CPC COOPERATIVE PATENT CLASSIFICATION

F04D NON-POSITIVE DISPLACEMENT PUMPS

NOTE

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.

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.

Attention is drawn to the Notes preceding class F01, especially as regards the definition of "pump".

Guidance heading: **Pumping liquids, or liquids and elastic fluids, by rotary pumps**(pumping liquids and elastic fluids at the same time F04D 31/00)

F04D 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)

F04D 1/003 . {Having contrarotating parts}

F04D 1/006 . {double suction pumps}

F04D 1/02 . having non-centrifugal stages, e.g. centripetal

F04D 1/025 . . {Comprising axial and raidal stages}

F04D 1/04 . Helico-centrifugal pumps

F04D 1/06 . Multi-stage pumps(F04D 1/02 , F04D 13/10 take precedence)

F04D 1/063 . . {of the vertically split casing type}

F04D 1/066 . . . {the casing consisting of a plurality of annuli bolted together}

F04D 1/08 . . the stages being situated concentrically

F04D 1/10 . . with means for changing the flow-path through the stages, e.g. series-parallel, e.g. side loads

F04D 1/12 . Pumps with scoops or like paring members protruding in the fluid circulating in a bowl

F04D 1/14 . Pumps raising fluids by centrifugal force within a conical rotary bowl with vertical axis

F04D 3/00 **Axial-flow pumps**(priming or boosting F04D 9/00)

F04D 3/005 . {with a conventional single stage rotor}

F04D 3/02 . of screw type

F04D 5/00 **Pumps with circumferential or transverse flow**{(control thereof F04D 15/005)}

F04D 5/001 . {Shear force pumps}

F04D 5/002 . {Regenerative pumps(for elastic fluids F04D 23/008)}
F04D 5/003 . . {of multistage type}
F04D 5/005 . . . {the stages being radially offset}
F04D 5/006 . . . {the stages being axially offset}
F04D 5/007 . . {Details of the inlet or outlet}
F04D 5/008 . . {Details of the stator, e.g. channel shape}

F04D 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)

F04D 7/02 . of centrifugal type
F04D 7/04 . . the fluids being viscous or non-homogenous
F04D 7/045 . . . {with means for comminuting, mixing stirring or otherwise treating}
F04D 7/06 . . the fluids being hot or corrosive, e.g. liquid metals
F04D 7/065 . . . {for liquid metal}
F04D 7/08 . . the fluids being radioactive

F04D 9/00 **Priming; Preventing vapour lock**

F04D 9/001 . {Preventing vapour lock(F04D 9/041 takes precedence)}
F04D 9/002 . . {by means in the very pump(F04D 9/041 takes precedence)}
F04D 9/003 . . . {separating and removing the vapour}

F04D 9/004 . {Priming of not self-priming pumps}
F04D 9/005 . . {by adducting or recycling liquid(F04D 9/006 takes precedence)}
F04D 9/006 . . {by venting gas or using gas valves}

F04D 9/007 . {Preventing loss of prime, siphon breakers(stopping of pumps F04D 15/02)}
F04D 9/008 . . {by means in the suction mouth, e.g. foot valves}

F04D 9/02 . Self-priming pumps

F04D 9/04 . Using priming pumps; Using booster pumps to prevent vapour-lock
F04D 9/041 . . {the priming pump having evacuating action(F04D 9/043 and F04D 9/06 take precedence)}
F04D 9/042 . . . {and means for rendering its in operative}
F04D 9/043 . . {the priming pump being hand operated or of the reciprocating type}

F04D 9/044 .. {Means for rendering the priming pump inoperative}
F04D 9/045 ... {the means being liquid level sensors}
F04D 9/046 .... {the means being floats}
F04D 9/047 ... {the means being flow sensors}
F04D 9/048 ... {the means being outlet pressure sensors}
F04D 9/049 ... {by operator interventions}
F04D 9/06 .. of jet type
F04D 9/065 ... {the driving fluid being a gas or vapour, e.g. exhaust of a combustion engine}

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

F04D 11/005 . {Swash-type impeller pumps}

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

F04D 13/02 . Units comprising pumps and their driving means(predominant aspects of the driving means, see the relevant classes for such means)
F04D 13/021 .. {containing a coupling}
F04D 13/022 ... {a coupling allowing slip, e.g. torque converter}
F04D 13/023 .... {for reducing start torque}
F04D 13/024 ... {a magnetic coupling}
F04D 13/025 .... {Details of the can separating the pump and drive area}
F04D 13/026 .... {Details of the bearings}
F04D 13/027 .... {Details of the magnetic circuit}
F04D 13/028 .. {the driving means being a planetary gear}
F04D 13/04 .. the pump being fluid driven
F04D 13/043 ... {the pump wheel carrying the fluid driving means}
F04D 13/046 ... {the fluid driving means being a hydraulic motor of the positive displacement type}
F04D 13/06 .. the pump being electrically driven
F04D 13/0606 ... {Canned motor pumps}
F04D 13/0613 .... {Special connection between the rotor compartments}
F04D 13/062 .... {pressure compensation between motor- and pump- compartment}
F04D 13/0626 .... {Details of the can}
F04D 13/0633 .... {Details of the bearings}
F04D 13/064 .... {Details of the magnetic circuit}
F04D 13/0646 ... {the hollow pump or motor shaft being the conduit for the working fluid}
F04D 13/0653 ... {the motor being flooded}
F04D 13/066 ... {Floating-units}
F04D 13/0666 ... {the motor being of the plane gap type}

F04D 13/0673 . . . {the motor being of the inside-out type}
F04D 13/068 . . . {Battery powered}
F04D 13/0686 . . . {Mechanical details of the pump control unit(pump control F04D 15/00)}
F04D 13/0693 . . . {Details or arrangements of the wiring}
F04D 13/08 . . . for submerged use
F04D 13/083 . . . . {and protected by a gas-bell}
F04D 13/086 . . . . {the pump and drive motor are both submerged}
F04D 13/10 . . . . adapted for use in mining bore holes

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

F04D 13/16 . with storage reservoirs

F04D 15/00 **Control, e.g. regulation, of pumps, pumping installations or systems**

F04D 15/0005 . {by using valves}
F04D 15/0011 . . {by-pass valves}
F04D 15/0016 . . {mixing-reversing- or deviation valves}
F04D 15/0022 . . {throttling valves or valves varying the pump inlet opening or the outlet opening}

F04D 15/0027 . {Varying behaviour or the very pump(F04D 15/0055 and F04D 29/46 take precedence)}
F04D 15/0033 . . {By-passing by increasing clearance between impeller and its casing}
F04D 15/0038 . . {by varying the effective cross-sectional area of flow through the rotor}
F04D 15/0044 . . {by introducing a gas}
F04D 15/005 . . {the pumps being of the circumferential flow type}

F04D 15/0055 . {Rotors with adjustable blades}
F04D 15/0061 . . {responsive to temperature}

F04D 15/0066 . {by changing the speed, e.g. of the driving engine}

F04D 15/0072 . {Installation or systems with two or more pumps, wherein the flow path through the stages can be changed, e.g. series-parallel}

F04D 15/0077 . {Safety measures(F04D 15/02 takes precedence)}
F04D 15/0083 . . {Protection against sudden pressure change, e.g. check valves}

F04D 15/0088 . {Testing machines}

F04D 15/0094 . {Indicators of rotational movement}

F04D 15/02 . Stopping of pumps, or operating valves, on occurrence of unwanted conditions

F04D 15/0209 . . {responsive to a condition of the working fluid(F04D 15/029 takes precedence)}
F04D 15/0218 . . . {the condition being a liquid level or a lack of liquid supply}
F04D 15/0227 . . . . {Lack of liquid level being detected using a flow transducer}
F04D 15/0236 . . . . {Lack of liquid level being detected by analysing the parameters of the electric drive, e.g. current or power consumption}
F04D 15/0245 . . {responsive to a condition of the pump}
F04D 15/0254 . . . {the condition being speed or load}
F04D 15/0263 . . . {the condition being temperature, ingress of humidity or leakage}
F04D 15/0272 . . . {the condition being wear or a position}
F04D 15/0281 . . {responsive to a condition not otherwise provided for}
F04D 15/029 . . {for pumps operating in parallel}

Guidance heading: **Pumping elastic fluids by rotary pumps**

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

F04D 17/02 . having non-centrifugal stages, e.g. centripetal
F04D 17/025 . . {comprising axial flow and radial flow stages}
F04D 17/04 . . of transverse-flow type

F04D 17/06 . Helico-centrifugal pumps

F04D 17/08 . Centrifugal pumps
F04D 17/10 . . for compressing or evacuating
F04D 17/105 . . . {with double suction}
F04D 17/12 . . . Multi-stage pumps
F04D 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}
F04D 17/125 . . . . . {the casing being vertically split}
F04D 17/127 . . . . {with radially spaced stages, e.g. for contrarotating type}
F04D 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)
F04D 17/16 . . for displacing without appreciable compression
F04D 17/161 . . . {Shear force pumps}
F04D 17/162 . . . {Double suction pumps}
F04D 17/164 . . . {Multi-stage fans, e.g. for vacuum cleaners}
F04D 17/165 . . . {Axial entry and discharge}
F04D 17/167 . . . {Operating by means of fibrous or porous elements(suction filters F04D 29/701); e.g. with sponge rotors}
F04D 17/168 . . . {Pumps specially adapted to produce a vacuum}

F04D 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}

F04D 19/00 **Axial-flow pumps**(F04D 21/00 takes precedence)**;**{ pump comprising axial flow and radial flow stages F04D 17/025}

F04D 19/002 . {Axial flow fans}

F04D 19/005 . . {reversible fans}

F04D 19/007 . {multistage fans}

F04D 19/02 . Multi-stage pumps

F04D 19/022 . . {with concentric rows of vanes;}

F04D 19/024 . . {with contrarotating parts}

F04D 19/026 . . {with a plurality of shafts rotating at different speeds(F04D 19/022 takes precedence)}

F04D 19/028 . . {Layout of fluid flow through the stages}

F04D 19/04 . . specially adapted to the production of a high vacuum, e.g. molecular pumps

F04D 19/042 . . . {Turbomolecular vacuum pumps}

F04D 19/044 . . . {Holweck-type pumps}

F04D 19/046 . . . {Combinations of two or more different types of pumps}

F04D 19/048 . . . {comprising magnetic bearings}

F04D 21/00 **Pump involving supersonic speed of pumped fluids**

F04D 23/00 **Other rotary non-positive-displacement pumps**(pumping installations or systems F04D 25/00)

F04D 23/001 . {Pumps adapted for conveying materials or for handling specific elastic fluids}

F04D 23/003 . . {of radial-flow type}

F04D 23/005 . . {of axial-flow type}

F04D 23/006 . {Creating a pulsating flow}

F04D 23/008 . {Regenerative pumps(for liquids or for liquids and elastic fluids F04D 5/002)}

F04D 25/00 **Pumping installations or systems**(controlling F04D 27/00)

F04D 25/02 . Units comprising pumps and their driving means(predominant aspect of the driving means, see the relevant classes for such means)

F04D 25/022 . . {comprising a yielding coupling, e.g. hydraulic(a magnetic coupling F04D 25/026)}

F04D 25/024 . . {the driving means being assisted by a power recovery turbine}

F04D 25/026 . . {with a magnetic coupling}

F04D 25/028 . . {the driving means being a planetary gear}

F04D 25/04 . . the pump being fluid-driven{(pumps driven by exhaust gases F02B 37/00 , F02B 39/00 ; turbochargers F02C 6/12)}

F04D 25/045 . . . {the pump wheel carrying the fluid driving means, e.g. turbine blades}

F04D 25/06 . . the pump being electrically driven(F04D 25/08 takes precedence)

F04D 25/0606 . . . {the electric motor being specially adapted for integration in the pump}

F04D 25/0613 . . . . {the electric motor being of the inside-out type, i.e. the rotor is arranged radially outside a central stator}

F04D 25/062 . . . . . {Details of the bearings}

F04D 25/0626 . . . . . {Details of the lubrication}

F04D 25/0633 . . . . . {Details of the magnetic circuit}

F04D 25/064 . . . . . {Details of the rotor}

F04D 25/0646 . . . . . {Details of the stator}

F04D 25/0653 . . . . {the motor having a plane air gap, e.g. disc-type}

F04D 25/066 . . . . {Linear Motors}

F04D 25/0666 . . . . {a sensor is integrated into the pump/motor design}

F04D 25/0673 . . . {Battery powered}

F04D 25/068 . . . {Mechanical details of the pump control unit(pump control details F04D 27/00)}

F04D 25/0686 . . . {specially adapted for submerged use}

F04D 25/0693 . . . {Details or arrangements of the wiring}

F04D 25/08 . . the working fluid being air, e.g. for ventilation

F04D 25/082 . . . {the unit having provision for cooling the motor}

F04D 25/084 . . . {hand fans}

F04D 25/086 . . . . {hand operated}

F04D 25/088 . . . {Ceiling fans}

F04D 25/10 . . . the unit having provisions for automatically changing direction of output air

F04D 25/105 . . . . {by changing rotor axis direction, e.g. oscillating fans(interconnecting rotary motion and oscillating motion F16H)}

F04D 25/12 . . . the unit being adapted for mounting in apertures

F04D 25/14 . . . . and having shutters, e.g. automatically closed when not in use

F04D 25/16 . Combinations of two or more pumps{Producing two or more separate gas flows}

F04D 25/163 . . {driven by a common gearing arrangement}

F04D 25/166 . . {using fans}

F04D 27/00 **Control, e.g. regulation, of pumps, pumping installations or systems**

WARNING

This group is not complete pending a reorganisation. See also group F04D 27/02 which covers also control in general not focussing on surge control

F04D 27/001 . {Testing thereof; Determination or simulation of flow characteristics; Stall or surge detection, e.g. condition monitoring}

F04D 27/002 . {by varying geometry within the pumps, e.g. by adjusting vanes}

WARNING

This group is not complete pending a reorganisation. See also group **F04D 27/02C**

F04D 27/003 . {by throttling(F04D 27/002 takes precedence)}

WARNING

This group is not complete pending a reorganisation. See also group F04D 27/02 D)

F04D 27/004 . {by varying driving speed}

WARNING

This group is not complete pending a reorganisation. See also group **F04D 27/02F**

F04D 27/005 . {by changing flow path between different stages or between a plurality of compressors; Load distribution between compressors}

WARNING

This group is not complete pending a reorganisation. See also group F04D 27/02 G]

F04D 27/006 . {by influencing fluid temperatures}

WARNING

This group is not complete pending a reorganisation. See also group **F04D 27/02K**

F04D 27/007 . {Conjoint control of two or more different functions}

WARNING

This group is not complete pending a reorganisation. See also group **F04D 27/02L**

F04D 27/008 . {Stop safety or alarm devices, e.g. stop-and-go control; Disposition of check-valves}

WARNING

This group is not complete pending a reorganisation. See also group F04D 27/0292

F04D 27/009 . {by bleeding, by passing or recycling fluid}

WARNING

This group is not complete pending a reorganisation. See also group **F04D 27/02B**

F04D 27/02 . Surge control{(surge detection F04D 27/001)}

F04D 27/0207 . . {by bleeding, bypassing or recycling fluids}(influencing the boundary layer by an uncontrolled bleeding of the working fluid F04D 29/681)

F04D 27/0215 . . . {Arrangements therefor, e.g. bleed or by-pass valves}

F04D 27/0223 . . . {Control schemes therefor}

F04D 27/023 . . . {Details or means for fluid extraction}

F04D 27/0238 . . . {Details or means for fluid reinjection}

F04D 27/0246 . . {by varying geometry within the pumps, e.g. by adjusting vanes}

F04D 27/0253 . . {by throttling(F04D 27/0246 takes precedence)}

F04D 27/0261 . . {by varying driving speed}

F04D 27/0269 . . {by changing flow path between different stages or between a plurality of compressors; load distribution between compressors}

F04D 27/0276 . . {by influencing fluid temperature}

F04D 27/0284 . . {Conjoint control of two or more different functions}

F04D 27/0292 . . {Stop safety or alarm devices, e.g. stop-and-go control; Disposition of check-valves}

F04D 29/00 **Details, component parts, or accessories**(machine elements in general F16)

F04D 29/002 . {especially adapted for elastic fluid pumps}

F04D 29/005 . {Decorative aspects, i.e. features which have no effect on the functioning of the pump}

F04D 29/007 . {especially adapted for liquid pumps}

F04D 29/02 . Selection of particular materials(for handling specific liquids F04D 7/00{F04D 23/001})

F04D 29/023 . . {especially adapted for elastic fluid pumps}

F04D 29/026 . . {especially adapted for liquid pumps}

F04D 29/04 . Shafts or bearings, or assemblies thereof(specially adapted for elastic fluid pumps F04D 29/05)

F04D 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}

F04D 29/041 .. Axial thrust balancing

F04D 29/0413 ... {hydrostatic; hydrodynamic thrust bearings}

F04D 29/0416 ... {balancing pistons}

F04D 29/042 .. Axially shiftable rotors F04D 29/041 takes precedence { control by creating a by-pass F04D 15/0027}

F04D 29/043 .. Shafts

F04D 29/044 ... Arrangements for joining or assembling shafts

F04D 29/046 .. Bearings

F04D 29/0462 ... {Bearing cartridges}

F04D 29/0465 ... {Ceramic bearing designs}

F04D 29/0467 ... {Spherical bearings}

F04D 29/047 ... hydrostatic; hydrodynamic

F04D 29/0473 .... {for radial pumps}

F04D 29/0476 .... {for axial pumps}

F04D 29/048 ... magnetic; electromagnetic

F04D 29/049 ... Roller bearings

F04D 29/05 . Shafts or bearings, or assemblies thereof, specially adapted for elastic fluid pumps

F04D 29/051 .. Axial thrust balancing

F04D 29/0513 ... {hydrostatic; hydrodynamic thrust bearings}

F04D 29/0516 ... {balancing pistons}

F04D 29/052 .. Axially shiftable rotors F04D 29/051 takes precedence { control by creating a by-pass F04D 27/0246}

F04D 29/053 .. Shafts

F04D 29/054 ... Arrangements for joining or assembling shafts

F04D 29/056 .. Bearings

F04D 29/0563 ... {Bearings cartridges}

F04D 29/0566 ... {Ceramic bearing designs}

F04D 29/057 ... hydrostatic; hydrodynamic

F04D 29/058 ... magnetic; electromagnetic

F04D 29/059 ... Roller bearings

F04D 29/06 . Lubrication{(F04D 13/0606 , F04D 13/0646 , F04D 13/0653 take precedence)}

F04D 29/061 .. {especially adapted for liquid pumps}

F04D 29/063 .. especially adapted for elastic fluid pumps

F04D 29/08 . Sealings

F04D 29/083 .. {especially adapted for elastic fluid pumps}

F04D 29/086 .. {especially adapted for liquid pumps}

F04D 29/10 .. Shaft sealings
F04D 29/102 ... {especially adapted for elastic fluid pumps}
F04D 29/104 .... {the sealing fluid being other than the working fluid or being the working fluid treated}
F04D 29/106 ... {especially adapted for liquid pumps}
F04D 29/108 .... {the sealing fluid being other than the working liquid or being the working liquid treated}
F04D 29/12 ... using sealing-rings
F04D 29/122 .... {especially adapted for elastic fluid pumps}
F04D 29/124 ..... {with special means for adducting cooling or sealing fluid}
F04D 29/126 .... {especially adapted for liquid pumps}
F04D 29/128 ..... {with special means for adducting cooling or sealing fluid}
F04D 29/14 ... operative only when pump is inoperative
F04D 29/143 .... {especially adapted for elastic fluid pumps}
F04D 29/146 .... {especially adapted for liquid pumps}
F04D 29/16 .. between pressure and suction sides
F04D 29/161 ... {especially adapted for elastic fluid pumps}
F04D 29/162 .... {of a centrifugal flow wheel}
F04D 29/164 .... {of an axial flow wheel}
F04D 29/165 ... {especially adapted for liquid pumps}
F04D 29/167 .... {of a centrifugal flow wheel}
F04D 29/168 .... {of an axial flow wheel}

F04D 29/18 . Rotors(specially for elastic fluids F04D 29/26)
F04D 29/181 .. {Axial flow rotors(F04D 29/185 take precedence)}
F04D 29/183 ... {Semi axial flow rotors}
F04D 29/185 .. {Rotors consisting of a plurality of wheels}
F04D 29/186 .. {Shaftless rotors(F04D 13/024 takes precedence)}
F04D 29/188 .. {specially for regenerative pumps}
F04D 29/20 .. Mounting rotors on shafts
F04D 29/22 .. specially for centrifugal pumps
F04D 29/2205 ... {Conventional flow pattern(F04D 29/18 takes precedence)}
F04D 29/2211 .... {More than one set of flow passages}
F04D 29/2216 .... {Shape, geometry(F04D 29/2211 takes precedence)}
F04D 29/2222 .... {Construction and assembly(F04D 29/2211 takes precedence)}
F04D 29/2227 ..... {for special materials}
F04D 29/2233 ..... {entirely open or stamped from one sheet}
F04D 29/2238 ... {Special flow patterns(F04D 11/005 takes precedence)}
F04D 29/2244 .... {Free vortex}
F04D 29/225 .... {Channel wheels, e.g. one blade or one flow channel}

F04D 29/2255 .... {flow-channels with a special cross-section contour, e.g. ejecting, throttling or diffusing effect}

F04D 29/2261 ... {with special measures}

F04D 29/2266 .... {for sealing or thrust balance(F04D 29/04 and F04D 29/16 take precedence)}

F04D 29/2272 .... {for influencing flow or boundary layer}

F04D 29/2277 .... {for increasing NPSH or dealing with liquids near boiling-point}

F04D 29/2283 .... {for reverse pumping action}

F04D 29/2288 .... {for comminuting, mixing or separating}

F04D 29/2294 .... {for protection, e.g. against abrasion}

F04D 29/24 ... Vanes

F04D 29/242 .... {Geometry, shape}

F04D 29/245 ..... {for special effects}

F04D 29/247 .... {elastic or self-adjusting}

F04D 29/26 . Rotors specially for elastic fluids

F04D 29/263 .. {mounting fan or blower rotors on shafts}

F04D 29/266 .. {mounting compressor rotors on shafts}

F04D 29/28 .. for centrifugal or helico-centrifugal pumps{for radial-flow or helico-centrifugal pumps}

F04D 29/281 ... {for fans or blowers}

F04D 29/282 .... {the leading edge of each vane being substantially parallel to the rotation axis}

F04D 29/283 ..... {rotors of the squirrel-cage type}

F04D 29/284 ... {for compressors}

F04D 29/285 .... {the compressor wheel comprising a pair of rotatable bladed hub portions axially aligned and clamped together}

F04D 29/286 .... {multi-stage rotors}

F04D 29/287 ... {with adjusting means}

F04D 29/288 ... {Part of the wheel having an ejecting effect e.g. being bladeless diffuser}

F04D 29/289 ... {having provision against erosion or for dust-separation}

F04D 29/30 ... Vanes

F04D 29/305 .... {Flexible vanes}

F04D 29/32 .. for axial flow pumps{ multistage rotors F01D 5/00}

F04D 29/321 ... {for axial flow compressors}

F04D 29/322 .... {blade mountings(F01D 5/30 takes precedence)}

F04D 29/323 ..... {adjustable}

F04D 29/324 .... {blades(F01D 5/282 takes precedence)}

F04D 29/325 ... {for axial flow fans(blade mountings F04D 29/34 , blades F04D 29/38)}

F04D 29/326 .... {comprising a rotating shroud}

F04D 29/327 .... {with non identical blades}

F04D 29/328 .... {with unequal distribution of blades around the hub}

F04D 29/329 .... {Details of the hub}
F04D 29/34 ... Blade mountings{ for axial flow compressors F04D 29/322}
F04D 29/36 .... adjustable{ flexible blades F04D 29/382}
F04D 29/362 ..... {during rotation}
F04D 29/364 ..... {The blades having only a predetermined number of possible positions}
F04D 29/366 ..... {Adjustment by interaction of inertion and lift}
F04D 29/368 ..... {Adjustment by differences of temperature}
F04D 29/38 ... Blades{(for axial flow compressors F04D 29/324)}
F04D 29/382 .... {Flexible blades}
F04D 29/384 .... {characterised by form}
F04D 29/386 ..... {Skewed blades}
F04D 29/388 .... {characterised by construction}

F04D 29/40 . Casings; Connections of working fluid{ bleed or by-pass valves F04D 15/0011 , F04D 27/0215}
F04D 29/403 .. {especially adapted for elastic fluid pumps}
F04D 29/406 .. {especially adapted for liquid pumps}
F04D 29/42 .. for radial or helico-centrifugal pumps
F04D 29/4206 ... {especially adapted for elastic fluid pumps}
F04D 29/4213 .... {suction ports}
F04D 29/422 .... {Discharge tongues(F04D 17/04 takes precedence)}
F04D 29/4226 .... {Fan casings}
F04D 29/4233 ..... {with volutes extending mainly in axial or radially inward direction}
F04D 29/424 ..... {Double entry casings}
F04D 29/4246 ..... {comprising more than one outlet}
F04D 29/4253 ..... {with axial entry and discharge}
F04D 29/426 ... {especially adapted for liquid pumps}
F04D 29/4266 .... {made of sheet metal}
F04D 29/4273 .... {suction eyes}
F04D 29/428 .... {Discharge tongues(F04D 17/04 takes precedence)}
F04D 29/4286 .... {inside lining e.g. rubber}
F04D 29/4293 .... {Details of fluid inlet or outlet}
F04D 29/44 ... Fluid-guiding means, e.g. diffusers
F04D 29/441 .... {especially adapted for elastic fluid pumps}
F04D 29/442 ..... {rotating diffusers}
F04D 29/444 ..... {Bladed diffusers}
F04D 29/445 .... {especially adapted for liquid pumps}
F04D 29/447 ..... {rotating diffusers}
F04D 29/448 ..... {bladed diffusers}
F04D 29/46 .... adjustable

F04D 29/462 ..... {especially adapted for elastic fluid pumps}

F04D 29/464 ..... {adjusting flow cross-section, otherwise than by using adjustable stator blades}

F04D 29/466 ..... {especially adapted for liquid fluid pumps}

F04D 29/468 ..... {adjusting flow cross-section, otherwise than by using adjustable stator blades}

F04D 29/48 ..... for unidirectional fluid flow in reversible pumps{ rotors for reverse action F04D 29/2283}

F04D 29/483 ..... {especially adapted for elastic fluid pumps}

F04D 29/486 ..... {especially adapted for liquid pumps}

F04D 29/50 ..... for reversing fluid flow{ rotors for reverse action F04D 29/2283}

F04D 29/503 ..... {especially adapted for elastic fluid pumps}

F04D 29/506 ..... {especially adapted for liquid pumps}

F04D 29/52 .. for axial pumps

F04D 29/522 ... {especially adapted for elastic fluid pumps}

F04D 29/524 .... {shiftable members for obturating part of the flow path}

F04D 29/526 .... {Details of the casing section radially opposing blade tips(ducts F04D 29/545)}

F04D 29/528 ... {especially adapted for liquid pumps}

F04D 29/54 ... Fluid-guiding means, e.g. diffusers

F04D 29/541 .... {Specially adapted for elastic fluid pumps(F04D 29/56 takes precedence)}

F04D 29/542 ..... {Bladed diffusers(fixing blades to stators F01D 9/042)}

F04D 29/544 ..... {Blade shapes}

F04D 29/545 ..... {Ducts}

F04D 29/547 ..... {having a special shape in order to influence fluid flow}

F04D 29/548 .... {Specially adapted for liquid pumps(F04D 29/56 takes precedence)}

F04D 29/56 .... adjustable

F04D 29/563 ..... {specially adapted for elastic fluid pumps}

F04D 29/566 ..... {specially adapted for liquid pumps}

F04D 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}

F04D 29/5806 .. {Cooling the drive system}

F04D 29/5813 .. {Cooling the control unit}

F04D 29/582 .. {specially adapted for elastic fluid pumps}

F04D 29/5826 ... {Cooling at least part of the working fluid in a heat exchanger}

F04D 29/5833 .... {flow schemes and regulation thereto}

F04D 29/584 ... {cooling or heating the machine(F04D 29/5846 , F04D 29/5853 take precedence)}

F04D 29/5846 ... {cooling by injection}

F04D 29/5853 ... {heat insulation or conduction}

F04D 29/586 .. {specially adapted for liquid pumps}

F04D 29/5866 ... {Cooling at last part of the working fluid in a heat exchanger}

F04D 29/5873 .... {flow schemes and regulation thereto}

F04D 29/588 ... {cooling or heating the machine(F04D 29/5886 , F04D 29/5893 take precedence)}

F04D 29/5886 ... {cooling by injection}

F04D 29/5893 ... {heat insulation or conduction}

F04D 29/60 . Mounting; Assembling; Disassembling{F04D 13/10 takes precedence }

F04D 29/601 .. {specially adapted for elastic fluid pumps}

F04D 29/602 ... {Mounting in cavities}

F04D 29/603 .... {means for positioning from outside}

F04D 29/604 .... {means for removing without depressurising the cavity}

F04D 29/605 .. {specially adapted for liquid pumps}

F04D 29/606 ... {Mounting in cavities}

F04D 29/607 .... {means for positioning from outside}

F04D 29/608 .... {means for removing without depressurizing the cavity}

F04D 29/62 .. of radial or helico-centrifugal pumps

F04D 29/622 ... {Adjusting the clearances between rotary and stationary parts}

F04D 29/624 ... {especially adapted for elastic fluid pumps}

F04D 29/626 .... {Mounting or removal of fans}

F04D 29/628 ... {especially adapted for liquid pumps}

F04D 29/64 .. of axial pumps

F04D 29/642 ... {by adjusting the clearances between rotary and stationary parts}

F04D 29/644 ... {especially adapted for elastic fluid pumps}

F04D 29/646 .... {Mounting or removal of fans}

F04D 29/648 ... {especially adapted for liquid pumps}

F04D 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)

F04D 29/661 .. {especially adapted for elastic fluid pumps}

F04D 29/662 ... {Balancing of rotors(compensating unbalance G01M 1/36)}

F04D 29/663 ... {Sound attenuation}

F04D 29/664 .... {by means of sound absorbing material}

F04D 29/665 .... {by means of resonance chambers or interference}

F04D 29/666 ... {by means of rotor construction or layout, e.g. unequal distribution of blades or vanes}

F04D 29/667 ... {by influencing the flow pattern, e.g. suppression of turbulence}

F04D 29/668 ... {damping or preventing mechanical vibrations}

F04D 29/669 .. {especially adapted for liquid pumps(F04D 29/18 takes precedence)}

F04D 29/68 .. by influencing boundary layers{(by bleeding elastic fluid F04D 27/0215)}

F04D 29/681 ... {especially adapted for elastic fluid pumps}

F04D 29/682 . . . . {by fluid extraction}
F04D 29/684 . . . . {by fluid injection}
F04D 29/685 . . . . {Inducing localised fluid recirculation in the stator-rotor interface}
F04D 29/687 . . . . {Plasma actuators therefore}
F04D 29/688 . . . {especially adapted for liquid pumps}

F04D 29/70 . Suction grids; Strainers; Dust separation; Cleaning
F04D 29/701 . . {especially adapted for elastic fluid pumps}
F04D 29/703 . . . {specially for fans, e.g. fan guards}
F04D 29/705 . . . {Adding liquids}
F04D 29/706 . . . {Humidity separation}
F04D 29/708 . . {specially for liquid pumps}

Guidance heading: **Other non-positive-displacement pumps**

F04D 31/00 **Pumping liquids and elastic fluids at the same time**

F04D 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)

F04D 35/00 **Pumps producing waves in liquids, i.e. wave.producers**(for bath tubs A47K 3/10)