

**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](#)

**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 ( <a href="#">F04B 1/0408</a> , <a href="#">F04B 53/164</a> take precedence)}
F04B 1/0452	...	{Particularities relating to the distribution members ( <a href="#">F04B 1/0472</a> , <a href="#">F04B 1/0531</a> and <a href="#">F04B 1/0535</a> 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 {( <a href="#">F04B 49/12</a> , <a href="#">F04B 49/18</a> 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 {( <a href="#">F04B 1/20</a> and <a href="#">F04B 3/006</a> 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 ( <a href="#">F04B 1/1075</a> and <a href="#">F04B 1/1078</a> 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 ( <a href="#">F04B 1/1078</a> 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 ( <a href="#">F04B 1/2014</a> 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**

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 <a href="#">F04B 7/00</a> )}
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 <a href="#">F04B 7/00</a> )}
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 <a href="#">F04B 7/00</a> )}
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 <a href="#">B05B 11/00</a> }
<b>F04B 11/00</b>		<b>Equalisation of pulses, e.g. by use of air vessels; Counteracting cavitation</b>
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 ( <a href="#">F04B 11/0058</a> 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}



<b>F04B 13/00</b>	<b>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 <a href="#">B67D 7/58</a>)</b>
F04B 13/02	. of two or more fluids at the same time
<b>F04B 15/00</b>	<b>Pumps adapted to handle specific fluids, e.g. by selection of specific materials for pumps or pump parts</b>
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 ( <a href="#">F04B 15/06</a> 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 }
<b>F04B 17/00</b>	<b>Pumps characterised by combination with, or adaptation to, specific driving engines or motors</b>
F04B 17/003	. {driven by piezo-electric means ( <a href="#">F04B 43/046</a> and <a href="#">F04B 43/095</a> 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
<b>F04B 19/00</b>	<b>Machines or pumps having pertinent characteristics not provided for in, or of interest apart from, groups <a href="#">F04B 1/00</a> to <a href="#">F04B 17/00</a></b>
F04B 19/003	. {free-piston type pumps}
F04B 19/006	. {Micro pumps ( <a href="#">F04B 43/043</a> and <a href="#">F04B 43/095</a> 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 coacting 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 ( <a href="#">F04B 27/0631</a> and <a href="#">F04B 27/0644</a> take precedence)}
F04B 27/0625	.....	{with two or more series radial piston cylinder units}
F04B 27/0631	.....	{cylinder block and actuating cam both rotating ( <a href="#">F04B 27/0644</a> 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 ( <a href="#">see F01B 3/0032</a> , <a href="#">F03C 1/0636</a> , <a href="#">F03C 1/20</a> )}
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	<ul style="list-style-type: none"> <li>Control not provided for in a single group of groups <a href="#">F04B 27/02</a> to <a href="#">F04B 27/22</a></li> </ul>
<b>F04B 29/00</b>	<b>Other pumps with movable, e.g. rotatable cylinders</b>
<b>F04B 31/00</b>	<b>Free-piston pumps; Systems incorporating such pumps</b> (muscle-driven pumps in which the stroke is not defined by gearing <a href="#">F04B 33/00</a> ; free-piston combustion engines, free-piston gas generators <a href="#">F02B 71/00</a> ; systems predominated by prime mover aspects, see the relevant classes for the prime mover)
<b>F04B 33/00</b>	<b>Pumps actuated by muscle power, e.g. for inflating</b>
F04B 33/005	<ul style="list-style-type: none"> <li>{specially adapted for inflating tyres of non-motorised vehicles, e.g. cycles, tricycles}</li> </ul>
F04B 33/02	<ul style="list-style-type: none"> <li>with intermediate gearing</li> </ul>
<b>F04B 35/00</b>	<b>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</b> (predominant aspects of the engines or motors, see the relevant classes)
F04B 35/002	<ul style="list-style-type: none"> <li>{driven by internal combustion engines}</li> </ul>
F04B 35/004	<ul style="list-style-type: none"> <li>{driven by floating elements}</li> </ul>
F04B 35/006	<ul style="list-style-type: none"> <li>{driven by steam engines}</li> </ul>
F04B 35/008	<ul style="list-style-type: none"> <li>{the means being a fluid transmission link}</li> </ul>
F04B 35/01	<ul style="list-style-type: none"> <li>the means being mechanical</li> </ul>
F04B 35/04	<ul style="list-style-type: none"> <li>the means being electric</li> </ul>
F04B 35/045	<ul style="list-style-type: none"> <li>.. {using solenoids}</li> </ul>
F04B 35/06	<ul style="list-style-type: none"> <li>Mobile combinations</li> </ul>
<b>F04B 37/00</b>	<b>Pumps having pertinent characteristics not provided for in, or of interest apart from, groups <a href="#">F04B 25/00</a> to <a href="#">F04B 35/00</a></b>
F04B 37/02	<ul style="list-style-type: none"> <li>for evacuating by absorption or adsorption (absorption or adsorption in general <a href="#">B01J</a>; {for gas-filled discharge tubes see <a href="#">H01J 17/24</a>})</li> </ul>
F04B 37/04	<ul style="list-style-type: none"> <li>.. Selection of specific absorption or adsorption materials</li> </ul>
F04B 37/06	<ul style="list-style-type: none"> <li>for evacuating by thermal means</li> </ul>
F04B 37/08	<ul style="list-style-type: none"> <li>.. by condensing or freezing, e.g. cryogenic pumps (cold traps <a href="#">B01D 8/00</a>)</li> </ul>
F04B 37/085	<ul style="list-style-type: none"> <li>... {Regeneration of cyro-pumps}</li> </ul>
F04B 37/10	<ul style="list-style-type: none"> <li>for special use (<a href="#">F04B 37/02</a>, <a href="#">F04B 37/06</a> take precedence)</li> </ul>
F04B 37/12	<ul style="list-style-type: none"> <li>.. to obtain high pressure</li> </ul>
F04B 37/14	<ul style="list-style-type: none"> <li>.. to obtain high vacuum</li> </ul>
F04B 37/16	<ul style="list-style-type: none"> <li>... Means for nullifying unswept space</li> </ul>
F04B 37/18	<ul style="list-style-type: none"> <li>.. for specific elastic fluid</li> </ul>
F04B 37/20	<ul style="list-style-type: none"> <li>... for wet gases, e.g. wet air</li> </ul>
<b>F04B 39/00</b>	<b>Component parts, details, or accessories, of pumps or pumping systems, not otherwise provided for in, or of interest apart from, groups <a href="#">F04B 25/00</a> to <a href="#">F04B 37/00</a></b> (for controlling <a href="#">F04B 49/00</a> )
F04B 39/0005	<ul style="list-style-type: none"> <li>{adaptations of pistons}</li> </ul>

- 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 eccentric 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**

F04B 53/001

(continued)

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 ( <a href="#">F04B 53/101</a> and <a href="#">F04B 53/1035</a> 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 ( <a href="#">F04B 43/06</a> and <a href="#">F04B 43/10</a> take precedence)}
F04B 53/142	..	{Intermediate liquid-piston between a driving piston and a driven piston ( <a href="#">F04B 9/10</a> , <a href="#">F04B 43/06</a> , <a href="#">F04B 43/10</a> and <a href="#">F04B 53/141</a> 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 <a href="#">F01M</a> )
F04B 53/20	. Filtering
F04B 53/22	. Arrangements for enabling ready assembly or disassembly

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**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 ( <a href="#">F04B 7/06</a> )
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	...	minmum
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