

F04 POSITIVE-DISPLACEMENT MACHINES FOR LIQUIDS; PUMPS FOR LIQUIDS OR ELASTIC FLUIDS (portable fire extinguishers with manually-operated pumps A62C 11/00, with power-driven pumps A62C 25/00; charging or scavenging combustion engines by pumps F02B; engine fuel-injection pumps F02M; ion pumps H01J 41/12; electrodynamic pumps H02K 44/02)

F04D NON-POSITIVE-DISPLACEMENT PUMPS

- (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".

ROTARY PUMPS FOR LIQUID AND ELASTIC FLUID OR LIQUID ALONE

Kind of flow: radial or helico-centrifugal; axial; circumferential or transverse; other..... 1/00; 3/00; 5/00; 11/00

For handling specific fluids 7/00

Priming, preventing vapour lock 9/00

Pumping installations or systems; control 13/00; 15/00

ROTARY PUMPS FOR ELASTIC FLUID

Kind of flow: radial or helico-centrifugal; axial; other 17/00; 19/00; 23/00

Involving supersonic speed of fluid 21/00

Pumping installations; control 25/00; 27/00

DETAILS OR ACCESSORIES 29/00

OTHER KINDS OF PUMPS

Pumping liquid and elastic fluid at the same time 31/00

With other than pure rotation 33/00

Wave producers 35/00

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)

- 1/02 . having non-centrifugal stages, e.g. centripetal
- 1/04 . Helico-centrifugal pumps
- 1/06 . Multi-stage pumps (F04D 1/02 takes precedence)
- 1/08 . . the stages being situated concentrically
- 1/10 . . with means for changing the flow-path through the stages, e.g. series/parallel
- 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)

- 3/02 . of screw type

5/00 Pumps with circumferential or transverse flow

7/00 Pumps adapted for handling specific fluids, e.g. by selection of specific materials for pumps or pump parts

- 7/02 . of centrifugal type
- 7/04 . . the fluids being viscous or non-homogeneous
- 7/06 . . the fluids being hot or corrosive, e.g. liquid metal
- 7/08 . . the fluids being radioactive

9/00 Priming; Preventing vapour lock

- 9/02 . Self-priming pumps

- 9/04 . using priming pumps; using booster pumps to prevent vapour lock

- 9/06 . . of jet type

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

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)
- 13/04 . . the pump being fluid-driven
- 13/06 . . the pump being electrically driven
- 13/08 . . . for submerged use
- 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 counter-act vapour lock F04D 9/04)
- 13/14 . . the pumps being all of centrifugal type
- 13/16 . with storage reservoirs
- 15/00 **Control, e.g. regulation, of pumps, pumping installations, or systems**
- 15/02 . Stopping of pumps, or operating valves, on occurrence of unwanted conditions

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
- 17/04 . . of transverse-flow type
- 17/06 . Helico-centrifugal pumps

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- 17/08 . Centrifugal pumps
- 17/10 . . for compressing or evacuating
- 17/12 . . . Multi-stage pumps
- 17/14 with means for changing the flow-path through the stages, e.g. series/parallel (surge control F04D 27/02)
- 17/16 . . for displacing without appreciable compression
- 17/18 . . characterised by use of centrifugal force of liquids entrained in pumps

19/00 Axial-flow pumps (F04D 21/00 takes precedence)

- 19/02 . Multi-stage pumps
- 19/04 . . specially adapted to the production of a high vacuum, e.g. molecular pumps

21/00 Pumps involving supersonic speed of pumped fluids

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

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

- 25/02 . Units comprising pumps and their driving means (predominant aspects of the driving means, see the relevant classes for such means)
- 25/04 . . the pump being fluid-driven
- 25/06 . . the pump being electrically driven (F04D 25/08 takes precedence)
- 25/08 . . the working fluid being air, e.g. for ventilation
- 25/10 . . . the unit having provisions for automatically changing the direction of output air
- 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
- 27/00 **Control, e.g. regulation, of pumps, pumping installations, or systems**
- 27/02 . Surge control

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

- 29/02 . Selection of particular materials (for handling specific liquids F04D 7/00)
- 29/04 . Shafts or bearings, or assemblies thereof (specially adapted for elastic fluid pumps F04D 29/05) [1,8]
- 29/041 . . Axial thrust balancing [8]
- 29/042 . . Axially shiftable rotors (F04D 29/041 takes precedence) [8]
- 29/043 . . Shafts [8]
- 29/044 . . . Arrangements for joining or assembling shafts [8]
- 29/046 . . Bearings [8]
- 29/047 . . . hydrostatic; hydrodynamic [8]
- 29/048 . . . magnetic; electromagnetic [8]
- 29/049 . . . Roller bearings [8]
- 29/05 . Shafts or bearings, or assemblies thereof, specially adapted for elastic fluid pumps [8]
- 29/051 . . Axial thrust balancing [8]
- 29/052 . . Axially shiftable rotors (F04D 29/051 takes precedence) [8]

- 29/053 . . Shafts [8]
- 29/054 . . . Arrangements for joining or assembling shafts [8]
- 29/056 . . Bearings [8]
- 29/057 . . . hydrostatic; hydrodynamic [8]
- 29/058 . . . magnetic; electromagnetic [8]
- 29/059 . . . Roller bearings [8]
- 29/06 . Lubrication [1,8]
- 29/063 . . specially adapted for elastic fluid pumps [8]
- 29/08 . Sealings
- 29/10 . . Shaft sealings
- 29/12 . . . using sealing-rings
- 29/14 . . . operative only when pump is inoperative
- 29/16 . . between pressure and suction sides
- 29/18 . Rotors (specially adapted for elastic fluids F04D 29/26)
- 29/20 . . Mounting rotors on shafts
- 29/22 . . specially for centrifugal pumps
- 29/24 . . . Vanes
- 29/26 . Rotors specially adapted for elastic fluids
- 29/28 . . for centrifugal or helico-centrifugal pumps
- 29/30 . . . Vanes
- 29/32 . . for axial-flow pumps
- 29/34 . . . Blade mountings
- 29/36 adjustable
- 29/38 . . . Blades
- 29/40 . Casings; Connections for working fluid
- 29/42 . . for radial or helico-centrifugal pumps
- 29/44 . . . Fluid-guiding means, e.g. diffusers
- 29/46 adjustable
- 29/48 for unidirectional fluid flow in reversible pumps
- 29/50 for reversing fluid flow
- 29/52 . . for axial pumps
- 29/54 . . . Fluid-guiding means, e.g. diffusers
- 29/56 adjustable
- 29/58 . Cooling (of machines or engines in general F01P); Heating; Diminishing heat transfer
- 29/60 . Mounting; Assembling; Disassembling
- 29/62 . . of radial or helico-centrifugal pumps
- 29/64 . . of axial 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)
- 29/68 . . by influencing boundary layers
- 29/70 . Suction grids; Strainers; Dust separation; Cleaning

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) [2]

35/00 Pumps producing waves in liquids, i.e. wave-producers (for bath tubs A47K 3/10) [2]