

CPC**COOPERATIVE PATENT CLASSIFICATION****F04C**

**ROTARY-PISTON, OR OSCILLATING-PISTON,
POSITIVE-DISPLACEMENT MACHINES FOR LIQUIDS** (engines [F03C](#)) ;
**ROTARY-PISTON, OR OSCILLATING-PISTON,
POSITIVE-DISPLACEMENT PUMPS**

NOTE

Attention is drawn to the notes preceding class [F01](#) especially as regards the definitions of "machines", "pumps", "positive displacement", "rotary-piston machines", "oscillating-piston machines", "rotary piston", "co-operating members", "movement of co-operating members", "teeth or tooth-equivalents" and "internal axis".

Guidance heading:**F04C 2/00**

Rotary-piston machines or pumps (with non-parallel axes of co-operating members [F04C 3/00](#); with the working-chamber walls at least partly resiliently deformable [F04C 5/00](#); with fluid ring or the like [F04C 7/00](#); rotary-piston pumps specially adapted for elastic fluids [F04C 18/00](#); rotary-piston machines or pumps in which the working-fluid is exclusively displaced by, or exclusively displaces, one or more reciprocating pistons [F04B](#))

NOTE

Group [F04C 2/30](#) takes precedence over groups [F04C 2/02](#) to [F04C 2/28](#)

F04C 2/02

- . of arcuate-engagement type, i.e. with circular translatory movement of co-operating members, each member having the same number of teeth or tooth-equivalents

F04C 2/025

- .. {the moving and the stationary member having co-operating elements in spiral form }

F04C 2/04

- .. of internal axis type

F04C 2/045

- ... { having a C-shaped piston }

F04C 2/06

- .. of other than internal-axis type

F04C 2/063

- ... with coaxially-mounted members having continuously-changing circumferential spacing between them

F04C 2/067

- having cam-and-follower type drive

F04C 2/07

- having crankshaft-and-connecting-rod type drive

F04C 2/073

- having pawl-and-ratchet type drive

F04C 2/077

- having toothed-gearing type drive

F04C 2/08

- . of intermeshing-engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing

F04C 2/082

- .. {Details specially related to intermeshing engagement type machines or pumps }

F04C 2/084

- ... {Toothed wheels }

F04C 2/086

- ... {Carter }

- F04C 2/088 . . . { Elements in the toothed wheels or the carter for relieving the pressure of fluid imprisoned in the zones of engagement }
- F04C 2/10 . . of internal-axis type with the outer member having more teeth or tooth-equivalents, e.g. rollers, than the inner member
- F04C 2/101 . . . {with a crescent-shaped filler element, located between the inner and outer intermeshing members }
- F04C 2/102 . . . {the two members rotating simultaneously around their respective axes }
- F04C 2/103 . . . {one member having simultaneously a rotational movement about its own axis and an orbital movement }
- F04C 2/104 {having an articulated driving shaft }
- F04C 2/105 {Details concerning timing or distribution valves }
- F04C 2/106 {Spool type distribution valves }
- F04C 2/107 . . . with helical teeth
- F04C 2/1071 {the inner and outer member having a different number of threads and one of the two being made of elastic materials, e.g. Moineau type }
- F04C 2/1073 {where one member is stationary while the other member rotates and orbits }
- F04C 2/1075 {Construction of the stationary member }
- F04C 2/1076 {where one member orbits or wobbles relative to the other member which rotates around a fixed axis }
- F04C 2/1078 {where one member rotates and both members are allowed to orbit or wobble }
- F04C 2/113 . . . the inner member carrying rollers intermeshing with the outer member
- F04C 2/12 . . of other than internal-axis type
- F04C 2/123 . . . {with radially or approximately radially from the rotor body extending tooth-like elements, co-operating with recesses in the other rotor, e.g. one tooth }
- F04C 2/126 . . . {with radially from the rotor body extending elements, not necessarily co-operating with corresponding recesses in the other rotor, e.g. lobes, Roots type }
- F04C 2/14 . . . with toothed rotary pistons
- F04C 2/16 with helical teeth, e.g. chevron-shaped, screw type { (for non-parallel axes of movement [F04C 3/00](#)) }
- F04C 2/165 {having more than two rotary pistons with parallel axes }
- F04C 2/18 . . . with similar tooth forms ([F04C 2/16](#) takes precedence)
- F04C 2/20 . . . with dissimilar tooth forms ([F04C 2/16](#) takes precedence)
- F04C 2/22 . of internal-axis type with equidirectional movement of co-operating members at the points of engagement, or with one of the co-operating members being stationary, the inner member having more teeth or tooth-equivalents than the outer member
- F04C 2/24 . of counter-engagement type, i.e. the movement of co-operating members at the points of engagement being in opposite directions
- F04C 2/26 . . of internal-axis type
- F04C 2/28 . . of other than internal-axis type
- F04C 2/30 . having the characteristics covered by two or more groups [F04C 2/02](#), [F04C 2/08](#), [F04C 2/22](#), [F04C 2/24](#) or having the characteristics covered by one of these groups together with some other type of movement between co-operating members

- F04C 2/32 .. having both the movement defined in groups [F04C 2/02](#) and relative reciprocation between co-operating members
- F04C 2/321 ... { with vanes hinged to the inner member and reciprocating with respect to the inner member }
- F04C 2/322 ... { with vanes hinged to the outer member and reciprocating with respect to the outer member }
- F04C 2/324 ... with vanes hinged to the inner member and reciprocating with respect to the outer member
- F04C 2/328 and hinged to the outer member
- F04C 2/332 ... with vanes hinged to the outer member and reciprocating with respect to the inner member
- F04C 2/336 and hinged to the inner member
- F04C 2/34 .. having the movement defined in groups [F04C 2/08](#) or [F04C 2/22](#) and relative reciprocation between the co-operating members
- F04C 2/344 ... with vanes reciprocating with respect to the inner member
- F04C 2/3441 {the inner and outer member being in contact along one line or continuous surface substantially parallel to the axis of rotation }
- F04C 2/3442 {the surfaces of the inner and outer member, forming the working space, being surfaces of revolution }
- F04C 2/3443 {with a separation element located between the inlet and outlet opening }
- F04C 2/3445 {the vanes having the form of rollers, slippers or the like }
- F04C 2/3446 {the inner and outer member being in contact along more than one line or surface }
- F04C 2/3447 {the vanes having the form of rollers, slippers or the like }
- F04C 2/3448 {with axially movable vanes }
- F04C 2/348 the vanes positively engaging, with circumferential play, an outer rotatable member
- F04C 2/352 the vanes being pivoted on the axis of the outer member
- F04C 2/356 ... with vanes reciprocating with respect to the outer member
- F04C 2/3562 {the inner and outer member being in contact along one line or continuous surface substantially parallel to the axis of rotation }
- F04C 2/3564 {the surfaces of the inner and outer member, forming the working space, being surfaces of revolution }
- F04C 2/3566 {the inner and outer member being in contact along more than one line or surface }
- F04C 2/3568 {with axially movable vanes }
- F04C 2/36 .. having both the movements defined in groups [F04C 2/22](#) and [F04C 2/24](#)
- F04C 2/38 .. having the movement defined in group [F04C 2/02](#) and having a hinged member ([F04C 2/32](#) takes precedence)
- F04C 2/39 ... with vanes hinged to the inner as well as to the outer member
- F04C 2/40 .. having the movement defined in group [F04C 2/08](#) or [F04C 2/22](#) and having a hinged member
- F04C 2/44 ... with vanes hinged to the inner member
- F04C 2/46 ... with vanes hinged to the outer member

F04C 3/00 **Rotary-piston machines or pumps, with non-parallel axes of movement of co-operating members, e.g. of screw type** (with the working-chamber walls at least partly resiliently deformable [F04C 5/00](#); rotary-piston pumps with non-parallel axes of movement of co-operating members specially adapted for elastic fluids [F04C 18/48](#))

- F04C 3/02 . the axes being arranged at an angle of 90 degrees
- F04C 3/04 . . of intermeshing engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing
- F04C 3/06 . the axes being arranged otherwise than at an angle of 90 degrees
- F04C 3/08 . . of intermeshing engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing
- F04C 3/085 . . . {the axes of cooperating members being on the same plane }
- F04C 5/00 Rotary-piston machines or pumps with the working-chamber walls at least partly resiliently deformable** (such pumps specially adapted for elastic fluids [F04C 18/00](#))
- F04C 7/00 Rotary-piston machines or pumps with fluid ring or the like** (such pumps specially adapted for elastic fluids [F04C 19/00](#))
- F04C 9/00 Oscillating-piston machines or pumps** (such pumps specially adapted for elastic fluids [F04C 21/00](#))
- F04C 9/002 . {the piston oscillating around a fixed axis }
- F04C 9/005 . {the piston oscillating in the space, e.g. around a fixed point (rotary-piston machines or pumps with non-parallel axes of movement between co-operating members [F04C 3/00](#)) }
- F04C 9/007 . {the points of the moving element describing approximately an alternating movement in axial direction with respect to the other element }
- F04C 11/00 Combinations of two or more machines or pumps, each being of rotary-piston or oscillating-piston type** (combinations of such pumps specially adapted for elastic fluids [F04C 23/00](#)) ; **Pumping installations** ([F04C 13/00](#) takes precedence; specially adapted for elastic fluids [F04C 23/00](#); fluid gearing [F16H](#))
- NOTE**
- Multi-stage engines, motors, pumps or compressors with stages connected in series or in parallel are not considered as having complementary function
- F04C 11/001 . {of similar working principle }
- F04C 11/003 . . {having complementary function }
- F04C 11/005 . {of dissimilar working principle }
- F04C 11/006 . . {having complementary function }
- F04C 11/008 . {Enclosed motor pump units }
- F04C 13/00 Adaptations of machines or pumps for special use, e.g. for extremely high pressures** (of pumps specially adapted for elastic fluids [F04C 25/00](#))

- F04C 13/001 . {Pumps for particular liquids }
- F04C 13/002 . . {for homogeneous viscous liquids }
- F04C 13/004 . . . {with means for fluidising or diluting the material being pumped }
- F04C 13/005 . { Removing contaminants, deposits or scale from the pump; Cleaning }
- F04C 13/007 . {Venting; Gas and vapour separation during pumping (preventing vapour lock in fuel pumps [F02M 37/20](#), in centrifugal pumps [F04D 9/00](#)) }
- F04C 13/008 . {Pumps for submersible use, i.e. down-hole pumping }
- F04C 14/00** **Control of, monitoring of, or safety arrangements for, machines, pumps or pumping installations** (of pumps or pumping installations specially adapted for elastic fluids [F04C 28/00](#))
- F04C 14/02 . specially adapted for several machines or pumps connected in series or in parallel
- F04C 14/04 . specially adapted for reversible machines or pumps
- F04C 14/06 . specially adapted for stopping, starting, idling or no-load operation
- F04C 14/065 . . { Capacity control using a multiplicity of units or pumping capacities, e.g. multiple chambers, individually switchable or controllable }
- F04C 14/08 . characterised by varying the rotational speed
- F04C 14/10 . characterised by changing the positions of the inlet or outlet openings with respect to the working chamber
- F04C 14/12 . . using sliding valves
- F04C 14/14 . . using rotating valves
- F04C 14/16 . . using lift valves
- F04C 14/18 . characterised by varying the volume of the working chamber (by changing the positions of inlet or outlet openings [F04C 14/10](#))
- F04C 14/185 . . { by varying the useful pumping length of the cooperating members in the axial direction }
- F04C 14/20 . . by changing the form of the inner or outer contour of the working chamber
- F04C 14/22 . . by changing the eccentricity between cooperating members
- F04C 14/223 . . . {using a movable cam }
- F04C 14/226 {by pivoting the cam around an eccentric axis }
- F04C 14/24 . characterised by using valves regulating pressure or flow rate, e.g. discharge valves, { unloading valves } ([F04C 14/10](#) takes precedence)
- F04C 14/26 . . using bypass channels
- F04C 14/265 . . . {being obtained by displacing a lateral sealing face }
- F04C 14/28 . Safety arrangements; Monitoring
- F04C 15/00** **Component parts, details or accessories of machines, pumps or pumping installations, not provided for in groups [F04C 2/00](#) to [F04C 14/00](#)** (of pumps specially

adapted for elastic fluids [F04C 18/00](#) to [F04C 29/00](#))

- F04C 15/0003 . {Sealing arrangements in rotary-piston machines or pumps ([sealing in general F16J](#)) }
- F04C 15/0007 .. {Radial sealings for working fluid }
- F04C 15/0011 ... {of rigid material }
- F04C 15/0015 ... {of resilient material }
- F04C 15/0019 ... {Radial sealing elements specially adapted for intermeshing-engagement type machines or pumps, e.g. gear machines or pumps }
- F04C 15/0023 .. {Axial sealings for working fluid }
- F04C 15/0026 ... {Elements specially adapted for sealing of the lateral faces of intermeshing-engagement type machines or pumps, e.g. gear machines or pumps }
- F04C 15/003 .. {Sealings for working fluid between radially and axially moving parts }
- F04C 15/0034 .. { for other than the working fluid, i.e. the sealing arrangements are not between working chambers of the machine }
- F04C 15/0038 ... {Shaft sealings specially adapted for rotary-piston machines or pumps }
- F04C 15/0042 . {Systems for the equilibration of forces acting on the machines or pump ([interstice adjustment other than by fluid pressure F01C 21/102](#)) }
- F04C 15/0046 .. {Internal leakage control }
- F04C 15/0049 .. { Equalization of pressure pulses ([silencing for compressors F04C 29/06](#)) }
- F04C 15/0053 . {Venting means for starting }
- F04C 15/0057 . {Driving elements, brakes, couplings, transmission specially adapted for machines or pumps ([brakes, couplings, transmissions per se F16](#) , [B60](#)) }
- F04C 15/0061 .. {Means for transmitting movement from the prime mover to driven parts of the pump, e.g. clutches, couplings, transmissions }
- F04C 15/0065 ... {for eccentric movement }
- F04C 15/0069 ... {Magnetic couplings }
- F04C 15/0073 ... {Couplings between rotors and input or output shafts acting by interengaging or mating parts, i.e. positive coupling of rotor and shaft }
- F04C 15/0076 .. {Fixing rotors on shafts, e.g. by clamping together hub and shaft }
- F04C 15/008 .. {Prime movers }
- F04C 15/0084 .. { Brakes, braking assemblies }
- F04C 15/0088 . {Lubrication ([of machines or engines in general F01M](#)) }
- F04C 15/0092 .. {Control systems for the circulation of the lubricant }
- F04C 15/0096 . {Heating; Cooling ([of machines or engines in general F01P](#)) }
- F04C 15/06 . Arrangements for admission or discharge of the working fluid, e.g. constructional features of the inlet or outlet
- F04C 15/062 .. {Arrangements for supercharging the working space ([similar arrangements for internal combustion engines F02B 33/00](#), [F02B 37/00](#)) }
- F04C 15/064 .. {with inlet and outlet valves specially adapted for rotary or oscillating piston machines or pumps }

- F04C 15/066 . . . {of the non-return type }
- F04C 15/068 {of the elastic type, e.g. reed valves }

F04C 18/00

Rotary-piston pumps specially adapted for elastic fluids (with fluid ring or the like [F04C 19/00](#); rotary-piston pumps in which the working-fluid is exclusively displaced by one or more reciprocating pistons [F04B](#))

NOTE

Group [F04C 18/30](#) takes precedence over groups [F04C 18/02](#) to [F04C 18/28](#) and [F04C 18/48](#) to [F04C 18/56](#).

- F04C 18/02 . of arcuate-engagement type, i.e. with circular translatory movement of co-operating members, each member having the same number of teeth or tooth-equivalents
 - F04C 18/0207 . . {both members having co-operating elements in spiral form }
 - F04C 18/0215 . . . {where only one member is moving }
 - F04C 18/0223 {with symmetrical double wraps }
 - F04C 18/023 . . . {where both members are moving }
 - F04C 18/0238 {with symmetrical double wraps }
 - F04C 18/0246 . . . {Details concerning the involute wraps or their base, e.g. geometry }
 - F04C 18/0253 { Details concerning the base }
 - F04C 18/0261 { Details of the ports, e.g. location, number, geometry }
 - F04C 18/0269 { Details concerning the involute wraps }
 - F04C 18/0276 { Different wall heights }
 - F04C 18/0284 { Details of the wrap tips }
 - F04C 18/0292 { Ports or channels located in the wrap }
- F04C 18/04 . . of internal-axis type
 - F04C 18/045 . . . { having a C-shaped piston }
- F04C 18/06 . . of other than internal-axis type
 - F04C 18/063 . . . with coaxially-mounted members having continuously-changing circumferential spacing between them
 - F04C 18/067 having cam-and-follower type drive
 - F04C 18/07 having crankshaft-and-connecting-rod type drive
 - F04C 18/073 having pawl-and-ratchet type drive
 - F04C 18/077 having toothed-gearing type drive
- F04C 18/08 . of intermeshing-engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing
 - F04C 18/082 . . {Details specially related to intermeshing engagement type pumps }
 - F04C 18/084 . . . {Toothed wheels }
 - F04C 18/086 . . . {Carter }
 - F04C 18/088 . . . { Elements in the toothed wheels or the carter for relieving the pressure of fluid imprisoned in the zones of engagement }
- F04C 18/10 . . of internal-axis type with the outer member having more teeth or tooth equivalents, e.g. rollers, than the inner member

- F04C 18/103 . . . {with a crescent shaped filler element, located between the inner and outer intermeshing elements }
- F04C 18/107 . . . with helical teeth
- F04C 18/1075 {the inner and outer member having a different number of threads and one of the two being made of elastic material, e.g. Moineau type }
- F04C 18/113 . . . the inner member carrying rollers intermeshing with the outer member
- F04C 18/12 . . of other than internal-axis type
- F04C 18/123 . . . {with radially or approximately radially from the rotor body extending tooth-like elements, co-operating with recesses in the other rotor, e.g. one tooth }
- F04C 18/126 . . . {with radially from the rotor body extending elements, not necessarily co-operating with corresponding recesses in the other rotor, e.g. lobes, Roots type }
- F04C 18/14 . . . with toothed rotary pistons
- F04C 18/16 with helical teeth, e.g. chevron-shaped, screw type { (for non-parallel axes of movement [F04C 18/48](#)) }
- F04C 18/165 {having more than two rotary pistons with parallel axes }
- F04C 18/18 . . . with similar tooth forms ([F04C 18/16](#) takes precedence)
- F04C 18/20 . . . with dissimilar tooth forms ([F04C 18/16](#) takes precedence)
- F04C 18/22 . of internal-axis type with equidirectional movement of co-operating members at the points of engagement, or with one of the co-operating members being stationary, the inner member having more teeth or tooth equivalents than the outer member
- F04C 18/24 . of counter-engagement type, i.e. the movement of co-operating members at the points of engagement being in opposite directions
- F04C 18/26 . . of internal-axis type
- F04C 18/28 . . of other than internal-axis type
- F04C 18/30 . having the characteristics covered by two or more of groups [F04C 18/02](#), [F04C 18/08](#), [F04C 18/22](#), [F04C 18/24](#), [F04C 18/48](#), or having the characteristics covered by one of these groups together with some other type of movement between co-operating members
- F04C 18/32 . . having both the movement defined in group [F04C 18/02](#) and relative reciprocation between the co-operating members
- F04C 18/321 . . . { with vanes hinged to the inner member and reciprocating with respect to the inner member }
- F04C 18/322 . . . { with vanes hinged to the outer member and reciprocating with respect to the outer member }
- F04C 18/324 . . . with vanes hinged to the inner member and reciprocating with respect to the outer member
- F04C 18/328 and hinged to the outer member
- F04C 18/332 . . . with vanes hinged to the outer member and reciprocating with respect to the inner member
- F04C 18/336 and hinged to the inner member
- F04C 18/34 . . having the movement defined in group [F04C 18/08](#) or [F04C 18/22](#) and relative reciprocation between the co-operating members
- F04C 18/344 . . . with vanes reciprocating with respect to the inner member
- F04C 18/3441 {the inner and outer member being in contact along one line or continuous surface substantially parallel to the axis of rotation }

F04C 18/3442	.....	{the surfaces of the inner and outer member, forming the inlet and outlet opening }
F04C 18/3443	.....	{with a separation element located between the inlet and outlet opening }
F04C 18/3445	.....	{the vanes having the form of rollers, slippers or the like }
F04C 18/3446	....	{the inner and outer member being in contact along more than one line or surface }
F04C 18/3447	.....	{the vanes having the form of rollers, slippers or the like }
F04C 18/3448	....	{with axially movable vanes }
F04C 18/348	....	the vanes positively engaging, with circumferential play, an outer rotatable member
F04C 18/352	....	the vanes being pivoted on the axis of the outer member
F04C 18/356	...	with vanes reciprocating with respect to the outer member
F04C 18/3562	....	{the inner and outer member being in contact along one line or continuous surfaces substantially parallel to the axis of rotation }
F04C 18/3564	.....	{the surfaces of the inner and outer member, forming the working space, being surfaces of revolution }
F04C 18/3566	....	{the inner and outer member being in contact along more than line or surface }
F04C 18/3568	....	{with axially movable vanes }
F04C 18/36	..	having both the movement defined in groups F04C 18/22 and F04C 18/24
F04C 18/38	..	having the movement defined in group F04C 18/02 and having a hinged member (F04C 18/32 takes precedence)
F04C 18/39	...	with vanes hinged to the inner as well as to the outer member
F04C 18/40	..	having the movement defined in group F04C 18/08 or F04C 18/22 and having a hinged member
F04C 18/44	...	with vanes hinged to the inner member
F04C 18/46	...	with vanes hinged to the outer member
F04C 18/48	.	Rotary-piston pumps with non-parallel axes of movement of co-operating members
F04C 18/50	..	the axes being arranged at an angle of 90 degrees
F04C 18/52	...	of intermeshing engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing
F04C 18/54	..	the axes being arranged otherwise than at an angle of 90 degrees
F04C 18/56	...	of intermeshing engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing
F04C 18/565	....	{the axes of cooperating members being on the same plane }
F04C 19/00		Rotary-piston pumps with fluid ring or the like, specially adapted for elastic fluids
F04C 19/001	.	{General arrangements, plants, flowsheets }
F04C 19/002	.	{with rotating outer members }
F04C 19/004	.	{Details concerning the operating liquid, e.g. nature, separation, cooling, cleaning, control of the supply }
F04C 19/005	.	{Details concerning the admission or discharge }

- F04C 19/007 . . {Port members in the form of side plates }
- F04C 19/008 . . {Port members in the form of conical or cylindrical pieces situated in the centre of the impeller }

F04C 21/00 Oscillating-piston pumps specially adapted for elastic fluids

- F04C 21/002 . {the piston oscillating around a fixed axis }
- F04C 21/005 . {the piston oscillating in the space, e.g. around a fixed point (rotary-piston pumps with non-parallel axes of rotation between co-operating members [F04C 18/48](#)) }
- F04C 21/007 . {the points of the moving element describing approximately an alternating movement in axial direction with respect to the other element }

F04C 23/00 Combinations of two or more pumps, each being of rotary-piston or oscillating-piston type, specially adapted for elastic fluids; Pumping installations specially adapted for elastic fluids; Multi-stage pumps specially adapted for elastic fluids ([F04C 25/00](#) takes precedence)

NOTE

Multi-stage pumps or compressors with stages connected in series or in parallel are not considered as having complementary function

- F04C 23/001 . {of similar working principle }
- F04C 23/003 . . {having complementary function }
- F04C 23/005 . {of dissimilar working principle }
- F04C 23/006 . . {having complementary function }
- F04C 23/008 . {Hermetic pumps }

NOTE

Multi-stage steam engines, motors, pumps or compressors with stages connected in series or in parallel are not considered as having complementary function

- F04C 23/02 . Pumps characterised by combination with or adaptation to specific driving engines or motors ([predominant aspects of the engines or motors, see the relevant classes](#))

F04C 25/00 Adaptations of pumps for special use of pumps for elastic fluids

- F04C 25/02 . for producing high vacuum ([sealing arrangements \[F04C 27/00\]\(#\); silencing \[F04C 29/06\]\(#\)](#))

F04C 27/00 Sealing arrangements in rotary-piston pumps specially adapted for elastic fluids

- F04C 27/001 . {Radial sealings for working fluid }
- F04C 27/002 . . {of rigid material }

- F04C 27/003 . . {of resilient material }
- F04C 27/004 . . {Radial sealing elements specially adapted for intermeshing-engagement type pumps, e.g. gear pumps }
- F04C 27/005 . {Axial sealings for working fluid }
- F04C 27/006 . . {Elements specially adapted for sealing of the lateral faces of intermeshing-engagement type pumps, e.g. gear pumps }
- F04C 27/007 . {Sealings for working fluid between radially and axially moving parts }
- F04C 27/008 . { for other than working fluid, i.e. the sealing arrangements are not between working chambers of the machine }
- F04C 27/009 . . {Shaft sealings specially adapted for pumps }
- F04C 27/02 . Liquid sealing for high-vacuum pumps {or for compressors }
- F04C 28/00 Control of, monitoring of, or safety arrangements for, pumps or pumping installations specially adapted for elastic fluids**
- F04C 28/02 . specially adapted for several pumps connected in series or in parallel
- F04C 28/04 . specially adapted for reversible pumps
- F04C 28/06 . specially adapted for stopping, starting, idling or no-load operation
- F04C 28/065 . . { Capacity control using a multiplicity of units or pumping capacities, e.g. multiple chambers, individually switchable or controllable }
- F04C 28/08 . characterised by varying the rotational speed
- F04C 28/10 . characterised by changing the positions of the inlet or outlet openings with respect to the working chamber
- F04C 28/12 . . using sliding valves
- F04C 28/125 . . . {with sliding valves controlled by the use of fluid other than the working fluid }
- F04C 28/14 . . using rotating valves
- F04C 28/16 . . using lift valves
- F04C 28/18 . characterised by varying the volume of the working chamber (by changing the positions of inlet or outlet openings [F04C 28/10](#))
- F04C 28/185 . . { by varying the useful pumping length of the cooperating members in the axial direction }
- F04C 28/20 . . by changing the form of the inner or outer contour of the working chamber
- F04C 28/22 . . by changing the eccentricity between cooperating members
- F04C 28/24 . characterised by using valves regulating pressure or flow rate, e.g. discharge valves { unloading valves } ([F04C 28/10](#) takes precedence)
- F04C 28/26 . . using bypass channels
- F04C 28/265 . . . {being obtained by displacing a lateral sealing face }
- F04C 28/28 . Safety arrangements; Monitoring

F04C 29/00	Component parts, details or accessories of pumps or pumping installations, not provided for in groups F04C 18/00 to F04C 28/00
F04C 29/0007	. {Injection of a fluid in the working chamber for sealing, cooling and lubricating (sealing only F04C 27/00 ; lubrication only F04C 29/02 ; cooling F02B 47/02 , F02D 21/00 , F02M 25/00) }
F04C 29/0014	.. {with control systems for the injection of the fluid }
F04C 29/0021	. {Systems for the equilibration of forces acting on the pump } (interstice adjustment other than by fluid pressure F01C 21/102)
F04C 29/0028	.. {Internal leakage control }
F04C 29/0035	.. {Equalization of pressure pulses (silencing F04C 29/06) }
F04C 29/0042	. {Driving elements, brakes, couplings, transmissions specially adapted for pumps (brakes, couplings, transmissions per se F16 , B60) }
F04C 29/005	.. {Means for transmitting movement from the prime mover to driven parts of the pump, e.g. clutches, couplings, transmissions }
F04C 29/0057	... {for eccentric movement }
F04C 29/0064	... {Magnetic couplings }
F04C 29/0071	... {Couplings between rotors and input or output shafts acting by interengaging or mating parts, i.e. positive coupling of rotor and shaft }
F04C 29/0078	.. {Fixing rotors on shafts, e.g. by clamping together hub and shaft }
F04C 29/0085	.. {Prime movers }
F04C 29/0092	. {Removing solid or liquid contaminants from the gas under pumping, e.g. by filtering or deposition; Purging; Scrubbing; Cleaning }
F04C 29/02	. Lubrication (of machines or engines in general F01M) ; Lubricant separation (separation in general B01D)
F04C 29/021	.. {Control systems for the circulation of the lubricant }
F04C 29/023	.. {Lubricant distribution through a hollow driving shaft (F04C 29/025 takes precedence) }
F04C 29/025	.. {using a lubricant pump }
F04C 29/026	.. {Lubricant separation }
F04C 29/028	.. {Means for improving or restricting lubricant flow }
F04C 29/04	. Heating; Cooling (of machines or engines in general F01P) ; Heat insulation (heat insulation in general F16L 59/00)
F04C 29/042	.. {by injecting a fluid (injection of fluid for sealing, cooling or lubrication F04C 29/0007) }
F04C 29/045	.. {of the electric motor in hermetic pumps }
F04C 29/047	.. { Cooling of electronic devices installed inside the pump housing, e.g. inverters }
<u>WARNING</u>	
WARNING this group is pending a reorganisation, see also F04C 29/04	
F04C 29/06	. Silencing (gas-flow silencers or exhaust apparatus for machines or engines in general F01N)

WARNING

{ WARNING Subgroups [F04C 29/061](#) to [F04C 29/068](#) pending a reorganisation, see also [F04C 29/06](#) }

- [F04C 29/061](#) . . { Silencers using overlapping frequencies, e.g. Helmholtz resonators }
- [F04C 29/063](#) . . { Sound absorbing materials }
- [F04C 29/065](#) . . { Noise dampening volumes, e.g. muffler chambers }
- [F04C 29/066](#) . . . { with means to enclose the source of noise }
- [F04C 29/068](#) . . { the silencing means being arranged inside the pump housing }

- [F04C 29/12](#) . Arrangements for admission or discharge of the working fluid, e.g. constructional features of the inlet or outlet
- [F04C 29/122](#) . . {Arrangements for supercharging the working space (similar arrangements for internal combustion engines [F02B 33/00](#), [F02B 37/00](#)) }
- [F04C 29/124](#) . . {with inlet and outlet valves specially adapted for rotary or oscillating piston pumps }
- [F04C 29/126](#) . . . {of the non-return type }
- [F04C 29/128](#) {of the elastic type, e.g. reed valves }

Guidance heading:**[F04C 2210/00](#)****Fluid**

- [F04C 2210/10](#) . working
- [F04C 2210/1005](#) . . Air
- [F04C 2210/1011](#) . . Amine
- [F04C 2210/1016](#) . . Blood
- [F04C 2210/1022](#) . . C3HmFn
- [F04C 2210/1027](#) . . CO2
- [F04C 2210/1033](#) . . Concrete
- [F04C 2210/1038](#) . . Cooking oil
- [F04C 2210/1044](#) . . Fuel
- [F04C 2210/105](#) . . Helium (He)
- [F04C 2210/1055](#) . . Hydrogen (H2)
- [F04C 2210/1061](#) . . LPG
- [F04C 2210/1066](#) . . Nitrogen (N2)
- [F04C 2210/1072](#) . . Oxygen (O2)
- [F04C 2210/1077](#) . . Steam
- [F04C 2210/1083](#) . . Urea
- [F04C 2210/1088](#) . . Vegetable oil
- [F04C 2210/1094](#) . . Water

- [F04C 2210/12](#) . auxiliary

F04C 2210/122	.. Nitrogen (N2)
F04C 2210/124	.. Sodium (Na)
F04C 2210/126	.. Tin
F04C 2210/128	.. Water
F04C 2210/14	. Lubricant
F04C 2210/142	.. Ester
F04C 2210/145	.. PAG
F04C 2210/147	.. Water
F04C 2210/20	. liquid, i.e. incompressible
F04C 2210/201	.. DME
F04C 2210/203	.. Fuel
F04C 2210/205	.. Ink
F04C 2210/206	.. Oil
F04C 2210/208	.. Water
F04C 2210/22	. gaseous, i.e. compressible
F04C 2210/221	.. Air
F04C 2210/222	.. Carbon dioxide (CO2)
F04C 2210/224	.. Hydrogen (H2)
F04C 2210/225	.. Nitrogen (N2)
F04C 2210/227	.. Steam
F04C 2210/228	.. Vapour
F04C 2210/24	. mixed, e.g. two-phase fluid
F04C 2210/242	.. Steam
F04C 2210/245	.. Vapour
F04C 2210/247	.. Water
F04C 2210/26	. Refrigerants with particular properties, e.g. HFC- 134a
F04C 2210/261	.. Carbon dioxide (CO2)
F04C 2210/263	.. HFO1234YF
F04C 2210/265	.. Ammoniac (NH3)
F04C 2210/266	.. Propane
F04C 2210/268	.. R32
F04C 2210/40	. Properties
F04C 2210/42	.. magnetic or ferromagnetic; Ferrofluids
F04C 2210/44	.. Viscosity
F04C 2210/60	. Condition
F04C 2210/62	.. Purity

Guidance heading:

F04C 2220/00**Application**

- F04C 2220/10 . Vacuum
- F04C 2220/12 . . Dry running
- F04C 2220/20 . Pumps with means for separating and evacuating the gaseous phase
- F04C 2220/22 . for very low temperatures, i.e. cryogenic
- F04C 2220/24 . for metering throughflow
- F04C 2220/26 . for step-by-step output movement
- F04C 2220/28 . for pulsed fluid flow
- F04C 2220/30 . Use in a chemical vapor deposition (CVD) process or in a similar process
- F04C 2220/40 . Pumps with means for venting areas other than the working chamber, e.g. bearings, gear chambers, shaft seals
- F04C 2220/50 . Pumps with means for introducing gas under pressure for ballasting

F04C 2230/00**Manufacture****NOTE**

Manufacture comprises also treatment, assembly or disassembly methods, repairing, handling or the like.

- F04C 2230/10 . by removing material
- F04C 2230/101 . . by electrochemical methods
- F04C 2230/102 . . by spark erosion methods
- F04C 2230/103 . . using lasers
- F04C 2230/20 . essentially without removing material
- F04C 2230/21 . . by casting
- F04C 2230/22 . . by sintering
- F04C 2230/23 . . by permanently joining parts together
- F04C 2230/231 . . . by welding
- F04C 2230/24 . . by extrusion
- F04C 2230/25 . . by forging
- F04C 2230/26 . . by rolling
- F04C 2230/27 . . by hydroforming
- F04C 2230/40 . Heat treatment
- F04C 2230/41 . . Hardening; Annealing

- F04C 2230/60 . Assembly methods
- F04C 2230/601 . . Adjustment
- F04C 2230/602 . . Gap; Clearance
- F04C 2230/603 . . Centering; Aligning
- F04C 2230/604 . . Mounting devices for pumps or compressors
- F04C 2230/605 . . Balancing

- F04C 2230/70 . Disassembly methods

- F04C 2230/80 . Repairing methods

- F04C 2230/85 . Methods for improvement by repair or exchange of parts

- F04C 2230/90 . Improving properties of machine parts
- F04C 2230/91 . . Coating
- F04C 2230/92 . . Surface treatment

F04C 2240/00 Components

- F04C 2240/10 . Stators
- F04C 2240/102 . . with means for discharging condensate or liquid separated from the gas pumped

- F04C 2240/20 . Rotors

- F04C 2240/30 . Casings or housings

- F04C 2240/40 . Electric motor
- F04C 2240/401 . . Linear motor
- F04C 2240/402 . . Plurality of electronically synchronised motors
- F04C 2240/403 . . with inverter for speed control

- F04C 2240/45 . Hybrid prime mover

- F04C 2240/50 . Bearings
- F04C 2240/51 . . for cantilever assemblies
- F04C 2240/52 . . for assemblies with supports on both sides
- F04C 2240/54 . . Hydrostatic or hydrodynamic bearing assemblies specially adapted for rotary positive displacement pumps or compressors
- F04C 2240/56 . . Bearing bushings or details thereof

- F04C 2240/60 . Shafts
- F04C 2240/601 . . Shaft flexion
- F04C 2240/603 . . with internal channels for fluid distribution, e.g. hollow shaft
- F04C 2240/605 . . Shaft sleeves or details thereof

- F04C 2240/70 . Use of multiplicity of similar components; Modular construction

F04C 2240/80	. Other components
F04C 2240/801	.. Wear plates
F04C 2240/802	.. Liners
F04C 2240/803	.. Electric connectors or cables; Fittings therefor
F04C 2240/804	.. Accumulators for refrigerant circuits
F04C 2240/805	.. Fastening means, e.g. bolts
F04C 2240/806	.. Pipes for fluids; Fittings therefor
F04C 2240/807	.. Balance weight, counterweight
F04C 2240/808	.. Electronic circuits (e.g. inverters) installed inside the machine
F04C 2240/809	.. Lubricant sump
F04C 2240/81	.. Sensor, e.g. electronic sensor for control or monitoring
F04C 2240/811	.. Actuator for control, e.g. pneumatic, hydraulic, electric

F04C 2250/00**Geometry**

F04C 2250/10	. of the inlet or outlet
F04C 2250/101	.. of the inlet
F04C 2250/102	.. of the outlet
F04C 2250/20	. of the rotor
F04C 2250/201	.. conical shape
F04C 2250/30	. of the stator
F04C 2250/301	.. compression chamber profile defined by a mathematical expression or by parameters

F04C 2270/00**Control; Monitoring or safety arrangements**

F04C 2270/01	. Load
F04C 2270/015	.. Controlled or regulated
F04C 2270/02	. Power
F04C 2270/025	.. Controlled or regulated
F04C 2270/03	. Torque
F04C 2270/035	.. Controlled or regulated
F04C 2270/04	. Force
F04C 2270/041	.. Controlled or regulated
F04C 2270/042	.. radial
F04C 2270/0421	... Controlled or regulated
F04C 2270/0422	... centrifugal
F04C 2270/04225	.... Controlled or regulated
F04C 2270/044	.. axial

F04C 2270/0445	... Controlled or regulated
F04C 2270/05	. Speed
F04C 2270/051	.. Controlled or regulated
F04C 2270/052	.. angular
F04C 2270/0525	... Controlled or regulated
F04C 2270/054	.. linear
F04C 2270/0545	... Controlled or regulated
F04C 2270/06	. Acceleration
F04C 2270/065	.. Controlled or regulated
F04C 2270/07	. Electric current
F04C 2270/075	.. Controlled or regulated
F04C 2270/08	. Amplitude of electric current
F04C 2270/085	.. Controlled or regulated
F04C 2270/09	. Electric current frequency
F04C 2270/095	.. Controlled or regulated
F04C 2270/10	. Voltage
F04C 2270/105	.. Controlled or regulated
F04C 2270/11	. Magnetic flux
F04C 2270/115	.. Controlled or regulated
F04C 2270/12	. Vibration
F04C 2270/125	.. Controlled or regulated
F04C 2270/13	. Noise
F04C 2270/135	.. Controlled or regulated
F04C 2270/14	. Pulsations
F04C 2270/145	.. Controlled or regulated
F04C 2270/15	. Resonance
F04C 2270/155	.. Controlled or regulated
F04C 2270/16	. Wear
F04C 2270/165	.. Controlled or regulated
F04C 2270/17	. Tolerance; Play; Gap
F04C 2270/175	.. Controlled or regulated
F04C 2270/18	. Pressure
F04C 2270/185	.. Controlled or regulated

F04C 2270/19	. Temperature
F04C 2270/195	.. Controlled or regulated
F04C 2270/20	. Flow
F04C 2270/205	.. Controlled or regulated
F04C 2270/21	. Pressure difference
F04C 2270/215	.. Controlled or regulated
F04C 2270/22	. Temperature difference
F04C 2270/225	.. Controlled or regulated
F04C 2270/23	. Working cycle timing control
F04C 2270/24	. Level of liquid, e.g. lubricant or cooling liquid
F04C 2270/40	. Conditions across a pump or machine
F04C 2270/42	. Conditions at the inlet of a pump or machine
F04C 2270/44	. Conditions at the outlet of a pump or machine
F04C 2270/46	. Conditions in the working chamber
F04C 2270/48	. Conditions of a reservoir linked to a pump or machine
F04C 2270/50	. Conditions before a throttle
F04C 2270/52	. Conditions after a throttle
F04C 2270/54	. Conditions in a control cylinder/piston unit
F04C 2270/56	. Number of pump/machine units in operation
F04C 2270/58	. Valve parameters
F04C 2270/585	.. Controlled or regulated
F04C 2270/60	. Prime mover parameters
F04C 2270/605	.. Controlled or regulated
F04C 2270/70	. Safety, emergency conditions or requirements
F04C 2270/701	.. Cold start
F04C 2270/72	.. preventing reverse rotation
F04C 2270/78	. Warnings
F04C 2270/782	.. Sound
F04C 2270/784	.. Light
F04C 2270/80	. Diagnostics

F04C 2270/86 . Detection

F04C 2270/90 . Remote control, e.g. wireless, via LAN, by radio, or by a wired connection from a central computer

Guidance heading:

F04C 2280/00 Arrangements for preventing or removing deposits or corrosion

F04C 2280/02 . Preventing solid deposits in pumps, e.g. in vacuum pumps with chemical vapour deposition (CVD) processes

F04C 2280/04 . Preventing corrosion