

**CPC****COOPERATIVE PATENT CLASSIFICATION****F04B****POSITIVE DISPLACEMENT MACHINES FOR LIQUIDS; PUMPS**

(machines for liquids, or pumps, of rotary piston or oscillating piston type [F04C](#) ; non-positive displacement pumps [F04D](#) ; pumping of fluid by direct contact of another fluid or by using inertia of fluid to be pumped [F04F](#) ; crankshafts, crossheads, connecting-rods [F16C](#) ; flywheels [F16F](#) ; gearings for interconverting rotary motion and reciprocating motion in general [F16H](#) ; pistons, piston-rods, cylinders, in general [F16J](#) )

**NOTE**

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

- "piston" also covers a plunger.

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

**WARNING**

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

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

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

**F04B 1/00**

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

## F04B 1/005

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

## F04B 1/02

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

## F04B 1/04

- . having cylinders in star- or fan-arrangement

## F04B 1/0404

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

## F04B 1/0408

- ... {Pistons }

## F04B 1/0413

- ... {Cams }

## F04B 1/0417

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

## F04B 1/0421

- ... {Cylinders }

## F04B 1/0426

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

## F04B 1/043

- .... {hydraulically }

## F04B 1/0435

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

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 coaxing within one cylinder e.g. multi-stage**
  
- F04B 3/003 . . . {with two or more pistons reciprocating one within another, e.g. one piston forming cylinder of the other }
- F04B 3/006 . . . {with rotating cylinder block }
  
- F04B 5/00** **Machines or pumps with differential surface pistons**
  
- F04B 5/02 . . . with double-acting pistons
  
- F04B 7/00** **Piston machines or pumps characterised by having positively-driven valving (with cylinders in star- or fan-arrangement [F04B 1/04](#); with cylinder axes coaxial with, or parallel or inclined to, main shaft axis [F04B 1/12](#))**
  
- F04B 7/0003 . . . {the distribution member forming both the inlet and discharge distributor for one single pumping chamber ([F04B 7/0208](#) takes precedence) }
- F04B 7/0007 . . . {and having a rotating movement }
- F04B 7/0011 . . . {and having an oscillating movement }
- F04B 7/0015 . . . {and having a slidable movement }
  
- F04B 7/0019 . . . {a common distribution member forming a single discharge distributor for a plurality of pumping chambers ([F04B 7/0233](#) takes precedence) }
- F04B 7/0023 . . . {and having a rotating movement }
- F04B 7/0026 . . . {and having an oscillating movement }
- F04B 7/003 . . . {and having a slidable movement }
- F04B 7/0034 . . . {and having an orbital movement, e.g. elbow-pipe type members }
  
- F04B 7/0038 . . . {the distribution member forming a single inlet for a plurality of pumping chambers or a multiple discharge for one single pumping chamber }
  
- F04B 7/0042 . . . {with specific kinematics of the distribution member ([F04B 7/0003](#), [F04B 7/0019](#) take precedence) }
- F04B 7/0046 . . . {for rotating distribution members }
- F04B 7/0049 . . . {for oscillating distribution members }
- F04B 7/0053 . . . {for reciprocating distribution members }

**WARNING**

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

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

- 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> }

#### **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 ( <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 }
  
- F04B 13/00** **Pumps specially modified to deliver fixed or variable measured quantities (for transferring liquid from bulk storage containers or reservoirs into vehicles or into portable containers [B67D 5/40](#))**
  
- F04B 13/02 . of two or more fluids at the same time
  
- F04B 15/00** **Pumps adapted to handle specific fluids, e.g. by selection of specific materials for pumps or pump parts**
  
- F04B 15/02 . the fluids being viscous or non-homogeneous
- F04B 15/023 . . {supply of fluid to the pump by gravity through a hopper, e.g. without intake valve }
- F04B 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 5/40](#))
- F04B 19/06 . . Pumps for delivery of both liquid and elastic fluid at the same time (wet gas pumps [F04B 37/20](#))
  
- F04B 19/08 . Scoop devices
- F04B 19/10 . . of wheel type
- F04B 19/12 . . of helical or screw-type
- F04B 19/14 . . of endless-chain type, e.g. with the chains carrying pistons co-operating with open-ended cylinders
  
- F04B 19/16 . Adhesion-type liquid-lifting devices
- F04B 19/18 . . Adhesion members therefor
  
- F04B 19/20 . Other positive-displacement pumps
- F04B 19/22 . . of reciprocating-piston type
- F04B 19/24 . . Pumping by heat expansion of pumped fluid
  
- F04B 23/00** **Pumping installations or systems ([F04B 17/00](#) takes precedence)**
  
- F04B 23/02 . having reservoirs
- F04B 23/021 . . {the pump being immersed in the reservoir }
- F04B 23/023 . . . {only the pump-part being immersed, the driving-part being outside the reservoir }
- F04B 23/025 . . {the pump being located directly adjacent the reservoir }

- F04B 23/026 . . . {a pump-side forming a wall of the reservoir }
- F04B 23/028 . . . {the pump being mounted on top of the reservoir }
- F04B 23/04 . Combinations of two or more pumps
- F04B 23/06 . . the pumps being all of reciprocating positive-displacement type
- F04B 23/08 . . the pumps being of different types
- F04B 23/10 . . . at least one pump being of the reciprocating positive-displacement type
- F04B 23/103 . . . . {being a radial piston pump }
- F04B 23/106 . . . . {being an axial piston pump }
- F04B 23/12 . . . at least one pump being of the rotary-piston positive-displacement type  
([F04B 23/10](#) takes precedence)
- F04B 23/14 . . . at least one pump being of the non-positive-displacement type ([F04B 23/10](#),  
[F04B 23/12](#) take precedence)

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

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

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

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

- F04B 27/005 . {with two cylinders }
- F04B 27/02 . having cylinders arranged oppositely relative to main shaft
- F04B 27/04 . having cylinders in star- or fan-arrangement
- F04B 27/0404 . . {Details, component parts specially adapted for such pumps }
- F04B 27/0409 . . . {Pistons }
- F04B 27/0414 . . . {Cams }
- F04B 27/0418 . . . . {consisting of several cylindrical elements, e.g. rollers }
- F04B 27/0423 . . . {Cylinders }
- F04B 27/0428 . . . {Arrangements for pressing or connecting the pistons against the actuated cam }
- F04B 27/0432 . . . . {hydraulically }
- F04B 27/0437 . . . {Disconnecting the pistons from the actuated cam (in general [F01B 31/24](#)) }
- F04B 27/0442 . . . {Supporting and guiding means for the pistons }
- F04B 27/0446 . . . {Draining of the engine housing; Arrangements dealing with leakage fluid }

F04B 27/0451	...	{Particularities relating to the distribution members ( <a href="#">F04B 27/0472</a> , <a href="#">F04B 27/0531</a> and <a href="#">F04B 27/0535</a> 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 { ( <a href="#">F04B 27/08</a> 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 (see <a href="#">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	.	Control not provided for in a single group of groups <a href="#">F04B 27/02</a> to <a href="#">F04B 27/22</a>

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

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

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

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

**F04B 35/00**      **Piston pumps characterised by the driving means to their working members, or by combination with, or adaptation to, specific driving engines or motors, not otherwise provided for** (predominant aspects of the engines or motors, see the relevant classes)

- F04B 35/002      . {driven by internal combustion engines }
- F04B 35/004      . {driven by floating elements }
- F04B 35/006      . {driven by steam engines }
- F04B 35/008      . {the means being a fluid transmission link }
- F04B 35/01      . the means being mechanical

- F04B 35/04 . the means being electric
- F04B 35/045 .. {using solenoids }
- F04B 35/06 . Mobile combinations
- F04B 37/00** **Pumps having pertinent characteristics not provided for in, or of interest apart from, groups [F04B 25/00](#) to [F04B 35/00](#)**
- F04B 37/02 . for evacuating by absorption or adsorption ([absorption or adsorption in general B01J](#) ; {for gas-filled discharge tubes see [H01J 17/24](#) })
- F04B 37/04 .. Selection of specific absorption or adsorption materials
- F04B 37/06 . for evacuating by thermal means
- F04B 37/08 .. by condensing or freezing, e.g. cryogenic pumps ([cold traps B01D 8/00](#))
- F04B 37/085 ... {Regeneration of cyro-pumps }
- F04B 37/10 . for special use ([F04B 37/02](#), [F04B 37/06](#) take precedence)
- F04B 37/12 .. to obtain high pressure
- F04B 37/14 .. to obtain high vacuum
- F04B 37/16 ... Means for nullifying unswept space
- F04B 37/18 .. for specific elastic fluid
- F04B 37/20 ... for wet gases, e.g. wet air
- F04B 39/00** **Component parts, details, or accessories, of pumps or pumping systems, not otherwise provided for in, or of interest apart from, groups [F04B 25/00](#) to [F04B 37/00](#) (for controlling [F04B 49/00](#))**
- F04B 39/0005 . {adaptations of pistons }
- F04B 39/0011 .. {liquid pistons }
- F04B 39/0016 .. {with valve arranged in the piston }
- F04B 39/0022 .. {piston rods }
- F04B 39/0027 . {Pulsation and noise damping means }
- F04B 39/0033 .. {with encapsulations }
- F04B 39/0038 ... {of inlet or outlet channels }
- F04B 39/0044 .. {with vibration damping supports }
- F04B 39/005 .. {with direct action on the fluid flow using absorptive materials }
- F04B 39/0055 .. {with a special shape of fluid passage, e.g. bends, throttles, diameter changes, pipes }
- F04B 39/0061 ... {using muffler volumes }
- F04B 39/0066 ... {using sidebranch resonators, e.g. Helmholtz resonators }
- F04B 39/0072 ... {characterised by assembly or mounting }
- F04B 39/0077 .. {by generating oil foam }
- F04B 39/0083 .. {using blow off silencers }
- F04B 39/0088 .. {using mechanical tuned resonators }

- F04B 39/0094 . {crankshaft }
- F04B 39/02 . Lubrication (of machines or engines in general [F01M](#) )
- F04B 39/0207 .. {with lubrication control systems }
- F04B 39/0215 .. {characterised by the use of a special lubricant }
- F04B 39/0223 .. {characterised by the compressor type (swash-plate compressors [F04B 27/109](#) ) }
- F04B 39/023 ... {Hermetic compressors }
- F04B 39/0238 .... {with oil distribution channels }
- F04B 39/0246 ..... {in the rotating shaft }
- F04B 39/0253 ..... {using centrifugal force for transporting the oil }
- F04B 39/0261 .... {with an auxiliary oil pump }
- F04B 39/0269 .... {with device for spraying lubricant or with mist lubrication }
- F04B 39/0276 ... {the pump being of the reciprocating piston type, e.g. oscillating, free-piston compressors }
- F04B 39/0284 .. { Constructional details, e.g. reservoirs in the casing (swash-plate compressors [F04B 27/0878](#), [F04B 27/109](#) ) }
- F04B 39/0292 ... {Lubrication of pistons or cylinders }
- F04B 39/04 . Measures to avoid lubricant contaminating the pumped fluid
- F04B 39/041 .. {sealing for a reciprocating rod (sealing in general [F16J](#) ) }
- F04B 39/042 ... {sealing being provided on the piston }
- F04B 39/044 ... {sealing with a rolling diaphragm between piston and cylinder }
- F04B 39/045 ... {Labyrinth-sealing between piston and cylinder }
- F04B 39/047 ... {Sealing between piston and carter being provided by a bellow }
- F04B 39/048 ... {Sealing between piston and carter being provided by a diaphragm }
- F04B 39/06 . Cooling (of machines or engines in general [F01P](#) ) ; Heating; Prevention of freezing
- F04B 39/062 .. {Cooling by injecting a liquid in the gas to be compressed }
- F04B 39/064 .. {Cooling by a cooling jacket in the pump casing }
- F04B 39/066 .. {Cooling by ventilation }
- F04B 39/068 .. {prevention of freezing }
- F04B 39/08 . Actuation of distribution members
- F04B 39/10 . Adaptations or arrangements of distribution members
- F04B 39/1006 .. {the members being ball valves }
- F04B 39/1013 .. {the members being of the poppet valve type }
- F04B 39/102 .. {the members being disc valves }
- F04B 39/1026 ... {without spring ([F04B 39/1033](#) takes precedence) }
- F04B 39/1033 ... {annular disc valves }
- F04B 39/104 .. {the members being parallel flexible strips }
- F04B 39/1046 .. {Combination of in- and outlet valve }
- F04B 39/1053 .. {the members being Hoerbigen valves }
- F04B 39/106 .. {the members being parallel non-flexible strips }



- F04B 39/1066 . . {Valve plates }
- F04B 39/1073 . . {the members being reed valves }
- F04B 39/108 . . . {circular reed valves }
- F04B 39/1086 . . . {flat annular reed valves }
- F04B 39/1093 . . {the members being low-resistance valves allowing free streaming }
  
- F04B 39/12 . Casings (casings for machines or engines in general [F16M](#) ) ; Cylinders; Cylinders heads; Fluid connections
- F04B 39/121 . . {Casings }
- F04B 39/122 . . {Cylinder block }
- F04B 39/123 . . {Fluid connections }
- F04B 39/125 . . {Cylinder heads }
- F04B 39/126 . . {Cylinder liners }
- F04B 39/127 . . {Mounting of a cylinder block in a casing }
- F04B 39/128 . . {Crankcases }
  
- F04B 39/14 . Provisions for readily assembling or disassembling
- F04B 39/16 . Filtration; Moisture separation

**F04B 41/00**      **Pumping installations or systems** ([F04B 31/00](#), [F04B 35/00](#) take precedence)

- F04B 41/02 . having reservoirs
- F04B 41/04 . Conversion of internal-combustion engine cylinder units to pumps
- F04B 41/06 . Combinations of two or more pumps

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

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

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

- F04B 43/02 . having plate-like flexible members, e.g. diaphragms
- F04B 43/021 .. {the plate-like flexible member is pressed against a wall by a number of elements, each having an alternating movement in a direction perpendicular to the plane of the plate-like flexible member and each having its own driving mechanism }
- F04B 43/023 .. {double acting plate-like flexible member }
- F04B 43/025 .. {two or more plate-like pumping members in parallel }
- F04B 43/026 ... {each plate-like pumping flexible member working in its own pumping chamber }
- F04B 43/028 .. {with in- or outlet valve arranged in the plate-like flexible member (valve arranged in the piston [F04B 53/12](#)) }
- F04B 43/04 .. Pumps having electric drive
- F04B 43/043 ... {Micro pumps }
- F04B 43/046 .... {with piezo-electric drive }
- F04B 43/06 .. Pumps having fluid drive
- F04B 43/067 ... the fluid being actuated directly by a piston
- F04B 43/073 ... the actuating fluid being controlled by at least one valve
- F04B 43/0733 .... {with fluid-actuated pump inlet or outlet valves; with two or more pumping chambers in series }
- F04B 43/0736 .... {with two or more pumping chambers in parallel }
- F04B 43/08 . having tubular flexible members ([F04B 43/12](#) takes precedence)
- F04B 43/082 .. {the tubular flexible member being pressed against a wall by a number of elements, each having an alternating movement in a direction perpendicular to the axes of the tubular member and each having its own driving mechanism }
- F04B 43/084 .. {the tubular member being deformed by stretching ou 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**

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 <a href="#">F01P</a> ) ; 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 ( <a href="#">F04B 53/1022</a> , <a href="#">F04B 53/103</a> 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 [F01M](#) )
- F04B 53/20 . Filtering
- F04B 53/22 . Arrangements for enabling ready assembly or disassembly

#### Guidance heading:

#### 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
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F04B 2201/06061	...	of the inlet valve
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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
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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
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F04B 2201/1241	...	Engagement
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#### Guidance heading:

#### **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
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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
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- 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
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- 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
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- F04B 2207/04 . Settings
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- F04B 2207/0411 . . . maximum
- F04B 2207/0412 . . . minimum
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- 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
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- F04B 2207/045 . . of the resonant frequency of the unit motor-pump
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- F04B 2207/70 . Warnings
- F04B 2207/701 . . Sound
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