

**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}

<b>F04C 13/00</b>	<b>Adaptations of machines or pumps for special use, e.g. for extremely high pressures</b> (of pumps specially adapted for elastic fluids <a href="#">F04C 25/00</a> )
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 <a href="#">F02M 37/20</a> , in centrifugal pumps <a href="#">F04D 9/00</a> )}
F04C 13/008	• {Pumps for submersible use, i.e. down-hole pumping}
<b>F04C 14/00</b>	<b>Control of, monitoring of, or safety arrangements for, machines, pumps or pumping installations</b> (of pumps or pumping installations specially adapted for elastic fluids <a href="#">F04C 28/00</a> )
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 <a href="#">F04C 14/10</a> )
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} ( <a href="#">F04C 14/10</a> 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
<b>F04C 15/00</b>	<b>Component parts, details or accessories of machines, pumps or pumping installations, not provided for in groups <a href="#">F04C 2/00</a> to <a href="#">F04C 14/00</a></b> (of pumps specially adapted for elastic fluids <a href="#">F04C 18/00</a> to <a href="#">F04C 29/00</a> )
F04C 15/0003	• {Sealing arrangements in rotary-piston machines or pumps (sealing in general <a href="#">F16J</a> )}

- 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<sub>2</sub>
- F04C 2210/1033 . . Concrete
- F04C 2210/1038 . . Cooking oil
- F04C 2210/1044 . . Fuel
- F04C 2210/105 . . Helium (He)
- F04C 2210/1055 . . Hydrogen (H<sub>2</sub>)
- F04C 2210/1061 . . LPG
- F04C 2210/1066 . . Nitrogen (N<sub>2</sub>)
- F04C 2210/1072 . . Oxygen (O<sub>2</sub>)
- 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<sub>2</sub>)
- 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 <sub>2</sub> )
F04C 2210/224	• • Hydrogen (H <sub>2</sub> )
F04C 2210/225	• • Nitrogen (N <sub>2</sub> )
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 <sub>2</sub> )
F04C 2210/263	• • HFO1234YF
F04C 2210/265	• • Ammoniac (NH <sub>3</sub> )
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
<b>F04C 2220/00</b>	<b>Application</b>
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
<b>F04C 2280/00</b>	<b>Arrangements for preventing or removing deposits or corrosion</b>
F04C 2280/02	. Preventing solid deposits in pumps, e.g. in vacuum pumps with chemical vapour deposition [CVD] processes
F04C 2280/04	. Preventing corrosion