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

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

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, 2006.01]**

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) **[1, 5, 2006.01]**

1/04 • • traversed by the working-fluid substantially axially **[1, 2006.01]**

1/06 • • traversed by the working-fluid substantially radially **[1, 2006.01]**

1/08 • • • having inward flow **[1, 2006.01]**

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, 2006.01]**

1/12 • • with repeated action on same blade ring **[1, 2006.01]**

1/14 • • • traversed by the working-fluid substantially radially **[1, 2006.01]**

1/16 • • characterised by having both reaction stages and impulse stages **[1, 2006.01]**

1/18 • without working-fluid guiding means (F01D 1/24, F01D 1/32, F01D 1/34 take precedence) **[1, 5, 2006.01]**

1/20 • • traversed by the working-fluid substantially axially **[1, 2006.01]**

1/22 • • traversed by the working-fluid substantially radially **[1, 2006.01]**

1/24 • characterised by counter-rotating rotors subjected to same working-fluid stream without intermediate stator blades or the like **[1, 2006.01]**

1/26 • • traversed by the working-fluid substantially axially **[1, 2006.01]**

1/28 • • traversed by the working-fluid substantially radially **[1, 2006.01]**

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, 2006.01]**

1/32 • with pressure/velocity transformation exclusively in rotor, e.g. the rotor rotating under the influence of jets issuing from the rotor **[1, 2006.01]**

1/34 • characterised by non-bladed rotor, e.g. with drilled holes (F01D 1/32 takes precedence; sirens G10K 7/00) **[1, 5, 2006.01]**

1/36 • • using fluid friction **[1, 2006.01]**

1/38 • • of the screw type **[5, 2006.01]**

3/00 **Machines or engines with axial-thrust balancing effected by working fluid [1, 2006.01]**

3/02 • characterised by having one fluid flow in one axial direction and another fluid flow in the opposite direction **[1, 2006.01]**

3/04 • axial thrust being compensated by thrust-balancing dummy piston or the like **[1, 2006.01]**

5/00 **Blades; Blade-carrying members** (nozzle boxes F01D 9/02)**; Heating, heat-insulating, cooling, or antivibration means on the blades or the members [1, 2006.01]**

5/02 • Blade-carrying members, e.g. rotors (rotors of non-bladed type F01D 1/34; stators F01D 9/00) **[1, 2006.01]**

5/03 • • Annular blade-carrying members having blades on the inner periphery of the annulus and extending inwardly radially, i.e. inverted rotors **[6, 2006.01]**

5/04 • • for radial-flow machines or engines **[1, 2006.01]**

5/06 • • Rotors for more than one axial stage, e.g. of drum or multiple-disc type; Details thereof, e.g. shafts, shaft connections **[1, 2006.01]**

5/08 • • Heating, heat-insulating, or cooling means **[1, 2006.01]**

5/10 • • Antivibration means **[1, 2006.01]**

5/12 • Blades (blade roots F01D 5/30; rotors with blades adjustable in operation F01D 7/00; stator blades F01D 9/02) **[1, 2006.01]**

5/14 • • Form or construction (selecting particular materials, measures against erosion or corrosion F01D 5/28) **[1, 2006.01]**

5/16 • • • for counteracting blade vibration **[1, 2006.01]**

5/18 • • • Hollow blades; Heating, heat-insulating, or cooling means on blades **[1, 2006.01]**

5/20 • • • Specially-shaped blade tips to seal space between tips and stator **[1, 2006.01]**

5/22 • • Blade-to-blade connections, e.g. by shrouding **[1, 2006.01]**

5/24 • • • using wire or the like **[1, 2006.01]**

5/26 • • Antivibration means not restricted to blade form or construction or to blade-to-blade connections **[1, 2006.01]**

5/28 • • Selecting particular materials; Measures against erosion or corrosion **[1, 2006.01]**

5/30 • Fixing blades to rotors; Blade roots **[1, 2006.01]**

5/32 • • Locking, e.g. by final locking-blades or keys **[1, 2006.01]**

5/34 • Rotor-blade aggregates of unitary construction **[1, 2006.01]**

7/00 **Rotors with blades adjustable in operation; Control thereof** (for reversing F01D 1/30) **[1, 2006.01]**

7/02 • having adjustment responsive to speed **[1, 2006.01]**

9/00 **Stators** (non-fluid guiding aspects of casings, regulating, controlling, or safety aspects, see the relevant groups) **[1, 2006.01]**

9/02 • Nozzles; Nozzle boxes; Stator blades; Guide conduits **[1, 2006.01]**

9/04 • • forming ring or sector **[1, 2006.01]**

9/06 • Fluid supply conduits to nozzles or the like **[1, 2006.01]**

11/00 **Preventing or minimising internal leakage of working fluid, e.g. between stages** (sealings in general F16J) **[1, 2006.01]**

11/02 • by non-contact sealings, e.g. of labyrinth type (for sealing space between rotor blade tips and stator F01D 11/08) **[1, 2006.01]**

11/04 • • using sealing fluid, e.g. steam **[1, 2006.01]**

11/06 • • • Control thereof **[1, 2006.01]**

11/08 • for sealing space between rotor blade tips and stator (specially-shaped blade tips therefor F01D 5/20) **[1, 2006.01]**

11/10 • • using sealing fluid, e.g. steam **[1, 2006.01]**

11/12 • • using a rubstrip, e.g. erodible, deformable or resiliently biased part **[6, 2006.01]**

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, 2006.01]**

11/16 • • • by self-adjusting means (F01D 11/12 takes precedence) **[6, 2006.01]**

11/18 • • • • using stator or rotor components with predetermined thermal response, e.g. selective insulation, thermal inertia, differential expansion **[6, 2006.01]**

11/20 • • • Actively adjusting tip-clearance **[6, 2006.01]**

11/22 • • • • by mechanically actuating the stator or rotor components, e.g. moving shroud sections relative to the rotor **[6, 2006.01]**

11/24 • • • • by selectively cooling or heating stator or rotor components **[6, 2006.01]**

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) **[1, 2006.01]**

13/02 • Working-fluid interconnection of machines or engines **[1, 2006.01]**

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) **[1, 2006.01]**

15/02 • Adaptations for driving vehicles, e.g. locomotives (arrangement in vehicles, see the relevant vehicle classes) **[1, 2006.01]**

15/04 • • the vehicles being waterborne vessels **[1, 2006.01]**

15/06 • Adaptations for driving, or combinations with, hand-held tools or the like **[1, 2006.01]**

15/08 • Adaptations for driving, or combinations with, pumps **[1, 2006.01]**

15/10 • Adaptations for driving, or combinations with, electric generators **[1, 2006.01]**

15/12 • Combinations with mechanical gearing (driven by multiple engines F01D 13/00) **[1, 2006.01]**

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) **[1, 2006.01]**

17/02 • Arrangement of sensing elements (sensing elements per se, see the relevant subclasses) **[1, 2006.01]**

17/04 • • responsive to load **[1, 2006.01]**

17/06 • • responsive to speed **[1, 2006.01]**

17/08 • • responsive to condition of working fluid, e.g. pressure **[1, 2006.01]**

17/10 • Final actuators (valves in general F16K) **[1, 2006.01]**

17/12 • • arranged in stator parts **[1, 2006.01]**

17/14 • • • varying effective cross-sectional area of nozzles or guide conduits **[1, 2006.01]**

17/16 • • • • by means of nozzle vanes **[1, 2006.01]**
17/18 • • • varying effective number of nozzles or guide conduits **[1, 2006.01]**
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) **[1, 2006.01]**
17/22 • • the operation or power assistance being predominantly non-mechanical **[1, 2006.01]**
17/24 • • • electrical **[1, 2006.01]**
17/26 • • • fluid, e.g. hydraulic **[1, 2006.01]**

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) **[1, 2006.01]**
19/02 • dependent on temperature of component parts, e.g. of turbine casing **[1, 2006.01]**

21/00 Shutting-down of machines or engines, e.g. in emergency; Regulating, controlling, or safety means not otherwise provided for [1, 2006.01]
21/02 • Shutting-down responsive to overspeed **[1, 2006.01]**
21/04 • responsive to undesired position of rotor relative to stator, e.g. indicating such position **[1, 2006.01]**
21/06 • • Shutting-down **[1, 2006.01]**
21/08 • • Restoring position **[1, 2006.01]**
21/10 • responsive to unwanted deposits on blades, in working-fluid conduits, or the like **[1, 2006.01]**
21/12 • responsive to temperature **[1, 2006.01]**
21/14 • responsive to other specific conditions **[1, 2006.01]**
21/16 • Trip gear **[1, 2006.01]**
21/18 • • involving hydraulic means **[1, 2006.01]**
21/20 • Checking operation of shut-down devices **[1, 2006.01]**

23/00 Non-positive-displacement machines or engines with movement other than pure rotation, e.g. of endless-chain type [1, 2006.01]

25/00 Component parts, details, or accessories, not provided for in, or of interest apart from, other groups [1, 2006.01]
25/02 • De-icing means for engines having icing phenomena **[1, 2006.01]**
25/04 • Antivibration arrangements **[1, 2006.01]**
25/06 • • for preventing blade vibration (means on blade-carrying members or blades F01D 5/00) **[1, 2006.01]**
25/08 • Cooling (of machines or engines in general F01P); Heating; Heat insulation (of blade-carrying members, of blades F01D 5/00) **[1, 2006.01]**
25/10 • • Heating, e.g. warming-up before starting **[1, 2006.01]**
25/12 • • Cooling **[1, 2006.01]**
25/14 • • Casings modified therefor (double casings F01D 25/26) **[1, 2006.01]**
25/16 • Arrangement of bearings; Supporting or mounting bearings in casings (bearings per se F16C) **[1, 2006.01]**
25/18 • Lubricating arrangements (of machines or engines in general F01M) **[1, 2006.01]**
25/20 • • using lubrication pumps **[1, 2006.01]**
25/22 • • using working fluid or other gaseous fluid as lubricant **[1, 2006.01]**
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) **[1, 2006.01]**
25/26 • • Double casings; Measures against temperature strain in casings **[1, 2006.01]**
25/28 • Supporting or mounting arrangements, e.g. for turbine casing **[1, 2006.01]**
25/30 • Exhaust heads, chambers, or the like **[1, 2006.01]**
25/32 • Collecting of condensation water; Drainage **[1, 2006.01]**
25/34 • Turning or inching gear **[1, 2006.01]**
25/36 • • using electric motors **[1, 2006.01]**