

# 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)

## F04D NON-POSITIVE-DISPLACEMENT PUMPS (engine fuel-injection pumps [F02M](#); ion pumps [H01J 41/12](#); electrodynamic pumps [H02K 44/02](#))

### NOTES

1. This subclass covers non-positive-displacement pumps for liquids, for elastic fluids, or for liquids and elastic fluids whether rotary or not having pure rotation.
2. This subclass does not cover combinations of non-positive-displacement pumps with other pumps, which are covered by subclass [F04B](#), except that the use of such other pumps for priming or boosting non-positive-displacement is covered by this subclass.
3. Attention is drawn to the Notes preceding class [F01](#), especially as regards the definition of "pump".

### 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.

### Pumping liquids, or liquids and elastic fluids, by rotary pumps (pumping liquids and elastic fluids at the same time [F04D 31/00](#))

- 1/00 Radial-flow pumps, e.g. centrifugal pumps; Helico-centrifugal pumps (adapted for pumping specific fluids [F04D 7/00](#); priming or boosting [F04D 9/00](#))**
  - 1/003 . {Having contrarotating parts}
  - 1/006 . {double suction pumps}
  - 1/02 . having non-centrifugal stages, e.g. centripetal
  - 1/025 . . {Comprising axial and radial stages}
  - 1/04 . Helico-centrifugal pumps
  - 1/06 . Multi-stage pumps ([F04D 1/02](#), [F04D 13/10](#) take precedence)
  - 1/063 . . {of the vertically split casing type}
  - 1/066 . . . {the casing consisting of a plurality of annuli bolted together}
  - 1/08 . . the stages being situated concentrically
  - 1/10 . . with means for changing the flow-path through the stages, e.g. series-parallel, e.g. side loads
  - 1/12 . Pumps with scoops or like paring members protruding in the fluid circulating in a bowl
  - 1/14 . Pumps raising fluids by centrifugal force within a conical rotary bowl with vertical axis
- 3/00 Axial-flow pumps (priming or boosting [F04D 9/00](#))**
  - 3/005 . {with a conventional single stage rotor}
  - 3/02 . of screw type
- 5/00 Pumps with circumferential or transverse flow {(control thereof [F04D 15/005](#))}**
  - 5/001 . {Shear force pumps}
  - 5/002 . {Regenerative pumps (for elastic fluids [F04D 23/008](#))}
  - 5/003 . . {of multistage type}
  - 5/005 . . . {the stages being radially offset}

- 5/006 . . . {the stages being axially offset}
- 5/007 . . {Details of the inlet or outlet}
- 5/008 . . {Details of the stator, e.g. channel shape}
- 7/00 Pumps adapted for handling specific fluids, e.g. by selection of specific materials for pumps or pump parts ([F04D 11/005](#), [F04D 29/22](#) take precedence)**
  - 7/02 . of centrifugal type
  - 7/04 . . the fluids being viscous or non-homogenous
  - 7/045 . . . {with means for comminuting, mixing stirring or otherwise treating}
  - 7/06 . . the fluids being hot or corrosive, e.g. liquid metals
  - 7/065 . . . {for liquid metal}
  - 7/08 . . the fluids being radioactive
- 9/00 Priming; Preventing vapour lock**
  - 9/001 . {Preventing vapour lock ([F04D 9/041](#) takes precedence)}
  - 9/002 . . {by means in the very pump ([F04D 9/041](#) takes precedence)}
  - 9/003 . . . {separating and removing the vapour}
  - 9/004 . {Priming of not self-priming pumps}
  - 9/005 . . {by adducting or recycling liquid ([F04D 9/006](#) takes precedence)}
  - 9/006 . . {by venting gas or using gas valves}
  - 9/007 . {Preventing loss of prime, siphon breakers (stopping of pumps [F04D 15/02](#))}
  - 9/008 . . {by means in the suction mouth, e.g. foot valves}
  - 9/02 . Self-priming pumps
  - 9/04 . using priming pumps; using booster pumps to prevent vapour-lock
  - 9/041 . . {the priming pump having evacuating action ([F04D 9/043](#) and [F04D 9/06](#) take precedence)}

- 9/042 . . . {and means for rendering its in operative}
- 9/043 . . {the priming pump being hand operated or of the reciprocating type}
- 9/044 . . {Means for rendering the priming pump inoperative}
- 9/045 . . . {the means being liquid level sensors}
- 9/046 . . . . {the means being floats}
- 9/047 . . . {the means being flow sensors}
- 9/048 . . . {the means being outlet pressure sensors}
- 9/049 . . . {by operator interventions}
- 9/06 . . of jet type
- 9/065 . . . {the driving fluid being a gas or vapour, e.g. exhaust of a combustion engine}

**11/00 Other rotary non-positive-displacement pumps (pumping installations or systems [F04D 13/00](#))**

- 11/005 . {Swash-type impeller pumps}

**13/00 Pumping installations or systems (controlling [F04D 15/00](#))**

- 13/02 . Units comprising pumps and their driving means (predominant aspects of the driving means, [see the relevant classes for such means](#))
- 13/021 . . {containing a coupling}
- 13/022 . . . {a coupling allowing slip, e.g. torque converter}
- 13/023 . . . . {for reducing start torque}
- 13/024 . . . {a magnetic coupling}
- 13/025 . . . . {Details of the can separating the pump and drive area}
- 13/026 . . . . {Details of the bearings}
- 13/027 . . . . {Details of the magnetic circuit}
- 13/028 . . {the driving means being a planetary gear}
- 13/04 . . the pump being fluid driven
- 13/043 . . . {the pump wheel carrying the fluid driving means}
- 13/046 . . . {the fluid driving means being a hydraulic motor of the positive displacement type}
- 13/06 . . the pump being electrically driven
- 13/0606 . . . {Canned motor pumps}
- 13/0613 . . . . {Special connection between the rotor compartments}
- 13/062 . . . . {pressure compensation between motor- and pump- compartment}
- 13/0626 . . . . {Details of the can}
- 13/0633 . . . . {Details of the bearings}
- 13/064 . . . . {Details of the magnetic circuit}
- 13/0646 . . . {the hollow pump or motor shaft being the conduit for the working fluid}
- 13/0653 . . . {the motor being flooded}
- 13/066 . . . {Floating-units}
- 13/0666 . . . {the motor being of the plane gap type}
- 13/0673 . . . {the motor being of the inside-out type}
- 13/068 . . . {Battery powered}
- 13/0686 . . . {Mechanical details of the pump control unit (pump control [F04D 15/00](#))}
- 13/0693 . . . {Details or arrangements of the wiring}
- 13/08 . . . for submerged use
- 13/083 . . . . {and protected by a gas-bell}
- 13/086 . . . . {the pump and drive motor are both submerged}
- 13/10 . . . . adapted for use in mining bore holes

- 13/12 . Combinations of two or more pumps (combinations with priming pumps or booster pumps to counteract vapour-lock [F04D 9/04](#))
- 13/14 . . the pumps being all of centrifugal type ((deviation valves [F04D 15/0016](#))}
- 13/16 . with storage reservoirs

**15/00 Control, e.g. regulation, of pumps, pumping installations or systems**

- 15/0005 . {by using valves}
- 15/0011 . . {by-pass valves}
- 15/0016 . . {mixing-reversing- or deviation valves}
- 15/0022 . . {throttling valves or valves varying the pump inlet opening or the outlet opening}
- 15/0027 . {Varying behaviour or the very pump ([F04D 15/0055](#) and [F04D 29/46](#) take precedence)}
- 15/0033 . . {By-passing by increasing clearance between impeller and its casing}
- 15/0038 . . {by varying the effective cross-sectional area of flow through the rotor}
- 15/0044 . . {by introducing a gas}
- 15/005 . . {the pumps being of the circumferential flow type}
- 15/0055 . {Rotors with adjustable blades}
- 15/0061 . . {responsive to temperature}
- 15/0066 . {by changing the speed, e.g. of the driving engine}
- 15/0072 . {Installation or systems with two or more pumps, wherein the flow path through the stages can be changed, e.g. series-parallel}
- 15/0077 . {Safety measures ([F04D 15/02](#) takes precedence)}
- 15/0083 . . {Protection against sudden pressure change, e.g. check valves}
- 15/0088 . {Testing machines}
- 15/0094 . {Indicators of rotational movement}
- 15/02 . Stopping of pumps, or operating valves, on occurrence of unwanted conditions
- 15/0209 . . {responsive to a condition of the working fluid ([F04D 15/029](#) takes precedence)}
- 15/0218 . . . {the condition being a liquid level or a lack of liquid supply}
- 15/0227 . . . . {Lack of liquid level being detected using a flow transducer}
- 15/0236 . . . . {Lack of liquid level being detected by analysing the parameters of the electric drive, e.g. current or power consumption}
- 15/0245 . . {responsive to a condition of the pump}
- 15/0254 . . . {the condition being speed or load}
- 15/0263 . . . {the condition being temperature, ingress of humidity or leakage}
- 15/0272 . . . {the condition being wear or a position}
- 15/0281 . . {responsive to a condition not otherwise provided for}
- 15/029 . . {for pumps operating in parallel}

**Pumping elastic fluids by rotary pumps**

**17/00 Radial-flow pumps, e.g. centrifugal pumps; Helico-centrifugal pumps ([F04D 21/00](#) takes precedence)**

- 17/02 . having non-centrifugal stages, e.g. centripetal
- 17/025 . . {comprising axial flow and radial flow stages}
- 17/04 . . of transverse-flow type
- 17/06 . Helico-centrifugal pumps
- 17/08 . Centrifugal pumps
- 17/10 . . for compressing or evacuating

- 17/105 . . . {with double suction}
- 17/12 . . . Multi-stage pumps
- 17/122 . . . . {the individual rotor discs being, one for each stage, on a common shaft and axially spaced, e.g. conventional centrifugal multi-stage compressors}
- 17/125 . . . . . {the casing being vertically split}
- 17/127 . . . . {with radially spaced stages, e.g. for contrarotating type}
- 17/14 . . . . with means for changing the flow-path through the stages, e.g. series-parallel, e.g. side-loads, (surge control F04D 27/02)
- 17/16 . . for displacing without appreciable compression
- 17/161 . . . {Shear force pumps}
- 17/162 . . . {Double suction pumps}
- 17/164 . . . {Multi-stage fans, e.g. for vacuum cleaners}
- 17/165 . . . {Axial entry and discharge}
- 17/167 . . . {Operating by means of fibrous or porous elements (suction filters F04D 29/701), e.g. with sponge rotors}
- 17/168 . . . {Pumps specially adapted to produce a vacuum}
- 17/18 . . characterised by use of centrifugal force of liquids entrained in pumps {(, e.g. by means of an auxiliary liquid; fluid ring compressors F04C 19/00)}
- 19/00 Axial-flow pumps (F04D 21/00 takes precedence; {pump comprising axial flow and radial flow stages F04D 17/025})**
- 19/002 . {Axial flow fans}
- 19/005 . . {reversible fans}
- 19/007 . {multistage fans}
- 19/02 . Multi-stage pumps
- 19/022 . . {with concentric rows of vanes;}
- 19/024 . . {with contrarotating parts}
- 19/026 . . {with a plurality of shafts rotating at different speeds (F04D 19/022 takes precedence)}
- 19/028 . . {Layout of fluid flow through the stages}
- 19/04 . . specially adapted to the production of a high vacuum, e.g. molecular pumps
- 19/042 . . . {Turbomolecular vacuum pumps}
- 19/044 . . . {Holweck-type pumps}
- 19/046 . . . {Combinations of two or more different types of pumps}
- 19/048 . . . {comprising magnetic bearings}
- 21/00 Pump involving supersonic speed of pumped fluids**
- 23/00 Other rotary non-positive-displacement pumps (pumping installations or systems F04D 25/00)**
- 23/001 . {Pumps adapted for conveying materials or for handling specific elastic fluids}
- 23/003 . . {of radial-flow type}
- 23/005 . . {of axial-flow type}
- 23/006 . {Creating a pulsating flow}
- 23/008 . {Regenerative pumps (for liquids or for liquids and elastic fluids F04D 5/002)}
- 25/00 Pumping installations or systems (controlling F04D 27/00)**
- 25/02 . Units comprising pumps and their driving means (predominant aspect of the driving means, see the relevant classes for such means)
- 25/022 . . {comprising a yielding coupling, e.g. hydraulic (a magnetic coupling F04D 25/026)}
- 25/024 . . {the driving means being assisted by a power recovery turbine}
- 25/026 . . {with a magnetic coupling}
- 25/028 . . {the driving means being a planetary gear}
- 25/04 . . the pump being fluid-driven {(pumps driven by exhaust gases F02B 37/00, F02B 39/00; turbochargers F02C 6/12)}
- 25/045 . . . {the pump wheel carrying the fluid driving means, e.g. turbine blades}
- 25/06 . . the pump being electrically driven (F04D 25/08 takes precedence)
- 25/0606 . . . {the electric motor being specially adapted for integration in the pump}
- 25/0613 . . . . {the electric motor being of the inside-out type, i.e. the rotor is arranged radially outside a central stator}
- 25/062 . . . . . {Details of the bearings}
- 25/0626 . . . . . {Details of the lubrication}
- 25/0633 . . . . . {Details of the magnetic circuit}
- 25/064 . . . . . {Details of the rotor}
- 25/0646 . . . . . {Details of the stator}
- 25/0653 . . . . {the motor having a plane air gap, e.g. disc-type}
- 25/066 . . . . {Linear Motors}
- 25/0666 . . . . {a sensor is integrated into the pump/motor design}
- 25/0673 . . . {Battery powered}
- 25/068 . . . {Mechanical details of the pump control unit (pump control details F04D 27/00)}
- 25/0686 . . . {specially adapted for submerged use}
- 25/0693 . . . {Details or arrangements of the wiring}
- 25/08 . . the working fluid being air, e.g. for ventilation
- 25/082 . . . {the unit having provision for cooling the motor}
- 25/084 . . . {hand fans}
- 25/086 . . . . {hand operated}
- 25/088 . . . {Ceiling fans}
- 25/10 . . . the unit having provisions for automatically changing direction of output air
- 25/105 . . . . {by changing rotor axis direction, e.g. oscillating fans (interconnecting rotary motion and oscillating motion F16H)}
- 25/12 . . . the unit being adapted for mounting in apertures
- 25/14 . . . . and having shutters, e.g. automatically closed when not in use
- 25/16 . . Combinations of two or more pumps {Producing two or more separate gas flows}
- 25/163 . . {driven by a common gearing arrangement}
- 25/166 . . {using fans}
- 27/00 Control, e.g. regulation, of pumps, pumping installations or systems**
- 27/001 . {Testing thereof; Determination or simulation of flow characteristics; Stall or surge detection, e.g. condition monitoring}
- 27/002 . {by varying geometry within the pumps, e.g. by adjusting vanes}
- 27/003 . {by throttling (F04D 27/002 takes precedence)}
- 27/004 . {by varying driving speed}

- 27/005 . {by changing flow path between different stages or between a plurality of compressors; Load distribution between compressors}
- 27/006 . {by influencing fluid temperatures}
- 27/007 . {Conjoint control of two or more different functions}
- 27/008 . {Stop safety or alarm devices, e.g. stop-and-go control; Disposition of check-valves}
- 27/009 . {by bleeding, by passing or recycling fluid}
- 27/02 . Surge control {(surge detection [F04D 27/001](#))}
- 27/0207 . . {by bleeding, bypassing or recycling fluids (influencing the boundary layer by an uncontrolled bleeding of the working fluid [F04D 29/681](#))}
- 27/0215 . . . {Arrangements therefor, e.g. bleed or by-pass valves}
- 27/0223 . . . {Control schemes therefor}
- 27/023 . . . {Details or means for fluid extraction}
- 27/0238 . . . {Details or means for fluid reinjection}
- 27/0246 . . {by varying geometry within the pumps, e.g. by adjusting vanes}
- 27/0253 . . {by throttling ([F04D 27/0246](#) takes precedence)}
- 27/0261 . . {by varying driving speed}
- 27/0269 . . {by changing flow path between different stages or between a plurality of compressors; load distribution between compressors}
- 27/0276 . . {by influencing fluid temperature}
- 27/0284 . . {Conjoint control of two or more different functions}
- 27/0292 . . {Stop safety or alarm devices, e.g. stop-and-go control; Disposition of check-valves}
- 29/00 Details, component parts, or accessories (machine elements in general [F16](#))**
  - 29/002 . {especially adapted for elastic fluid pumps}
  - 29/005 . {Decorative aspects, i.e. features which have no effect on the functioning of the pump}
  - 29/007 . {especially adapted for liquid pumps}
  - 29/02 . Selection of particular materials (for handling specific liquids [F04D 7/00](#) {[F04D 23/001](#)})
  - 29/023 . . {especially adapted for elastic fluid pumps}
  - 29/026 . . {especially adapted for liquid pumps}
  - 29/04 . Shafts or bearings, or assemblies thereof (specially adapted for elastic fluid pumps [F04D 29/05](#))
  - 29/0405 . . {joining shafts, e.g. rigid couplings, quill shafts}
- WARNING**

The group [F04D 29/0405](#) is no longer used for the classification of new documents as from July 1st, 2007. The backlog of this group is being continuously reclassified to [F04D 29/044](#) and [F04D 29/054](#)
- 29/041 . . Axial thrust balancing
- 29/0413 . . . {hydrostatic; hydrodynamic thrust bearings}
- 29/0416 . . . {balancing pistons}
- 29/042 . . Axially shiftable rotors ([F04D 29/041](#) takes precedence {; control by creating a by-pass [F04D 15/0027](#)})
- 29/043 . . Shafts
- 29/044 . . . Arrangements for joining or assembling shafts
- 29/046 . . Bearings
- 29/0462 . . . {Bearing cartridges}
- 29/0465 . . . {Ceramic bearing designs}
- 29/0467 . . . {Spherical bearings}
- 29/047 . . . hydrostatic; hydrodynamic
- 29/0473 . . . . {for radial pumps}
- 29/0476 . . . . {for axial pumps}
- 29/048 . . . magnetic; electromagnetic
- 29/049 . . . Roller bearings
- 29/05 . Shafts or bearings, or assemblies thereof, specially adapted for elastic fluid pumps
  - 29/051 . . Axial thrust balancing
  - 29/0513 . . . {hydrostatic; hydrodynamic thrust bearings}
  - 29/0516 . . . {balancing pistons}
  - 29/052 . . Axially shiftable rotors ([F04D 29/051](#) takes precedence {; control by creating a by-pass [F04D 27/0246](#)})
- 29/053 . . Shafts
- 29/054 . . . Arrangements for joining or assembling shafts
- 29/056 . . Bearings
- 29/0563 . . . {Bearing cartridges}
- 29/0566 . . . {Ceramic bearing designs}
- 29/057 . . . hydrostatic; hydrodynamic
- 29/058 . . . magnetic; electromagnetic
- 29/059 . . . Roller bearings
- 29/06 . Lubrication {([F04D 13/0606](#), [F04D 13/0646](#), [F04D 13/0653](#) take precedence)}
- 29/061 . . {especially adapted for liquid pumps}
- 29/063 . . specially adapted for elastic fluid pumps
- 29/08 . Sealings
- 29/083 . . {especially adapted for elastic fluid pumps}
- 29/086 . . {especially adapted for liquid pumps}
- 29/10 . Shaft sealings
- 29/102 . . . {especially adapted for elastic fluid pumps}
- 29/104 . . . . {the sealing fluid being other than the working fluid or being the working fluid treated}
- 29/106 . . . {especially adapted for liquid pumps}
- 29/108 . . . . {the sealing fluid being other than the working liquid or being the working liquid treated}
- 29/12 . . . using sealing-rings
- 29/122 . . . . {especially adapted for elastic fluid pumps}
- 29/124 . . . . . {with special means for adducting cooling or sealing fluid}
- 29/126 . . . . {especially adapted for liquid pumps}
- 29/128 . . . . . {with special means for adducting cooling or sealing fluid}
- 29/14 . . . operative only when pump is inoperative
- 29/143 . . . . {especially adapted for elastic fluid pumps}
- 29/146 . . . . {especially adapted for liquid pumps}
- 29/16 . . between pressure and suction sides
- 29/161 . . . {especially adapted for elastic fluid pumps}
- 29/162 . . . . {of a centrifugal flow wheel}
- 29/164 . . . . {of an axial flow wheel}
- 29/165 . . . {especially adapted for liquid pumps}
- 29/167 . . . . {of a centrifugal flow wheel}
- 29/168 . . . . {of an axial flow wheel}
- 29/18 . Rotors (specially for elastic fluids [F04D 29/26](#))
- 29/181 . . {Axial flow rotors ([F04D 29/185](#) take precedence)}
- 29/183 . . . {Semi axial flow rotors}
- 29/185 . . {Rotors consisting of a plurality of wheels}
- 29/186 . . {Shaftless rotors ([F04D 13/024](#) takes precedence)}



- 29/188 . . {specially for regenerative pumps}
- 29/20 . . Mounting rotors on shafts
- 29/22 . . specially for centrifugal pumps
- 29/2205 . . . {Conventional flow pattern ([F04D 29/18](#) takes precedence)}
- 29/2211 . . . . {More than one set of flow passages}
- 29/2216 . . . . {Shape, geometry ([F04D 29/2211](#) takes precedence)}
- 29/2222 . . . . {Construction and assembly ([F04D 29/2211](#) takes precedence)}
- 29/2227 . . . . . {for special materials}
- 29/2233 . . . . . {entirely open or stamped from one sheet}
- 29/2238 . . . {Special flow patterns ([F04D 11/005](#) takes precedence)}
- 29/2244 . . . . {Free vortex}
- 29/225 . . . . {Channel wheels, e.g. one blade or one flow channel}
- 29/2255 . . . . {flow-channels with a special cross-section contour, e.g. ejecting, throttling or diffusing effect}
- 29/2261 . . . {with special measures}
- 29/2266 . . . . {for sealing or thrust balance ([F04D 29/04](#) and [F04D 29/16](#) take precedence)}
- 29/2272 . . . . {for influencing flow or boundary layer}
- 29/2277 . . . . {for increasing NPSH or dealing with liquids near boiling-point}
- 29/2283 . . . . {for reverse pumping action}
- 29/2288 . . . . {for comminuting, mixing or separating}
- 29/2294 . . . . {for protection, e.g. against abrasion}
- 29/24 . . . Vanes
- 29/242 . . . . {Geometry, shape}
- 29/245 . . . . . {for special effects}
- 29/247 . . . . {elastic or self-adjusting}
- 29/26 . . Rotors specially for elastic fluids
- 29/263 . . {mounting fan or blower rotors on shafts}
- 29/266 . . {mounting compressor rotors on shafts}
- 29/28 . . for centrifugal or helico-centrifugal pumps {for radial-flow or helico-centrifugal pumps}
- 29/281 . . . {for fans or blowers}
- 29/282 . . . . {the leading edge of each vane being substantially parallel to the rotation axis}
- 29/283 . . . . . {rotors of the squirrel-cage type}
- 29/284 . . . {for compressors}
- 29/285 . . . . {the compressor wheel comprising a pair of rotatable bladed hub portions axially aligned and clamped together}
- 29/286 . . . . {multi-stage rotors}
- 29/287 . . . {with adjusting means}
- 29/288 . . . {Part of the wheel having an ejecting effect, e.g. being bladeless diffuser}
- 29/289 . . . {having provision against erosion or for dust-separation}
- 29/30 . . . Vanes
- 29/305 . . . . {Flexible vanes}
- 29/32 . . for axial flow pumps
- 29/321 . . . {for axial flow compressors}
- 29/322 . . . . {Blade mountings}
- 29/323 . . . . . {adjustable}
- 29/324 . . . . {Blades}
- 29/325 . . . {for axial flow fans (blade mountings [F04D 29/34](#), blades [F04D 29/38](#))}
- 29/326 . . . . {comprising a rotating shroud}
- 29/327 . . . . {with non identical blades}
- 29/328 . . . . . {with unequal distribution of blades around the hub}
- 29/329 . . . . . {Details of the hub}
- 29/34 . . . Blade mountings {(for axial flow compressors [F04D 29/322](#))}
- 29/36 . . . . adjustable {(flexible blades [F04D 29/382](#))}
- 29/362 . . . . . {during rotation}
- 29/364 . . . . . {The blades having only a predetermined number of possible positions}
- 29/366 . . . . . {Adjustment by interaction of inertia and lift}
- 29/368 . . . . . {Adjustment by differences of temperature}
- 29/38 . . . Blades {(for axial flow compressors [F04D 29/324](#))}
- 29/382 . . . . {Flexible blades}
- 29/384 . . . . {characterised by form}
- 29/386 . . . . . {Skewed blades}
- 29/388 . . . . {characterised by construction}
- 29/40 . . Casings; Connections of working fluid {(bleed or by-pass valves [F04D 15/0011](#), [F04D 27/0215](#))}
- 29/403 . . {especially adapted for elastic fluid pumps}
- 29/406 . . {especially adapted for liquid pumps}
- 29/42 . . for radial or helico-centrifugal pumps
- 29/4206 . . . {especially adapted for elastic fluid pumps}
- 29/4213 . . . . {suction ports}
- 29/422 . . . . {Discharge tongues ([F04D 17/04](#) takes precedence)}
- 29/4226 . . . . {Fan casings}
- 29/4233 . . . . . {with volutes extending mainly in axial or radially inward direction}
- 29/424 . . . . . {Double entry casings}
- 29/4246 . . . . . {comprising more than one outlet}
- 29/4253 . . . . . {with axial entry and discharge}
- 29/426 . . . {especially adapted for liquid pumps}
- 29/4266 . . . . {made of sheet metal}
- 29/4273 . . . . {suction eyes}
- 29/428 . . . . {Discharge tongues ([F04D 17/04](#) takes precedence)}
- 29/4286 . . . . . {inside lining, e.g. rubber}
- 29/4293 . . . . . {Details of fluid inlet or outlet}
- 29/44 . . . Fluid-guiding means, e.g. diffusers
- 29/441 . . . . {especially adapted for elastic fluid pumps}
- 29/442 . . . . . {rotating diffusers}
- 29/444 . . . . . {Bladed diffusers}
- 29/445 . . . . {especially adapted for liquid pumps}
- 29/447 . . . . . {rotating diffusers}
- 29/448 . . . . . {bladed diffusers}
- 29/46 . . . . adjustable
- 29/462 . . . . . {especially adapted for elastic fluid pumps}
- 29/464 . . . . . {adjusting flow cross-section, otherwise than by using adjustable stator blades}
- 29/466 . . . . . {especially adapted for liquid fluid pumps}
- 29/468 . . . . . {adjusting flow cross-section, otherwise than by using adjustable stator blades}
- 29/48 . . . . . for unidirectional fluid flow in reversible pumps {(rotors for reverse action [F04D 29/283](#))}
- 29/483 . . . . . {especially adapted for elastic fluid pumps}

- 29/486 . . . . . {especially adapted for liquid pumps}
- 29/50 . . . . . for reversing fluid flow {(rotors for reverse action [F04D 29/2283](#))}
- 29/503 . . . . . {especially adapted for elastic fluid pumps}
- 29/506 . . . . . {especially adapted for liquid pumps}
- 29/52 . . . . . for axial pumps
- 29/522 . . . . . {especially adapted for elastic fluid pumps}
- 29/524 . . . . . {shiftable members for obturating part of the flow path}
- 29/526 . . . . . {Details of the casing section radially opposing blade tips ([ducts F04D 29/545](#))}
- 29/528 . . . . . {especially adapted for liquid pumps}
- 29/54 . . . . . Fluid-guiding means, e.g. diffusers
- 29/541 . . . . . {Specially adapted for elastic fluid pumps ([F04D 29/56 takes precedence](#))}
- 29/542 . . . . . {Bladed diffusers ([fixing blades to stators F01D 9/042](#))}
- 29/544 . . . . . {Blade shapes}
- 29/545 . . . . . {Ducts}
- 29/547 . . . . . {having a special shape in order to influence fluid flow}
- 29/548 . . . . . {Specially adapted for liquid pumps ([F04D 29/56 takes precedence](#))}
- 29/56 . . . . . adjustable
- 29/563 . . . . . {specially adapted for elastic fluid pumps}
- 29/566 . . . . . {specially adapted for liquid pumps}
- 29/58 . . . . . Cooling ([of machines or engines in general F01P](#)); Heating; Diminishing heat transfer {(for the motor of air-pump units [F04D 25/082](#); cooling of shafts or bearings [F04D 29/04](#))}
- 29/5806 . . . . . {Cooling the drive system}
- 29/5813 . . . . . {Cooling the control unit}
- 29/582 . . . . . {specially adapted for elastic fluid pumps}
- 29/5826 . . . . . {Cooling at least part of the working fluid in a heat exchanger}
- 29/5833 . . . . . {flow schemes and regulation thereto}
- 29/584 . . . . . {cooling or heating the machine ([F04D 29/5846](#), [F04D 29/5853 take precedence](#))}
- 29/5846 . . . . . {cooling by injection}
- 29/5853 . . . . . {heat insulation or conduction}
- 29/586 . . . . . {specially adapted for liquid pumps}
- 29/5866 . . . . . {Cooling at last part of the working fluid in a heat exchanger}
- 29/5873 . . . . . {flow schemes and regulation thereto}
- 29/588 . . . . . {cooling or heating the machine ([F04D 29/5886](#), [F04D 29/5893 take precedence](#))}
- 29/5886 . . . . . {cooling by injection}
- 29/5893 . . . . . {heat insulation or conduction}
- 29/60 . . . . . Mounting; Assembling; Disassembling {([F04D 13/10 takes precedence](#))}
- 29/601 . . . . . {specially adapted for elastic fluid pumps}
- 29/602 . . . . . {Mounting in cavities}
- 29/603 . . . . . {means for positioning from outside}
- 29/604 . . . . . {means for removing without depressurizing the cavity}
- 29/605 . . . . . {specially adapted for liquid pumps}
- 29/606 . . . . . {Mounting in cavities}
- 29/607 . . . . . {means for positioning from outside}
- 29/608 . . . . . {means for removing without depressurizing the cavity}
- 29/62 . . . . . of radial or helico-centrifugal pumps
- 29/622 . . . . . {Adjusting the clearances between rotary and stationary parts}
- 29/624 . . . . . {especially adapted for elastic fluid pumps}
- 29/626 . . . . . {Mounting or removal of fans}
- 29/628 . . . . . {especially adapted for liquid pumps}
- 29/64 . . . . . of axial pumps
- 29/642 . . . . . {by adjusting the clearances between rotary and stationary parts}
- 29/644 . . . . . {especially adapted for elastic fluid pumps}
- 29/646 . . . . . {Mounting or removal of fans}
- 29/648 . . . . . {especially adapted for liquid pumps}
- 29/66 . . . . . Combating cavitation, whirls, noise, vibration or the like ([gas-flow silencers for machines or engines in general F01N](#)); Balancing (surge control [F04D 27/02](#))
- 29/661 . . . . . {especially adapted for elastic fluid pumps}
- 29/662 . . . . . {Balancing of rotors ([compensating unbalance G01M 1/36](#))}
- 29/663 . . . . . {Sound attenuation}
- 29/664 . . . . . {by means of sound absorbing material}
- 29/665 . . . . . {by means of resonance chambers or interference}
- 29/666 . . . . . {by means of rotor construction or layout, e.g. unequal distribution of blades or vanes}
- 29/667 . . . . . {by influencing the flow pattern, e.g. suppression of turbulence}
- 29/668 . . . . . {damping or preventing mechanical vibrations}
- 29/669 . . . . . {especially adapted for liquid pumps ([F04D 29/18 takes precedence](#))}
- 29/68 . . . . . by influencing boundary layers {(by bleeding elastic fluid [F04D 27/0215](#))}
- 29/681 . . . . . {especially adapted for elastic fluid pumps}
- 29/682 . . . . . {by fluid extraction}
- 29/684 . . . . . {by fluid injection}
- 29/685 . . . . . {Inducing localised fluid recirculation in the stator-rotor interface}
- 29/687 . . . . . {Plasma actuators therefore}
- 29/688 . . . . . {especially adapted for liquid pumps}
- 29/70 . . . . . Suction grids; Strainers; Dust separation; Cleaning
- 29/701 . . . . . {especially adapted for elastic fluid pumps}
- 29/703 . . . . . {specially for fans, e.g. fan guards}
- 29/705 . . . . . {Adding liquids}
- 29/706 . . . . . {Humidity separation}
- 29/708 . . . . . {specially for liquid pumps}

#### Other non-positive-displacement pumps

- 31/00** Pumping liquids and elastic fluids at the same time
- 33/00** Non-positive-displacement pumps with other than pure rotation, e.g. of oscillating type ([F04D 35/00 takes precedence](#); hand-held fans [A45B](#))
- 35/00** Pumps producing waves in liquids, i.e. wave-producers (for bath tubs [A47K 3/10](#))