

**CPC****COOPERATIVE PATENT CLASSIFICATION****F05D****INDEXING SCHEME FOR ASPECTS RELATING TO NON-POSITIVE-DISPLACEMENT MACHINES OR ENGINES, GAS-TURBINES OR JET-PROPULSION PLANTS****F05D 2200/00****Mathematical features**

F05D 2200/10

- . Basic functions

F05D 2200/11

- . . Sum

F05D 2200/12

- . . Subtraction

F05D 2200/13

- . . Product

F05D 2200/14

- . . Division

F05D 2200/15

- . . Inverse

F05D 2200/20

- . Special functions

F05D 2200/21

- . . Root

F05D 2200/211

- . . . Square root

F05D 2200/212

- . . . Cubic root

F05D 2200/22

- . . Power

F05D 2200/221

- . . . Square power

F05D 2200/222

- . . . Cubic power

F05D 2200/23

- . . Logarithm

F05D 2200/24

- . . exponential

F05D 2200/25

- . . Hyperbolic trigonometric, e.g. sinh, cosh, tanh

F05D 2200/26

- . . trigonometric

F05D 2200/261

- . . . Sine

F05D 2200/262

- . . . Cosine

F05D 2200/263

- . . . Tangent

F05D 2200/264

- . . . Cotangent

F05D 2200/30

- . miscellaneous

F05D 2200/31

- . . odd

F05D 2200/32

- . . even

F05D 2200/33

- . . bigger or smaller

F05D 2200/34

- . . biggest or smallest

F05D 2200/35

- . . first

F05D 2200/36

- . . last

**F05D 2210/00****Working fluids**

F05D 2210/10

- . Kind or type

F05D 2210/11

- . . liquid, i.e. incompressible

F05D 2210/12

- . . gaseous, i.e. compressible

F05D 2210/13

- . . mixed, e.g. two-phase fluid

- F05D 2210/132 . . . Pumps with means for separating and evacuating the gaseous phase
- F05D 2210/14 . . Refrigerants with particular properties, e.g. HFC
- F05D 2210/20 . Properties
- F05D 2210/30 . Flow characteristics
- F05D 2210/31 . . with Mach-number kept constant along the flow
- F05D 2210/32 . . Pressure kept constant along the flow
- F05D 2210/33 . . Turbulent flow
- F05D 2210/34 . . Laminar flow
- F05D 2210/40 . Flow geometry or direction
- F05D 2210/41 . . upwards due to the buoyancy of compressed air
- F05D 2210/42 . . Axial inlet and radial outlet
- F05D 2210/43 . . Radial inlet and axial outlet
- F05D 2210/44 . . bidirectional, i.e. in opposite, alternating directions

**F05D 2220/00****Application**

- F05D 2220/10 . in ram-jet engines or ram-jet driven vehicles
- F05D 2220/20 . within closed fluid conduits, e.g. pipes
- F05D 2220/30 . in turbines
- F05D 2220/31 . . in steam turbines
- F05D 2220/32 . . in gas turbines
- F05D 2220/321 . . . for a special turbine stage
- F05D 2220/3212 . . . . the first stage of a turbine
- F05D 2220/3213 . . . . an intermediate stage of the turbine
- F05D 2220/3215 . . . . the last stage of the turbine
- F05D 2220/3216 . . . . for a special compressor stage
- F05D 2220/3217 . . . . . for the first stage of a compressor or a low pressure compressor
- F05D 2220/3218 . . . . . for an intermediate stage of a compressor
- F05D 2220/3219 . . . . . for the last stage of a compressor or a high pressure compressor
- F05D 2220/323 . . . for aircraft propulsion, e.g. jet engines
- F05D 2220/324 . . . to drive unshrouded, low solidity propeller
- F05D 2220/325 . . . to drive unshrouded, high solidity propeller
- F05D 2220/326 . . . to drive shrouded, low solidity propeller
- F05D 2220/327 . . . to drive shrouded, high solidity propeller
- F05D 2220/328 . . . providing direct vertical lift
- F05D 2220/329 . . . in helicopters
- F05D 2220/34 . . in ram-air turbines ("RATS")
- F05D 2220/36 . . specially adapted for the fan of turbofan engines
- F05D 2220/40 . in turbochargers
- F05D 2220/50 . for auxiliary power units (APU's)
- F05D 2220/60 . making use of surplus or waste energy

F05D 2220/62	<ul style="list-style-type: none"> <li>with energy recovery turbines</li> </ul>
F05D 2220/64	<ul style="list-style-type: none"> <li>for domestic central heating or production of electricity</li> </ul>
F05D 2220/70	<ul style="list-style-type: none"> <li>in combination with</li> </ul>
F05D 2220/72	<ul style="list-style-type: none"> <li>a steam turbine</li> </ul>
F05D 2220/722	<ul style="list-style-type: none"> <li>as part of an integrated gasification combined cycle</li> </ul>
F05D 2220/74	<ul style="list-style-type: none"> <li>a gas turbine</li> </ul>
F05D 2220/75	<ul style="list-style-type: none"> <li>equipment using fuel having a low calorific value, e.g. low BTU fuel, waste end, syngas, biomass fuel or flare gas</li> </ul>
F05D 2220/76	<ul style="list-style-type: none"> <li>an electrical generator</li> </ul>
F05D 2220/762	<ul style="list-style-type: none"> <li>of the direct current (D.C.) type</li> </ul>
F05D 2220/764	<ul style="list-style-type: none"> <li>of the alternating current (A.C.) type</li> </ul>
F05D 2220/7642	<ul style="list-style-type: none"> <li>of the synchronous type</li> </ul>
F05D 2220/7644	<ul style="list-style-type: none"> <li>of the asynchronous type, i.e. induction type</li> </ul>
F05D 2220/7646	<ul style="list-style-type: none"> <li>Double fed induction generators (DFIGs)</li> </ul>
F05D 2220/766	<ul style="list-style-type: none"> <li>via a direct connection, i.e. a gearless transmission</li> </ul>
F05D 2220/768	<ul style="list-style-type: none"> <li>equipped with permanent magnets</li> </ul>
F05D 2220/77	<ul style="list-style-type: none"> <li>of the linear type</li> </ul>
F05D 2220/80	<ul style="list-style-type: none"> <li>in supersonic vehicles excluding hypersonic vehicles or ram, scram or rocket propulsion</li> </ul>
F05D 2220/90	<ul style="list-style-type: none"> <li>in vehicles adapted for vertical or short take off and landing (v/stol vehicles)</li> </ul>
<b>F05D 2230/00</b>	<b>Manufacture</b>
F05D 2230/10	<ul style="list-style-type: none"> <li>by removing material</li> </ul>
F05D 2230/11	<ul style="list-style-type: none"> <li>by electrochemical methods</li> </ul>
F05D 2230/12	<ul style="list-style-type: none"> <li>by spark erosion methods</li> </ul>
F05D 2230/13	<ul style="list-style-type: none"> <li>using lasers</li> </ul>
F05D 2230/14	<ul style="list-style-type: none"> <li>Micromachining</li> </ul>
F05D 2230/18	<ul style="list-style-type: none"> <li>Manufacturing tolerances</li> </ul>
F05D 2230/20	<ul style="list-style-type: none"> <li>essentially without removing material</li> </ul>
F05D 2230/21	<ul style="list-style-type: none"> <li>by casting</li> </ul>
F05D 2230/211	<ul style="list-style-type: none"> <li>by precision casting, e.g. microfusing or investment casting</li> </ul>
F05D 2230/22	<ul style="list-style-type: none"> <li>by sintering</li> </ul>
F05D 2230/23	<ul style="list-style-type: none"> <li>by permanently joining parts together</li> </ul>
F05D 2230/232	<ul style="list-style-type: none"> <li>by welding</li> </ul>
F05D 2230/233	<ul style="list-style-type: none"> <li>Electron beam welding</li> </ul>
F05D 2230/234	<ul style="list-style-type: none"> <li>Laser welding</li> </ul>
F05D 2230/235	<ul style="list-style-type: none"> <li>TIG or MIG welding</li> </ul>
F05D 2230/236	<ul style="list-style-type: none"> <li>Diffusion bonding</li> </ul>
F05D 2230/237	<ul style="list-style-type: none"> <li>Brazing</li> </ul>
F05D 2230/238	<ul style="list-style-type: none"> <li>Soldering</li> </ul>
F05D 2230/239	<ul style="list-style-type: none"> <li>Inertia or friction welding</li> </ul>

- F05D 2230/24 . . by extrusion
- F05D 2230/25 . . by forging
- F05D 2230/26 . . by rolling
- F05D 2230/30 . with deposition of material
- F05D 2230/31 . . Layer deposition
- F05D 2230/311 . . . by torch or flame spraying
- F05D 2230/312 . . . by plasma spraying
- F05D 2230/313 . . . by physical vapour deposition
- F05D 2230/314 . . . by chemical vapour deposition
- F05D 2230/40 . Heat treatment
- F05D 2230/41 . . Hardening; Annealing
- F05D 2230/411 . . . Precipitation hardening
- F05D 2230/42 . . by hot isostatic pressing
- F05D 2230/50 . Building or constructing in particular ways
- F05D 2230/51 . . in a modular way, e.g. using several identical or complementary parts or features
- F05D 2230/52 . . using existing or "off the shelf" parts, e.g. using standardized turbocharger elements
- F05D 2230/53 . . by integrally manufacturing a component, e.g. by milling from a billet or one piece construction
- F05D 2230/54 . . by sheet metal manufacturing
- F05D 2230/60 . Assembly methods
- F05D 2230/61 . . using limited numbers of standard modules which can be adapted by machining
- F05D 2230/64 . . using positioning or alignment devices for aligning or centring, e.g. pins
- F05D 2230/642 . . . using maintaining alignment while permitting differential dilatation
- F05D 2230/644 . . . for adjusting the position or the alignment, e.g. wedges or eccenters
- F05D 2230/68 . . using auxiliary equipment for lifting or holding
- F05D 2230/70 . Disassembly methods
- F05D 2230/72 . Maintenance
- F05D 2230/80 . Repairing, retrofitting or upgrading methods
- F05D 2230/90 . Coating; Surface treatment ([manufacture with deposition of material F05D 2230/30](#))

**F05D 2240/00****Components****NOTE**

Components are the basic elements of construction

- F05D 2240/10 . Stators
- F05D 2240/11 . . Shroud seal segments
- F05D 2240/12 . . Fluid guiding means, e.g. vanes
- F05D 2240/121 . . . related to the leading edge of a stator vane

- F05D 2240/122 . . . related to the trailing edge of a stator vane
- F05D 2240/123 . . . related to the pressure side of a stator vane
- F05D 2240/124 . . . related to the suction side of a stator vane
- F05D 2240/125 . . . related to the tip of a stator vane
- F05D 2240/126 . . . Baffles or ribs
- F05D 2240/127 . . . Vortex generators, turbulators, or the like, for mixing ([by creating turbulence F05D 2260/2212](#))
- F05D 2240/128 . . . Nozzles
- F05D 2240/1281 . . . . Plug nozzles
- F05D 2240/129 . . . Cascades, i.e. assemblies of similar profiles acting in parallel
- F05D 2240/14 . . Casings or housings protecting or supporting assemblies within
- F05D 2240/15 . . Heat shield
- F05D 2240/20 . Rotors
- F05D 2240/24 . . for turbines
- F05D 2240/241 . . . of impulse type
- F05D 2240/242 . . . of reaction type
- F05D 2240/243 . . . of the Archimedes screw type
- F05D 2240/30 . . Characteristics of rotor blades, i.e. of any element transforming dynamic fluid energy to or from rotational energy and being attached to a rotor
- F05D 2240/301 . . . Cross-sectional characteristics
- F05D 2240/302 . . . characteristics related to shock waves, transonic or supersonic flow
- F05D 2240/303 . . . related to the leading edge of a rotor blade
- F05D 2240/304 . . . related to the trailing edge of a rotor blade
- F05D 2240/305 . . . related to the pressure side of a rotor blade
- F05D 2240/306 . . . related to the suction side of a rotor blade
- F05D 2240/307 . . . related to the tip of a rotor blade
- F05D 2240/31 . . . with roughened surfaces
- F05D 2240/35 . Combustors or associated equipment
- F05D 2240/36 . . Fuel vaporizer
- F05D 2240/40 . Use of a multiplicity of similar components
- F05D 2240/50 . Bearings
- F05D 2240/51 . . Magnetic
- F05D 2240/511 . . . with permanent magnets
- F05D 2240/515 . . . Electromagnetic
- F05D 2240/52 . . Axial thrust bearings
- F05D 2240/53 . . Hydrodynamic or hydrostatic bearings
- F05D 2240/54 . . Radial bearings
- F05D 2240/55 . Seals
- F05D 2240/56 . . Brush seals
- F05D 2240/57 . . Leaf seals

- F05D 2240/58 . . Piston ring seals
- F05D 2240/581 . . . Double or plural piston ring arrangements, i.e. two or more piston rings
- F05D 2240/59 . . Lamellar seals
- F05D 2240/60 . Shafts
- F05D 2240/61 . . Hollow
- F05D 2240/62 . . Flexible
- F05D 2240/63 . . Glands for admission or removal of fluids from shafts
- F05D 2240/70 . Slinger plates or washers
- F05D 2240/80 . Platforms for stationary or moving blades
- F05D 2240/81 . . Cooled platforms
- F05D 2240/90 . Mounting on supporting structures or systems
- F05D 2240/91 . . on a stationary structure

**F05D 2250/00****Geometry****NOTE**

Geometry indicates the shape or form of a component or the configuration or arrangement of components in a machine or in a plant

- F05D 2250/10 . Two-dimensional
- F05D 2250/11 . . triangular
- F05D 2250/12 . . rectangular
- F05D 2250/121 . . . square
- F05D 2250/13 . . trapezoidal
- F05D 2250/131 . . . polygonal
- F05D 2250/132 . . . hexagonal
- F05D 2250/14 . . elliptical
- F05D 2250/141 . . . circular
- F05D 2250/15 . . spiral
- F05D 2250/16 . . parabolic
- F05D 2250/17 . . hyperbolic
- F05D 2250/18 . . patterned
- F05D 2250/181 . . . ridged
- F05D 2250/182 . . . crenellated, notched
- F05D 2250/183 . . . zigzag
- F05D 2250/184 . . . sinusoidal
- F05D 2250/185 . . . serpentine-like
- F05D 2250/19 . . machined; miscellaneous
- F05D 2250/191 . . . perforated
- F05D 2250/192 . . . bevelled
- F05D 2250/193 . . . milled
- F05D 2250/20 . Three-dimensional

F05D 2250/21	. . pyramidal
F05D 2250/22	. . parallelepipedal
F05D 2250/221	. . . cubic
F05D 2250/23	. . prismatic
F05D 2250/231	. . . cylindrical
F05D 2250/232	. . . conical
F05D 2250/24	. . ellipsoidal
F05D 2250/241	. . . spherical
F05D 2250/25	. . helical
F05D 2250/26	. . paraboloid
F05D 2250/27	. . hyperboloid
F05D 2250/28	. . patterned
F05D 2250/281	. . . threaded
F05D 2250/282	. . . cubic pattern
F05D 2250/283	. . . honeycomb
F05D 2250/29	. . machined; miscellaneous
F05D 2250/291	. . . hollowed
F05D 2250/292	. . . tapered
F05D 2250/293	. . . lathed, e.g. rotation symmetrical
F05D 2250/294	. . . grooved
F05D 2250/30	. Arrangement of components
F05D 2250/31	. . according to the direction of their main axis or their axis of rotation
F05D 2250/311	. . . the axes being in line
F05D 2250/312	. . . the axes being parallel to each other
F05D 2250/313	. . . the axes being perpendicular to each other
F05D 2250/314	. . . the axes being inclined in relation to each other
F05D 2250/315	. . . the main axis being substantially vertical
F05D 2250/32	. . according to their shape
F05D 2250/321	. . . asymptotic
F05D 2250/322	. . . tangential
F05D 2250/323	. . . convergent
F05D 2250/324	. . . divergent
F05D 2250/33	. . symmetrical
F05D 2250/34	. . translated
F05D 2250/35	. . rotated
F05D 2250/36	. . in inner-outer relationship, e.g. shaft-bearing arrangements
F05D 2250/37	. . circumferential
F05D 2250/38	. . angled, e.g. sweep angle
F05D 2250/40	. Movement of components
F05D 2250/41	. . with one degree of freedom

F05D 2250/411	. . . in rotation
F05D 2250/42	. . with two degrees of freedom
F05D 2250/43	. . with three degrees of freedom
F05D 2250/44	. . by counter rotation
F05D 2250/50	. Inlet or outlet
F05D 2250/51	. . Inlet
F05D 2250/511	. . . augmenting, i.e. with intercepting fluid flow cross sectional area greater than the rest of the machine behind the inlet
F05D 2250/512	. . . concentrating only, i.e. with intercepting fluid flow cross sectional area not greater than the rest of the machine behind the inlet
F05D 2250/52	. . Outlet
F05D 2250/53	. . of regenerative pumps
F05D 2250/60	. Structure; Surface texture
F05D 2250/61	. . corrugated
F05D 2250/611	. . . undulated
F05D 2250/62	. . smooth or fine
F05D 2250/621	. . . polished
F05D 2250/63	. . coarse
F05D 2250/70	. Shape
F05D 2250/71	. . curved
F05D 2250/711	. . . convex
F05D 2250/712	. . . concave
F05D 2250/713	. . . inflexed
F05D 2250/72	. . symmetric
F05D 2250/73	. . asymmetric
F05D 2250/74	. . given by a set or table of xyz-coordinates
F05D 2250/75	. . given by its similarity to a letter, e.g. T-shaped
F05D 2250/80	. Size or power range of the machines
F05D 2250/82	. . Micromachines
F05D 2250/84	. . Nanomachines
F05D 2250/90	. Variable geometry

**F05D 2260/00****Function**

F05D 2260/02	. Transport and handling during maintenance and repair
F05D 2260/10	. Particular cycles
F05D 2260/12	. Testing on a test bench
F05D 2260/14	. Preswirling
F05D 2260/15	. Load balancing
F05D 2260/16	. Fluid modulation at a certain frequency
F05D 2260/20	. Heat transfer, e.g. cooling
F05D 2260/201	. . by impingement of a fluid



- F05D 2260/202 . . by film cooling
- F05D 2260/203 . . by transpiration cooling
- F05D 2260/204 . . by the use of microcircuits
- F05D 2260/205 . . Cooling fluid recirculation, i.e. after cooling one or more components is the cooling fluid recovered and used elsewhere for other purposes
- F05D 2260/207 . . using a phase changing mass, e.g. heat absorbing by melting or boiling
- F05D 2260/208 . . using heat pipes
- F05D 2260/209 . . using vortex tubes
- F05D 2260/211 . . by intercooling, e.g. during a compression cycle
- F05D 2260/212 . . by water injection
- F05D 2260/213 . . by the provision of a heat exchanger within the cooling circuit
- F05D 2260/221 . . Improvement of heat transfer
- F05D 2260/2212 . . . by creating turbulence ([vortex generators, turbulators or the like for mixing F05D 2240/127](#))
- F05D 2260/2214 . . . by increasing the heat transfer surface
- F05D 2260/22141 . . . . using fins or ribs
- F05D 2260/231 . . Preventing heat transfer
- F05D 2260/232 . . characterized by the cooling medium
- F05D 2260/2322 . . . steam
- F05D 2260/234 . . of the generator by compressor inlet air
- F05D 2260/24 . . for draft enhancement in chimneys, using solar or other heat sources
- F05D 2260/30 . Retaining components in desired mutual position
- F05D 2260/31 . Retaining bolts or nuts
- F05D 2260/311 . of the frangible or shear type
- F05D 2260/32 . . by means of magnetic or electromagnetic forces
- F05D 2260/33 . . with a bayonet coupling
- F05D 2260/34 . . Balancing of radial or axial forces on regenerative rotors
- F05D 2260/35 . . Reducing friction between regenerative impeller discs and casing walls
- F05D 2260/36 . . by a form fit connection, e.g. by interlocking
- F05D 2260/37 . . by a press fit connection
- F05D 2260/38 . . by a spring, i.e. spring loaded or biased towards a certain position
- F05D 2260/39 . . by a V-shaped ring to join the flanges of two cylindrical sections, e.g. casing sections of a turbocharger
- F05D 2260/40 . Transmission of power
- F05D 2260/402 . . through friction drives
- F05D 2260/4021 . . . through belt drives
- F05D 2260/4022 . . . through endless chains
- F05D 2260/4023 . . . through a friction clutch
- F05D 2260/403 . . through the shape of the drive components
- F05D 2260/4031 . . . as in toothed gearing
- F05D 2260/40311 . . . . of the epicyclical, planetary or differential type

- F05D 2260/404 . . through magnetic drive coupling
- F05D 2260/4041 . . . the driven magnets encircling the driver magnets
- F05D 2260/406 . . through hydraulic systems
- F05D 2260/407 . . through piezoelectric conversion
- F05D 2260/408 . . through magnetohydrodynamic conversion
- F05D 2260/42 . Storage of energy
- F05D 2260/43 . . in the form of rotational kinetic energy, e.g. in flywheels
- F05D 2260/50 . Kinematic linkage, i.e. transmission of position
- F05D 2260/52 . . involving springs
- F05D 2260/53 . . using gears
- F05D 2260/532 . . . of the bevelled or angled type
- F05D 2260/54 . . using flat or V-belts and pulleys
- F05D 2260/55 . . using chains and sprockets; using toothed belts
- F05D 2260/56 . . using cams or eccentrics
- F05D 2260/57 . . using servos, independent actuators, etc.
- F05D 2260/60 . Fluid transfer
- F05D 2260/601 . . using an ejector or a jet pump
- F05D 2260/602 . . Drainage
- F05D 2260/6022 . . . of leakage having past a seal ([seals F05D 2240/57](#); [glands F05D 2240/63](#))
- F05D 2260/604 . . Vortex non-clogging type pumps
- F05D 2260/605 . . Venting into the ambient atmosphere or the like
- F05D 2260/606 . . Bypassing the fluid
- F05D 2260/607 . . Preventing clogging or obstruction of flow paths by dirt, dust, or foreign particles
- F05D 2260/608 . . Aeration, ventilation, dehumidification or moisture removal of closed spaces
- F05D 2260/609 . . Deoiling or demisting
- F05D 2260/61 . . Removal of CO<sub>2</sub> ([removal of CO<sub>2</sub> from waste gases B01D 53/62](#))
- F05D 2260/611 . . Sequestration of CO<sub>2</sub>
- F05D 2260/70 . Adjusting of angle of incidence or attack of rotating blades
- F05D 2260/71 . . as a function of flow velocity
- F05D 2260/72 . . by turning around an axis parallel to the rotor centre line
- F05D 2260/74 . . by turning around an axis perpendicular the rotor centre line
- F05D 2260/75 . . the adjusting mechanism not using auxiliary power sources, e.g. by "servos"
- F05D 2260/76 . . the adjusting mechanism using auxiliary power sources
- F05D 2260/77 . . the adjusting mechanism driven or triggered by centrifugal forces
- F05D 2260/78 . . the adjusting mechanism driven or triggered by aerodynamic forces
- F05D 2260/79 . . Bearing, support or actuation arrangements therefor
- F05D 2260/80 . Diagnostics
- F05D 2260/81 . Modelling or simulation

- F05D 2260/82 . Forecasts
- F05D 2260/821 . . Parameter estimation or prediction
- F05D 2260/83 . Testing, e.g. methods, components or tools therefor
- F05D 2260/84 . Redundancy
- F05D 2260/85 . Starting
- F05D 2260/90 . Braking
- F05D 2260/901 . . using aerodynamic forces, i.e. lift or drag
- F05D 2260/902 . . using frictional mechanical forces
- F05D 2260/903 . . using electrical or magnetic forces
- F05D 2260/904 . . using hydrodynamic forces
- F05D 2260/94 . Functionality given by mechanical stress related aspects such as low cycle fatigue [LCF] of high cycle fatigue [HCF]
- F05D 2260/941 . . particularly aimed at mechanical or thermal stress reduction
- F05D 2260/95 . Preventing corrosion ([coating or surface treatment F05D 2230/90](#))
- F05D 2260/96 . Preventing, counteracting or reducing vibration or noise
- F05D 2260/961 . . by mistuning rotor blades or stator vanes with irregular interblade spacing, airfoil shape
- F05D 2260/962 . . by means of "anti-noise"
- F05D 2260/963 . . by Helmholtz resonators
- F05D 2260/964 . . counteracting thermoacoustic noise
- F05D 2260/97 . Reducing windage losses
- F05D 2260/972 . . in radial flow machines
- F05D 2260/98 . Lubrication
- F05D 2260/99 . Ignition, e.g. ignition by warming up of fuel or oxidizer in a resonant acoustic cavity

**F05D 2270/00****Control**

- F05D 2270/01 . Purpose of the control system
- F05D 2270/02 . . to control rotational speed (n)
- F05D 2270/021 . . . to prevent overspeed
- F05D 2270/022 . . . to prevent underspeed
- F05D 2270/023 . . . of different spools or shafts
- F05D 2270/024 . . . to keep rotational speed constant
- F05D 2270/03 . . in variable speed operation
- F05D 2270/04 . . to control acceleration (u)
- F05D 2270/042 . . . by keeping it below damagingly high values
- F05D 2270/044 . . . by making it as high as possible
- F05D 2270/05 . . to affect the output of the engine
- F05D 2270/051 . . . Thrust
- F05D 2270/052 . . . Torque
- F05D 2270/053 . . . Explicitly mentioned power

F05D 2270/06	. . to match engine to driven device
F05D 2270/061	. . . in particular the electrical frequency of driven generator
F05D 2270/07	. . to improve fuel economy
F05D 2270/071	. . . in particular at idling speed
F05D 2270/08	. . to produce clean exhaust gases
F05D 2270/081	. . . with as little smoke as possible
F05D 2270/082	. . . with as little NOx as possible
F05D 2270/083	. . . by monitoring combustion conditions
F05D 2270/0831	. . . . indirectly, at the exhaust
F05D 2270/09	. . to cope with emergencies
F05D 2270/091	. . . in particular sudden load loss
F05D 2270/092	. . . in particular blow-out and relight
F05D 2270/093	. . . of one engine in a multi-engine system
F05D 2270/094	. . . by using back-up controls
F05D 2270/095	. . . by temporary overriding set control limits
F05D 2270/096	. . . caused by water or hail ingestion
F05D 2270/10	. . to cope with, or avoid, compressor flow instabilities
F05D 2270/101	. . . Compressor surge or stall
F05D 2270/102	. . . . caused by working fluid flow velocity profile distortion
F05D 2270/1022	. . . . . due to high angle of attack of aircraft
F05D 2270/1024	. . . . . due to compressor degradation
F05D 2270/11	. . to prolong engine life
F05D 2270/112	. . . by limiting temperatures
F05D 2270/114	. . . by limiting mechanical stresses
F05D 2270/116	. . . by preventing reverse rotation
F05D 2270/12	. . to maintain desired vehicle trajectory parameters
F05D 2270/121	. . . Altitude
F05D 2270/122	. . . Speed or Mach number
F05D 2270/13	. . to control two or more engines simultaneously
F05D 2270/14	. . to control thermoacoustic behaviour in the combustion chambers ( <a href="#">counteracting noise or vibration F05D 2260/96</a> )
F05D 2270/16	. . to control water or steam injection
F05D 2270/17	. . to control boundary layer
F05D 2270/172	. . . by a plasma generator, e.g. control of ignition
F05D 2270/173	. . . by the Coanda effect
F05D 2270/18	. . using fluidic amplifiers or actuators
F05D 2270/20	. . to optimize the performance of a machine
F05D 2270/30	. Control parameters, e.g. input parameters
F05D 2270/301	. . Pressure
F05D 2270/3011	. . . Inlet pressure

F05D 2270/3013	. . . Outlet pressure
F05D 2270/3015	. . . differential pressure
F05D 2270/303	. . Temperature
F05D 2270/3032	. . . excessive temperatures, e.g. caused by overheating
F05D 2270/304	. . Spool rotational speed
F05D 2270/305	. . Tolerances
F05D 2270/306	. . Mass flow
F05D 2270/3061	. . . of the working fluid
F05D 2270/3062	. . . of the auxiliary fluid for heating or cooling purposes
F05D 2270/309	. . Rate of change of parameters
F05D 2270/31	. . Fuel schedule for stage combustors
F05D 2270/311	. . Air humidity
F05D 2270/312	. . Air pressure
F05D 2270/313	. . Air temperature
F05D 2270/331	. . Mechanical loads
F05D 2270/332	. . Maximum loads or fatigue criteria
F05D 2270/333	. . Noise or sound levels
F05D 2270/334	. . Vibration measurements
F05D 2270/335	. . Output power or torque
F05D 2270/336	. . Blade lift measurements
F05D 2270/40	. Type of control system
F05D 2270/42	. . passive or reactive, e.g. using large wind vanes
F05D 2270/44	. . active, predictive, or anticipative
F05D 2270/46	. . redundant, i.e. failsafe operation
F05D 2270/50	. Control logic embodiments
F05D 2270/52	. . by electrical means, e.g. relays or switches
F05D 2270/54	. . by electronic means, e.g. electronic tubes, transistors or IC's within an electronic circuit
F05D 2270/56	. . by hydraulic means, e.g. hydraulic valves within a hydraulic circuit
F05D 2270/58	. . by mechanical means, e.g. levers, gears or cams
F05D 2270/60	. Control system actuates means
F05D 2270/62	. . Electrical actuators
F05D 2270/64	. . Hydraulic actuators
F05D 2270/65	. . Pneumatic actuators
F05D 2270/66	. . Mechanical actuators ( <a href="#">F05D 2270/62</a> takes precedence)
F05D 2270/70	. Type of control algorithm
F05D 2270/701	. . proportional
F05D 2270/702	. . differential
F05D 2270/703	. . integral
F05D 2270/704	. . proportional-differential

- F05D 2270/705 . . proportional-integral
- F05D 2270/706 . . proportional-integral-differential
- F05D 2270/707 . . fuzzy logic
- F05D 2270/708 . . with comparison tables
- F05D 2270/709 . . with neural networks
- F05D 2270/71 . . synthesized, i.e. parameter computed by a mathematical model
- F05D 2270/80 . Devices generating input signals, e.g. transducers, sensors, cameras or strain gauges
- F05D 2270/802 . . Calibration thereof
- F05D 2270/803 . . Sampling thereof
- F05D 2270/804 . . Optical devices
- F05D 2270/8041 . . . Cameras
- F05D 2270/805 . . Radars
- F05D 2270/806 . . Sonars
- F05D 2270/807 . . Accelerometers
- F05D 2270/808 . . Strain gauges; Load cells
- F05D 2270/809 . . Encoders
- F05D 2270/81 . . Microphones
- F05D 2270/821 . . Displacement measuring means, e.g. inductive

#### **F05D 2300/00 Materials; Properties thereof**

- F05D 2300/10 . Metals, alloys or intermetallic compounds
- F05D 2300/11 . . Iron
- F05D 2300/111 . . . Cast iron
- F05D 2300/12 . . Light metals
- F05D 2300/121 . . . Aluminium
- F05D 2300/122 . . . Beryllium
- F05D 2300/123 . . . Boron
- F05D 2300/124 . . . Lithium
- F05D 2300/125 . . . Magnesium
- F05D 2300/13 . . Refractory metals, i.e. Ti, V, Cr, Zr, Nb, Mo, Hf, Ta, W
- F05D 2300/131 . . . Molybdenum
- F05D 2300/132 . . . Chromium
- F05D 2300/133 . . . Titanium
- F05D 2300/134 . . . Zirconium
- F05D 2300/135 . . . Hafnium
- F05D 2300/14 . . Noble metals, i.e. Ag, Au, platinum group metals
- F05D 2300/141 . . . Silver
- F05D 2300/142 . . . Gold
- F05D 2300/143 . . . Platinum group metals, i.e. Os, Ir, Pt, Ru, Rh, Pd
- F05D 2300/1431 . . . . Palladium

F05D 2300/1432	. . . . Ruthenium
F05D 2300/1433	. . . . Osmium
F05D 2300/1434	. . . . Iridium
F05D 2300/1435	. . . . Rhodium
F05D 2300/15	. . Rare earth metals, i.e. Sc, Y, lanthanides
F05D 2300/16	. . Other metals not provided for in groups <a href="#">F05D 2300/11</a> to <a href="#">F05D 2300/15</a>
F05D 2300/1602	. . . Arsenic
F05D 2300/1604	. . . Antimony
F05D 2300/1606	. . . Bismuth
F05D 2300/1608	. . . Barium
F05D 2300/161	. . . Manganese
F05D 2300/1612	. . . Lead
F05D 2300/1614	. . . Tin
F05D 2300/1616	. . . Zinc
F05D 2300/1618	. . . Mercury
F05D 2300/17	. . Alloys
F05D 2300/171	. . . Steel alloys
F05D 2300/172	. . . Copper alloys
F05D 2300/1721	. . . . Bronze
F05D 2300/1722	. . . . Phosphor-bronze alloy
F05D 2300/1723	. . . . Nickel-Copper alloy, e.g. Monel
F05D 2300/173	. . . Aluminium alloys, e.g. AlCuMgPb
F05D 2300/174	. . . Titanium alloys, e.g. TiAl
F05D 2300/175	. . . Superalloys
F05D 2300/176	. . . Heat-stable alloys
F05D 2300/177	. . . Ni - Si alloys
F05D 2300/18	. . Intermetallic compounds
F05D 2300/182	. . . Metal-aluminide intermetallic compounds
F05D 2300/20	. Oxide or non-oxide ceramics
F05D 2300/21	. . Oxide ceramics
F05D 2300/2102	. . . Glass
F05D 2300/2104	. . . MIBA
F05D 2300/2106	. . . Quartz
F05D 2300/2108	. . . Phosphor
F05D 2300/211	. . . Silica
F05D 2300/2112	. . . Aluminium oxides
F05D 2300/2114	. . . Sapphire
F05D 2300/2116	. . . Zinc oxide
F05D 2300/2118	. . . Zirconium oxides
F05D 2300/212	. . . Aluminium titanate

F05D 2300/22	. . Non-oxide ceramics
F05D 2300/222	. . . Silicon
F05D 2300/224	. . . Carbon, e.g. graphite
F05D 2300/226	. . . Carbides
F05D 2300/2261	. . . . of silicon
F05D 2300/2262	. . . . of titanium, e.g. TiC
F05D 2300/2263	. . . . of tungsten, e.g. WC
F05D 2300/228	. . . Nitrides
F05D 2300/2281	. . . . of aluminium
F05D 2300/2282	. . . . of boron
F05D 2300/2283	. . . . of silicon
F05D 2300/2284	. . . . of titanium
F05D 2300/2285	. . . . of zirconium
F05D 2300/229	. . . Sulfides
F05D 2300/2291	. . . . of molybdenum
F05D 2300/30	. Inorganic materials other than provided for in groups <a href="#">F05D 2300/10</a> to <a href="#">F05D 2300/2291</a>
F05D 2300/40	. Organic materials
F05D 2300/41	. . Leather
F05D 2300/42	. . Cellulosic materials, e.g. wood
F05D 2300/43	. . Synthetic polymers, e.g. plastics; Rubber
F05D 2300/431	. . . Rubber
F05D 2300/432	. . . PTFE [PolyTetraFluorEthylene]
F05D 2300/433	. . . Polyamides, e.g. NYLON
F05D 2300/434	. . . Polyimides, e.g. AURUM
F05D 2300/436	. . . Polyetherketones, e.g. PEEK
F05D 2300/437	. . . Silicon polymers
F05D 2300/44	. . Resins
F05D 2300/48	. . other organic materials
F05D 2300/50	. Intrinsic material properties or characteristics
F05D 2300/501	. . Elasticity
F05D 2300/502	. . Thermal properties
F05D 2300/5021	. . . Expansivity
F05D 2300/50211	. . . . similar
F05D 2300/50212	. . . . dissimilar
F05D 2300/5023	. . . Thermal capacity
F05D 2300/5024	. . . Heat conductivity
F05D 2300/504	. . Reflective properties
F05D 2300/505	. . Shape memory behaviour
F05D 2300/506	. . Hardness



F05D 2300/507	. . Magnetic properties
F05D 2300/509	. . Self lubricating materials; Solid lubricants
F05D 2300/51	. . Hydrophilic, i.e. being or having wettable properties
F05D 2300/512	. . Hydrophobic, i.e. being or having non-wettable properties
F05D 2300/514	. . Porosity
F05D 2300/516	. . Surface roughness
F05D 2300/518	. . Ductility
F05D 2300/52	. . Translucence
F05D 2300/522	. . Density
F05D 2300/60	. Properties or characteristics given to material by treatment or manufacturing
F05D 2300/601	. . Fabrics
F05D 2300/6012	. . . Woven fabrics
F05D 2300/603	. . Composites; e.g. fibre-reinforced
F05D 2300/6031	. . . Functionally graded composites
F05D 2300/6032	. . . Metal matrix composites [MMC]
F05D 2300/6033	. . . Ceramic matrix composites [CMC]
F05D 2300/6034	. . . Orientation of fibres, weaving, ply angle
F05D 2300/604	. . Amorphous
F05D 2300/605	. . Crystalline
F05D 2300/606	. . Directionally-solidified crystalline structures
F05D 2300/607	. . Monocrystallinity
F05D 2300/608	. . Microstructure
F05D 2300/609	. . Grain size
F05D 2300/61	. . Syntactic materials, i.e. hollow spheres embedded in a matrix
F05D 2300/611	. . Coating
F05D 2300/6111	. . functionally graded coating
F05D 2300/612	. . Foam
F05D 2300/613	. . Felt
F05D 2300/614	. . Fibres or filaments
F05D 2300/615	. . Filler
F05D 2300/70	. Treatment or modification of materials
F05D 2300/701	. . Heat treatment
F05D 2300/702	. . Reinforcement