

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
- 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
 - 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 pumping systems specially adapted for elastic fluids**
 - 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 . . . {Bearings 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}
- 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 29/2283](#))}
- 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 depressurising 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 imbalance 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](#))**