# CPC COOPERATIVE PATENT CLASSIFICATION

## F MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING

*(NOTE omitted)*

## ENGINES OR PUMPS

## F02 COMBUSTION ENGINES; HOT-GAS OR COMBUSTION-PRODUCT ENGINE PLANTS

## F02C GAS-TURBINE PLANTS; AIR INTAKES FOR JET-PROPULSION PLANTS; CONTROLLING FUEL SUPPLY IN AIR-BREATHING JET-PROPULSION PLANTS

(construction of turbines F01D; jet-propulsion plants F02K; construction of compressors or fans F04; generating combustion products of high pressure or high velocity F23R; using gas turbines in compression refrigeration plants F25B 11/00)

**NOTES**

1. This subclass covers:
   - combustion product or hot gas turbine plants;
   - internal combustion turbines or turbine plants;
   - turbine plants in which the working fluid is an unheated, pressurised gas.
2. This subclass does not cover:
   - steam turbine plants, which are covered by subclass F01K;
   - special vapour plants, which are covered by subclass F01K.
   - { combined cycle plants, which are covered by subclass F01K 23/00}
3. In this subclass, the following expression is used with the meaning indicated:
   - "gas-turbine plants" covers all the subject matter of Note (1) above and covers also features of jet-propulsion plants common to gas-turbine plants.
4. Attention is drawn to the Notes preceding class F01.

**WARNING**

In this subclass non-limiting references (in the sense of paragraph 39 of the Guide to the IPC) may still be displayed in the scheme.

**1/00** **Gas-turbine plants characterised by the use of hot gases or unheated pressurised gases, as the working fluid** (by the use of combustion products F02C 3/00, F02C 5/00)

1/002 . {using an auxiliary fluid}

1/005 . . {being recirculated}

1/007 . {combination of cycles}

1/02 . the working fluid being an unheated pressurised gas

1/04 . the working fluid being heated indirectly {(in a fluidised-bed combustor F02C 3/205)}

1/05 . . characterised by the type or source of heat, e.g. using nuclear or solar energy

1/06 . . . using reheated exhaust gas (F02C 1/08 takes precedence)

1/08 . . Semi-closed cycles

1/10 . . Closed cycles

1/105 . . . {construction; details}

**3/00** **Gas-turbine plants characterised by the use of combustion products as the working fluid** (generated by intermittent combustion F02C 5/00)

3/02 . using exhaust-gas pressure in a pressure exchanger to compress combustion-air (pressure exchangers per se F04F 13/00)

3/04 . having a turbine driving a compressor (power transmission arrangements F02C 7/36; control of working fluid flow F02C 9/16)

3/045 . . having compressor and turbine passages in a single rotor-module (F02C 3/073 takes precedence)

3/05 . . . the compressor and the turbine being of the radial flow type

3/055 . . the compressor being of the positive-displacement type

3/06 . . the compressor comprising only axial stages (F02C 3/10 takes precedence)

3/062 . . . {the turbine being of the radial-flow type}

3/064 . . . {the compressor having concentric stages}

3/067 . . . having counter-rotating rotors (F02C 3/073 takes precedence)

3/073 . . . the compressor and turbine stages being concentric

3/08 . . the compressor comprising at least one radial stage (F02C 3/10 takes precedence)

3/085 . . . {the turbine being of the radial-flow type (radial-radial) (F02C 3/05 takes precedence)}

3/09 . . . of the centripetal type

3/10 . . with another turbine driving an output shaft but not driving the compressor

3/103 . . . {the compressor being of the centrifugal type}
3/107 . . with two or more rotors connected by power transmission
3/113 . . . with variable power transmission between rotors
3/13 . . having variable working fluid interconnections between turbines or compressors or stages of different rotors {(controlling flow ratio between different flows of multi-flow jet-propulsion plant, e.g. ducted fan F02K 3/075)}
3/14 . characterised by the arrangement of the combustion chamber in the plant (combustion chambers per se F23R; F02C 3/205 takes precedence)
3/145 . . {the combustion chamber being in the reverse flow-type}
3/16 . . the combustion chambers being formed at least partly in the turbine rotor {or in an other rotating part of the plant}
3/165 . . . {the combustion chamber contributes to the driving force by creating reactive thrust}
3/20 . using a special fuel, oxidant, or dilution fluid to generate the combustion products
3/205 . . {in a fluidised-bed combustor (in combination with a steam cycle see F01K 23/061; fluidised-bed apparatus in general B01J 8/18; fluidised-bed combustors in general F23C 10/00)}
3/22 . . the fuel or oxidant being gaseous at standard temperature and pressure (F02C 3/28 takes precedence)
3/24 . . the fuel or oxidant being liquid at standard temperature and pressure
3/26 . . the fuel or oxidant being solid or pulverulent, e.g. in slurry or suspension
3/28 . . . using a separate gas producer for gasifying the fuel before combustion
3/30 . . Adding water, steam or other fluids {for influencing combustion, e.g. to obtain cleaner exhaust gases (F02C 7/141, F02C 7/30, F01D 21/00, F01K 21/04, F23D 11/10 take precedence)}
3/305 . . . {Increasing the power, speed, torque or efficiency of a gas turbine or the thrust of a turbojet engine by injecting or adding water, steam or other fluids (F01K 21/04 takes precedence)}
3/32 . Inducing air flow by fluid jet, e.g. ejector action
3/34 . with recycling of part of the working fluid, i.e. semi-closed cycles with combustion products in the closed part of the cycle
3/36 . Open cycles
3/365 . . {a part of the compressed air being burned, the other part being heated indirectly (in a fluidised-bed combustor F02C 3/205)}

**5/00 Gas-turbine plants characterised by the working fluid being generated by intermittent combustion**

5/02 . characterised by the arrangement of the combustion chamber in the chamber in the plant (combustion chambers per se F23R)
5/04 . . the combustion chambers being formed at least partly in the turbine rotor
5/06 . the working fluid being generated in an internal-combustion gas generated of the positive-displacement type having essentially no mechanical power output (internal-combustion engines with prolonged expansion using exhaust gas turbines F02B)
5/08 . . the gas generator being of the free-piston type
5/10 . the working fluid forming a resonating or oscillating gas column, i.e. the combustion chambers having no positively actuated valves, e.g. using Helmholtz effect
5/11 . . using valveless combustion chambers
5/12 . the combustion chambers having inlet or outlet valves, e.g. Holzwarth gas-turbine plants

**6/00 Plural gas-turbine plants; Combinations of gas-turbine plants with other apparatus; Adaptations of gas-turbine plants for special use**

6/003 . {Gas-turbine plants with heaters between turbine stages}
6/006 . {Open cycle gas-turbine in which the working fluid is expanded to a pressure below the atmospheric pressure and then compressed to atmospheric pressure}
6/02 . Plural gas-turbine plants having a common power output
6/04 . Gas-turbine plants providing heated or pressurised working fluid for other apparatus, e.g. without mechanical power output (F02C 6/18 takes precedence {; for a fluidised-bed combustor F02C 3/205})
6/06 . . providing compressed gas (F02C 6/10 takes precedence)
6/08 . . . the gas being bled from the gas-turbine compressor
6/10 . . supplying working fluid to a user, e.g. a chemical process, which returns working fluid to a turbine of the plant
6/12 . . . Turbochargers, i.e. plants for augmenting mechanical power output of internal-combustion piston engines by increase of charge pressure
6/14 . Gas-turbine plants having means for storing energy, e.g. for meeting peak loads
6/16 . . for storing compressed air
6/18 . using the waste heat of gas-turbine plants outside the plants themselves, e.g. gas-turbine power heat plants (using waste heat as source of energy for refrigeration plants F25B 27/02; using the waste heat of a gasturbine for steam generation or in a steam cycle see F01K 23/10)
6/20 . Adaptations of gas-turbine plants for driving vehicles
6/203 . . {the vehicles being waterborne vessels}
6/206 . . {the vehicles being airscrew driven}

**7/00 Features, components parts, details or accessories, not provided for in, or of interest apart form groups F02C 1/00 - F02C 6/00; Air intakes for jet-propulsion plants** (controlling F02C 9/00)

7/04 . Air intakes for gas-turbine plants or jet-propulsion plants
7/042 . . having variable geometry
7/045 . . having provisions for noise suppression
7/047 . . Heating to prevent icing

7/05 . . having provisions for obviating the penetration of damaging objects or particles
7/052 . . . with dust-separation devices
7/055 . . . with intake grids, screens or guards
7/057 . . Control or regulation (conjointly with fuel supply control F02C 9/50, with nozzle area control F02K 1/16)
7/06 . Arrangements of bearings (bearings F16C); Lubricating ({of turbo machines F01D 25/18; of machines or} engines in general F01M)
7/08 . Heating air supply before combustion, e.g. by exhaust gases
7/10 . . by means of regenerative heat-exchangers
7/105 . . . of the rotary type (rotary heat exchangers per se F28D)
7/12 . Cooling of plants (of component parts, see the relevant subclasses, e.g. F01D; cooling of engines in general F01P)
7/125 . . {by partial arc admission of the working fluid or by intermittent admission of working and cooling fluid}
7/14 . . of fluids in the plant {, e.g. lubricant or fuel (F02C 7/185 takes precedence)}
7/141 . . . of working fluid
7/143 . . . . before or between the compressor stages
7/1435 . . . . . {by water injection}
7/16 . . characterised by cooling medium
7/18 . . . the medium being gaseous, e.g. air {(F02C 7/125 takes precedence)}
7/185 . . . . {Cooling means for reducing the temperature of the cooling air or gas}
7/20 . Mounting or supporting of plant; Accommodating heat expansion or creep
7/22 . Fuel supply systems
7/222 . . {Fuel flow conduits, e.g. manifolds}
7/224 . . Heating fuel before feeding to the burner
7/228 . . Dividing fuel between various burners
7/232 . . Fuel valves {(control of fuel supply by means of fuel metering valves F02C 9/263)}; Draining valves or systems (valves in general F16K)
7/236 . . Fuel delivery systems comprising two or more pumps
7/2365 . . . {comprising an air supply system for the atomisation of fuel}
7/24 . Heat or noise insulation (air intakes having provisions for noise suppression F02C 7/045; turbine exhaust heads, chambers, or the like F01D 25/30; silencing nozzles of jet-propulsion plants F02K 1/00)
7/25 . . Fire protection or prevention (in general A62)
7/26 . Starting; Ignition
7/262 . . Restarting after flame-out
7/264 . . Ignition
7/266 . . . Electric (sparking plugs H01T)
7/268 . . Starting drives for the rotor {, acting directly on the rotor of the gas turbine to be started}
7/27 . . . Fluid drives (turbine starters F02C 7/277)
7/272 . . . . generated by cartridges
7/275 . . . Mechanical drives
7/277 . . . . the starter being a {separate} turbine
7/28 . Arrangement of seals
7/30 . Preventing corrosion {or unwanted deposits} in gas-swept spaces
7/32 . Arrangement, mounting, or driving, of auxiliaries
7/36 . Power transmission arrangements between the different shafts of the gas turbine plant, or between the gas-turbine plant and the power user ({F02C 3/107 - F02C 3/13 and} F02C 7/32 take precedence; couplings for transmitting rotation F16D; gearing in general F16H)

**9/00 Controlling gas-turbine plants; Controlling fuel supply in air- breathing jet-propulsion plants** (controlling air intakes F02C 7/057; controlling turbines F01D; controlling compressors F04D 27/00; controlling in general G05)

9/16 . Control of working fluid flow (F02C 9/48 takes precedence; control of air-intake flow F02C 7/057)
9/18 . . by bleeding, bypassing or acting on variable working fluid interconnections between turbines or compressors or their stages {(F02C 3/113 takes precedence)}
9/20 . . by throttling; by adjusting vanes
9/22 . . . by adjusting turbine vanes
9/24 . . Control of the pressure level in closed cycles
9/26 . Control of fuel supply (F02C 9/48 takes precedence; fuel valves F02C 7/232)
9/263 . . {by means of fuel metering valves}
9/266 . . {specially adapted for gas turbines with intermittent fuel injection}
9/28 . . Regulating systems responsive to plant or ambient parameters, e.g. temperature, pressure, rotor speed (F02C 9/30 - F02C 9/38, F02C 9/44 take precedence)
9/285 . . . {Mechanical command devices linked to the throttle lever}
9/30 . . characterised by variable fuel pump output
9/32 . . characterised by throttling of fuel (F02C 9/38 takes precedence)
9/34 . . . Joint control of separate flows to main and auxiliary burners
9/36 . . characterised by returning of fuel to sump (F02C 9/38 takes precedence)
9/38 . . characterised by throttling and returning of fuel to sump
9/40 . . specially adapted to the use of a special fuel or a plurality of fuels
9/42 . . specially adapted for the control of two or more plants simultaneously
9/44 . . responsive to the speed of aircraft, e.g. Mach number control, optimisation of fuel consumption
9/46 . . Emergency fuel control
9/48 . Control of fuel supply conjointly with another control of the plant (with nozzle section control F02K 1/17)
9/50 . . with control of working fluid flow
9/52 . . . by bleeding or by-passing the working fluid
9/54 . . . by throttling the working fluid, by adjusting vanes
9/56 . . with power transmission control
9/58 . . . with control of a variable-pitch propeller