

**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 radial 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 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 [5/00R](#) ) }

#### **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 [25/02D](#) ) }
- 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 F04D27](#) ) }
- 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 27/02 C](#)

- 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 27/02 F](#)

- [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 27/02 K](#)

- [F04D 27/007](#) . { Conjoint control of two or more different functions }

**WARNING**

This group is not complete pending a reorganisation. See also group [F04D 27/02 L](#)

- [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 27/02 B](#)

- [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 <a href="#">F04D 29/051</a> takes precedence { control by creating a by-pass <a href="#">F04D 27/0246</a> }
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 { ( <a href="#">F04D 13/0606</a> , <a href="#">F04D 13/0646</a> , <a href="#">F04D 13/0653</a> 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 <a href="#">F04D 29/26</a> )
F04D 29/181	.. { Axial flow rotors ( <a href="#">F04D 29/185</a> take precedence ) }
F04D 29/183	... { Semi axial flow rotors }
F04D 29/185	.. { Rotors consisting of a plurality of wheels }
F04D 29/186	.. { Shaftless rotors ( <a href="#">F04D 13/024</a> 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 ( <a href="#">F04D 29/18</a> takes precedence ) }
F04D 29/2211	.... { More than one set of flow passages }
F04D 29/2216	.... { Shape, geometry ( <a href="#">F04D 29/2211</a> takes precedence ) }
F04D 29/2222	.... { Construction and assembly ( <a href="#">F04D 29/2211</a> takes precedence ) }
F04D 29/2227	..... { for special materials }
F04D 29/2233	..... { entirely open or stamped from one sheet }
F04D 29/2238	... { Special flow patterns ( <a href="#">F04D 11/005</a> 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 ( <a href="#">F04D 29/04</a> and <a href="#">F04D 29/16</a> 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 <a href="#">F01D 5/00</a> }
F04D 29/321	...	{ for axial flow compressors }
F04D 29/322	....	{ blade mountings ( <a href="#">F01D 5/30</a> takes precedence ) }
F04D 29/323	.....	{ adjustable }
F04D 29/324	....	{ blades ( <a href="#">F01D 5/282</a> takes precedence ) }
F04D 29/325	...	{ for axial flow fans ( blade mountings <a href="#">F04D 29/34</a> , blades <a href="#">F04D 29/38</a> ) }
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 <a href="#">F04D 29/322</a> }
F04D 29/36	....	adjustable { flexible blades <a href="#">F04D 29/382</a> }
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 inertia and lift }
F04D 29/368	.....	{ Adjustment by differences of temperature }
F04D 29/38	...	Blades { ( for axial flow compressors <a href="#">F04D 29/324</a> ) }
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 <a href="#">F04D 15/0011</a> , <a href="#">F04D 27/0215</a> }
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 ( <a href="#">F04D 17/04</a> 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 ( <a href="#">F04D 17/04</a> 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 <a href="#">F04D 29/2283</a> }
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 <a href="#">F04D 29/2283</a> }
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 ( <a href="#">ducts F04D 29/545</a> ) }
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 ( <a href="#">F04D 29/56</a> takes precedence ) }
F04D 29/542	.....	{ Bladed diffusers ( fixing blades to stators <a href="#">F01D 9/042</a> ) }
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 ( <a href="#">F04D 29/56</a> 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 <a href="#">G01M 1/36</a> ) }
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 ( <a href="#">F04D 29/18</a> takes precedence ) }
F04D 29/68	..	by influencing boundary layers { ( by bleeding elastic fluid <a href="#">F04D 27/0215</a> ) }
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

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