

SECTION F – MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING

F01 MACHINES OR ENGINES IN GENERAL (combustion engines F02; machines for liquids F03, F04); ENGINE PLANTS IN GENERAL; STEAM ENGINES

F01D NON-POSITIVE-DISPLACEMENT MACHINES OR ENGINES, E.G. STEAM TURBINES (machines or engines for liquids F03; non-positive-displacement pumps F04D)

- (1) This subclass covers:
- non-positive-displacement engines for elastic fluids, e.g. steam turbines;
 - non-positive-displacement engines for liquids and elastic fluids;
 - non-positive-displacement machines for elastic fluids;
 - non-positive-displacement machines for liquids and elastic fluids.
- (2) Attention is drawn to the Notes preceding class F01, especially as regards the definitions of “reaction type”, e.g. with airfoil-like blades, and “impulse type”, e.g. bucket turbines.

NON-POSITIVE-DISPLACEMENT MACHINES OR ENGINES

General characteristics; with axial-thrust balancing; with other than pure rotation..... 1/00; 3/00; 23/00

Component parts
blades and carrying members, protection thereof; rotors with adjustable blades; stators 5/00; 7/00; 9/00

means against internal leakage..... 11/00
COMBINATIONS OR ADAPTATIONS OF MACHINES OR ENGINES..... 13/00, 15/00
REGULATION, CONTROLLING, SAFETY MEANS..... 17/00, 19/00, 21/00
STARTING; SHUTTING-DOWN..... 19/00; 21/00
OTHER DETAILS AND ACCESSORIES 25/00

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| <p>1/00 Non-positive-displacement machines or engines, e.g. steam turbines (with working-fluid flows in opposite axial directions for balancing axial thrust F01D 3/02; with other than pure rotation F01D 23/00; turbines characterised by their use in special steam systems, cycles, or processes, regulating devices therefor F01K)</p> | <p>1/22 . . traversed by the working-fluid substantially radially</p> |
| <p>1/02 . with stationary working-fluid guiding means and bladed or like rotor (F01D 1/24 takes precedence; without working-fluid guiding means F01D 1/18) [5]</p> | <p>1/24 . characterised by counter-rotating rotors subjected to same working-fluid stream without intermediate stator blades or the like</p> |
| <p>1/04 . . traversed by the working-fluid substantially axially</p> | <p>1/26 . . traversed by the working-fluid substantially axially</p> |
| <p>1/06 . . traversed by the working-fluid substantially radially</p> | <p>1/28 . . traversed by the working-fluid substantially radially</p> |
| <p>1/08 . . . having inward flow</p> | <p>1/30 . characterised by having a single rotor operable in either direction of rotation, e.g. by reversing of blades (combinations of machines or engines F01D 13/00)</p> |
| <p>1/10 . . having two or more stages subjected to working-fluid flow without essential intermediate pressure change, i.e. with velocity stages (F01D 1/12 takes precedence)</p> | <p>1/32 . with pressure/velocity transformation exclusively in rotor, e.g. the rotor rotating under the influence of jets issuing from the rotor</p> |
| <p>1/12 . . with repeated action on same blade ring</p> | <p>1/34 . characterised by non-bladed rotor, e.g. with drilled holes (F01D 1/32 takes precedence; sirens G10K 7/00) [5]</p> |
| <p>1/14 . . . traversed by the working-fluid substantially radially</p> | <p>1/36 . . using fluid friction</p> |
| <p>1/16 . . characterised by having both reaction stages and impulse stages</p> | <p>1/38 . . of the screw type [5]</p> |
| <p>1/18 . without working-fluid guiding means (F01D 1/24, F01D 1/32, F01D 1/34 take precedence) [5]</p> | <p>3/00 Machines or engines with axial-thrust balancing effected by working fluid</p> |
| <p>1/20 . . traversed by the working-fluid substantially axially</p> | <p>3/02 . characterised by having one fluid flow in one axial direction and another fluid flow in the opposite direction</p> |
| | <p>3/04 . axial thrust being compensated by thrust-balancing dummy piston or the like</p> |

- 5/00 Blades; Blade-carrying members** (nozzle boxes F01D 9/02); **Heating, heat-insulating, cooling, or antivibration means on the blades or the members**
- 5/02 . Blade-carrying members, e.g. rotors (rotors of non-bladed type F01D 1/34; stators F01D 9/00)
 - 5/03 . . Annular blade-carrying members having blades on the inner periphery of the annulus and extending inwardly radially, i.e. inverted rotors [6]
 - 5/04 . . for radial-flow machines or engines
 - 5/06 . . Rotors for more than one axial stage, e.g. of drum or multiple-disc type; Details thereof, e.g. shafts, shaft connections
 - 5/08 . . Heating, heat-insulating, or cooling means
 - 5/10 . . Antivibration means
 - 5/12 . Blades (blade roots F01D 5/30; rotors with blades adjustable in operation F01D 7/00; stator blades F01D 9/02)
 - 5/14 . . Form or construction (selecting particular materials, measures against erosion or corrosion F01D 5/28)
 - 5/16 . . . for counteracting blade vibration
 - 5/18 . . . Hollow blades; Heating, heat-insulating, or cooling means on blades
 - 5/20 . . . Specially-shaped blade tips to seal space between tips and stator
 - 5/22 . . Blade-to-blade connections, e.g. by shrouding
 - 5/24 . . . using wire or the like
 - 5/26 . . Antivibration means not restricted to blade form or construction or to blade-to-blade connections
 - 5/28 . . Selecting particular materials; Measures against erosion or corrosion
 - 5/30 . Fixing blades to rotors; Blade roots
 - 5/32 . . Locking, e.g. by final locking-blades or keys
 - 5/34 . Rotor-blade aggregates of unitary construction
- 7/00 Rotors with blades adjustable in operation; Control thereof** (for reversing F01D 1/30)
- 7/02 . having adjustment responsive to speed
- 9/00 Stators** (non-fluid guiding aspects of casings, regulating, controlling, or safety aspects, see the relevant groups)
- 9/02 . Nozzles; Nozzle boxes; Stator blades; Guide conduits
 - 9/04 . . forming ring or sector
 - 9/06 . Fluid supply conduits to nozzles or the like
- 11/00 Preventing or minimising internal leakage of working fluid, e.g. between stages** (sealings in general F16J)
- 11/02 . by non-contact sealings, e.g. of labyrinth type (for sealing space between rotor blade tips and stator F01D 11/08)
 - 11/04 . . using sealing fluid, e.g. steam
 - 11/06 . . . Control thereof
 - 11/08 . for sealing space between rotor blade tips and stator (specially-shaped blade tips therefor F01D 5/20)
 - 11/10 . . using sealing fluid, e.g. steam
 - 11/12 . . using a rubstrip, e.g. erodible, deformable or resiliently biased part [6]
 - 11/14 . . Adjusting or regulating tip-clearance, i.e. distance between rotor-blade tips and stator casing (rotors with blades adjustable in operation F01D 7/00) [6]
 - 11/16 . . . by self-adjusting means (F01D 11/12 takes precedence) [6]
 - 11/18 using stator or rotor components with predetermined thermal response, e.g. selective insulation, thermal inertia, differential expansion [6]
- 11/20 . . . Actively adjusting tip-clearance [6]
 - 11/22 by mechanically actuating the stator or rotor components, e.g. moving shroud sections relative to the rotor [6]
 - 11/24 by selectively cooling or heating stator or rotor components [6]
- 13/00 Combinations of two or more machines or engines** (F01D 15/00 takes precedence; combinations of two or more pumps F04; fluid gearing F16H; regulating or controlling, see the relevant groups)
- 13/02 . Working-fluid interconnection of machines or engines
- 15/00 Adaptations of machines or engines for special use; Combinations of engines with devices driven thereby** (regulating or controlling, see the relevant groups; aspects predominantly concerning driven devices, see the relevant classes for the devices)
- 15/02 . Adaptations for driving vehicles, e.g. locomotives (arrangement in vehicles, see the relevant vehicle classes)
 - 15/04 . . the vehicles being waterborne vessels
 - 15/06 . Adaptations for driving, or combinations with, hand-held tools or the like
 - 15/08 . Adaptations for driving, or combinations with, pumps
 - 15/10 . Adaptations for driving, or combinations with, electric generators
 - 15/12 . Combinations with mechanical gearing (driven by multiple engines F01D 13/00)
- 17/00 Regulating or controlling by varying flow** (for reversing F01D 1/30; by varying rotor blade position F01D 7/00; specially for starting F01D 19/00; shutting-down F01D 21/00; regulating or controlling in general G05)
- 17/02 . Arrangement of sensing elements (sensing elements per se, see the relevant subclasses)
 - 17/04 . . responsive to load
 - 17/06 . . responsive to speed
 - 17/08 . . responsive to condition of working fluid, e.g. pressure
 - 17/10 . Final actuators (valves in general F16K)
 - 17/12 . . arranged in stator parts
 - 17/14 . . . varying effective cross-sectional area of nozzles or guide conduits
 - 17/16 by means of nozzle vanes
 - 17/18 . . . varying effective number of nozzles or guide conduits
 - 17/20 . Devices dealing with sensing elements or final actuators or transmitting means between them, e.g. power-assisted (sensing elements alone F01D 17/02; final actuators alone F01D 17/10)
 - 17/22 . . the operation or power assistance being predominantly non-mechanical
 - 17/24 . . . electrical
 - 17/26 . . . fluid, e.g. hydraulic
- 19/00 Starting of machines or engines; Regulating, controlling, or safety means in connection therewith** (warming-up before starting F01D 25/10; turning or inching gear F01D 25/34)
- 19/02 . dependent on temperature of component parts, e.g. of turbine casing
- 21/00 Shutting-down of machines or engines, e.g. in emergency; Regulating, controlling, or safety means not otherwise provided for**
- 21/02 . Shutting-down responsive to overspeed

- 21/04 . responsive to undesired position of rotor relative to stator, e.g. indicating such position
- 21/06 . . Shutting-down
- 21/08 . . Restoring position
- 21/10 . responsive to unwanted deposits on blades, in working-fluid conduits, or the like
- 21/12 . responsive to temperature
- 21/14 . responsive to other specific conditions
- 21/16 . Trip gear
- 21/18 . . involving hydraulic means
- 21/20 . Checking operation of shut-down devices
- 23/00 Non-positive-displacement machines or engines with movement other than pure rotation, e.g. of endless-chain type**
- 25/00 Component parts, details, or accessories, not provided for in, or of interest apart from, other groups**
- 25/02 . De-icing means for engines having icing phenomena
- 25/04 . Antivibration arrangements
- 25/06 . . for preventing blade vibration (means on blade-carrying members or blades F01D 5/00)
- 25/08 . Cooling (of machines or engines in general F01P); Heating; Heat insulation (of blade-carrying members, of blades F01D 5/00)
- 25/10 . . Heating, e.g. warming-up before starting
- 25/12 . . Cooling
- 25/14 . . Casings modified therefor (double casings F01D 25/26)
- 25/16 . Arrangement of bearings; Supporting or mounting bearings in casings (bearings per se F16C)
- 25/18 . Lubricating arrangements (of machines or engines in general F01M)
- 25/20 . . using lubrication pumps
- 25/22 . . using working fluid or other gaseous fluid as lubricant
- 25/24 . Casings (modified for heating or cooling F01D 25/14); Casing parts, e.g. diaphragms, casing fastenings (casings for rotary machines or engines in general F16M)
- 25/26 . . Double casings; Measures against temperature strain in casings
- 25/28 . Supporting or mounting arrangements, e.g. for turbine casing
- 25/30 . Exhaust heads, chambers, or the like
- 25/32 . Collecting of condensation water; Drainage
- 25/34 . Turning or inching gear
- 25/36 . . using electric motors