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 cleanig 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