

**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**

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](#).

**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 from 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