INSTALLATION FOR GENERATING STEAM

The present invention relates to an installation for generating steam, comprising a standing evaporator boiler with an evaporator unit provided with substantially lying evaporator conduits, which evaporator unit is connected to a tank for separating steam and water and forms with the tank a water circuit.

Such an installation is used for instance for generating steam, wherein heat is extracted from exhaust gas coming from a gas turbine.

Such an installation requires the use of means for initiating the water circulation in the evaporator unit during start-up of the steam generating process, particularly with a cold start. If the water circulation is not initiated adequately, problems can occur as a result of the occurrence of a steam bubble in the lower part of the evaporator unit.

The European patent application EP-A-357 590 describes a number of provisions which are included in the water-steam circuit between evaporator unit and separation tank in order to avoid the firing problems. These provisions comprise inter alia liquid injectors in the descending or ascending portion of the water part of the water-steam circuit and/or circulation pumps.

The present invention has for its object to provide an installation of the type stated in the preamble wherein firing problems are avoided as far as possible, while the above mentioned provisions for initiating the water circulation can be dispensed with.

This is achieved according to the invention in that the evaporator unit comprises at least one evaporator conduit, whereof a standing, for instance substantially vertical, evaporator conduit part extends over a considerable part of the height of the evaporator unit.

By making use of at least one evaporator conduit with a standing evaporator conduit part extending over a

considerable part of the height of the evaporator unit the steam entering therein will rise and thereby initiate the circulation.

An evaporator conduit part extends according to the invention over a considerable part of the evaporator unit when this height is equal to at least two, preferably three or more, such as five pitch distances, of pipes which run meandering upward through the evaporator boiler in the direction of the heating medium.

When the standing evaporator conduit part extends over the whole height of the evaporator unit the effect of the forming steam in initiating the water circulation will be maximalized.

If in further preference the standing evaporator conduit part connects directly onto an outlet of the evaporator unit the initiating of the circulation will be maximal because the circulation initiated in that part of the evaporator conduit leaves the evaporator unit immediately in the direction of the separating tank.

The standing evaporator conduit part can be located not only in the heating exhaust gases flow but also inside the evaporator boiler outside the exhaust gases flow. In order to achieve the effect according to the invention it is also possible for the standing evaporator conduit part to be located partially or wholly outside the evaporator boiler. To achieve the effect according to the invention it is in any case only necessary for steam bubbles to reach the standing evaporator conduit part, so that the circulation is initiated as a result of the positive hydrostatic pressure difference between the supply conduits to the evaporator unit and the standing evaporator conduit part. According to another embodiment the fraction lies between 1/3 and 1/15.

In order to avoid initiation of the water circulation taking place in a jerky manner it is recommended that a fraction of the evaporator conduits is provided with the evaporator conduit part extending over a considerable part of the height of the evaporator unit. The circulation will thus be initiated in one or in a limited number of the evaporator conduits.

The fraction lies for instance between 1/3 and 1/15.

Another aspect of the present invention relates to an evaporator unit provided with at least one evaporator conduit with an evaporator conduit part extending over a considerable part of the height of the evaporator unit.

Mentioned and other features of the installation for generating steam according to the invention will be further elucidated hereinafter on the basis of a number of embodiments which are only given by way of example without the invention being deemed as limited thereto, while reference is made to the annexed drawing.

In the drawing:

figure 1 is a schematic broken away perspective view of an installation according to the invention for generating steam;

figures 2 and 3 each show another configuration of an evaporator unit according to the invention; and

figure 4 is a perspective view of another evaporator unit.

Figure 1 shows an installation 1 according to the invention for generating steam from exhaust gas coming from a gas turbine (not shown) which enters via an inlet 2 and exits via an outlet 3. The installation 1 comprises a vertical evaporator boiler 4, in which the gas flow is oriented in substantially upright (vertical) direction, and comprises an evaporator unit 5 according to the invention.

The evaporator unit 5 comprises an inlet 7 and an outlet 8 which form a water circuit together with a tank 9 for separating water 10 and steam.

A suppletion line 12 provided with a pump 11 is connected onto the tank 9. On the water side the tank 9 is connected via a conduit 13 to inlet 7 and on the steam side is connected via the conduit 14 and/or 15 to outlet 8.

The evaporator unit 5 comprises a number of evaporator conduits 19 which are connected to a feed conduit 18 and which are each provided with an evaporator conduit part 20, 21 extending over a considerable part of the height of evaporator unit 5.

At start-up of installation 5 when exhaust gas is supplied via inlet 2, steam generated in the parts 20 and 21 will initiate the circulation in the circuit between the evaporator unit 5 and the tank 9 via the conduits 13 and 8.

Figure 2 shows another embodiment of the evaporator 5 of figure 1. In this case the evaporator unit 22 comprises a number of conduits 23-26 which extend over increasingly larger parts of the height of the evaporator unit. Particularly in the parts 27, 28 and 29 of conduits 24, 25 and 26 respectively the circulation of the steam present therein will be initiated increasingly better.

Figure 3 shows an evaporator unit 30 according to the invention which comprises two evaporator conduits 31 and 32 having parts 33 and 34 respectively which extend practically over the whole height of the evaporator unit 30 and which connect directly onto the outlet 8 of evaporator unit 30 and are located wholly outside the evaporator boiler 4.

Figure 4 shows an evaporator boiler 4 with an evaporator unit 35 comprising a number of evaporator conduits 36, 37 which are bent in conventional manner and which extend between the feed conduit 18 and the outlet 8.

The evaporator unit 35 further comprises an evaporator conduit 38 which is provided with a part 39 extending practically over the whole height of the evaporator unit 35. It will be apparent that this conduit part 39 can assume a sloping or standing position but also a practically or wholly vertical position. All that is important is that the evaporator conduit 39 rises to the level of the outlet 8.

Finally, this evaporator conduit part 39 can be located wholly or partially inside or outside the evaporator boiler 4.

In the evaporator unit 22 of figure 2 the fraction of the evaporator conduits with a part of the evaporator conduits extending over a considerable part of the height amounts to about 1/3. In the evaporator unit 30 according to figure 3 such a fraction amounts to about 2/11.

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CLAIMS

1. Installation for generating steam, comprising a standing evaporator boiler with an evaporator unit provided with substantially lying evaporator conduits, which evaporator unit is connected to a tank for separating steam and water and forms with the tank a water circuit, **characterized in that** the evaporator unit comprises at least one evaporator conduit, whereof a standing evaporator conduit part extends over a considerable part of the height of the evaporator unit.

2. Installation as claimed in claim 1, wherein the standing evaporator conduit part extends over the whole height of the evaporator unit.

3. Installation as claimed in claim 1 or 2, wherein the standing evaporator conduit part connects directly onto an outlet of the evaporator unit.

4. Installation as claimed in claims 1-3, wherein at least a portion of the standing evaporator conduit part is located outside the evaporator boiler.

5. Installation as claimed in claim 4, wherein the standing evaporator conduit part is located wholly outside the evaporator boiler.

6. Installation as claimed in claims 1-5, wherein a fraction of the evaporator conduits is provided with the evaporator conduit part extending over a considerable part of the height of the evaporator unit.

7. Installation as claimed in claim 6, wherein the fraction lies between 1/3 and 1/15.

8. Evaporator unit as claimed in claims 1-7, provided with at least one evaporator conduit with an evaporator conduit part extending over a considerable part of the height of the evaporator unit.

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