

CPC**COOPERATIVE PATENT CLASSIFICATION****F22B**

METHODS OF STEAM GENERATION; STEAM BOILERS (steam engine plants where engine aspects predominate [F01K](#) ; 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

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

Guidance heading: General aspects of, or methods for, steam generation

F22B 1/00

Methods of steam generation characterised by form of heating method (solar heating [F24J](#) ; jackets or other cooling means in which steam is generated and which serve for cooling other apparatus, see the subclasses for such apparatus)

F22B 1/003

- . {using combustion of hydrogen with oxygen (power plants using steam created by combustion of hydrogen with oxygen [F01K 25/005](#)) }

F22B 1/006

- . { using solar heat (solar heat collectors per se [F24J 2/00](#); devices for producing mechanical power from solar energy [F03G 6/00](#)) }

F22B 1/02

- . by exploitation of the heat content of hot heat carriers

F22B 1/021

- .. {with heating tubes in which flows a non-specified heating fluid (for nuclear reactors [F22B 1/023](#), for hot gas [F22B 1/1884](#)) }

F22B 1/023

- .. {with heating tubes, for nuclear reactors as far as they are not classified, according to a specified heating fluid, in another group }

F22B 1/025

- ... {with vertical U shaped tubes carried on a horizontal tube sheet }

F22B 1/026

- ... {with vertical tubes between to horizontal tube sheets }

F22B 1/028

- .. {Steam generation using heat accumulators ([F22B 27/14](#) takes precedence) }

F22B 1/04

- .. the heat carrier being hot slag, hot residues, or heated blocks, e.g. iron blocks

F22B 1/06

- .. the heat carrier being molten; Use of molten metal, e.g. zinc, as heat transfer medium

F22B 1/063

- ... { for metal cooled nuclear reactors (heat-exchangers having a liquid metal as heat exchange medium [F28D 7/00C](#)) }

F22B 1/066

- {with double-wall tubes having a third fluid between these walls, e.g. helium for leak detection (heat-exchangers with double-wall tubes [F28D 7/10](#); double-wall pipes per se [F16L 9/18](#)) }

F22B 1/08

- .. the heat carrier being steam

F22B 1/10

- ... released from heat accumulators

F22B 1/12

- ... produced by an indirect cyclic process

F22B 1/123

- {Steam generators downstream of a nuclear boiling water reactor }

F22B 1/126

- {Steam generators of the Schmidt-Hartmann type }

F22B 1/14

- ... coming in direct contact with water in bulk or in sprays

- F22B 1/143 {in combination with a nuclear installation }
- F22B 1/146 {Loffler boilers }
- F22B 1/16 .. the heat carrier being hot liquid or hot vapour, e.g. waste liquid, waste vapour
- F22B 1/162 . . . {in combination with a nuclear installation }
- F22B 1/165 . . . {using heat pipes (heat pipes per se [F28D 15/00B](#)) }
- F22B 1/167 . . . {using an organic fluid }
- F22B 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, [F02G](#))
- F22B 1/1807 . . . {using the exhaust gases of combustion engines }
- F22B 1/1815 {using the exhaust gases of gas-turbines }
- F22B 1/1823 . . . {for gas-cooled nuclear reactors }
- F22B 1/183 . . . {in combination with metallurgical converter installations }
- F22B 1/1838 . . . {the hot gas being under a high pressure, e.g. in chemical installations }
- F22B 1/1846 {the hot gas being loaded with particles, e.g. waste heat boilers after a coal gasification plant }
- F22B 1/1853 . . . {coming in direct contact with water in bulk or in sprays }
- F22B 1/1861 . . . {Waste heat boilers with supplementary firing }
- F22B 1/1869 . . . {Hot gas water tube boilers not provided for in [F22B 1/1807](#) - [F22B 1/1861](#) }
- F22B 1/1876 {the hot gas being loaded with particles, e.g. dust (with the hot gas being under high pressure [F22B 1/1846](#)) }
- F22B 1/1884 . . . {Hot gas heating tube boilers with one or more heating tubes }
- F22B 1/1892 . . . {Systems therefor not provided for in [F22B 1/1807](#) to [F22B 1/1861](#) }
- F22B 1/20 . . using heat evolved in a solution absorbing steam; Soda steam boilers
- F22B 1/22 . . using combustion under pressure substantially exceeding atmospheric pressure
- F22B 1/24 .. Pressure-fired steam boilers, e.g. using turbo-air compressors actuated by hot gases from boiler furnace
- F22B 1/26 .. Steam boilers of submerged-flame type, i.e. the flame being surrounded by, or impinging on, the water to be vaporised { e.g. water in sprays }
- F22B 1/265 . . . {the water being in bulk }
- F22B 1/28 . . in boilers heated electrically { (superheating using an electrical heat source independent from heat supply of the steam boiler [F22G 1/165](#)) }
- F22B 1/281 .. {other than by electrical resistances or electrodes }
- F22B 1/282 .. {with water or steam circulating in tubes or ducts }
- F22B 1/284 .. {with water in reservoirs }
- F22B 1/285 . . . {the water being fed by a pump to the reservoirs }
- F22B 1/287 .. {with water in sprays or in films }
- F22B 1/288 .. {Instantaneous electrical steam generators built-up from heat-exchange elements arranged within a confined chamber having heat-retaining walls }
- F22B 1/30 .. Electrode boilers
- F22B 1/303 . . . {with means for injecting or spraying water against electrodes or with means for water circulation }
- F22B 1/306 {with at least one electrode permanently above the water surface }

F22B 3/00 **Other methods of steam generation; Steam boilers not provided for in other groups of this subclass**

- F22B 3/02 . involving the use of working media other than water
- F22B 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](#))
- F22B 3/045 . . {the drop in pressure being achieved by compressors, e.g. with steam jet pumps }
- F22B 3/06 . by transformation of mechanical, e.g. kinetic, energy into heat energy
- F22B 3/08 . at critical or supercritical pressure values

Guidance heading: **Kinds of steam boilers**

F22B 5/00 **Steam boilers of drum type, i.e. without internal furnace or fire tubes, the boiler body being contacted externally by flue gas**

- F22B 5/005 . {with rotating drums }
- F22B 5/02 . with auxiliary water tubes outside the boiler body
- F22B 5/04 . Component parts thereof; Accessories therefor ([covers or similar closure members F16J 13/00](#))

F22B 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**

- F22B 7/02 . without auxiliary water tubes
- F22B 7/04 . with auxiliary water tubes
- F22B 7/06 . . inside the furnace tube in transverse arrangements
- F22B 7/08 . . inside the furnace tube in longitudinal arrangement
- F22B 7/10 . . outside the boiler body
- F22B 7/12 . with auxiliary fire tubes; Arrangement of header boxes providing for return diversion of flue gas flow
- F22B 7/14 . with both auxiliary water tubes and auxiliary fire tubes
- F22B 7/16 . Component parts thereof; Accessories therefor, e.g. stay-bolt connections
- F22B 7/18 . . Walling of flues; Flue gas header boxes
- F22B 7/20 . . Furnace tubes

F22B 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**

- F22B 9/02 . the boiler body being disposed upright, e.g. above the combustion chamber

- F22B 9/04 . . . the fire tubes being in upright arrangement
- F22B 9/06 . . . Arrangement of header boxes providing for return diversion of flue gas flow
- F22B 9/08 . . . the fire tubes being in horizontal arrangement
- F22B 9/10 . the boiler body being disposed substantially horizontally, e.g. at the side of the combustion chamber
- F22B 9/12 . . . the fire tubes being in substantially horizontal arrangement
- F22B 9/14 . . . Arrangement of header boxes providing for return diversion of flue gas flow
- F22B 9/16 . the boiler body containing fire tubes disposed crosswise in inclined upward arrangement
- F22B 9/18 . Component parts thereof; Accessories therefor, e.g. stay-bolt connections
- F22B 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**
- F22B 11/02 . the fire tubes being in upright arrangement
- F22B 11/04 . the fire tubes being in horizontal arrangement
- F22B 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**
- F22B 13/005 . { with flues, other than fire tubes }
- F22B 13/02 . mounted in fixed position with the boiler body disposed upright
- F22B 13/023 . . {with auxiliary water tubes inside the fire-box, e.g. vertical tubes ([F22B 13/10](#) takes precedence) }
- F22B 13/026 . . . {the tubes being in substantially horizontal arrangement }
- F22B 13/04 . mounted in fixed position with the boiler body disposed substantially horizontally
- F22B 13/06 . Locomobile, traction-engine, steam-roller, or locomotive boilers
- F22B 13/065 . . {Combination of low and high pressure locomotive boilers }
- F22B 13/08 . . without auxiliary water tubes inside the fire-box
- F22B 13/10 . . with auxiliary water tubes inside the fire-box
- F22B 13/12 . . . the auxiliary water tubes lining the fire-box
- F22B 13/14 . Component parts thereof; Accessories therefor
- F22B 13/145 . . {Firebox thermosiphons }
- F22B 13/16 . . Stay-bolt connections, e.g. rigid connections
- F22B 13/18 . . . Flexible connections, e.g. of ball-and-socket type
- F22B 15/00 Water-tube boilers of horizontal type, i.e. the water-tube sets being arranged horizontally**

- F22B 17/00** **Water-tube boilers of horizontally-inclined type, e.g. the water-tube sets being inclined slightly with respect to the horizontal plane**
- F22B 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
- F22B 17/025 . . {with combined inlet and outlet header boxes, e.g. connected by U-tubes or Field tubes }
- F22B 17/04 . . the water-tube sets being inclined in opposite directions, e.g. crosswise
- F22B 17/06 . . the water-tube sets being bent angularly
- F22B 17/08 . . the water-tube sets being curved
- F22B 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
- F22B 17/105 . . {with tubes in series flow arrangement }
- F22B 17/12 . . the sectional headers being in vertical or substantially vertical arrangement
- F22B 17/14 . . the sectional headers being in horizontal or substantially horizontal arrangement
- F22B 17/16 . Component parts thereof; Accessories therefor
- F22B 17/18 . . Header boxes; Sectional headers
- F22B 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**
- F22B 21/00** **Water-tube boilers of vertical or steeply-inclined type, i.e. the water-tube sets being arranged vertically or substantially vertically**
- F22B 21/002 . { involving a single upper drum ([F22B 21/36](#) takes precedence) }
- F22B 21/005 . {involving a central vertical drum, header or downcomer }
- F22B 21/007 . {specially adapted for locomotives }
- F22B 21/02 . built-up from substantially straight water tubes
- F22B 21/04 . . involving a single upper drum and a single lower drum, e.g. the drums being arranged transversely
- F22B 21/06 . . . the water tubes being arranged annularly in sets, e.g. in abutting connection with drums of annular shape
- F22B 21/065 {involving an upper and lower drum of annular shape }
- F22B 21/08 . . . the water tubes being arranged sectionally in groups or in banks, e.g. bent over at their ends
- F22B 21/081 {involving a combustion chamber, placed at the side and built-up from water tubes }
- F22B 21/083 {involving an upper drum and a lower drum and a fire-place between the two drums }
- F22B 21/085 {the tubes being placed in layers }

- F22B 21/086 {Frames built-up from water tubes }
- F22B 21/088 { involving an upper drum and a lower drum and two lateral drums }
- F22B 21/10 . . . the water tubes being arranged in staggered rows
- F22B 21/12 . . involving two or more upper drums and two or more lower drums, e.g. with crosswise-arranged water-tube sets in abutting connections with drums
- F22B 21/123 . . . {involving crossed water tubes }
- F22B 21/126 . . . { involving more than two lower or upper drums }
- F22B 21/14 . . involving a single upper drum and two or more lower drums
- F22B 21/16 . . . the lower drums being interconnected by further water tubes
- F22B 21/18 . . involving two or more upper drums and a single lower drum
- F22B 21/185 . . . {involving more than two upper drums and a single lower drum }
- F22B 21/20 . . involving sectional or subdivided headers in separate arrangement for each water-tube set

- F22B 21/22 . built-up from water tubes of form other than straight or substantially straight
- F22B 21/24 . . bent in serpentine or sinuous form
- F22B 21/26 . . bent helically, i.e. coiled
- F22B 21/28 . . bent spirally
- F22B 21/30 . . bent in U-loop form
- F22B 21/32 . . . disposed horizontally in abutting connection with upright headers or rising water mains

- F22B 21/34 . built-up from water tubes grouped in panel form surrounding the combustion chamber, i.e. radiation boilers
- F22B 21/341 . . { Vertical radiation boilers with combustion in the lower part }
- F22B 21/343 . . . {the vertical radiation combustion chamber being connected at its upper part to a sideways convection chamber }
- F22B 21/345 {with a tube bundle between an upper and a lower drum in the convection pass }
- F22B 21/346 . . { Horizontal radiation boilers }
- F22B 21/348 . . {Radiation boilers with a burner at the top }
- F22B 21/36 . . involving an upper drum or headers mounted at the top of the combustion chamber
- F22B 21/363 . . . {involving a horizontal drum mounted in an upper corner of the boiler }
- F22B 21/366 . . . {involving a horizontal drum mounted in the middle of the boiler }
- F22B 21/38 . . Component parts thereof, e.g. prefabricated panels

- F22B 21/40 . built-up from water tubes arranged in a comparatively long vertical shaft, i.e. tower boilers

- F22B 23/00 Water-tube boilers built-up from sets of spaced double-walled water tubes of return type in unilateral 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**

- F22B 23/02 . the water-tube, i.e. Field-tube, sets being horizontal or substantially horizontal
- F22B 23/04 . the water-tube, i.e. Field-tube, sets being vertical or substantially vertical

- F22B 23/06
 - . Component parts thereof, e.g. Field water tubes ([heat-exchange tubes in general F28F](#))
- F22B 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
- F22B 27/00**
Instantaneous or flash steam boilers
- F22B 27/02
 - . built-up from fire tubes
- F22B 27/04
 - . built-up from water tubes ([F22B 27/12 to F22B 27/16 take precedence](#))
- F22B 27/06
 - . . bent in serpentine or sinuous form
- F22B 27/08
 - . . bent helically, i.e. coiled
- F22B 27/10
 - . . bent spirally
- F22B 27/12
 - . built-up from rotary heat-exchange elements, e.g. from tube assemblies
- F22B 27/14
 - . built-up from heat-exchange elements arranged within a confined chamber having heat-retaining walls { ([F22B 1/288 takes precedence](#)) }
- F22B 27/16
 - . involving spray nozzles for sprinkling or injecting water particles on to or into hot heat-exchange elements, e.g. into tubes { ([F22B 1/287 takes precedence](#)) }
- F22B 27/165
 - . . {with film flow of water on heated surfaces }
- F22B 29/00**
Steam boilers of forced-flow type
- F22B 29/02
 - . of forced-circulation type { ([F22B 29/06 takes precedence](#)) }
- F22B 29/023
 - . . { without drums, i.e. without hot water storage in the boiler }
- F22B 29/026
 - . . . {operating at critical or supercritical pressure }
- F22B 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
- F22B 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](#))
- F22B 29/061
 - . . {Construction of tube walls }
- F22B 29/062
 - . . . {involving vertically-disposed water tubes }
- F22B 29/064
 - . . . {involving horizontally- or helically-disposed water tubes }
- F22B 29/065
 - . . . {involving upper vertically disposed water tubes and lower horizontally- or helically disposed water tubes }
- F22B 29/067
 - . . {operating at critical or supercritical pressure (with recirculation during normal operation [F22B 29/026](#)) }
- F22B 29/068
 - . . {operating with superimposed recirculation during normal operation ([F22B 29/12 takes precedence](#)) }
- F22B 29/08
 - . . operating with fixed point of final state of complete evaporation ({ evaporation or evaporation apparatus for physical or chemical purposes, e.g. evaporation of

- liquids for gas phase reactions [B01B 1/005](#) }
- F22B 29/10 . . operating with sliding point of final state of complete evaporation ({ evaporation or evaporation apparatus for physical or chemical purposes, e.g. evaporation of liquids for gas phase reactions [B01B 1/005](#) }
- F22B 29/12 . . operating with superimposed recirculation during starting and low-load periods, e.g. composite boilers
- F22B 31/00** **Modifications of boiler construction, or of tube systems, dependent on installation of combustion apparatus; Arrangements of dispositions of combustion apparatus** (steam generation characterised by heating method [F22B 1/00](#); combustion apparatus per se [F23](#))
- F22B 31/0007 . {with combustion in a fluidized bed (fluidized bed apparatus per se [B01J 8/00](#); fluidized bed combustors [F23C 11/02](#) }
- F22B 31/0015 . . {for boilers of the water tube type }
- F22B 31/0023 . . . {with tubes in the bed ([F22B 31/003](#) takes precedence) }
- F22B 31/003 . . . {with tubes surrounding the bed or with water tube wall partitions }
- F22B 31/0038 {with tubes in the bed }
- F22B 31/0046 . . {for boilers of the shell type, e.g. with furnace box }
- F22B 31/0053 . . . {with auxiliary water tubes }
- F22B 31/0061 . . {Constructional features of bed cooling }
- F22B 31/0069 . . {Systems therefor }
- F22B 31/0076 . . {Controlling processes for fluidized bed boilers not related to a particular type }
- F22B 31/0084 . . {with recirculation of separated solids or with cooling of the bed particles outside the combustion bed }
- F22B 31/0092 . . . {with a fluidized heat exchange bed and a fluidized combustion bed separated by a partition, the bed particles circulating around or through that partition }
- F22B 31/02 . Installation of water-tube boilers in chimneys, e.g. in converter chimneys
- F22B 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
- F22B 31/045 . . {Steam generators specially adapted for burning refuse }
- F22B 31/06 . . Installation of emergency heat supply
- F22B 31/08 . Installation of heat-exchange apparatus or of means in boilers for heating air supplied for combustion

Guidance heading: Steam-generation plants; Control systems

- F22B 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](#))
- F22B 33/02 . Combinations of boilers having a single combustion apparatus in common
- F22B 33/04 . . of boilers of furnace-tube type with boilers of water-tube type
- F22B 33/06 . . of boilers of furnace-tube type with boilers of fire-tube type

- F22B 33/08 . . of boilers of water tube type with boilers of fire-tube type
- F22B 33/10 . . of two or more superposed boilers with separate water volumes and operating with two or more separate water levels
- F22B 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
- F22B 33/14 . Combination of low and high pressure boilers ([F22B 13/065](#) takes precedence)
- F22B 33/16 . . of forced-flow type
- F22B 33/18 . Combinations of steam boilers with other apparatus
- F22B 33/185 . . {in combination with a steam accumulator }
- F22B 35/00** **Control systems for steam boilers** ({for fluidized bed boilers [F22B 31/0076](#); } 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](#) ; regulating or controlling in general [G05](#))
- F22B 35/001 . {Controlling by flue gas dampers (for superheaters [F22G 5/04](#)) }
- F22B 35/002 . {Control by recirculating flue gases (for superheaters [F22G 5/06](#)) }
- F22B 35/004 . {Control systems for steam generators of nuclear power plants }
- F22B 35/005 . {Control systems for instantaneous steam boilers }
- F22B 35/007 . {Control systems for waste heat boilers }
- F22B 35/008 . {Control systems for two or more steam generators ([F22D 5/36](#) takes precedence) }
- F22B 35/02 . for steam boilers with natural convection circulation
- F22B 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
- F22B 35/06 . for steam boilers of forced-flow type
- F22B 35/08 . . of forced-circulation type
- F22B 35/083 . . . {without drum, i.e. without hot water storage in the boiler }
- F22B 35/086 {operating at critical or supercritical pressure }
- F22B 35/10 . . of once-through type
- F22B 35/101 . . . {operating with superimposed recirculation during starting or low load periods, e.g. composite boilers ([F22B 35/125](#) takes precedence) }
- F22B 35/102 . . . {operating with fixed point of final state of complete evaporation, e.g. in a steam-water separator }
- F22B 35/104 . . . {Control systems by injecting water (for superheaters [F22G 5/12](#)) }
- F22B 35/105 . . . {operating at sliding pressure }
- F22B 35/107 . . . {Control systems with auxiliary heating surfaces }
- F22B 35/108 . . . {Control systems for steam generators having multiple flow paths }
- F22B 35/12 . . . operating at critical or supercritical pressure

- F22B 35/125 {operating with superimposed recirculation during starting or low load periods, e.g. composite boilers }
- F22B 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
- F22B 35/16 . . responsive to the percentage of steam in the mixture of steam and water
- F22B 35/18 . Application of computers to steam boiler control
- F22B 37/00** **Component parts or details of steam boilers** (venting devices [F16K 24/00](#); steam traps or like apparatus [F16T](#))
- F22B 37/001 . {Steam generators built-up from pre-fabricated elements }
- F22B 37/002 . {specially adapted for nuclear steam generators, e.g. maintenance, repairing or inspecting equipment not otherwise provided for }
- F22B 37/003 . . {Maintenance, repairing or inspecting equipment positioned in or via the headers }
- F22B 37/005 . . . { Positioning apparatus specially adapted therefor ([F22B 37/70C3](#) takes precedence) }
- F22B 37/006 . . {Walking equipment, e.g. walking platforms suspended at the tube sheet (walking mechanism per se [B62D 57/02](#)) }
- F22B 37/007 . . {Installation or removal of nuclear steam generators }
- F22B 37/008 . { Adaptations for flue gas purification in steam generators, (flue gas purification in general [F23J](#) ; gas purification in general [B01D](#)) }
- F22B 37/02 . applicable to more than one kind or type of steam boiler
- F22B 37/025 . . {Devices and methods for diminishing corrosion, e.g. by preventing cooling beneath the dew point }
- F22B 37/04 . . and characterised by material, e.g. use of special steel alloy
- F22B 37/06 . . Flue or fire tubes; Accessories therefor, e.g. fire-tube inserts
- F22B 37/08 . . . Fittings preventing burning-off of the tube edges
- F22B 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](#); baffles, screens, or deflectors formed of water tubes [F23M 9/10](#); cleaning internal or external surfaces of water tubes [F28G](#))
- F22B 37/101 . . . {Tubes having fins or ribs }
- F22B 37/102 {Walls built-up from finned tubes }
- F22B 37/103 {Internally ribbed tubes }
- F22B 37/104 . . . { Connection of tubes one with the other or with collectors, drums or distributors (in general [F16L](#)) }
- F22B 37/105 . . . {Penetrations of tubes through a wall and their sealing (in general [F16L 5/00](#)) }
- F22B 37/106 . . . {Studding of tubes }
- F22B 37/107 . . . {Protection of water tubes (in general [F16L 57/00](#)) }
- F22B 37/108 {Protection of water tube walls }
- F22B 37/12 . . . Forms of water tubes, e.g. of varying cross-section
- F22B 37/125 {Bifurcates }
- F22B 37/14 . . . Supply mains, e.g. rising mains, down-comers, in connection with water tubes

F22B 37/141	....	{involving vertically-disposed water tubes, e.g. walls built-up from vertical tubes }
F22B 37/142	....	{involving horizontally-or helically-disposed water tubes, e.g. walls built-up from horizontal or helical tubes }
F22B 37/143	....	{Panel shaped heating surfaces built up from tubes (F22B 37/145 takes precedence) }
F22B 37/145	....	{Flag-shaped panels built-up from tubes, e.g. from U-shaped tubes }
F22B 37/146	....	{Tube arrangements for ash hoppers and grates and for combustion chambers of the cyclone or similar type out of the flues }
F22B 37/147	....	{Tube arrangements for cooling orifices, doors and burners }
F22B 37/148	....	{Tube arrangements for the roofs }
F22B 37/16	...	Return bends
F22B 37/165	....	{Closures for access openings in return bends (boiler plugs for drums or headers F22B 37/223) }
F22B 37/18	...	Inserts, e.g. for receiving deposits from water
F22B 37/20	...	Supporting arrangements, e.g. for securing water-tube sets (construction of tube walls of furnaces including boiler furnaces F23M 5/08)
F22B 37/201	....	{Suspension and securing arrangements for walls built-up from tubes }
F22B 37/202	....	{Suspension and securing arrangements for contact heating surfaces }
F22B 37/203	.....	{Horizontal tubes supported only away from their ends on vertical support tubes }
F22B 37/204	....	{Supporting arrangements for individual tubes, e.g. for securing tubes to a refractory wall }
F22B 37/205	....	{Supporting and spacing arrangements for tubes of a tube bundle }
F22B 37/206	.....	{Anti-vibration supports for the bends of U-tube steam generators }
F22B 37/207	....	{Supporting arrangements for drums and collectors }
F22B 37/208	....	{Backstay arrangements }
F22B 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 F16J 13/00)
F22B 37/221	...	{Covers for drums, collectors, manholes or the like (in general F16J 13/00) }
F22B 37/222	....	{Nozzle dams introduced through a smaller manway, e.g. foldable }
F22B 37/223	....	{Boiler plugs, e.g. for handholes (closures for access openings in return bends F22B 37/165) }
F22B 37/225	...	{Arrangements on drums or collectors for fixing tubes or for connecting collectors to each other }
F22B 37/226	...	{Protection of drums against combustion }
F22B 37/227	...	{Drums and collectors for mixing }
F22B 37/228	...	{Headers for distributing feedwater into steam generator vessels; Accessories therefor }
F22B 37/24	..	Supporting, suspending, or setting arrangements, e.g. heat shielding (frames, engine beds F16M)
F22B 37/242	...	{for bottom supported water-tube steam generators }
F22B 37/244	...	{for water-tube steam generators suspended from the top }
F22B 37/246	...	{for steam generators of the reservoir type, e.g. nuclear steam generators }
F22B 37/248	....	{with a vertical cylindrical wall }

- F22B 37/26 .. Steam-separating arrangements ([vapour-liquid separators](#), e.g. for drying steam, [B01D](#) ; [B04](#))
- F22B 37/261 ... {specially adapted for boiler drums }
- F22B 37/263 ... {Valves with water separators }
- F22B 37/265 ... { Apparatus for washing and purifying steam }
- F22B 37/266 ... {Separator reheaters }
- F22B 37/268 ... {specially adapted for steam generators of nuclear power plants }
- F22B 37/28 ... involving reversal of direction of flow
- F22B 37/283 {specially adapted for boiler drums }
- F22B 37/286 {specially adapted for steam generators of nuclear power plants }
- F22B 37/30 ... using impingement against baffle separators
- F22B 37/303 {specially adapted for boiler drums }
- F22B 37/306 {specially adapted for steam generators of nuclear power plants }
- F22B 37/32 ... using centrifugal force
- F22B 37/322 {specially adapted for boiler drums }
- F22B 37/325 {using a revolving element }
- F22B 37/327 {specially adapted for steam generators of nuclear power plants }
- F22B 37/34 .. Adaptations of boilers for promoting water circulation ({ [F22B 13/145](#) takes precedence } ; [auxiliary devices for promoting water circulation F22D 7/00](#))
- F22B 37/36 .. Arrangements for sheathing or casing boilers
- F22B 37/365 ... {Casings of metal sheets, e.g. expansion plates, expansible joints }
- F22B 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](#))
- F22B 37/40 .. Arrangements of partition walls in flues of steam boilers, e.g. built-up from baffles ([in flues or chimneys F23J 13/00](#))
- F22B 37/42 .. Applications, arrangements, or dispositions of alarm or automatic safety devices ([for feed-water heaters F22D 1/14](#); { [emergency feed-water supply F22D 11/003](#) }; [alarms responsive to undesired or abnormal conditions G08B](#))
- F22B 37/421 ... {Arrangements for detecting leaks }
- F22B 37/423 ... {Valves for testing steam generators }
- F22B 37/425 ... {Feed-water supply alarm devices using floats }
- F22B 37/426 ... {Feed-water supply alarm devices using electric signals }
- F22B 37/428 ... {Feed-water supply alarm devices using dilatation of solids or liquids }
- F22B 37/44 ... of safety valves ([safety valves per se F16K](#))
- F22B 37/443 {Safety devices extinguishing the fire }
- F22B 37/446 {Safety devices responsive to overpressure }
- F22B 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](#))
- F22B 37/47 ... responsive to abnormal temperature, e.g. actuated by fusible plugs ([such alarms or devices per se G08B](#))
- F22B 37/475 {Safety devices with fusible plugs }
- F22B 37/48 .. Devices for removing water, salt, or sludge from boilers ([cleaning internal or external surfaces of water tubes F28G](#)) ; Arrangements of cleaning apparatus in boilers ([cleaning external surfaces of tubes by soot blowers F23J](#)) ; Combinations thereof with boilers

- F22B 37/483 . . . {specially adapted for nuclear steam generators }
- F22B 37/486 . . . {Devices for removing water, salt, or sludge from boilers ([F22B 37/483](#), [F22B 37/50](#), [F22B 37/52](#) and [F22B 37/54](#) take precedence) }
- F22B 37/50 . . . for draining or expelling water
- F22B 37/52 . . . Washing-out devices
- F22B 37/54 . . . De-sludging or blow-down devices { ([F22B 37/565](#) takes precedence) }
- F22B 37/545 {Valves specially adapted therefor (valves in general [F16K](#)) }
- F22B 37/56 . . Boiler cleaning control devices, e.g. for ascertaining proper duration of boiler blow-down
- F22B 37/565 . . . {Blow-down control, e.g. for ascertaining proper duration of boiler blow-down }
- F22B 37/58 . . Removing tubes from headers or drums; Extracting tools

- F22B 37/60 . specially adapted for steam boilers of instantaneous or flash type

- F22B 37/62 . specially adapted for steam boilers of forced-flow type
- F22B 37/64 . . Mounting of, or supporting arrangements for, tube units ([construction of tube walls of furnaces, e.g. boiler furnaces \[F23M 5/08\]\(#\)](#))
- F22B 37/645 . . . {involving upper vertically-disposed water tubes and lower horizontally- or helically disposed water tubes }
- F22B 37/66 . . . involving vertically-disposed water tubes ([F22B 37/645](#) takes precedence)
- F22B 37/68 . . . involving horizontally-disposed water tubes ([F22B 37/645](#) takes precedence)
- F22B 37/70 . . Arrangements for distributing water into water tubes
- F22B 37/72 . . . involving injection devices
- F22B 37/74 . . . Throttling arrangements for tubes or sets of tubes

- F22B 37/76 . Adaptations or mounting of devices for observing existence or direction of fluid flow ([devices per se \[G01P\]\(#\) \)](#))

- F22B 37/78 . Adaptations or mounting of level indicators ([level indicators per se \[G01F\]\(#\) \)](#))