

# 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 ( <a href="#">manufacture with deposition of material F05D 2230/30</a> )
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 ( <a href="#">by creating turbulence F05D 2260/2212</a> )
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		
2230/61	. . using limited numbers of standard modules which can be adapted by machining		

2240/54	. . Radial bearings	2250/283	. . . honeycomb
2240/55	. Seals	2250/29	. . machined; miscellaneous
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
<b>2250/00</b>	<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	Function	2260/4041	. . . the driven magnets encircling the driver magnets
2260/02	. Transport and handling during maintenance and repair	2260/406	. . through hydraulic systems
2260/10	. Particular cycles	2260/407	. . through piezoelectric conversion
2260/12	. Testing on a test bench	2260/408	. . through magnetohydrodynamic conversion
2260/14	. Preswirling	2260/42	. Storage of energy
2260/15	. Load balancing	2260/43	. . in the form of rotational kinetic energy, e.g. in flywheels
2260/16	. Fluid modulation at a certain frequency	2260/50	. Kinematic linkage, i.e. transmission of position
2260/20	. Heat transfer, e.g. cooling	2260/52	. . involving springs
2260/201	. . by impingement of a fluid	2260/53	. . using gears
2260/202	. . by film cooling	2260/532	. . . of the bevelled or angled type
2260/203	. . by transpiration cooling	2260/54	. . using flat or V-belts and pulleys
2260/204	. . by the use of microcircuits	2260/55	. . using chains and sprockets; using toothed belts
2260/205	. . Cooling fluid recirculation, i.e. after cooling one or more components is the cooling fluid recovered and used elsewhere for other purposes	2260/56	. . using cams or eccentrics
2260/207	. . using a phase changing mass, e.g. heat absorbing by melting or boiling	2260/57	. . using servos, independent actuators, etc.
2260/208	. . using heat pipes	2260/60	. Fluid transfer
2260/209	. . using vortex tubes	2260/601	. . using an ejector or a jet pump
2260/211	. . by intercooling, e.g. during a compression cycle	2260/602	. . Drainage
2260/212	. . by water injection	2260/6022	. . . of leakage having past a seal ( <a href="#">seals F05D 2240/57</a> ; <a href="#">glands F05D 2240/63</a> )
2260/213	. . by the provision of a heat exchanger within the cooling circuit	2260/604	. . Vortex non-clogging type pumps
2260/221	. . Improvement of heat transfer	2260/605	. . Venting into the ambient atmosphere or the like
2260/2212	. . . by creating turbulence ( <a href="#">vortex generators, turbulators or the like for mixing F05D 2240/127</a> )	2260/606	. . Bypassing the fluid
2260/2214	. . . by increasing the heat transfer surface	2260/607	. . Preventing clogging or obstruction of flow paths by dirt, dust, or foreign particles
2260/22141	. . . . using fins or ribs	2260/608	. . Aeration, ventilation, dehumidification or moisture removal of closed spaces
2260/231	. . Preventing heat transfer	2260/609	. . Deoiling or demisting
2260/232	. . characterized by the cooling medium	2260/61	. . Removal of CO <sub>2</sub> ( <a href="#">removal of CO<sub>2</sub> from waste gases B01D 53/62</a> )
2260/2322	. . . steam	2260/611	. . Sequestration of CO <sub>2</sub>
2260/234	. . of the generator by compressor inlet air	2260/70	. Adjusting of angle of incidence or attack of rotating blades
2260/24	. . for draft enhancement in chimneys, using solar or other heat sources	2260/71	. . as a function of flow velocity
2260/30	. Retaining components in desired mutual position	2260/72	. . by turning around an axis parallel to the rotor centre line
2260/31	. . Retaining bolts or nuts	2260/74	. . by turning around an axis perpendicular the rotor centre line
2260/311	. . . of the frangible or shear type	2260/75	. . the adjusting mechanism not using auxiliary power sources, e.g. by "servos"
2260/32	. . by means of magnetic or electromagnetic forces	2260/76	. . the adjusting mechanism using auxiliary power sources
2260/33	. . with a bayonet coupling	2260/77	. . the adjusting mechanism driven or triggered by centrifugal forces
2260/34	. . Balancing of radial or axial forces on regenerative rotors	2260/78	. . the adjusting mechanism driven or triggered by aerodynamic forces
2260/35	. . Reducing friction between regenerative impeller discs and casing walls	2260/79	. . Bearing, support or actuation arrangements therefor
2260/36	. . by a form fit connection, e.g. by interlocking	2260/80	. Diagnostics
2260/37	. . by a press fit connection	2260/81	. Modelling or simulation
2260/38	. . by a spring, i.e. spring loaded or biased towards a certain position	2260/82	. Forecasts
2260/39	. . by a V-shaped ring to join the flanges of two cylindrical sections, e.g. casing sections of a turbocharger	2260/821	. . Parameter estimation or prediction
2260/40	. Transmission of power	2260/83	. Testing, e.g. methods, components or tools therefor
2260/402	. . through friction drives	2260/84	. Redundancy
2260/4021	. . . through belt drives	2260/85	. Starting
2260/4022	. . . through endless chains	2260/90	. Braking
2260/4023	. . . through a friction clutch	2260/901	. . using aerodynamic forces, i.e. lift or drag
2260/403	. . through the shape of the drive components	2260/902	. . using frictional mechanical forces
2260/4031	. . . as in toothed gearing	2260/903	. . using electrical or magnetic forces
2260/40311	. . . . of the epicyclical, planetary or differential type	2260/904	. . using hydrodynamic forces
2260/404	. . through magnetic drive coupling		

2260/94	• Functionality given by mechanical stress related aspects such as low cycle fatigue [LCF] of high cycle fatigue [HCF]	2270/12	• • to maintain desired vehicle trajectory parameters
2260/941	• • particularly aimed at mechanical or thermal stress reduction	2270/121	• • • Altitude
2260/95	• Preventing corrosion ( <a href="#">coating or surface treatment F05D 2230/90</a> )	2270/122	• • • Speed or Mach number
2260/96	• Preventing, counteracting or reducing vibration or noise	2270/13	• • to control two or more engines simultaneously
2260/961	• • by mistuning rotor blades or stator vanes with irregular interblade spacing, airfoil shape	2270/14	• • to control thermoacoustic behaviour in the combustion chambers ( <a href="#">counteracting noise or vibration F05D 2260/96</a> )
2260/962	• • by means of "anti-noise"	2270/16	• • to control water or steam injection
2260/963	• • by Helmholtz resonators	2270/17	• • to control boundary layer
2260/964	• • counteracting thermoacoustic noise	2270/172	• • • by a plasma generator, e.g. control of ignition
2260/97	• Reducing windage losses	2270/173	• • • by the Coanda effect
2260/972	• • in radial flow machines	2270/18	• • using fluidic amplifiers or actuators
2260/98	• Lubrication	2270/20	• • to optimize the performance of a machine
2260/99	• Ignition, e.g. ignition by warming up of fuel or oxidizer in a resonant acoustic cavity	2270/30	• Control parameters, e.g. input parameters
<b>2270/00</b>	<b>Control</b>	2270/301	• • Pressure
2270/01	• Purpose of the control system	2270/3011	• • • Inlet pressure
2270/02	• • to control rotational speed (n)	2270/3013	• • • Outlet pressure
2270/021	• • • to prevent overspeed	2270/3015	• • • differential pressure
2270/022	• • • to prevent underspeed	2270/303	• • Temperature
2270/023	• • • of different spools or shafts	2270/3032	• • • excessive temperatures, e.g. caused by overheating
2270/024	• • • to keep rotational speed constant	2270/304	• • Spool rotational speed
2270/03	• • in variable speed operation	2270/305	• • Tolerances
2270/04	• • to control acceleration (u)	2270/306	• • Mass flow
2270/042	• • • by keeping it below damagingly high values	2270/3061	• • • of the working fluid
2270/044	• • • by making it as high as possible	2270/3062	• • • of the auxiliary fluid for heating or cooling purposes
2270/05	• • to affect the output of the engine	2270/309	• • Rate of change of parameters
2270/051	• • • Thrust	2270/31	• • Fuel schedule for stage combustors
2270/052	• • • Torque	2270/311	• • Air humidity
2270/053	• • • Explicitly mentioned power	2270/312	• • Air pressure
2270/06	• • to match engine to driven device	2270/313	• • Air temperature
2270/061	• • • in particular the electrical frequency of driven generator	2270/331	• • Mechanical loads
2270/07	• • to improve fuel economy	2270/332	• • Maximum loads or fatigue criteria
2270/071	• • • in particular at idling speed	2270/333	• • Noise or sound levels
2270/08	• • to produce clean exhaust gases	2270/334	• • Vibration measurements
2270/081	• • • with as little smoke as possible	2270/335	• • Output power or torque
2270/082	• • • with as little NOx as possible	2270/336	• • Blade lift measurements
2270/083	• • • by monitoring combustion conditions	2270/40	• Type of control system
2270/0831	• • • • indirectly, at the exhaust	2270/42	• • passive or reactive, e.g. using large wind vanes
2270/09	• • to cope with emergencies	2270/44	• • active, predictive, or anticipative
2270/091	• • • in particular sudden load loss	2270/46	• • redundant, i.e. failsafe operation
2270/092	• • • in particular blow-out and relight	2270/50	• Control logic embodiments
2270/093	• • • of one engine in a multi-engine system	2270/52	• • by electrical means, e.g. relays or switches
2270/094	• • • by using back-up controls	2270/54	• • by electronic means, e.g. electronic tubes, transistors or IC's within an electronic circuit
2270/095	• • • by temporary overriding set control limits	2270/56	• • by hydraulic means, e.g. hydraulic valves within a hydraulic circuit
2270/096	• • • caused by water or hail ingestion	2270/58	• • by mechanical means, e.g. levers, gears or cams
2270/10	• • to cope with, or avoid, compressor flow instabilities	2270/60	• Control system actuates means
2270/101	• • • Compressor surge or stall	2270/62	• • Electrical actuators
2270/102	• • • • caused by working fluid flow velocity profile distortion	2270/64	• • Hydraulic actuators
2270/1022	• • • • • due to high angle of attack of aircraft	2270/65	• • Pneumatic actuators
2270/1024	• • • • • due to compressor degradation	2270/66	• • Mechanical actuators ( <a href="#">F05D 2270/62 takes precedence</a> )
2270/11	• • to prolong engine life	2270/70	• Type of control algorithm
2270/112	• • • by limiting temperatures	2270/701	• • proportional
2270/114	• • • by limiting mechanical stresses	2270/702	• • differential
2270/116	• • • by preventing reverse rotation	2270/703	• • integral
		2270/704	• • proportional-differential
		2270/705	• • proportional-integral
		2270/706	• • proportional-integral-differential



2270/707	. . fuzzy logic	2300/1722	. . . . Phosphor-bronze alloy
2270/708	. . with comparison tables	2300/1723	. . . . Nickel-Copper alloy, e.g. Monel
2270/709	. . with neural networks	2300/173	. . . Aluminium alloys, e.g. AlCuMgPb
2270/71	. . synthesized, i.e. parameter computed by a mathematical model	2300/174	. . . Titanium alloys, e.g. TiAl
2270/80	. Devices generating input signals, e.g. transducers, sensors, cameras or strain gauges	2300/175	. . . Superalloys
2270/802	. . Calibration thereof	2300/176	. . . Heat-stable alloys
2270/803	. . Sampling thereof	2300/177	. . . Ni - Si alloys
2270/804	. . Optical devices	2300/18	. . Intermetallic compounds
2270/8041	. . . Cameras	2300/182	. . . Metal-aluminide intermetallic compounds
2270/805	. . Radars	2300/20	. Oxide or non-oxide ceramics
2270/806	. . Sonars	2300/21	. . Oxide ceramics
2270/807	. . Accelerometers	2300/2102	. . . Glass
2270/808	. . Strain gauges; Load cells	2300/2104	. . . MIBA
2270/809	. . Encoders	2300/2106	. . . Quartz
2270/81	. . Microphones	2300/2108	. . . Phosphor
2270/821	. . Displacement measuring means, e.g. inductive	2300/211	. . . Silica
<b>2300/00</b>	<b>Materials; Properties thereof</b>	2300/2112	. . . Aluminium oxides
2300/10	. Metals, alloys or intermetallic compounds	2300/2114	. . . Sapphire
2300/11	. . Iron	2300/2116	. . . Zinc oxide
2300/111	. . . Cast iron	2300/2118	. . . Zirconium oxides
2300/12	. . Light metals	2300/212	. . . Aluminium titanate
2300/121	. . . Aluminium	2300/22	. . Non-oxide ceramics
2300/122	. . . Beryllium	2300/222	. . . Silicon
2300/123	. . . Boron	2300/224	. . . Carbon, e.g. graphite
2300/124	. . . Lithium	2300/226	. . . Carbides
2300/125	. . . Magnesium	2300/2261	. . . . of silicon
2300/13	. . Refractory metals, i.e. Ti, V, Cr, Zr, Nb, Mo, Hf, Ta, W	2300/2262	. . . . of titanium, e.g. TiC
2300/131	. . . Molybdenum	2300/2263	. . . . of tungsten, e.g. WC
2300/132	. . . Chromium	2300/228	. . . Nitrides
2300/133	. . . Titanium	2300/2281	. . . . of aluminium
2300/134	. . . Zirconium	2300/2282	. . . . of boron
2300/135	. . . Hafnium	2300/2283	. . . . of silicon
2300/14	. . Noble metals, i.e. Ag, Au, platinum group metals	2300/2284	. . . . of titanium
2300/141	. . . Silver	2300/2285	. . . . of zirconium
2300/142	. . . Gold	2300/229	. . . Sulfides
2300/143	. . . Platinum group metals, i.e. Os, Ir, Pt, Ru, Rh, Pd	2300/2291	. . . . of molybdenum
2300/1431	. . . . Palladium	2300/30	. Inorganic materials other than provided for in groups <a href="#">F05D 2300/10</a> - <a href="#">F05D 2300/2291</a>
2300/1432	. . . . Ruthenium	2300/40	. Organic materials
2300/1433	. . . . Osmium	2300/41	. . Leather
2300/1434	. . . . Iridium	2300/42	. . Cellulosic materials, e.g. wood
2300/1435	. . . . Rhodium	2300/43	. . Synthetic polymers, e.g. plastics; Rubber
2300/15	. . Rare earth metals, i.e. Sc, Y, lanthanides	2300/431	. . . Rubber
2300/16	. . Other metals not provided for in groups <a href="#">F05D 2300/11</a> - <a href="#">F05D 2300/15</a>	2300/432	. . . PTFE [PolyTetraFluorEthylene]
2300/1602	. . . Arsenic	2300/433	. . . Polyamides, e.g. NYLON
2300/1604	. . . Antimony	2300/434	. . . Polyimides, e.g. AURUM
2300/1606	. . . Bismuth	2300/436	. . . Polyetherketones, e.g. PEEK
2300/1608	. . . Barium	2300/437	. . . Silicon polymers
2300/161	. . . Manganese	2300/44	. . Resins
2300/1612	. . . Lead	2300/48	. . other organic materials
2300/1614	. . . Tin	2300/50	. Intrinsic material properties or characteristics
2300/1616	. . . Zinc	2300/501	. . Elasticity
2300/1618	. . . Mercury	2300/502	. . Thermal properties
2300/17	. . Alloys	2300/5021	. . . Expansivity
2300/171	. . . Steel alloys	2300/50211	. . . . similar
2300/172	. . . Copper alloys	2300/50212	. . . . dissimilar
2300/1721	. . . . Bronze	2300/5023	. . . Thermal capacity
		2300/5024	. . . Heat conductivity
		2300/504	. . Reflective properties
		2300/505	. . Shape memory behaviour
		2300/506	. . Hardness

## F05D

- 2300/507 . . Magnetic properties
- 2300/509 . . Self lubricating materials; Solid lubricants
- 2300/51 . . Hydrophilic, i.e. being or having wettable properties
- 2300/512 . . Hydrophobic, i.e. being or having non-wettable properties
- 2300/514 . . Porosity
- 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