

# CPC COOPERATIVE PATENT CLASSIFICATION

## F MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING (NOTE omitted)

### ENGINES OR PUMPS

#### F05 INDEXING SCHEMES RELATING TO ENGINES OR PUMPS IN VARIOUS SUBCLASSES OF CLASSES [F01-F04](#)

#### F05D INDEXING SCHEME FOR ASPECTS RELATING TO NON-POSITIVE-DISPLACEMENT MACHINES OR ENGINES, GAS-TURBINES OR JET-PROPULSION PLANTS

##### 2200/00 Mathematical features

- 2200/10 . Basic functions
- 2200/11 . . Sum
- 2200/12 . . Subtraction
- 2200/13 . . Product
- 2200/14 . . Division
- 2200/15 . . Inverse
- 2200/20 . Special functions
- 2200/21 . . Root
- 2200/211 . . . Square root
- 2200/212 . . . Cubic root
- 2200/22 . . Power
- 2200/221 . . . Square power
- 2200/222 . . . Cubic power
- 2200/23 . . Logarithm
- 2200/24 . . exponential
- 2200/25 . . Hyperbolic trigonometric, e.g. sinh, cosh, tanh
- 2200/26 . . trigonometric
- 2200/261 . . . Sine
- 2200/262 . . . Cosine
- 2200/263 . . . Tangent
- 2200/264 . . . Cotangent
- 2200/30 . miscellaneous
- 2200/31 . . odd
- 2200/32 . . even
- 2200/33 . . bigger or smaller
- 2200/34 . . biggest or smallest
- 2200/35 . . first
- 2200/36 . . last

##### 2210/00 Working fluids

- 2210/10 . Kind or type
- 2210/11 . . liquid, i.e. incompressible
- 2210/12 . . gaseous, i.e. compressible
- 2210/13 . . mixed, e.g. two-phase fluid
- 2210/132 . . . Pumps with means for separating and evacuating the gaseous phase
- 2210/14 . . Refrigerants with particular properties, e.g. HFC
- 2210/20 . Properties
- 2210/30 . Flow characteristics
- 2210/31 . . with Mach-number kept constant along the flow
- 2210/32 . . Pressure kept constant along the flow
- 2210/33 . . Turbulent flow
- 2210/34 . . Laminar flow

- 2210/40 . Flow geometry or direction
- 2210/41 . . upwards due to the buoyancy of compressed air
- 2210/42 . . Axial inlet and radial outlet
- 2210/43 . . Radial inlet and axial outlet
- 2210/44 . . bidirectional, i.e. in opposite, alternating directions

##### 2220/00 Application

- 2220/10 . in ram-jet engines or ram-jet driven vehicles
- 2220/20 . within closed fluid conduits, e.g. pipes
- 2220/30 . in turbines
- 2220/31 . . in steam turbines
- 2220/32 . . in gas turbines
- 2220/321 . . . for a special turbine stage
- 2220/3212 . . . . the first stage of a turbine
- 2220/3213 . . . . an intermediate stage of the turbine
- 2220/3215 . . . . the last stage of the turbine
- 2220/3216 . . . . for a special compressor stage
- 2220/3217 . . . . for the first stage of a compressor or a low pressure compressor
- 2220/3218 . . . . for an intermediate stage of a compressor
- 2220/3219 . . . . for the last stage of a compressor or a high pressure compressor
- 2220/323 . . . for aircraft propulsion, e.g. jet engines
- 2220/324 . . . to drive unshrouded, low solidity propeller
- 2220/325 . . . to drive unshrouded, high solidity propeller
- 2220/326 . . . to drive shrouded, low solidity propeller
- 2220/327 . . . to drive shrouded, high solidity propeller
- 2220/328 . . . providing direct vertical lift
- 2220/329 . . . in helicopters
- 2220/34 . . in ram-air turbines ("RATS")
- 2220/36 . . specially adapted for the fan of turbofan engines
- 2220/40 . in turbochargers
- 2220/50 . for auxiliary power units (APU's)
- 2220/60 . making use of surplus or waste energy
- 2220/62 . . with energy recovery turbines
- 2220/64 . . for domestic central heating or production of electricity
- 2220/70 . in combination with
- 2220/72 . . a steam turbine
- 2220/722 . . . as part of an integrated gasification combined cycle
- 2220/74 . . a gas turbine

2220/75	. . equipment using fuel having a low calorific value, e.g. low BTU fuel, waste end, syngas, biomass fuel or flare gas	2230/64	. . using positioning or alignment devices for aligning or centring, e.g. pins
2220/76	. . an electrical generator	2230/642	. . . using maintaining alignment while permitting differential dilatation
2220/762	. . . of the direct current (D.C.) type	2230/644	. . . for adjusting the position or the alignment, e.g. wedges or eccenters
2220/764	. . . of the alternating current (A.C.) type	2230/68	. . using auxiliary equipment for lifting or holding
2220/7642	. . . . of the synchronous type	2230/70	. Disassembly methods
2220/7644	. . . . of the asynchronous type, i.e. induction type	2230/72	. Maintenance
2220/7646	. . . . . Double fed induction generators (DFIGs)	2230/80	. Repairing, retrofitting or upgrading methods
2220/766	. . . via a direct connection, i.e. a gearless transmission	2230/90	. Coating; Surface treatment
2220/768	. . . equipped with permanent magnets		
2220/77	. . . of the linear type	<b>2240/00</b>	<b>Components</b>
2220/80	. in supersonic vehicles excluding hypersonic vehicles or ram, scram or rocket propulsion		<b>NOTE</b>
2220/90	. in vehicles adapted for vertical or short take off and landing (v/stol vehicles)		Components are the basic elements of construction
<b>2230/00</b>	<b>Manufacture</b>	2240/10	. Stators
2230/10	. by removing material	2240/11	. . Shroud seal segments
2230/11	. . by electrochemical methods	2240/12	. . Fluid guiding means, e.g. vanes
2230/12	. . by spark erosion methods	2240/121	. . . related to the leading edge of a stator vane
2230/13	. . using lasers	2240/122	. . . related to the trailing edge of a stator vane
2230/14	. . Micromachining	2240/123	. . . related to the pressure side of a stator vane
2230/18	. . Manufacturing tolerances	2240/124	. . . related to the suction side of a stator vane
2230/20	. essentially without removing material	2240/125	. . . related to the tip of a stator vane
2230/21	. . by casting	2240/126	. . . Baffles or ribs
2230/211	. . . by precision casting, e.g. microfusing or investment casting	2240/127	. . . Vortex generators, turbulators, or the like, for mixing
2230/22	. . by sintering	2240/128	. . . Nozzles
2230/23	. . by permanently joining parts together	2240/1281	. . . . Plug nozzles
2230/232	. . . by welding	2240/129	. . . Cascades, i.e. assemblies of similar profiles acting in parallel
2230/233	. . . . Electron beam welding	2240/14	. . Casings or housings protecting or supporting assemblies within
2230/234	. . . . Laser welding	2240/15	. . Heat shield
2230/235	. . . . TIG or MIG welding	2240/20	. Rotors
2230/236	. . . . Diffusion bonding	2240/24	. . for turbines
2230/237	. . . . Brazing	2240/241	. . . of impulse type
2230/238	. . . . Soldering	2240/242	. . . of reaction type
2230/239	. . . . Inertia or friction welding	2240/243	. . . of the Archimedes screw type
2230/24	. . by extrusion	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
2230/25	. . by forging	2240/301	. . . Cross-sectional characteristics
2230/26	. . by rolling	2240/302	. . . characteristics related to shock waves, transonic or supersonic flow
2230/30	. with deposition of material	2240/303	. . . related to the leading edge of a rotor blade
2230/31	. . Layer deposition	2240/304	. . . related to the trailing edge of a rotor blade
2230/311	. . . by torch or flame spraying	2240/305	. . . related to the pressure side of a rotor blade
2230/312	. . . by plasma spraying	2240/306	. . . related to the suction side of a rotor blade
2230/313	. . . by physical vapour deposition	2240/307	. . . related to the tip of a rotor blade
2230/314	. . . by chemical vapour deposition	2240/31	. . . with roughened surfaces
2230/40	. Heat treatment	2240/35	. Combustors or associated equipment
2230/41	. . Hardening; Annealing	2240/36	. . Fuel vaporizer
2230/411	. . . Precipitation hardening	2240/40	. Use of a multiplicity of similar components
2230/42	. . by hot isostatic pressing	2240/50	. Bearings
2230/50	. Building or constructing in particular ways	2240/51	. . Magnetic
2230/51	. . in a modular way, e.g. using several identical or complementary parts or features	2240/511	. . . with permanent magnets
2230/52	. . using existing or "off the shelf" parts, e.g. using standardized turbocharger elements	2240/515	. . . Electromagnetic
2230/53	. . by integrally manufacturing a component, e.g. by milling from a billet or one piece construction	2240/52	. . Axial thrust bearings
2230/54	. . by sheet metal manufacturing	2240/53	. . Hydrodynamic or hydrostatic bearings
2230/60	. Assembly methods	2240/54	. . Radial bearings
2230/61	. . using limited numbers of standard modules which can be adapted by machining	2240/55	. Seals

2240/56	. . Brush seals	2250/291	. . . hollowed
2240/57	. . Leaf seals	2250/292	. . . tapered
2240/58	. . Piston ring seals	2250/293	. . . lathed, e.g. rotation symmetrical
2240/581	. . . Double or plural piston ring arrangements, i.e. two or more piston rings	2250/294	. . . grooved
2240/59	. . Lamellar seals	2250/30	. Arrangement of components
2240/60	. Shafts	2250/31	. . according to the direction of their main axis or their axis of rotation
2240/61	. . Hollow	2250/311	. . . the axes being in line
2240/62	. . Flexible	2250/312	. . . the axes being parallel to each other
2240/63	. . Glands for admission or removal of fluids from shafts	2250/313	. . . the axes being perpendicular to each other
2240/70	. Slinger plates or washers	2250/314	. . . the axes being inclined in relation to each other
2240/80	. Platforms for stationary or moving blades	2250/315	. . . the main axis being substantially vertical
2240/81	. . Cooled platforms	2250/32	. . according to their shape
2240/90	. Mounting on supporting structures or systems	2250/321	. . . asymptotic
2240/91	. . on a stationary structure	2250/322	. . . tangential
2250/00	<b>Geometry</b>	2250/323	. . . convergent
	<b>NOTE</b>	2250/324	. . . divergent
	Geometry indicates the shape or form of a component or the configuration or arrangement of components in a machine or in a plant	2250/33	. . symmetrical
2250/10	. Two-dimensional	2250/34	. . translated
2250/11	. . triangular	2250/35	. . rotated
2250/12	. . rectangular	2250/36	. . in inner-outer relationship, e.g. shaft-bearing arrangements
2250/121	. . . square	2250/37	. . circumferential
2250/13	. . trapezoidal	2250/38	. . angled, e.g. sweep angle
2250/131	. . . polygonal	2250/40	. Movement of components
2250/132	. . . hexagonal	2250/41	. . with one degree of freedom
2250/14	. . elliptical	2250/411	. . . in rotation
2250/141	. . . circular	2250/42	. . with two degrees of freedom
2250/15	. . spiral	2250/43	. . with three degrees of freedom
2250/16	. . parabolic	2250/44	. . by counter rotation
2250/17	. . hyperbolic	2250/50	. Inlet or outlet
2250/18	. . patterned	2250/51	. . Inlet
2250/181	. . . ridged	2250/511	. . . augmenting, i.e. with intercepting fluid flow cross sectional area greater than the rest of the machine behind the inlet
2250/182	. . . crenellated, notched	2250/512	. . . concentrating only, i.e. with intercepting fluid flow cross sectional area not greater than the rest of the machine behind the inlet
2250/183	. . . zigzag	2250/52	. . Outlet
2250/184	. . . sinusoidal	2250/53	. . of regenerative pumps
2250/185	. . . serpentine-like	2250/60	. Structure; Surface texture
2250/19	. . machined; miscellaneous	2250/61	. . corrugated
2250/191	. . . perforated	2250/611	. . . undulated
2250/192	. . . bevelled	2250/62	. . smooth or fine
2250/193	. . . milled	2250/621	. . . polished
2250/20	. Three-dimensional	2250/63	. . coarse
2250/21	. . pyramidal	2250/70	. Shape
2250/22	. . parallelepipedal	2250/71	. . curved
2250/221	. . . cubic	2250/711	. . . convex
2250/23	. . prismatic	2250/712	. . . concave
2250/231	. . . cylindrical	2250/713	. . . inflexed
2250/232	. . . conical	2250/72	. . symmetric
2250/24	. . ellipsoidal	2250/73	. . asymmetric
2250/241	. . . spherical	2250/74	. . given by a set or table of xyz-coordinates
2250/25	. . helical	2250/75	. . given by its similarity to a letter, e.g. T-shaped
2250/26	. . paraboloid	2250/80	. Size or power range of the machines
2250/27	. . hyperboloid	2250/82	. . Micromachines
2250/28	. . patterned	2250/84	. . Nanomachines
2250/281	. . . threaded	2250/90	. Variable geometry
2250/282	. . . cubic pattern	2260/00	<b>Function</b>
2250/283	. . . honeycomb		
2250/29	. . machined; miscellaneous		

- 2260/02 . Transport and handling during maintenance and repair
- 2260/10 . Particular cycles
- 2260/12 . Testing on a test bench
- 2260/14 . Preswirling
- 2260/15 . Load balancing
- 2260/16 . Fluid modulation at a certain frequency
- 2260/20 . Heat transfer, e.g. cooling
- 2260/201 . . by impingement of a fluid
- 2260/202 . . by film cooling
- 2260/203 . . by transpiration cooling
- 2260/204 . . by the use of microcircuits
- 2260/205 . . Cooling fluid recirculation, i.e. after cooling one or more components is the cooling fluid recovered and used elsewhere for other purposes
- 2260/207 . . using a phase changing mass, e.g. heat absorbing by melting or boiling
- 2260/208 . . using heat pipes
- 2260/209 . . using vortex tubes
- 2260/211 . . by intercooling, e.g. during a compression cycle
- 2260/212 . . by water injection
- 2260/213 . . by the provision of a heat exchanger within the cooling circuit
- 2260/221 . . Improvement of heat transfer
- 2260/2212 . . . by creating turbulence
- 2260/2214 . . . by increasing the heat transfer surface
- 2260/22141 . . . . using fins or ribs
- 2260/231 . . Preventing heat transfer
- 2260/232 . . characterized by the cooling medium
- 2260/2322 . . . steam
- 2260/234 . . of the generator by compressor inlet air
- 2260/24 . . for draft enhancement in chimneys, using solar or other heat sources
- 2260/30 . Retaining components in desired mutual position
- 2260/31 . . Retaining bolts or nuts
- 2260/311 . . . of the frangible or shear type
- 2260/32 . . by means of magnetic or electromagnetic forces
- 2260/33 . . with a bayonet coupling
- 2260/34 . . Balancing of radial or axial forces on regenerative rotors
- 2260/35 . . Reducing friction between regenerative impeller discs and casing walls
- 2260/36 . . by a form fit connection, e.g. by interlocking
- 2260/37 . . by a press fit connection
- 2260/38 . . by a spring, i.e. spring loaded or biased towards a certain position
- 2260/39 . . by a V-shaped ring to join the flanges of two cylindrical sections, e.g. casing sections of a turbocharger
- 2260/40 . Transmission of power
- 2260/402 . . through friction drives
- 2260/4021 . . . through belt drives
- 2260/4022 . . . through endless chains
- 2260/4023 . . . through a friction clutch
- 2260/403 . . through the shape of the drive components
- 2260/4031 . . . as in toothed gearing
- 2260/40311 . . . . of the epicyclical, planetary or differential type
- 2260/404 . . through magnetic drive coupling
- 2260/4041 . . . the driven magnets encircling the driver magnets
- 2260/406 . . through hydraulic systems
- 2260/407 . . through piezoelectric conversion
- 2260/408 . . through magnetohydrodynamic conversion
- 2260/42 . Storage of energy
- 2260/43 . . in the form of rotational kinetic energy, e.g. in flywheels
- 2260/50 . Kinematic linkage, i.e. transmission of position
- 2260/52 . . involving springs
- 2260/53 . . using gears
- 2260/532 . . . of the bevelled or angled type
- 2260/54 . . using flat or V-belts and pulleys
- 2260/55 . . using chains and sprockets; using toothed belts
- 2260/56 . . using cams or eccentrics
- 2260/57 . . using servos, independent actuators, etc.
- 2260/60 . Fluid transfer
- 2260/601 . . using an ejector or a jet pump
- 2260/602 . . Drainage
- 2260/6022 . . . of leakage having past a seal
- 2260/604 . . Vortex non-clogging type pumps
- 2260/605 . . Venting into the ambient atmosphere or the like
- 2260/606 . . Bypassing the fluid
- 2260/607 . . Preventing clogging or obstruction of flow paths by dirt, dust, or foreign particles
- 2260/608 . . Aeration, ventilation, dehumidification or moisture removal of closed spaces
- 2260/609 . . Deoiling or demisting
- 2260/61 . . Removal of CO<sub>2</sub>
- 2260/611 . . Sequestration of CO<sub>2</sub>
- 2260/70 . Adjusting of angle of incidence or attack of rotating blades
- 2260/71 . . as a function of flow velocity
- 2260/72 . . by turning around an axis parallel to the rotor centre line
- 2260/74 . . by turning around an axis perpendicular the rotor centre line
- 2260/75 . . the adjusting mechanism not using auxiliary power sources, e.g. by "servos"
- 2260/76 . . the adjusting mechanism using auxiliary power sources
- 2260/77 . . the adjusting mechanism driven or triggered by centrifugal forces
- 2260/78 . . the adjusting mechanism driven or triggered by aerodynamic forces
- 2260/79 . . Bearing, support or actuation arrangements therefor
- 2260/80 . Diagnostics
- 2260/81 . Modelling or simulation
- 2260/82 . Forecasts
- 2260/821 . . Parameter estimation or prediction
- 2260/83 . Testing, e.g. methods, components or tools therefor
- 2260/84 . Redundancy
- 2260/85 . Starting
- 2260/90 . Braking
- 2260/901 . . using aerodynamic forces, i.e. lift or drag
- 2260/902 . . using frictional mechanical forces
- 2260/903 . . using electrical or magnetic forces
- 2260/904 . . using hydrodynamic forces
- 2260/94 . Functionality given by mechanical stress related aspects such as low cycle fatigue [LCF] of high cycle fatigue [HCF]
- 2260/941 . . particularly aimed at mechanical or thermal stress reduction
- 2260/95 . Preventing corrosion

2260/96	. Preventing, counteracting or reducing vibration or noise	2270/16	. . to control water or steam injection
2260/961	. . by mistuning rotor blades or stator vanes with irregular interblade spacing, airfoil shape	2270/17	. . to control boundary layer
2260/962	. . by means of "anti-noise"	2270/172	. . . by a plasma generator, e.g. control of ignition
2260/963	. . by Helmholtz resonators	2270/173	. . . by the Coanda effect
2260/964	. . counteracting thermoacoustic noise	2270/18	. . using fluidic amplifiers or actuators
2260/97	. Reducing windage losses	2270/20	. . to optimize the performance of a machine
2260/972	. . in radial flow machines	2270/30	. Control parameters, e.g. input parameters
2260/98	. Lubrication	2270/301	. . Pressure
2260/99	. Ignition, e.g. ignition by warming up of fuel or oxidizer in a resonant acoustic cavity	2270/3011	. . . Inlet pressure
<b>2270/00</b>	<b>Control</b>	2270/3013	. . . Outlet pressure
2270/01	. Purpose of the control system	2270/3015	. . . differential pressure
2270/02	. . to control rotational speed (n)	2270/303	. . Temperature
2270/021	. . . to prevent overspeed	2270/3032	. . . excessive temperatures, e.g. caused by overheating
2270/022	. . . to prevent underspeed	2270/304	. . Spool rotational speed
2270/023	. . . of different spools or shafts	2270/305	. . Tolerances
2270/024	. . . to keep rotational speed constant	2270/306	. . Mass flow
2270/03	. . in variable speed operation	2270/3061	. . . of the working fluid
2270/04	. . to control acceleration (u)	2270/3062	. . . of the auxiliary fluid for heating or cooling purposes
2270/042	. . . by keeping it below damagingly high values	2270/309	. . Rate of change of parameters
2270/044	. . . by making it as high as possible	2270/31	. . Fuel schedule for stage combustors
2270/05	. . to affect the output of the engine	2270/311	. . Air humidity
2270/051	. . . Thrust	2270/312	. . Air pressure
2270/052	. . . Torque	2270/313	. . Air temperature
2270/053	. . . Explicitly mentioned power	2270/331	. . Mechanical loads
2270/06	. . to match engine to driven device	2270/332	. . Maximum loads or fatigue criteria
2270/061	. . . in particular the electrical frequency of driven generator	2270/333	. . Noise or sound levels
2270/07	. . to improve fuel economy	2270/334	. . Vibration measurements
2270/071	. . . in particular at idling speed	2270/335	. . Output power or torque
2270/08	. . to produce clean exhaust gases	2270/336	. . Blade lift measurements
2270/081	. . . with as little smoke as possible	2270/40	. Type of control system
2270/082	. . . with as little NOx as possible	2270/42	. . passive or reactive, e.g. using large wind vanes
2270/083	. . . by monitoring combustion conditions	2270/44	. . active, predictive, or anticipative
2270/0831	. . . . indirectly, at the exhaust	2270/46	. . redundant, i.e. failsafe operation
2270/09	. . to cope with emergencies	2270/50	. Control logic embodiments
2270/091	. . . in particular sudden load loss	2270/52	. . by electrical means, e.g. relays or switches
2270/092	. . . in particular blow-out and relight	2270/54	. . by electronic means, e.g. electronic tubes, transistors or IC's within an electronic circuit
2270/093	. . . of one engine in a multi-engine system	2270/56	. . by hydraulic means, e.g. hydraulic valves within a hydraulic circuit
2270/094	. . . by using back-up controls	2270/58	. . by mechanical means, e.g. levers, gears or cams
2270/095	. . . by temporary overriding set control limits	2270/60	. Control system actuates means
2270/096	. . . caused by water or hail ingestion	2270/62	. . Electrical actuators
2270/10	. . to cope with, or avoid, compressor flow instabilities	2270/64	. . Hydraulic actuators
2270/101	. . . Compressor surge or stall	2270/65	. . Pneumatic actuators
2270/102	. . . . caused by working fluid flow velocity profile distortion	2270/66	. . Mechanical actuators ( <a href="#">F05D 2270/62 takes precedence</a> )
2270/1022	. . . . . due to high angle of attack of aircraft	2270/70	. Type of control algorithm
2270/1024	. . . . . due to compressor degradation	2270/701	. . proportional
2270/11	. . to prolong engine life	2270/702	. . differential
2270/112	. . . by limiting temperatures	2270/703	. . integral
2270/114	. . . by limiting mechanical stresses	2270/704	. . proportional-differential
2270/116	. . . by preventing reverse rotation	2270/705	. . proportional-integral
2270/12	. . to maintain desired vehicle trajectory parameters	2270/706	. . proportional-integral-differential
2270/121	. . . Altitude	2270/707	. . fuzzy logic
2270/122	. . . Speed or Mach number	2270/708	. . with comparison tables
2270/13	. . to control two or more engines simultaneously	2270/709	. . with neural networks
2270/14	. . to control thermoacoustic behaviour in the combustion chambers	2270/71	. . synthesized, i.e. parameter computed by a mathematical model
		2270/80	. Devices generating input signals, e.g. transducers, sensors, cameras or strain gauges

2270/802	. . Calibration thereof	2300/18	. . Intermetallic compounds
2270/803	. . Sampling thereof	2300/182	. . . Metal-aluminide intermetallic compounds
2270/804	. . Optical devices	2300/20	. Oxide or non-oxide ceramics
2270/8041	. . . Cameras	2300/21	. . Oxide ceramics
2270/805	. . Radars	2300/2102	. . . Glass
2270/806	. . Sonars	2300/2104	. . . MIBA
2270/807	. . Accelerometers	2300/2106	. . . Quartz
2270/808	. . Strain gauges; Load cells	2300/2108	. . . Phosphor
2270/809	. . Encoders	2300/211	. . . Silica
2270/81	. . Microphones	2300/2112	. . . Aluminium oxides
2270/821	. . Displacement measuring means, e.g. inductive	2300/2114	. . . Sapphire
<b>2300/00</b>	<b>Materials; Properties thereof</b>	2300/2116	. . . Zinc oxide
2300/10	. Metals, alloys or intermetallic compounds	2300/2118	. . . Zirconium oxides
2300/11	. . Iron	2300/212	. . . Aluminium titanate
2300/111	. . . Cast iron	2300/22	. . Non-oxide ceramics
2300/12	. . Light metals	2300/222	. . . Silicon
2300/121	. . . Aluminium	2300/224	. . . Carbon, e.g. graphite
2300/122	. . . Beryllium	2300/226	. . . Carbides
2300/123	. . . Boron	2300/2261	. . . . of silicon
2300/124	. . . Lithium	2300/2262	. . . . of titanium, e.g. TiC
2300/125	. . . Magnesium	2300/2263	. . . . of tungsten, e.g. WC
2300/13	. . Refractory metals, i.e. Ti, V, Cr, Zr, Nb, Mo, Hf, Ta, W	2300/228	. . . Nitrides
2300/131	. . . Molybdenum	2300/2281	. . . . of aluminium
2300/132	. . . Chromium	2300/2282	. . . . of boron
2300/133	. . . Titanium	2300/2283	. . . . of silicon
2300/134	. . . Zirconium	2300/2284	. . . . of titanium
2300/135	. . . Hafnium	2300/2285	. . . . of zirconium
2300/14	. . Noble metals, i.e. Ag, Au, platinum group metals	2300/229	. . . Sulfides
2300/141	. . . Silver	2300/2291	. . . . of molybdenum
2300/142	. . . Gold	2300/30	. Inorganic materials other than provided for in groups <a href="#">F05D 2300/10</a> - <a href="#">F05D 2300/2291</a>
2300/143	. . . Platinum group metals, i.e. Os, Ir, Pt, Ru, Rh, Pd	2300/40	. Organic materials
2300/1431	. . . . Palladium	2300/41	. . Leather
2300/1432	. . . . Ruthenium	2300/42	. . Cellulosic materials, e.g. wood
2300/1433	. . . . Osmium	2300/43	. . Synthetic polymers, e.g. plastics; Rubber
2300/1434	. . . . Iridium	2300/431	. . . Rubber
2300/1435	. . . . Rhodium	2300/432	. . . PTFE [PolyTetraFluorEthylene]
2300/15	. . Rare earth metals, i.e. Sc, Y, lanthanides	2300/433	. . . Polyamides, e.g. NYLON
2300/16	. . Other metals not provided for in groups <a href="#">F05D 2300/11</a> - <a href="#">F05D 2300/15</a>	2300/434	. . . Polyimides, e.g. AURUM
2300/1602	. . . Arsenic	2300/436	. . . Polyetherketones, e.g. PEEK
2300/1604	. . . Antimony	2300/437	. . . Silicon polymers
2300/1606	. . . Bismuth	2300/44	. . Resins
2300/1608	. . . Barium	2300/48	. . other organic materials
2300/161	. . . Manganese	2300/50	. Intrinsic material properties or characteristics
2300/1612	. . . Lead	2300/501	. . Elasticity
2300/1614	. . . Tin	2300/502	. . Thermal properties
2300/1616	. . . Zinc	2300/5021	. . . Expansivity
2300/1618	. . . Mercury	2300/50211	. . . . similar
2300/17	. . Alloys	2300/50212	. . . . dissimilar
2300/171	. . . Steel alloys	2300/5023	. . . Thermal capacity
2300/172	. . . Copper alloys	2300/5024	. . . Heat conductivity
2300/1721	. . . . Bronze	2300/504	. . Reflective properties
2300/1722	. . . . Phosphor-bronze alloy	2300/505	. . Shape memory behaviour
2300/1723	. . . . Nickel-Copper alloy, e.g. Monel	2300/506	. . Hardness
2300/173	. . . Aluminium alloys, e.g. AlCuMgPb	2300/507	. . Magnetic properties
2300/174	. . . Titanium alloys, e.g. TiAl	2300/509	. . Self lubricating materials; Solid lubricants
2300/175	. . . Superalloys	2300/51	. . Hydrophilic, i.e. being or having wettable properties
2300/176	. . . Heat-stable alloys	2300/512	. . Hydrophobic, i.e. being or having non-wettable properties
2300/177	. . . Ni - Si alloys	2300/514	. . Porosity

## F05D

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