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

F22 STEAM GENERATION

F22B METHODS OF STEAM GENERATION; STEAM BOILERS (steam engine plants where engine aspects predominate F01K; removal of combustion products or residues, e.g. cleaning of the combustion contaminated surfaces of tubes of boilers, F23J 3/00; domestic central-heating systems using steam F24D; heat exchange or heat transfer in general F28; generation of vapour in the cores of nuclear reactors G21)

Note(s)

This subclass covers only methods of, or apparatus for, the generation of steam under pressure for heating or power purposes.

Subclass index

METHODS FOR STEAM GENERATION.....1/00, 3/00
STEAM BOILERS
General characteristics
having drum; having furnace tube; having fire tube; having combined fire tube and water tube; having fire-box.....5/00, 7/00, 9/00, 11/00, 13/00
having water tubes
auxiliary tubes.....11/00
horizontal; horizontally-inclined; combined horizontally-inclined and vertical; vertical or steeply-inclined.....15/00, 17/00, 19/00, 21/00
formed of sets of spaced double-walled water tubes or of return tubes; water tubes with internally-arranged flue tubes.....23/00, 25/00
Special characteristics.....27/00, 29/00
Modifications or arrangements; details of general application.....31/00, 37/00
PLANTS; CONTROL SYSTEMS.....33/00, 35/00

1/00 Methods of steam generation characterised by form of heating method (use of solar heat F24J 2/00; jackets or other cooling means in which steam is generated and which serve for cooling other apparatus, see the subclasses for such apparatus) **[1, 2006.01]**

1/02 • by exploitation of the heat content of hot heat carriers **[1, 2006.01]**

1/04 • • the heat carrier being hot slag, hot residues, or heated blocks, e.g. iron blocks **[1, 2006.01]**

1/06 • • the heat carrier being molten; Use of molten metal, e.g. zinc, as heat transfer medium **[1, 2006.01]**

1/08 • • the heat carrier being steam **[1, 2006.01]**

1/10 • • • released from heat accumulators **[1, 2006.01]**

1/12 • • • produced by an indirect cyclic process **[1, 2006.01]**

1/14 • • • coming in direct contact with water in bulk or in sprays **[1, 2006.01]**

1/16 • • the heat carrier being hot liquid or hot vapour, e.g. waste liquid, waste vapour **[1, 2006.01]**

1/18 • • the heat carrier being a hot gas, e.g. waste gas such as exhaust gas of internal-combustion engines (use of waste heat of combustion engines, in general, F02) **[1, 2006.01]**

1/20 • using heat evolved in a solution absorbing steam; Soda steam boilers **[1, 2006.01]**

1/22 • using combustion under pressure substantially exceeding atmospheric pressure **[1, 2006.01]**

1/24 • • Pressure-fired steam boilers, e.g. using turbo air compressors actuated by hot gases from boiler furnace **[1, 2006.01]**

1/26 • • Steam boilers of submerged-flame type, i.e. the flame being surrounded by, or impinging on, the water to be vaporised **[1, 2006.01]**

1/28 • in boilers heated electrically **[1, 2006.01]**

1/30 • • Electrode boilers **[1, 2006.01]**

3/00 Other methods of steam generation; Steam boilers not provided for in other groups of this subclass [1, 2006.01]

3/02 • involving the use of working media other than water **[1, 2006.01]**

3/04 • by drop in pressure of high-pressure hot water within pressure-reducing chambers, e.g. in accumulators (steam accumulators per se F01K 1/00) **[1, 2006.01]**

3/06 • by transformation of mechanical, e.g. kinetic, energy into heat energy **[1, 2006.01]**

3/08 • at critical or supercritical pressure values **[1, 2006.01]**

5/00 Steam boilers of drum type, i.e. without internal furnace or fire tubes, the boiler body being contacted externally by flue gas [1, 2006.01]

5/02 • with auxiliary water tubes outside the boiler body **[1, 2006.01]**

5/04 • Component parts thereof; Accessories therefor (covers or similar closure members for pressure vessels in general F16J 13/00) **[1, 2006.01]**

7/00 Steam boilers of furnace-tube type, i.e. the combustion of fuel being performed inside one or more furnace tubes built-in in the boiler body [1, 2006.01]

7/02 • without auxiliary water tubes **[1, 2006.01]**

7/04 • with auxiliary water tubes **[1, 2006.01]**

7/06 • • inside the furnace tube in transverse arrangement **[1, 2006.01]**

7/08 • • inside the furnace tube in longitudinal arrangement **[1, 2006.01]**

7/10 • • outside the boiler body **[1, 2006.01]**

7/12 • with auxiliary fire tubes; Arrangement of header boxes providing for return diversion of flue gas flow **[1, 2006.01]**

7/14 • with both auxiliary water tubes and auxiliary fire tubes **[1, 2006.01]**

7/16 • Component parts thereof; Accessories therefor, e.g. stay-bolt connections **[1, 2006.01]**

7/18 • • Walling of flues; Flue-gas header boxes **[1, 2006.01]**

7/20 • • Furnace tubes **[1, 2006.01]**

9/00 Steam boilers of fire-tube type, i.e. the flue gas from a combustion chamber outside the boiler body flowing through tubes built-in in the boiler body [1, 2006.01]

9/02 • the boiler body being disposed upright, e.g. above the combustion chamber **[1, 2006.01]**

9/04 • • the fire tubes being in upright arrangement **[1, 2006.01]**

9/06 • • • Arrangement of header boxes providing for return diversion of flue gas flow **[1, 2006.01]**

9/08 • • the fire tubes being in horizontal arrangement **[1, 2006.01]**

9/10 • the boiler body being disposed substantially horizontally, e.g. at the side of the combustion chamber **[1, 2006.01]**

9/12 • • the fire tubes being in substantially-horizontal arrangement **[1, 2006.01]**

9/14 • • • Arrangement of header boxes providing for return diversion of flue gas flow **[1, 2006.01]**

9/16 • the boiler body containing fire tubes disposed crosswise in inclined upward arrangement **[1, 2006.01]**

9/18 • Component parts thereof; Accessories therefor, e.g. stay-bolt connections **[1, 2006.01]**

11/00 Steam boilers of combined fire-tube type and water-tube type, i.e. steam boilers of fire-tube type having auxiliary water tubes [1, 2006.01]

11/02 • the fire tubes being in upright arrangement **[1, 2006.01]**

11/04 • the fire tubes being in horizontal arrangement **[1, 2006.01]**

13/00 Steam boilers of fire-box type, i.e. the combustion of fuel being performed in a chamber or fire-box with subsequent flue(s) or fire tube(s), both chamber or fire-box and flues or fire tubes being built-in in the boiler body [1, 2006.01]

13/02 • mounted in fixed position with the boiler body disposed upright **[1, 2006.01]**

13/04 • mounted in fixed position with the boiler body disposed substantially horizontally **[1, 2006.01]**

13/06 • Locomobile, traction-engine, steam-roller, or locomotive boilers **[1, 2006.01]**

13/08 • • without auxiliary water tubes inside the fire-box **[1, 2006.01]**

13/10 • • with auxiliary water tubes inside the fire-box **[1, 2006.01]**

13/12 • • • the auxiliary water tubes lining the fire-box **[1, 2006.01]**

13/14 • Component parts thereof; Accessories therefor **[1, 2006.01]**

13/16 • • Stay-bolt connections, e.g. rigid connections **[1, 2006.01]**

13/18 • • • Flexible connections, e.g. of ball-and-socket type **[1, 2006.01]**

15/00 Water-tube boilers of horizontal type, i.e. the water-tube sets being arranged horizontally [1, 2006.01]

17/00 Water-tube boilers of horizontally-inclined type, i.e. the water-tube sets being inclined slightly with respect to the horizontal plane [1, 2006.01]

17/02 • built-up from water-tube sets in abutting connection with two header boxes in common for all sets, e.g. with flat header boxes **[1, 2006.01]**

17/04 • • the water-tube sets being inclined in opposite directions, e.g. crosswise **[1, 2006.01]**

17/06 • • the water-tube sets being bent angularly **[1, 2006.01]**

17/08 • • the water-tube sets being curved **[1, 2006.01]**

17/10 • built-up from water-tube sets in abutting connection with two sectional headers each for every set, i.e. with headers in a number of sections across the width or height of the boiler **[1, 2006.01]**

17/12 • • the sectional headers being in vertical or substantially-vertical arrangement **[1, 2006.01]**

17/14 • • the sectional headers being in horizontal or substantially-horizontal arrangement **[1, 2006.01]**

17/16 • Component parts thereof; Accessories therefor **[1, 2006.01]**

17/18 • • Header boxes; Sectional headers **[1, 2006.01]**

19/00 Water-tube boilers of combined horizontally-inclined type and vertical type, i.e. water-tube boilers of horizontally-inclined type having auxiliary water-tube sets in vertical or substantially-vertical arrangement [1, 2006.01]

21/00 Water-tube boilers of vertical or steeply-inclined type, i.e. the water-tube sets being arranged vertically or substantially vertically [1, 2006.01]

21/02 • built-up from substantially-straight water tubes **[1, 2006.01]**

21/04 • • involving a single upper drum and a single lower drum, e.g. the drums being arranged transversely **[1, 2006.01]**

21/06 • • • the water tubes being arranged annularly in sets, e.g. in abutting connection with drums of annular shape **[1, 2006.01]**

21/08 • • • the water tubes being arranged sectionally in groups or in banks, e.g. bent over at their ends **[1, 2006.01]**

21/10 • • • the water tubes being arranged in staggered rows **[1, 2006.01]**

21/12 • • involving two or more upper drums and two or more lower drums, e.g. with crosswise-arranged water-tube sets in abutting connection with drums **[1, 2006.01]**
21/14 • • involving a single upper drum and two or more lower drums **[1, 2006.01]**
21/16 • • • the lower drums being interconnected by further water tubes **[1, 2006.01]**
21/18 • • involving two or more upper drums and a single lower drum **[1, 2006.01]**
21/20 • • involving sectional or subdivided headers in separate arrangement for each water-tube set **[1, 2006.01]**
21/22 • built-up from water tubes of form other than straight or substantially straight **[1, 2006.01]**
21/24 • • bent in serpentine or sinuous form **[1, 2006.01]**
21/26 • • bent helically, i.e. coiled **[1, 2006.01]**
21/28 • • bent spirally **[1, 2006.01]**
21/30 • • bent in U-loop form **[1, 2006.01]**
21/32 • • • disposed horizontally in abutting connection with upright headers or rising water mains **[1, 2006.01]**
21/34 • built-up from water tubes grouped in panel form surrounding the combustion chamber, i.e. radiation boilers **[1, 2006.01]**
21/36 • • involving an upper drum or headers mounted at the top of the combustion chamber **[1, 2006.01]**
21/38 • • Component parts thereof, e.g. prefabricated panels **[1, 2006.01]**
21/40 • built-up from water tubes arranged in a comparatively long vertical shaft, i.e. tower boilers **[1, 2006.01]**

23/00 Water-tube boilers built-up from sets of spaced double-walled water tubes of return type in unilaterial abutting connection with a boiler drum or with a header box, i.e. built-up from Field water tubes comprising an inner tube arranged within an outer unilaterally-closed tube [1, 2006.01]
23/02 • the water-tube, i.e. Field-tube, sets being horizontal or substantially horizontal **[1, 2006.01]**
23/04 • the water-tube, i.e. Field-tube, sets being vertical or substantially vertical **[1, 2006.01]**
23/06 • Component parts thereof, e.g. Field water tubes (heat-exchange tubes in general F28F) **[1, 2006.01]**

25/00 Water-tube boilers built-up from sets of water tubes with internally-arranged flue tubes, or fire tubes, extending through the water tubes [1, 2006.01]

27/00 Instantaneous or flash steam boilers [1, 2006.01]
27/02 • built-up from fire tubes **[1, 2006.01]**
27/04 • built-up from water tubes (F22B 27/12-F22B 27/16 take precedence) **[1, 2006.01]**
27/06 • • bent in serpentine or sinuous form **[1, 2006.01]**
27/08 • • bent helically, i.e. coiled **[1, 2006.01]**
27/10 • • bent spirally **[1, 2006.01]**
27/12 • built-up from rotary heat-exchange elements, e.g. from tube assemblies **[1, 2006.01]**
27/14 • built-up from heat-exchange elements arranged within a confined chamber having heat-retaining walls **[1, 2006.01]**
27/16 • involving spray nozzles for sprinkling or injecting water particles on to or into hot heat-exchange elements, e.g. into tubes **[1, 2006.01]**

29/00 Steam boilers of forced-flow type [1, 2006.01]
29/02 • of forced-circulation type **[1, 2006.01]**
29/04 • of combined-circulation type, i.e. in which convection circulation due to the difference in specific gravity between cold and hot water is promoted by additional measures, e.g. by injecting pressure-water temporarily **[1, 2006.01]**
29/06 • of once-through type, i.e. built-up from tubes receiving water at one end and delivering superheated steam at the other end of the tubes (F22B 33/00 takes precedence) **[1, 2006.01]**
29/08 • • operating with fixed point of final state of complete evaporation **[1, 2006.01]**
29/10 • • operating with sliding point of final state of complete evaporation **[1, 2006.01]**
29/12 • • operating with superimposed recirculation during starting and low-load periods, e.g. composite boilers **[1, 2006.01]**

31/00 Modifications of boiler construction, or of tube systems, dependent on installation of combustion apparatus; Arrangements or dispositions of combustion apparatus (steam generation characterised by heating method F22B 1/00; combustion apparatus per se F23) **[1, 2006.01]**
31/02 • Installation of water-tube boilers in chimneys, e.g. in converter chimneys **[1, 2006.01]**
31/04 • Heat supply by installation of two or more combustion apparatus, e.g. of separate combustion apparatus for the boiler and the superheater respectively **[1, 2006.01]**
31/06 • • Installation of emergency heat supply **[1, 2006.01]**
31/08 • Installation of heat-exchange apparatus or of means in boilers for heating air supplied for combustion **[1, 2006.01]**

Steam-generation plants; Control systems

33/00 Steam-generation plants, e.g. comprising steam boilers of different types in mutual association (arrangements or dispositions of steam-generation plants in marine vessels B63H 21/00) **[1, 2006.01]**
33/02 • Combinations of boilers having a single combustion apparatus in common **[1, 2006.01]**
33/04 • • of boilers of furnace-tube type with boilers of water-tube type **[1, 2006.01]**
33/06 • • of boilers of furnace-tube type with boilers of fire-tube type **[1, 2006.01]**
33/08 • • of boilers of water-tube type with boilers of fire-tube type **[1, 2006.01]**
33/10 • • of two or more superposed boilers with separate water volumes and operating with two or more separate water levels **[1, 2006.01]**
33/12 • Self-contained steam boilers, i.e. comprising as a unit the steam boiler, the combustion apparatus, the fuel storage, accessory machines, and equipment **[1, 2006.01]**
33/14 • Combinations of low- and high-pressure boilers **[1, 2006.01]**
33/16 • • of forced-flow type **[1, 2006.01]**
33/18 • Combinations of steam boilers with other apparatus **[1, 2006.01]**

35/00 Control systems for steam boilers (regulation or control of steam power plants F01K 7/00; for regulating feed-water supply F22D; for controlling superheat temperature F22G 5/00; control of combustion F23N) **[1, 2006.01]**
35/02 • for steam boilers with natural convection circulation **[1, 2006.01]**

35/04 • • during starting-up periods, i.e. during the periods between the lighting of the furnaces and the attainment of the normal operating temperature of the steam boilers **[1, 2006.01]**

35/06 • for steam boilers of forced-flow type **[1, 2006.01]**

35/08 • • of forced-circulation type **[1, 2006.01]**

35/10 • • of once-through type **[1, 2006.01]**

35/12 • • • operating at critical or supercritical pressure **[1, 2006.01]**

35/14 • • during the starting-up periods, i.e. during the periods between the lighting of the furnaces and the attainment of the normal operating temperature of the steam boilers **[1, 2006.01]**

35/16 • • responsive to the percentage of steam in the mixture of steam and water **[1, 2006.01]**

35/18 • Applications of computers to steam-boiler control **[1, 2006.01]**

37/00 Component parts or details of steam boilers (venting devices F16K 24/00; steam traps or like apparatus F16T) **[1, 2006.01]**

37/02 • applicable to more than one kind or type of steam boiler **[1, 2006.01]**

37/04 • • and characterised by material, e.g. use of special steel alloy **[1, 2006.01]**

37/06 • • Flue or fire tubes; Accessories therefor, e.g. fire-tube inserts **[1, 2006.01]**

37/08 • • • Fittings preventing burning-off of the tube edges **[1, 2006.01]**

37/10 • • Water tubes; Accessories therefor (working of metal tubes B21D; pipes in general F16L; repairing leaks in water tubes F16L 55/16, F28F 11/00; cleaning water tubes of boilers F23J, F28G; baffles, screens, or deflectors formed of water tubes F23M 9/10) **[1, 2006.01]**

37/12 • • • Forms of water tubes, e.g. of varying cross-section **[1, 2006.01]**

37/14 • • • Supply mains, e.g. rising mains, down-comers, in connection with water tubes **[1, 2006.01]**

37/16 • • • Return bends **[1, 2006.01]**

37/18 • • • Inserts, e.g. for receiving deposits from water **[1, 2006.01]**

37/20 • • • Supporting arrangements, e.g. for securing water-tube sets (construction of tube walls of furnaces including boiler furnaces F23M 5/08) **[1, 2006.01]**

37/22 • • Drums; Headers; Accessories therefor (making boilers from sheet metal B21D 51/24; pressure vessels in general F16J 12/00; covers or similar closure members for pressure vessels in general F16J 13/00) **[1, 2006.01]**

37/24 • • Supporting, suspending, or setting arrangements, e.g. heat shielding (frames, engine beds F16M) **[1, 2006.01]**

37/26 • • Steam-separating arrangements (vapour-liquid separators, e.g. for drying steam, B01D, B04) **[1, 2006.01]**

37/28 • • • involving reversal of direction of flow **[1, 2006.01]**

37/30 • • • using impingement against baffle separators **[1, 2006.01]**

37/32 • • • using centrifugal force **[1, 2006.01]**

37/34 • • Adaptations of boilers for promoting water circulation (auxiliary devices for promoting water circulation F22D 7/00) **[1, 2006.01]**

37/36 • • Arrangements for sheathing or casing boilers **[1, 2006.01]**

37/38 • • Determining or indicating operating conditions in steam boilers, e.g. monitoring direction or rate of water flow through water tubes (measuring or indicating instruments in general G01) **[1, 2006.01]**

37/40 • • Arrangements of partition walls in flues of steam boilers, e.g. built-up from baffles (in flues or chimneys F23J 13/00) **[1, 2006.01]**

37/42 • • Applications, arrangements, or dispositions of alarm or automatic safety devices (for feed-water heaters F22D 1/14; alarms responsive to undesired or abnormal conditions G08B) **[1, 2006.01]**

37/44 • • • of safety valves (safety valves per se F16K) **[1, 2006.01]**

37/46 • • • responsive to low or high water level, e.g. for checking, suppressing, extinguishing combustion in boilers (fire-fighting, fire extinction in general A62) **[1, 2006.01]**

37/47 • • • responsive to abnormal temperature, e.g. actuated by fusible plugs (such alarms or devices per se G08B) **[1, 2006.01]**

37/48 • • Devices or arrangements for removing water, minerals, or sludge from boilers (cleaning water tubes, furnace tubes, or the like of boilers F23J, F28G) **[1, 2006.01]**

Note(s) [4]

Group F22B 37/48covers only systems used while the boiler is in operation, or which remain in position while the boiler is in operation, or are specifically adapted to boilers without any other utility.

37/50 • • • for draining or expelling water **[1, 2006.01]**

37/52 • • • Washing-out devices **[1, 2006.01]**

37/54 • • • De-sludging or blow-down devices **[1, 2006.01]**

37/56 • • Boiler-cleaning control devices, e.g. for ascertaining proper duration of boiler blow-down **[1, 2006.01]**

37/58 • • Removing tubes from headers or drums; Extracting tools **[1, 2006.01]**

37/60 • specially adapted for steam boilers of instantaneous or flash type **[1, 2006.01]**

37/62 • specially adapted for steam boilers of forced-flow type **[1, 2006.01]**

37/64 • • Mounting of, or supporting arrangements for, tube units (construction of tube walls of furnaces, e.g. boiler furnaces F23M 5/08) **[1, 2006.01]**

37/66 • • • involving vertically-disposed water tubes **[1, 2006.01]**

37/68 • • • involving horizontally-disposed water tubes **[1, 2006.01]**

37/70 • • Arrangements for distributing water into water tubes **[1, 2006.01]**

37/72 • • • involving injection devices **[1, 2006.01]**

37/74 • • • Throttling arrangements for tubes or sets of tubes **[1, 2006.01]**

37/76 • Adaptations or mounting of devices for observing existence or direction of fluid flow (devices per se G01P) **[1, 2006.01]**

37/78 • Adaptations or mounting of level indicators (level indicators per se G01F) **[1, 2006.01]**