

**CPC****COOPERATIVE PATENT CLASSIFICATION****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](#); gas-turbine combustion chambers [F23R](#); using gas turbines in compression refrigeration plants [F25B 11/00](#); using gas-turbine plants in vehicles, see the relevant vehicle classes)

**NOTE**

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.

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](#)}

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.

Attention is drawn to the Notes preceding class [F01](#).

**F02C 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 product [F02C 3/00](#), [F02C 5/00](#))

**F02C 1/002**

- . {using an auxiliary fluid}

**F02C 1/005**

- .. {being recirculated}

**F02C 1/007**

- . {combination of cycles}

**F02C 1/02**

- . the working fluid being an unheated pressurised gas

**F02C 1/04**

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

**F02C 1/05**

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

**F02C 1/06**

- ... using reheated exhaust gas ([F02C 1/08](#) takes precedence)

**F02C 1/08**

- .. Semi-closed cycles

- F02C 1/10 . . Closed cycles
- F02C 1/105 . . . {construction; details}
  
- F02C 3/00** **Gas-turbine plants characterised by the use of combustion products as the working fluid (generated by intermittent combustion F02C 5/00)**
- F02C 3/02 . using exhaust-gas pressure in a pressure exchanger to compress combustion-air (pressure exchangers per se F04F 13/00)
- F02C 3/04 . having a turbine driving a compressor (power transmission arrangements F02C 7/36; control of working fluid flow F02C 9/16)
- F02C 3/045 . . having compressor and turbine passages in a single rotor-module (F02C 3/073 takes precedence)
- F02C 3/05 . . . the compressor and the turbine being of the radial flow type
- F02C 3/055 . . the compressor being of the positive-displacement type
- F02C 3/06 . . the compressor comprising only axial stages (F02C 3/10 takes precedence)
- F02C 3/062 . . . {the turbine being of the radial-flow type}
- F02C 3/064 . . . {the compressor having concentric stages}
- F02C 3/067 . . . having counter-rotating rotors (F02C 3/073 takes precedence)
- F02C 3/073 . . . the compressor and turbine stages being concentric
- F02C 3/08 . . the compressor comprising at least one radial stage (F02C 3/10 takes precedence)
- F02C 3/085 . . . {the turbine being of the radial-flow type (radial-radial) (F02C 3/05 takes precedence)}
- F02C 3/09 . . . of the centripetal type
- F02C 3/10 . . with another turbine driving an output shaft but not driving the compressor
- F02C 3/103 . . . {the compressor being of the centrifugal type}
- F02C 3/107 . . with two or more rotors connected by power transmission
- F02C 3/113 . . . with variable power transmission between rotors
- F02C 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)}
- F02C 3/14 . characterised by the arrangement of the combustion chamber in the plant (combustion chambers per se F23R; F02C 3/205 takes precedence)
- F02C 3/145 . . {the combustion chamber being in the reverse flow-type}
- F02C 3/16 . . the combustion chambers being formed at least partly in the turbine rotor {or in an other rotating part of the plant}
- F02C 3/165 . . . {the combustion chamber contributes to the driving force by creating reactive thrust}
- F02C 3/20 . using a special fuel, oxidant, or dilution fluid to generate the combustion products
- F02C 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)}
- F02C 3/22 . . the fuel or oxidant being gaseous at standard temperature and pressure (F02C 3/28 takes precedence)
- F02C 3/24 . . the fuel or oxidant being liquid at standard temperature and pressure
- F02C 3/26 . . the fuel or oxidant being solid or pulverulent, e.g. in slurry or suspension

- F02C 3/28 . . . using a separate gas producer for gasifying the fuel before combustion
- F02C 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)}
- F02C 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)}
- F02C 3/32 . Inducing air flow by fluid jet, e.g. ejector action
- F02C 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
- F02C 3/36 . Open cycles
- F02C 3/365 . . {a part of the compressed air being burned, the other part being heated indirectly (in a fluidised-bed combustor F02C 3/205)}

#### **F02C 5/00 Gas-turbine plants characterised by the working fluid being generated by intermittent combustion**

- F02C 5/02 . characterised by the arrangement of the combustion chamber in the chamber in the plant (combustion chambers per se F23R)
- F02C 5/04 . . the combustion chambers being formed at least partly in the turbine rotor
- F02C 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)
- F02C 5/08 . . the gas generator being of the free-piston type
- F02C 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
- F02C 5/11 . . using valveless combustion chambers
- F02C 5/12 . the combustion chambers having inlet or outlet valves, e.g. Holzwarth gas-turbine plants

#### **F02C 6/00 Plural gas-turbine plants; Combinations of gas-turbine plants with other apparatus (aspects predominantly concerning such apparatus, see the relevant classes for the apparatus); Adaptations of gas-turbine plants for special use**

- F02C 6/003 . {Gas-turbine plants with heaters between turbine stages}
- F02C 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}
- F02C 6/02 . Plural gas-turbine plants having a common power output
- F02C 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})
- F02C 6/06 . . providing compressed gas (F02C 6/10 takes precedence)
- F02C 6/08 . . . the gas being bled from the gas-turbine compressor
- F02C 6/10 . . supplying working fluid to a user, e.g. a chemical process, which returns working fluid to a turbine of the plant
- F02C 6/12 . . . Turbochargers, i.e. plants for augmenting mechanical power output of internal-combustion piston engines by increase of charge pressure
- F02C 6/14 . Gas-turbine plants having means for storing energy, e.g. for meeting peak loads

- F02C 6/16
  - .. for storing compressed air
- F02C 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](#))
- F02C 6/20
  - . Adaptations of gas-turbine plants for driving vehicles
- F02C 6/203
  - .. {the vehicles being waterborne vessels}
- F02C 6/206
  - .. {the vehicles being airscrew driven}
- F02C 7/00**

**Features, components parts, details or accessories, not provided for in, or of interest apart form groups [F02C 1/00](#) to [F02C 6/00](#); Air intakes for jet-propulsion plants (controlling [F02C 9/00](#))**
- F02C 7/04
  - . Air intakes for gas-turbine plants or jet-propulsion plants
- F02C 7/042
  - .. having variable geometry
- F02C 7/045
  - .. having provisions for noise suppression
- F02C 7/047
  - .. Heating to prevent icing
- F02C 7/05
  - .. having provisions for obviating the penetration of damaging objects or particles
- F02C 7/052
  - ... with dust-separation devices
- F02C 7/055
  - ... with intake grids, screens or guards
- F02C 7/057
  - .. Control or regulation (conjointly with fuel supply control [F02C 9/50](#), with nozzle area control [F02K 1/16](#))
- F02C 7/06
  - . Arrangements of bearings (bearings [F16C](#)); Lubricating ({of turbo machines [F01D 25/18](#); of machines or} engines in general [F01M](#))
- F02C 7/08
  - . Heating air supply before combustion, e.g. by exhaust gases
- F02C 7/10
  - .. by means of regenerative heat-exchangers
- F02C 7/105
  - ... of the rotary type (rotary heat exchangers per se [F28D](#))
- F02C 7/12
  - . Cooling of plants (of component parts, see the relevant subclasses, e.g. [F01D](#); cooling of engines in general [F01P](#))
- F02C 7/125
  - .. {by partial arc admission of the working fluid or by intermittent admission of working and cooling fluid}
- F02C 7/14
  - .. of fluids in the plant, {e.g. lubricant or fuel ([F02C 7/185](#) takes precedence)}
- F02C 7/141
  - ... of working fluid
- F02C 7/143
  - .... before or between the compressor stages
- F02C 7/1435
  - ..... {by water injection}
- F02C 7/16
  - .. characterised by cooling medium
- F02C 7/18
  - ... the medium being gaseous, e.g. air {([F02C 7/125](#) takes precedence)}
- F02C 7/185
  - .... {Cooling means for reducing the temperature of the cooling air or gas}
- F02C 7/20
  - . Mounting or supporting of plant; Accomodating heat expansion or creep
- F02C 7/22
  - . Fuel supply systems
- F02C 7/222
  - .. {Fuel flow conduits, e.g. manifolds}
- F02C 7/224
  - .. Heating fuel before feeding to the burner
- F02C 7/228
  - .. Dividing fuel between various burners

- F02C 7/232 .. Fuel valves [{\(control of fuel supply by means of fuel metering valves F02C 9/263\)}](#); Draining valves or systems [\(valves in general F16K\)](#)
- F02C 7/236 .. Fuel delivery systems comprising two or more pumps
- F02C 7/2365 ... [{comprising an air supply system for the atomisation of fuel}](#)
- F02C 7/24 . Heat or noise insulation [\(air intakes having provisions for noise suppression F02C 7/045; turbine exhaust heads, chambers, or the like F01D 25/30; silencing nozzles of jet-propulsion plants F02K 1/00\)](#)
- F02C 7/25 .. Fire protection or prevention [\(in general A62\)](#)
- F02C 7/26 . Starting; Ignition
- F02C 7/262 .. Restarting after flame-out
- F02C 7/264 .. Ignition
- F02C 7/266 ... Electric [\(sparking plugs H01T\)](#)
- F02C 7/268 .. Starting drives for the rotor, [{acting directly on the rotor of the gas turbine to be started}](#)
- F02C 7/27 ... Fluid drives [\(turbine starters F02C 7/277\)](#)
- F02C 7/272 .... generated by cartridges
- F02C 7/275 ... Mechanical drives
- F02C 7/277 .... the starter being a [{separate}](#) turbine
- F02C 7/28 . Arrangement of seals
- F02C 7/30 . Preventing corrosion [{or unwanted deposits}](#) in gas-swept spaces
- F02C 7/32 . Arrangement, mounting, or driving, of auxiliaries
- F02C 7/36 . Power transmission arrangements between the different shafts of the gas turbine plant, or between the gas-turbine plant and the power user [{\(F02C 3/107 to F02C 3/13 and} F02C 7/32 take precedence; couplings for transmitting rotation F16D; gearing in general F16H\)](#)
- F02C 9/00** **Controlling gas-turbine plants; Controlling fuel supply in air-breathing jet-propulsion plants** [\(controlling air intakes F02C 7/057; controlling turbines F01D; controlling compressors F04D 27/00; controlling in general G05\)](#)
- F02C 9/16 . Control of working fluid flow [\(F02C 9/48 takes precedence; control of air-intake flow F02C 7/057\)](#)
- F02C 9/18 .. by bleeding, bypassing or acting on variable working fluid interconnections between turbines or compressors or their stages [{\(F02C 3/113 takes precedence\)}](#)
- F02C 9/20 .. by throttling; by adjusting vanes
- F02C 9/22 ... by adjusting turbine vanes
- F02C 9/24 .. Control of the pressure level in closed cycles
- F02C 9/26 . Control of fuel supply [\(F02C 9/48 takes precedence; fuel valves F02C 7/232\)](#)
- F02C 9/263 .. [{by means of fuel metering valves}](#)
- F02C 9/266 .. [{specially adapted for gas turbines with intermittent fuel injection}](#)
- F02C 9/28 .. Regulating systems responsive to plant or ambient parameters, e.g. temperature, pressure, rotor speed [\(F02C 9/30 to F02C 9/38, F02C 9/44 take precedence\)](#)
- F02C 9/285 ... [{Mechanical command devices linked to the throttle lever}](#)
- F02C 9/30 .. characterised by variable fuel pump output
- F02C 9/32 .. characterised by throttling of fuel [\(F02C 9/38 takes precedence\)](#)

- F02C 9/34 . . . Joint control of separate flows to main and auxiliary burners
- F02C 9/36 . . characterised by returning of fuel to sump ([F02C 9/38 takes precedence](#))
- F02C 9/38 . . characterised by throttling and returning of fuel to sump
- F02C 9/40 . . specially adapted to the use of a special fuel or a plurality of fuels
- F02C 9/42 . . specially adapted for the control of two or more plants simultaneously
- F02C 9/44 . . responsive to the speed of aircraft, e.g. Mach number control, optimisation of fuel consumption
- F02C 9/46 . . Emergency fuel control
- F02C 9/48 . Control of fuel supply conjointly with another control of the plant ([with nozzle section control F02K 1/17](#))
- F02C 9/50 . . with control of working fluid flow
- F02C 9/52 . . . by bleeding or by-passing the working fluid
- F02C 9/54 . . . by throttling the working fluid, by adjusting vanes
- F02C 9/56 . . with power transmission control
- F02C 9/58 . . . with control of a variable-pitch propeller