

**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 <a href="#">F04C 3/00</a> )}
F04C 2/165	.....	{having more than two rotary pistons with parallel axes}
F04C 2/18	....	with similar tooth forms ( <a href="#">F04C 2/16</a> takes precedence)
F04C 2/20	....	with dissimilar tooth forms ( <a href="#">F04C 2/16</a> 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}

<b>F04C 28/00</b>	<b>Control of, monitoring of, or safety arrangements for, pumps or pumping installations specially adapted for elastic fluids</b>
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 <a href="#">F04C 28/10</a> )
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
<b>F04C 29/00</b>	<b>Component parts, details or accessories of pumps or pumping installations, not provided for in groups <a href="#">F04C 18/00</a> to <a href="#">F04C 28/00</a></b>
F04C 29/0007	. {Injection of a fluid in the working chamber for sealing, cooling and lubricating (sealing only <a href="#">F04C 27/00</a> ; lubrication only <a href="#">F04C 29/02</a> ; cooling <a href="#">F02B 47/02</a> , <a href="#">F02D 21/00</a> , <a href="#">F02M 25/00</a> )}
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 <a href="#">F01C 21/102</a> )
F04C 29/0028	.. {Internal leakage control}
F04C 29/0035	.. {Equalization of pressure pulses (silencing <a href="#">F04C 29/06</a> )}

- 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 .. 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 .. O<sub>x</sub>ygen (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
<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. <a href="#">inverters</a> ) 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