

# CPC COOPERATIVE PATENT CLASSIFICATION

## F MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING (NOTE omitted)

### ENGINES OR PUMPS

#### F04 POSITIVE - DISPLACEMENT MACHINES FOR LIQUIDS; PUMPS FOR LIQUIDS OR ELASTIC FLUIDS (NOTE omitted)

#### 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".

##### WARNING

In this subclass non-limiting references (in the sense of paragraph 39 of the Guide to the IPC) may still be displayed in the scheme.

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| <p><b>2/00</b> Rotary-piston machines or pumps (with non-parallel axes of co-operating members <a href="#">F04C 3/00</a>; with the working-chamber walls at least partly resiliently deformable <a href="#">F04C 5/00</a>; with fluid ring or the like <a href="#">F04C 7/00</a>; rotary-piston pumps specially adapted for elastic fluids <a href="#">F04C 18/00</a>; rotary-piston machines or pumps in which the working-fluid is exclusively displaced by, or exclusively displaces, one or more reciprocating pistons <a href="#">F04B</a>)</p> <p><b>NOTE</b></p> <p>Group <a href="#">F04C 2/30</a> takes precedence over groups <a href="#">F04C 2/02</a> - <a href="#">F04C 2/28</a></p>  | <p>2/082 . . {Details specially related to intermeshing engagement type machines or pumps}</p> <p>2/084 . . . {Toothed wheels}</p> <p>2/086 . . . {Carter}</p> <p>2/088 . . . {Elements in the toothed wheels or the carter for relieving the pressure of fluid imprisoned in the zones of engagement}</p> <p>2/10 . . of internal-axis type with the outer member having more teeth or tooth-equivalents, e.g. rollers, than the inner member</p> <p>2/101 . . . {with a crescent-shaped filler element, located between the inner and outer intermeshing members}</p> <p>2/102 . . . {the two members rotating simultaneously around their respective axes}</p> <p>2/103 . . . {one member having simultaneously a rotational movement about its own axis and an orbital movement}</p> <p>2/104 . . . . {having an articulated driving shaft}</p> <p>2/105 . . . . {Details concerning timing or distribution valves}</p> <p>2/106 . . . . . {Spool type distribution valves}</p> <p>2/107 . . . with helical teeth</p> <p>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}</p> <p>2/1073 . . . . . {where one member is stationary while the other member rotates and orbits}</p> <p>2/1075 . . . . . {Construction of the stationary member}</p> <p>2/1076 . . . . . {where one member orbits or wobbles relative to the other member which rotates around a fixed axis}</p> <p>2/1078 . . . . . {where one member rotates and both members are allowed to orbit or wobble}</p> |
| <p>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</p> <p>2/025 . . {the moving and the stationary member having co-operating elements in spiral form}</p> <p>2/04 . . of internal axis type</p> <p>2/045 . . . {having a C-shaped piston}</p> <p>2/06 . . of other than internal-axis type (<a href="#">F04C 2/063</a> takes precedence)</p> <p>2/063 . . with coaxially-mounted members having continuously-changing circumferential spacing between them</p> <p>2/067 . . . having cam-and-follower type drive</p> <p>2/07 . . . having crankshaft-and-connecting-rod type drive</p> <p>2/073 . . . having pawl-and-ratchet type drive</p> <p>2/077 . . . having toothed-gearing type drive</p> <p>2/08 . of intermeshing-engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing</p> |   |

- 2/113 . . . the inner member carrying rollers intermeshing with the outer member
- 2/12 . . of other than internal-axis type
- 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}
- 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}
- 2/14 . . . with toothed rotary pistons
- 2/16 . . . with helical teeth, e.g. chevron-shaped, screw type {(for non-parallel axes of movement [F04C 3/00](#))}
- 2/165 . . . . {having more than two rotary pistons with parallel axes}
- 2/18 . . . . with similar tooth forms ([F04C 2/16](#) takes precedence)
- 2/20 . . . . with dissimilar tooth forms ([F04C 2/16](#) takes precedence)
- 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
- 2/24 . of counter-engagement type, i.e. the movement of co-operating members at the points of engagement being in opposite directions
- 2/26 . . of internal-axis type
- 2/28 . . of other than internal-axis type
- 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
- 2/32 . . having both the movement defined in groups [F04C 2/02](#) and relative reciprocation between co-operating members
- 2/321 . . . {with vanes hinged to the inner member and reciprocating with respect to the inner member}
- 2/322 . . . {with vanes hinged to the outer member and reciprocating with respect to the outer member}
- 2/324 . . . with vanes hinged to the inner member and reciprocating with respect to the outer member
- 2/328 . . . . and hinged to the outer member
- 2/332 . . . with vanes hinged to the outer member and reciprocating with respect to the inner member
- 2/336 . . . . and hinged to the inner member
- 2/34 . . having the movement defined in groups [F04C 2/08](#) or [F04C 2/22](#) and relative reciprocation between the co-operating members
- 2/344 . . . with vanes reciprocating with respect to the inner member
- 2/3441 . . . . {the inner and outer member being in contact along one line or continuous surface substantially parallel to the axis of rotation}
- 2/3442 . . . . {the surfaces of the inner and outer member, forming the working space, being surfaces of revolution}
- 2/3443 . . . . {with a separation element located between the inlet and outlet opening}
- 2/3445 . . . . . {the vanes having the form of rollers, slippers or the like}
- 2/3446 . . . . {the inner and outer member being in contact along more than one line or surface}
- 2/3447 . . . . . {the vanes having the form of rollers, slippers or the like}
- 2/3448 . . . . . {with axially movable vanes}
- 2/348 . . . . the vanes positively engaging, with circumferential play, an outer rotatable member
- 2/352 . . . . the vanes being pivoted on the axis of the outer member
- 2/356 . . . with vanes reciprocating with respect to the outer member
- 2/3562 . . . . {the inner and outer member being in contact along one line or continuous surface substantially parallel to the axis of rotation}
- 2/3564 . . . . . {the surfaces of the inner and outer member, forming the working space, being surfaces of revolution}
- 2/3566 . . . . {the inner and outer member being in contact along more than one line or surface}
- 2/3568 . . . . . {with axially movable vanes}
- 2/36 . . having both the movements defined in groups [F04C 2/22](#) and [F04C 2/24](#)
- 2/38 . . having the movement defined in group [F04C 2/02](#) and having a hinged member ([F04C 2/32](#) takes precedence)
- 2/39 . . . with vanes hinged to the inner as well as to the outer member
- 2/40 . . having the movement defined in group [F04C 2/08](#) or [F04C 2/22](#) and having a hinged member
- 2/44 . . . with vanes hinged to the inner member
- 2/46 . . . with vanes hinged to the outer member
- 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](#))**
- 3/02 . the axes being arranged at an angle of 90 degrees
- 3/04 . . of intermeshing engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing
- 3/06 . the axes being arranged otherwise than at an angle of 90 degrees
- 3/08 . . of intermeshing engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing
- 3/085 . . . {the axes of cooperating members being on the same plane}
- 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](#))**
- 7/00 Rotary-piston machines or pumps with fluid ring or the like (such pumps specially adapted for elastic fluids [F04C 19/00](#))**
- 9/00 Oscillating-piston machines or pumps (such pumps specially adapted for elastic fluids [F04C 21/00](#))**
- 9/002 . {the piston oscillating around a fixed axis}

- 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 cooperating members [F04C 3/00](#))}
- 9/007 . {the points of the moving element describing approximately an alternating movement in axial direction with respect to the other element}
- 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
- 11/001 . {of similar working principle}
- 11/003 . . {having complementary function}
- 11/005 . {of dissimilar working principle}
- 11/006 . . {having complementary function}
- 11/008 . {Enclosed motor pump units}
- 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](#))**
- 13/001 . {Pumps for particular liquids}
- 13/002 . . {for homogeneous viscous liquids}
- 13/004 . . . {with means for fluidising or diluting the material being pumped}
- 13/005 . {Removing contaminants, deposits or scale from the pump; Cleaning}
- 13/007 . {Venting; Gas and vapour separation during pumping (preventing vapour lock in fuel pumps [F02M 37/20](#), in centrifugal pumps [F04D 9/00](#))}
- 13/008 . {Pumps for submersible use, i.e. down-hole pumping}
- 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](#))**
- 14/02 . specially adapted for several machines or pumps connected in series or in parallel
- 14/04 . specially adapted for reversible machines or pumps
- 14/06 . specially adapted for stopping, starting, idling or no-load operation
- 14/065 . . {Capacity control using a multiplicity of units or pumping capacities, e.g. multiple chambers, individually switchable or controllable}
- 14/08 . characterised by varying the rotational speed
- 14/10 . characterised by changing the positions of the inlet or outlet openings with respect to the working chamber
- 14/12 . . using sliding valves
- 14/14 . . using rotating valves
- 14/16 . . using lift valves
- 14/18 . characterised by varying the volume of the working chamber (by changing the positions of inlet or outlet openings [F04C 14/10](#))
- 14/185 . . {by varying the useful pumping length of the cooperating members in the axial direction}
- 14/20 . . by changing the form of the inner or outer contour of the working chamber
- 14/22 . . by changing the eccentricity between cooperating members
- 14/223 . . . {using a movable cam}
- 14/226 . . . . {by pivoting the cam around an eccentric axis}
- 14/24 . characterised by using valves controlling pressure or flow rate, e.g. discharge valves {or unloading valves} ([F04C 14/10](#) takes precedence)
- 14/26 . . using bypass channels
- 14/265 . . . {being obtained by displacing a lateral sealing face}
- 14/28 . Safety arrangements; Monitoring
- 15/00 Component parts, details or accessories of machines, pumps or pumping installations, not provided for in groups [F04C 2/00](#) - [F04C 14/00](#) (of pumps specially adapted for elastic fluids [F04C 18/00](#) - [F04C 29/00](#))**
- 15/0003 . {Sealing arrangements in rotary-piston machines or pumps (sealing in general [F16J](#))}
- 15/0007 . . {Radial sealings for working fluid}
- 15/0011 . . . {of rigid material}
- 15/0015 . . . {of resilient material}
- 15/0019 . . . {Radial sealing elements specially adapted for intermeshing-engagement type machines or pumps, e.g. gear machines or pumps}
- 15/0023 . . {Axial sealings for working fluid}
- 15/0026 . . . {Elements specially adapted for sealing of the lateral faces of intermeshing-engagement type machines or pumps, e.g. gear machines or pumps}
- 15/003 . . {Sealings for working fluid between radially and axially moving parts}
- 15/0034 . . {for other than the working fluid, i.e. the sealing arrangements are not between working chambers of the machine}
- 15/0038 . . . {Shaft sealings specially adapted for rotary-piston machines or pumps}
- 15/0042 . {Systems for the equilibration of forces acting on the machines or pump (interstice adjustment other than by fluid pressure [F01C 21/102](#))}
- 15/0046 . . {Internal leakage control}
- 15/0049 . . {Equalization of pressure pulses (silencing for compressors [F04C 29/06](#))}
- 15/0053 . {Venting means for starting}
- 15/0057 . {Driving elements, brakes, couplings, transmission specially adapted for machines or pumps (brakes, couplings, transmissions per se [F16](#), [B60](#))}
- 15/0061 . . {Means for transmitting movement from the prime mover to driven parts of the pump, e.g. clutches, couplings, transmissions}
- 15/0065 . . . {for eccentric movement}
- 15/0069 . . . {Magnetic couplings}
- 15/0073 . . . {Couplings between rotors and input or output shafts acting by interengaging or mating parts, i.e. positive coupling of rotor and shaft}
- 15/0076 . . {Fixing rotors on shafts, e.g. by clamping together hub and shaft}
- 15/008 . . {Prime movers}
- 15/0084 . . {Brakes, braking assemblies}
- 15/0088 . {Lubrication (of machines or engines in general [F01M](#))}

- 15/0092 . . {Control systems for the circulation of the lubricant}
- 15/0096 . {Heating; Cooling (of machines or engines in general [F01P](#))}
- 15/06 . Arrangements for admission or discharge of the working fluid, e.g. constructional features of the inlet or outlet
- 15/062 . . {Arrangements for supercharging the working space (similar arrangements for internal combustion engines [F02B 33/00](#), [F02B 37/00](#))}
- 15/064 . . {with inlet and outlet valves specially adapted for rotary or oscillating piston machines or pumps}
- 15/066 . . . {of the non-return type}
- 15/068 . . . . {of the elastic type, e.g. reed valves}
- 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](#) - [F04C 18/28](#) and [F04C 18/48](#) - [F04C 18/56](#).
- 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
- 18/0207 . . {both members having co-operating elements in spiral form}
- 18/0215 . . . {where only one member is moving}
- 18/0223 . . . . {with symmetrical double wraps}
- 18/023 . . . {where both members are moving}
- 18/0238 . . . . {with symmetrical double wraps}
- 18/0246 . . . {Details concerning the involute wraps or their base, e.g. geometry}
- 18/0253 . . . . {Details concerning the base}
- 18/0261 . . . . . {Details of the ports, e.g. location, number, geometry}
- 18/0269 . . . . {Details concerning the involute wraps}
- 18/0276 . . . . . {Different wall heights}
- 18/0284 . . . . . {Details of the wrap tips}
- 18/0292 . . . . . {Ports or channels located in the wrap}
- 18/04 . . of internal-axis type
- 18/045 . . . {having a C-shaped piston}
- 18/06 . . of other than internal-axis type
- 18/063 . . with coaxially-mounted members having continuously-changing circumferential spacing between them
- 18/067 . . . having cam-and-follower type drive
- 18/07 . . . having crankshaft-and-connecting-rod type drive
- 18/073 . . . having pawl-and-ratchet type drive
- 18/077 . . . having toothed-gearing type drive
- 18/08 . of intermeshing-engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing
- 18/082 . . {Details specially related to intermeshing engagement type pumps}
- 18/084 . . . {Toothed wheels}
- 18/086 . . . {Carter}
- 18/088 . . . {Elements in the toothed wheels or the carter for relieving the pressure of fluid imprisoned in the zones of engagement}
- 18/10 . . of internal-axis type with the outer member having more teeth or tooth equivalents, e.g. rollers, than the inner member
- 18/103 . . . {with a crescent shaped filler element, located between the inner and outer intermeshing elements}
- 18/107 . . . with helical teeth
- 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}
- 18/113 . . . the inner member carrying rollers intermeshing with the outer member
- 18/12 . . of other than internal-axis type
- 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}
- 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}
- 18/14 . . . with toothed rotary pistons
- 18/16 . . . . with helical teeth, e.g. chevron-shaped, screw type {(for non-parallel axes of movement [F04C 18/48](#))}
- 18/165 . . . . . {having more than two rotary pistons with parallel axes}
- 18/18 . . . . with similar tooth forms ([F04C 18/16](#) takes precedence)
- 18/20 . . . . with dissimilar tooth forms ([F04C 18/16](#) takes precedence)
- 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
- 18/24 . of counter-engagement type, i.e. the movement of co-operating members at the points of engagement being in opposite directions
- 18/26 . . of internal-axis type
- 18/28 . . of other than internal-axis type
- 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
- 18/32 . . having both the movement defined in group [F04C 18/02](#) and relative reciprocation between the co-operating members
- 18/321 . . . {with vanes hinged to the inner member and reciprocating with respect to the inner member}
- 18/322 . . . {with vanes hinged to the outer member and reciprocating with respect to the outer member}
- 18/324 . . . with vanes hinged to the inner member and reciprocating with respect to the outer member
- 18/328 . . . . and hinged to the outer member
- 18/332 . . . with vanes hinged to the outer member and reciprocating with respect to the inner member
- 18/336 . . . . and hinged to the inner member



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| 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 | 19/002       | . {with rotating outer members}  |
| 18/344       | . . . with vanes reciprocating with respect to the inner member   | 19/004       | . {Details concerning the operating liquid, e.g. nature, separation, cooling, cleaning, control of the supply}   |
| 18/3441      | . . . . {the inner and outer member being in contact along one line or continuous surface substantially parallel to the axis of rotation}                     | 19/005       | . {Details concerning the admission or discharge}  |
| 18/3442      | . . . . . {the surfaces of the inner and outer member, forming the inlet and outlet opening}  | 19/007       | . . {Port members in the form of side plates}  |
| 18/3443      | . . . . . {with a separation element located between the inlet and outlet opening}  | 19/008       | . . {Port members in the form of conical or cylindrical pieces situated in the centre of the impeller}   |
| 18/3445      | . . . . . {the vanes having the form of rollers, slippers or the like}  |              |  |
| 18/3446      | . . . . . {the inner and outer member being in contact along more than one line or surface}   | <b>21/00</b> | <b>Oscillating-piston pumps specially adapted for elastic fluids</b>   |
| 18/3447      | . . . . . {the vanes having the form of rollers, slippers or the like}  | 21/002       | . {the piston oscillating around a fixed axis}   |
| 18/3448      | . . . . . {with axially movable vanes}  | 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 <a href="#">F04C 18/48</a> )}   |
| 18/348       | . . . . the vanes positively engaging, with circumferential play, an outer rotatable member   | 21/007       | . {the points of the moving element describing approximately an alternating movement in axial direction with respect to the other element}   |
| 18/352       | . . . . the vanes being pivoted on the axis of the outer member   |              |  |
| 18/356       | . . . with vanes reciprocating with respect to the outer member   | <b>23/00</b> | <b>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 (<a href="#">F04C 25/00</a> takes precedence)</b> |
| 18/3562      | . . . . {the inner and outer member being in contact along one line or continuous surfaces substantially parallel to the axis of rotation}                    |              | <b>NOTE</b>  |
| 18/3564      | . . . . . {the surfaces of the inner and outer member, forming the working space, being surfaces of revolution}   |              | Multi-stage pumps or compressors with stages connected in series or in parallel are not considered as having complementary function  |
| 18/3566      | . . . . {the inner and outer member being in contact along more than one line or surface}   | 23/001       | . {of similar working principle}   |
| 18/3568      | . . . . {with axially movable vanes}  | 23/003       | . . {having complementary function}  |
| 18/36        | . . having both the movements defined in groups <a href="#">F04C 18/22</a> and <a href="#">F04C 18/24</a>   | 23/005       | . {of dissimilar working principle}  |
| 18/38        | . . having the movement defined in group <a href="#">F04C 18/02</a> and having a hinged member ( <a href="#">F04C 18/32</a> takes precedence)                 | 23/006       | . . {having complementary function}  |
| 18/39        | . . . with vanes hinged to the inner as well as to the outer member   | 23/008       | . {Hermetic pumps}   |
| 18/40        | . . having the movement defined in group <a href="#">F04C 18/08</a> or <a href="#">F04C 18/22</a> and having a hinged member                                  |              | <b>NOTE</b>  |
| 18/44        | . . . with vanes hinged to the inner member   |              | Multi-stage steam engines, motors, pumps or compressors with stages connected in series or in parallel are not considered as having complementary function   |
| 18/46        | . . . with vanes hinged to the outer member   | 23/02        | . Pumps characterised by combination with, or adaptation to, specific driving engines or motors  |
| 18/48        | . Rotary-piston pumps with non-parallel axes of movement of co-operating members  | <b>25/00</b> | <b>Adaptations of pumps for special use of pumps for elastic fluids</b>  |
| 18/50        | . . the axes being arranged at an angle of 90 degrees   | 25/02        | . for producing high vacuum ( <a href="#">sealing arrangements F04C 27/00</a> ; <a href="#">silencing F04C 29/06</a> )   |
| 18/52        | . . . of intermeshing engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing  | <b>27/00</b> | <b>Sealing arrangements in rotary-piston pumps specially adapted for elastic fluids</b>  |
| 18/54        | . . the axes being arranged otherwise than at an angle of 90 degrees  | 27/001       | . {Radial sealings for working fluid}  |
| 18/56        | . . . of intermeshing engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing  | 27/002       | . . {of rigid material}  |
| 18/565       | . . . . {the axes of cooperating members being on the same plane}   | 27/003       | . . {of resilient material}  |
| <b>19/00</b> | <b>Rotary-piston pumps with fluid ring or the like, specially adapted for elastic fluids</b>  | 27/004       | . . {Radial sealing elements specially adapted for intermeshing-engagement type pumps, e.g. gear pumps}  |
| 19/001       | . {General arrangements, plants, flowsheets}  | 27/005       | . {Axial sealings for working fluid}   |
|              |   | 27/006       | . . {Elements specially adapted for sealing of the lateral faces of intermeshing-engagement type pumps, e.g. gear pumps}   |
|              |   | 27/007       | . {Sealings for working fluid between radially and axially moving parts}   |

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| 27/008       | . {for other than working fluid, i.e. the sealing arrangements are not between working chambers of the machine}  | 29/0057        | . . . {for eccentric movement}   |
| 27/009       | . . {Shaft sealings specially adapted for pumps}   | 29/0064        | . . . {Magnetic couplings}   |
| 27/02        | . Liquid sealing for high-vacuum pumps {or for compressors}  | 29/0071        | . . . {Couplings between rotors and input or output shafts acting by interengaging or mating parts, i.e. positive coupling of rotor and shaft}                         |
| <b>28/00</b> | <b>Control of, monitoring of, or safety arrangements for, pumps or pumping installations specially adapted for elastic fluids</b>  | 29/0078        | . . {Fixing rotors on shafts, e.g. by clamping together hub and shaft}   |
| 28/02        | . specially adapted for several pumps connected in series or in parallel   | 29/0085        | . . {Prime movers}   |
| 28/04        | . specially adapted for reversible pumps   | 29/0092        | . {Removing solid or liquid contaminants from the gas under pumping, e.g. by filtering or deposition; Purging; Scrubbing; Cleaning}                                    |
| 28/06        | . specially adapted for stopping, starting, idling or no-load operation  | 29/02          | . Lubrication (of machines or engines in general <a href="#">F01M</a> ); Lubricant separation (separation in general <a href="#">B01D</a> )                            |
| 28/065       | . . {Capacity control using a multiplicity of units or pumping capacities, e.g. multiple chambers, individually switchable or controllable}  | 29/021         | . . {Control systems for the circulation of the lubricant}   |
| 28/08        | . characterised by varying the rotational speed  | 29/023         | . . {Lubricant distribution through a hollow driving shaft ( <a href="#">F04C 29/025</a> takes precedence)}  |
| 28/10        | . characterised by changing the positions of the inlet or outlet openings with respect to the working chamber  | 29/025         | . . {using a lubricant pump}   |
| 28/12        | . . using sliding valves   | 29/026         | . . {Lubricant separation}   |
| 28/125       | . . . {with sliding valves controlled by the use of fluid other than the working fluid}  | 29/028         | . . {Means for improving or restricting lubricant flow}  |
| 28/14        | . . using rotating valves  | 29/04          | . Heating; Cooling (of machines or engines in general <a href="#">F01P</a> ); Heat insulation (heat insulation in general <a href="#">F16L 59/00</a> )                 |
| 28/16        | . . using lift valves  | 29/042         | . . {by injecting a fluid (injection of fluid for sealing, cooling or lubrication <a href="#">F04C 29/0007</a> )}  |
| 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> )   | 29/045         | . . {of the electric motor in hermetic pumps}  |
| 28/185       | . . {by varying the useful pumping length of the cooperating members in the axial direction}   | 29/047         | . . {Cooling of electronic devices installed inside the pump housing, e.g. inverters}  |
| 28/20        | . . by changing the form of the inner or outer contour of the working chamber  | 29/06          | . Silencing (gas-flow silencers or exhaust apparatus for machines or engines in general <a href="#">F01N</a> )   |
| 28/22        | . . by changing the eccentricity between cooperating members   | 29/061         | . . {Silencers using overlapping frequencies, e.g. Helmholtz resonators}   |
| 28/24        | . characterised by using valves controlling pressure or flow rate, e.g. discharge valves {or unloading valves} ( <a href="#">F04C 28/10</a> takes precedence)  | 29/063         | . . {Sound absorbing materials}  |
| 28/26        | . . using bypass channels  | 29/065         | . . {Noise dampening volumes, e.g. muffler chambers}   |
| 28/265       | . . . {being obtained by displacing a lateral sealing face}  | 29/066         | . . . {with means to enclose the source of noise}  |
| 28/28        | . Safety arrangements; Monitoring  | 29/068         | . . {the silencing means being arranged inside the pump housing}   |
| <b>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> - <a href="#">F04C 28/00</a></b>   | 29/12          | . Arrangements for admission or discharge of the working fluid, e.g. constructional features of the inlet or outlet  |
| 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> )} | 29/122         | . . {Arrangements for supercharging the working space (similar arrangements for internal combustion engines <a href="#">F02B 33/00</a> , <a href="#">F02B 37/00</a> )} |
| 29/0014      | . . {with control systems for the injection of the fluid}  | 29/124         | . . {with inlet and outlet valves specially adapted for rotary or oscillating piston pumps}  |
| 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> )}   | 29/126         | . . . {of the non-return type}   |
| 29/0028      | . . {Internal leakage control}   | 29/128         | . . . . {of the elastic type, e.g. reed valves}  |
| 29/0035      | . . {Equalization of pressure pulses (silencing <a href="#">F04C 29/06</a> )}  | <b>2210/00</b> | <b>Fluid</b>   |
| 29/0042      | . {Driving elements, brakes, couplings, transmissions specially adapted for pumps (brakes, couplings, transmissions per se <a href="#">F16</a> , <a href="#">B60</a> )}  | 2210/10        | . working  |
| 29/005       | . . {Means for transmitting movement from the prime mover to driven parts of the pump, e.g. clutches, couplings, transmissions}  | 2210/1005      | . . Air  |
|              |  | 2210/1011      | . . Amine  |
|              |  | 2210/1016      | . . Blood  |
|              |  | 2210/1022      | . . C <sub>3</sub> H <sub>m</sub> F <sub>n</sub>   |
|              |  | 2210/1027      | . . CO <sub>2</sub>  |
|              |  | 2210/1033      | . . Concrete   |
|              |  | 2210/1038      | . . Cooking oil  |
|              |  | 2210/1044      | . . Fuel   |
|              |  | 2210/105       | . . Helium (He)  |
|              |  | 2210/1055      | . . Hydrogen (H <sub>2</sub> )   |

|                |  |
|----------------|--|
| 2210/1061      | . . LPG  |
| 2210/1066      | . . Nitrogen (N <sub>2</sub> )   |
| 2210/1072      | . . Oxygen (O <sub>2</sub> )   |
| 2210/1077      | . . Steam  |
| 2210/1083      | . . Urea   |
| 2210/1088      | . . Vegetable oil  |
| 2210/1094      | . . Water  |
| 2210/12        | . auxiliary  |
| 2210/122       | . . Nitrogen (N <sub>2</sub> )   |
| 2210/124       | . . Sodium (Na)  |
| 2210/126       | . . Tin  |
| 2210/128       | . . Water  |
| 2210/14        | . Lubricant  |
| 2210/142       | . . Ester  |
| 2210/145       | . . PAG  |
| 2210/147       | . . Water  |
| 2210/20        | . liquid, i.e. incompressible  |
| 2210/201       | . . DME  |
| 2210/203       | . . Fuel   |
| 2210/205       | . . Ink  |
| 2210/206       | . . Oil  |
| 2210/208       | . . Water  |
| 2210/22        | . gaseous, i.e. compressible   |
| 2210/221       | . . Air  |
| 2210/222       | . . Carbon dioxide (CO <sub>2</sub> )  |
| 2210/224       | . . Hydrogen (H <sub>2</sub> )   |
| 2210/225       | . . Nitrogen (N <sub>2</sub> )   |
| 2210/227       | . . Steam  |
| 2210/228       | . . Vapour   |
| 2210/24        | . mixed, e.g. two-phase fluid  |
| 2210/242       | . . Steam  |
| 2210/245       | . . Vapour   |
| 2210/247       | . . Water  |
| 2210/26        | . Refrigerants with particular properties, e.g. HFC-134a   |
| 2210/261       | . . Carbon dioxide (CO <sub>2</sub> )  |
| 2210/263       | . . HFO1234YF  |
| 2210/265       | . . Ammoniac (NH <sub>3</sub> )  |
| 2210/266       | . . Propane  |
| 2210/268       | . . R32  |
| 2210/40        | . Properties   |
| 2210/42        | . . magnetic or ferromagnetic; Ferrofluids   |
| 2210/44        | . . Viscosity  |
| 2210/60        | . Condition  |
| 2210/62        | . . Purity   |
| <b>2220/00</b> | <b>Application</b>   |
| 2220/10        | . Vacuum   |
| 2220/12        | . . Dry running  |
| 2220/20        | . Pumps with means for separating and evacuating the gaseous phase   |
| 2220/22        | . for very low temperatures, i.e. cryogenic  |
| 2220/24        | . for metering throughflow   |
| 2220/26        | . for step-by-step output movement   |
| 2220/28        | . for pulsed fluid flow  |
| 2220/30        | . Use in a chemical vapor deposition [CVD] process or in a similar process                                     |
| 2220/40        | . Pumps with means for venting areas other than the working chamber, e.g. bearings, gear chambers, shaft seals |
| 2220/50        | . Pumps with means for introducing gas under pressure for ballasting   |

**2230/00 Manufacture****NOTE**

Manufacture comprises also treatment, assembly or disassembly methods, repairing, handling or the like.

|          |  |
|----------|--|
| 2230/10  | . by removing material                                   |
| 2230/101 | . . by electrochemical methods                           |
| 2230/102 | . . by spark erosion methods                             |
| 2230/103 | . . using lasers   |
| 2230/20  | . essentially without removing material                  |
| 2230/21  | . . by casting   |
| 2230/22  | . . by sintering   |
| 2230/23  | . . by permanently joining parts together                |
| 2230/231 | . . . by welding   |
| 2230/24  | . . by extrusion   |
| 2230/25  | . . by forging   |
| 2230/26  | . . by rolling   |
| 2230/27  | . . by hydroforming                                      |
| 2230/40  | . Heat treatment   |
| 2230/41  | . . Hardening; Annealing                                 |
| 2230/60  | . Assembly methods                                       |
| 2230/601 | . . Adjustment   |
| 2230/602 | . . Gap; Clearance                                       |
| 2230/603 | . . Centering; Aligning                                  |
| 2230/604 | . . Mounting devices for pumps or compressors            |
| 2230/605 | . . Balancing  |
| 2230/70  | . Disassembly methods                                    |
| 2230/80  | . Repairing methods                                      |
| 2230/85  | . Methods for improvement by repair or exchange of parts |
| 2230/90  | . Improving properties of machine parts                  |
| 2230/91  | . . Coating  |
| 2230/92  | . . Surface treatment                                    |

**2240/00 Components**

|          |  |
|----------|--|
| 2240/10  | . Stators  |
| 2240/102 | . . with means for discharging condensate or liquid separated from the gas pumped  |
| 2240/20  | . Rotors   |
| 2240/30  | . Casings or housings  |
| 2240/40  | . Electric motor   |
| 2240/401 | . . Linear motor   |
| 2240/402 | . . Plurality of electronically synchronised motors  |
| 2240/403 | . . with inverter for speed control  |
| 2240/45  | . Hybrid prime mover   |
| 2240/50  | . Bearings   |
| 2240/51  | . . for cantilever assemblies  |
| 2240/52  | . . for assemblies with supports on both sides   |
| 2240/54  | . . Hydrostatic or hydrodynamic bearing assemblies specially adapted for rotary positive displacement pumps or compressors |
| 2240/56  | . . Bearing bushings or details thereof  |
| 2240/60  | . Shafts   |
| 2240/601 | . . Shaft flexion  |
| 2240/603 | . . with internal channels for fluid distribution, e.g. hollow shaft   |
| 2240/605 | . . Shaft sleeves or details thereof   |
| 2240/70  | . Use of multiplicity of similar components; Modular construction  |
| 2240/80  | . Other components   |
| 2240/801 | . . Wear plates  |

|                |   |                |  |
|----------------|---|----------------|--|
| 2240/802       | . . Liners  | 2270/15        | . Resonance  |
| 2240/803       | . . Electric connectors or cables; Fittings therefor                                  | 2270/155       | . . Controlled or regulated  |
| 2240/804       | . . Accumulators for refrigerant circuits   | 2270/16        | . Wear   |
| 2240/805       | . . Fastening means, e.g. bolts   | 2270/165       | . . Controlled or regulated  |
| 2240/806       | . . Pipes for fluids; Fittings therefor   | 2270/17        | . Tolerance; Play; Gap   |
| 2240/807       | . . Balance weight, counterweight   | 2270/175       | . . Controlled or regulated  |
| 2240/808       | . . Electronic circuits (e.g. inverters) installed inside the machine                 | 2270/18        | . Pressure   |
| 2240/809       | . . Lubricant sump  | 2270/185       | . . Controlled or regulated  |
| 2240/81        | . . Sensor, e.g. electronic sensor for control or monitoring                          | 2270/19        | . Temperature  |
| 2240/811       | . . Actuator for control, e.g. pneumatic, hydraulic, electric                         | 2270/195       | . . Controlled or regulated  |
|                |   | 2270/20        | . Flow   |
| <b>2250/00</b> | <b>Geometry</b>   | 2270/205       | . . Controlled or regulated  |
| 2250/10        | . of the inlet or outlet  | 2270/21        | . Pressure difference  |
| 2250/101       | . . of the inlet  | 2270/215       | . . Controlled or regulated  |
| 2250/102       | . . of the outlet   | 2270/22        | . Temperature difference   |
| 2250/20        | . of the rotor  | 2270/225       | . . Controlled or regulated  |
| 2250/201       | . . conical shape   | 2270/23        | . Working cycle timing control   |
| 2250/30        | . of the stator   | 2270/24        | . Level of liquid, e.g. lubricant or cooling liquid  |
| 2250/301       | . . compression chamber profile defined by a mathematical expression or by parameters | 2270/40        | . Conditions across a pump or machine  |
|                |   | 2270/42        | . Conditions at the inlet of a pump or machine   |
| <b>2270/00</b> | <b>Control; Monitoring or safety arrangements</b>                                     | 2270/44        | . Conditions at the outlet of a pump or machine  |
| 2270/01        | . Load  | 2270/46        | . Conditions in the working chamber  |
| 2270/015       | . . Controlled or regulated   | 2270/48        | . Conditions of a reservoir linked to a pump or machine  |
| 2270/02        | . Power   | 2270/50        | . Conditions before a throttle   |
| 2270/025       | . . Controlled or regulated   | 2270/52        | . Conditions after a throttle  |
| 2270/03        | . Torque  | 2270/54        | . Conditions in a control cylinder/piston unit   |
| 2270/035       | . . Controlled or regulated   | 2270/56        | . Number of pump/machine units in operation  |
| 2270/04        | . Force   | 2270/58        | . Valve parameters   |
| 2270/041       | . . Controlled or regulated   | 2270/585       | . . Controlled or regulated  |
| 2270/042       | . . radial  | 2270/60        | . Prime mover parameters   |
| 2270/0421      | . . . Controlled or regulated   | 2270/605       | . . Controlled or regulated  |
| 2270/0422      | . . . centrifugal   | 2270/70        | . Safety, emergency conditions or requirements   |
| 2270/04225     | . . . . Controlled or regulated   | 2270/701       | . . Cold start   |
| 2270/044       | . . axial   | 2270/72        | . . preventing reverse rotation  |
| 2270/0445      | . . . Controlled or regulated   | 2270/78        | . Warnings   |
| 2270/05        | . Speed   | 2270/782       | . . Sound  |
| 2270/051       | . . Controlled or regulated   | 2270/784       | . . Light  |
| 2270/052       | . . angular   | 2270/80        | . Diagnostics  |
| 2270/0525      | . . . Controlled or regulated   | 2270/86        | . Detection  |
| 2270/054       | . . linear  | 2270/90        | . Remote control, e.g. wireless, via LAN, by radio, or by a wired connection from a central computer       |
| 2270/0545      | . . . Controlled or regulated   |                |  |
| 2270/06        | . Acceleration  | <b>2280/00</b> | <b>Arrangements for preventing or removing deposits or corrosion</b>                                       |
| 2270/065       | . . Controlled or regulated   | 2280/02        | . Preventing solid deposits in pumps, e.g. in vacuum pumps with chemical vapour deposition [CVD] processes |
| 2270/07        | . Electric current  | 2280/04        | . Preventing corrosion   |
| 2270/075       | . . Controlled or regulated   |                |  |
| 2270/08        | . Amplitude of electric current   |                |  |
| 2270/085       | . . Controlled or regulated   |                |  |
| 2270/09        | . Electric current frequency  |                |  |
| 2270/095       | . . Controlled or regulated   |                |  |
| 2270/10        | . Voltage   |                |  |
| 2270/105       | . . Controlled or regulated   |                |  |
| 2270/11        | . Magnetic flux   |                |  |
| 2270/115       | . . Controlled or regulated   |                |  |
| 2270/12        | . Vibration   |                |  |
| 2270/125       | . . Controlled or regulated   |                |  |
| 2270/13        | . Noise   |                |  |
| 2270/135       | . . Controlled or regulated   |                |  |
| 2270/14        | . Pulsations  |                |  |
| 2270/145       | . . Controlled or regulated   |                |  |