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)

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.

Subclass index

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)

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]**

1/04 • • traversed by the working-fluid substantially axially

1/06 • • traversed by the working-fluid substantially radially

1/08 • • • having inward flow

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)

1/12 • • with repeated action on same blade ring

1/14 • • • traversed by the working-fluid substantially radially

1/16 • • characterised by having both reaction stages and impulse stages

1/18 • without working-fluid guiding means (F01D 1/24, F01D 1/32, F01D 1/34 take precedence) **[5]**

1/20 • • traversed by the working-fluid substantially axially

1/22 • • traversed by the working-fluid substantially radially

1/24 • characterised by counter-rotating rotors subjected to same working-fluid stream without intermediate stator blades or the like

1/26 • • traversed by the working-fluid substantially axially

1/28 • • traversed by the working-fluid substantially radially

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)

1/32 • with pressure/velocity transformation exclusively in rotor, e.g. the rotor rotating under the influence of jets issuing from the rotor

1/34 • characterised by non-bladed rotor, e.g. with drilled holes (F01D 1/32 takes precedence; sirens G10K 7/00) **[5]**

1/36 • • using fluid friction

1/38 • • of the screw type **[5]**

3/00 Machines or engines with axial-thrust balancing effected by working fluid

3/02 • characterised by having one fluid flow in one axial direction and another fluid flow in the opposite direction

3/04 • axial thrust being compensated by thrust-balancing dummy piston or the like

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