear electric motors	2205/17	. Opening width of a throttling device
2203/0401	. . Current	2205/171	. . before the pump inlet
2203/0402	. . Voltage	2205/172	. . after the pump outlet
2203/0403	. . Magnetic flux	2205/173	. . in a circuit
2203/0404	. . Frequency of the electric current	2205/18	. Pressure in a control cylinder/piston unit
2203/0405	. . Temperature	2205/50	. Presence of foreign matter in the fluid
2203/0406	. . Vibration	2205/501	. . of solid particles
2203/0407	. . Force	2205/503	. . of gas in a liquid flow, e.g. gas bubbles
2203/0408	. . Power		
2203/0409	. . Linear speed	2207/00	External parameters
2203/041	. . Lubricating-oil temperature	2207/01	. Load in general
2203/0411	. . Noise	2207/02	. External pressure
2203/06	. of internal combustion engines	2207/03	. External temperature
2203/0601	. . Temperature	2207/04	. Settings
2203/0602	. . Vibration	2207/041	. . of flow
2203/0603	. . Torque	2207/0411	. . . maximum
2203/0604	. . Power	2207/0412	. . . minimum
2203/0605	. . Rotational speed	2207/0413	. . . medium
2203/0606	. . Lubricating-oil temperature	2207/042	. . of pressure
2203/0607	. . Fuel consumption	2207/0421	. . . maximum
2203/06071	. . . position of the carburettor valve	2207/0422	. . . minimum
2203/09	. of linear hydraulic motors	2207/0423	. . . medium
2203/0901	. . Opening time of the valves	2207/043	. . of time
2203/0902	. . Liquid pressure in a working chamber	2207/044	. . of the rotational speed of the driving motor
2203/0903	. . Position of the driving piston	2207/0441	. . . maximum
2203/091	. . . Opening time of the valves	2207/0442	. . . minimum
2203/10	. of linear elastic fluid motors	2207/045	. . of the resonant frequency of the unit motor-pump
2203/1001	. . Opening time of the valves	2207/046	. . of length of piston stroke
2203/11	. of a gas turbine	2207/047	. . of the nominal power of the driving motor
2203/1101	. . Rotational speed of the turbine	2207/048	. . of a reference voltage of the driving motor
2203/1102	. . Flow rate of the driving fluid	2207/70	. Warnings
2203/1103	. . Rotation sense of the turbine	2207/701	. . Sound
2203/12	. of rotating hydraulic motors	2207/702	. . Light
2203/1201	. . Rotational speed	2207/703	. . Stopping
2203/1202	. . Pressure at the motor inlet	2207/704	. . Idling
2205/00	Fluid parameters		
2205/01	. Pressure before the pump inlet		
2205/02	. Pressure in the inlet chamber		
2205/03	. Pressure in the compression chamber		
2205/04	. Pressure in the outlet chamber		
2205/05	. Pressure after the pump outlet		
2205/06	. Pressure in a (hydraulic) circuit		
2205/061	. . after a throttle		
2205/062	. . before a throttle		
2205/063	. . in a reservoir linked to the pump outlet		
2205/064	. . in a reservoir linked to the pump inlet		