F22B

METHODS OF STEAM GENERATION; STEAM BOILERS

Definition statement

This place covers:

This subclass covers general aspects of, or methods for, steam generation. Methods of steam generation characterised by the form of heating method, constructional features of steam boilers, control systems for steam boilers and all component parts or details of steam boilers are covered. Thereby this subclass is limited in only methods of, or apparatus for, the generation of steam under pressure for heating or power purposes.

Relationships with other classification places

Steam engine plants where engine aspects predominate are classified in F01K, domestic central heating systems using steam are classified in F24D, heat exchange or heat transfer in general is classified in F28 and the generation of vapour in cores of nuclear reactors is classified in G21.

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Steam engine plants	F01K
Domestic central-heating systems using steam	F24D 1/00, F24D 9/02

Informative references

Attention is drawn to the following places, which may be of interest for search:

Cooking vessels	A47J 27/00
Apparatus for making beverages	A47J 31/00
Baking; Roasting; Grilling; Frying	A47J 37/00
Machines for cleaning floors, carpets, furniture, walls or wall coverings with arrangements for steam generation	A47L 11/4086
Bathing devices for special therapeutic or hygienic purposes	A61H 33/00
Chemical or physical apparatus for generating gases	B01J
Cleaning by methods involving the use or presence of liquid steam	B08B 3/00
Washing machines with steam generation	D06F 39/40
Hand irons	D06F 75/00
Reciprocating piston steam engines	F01B 17/04
Removal or treatment of combustion products or combustion residues, e.g. cleaning furnace tubes	F23J, F23J 3/02
Generating combustion products of high pressure or high velocity	F23R
Water heaters not for steam generation	F24H
Heat exchange or heat transfer in general	F28
Cleaning of internal or external surfaces of heat-transfer conduits, e.g. water tubes of boilers	F28G

Nuclear power plant	G21D

Special rules of classification

Attention is drawn to the definition of "steam" and "vapour". In cases where a specific entry for vapour is missing, documents related to special vapours are classified in groups where only "steam" is explicitly mentioned.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

once-through boiler	type of boiler in which water is input at one side, and steam is extracted from the other side of the flow path
forced-flow boiler	type of boiler in which a pump ensures flow
forced-once-through boiler	combination of a once-through and a forced-flow boiler (a pump ensures flow of a boiler in which water is input at one side, and steam is extracted from the other side of the flow path)
forced-circulation boiler	type of boiler in which recirculation is achieved by a circulation pump
natural-circulation boiler	type of boiler in which the circulation is achieved by the difference in density of the heated water in the boiler causing convection currents

Synonyms and Keywords

In patent documents, the following abbreviations are often used:

HRSG	Heat Recovery Steam Generator
CFCB	Circulated Fluidized Combustion Bed
PFCB	Pressurized Fluidized Combustion Bed
AFCB	Atmospheric classic Fluidized Combustion Bed (Bubbling bed)

F22B 1/00

Methods of steam generation characterised by form of heating method

Definition statement

This place covers:

Methods of steam generation

- using combustion of hydrogen with oxygen,
- using solar heat,
- by the exploitation of the heat content of hot heat carriers, for example, the heat carrier being hot slag, hot residues or heated blocks of the heat carrier being molten like a molten metal, the heat carrier being hot liquid or hot vapour (i.e. steam), the heat carrier being a hot gas (i.e. waste gas or exhaust gas),
- using heat evolved in a solution absorbing steam, for example soda steam boilers,
- using combustion under pressure substantially exceeding atmospheric pressure,
- boilers heated electrically.

Relationships with other classification places

Jackets or other cooling means in which steam is generated, and which serve for cooling other apparatus, are classified in the places for that apparatus.

Use of waste heat of combustion engines, in general, is classified in F02G, solar heat collectors per se in F24S, heat pipes in F28D 15/02. When steam is produced and explicitly mentioned as being superheated steam, F22G should be consulted.

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Steam power plants using electrical heat	F01K 3/186
Power plants using steam created by combustion of hydrogen with oxygen	F01K 25/005

Informative references

Attention is drawn to the following places, which may be of interest for search:

Methods involving the use of working media other than water, drop in pressure and transforming mechanical energy into heat energy	F22B 3/00
Methods of steam generation at critical or supercritical pressure values	F22B 3/08
Devices for producing mechanical power from solar energy	F03G 6/00
Solar power plants	F03G 6/02
Superheating of steam	F22G
Superheating using an electrical heat source independent from heat supply of the steam boiler	F22G 1/165
Solar heat collectors; Solar heat systems, e.g. use of solar heat	F24S

F22B 1/003

{using combustion of hydrogen with oxygen}

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Power plants using steam created by combustion of hydrogen with oxygen	F01K 25/005

F22B 1/006

{using solar heat}

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Devices for producing mechanical power from solar energy	F03G 6/00

F22B 1/021

{with heating tubes in which flows a non-specified heating fluid (for nuclear reactors F22B 1/023)}

References

Limiting references

This place does not cover:

Steam generation methods in nuclear reactors with heating tubes, as long as they are not classified according to a specified heating fluid, in another group	F22B 1/023

Informative references

Attention is drawn to the following places, which may be of interest for search:

Heat carrier being a hot gas, e.g. waste gas such as exhaust gas of internal-combustion engines	F22B 1/18

F22B 1/063

{for metal cooled nuclear reactors}

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Heat-exchange apparatus for nuclear applications	F28D 2021/0054

F22B 1/066

{with double-wall tubes having a third fluid between these walls, e.g. helium for leak detection}

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Double-wall pipes per se	F16L 9/18

Heat-exchange apparatus with double-wall conduits	F28D 7/10

F22B 1/165

{using heat pipes}

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Heat-pipes per se	F28D 15/02

F22B 1/18

the heat carrier being a hot gas, e.g. waste gas such as exhaust gas of internal-combustion engines

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Engine plants with two or more engines with thermally coupled engine cycles driven by different fluids, in which combustion heat from the exhaust fluid of one cycle heats the fluid in another cycle	F01K 23/10
Using the waste heat of gas-turbine plants outside the plants themselves	F02C 6/18
Profiting from waste heat of combustion engines, not otherwise provided for	F02G 5/00

F22B 1/26

Steam boilers of submerged-flame type, i.e. the flame being surrounded by, or impinging on, the water to be vaporised

Definition statement

This place covers:

Steam boilers of the submerged-flame type, i.e. the flame being surrounded by, or impinging on, the water to be vaporised, e.g. water in sprays.

F22B 1/28

in boilers heated electrically

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Steam superheating using an electrical heat source independent from heat supply of the steam boiler	F22G 1/165

F22B 3/00

Other methods of steam generation; Steam boilers not provided for in other groups of this subclass

Definition statement

This place covers:

Steam generation and steam boilers involving working media other than water, steam generation by drop in pressure of high-pressure hot water within pressure reducing chambers, by transformation of mechanical (kinetic) energy into heat energy and steam generation at critical or supercritical pressure values.

Relationships with other classification places

Methods for superheating steam are classified in F22G.

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Steam engine plants characterised by the use of special working fluids	F01K 25/00

F22B 3/04

by drop in pressure of high-pressure hot water within pressure-reducing chambers, e.g. in accumulators

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Steam accumulators per se	F01K 1/00

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

Definition statement

This place covers:

Steam boilers containing a closed vessel designed to withstand internal pressure for generating steam. The drum is contacted externally by flue gases. This place also covers old documents (state of the art, which basis is not up to date, for example basic techniques used at the beginning of the 19th century) with big rotating drums, documents with auxiliary water tubes outside the boiler body and components and accessories of the drum.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Instantaneous boiler with rotating heat exchange elements	F22B 27/12
Steam generation plants with a boiler of furnace-tube type and a boiler of water-tube type	F22B 33/04
Covers or similar closure members for pressure vessels in general	F16J 13/00

F22B 5/04

Component parts thereof; Accessories therefor

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Covers or similar closure members for pressure vessels in general	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

Definition statement

This place covers:

Boilers in which combustion of fuel is performed inside one or more furnace-tubes running through a sealed container of water. Combustion heat is transferred through the walls of the tubes by thermal conduction, thereby heating water and creating steam. This place also covers steam boilers of furnace-tube type with auxiliary water tubes inside the furnace tube and outside the boiler body, with auxiliary fire tubes and component parts of the boiler, for example walling of flues.

Relationships with other classification places

The following types of steam boilers are covered by the following classification places:

- Steam boilers of drum type are classified in F22B 5/00.
- Steam boilers of fire-tube type are classified in F22B 9/00.
- Steam boilers of combined fire-tube type and water-tube type are classified in F22B 11/00.
- Steam boilers of fire-box type are classified in F22B 13/00.
- Steam boilers of water-tube type are classified in F22B 15/00, F22B 17/00, F22B 19/00 and F22B 23/00.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Steam generation plants comprising boilers of water-tube type in mutual association with a boiler of furnace-tube type	F22B 33/04
Steam generation plants comprising boilers of furnace-tube type in mutual association with a boiler of fire-tube type	F22B 33/06

Flue or fire tubes; Accessories therefor, e.g. fire-tube inserts	F22B 37/06
Auxiliary devices for promoting water circulation fitted to furnace tubes	F22D 7/02

Special rules of classification

Steam boilers with drums having a furnace tube or a furnace box also in combination with drums contacted externally with flue gases should be classified in F22B 7/00 and F22B 13/005. This applies also to boilers with special shape of furnace tube and subsequent flue.

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 the boiler body

Definition statement

This place covers:

Boilers in which hot flue gases from a combustion chamber outside the boiler body, said body being a sealed container, are channelled through tubes built-in the boiler body that are surrounded by the fluid to be heated. Heat of the gases is transferred through the walls of the tubes by thermal conduction, heating the water and creating steam. This place also covers arrangements of the fire tubes and the boiler as well as components of the boiler itself.

Relationships with other classification places

The following types of steam boilers are covered by the following classification places:

- Steam boilers of drum type are classified in F22B 5/00.
- Steam boilers of furnace-tube type are classified in F22B 7/00.
- Steam boilers of combined fire-tube type and water-tube type are classified in F22B 11/00.
- Steam boilers of fire-box type are classified in F22B 13/00.
- Steam boilers of water-tube type are classified in F22B 15/00, F22B 17/00, F22B 19/00 and F22B 23/00.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Methods of steam generation with heating tubes in which flows a non-specified heating fluid	F22B 1/021
Methods of steam generation with hit gas heating tube boilers with one or more heating tubes	F22B 1/1884
Steam generation plants comprising boilers of furnace-tube type in mutual association with a boiler of fire-tube type	F22B 33/06
Steam generation plants comprising boilers of water-tube type in mutual association with a boiler of fire-tube type	F22B 33/08
Flue or fire tubes; Accessories therefor, e.g. fire-tube inserts	F22B 37/06

Special rules of classification

In this group boilers which are mainly of fire-tube type are classified. If the boiler contains also water tubes, the boiler is considered of being a combined fire-tube and water-tube boiler. Concerned documents should be classified in F22B 11/00.

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

Definition statement

This place covers:

All combinations of the steam boilers of fire-tube type with steam boilers of water-tube type consisting of a fire-tube boiler with auxiliary water tubes or a water-tube boiler having auxiliary fire tubes in a water or steam containing vessel. This place also covers boilers with fire tubes being in upright and horizontal arrangement.

Relationships with other classification places

The following types of steam boilers are covered by the following classification places:

- Steam boilers of drum type are classified in F22B 5/00.
- Steam boilers of furnace-tube type are classified in F22B 7/00.
- Steam boilers of fire-tube type are classified in F22B 9/00.
- Steam boilers of fire-box type are classified in F22B 13/00.
- Steam boilers of water-tube type are classified in F22B 15/00, F22B 17/00, F22B 19/00 and F22B 23/00.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Steam boilers of drum type with auxiliary water tubes outside the boiler body	F22B 5/02
Steam boilers of furnace-type with auxiliary water tubes	F22B 7/04
Steam boilers of furnace-type with auxiliary fire tubes	F22B 7/12
Steam boilers of furnace-type with auxiliary fire tubes and auxiliary water tubes	F22B 7/14
Steam boilers of fire-box type with flues other than fire tubes and with auxiliary water tubes inside the fire box	F22B 13/023
Steam boilers of fire-box type with auxiliary water tubes inside the fire box	F22B 13/10

F22B 13/00

Steam boilers of fire-box type, i.e. boilers where both combustion chambers and subsequent flues or fire tubes are arranged within the boiler body

Definition statement

This place covers:

Boilers in which combustion of fuel is performed inside a chamber called a fire box, including fire tubes of flues attached to the wall of the fire-box that carry the hot gaseous products of combustion through the boiler water, heating it, before the gaseous products escape to the atmosphere. Both the fire-box and fire tubes are built-in in the boiler body. This place covers locomotive boilers, fire-box boiler with flues other than fire tubes and component parts of said boilers.

Relationships with other classification places

The following types of steam boilers are covered by the following classification places:

- Steam boilers of drum type are classified in F22B 5/00.
- Steam boilers of furnace-tube type are classified in F22B 7/00.
- Steam boilers of fire-tube type are classified in F22B 9/00.
- Steam boilers of combined fire-tube type and water-tube type are classified in F22B 11/00.
- Steam boilers of water-tube type are classified in F22B 15/00, F22B 17/00, F22B 19/00 and F22B 23/00.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Modifications of boiler construction with combustion in a fluidized bed for boilers of shell type (furnace-box)	F22B 31/0046
Modifications of boiler construction with combustion in a fluidized bed for boilers of shell type (furnace-box) with auxiliary water tubes	F22B 31/0053
Steam generation plants comprising boilers of water-tube type in mutual association with a boiler of furnace-tube type	F22B 33/04
Steam generation plants comprising boilers of furnace-tube type in mutual association with a boiler of fire-tube type	F22B 33/06
Flue or fire tubes; Accessories therefor, e.g. fire-tube inserts	F22B 37/06
Water heaters with water mantle surrounding the combustion chamber including one or more furnace or fire tubes	F24H 1/282

F22B 15/00

Water-tube boilers of horizontal type, i.e. the water-tube sets being arranged horizontally

Definition statement

This place covers:

Details and constructional features of water-tube boilers in which water circulates in tubes heated externally and characterised by strictly horizontal arranged water tubes or water tube walls.

Relationships with other classification places

The following other types of steam boilers are covered by the following classification places:

- Steam boilers of drum type are classified in F22B 5/00.
- Steam boilers of furnace-tube type are classified in F22B 7/00.
- Steam boilers of fire-tube type are classified in F22B 9/00.
- Steam boilers of combined fire-tube type and water-tube type are classified in F22B 11/00.
- Steam boilers of fire-box type are classified in F22B 13/00.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Water-tube boilers of horizontally-inclined type, i.e. the water-tube sets being inclined slightly with respect to the horizontal plane	F22B 17/00
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 19/00
Water-tube boilers of vertical or steeply-inclined type, i.e. the water-tube sets being arranged vertically or substantially vertically	F22B 21/00
Water-tube boilers built up from sets of spaced double-walled water tubes	F22B 23/00
Water-tube boilers built up from sets of water tubes with internally-arranged flue tubes or fire tubes	F22B 25/00
Fluid heaters with water tube or tubes	F24H 1/40

F22B 17/00

Water-tube boilers of horizontally-inclined type, i.e. the water-tube sets being inclined slightly with respect to the horizontal plane

Definition statement

This place covers:

Details, constructional features and component parts of water-tube boilers in which water circulates in tubes heated externally and characterised by horizontally-inclined water tubes or water tube walls.

Relationships with other classification places

If the water-tube sets are inclined horizontally, then group F22B 15/00 should be considered.

The following other types of steam boilers are covered by the following classification places:

- Steam boilers of drum type are classified in F22B 5/00.
- Steam boilers of furnace-tube type are classified in F22B 7/00.
- Steam boilers of fire-tube type are classified in F22B 9/00.
- Steam boilers of combined fire-tube type and water-tube type are classified in F22B 11/00.
- Steam boilers of fire-box type are classified in F22B 13/00.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Water-tube boilers of horizontal type, i.e. the water-tube sets being arranged horizontally	F22B 15/00
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 19/00
Water-tube boilers of vertical or steeply-inclined type, i.e. the water-tube sets being arranged vertically or substantially vertically	F22B 21/00
Water-tube boilers built up from sets of spaced double-walled water tubes	F22B 23/00

Water-tube boilers built up from sets of water tubes with internally-arranged flue tubes or fire tubes	F22B 25/00
Fluid heaters with water tube or tubes	F24H 1/40

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

Definition statement

This place covers:

Details, constructional features and component parts of water-tube boilers in which water circulates in tubes heated externally and characterised by horizontally inclined water-tube sets being connected to or having also an auxiliary water-tube set with vertical or substantially vertical water tubes.

Relationships with other classification places

The following other types of steam boilers are covered by the following classification places:

- Steam boilers of drum type are classified in F22B 5/00.
- Steam boilers of furnace-tube type are classified in F22B 7/00.
- Steam boilers of fire-tube type are classified in F22B 9/00.
- Steam boilers of combined fire-tube type and water-tube type are classified in F22B 11/00.
- Steam boilers of fire-box type are classified in F22B 13/00.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Water-tube boilers of horizontal type, i.e. the water-tube sets being arranged horizontally	F22B 15/00
Water-tube boilers of horizontally-inclined type, i.e. the water-tube sets being inclined slightly with respect to the horizontal plane	F22B 17/00
Water-tube boilers of vertical or steeply-inclined type, i.e. the water-tube sets being arranged vertically or substantially vertically	F22B 21/00
Water-tube boilers built up from sets of spaced double-walled water tubes	F22B 23/00
Water-tube boilers built up from sets of water tubes with internally-arranged flue tubes or fire tubes	F22B 25/00
Fluid heaters with water tube or tubes	F24H 1/40

F22B 21/00

Water-tube boilers of vertical or steeply-inclined type, i.e. the water-tube sets being arranged vertically or substantially vertically

Definition statement

This place covers:

Details, constructional features and component parts of water-tube boilers in which water circulates in tubes heated externally and characterised by vertically or substantially vertically water tubes or water

tube walls. This place covers straight water tubes and serpentine, helical bent in U-loop or spirally formed water tubes disposed vertically.

Relationships with other classification places

The following other types of steam boilers are covered by the following classification places:

- Steam boilers of drum type are classified in F22B 5/00.
- Steam boilers of furnace-tube type are classified in F22B 7/00.
- Steam boilers of fire-tube type are classified in F22B 9/00.
- Steam boilers of combined fire-tube type and water-tube type are classified in F22B 11/00.
- Steam boilers of fire-box type are classified in F22B 13/00.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Water-tube boilers of horizontal type, i.e. the water-tube sets being arranged horizontally	F22B 15/00
Water-tube boilers of horizontally-inclined type, i.e. the water-tube sets being inclined slightly with respect to the horizontal plane	F22B 17/00
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 19/00
Water-tube boilers built up from sets of spaced double-walled water tubes	F22B 23/00
Water-tube boilers built up from sets of water tubes with internally-arranged flue tubes or fire tubes	F22B 25/00
Fluid heaters with water tube or tubes	F24H 1/40

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

Definition statement

This place covers:

Details, constructional features and component parts of water-tube boilers in which water circulates in tubes heated externally and characterised by sets of spaced double-walled water tubes of return type in unilateral abutting connection with a boiler drum or with a header box forming for example an annular flow.

Relationships with other classification places

The following other types of steam boilers are covered by the following classification places:

- Steam boilers of drum type are classified in F22B 5/00.
- Steam boilers of furnace-tube type are classified in F22B 7/00.
- Steam boilers of fire-tube type are classified in F22B 9/00.
- Steam boilers of combined fire-tube type and water-tube type are classified in F22B 11/00.
- Steam boilers of fire-box type are classified in F22B 13/00.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Water-tube boilers of horizontal type, i.e. the water-tube sets being arranged horizontally	F22B 15/00
Water-tube boilers of horizontally-inclined type, i.e. the water-tube sets being inclined slightly with respect to the horizontal plane	F22B 17/00
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 19/00
Water-tube boilers of vertical or steeply-inclined type, i.e. the water-tube sets being arranged vertically or substantially vertically	F22B 21/00
Water-tube boilers built up from sets of water tubes with internally-arranged flue tubes or fire tubes	F22B 25/00
Steam superheaters with steam tubes with steam flowing in opposite directions in one pipe	F22G 3/004
Steam superheaters with annular steam tubes, i.e. the steam being heated between concentric tubes with the heating fluid flowing in inner and around tube	F22G 3/005
Fluid heaters with water tube or tubes	F24H 1/40

F22B 23/06

Component parts thereof, e.g. Field water tubes

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Heat-exchange tubes in general	F28F 1/00

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

Definition statement

This place covers:

Details, constructional features and component parts of water-tube boilers in which water circulates in tubes heated externally and characterised by sets of water tubes with internally arranged flue tubes or fire tubes forming thereby an annular flow of the water to be evaporated.

Relationships with other classification places

The following other types of steam boilers are covered by the following classification places:

- Steam boilers of drum type are classified in F22B 5/00.
- Steam boilers of furnace-tube type are classified in F22B 7/00.
- Steam boilers of fire-tube type are classified in F22B 9/00.

- Steam boilers of combined fire-tube type and water-tube type are classified in F22B 11/00.
- Steam boilers of fire-box type are classified in F22B 13/00.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Water-tube boilers of horizontal type, i.e. the water-tube sets being arranged horizontally	F22B 15/00
Water-tube boilers of horizontally-inclined type, i.e. the water-tube sets being inclined slightly with respect to the horizontal plane	F22B 17/00
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 19/00
Water-tube boilers of vertical or steeply-inclined type, i.e. the water-tube sets being arranged vertically or substantially vertically	F22B 21/00
Water-tube boilers built up from sets of spaced double-walled water tubes	F22B 23/00
Steam superheaters with steam tubes with steam flowing in opposite directions in one pipe	F22G 3/004
Steam superheaters with steam tubes with annular steam tubes	F22G 3/005
Fluid heaters with water tube or tubes	F24H 1/40

F22B 27/00

Instantaneous or flash steam boilers

Definition statement

This place covers:

All steam generators and steam generation methods with an instant steam generation process including flash steam boilers. This place covers instantaneous steam boilers built up from fire tubes, from water tubes, from rotary heat-exchange elements or from heat-exchange elements arranged within a confined chamber having heat retaining walls and steam boilers with spray nozzles for sprinkling or injecting water particles on to or into hot heat-exchange elements.

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Steam engine plants with steam generation in engine-cylinders	F01K 21/02

Informative references

Attention is drawn to the following places, which may be of interest for search:

Steam generation using heat accumulators	F22B 1/028
Steam boilers heated electrically with water in sprays or in films	F22B 1/287
Instantaneous electrical steam generators built up from heat exchange elements arranged within a confined chamber having heat retaining walls	F22B 1/288

Steam boiler of drum type with rotating drums	F22B 5/005
Water-tube boiler of vertical type with water tubes bent in serpentine or sinuous form	F22B 21/24
Water-tube boiler of vertical type with water tubes bent helically	F22B 21/26
Water-tube boiler of vertical type with water tubes bent spirally	F22B 21/28
Control systems for instantaneous steam generators	F22B 35/005
Component parts or details of steam boilers specially adapted for steam boilers of instantaneous or flash type	F22B 37/60

F22B 29/00

Steam boilers of forced-flow type

Definition statement

This place covers:

Steam boilers in which means are provided, such as a pump, in order to ensure the flow of the working medium. This place covers details, component parts and arrangements of steam boilers of forced-circulation type, steam boilers of combination type in which natural flow (convection circulation) is promoted by additional measures and boilers of once-through type in which flow is forced (forced once through boilers).

Relationships with other classification places

Water-tube boilers of horizontal type (F22B 15/00) are normally steam boilers of forced-flow type and Water-tube boilers of vertical type (F22B 21/00) are normally boilers of natural convection type.

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Steam plants with engines using steam of critical or overcritical pressure	F01K 7/32

Informative references

Attention is drawn to the following places, which may be of interest for search:

Steam generation at critical or supercritical pressure values	F22B 3/08
Water-tube boilers of vertical type with water tubes bent helically	F22B 21/26
Water-tube boilers of vertical type with water tubes bent spirally	F22B 21/28
Steam boilers built up from water tubes surrounding the combustion chamber (radiation boilers)	F22B 21/34
Steam-generation plants with combinations of boilers having a single combustor in common	F22B 33/00
Control systems of steam boilers with natural convection circulation	F22B 35/02
Supply means for steam boilers with vertically and horizontally or helically disposed water tubes	F22B 37/141, F22B 37/142
Details and component parts specially adapted for boilers of forced-flow type	F22B 37/62

Details of boilers of forced-flow type with vertically disposed water tubes	F22B 37/66
Details of boilers of forced-flow type with horizontally disposed water tubes	F22B 37/68
Devices for promoting water circulation in preheaters by injecting water or steam	F22D 7/04

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

once-through boiler	type of boiler in which water is input at one side, and steam is extracted from the other side of the flow path
forced-flow boiler	type of boiler in which a pump ensures flow
forced-once-through boiler	combination of a once-through and a forced-flow boiler (a pump ensures flow of a boiler in which water is input at one side, and steam is extracted from the other side of the flow path)
forced-circulation boiler	type of boiler in which recirculation is achieved by a circulation pump
natural-circulation boiler	type of boiler in which the circulation is achieved by the difference in density of the heated water in the boiler causing convection currents

F22B 29/02

of forced-circulation type

Definition statement

This place covers:

Forced-flow steam boilers of forced-circulation, i.e. recirculation type.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Forced-flow steam boilers of once-through type	F22B 29/06

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 (combined low- and high-pressure boilers of forced-flow type F22B 33/16)

References

Limiting references

This place does not cover:

Combinations of low- and high-pressure boilers of forced-flow type	F22B 33/16

Informative references

Attention is drawn to the following places, which may be of interest for search:

Forced-flow steam boilers of forced-circulation type	F22B 29/02

F22B 29/067

{operating at critical or supercritical pressure}

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

With recirculation during normal operation	F22B 29/026

F22B 29/08

operating with fixed point of final state of complete evaporation

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

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

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Evaporation or evaporation apparatus for physical or chemical purposes, e.g. evaporation of liquids for gas phase reactions	B01B 1/005

F22B 31/00

Modifications of boiler construction, or of tube systems, dependent on installation of combustion apparatus; Arrangements or dispositions of combustion apparatus

Definition statement

This place covers:

Modifications of boiler construction or of tube systems dependent on the installation of combustion apparatus, for example:

- boilers with combustion in a fluidized bed (boilers of water-tube type, constructional features of bed cooling, control systems thereof, details concerning the recirculation of the fluidized bed particles),

- installation of water-tube boilers in chimneys,
- heat supply by installation of two or more combustion apparatus, and
- installations of heat exchangers in boilers for heating air supplied for combustion.

Relationships with other classification places

Chemical or physical processes in general, conducted in the presence of fluids and solid particles and apparatus for such processes are covered by B01J 8/00. Fluidized bed combustion apparatus per se are covered by group F23C 10/00 and fluidised bed furnaces by group F27B 15/00.

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Steam engine plants having heaters using heat from a specified chemical reaction	F01K 3/188
Steam engine plants having heaters with heating by separately fired heaters	F01K 3/24
Plants in which combustion heat from one cycle is heating the fluid in the other cycle and where the combustion is performed in a fluidised bed	F01K 23/061

Informative references

Attention is drawn to the following places, which may be of interest for search:

Steam generation characterised by heating method	F22B 1/00
Waste heat boiler with supplementary firing, the hot gas being loaded with particles	F22B 1/1876
Feed water heaters with water and air preheating systems	F22D 1/36
Steam superheaters using heat generated by chemical reactions	F22G 1/14
Combustion apparatus per se	F23
Heating of air supplied for combustion	F23L 15/00
Heat exchange apparatus using a fluidised bed	F28D 13/00

Synonyms and Keywords

In patent documents, the following abbreviations are often used:

FBC	Fluidized Bed Combustion
PFBC	Pressurised Fluidized Bed Combustion
APFBC	Advanced Pressurised Fluidized Bed Combustion
GFBCC	Gasification Fluidized Bed Combustion Combined cycle systems
CHIPPS	Combustion-based High Performance Power System

F22B 31/0007

{with combustion in a fluidized bed}

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Fluidised bed apparatus per se	B01J 8/00
Apparatus in which combustion takes place in a fluidised bed of fuel or other particles	F23C 10/00

F22B 33/00

Steam-generation plants, e.g. comprising steam boilers of different types in mutual association

Definition statement

This place covers:

Steam generation plants in the meaning of devices for the generation of steam with other apparatus in mutual association with the steam boilers. Steam boilers of different types in mutual association having a single combustion apparatus in common, e.g. combinations of:

- boilers of furnace-tube type with boilers of water-tube type,
- boilers of furnace-tube type with boilers of fire-tube type,
- boilers of water-tube type with boilers of fire-tube type,
- two or more superposed boilers,

self-contained boilers comprising as a unit the steam boiler, the combustor and fuel storage accessory machines,

combinations of low- and high-pressure boilers, and

combinations of steam boilers with other apparatus, like a condenser, a chemical reactor or other are also covered.

Relationships with other classification places

Steam engine plants related to the thermodynamic cycle and focused in power generation are classified in F01K.

The following types of steam boilers are covered by the following classification places:

- Steam boilers of drum type are classified in F22B 5/00.
- Steam boilers of furnace-tube type are classified in F22B 7/00.
- Steam boilers of fire-tube type are classified in F22B 9/00.
- Steam boilers of combined fire-tube type and water-tube type are classified in F22B 11/00.
- Steam boilers of fire-box type are classified in F22B 13/00.
- Steam boilers of water-tube type are classified in F22B 15/00, F22B 17/00, F22B 19/00 and F22B 23/00.

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Arrangements or dispositions of steam-generation plants in marine vessels	B63H 21/00
Steam engine plants having separately fired heaters delivering steam to a common mains	F01K 3/242
Steam engine plants having separately fired heaters delivering steam at different pressure levels	F01K 3/245

Informative references

Attention is drawn to the following places, which may be of interest for search:

Steam boilers of fire-box type with combinations of low- and high-pressure locomotive boilers	F22B 13/065

Special rules of classification

Documents which contain a boiler of combined water-tube and fire-tube type should be classified in F22B 11/00. Subgroup F22B 33/08 covers steam generation plants comprising several boilers having a single combustion apparatus in common where at least one boiler is a boiler of water-tube type and at least another is a boiler of fire-tube type.

F22B 35/00

Control systems for steam boilers (for regulating feed-water supply F22D 5/00; for controlling superheat temperature F22G 5/00)

Definition statement

This place covers:

Control system of steam boilers in general, for example, control by flue gas dampers, control by recirculating flue gases, control systems for steam generators of nuclear power plants, control systems for instantaneous steam boilers, control systems for waste heat boilers, control systems for two or more steam generators, control systems for steam boilers with natural convection circulation and control systems for steam boilers of forced-flow type.

References

Limiting references

This place does not cover:

Controlling water feed or water level	F22D 5/00
Automatic water-feed control for a number of steam boilers designed for different ranges of temperature and pressure	F22D 5/36
Controlling superheat temperature	F22G 5/00
Controlling superheat temperature by regulating flue gas flow	F22G 5/04
Controlling superheat temperature by recirculating flue gases	F22G 5/06
Controlling superheat temperature by attemperating the superheated steam	F22G 5/12

Controlling superheat temperature by indirectly cooling or heating the superheated steam in auxiliary enclosed heat exchanger	F22G 5/16

Informative references

Attention is drawn to the following places, which may be of interest for search:

Steam boilers of once-through type operating with superimposed recirculation during starting and low load periods	F22B 29/12
Safety devices for boilers in general	F22B 37/42
Regulation or control of steam power plants	F01K 7/00, F01K 13/02
Emergency feed water supply	F22D 11/003
Control of combustion	F23N
Control of steam power plants	G05
Control of nuclear reaction	G21C 7/00
Control of nuclear power plant	G21D 3/00

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

once-through boiler	type of boiler in which water is input at one side, and steam is extracted from the other side of the flow path
forced-flow boiler	type of boiler in which a pump ensures flow
forced-once-through boiler	combination of a once-through and a forced-flow boiler (a pump ensures flow of a boiler in which water is input at one side, and steam is extracted from the other side of the flow path)
forced-circulation boiler	type of boiler in which recirculation is achieved by a circulation pump
natural-circulation boiler	type of boiler in which the circulation is achieved by the difference in density of the heated water in the boiler causing convection currents

F22B 37/00

Component parts or details of steam boilers

Definition statement

This place covers:

Component parts or details of steam boilers categorised in these groups:

- of steam generators built up from pre-fabricated elements,
- of nuclear steam generators including maintenance or repairing,
- applicable to more than one kind of steam boiler,
- specially adapted for steam boilers of instantaneous or flash type,
- specially adapted for steam boilers of forced-flow type,
- adaptations or mounting of devices for observing existence or direction of fluid flow,
- adaptations or mounting of level indicators.

This place, which is applicable to more than one kind of steam boiler and which could be applied also to nuclear steam boilers, steam boilers of pre-fabricated elements, instantaneous type boilers and forced-flow type boilers, covers:

- steam boilers characterised by material,
- accessories of flue or fire tubes,
- accessories of water tubes,
- accessories of drums or headers,
- arrangements for supporting, suspending or setting,
- steam separating arrangements,
- adaptation of boilers for promoting water circulation,
- arrangements for sheathing or casing boilers,
- devices and methods for determining or indicating operation conditions,
- arrangements of partition walls in flues of steam boilers,
- applications of alarm or automatic safety devices,
- devices and methods for removing water, salt or sludge,
- boiler cleaning control devices,
- methods and tools for removing tubes from headers or drums.

Relationships with other classification places

Working or processing of sheet metal or metal tubes are classified in B21D, pipes, joints and fittings for pipes in F16L and cleaning of internal or external surfaces of heat exchangers in F28D.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Steam generator using hot slag, hot residues with double-wall tubes	F22B 1/066
Furnace tubes of furnace-tube type boilers	F22B 7/20
Vertical water-tube boilers with frames built from water tubes	F22B 21/086
Component parts of water tubes surrounding the combustion chamber	F22B 21/38
Venting devices	F16K 24/00
Devices for use where pipes pass through walls or partitions	F16L 5/00
Devices for covering leaks in pipes or hoses	F16L 55/16
Protection of tubes against external or internal damage or wear	F16L 57/00
Steam traps or like apparatus	F16T
Radiant superheaters	F22G 1/06
Connecting or sealing of superheater or reheater tubes with collectors or distributors	F22G 3/009
Baffles, screens or deflectors formed of water tubes	F23M 9/10
Details for water heaters	F24H 9/0036
Arrangements for sealing leaky tubes and conduits of heat exchangers	F28F 11/00
Surface treatment or coating for heat exchangers	F28F 13/18
Preventing the formation of deposits or corrosion from heat exchangers	F28F 19/00
Decontamination of radioactive contaminated objects	G21F 9/001

F22B 37/006

{Walking equipment, e.g. walking platforms suspended at the tube sheet}

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Walking mechanism per se	B62D 57/02

F22B 37/008

{Adaptations for flue-gas purification in steam generators}

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Gas purification in general	B01D
Flue gas purification in general	F23J

F22B 37/10

Water tubes; Accessories therefor

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Working or processing of metal tubes	B21D
Pipes in general	F16L
Repairing leaks in water tubes	F16L 55/16, F28F 11/00
Removing solid combustion residues from passages or chambers beyond the fire	F23J 3/00
Baffles or deflectors formed as tubes in combustion chambers of water-tube boilers	F23M 9/10
Cleaning of internal or external surfaces of heat-exchange or heat-transfer conduits, e.g. water tubes of boilers	F28G

F22B 37/104

{Connection of tubes one with the other or with collectors, drums or distributors}

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Pipes, joints or fittings therefor, in general	F16L

F22B 37/105

{Penetrations of tubes through a wall and their sealing}

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Devices for use where pipes, cables or protective tubing pass through walls or partitions	F16L 5/00

F22B 37/107

{Protection of water tubes}

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Protection of pipes against external or internal damage or wear in general	F16L 57/00

F22B 37/165

{Closures for access openings in return bends}

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Boiler plugs for drums or headers	F22B 37/223

F22B 37/20

Supporting arrangements, e.g. for securing water-tube sets

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Tube walls of combustion chambers	F23M 5/08

F22B 37/22

Drums; Headers; Accessories therefor

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

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

F22B 37/221

{Covers for drums, collectors, manholes or the like}

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Covers or similar closure members for pressure vessels in general	F16J 13/00

F22B 37/223

{Boiler plugs, e.g. for handholes}

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Closures for access openings in return bends	F22B 37/165

F22B 37/24

Supporting, suspending or setting arrangements, e.g. heat shielding

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Frames, casings or beds of engines, machines or apparatus	F16M

F22B 37/26

Steam-separating arrangements

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Separating dispersed particles from gases or vapours by gravity, inertia or centrifugal forces	B01D 45/00
Apparatus using free vortex flow, e.g. cyclones, in general	B04C

F22B 37/34

Adaptations of boilers for promoting water circulation (auxiliary devices for promoting water circulation F22D 7/00)

References

Limiting references

This place does not cover:

Auxiliary devices for promoting water circulation	F22D 7/00

Informative references

Attention is drawn to the following places, which may be of interest for search:

Thermosiphons for steam boilers of the fire-box type	F22B 13/145

F22B 37/38

Determining or indicating operating conditions in steam boilers, e.g. monitoring direction or rate of water flow through water tubes

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Measuring volume, volume flow, mass flow or liquid level in general	G01F

F22B 37/40

Arrangements of partition walls in flues of steam boilers, e.g. built-up from baffles

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Fittings for chimneys or flues of combustion apparatus	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})

References

Limiting references

This place does not cover:

Safety devices for feed-water heaters	F22D 1/14
Emergency feed-water supply	F22D 11/003

Informative references

Attention is drawn to the following places, which may be of interest for search:

Fire-fighting in general	A62C
Fire-extinguishing compositions; Use of chemical substances in extinguishing fires	A62D 1/00
Alarms responsive to undesired or abnormal conditions in general	G08B 17/00 - G08B 23/00

F22B 37/44

of safety valves

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Safety valves per se	F16K 17/00

F22B 37/46

responsive to low or high water level, e.g. for checking, suppressing or extinguishing combustion in boilers

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Fire-fighting, fire extinction in general	A62

F22B 37/47

responsive to abnormal temperature, e.g. actuated by fusible plugs

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Alarms or devices responsive to abnormal temperature per se	G08B

F22B 37/545

{Valves specially adapted therefor}

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Valves in general	F16K

F22B 37/64

Mounting of, or supporting arrangements for, tube units

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Tube walls of combustion chambers	F23M 5/08

F22B 37/76

Adaptations or mounting of devices for observing existence or direction of fluid flow

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Measuring speed of fluids in general	G01P 5/00
Indicating or recording presence or direction of movement in general	G01P 13/00

F22B 37/78

Adaptations or mounting of level indicators

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Level indicators per se	G01F 23/00