SECTION F — MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING

F23 COMBUSTION APPARATUS; COMBUSTION PROCESSES

Note(s)

In this class, the following terms or expressions are used with the meanings indicated:

- "combustion" means the direct combination of oxygen gas, e.g. in air, and a burnable substance. Any other heat-producing combination of chemical substances, e.g. hydrogen peroxide and methane, iron oxide and aluminium, is covered by section C or by subclass F24J;
- "combustion chamber" means a chamber in which fuel is burned to establish a self-supporting fire or flame and which surrounds that fire or flame;
- "burner" means a device by which fluent fuel is passed to a combustion space where it burns to produce a self-supporting flame;
- "air" means a mixture of gases containing free oxygen and able to promote or support combustion.

F23B **METHODS OR APPARATUS FOR COMBUSTION USING ONLY SOLID FUEL** (for combustion of fuels that are solid at room temperatures, but burned in melted form, e.g. candle wax, C11C 5/00, F23C, F23D; using solid fuel suspended in air F23C, F23D 1/00; using solid fuel suspended in liquids F23C, F23D 11/00; using solid fuel and fluent fuel simultaneously or alternately F23C, F23D 17/00)

Note(s)

1. This subclass only covers combustion wherein the main body of fuel is either essentially stationary during combustion or mechanically transported, as opposed to pneumatically transported or suspended in air, during combustion.
2. In this subclass, the first place priority rule is applied, i.e. at each hierarchical level, classification is made in the first appropriate place.
3. In this subclass, methods are classified in the groups that cover the apparatus used. Methods that are not related to a particular type of apparatus are classified in group F23B 90/00.
4. In this subclass, it is desirable to add the indexing codes of groups F23B 101/00-F23B 103/00.

Subclass index

10/00 ***Combustion apparatus characterised by the combination of two or more combustion chambers [2006.01, 2011.01]***

10/02 • *including separate secondary combustion chambers **[2011.01]***

20/00 **Combustion apparatus specially adapted for portability or transportability [2006.01]**

30/00 **Combustion apparatus with driven means for agitating the burning fuel; Combustion apparatus with driven means for advancing the burning fuel through the combustion chamber [2006.01]**

30/02 • with movable, e.g. vibratable, fuel-supporting surfaces; with fuel-supporting surfaces that have movable parts **[2006.01]**

30/04 • • with fuel-supporting surfaces that are rotatable around a horizontal or inclined axis and support the fuel on their inside, e.g. cylindrical grates **[2006.01]**

30/06 • • with fuel-supporting surfaces that are specially adapted for advancing the fuel through the combustion zone **[2006.01]**

30/08 • • • with fuel-supporting surfaces that move through the combustion zone, e.g. with chain grates **[2006.01]**

30/10 • • • with fuel-supporting surfaces having fuel advancing elements that are movable, but remain essentially in the same place, e.g. with rollers or reciprocating grate bars **[2006.01]**

40/00 **Combustion apparatus with driven means for feeding fuel into the combustion chamber [2006.01]**

40/02 • the fuel being fed by scattering over the fuel-supporting surface **[2006.01]**

40/04 • the fuel being fed from below through an opening in the fuel-supporting surface **[2006.01]**

40/06 • the fuel being fed along the fuel-supporting surface **[2006.01]**

40/08 • • into pot- or trough-shaped grates **[2006.01]**

50/00 Combustion apparatus in which the fuel is fed into or through the combustion zone by gravity, e.g. from a fuel storage situated above the combustion zone [2006.01]

50/02 • the fuel forming a column, stack or thick layer with the combustion zone at its bottom **[2006.01]**

50/04 • • the movement of combustion air and flue gases being substantially transverse to the movement of the fuel **[2006.01]**

50/06 • • the flue gases being removed downwards through one or more openings in the fuel-supporting surface **[2006.01]**

50/08 • • with fuel-deflecting bodies forming free combustion spaces inside the fuel layer **[2006.01]**

50/10 • • with the combustion zone at the bottom of fuel-filled conduits ending at the surface of a fuel bed **[2006.01]**

50/12 • the fuel being fed to the combustion zone by free fall or by sliding along inclined surfaces, e.g. from a conveyer terminating above the fuel bed **[2006.01]**

60/00 Combustion apparatus in which the fuel burns essentially without moving [2006.01]

60/02 • with combustion air supplied through a grate **[2006.01]**

70/00 Combustion apparatus characterised by means for returning solid combustion residues to the combustion chamber [2006.01]

80/00 Combustion apparatus characterised by means creating a distinct flow path for flue gases or for non-combusted gases given off by the fuel [2006.01]

80/02 • by means for returning flue gases to the combustion chamber or to the combustion zone **[2006.01]**

80/04 • by means for guiding the flow of flue gases, e.g. baffles **[2006.01]**

90/00 Combustion methods not related to a particular type of apparatus [2006.01, 2011.01]

90/02 • *Start-up techniques **[2011.01]***

90/04 • *including secondary combustion (in separate combustion chambers F23B 10/02) **[2011.01]***

90/06 • • *the primary combustion being a gasification or pyrolysis in a reductive atmosphere **[2011.01]***

90/08 • • *in the presence of catalytic material **[2011.01]***

99/00 Subject matter not provided for in other groups of this subclass [2006.01]

Indexing scheme related to adaptation of combustion apparatus to boilers [2006.01]

101/00 Adaptation of combustion apparatus to boilers in which the combustion chamber is situated inside the boiler vessel, e.g. surrounded by cooled surfaces [2006.01]

103/00 Adaptation of combustion apparatus for placement in or against an opening of a boiler, e.g. for replacing an oil burner [2006.01]

103/02 • for producing an essentially horizontal flame **[2006.01]**

F23C METHODS OR APPARATUS FOR COMBUSTION USING FLUENT FUEL (burners F23D)

Note(s) [2006.01]

In this subclass, methods are classified in the groups that cover the apparatus used.

Subclass index

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) **[1, 7, 2006.01]**

1/02 • lump and liquid fuel

1/04 • lump and gaseous fuel

1/06 • lump and pulverulent fuel

1/08 • liquid and gaseous fuel
1/10 • liquid and pulverulent fuel
1/12 • gaseous and pulverulent fuel

3/00 Combustion apparatus characterised by the shape of the combustion chamber (F23C 15/00 takes precedence) **[1, 7, 2006.01]**

5/00 Combustion apparatus characterised by the arrangement or mounting of burners [1, 7, 2006.01]
5/02 • Structural details of mounting
5/06 • • Provision for adjustment of burner position during operation
5/08 • Disposition of burners
5/14 • • to obtain a single flame of concentrated or substantially planar form, e.g. pencil or sheet flame (F23C 5/32 takes precedence) **[3]**
5/24 • • to obtain a loop flame
5/28 • • to obtain flames in opposing directions, e.g. impacting flames
5/32 • • to obtain rotating flames, i.e. flames moving helically or spirally **[3]**

6/00 Combustion apparatus characterised by the combination of two or more combustion chambers [3, 7, 2006.01]
6/02 • in parallel arrangement **[3]**
6/04 • in series connection **[3]**

7/00 Combustion apparatus characterised by arrangements for air supply (inlets for fluidisation air F23C 10/20) **[1, 7, 2006.01]**
7/02 • Disposition of air supply not passing through burner
7/04 • • to obtain maximum heat transfer to wall of combustion chamber
7/06 • • for heating the incoming air (arrangements of regenerators or recuperators F23L 15/00)
7/08 • • • indirectly by a secondary fluid other than the combustion products

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) **[1, 7, 2006.01]**
9/06 • for completing combustion **[3]**
9/08 • for reducing temperature in combustion chamber, e.g. for protecting walls of combustion chamber **[3]**

10/00 Apparatus in which combustion takes place in a fluidised bed of fuel or other particles [7]

Note(s)

In this group, it is desirable to add the indexing code of group F23C 101/00.

10/01 • in a fluidised bed of catalytic particles **[2006.01]**
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 **[7]**
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 **[7]**
10/06 • • • the circulating movement being promoted by inducing differing degrees of fluidisation in different parts of the bed **[7]**
10/08 • • • characterised by the arrangement of separation apparatus, e.g. cyclones, for separating particles from the flue gases **[7]**
10/10 • • • • the separation apparatus being located outside the combustion chamber **[7]**
10/12 • • the particles being circulated exclusively within the combustion zone **[7]**
10/14 • • • the circulating movement being promoted by inducing differing degrees of fluidisation in different parts of the bed **[7]**
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 **[7]**
10/18 • Details; Accessories **[7]**
10/20 • • Inlets for fluidisation air, e.g. grids; Bottoms **[7]**
10/22 • • Fuel feeders specially adapted for fluidised bed combustion apparatus (F23C 10/26 takes precedence) **[7]**
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) **[7]**
10/26 • • • combined with devices for partial reintroduction of material into the bed, e.g. after separation of agglomerated parts **[7]**
10/28 • • Control devices specially adapted for fluidised bed combustion apparatus **[7]**
10/30 • • • for controlling the level of the bed or the amount of material in the bed **[7]**
10/32 • • • • by controlling the rate of recirculation of particles separated from the flue gases **[7]**

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) **[2006.01]**
13/02 • characterised by arrangements for starting the operation, e.g. for heating the catalytic material to operating temperature **[2006.01]**
13/04 • characterised by the arrangement of two or more catalytic elements in series connection **[2006.01]**
13/06 • in which non-catalytic combustion takes place in addition to catalytic combustion, e.g. downstream of a catalytic element **[2006.01]**
13/08 • characterised by the catalytic material **[2006.01]**

15/00 Apparatus in which combustion takes place in pulses influenced by acoustic resonance in a gas mass [2006.01]

99/00 Subject matter not provided for in other groups of this subclass [2006.01]

Indexing scheme associated with group F23C 10/00, relating to combustion in entrained fluidised beds. [7]

101/00 Combustion in entrained fluidised beds, i.e. fluidised beds which have no distinct upper surface [7]

F23D BURNERS (generating combustion products of high pressure or high velocity F23R)

Subclass index

1/00 Burners for combustion of pulverulent fuel (arrangement or mounting of burners F23C 5/00)

1/02 • Vortex burners, e.g. for cyclone-type combustion apparatus
1/04 • Burners producing cylindrical flames without centrifugal action
1/06 • Burners producing sheet flames

Combustion of a liquid

3/00 Burners using capillary action
3/02 • Wick burners
3/04 • • with flame spreaders (F23D 3/12 takes precedence)
3/06 • • Inverted wick burners, e.g. for illumination
3/08 • • characterised by shape, construction, or material, of wick
3/10 • • Blue-flame burners
3/12 • • • with flame spreaders
3/14 • • • with mixing of air and fuel vapour in a chamber before the flame
3/16 • • using candles (candles per se C11C)
3/18 • • Details of wick burners
3/20 • • • Flame spreaders
3/22 • • • Devices for mixing evaporated fuel with air
3/24 • • • Carriers for wicks
3/26 • • • • Safety devices thereon
3/28 • • • Wick-adjusting devices
3/30 • • • • directly engaging with the wick
3/32 • • • • engaging with a tube carrying the wick
3/34 • • • • Wick stop devices; Wick-fixing devices
3/36 • • • Devices for trimming wicks
3/38 • • • Devices for replacement of wicks
3/40 • the capillary action taking place in one or more rigid porous bodies

5/00 Burners in which liquid fuel evaporates in the combustion space, with or without chemical conversion of evaporated fuel
5/02 • the liquid forming a pool, e.g. bowl-type evaporators, dish-type evaporators
5/04 • • Pot-type evaporators, i.e. using a partially-enclosed combustion space
5/06 • the liquid forming a film on one or more plane or convex surfaces
5/08 • • on cascaded surfaces
5/10 • • on grids
5/12 • Details
5/14 • • Maintaining predetermined amount of fuel in evaporator
5/16 • • Safety devices
5/18 • • Preheating devices

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

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

11/00 Burners using a direct spraying action of liquid droplets or vaporised liquid into the combustion space (spraying in general B05B, B05D)
11/02 • the combustion space being a chamber substantially at atmospheric pressure
11/04 • the spraying action being obtained by centrifugal action
11/06 • • using a horizontal shaft
11/08 • • using a vertical shaft
11/10 • the spraying being induced by a gaseous medium, e.g. water vapour
11/12 • • characterised by the shape or arrangement of the outlets from the nozzle
11/14 • • • with a single outlet, e.g. slit
11/16 • • in which an emulsion of water and fuel is sprayed
11/18 • • the gaseous medium being water vapour generated at the nozzle
11/20 • • • the water vapour being superheated
11/22 • • the gaseous medium being vaporised fuel, e.g. for a soldering lamp
11/24 • by pressurisation of the fuel before a nozzle through which it is sprayed by a substantial pressure reduction into a space
11/26 • • with provision for varying the rate at which the fuel is sprayed
11/28 • • • with flow-back of fuel at the burner, e.g. using by-pass
11/30 • • • with return feed of uncombusted sprayed fuel to reservoir
11/32 • by electrostatic means
11/34 • by ultrasonic means
11/36 • Details
11/38 • • Nozzles (nozzles in general B05B); Cleaning devices therefor
11/40 • • Mixing tubes; Burner heads
11/42 • • Starting devices (igniting F23Q)
11/44 • • Preheating devices; Vaporising devices

11/46 • • Devices on the vaporiser for controlling the feeding of the fuel

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14/00 Burners for combustion of a gas, e.g. of a gas stored under pressure as a liquid [4]

14/02 • Premix gas burners, i.e. in which gaseous fuel is mixed with combustion air upstream of the combustion zone **[4]**
14/04 • • induction type, e.g. Bunsen burner **[4]**
14/06 • • • with radial outlets at the burner head **[4]**
14/08 • • • with axial outlets at the burner head **[4]**
14/10 • • • with elongated tubular burner head **[4]**
14/12 • Radiant burners **[4]**
14/14 • • using screens or perforated plates **[4]**
14/16 • • using permeable blocks **[4]**
14/18 • • using catalysis for flameless combustion **[4]**
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-F23D 14/44 take precedence) **[4]**
14/22 • • with separate air and gas feed ducts, e.g. with ducts running parallel or crossing each other **[4]**
14/24 • • • at least one of the fluids being submitted to a swirling motion **[4]**
14/26 • with provision for a retention flame (pilot flame igniters F23Q 9/00) **[4]**
14/28 • in association with a gaseous fuel source, e.g. acetylene generator, or a container for liquefied gas **[4]**
14/30 • Inverted burners, e.g. for illumination **[4]**
14/32 • using a mixture of gaseous fuel and pure oxygen or oxygen-enriched air (F23D 14/38 takes precedence) **[4]**
14/34 • Burners specially adapted for use with means for pressurising the gaseous fuel or the combustion air (F23D 14/38 takes precedence) **[4]**
14/36 • • in which the compressor and burner form a single unit **[4]**
14/38 • Torches, e.g. for cutting, brazing, welding or heating (nozzles F23D 14/48) **[4]**
14/40 • • for welding (F23D 14/44 takes precedence) **[4]**
14/42 • • for cutting (F23D 14/44 takes precedence) **[4]**
14/44 • • for use under water **[4]**
14/46 • Details **[4]**
14/48 • • Nozzles (for spraying or coating B05B) **[4]**
14/50 • • • Cleaning devices therefor **[4]**
14/52 • • • for torches; for blow-pipes **[4]**
14/54 • • • • for cutting or welding metal **[4]**
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) **[4]**
14/58 • • • characterised by the shape or arrangement of the outlet or outlets from the nozzle, e.g. of annular configuration **[4]**
14/60 • • Devices for simultaneous control of gas and combustion air (regulation of combustion in general F23N) **[4]**
14/62 • • Mixing devices; Mixing tubes **[4]**
14/64 • • • with injectors **[4]**
14/66 • • Preheating the combustion air or gas **[4]**
14/68 • • Treating the combustion air or gas, e.g. by filtering, by moistening (in general B01) **[4]**
14/70 • • Baffles or like flow-disturbing devices **[4]**
14/72 • • Safety devices, e.g. operative in case of failure of gas supply (protection or supervision of pipe-line systems F17D 5/00) **[4]**
14/74 • • • Preventing flame lift-off (F23D 14/70 takes precedence) **[4]**
14/76 • • • Protecting flame and burner parts **[4]**
14/78 • • • Cooling burner parts **[4]**
14/80 • • • Selection of a non-toxic gas **[4]**
14/82 • • • Preventing flashback or blowback (F23D 14/70 takes precedence; in gas feed lines A62C 4/02) **[4]**
14/84 • • Flame spreading or otherwise shaping (F23D 14/70 takes precedence) **[4]**

Other burners

17/00 Burners for combustion simultaneously or alternately of gaseous or liquid or pulverulent fuel

23/00 Assemblies of two or more burners (gas burners with provision for a retention flame F23D 14/26; arrangement or mounting of burners F23C 5/00; for industrial furnaces F27)

99/00 Subject matter not provided for in other groups of this subclass [2010.01]

F23G CREMATION FURNACES; CONSUMING WASTE OR LOW GRADE FUELS BY COMBUSTION

Subclass index

1/00 Methods or apparatus specially adapted for cremation of human or animal carcasses

5/00 Methods or apparatus, e.g. incinerators, specially adapted for combustion of waste or low-grade fuels [4]

5/02 • including pretreatment **[4]**

5/027 • • pyrolising or gasifying (pyrolisation of sludge C02F 11/00; destructive distillation of carbonaceous materials C10B 53/00) **[4]**
5/033 • • comminuting or crushing **[4]**
5/04 • • drying **[4]**
5/05 • • • using drying grates **[4]**
5/08 • including supplementary heating **[4]**
5/10 • • using electric means **[4]**
5/12 • • using gaseous or liquid fuel (F23G 5/14 takes precedence) **[4]**
5/14 • • including secondary combustion **[4]**
5/16 • • • in a separate combustion chamber **[4]**
5/18 • • • in a stack **[4]**
5/20 • with combustion in rotating or oscillating drums **[4]**
5/22 • • the drums being conically shaped **[4]**
5/24 • with combustion in a vertical, substantially cylindrical, combustion chamber **[4]**
5/26 • • having rotating bottom **[4]**
5/28 • • having raking arms **[4]**
5/30 • with combustion in a fluidised bed **[4]**
5/32 • in which the waste or low-grade fuel is subjected to a whirling movement, e.g. cyclonic incinerators **[4]**
5/34 • in which the waste or low-grade fuel is burnt in a pit or arranged in a heap for combustion **[4]**
5/36 • with combustion in a conical combustion chamber, e.g. "teepee" incinerators (F23G 5/22 takes precedence) **[4]**
5/38 • having multi-hearth arrangements **[4]**
5/40 • Portable or mobile apparatus **[4]**
5/42 • • of the basket type **[4]**
5/44 • Details; Accessories **[4]**
5/46 • • Recuperation of heat **[4]**
5/48 • • Preventing corrosion **[4]**
5/50 • Control or safety arrangements **[4]**

7/00 Methods or apparatus, e.g. incinerators, specially adapted for combustion of specific waste or low grade fuels, e.g. chemicals (F23G 1/00 takes precedence; incinerator closets A47K 11/02; oxidation of sludge C02F 11/06; incinerating radioactive waste G21F 9/00) **[4, 2006.01]**
7/02 • of bagasse, megasse or the like **[4]**
7/04 • of waste liquors, e.g. sulfite liquors **[4]**
7/05 • of waste oils **[4]**
7/06 • of waste gases or noxious gases, e.g. exhaust gases (exhaust apparatus for engines with means for rendering the exhaust innocuous, e.g. by thermal or catalytic conversion, F01N 3/08; combustion of uncombusted material from primary combustion within apparatus for combustion of solid or fluent fuel F23B, F23C) **[4]**
7/07 • • in which combustion takes place in the presence of catalytic material **[2006.01]**
7/08 • • using flares, e.g. in stacks **[4]**
7/10 • of field or garden waste **[4]**
7/12 • of plastics, e.g. rubber **[4]**
7/14 • of contaminated soil, e.g. soil contaminated by oil **[4]**

F23H GRATES (inlets for fluidisation air for fluidised bed combustion apparatus F23C 10/20)**; CLEANING OR RAKING GRATES**

Subclass index

1/00 Grates with solid bars (double grates F23H 5/00)
1/02 • having provision for air supply or air preheating, e.g. air-supply or blast fittings which form part of the grate structure or serve as supports
1/04 • having a variable burning surface
1/06 • having bars at different levels
1/08 • Vertical grates

3/00 Grates with hollow bars
3/02 • internally cooled
3/04 • externally cooled, e.g. with water, steam, or air

5/00 Double grates

7/00 Inclined grates (inclined travelling grates F23H 11/12)
7/02 • with fixed bars
7/04 • • in parallel disposition
7/06 • with movable bars disposed parallel to direction of fuel feeding
7/08 • • reciprocating along their axes
7/10 • • rocking about their axes
7/12 • with movable bars disposed transversely to direction of fuel feeding
7/14 • • reciprocating along their axes
7/16 • • rocking about their axes
7/18 • • reciprocating in an upward direction

9/00 Revolving grates; Rocking grates (F23H 7/00 takes precedence)
9/02 • Revolving cylindrical grates
9/04 • Grates rocked as a whole
9/06 • the bars being rocked about axes transverse to their lengths
9/08 • the bars being rocked about their longitudinal axes
9/10 • • and modified to move fuel along the grate
9/12 • the bars being vertically movable in a plane

11/00 Travelling grates
11/02 • with the bars disposed on transverse bearers
11/04 • with the bars pivoted at one side
11/06 • with the bars movable relatively to one another
11/08 • with several individually-movable grate surfaces
11/10 • with special provision for supply of air from below and for regulating air supply
11/12 • inclined travelling grates; Stepped travelling grates

11/14 • serving as auxiliary grates
11/16 • for multi-layer stoking
11/18 • Details
11/20 • • Driving means
11/22 • • Moving fuel along grate; Cleaning of grate
11/24 • • Removal of ashes; Removal of clinker
11/26 • • • by dumping
11/28 • • Replaceable burning-surface

13/00 Grates not covered by any of groups F23H 1/00-F23H 11/00
13/02 • Basket grates, e.g. with shaking arrangement
13/04 • Telescoping grates
13/06 • Dumping-grates
13/08 • Grates specially adapted for gas generators and also applicable to furnaces

15/00 Cleaning arrangements for grates (not forming part of the grate F23J 1/00)**; Moving fuel along grate** (rocking grates modified for moving fuel F23H 9/10; for travelling grates F23H 11/22)

17/00 Details of grates
17/02 • End fittings on bars
17/04 • • of travelling grates
17/06 • Provision for vertical adjustment of grate
17/08 • Bearers; Frames; Spacers; Supports
17/10 • • Dead plates; Imperforate fuel supports
17/12 • Fire-bars

F23J REMOVAL OR TREATMENT OF COMBUSTION PRODUCTS OR COMBUSTION RESIDUES; FLUES (precipitating dust from flue gases B01D; composition of fuels C10; combustion apparatus for consuming smoke or fumes, e.g. exhaust gases, F23G 7/06)

Note(s)

1. This subclass covers also the cleaning of surfaces of furnace tubes, flame tubes, water tubes, flues or the like of boilers, heat-exchange or heat-transfer conduits, which surfaces are contaminated by combustion products or combustion residues.
2. This subclass does not cover the cleaning of surfaces of boilers, heat exchange or heat-transfer conduits contaminated by other than combustion products or combustion residues, which is covered by subclass F28G.

Subclass index

1/00 Removing ash, clinker, or slag from combustion chambers (devices for removal of material from the bed of fluidised bed combustion apparatus F23C 10/24)
1/02 • Apparatus for removing ash, clinker, or slag from ash-pits, e.g. by employing trucks or conveyers, by employing suction devices
1/04 • Hand tools, e.g. rakes, prickers, tongs
1/06 • Mechanically-operated devices, e.g. clinker pushers (forming part of the grate F23H)
1/08 • Liquid slag removal **[3]**

3/00 Removing solid residues from passages or chambers beyond the fire, e.g. from flues by soot blowers
3/02 • Cleaning furnace tubes; Cleaning flues or chimneys (by means which do not differ materially from the cleaning of any other tube once the fire is out B08B)
3/04 • Traps
3/06 • Systems for accumulating residues from different parts of furnace plant

7/00 Arrangement of devices for supplying chemicals to fire (supplying chemicals to fire C10L)

9/00 Preventing premature solidification of molten combustion residues

11/00 Devices for conducting smoke or fumes, e.g. flues (heat insulation therefor E04B 1/94; chimneys E04H 12/28; removing cooking fumes from domestic stoves or ranges F24C 15/20) **[5]**
11/02 • for conducting smoke or fumes originating from various locations to the outside, e.g. in locomotive sheds, in garages
11/04 • in locomotives; in road vehicles; in ships
11/06 • • for conducting smoke horizontally
11/08 • for portable apparatus
11/10 • for tents; for log huts; for other inflammable structures
11/12 • Smoke conduit systems for factories or large buildings

13/00 Fittings for chimneys or flues (staying, stiffening E04H; means for facilitating climbing E06C; draught-inducing apparatus associated with chimneys or flues F23L)
13/02 • Linings; Jackets; Casings
13/04 • Joints; Connections (pipe joints in general F16L)
13/06 • Mouths; Inlet holes
13/08 • Doors or covers specially adapted for smoke-boxes, flues, or chimneys (in general E06B)

15/00 **Arrangements of devices for treating smoke or fumes** (such devices per se, methods for treating smoke or fumes, see the relevant places for the treatment, e.g. B01D 53/00)

15/02 • of purifiers, e.g. for removing noxious material (traps for solid residues F23J 3/04) **[6]**

15/04 • • using washing fluids **[6]**

15/06 • of coolers **[6]**

15/08 • of heaters **[6]**

99/00 **Subject matter not provided for in other groups of this subclass [2006.01]**

F23K **FEEDING FUEL TO COMBUSTION APPARATUS** (fuel feeders specially adapted for fluidised bed combustion apparatus F23C 10/22; regulating or controlling combustion F23N)

1/00 **Preparation of lump or pulverulent fuel in readiness for delivery to combustion apparatus** (filtration B01D; mixing B01F; pulverising B02C; drying F26B)

1/02 • Mixing solid fuel with a liquid, e.g. preparing slurries

1/04 • Heating fuel prior to delivery to combustion apparatus

3/00 **Feeding or distributing of lump or pulverulent fuel to combustion apparatus** (conveying in general B65G)

3/02 • Pneumatic feeding arrangements, i.e. by air blast

3/04 • for locomotive boiler furnaces

3/06 • for shaft-type furnaces

3/08 • for furnaces having movable grate bars

3/10 • Under-feed arrangements

3/12 • • feeding by piston

3/14 • • feeding by screw

3/16 • Over-feed arrangements

3/18 • • Spreader stokers

3/20 • • • with moving hoppers

3/22 • Controlling thickness of fuel bed

5/00 **Feeding or distributing other fuel to combustion apparatus**

5/02 • Liquid fuel **[5]**

5/04 • • Feeding or distributing systems using pumps (F23K 5/06 takes precedence) **[5]**

5/06 • • from a central source to a plurality of burners **[5]**

5/08 • • Preparation of fuel **[5]**

5/10 • • • Mixing with other fluids **[5]**

5/12 • • • • Preparing emulsions (burners spraying an emulsion of water and fuel into the combustion space F23D 11/16) **[5]**

5/14 • • Details thereof **[5]**

5/16 • • • Safety devices (F23K 5/18 takes precedence; safety arrangements for combustion chambers F23M 11/00) **[5]**

5/18 • • • Cleaning or purging devices, e.g. filters **[5]**

5/20 • • • Preheating devices (in burners using a direct spraying action of liquid droplets or vaporised liquid into the combustion space F23D 11/44) **[5]**

5/22 • • • Vaporising devices (in burners using a direct spraying action of liquid droplets or vaporised liquid into the combustion space F23D 11/44) **[5]**

F23L **AIR SUPPLY; DRAUGHT-INDUCING; SUPPLYING NON-COMBUSTIBLE LIQUID OR GAS** (air-supply arrangements for combustion apparatus using fluent fuel, e.g. fluidised bed combustion apparatus, F23C; dampers or throat restrictors for open fire-places F24; air inlet valves for open fire fronts F24)

Subclass index

1/00 **Passages or apertures for delivering primary air for combustion**

1/02 • by discharging the air below the fire

3/00 **Arrangements of valves or dampers before the fire**

5/00 **Blast-producing apparatus before the fire**

5/02 • Arrangements of fans or blowers (fans or blowers per se F04)

5/04 • by induction of air for combustion, e.g. using steam jet

7/00 **Supplying non-combustible liquids or gases, other than air, to the fire, e.g. oxygen, steam**

9/00 **Passages or apertures for delivering secondary air for completing combustion of fuel**

9/02 • by discharging the air above the fire

9/04 • by discharging the air beyond the fire, i.e. nearer the smoke outlet

9/06 • by discharging the air into the fire bed

11/00 **Arrangements of valves or dampers after the fire**

11/02 • for reducing draught by admission of air to flues

13/00 **Construction of valves or dampers for controlling air supply or draught** (in general F16K)
13/02 • pivoted about a single axis but having no other movement (formed as linked slats each pivoted about an axis F23L 13/08)
13/04 • • with axis perpendicular to face
13/06 • slidable only
13/08 • operating as a roller blind; operating as a venetian blind
13/10 • having a compound movement involving both sliding and pivoting

15/00 **Heating of air supplied for combustion**
15/02 • Arrangements of regenerators
15/04 • Arrangements of recuperators

17/00 **Inducing draught**
17/02 • Tops for chimneys or ventilating shafts; Terminals for flues
17/04 • • Balanced-flue arrangements, i.e. devices which combine air inlet to combustion unit with smoke outlet
17/06 • • branched; T-headed
17/08 • • with coaxial cones or louvres
17/10 • • wherein the top moves as a whole
17/12 • • Devices for fastening the top or terminal to chimney, shaft, or flue
17/14 • • Draining devices
17/16 • Induction apparatus, e.g. steam jet, acting on combustion products beyond the fire

99/00 **Subject matter not provided for in other groups of this subclass [2006.01]**

F23M **CONSTRUCTIONAL DETAILS OF COMBUSTION CHAMBERS, NOT OTHERWISE PROVIDED FOR** (construction or support of tube walls for steam boilers F22B; generating combustion products of high pressure or high velocity F23R)

3/00 **Firebridges** (baffles not confining the fire F23M 9/06)
3/02 • modified for circulation of fluids, e.g. air, steam, water
3/04 • • for delivery of gas, e.g. air, steam
3/06 • • • into or towards fire
3/08 • • • away from fire, e.g. towards smoke outlet
3/10 • • • transversely
3/12 • characterised by shape or construction (F23M 3/02 takes precedence)
3/14 • • with apertures for passage of combustion products
3/16 • • built-up in sections, e.g. using bars or blocks
3/18 • • double; multiple
3/20 • • comprising loose refractory material, wholly or in part
3/22 • movable; adjustable

5/00 **Casings; Linings; Walls** (casings, linings, or walls of heat-treatment chambers of ovens, kilns, or retorts F27D)
5/02 • characterised by the shape of the bricks or blocks used (ceramic materials C04B 33/00, C04B 35/00)
5/04 • Supports for linings
5/06 • Crowns or roofs for combustion chambers (F23M 5/02, F23M 5/04 take precedence)
5/08 • Cooling thereof; Tube walls

7/00 **Doors specially adapted for combustion chambers** (in general E06B; for flues or smoke-boxes F23J 13/08)
7/02 • Frames therefor
7/04 • Cooling doors or door frames

9/00 **Baffles or deflectors for air or combustion products; Flame shields**
9/02 • in air inlets
9/04 • with air-supply passages in the baffle or shield
9/06 • in fire-boxes
9/08 • Helical or twisted baffles or deflectors
9/10 • Baffles or deflectors formed as tubes, e.g. in water-tube boilers (interconnection of such tubes in boilers for fluid flow F22)

11/00 **Safety arrangements** (by controlling combustion F23N 5/24)
11/02 • Preventing emission of flames or hot gases, or admission of air, through working or charging apertures
11/04 • Means for supervising combustion, e.g. window (alarm systems G08B)

99/00 **Subject matter not provided for in other groups of this subclass [2010.01]**

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)

1/00 **Regulating fuel supply**
1/02 • conjointly with air supply
1/04 • conjointly with air supply and with draught
1/06 • conjointly with draught
1/08 • conjointly with another medium, e.g. boiler water
1/10 • • and with air supply or draught

3/00 **Regulating air supply or draught** (conjointly with fuel supply F23N 1/00)
3/02 • Regulating draught by direct pressure operation of single valves or dampers
3/04 • by operation of single valves or dampers by temperature-sensitive elements
3/06 • by conjoint operation of two or more valves or dampers (F23N 3/08 takes precedence)
3/08 • by power-assisted systems

5/00 **Systems for controlling combustion** (F23N 1/00, F23N 3/00 take precedence)
5/02 • using devices responsive to thermal changes or to thermal expansion of a medium
5/04 • • using bimetallic elements
5/06 • • using bellows; using diaphragms

5/08 • • using light-sensitive elements
5/10 • • using thermocouples
5/12 • • using ionisation-sensitive elements, i.e. flame rods
5/14 • • using thermo-sensitive resistors
5/16 • using noise-sensitive detectors
5/18 • using detectors sensitive to rate of flow of air or fuel
5/20 • with a time programme acting through electrical means, e.g. using time-delay relays
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)
5/26 • Details

F23Q IGNITION (devices for igniting matches A24F; chemical igniters C06C 9/00)**; EXTINGUISHING DEVICES**

Subclass index

1/00 Mechanical ignition (lighters containing fuel F23Q 2/00; matches C06F)
1/02 • using friction or shock effects
1/04 • • on a part moved by the fuel-controlling member, e.g. by a tap on a gas cooker
1/06 • • Portable igniters

2/00 Lighters containing fuel, e.g. for cigarettes
2/02 • Lighters with liquid fuel
2/04 • • with cerium-iron alloy and wick
2/06 • • • with friction wheel
2/08 • • • • with ignition by spring action of the cover
2/10 • • • with other friction member
2/12 • • with cerium-iron alloy without wick
2/14 • • with cerium-iron alloy and torch ignited by striking or pushing
2/16 • Lighters with gaseous fuel, e.g. the gas being stored in liquid phase
2/167 • • with adjustable flame **[3]**
2/173 • • • Valves therefor **[3]**
2/18 • Lighters with solid fuel
2/20 • • with cerium-iron alloy and friction wheel
2/22 • • with cerium-iron alloy and tinder
2/24 • • with ignition pills or strips with inflammable parts
2/26 • • combined with liquid-fuel lighters
2/28 • Lighters characterised by electrical ignition of the fuel
2/30 • Lighters characterised by catalytic ignition of fuel
2/32 • Lighters characterised by being combined with other objects (combinations with smokers' equipment A24F)
2/34 • Component parts or accessories
2/36 • • Casings
2/38 • • • with containers for flints or tools
2/40 • • Cover fastenings
2/42 • • Fuel containers; Closures for fuel containers
2/44 • • Wicks; Wick guides or fastenings
2/46 • • Friction wheels; Arrangement of friction wheels
2/48 • • Flints (composition, manufacture C06C 15/00); Guides for, or arrangements of, flints
2/50 • • Protecting coverings
2/52 • • Filling devices

3/00 Ignition using electrically-produced sparks (lighters containing fuel F23Q 2/28; sparking-plugs H01T 13/00)
3/01 • Hand-held lighters, e.g. for cigarettes

5/00 Make-and-break ignition, i.e. with spark generated between electrodes by breaking contact therebetween

7/00 Incandescent ignition; Ignition using electrically-produced heat, e.g. lighters for cigarettes; Electrically-heated glowing plugs
7/02 • for igniting solid fuel
7/04 • • with fans for transfer of heat to fuel
7/06 • Igniters structurally associated with fluid-fuel burners (lighters containing fuel F23Q 2/00)
7/08 • • for evaporating and igniting liquid fuel, e.g. in hurricane lanterns
7/10 • • for gaseous fuel, e.g. in welding appliances
7/12 • • • actuated by gas-controlling device
7/14 • Portable igniters
7/16 • • with built-in battery
7/18 • • with built-in generator
7/20 • • with built-in mains transformer
7/22 • Details
7/24 • • Safety arrangements
7/26 • • • Provision for re-ignition

9/00 Ignition by a pilot flame
9/02 • without interlock with main fuel supply
9/04 • • for upright burners, e.g. gas-cooker burners
9/06 • • for inverted burners, e.g. gas lamps
9/08 • with interlock with main fuel supply
9/10 • • to determine the sequence of supply of fuel to pilot and main burners

9/12 • • to permit the supply to the main burner in dependence upon existence of pilot flame
9/14 • • • using electric means, e.g. by light-sensitive elements

11/00 Arrangement of catalytic igniters
11/04 • at the burner
11/06 • remote from the burner, e.g. on the chimney of a lamp
11/08 • on a part moved by the fuel-controlling member
11/10 • • and moving out of the flame after ignition

13/00 Ignition not otherwise provided for
13/02 • using gas burners, e.g. gas pokers
13/04 • using portable burners, e.g. torches, fire pots

21/00 Devices for effecting ignition from a remote location

23/00 Testing of ignition installations (peculiar to internal-combustion engines F02P 17/00; testing of sparking plugs H01T 13/58)
23/02 • Testing of ignition timing
23/08 • Testing of components
23/10 • • electrically

25/00 Extinguishing devices, e.g. for blowing-out or snuffing candle flames

F23R GENERATING COMBUSTION PRODUCTS OF HIGH PRESSURE OR HIGH VELOCITY, e.g. GAS-TURBINE COMBUSTION CHAMBERS (fluidised bed combustion apparatus specially adapted for operation at superatmospheric pressures F23C 10/16)

3/00 Continuous combustion chambers using liquid or gaseous fuel [3]
3/02 • characterised by the air-flow or gas-flow configuration (reverse-flow combustion chambers F23R 3/54; cyclone or vortex type combustion chambers F23R 3/58) **[3]**
3/04 • • Air inlet arrangements **[3]**
3/06 • • • Arrangement of apertures along the flame tube **[3]**
3/08 • • • • between annular flame tube sections, e.g. flame tubes with telescopic sections **[3]**
3/10 • • • for primary air (F23R 3/06 takes precedence) **[3]**
3/12 • • • • inducing a vortex **[3]**
3/14 • • • • • by using swirl vanes **[3]**
3/16 • • with devices inside the flame tube or the combustion chamber to influence the air or gas flow **[3]**
3/18 • • • Flame stabilising means, e.g. flame holders for after-burners of jet-propulsion plants **[3]**
3/20 • • • • incorporating fuel injection means **[3]**
3/22 • • • • movable, e.g. to an inoperative position; adjustable, e.g. self-adjusting **[3]**
3/24 • • • • of the fluid-screen type **[3]**
3/26 • • Controlling the air flow **[3]**
3/28 • characterised by the fuel supply **[3]**
3/30 • • comprising fuel prevapourising devices **[3]**
3/32 • • • being tubular **[3]**
3/34 • • Feeding into different combustion zones **[3]**
3/36 • • Supply of different fuels **[3]**
3/38 • • comprising rotary fuel injection means **[3]**
3/40 • characterised by the use of catalytic means **[3]**
3/42 • characterised by the arrangement or form of the flame tubes or combustion chambers **[3]**
3/44 • • Combustion chambers comprising a tubular flame tube within a tubular casing (reverse-flow combustion chambers F23R 3/54) **[3]**
3/46 • • Combustion chambers comprising an annular arrangement of flame tubes within a common annular casing or within individual casings **[3]**
3/48 • • • Flame tube interconnectors, e.g. cross-over tubes **[3]**
3/50 • • Combustion chambers comprising an annular flame tube within an annular casing (toroidal combustion chambers F23R 3/52) **[3]**
3/52 • • Toroidal combustion chambers **[3]**
3/54 • • Reverse-flow combustion chambers **[3]**
3/56 • • Combustion chambers having rotary flame tubes **[3]**
3/58 • • Cyclone or vortex type combustion chambers **[3]**
3/60 • • Support structures; Attaching or mounting means **[3]**

5/00 Continuous combustion chambers using solid or pulverulent fuel [3]

7/00 Intermittent or explosive combustion chambers [3]