

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](#); gears for interconverting rotary motion and reciprocating motion in general [F16H](#); pistons, piston-rods, cylinders, in general [F16J](#))

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 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](#)

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](#))}
- [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}

- 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 coacting 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

F04B 7/0053

(continued)

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

- 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 7/58](#))**
- 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 2015/026 . . {with a priming plunger or piston ahead of the pumping piston and connected on the same piston rod}
- 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 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 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 7/58](#))

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)

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}

- 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}
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 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 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

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 distersion}
- 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}
- 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}
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 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
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
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
- 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
- F04B 2203/06 . of internal combustion engines
- F04B 2203/0601 . . Temperature
- F04B 2203/0602 . . Vibration
- 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
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
- 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