

## SECTION F — MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING

### F01 MACHINES OR ENGINES IN GENERAL; ENGINE PLANTS IN GENERAL; STEAM ENGINES

**F01D NON-POSITIVE-DISPLACEMENT MACHINES OR ENGINES, e.g. STEAM TURBINES** (combustion engines F02; machines or engines for liquids F03, F04; non-positive-displacement pumps F04D)

#### Note(s)

- 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.
- 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.

#### Subclass index

##### 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><b>1/00 Non-positive-displacement machines or engines, e.g. steam turbines</b> (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</p> <p>1/24</p> <p>1/26</p> <p>1/28</p> <p>1/30</p> <p>1/32</p> <p>1/34</p> <p>1/36</p> <p>1/38</p> | <ul style="list-style-type: none"> <li>traversed by the working-fluid substantially radially</li> <li>characterised by counter-rotating rotors subjected to same working-fluid stream without intermediate stator blades or the like</li> <li>traversed by the working-fluid substantially axially</li> <li>traversed by the working-fluid substantially radially</li> <li>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)</li> <li>with pressure/velocity transformation exclusively in rotor, e.g. the rotor rotating under the influence of jets issuing from the rotor</li> <li>characterised by non-bladed rotor, e.g. with drilled holes (F01D 1/32 takes precedence; sirens G10K 7/00) [5]</li> <li>using fluid friction</li> <li>of the screw type [5]</li> </ul> |
| <p>1/02</p> <ul style="list-style-type: none"> <li>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]</li> </ul>   | <p>1/28</p>   | <ul style="list-style-type: none"> <li>traversed by the working-fluid substantially radially</li> </ul>   |
| <p>1/04</p> <ul style="list-style-type: none"> <li>traversed by the working-fluid substantially axially</li> </ul>   | <p>1/30</p>   | <ul style="list-style-type: none"> <li>characterised by having both reaction stages and impulse stages</li> </ul>   |
| <p>1/06</p> <ul style="list-style-type: none"> <li>traversed by the working-fluid substantially radially</li> </ul>  | <p>1/32</p>   | <ul style="list-style-type: none"> <li>characterised by having one fluid flow in one axial direction and another fluid flow in the opposite direction</li> </ul>  |
| <p>1/08</p> <ul style="list-style-type: none"> <li>having inward flow</li> </ul>   | <p>1/34</p>   | <ul style="list-style-type: none"> <li>axial thrust being compensated by thrust-balancing dummy piston or the like</li> </ul>   |
| <p>1/10</p> <ul style="list-style-type: none"> <li>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)</li> </ul>   | <p>3/00</p>   |   |
| <p>1/12</p> <ul style="list-style-type: none"> <li>with repeated action on same blade ring</li> </ul>  | <p>3/02</p>   |   |
| <p>1/14</p> <ul style="list-style-type: none"> <li>traversed by the working-fluid substantially radially</li> </ul>  | <p>3/04</p>   |   |
| <p>1/16</p> <ul style="list-style-type: none"> <li>characterised by having both reaction stages and impulse stages</li> </ul>  |   |   |
| <p>1/18</p> <ul style="list-style-type: none"> <li>without working-fluid guiding means (F01D 1/24, F01D 1/32, F01D 1/34 take precedence) [5]</li> </ul>  |   |   |
| <p>1/20</p> <ul style="list-style-type: none"> <li>traversed by the working-fluid substantially axially</li> </ul>   |   |   |

- 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