

**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**

<b>F22B 17/00</b>	<b>Water-tube boilers of horizontally-inclined type, e.g. the water-tube sets being inclined slightly with respect to the horizontal plane</b>
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
<b>F22B 19/00</b>	<b>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</b>
<b>F22B 21/00</b>	<b>Water-tube boilers of vertical or steeply-inclined type, i.e. the water-tube sets being arranged vertically or substantially vertically</b>
F22B 21/002	. { involving a single upper drum ( <a href="#">F22B 21/36</a> 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 ( <a href="#">F22B 37/145</a> 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 <a href="#">F22B 37/223</a> ) }
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 <a href="#">F23M 5/08</a> )
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 <a href="#">B21D 51/24</a> ; pressure vessels in general <a href="#">F16J 12/00</a> ; covers or similar closure members <a href="#">F16J 13/00</a> )
F22B 37/221	...	{ Covers for drums, collectors, manholes or the like ( in general <a href="#">F16J 13/00</a> ) }
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 <a href="#">F22B 37/165</a> ) }
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 <a href="#">F16M</a> )
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](#) )