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Description

[0001] The invention relates to a boiler having a suction fan for the exhaust gases which act upon a heat exchanger arranged in the boiler housing for a heat transfer medium and upon a condensation heat exchanger connected downstream of this heat exchanger outside of the boiler housing, which condensation heat exchanger has a housing having an exhaust gas duct through which a heat transfer medium duct passes and which forms a downwardly directed inflow section and an upwardly directed outflow section separated from the inflow section by a partition wall.

10 [0002] In order to make advantageous use of the latent heat in the exhaust gases of boilers that can be heated with solid fuels, it is known (WO 2010/075601 A2) that a condensation heat exchanger for the cooled, moist exhaust gases can be provided outside the boiler housing between the heat exchanger of the boiler and the downstream suction fan, so that the basic design of the boiler can be retained. The exhaust gases cooled by the heat exchange in the boiler to a temperature just above the dew point necessitate relatively simple design requirements for the condensation heat exchanger, because only the steam contained in the exhaust gases needs to be condensed. The disadvantage, however, is the design of the condensation heat exchanger, which involves a corresponding amount of construction work and comprises a housing with a rectangular cross-section, which is divided by a central partition wall into a downwardly directed inflow section and an upwardly directed outflow section for the exhaust gas. Both the inflow section and the outflow section are penetrated by heat transfer medium pipes extending parallel to the partition wall transversely to the flow of exhaust gas, which are provided between distribution and collection chambers for a heat transfer medium, in particular water, which are located opposite one another with respect to the inflow and outflow section. In addition, retrofitting an existing boiler is difficult because the condensation heat exchanger must be integrated into the exhaust gas duct upstream of the suction fan.

[0003] The invention is based on the object of designing the condensation heat exchanger of a boiler of the type described above in such a way that it is not only simply constructed but can also be attached to the boiler without any special effort.

[0004] Based on a boiler of the type described above, the invention solves the object in that the housing of the condensation heat exchanger arranged downstream of the suction fan comprises an annular chamber producing the inflow section between a cylindrical outer jacket and a riser pipe coaxial to the outer jacket and forming the outflow section, and in that the heat transfer medium duct includes a heat transfer medium pipe extending in the inflow

section between the outer jacket and the riser pipe and surrounding the riser pipe in a helical manner in a descending branch and an adjoining ascending branch.

5 [0005] The arrangement of the condensation heat exchanger in the direction of flow of the exhaust gas downstream of the suction fan provides simple conditions for connecting the condensation heat exchanger to a boiler, because the condensation heat exchanger does not have to be integrated into the exhaust gas duct on the suction side of the suction fan, but only has to be connected to the suction fan on the pressure side. The arrangement of the condensation heat exchanger downstream of the suction fan also ensures that the dew point
10 of the exhaust gas flow does not fall below in the area of the suction fan, so that the housing of the suction fan does not have to be made of corrosion-resistant steel.

[0006] Since these branches extending along opposite helical lines around a common screw axis enclose the central riser pipe of the housing, a comparatively large heat exchange
15 surface can be made available for the downwardly directed exhaust gas flow in the annular chamber between the cylindrical outer jacket and the central riser pipe due to the heat transfer medium duct, which ensures complete condensation of the steam contained in the exhaust gas flow in the area of the downwardly directed inflow section of the exhaust gas duct, so that no condensate is produced in the upwardly directed outflow section, i.e. in the
20 riser pipe. The condensate produced in the downwardly directed inflow section can be collected and discharged in the bottom area of the housing, wherein the condensate flowing down along the heat transfer medium pipe has a self-cleaning effect. The exhaust gas duct in the annular chamber between the outer jacket and the riser pipe ensures low exhaust gas pressure losses despite the heat transfer medium pipe running in two concentric thread lines
25 in opposite directions, so that the suction fan is not overloaded when retrofitting boilers with condensation heat exchangers of this type.

[0007] In order to ensure favorable design conditions with regard to the connections for the supply and discharge of the heat transfer medium as well as for the continuation of the dry
30 exhaust gases, feed and return connections for the heat transfer medium pipe and an exhaust gas outlet for the riser pipe can be provided in the ceiling of the housing, so that all necessary connections are combined in the cover area of the housing.

[0008] If the heat transfer medium pipe is designed as a corrugated pipe, the total heat
35 exchanger surface can be additionally increased and thus the conditions for exhaust gas condensation in the area of the inflow section can be improved.

[0009] The drawing shows the subject matter of the invention by way of example, namely a condensation heat exchanger according to the invention in a schematic axial section.

[0010] The condensation heat exchanger connected to the pressure side of a suction fan 1 of a boiler 2, which is only indicated by dashed dots, has a housing 3 which comprises a thermally insulated, cylindrical outer jacket 4 and a riser pipe 5 coaxial with this outer jacket 4, so that the exhaust gases flowing tangentially into the annular chamber 7 between the outer jacket 4 and the riser pipe 5 through a discharge pipe 6 connected to the suction fan 1 flow downwards into this annular chamber 7, which forms an inflow section, are deflected in the region of the housing bottom 8 and exit from the condensation heat exchanger through the riser pipe 5, which forms an outflow section of the exhaust gas duct.

[0011] A heat transfer medium pipe 9 is provided in annular chamber 7, which has a branch 10 leading downwards in several turns in a helical pattern and an adjoining branch 11 leading upwards, which runs along an opposite, coaxial helical line. The windings of the branch 10 therefore enclose the windings of the branch 11, wherein the exhaust gas flows downwards through the annular chamber 7 between the windings of the branches 10 and 11, is cooled while giving off heat to the heat transfer medium, usually water, flowing through the heat transfer medium pipe 9, and thereby condenses. The condensate flows out of the housing 3 from a bottom outlet 12 closed by a siphon.

[0012] Connections 13 and 14 for the inlet and outlet of the heat transfer medium are provided on the ceiling 15 of the housing 3 next to the exhaust gas outlet 16 of the riser pipe 5, which also passes through the ceiling 15, so that simple connection conditions are provided for the heat transfer medium and the inlet and outlet of the exhaust gas in the area of the ceiling 15 of the housing 3.

PATENTKRAV

1. Varmekedel (2) med en sugeblæser (1) til afgangsgasserne, som virker på en varmeveksler, der er anbragt i kedelhuset, for et varmeoverføringsmedie og en kondensationsvarmeveksler, som er forbundet nedstrøms for denne varmeveksler uden for kedelhuset, hvilken kondensationsvarmeveksler omfatter et hus (3) med en afgangsgas-kanal, gennem hvilken en varmeoverføringsmediekanal passerer, og som danner et nedad rettet indstrømningsafsnit og et opad rettet udstrømningsafsnit, der er adskilt fra indstrømningsafsnittet med en skillevæg, **kendetegnet ved, at** huset (3) for kondensationsvarmeveksleren, som er anbragt nedstrøms for sugeblæseren (1), omfatter et ringformet kammer (7), der danner indstrømningsafsnittet mellem en cylindrisk yderkappe (4) og et stigrør (5), som er koaksialt med yderkappen (4) og danner udstrømningsafsnittet, og **ved, at** varmeoverføringsmedie-kanalen omfatter et varmeoverføringsmedierør (9), der strækker sig ind i indstrømningsafsnittet mellem den ydre kappe (4) og stigrøret (5) samt spiralformet omgiver stigrøret (5) i en nedstigende gren (10) og en opstigende gren (11), som er forbundet dertil.
2. Varmekedel (2) ifølge krav 1, **kendetegnet ved, at** der i husets (3) top (15) er tilvejebragt frem- og tilbageløbskonnektorer (13, 14) for varmeoverføringsmedierøret (9) samt en afgangsgas-udgang (16) for stigrøret (5).
3. Varmekedel (2) ifølge krav 1 eller 2, **kendetegnet ved, at** varmeoverføringsmedierøret (9) er udformet som bølgerør.

