

CPC**COOPERATIVE PATENT CLASSIFICATION****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](#) ; crankshafts, crossheads, connecting-rods [F16C](#) ; flywheels [F16F](#) ; gearings for interconverting rotary motion and reciprocating motion in general [F16H](#) ; pistons, piston-rods, cylinders, in general [F16J](#))

NOTE

In this subclass, the following term is used with the meaning indicated:

- "piston" also covers a plunger.

Attention is drawn to the notes preceding class [F01](#) , especially as regards the definitions of "machines", "pumps", and "positive-displacement".

WARNING

The following IPC groups are not used in the CPC scheme. Subject matter covered by these groups is classified in the following CPC groups:

[F04B 35/02](#) covered by [F04B 9/08](#)

Guidance heading: **Pumps for liquids or for liquid and elastic fluids; Positive-displacement machines for liquids** (pumps for raising fluids from great depths [F04B 47/00](#); having flexible working members [F04B 43/00](#))

F04B 1/00

Multi-cylinder machines or pumps characterised by number or arrangements of cylinders ([F04B 3/00](#) takes precedence; fluid-driven pumps [F04B 9/08](#); control of reciprocating machines or pumps in general [F04B 49/00](#))

F04B 1/005

. { Pumps with cylinder axis arranged substantially tangentially to a circle centred on main shaft axis }

F04B 1/02

. having two cylinders (in V-arrangement [F04B 1/04](#))

F04B 1/04

. having cylinders in star- or fan-arrangement

F04B 1/0404

.. { Details, component parts specially adapted for such pumps }

F04B 1/0408

... { Pistons }

F04B 1/0413

... { Cams }

F04B 1/0417

.... { consisting of several cylindrical elements, e.g. rollers }

F04B 1/0421

... { Cylinders }

F04B 1/0426

... { Arrangements for pressing or connecting the pistons against the actuated cam }

F04B 1/043

.... { hydraulically }

F04B 1/0435

... { Disconnecting the pistons from the actuated cam (in general [F01B 31/24](#)) }

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| F04B 1/0439 | ... | { Supporting and guiding means for the pistons } |
| F04B 1/0443 | ... | { Draining of the engine housing; arrangements dealing with leakage fluid } |
| F04B 1/0448 | ... | { Sealing, e.g. seals for shafts or housings (F04B 1/0408 , F04B 53/164 take precedence) } |
| F04B 1/0452 | ... | { Particularities relating to the distribution members (F04B 1/0472 , F04B 1/0531 and F04B 1/0535 take precedence) } |
| F04B 1/0456 | .... | { to cylindrical distribution members } |
| F04B 1/0461 | .... | { to conical distribution members } |
| F04B 1/0465 | .... | { to plate-like distribution members } |
| F04B 1/047 | .. | with an actuating or actuated element at the outer ends of the cylinders |
| F04B 1/0472 | ... | { with cam-actuated distribution members } |
| F04B 1/0474 | ... | { with two or more series radial piston-cylinder units } |
| F04B 1/0476 | .... | { directly located side-by-side } |
| F04B 1/0478 | .... | { Coupling of several cylinder-barrels } |
| F04B 1/053 | .. | with an actuating or actuated element at the inner ends of the cylinders |
| F04B 1/0531 | ... | { with cam-actuated distribution members } |
| F04B 1/0533 | .... | { each machine piston being provided with channels which are coacting with the cylinder and are used as a distribution member for another piston-cylinder unit } |
| F04B 1/0535 | ... | { the piston-driving cam being provided with an inlet and an outlet } |
| F04B 1/0536 | ... | { with two or more series radial piston-cylinder units } |
| F04B 1/0538 | .... | { directly located side-by-side } |
| F04B 1/06 | .. | Control { (F04B 49/12 , F04B 49/18 take precedence) } |
| F04B 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. series-parallel } |
| F04B 1/066 | ... | { by changing the phase relationship between the actuating cam and the distributing means } |
| F04B 1/07 | ... | by varying the relative eccentricity between two members, e.g. a cam and a drive shaft |
| F04B 1/08 | ... | regulated by delivery pressure |
| F04B 1/10 | .. | the cylinders being movable, e.g. rotary { (F04B 1/20 and F04B 3/006 take precedence) } |
| F04B 1/107 | ... | with an actuating or actuated element at the outer ends of the cylinders |
| F04B 1/1071 | .... | { with rotary cylinder block } |
| F04B 1/1072 | .... | { with cylinder block and actuating cam rotating together (F04B 1/1075 and F04B 1/1078 take precedence) } |
| F04B 1/1074 | .... | { with two or more series radial piston-cylinder units } |
| F04B 1/1075 | ..... | { with cylinder block and actuating cam both rotating (F04B 1/1078 takes precedence) } |
| F04B 1/1077 | ..... | { directly located side-by-side } |
| F04B 1/1078 | ..... | { with cylinder block and actuating cam both rotating } |
| F04B 1/113 | ... | with an actuating or actuated element at the inner ends of the cylinders |
| F04B 1/1133 | .... | { with rotary cylinder block } |
| F04B 1/1136 | | { the rotary cylinder being provided with only one piston, reciprocating within the cylinder } |

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| F04B 1/12 | . having cylinder axes coaxial with, or parallel or inclined to main shaft axis |
| F04B 1/122 | .. { Component parts, details, e.g. valves, sealing, lubrication (F04B 1/2014 takes precedence) } |
| F04B 1/124 | ... { Pistons } |
| F04B 1/126 | { Piston shoe retaining means } |
| F04B 1/128 | .. { Driving means } |
| F04B 1/14 | .. { having stationary cylinders } |
| F04B 1/141 | ... { Component parts } |
| F04B 1/143 | { Cylinders } |
| F04B 1/145 | { Housings } |
| F04B 1/146 | { Swash plates or actuating elements } |
| F04B 1/148 | { Swash plate or actuating element bearing means or driving axis bearing means } |
| F04B 1/16 | ... having two or more sets of cylinders or pistons |
| F04B 1/18 | ... having self-acting distribution members, i.e. actuated by working fluid |
| F04B 1/182 | { Check valves } |
| F04B 1/184 | { Cylindrical distribution members } |
| F04B 1/186 | { Conical distribution members } |
| F04B 1/188 | { Plate-like distribution members } |
| F04B 1/20 | .. having rotary cylinder block |
| F04B 1/2007 | ... { Arrangements for pressing the cylinder barrel against the valve plate, e.g. by fluid pressure } |
| F04B 1/2014 | ... { Component parts } |
| F04B 1/2021 | { Particularities in the contacting area between cylinder barrel or valve plate } |
| F04B 1/2028 | { Bearing means } |
| F04B 1/2035 | { Cylinder barrel } |
| F04B 1/2042 | { Valve means } |
| F04B 1/205 | { Cylindrical valve means } |
| F04B 1/2057 | { Conical valve means } |
| F04B 1/2064 | { Pumphousing } |
| F04B 1/2071 | { Cylinder barrel bearing means } |
| F04B 1/2078 | { Swash plate } |
| F04B 1/2085 | { Swash plate bearing means or driving axis bearing means } |
| F04B 1/2092 | ... { Connection between rotating cylinder barrel and rotating inclined swash plate } |
| F04B 1/22 | ... having two or more sets of cylinders or pistons |
| F04B 1/24 | inclined to main shaft axis |
| F04B 1/26 | .. Control |
| F04B 1/28 | ... for machines or pumps with stationary cylinders |
| F04B 1/29 | by varying the relative positions of a swash plate and a cylinder block |
| F04B 1/295 | { by changing the inclination of the swash plate } |
| F04B 1/30 | ... for machines or pumps with rotary cylinder block |
| F04B 1/303 | { by turning the valve plate } |

- F04B 1/306 { by turning the swash plate (with fixed inclination) }
- F04B 1/32 by varying the relative positions of a swash plate and a cylinder block
- F04B 1/322 { by moving the swash plate in a direction perpendicular to the axis of rotation of the cylinder barrel }
- F04B 1/324 { by changing the inclination of the swash plate }
- F04B 1/326 { using wedges }
- F04B 1/328 { by changing the inclination of the axis of the cylinder barrel relative to the swash plate ([F04B 1/30](#) takes precedence) }

- F04B 1/34 . . . Control not provided for in a single group of groups [F04B 1/02](#) to [F04B 1/32](#)

- F04B 3/00** **Machines or pumps with pistons coaxing within one cylinder e.g. multi-stage**

- F04B 3/003 . . { with two or more pistons reciprocating one within another, e.g. one piston forming cylinder of the other }
- F04B 3/006 . . { with rotating cylinder block }

- F04B 5/00** **Machines or pumps with differential surface pistons**

- F04B 5/02 . . with double-acting pistons

- F04B 7/00** **Piston machines or pumps characterised by having positively-driven valving (with cylinders in star- or fan-arrangement [F04B 1/04](#); with cylinder axes coaxial with, or parallel or inclined to, main shaft axis [F04B 1/12](#))**

- F04B 7/0003 . . { the distribution member forming both the inlet and discharge distributor for one single pumping chamber ([F04B 7/0208](#) takes precedence) }
- F04B 7/0007 . . { and having a rotating movement }
- F04B 7/0011 . . { and having an oscillating movement }
- F04B 7/0015 . . { and having a slidable movement }

- F04B 7/0019 . . { a common distribution member forming a single discharge distributor for a plurality of pumping chambers ([F04B 7/0233](#) takes precedence) }
- F04B 7/0023 . . { and having a rotating movement }
- F04B 7/0026 . . { and having an oscillating movement }
- F04B 7/003 . . { and having a slidable movement }
- F04B 7/0034 . . { and having an orbital movement, e.g. elbow-pipe type members }

- F04B 7/0038 . . { the distribution member forming a single inlet for a plurality of pumping chambers or a multiple discharge for one single pumping chamber }

- F04B 7/0042 . . { with specific kinematics of the distribution member ([F04B 7/0003](#), [F04B 7/0019](#) take precedence) }
- F04B 7/0046 . . { for rotating distribution members }
- F04B 7/0049 . . { for oscillating distribution members }
- F04B 7/0053 . . { for reciprocating distribution members }

WARNING

Groups [F04B 7/0057](#) to [F04B 7/0069](#) are not used for classification. The documents are in the process of being reclassified to subclass [F01L](#)

- [F04B 7/0057](#) . { Mechanical driving means therefor, e.g. cams }
- [F04B 7/0061](#) .. { for a rotating member }
- [F04B 7/0065](#) ... { being mounted on the main shaft }
- [F04B 7/0069](#) .. { for a sliding member }

- [F04B 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 }

- [F04B 7/0076](#) . { the members being actuated by electro-magnetic means }

- [F04B 7/008](#) . { the distribution being realised by moving the cylinder itself, e.g. by sliding or swinging ([F04B 7/0291](#) takes precedence) }

- [F04B 7/0084](#) . { Component parts or details specially adapted therefor }
- [F04B 7/0088](#) .. { Sealing arrangements between the distribution members and the housing }
- [F04B 7/0092](#) ... { for oscillating distribution members }
- [F04B 7/0096](#) ... { for pipe-type distribution members }

- [F04B 7/02](#) . the valving being fluid-actuated
- [F04B 7/0208](#) .. { the distribution member forming both the inlet and discharge distributor for one single pumping chamber }
- [F04B 7/0216](#) ... { and having an oscillating movement }
- [F04B 7/0225](#) ... { and having a slidable movement }
- [F04B 7/0233](#) .. { a common distribution member forming a single discharge distributor for a plurality of pumping chambers }
- [F04B 7/0241](#) ... { and having an oscillating movement }
- [F04B 7/025](#) ... { and having a slidable movement }
- [F04B 7/0258](#) ... { and having an orbital movement, e.g. elbow-pipe type members }
- [F04B 7/0266](#) .. { the inlet and discharge means being separate members }
- [F04B 7/0275](#) ... { and being deformable, e.g. membranes }
- [F04B 7/0283](#) ... { and having a rotating movement }
- [F04B 7/0291](#) .. { the distribution being realised by moving the cylinder itself, e.g. by sliding or swinging }

- [F04B 7/04](#) . in which the valving is performed by pistons and cylinders coacting to open and close intake or outlet ports
- [F04B 7/045](#) .. { Two pistons coacting within one cylinder }
- [F04B 7/06](#) .. the pistons and cylinders being relatively reciprocated and rotated

- [F04B 9/00](#) **Piston machines or pumps characterised by the driving or driven means to or from their working members****

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| F04B 9/02 | . the means being mechanical |
| F04B 9/025 | .. { Driving of pistons coacting within one cylinder } |
| F04B 9/04 | .. the means being cams, eccentrics, or pin-and-slot mechanisms (with cylinder axes coaxial with, or parallel or inclined to, main shaft axis F04B 1/12) |
| F04B 9/042 | ... { the means being cams } |
| F04B 9/045 | ... { the means being eccentrics } |
| F04B 9/047 | ... { the means being pin-and-slot mechanisms } |
| F04B 9/06 | .. the means including spring- or weight-loaded lost-motion devices |
| F04B 9/08 | . the means being fluid |
| F04B 9/10 | .. the fluid being liquid |
| F04B 9/103 | ... having only one pumping chamber |
| F04B 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 } |
| F04B 9/105 | reciprocating movement of the pumping member being obtained by a double-acting liquid motor |
| F04B 9/1053 | { one side of the double-acting liquid motor being always under the influence of the liquid under pressure } |
| F04B 9/1056 | { with fluid-actuated inlet or outlet valve (mechanically controlled F04B 7/00) } |
| F04B 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 |
| F04B 9/1073 | { with actuation in the other direction by gravity } |
| F04B 9/1076 | { with fluid-actuated inlet or outlet valve (mechanically controlled F04B 7/00) } |
| F04B 9/109 | ... having plural pumping chambers |
| F04B 9/1095 | { having two or more pumping chambers in series } |
| F04B 9/111 | with two mechanically connected pumping members |
| F04B 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 } |
| F04B 9/113 | reciprocating movement of the pumping members being obtained by a double-acting liquid motor |
| F04B 9/115 | reciprocating movement of the pumping members being obtained by two single-acting liquid motors, each acting in one direction |
| F04B 9/117 | the pumping members not being mechanically connected to each other |
| F04B 9/1172 | { the movement of each pump piston in the two directions being obtained by a double-acting piston liquid motor } |
| F04B 9/1174 | { with fluid-actuated inlet or outlet valve (mechanically controlled F04B 7/00) } |
| F04B 9/1176 | { the movement of each piston in one direction being obtained by a single-acting piston liquid motor } |
| F04B 9/1178 | { the movement in the other direction being obtained by a hydraulic connection between the liquid motor cylinders } |
| F04B 9/12 | .. the fluid being elastic, e.g. steam or air |
| F04B 9/1207 | ... { using a source of partial vacuum or sub-atmospheric pressure } |

- F04B 9/1215 { the return stroke being obtained by a spring }
- F04B 9/1222 { the return stroke being obtained by an elastic fluid under pressure }
- F04B 9/123 . . . having only one pumping chamber
- F04B 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 }
- F04B 9/125 reciprocating movement of the pumping member being obtained by a double-acting elastic-fluid motor
- F04B 9/1253 { one side of the double-acting piston fluid motor being always under the influence of the fluid under pressure }
- F04B 9/1256 { with fluid-actuated inlet or outlet valve ([mechanically controlled F04B 7/00](#)) }
- F04B 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
- F04B 9/1273 { with actuation in the other direction by gravity }
- F04B 9/1276 { with fluid-actuated inlet or outlet valve ([mechanically controlled F04B 7/00](#)) }
- F04B 9/129 . . . having plural pumping chambers
- F04B 9/1295 { having two or more pumping chambers in series }
- F04B 9/131 with two mechanically connected pumping members
- F04B 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 }
- F04B 9/133 reciprocating movement of the pumping members being obtained by a double-acting elastic-fluid motor
- F04B 9/135 reciprocating movement of the pumping members being obtained by two single-acting elastic-fluid motors, each acting in one direction
- F04B 9/137 the pumping members not being mechanically connected to each other
- F04B 9/1372 { the movement of each pump piston in the two directions is obtained by a double-acting piston fluid motor }
- F04B 9/1374 { with fluid-actuated inlet or outlet valve ([mechanically controlled F04B 7/00](#)) }
- F04B 9/1376 { the movement of each piston in one direction being obtained by a single-acting piston fluid motor }
- F04B 9/1378 { the movement in the other direction being obtained by an hydraulic connection between the fluid motor cylinders }
- F04B 9/14 . . . Pumps characterised by muscle-power operation { hand-held spraying or dispensing apparatus using pumps or bulbs [B05B 11/00](#) }

F04B 11/00 Equalisation of pulses, e.g. by use of air vessels; Counteracting cavitation

- F04B 11/0008 . . { using accumulators }
- F04B 11/0016 . . { with a fluid spring }
- F04B 11/0025 . . . { the spring fluid being in direct contact with the pumped fluid }
- F04B 11/0033 . . { with a mechanical spring }
- F04B 11/0041 . . { by piston speed control ([F04B 11/0058](#) takes precedence) }

- F04B 11/005 . { using two or more pumping pistons }
- F04B 11/0058 . . { with piston speed control }
- F04B 11/0066 . . . { with special shape of the actuating element }
- F04B 11/0075 . . { connected in series }
- F04B 11/0083 . . . { the pistons having different cross-sections }
- F04B 11/0091 . { using a special shape of fluid pass, e.g. throttles, ducts }

- F04B 13/00** **Pumps specially modified to deliver fixed or variable measured quantities (for transferring liquid from bulk storage containers or reservoirs into vehicles or into portable containers [B67D 5/40](#))**
- F04B 13/02 . of two or more fluids at the same time

- F04B 15/00** **Pumps adapted to handle specific fluids, e.g. by selection of specific materials for pumps or pump parts**
- F04B 15/02 . the fluids being viscous or non-homogeneous
- F04B 15/023 . . { supply of fluid to the pump by gravity through a hopper, e.g. without intake valve }
- F04B 15/04 . the fluids being hot or corrosive ([F04B 15/06](#) takes precedence)
- F04B 15/06 . for liquids near their boiling point, e.g. under subnormal pressure
- F04B 15/08 . . the liquids having low boiling points

- F04B 17/00** **Pumps characterised by combination with, or adaptation to, specific driving engines or motors**
- F04B 17/003 . { driven by piezo-electric means ([F04B 43/046](#) and [F04B 43/095](#) take precedence) }
- F04B 17/006 . { Solar operated }
- F04B 17/02 . driven by wind motors
- F04B 17/03 . driven by electric motors
- F04B 17/04 . . using solenoids
- F04B 17/042 . . . { the solenoid motor being separated from the fluid flow }
- F04B 17/044 { using solenoids directly actuating the piston }
- F04B 17/046 . . . { the fluid flowing through the moving part of the motor }
- F04B 17/048 . . . { the fluid flowing around the moving part of the motor }
- F04B 17/05 . driven by internal-combustion engines
- F04B 17/06 . Mobile combinations

- F04B 19/00** **Machines or pumps having pertinent characteristics not provided for in, or of interest apart from, groups [F04B 1/00](#) to [F04B 17/00](#)**

- F04B 19/003 . { free-piston type pumps }
- F04B 19/006 . { Micro pumps ([F04B 43/043](#) and [F04B 43/095](#) take precedence) }
- F04B 19/02 . having movable cylinders
- F04B 19/022 . . { reciprocating cylinders }
- F04B 19/025 . . { cylinders rotating around their own axis }
- F04B 19/027 . . { cylinders oscillating around an axis perpendicular to their own axis }
- F04B 19/04 . Pumps for special use (for transferring liquids from bulk storage containers or reservoirs into vehicles or into portable containers [B67D 5/40](#))
- F04B 19/06 . . Pumps for delivery of both liquid and elastic fluid at the same time (wet gas pumps [F04B 37/20](#))
- F04B 19/08 . Scoop devices
- F04B 19/10 . . of wheel type
- F04B 19/12 . . of helical or screw-type
- F04B 19/14 . . of endless-chain type, e.g. with the chains carrying pistons co-operating with open-ended cylinders
- F04B 19/16 . Adhesion-type liquid-lifting devices
- F04B 19/18 . . Adhesion members therefor
- F04B 19/20 . Other positive-displacement pumps
- F04B 19/22 . . of reciprocating-piston type
- F04B 19/24 . . Pumping by heat expansion of pumped fluid
- F04B 23/00** **Pumping installations or systems ([F04B 17/00](#) takes precedence)**
- F04B 23/02 . having reservoirs
- F04B 23/021 . . { the pump being immersed in the reservoir }
- F04B 23/023 . . . { only the pump-part being immersed, the driving-part being outside the reservoir }
- F04B 23/025 . . { the pump being located directly adjacent the reservoir }
- F04B 23/026 . . . { a pump-side forming a wall of the reservoir }
- F04B 23/028 . . . { the pump being mounted on top of the reservoir }
- F04B 23/04 . Combinations of two or more pumps
- F04B 23/06 . . the pumps being all of reciprocating positive-displacement type
- F04B 23/08 . . the pumps being of different types
- F04B 23/10 . . . at least one pump being of the reciprocating positive-displacement type
- F04B 23/103 { being a radial piston pump }
- F04B 23/106 { being an axial piston pump }
- F04B 23/12 . . . at least one pump being of the rotary-piston positive-displacement type ([F04B 23/10](#) takes precedence)
- F04B 23/14 . . . at least one pump being of the non-positive-displacement type ([F04B 23/10](#),

[F04B 23/12](#) take precedence)

Guidance heading: **Pumps specially adapted for elastic fluids** ([having a flexible working member F04B 45/00](#); for raising fluid from great depths [F04B 47/00](#))

F04B 25/00 **Multi-stage pumps**

- F04B 25/005 . { with two cylinders }
- F04B 25/02 . of stepped piston type
- F04B 25/04 . having cylinders coaxial with, or parallel or inclined to, main shaft axis

F04B 27/00 **Multi-cylinder pumps characterised by number or arrangement of cylinders**
([F04B 25/00](#) takes precedence; control of reciprocating machines or pumps in general [F04B 49/00](#))

- F04B 27/005 . { with two cylinders }
- F04B 27/02 . having cylinders arranged oppositely relative to main shaft
- F04B 27/04 . having cylinders in star- or fan-arrangement
- F04B 27/0404 .. { Details, component parts specially adapted for such pumps }
- F04B 27/0409 ... { Pistons }
- F04B 27/0414 ... { Cams }
- F04B 27/0418 { consisting of several cylindrical elements, e.g. rollers }
- F04B 27/0423 ... { Cylinders }
- F04B 27/0428 ... { Arrangements for pressing or connecting the pistons against the actuated cam }
- F04B 27/0432 { hydraulically }
- F04B 27/0437 ... { Disconnecting the pistons from the actuated cam (in general [F01B 31/24](#)) }
- F04B 27/0442 ... { Supporting and guiding means for the pistons }
- F04B 27/0446 ... { Draining of the engine housing; Arrangements dealing with leakage fluid }
- F04B 27/0451 ... { Particularities relating to the distribution members ([F04B 27/0472](#), [F04B 27/0531](#) and [F04B 27/0535](#) take precedence) }
- F04B 27/0456 { to cylindrical distribution members }
- F04B 27/046 { to conical distribution members }
- F04B 27/0465 { to plate like distribution members }
- F04B 27/047 .. with an actuating element at the outer ends of the cylinders
- F04B 27/0472 ... { with cam-actuated distribution members }
- F04B 27/0474 ... { with two or more series radial piston-cylinder units }
- F04B 27/0476 { directly located side-by-side }
- F04B 27/0478 { Coupling of several cylinder-barrels }
- F04B 27/053 .. with an actuating element at the inner ends of the cylinders
- F04B 27/0531 ... { with cam-actuated distribution members }

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| F04B 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 } |
| F04B 27/0535 | ... | { the piston-driving cam being provided with an inlet or an outlet } |
| F04B 27/0536 | ... | { with two or more series radial piston-cylinder units } |
| F04B 27/0538 | .... | { directly located side-by-side } |
| F04B 27/06 | .. | the cylinders being movable, e.g. rotary { (F04B 27/08 takes precedence) } |
| F04B 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 } |
| F04B 27/0612 | .... | { rotary cylinder block } |
| F04B 27/0619 | ..... | { cylinder block and actuating cam rotating together (F04B 27/0631 and F04B 27/0644 take precedence) } |
| F04B 27/0625 | ..... | { with two or more series radial piston cylinder units } |
| F04B 27/0631 | ..... | { cylinder block and actuating cam both rotating (F04B 27/0644 takes precedence) } |
| F04B 27/0638 | ..... | { directly located side by side } |
| F04B 27/0644 | ..... | { cylinder block and actuating cam both rotating } |
| F04B 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 } |
| F04B 27/0657 | .... | { rotary cylinder block } |
| F04B 27/0663 | ..... | { the rotary cylinder being provided with only one piston, reciprocating within this cylinder } |
| F04B 27/067 | .. | Control |
| F04B 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 } |
| F04B 27/0676 | ... | { by changing the phase relationship between the actuating cam and the distribution means } |
| F04B 27/073 | ... | by varying the relative eccentricity between two members, e.g. a cam and a drive shaft |
| F04B 27/08 | . | having cylinders coaxial with, or parallel or inclined to, main shaft axis |
| F04B 27/0804 | .. | { having rotary cylinder block (see F01B 3/0032 , F03C 1/0636 , F03C 1/20) } |
| F04B 27/0808 | ... | { having two or more sets of cylinders or pistons } |
| F04B 27/0813 | .... | { inclined to main shaft axis } |
| F04B 27/0817 | ... | { arrangements for pressing the cylinder barrel against the valve plate e.g. by fluid pressure } |
| F04B 27/0821 | ... | { component parts, details, e.g. valves, sealings, lubrication } |
| F04B 27/0826 | .... | { particularities in the contacting area between cylinder barrel and valve plate } |
| F04B 27/083 | ..... | { bearing means } |
| F04B 27/0834 | .... | { cylinder barrel } |
| F04B 27/0839 | .... | { valve means, e.g. valve plate } |
| F04B 27/0843 | ..... | { cylindrical valve means } |
| F04B 27/0847 | ..... | { conical valve means } |
| F04B 27/0852 | | { machine housing } |
| F04B 27/0856 | | { cylinder barrel bearing means } |

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| F04B 27/086 | { swash plate } |
| F04B 27/0865 | { swash plate bearing means or driving axis bearing means } |
| F04B 27/0869 | ... { connection between rotating cylinder barrel and rotating inclined swash plate } |
| F04B 27/0873 | .. { Component parts, e.g. sealings; Manufacturing or assembly thereof } |
| F04B 27/0878 | ... { Pistons } |
| F04B 27/0882 | { piston shoe retaining means } |
| F04B 27/0886 | { Piston shoes } |
| F04B 27/0891 | ... { casings, housings } |
| F04B 27/0895 | ... { driving means } |
| F04B 27/10 | .. having stationary cylinders |
| F04B 27/1009 | ... { Distribution members } |
| F04B 27/1018 | { Cylindrical distribution members } |
| F04B 27/1027 | { Conical distribution members } |
| F04B 27/1036 | ... { Component parts, details, e.g. sealings, lubrication } |
| F04B 27/1045 | { Cylinders } |
| F04B 27/1054 | { Actuating elements } |
| F04B 27/1063 | { Actuating-element bearing means or driving-axis bearing means } |
| F04B 27/1072 | { Pivot mechanisms } |
| F04B 27/1081 | { Casings, housings } |
| F04B 27/109 | { Lubrication } |
| F04B 27/12 | ... having plural sets of cylinders or pistons |
| F04B 27/14 | .. Control |
| F04B 27/16 | ... of pumps with stationary cylinders |
| F04B 27/18 | by varying the relative positions of a swash plate and a cylinder block |
| F04B 27/1804 | { Controlled by crankcase pressure } |
| F04B 27/20 | ... of pumps with rotary cylinder block |
| F04B 27/22 | by varying the relative positions of a swash plate and a cylinder block |
| F04B 27/24 | . Control not provided for in a single group of groups F04B 27/02 to F04B 27/22 |

F04B 29/00 Other pumps with movable, e.g. rotatable cylinders

F04B 31/00 Free-piston pumps; Systems incorporating such pumps (muscle-driven pumps in which the stroke is not defined by gearing [F04B 33/00](#); free-piston combustion engines, free-piston gas generators [F02B 71/00](#); systems predominated by prime mover aspects, see the relevant classes for the prime mover)

F04B 33/00 Pumps actuated by muscle power, e.g. for inflating

- F04B 33/005 . { specially adapted for inflating tyres of non-motorised vehicles, e.g. cycles, tricycles }
- F04B 33/02 . with intermediate gearing

F04B 35/00 Piston pumps 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 ([predominant aspects of the engines or motors, see the relevant classes](#))

F04B 35/002 . { driven by internal combustion engines }

F04B 35/004 . { driven by floating elements }

F04B 35/006 . { driven by steam engines }

F04B 35/008 . { the means being a fluid transmission link }

F04B 35/01 . the means being mechanical

F04B 35/04 . the means being electric

F04B 35/045 . . { using solenoids }

F04B 35/06 . Mobile combinations

F04B 37/00 **Pumps having pertinent characteristics not provided for in, or of interest apart from, groups [F04B 25/00](#) to [F04B 35/00](#)**

F04B 37/02 . for evacuating by absorption or adsorption ([absorption or adsorption in general \[B01J\]\(#\)](#) ; { for gas-filled discharge tubes see [H01J 17/24](#) })

F04B 37/04 . . Selection of specific absorption or adsorption materials

F04B 37/06 . for evacuating by thermal means

F04B 37/08 . . by condensing or freezing, e.g. cryogenic pumps ([cold traps \[B01D 8/00\]\(#\)](#))

F04B 37/085 . . . { [Regeneration of cyro-pumps](#) }

F04B 37/10 . for special use ([F04B 37/02](#), [F04B 37/06](#) take precedence)

F04B 37/12 . . to obtain high pressure

F04B 37/14 . . to obtain high vacuum

F04B 37/16 . . . Means for nullifying unswept space

F04B 37/18 . . for specific elastic fluid

F04B 37/20 . . . for wet gases, e.g. wet air

F04B 39/00 **Component parts, details, or accessories, of pumps or pumping systems, not otherwise provided for in, or of interest apart from, groups [F04B 25/00](#) to [F04B 37/00](#) ([for controlling \[F04B 49/00\]\(#\)](#))**

F04B 39/0005 . { adaptations of pistons }

F04B 39/0011 . . { liquid pistons }

F04B 39/0016 . . { with valve arranged in the piston }

F04B 39/0022 . . { piston rods }

F04B 39/0027 . { Pulsation and noise damping means }

- F04B 39/0033 .. { with encapsulations }
- F04B 39/0038 ... { of inlet or outlet channels }
- F04B 39/0044 .. { with vibration damping supports }
- F04B 39/005 .. { with direct action on the fluid flow using absorptive materials }
- F04B 39/0055 .. { with a special shape of fluid passage, e.g. bends, throttles, diameter changes, pipes }
- F04B 39/0061 ... { using muffler volumes }
- F04B 39/0066 ... { using sidebranch resonators, e.g. Helmholtz resonators }
- F04B 39/0072 ... { characterised by assembly or mounting }
- F04B 39/0077 .. { by generating oil foam }
- F04B 39/0083 .. { using blow off silencers }
- F04B 39/0088 .. { using mechanical tuned resonators }
- F04B 39/0094 . { crankshaft }
- F04B 39/02 . Lubrication (of machines or engines in general [F01M](#))
- F04B 39/0207 .. { with lubrication control systems }
- F04B 39/0215 .. { characterised by the use of a special lubricant }
- F04B 39/0223 .. { characterised by the compressor type (swash-plate compressors [F04B 27/109](#)) }
- F04B 39/023 ... { Hermetic compressors }
- F04B 39/0238 { with oil distribution channels }
- F04B 39/0246 { in the rotating shaft }
- F04B 39/0253 { using centrifugal force for transporting the oil }
- F04B 39/0261 { with an auxiliary oil pump }
- F04B 39/0269 { with device for spraying lubricant or with mist lubrication }
- F04B 39/0276 ... { the pump being of the reciprocating piston type, e.g. oscillating, free-piston compressors }
- F04B 39/0284 .. { Constructional details, e.g. reservoirs in the casing (swash-plate compressors [F04B 27/0878](#), [F04B 27/109](#)) }
- F04B 39/0292 ... { Lubrication of pistons or cylinders }
- F04B 39/04 . Measures to avoid lubricant contaminating the pumped fluid
- F04B 39/041 .. { sealing for a reciprocating rod (sealing in general [F16J](#)) }
- F04B 39/042 ... { sealing being provided on the piston }
- F04B 39/044 ... { sealing with a rolling diaphragm between piston and cylinder }
- F04B 39/045 ... { Labyrinth-sealing between piston and cylinder }
- F04B 39/047 ... { Sealing between piston and carter being provided by a bellow }
- F04B 39/048 ... { Sealing between piston and carter being provided by a diaphragm }
- F04B 39/06 . Cooling (of machines or engines in general [F01P](#)); Heating; Prevention of freezing
- F04B 39/062 .. { Cooling by injecting a liquid in the gas to be compressed }
- F04B 39/064 .. { Cooling by a cooling jacket in the pump casing }
- F04B 39/066 .. { Cooling by ventilation }
- F04B 39/068 .. { prevention of freezing }

- F04B 39/08 . Actuation of distribution members
- F04B 39/10 . Adaptations or arrangements of distribution members
- F04B 39/1006 .. { the members being ball valves }
- F04B 39/1013 .. { the members being of the poppet valve type }
- F04B 39/102 .. { the members being disc valves }
- F04B 39/1026 ... { without spring ([F04B 39/1033](#) takes precedence) }
- F04B 39/1033 ... { annular disc valves }
- F04B 39/104 .. { the members being parallel flexible strips }
- F04B 39/1046 .. { Combination of in- and outlet valve }
- F04B 39/1053 .. { the members being Hoerbigen valves }
- F04B 39/106 .. { the members being parallel non-flexible strips }
- F04B 39/1066 .. { Valve plates }
- F04B 39/1073 .. { the members being reed valves }
- F04B 39/108 ... { circular reed valves }
- F04B 39/1086 ... { flat annular reed valves }
- F04B 39/1093 .. { the members being low-resistance valves allowing free streaming }
- F04B 39/12 . Casings ([casings for machines or engines in general F16M](#)); Cylinders; Cylinders heads; Fluid connections
- F04B 39/121 .. { Casings }
- F04B 39/122 .. { Cylinder block }
- F04B 39/123 .. { Fluid connections }
- F04B 39/125 .. { Cylinder heads }
- F04B 39/126 .. { Cylinder liners }
- F04B 39/127 .. { Mounting of a cylinder block in a casing }
- F04B 39/128 .. { Crankcases }
- F04B 39/14 . Provisions for readily assembling or disassembling
- F04B 39/16 . Filtration; Moisture separation
- F04B 41/00** **Pumping installations or systems** ([F04B 31/00](#), [F04B 35/00](#) take precedence)
- F04B 41/02 . having reservoirs
- F04B 41/04 . Conversion of internal-combustion engine cylinder units to pumps
- F04B 41/06 . Combinations of two or more pumps

Guidance heading: **Machines or pumps having flexible working members**

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

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

- F04B 43/02 . having plate-like flexible members, e.g. diaphragms
- F04B 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 }
- F04B 43/023 .. { double acting plate-like flexible member }
- F04B 43/025 .. { two or more plate-like pumping members in parallel }
- F04B 43/026 ... { each plate-like pumping flexible member working in its own pumping chamber }
- F04B 43/028 .. { with in- or outlet valve arranged in the plate-like flexible member (valve arranged in the piston [F04B 53/12](#)) }
- F04B 43/04 .. Pumps having electric drive
- F04B 43/043 ... { Micro pumps }
- F04B 43/046 { with piezo-electric drive }
- F04B 43/06 .. Pumps having fluid drive
- F04B 43/067 ... the fluid being actuated directly by a piston
- F04B 43/073 ... the actuating fluid being controlled by at least one valve
- F04B 43/0733 { with fluid-actuated pump inlet or outlet valves; with two or more pumping chambers in series }
- F04B 43/0736 { with two or more pumping chambers in parallel }

- F04B 43/08 . having tubular flexible members ([F04B 43/12](#) takes precedence)
- F04B 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 }
- F04B 43/084 .. { the tubular member being deformed by stretching ou distorsion }
- F04B 43/086 .. { with two or more tubular flexible members in parallel ([F04B 43/1136](#) takes precedence) }
- F04B 43/088 .. { with two or more tubular flexible members in series ([F04B 43/1133](#) takes precedence) }
- F04B 43/09 .. Pumps having electric drive
- F04B 43/095 ... { Piezo-electric drive }
- F04B 43/10 .. Pumps having fluid drive

- F04B 43/107 . . . the fluid being actuated directly by a piston
- F04B 43/113 . . . the actuating fluid being controlled by at least one valve
- F04B 43/1133 { with fluid-actuated pump inlet or outlet valves; with two or more pumping chambers in series }
- F04B 43/1136 { with two or more pumping chambers in parallel }

- F04B 43/12 . . having peristaltic action
- F04B 43/1207 . . { the actuating element being a swash plate }
- F04B 43/1215 . . { having no backing plate (deforming of the tube only by rollers) }
- F04B 43/1223 . . { the actuating elements, e.g. rollers, moving in a straight line during squeezing }
- F04B 43/123 . . { using an excenter as the squeezing element }
- F04B 43/1238 . . { using only one roller as the squeezing element, the roller moving on an arc of a circle during squeezing }
- F04B 43/1246 . . . { the roller being placed at the outside of the tubular flexible member }
- F04B 43/1253 . . { by using two or more rollers as squeezing elements, the rollers moving on an arc of a circle during squeezing }
- F04B 43/1261 . . . { the rollers being placed at the outside of the tubular flexible member }
- F04B 43/1269 . . . { the rotary axes of the rollers lying in a plane perpendicular to the rotary axis of the driving motor }
- F04B 43/1276 . . . { Means for pushing the rollers against the tubular flexible member }
- F04B 43/1284 . . . { Means for pushing the backing-plate against the tubular flexible member }
- F04B 43/1292 . . . { Pumps specially adapted for several tubular flexible members }
- F04B 43/14 . . having plate-like flexible members

F04B 45/00 Pumps or pumping installations having flexible working members and specially adapted for elastic fluids

- F04B 45/02 . . having bellows
- F04B 45/022 . . { with two or more bellows in parallel }
- F04B 45/024 . . { with two or more bellows in series }
- F04B 45/027 . . having electric drive
- F04B 45/033 . . having fluid drive
- F04B 45/0333 . . . { the fluid being actuated directly by a piston }
- F04B 45/0336 . . . { the actuating fluid being controlled by one or more valves }

- F04B 45/04 . . having plate-like flexible members, e.g. diaphragms
- F04B 45/041 . . { double acting plate-like flexible pumping member }
- F04B 45/043 . . { two or more plate-like pumping flexible members in parallel }
- F04B 45/045 . . { with in- or outlet valve arranged in the plate-like pumping flexible members }
- F04B 45/047 . . Pumps having electric drive
- F04B 45/053 . . Pumps having fluid drive
- F04B 45/0533 . . . { the fluid being actuated directly by a piston }
- F04B 45/0536 . . . { the actuating fluid being controlled by one or more valves }

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

- F04B 45/061 . . { with fluid drive }
- F04B 45/062 . . . { the fluid being actuated directly by a piston }
- F04B 45/064 . . . { the actuating fluid being controlled by one or more valves }
- F04B 45/065 . . { with electric drive }
- F04B 45/067 . . Pumps having electric drive
- F04B 45/073 . . Pumps having fluid drive
- F04B 45/0733 . . . { the fluid being actuated directly by a piston }
- F04B 45/0736 . . . { the actuating fluid being controlled by one or more valves }
- F04B 45/08 . . having peristaltic action
- F04B 45/085 . . . { the actuating element being a swash plate }
- F04B 45/10 . . having plate-like flexible members

F04B 47/00 **Pumps or pumping installation 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](#))

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

F04B 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](#) to [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

- F04B 49/002 . { Hydraulic systems to change the pump delivery }
- F04B 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 }
- F04B 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](#)) }
- F04B 49/02 . Stopping, starting, unloading or idling control (controlled electrically [F04B 49/06](#))
- F04B 49/022 . . { by means of pressure }
- F04B 49/025 . . by means of floats
- F04B 49/03 . . by means of valves
- F04B 49/035 . . . Bypassing
- F04B 49/04 . Regulating by means of floats ([F04B 49/025](#) takes precedence)
- F04B 49/06 . Control using electricity (regulating by means of floats actuating electric switches [F04B 49/04](#))
- F04B 49/065 . . { and making use of computers }
- F04B 49/08 . Regulating by delivery pressure
- F04B 49/10 . Other safety measures
- F04B 49/103 . . { Responsive to speed }
- F04B 49/106 . . { Responsive to pumped volume }
- F04B 49/12 . by varying the length of stroke of the working members
- F04B 49/121 . . { Lost-motion device in the driving mechanism }
- F04B 49/123 . . { by changing the eccentricity of one element relative to another element }
- F04B 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) }
- F04B 49/126 { with a double eccenter mechanism }
- F04B 49/128 . . . { by changing the eccentricity of the cylinders, e.g. by moving a cylinder block }
- F04B 49/14 . . Adjusting abutments located in the path of reciprocation
- F04B 49/16 . by adjusting the capacity of dead spaces of working chambers
- F04B 49/18 . by changing the effective cross-section of the working surface of the piston
- F04B 49/20 . by changing the driving speed (controlled electrically [F04B 49/06](#))
- F04B 49/22 . by means of valves ([F04B 49/03](#) takes precedence)

- F04B 49/225 .. { with throttling valves or valves varying the pump inlet opening or the outlet opening }
- F04B 49/24 .. Bypassing
- F04B 49/243 ... { by keeping open the inlet valve }
- F04B 49/246 ... { by keeping open the outlet valve }

F04B 51/00 Testing machines, pumps, or pumping installations

F04B 53/00 Component parts, details or accessories not provided for in, or of interest apart from, groups [F04B 1/00](#) to [F04B 23/00](#) or [F04B 39/00](#) to [F04B 47/00](#)

- F04B 53/001 . { Noise damping }

WARNING

Group [F04B 53/001](#) and subgroups are not complete, see [F04B 11/00](#), [F04B 53/16](#)

- F04B 53/002 .. { by encapsulation }
- F04B 53/003 .. { by damping supports }
- F04B 53/004 .. { by mechanical resonators }
- F04B 53/005 . { Adaptations or arrangements of valves used as foot valves, of suction strainers, or of mud-boxes }
- F04B 53/006 . { Crankshafts }
- F04B 53/007 . { Cylinder heads }
- F04B 53/008 . { Spacing or clearance between cylinder and piston }
- F04B 53/02 . Packing the free space between cylinders and pistons
- F04B 53/04 . Draining
- F04B 53/06 . Venting
- F04B 53/08 . Cooling (of machines or engines in general [F01P](#)); Heating; Preventing freezing
- F04B 53/10 . Valves; Arrangement of valves
- F04B 53/1002 .. { Ball valves }
- F04B 53/1005 ... { being formed by two closure members working in series }
- F04B 53/1007 ... { having means for guiding the closure member }
- F04B 53/101 ... { having means for limiting the opening height }
- F04B 53/1012 { and means for controlling the opening height }
- F04B 53/1015 ... { Combinations of ball valves working in parallel }
- F04B 53/1017 ... { Semi-spherical ball valves }
- F04B 53/102 .. { Disc valves }

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| F04B 53/1022 | ... | { having means for guiding the closure member axially } |
| F04B 53/1025 | | { the guiding means being provided within the valve opening } |
| F04B 53/1027 | .... | { the guiding means being provided at both sides of the disc } |
| F04B 53/103 | ... | { Flat-annular type disc valves } |
| F04B 53/1032 | ... | { Spring-actuated disc valves (F04B 53/1022 , F04B 53/103 take precedence) } |
| F04B 53/1035 | ... | { with means for limiting the opening height } |
| F04B 53/1037 | .. | { Flap valves } |
| F04B 53/104 | ... | { the closure member being a rigid element oscillating around a fixed point } |
| F04B 53/1042 | .... | { by means of a flexible connection } |
| F04B 53/1045 | .... | { the valve being formed by two elements } |
| F04B 53/1047 | ... | { the valve being formed by one or more flexible elements } |
| F04B 53/105 | .... | { one flexible element oscillating around a fixed point } |
| F04B 53/1052 | .... | { two flexible elements oscillating around a fixed point } |
| F04B 53/1055 | .... | { more than two flexible elements oscillating around a fixed point } |
| F04B 53/1057 | .... | { the valve being a tube, e.g. normally closed at one end } |
| F04B 53/106 | .... | { the valve being a membrane } |
| F04B 53/1062 | ..... | { fixed at two or more points at its periphery } |
| F04B 53/1065 | ..... | { fixed at its centre } |
| F04B 53/1067 | ..... | { fixed at its whole periphery and with an opening at its centre } |
| F04B 53/107 | ..... | { the opening normally being closed by a fixed element } |
| F04B 53/1072 | .. | { the valve being an elastic body, the length thereof changing in the opening direction } |
| F04B 53/1075 | .. | { the valve being a flexible annular ring } |
| F04B 53/1077 | .. | { Flow resistance valves, e.g. without moving parts } |
| F04B 53/108 | .. | { Valves characterised by the material } |
| F04B 53/1082 | ... | { magnetic } |
| F04B 53/1085 | .. | { having means for limiting the opening height (F04B 53/101 and F04B 53/1035 take precedence) } |
| F04B 53/1087 | .. | { Valve seats } |
| F04B 53/109 | .. | { inlet and outlet valve forming one unit } |
| F04B 53/1092 | ... | { and one single element forming both the inlet and outlet closure member } |
| F04B 53/1095 | .. | { Valves linked to another valve of another pumping chamber } |
| F04B 53/1097 | .. | { with means for lifting the closure member for pump cleaning purposes } |
| F04B 53/12 | .. | arranged in or on pistons |
| F04B 53/121 | ... | { the valve being an annular ring surrounding the piston, e.g. an O-ring } |
| F04B 53/122 | ... | { the piston being free-floating, e.g. the valve being formed between the actuating rod and the piston } |
| F04B 53/123 | ... | { Flexible valves } |
| F04B 53/124 | ... | { Oscillating valves } |
| F04B 53/125 | ... | { Reciprocating valves } |
| F04B 53/126 | | { Ball valves } |
| F04B 53/127 | | { Disc valves } |
| F04B 53/128 | | { Annular disc valves } |

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| F04B 53/129 | { Poppet valves } |
| F04B 53/14 | . Pistons, piston-rods or piston-rod connections |
| F04B 53/141 | .. { Intermediate liquid piston between the driving piston and the pumped liquid (F04B 43/06 and F04B 43/10 take precedence) } |
| F04B 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) } |
| F04B 53/143 | .. { Sealing provided on the piston } |
| F04B 53/144 | .. { Adaptation of piston-rods } |
| F04B 53/145 | ... { Rod shock absorber } |
| F04B 53/146 | ... { Piston-rod guiding arrangements } |
| F04B 53/147 | ... { Mounting or detaching of piston rod } |
| F04B 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 } |
| F04B 53/16 | . Casings; Cylinders; Cylinder liners or heads; Fluid connections |
| F04B 53/162 | .. { Adaptations of cylinders } |
| F04B 53/164 | ... { Stuffing boxes } |
| F04B 53/166 | ... { Cylinder liners } |
| F04B 53/168 | { Mounting of cylinder liners in cylinders } |
| F04B 53/18 | . Lubricating (of machines or engines in general F01M) |
| F04B 53/20 | . Filtering |
| F04B 53/22 | . Arrangements for enabling ready assembly or disassembly |
| F04B 2015/00 | Pumps adapted to handle specific fluids, e.g. by selection of specific materials for pumps or pump parts |
| F04B 2015/02 | . the fluids being viscous or non-homogeneous |
| F04B 2015/026 | .. with a priming plunger or piston ahead of the pumping piston and connected on the same piston rod |
| F04B 2015/06 | . for liquids near their boiling point, e.g. under subnormal pressure |
| F04B 2015/08 | .. the liquids having low boiling points |
| F04B 2015/081 | ... Liquified gases |
| F04B 2015/0812 | Air |
| F04B 2015/0814 | Argon |
| F04B 2015/0816 | Carbon monoxide |
| F04B 2015/0818 | Carbon dioxide |
| F04B 2015/082 | Helium |
| F04B 2015/0822 | Hydrogen |
| F04B 2015/0824 | Nitrogen |
| F04B 2015/0826 | Oxygen |

F04B 2027/00 **Multi-cylinder pumps characterised by number or arrangement of cylinders**

[25/00 takes precedence; control of reciprocating machines or pumps in general F04B 49/00 \)](#)

| | |
|----------------|--|
| F04B 2027/08 | . having cylinders coaxial with, or parallel or inclined to, main shaft axis |
| F04B 2027/14 | .. Control |
| F04B 2027/16 | ... of pumps with stationary cylinders |
| F04B 2027/18 | by varying the relative positions of a swash plate and a cylinder block |
| F04B 2027/1804 | { Controlled by crankcase pressure } |
| F04B 2027/1809 | Controlled pressure |
| F04B 2027/1813 | Crankcase pressure |
| F04B 2027/1818 | Suction pressure |
| F04B 2027/1822 | Valve-controlled fluid connection |
| F04B 2027/1827 | between crankcase and discharge chamber |
| F04B 2027/1831 | between crankcase and suction chamber |
| F04B 2027/1836 | between crankcase and working chamber |
| F04B 2027/184 | Valve controlling parameter |
| F04B 2027/1845 | Crankcase pressure |
| F04B 2027/185 | Discharge pressure |
| F04B 2027/1854 | External parameters |
| F04B 2027/1859 | Suction pressure |
| F04B 2027/1863 | with an auxiliary valve, controlled by |
| F04B 2027/1868 | Crankcase pressure |
| F04B 2027/1872 | Discharge pressure |
| F04B 2027/1877 | External parameters |
| F04B 2027/1881 | Suction pressure |
| F04B 2027/1886 | Open (not controlling) fluid passage |
| F04B 2027/189 | between crankcase and discharge chamber |
| F04B 2027/1895 | between crankcase and suction chamber |

F04B 2201/00 Pump parameters

| | |
|-----------------|---|
| F04B 2201/02 | . Piston parameters |
| F04B 2201/0201 | .. Position of the piston |
| F04B 2201/02011 | ... Angular position of a piston rotating around its own axis |
| F04B 2201/0202 | .. Linear speed of the piston |
| F04B 2201/0203 | .. Acceleration of the piston |
| F04B 2201/0204 | .. Power on the piston |
| F04B 2201/0205 | .. Piston ring wear |
| F04B 2201/0206 | .. Length of piston stroke |
| F04B 2201/0207 | .. Number of pumping strokes in unit time |
| F04B 2201/02071 | ... Total number of pumping strokes |
| F04B 2201/0208 | .. Leakage across the piston |

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|-----------------|-----|---|
| F04B 2201/0209 | .. | Duration of piston stroke |
| F04B 2201/021 | .. | Rotational speed of a piston rotating around its own axis (F04B 7/06) |
| F04B 2201/04 | . | Carter parameters |
| F04B 2201/0401 | .. | Carter pressure |
| F04B 2201/0402 | .. | Lubricating oil temperature |
| F04B 2201/0403 | .. | Carter housing temperature |
| F04B 2201/0404 | .. | Lubricating oil condition |
| F04B 2201/0405 | .. | Leakage |
| F04B 2201/0406 | .. | Pressure change across an oil filter |
| F04B 2201/06 | . | Valve parameters |
| F04B 2201/0601 | .. | Opening times |
| F04B 2201/06011 | ... | of the inlet valve only |
| F04B 2201/06012 | ... | of the outlet valve only |
| F04B 2201/0602 | .. | Valve acceleration |
| F04B 2201/0603 | .. | Valve wear |
| F04B 2201/0604 | .. | Valve noise |
| F04B 2201/0605 | .. | Leakage over a valve |
| F04B 2201/0606 | .. | Opening width or height |
| F04B 2201/06061 | ... | of the inlet valve |
| F04B 2201/06062 | ... | of the outlet valve |
| F04B 2201/08 | . | Cylinder or housing parameters |
| F04B 2201/0801 | .. | Temperature |
| F04B 2201/0802 | .. | Vibration |
| F04B 2201/0803 | .. | Leakage |
| F04B 2201/0804 | .. | Noise |
| F04B 2201/0805 | .. | Rotational speed of a rotating cylinder block |
| F04B 2201/0806 | .. | Resonant frequency |
| F04B 2201/0807 | .. | Number of working cylinders |
| F04B 2201/0808 | .. | Size of the dead volume |
| F04B 2201/12 | . | Parameters of driving or driven means |
| F04B 2201/1201 | .. | Rotational speed of the axis |
| F04B 2201/1202 | .. | Torque on the axis |
| F04B 2201/1203 | .. | Power on the axis |
| F04B 2201/1204 | .. | Position of a rotating inclined plate |
| F04B 2201/12041 | ... | Angular position |
| F04B 2201/1205 | .. | Position of a non-rotating inclined plate |
| F04B 2201/12051 | ... | Angular position |
| F04B 2201/1206 | .. | Rotational speed of a rotating inclined plate |
| F04B 2201/1207 | .. | Wear of the bearings |
| F04B 2201/1208 | .. | Angular position of the shaft |

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| F04B 2201/1209 | .. | Radial force on the bearings |
| F04B 2201/121 | .. | Load on the sucker rod |
| F04B 2201/1211 | .. | Position of the walking beam |
| F04B 2201/1212 | .. | Oil pressure in the bearings |
| F04B 2201/1213 | .. | Eccentricity of an outer annular cam |
| F04B 2201/124 | .. | Coupling parameters |
| F04B 2201/1241 | ... | Engagement |
| F04B 2201/127 | .. | Braking parameters |

F04B 2203/00 Motor parameters

| | | |
|----------------|----|---|
| F04B 2203/02 | . | of rotating electric motors |
| F04B 2203/0201 | .. | Current |
| F04B 2203/0202 | .. | Voltage |
| F04B 2203/0203 | .. | Magnetic flux |
| F04B 2203/0204 | .. | Frequency of the electric current |
| F04B 2203/0205 | .. | Temperature |
| F04B 2203/0206 | .. | Vibration |
| F04B 2203/0207 | .. | Torque |
| F04B 2203/0208 | .. | Power |
| F04B 2203/0209 | .. | Rotational speed |
| F04B 2203/021 | .. | Lubricating-oil temperature |
| F04B 2203/0211 | .. | Noise |
| F04B 2203/0212 | .. | Amplitude of the electric current |
| F04B 2203/0213 | .. | Pulses per unit of time (pulse motor) |
| F04B 2203/0214 | .. | Number of working motor-pump units |

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|----------------|----|-----------------------------------|
| F04B 2203/04 | . | of linear electric motors |
| F04B 2203/0401 | .. | Current |
| F04B 2203/0402 | .. | Voltage |
| F04B 2203/0403 | .. | Magnetic flux |
| F04B 2203/0404 | .. | Frequency of the electric current |
| F04B 2203/0405 | .. | Temperature |
| F04B 2203/0406 | .. | Vibration |
| F04B 2203/0407 | .. | Force |
| F04B 2203/0408 | .. | Power |
| F04B 2203/0409 | .. | Linear speed |
| F04B 2203/041 | .. | Lubricating-oil temperature |
| F04B 2203/0411 | .. | Noise |

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| F04B 2203/06 | . | of internal combustion engines |
| F04B 2203/0601 | .. | Temperature |
| F04B 2203/0602 | .. | Vibration |

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|---------------------|-----|--|
| F04B 2203/0603 | .. | Torque |
| F04B 2203/0604 | .. | Power |
| F04B 2203/0605 | .. | Rotational speed |
| F04B 2203/0606 | .. | Lubricating-oil temperature |
| F04B 2203/0607 | .. | Fuel consumption |
| F04B 2203/06071 | ... | position of the carburettor valve |
| F04B 2203/09 | . | of linear hydraulic motors |
| F04B 2203/0901 | .. | Opening time of the valves |
| F04B 2203/0902 | .. | Liquid pressure in a working chamber |
| F04B 2203/0903 | .. | Position of the driving piston |
| F04B 2203/091 | ... | Opening time of the valves |
| F04B 2203/10 | . | of linear elastic fluid motors |
| F04B 2203/1001 | .. | Opening time of the valves |
| F04B 2203/11 | . | of a gas turbine |
| F04B 2203/1101 | .. | Rotational speed of the turbine |
| F04B 2203/1102 | .. | Flow rate of the driving fluid |
| F04B 2203/1103 | .. | Rotation sense of the turbine |
| F04B 2203/12 | . | of rotating hydraulic motors |
| F04B 2203/1201 | .. | Rotational speed |
| F04B 2203/1202 | .. | Pressure at the motor inlet |
| F04B 2205/00 | | Fluid parameters |
| F04B 2205/01 | . | Pressure before the pump inlet |
| F04B 2205/02 | . | Pressure in the inlet chamber |
| F04B 2205/03 | . | Pressure in the compression chamber |
| F04B 2205/04 | . | Pressure in the outlet chamber |
| F04B 2205/05 | . | Pressure after the pump outlet |
| F04B 2205/06 | . | Pressure in a (hydraulic) circuit |
| F04B 2205/061 | .. | after a throttle |
| F04B 2205/062 | .. | before a throttle |
| F04B 2205/063 | .. | in a reservoir linked to the pump outlet |
| F04B 2205/064 | .. | in a reservoir linked to the pump inlet |
| F04B 2205/065 | .. | between two stages in a multi-stage pump |
| F04B 2205/07 | . | Pressure difference over the pump |
| F04B 2205/08 | . | Pressure difference over a throttle |

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| F04B 2205/0801 | . . the throttle being a filter |
| F04B 2205/09 | . Flow through the pump |
| F04B 2205/10 | . Inlet temperature |
| F04B 2205/11 | . Outlet temperature |
| F04B 2205/111 | . . after a throttle |
| F04B 2205/112 | . . between two stages in a multi-stage pump |
| F04B 2205/12 | . Pressure pulsations before the pump |
| F04B 2205/13 | . Pressure pulsations after the pump |
| F04B 2205/14 | . Viscosity |
| F04B 2205/15 | . By-passing over the pump |
| F04B 2205/151 | . . Opening width of a bypass valve |
| F04B 2205/16 | . Opening or closing of a valve in a circuit |
| F04B 2205/17 | . Opening width of a throttling device |
| F04B 2205/171 | . . before the pump inlet |
| F04B 2205/172 | . . after the pump outlet |
| F04B 2205/173 | . . in a circuit |
| F04B 2205/18 | . Pressure in a control cylinder/piston unit |
| F04B 2205/50 | . Presence of foreign matter in the fluid |
| F04B 2205/501 | . . of solid particles |
| F04B 2205/503 | . . of gas in a liquid flow, e.g. gas bubbles |
| F04B 2207/00 | External parameters |
| F04B 2207/01 | . Load in general |
| F04B 2207/02 | . External pressure |
| F04B 2207/03 | . External temperature |
| F04B 2207/04 | . Settings |
| F04B 2207/041 | . . of flow |
| F04B 2207/0411 | . . . maximum |
| F04B 2207/0412 | . . . minimum |
| F04B 2207/0413 | . . . medium |
| F04B 2207/042 | . . of pressure |
| F04B 2207/0421 | . . . maximum |
| F04B 2207/0422 | . . . minimum |

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| F04B 2207/0423 | ... | medium |
| F04B 2207/043 | .. | of time |
| F04B 2207/044 | .. | of the rotational speed of the driving motor |
| F04B 2207/0441 | ... | maximum |
| F04B 2207/0442 | ... | minimum |
| F04B 2207/045 | .. | of the resonant frequency of the unit motor-pump |
| F04B 2207/046 | .. | of length of piston stroke |
| F04B 2207/047 | .. | of the nominal power of the driving motor |
| F04B 2207/048 | .. | of a reference voltage of the driving motor |
| F04B 2207/70 | . | Warnings |
| F04B 2207/701 | .. | Sound |
| F04B 2207/702 | .. | Light |
| F04B 2207/703 | .. | Stopping |
| F04B 2207/704 | .. | Idling |