

# CPC COOPERATIVE PATENT CLASSIFICATION

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

### LIGHTING; HEATING

## F23 COMBUSTION APPARATUS; COMBUSTION PROCESSES (NOTE omitted)

## F23N REGULATING OR CONTROLLING COMBUSTION (control devices specially adapted for combustion apparatus in which combustion takes place in a fluidised bed of fuel or other particles [F23C 10/28](#); condition responsive controls for regulating combustion in domestic stoves with open fires for solid fuel [F24B 1/187](#))

- |             |  |             |   |
|-------------|--|-------------|---|
| <b>1/00</b> | <b>Regulating fuel supply</b>  | 3/06        | • by conjoint operation of two or more valves or dampers (by power-assisted systems <a href="#">F23N 3/08</a> )   |
| 1/002       | • {using electronic means ( <a href="#">F23N 1/04</a> - <a href="#">F23N 1/10</a> take precedence)}                      | 3/065       | • • {using mechanical means}  |
| 1/005       | • {using electrical or electromechanical means ( <a href="#">F23N 1/04</a> - <a href="#">F23N 1/10</a> take precedence)} | 3/08        | • by power-assisted systems   |
| 1/007       | • {using mechanical means ( <a href="#">F23N 1/04</a> - <a href="#">F23N 1/10</a> take precedence)}                      | 3/082       | • • {using electronic means}  |
| 1/02        | • conjointly with air supply   | 3/085       | • • {using electrical or electromechanical means}   |
| 1/022       | • • {using electronic means}   | 3/087       | • • {using mechanical means}  |
| 1/025       | • • {using electrical or electromechanical means}  | <b>5/00</b> | <b>Systems for controlling combustion (regulating fuel supply <a href="#">F23N 1/00</a>, regulating air supply or draught <a href="#">F23N 3/00</a>)</b>        |
| 1/027       | • • {using mechanical means}   | 5/003       | • {using detectors sensitive to combustion gas properties ( <a href="#">F23N 5/02</a> , <a href="#">F23N 5/18</a> - <a href="#">F23N 5/26</a> take precedence)} |
| 1/04        | • conjointly with air supply and with draught  | 5/006       | • • {the detector being sensitive to oxygen}  |
| 1/042       | • • {using electronic means}   | 5/02        | • using devices responsive to thermal changes or to thermal expansion of a medium   |
| 1/045       | • • {using electrical or electromechanical means}  | 5/022       | • • {using electronic means ( <a href="#">F23N 5/04</a> - <a href="#">F23N 5/14</a> take precedence)}   |
| 1/047       | • • {using mechanical means}   | 5/025       | • • {using electrical or electromechanical means ( <a href="#">F23N 5/04</a> - <a href="#">F23N 5/14</a> take precedence)}                                      |
| 1/06        | • conjointly with draught  | 5/027       | • • {using mechanical means ( <a href="#">F23N 5/04</a> - <a href="#">F23N 5/14</a> take precedence)}   |
| 1/062       | • • {using electronic means}   | 5/04        | • • using bimetallic elements   |
| 1/065       | • • {using electrical or electromechanical means}  | 5/042       | • • • {using electronic means}  |
| 1/067       | • • {using mechanical means}   | 5/045       | • • • {using electrical or electromechanical means}   |
| 1/08        | • conjointly with another medium, e.g. boiler water  | 5/047       | • • • {using mechanical means}  |
| 1/082       | • • {using electronic means}   | 5/06        | • • using bellows; using diaphragms   |
| 1/085       | • • {using electrical or electromechanical means}  | 5/062       | • • • {using electronic means}  |
| 1/087       | • • {using mechanical means}   | 5/065       | • • • {using electrical or electromechanical means}   |
| 1/10        | • • and with air supply or draught   | 5/067       | • • • {using mechanical means}  |
| 1/102       | • • • {using electronic means}   | 5/08        | • • using light-sensitive elements  |
| 1/105       | • • • {using electrical or electromechanical means}  | 5/082       | • • • {using electronic means}  |
| 1/107       | • • • {using mechanical means}   | 5/085       | • • • {using electrical or electromechanical means}   |
| <b>3/00</b> | <b>Regulating air supply or draught (conjointly with fuel supply <a href="#">F23N 1/00</a>)</b>                          | 5/087       | • • • {using mechanical means}  |
| 3/002       | • {using electronic means ( <a href="#">F23N 3/02</a> - <a href="#">F23N 3/08</a> take precedence)}                      | 5/10        | • • using thermocouples   |
| 3/005       | • {using electrical or electromechanical means ( <a href="#">F23N 3/02</a> - <a href="#">F23N 3/08</a> take precedence)} | 5/102       | • • • {using electronic means}  |
| 3/007       | • {using mechanical means ( <a href="#">F23N 3/02</a> - <a href="#">F23N 3/08</a> take precedence)}                      | 5/105       | • • • {using electrical or electromechanical means}   |
| 3/02        | • Regulating draught by direct pressure operation of single valves or dampers  | 5/107       | • • • {using mechanical means, e.g. safety valves}  |
| 3/04        | • by operation of single valves or dampers by temperature sensitive elements   | 5/12        | • • using ionisation-sensitive elements, i.e. flame rods  |
| 3/042       | • • {using electronic means}   | 5/123       | • • • {using electronic means}  |
| 3/045       | • • {using electrical or electromechanical means}  | 5/126       | • • • {using electrical or electromechanical means}   |
| 3/047       | • • {using mechanical means}   | 5/14        | • • using thermo-sensitive resistors  |

- 5/143 . . . {using electronic means}
- 5/146 . . . {using electrical or electromechanical means}
- 5/16 . using noise-sensitive detectors
- 2005/165 . . . {with ultrasonic means}
- 5/18 . using detectors sensitive to rate of flow of air or fuel
- 2005/181 . . . {using detectors sensitive to rate of flow of air}
- 2005/182 . . . {Air flow switch}
- 5/184 . . . {using electronic means}
- 2005/185 . . . {using detectors sensitive to rate of flow of fuel}
- 5/187 . . . {using electrical or electromechanical means}
- 5/188 . . . {using mechanical means}
- 5/20 . with a time programme acting through electrical means, e.g. using time-delay relays
- 5/203 . . . {using electronic means}
- 5/206 . . . {using electrical or electromechanical means}
- 5/22 . with a time programme acting through mechanical means, e.g. using cams
- 5/24 . Preventing development of abnormal or undesired conditions, i.e. safety arrangements  
(F23N 5/02 - F23N 5/18 take precedence)
- 5/242 . . . {using electronic means}
- 5/245 . . . {using electrical or electromechanical means}
- 5/247 . . . {using mechanical means}
- 5/26 . Details
- 5/265 . . . {using electronic means}

#### 2221/00 Pretreatment or prehandling

- 2221/02 . using belt conveyors
- 2221/04 . Preheating liquid fuel
- 2221/06 . Preheating gaseous fuel
- 2221/08 . Preheating the air
- 2221/10 . Analysing fuel properties, e.g. density, calorific
- 2221/12 . Recycling exhaust gases

#### 2223/00 Signal processing; Details thereof

- 2223/02 . Multiplex transmission
- 2223/04 . Memory
- 2223/06 . Sampling
- 2223/08 . Microprocessor; Microcomputer
- 2223/10 . Correlation
- 2223/12 . Integration
- 2223/14 . Differentiation
- 2223/16 . Measuring bridge
- 2223/18 . Chopper
- 2223/20 . Opto-coupler
- 2223/22 . Timing network
- 2223/24 . . with bimetallic elements
- 2223/26 . . with capacitors
- 2223/28 . . with more than one timing element
- 2223/30 . Switches
- 2223/32 . . Reed switches
- 2223/34 . with feedforward processing
- 2223/36 . PID signal processing
- 2223/38 . Remote control
- 2223/40 . Simulation
- 2223/42 . Function generator
- 2223/44 . Optimum control
- 2223/46 . Identification
- 2223/48 . Learning / Adaptive control
- 2223/50 . Human control
- 2223/52 . Fuzzy logic
- 2223/54 . Recording

#### 2225/00 Measuring

- 2225/02 . filling height in burners
- 2225/04 . pressure
- 2225/06 . . for determining flow
- 2225/08 . temperature
- 2225/10 . . stack temperature
- 2225/12 . . room temperature
- 2225/13 . . outdoor temperature
- 2225/14 . . Ambient temperature around burners
- 2225/16 . . burner temperature
- 2225/18 . . feedwater temperature
- 2225/19 . . outlet temperature water heat-exchanger
- 2225/20 . . entrant temperature
- 2225/21 . . outlet temperature
- 2225/22 . heat losses
- 2225/24 . . indicated in an amount of money
- 2225/26 . humidity
- 2225/30 . . measuring lambda

#### 2227/00 Ignition or checking

- 2227/02 . Starting or ignition cycles
- 2227/04 . Prepurge
- 2227/06 . Postpurge
- 2227/08 . Hold fire apparatus
- 2227/10 . Sequential burner running
- 2227/12 . Burner simulation or checking
- 2227/14 . . Flame simulation
- 2227/16 . . Checking components, e.g. electronic
- 2227/18 . Applying test signals, e.g. periodic
- 2227/20 . Calibrating devices
- 2227/22 . Pilot burners
- 2227/24 . . the pilot burner not burning continuously
- 2227/26 . . comprising two or more distinct pilot burners
- 2227/28 . Ignition circuits
- 2227/30 . . for pilot burners
- 2227/32 . Igniting for a predetermined number of cycles
- 2227/34 . Continuously applied ignition cycles
- 2227/36 . Spark ignition, e.g. by means of a high voltage
- 2227/38 . Electrical resistance ignition
- 2227/40 . Catalytic ignition
- 2227/42 . Ceramic glow ignition

#### 2229/00 Flame sensors

- 2229/02 . Pilot flame sensors
- 2229/04 . sensitive to the colour of flames
- 2229/06 . with periodical shutters; Modulation signals
- 2229/08 . detecting flame flicker
- 2229/10 . comprising application of periodical fuel flow fluctuations
- 2229/12 . with flame rectification current detecting means
- 2229/14 . using two or more different types of flame sensor
- 2229/16 . using two or more of the same types of flame sensor
- 2229/18 . Flame sensor cooling means
- 2229/20 . Camera viewing
- 2229/22 . the sensor's sensitivity being variable

#### 2231/00 Fail safe

- 2231/02 . using electric energy accumulators
- 2231/04 . for electrical power failures
- 2231/06 . for flame failures
- 2231/08 . . for pilot flame failures
- 2231/10 . for component failures
- 2231/12 . for ignition failures

- 2231/14 . for earthquakes
- 2231/16 . using melting materials or shape memory alloys
- 2231/18 . Detecting fluid leaks
- 2231/20 . Warning devices
- 2231/22 . . using warning lamps
- 2231/24 . Freezing
- 2231/26 . for clogging air inlet
- 2231/28 . preventing flash-back or blow-back
- 2231/30 . Representation of working time

**2233/00 Ventilators**

- 2233/02 . in stacks
- 2233/04 . . with variable speed
- 2233/06 . at the air intake
- 2233/08 . . with variable speed
- 2233/10 . forcing air through heat exchangers

**2235/00 Valves, nozzles or pumps**

- 2235/02 . Air or combustion gas valves or dampers
- 2235/04 . . in stacks
- 2235/06 . . at the air intake
- 2235/08 . . used with heat exchanges
- 2235/10 . . power assisted, e.g. using electric motors
- 2235/12 . Fuel valves
- 2235/14 . . electromagnetically operated
- 2235/16 . . variable flow or proportional valves
- 2235/18 . . Groups of two or more valves
- 2235/20 . . Membrane valves
- 2235/22 . . cooperating with magnets
- 2235/24 . . Valve details
- 2235/26 . Fuel nozzles
- 2235/28 . . Spray fuel nozzles
- 2235/30 . Pumps

**2237/00 Controlling**

- 2237/02 . two or more burners
- 2237/04 . at two or more different localities
- 2237/06 . two predetermining temperatures, e.g. day-night
- 2237/08 . two or more different types of fuel simultaneously
- 2237/10 . High or low fire
- 2237/12 . catalytic burners
- 2237/14 . burners with gasification or vaporizer elements
- 2237/16 . secondary air
- 2237/18 . fluidized bed burners
- 2237/20 . one or more bypass conduits
- 2237/22 . water injection
- 2237/24 . height of burner
- 2237/26 . . oxygen-air ratio
- 2237/28 . . oxygen as pure oxydant
- 2237/30 . . matrix burners
- 2237/32 . . Nox

**2239/00 Fuels**

- 2239/02 . Solid fuels
- 2239/04 . Gaseous fuels
- 2239/06 . Liquid fuels

**2241/00 Applications**

- 2241/02 . Space-heating
- 2241/04 . Heating water
- 2241/06 . Space-heating and heating water
- 2241/08 . Household apparatus
- 2241/10 . Generating vapour
- 2241/11 . Torches

- 2241/12 . Stack-torches
- 2241/14 . Vehicle heating, the heat being derived otherwise than from the propulsion plant
- 2241/16 . Spectrometer burners
- 2241/18 . Incinerating apparatus
- 2241/20 . Gas turbines
- 2241/22 . Absorption refrigerator

**2900/00 Special features of, or arrangements for controlling combustion**

- 2900/01001 . Micro Electro Mechanical Systems [MEMS] for controlling fuel supply to burners
- 2900/01002 . Electromagnetically operated fuel valves with a single solenoid controlling two or more cores
- 2900/05001 . Measuring CO content in flue gas
- 2900/05002 . Measuring CO<sub>2</sub> content in flue gas
- 2900/05003 . Measuring NO<sub>x</sub> content in flue gas
- 2900/05004 . Details of components, e.g. connecting adaptors
- 2900/05005 . Mounting arrangements for sensing, detecting or measuring devices
- 2900/05006 . Controlling systems using neuronal networks
- 2900/05101 . Connections between thermocouple and magnetic valves, e.g. by plug and socket connectors
- 2900/05181 . Controlling air to fuel ratio by using a single differential pressure detector