

CPC**COOPERATIVE PATENT CLASSIFICATION****F23D****BURNERS** (generating combustion products of high pressure or high velocity [F23R](#))**F23D 1/00****Burners for combustion of pulverulent fuel** (disposition of burners [F23C](#))[F23D 1/005](#)

- . { burning a mixture of pulverulent fuel delivered as a slurry, i.e. comprising a carrying liquid (preparing slurries [F23K 1/02](#)) }

[F23D 1/02](#)

- . Vortex burners, e.g. for cyclone-type combustion apparatus

[F23D 1/04](#)

- . Burners producing cylindrical flames without centrifugal action

[F23D 1/06](#)

- . Burners producing sheet flames

Guidance heading: Combustion of a liquid**F23D 3/00****Burner using capillary action**[F23D 3/02](#)

- . Wick burners

[F23D 3/04](#)

- . . with flame spreaders ([F23D 3/12](#) takes precedence)

[F23D 3/06](#)

- . . Inverted wick burners, e.g. for illumination

[F23D 3/08](#)

- . . characterised by shape, construction, or material, of wick

[F23D 3/10](#)

- . . Blue-flame burners

[F23D 3/12](#)

- . . . with flame spreaders

[F23D 3/14](#)

- . . . with mixing of air and fuel vapour in a chamber before the flame

[F23D 3/16](#)

- . . using candles (candles per se [C11C](#))

[F23D 3/18](#)

- . . Details of wick burners

[F23D 3/20](#)

- . . . Flame spreaders

[F23D 3/22](#)

- . . . Devices for mixing evaporated fuel with air

[F23D 3/24](#)

- . . . Carriers for wicks

[F23D 3/26](#)

- Safety devices thereon

[F23D 3/28](#)

- . . . Wick-adjusting devices

[F23D 3/30](#)

- directly engaging with the wick

[F23D 3/32](#)

- engaging with a tube carrying the wick

[F23D 3/34](#)

- Wick stop devices; Wick-fixing devices

[F23D 3/36](#)

- . . . Devices for trimming wicks

[F23D 3/38](#)

- . . . Devices for replacement of wicks

[F23D 3/40](#)

- . the capillary action taking place in one or more rigid porous bodies

F23D 5/00**Burners in which liquid fuel evaporates in the combustion space, with or without chemical conversion of evaporated fuel**

- F23D 5/02 . the liquid forming a pool, e.g. bowl-type evaporators, dish-type evaporators
- F23D 5/04 . . Pot-type evaporators, i.e. using a partially-enclosed combustion space
- F23D 5/045 . . . { with forced draft }

- F23D 5/06 . the liquid forming a film on one or more plane or convex surfaces
- F23D 5/08 . . on cascaded surfaces
- F23D 5/10 . . on grids

- F23D 5/12 . Details
- F23D 5/123 . . { Inserts promoting evaporation }
- F23D 5/126 . . { Catalytic elements }
- F23D 5/14 . . Maintaining predetermined amount of fuel in evaporator
- F23D 5/16 . . Safety devices
- F23D 5/18 . . Preheating devices

- F23D 7/00 Burners in which drops of liquid fuel impinge on a surface**

- F23D 9/00 Burners in which a stream of liquid fuel impinges intermittently on a hot surface**

- F23D 11/00 Burners using a direct spraying action of liquid droplets or vaporised liquid into the combustion space (spraying in general [B05B](#) , [B05D](#))**

- F23D 11/001 . { spraying nozzle combined with forced draft fan in one unit (nozzles per se [F23D 11/38](#)) }
- F23D 11/002 . { spraying nozzle arranged within furnace openings (refractory bricks or blocks specially shaped for burner openings [F23M 5/025](#)) }
- F23D 11/004 . . { for producing radiant heat }

- F23D 11/005 . { with combinations of different spraying or vaporising means }
- F23D 11/007 . . { combination of means covered by sub-groups [F23D 11/10](#) and [F23D 11/24](#) }
- F23D 11/008 . . { combination of means covered by sub-groups [F23D 5/00](#) and [F23D 11/00](#) }

- F23D 11/02 . the combustion space being a chamber substantially at atmospheric pressure

- F23D 11/04 . the spraying action being obtained by centrifugal action
- F23D 11/06 . . using a horizontal shaft
- F23D 11/08 . . using a vertical shaft

- F23D 11/10 . the spraying being induced by a gaseous medium, e.g. water vapour
- F23D 11/101 . . { medium and fuel meeting before the burner outlet }
- F23D 11/102 . . . { in an internal mixing chamber }
- F23D 11/103 { with means creating a swirl inside the mixing chamber }
- F23D 11/104 . . . { intersecting at a sharp angle, e.g. Y-jet atomiser }
- F23D 11/105 . . . { at least one of the fluids being submitted to a swirling motion }

- F23D 11/106 . . . { medium and fuel meeting at the burner outlet }
- F23D 11/107 . . . { at least one of both being subjected to a swirling motion }
- F23D 11/108 . . . { medium and fuel intersecting downstream of the burner outlet }
- F23D 11/12 . . . characterised by the shape or arrangement of the outlets from the nozzle
- F23D 11/14 . . . with a single outlet, e.g. slit
- F23D 11/16 . . . in which an emulsion of water and fuel is sprayed
- F23D 11/18 . . . the gaseous medium being water vapour generated at the nozzle
- F23D 11/20 . . . the water vapour being superheated
- F23D 11/22 . . . the gaseous medium being vaporised fuel, e.g. for a soldering lamp, { or other gaseous fuel }

- F23D 11/24 . . . by pressurisation of the fuel before a nozzle through which it is sprayed by a substantial pressure reduction into a space
- F23D 11/26 . . . with provision for varying the rate at which the fuel is sprayed
- F23D 11/28 . . . with flow-back of fuel at the burner, e.g. using by-pass
- F23D 11/30 . . . with return feed of uncombusted sprayed fuel to reservoir

- F23D 11/32 . . . by electrostatic means

- F23D 11/34 . . . by ultrasonic means { or other kinds of vibrations }
- F23D 11/345 . . . { with vibrating atomiser surfaces }

- F23D 11/36 . . . Details { e.g. burner cooling means, noise reduction means }
- F23D 11/38 . . . Nozzles (nozzles in general [B05B](#)); Cleaning devices therefor
- F23D 11/383 . . . { with swirl means }
- F23D 11/386 . . . { Nozzle cleaning }
- F23D 11/40 . . . Mixing tubes [or chambers]; Burner heads
- F23D 11/402 . . . { Mixing chambers downstream of the nozzle }
- F23D 11/404 . . . { Flame tubes (not forming part of the burner [F23M 9/06](#)) }
- F23D 11/406 . . . { Flame stabilising means, e.g. flame holders }
- F23D 11/408 . . . { Flow influencing devices in the air tube }
- F23D 11/42 . . . Starting devices (igniting [F23Q](#))
- F23D 11/44 . . . Preheating devices; Vaporising devices (vaporising devices per se [F23K 5/22](#))
- F23D 11/441 . . . { Vaporizing devices incorporated with burners }
- F23D 11/443 . . . { heated by the main burner flame }
- F23D 11/445 . . . { the flame and the vaporiser not coming into direct contact }
- F23D 11/446 . . . { heated by an auxiliary flame }
- F23D 11/448 . . . { heated by electrical means }
- F23D 11/46 . . . Devices on the vaporiser for controlling the feeding of the fuel

- F23D 14/00** **Burners for combustion of a gas, e.g. of a gas stored under pressure as a liquid**

- F23D 14/02 . . . Premix gas burners, i.e. in which gaseous fuel is mixed with combustion air upstream of the combustion zone
- F23D 14/04 . . . induction type, e.g. Bunsen burner, ({ atmospheric or aerated gas burner })

- F23D 14/045 . . . { with a plurality of burner bars assembled together, e.g. in a grid-like arrangement }
- F23D 14/06 . . . with radial outlets at the burner head
- F23D 14/065 . . . { with injector axis inclined to the burner head axis }
- F23D 14/08 . . . with axial outlets at the burner head
- F23D 14/085 . . . { with injector axis inclined to the burner head axis }
- F23D 14/10 . . . with elongated tubular burner head
- F23D 14/105 . . . [N. with injector axis parallel to the burner head axis]

- F23D 14/12 . Radiant burners
- F23D 14/125 . . { heating a wall surface to incandescence }
- F23D 14/14 . . using screens or perforated plates
- F23D 14/145 . . . { the burner plate being a screen }
- F23D 14/16 . . using permeable blocks
- F23D 14/18 . . using catalysis for flameless combustion

- F23D 14/20 . Non-premix gas burners, i.e. in which gaseous fuel is mixed with combustion air on arrival at the combustion zone ([F23D 14/30](#) to [F23D 14/44](#) take precedence)
- F23D 14/22 . . with separate air and gas feed ducts, e.g. with ducts running parallel or crossing each other
- F23D 14/24 . . . at least one of the fluids being submitted to a swirling motion

- F23D 14/26 . with provision for a retention flame ([pilot flame igniters F23Q 9/00](#))

- F23D 14/28 . in association with a gaseous fuel source, e.g. acetylene generator, or a container for liquefied gas

- F23D 14/30 . Inverted burners, e.g. for illumination

- F23D 14/32 . using a mixture of gaseous fuel and pure oxygen or oxygen-enriched air ([F23D 14/38](#) takes precedence)

- F23D 14/34 . Burners specially adapted for use with means for pressurising the gaseous fuel or the combustion air ([F23D 14/38](#) takes precedence)
- F23D 14/36 . . in which the compressor and burner form a single unit

- F23D 14/38 . Torches, e.g. for cutting, brazing, welding or heating ({ [nozzles for torches F23D 14/52](#) })
- F23D 14/40 . . for welding ([F23D 14/44](#) takes precedence)
- F23D 14/42 . . for cutting ([F23D 14/44](#) takes precedence)
- F23D 14/44 . . for use under water

- F23D 14/46 . Details { e.g. noise reduction means }
- F23D 14/465 . . { for torches ([F23D 14/52](#) takes precedence) }
- F23D 14/48 . . Nozzles ({ [injectors for mixing devices F23D 14/64](#) }; for spraying or coating [B05B](#))

- F23D 14/50 . . . Cleaning devices therefor
- F23D 14/52 . . . for torches; for blow-pipes

- F23D 14/54 for cutting or welding metal
- F23D 14/56 . . . for spreading the flame over an area, e.g. for desurfacing of solid material, for surface hardening, for heating workpieces, ([scarfing by applying flames B23K 7/00](#))
- F23D 14/58 . . . characterised by the shape or arrangement of the outlet or outlets from the nozzle, e.g. of annular configuration
- F23D 14/583 { of elongated shape, e.g. slits }
- F23D 14/586 { formed by a set of sheets, strips, ribbons or the like }
- F23D 14/60 . . Devices for simultaneous control of gas and combustion air ([regulation of combustion in general F23N](#))
- F23D 14/62 . . Mixing devices; Mixing tubes
- F23D 14/64 . . . with injectors
- F23D 14/66 . . Preheating the combustion air or gas
- F23D 14/68 . . Treating the combustion air or gas, e.g. by filtering, by moistening ([in general B01](#))
- F23D 14/70 . . Baffles or like flow-disturbing devices
- F23D 14/72 . . Safety devices, e.g. operative in case of failure of gas supply ([protection or supervision of pipe-line systems F17D 5/00](#))
- F23D 14/725 . . . { [Protection against flame failure by using flame detection devices \(pilot flame igniters with interlock with main fuel supply F23Q 9/08 \)](#) }
- F23D 14/74 . . . Preventing flame lift-off ([F23D 14/70 takes precedence](#))
- F23D 14/76 . . . Protecting flame and burner parts
- F23D 14/78 . . . Cooling burner parts
- F23D 14/80 . . . Selection of a non-toxic gas
- F23D 14/82 . . . Preventing flashback or blowback ([F23D 14/70 takes precedence](#); { [by use of a retention flame F23D 14/26](#) }; [in gas feed lines A62C 4/02](#))
- F23D 14/825 { [using valves](#) }
- F23D 14/84 . . Flame spreading or otherwise shaping ([F23D 14/70 takes precedence](#))

Guidance heading: Other burners

- F23D 17/00** **Burners for combustion conjointly or alternatively of gaseous or liquid or pulverulent fuel**
- F23D 17/002 . { [gaseous or liquid fuel](#) }
- F23D 17/005 . { [gaseous or pulverulent fuel](#) }
- F23D 17/007 . { [liquid or pulverulent fuel](#) }
- F23D 21/00** **Burners not otherwise provided for** { [Note : combinations of spraying or vaporising means covered by sub-groups F23D 5/00 and F23D 21/00 are classified in F23D 11/008](#) }
- F23D 21/005 . { [specially adapted for use in particular heating operations](#) }
- F23D 23/00** **Assemblies of two or more burners** ([gas burners with provision for a retention flame F23D 14/26](#); [disposition of burners F23C](#) ; [for industrial furnaces F27](#))

F23D 99/00	Subject matter not provided for in other groups of this subclass
F23D 99/003	. { specially adapted for use in particular heating operations }
F23D 99/006	.. { for heating liquids, e.g. for vaporising, for concentrating }
F23D 2200/00	Burners for fluid fuel
F23D 2201/00	Burners adapted for particulate solid or pulverulent fuels
F23D 2201/10	. Nozzle tips
F23D 2201/101	.. tiltable
F23D 2201/20	. Fuel flow guiding devices
F23D 2201/30	. Wear protection
F23D 2202/00	Liquid fuel burners
F23D 2203/00	Gaseous fuel burners
F23D 2203/002	. Radiant burner mixing tubes
F23D 2203/005	. Radiant burner heads
F23D 2203/007	. Mixing tubes, air supply regulation
F23D 2203/10	. Flame diffusing means
F23D 2203/101	.. characterised by surface shape
F23D 2203/1012	... tubular
F23D 2203/1015	... spherical
F23D 2203/1017	... curved
F23D 2203/102	.. using perforated plates
F23D 2203/1023	... with specific free passage areas
F23D 2203/1026	... with slotshaped openings
F23D 2203/103	.. using screens
F23D 2203/104	.. Grids, e.g. honeycomb grids
F23D 2203/105	.. Porous plates
F23D 2203/1055	... with a specific void range
F23D 2203/106	.. Assemblies of different layers
F23D 2203/107	.. coated with catalysts
F23D 2203/108	.. with stacked sheets or strips forming the outlets
F23D 2204/00	Burners adapted for simultaneous or alternative combustion having more than one fuel supply

F23D 2204/10	. gaseous and liquid fuel
F23D 2204/20	. gaseous and pulverulent fuel
F23D 2204/30	. liquid and pulverulent fuel
F23D 2205/00	Assemblies of two or more burners, irrespective of fuel type
F23D 2206/00	Burners for specific applications
F23D 2206/0005	. Liquid fuel burners adapted for use in locomotives
F23D 2206/001	. Liquid fuel burners adapted for use in automobile steam boilers
F23D 2206/0015	. Gas burners for use in retort furnaces
F23D 2206/0021	. Gas burners for use in furnaces of the reverberatory, muffle or crucible type
F23D 2206/0026	. Vapour burners adapted for use in illumination devices
F23D 2206/0031	. Liquid fuel burners adapted for use in welding lamps
F23D 2206/0036	. . Liquid fuel burners adapted for use in welding and cutting metals
F23D 2206/0042	. Vapour burners for illumination by radiation, with vaporiser heated by an auxiliary flame
F23D 2206/0047	. Vapour burners for illumination by radiation, with vaporiser heated by the main flame
F23D 2206/0052	. Vapour burners for illumination by radiation, with vaporiser heated by conduction
F23D 2206/0057	. Liquid fuel burners adapted for use in illumination and heating
F23D 2206/0063	. . Catalytic burners adapted for use in illumination and heating
F23D 2206/0068	. Gas burners for illumination with slot type nozzles
F23D 2206/0073	. Gas burners for illumination with Argand nozzles
F23D 2206/0078	. Gas burners adapted for use in lamps with preheated air
F23D 2206/0084	. Gas burners adapted for use in ceiling and wagon lamps
F23D 2206/0089	. Gas burners for illumination using acetylene as a fuel
F23D 2206/0094	. Gas burners adapted for use in illumination and heating
F23D 2206/10	. Turbines
F23D 2207/00	Ignition devices associated with burner

F23D 2208/00 Control devices associated with burners

F23D 2208/005 . Controlling air supply in radiant gas burners

F23D 2208/10 . Sensing devices

F23D 2209/00 Safety arrangements

F23D 2209/10 . Flame flashback

F23D 2209/20 . Flame lift-off / stability

F23D 2209/30 . Purging

F23D 2210/00 Noise abatement

F23D 2210/101 . using noise dampening material

F23D 2211/00 Thermal dilatation prevention or compensation**F23D 2212/00 Burner material specifications**

F23D 2212/005 . Radiant gas burners made of specific materials, e.g. rare earths

F23D 2212/10 . ceramic

F23D 2212/101 . . Foam, e.g. reticulated

F23D 2212/103 . . Fibres

F23D 2212/105 . . Particles

F23D 2212/20 . metallic

F23D 2212/201 . . Fibres

F23D 2212/203 . . Particles

F23D 2213/00 Burner manufacture specifications**F23D 2214/00 Cooling****F23D 2700/00 TBD**

F23D 2700/001 . Air supply for wick burners

F23D 2700/002 . Wick burners without flame spreaders or burner hood

F23D 2700/003 . Wick burners with flame spreaders or burner hood

- F23D 2700/004 . Inverted wick burners, wick burners using preheated air
- F23D 2700/005 . Wick burners using alcohol as a fuel
- F23D 2700/006 . Wick burners using oil as a fuel
- F23D 2700/009 . Details of blue flame wick burners
- F23D 2700/01 . Blue flame burners without flame spreader or burner hood
- F23D 2700/011 . Blue flame burners with flame spreader or burner hood without a bead at the wick carrying tube
- F23D 2700/012 . Blue flame burners with flame spreader or burner hood with a bead at the wick carrying tube
- F23D 2700/013 . Blue flame burners with flame on one side only without a bead at the wick carrying tube
- F23D 2700/014 . Blue flame burners with flame on one side only and a bead at the wick carrying tube
- F23D 2700/015 . Tubes carrying the wick
- F23D 2700/016 . Safety devices for wick carrying tubes
- F23D 2700/017 . Wick adjusting devices directly engaging the wick
- F23D 2700/018 . Wick adjusting devices engaging the tube carrying the wick
- F23D 2700/019 . Wick stop devices and wick fixing devices
- F23D 2700/02 . Devices for mounting the wick to the carrier
- F23D 2700/021 . Burners in which the gas produced in the wick is not burned instantaneously
- F23D 2700/022 . Burners using carburetted gas
- F23D 2700/023 . Gasifying and evaporating devices
- F23D 2700/024 . Nozzles and cleaning devices therefor
- F23D 2700/025 . Mixing tubes and burner heads
- F23D 2700/026 . Preheating devices, starting devices
- F23D 2700/027 . Vaporisers with devices for controlling the feeding of the fuel
- F23D 2700/03 . Alcohol vapour burners
- F23D 2700/031 . Vapour burners where the vaporiser is heated by an auxiliary flame
- F23D 2700/032 . Vapour burners where the vaporiser is heated by the main flame itself

- F23D 2700/033 . Vapour burners where the vaporiser is heated by conduction
- F23D 2900/00 Special features of, or arrangements for burners using fluid fuels or solid fuels suspended in a carrier gas**
- F23D 2900/00001 . local catalytic coatings applied to burner surfaces
- F23D 2900/00002 . Cleaning burner parts, e.g. burner tips
- F23D 2900/00003 . Fuel or fuel-air mixtures flow distribution devices upstream of the outlet
- F23D 2900/00004 . Burners specially adapted for generating high luminous flames, e.g. yellow for fuel-rich mixtures
- F23D 2900/00006 . Liquid fuel burners using pure oxygen or O₂-enriched air as oxidant ([for gaseous fuels F23D 14/32](#))
- F23D 2900/00008 . Burner assemblies with diffusion and premix modes, i.e. dual mode burners
- F23D 2900/00011 . Burner with means for propagating the flames along a wall surface
- F23D 2900/00012 . Liquid or gas fuel burners with flames spread over a flat surface, either premix or non-premix type, e.g. "Flächenbrenner"
- F23D 2900/00013 . . with means for spreading the flame in a fan or fishtail shape over a melting bath
- F23D 2900/00014 . Pilot burners specially adapted for ignition of main burners in furnaces or gas turbines
- F23D 2900/00015 . Pilot burners specially adapted for low load or transient conditions, e.g. for increasing stability
- F23D 2900/00016 . Preventing or reducing deposit build-up on burner parts, e.g. from carbon
- F23D 2900/00017 . Assembled burner modules
- F23D 2900/00018 . Means for protecting parts of the burner, e.g. ceramic lining outside of the flame tube
- F23D 2900/00019 . Outlet manufactured from knitted fibres
- F23D 2900/01001 . Pulverised solid fuel burner with means for swirling the fuel-air mixture
- F23D 2900/03081 . Catalytic wick burners
- F23D 2900/03082 . Wick made of specific material, e.g. ceramic
- F23D 2900/05001 . Burner using gel type fuel
- F23D 2900/05002 . Use of porous members to convert liquid fuel into vapor
- F23D 2900/11001 . Impinging-jet injectors or jet impinging on a surface
- F23D 2900/11002 . Liquid fuel burners with more than one nozzle

- F23D 2900/11101 . Pulverising gas flow impinging on fuel from pre-filming surface, e.g. lip atomizers
- F23D 2900/11401 . Flame intercepting baffles forming part of burner head
- F23D 2900/11402 . Airflow diaphragms at burner nozzle
- F23D 2900/11403 . Flame surrounding tubes in front of burner nozzle
- F23D 2900/14 . Special features of gas burners
 - F23D 2900/14001 .. Sealing or support of burner plate borders
 - F23D 2900/14002 .. of premix or non premix types, specially adapted for the combustion of low heating value (LHV) gas
 - F23D 2900/14003 .. with more than one nozzle
 - F23D 2900/14004 .. with radially extending gas distribution spokes
 - F23D 2900/14005 .. Rotary gas burner
 - F23D 2900/14021 .. Premixing burners with swirling or vortices creating means for fuel or air
 - F23D 2900/14041 .. Segmented or straight line assembly of burner bars
 - F23D 2900/14042 .. Star shaped assembly of burner bars or arms
 - F23D 2900/14061 .. for cooking ranges having a coated burner cap
 - F23D 2900/14062 .. for cooking ranges having multiple flame rings
 - F23D 2900/14063 .. for cooking ranges having one flame ring fed by multiple venturis
 - F23D 2900/14064 .. Burner heads of non circular shape
 - F23D 2900/1412 .. for radiant burners
 - F23D 2900/14121 ... with radiation intensifying means
 - F23D 2900/14122 ... with extra radiation grids, e.g. strips or rods
 - F23D 2900/14123 ... with radiation intensifying perforated plates
 - F23D 2900/14124 ... cooperating with refractory wall surfaces
 - F23D 2900/14125 ... with extra radiation screens, e.g. wires, threads or gauzes
 - F23D 2900/14181 ... Catalytic type with carbon containing radiating surface
 - F23D 2900/14241 .. Post-mixing with swirling means
 - F23D 2900/14381 .. Single operating member opening and closing fuel and oxidant supply valves in torches
 - F23D 2900/14481 .. Burner nozzles incorporating flow adjusting means
 - F23D 2900/14482 .. Burner nozzles incorporating a fluidic oscillator
 - F23D 2900/14581 .. with outlets consisting of a bed of irregular particles, e.g. glass
 - F23D 2900/14582 .. with outlets consisting of layers of spherical particles
 - F23D 2900/14641 .. with gas distribution manifolds or bars provided with a plurality of nozzles
 - F23D 2900/14642 .. with jet mixers with more than one gas injection nozzles or orifices for a single mixing tube
 - F23D 2900/14681 .. Adding steam or water vapor to primary or secondary combustion air
 - F23D 2900/14701 .. Swirling means inside the mixing tube or chamber to improve premixing
- F23D 2900/21 . Burners specially adapted for a particular use
 - F23D 2900/21001 .. for use in blast furnaces

- F23D 2900/21002 . . for use in car heating systems
- F23D 2900/21003 . . for heating or re-burning air or gas in a duct
- F23D 2900/21004 . . for use in gas fed fireplaces
- F23D 2900/21005 . . for flame deposition, e.g. FHD, flame hydrolysis deposition
- F23D 2900/21006 . . for heating a catalyst in a car
- F23D 2900/21007 . . for producing soot, e.g. nano particle soot