COOPERATIVE PATENT CLASSIFICATION

MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING

ENGINES OR PUMPS

F04 POSITIVE - DISPLACEMENT MACHINES FOR LIQUIDS; PUMPS FOR LIQUIDS OR ELASTIC FLUIDS

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

NOTES

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

WARNING
The following IPC groups are not in the CPC scheme. The subject matter for these IPC groups is classified in the following CPC groups:
F04B 35/02 covered by F04B 9/08

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

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

WARNING
Group F04B 1/00 is impacted by reclassification into group F04B 1/03.
Groups F04B 1/00 and F04B 1/03 should be considered in order to perform a complete search.

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

WARNING
Group F04B 1/03 is incomplete pending reclassification of documents from group F04B 1/00.
Groups F04B 1/00 and F04B 1/03 should be considered in order to perform a complete search.

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

1/0408 . . . Pistons
1/0413 . . . Cams
1/0417 . . . consisting of two or more cylindrical elements, e.g. rollers
1/0421 . . . Cylinders
1/0426 . . . Arrangements for pressing the pistons against the actuated cam; Arrangements for connecting the pistons to the actuated cam
1/043 . . . Hydraulic arrangements
1/0435 . . . Arrangements for disconnecting the pistons from the actuated cam
1/0439 . . . Supporting or guiding means for the pistons
1/0443 . . . Draining of the housing; Arrangements for handling leaked fluids
1/0448 . . . Sealing means, e.g. for shafts or housings (for pistons F04B 1/048 [; Stoffing boxes F04B 53/164])
1/0452 . . . Distribution members, e.g. valves (machines or pumps with cam-actuated distribution members at the outer ends of the cylinders F04B 1/0472; machines or pumps with cam-actuated distribution members at the inner ends of the cylinders F04B 1/0531; the piston-driving cams being provided with inlets and outlets F04B 1/0535)
1/0456 . . . Cylindrical
1/0461 . . . Conical
1/0465 . . . plate-like
Pumps for liquids or for liquid and elastic fluids; Positive-displacement machines for liquids

F04B

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

**WARNING**

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

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

**WARNING**

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

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

**WARNING**

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

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

**WARNING**

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

1/08 . . . regulated by delivery pressure

**WARNING**

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

1/10 . . . the cylinders being movable, e.g. rotary

**WARNING**

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

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

**WARNING**


1/1071 . . . with rotary cylinder blocks

**WARNING**

Group F04B 1/1071 is incomplete pending recategorization of documents from groups F04B 1/20, F04B 1/24. All groups listed in this Warning should be considered in order to perform a complete search.

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

**WARNING**

Group F04B 1/1072 is incomplete pending recategorization of documents from groups F04B 1/1078, F04B 1/20 - F04B 1/24. All groups listed in this Warning should be considered in order to perform a complete search.
Groups F04B 1/1074 - F04B 1/1078 are incomplete pending reclassification of documents from groups F04B 1/10 - F04B 1/24. All groups listed in this Warning should be considered in order to perform a complete search.

Groups F04B 1/1078 are incomplete pending reclassification of documents from groups F04B 1/20 - F04B 1/24. All groups listed in this Warning should be considered in order to perform a complete search.

Groups F04B 1/113 - F04B 1/1136 are incomplete pending reclassification of documents from groups F04B 1/20 - F04B 1/24. All groups listed in this Warning should be considered in order to perform a complete search.

Groups F04B 1/2007 are incomplete pending reclassification of documents from groups F04B 1/10 - F04B 1/1136. All groups listed in this Warning should be considered in order to perform a complete search.

Groups F04B 1/2092 are impacted by reclassification into groups F04B 1/10 - F04B 1/1136. All groups listed in this Warning should be considered in order to perform a complete search.

Groups F04B 1/2092 is impacted by reclassification into groups F04B 1/10 - F04B 1/1136. All groups listed in this Warning should be considered in order to perform a complete search.

Groups F04B 1/22 and F04B 1/24 are impacted by reclassification into groups F04B 1/10 - F04B 1/1136. All groups listed in this Warning should be considered in order to perform a complete search.
Pumps for liquids or for liquid and elastic fluids; Positive-displacement machines for liquids

7/0042 . . . [with specific kinematics of the distribution member (F04B 7/0003, F04B 7/0019 take precedence)]

7/0046 . . . [for rotating distribution members]

7/0049 . . . [for oscillating distribution members]

7/0053 . . . [for reciprocating distribution members]

7/0057 . . . [Mechanical driving means therefor, e.g. cams]

7/0061 . . . [for a rotating member]

7/0065 . . . [being mounted on the main shaft]

7/0069 . . . [for a sliding member]

7/0073 . . . [the member being of the lost-motion type, e.g. friction-actuated members, or having means for pushing it against or pulling it from its seat]

7/0076 . . . [the members being actuated by electro-magnetic means]

7/008 . . . [the distribution being realised by moving the cylinder itself, e.g. by sliding or swinging (F04B 7/00291 takes precedence)]

7/0084 . . . [Component parts or details specially adapted therefor]

7/0088 . . . [Sealing arrangements between the distribution members and the housing]

7/0092 . . . [for oscillating distribution members]

7/0096 . . . [for pipe-type distribution members]

7/02 . . . the valving being fluid-actuated

7/0208 . . . [the distribution member forming both the inlet and discharge distributor for one single pumping chamber]

7/0216 . . . [and having an oscillating movement]

7/0225 . . . [and having a sliding movement]

7/0233 . . . [a common distribution member forming a single discharge distributor for a plurality of pumping chambers]

7/0241 . . . [and having an oscillating movement]

7/025 . . . [and having a sliding movement]

7/0258 . . . [and having an orbital movement, e.g. elbow-pipe type members]

7/0266 . . . [the inlet and discharge means being separate members]

7/0275 . . . [and being deformable, e.g. membranes]

7/0283 . . . [and having a rotating movement]

7/0291 . . . [the distribution being realised by moving the cylinder itself, e.g. by sliding or swinging]

7/04 . . . in which the valving is performed by pistons and cylinders coacting to open and close intake or outlet ports

7/045 . . . [Two pistons acting within one cylinder]

7/06 . . . the pistons and cylinders being relatively reciprocated and rotated

9/00 Piston machines or pumps characterised by the driving or driven means to or from their working members

9/02 . . . the means being mechanical

9/025 . . . [Driving of pistons coating within one cylinder]

9/04 . . . the means being cams, eccentrics or pin-and-slot mechanisms

9/042 . . . [the means being cams]

9/045 . . . [the means being eccentrics]

9/047 . . . [the means being pin-and-slot mechanisms]

9/06 . . . the means including spring- or weight-loaded lost-motion devices

9/08 . . . the means being fluid

9/10 . . . the fluid being liquid
Pumps for liquids or for liquid and elastic fluids; Positive-displacement machines for liquids

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

11/00 Equalisation of pulses, e.g. by use of air vessels; Counteracting cavitation
11/0008 . . . {using accumulators}
11/0016 . . . {with a fluid spring}
11/0025 . . . {the spring fluid being in direct contact with the pumped fluid}
11/0033 . . . {with a mechanical spring}
11/0041 . . . {by piston speed control (F04B 11/0058 takes precedence)}
11/005 . . . {using two or more pumping pistons}
11/0058 . . . {with piston speed control}
11/0066 . . . {with special shape of the actuating element}
11/0075 . . . {connected in series}
Pumps for liquids or for liquid and elastic fluids; Positive-displacement machines for liquids

19/06 . . . Pumps for delivery of both liquid and elastic fluids at the same time (wet gas pumps F04B 37/20)
19/08 . Scoop devices
19/10 . . of wheel type
19/12 . . of helical or screw-type
19/14 . . of endless-chain type, e.g. with the chains carrying pistons co-operating with open-ended cylinders
19/16 . Adhesion-type liquid-lifting devices
19/18 . . Adhesion members therefor
19/20 . Other positive-displacement pumps
19/22 . . of reciprocating-piston type
19/24 . . Pumping by heat expansion of pumped fluid

23/00 Pumping installations or systems (pumps characterised by combination with, or adaptation to, specific driving engines or motors F04B 17/00)

23/02 . having reservoirs
23/021 . . . (the pump being immersed in the reservoir)
23/023 . . . . (only the pump-part being immersed, the driving-part being outside the reservoir)
23/025 . . . (the pump being located directly adjacent the reservoir)
23/026 . . . . . [a pump-side forming a wall of the reservoir]
23/028 . . . . . [the pump being mounted on top of the reservoir]
23/04 . Combinations of two or more pumps
23/06 . . . the pumps being all of reciprocating positive-displacement type
23/08 . . . . the pumps being of different types
23/10 . . . . at least one pump being of the reciprocating positive-displacement type

WARNING
Group F04B 23/10 is impacted by reclassification into groups F04B 23/12 and F04B 23/14.

Groups F04B 23/10, F04B 23/12, and F04B 23/14 should be considered in order to perform a complete search.

23/103 . . . . . (being a radial piston pump)

WARNING
Group F04B 23/103 is impacted by reclassification into groups F04B 23/12 and F04B 23/14.
Groups F04B 23/103, F04B 23/12, and F04B 23/14 should be considered in order to perform a complete search.

23/106 . . . . . (being an axial piston pump)

WARNING
Group F04B 23/106 is impacted by reclassification into groups F04B 23/12 and F04B 23/14.
Groups F04B 23/106, F04B 23/12, and F04B 23/14 should be considered in order to perform a complete search.
27/0472 . . . (with two or more series radial piston-cylinder units)
27/0476 . . . . [directly located side-by-side]
27/0478 . . . . [Coupling of several cylinder-barrels]
27/053 . . with an actuating element at the inner ends of the cylinders
27/0531 . . . . [with cam-actuated distribution members]
27/0533 . . . . . . . . . . [each machine piston being provided with channels, which are coating with the cylinder and are used as a distribution member for another piston-cylinder unit]
27/0535 . . . . [the piston-driving cam being provided with an inlet or an outlet]
27/0538 . . . . [directly located side-by-side]
27/06 . . the cylinders being movable, e.g. rotary ((F04B 27/08 takes precedence))
27/0606 . . . . [having cylinders in star- or fan-arrangement, the connection of the pistons with an actuating element being at the outer ends of the cylinders]
27/0612 . . . . [rotary cylinder block]
27/0619 . . . . . . . . . . cylinder block and actuacting cam rotating together (F04B 27/0631 and F04B 27/0644 take precedence)
27/0625 . . . . . . . . . . [with two or more series radial piston-cylinder units]
27/0631 . . . . . . . . . . [cylinder block and actuacting cam both rotating (F04B 27/0644 takes precedence)]
27/0638 . . . . . . . . . . [directly located side by side]
27/0644 . . . . . . . . . . [cylinder block and actuacting cam both rotating]
27/065 . . . . . . . . . . [having cylinders in star- or fan-arrangement, the connection of the pistons with an actuating element being at the inner ends of the cylinders]
27/0657 . . . . . . . . . . [rotary cylinder block]
27/0663 . . . . . . . . . . [the rotary cylinder being provided with only one piston, reciprocating within this cylinder]
27/067 . . . . Control
27/0673 . . . . . . . . . . [by using a valve in a system with several pumping chambers, wherein the flow-path through the chambers can be changed, e.g. series-parallel]
27/0676 . . . . . . . . . . [by changing the phase relationship between the actuating cam and the distribution means]
27/073 . . . . . . . . . . by varying the relative eccentricity between two members, e.g. a cam and a drive shaft
27/08 . . . . . . . . . . having cylinders coaxial with, or parallel or inclined to, main shaft axis
27/0804 . . . . . . . . . . [having rotary cylinder block]
27/0808 . . . . . . . . . . [having two or more sets of cylinders or pistons]
27/0813 . . . . . . . . . . [inclined to main shaft axis]
27/0817 . . . . . . . . . . [arrangements for pressing the cylinder barrel against the valve plate, e.g. by fluid pressure]
27/0821 . . . . . . . . . . [component parts, details, e.g. valves, sealings, lubrication]
27/0826 . . . . . . . . . . [particularities in the contacting area between cylinder barrel and valve plate]
27/083 . . . . . . . . . . [bearing means]

Widening

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

WARNING


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

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

WARNING


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

Pumps specially adapted for elastic fluids

25/00 Multi-stage pumps
25/005 . . . . [with two cylinders]
25/02 . . . . of stepped piston type
25/04 . . . . having cylinders coaxial with, or parallel or inclined to, main shaft axis

27/00 Multi-cylinder pumps specially adapted for elastic fluids and characterised by number or arrangement of cylinders (multi-stage pumps specially adapted for elastic fluids F04B 25/00)
27/005 . . . . [with two cylinders]
27/02 . . . . having cylinders arranged oppositely relative to main shaft
27/04 . . . . having cylinders in star- or fan-arrangement
27/0404 . . . . . . . . . . [Details, component parts specially adapted for such pumps]
27/0409 . . . . . . . . . . [Pistons]
27/0414 . . . . . . . . . . [Cams]
27/0418 . . . . . . . . . . [consisting of several cylindrical elements, e.g. rollers]
27/0423 . . . . . . . . . . [Cylinders]
27/0428 . . . . . . . . . . [Arrangements for pressing or connecting the pistons against the actuated cam]
27/0432 . . . . . . . . . . [hydraulically]
27/0437 . . . . . . . . . . [Disconnecting the pistons from the actuated cam]
27/0442 . . . . . . . . . . [Supporting and guiding means for the pistons]
27/0446 . . . . . . . . . . [Draining of the engine housing; Arrangements dealing with leakage fluid]
27/0451 . . . . . . . . . . [Particularities relating to the distribution members (F04B 27/0472, F04B 27/0531 and F04B 27/0535 take precedence)]
27/0456 . . . . . . . . . . [to cylindrical distribution members]
27/046 . . . . . . . . . . [to conical distribution members]
27/0465 . . . . . . . . . . [to plate like distribution members]
27/047 . . . . . . . . . . [with an actuating element at the outer ends of the cylinders]
27/0472 . . . . . . . . . . [with cam-actuated distribution members]
Pumps specially adapted for elastic fluids

27/0834 . . . . . [cylinder barrel]
27/0839 . . . . . [valve means, e.g. valve plate]
27/0843 . . . . . [cylindrical valve means]
27/0847 . . . . . [conical valve means]
27/0852 . . . . . [machine housing]
27/0856 . . . . . [cylinder barrel means]
27/086 . . . . . [swash plate]
27/0865 . . . . . [swash plate bearing means or driving axis bearing means]
27/0869 . . . . . [connection between rotating cylinder barrel and rotating inclined swash plate]
27/0873 . . . . . [Component parts, e.g. sealings; Manufacturing or assembly thereof]
27/0878 . . . . . [Pistons]
27/0882 . . . . . [piston shoe retaining means]
27/0886 . . . . . [Piston shoes]
27/0891 . . . . . [casings, housings]
27/0895 . . . . . [driving means]
27/10 . . . . . having stationary cylinders
27/1009 . . . . . [Distribution members]
27/1018 . . . . . [Cylindrical distribution members]
27/1027 . . . . . [Conical distribution members]
27/1036 . . . . . [Component parts, details, e.g. sealings, lubrication]
27/1045 . . . . . [Cylinders]
27/1054 . . . . . [Actuating elements]
27/1063 . . . . . [Actuating-element bearing means or driving-axis bearing means]
27/1072 . . . . . [Pivot mechanisms]
27/1081 . . . . . [Casings, housings]
27/109 . . . . . [Lubrication]
27/12 . . . . . having plural sets of cylinders or pistons
27/14 . . . . . Control
27/16 . . . . . of pumps with stationary cylinders
27/18 . . . . . by varying the relative positions of a swash plate and a cylinder block
27/1804 . . . . . [Controlled by crankcase pressure]
2027/1809 . . . . . [Controlled pressure]
2027/1813 . . . . . [Crankcase pressure]
2027/1818 . . . . . [Suction pressure]
2027/1822 . . . . . [Valve-controlled fluid connection]
2027/1827 . . . . . [between crankcase and discharge chamber]
2027/1831 . . . . . [between crankcase and suction chamber]
2027/1836 . . . . . [between crankcase and working chamber]
2027/184 . . . . . [Valve controlling parameter]
2027/1845 . . . . . [Crankcase pressure]
2027/185 . . . . . [Discharge pressure]
2027/1854 . . . . . [External parameters]
2027/1859 . . . . . [Suction pressure]
2027/1863 . . . . . [with an auxiliary valve, controlled by]
2027/1868 . . . . . [Crankcase pressure]
2027/1872 . . . . . [Discharge pressure]
2027/1877 . . . . . [External parameters]
2027/1881 . . . . . [Suction pressure]
2027/1886 . . . . . [Open (not controlling) fluid passage]
2027/1889 . . . . . [between crankcase and discharge chamber]
2027/1895 . . . . . [between crankcase and suction chamber]
27/20 . . . . . of pumps with rotary cylinder block
27/22 . . . . . by varying the relative positions of a swash plate and a cylinder block
27/24 . Control not provided for in a single group of groups F04B 27/02 - F04B 27/22
29/00 [Other pumps with movable, e.g. rotatable cylinders]
31/00 Free-piston pumps specially adapted for elastic fluids; Systems incorporating such pumps (muscle-driven pumps in which the stroke is not defined by gearing F04B 33/00)
33/00 Pumps actuated by muscle power, e.g. for inflating
33/005 . . . . . [specially adapted for inflating tyres of non-motorised vehicles, e.g. cycles, tricycles]
33/02 . with intermediate gearing
35/00 Piston pumps specially adapted for elastic fluids and characterised by the driving means to their working members, or by combination with, or adaptation to, specific driving engines or motors, not otherwise provided for
35/002 . . . . . [driven by internal combustion engines]
35/004 . . . . . [driven by floating elements]
35/06 . . . . . [driven by steam engines]
35/008 . . . . . [the means being a fluid transmission link]
35/01 . . . . . the means being mechanical
35/04 . . . . . the means being electric
35/045 . . . . . [using solenoids]
35/06 . . . . . Mobile combinations
37/00 Pumps having pertinent characteristics not provided for in, or of interest apart from, groups F04B 25/00 - F04B 35/00
37/02 . . . . . for evacuating by absorption or adsorption
37/04 . . . . . Selection of specific absorption or adsorption materials
37/06 . . . . . for evacuating by thermal means
37/08 . . . . . by condensing or freezing, e.g. cryogenic pumps
37/085 . . . . . [Regeneration of cryo-pumps]
37/10 . . . . . for special use (for evacuating by absorption or adsorption F04B 37/A2; for evacuating by thermal means F04B 37/06)
37/12 . . . . . to obtain high pressure
37/14 . . . . . to obtain high vacuum
37/16 . . . . . Means for nullifying unswept space
37/18 . . . . . for specific elastic fluids
37/20 . . . . . for wet gases, e.g. wet air
39/00 Component parts, details, or accessories, of pumps or pumping systems specially adapted for elastic fluids, not otherwise provided for in, or of interest apart from, groups F04B 25/00 - F04B 37/00
39/0005 . . . . . [adaptations of pistons]
39/0011 . . . . . [liquid pistons]
39/0016 . . . . . [with valve arranged in the piston]
39/0022 . . . . . [piston rods]
39/0027 . . . . . [Pulsation and noise damping means]
39/0033 . . . . . [with encapsulations]
39/0038 . . . . . [of inlet or outlet channels]
39/0044 . . . . . [with vibration damping supports]
39/005 . . . . . [with direct action on the fluid flow using absorptive materials]
Pumps specially adapted for elastic fluids

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

43/009 . . . [Special features]
43/0018 . . . [the periphery of the flexible member being not fixed to the pump-casing, but acting as a valve]
43/0027 . . . [without valves]
43/0036 . . . [the flexible member being formed as an O-ring]
43/0045 . . . [with a number of independent working chambers which are actuated successively by one mechanism]
43/0054 . . . [particularities of the flexible members]
43/0063 . . . [cylindrical flexible members]
43/0072 . . . [of tubular flexible members]
43/0081 . . . [systems, control, safety measures]
43/009 . . . [leakage control; pump systems with two flexible members; between the actuating element and the pumped fluid]
43/012 . . . [having plate-like flexible members, e.g. diaphragms (F04B 43/14 takes precedence)]

WARNING
Groups F04B 43/02 - F04B 43/0736 are impacted by reclassification into group F04B 43/14.

All groups listed in this Warning should be considered in order to perform a complete search.
Machines or pumps having flexible working members

43/021 . . . (the plate-like flexible member is pressed against a wall by a number of elements, each having an alternating movement in a direction perpendicular to the plane of the plate-like flexible member and each having its own driving mechanism)

43/023 . . . (double acting plate-like flexible member)

43/025 . . . (two or more plate-like pumping members in parallel)

43/026 . . . (each plate-like pumping flexible member working in its own pumping chamber)

43/028 . . . (with in- or outlet valve arranged in the plate-like flexible member (valve arranged in the piston F04B 53/12))

43/04 . . . Pumps having electric drive

43/043 . . . (Micropumps)

43/046 . . . . (with piezo-electric drive)

43/06 . . . Pumps having fluid drive

43/07 . . . the fluid being actuated directly by a piston

43/073 . . . the actuating fluid being controlled by at least one valve

43/0733 . . . . (with fluid-actuated pump inlet or outlet valves; with two or more pumping chambers in series)

43/0736 . . . . (with two or more pumping chambers in parallel)

43/08 . . . having tubular flexible members (F04B 43/12 takes precedence)

43/082 . . . (the tubular flexible member being pressed against a wall by a number of elements, each having an alternating movement in a direction perpendicular to the axes of the tubular member and each having its own driving mechanism)

43/084 . . . (the tubular member being deformed by stretching or distortion)

43/086 . . . (with two or more tubular flexible members in parallel (F04B 43/1136 takes precedence))

43/088 . . . (with two or more tubular flexible members in series (F04B 43/1133 takes precedence))

43/09 . . . Pumps having electric drive

43/095 . . . (Piezo-electric drive)

43/10 . . . Pumps having fluid drive

43/107 . . . the fluid being actuated directly by a piston

43/113 . . . the actuating fluid being controlled by at least one valve

43/1133 . . . . (with fluid-actuated pump inlet or outlet valves; with two or more pumping chambers in series)

43/1136 . . . . (with two or more pumping chambers in parallel)

43/12 . . . having peristaltic action

43/1207 . . . (the actuating element being a swash plate)

43/1215 . . . (having no backing plate (deforming of the tube only by rollers))

43/1223 . . . (the actuating elements, e.g. rollers, moving in a straight line during squeezing)

43/123 . . . (using an excenter as the squeezing element)

43/1238 . . . (using only one roller as the squeezing element, the roller moving on an arc of a circle during squeezing)

43/1246 . . . (the roller being placed at the outside of the tubular flexible member)

43/1253 . . . (by using two or more rollers as squeezing elements, the rollers moving on an arc of a circle during squeezing)

43/1261 . . . (the rollers being placed at the outside of the tubular flexible member)

43/1269 . . . (the rotary axes of the rollers lying in a plane perpendicular to the rotary axis of the driving motor)

43/1276 . . . (Means for pushing the rollers against the tubular flexible member)

43/1284 . . . (Means for pushing the backing-plate against the tubular flexible member)

43/1292 . . . (Pumps specially adapted for several tubular flexible members)

43/14 . . . having plate-like flexible members

WARNING

Group F04B 43/14 is incomplete pending reclassification of documents from groups F04B 43/02, F04B 43/021, F04B 43/023, F04B 43/025, F04B 43/026, F04B 43/028, F04B 43/04, F04B 43/043, F04B 43/046, F04B 43/06, F04B 43/067, F04B 43/073, F04B 43/0736, and F04B 43/073. All groups listed in this Warning should be considered in order to perform a complete search.

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

45/02 . . . having bellows

45/022 . . . (with two or more bellows in parallel)

45/024 . . . (with two or more bellows in series)

45/027 . . . having electric drive

45/033 . . . having fluid drive

45/0333 . . . (the fluid being actuated directly by a piston)

45/0336 . . . (the actuating fluid being controlled by one or more valves)

45/04 . . . having plate-like flexible members, e.g. diaphragms (F04B 45/10 takes precedence)

WARNING

Group F04B 45/04 - F04B 45/0536 are impacted by reclassification into group F04B 45/10. All groups listed in this Warning should be considered in order to perform a complete search.

45/041 . . . (double acting plate-like flexible pumping member)

45/043 . . . (two or more plate-like pumping flexible members in parallel)

45/045 . . . (with in- or outlet valve arranged in the plate-like pumping flexible members)

45/047 . . . Pumps having electric drive

45/053 . . . Pumps having fluid drive

45/0533 . . . (the fluid being actuated directly by a piston)

45/0536 . . . (the actuating fluid being controlled by one or more valves)
Machines or pumps having flexible working members

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

WARNING
Group F04B 45/06 is impacted by reclassification into groups F04B 45/08 and F04B 45/085.
Groups F04B 45/06, F04B 45/08, and F04B 45/085 should be considered in order to perform a complete search.

45/061 . . {with fluid drive}

WARNING
Groups F04B 45/061, F04B 45/064 are impacted by reclassification into groups F04B 45/08 and F04B 45/085.
All groups listed in this Warning should be considered in order to perform a complete search.

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

WARNING
Group F04B 45/065 is impacted by reclassification into groups F04B 45/08 and F04B 45/085.
Groups F04B 45/065, F04B 45/08, and F04B 45/085 should be considered in order to perform a complete search.

45/067 . . Pumps having electric drive

WARNING
Group F04B 45/067 is impacted by reclassification into groups F04B 45/08 and F04B 45/085.
Groups F04B 45/067, F04B 45/08, and F04B 45/085 should be considered in order to perform a complete search.

45/073 . . Pumps having fluid drive

WARNING
Groups F04B 45/073, F04B 45/0736 are impacted by reclassification into groups F04B 45/08 and F04B 45/085.
All groups listed in this Warning should be considered in order to perform a complete search.

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

WARNING
Group F04B 45/08 is incomplete pending reclassification of documents from groups F04B 45/06, F04B 45/0736.
All groups listed in this Warning should be considered in order to perform a complete search.

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

WARNING
Group F04B 45/085 is incomplete pending reclassification of documents from groups F04B 45/06, F04B 45/0736.
All groups listed in this Warning should be considered in order to perform a complete search.

45/10 . having plate-like flexible members

WARNING
Group F04B 45/10 is incomplete pending reclassification of documents from groups F04B 45/04, F04B 45/0536.
Groups F04B 45/04, F04B 45/0536 and F04B 45/10 should be considered in order to perform a complete search.

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

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

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

NOTE
The classification symbols in group F04B 49/00 and subgroups can be followed by additional symbols preceded by the sign “+”. The symbols are applied in subgroups F04B 49/06, F04B 49/08, F04B 49/16 and F04B 49/275. The symbols have the meanings as listed below:
+C specially adapted for pumps for elastic fluids, e.g. compressors
+P specially adapted for pumps for liquids

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

53/00  Component parts, details or accessories not provided for in, or of interest apart from, groups F04B 1/00 - F04B 23/00 or F04B 39/00 - F04B 47/00

53/001  .  [Noise damping]
53/002  .  .  [by encapsulation]
53/003  .  .  [by damping supports]
53/004  .  .  [by mechanical resonators]
53/005  .  [Adaptations or arrangements of valves used as foot valves, of suction strainers, or of mud-boxes]
53/006  .  [Crankshafts]
53/007  .  [Cylinder heads]
53/008  .  [Spacing or clearance between cylinder and piston]
53/009  .  [Packaging the free space between cylinders and pistons]
53/010  .  [Draining]
53/011  .  [Venting]
53/012  .  [Cooling; Heating; Preventing freezing]
53/013  .  [Valves; Arrangement of valves]
53/1002  .  [Ball valves]
53/1005  .  .  [being formed by two closure members working in series]
53/1007  .  .  [having means for guiding the closure member]
53/101  .  .  [having means for limiting the opening height]
53/1012  .  .  .  [and means for controlling the opening height]
53/1015  .  .  .  [Combinations of ball valves working in parallel]
53/1017  .  .  .  [Semi-spherical ball valves]
53/102  .  .  .  [Disc valves]
53/1022  .  .  .  [having means for guiding the closure member axially]
53/1025  .  .  .  .  [the guiding means being provided within the valve opening]
53/1027  .  .  .  .  .  [the guiding means being provided at both sides of the disc]
53/103  .  .  .  [Flat-annular type disc valves]
53/1032  .  .  .  [Spring-actuated disc valves (F04B 53/1022, F04B 53/103 take precedence)]
53/1035  .  .  [with means for limiting the opening height]
53/1037  .  .  [Flap valves]
53/104  .  .  .  [the closure member being a rigid element oscillating around a fixed point]
53/1042  .  .  .  [by means of a flexible connection]
53/1045  .  .  .  [the valve being formed by two elements]
53/1047  .  .  .  .  [the valve being formed by one or more flexible elements]
53/105  .  .  .  [one flexible element oscillating around a fixed point]
53/1052  .  .  .  [two flexible elements oscillating around a fixed point]
53/1055  .  .  .  [more than two flexible elements oscillating around a fixed point]
53/1057  .  .  [the valve being a tube, e.g. normally closed at one end]
53/106  .  .  .  [the valve being a membrane]
53/1062  .  .  .  .  [fixed at two or more points at its periphery]
53/1065  .  .  .  .  [fixed at its centre]
53/1067  .  .  .  .  .  [fixed at its whole periphery and with an opening at its centre]
53/107  .  .  .  .  .  .  [the opening normally being closed by a fixed element]

51/00  Testing machines, pumps, or pumping installations
Machines or pumps having flexible working members  

53/1072 . . . (the valve being an elastic body, the length thereof changing in the opening direction)  
53/1075 . . . (the valve being a flexible annular ring)  
53/1077 . . . (Valves characterised by the material)  
53/1087 . . . (Valve seats)  
53/109 . . . (inlet and outlet valve forming one unit)  
53/1092 . . . (and one single element forming both the inlet and outlet closure member)  
53/1095 . . . (Valves linked to another valve of another pumping chamber)  
53/1097 . . . (with means for lifting the closure member for pump cleaning purposes)  
53/12 . . . arranged in or on pistons  
53/121 . . . (the valve being an annular ring surrounding the piston, e.g. an O-ring)  
53/122 . . . (the piston being free-floating, e.g. the valve being formed between the actuating rod and the piston)  
53/123 . . . (Flexible valves)  
53/124 . . . (Oscillating valves)  
53/125 . . . (Reciprocating valves)  
53/126 . . . (Ball valves)  
53/127 . . . (Disc valves)  
53/128 . . . (Annular disc valves)  
53/129 . . . (Poppet valves)  
53/14 . . . Pistons, piston-rod or piston-rod connections  
53/141 . . . (Intermediate liquid piston between the driving piston and the pumped liquid (F04B 43/06 and F04B 43/10 take precedence))  
53/142 . . . (Intermediate liquid-piston between a driving piston and a driven piston (F04B 9/10, F04B 43/06, F04B 43/10 and F04B 53/141 take precedence))  
53/143 . . . (Sealing provided on the piston)  
53/145 . . . (Rod shock absorber)  
53/146 . . . (Piston-rod guiding arrangements)  
53/147 . . . (Mounting or detaching of piston rod)  
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)  
53/16 . . . Casings; Cylinders; Cylinder liners or heads; Fluid connections  
53/162 . . . (Adaptations of cylinders)  
53/164 . . . (Stroking boxes)  
53/166 . . . (Cylinder liners)  
53/168 . . . (Mounting of cylinder liners in cylinders)  
53/18 . . . Lubricating  
53/20 . . . Filtering  
53/22 . . . Arrangements for enabling ready assembly or disassembly  

2201/00 Pump parameters  
2201/02 Piston parameters  
2201/0201 . . . Position of the piston  
2201/02011 . . . Angular position of a piston rotating around its own axis  
2201/0202 . . . Linear speed of the piston  
2201/0203 . . . Acceleration of the piston  
2201/0204 . . . Power on the piston  
2201/0205 . . . Piston ring wear  
2201/0206 . . . Length of piston stroke  
2201/0207 . . . Number of pumping strokes in unit time  
2201/02071 . . . Total number of pumping strokes  
2201/0208 . . . Leakage across the piston  
2201/0209 . . . Duration of piston stroke  
2201/021 . . . Rotational speed of a piston rotating around its own axis (F04B 7/06)  
2201/04 . . . Carter parameters  
2201/0401 . . . Carter pressure  
2201/0402 . . . Lubricating oil temperature  
2201/0403 . . . Carter housing temperature  
2201/0404 . . . Lubricating oil condition  
2201/0405 . . . Leakage  
2201/0406 . . . Pressure change across an oil filter  
2201/04061 . . . Valve parameters  
2201/0601 . . . Opening times  
2201/06011 . . . of the inlet valve only  
2201/06012 . . . of the outlet valve only  
2201/0602 . . . Valve acceleration  
2201/0603 . . . Valve wear  
2201/0604 . . . Valve noise  
2201/0605 . . . Leakage over a valve  
2201/0606 . . . Opening width or height  
2201/06061 . . . of the inlet valve  
2201/06062 . . . of the outlet valve  
2201/08 . . . Cylinder or housing parameters  
2201/0801 . . . Temperature  
2201/0802 . . . Vibration  
2201/0803 . . . Leakage  
2201/0804 . . . Noise  
2201/0805 . . . Rotational speed of a rotating cylinder block  
2201/0806 . . . Resonant frequency  
2201/0807 . . . Number of working cylinders  
2201/0808 . . . Size of the dead volume  
2201/12 . . . Parameters of driving or driven means  
2201/1201 . . . Rotational speed of the axis  
2201/1202 . . . Torque on the axis  
2201/1203 . . . Power on the axis  
2201/1204 . . . Position of a rotating inclined plate  
2201/12041 . . . Angular position  
2201/1205 . . . Position of a non-rotating inclined plate  
2201/12051 . . . Angular position  
2201/1206 . . . Rotational speed of a rotating inclined plate  
2201/1207 . . . Wear of the bearings  
2201/1208 . . . Angular position of the shaft  
2201/1209 . . . Radial force on the bearings  
2201/121 . . . Load on the sucker rod  
2201/1211 . . . Position of the walking beam  
2201/1212 . . . Oil pressure in the bearings  
2201/1213 . . . Eccentricity of an outer annular cam  
2201/124 . . . Coupling parameters  
2201/1241 . . . Engagement  
2201/127 . . . Braking parameters  

2203/00 Motor parameters
Fluid parameters

Pressure in a (hydraulic) circuit
Pressure before the pump outlet
Pressure in the outlet chamber
Pressure in the compression chamber
Pressure in the inlet chamber
Pressure before the pump inlet
Pressure at the motor inlet

Pressure difference over the pump
Pressure difference over a throttle
the throttle being a filter
Flow through the pump
Inlet temperature
Outlet temperature
after a throttle
between two stages in a multi-stage pump
Pressure pulsations before the pump
Pressure pulsations after the pump
Viscosity
By-passing over the pump
Opening width of a bypass valve
Opening or closing of a valve in a circuit
Opening width of a throttling device
before the pump inlet
after the pump outlet
in a circuit
Pressure in a control cylinder/piston unit
Presence of foreign matter in the fluid
of solid particles
gas in a liquid flow, e.g. gas bubbles

External parameters
Load in general
External pressure
External temperature
Settings
of flow
maximum
minimum
medium
maximum
minimum
medium
of time
of the rotational speed of the driving motor
maximum
minimum
of the resonant frequency of the unit motor-pump
of length of piston stroke
of the nominal power of the driving motor
of a reference voltage of the driving motor
Warnings
Sound
Light
Stopping
Idling