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".

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 takes precedence)

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}

WARNING

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

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}

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 . . CO_2

F04C 2210/1033 . . Concrete

F04C 2210/1038 . . Cooking oil

F04C 2210/1044 . . Fuel

F04C 2210/105 . . Helium (He)

F04C 2210/1055 . . Hydrogen (H_2)

F04C 2210/1061 . . LPG

F04C 2210/1066 . . Nitrogen (N_2)

F04C 2210/1072 . . Oxygen (O_2)

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 (N_2)

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 (CO_2)
F04C 2210/224 . . Hydrogen (H_2)
F04C 2210/225 . . Nitrogen (N_2)
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 (CO_2)
F04C 2210/263 . . HFO1234YF
F04C 2210/265 . . Ammoniac (NH_3)
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

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

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