

CPC COOPERATIVE PATENT CLASSIFICATION

F23C **COMBUSTION APPARATUS USING FLUENT FUEL** (combustion apparatus for solid fuel only [F23B](#); burners [F23D](#); constructional details of combustion chambers not otherwise provided for [F23M](#); combustion chambers for generating combustion products of high pressure or high velocity [F23R](#))

WARNING

The following IPC groups are not used in the CPC scheme. Subject matter covered by these groups is classified in the following CPC groups:

[F23C 101/00](#) covered by

1/00	Combustion apparatus specially adapted for combustion of two or more kinds of fuel simultaneously or alternately, at least one kind of fuel being fluent (combustion apparatus characterised by the combination of two or more combustion chambers F23C 6/00 ; pilot flame igniters F23Q 9/00)	6/045	. . {with staged combustion in a single enclosure}
		6/047	. . . {with fuel supply in stages}
		7/00	Combustion apparatus characterised by arrangements for air supply (inlets for fluidisation air F23C 10/20)
1/02	. lump or liquid fuel	7/002	. {the air being submitted to a rotary or spinning motion (cyclonic combustion chamber F23C 3/006)}
1/04	. lump or gaseous fuel		
1/06	. lump or pulverulent fuel	7/004	. . {using vanes}
1/08	. liquid or gaseous fuel	7/006	. . . {adjustable}
1/10	. liquid or pulverulent fuel	7/008	. {Flow control devices (F23C 7/006 takes precedence)}
1/12	. gaseous or pulverulent fuel		
3/00	Combustion apparatus characterised by the shape of the combustion chamber	7/02	. Disposition of air supply not passing through burner (to obtain a cyclonic tapering flame when burning pulverulent fuel F23C 5/32)
3/002	. {the chamber having an elongated tubular form, e.g. for a radiant tube}	7/04	. . to obtain maximum heat transfer to wall of combustion chamber
3/004	. {the chamber being arranged for submerged combustion (F23C 3/002 takes precedence)}	7/06	. . for heating the incoming air (arrangements of regenerators and recuperators F23L 15/00)
3/006	. {the chamber being arranged for cyclonic combustion (for waste F23G 5/32)}	7/08	. . . indirectly by a secondary fluid other than the combustion products
3/008	. . {for pulverulent fuel}		
5/00	Disposition of burners with respect to the combustion chamber or to one another; Mounting of burners in combustion apparatus (F23C 1/00 , F23C 15/00 take precedence)	9/00	Combustion apparatus characterised by arrangements for returning combustion products or flue gases to the combustion chamber (fluidised bed combustion apparatus with means for recirculation of particles entrained from the bed F23C 10/02 ; fluidised bed combustion apparatus with devices for removal and partial reintroduction of material from the bed F23C 10/26)
5/02	. Structural details of mounting	9/003	. {for pulverulent fuel (for fluidized bed F23C 10/02)}
5/06	. . Provision for adjustment of burner position during operation	9/006	. {the recirculation taking place in the combustion chamber}
5/08	. Disposition of burners	9/06	. for completing combustion
5/10	. . {to obtain a flame ring}	9/08	. for reducing temperature in combustion chamber, e.g. for protecting walls of combustion chamber
5/12	. . . {for pulverulent fuel}		
5/14	. . to obtain a single flame of concentrated or substantially planar form, e.g. pencil or sheet flame (F23C 5/32 takes precedence)	10/00	Fluidised bed combustion apparatus
5/24	. . to obtain a loop flame	10/002	. {for pulverulent solid fuel (F23C 10/005 - F23C 10/32 take precedence)}
5/28	. . to obtain flames in opposing directions, e.g. impacting flames	10/005	. {comprising two or more beds}
5/32	. . to obtain rotating flames, i.e. flames moving helically or spirally	10/007	. {comprising a rotating bed}
		10/01	. in a fluidised bed of catalytic particles
6/00	Combustion apparatus characterised by the combination of two or more combustion chambers {or combustion zones, e.g. for staged combustion}	10/02	. with means specially adapted for achieving or promoting a circulating movement of particles within the bed or for a recirculation of particles entrained from the bed
6/02	. in parallel arrangement		
6/04	. in series connection (consuming smoke or fumes in separate combustion apparatus F23G 7/06)		
6/042	. . {with fuel supply in stages (for staged combustion F23C 6/047)}		

- 10/04 . . the particles being circulated to a section, e.g. a heat-exchange section or a return duct, at least partially shielded from the combustion zone, before being reintroduced into the combustion zone
- 10/06 . . . the circulating movement being promoted by inducing differing degrees of fluidisation in different parts of the bed
- 10/08 . . . characterised by the arrangement of separation apparatus, e.g. cyclones, for separating particles from the flue gases
- 10/10 the separation apparatus being located outside the combustion chamber
- 10/12 . . the particles being circulated exclusively within the combustion zone
- 10/14 . . . the circulating movement being promoted by inducing differing degrees of fluidisation in different parts of the bed
- 10/16 . specially adapted for operation at superatmospheric pressures, e.g. by the arrangement of the combustion chamber and its auxiliary systems inside a pressure vessel
- 10/18 . Details; Accessories
- 10/20 . . Inlets for fluidisation air, e.g. grids; Bottoms
- 10/22 . . Fuel feeders specially adapted for fluidised bed combustiuon apparatus ([F23C 10/26 takes precedence](#))
- 10/24 . . Devices for removal of material from the bed ([devices for controlling the level of the bed or the amount of material in the bed F23C 10/30](#))
- 10/26 . . . combined with devices for partial reintroduction of material into the bed, e.g. after separation of agglomerated parts
- 10/28 . . Control devices specially adapted for fluidised bed, combustion apparatus
- 10/30 . . . for controlling the level of the bed or the amount of material in the bed
- 10/32 by controlling the rate of recirculation of particles separated from the flue gases
- 13/00 Apparatus in which combustion takes place in the presence of catalytic material (in a fluidised bed of catalytic particles [F23C 10/01](#); radiant gas burners using catalysis for flameless combustion [F23D 14/18](#))**
- 13/02 . characterised by arrangements for starting the operation, e.g. for heating the catalytic material to operating temperature
- 13/04 . characterised by arrangements of two or more catalytic elements in series connection
- 13/06 . in which non-catalytic combustion takes place in addition to catalytic combustion, e.g. downstream of a catalytic element
- 13/08 . characterised by the catalytic material
- 15/00 Apparatus in which combustion takes place in pulses influenced by acoustic resonance in a gas mass {(for generating combustion products of high pressure or high velocity [F23R 7/00](#); starting devices [F23D 11/42](#))}**
- 99/00 Subject-matter not provided for in other groups of this subclass**
- 99/001 . {Applying electric means or magnetism to combustion (for combustion engines [F02B 51/04](#), [F02M 27/04](#))}
- 99/003 . {Combustion process using sound or vibrations (for combustion engines [F02B 51/06](#), [F02M 27/08](#); liquid fuel burners using ultrasonic means for spraying the fuel [F23D 11/34](#))}
- 99/005 . {Suspension-type burning, i.e. fuel particles carried along with a gas flow while burning (fluidized-bed combustion apparatus [F23C 10/00](#))}
- 99/006 . {Flameless combustion stabilised within a bed of porous heat-resistant material ([F23C 13/00 takes precedence](#); gas burners with radiant combustion on a porous surface [F23D 14/16](#))}
- 99/008 . {Combustion methods wherein flame cooling techniques other than fuel or air staging or fume recirculation are used}
- 2200/00 Combustion techniques for fluent fuel**
- 2201/00 Staged combustion**
- 2201/10 . Furnace staging
- 2201/101 . . in vertical direction, e.g. alternating lean and rich zones
- 2201/102 . . in horizontal direction
- 2201/20 . Burner staging
- 2201/30 . Staged fuel supply
- 2201/301 . . with different fuels in stages
- 2201/40 . Intermediate treatments between stages
- 2201/401 . . Cooling
- 2202/00 Fluegas recirculation**
- 2202/10 . Premixing fluegas with fuel and combustion air
- 2202/20 . Premixing fluegas with fuel
- 2202/30 . Premixing fluegas with combustion air
- 2202/40 . Inducing local whirls around flame
- 2202/50 . Control of recirculation rate
- 2203/00 Flame cooling methods otherwise than by staging or recirculation**
- 2203/10 . using heat exchanger
- 2203/20 . using heat absorbing device in flame ([F23C 2203/10 takes precedence](#))
- 2203/30 . Injection of tempering fluids
- 2205/00 Pulsating combustion**
- 2205/10 . with pulsating fuel supply
- 2205/20 . with pulsating oxidant supply
- 2206/00 Fluidised bed combustion**
- 2206/10 . Circulating fluidised bed
- 2206/101 . . Entrained or fast fluidised bed
- 2206/102 . . Control of recirculation rate
- 2206/103 . . Cooling recirculating particles
- 2700/00 Special arrangements for combustion apparatus using fluent fuel**
- 2700/02 . Combustion apparatus using liquid fuel
- 2700/023 . . without pre-vaporising means
- 2700/026 . . with pre-vaporising means
- 2700/04 . Combustion apparatus using gaseous fuel
- 2700/043 . . for surface combustion
- 2700/046 . . generating heat by heating radiant bodies
- 2700/06 . Combustion apparatus using pulverized fuel
- 2700/063 . . Arrangements for igniting, flame-guiding, air supply in
- 2700/066 . . Other special arrangements

2900/00 Special features of, or arrangements for combustion apparatus using fluid fuels or solid fuels suspended in air; Combustion processes therefor

- 2900/01001 . Co-combustion of biomass with coal
- 2900/03001 . Miniaturized combustion devices using fluid fuels
- 2900/03002 . Combustion apparatus adapted for incorporating a fuel reforming device
- 2900/03003 . Annular combustion chambers ([for gas turbines F23R 3/50](#))
- 2900/03004 . Tubular combustion chambers with swirling fuel/air flow
- 2900/03005 . Burners with an internal combustion chamber, e.g. for obtaining an increased heat release, a high speed jet flame or being used for starting the combustion
- 2900/03006 . Reverse flow combustion chambers
- 2900/03007 . Sealed combustion chambers with balanced flue
- 2900/03008 . Spherical or bulb-shaped combustion chambers
- 2900/03009 . Elongated tube-shaped combustion chambers
- 2900/05081 . Disposition of burners relative to each other creating specific heat patterns
- 2900/05082 . Disposition of radial jet burners in relation to an impingement surface, e.g. a heat transfer surface, to obtain flame re-attachment combustion
- 2900/06041 . Staged supply of oxidant
- 2900/06042 . Annular arrangement of burners in a furnace, e.g. in a gas turbine, operated in alternate lean-rich mode
- 2900/06043 . Burner staging, i.e. radially stratified flame core burners
- 2900/07001 . Air swirling vanes incorporating fuel injectors
- 2900/07002 . Premix burners with air inlet slots obtained between offset curved wall surfaces, e.g. double cone burners
- 2900/07021 . Details of lances
- 2900/07022 . Delaying secondary air introduction into the flame by using a shield or gas curtain
- 2900/09001 . Cooling flue gas before returning them to flame or combustion chamber
- 2900/09002 . Specific devices inducing or forcing flue gas recirculation
- 2900/10001 . Use of special materials for the fluidized bed
- 2900/10002 . Treatment devices for the fluidizing gas, e.g. cooling, filtering
- 2900/10003 . Fluidized beds with expanding freeboard, i.e. cross-section increasing upwardly
- 2900/10004 . Adding inert bed material to maintain proper fluidized bed inventory
- 2900/10005 . Arrangement comprising two or more beds in separate enclosures
- 2900/10006 . Pressurized fluidized bed combustors
- 2900/10007 . Spouted fluidized bed combustors
- 2900/10008 . Special arrangements of return flow seal valve in fluidized bed combustors
- 2900/13001 . Details of catalytic combustors
- 2900/13002 . Catalytic combustion followed by a homogeneous combustion phase or stabilizing a homogeneous combustion phase
- 2900/99001 . Cold flame combustion or flameless oxidation processes
- 2900/99003 . Combustion techniques using laser or light beams as ignition, stabilization or combustion enhancing means
- 2900/99004 . Combustion process using petroleum coke or any other fuel with a very low content in volatile matters
- 2900/99005 . Combustion techniques using plasma gas

- 2900/99006 . Arrangements for starting combustion
- 2900/99008 . Unmixed combustion, i.e. without direct mixing of oxygen gas and fuel, but using the oxygen from a metal oxide, e.g. FeO
- 2900/99009 . Combustion process using vegetable derived fuels, e.g. from rapes
- 2900/9901 . Combustion process using hydrogen, hydrogen peroxide water or brown gas as fuel
- 2900/99011 . Combustion process using synthetic gas as a fuel, i.e. a mixture of CO and H₂