

**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 <a href="#">F04C 2/08</a> or <a href="#">F04C 2/22</a> 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 <a href="#">F04C 2/22</a> and <a href="#">F04C 2/24</a>
F04C 2/38	..	having the movement defined in group <a href="#">F04C 2/02</a> and having a hinged member ( <a href="#">F04C 2/32</a> 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 <a href="#">F04C 2/08</a> or <a href="#">F04C 2/22</a> 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 <a href="#">{(for non-parallel axes of movement F04C 18/48)}</a>
F04C 18/165	.....	<a href="#">{having more than two rotary pistons with parallel axes}</a>
F04C 18/18	....	with similar tooth forms <a href="#">(F04C 18/16 takes precedence)</a>
F04C 18/20	....	with dissimilar tooth forms <a href="#">(F04C 18/16 takes precedence)</a>
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 <a href="#">F04C 18/02</a> , <a href="#">F04C 18/08</a> , <a href="#">F04C 18/22</a> , <a href="#">F04C 18/24</a> , <a href="#">F04C 18/48</a> , 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 <a href="#">F04C 18/02</a> and relative reciprocation between the co-operating members
F04C 18/321	...	<a href="#">{with vanes hinged to the inner member and reciprocating with respect to the inner member}</a>
F04C 18/322	...	<a href="#">{with vanes hinged to the outer member and reciprocating with respect to the outer member}</a>
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 <a href="#">F04C 18/08</a> or <a href="#">F04C 18/22</a> and relative reciprocation between the co-operating members
F04C 18/344	...	with vanes reciprocating with respect to the inner member
F04C 18/3441	....	<a href="#">{the inner and outer member being in contact along one line or continuous surface substantially parallel to the axis of rotation}</a>
F04C 18/3442	.....	<a href="#">{the surfaces of the inner and outer member, forming the inlet and outlet opening}</a>
F04C 18/3443	.....	<a href="#">{with a separation element located between the inlet and outlet opening}</a>
F04C 18/3445	.....	<a href="#">{the vanes having the form of rollers, slippers or the like}</a>
F04C 18/3446	....	<a href="#">{the inner and outer member being in contact along more than one line or surface}</a>
F04C 18/3447	.....	<a href="#">{the vanes having the form of rollers, slippers or the like}</a>
F04C 18/3448	....	<a href="#">{with axially movable vanes}</a>
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

**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
<b>F04C 2240/00</b>	<b>Components</b>
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