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

{ 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 . . 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

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