

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

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